Government of Georgia
Asian Development Bank

Environmental Assessment Report

April 2011

Preparation of Feasibility Study and Detailed Engineering Designs for Improving the Water Supply and Waste Water Systems in Selected Urban Centres of Georgia

INITIAL ENVIRONMENTAL EXAMINATION REPORT
Improvement of Mestia Water Supply and Sewer System Subproject

ABBREVIATIONS

ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
CA	-	Cross section area
CC	-	Civil Contractor
COD	-	Chemical Oxygen Demand
DC	-	Design Consultant
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIB	-	European Investment Bank
EIP	-	Environmental Impact Permit
EMP	-	Environmental Management Plan
GoG	-	Government of Georgia
GRC	-	Grievance Redress Mechanism
HDPE	-	High Density Poly Ethylene
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IP	-	Investment Program
IPMO	-	Investment Program Management Office
kg	-	Kilogram
km	-	Kilometer
lpcd	-	Liters per Capita per Day
M	-	meter
MC	-	Management Contractor
MDF	-	Municipal Development Fund
MFF-IP	-	Multitranche Financing Facility Investment Program
mg/l	-	milligram per liter
mm	-	millimeter
MoRDI	-	Ministry of Regional Development & Infrastructure
RCC	-	Reinforced Cement Concrete
uPVC	-	Un-plasticized Poly vinyl Chloride
UWSCG	-	United Water Supply Company of Georgia
WS		Water Sanitation
WSS	-	Water Supply & Sanitation
WWTP		Waste Water treatment Plant

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EXECUTIVE SUMMARY

1. It is proposed to improve the water supply system in Mestia under the Asian Development Bank (ADB) funded Urban Services Improvement Investment Program, which is under preparation stage. This Investment Program, implemented in six towns, including Mestia, will develop the water and sanitation services, which will improve quality of life and optimize the social and economic development. Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) and United Water Supply Company of Georgia (UWSCG) is the Implementing Agency (IA) of this Program. This subproject will be implemented from mid 2011 and likely to be completed by the end of 2012. Since the subproject is unlikely to have significant adverse impacts, it is classified as environment Category B, and accordingly an Initial Environmental Examination has been conducted. This is a summary of the IEE Report.

2. Situated in the north bordering Russia, Mestia is an important cultural and tourism centre in Georgia. The service levels of water supply are low with partial coverage, high system losses, and poor water quality at consumer end. With the government initiative to develop Mestia as a major tourist destination, the water demand is likely to grow significantly. This subproject will expand the system and improve the service standards, with a daily supply of potable water in adequate quantity (203 lpcd). The subproject is designed to meet the projected demand of 2040. This will be achieved by: (i) creating infrastructure to tap water from a new source (Mestiachala River); (ii) laying of transmission pipes and (iii) construction a water treatment plant, a reservoir and laboratory facilities.

3. Situated in the Caucasus, Mestia is surrounded by Greater Caucasus and Svaneti-Abkhazia Ranges. The elevation of the subproject area ranges between 1,400-3,600 m above the mean sea level, and forms upper part of the Enguri River Basin. The town is developed near the confluence of the Mukhura and Mestiachala rivers, tributaries of the Enguri. There are farmhouses and fields around the foothills and in the bottom of the valleys but the majority of the district E is covered with forests. The region which lies below 1,800 m MSL is covered by mixed and coniferous forests; and from 1,800 meters to about 3,000 m consists of alpine meadows and grasslands, above which lie the zone of snows and glaciers.

4. The subproject activities are partly located in the town and in the surrounding hills. The new drinking water intake will be located in the Mestiachala River about 6,5 km north of Mestia. It is proposed to collect water from the hilly upper reaches. An intake structure consisting of a Tyrolean weir will be constructed in the river bed. The transmission pipeline will be laid underground. First section will run along existing tracks downriver of the future intake, surrounded by pastures and partly by forests. The second section will run upward from the existing track to the future Water Treatment Plant which will be located on lower hills outside the town east of Mestiachala River. The pipeline from the WTP to a future reservoir will cross meadows and pastures. Two pipeline bridges are required to cross Mestiachala River and a feeder river of Mestiachala at the transmission main. Five more pipeline bridges are required within the water supply network in the township. As an option the existing Tsrniashi spring water can be mixed with the raw water from the new source in a valve chamber at the new WTP. If mixing will actually take place depends on the results of the water analysis and the discharge of Mestiachala River. Two existing reservoirs north of Mestia will be completed by a third one (Lanchavli reservoirs). The former design for a water intake at Gvaldiri River was given up due to insufficient flow. The activities for the WWTP and main collector are mostly located close to the southern suburbs of the town. The new WWTP will be located at a governmental owned location on the left shore of Mestiachala River. The main collector will have a length of 52 m only.

5. The existing waste water system consists of some underground pipes out of operation. Most of the sewage from households infiltrates into the underground or flows into adjacent rivers without any treatment. There is no industrial sewage. The construction of a sewer system will improve essentially the environmental situation in Mestia. Pipes will be laid underground in existing streets.

6. The Mestia water supply and waste water system improvement subproject is relatively small in scale and involves straightforward construction and low-maintenance operation. Although there are forest areas, none of the components will encroach into these areas and most of the activities are planned along the existing access roads. Further any disturbance will be limited to construction period. Construction work in river bed is also not likely to have adverse impacts as there are no dependent population and limited aquatic value. The identified impacts are mostly short-term, localized and can either be easily avoided or mitigated. After construction stage the project will have overall beneficial impacts on human health and life quality by providing the inhabitants of Mestia with an up to date sanitary system. Also the project has beneficial impacts on the environment as Mestiachala River will no longer be subject to untreated sewage pollution. Water quality and aquatic biota of Mestiachala River will benefit from the investment. Better water quality in Mestiachala River will also support the tourism development (e. g. rafting).

7. Most of the predicted impacts are associated with the construction process. Impacts mainly arise from the generation of dust from soil excavation and refilling; disturbance of residents, traffic and activities in the town; increase of silt load in the river; loss of top soil in pasture lands, removal of trees, and from the disturbance to wildlife due to trenches. These are common impacts of construction, and following methods are suggested for their mitigation: (i) Utilizing surplus soil for beneficial purposes; (ii) Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc); (iii) Providing prior public information; (iv) conducting no construction in the river bed in fish breeding season and with minimum interference with the water quality; (v) restoring the top soil after construction, (vi) avoiding tree cutting through location alignment changes, and (vii) to avoid safety hazards construction site will be secured at critical segments.

8. There are a number of development activities (for instance, road works) currently under implementation in Mestia. The following measures are suggested so that roads and inhabitants are not subject to repeated disturbance by work in the same area for different purposes: (i) scheduling construction in consultation with the other implementing agencies, and (ii) conducting the road work, where the transmission line is proposed, after the pipeline work.

9. During the operation, the main risk is that the water abstraction will deplete the water resource. Unsustainable reduction may affect downstream uses and may have ecological impacts. On the other hand, unsustainable source may also lead to closure of the system. Originating from a glacier and supplemented by rain and snow, the Mestiachala is a perennial river. The total abstraction of 79 l/s as a maximum daily water demand is calculated for 2040. This will be less than 10 % of the long term mean annual flow which is 840 l/s at the head works. In addition the flow from the existing intake of about 17 l/s may be added in case the results of the drinking water analyses allow a mixing of the two raw water sources. Adverse impacts are unlikely since there are no downstream water uses and aquatic life is limited. Additional measurements will be implemented to confirm the hydrological calculations and to ensure the source sustainability: conducting flow measurement in low flow period (winter) as part of detailed design; and limiting extraction to 2/3rd of absolute minimum flow.

10. Degradation of source water quality is identified as another risk that may have impacts on public health. Since there are no pollution sources or anthropogenic activities in the catchment, there is no future pollution risk. The water quality is good except turbidity, which is normally high during the heavy flow season. Regular monitoring of raw and treated water quality is suggested.

11. There are no health and safety risks associated with the subproject, as the disinfection will be through chlorine in powdered form. Treatment facilities are limited to disinfection and simple filtration, no major waste generation is anticipated. The subproject is likely to have several positive benefits during operation. The citizens will be provided with a constant supply of better quality water, which will improve the quality of life. This will also support the tourism development. There are no health and safety risks associated with operation of the WWTP, as the WWTP will be fenced. There will be no access for unauthorized persons. No major waste generation except sludge is anticipated. The sludge will be disposed off to the landfill located next to the WTP and WWTP. Concerning the WTP relevance for disposal depends on whether aluminium or iron salts are used as flocculants. Concerning the sludge from the WWTP an additional option would be to put it on fields, but this needs prior testing for heavy metals to be sure that legal standards are met.

12. To ensure that all the mitigation measures as suggested are implemented, a program of environmental monitoring is prepared. Department of Quality Management and Environmental Protection (DQMEP) of UWSCG will oversee and be responsible for implementation of mitigation and monitoring measures. Provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

I. INTRODUCTION

A. Background

1. The proposed Urban Services Improvement Investment Program is intended to optimize social and economic development in select urban areas (provincial capitals and secondary towns) through improved urban water and sanitation (WSS) services. This ADB funded Multitranche Financing Facility Investment Program (MFF-IP) complements the government's emerging vision for the WSS sector, formulated in its sector development strategy and road map, policy framework and reform implementation plan, and a business climate that encourages increased donor investment. This support will also complement ongoing donor efforts to improve and expand Georgia's urban WSS services. ADB identifies support to developing the country's municipal infrastructure a key contributor to enhancing sustainable economic growth, with the cross cutting themes of governance, regional cooperation and environmental protection. ADB's support can contribute to: (i) sector reforms; (ii) strengthening the link between financing local infrastructure projects and decentralization reforms; (iii) stimulating local economic development; and (v) improving the quality of life of urban population.

2. *WSS Services in Georgia*. The service levels of urban water supply and sanitation systems in Georgia at present are not satisfactory. Piped water supply service is available to less than 75 percent of urban population. Most of the serviced population suffers with inefficient service levels – inadequate and intermittent supply with low terminal pressure. Due to old systems, most of the pipelines are profusely leaking, and water losses in the system are as high as 50-70 percent. Similarly, less than 50 percent urban population is connected with underground sewerage system, and the rest depend on individual disposal systems like pit latrines, septic tanks etc. Sewage treatment facilities are almost non-existent and collected waste is disposed untreated into rivers/streams raising environment and public health concerns.

3. The Investment Program focuses on investments in improvement of basic urban infrastructure (i.e. water supply and sewerage). Besides, it will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. This Program will be implemented in 3 tranches over a period of 8 years beginning in 2011. The Executing Agency (EA) is the Ministry of Regional Development and Infrastructure (MoRDI), Government of Georgia; and the Implementing Agency (IA) is the United Water Supply Company of Georgia, a wholly-owned company of Government of Georgia under MoRDI. The proposed investments under Tranche-1 include improvement of water supply systems in urban areas of Marneuli, Zugdidi and Mestia.

4. The Mestia water supply improvement subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A). According to ADB procedures, the impacts of the subproject were assessed by the Initial Environmental Examination, conducted according to ADB Safeguard Policy Statement (2009). According to Georgian Legislation an Environmental Impact Assessment needs to be conducted for the following components of the Mestia subproject:

(i) Installation of the main sewage collector and
(ii) Construction of the sewage treatment plant, because it is exceeding 1000 cm^3 per day.

5. The main issues of this EIA are also subject to this IEE study.

B. Extent of the IEE Study

6. This is the Initial Environmental Examination (IEE) Report for the Mestia Water Supply and wastewater subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. It is one of the three IEE documents prepared for Tranche 1 subprojects. These were prepared in July-October 2010 by an International and a Domestic Environmental Specialist via inputs of 2.5 months each. The study was updated in March 2011 due to the change in design (see Executive Summary para. 4).

7. This IEE study is conducted based on the feasibility study and updated design. Certain details changed in the detailed design stage as the development of the subproject progressed.

8. This IEE report was prepared based on the Environmental Assessment Report according to Georgian Law, the former IEE study (2010), the Feasibility Study and the detailed design. It was also based on secondary information and data from various sources and field observations. Field surveys were limited to essential baseline factors such as source water quality and hydrological calculations. The IEE was prepared for improvement of the WSS and the waste water system in Mestia including head works, transmission lines, water treatment plant, reservoirs, water network, waste water network, main sewage collector, and waste water treatment plant (WWTP).

9. Since there are no significant, irreversible, or complex issues involved, no specialized techniques were required to be employed. All impacts were simple, easy to identify and mitigation measures were readily available.

C. Report Structure

10. This IEE Report is organized into seven sections including this introductory section:

Section 2 establishes the project need, rationale and alternatives
Section 3 describes project components and construction & operation details
Section 4 discusses impacts on physical and biological environment
Section 5 discusses impacts on socio-economic environment
Section 6 provides Environmental Management Plan and Monitoring Plan, and
Section 7 emphasizes on IEE recommendations and concludes the report

II. PROJECT RATIONALE AND NEED

A. Type of the Project

11. This is an urban water sanitary project including water supply and waste water improvement sub-project. It involves development of a new water supply source, providing a disinfection facility, construction of new or rehabilitation of old/damaged pipelines, and construction of new or rehabilitation of existing water storage reservoirs. Development of a sewer system and WWTP is also included.

B. Need of the Project

12. As discussed earlier, the service level of urban water supply and waste water treatment at present are not satisfactory in Georgia. Services are not available to entire population and the serviced areas suffer with inefficient service levels. Systems are old and

inefficient. The situation is no different in the program town of Mestia. Untreated sewage infiltrates into the underground and pollutes into rivers This sub-project is needed because the present water supply infrastructure in Mestia is inefficient and inadequate to the needs of the growing population and tourists. Untreated sewage contaminates soil and surface water. It endangers human health. Therefore the project is urgently needed.

13. The United Water Supply Company of Georgia1 (UWSCG) provides water supply in Mestia. Until recently (Jan 2010), the Mestia Municipality was providing the service. Owing to its location, there are numerous springs, small and big, in the hills around Mestia. These springs are main source of water supply to the town. These sources at present provide 2,600 m³ of water daily. Water is supplied from two head works: Skhedi (developed in 1956) and Tsnriashi (1978).

14. Skhedi headworks, situated 800m south of the town, gets water from three springs, Mebdura, Makhurapi and Skhedi, all within a radius of 500 m, and supplies about 1,100 m³ of water daily. Water from Makhurapi and Skhedi springs is collected in a settling tank, to reduce the turbidity, and then conveyed to a storage reservoir, from where water is supplied to distribution system by gravity. Due to lower elevation, Mebdura spring water is not passed through settling tank but directly connected to headworks reservoir. Makhurapi and Skhedi carry high turbidity in heavy flows, during which the settling tank is not very effective. Comparatively less, but Mebdura also carries turbidity. Because of these reasons turbid water enters the distributions system. Water yield changes seasonally depending on temperature (i.e. snow melting) and precipitation. Skhedi headworks supply water to the south, central and western districts of Mestia Town. Although some renovation has been carried out under municipal development fund, water quality problems have not been addressed. Further inclusion of new areas to Skhedi headworks system in 2010, lead to reduction of the net supply.

15. The Tsrnashi headworks, located 7 km north of Mestia, provides 1500 m³ (=17 l/s) of water per day. Water from an underground spring is collected in a RCC tank and conveyed to Lanchavli reservoirs, from where water is supplied to distribution system by gravity. Water is supplied to consumers without any treatment. This system supplies water to northern and eastern districts. Distribution lines of Lalidi, Lareli and Tetnashi are connected directly to the transmission main, which is affecting the supply to the reservoirs and ultimately to the distribution system.

16. The present water supply system covers about 70% of the population. Due to old system water losses are very high (80%), net water supply is about 200 LPCD. Existing water supply coverage and future water demand is shown in Table 1.

17. Besides the existing inadequacies, the water supply system requires augmentation to meet the growing population. With the government initiative to develop Mestia as an all weather tourist destination, the water demand is likely to grow significantly. As per the government estimates, 20,000 tourists are expected to visit daily by 2040.

18. The present sub-project is designed to improve the service standards of water supply in Mestia – daily supply of potable water in adequate quantity (203 lpcd) at requisite pressure. It is designed to improve the service standards of waste water treatment and discharge.

[1] A government company under Ministry of Regional Development and Infrastructure

C. Location

19. This sub-project is located in Mestia Town, the administrative centre of Svaneti Region, in north-eastern part of Georgia, bordering Russia. Geographically, it is located at 42o 42'06" E and 43o 04'30" N, about 430 km northwest of Tbilisi. Regional location of Mestia is shown in Map 1.

20. The proposed infrastructure improvement works will be located in and around the town. There are six main components of the project: (i) development of water intake headworks at a new source, the Mestiachala River, (ii) a transmission line from new source to new reservoir/treatment plant, and (iii) construction of Water Treatment Plant and reservoir, and (iv) transmission line from treatment plant/reservoir to existing reservoirs at Lanchavli, (v) sewer network within the town (vi) construction of WWTP (Map 8).

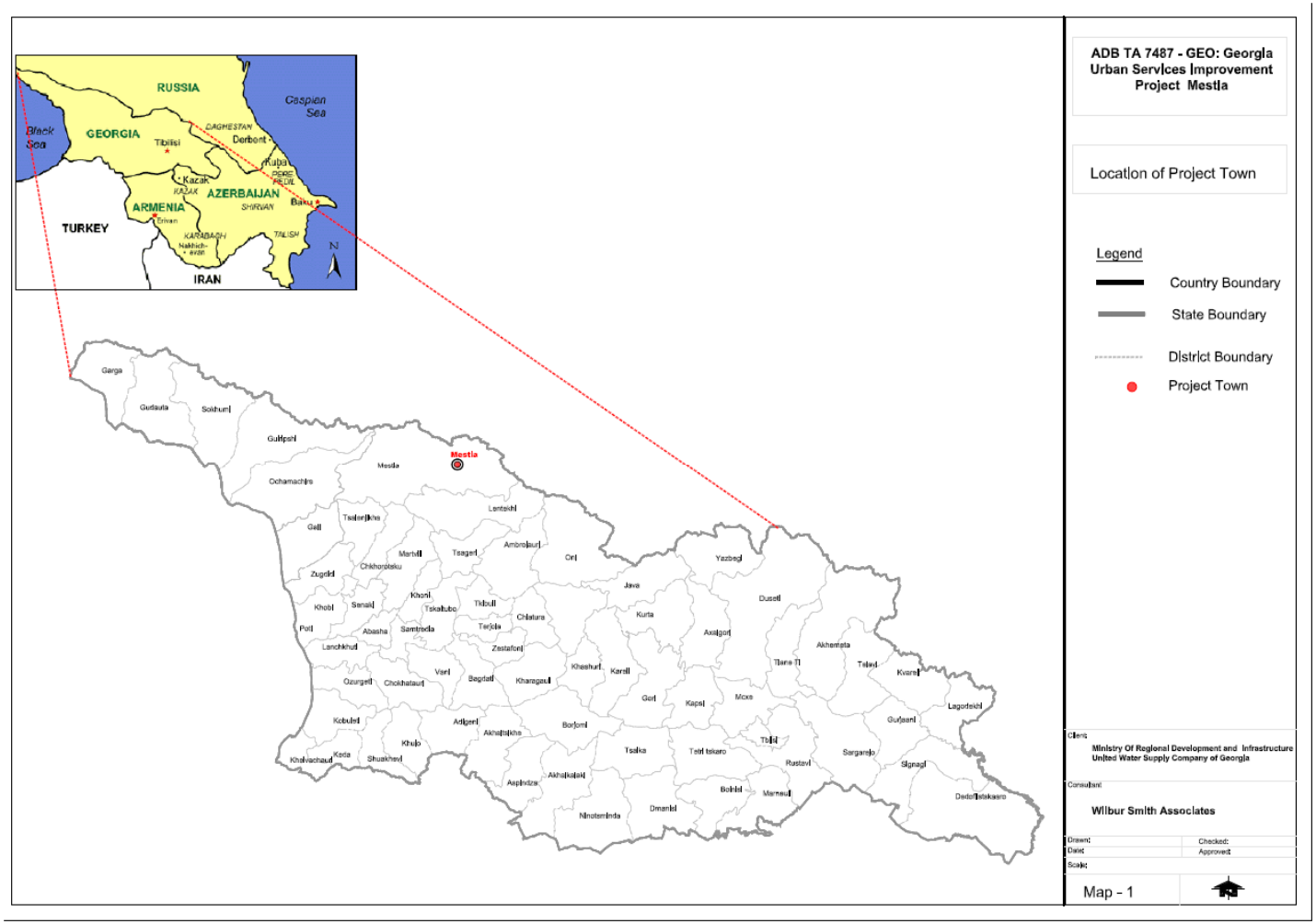
21. New headworks site of Mestiachala River located at about 6,5 km north of the town. Site is accessible by a field road. The Water Treatment Plant and Reservoir will be constructed on a government owned site located on a higher elevation in the outskirts of the town. The transmission pipeline will be laid along the road to the existing reservoirs, about 1 km west of town centre on a hill at Lanchavli. Locations of these are sites are shown in Map 3.

22. Location of the WWTP was selected during Feasibility Study. The Waste Water Treatment Plant will be constructed on a government owned site, comprising approximately 3 ha of land. It is located more than 100 m south of the town on the left hand side of Mestiachala River. Site is accessible by a field access road. The treated sewage will be discharged into the river. The WWTP will cover about 7800 population by 2015. New WWTP and main sewage collector are located in the southern suburbs of the town adjacent to Mestiachala River (Map 8).

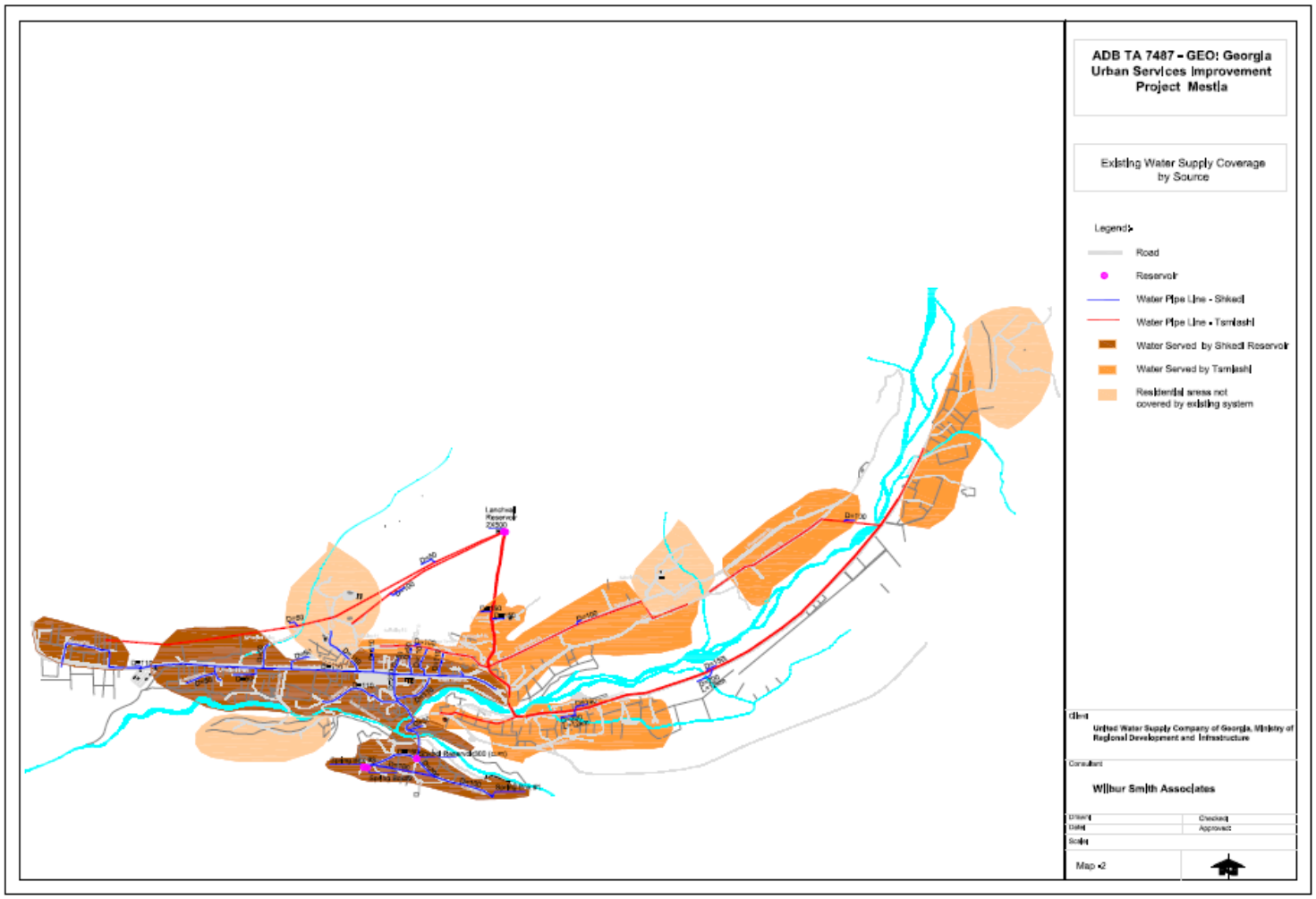
D. Implementation Schedule

23. Detailed design of the subproject will begin in October 2010 and should be completed by March 2011, after which construction will take about a year and half, so all work should be completed by the end of 2012.

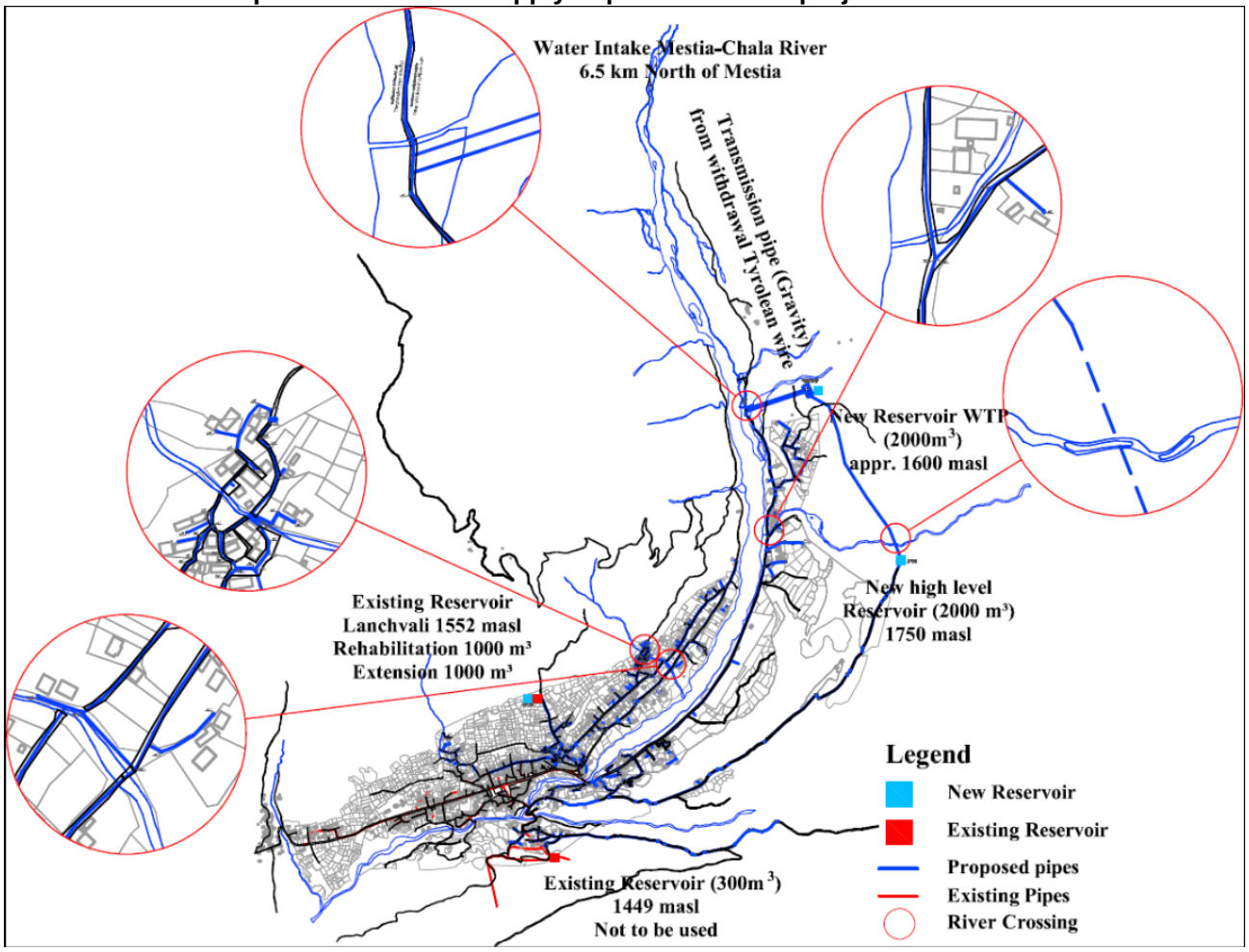
Map 1: Location of Project Town



Map 2: Existing Water Supply



Map 3: Mestia Water Supply Improvement Subproject - Overview



E. Project Alternatives

1. Water Supply System

24. The project development concept for improvement of Mestia water supply gives priority to water Demand Management (DM) measures, which are resource and cost efficient. Following DM measures are proposed to improve the existing system efficiency:

(i) repairs/replacement of leaking pipes and reservoirs,
(ii) leak detection & rectification,
(iii) improved monitoring through hydraulic zoning and metering

25. Inclusion of above DM measures is likely to reduce the losses from present 80% to 25%. The tabel below presents an overview of the projected water supply situation in Mestia. A maximum daily water demand of 6,834 m³/d is calculated for 2040.

26. With the above measures, the present supply can meet the present demand without any source augmentation. However, it will not be adequate to meet the future demand (mainly tourist demand). Ultimate gap (2040) in demand and supply is estimated to be 3,725 m³. Discouraging high volumes of water usage by consumers is also an option. However, recognizing that the per capita use of 200 LPCD is a minimum requirement in Georgia and therefore this was ignored. Therefore to meet the supply and demand gap augmentation of supply is necessary.

Table 1: Daily Water Demand-Supply Analysis

Description	Unit	Year			
		2011	2020	2030	2040
Water supply					
inhabitants (permanent stay)	capita	2.855	3.480	4.347	5.299
specific water demand (according UWSCG)	l/(c*d)	140	140	140	140
Minor commercial/institutional demand add.	%	10%	10%	10%	10%
Large consumer (industry) add.	%	0%	0%	0%	0%
Real losses (leakage, existing network) add.	%	25%	25%	25%	25%
Transmission losses add.	%	2%	2%	2%	2%
Apparent losses	%	0%	0%	0%	0%
Technical demand for water treatment add.	%	8%	8%	8%	8%
Total specific water demand	***l/(c*d)***	***203***	***203***	***203***	***203***
Subtotal daily water demand (inhabitants)	*m³/d*	*580*	*706*	*882*	*1.076*
tourists (non-permanent stay)	capita	3.500	6.375	11.847	20.000
specific water demand (according UWSCG)	l/(c*d)	170	170	170	170
Minor commercial/institutional demand add.	%	10%	10%	10%	10%
Large consumer (industry) add.	%	0%	0%	0%	0%
Real losses (leakage, existing network) add.	%	25%	25%	25%	25%
Transmission losses add.	%	2%	2%	2%	2%
Technical demand for water treatment add.	%	8%	8%	8%	8%
Total specific water demand	***l/(c*d)***	***247***	***247***	***247***	***247***
Subtotal daily water demand (tourists)	*m³/d*	*863*	*1.571*	*2.920*	*4.930*
Total water demand (average)	***m³/d***	***1.442***	***2.278***	***3.803***	***6.006***
Peak factor daily demand	-	2,00	2,00	1,90	1,50
Peak factor hourly demand	-	4,50	4,50	4,00	3,50
Max. daily water demand	**m³/d**	**2.188**	**3.456**	**5.481**	**6.834**

27. Following table presents the analysis of various alternatives considered to meet the gap in service delivery due to existing losses. Developing a new source with requisite treatment and storage facilities (Option 2) is evaluated as appropriate alternative which can achieve the desired objectives of the project. The Option-1 (augmentation of existing sources), which is found unfeasible due to limited yield, and Option-3 (no project), which cannot achieve the objectives, were rejected. Also retention of existing sewage disposal cannot be recommended.

Table 2: Project Design Alternatives

Option – 1	**Option – 2**	**Option – 3**
Augmentation of Supply from Existing Sources	**New Source Development – Development of new Waste water Network**	**No project**
This option involves augmentation of supply from the existing spring sources. The existing supply of 2,600 m³ is based on the lean period yield of sources. Although water is available during other periods, considering the worst scenario in lean period, these sources cannot supply more water.	There are numerous springs and streams/river in and around Mestia's hilly region. Mestiachala River, flowing through the town, is a large river carrying high volumes of water throughout the year. Due to following reasons this source is identified as a new source considering the following: (i) Adequate flow to meet the ultimate water demand of entire town including the tourist demand (ii) Being located in hilly area and originating from a glacier, water quality is good (iii) There are no present or future sources of pollution in the catchment (iv) Site is accessible by field roads along which the transmission pipeline can be laid Gvaldi River, a tributary of Mestiachala, is ignored as a source for the future water supply due to following reasons: (i) During the site visit on November 23rd the stream at Gvaldiri was found running almost dry with an estimated flow of maximum 150 l/s. (ii) It has to be expected, that the flow will decrease during the frost period. (iii) The terrain through which the transmission main would have to be laid is liable to land slides (iv) The site proposed for the WTP is located on terrain inaccessible for vehicles. The existing trail on the left bank of the river is too narrow for heavy vehicles. In order to construct an adequate access road acquisition	The existing system, without any improvement or augmentation, will not be able to meet even present town demand. With Mestia being developed as a major all-weather tourism centre in the northern Georgia (many tourism development works are in progress), lack of basic infrastructure like water supply and sewer system will be a set-back for these efforts. Lack of a sewer system will endanger human health and impair the environment (soil, surface water and ground water).

Option – 1	Option – 2	Option – 3
Augmentation of Supply from Existing Sources	**New Source Development – Development of new Waste water Network**	**No project**
	of private land is required.	
Creation of artificial storage to meet the lean season demand is not considered to be a feasible option both from technical as well as environmental views.	*Environmental value of* Mestiachala *River*: Water abstraction from river may have impacts on existing uses including the ecological requirements during lean season. During construction in river bed, the quality of water may also be degraded. Therefore it is necessary that a minimum environmental flow (both in terms of quantity and quality) is ensured downstream to sustain aquatic ecosystems and the ecological components, processes and function on which people depend. This project is likely to have no impacts on water quality, except during construction, which can be mitigated by measures. The impacts of water abstraction/reduction in downstream flow depend on the ecological value and commercial use of water. Aquatic life is limited to Trout fish fed by river benthos. There is no commercial fishing activity. The river also serves as a source of water for wild animals. Cattle grazing in the nearby pastures also use river water. River supports plants undergrowth along its course, which has a variety of flowering plants/bushes/shrubs. The river course of Mestiachala is said to be a breeding ground for trout in winter months. The long term mean annual flow of Mestiachala River is 840 l/s at the head works. With the project envisaging abstraction of 79 l/s (<10% of long term mean annual flow), and with most of the uses limiting to summer months during which flow is likely to be very high, no significant impacts are envisaged. Besides commercial uses, river requires to have a minimum flow to sustain aquatic and ecological values. To check this, a minimum flow (1/3rd of total) downstream (particularly in low flow period of winter months) will be ensured. Development of new waste water system – no significant irreversible impact can be identified	

28. Having selected the Option-2 for implementation, other alternatives within this are considered for selection of appropriate locations. Following alternatives have been considered for location of headworks and transmission main from headworks to new water treatment plant site (Table 3).

Table 3: Location and Design Alternatives within the Selected Option

Components	Location Justification
New headworks on Mestiachala River to abstract water	Mestiachala originates from a glacier on the upper reaches. From its origin Mestiachala flows through valley/gorges surrounded by hills covered with alpine forests and pasture lands. An appropriate location considering the following has been identified on the upper reaches: • Relatively plain landscape to develop headworks • Involve no clearing of trees • Most accessible location • Elevation of headworks to allow for gravity flow of water to the proposed WTP site; this will also help in laying of pipeline through field roads in pasture lands • Site is relatively safe from land-slides, rock fall from hills
Transmission main from Mestiachala headworks to new WTP site; and transmission line from WTP site to new reservoirs	Main criteria used for locating these facilities: • Government-owned land to avoid private land acquisition • Easily accessible • No clearance of trees/vegetation • No major earth cutting/filling activities • Allows for gravity flow from intake to WTP *Transmission main from headworks to WTP site*: Alignment traverses mostly hilly areas. Pipeline will be laid along the field roads under ground. *WTP and Reservoir Site*. Government owned site located on a higher elevation that the town to allow complete gravity flow based water supply. *Transmission line from WTP to Lanchavli Reservoirs*. This will be laid along the existing road passing through the centre of the town, allowing for gravity flow.

2. Waste Water System

29. Concerning alternatives for the WWTP there needs to be distinguished in between site alternatives and treatment alternatives.

30. Site alternatives: Location of the WWTP was selected during Feasibility Study. The Waste Water Treatment Plant will be constructed on a government owned site, comprising approximately 3 ha of land. Layout plan is shown in Fig. 3. It is located more than 100 m south of the town on the left hand side of Mestiachala River. Site is accessible by a field access road. The treated sewage will be discharged into the river. The chosen site has the disadvantage that it does not comply with ADB guidelines/criteria for site selection laid down in the Environmental and Assessment Review Framework for the Georgian Urban Services Improvement Investment Program (November 2010) as it is closer than 500 m to the next building structures and to residential area.

31. As there are no real site alternatives within the narrow valley of Mestiachala river the selected location is acceptable, provided mitigation measures are implemented to avoid odour emissions.

32. *Treatment alternatives:* As described in section III part A the proposed technology for the WWTP is a very common treatment method and has been implemented many times all over the world. Treatment process is very simple and easy to operate. As all associated environmental impacts occurring during construction and operation phase are of only minor extent and can easily be managed by the mitigation measures proposed in the Environmental Management Plan no alternative treatment process was investigated.

F. Consultation

1. Waste Water Treatment Plant and Main Sewage Collector (EIA)

33. For Georgian legal environmental approval of the waste water subproject (WWTP and main sewerage collector) there are basically two possibilities, the normal EIA procedure and the accelerated procedure by which waiver is given by MoEPNR which exempts from the need for public consultation and public hearing. The two possible approval procedures are described in the following.

34. Normal EIA procedure: According to Georgian Legislation EIA procedure requires disclosure of EIA and conduct of public hearing. Following the EIA submission there is the announcement of the public hearing. Public Hearing will take place 51 to 60 days after the announcement. At the same time with the announcement there is a letter to the Ministry informing about Public Hearing and EIA disclosure. Ministry is asked for comments to be incorporated into the EIA Report.

35. During the 51 to 60 days disclosure period comments may be received by stakeholders like local community members, governmental agencies etc. Comments will be submitted in written form and incorporated into the EIA report as far as technically feasible.

36. After the 51 to 60 days period public hearing will take place for the Mestia subproject in Mestia and for the Anaklia subproject in Anaklia.

37. After Public Hearing there is again a 5 day period for relevant changes concerning the received comments, before EIA report is submitted to the Ministry of Environment for Environmental Permit. State Ecological Expertise is then conducted and after 20 days there is Environmental Permit.

38. *Applying for waiver*: In addition to normal EIA procedure there is the possibility to apply for waiver. This will accelerate EIA process because it will exempt from the need for public consultation and public hearing. Waiver can be applied for projects which are of high public interest and priority.

39. Because the Mestia and Anaklia subprojects are both of high public interest and are in addition the first subprojects to start with construction UWSCG decided to apply for waiver.

2. Water Supply System and Waste Water System (IEE)

40. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Stakeholders of this project include:

(i) People who live, and work near construction sites of facilities in Mestia
(ii) UWSCG as implementing agency
(iii) Other government regulatory institutions
(iv) NGOs and CBOs working in the affected communities;
(v) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
(vi) The beneficiary community in Mestia in general; and
(vii) The ADB, as funding agency

41. Two forms of public consultation have been used during preparation of the IEE, to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

(i) A public meeting was held in Mestia Town in November 2010, to which stakeholders were invited. Participants were informed about the aim of the subprojects and the benefits together with their likely impacts and the ways in which they would be mitigated. Participants were invited to discuss their views and concerns, which were then incorporated into the IEE.
(ii) Ad hoc discussions were also held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

42. This IEE Report in Georgian language will be distributed to the interested public. Report will be available for review in Tbilisi (at UWSCG Head Office), and Mestia (at UWSCG Service Centre and the Town Hall). It will also be disclosed to public by making it available on websites of UWSCG, MoRDI and ADB, together with the IEEs prepared for the other subprojects.

43. The following changes in design were implemented:

- Installation of the sewage system
- Installation of the main sewage collector
- Construction of the sewage treatment plant
- New head works on Mestiachala River to abstract water
- Transmission main from Mestiachala head works to new WTP site and transmission line from WTP site to new reservoirs

44. An additional public consultation as required according to ADB regulations due to changes in the design was held in Mestia on 11th of April 2011. Annex 4 contains a summary of the meeting.

G. Licenses & Approvals Required

45. Environmental assessment of various activities and development projects in Georgia is governed by the Law on Environmental Impact Permits (EIP), which has entered into force in January 2008. This Law notifies the list of the activities and projects, which will be subjected to ecological expertise and require Environmental Impact Permit. The Law also makes the public participation mandatory in the process of environmental assessment, ecological expertise and decision making on issuance of an environmental impact permit. Under this Law, various projects/activities have been divided into four categories based on their size, importance and potential environmental impact, and sets out permitting process for each category.

46. None of the components of the proposed water supply improvement subproject in Mestia are notified in the Law on EIP and therefore environmental impact permit is not

required. According to current legislations in force, water abstraction from a surface water source does not require any permission/approval from Government of Georgia.

47. ADB Review and Approval. For Category B projects the Draft IEE report are reviewed by ADB's Operational Department (in this case Central & West Asia Department) and after addressing their comments, if any, the EA then officially submits the IEE reports to ADB. Completed reports are made available on the ADB website.

H. Policy, Legal, and Administrative Framework

48. This section discusses the national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party.

1. ADB Policy

49. Superseding the previous safeguard policies (the Involuntary Resettlement Policy, 1995, the Policy on Indigenous Peoples, 1998, and the Environment Policy 2002), ADB, has adopted a comprehensive Safeguard Policy Statement in 2009 (SPS, 2009). This Statement describes common objectives of ADB's safeguards, lays out policy principles, and outlines the delivery process for ADB's safeguard policy. It applies to all ADB-financed and administered projects, and their components including investment projects funded by a loan, grant or other means.

50. Aiming on promotion and sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts, the objectives of ADB's safeguards are to:

(i) avoid adverse impacts of projects on the environment and affected people, where possible;
(ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
(iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

51. The objective of environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. All ADB funded projects are screened at initial stages of preparation and categorized according to significance of the project's potential environmental impacts. Projects are assigned to one of the following three categories:

Category A - Projects likely to have significant adverse environmental impacts, which are irreversible, diverse or unprecedented and may affect an area larger than the location subject to physical works. An Environmental Impact Assessment is required.

Category B –. Projects with adverse environmental impacts that are less significant than those of Category A projects, are site-specific, generally not irreversible, and in most cases can be mitigated more readily than for Category A projects. An Initial Environmental Examination (IEE) is required.

Category C - likely to have minimal or no adverse environmental impacts; EIA is not required.

52. The Mestia WSS subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A) according to the criteria laid down in the checklists for sewerage projects and the checklist for water supply projects of the ADB's Environmental Assessment and Review Framework (November 2010) that was especially prepared for the environmental assessment of the Georgia Urban Services Improvement Investment Program.

2. Georgian Law

53. The Law of Georgia on Environmental Permit (2008) establishes legal bases for participation of the public. The purpose of the Law is to protect persons' health, natural surroundings, material assets and cultural heritage in the course of the activity. The installation of a WWTP and main sewage collector requires an Environmental Permit including Environmental Impact Assessment. Discharge of WWTP must follow limiting values.

54. The **Law of Georgia on Environmental Protection** regulates the legal relationship between the bodies of the state authority and the persons or legal entities (without distinction-legal form) in the scope of environmental protection and in the use of nature. Rights and obligations of citizens in the scope of environmental protection are described. Citizens may take part in the decision-making process in the scope of environmental protection. Basically the use of water is subject to licensing. Endangered wild animals and plants are listed in "The Red Book" and in "The Red List" of Georgia. Any activity relating to the endangered species of wild animals and plants, as well as to deterioration of their habitats are prohibited.

55. The state ensures protection of the environment and, correspondingly, protection of water as its main component in The Water Act of Georgia (16 October 1996). All residents of Georgia are liable to ensure the rational and sustainable use and protection of water. They have to prevent its contamination, pollution and depletion. The dumping of industrial, household and other garbage and wastes in water bodies is prohibited according to this act. The disposal of industrial, household and other effluents into water bodies is permitted on the basis of a license by the Ministry. With the object of protecting the Black Sea and preserving its ecological system, all natural and legal persons (including foreigners) are obliged to take measures for preventing pollution of the sea with waste water from the sources of pollution located on the land. The use of a surface water body for discharging industrial, communal-household, drainage and other waste waters is allowed only under a water use license issued on the basis of the Ministry-approved multipurpose water utilization plans and water management balance-sheet.

56. Environmental Assessment and Review Framework (November 2010, EARF) was established for the Asian Development Bank funded Georgia Urban Services Improvement Investment Program (or the Investment Program). This is prepared to adequately address the ADB Safeguard Policy Statement (2009) requirements and is to be endorsed by the Georgian government. Projects have to be assigned to Categories A, B, and C. General mitigation measures are listed for anticipated impacts. Following criteria shall be followed during investigation of a WWTP:

- distance to inhabited areas and cultural and touristic spots: at least 500 m
- discharge of the WWTP shall not cause any hazards to downstream users
- flooding of the river shall not endanger operation of the WWTP
- Project design shall ensure that sewage is treated at all times to wastewater discharge standards as per the "Technical Regulation of Environmental Protection, 2008 (Decree No. 745), MoEPNR (Annex 5)

III. PROJECT DESCRIPTION

57. A feasibility study was conducted to improve the water supply system in Mestia to meet the design year demand (2040) and the project is formulated for implementation under the proposed ADB funded Investment Program. Works are proposed to be implemented through multi tranche funding. **Table 4** shows the subproject and components selected for implementation under tranche-1, for which, according to ADB requirement, this IEE is conducted. Photographs of project sites are shown in Annex 3.

A. Subproject Components

58. This subproject focuses on creation of a new source based water supply system, and is limited to bulk water supply facilities – source development, treatment facility, transmission mains and storage. Construction of sewerage system, WWTP, and main collector is also included. The descriptions shown in Table 4 are based on the present proposals.

Table 4: Proposed Subproject & Components Water Supply System and Waste Water System

Water Supply System			
Infrastructure	**Function**	**Description**	**Location**
Water intake structure at Mestiachala River	To collect 6,834 m³ per day in 2040	Tyrolean weir, underground gallery to place the intake pipe	Mestiachala, about 6,5 km northeast of town, in a hilly area. Intake structure will be constructed in the river
Bulk flow meters	Monitor water flow at the source	Bulk meter; 300 mm diameter; 1 unit	As above
Transmission main from Mestiachala intake (headworks) to new WTP site	Convey water from head works to WTP for treatment	300 mm Diameter MS pipe over a length of 5,76 km	Alignment traverses mostly hilly areas. Pipeline will be laid along the field roads under ground.
Construction of treatment plant with chlorination facility, clarifiers and filters	Remove turbidity and disinfect water; capacity 6,834 m³/d	Chlorinator	On a government-owned site, situated in the northern outskirts of the town. This is located above the road between the town and water intake. Sludge disposal method will be clarified after final decision on treatment process. Sludge will either be disposed off on the landfill located next to the WTP or on agricultural fields if relevant legal standards are met.
Transmission main from WTP site to new high level reservoir	Convey water from WTP to new reservoir	280 mm diameter MS pipe over a length of app. 1,7 km	Alignment traverses mostly hilly areas on public land, river crossing
Construction of high level reservoir	To provide for water storage	RCC surface reservoirs Capacity:	On a government-owned site, situated in the north-eastern outskirts of the town

Water Supply System			
Infrastructure	**Function**	**Description**	**Location**
		1600 m³	
Extension existing Lanchvali reservoir	To provide for water storage	RCC surface reservoirs Capacity: 1,000 m³	On a government-owned site, situated in the south-western outskirts of the town
Rehabilitation Lanchvali Reservoir	To provide for water storage	RCC surface water reservoir Capacity: 1,000m³	On a government-owned site, situated in the south-western outskirts of the town
New reservoir WTP	To provide for water storage	RCC surface reservoir Capacity: 2,500 m³	On a governmental-owned site, situated in the north-eastern outskirts of the town
Water testing lab	Regular monitoring of water quality	Construction of laboratory facility (50 m^2 building) and provision of equipment	Urban district of Mestia
Transmission main from WTP to Lanchavli Reservoirs	Convey water from WTP to Lanchavli Reservoirs	200 mm Diameter MS pipe over a length of 3.5 km	Will be laid along the existing road in the centre of the town to Lanchavli, private properties required
Sewer system	Convey waste water to WWTP	Main pipes 200 – 400 mm Diameter app. 2 km	In the town in existing streets, river crossings
Waste Water System			
Main sewage trunk	To collect 6,834 m³ per day in 2040	DN 400, length app. 50m	South-eastern outskirts of Mestia on river terrace, left hand side of Mestiachala River
Coarse screen	Screening and removal of coarse material	Width of spacing: 20 mm	Inflow of WWTP
Fine screen	Screening and removal of fine material	Width of spacing: 6 mm	Inflow of WWTP
Inlet Pumping Station	Pumping of waste water	2040: 174m³/h	Inflow of WWTP
Aerated Grit chamber	Sedimentation of grit (sand, gravel, coarse material)	2m x 15m	After screening
Aeration tank	Activated sludge, de-Nitrification, phosphorus removal, diffused air system	45m x 10m x 6m	After grit chamber
Final Sedimentation Tank	Sedimentation of fine material, return sludge to	32m x 5m x 3,80m	After aeration tank

Water Supply System			
Infrastructure	**Function**	**Description**	**Location**
	reactor basin		
Sludge storage tank (circular tank)	storage of sludge for de-watering	diameter: 8m depth: 3.47	after final sedimentation tank
dewatering unit			after sludge storage
Outflow	Discharge of treated waste water into Mestiachala River	DN 400	After WWTP

59. The wastewater treatment plant (WWTP) will be designed according to DWA Standards. The application of this standard will result in a very robust treatment process, so that all required effluent criteria can be met even in case of chock loads.

60. All tanks will be constructed as compact concrete structures, so the space requirements will be much reduced compared with more nature orientated technologies like ponds or constructed wetlands. This compact design also results in a significant reduction of odour emissions.

61. Like for all wastewater treatment plants (WWTPs) in the project towns with a capacity up to 30,000 PE for Mestia the activated sludge technology with an extended aeration is proposed. This process basically includes the following treatment steps:

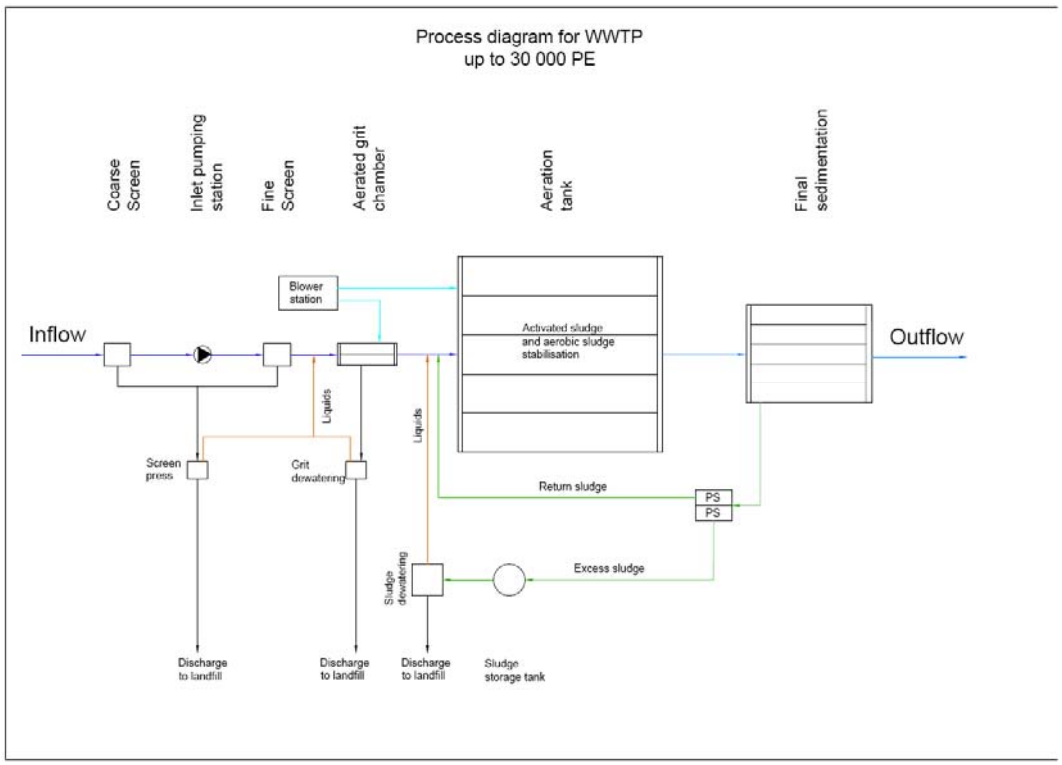
(i) Screens
(ii) Aerated grit chambers
(iii) Aeration tanks
(iv) Final sedimentation tanks
(v) Sludge storage tank
(vi) Sludge dewatering

62. The activated sludge process is a very common treatment method and has been implemented many times all over the world. In the special case of the extended aeration, the aeration tanks are dimensioned in such a way, that the sludge is stabilized simultaneously in the wastewater treatment process. Therefore no additional process steps have to be implemented for the separate stabilization of the sludge. This makes the treatment process very simple and easy to operate.

63. According to the experiences of the Consultant, the technology of extended aeration is the most economic solution up to a capacity of approximately 30,000 to 40,000 PE, in case realistic prices for electrical energy will be applied.

64. The following figure exemplifies the treatment process.

Figure 1: Treatment process for proposed WWTP for Mestia



65. Outflow of the WWTP goes to Mestiachala River.

66. Table 4 provides an overview over the main components of the WWTP. The descriptions are based on current design stage.

67. The main sewage collector will be laid within the access road to the WWTP. It has a length of approximately 50 m and will be built in at a depth of approximately 2.2 m. The Main sewage collector is indicated in Fig. 2. Cross section of the trench for the main sewage collector will be as follows.

Figure 2: Cross section of main sewage collector

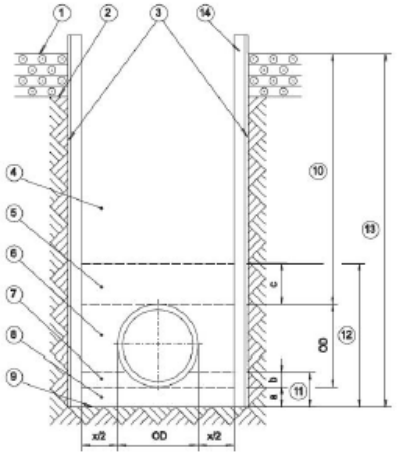
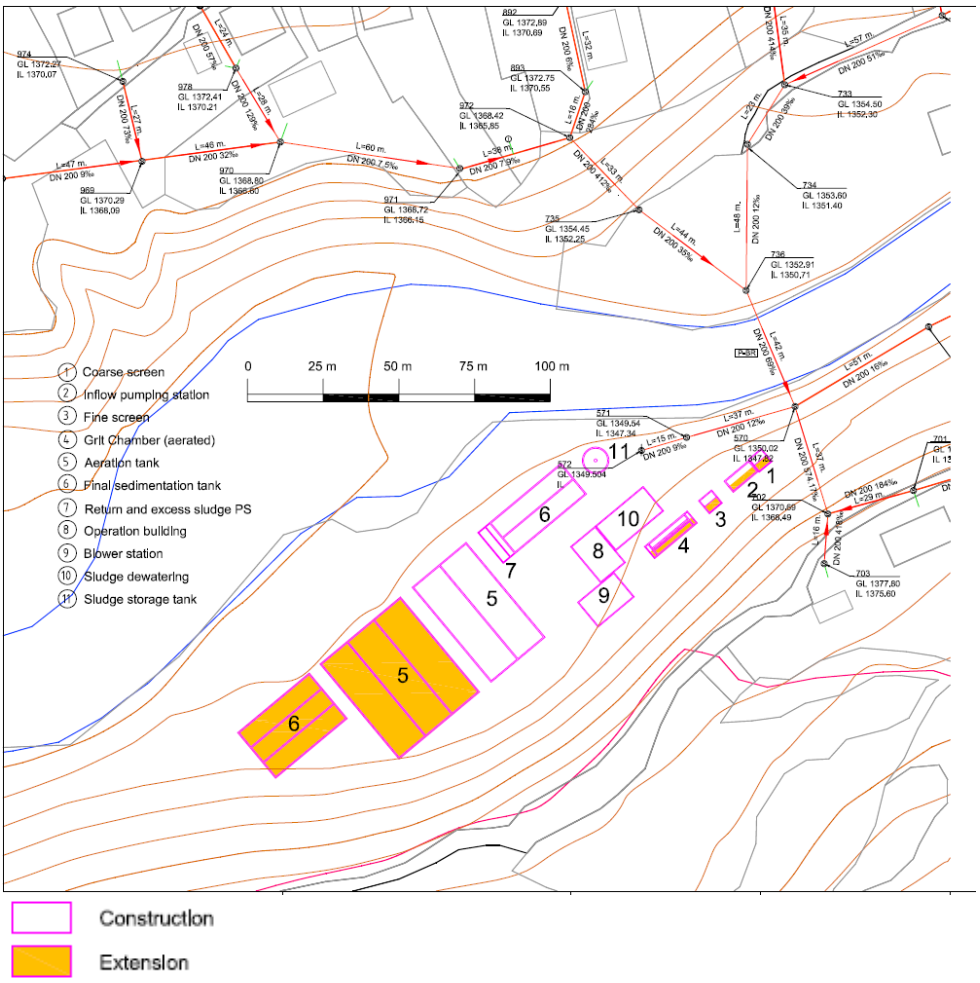


Figure 3: Layout Plan from Waste Water Treatment Plant and Sewage Main Collector



B. Construction Activities

68. There are four main elements in water supply component of the subproject: construction of intake structure; laying of transmission lines; construction of water treatment plant/disinfection facility, and construction of reservoir. Construction practices of these works are briefed below:

69. *Construction of Intake.* This will involve construction of a Tyrolean weir to collect the water from stream (exact construction details are however not available at this stage). A fully perforated pipe (with one end closed) will be placed in the trench and filter material (locally available gravel and aggregate) will be filled in the space between trench and pipe and on the top of the pipe. At the surface, an iron mesh will be provided over the top of the refilled trench to protect the loosely grained filter material. Transmission pipe will be connected to open end of the pipe. The excavated soil will be used for strengthening banks. Construction in the river bed will be taken up in two stages; trench excavation, fixing perforated pipe, filling filter media and placing the mesh of the top will conducted in the half the width of the stream, during which flow will continue from the remaining portion. Work in the remaining portion will be taken up subsequently. Work will be taken up during the low flow period. Construction will be done manually; except perforated pipe, all material (gravel, sand and aggregate) will be sourced locally.

70. *Construction of Water Treatment Plant.* Water treatment plant will involve construction of filter unit with clarifiers and chlorination facility, both of which will be located in a building. Filter unit consists of large rectangular tanks of adequate size filled with filter media (graded sand), pipes (inlet, outlet and backwash pipes) and fixtures. The chlorination facility will be a small unit to administer the chlorine into filtered water. Construction of the water treatment plant will be similar to building construction – excavation for foundation fixing of reinforcement and pouring of concrete mixed into voids to form foundation and columns, over which RCC roof will be laid in the similar manner. Walls will be constructed with locally available building stones/cement blocks. Rectangular RCC tanks for filter beds will be constructed similar to any tank/reservoir. Concrete will be mixed in mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity of earthwork or surplus soil generated from this work will be available only after design of the units; however, this quantity will be insignificant and can be used within the site to level the ground surface.

71. *Construction of Reservoir.* A new on-ground reservoir will be constructed in the premises of Water Treatment Plant. This work will involve excavation for foundations, placing of reinforcement rods in wooden shutters and pouring of concrete in voids to form foundations, floor, walls and roof. Cement mortar plaster will be applied to walls (outside and inside), floor and roof for smooth finish. Inlet and outlet pipes and fixers/valves will be installed. Excavation for foundation will be done by backhoe digger or manually, where required. Concrete will be mixed in concrete mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity waste/surplus soil generated from this activity will be insignificant and can be used within the site to level the ground surface.

72. *Laying of Transmission Mains*. A new transmission main (DN 300) will be laid from Mestiachala headworks to WTP site. The pipeline will follow the existing road. It will leave the road and traverse open land to reach the future WTP. One river crossing is required. The pipeline from WTP to new high level (DN 280) reservoir will cross pastures, open land, and a feeder river of Mestiachala. The transmission main from new high level reservoir to Lanchavli reservoirs is DN 315 and DN 225. A pipeline bridge will be required in one case. Tree losses will be unavoidable since the river valley is covered by forest. Most parts of the

pipeline will be laid along the road and through the town. Trenches will be dug using a backhoe digger (in the town), supplemented by manual digging.

73. Excavated soil will be placed alongside, and the pipes will be placed in the trench manually. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. The trench will be refilled with excavated soil and sand and compacted manually. The depth of trench will be 1m – 4m depending on topographical conditions. Minimum width of the trench will be between 0,8 and 0,9m. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material.

74. Laying of Sewer Lines including Main Sewer Trunk. Sewer lines (DN 200 – 400) will be laid along existing streets in the town. Several Pipe bridges will be required. The depth of the trench will be between 1m and 1,75m. Minimum width of the trench will be between 0.8m and 0.9m. The trench will be refilled with excavated soil and sand and compacted manually.

75. Source of construction materials. In Mestia, sand is sourced from River Mestiachala and aggregate is sourced from licensed crushers. Construction waste/debris is normally used for levelling low lying areas in the town. No additional IEE will be required as material extraction will be limited to licensed sites and facilities only.

76. The WWTP will be built in the southern suburbs of the town on governmental owned land.

C. Operation of Improved Water Supply System and Waste Water System

77. Utilizing the hilly topography, gravity based water supply system is designed for Mestia. A Pumping Station is required at the WTP to convey water to the new reservoir northeast of the town. This system involves – abstraction of water from Mestiachala, transmission to WTP (treatment and disinfection by chlorine) from where water is pumped to storage reservoirs. From reservoirs, water will be supplied into distribution system. Operation will also involve laboratory analysis of water supplies. This system will supply a maximum of 6,834 m³ of water per day.

78. Treatment will consist of sand filtration, in which water will be passed through a sand bed, and, application of chlorine into the water supplies. Average dose of chlorine will be about 5 mg/l; maximum daily usage of chlorine will be 32 kg. A solid powder solution containing chlorine will be used as disinfectant (most commonly used is Sodium Hypochlorite, NaClO, in white powder form), which contains about 25% of chlorine.

79. Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being used breaks are very rare, and leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way the pipe was laid, by locating the leaking section.

80. Waste water system will require repair and maintenance activities like cleaning inspection. Repair work will be conducted in the same way the pipe was laid.

81. The WWTP will require inspection and maintenance activities like physical and chemical analyses and disposal of stabilized sludge and compacted waste on a waste disposal site.

IV. IMPACTS ON THE PHYSICAL & BIOLOGICAL ENVIRONMENT

A. Introduction

82. Mestia is situated in Samegrelo-Zemo Svaneti Region of Northeast Georgia, about 430 km from Tbilisi. It borders Russia in the north. Geographically located at 42o42'6" and North latitude 43o4'30", Mestia is a hill town, developed near the confluence of Mestiachala and Mukhura Rivers. Altitude ranges from 1,200 m to 3,000 m above the mean sea level (MSL), with town centre at 1,450 m above the MSL.

83. The following sections evaluate the impacts on physical and biological environment due to the proposed project. Each subsection first describes the baseline profile followed by impact identification and assessment during construction and operation. Mitigation measures are also discussed in conjunction with the impacts.

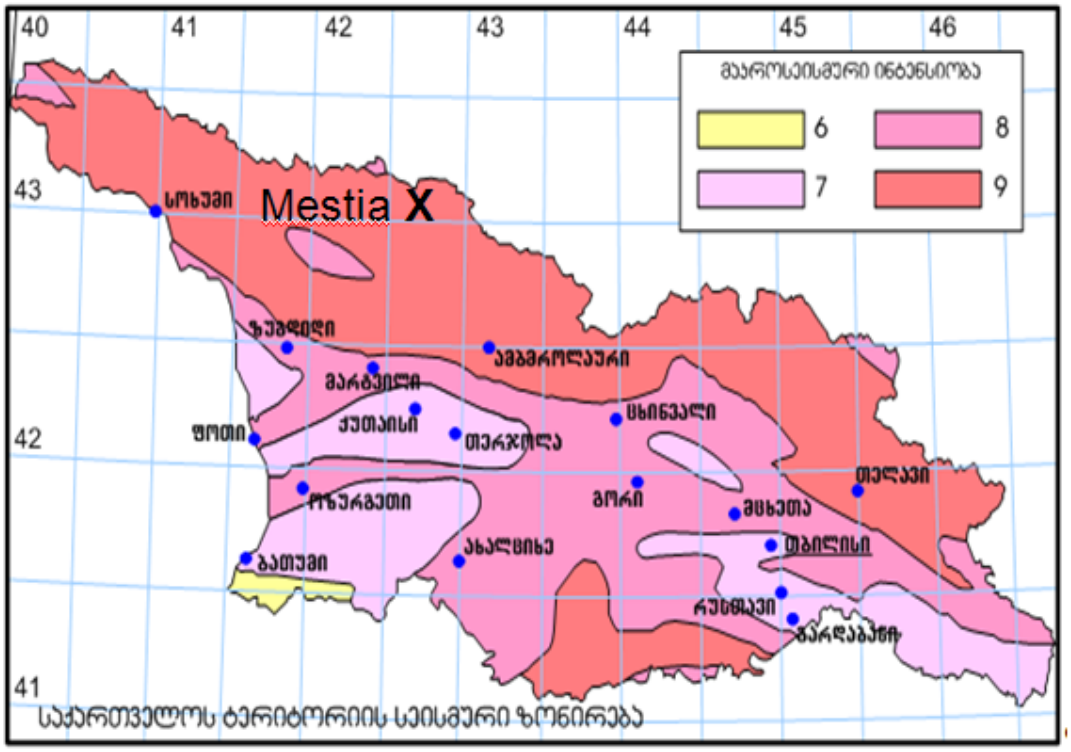
B. Topography, Geology & Soils

1. Baseline Conditions

84. Topography. Despite its small area, Georgia presents one of the most varied topographies within its geographical boundaries. Georgia lies mostly in the Caucasus Mountains, and its northern boundary is partly defined by the Greater Caucasus range. The Lesser Caucasus range runs parallel to the Turkish and Armenian borders and the Surami and Imereti ranges connect the Greater Caucasus and the Lesser Caucasus, create natural barriers in the region. Greater Caucasus Range borders Mestia Municipality in the North-East; Svaneti-Abkhazia range in the west and Svaneti Ridge in the South. Elevation of the municipal territory ranges from 1,400 m to 3,600 m above mean sea level, and forms upper part of Enguri River Basin.

85. Geology, Project area structurally belongs to central Caucasus unit. This section morphologically represents high-mountainous, locked depression (Zemo Svaneti depression), surrounded by southern slopes of Caucasus's main Ridge and Svaneti Ridge. Zemo Svaneti depression area tectonically belongs to Mestia-Tianeti and Chkhalta-Laili shelled zones of the Caucasus folded system. These tectonic areas are characterized by mid- Jurassic Period slates, and upper Jurassic and lower Cretaceous Period carbonate flysch and mid Jurassic volcanogenic sedimentary rocks. All these rocks are tectonically intensively dislocated and have produced many significant folded structures. According to seismic zoning map, Georgia is classified into Zone 6 to Zone 9 (in increasing order of seismic intensity, Map 4) and Mestia falls under Zone 9 (very high seismic intensity zone). There has been no history of major earthquakes in Mestia, however, a powerful earthquake (7.0 magnitude) occurred in 1991 in neighbouring Racha province. Much of the damage associated with this earthquake was caused by landslides.

Map 4: Seismic Zones of Georgia



86. *Soil.* The underlying rock strata as presented above under the conditions of relevant relief and with the surface inclination less than 450 are covered from with the Quaternary slope, alluvial and glacier deposits. The Pleistocene glacier deposits are quite significantly spread in and around Mestia. Mestiachala River and its tributaries and upper line of the gorges are structured with these deposits. Almost all the settlements in and nearby project area are located on the upper morainal sediments. The same type of glacial sediments are widely maintained on the slopes of the rivers/gorges at 50-500 m relative height from the current riverbed where several stages of Pleistocene freezing stages are observable. The depth of soil in the project area ranges from 1.5-2 m, below which the hard stratum lies. Forest Chernozem soils are present in the hilly zone. Mountain-meadow soils are developed above 1600 m MSL.

2. Impacts During Construction

87. During the construction, impacts on topography and geology are mainly to due to invasive nature of excavation activities.

88. Excavation works for reservoir and water treatment plant will be minor and confined to the project site, and therefore not expected to have any impacts on topography, soil and geology. The trench excavation for transmission mains will be 5.8 km long. This may affect the surface water drainage during rains (these impacts are discussed in surface water).

89. Works do not involve deep excavations. Due to hilly region, hard rock is available within a depth of 1.5-2 m and foundations will be laid directly on the hard rock, thus this work do not involve cutting of rocks. The hilly area through which the alignment runs shows rocky outcrops. At these locations, alignment will either be shifted or pipeline will be laid on the ground to avoid cutting of rocks.

90. Since the project is located in very high seismic intensity zone, appropriate precautions have to be included in the structural design of facilities:

(i) Apply design and construction norms of Zone-9 (MSK-64 scale) according to Government of Georgia “Construction in Seismological Regions”
(ii) Select appropriate pipe material and design for transmission lines according to seismic intensity of project area

91. Excavation for main collector comprises material excavation, pipe laying and backfill of material including compaction. Material will be stored temporary alongside the trench and build in again after pipe laying. Therefore impacts associated with earthworks for trench laying are of temporary nature. Excavated soil will be placed alongside the trench, and the pipes will be placed in the trench manually. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. A sand layer of 30 cm thickness will be laid on top of the pipe, after which the trench will be refilled with excavated material and compacted manually. The size of trench will be 2.2 m deep and 1.15 m wide. The excavation is expected to generate approximately 135 m³ surplus material (2.2m x 1.15m x 50m = 126.5 m³). After construction, part of trench will be occupied by pipe and sand layer and trench is refilled with the excavated material. Considering a trench width of 2.2 m and a depth of the sand layer of 0.75 m (0.3 m above pipe) in total 82.5 m³ (2.2 m x 0.75 m x 50m) of the excavated material needs to be substituted by sand. This 82.5 m³ of surplus material will be used as embankment fill as far as possible.

92. Construction work for WWTP and WTP is not expected to generate significant quantities of surplus material. The surplus soil from foundation work will be utilized at the same site for raising the ground level and embankment building. The trench excavation work for the main collector will generate 82.5 m³ surplus soil, which needs to be disposed properly without causing further physical impacts on topography or soil at the point of disposal. This will require:

- Utilizing surplus soil for beneficial purposes such as in construction or to raise the ground-level of low lying sites

93. The excavation and refilling works will disturb the soil characters at the sites. The excavation will lead to disturbance and loss of fertile top soil. Therefore the Contractor should implement the following measures:

94. Top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top. Depth for foundations for treatment plant component needs to be determined with the detailed design being further developed. According to the geotechnical investigations that were conducted for the site of the WWTP alluvial material prevail, represented by boulders, cobbles and gravel, with sand and silty sand filling. Depth of foundations for the WWTP will most probably be very shallow and only minor amounts of excavated material will result.

95. Along construction site of the WWTP there is active erosion ongoing alongside the river bank at a section of about 100 – 130 m. To protect WWTP site against future erosion processes suitable protection measures (dykes, bank protection walls, gabions) need to be designed for construction.

96. There is no risk for land slides since construction works for the transmission main between the WTP and the reservoirs will be carried out mostly on the upper plateau above the town. Trenches will be compacted properly.

97. The excavation work will also tend to loosen the top soil, which may lead to soil erosion due to winds and rains. As project area is situated in a hilly region, the risk of erosion is comparatively high. Removal of vegetation and tree cover will also lead to erosion. Therefore the contractor should:

(i) No trees shall be removed on the slopes; clearing of shrub, bushes and grass shall be limited to actual construction area only; no clearance is allowed for activities such as material/waste storage, concrete mixing, etc.
(ii) Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer
(iii) In the steep slopes, local grass species shall be planted on the refilled trenches

98. **Source of construction materials.** Due to Initial Environmental Examination conducted for the water supply components of the subproject in Mestia sand is sourced from River Mestiachala and aggregate is sourced from licensed crushers. In case that material demand exceeds supply it needs to be transported.

99. **Contractors yard:** The establishment of contractor's work camp may cause adverse impacts if various aspects such as liquid and solid waste management, equipment maintenance, materials' storage, and provision of safe drinking water are not addressed properly. The site for the work yard will be selected by the contractor.

100. To ensure that potentially resulting impacts are kept at a minimum the contractor will be required to prepare the following plans or method statements:

(i) Layout plan of the work camp including a description of all precautionary measures proposed to avoid potential adverse impacts on the receiving environment (surface and ground water, soils, ambient air, human settlement);
(ii) Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses or groundwater;
(iii) Waste management plan covering the provision of garbage bins, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with applicable national regulations; and
(iv) Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from Mestiachala River. Storage facilities for fuels and chemicals will be located at a distance to Mestiachala River. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination.
(v) These plans will be approved by the Engineer prior to beginning of construction activities.

101. Prior to establishment of the work camp(s) the contractor shall conduct consultations with local authorities to identify sources of potable water for the workforce that will not compete with the needs of the local population. Potable water for the workforce shall comply with the national quality standards. Construction water may be taken from Mestiachala River.

3. Impacts During Operation

102. Regular operation of water supply and the waste water system including WWTP will be within the constructed facilities and therefore no impacts envisaged.

103. The main requirement for maintenance of the water supply and sewage infrastructure will be for the detection and repair of leaks and for cleaning and inspection. Repairs will be conducted in essentially the same way as the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary. This activity however is not expected to generate any waste soil nor will have any impacts.

C. Surface Water and Groundwater

1. Baseline Conditions

104. *Surface Water.* Georgia is rich in water resources; there are in all 26,060 rivers with a total length of ~ 59,000 km. Besides, there are many thermal and mineral water springs, lakes and man-made water reservoirs. These however are distributed unequally, with major concentration in the western part of the country. Nearly all rivers of East Georgia flow into the Caspian Sea while and the rivers in the west join the Black Sea. These two basins are separated by Likhi Ridge. The project area, Mestia, is situated in the upper reaches of Enguri River Basin. Mestiachala and Mukhura, two of four main tributaries of Enguri River, flow through Mestia Town.

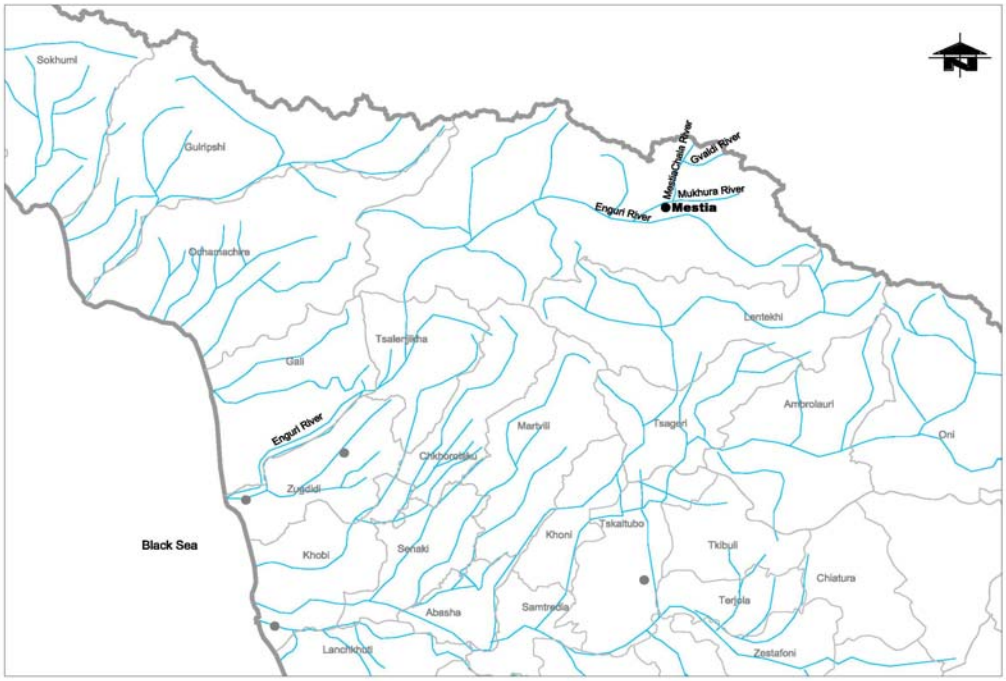
105. Originating in Greater Caucuses Range and flowing into Black Sea in the west, Enguri is one of the biggest rivers in Georgia (Map 5). It traverses a distance of 201 km, during which it is joined by 232 small and large streams/rivers. River flows mostly through hilly region, except last leg of for about 80 km. Due to steep slopes, river is deep, flow is turbulent and carries heavy loads of silt, which accumulates in Enguri Dam on the foothills near Dzvari Town. Water flow after the dam is low.

106. Mestia Town is developed in the upper reaches of Enguri River Basin, near the confluence of Mukhura and Mestiachala, two important tributaries of River Enguri. While the rivers flow through valley/gorge and low lands, town is mostly developed on hill slopes. Both the rivers originate in Glaciers in Causes Ranges, while Mukura originates in eastern upper region of Mestia, Mestiachala originates in the northern side. The combined river, Mukhura, flows down further and meets Enguri at 20 km south-west of the town.

107. Mestiachala originates from Chalaadi Glacier and flow is supplemented by snow and rainfall. It experiences floods during the warm seasons and low flow in colder periods. In July-September flow is very high, caused both by snow melting and the rainfall. Water quality is very good, except turbidity due to erosion from upper hilly areas.

108. Gvaldi River originates from Mukrvam Glacier in the Caucuses Range in the north-eastern upper reaches of Mestia Town. Gvaldi is a small river, and traverse a distance of about 8 km before it joins Mestiachala just upstream of Mestia Town River is glacier fed, and therefore experiences high flow during the warm seasons and low flow in colder periods. Flow measurement of Gvaldi conducted in mid September, 2010 indicated a flow of 0.5 m^3 per sec. Flow likely to be higher in peak summer (a rough flow estimate in July-10 indicated 1 m^3 per sec) and low during winter (December/January). River water in summer (June-September) is used for irrigation in the nearby pasture lands. Water is abstracted from upper reaches for irrigation of nearby fields by gravity and conveyed by earthen channels. Cattle and wild animals use Gvaldi water for drinking. As per the local information, river has changed its course in the past.

Map 5: River Network in Western Georgia



109. Table 5 shows the water quality of Gvaldi in comparison with the national surface and drinking water norms. All the parameters of Gvaldi River water are within the permissible limits of surface water norms.[2] In comparison with drinking water norms3, following parameters exceed the limits: turbidity, total coli form and E-coli. While turbidity is due to nature of river course, presence of bacteriological pollution is likely due to cattle and wildlife in the catchment. There are no pollution sources in the River basin. Currently no chemical analysis is available from Mestiachala River. The water quality of this river at the future intake is expected to be as good as the water quality of Gvaldi River since Mestiachala is fed by rain water and melted glacier water. There is no evidence for any further contamination.

Table 5: Water Quality of Gvaldi

S. No	Parameters	Gvaldi Water at Headworks Site	Surface Water Norms for Domestic Use	Drinking Water Norms
1	Colour	10	-	15
2	Odour	0	-	2
3	Turbidity	25	-	3.5
4	Sulphate mg/l	51.04	500	250
5	Chlorides mg/l	5.04	350.0	250
6	Calcium mg/l	20.04	-	140
7	Magnesium mg/l	5.30	-	85
8	Sodium mg/l	9.80	-	200
9	Zinc mg/l	0.019	1.0	3.0
10	Iron, total mg/l	0.18	0.3	0.3
11	Total coli form ∑/100 ml	60	-	Nil
12	E-coli ∑/100 ml	30	-	Nil
13	pH	7.0	-	6-9

[2] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG

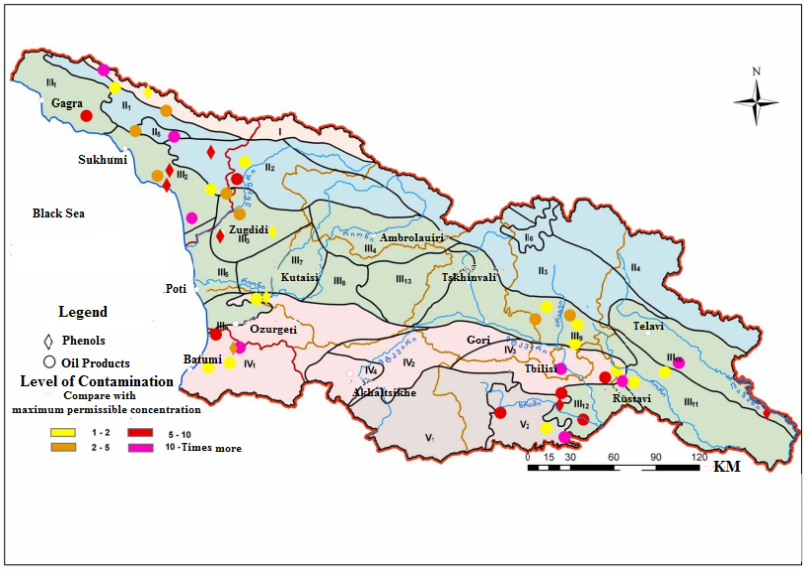
[3] Technical Regulation on Drinking Water, 2007, (Decree №349/N), Ministry of Labor, Health and Social Welfare, GoG

S. No	Parameters	Gvaldi Water at Headworks Site	Surface Water Norms for Domestic Use	Drinking Water Norms
14	Total mineralization mg/l	205	-	1000
16	Barium mg/l	0.03	0.1	0.7
18	Boron mg/l	0.1	0.5	0.5
19	Arsenic mg/l	0.0004	0.05	0.01
20	Mercury mg/l	ND	0.0005	0.006
21	Cadmium mg/l	ND	0.001	0.003
22	Manganese mg/l	ND	0.1	0.4
23	Nickel mg/l	ND	0.1	0.07
24	Nitrate mg/l	ND	45.0	50
25	Nitrite mg/l	ND	3.3	0.2
26	Selenium mg/l	0.0003	0.001	0.01
27	Copper mg/l	0.003	1.0	2.0
28	Aluminium mg/l	0.01	0.5	0.1
29	Lead mg/l	ND	0.03	0.01
30	Fluoride mg/l	0.1	0.05	0.7
31	Chromium mg/l	0.015	0.1	0.05
32	Antimony	ND	-	
33	Cyanide	ND	0.1	0.07
34	Pesticides	ND	-	0.05

Source: Sampling Survey, September 2010

110. *Groundwater.* Based on the groundwater characteristics, Georgia is divided into five hydro-geological zones, which are further defined into sub-zones/districts. Project area, Mestia, is in Zone – II (Zone of pressurized groundwater systems of south slope of the main Caucuses) and in hydro-geological district- III12 (Svatanian crack pressurized water systems). Water bearing strata is of contemporary alluvial deposits characterized by free groundwater table declined along the general flow of the rivers. The water table depths vary from 2.0 m to 5.0 m. At some locations near the riverbeds and groves, groundwater is very shallow depths (0.3 m). The aquifer is characterized by rich water resources, with groundwater springs yielding between 0.1-3.5 l/s. The aquifer is mainly fed from rivers and precipitation. Despite the aquifer is rich with water, its practical water use is limited. No information on groundwater quality is available.

Map 6: Hydro-geological Zones



2. Impacts and Mitigation Measures during Construction

111. The intake structure for abstraction of water will be constructed on the bed of Mestiachala River, which will directly pollute the river water. Contractor shall implement the following:

(i) Water flow shall not be interrupted completely/diverted; work shall be conducted into one-side of the stream, and water be allowed to flow on the other side
(ii) Enclose the construction area (may be with sand bags) so that water do not enter into work site
(iii) Water collected in the trench shall be disposed safely so that silt water do not get mixed in the river water

112. The above measures have potential to mitigate the impact to a greater extent. Nevertheless, there will still be some portion of silt/soil mixing in the water since the work is conducted in the bed of the river. This marginal increase (for a short period of less than a week) however can be ignored, if this is not conducted in the fish breeding season.

113. Excavation can affect local drainage patterns if surface- or groundwater- is affected as trenches are being dug.

114. During the rains, surface runoff can be collected in the trenches. Also, the silt-laden run-off from the construction areas may pollute the surface water by increasing the turbidity. Therefore the Contractor will:

(i) Avoid scheduling of excavation work during heavy rain
(ii) Complete the excavation and foundation during dry weather
(iii) In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil,
(iv) Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site
(v) Ensure that drains are not blocked with excavated soil

115. Ground water table is deeper than the excavation depths and therefore it is expected that construction will not interfere.

116. Construction of the new WWTP will involve encroachment of approximately 3.0 ha of land, most of which will be sealed. This results in reduced water infiltration rates and reduced rates of ground water regeneration. In total an area of 0.7 ha will be sealed.

117. Potential impact also arises from implementation and maintenance of contractors' yard, transport, maintenance of vehicles and handling and storage of lubricants and fuel. The required provisions for contractor's yard are described in the chapter on impacts and mitigation measures concerning topography, geology and soils.

118. If not properly compacted the backfilled trench may affect the surface water drainage during rains. To avoid this there is need for qualified site supervision.

3. Impacts and Mitigation Measures during Operation

119. During the operation stage no effects on groundwater is envisaged. However as this is a surface water based water supply system, the effects due to water abstraction from Mestiachala needs to be assessed. Also, the likely pollution of source water needs to be reviewed.

120. Generally the main risk to the physical environment of operating an improved water supply system is that of increased abstraction, which may deplete the water resource. Unsustainable reduction may affect downstream uses and may have ecological impacts (such as on flora, fauna and inadequate groundwater recharge). The lowest discharge in January every 20 years is 210 l/s at the future water intake. The maximum daily water demand for Mestia is 79l/s in 2040. A minimum downstream flow of 70l/s (33%) seems to be ensured since 17 l/s from existing intake (Tsrniashi source) may be added in the dry season.

121. Due to the following reasons, these impacts are negligible in the present project:

(i) Mestiachala is a perennial river; flow is mainly glacier water, supplemented by rain and snow
(ii) The downstream use for irrigation is limited to summer, during which river carries heavy flow

122. However, lack of flow data, is a major concern. Although local people and staff of UWSCG indicate that there is adequate flow in the river even during winter months, it is necessary that this is established with flow measurement data. Adequate flow is required for both water supply and as well as for minimum environmental discharge downstream. The following measures shall be integrated into the project design:

(i) Conduct comprehensive flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability
(ii) A minimum ecological flow (1/3rd of total flow) shall be released downstream all times; this means that the flow in the river shall not be less than 0.07 m³/s any time
(iii) In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow, and remaining demand shall be met by existing intake (17l/s).

123. Degradation of source water quality is another risk in operation of water supply system that may have impacts on public health. In the present case, the quality of water is good. Headworks site is located in hills, with no pollution sources or anthropogenic activities upstream, the source can be considered safe from pollution risk. Following source protection is however required to avoid contamination from cattle/wildlife movement just upstream of the headworks source:

- Fence the river banks up to a few meters (10 m above and 10 m below headworks site) to avoid any entry of animals (wild or cattle)

124. An important aspect of increased water supply is that of increased sewage generation, which needs to be treated and disposed properly without causing any impacts. In case of inadequate facilities, disposal of untreated sewage into rivers/streams is common and therefore it offers a potential impact to surface and groundwater.

125. At present, there is no proper sewerage system in Mestia. Although there is a system covering about 25% town population, there is no treatment facility and untreated sewage is disposed into Mukhura on the downstream side of the town. Households not serviced by

sewerage network either depend on septic tanks/pit latrines or dispose directly into Mestiachala or Mukhura Rivers

126. With the current project, water supply will be increased further. The increase in water supply will increase the sewage generation.

127. Without any proper sewage collection, treatment and disposal system, the increased sewage will have negative impacts on receiving water bodies It is therefore necessary that:

(i) Existing sewerage system is to be replaced by a new system to cover 100% of the population
(ii) Sewage system must be connected to a WWTP, which can treat the sewage to European standards and dispose safely
(iii) The above measures will be implemented along with the water supply system improvement

128. Impacts during operation phase of the WWTP refer to discharge of treated water into Mestiachala River which will result in positive impact, since situation will improve as compared to present situation and to the disposal of waste and sewage sludge.

129. An improved water supply system will cause an increased waste water flow. Waste water will be collected in a sewage system and treated in a modern WWTP. During operation stage no effects on surface water and ground water is envisaged. Basically water quality of Mestiachala River will be improved essentially due to long-term and sustainable waste water treatment. The effluent criteria for the WWTP are summarized in the following table:

Table 6: Effluent Criteria for Future WWTP in Mestia

	Parameters	EU effluent standard	effluent standard according to Georgian law	proposed effluent criteria consultant
Discharge Standard	BOD_5	25 mg/l O_2 (without nitrification)	25 mg/l O_2 (without nitrification)	25 mg/l
	COD	90 mg/l	125 mg/l	90 mg/l
	Suspended Solids	35 mg/l	30 mg/l	30 mg/l
Additional Discharge Standards for Discharge into sensitive Water Bodies	Total - N	15 mg/l N (10,000 to 100,000 PE)	15 mg/l N (10,000 to 100,000 PE)	15 mg/l N (10,000 to 100,000 PE)
		10 mg/l N (> 100,000 PE)	10 mg/l N (> 100,000 PE)	10 mg/l N (> 100,000 PE)
	Total - P	2 mg/l P (10,000 to 100,000 PE)	2 mg/l P (10,000 to 100,000 PE)	2 mg/l P (10,000 to 100,000 PE)
		1 mg/l P (> 100,000 PE)	1 mg/l P (> 100,000 PE)	1 mg/l P (> 100,000 PE)

130. The WWTP will be designed for up to 30,000 PE. The design standards will be adapted to European and Georgian regulations. The effluents of the future WWTP will

discharge via recipients (Mestiachala River, Enguri River) into the Black Sea. Basically the Black Sea should be considered as a sensitive water body since the water exchange with the connecting Mediterranean Sea and the Atlantic Ocean is very low and eutrophication especially of coastal waters cannot be excluded. Construction of the waste water network and treatment of waste water will improve extensively the water quality of Mestiachala River compared to the existing situation.

131. Regular operation of main sewage collector will not affect ground water.

132. Impacts may occur in case of leakages. Therefore main requirement for maintenance of the main sewage collector will be for the detection and repair of leaks. Repairs will be conducted in essentially the same way that the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

133. Disposal of Waste, Grit Chamber sediments, and Sewage Sludge

134. The following wastes should be disposed on a waste disposal site:

(i) compacted waste collected from the screen and from the grit chamber
(ii) Sand and gravel from the grit chamber
(iii) compacted and dewatered sludge from the sedimentation tank

135. Sludge can also be burnt to produce electric power. Mechanical composting is also possible. It is required that sludge should be used in such a way that the quality of surface and groundwater is not impaired. As it is unlikely that the sludge contain any heavy metals, land disposal is also an option.

D. Climate & Air Quality

1. Baseline Profile

136. *Air Quality*. Ambient air quality monitoring is conducted at only seven locations in Georgia. As there are no major air polluting sources like industries, none of these are located in Mestia, Although traffic is less, roads in town are in very bad condition, and vehicle movement tends to produce a lot of dust.

137. *Climate*. Situated in the Caucuses Range in the Zemo-Svaneti depression, climate of Mestia is humid and surrounded by mountains, it is influenced mostly by air masses coming from the Black Sea throughout the year. Long winters and short summers are characteristic of this region. Normally winter starts in the beginning of October and lasts till June. Summer is from June to September.

138. Average annual temperature in Mestia is +5.8^{o} C. Temperature of the coldest months (January, February, March and December) fluctuates from -1.4 ^{o}C to 2.7 ^{o}C (December) to -4.9 ^{o}C to 5 ^{o}C (January and February). The temperature during the warmest months (July, August and September) is in the range of 10.3 ^{o}C to 13.1 ^{o}C. Absolute minimum temperature is -35 ^{o}C, absolute maximum 35 ^{o}C, while average minimum temperature is -0.3 ^{o}C, and average maximum is +12.9 ^{o}C.

139. Relative humidity is generally low in colder months (lowest 23%), and for the hottest months 45%. Annual average rainfall is 970 mm. The rainfall increases with the elevation as one move upwards on hills. Average annual precipitation days are 168, while snowy days are 160. Average annual wind speed is 0.9 m/s; in winters it ranges from 0.2 m/s to 1.4 m/s while in summer it ranges from 0.8 m/s to 2.0 m/s.

2. Impacts during Construction

140. The activities that could cause impact on ambient air quality are (i) dust generation from construction activity and (ii) air emission from construction equipment (like excavators, crane) and material and waste transport vehicles.

141. There is a lot of potential for the creation of dust, from the excavation of dry soil and its storage, and levelling on the ground. As stated earlier, the construction activity does not involve significant quantities of earth work. However, some of the works will be conducted in the town (clear water transmission main will run through middle of the town for about 2 km length). Also Mestia is a tourist place and there are trekking routes near the project sites. Action will therefore be needed to reduce impacts on air quality at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

(i) Cover or damp down by water spray on the excavated mounds of soil to control dust generation;
(ii) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
(iii) Bring the material (aggregate and sand) as and when required;
(iv) Ensure speedy completion of work and proper site clearance after completion
(v) Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material
(vi) Use tarpaulins to cover loose material that is transported to and from the site by truck
(vii) Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
(viii) Clean wheels and undercarriage of haul trucks prior to leaving construction site
(ix) Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing

142. Various types of equipment and vehicles would be required for the construction activity. The exhaust emissions from these may degrade the ambient air quality. Considering the scale of work and use of equipment, impact will be insignificant, and will be beyond the scope of this project. However, to enhance the subproject benefits, the Contractor should implement the following:

(i) Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained
(ii) Ensure that all equipment & vehicles confirm to emission and noise norms

3. Impacts during Operation

143. Impacts on air quality during operation only refer to the WWTP. The odour emission components are the inflow, the screens and the aerated grit chambers. As mitigation measures these components will be covered.

E. Biological Environment

1. Baseline Profile

144. About 40 percent of total geographical area of the country accounts for forests. Average density of forests is 163 m^2 per ha. 97 percent of forests situated on mountain, the rest 3% are low-lying and flood plain forests in Kolhida Region and in the Western Georgia.

145. *Flora*. No information/data available on the extent of forest areas in Mestia. However except habilitation and agricultural lands on foot hills and flat land parcels on hills (which are converted long back as pastures), entire area is covered with various type of forests. The region which lies below 1,800 m MSL is covered by mixed and coniferous forests **(Map 7)**. The forest zone is made up of tree species such as spruce, fir, beech, oak, and hornbeam. Other species that are less common but may still be found in some areas include chestnut, birch, maple, pine and box. The zone which extends from 1,800 meters to about 3,000 m consists of alpine meadows and grasslands. Eternal snows and glaciers take over in areas that are over 3,000 meters above sea level. Overall, the region is covered with coniferous forest lower ranges, above which lies alpine belt in mid range above which lies the zone of eternal snow and glaciers. Main tree species in the area are spruce, fir, beech, oak, and hornbeam. There are a variety of flowering plant species in and around the headworks site. Species include *Campanula latifolia* (Bell flower family), *Helleborus caucasicus* (Caucasian Hellebore), and *Umbelliferae* (Apiaceae) – Parsley Family. Common wild animals in the forests around Mestia include hare, wolf, fox, and bear.

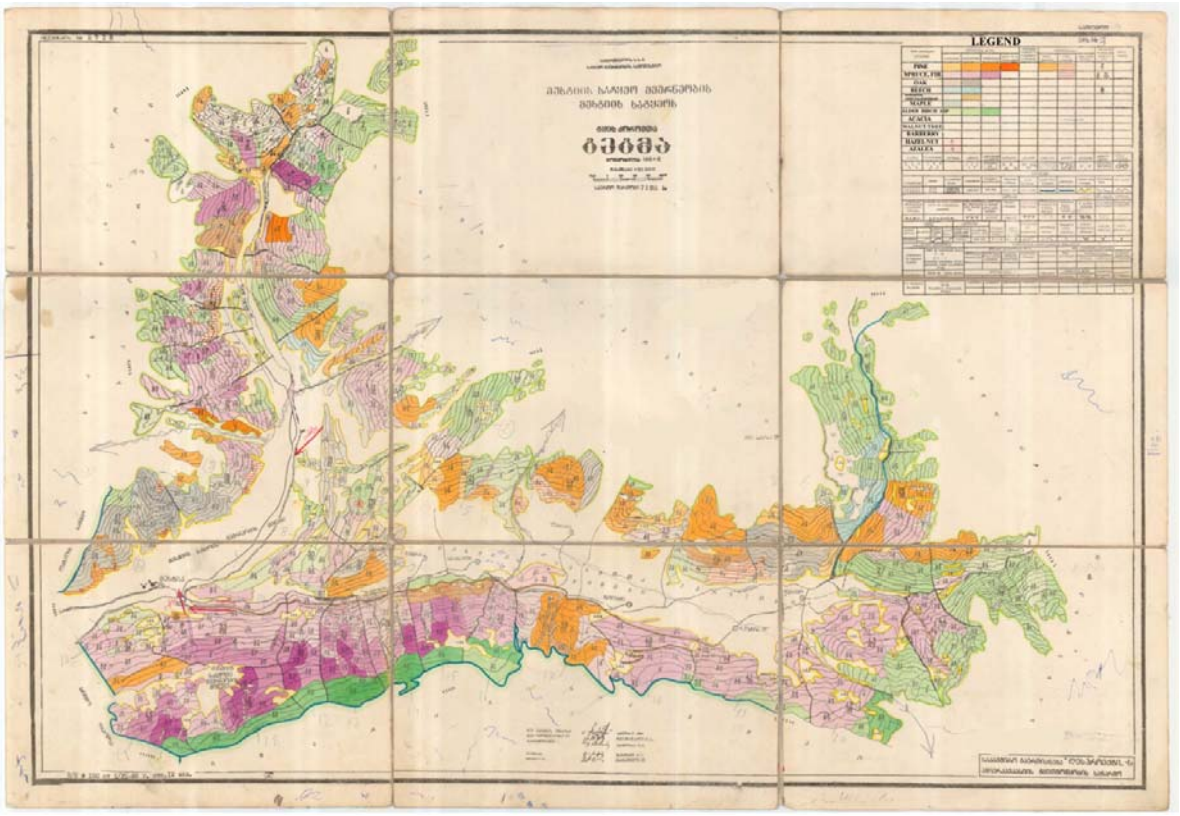
146. *Fauna*. Svaneti wild life is very diverse. Rodents are abundant. Caucasian endemic – Prometheomys satunin occurs in the alpine and sub-alpine meadows; snow vole is found in rocky areas of sub-alpine meadow (also in lower zones). Many voles are distributed within Okrugo sub-alpine and alpine meadow. Svaneti forest-meadows are rich with predators, of which brown bear is frequent. Caucasian wolf, Jackal, Trans-Caucasian fox, Caucasian boar, Lynx, Western Caucasian tur and Caucasian white throated marten are also present. Avifauna in the area include: Caucasian grouse, Caucasian snowcock, kite, goshawk, greater spotted eagle, cinereous vulture, griffon vulture, golden eagle and Eurasian griffon vulture from 1500 m till 3500 m above the sea level.

147. *Protected Areas*. There are 14 Strict Nature Reserves, 8 National Parks, 12 Managed Nature Reserves, 14 Natural Monuments and 2 Protected Landscapes in Georgia. These protected areas cover about 7 % of the country's territory. About 75 % of Protected Areas are covered by forests. Primary function of the Protected Areas is protection of natural heritage of the country. None of these protected areas are located in the region.

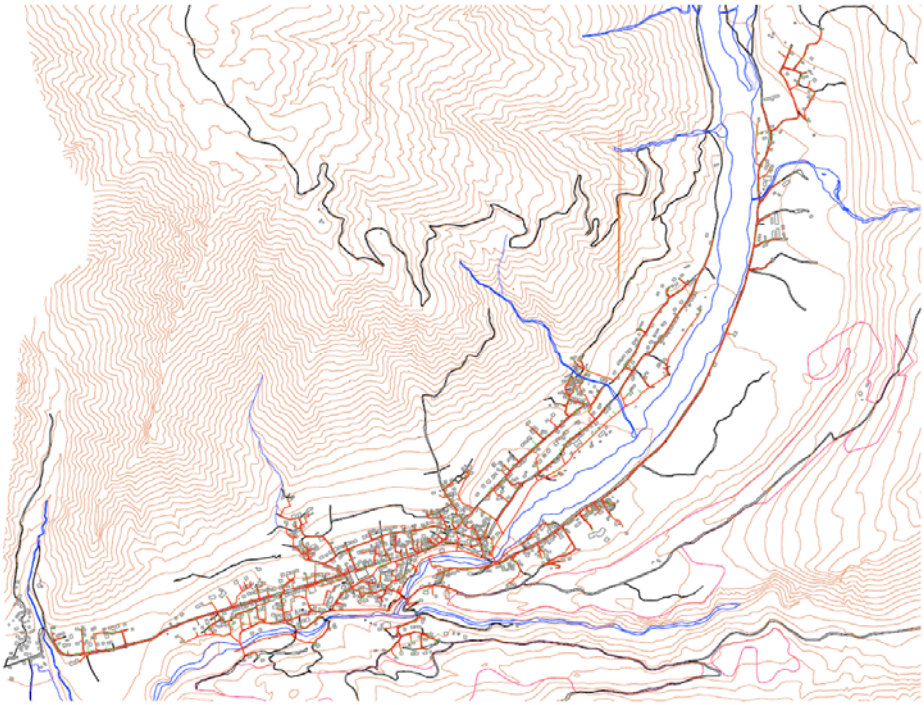
148. Gvaldi River, originating from Mukrvam Glacier in the mountain peaks, flows through a gorge surrounded by hills covered mostly with coniferous forests, and joins River Mestiachala just upstream of Mestia Town. Aquatic life of Gvaldi is very limited; supported by river bed benthic organism the river has trout in the lower reaches near its confluence with Mestiachala. It is known that Gvaldi River course for a length of 100 m near the confluence also acts as breeding ground (season is in winter months) for trout. During the breeding season, fish tend to move upstream for breeding. There is no commercial fishing activity in any of the rivers in Mestia. After that the alignment is along the field paths surrounded by pasture lands and as well as oak forests. These field paths are used as access roads to the pastures lands and for trekking.

149. Future WWTP site is fallow land dominated by grasses (*Poaceae*) with spontaneous woody vegetation. Photos of the site are in the Annex.

Map 7: Forests in Mestia



Map 8: Mestia Waste Water Network Improvement Subproject - Overview



2. Impacts during Construction

150. During the construction, impacts on flora and fauna are due to site clearance activities and implementation of contractor's yard.

151. Since headwork site is located in a pristine natural environment surrounded by hills and forest areas, there is an impact envisaged on natural forest. Tree losses will be unavoidable at river crossings of the transmission main and in the water network. Work will be conducted manually using locally available material and therefore there is no major disturbance anticipated during construction. The construction in river bed however likely to increase the silt level of water body; with the various measures suggested earlier, the silting of river will be reduced considerably, however, cannot completely avoided. The marginal increase may also have negative impacts on fish breeding. The following measures shall therefore be implemented:

- Construction works in the river bed shall not be conducted between November and March during breeding season of trout.

152. Similarly transmission main construction will be carried out manually in areas accessible only by foot. No new access roads will be developed. Trees may be removed, where it is required, especially at river crossings. Construction work may have negative impacts on movement of wildlife. Following measures needs to be implemented to avoid any impacts on flora and fauna:

(i) Avoid tree cutting by local and small change of layout plan/alignment
(ii) In unavoidable cases, plant two trees of same specie for each tree that is cut for construction
(iii) Bushes and grasses shall be cleared only in actual construction area; all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation.
(iv) Use excavated soil for refilling the pipeline trench; avoid sand layer on the top of the pipe in inaccessible areas to avoid importing material and related disturbances
(v) Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours. This will avoid any safety risk to wild animals.

153. The main collector will be laid into the gravel access road of the WWTP. Impact on biological environment will therefore only be minor and only concerns the deposition of excavated material on the grassland alongside the trench. Required width for construction and deposition of excavated material is approximately 5 m. Therefore grassland of approximately 250 m² will be temporarily impacted for construction of the main collector. Photo 3 of Annex 3 shows the gravel access road to the WWTP.

154. Site clearance activities for the WWTP will involve the loss of approximately 3 ha of spontaneous vegetation, mainly grass and shrub vegetation. Due to former construction activities (access road, telegraph pole) site is already impacted by human interference. In total 3 ha of grass and shrub vegetation will be lost, of which 2.3 ha are temporary losses due to construction activities (construction site, material storage, contractor's yard) and 0.7 ha are total losses. Because of spatial dimensions of WWTP and by also considering that the selected site has already been impacted by human interferences as described above impacts on movement of wildlife are expected to be only minor.

3. Impacts during Operation

155. The operation and maintenance activities would be conducted within the facilities, and therefore no impacts envisaged on biological environment. Certain measures suggested in previous sections to ensure minimum downstream flow, will avoid any impacts on downstream users.

156. Impacts during operation phase of the WWTP refer to discharge of treated water into Mestiachala River which will result in positive impact, since situation for aquatic fauna and flora will improve as compared to the present situation.

157. An additional impact during operation phase refers to the disposal of waste and sewage sludge. Sludge needs to be either burned, mechanical composed or brought to waste disposal site. If a new site needs to be designated for sludge disposal this may impact on fauna and flora.

V. IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

A. Economic Resources

1. Baseline Profile

158. *Land use.* Predominant land use in Mestia is under agriculture/pasture followed by inhabited areas. Hills slopes are covered with forests. Agriculture and agricultural related activates (animal husbandry for meat and milk products) is the main economy of the region. Potato and corn are the important crops in the area. Owning to extreme weather conditions, cultivation is limited to summers months. There are no industries.

159. *Mining*. The region is known for mineral resources like gold, silver, lead, zinc, copper, cobalt, molybdenum, barite, arsenic, wolfram and marble, which are almost untapped. The region has mineral and thermal water springs. The region also has a large potential for building stone material (decorative facing stones, marble, lime stone, barite etc). However, most of these minerals at present are untapped, the present activity is limited to mining for construction materials (sand, gravel and aggregate).

160. *Roads & transport*. Nestled in the main Caucuses mountain region, Mestia is connected by road with the rest of Georgia. This road passes, mainly along the banks of Enguri River, through highlands, mountains and has steep slopes. Landslides during rains are not uncommon and often lead to road closure. This road is presently under improvement. Internal roads in Mestia are not well developed. Except the main roads, all other roads are narrow and un-surfaced. Public transport facilities are available and connect to all areas.

161. *Urban Services*. UWSCG provides water supply and sewerage services in the town. Springs and streams are the main source of water supply. Sewerage system is not well developed, and is provided only to a part of Mestia Town population. There is no wastewater treatment facility; the collected wastewater is disposed into River Mukhura without any treatment. Storm water drainage is available in part of the town. Solid waste management system is not well developed; waste is collected and disposed in low-lying areas.

162. *Power Supply*. After the independence, Government of Georgia has made efforts to improve the power supply through new generating sources. Hydropower is the predominant source (88%), while rest is from gas based thermal power stations. Mestia gets uninterrupted good quality electricity supply from Enguri Hydropower Station.

2. Impacts During Construction

163. Head works, transmission lines, reservoirs, and pumping stations will be located on government owned land.

164. Parts of the water supply network and parts of the sewer system will be laid on private properties in the township. The impacts will be short in duration.

165. For location of the WWTP the government has identified an area of approximately 3 ha. Ownership of the land needed, inclusive the land needed temporarily during construction is depicted in the Resettlement Action Plan.

166. The main collector will be laid within the access road to the WWTP. Ownership of the land needed, inclusive the land needed temporarily during construction is depicted in the Resettlement Action Plan.

167. As the future WWTP is planned on fallow land located to the southwest of the city of Mestia for the two components investigated within this IEE report no negative economic impacts are expected to occur. The clear water main from WTP to Lanchavli will be laid along a road passing through the centre of town. Although work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material and workers discourage customers from visiting shops and other businesses, which lose income as a result. These losses however will be short in duration. Implementation of the following best construction measures will reduce the inconvenience and disturbance:

(i) Informing all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary;
(ii) Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required
(iii) Increasing workforce to complete the work in minimum time in these stretches
(iv) Initial situation of private properties has to be re-established after construction

168. Another aspect of the work that has economic implications is the transportation of material to the site and surplus soil from the site to locations where it can be put to beneficial use as recommended. The volume of surplus soil generated from the construction work is limited, which will generate truck trips (assuming a smaller truck, 5 m^3 capacity, due to narrow roads per trip during 1 year construction phase) – spread unevenly with more trips during initial stages. In addition there will be truck movements carrying material. Although this is not significant, considering the narrow roads, it could disrupt traffic in the Town. Dust generated during the transport may also impede the commercial and trade activities, which are predominantly located along the main roads. The transportation of material/waste shall be implemented by the Civil Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

(i) Plan transportation routes in consultation with Municipality and Police
(ii) Schedule transportation activities by avoiding peak traffic periods.
(iii) Use tarpaulins to cover loose material that is transported to and from the site by truck
(iv) Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area

(v) Clean wheels and undercarriage of haul trucks prior to leaving construction site

3. Impacts during Operation

169. As the operation and maintenance activities would be conducted within the existing facilities no impact is envisaged on economic resources. Repairs and leaks of the transmission main pipeline and the sewer system will be minor and localized. In fact, the improvements to the water supply system will bring various benefits. Availability of good infrastructure facilities will add to the quality of life, and there will be more people interested to live and visit, which will bring new investments and boost economic development.

B. Socio-Cultural Resources

1. Baseline Profile

170. *Demography*. The present population of Mestia is 2,855, and floating population (tourists) is about 3,500. Contrary to overall growth rate of Georgia, which had declined during the last two decades, population of Mestia has increased though marginally. This is mainly attributed to decline in out-migration due to revival of tourism related economy. With the government focusing on development of Mestia as a all-weather tourist destination with tourism related facilities and infrastructure, the tourist population is likely to increase to 20,000 by 2040 (*Source: Government Estimates*).

171. *Population Composition*. Almost entire population in Mestia is ethnic Georgians. Georgian is the main language, while most can speak Russian few can also speak English. There is no population which can be categorized as indigenous in the project area. About 98% of Mestia population is literate.

Table 7: Population of Project Area

Year	Population			CAGR
	Town	Tourist	Total	
2002	2,575	-	2,575	-
2011	2,855	3,500	6,355	-
2020	3,480	6,375	9,855	4.72%
2030	4,347	11,847	16,194	5.03%
2040	5,299	20,000	25,299	3.73%

172. *Education & health facilities*. There are three schools (primary and secondary) and two kindergartens in Mestia. For higher education, people mainly depend larger urban centres of Kutaisi and Tbilisi. Basic health facilities are available; there are two hospitals and a polyclinic in the town to serve the population.

173. *History & Culture*. Historically and ethnographically, Mestia has always been regarded a chief community of Zemo, or Upper Svaneti province. Despite its small size, the town has been an important centre of Georgian culture for centuries and contains a number of medieval monuments. The town is dominated by stone defensive towers (Svan towers). Mestia is also a centre of mountaineering tourism and alpinism. Early reference to Svans, an ethnic sub-group of Georgians of south-eastern slopes of the main Caucasus ridge, dates back to 3rd century BC. Archaeologists/historians found evidence of life in the region belonging Stone Age (Neolith). Svans adopted Christianity in 523 AD. Svans have played significant role in the life of the old and new kingdoms of Georgia. Their contribution during the reign of David the Builder and Queen Tamar in modern Georgia needs a special

mention. Swans are known for ages as fierce fighters and protectors of Georgia. Following are the important places of historical importance in Mestia:

(i) *Swan Towers*. There are a number of ancient Swan Towers in Mestia. An ancient dwelling, believed to be established in 14th century, comprising Machubi' (dwelling house with large hall), summer terrace-type structure 'Guband' and adjoining multi-storey tower (Swan-tower) built by large stone quadrants, is located in Lanchavli. Legend has it that these towers are evidence for the volatile situation in the region, which lead to construction of these defensive structures.

(ii) *Svaneti History and Ethnography Museum*. This museum was established in 1936 by ethnographer Egnate Gabliani and houses very important samples of the Christian culture. The cultural and material monuments kept in the museum are characterized with widespread chronology from the archaeological artefacts from 3 BC to modern age.

174. *Tourism*. Besides being an important cultural and historical centre, Mestia is known for its natural beauty, and notable for its glaciers and picturesque summits. Low and medium range hills mostly covered with mixed and coniferous forests. High hills are characterized by alpine meadows and grasslands, above which lie the zone of eternal snows and glaciers. With the Government of Georgia's focus on all-weather tourism development in Mestia, various initiatives such as development of ski lift and ski slopes, which are already underway, is likely to boost tourism inflow from present 3,500 to 20,000. Infrastructure works like improvement of roads (both internal and external) are being implemented in the town.

2. Impacts during Construction

175. There are various social-cultural resources (such as schools, hospitals, churches and tourism spots) in the town. The transmission main from WTP to existing reservoirs will run through Lanchavli area that houses few Swan Towers. The construction impact will include noise and dust, and interrupted access due to movement of heavy vehicles transporting material and waste. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above (under the impacts on air quality), including:

(i) Limiting dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks
(ii) Providing wooden walkways planks across trenches for pedestrians and metal sheets where vehicle access is required
(iii) Increasing the workforce in to complete the work quickly

176. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:

(i) Following standard and safe procedures for all activities – such as provision of shoring in deeper trenches (> 2 m)
(ii) Excluding public from the site – enclosing the construction area and provide warning and sign boards, and security personnel
(iii) Providing adequate lighting to avoid accidents

(iv) Ensuring that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc)
(v) Maintaining accidents records and report regularly

177. Svaneti Region, including Mestia, is an important centre of Georgian history and culture. So there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. Therefore steps should be taken minimize the risk. This should involve:

- Contractor should put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve:

    - Having excavation observed by a person with archaeological field training;
    - Stopping work immediately to allow further investigation if any finds are suspected;
    - Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

178. *Economic Benefits*. There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labour force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labour camps. If temporary labour camps are to be provided, Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

(i) To the extent possible labour force must be drawn from the local community
(ii) In unavoidable case of sourcing labour from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people. Following measures shall be followed:
    - Establish temporary labour camps in consultation with the local authority
    - Shall be located away from water bodies
    - No clearance of trees vegetation shall be allowed for establishment of camp
    - Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc)
    - Contractor shall provide fire wood and no worker shall be allowed to cut any tree
    - Ensure regular and clean maintenance of the camp

3. Impacts during Operation

179. As the operation and maintenance activities would be conducted within the facilities, no impacts on socio-cultural resources envisaged. Water will be disinfected through application of bleaching powder, and therefore no risk due to handling and application of chlorine gas.

180. Another impact associated with water supply system is supply delivery of unsafe water into distribution system, which may lead to public health issues. This may occur due to (i) degradation or pollution of source water quality, and (ii) pollution of treated water during transmission and distribution due to leakages.

181. As discussed in earlier sections, the present water quality of Mestiachala is good, and as the headworks site is located in hills, with no pollution sources or anthropogenic activities upstream, the source is free from pollution risk. The suggested measure of fencing the stream bank near the headworks will further protect the source from contamination due to entry of wild animals/cattle.

182. Nevertheless, a regular water quality surveillance program shall be implemented to avoid any public health risk as detailed below:

(i) Conduct regular water quality monitoring at source; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future
(ii) Develop & implement a water quality monitoring program for distribution system according to the Georgian Law[4]
(iii) Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel

183. Laboratory should be able to monitor the WWTP influent and effluent quality as well as potable water quality.

184. The improved water supply will bring numerous benefits when it is operated. The main beneficiaries will be the citizens of Mestia, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor and tourists as well. This will improve the quality of life of people as well as raise standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase. Improvement in infrastructure will bring more economic opportunities. Availability of good infrastructure will boost the tourism economy.

185. The improved and expanded water supply system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for local people.

186. The new WWTP, main sewage collector and associated sewage system will bring numerous benefits when it is operating. The main beneficiaries will be the citizens of Mestia, who will be provided with a constant sewage treatment facility. This will improve the quality of life of people as well as raise standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase. Improvement in infrastructure will bring more economic opportunities. Availability of good infrastructure will boost the tourism economy.

187. The new WWTP and sewage system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for approximately 15 local people.

[4] Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia

C. Noise and Vibration

1. Baseline Profile

188. Ambient noise is not subjected to monitoring in Georgia, so there is no data on ambient noise/vibration available. Main noise generating sources in the town are transport vehicles and local construction activities; there are no major noise generating activities like industries. Following table shows the subproject sites and their background noise levels (based on site observation) and sensitive receptors, if any.

Table 8: Ambient Noise & Vibration and Sensitive Receptors at Project Sites

Subproject Sites	Background Noise/Vibration	Sensitive Receptors
Mestiachala head works	Site is located in the hilly region away from any developmental activity, in a very pristine environment. There is no noise of any kind except that of flowing water.	This is a pristine and untouched environment.
Pipeline Alignment – from headworks to WTP site	Pipeline runs along existing road and field paths surrounded by pasture and forest lands. There no sources of noise, except occasional movement of farm vehicles in the lower reaches near the WTP site	There are no sensitive receptors in the vicinity
WTP/Reservoir site	Site is located on hill in the outskirts of the town overlooking an air strip, mostly used for military helicopters/choppers. It is situated at about 1 km from air strip. There is no background ambient noise.	There are no sensitive receptors in the vicinity
Pipeline Alignment – from WTP site to reservoirs	This alignment mostly runs through the town along the main road and across open land. Two river crossings are to be built. Residential and commercial establishments are located along the road. Background noise is mainly from traffic.	Sensitive receptors are residential areas along the road
Water Supply Network	The alignment runs mostly through the town along streets. Residential and commercial establishments are located along the road. Background noise is mainly from traffic.	Sensitive receptors are residential areas along the streets in town
Waste Water Network including main collector	The alignment runs mostly through the town along streets. Residential and commercial establishments are located along the road. Background noise is mainly from traffic.	Sensitive receptors are residential areas along the streets in town
WWTP	Site is located in the southern suburbs of Mestia	Sensitive receptors are residential areas closer than 500m to WWTP

2. Impacts during Construction

189. Construction activities are likely to generate noise and vibration from usage of equipment and haulage of construction materials/waste. This project however does not involve high noise/vibration generating activities like pile-driving or rock cutting. Use of equipment is very limited; excavation activities will mostly be conducted manually. Due to inaccessible location, works at headworks will be conducted manually by a small group of workers. Concrete mixers (80 dB) and concrete vibrators (76 dB) will be used in construction of WTP and reservoirs. As the site is located away from the town, no noise impacts envisaged. Appropriate personal protection equipment however needs to be provided for workers at the site. Haulage of materials/waste, and operation of backhoe (if used for transmission main trench excavation in the town), will also generate noise, but will be limited in duration and require no special measures. Sensitivity to noise increases during the night

hours in residential neighbourhoods; this is applicable to the transmission line work in the town. Following measures therefore shall be implemented:

(i) Provide prior information to the local people about the work
(ii) No construction of activities shall be conducted in the night
(iii) Provide personal protection equipment like ear plugs to the workers at the noisy working site

190. Another important activity is haulage of construction material and waste to and from site. Roads in the town are narrow and not in good condition. Following measures shall be included to avoid nuisance due to haulage of material and waste.

(i) Schedule material and waste haulage activities in consultation with local authorities
(ii) No night time haulage activity; limit to day time off peak hours
(iii) Educate drivers: limit speed between 20-25 kmph and avoid use of horn in the town
(iv) Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement

191. As for the construction vibration is considered, none of the activities in the subproject has potential to generate significant vibration, and there are no sensitive structures in the proximity of the site. Therefore there are no likely impacts.

3. Impacts during Operation

192. There are no sources of noise or vibration from the operation activity of the new water supply and waste water system.

193. The noise emission components of the WWTP are the blower, the pumps and the overflow weirs. As a mitigation measure the blower and the pumps will be covered. Overflow weirs are constructed in a manner that covering is also possible if required.

D. Cumulative Impacts

194. Project is designed to improve environmental quality and living conditions in Mestia through the improvement of water supply and waste water system. The potential negative impacts identified on various environmental parameters, during both construction and operation, in the previous sections of this report, are localized and temporary.

195. By nature, impacts such as on air quality and on people (due to disturbance, nuisance and safety risk of construction activity) can have cumulative impacts, as all the construction activities are conducted simultaneously. However, construction sites are not concentrated in a small area, and the major construction activity (WTP and reservoir) is confined to a single site located outside the town. Further, these are common impacts associated with any construction activity, and as discussed in the earlier sections, there exists proven and easy-to-implement measures to mitigate these impacts.

196. However, at present various development and construction activities (for instance, road works) are under implementation in Mestia. The proposed water supply and waste water improvement works shall therefore be scheduled in consultation with the other implementing agencies so that roads and inhabitants are not subject to repeated disturbance by trenching/construction work in the same area for different purposes. Road work of the

main road, where the transmission line is proposed, shall be conducted after the pipeline work.

197. No cumulative impacts envisaged during the operation stage.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

198. Following agencies will be involved in implementing this Water Supply Subproject in Mestia under this ADB funded Investment Program:

(i) Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. MoRDI will have overall responsibility for compliance with loan covenants.

(ii) United Water Supply Company of Georgia (UWSCG) is the implementing agency (IA), which will be responsible for administration, implementation (design, construction and operation) and all day-to-day activities under the loan. An, Investment Program Management Office (IPMO) will be established within the UWSCG for all Investment Program related functions. The IPMO will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.

(iii) The IPMO will be assisted by (a) Management Contractor (MC) who will provide Investment Program management support, assure the technical quality of design and construction, and provide advice on policy reforms, and (b) Detailed Engineering Design Consultants (DC), who will design the infrastructure and manage tendering process. Civil works contractors build the infrastructure.

(iv) ADB is the donor financing the Investment Program.

199. UWSCG, specifically its Department of Quality Management and Environment Protection (DQMEP), will bear the responsibility of implementing the subproject in compliance with the Georgian Law and ADB Policy throughout design and implementation phase. Specific tasks would include:

(i) Updating this IEE to reflect any changes in final project design,
(ii) Submission of revised IEE to ADB, for review and approval; incorporating ADB comments, if any
(iii) Implementation of the EMP including grievance redress

200. Currently DQMEP is staffed with an Ecologist/Environmental Specialist, who also heads the Department. The incumbent Ecologist/Environmental Specialist, with a master's degree in ecology and 7 years of professional experience (including 5 years in Licenses and Permits Department of the MoEPNR), is well versed with the Georgian environmental law, EIA and EIP processes, and other government regulations. With the existing staff, the DQMEP can update the IEE internally and can also coordinate with government agencies for necessary approvals. The DQMEP, however, requires support for implementation of EMP.

201. Implementation of EMP of this subproject require an experienced Environmental Management Specialist (EMS) to spend a total of around three months over the average 6 month design and 15 month construction period, conducting routine observations and surveys, and preparing monitoring reports. The EMS will also be responsible for: incorporation of mitigation measures in design and construction; and, baseline and construction-stage environmental quality monitoring. Support of an additional EMS is also required to oversee the EMP implementation, and collating and submitting bi-annual Environmental Monitoring Reports (EMR) to ADB. Since the specialist support is not required continuously, it will be feasible and convenient to engage consultants to implement these tasks, which can be part of MC and DC.

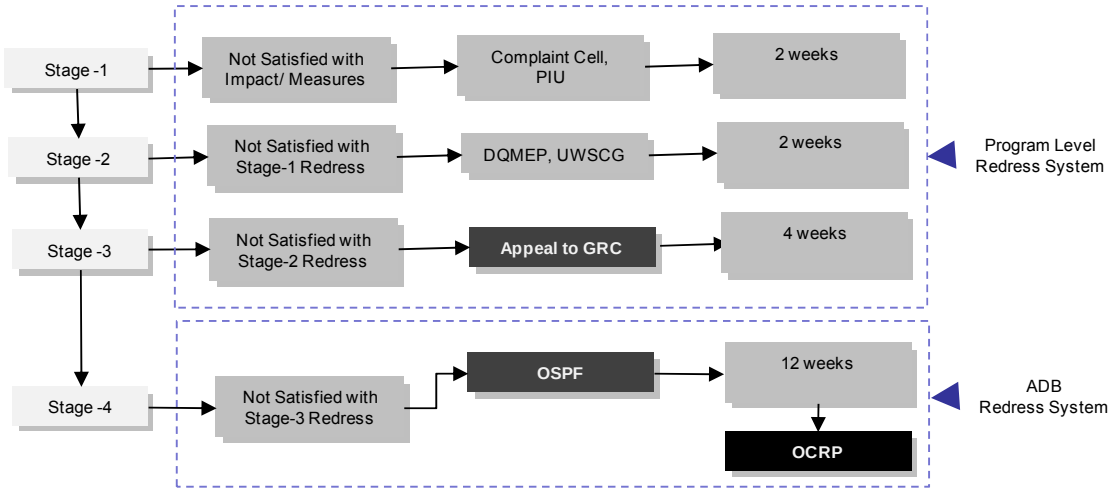
202. DC will be responsible for: incorporation of mitigation measures in design and construction; and, baseline and construction-stage environmental quality monitoring. The MC will review and approve IEE and/or EIA reports and oversee implementation of EMP. The civil works Civil Contractor will implement mitigation measures during construction. Implementation of mitigation and monitoring measures during operation will be the responsibility of DQMEP. Government regulatory agencies such as MoEPNR will also monitor the environmental performance.

B. Grievance Redress Mechanism

203. As the work is being done in inhabited areas, most of the impacts are construction-related, and therefore it is anticipated that improper or inadequate implementation of EMP may lead to disturbance and inconvenience to local people during construction. In order to provide a direct channel to the affected persons for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, UWSCG will establish a Grievance Redress Mechanism. A Complaint Cell and a Grievance Redress Committee will be established in Mestia Service Centre to function throughout the construction period.

204. The Complaint Cell at the UWSCG Service Centre in Mestia will accept complaints regarding the environment safeguard issues in implementation of the subproject. A four stage grievance redress mechanism is indicated in below. The grievances received and actions taken will be included into the environmental monitoring reports submitted to ADB.

Figure 1: Grievance Redress Mechanism



(i) Complaints received (written or oral communication) by the Complaint Cell (CC) will be registered in database system, assigning complaint number with date; Complaint Cell will inform the complainant the time frame in which the corrective action will be taken.
(ii) The Complaint Cell and UWSCG Investment Program Management Office (IPMO) will investigate the complaint to determine its validity, and assess whether the source of the problem is indeed subproject activities; if invalid, the Complaint Cell will intimate the complainant and may also provide advice on the appropriate agency to be approached.
(iii) If the complaint is valid, the Complaint Cell will check the environmental management plan (EMP) of the subproject whether this issue was identified and mitigation was suggested; if yes, the Complaint Cell and UWSCG IPMO will direct the civil works Contractor to take immediate actions as per the EMP.
(iv) If this is an unanticipated issue, the UWSCG IPMO will to identify mitigation measures and advise the civil works Contractor accordingly and a corrective action should be taken and a Corrective Action Plan (CAP) prepared.
(v) The Complaint Cell will review the civil works Contractor's response on corrective action and update the complainant within two weeks.
(vi) If the complainant is not satisfied with the action taken by the Contractor within two weeks from the start of corrective action as directed the Complain Cell, the grievance will be directed to the Department of Quality Management and Environmental Protection (DQMEP) of the UWSCG.
(vii) The DQMEP will review the issue with the IPMO and relevant Service Centre and may ask for additional information or conduct site visit, and will advise the IPMO and relevant Service Centre on actions to resolve the issue.
(viii) The Service Centre will submit the interim report in a week to DQMEP on the status of the complaint investigation and follow-up actions, and final action taken report within two weeks of completing the action. The DQMEP will intimate the complainant of the same.
(ix) If the complainant is still dissatisfied with the action taken or decision, he/she may approach the Grievance Redress Committee (GRC, see below) established in the town

205. A GRC will be established to resolve the unresolved issues at Stage 2 and this will function throughout the construction period, and will have hearings on need-basis. GRC will have following members:

(i) Chairman, Mestia Municipality or an elected member nominated by the Chairman
(ii) Service Centre Head
(iii) Member of IPMO

206. Considering the anticipated impacts, it is not expected that there is any likely issue which will remain unresolved in the Stage 3 of the process. In the unlikely event of dissatisfaction after Stage 3, the complainant can approach ADB with the complaint. ADB has in place a system under the ADB Accountability Mechanism, where people adversely affected by ADB-assisted projects can voice and find satisfactory solutions to their problems. An affected person can file a complaint (mail, facsimile, electronic mail, or by hand delivery) with:

(i) Office of the Special Project Facilitator (OSPF), ADB, 6 ADB Avenue
Mandaluyong City, 0401 Metro Manila, Philippines
Tel: (63-2) 632-4825; Fax: (63-2) 636-2490; Email: spf@adb.org
or

(ii) Georgia Resident Mission, which will forward it to OSPF

207. In the event of unsatisfactory redress from OSPF, the complainant can further approach Office of the Compliance Review Panel (OCRP) within ADB headquarters.

C. Environmental Impacts & Mitigation Measures

208. The Following table summarizes the environmental impacts and suggested mitigation measures as discussed in previous sections. It also delegates the responsibility of mitigation measures implementation to various project agencies.

Table 9: Environmental Impacts and Mitigation Measures

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Pre-Construction						
Resettlement impacts due to laying of pipeline through private properties	L	M	• Provide compensation and assistance to the affect persons as suggested by the Resettlement Plan of the subproject	UWSCG	Waste water network, water supply network	RP Cost
Construction						
Risk due to high risk seismic intensity zone	M	M	• Apply design and construction norms of Zone-9 (MSK-64 scale) according to Government of Georgia "Construction in Seismological Regions" • Select appropriate pipe material and design for transmission lines according to seismic intensity of project area	UWSCG	-	Design Cost
Impacts due to excavation and generation of waste soil	L	L	• Utilize surplus/waste soil for beneficial purposes such as in construction or to raise the ground-level of low lying sites	Civil Contractor	All construction sites	Part of construction cost
Loss of top soil	M	L	• Top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.	Civil Contractor	Pipeline work in pasture lands	Part of construction cost
Erosion due to excavation/refilling	M	L	• No trees shall be removed on the slopes; clearing of shrub, bushes and grass shall be limited to actual construction area only; no clearance is allowed for activities such as material/waste storage, concrete mixing, etc. • Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer • In the steep slopes, local grass species shall be planted on the refilled trenches	Civil Contractor	All construction sites	Part of construction cost
Impacts due to construction in the river	M	L	• Water flow shall not be interrupted completely/diverted; work shall be conducted into one-side of the stream, and water be allowed to flow on the other side • Enclose the construction area (may be with sand bags) so that water do not enter into work site • Water collected in the trench shall be disposed safely so that silt water do not get mixed in the river water	Civil Contractor	Mestiachala Headworks	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Impact on surface water bodies due to construction during heavy rains	L	L	• In case of heavy rain, protect open trenches from entry of rain water by raising earthen bunds with excavated soil • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site • Ensure that drains are not blocked with excavated soil	Civil Contractor	All construction sites	Part of construction cost
Impact on ambient air quality due to dust generation	M	L	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion–; • Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing	Civil Contractor	All construction sites	Part of construction cost
Impact on air quality due to emissions from construction equipment/ vehicles	I	L	• Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained • Ensure that all equipment & vehicles confirms to emission and noise norms	Civil Contractor	-	Part of construction cost
Impact on aquatic biota	L	M	• Construction works in the river bed shall not be conducted in fish breeding season (November – March).	Civil Contractor	Headworks site	NA

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Removal of vegetation/trees for construction and impacts due to presence of open trenches	L	L	• Avoid tree cutting by local and small change of layout plan/alignment • In unavoidable cases, plant two trees of same species for each tree that is cut for construction • Bushes and grasses shall be cleared only in actual construction area all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation • Use excavated soil for refilling the pipeline trench; avoid sand layer on the top of the pipe in inaccessible areas to avoid importing material and related disturbances • Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours. This will avoid any safety risk to wild animals.	Civil Contractor	Transmission line from headworks to WTP; river crossings of transmission mains, waste water network, water supply system	Part of construction cost
Disturbance to business, people, activities and socio-cultural resources due to construction work	L	M	• Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary; • Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks • Provide wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required • Increasing workforce to complete the work in minimum time in the town	Contractor	Transmission line from WTP to Lanchavli; waste water network, water supply network	Part of construction cost
Disturbance/nuisance/noise due to construction activity including haulage of material/waste	L	L	• Plan transportation routes in consultation with Municipality and Police • Schedule transportation activities by avoiding peak traffic periods • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material at	Civil Contractor	All construction sites	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
			the site by sprinkling water • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Educate drivers: limit speed between 20-25 kmph and avoid use of horn in the town • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement • Provide prior information to local people about work; • No night time construction activities including material/waste haulage • Educate drivers: limit speed between 20-25 kmph and avoid use of horn in the town • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement			
Socio-economic benefits from employing local people in construction work	L	M	• To the extent possible labour force must be drawn from the local community	Civil Contractor	All construction sites	Part of construction cost
Impacts due to import of labour and establishment of temporary labour camps	L	L	• In unavoidable case of sourcing labour from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people: o Establish temporary labour camps in consultation with the local authority o Shall be located away from water bodies o No clearance of trees vegetation shall be allowed for establishment of camp o Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc) o Contractor shall provide fire wood and no worker shall be allowed to cut any tree o Ensure regular and clean maintenance of the camp	Civil Contractor	Temporary labour camps	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Safety risk – public and worker	L	M	• Follow standard and safe procedures for all activities – such as provision of shoring in deep trenches (>2 m) • Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel • Provide adequate lighting to avoid accidents • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc); • Maintain accidents records and report regularly	Civil Contractor	All construction sites	Part of construction cost
Historical, archaeological chance finds during excavation	L	M	• Contractor shall put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve: o Having excavation observed by a person with archaeological field training; o Stopping work immediately to allow further investigation if any finds are suspected; o Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ..	UWSCG/Design Consultant	All construction sites	Part of construction cost
Cumulative impacts – repeated disturbance to roads and people	L	M	• Schedule the construction activities in harmony with the other ongoing works • Schedule works before road work	UWSCG	Transmission line works, works on waste water network, water supply network in the town	-
soil contamination due to leakages with mineral oil	L	M	• Provide double walled fuel tanks or store single walled fuel tanks in collecting basin for refuelling construction engines • Provide modern non-leaking equipment	Civil Contractor	WWTP and main collector	---
contamination of surface water	L	M	• Store fuel tanks away from surface water on a safe location minimum 50 m distance to surface water • Provide modern non-leaking equipment	Civil Contractor	WWTP and main collector	---

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Operation						
Impacts due to abstraction of river water	M	M	• Conduct comprehensive flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability • A minimum ecological flow (1/3rd of total flow) shall be released downstream all times; this means that the flow in the river shall not be less than 0.07 m³/sec at any point of time • In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow, and remaining demand shall be met by another source	UWSCG	Mestiachala headworks	Part of design costs
Contamination of water source			• Fence the river banks up to a few meters (10 m above and 10 m below headworks site) above headworks site to avoid any entry of animals (wild or cattle)	UWSCG	Mestiachala headworks	US $ 3,000
Impact on surface and groundwater due to disposal of increased volumes of sewage resulting from water supply augmentation	L	M	• Build new sewerage system with connection to treatment facilities, which can treat the sewage to European standards and dispose safely • New sewage system to cover 100% population • Implement above measures along with the water supply system improvement	UWSCG	-	US$ 12.7 million as per FS Report
Risk of delivery of unsafe water to consumers	L	M	• Conduct regular water quality monitoring; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future • Develop & implement water quality monitoring program for distribution system • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel	UWSCG	-	Part of project design – water quality testing laboratory is part of design
Odour emission to adjacent residential area	L	M	• Enclosure of inflow, screens, grit chamber, aeration tank, and sludge treatment (sludge storage tank, sludge pumps, sludge dewatering building) including waste air purification	UWSCG	WWTP	Part of construction costs
Noise emission to adjacent residential area	L	M	• Enclosure of aeration pumps, sludge pumps	UWSCG	WWTP	Part of construction costs

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsibility	Location	Cost
Disturbance/nuisance/noise due to operation activity including haulage of waste, dewatered sludge	L	L	• Plan transportation routes in consultation with Municipality and Police • Schedule transportation activities by avoiding peak traffic periods • Use tarpaulins to cover loose material that is transported to and from the site by truck • Educate drivers: limit speed between 20-25 kmph and avoid use of horn in the town • Provide prior information to local people about work; • No night time operation activities	UWSCG	WWTP, access road	Part of operation costs
Influx of insects, rodents	L	L	• Regular waste and sludge disposal, regular cleaning of the facility	UWSCG	WWTP	Part of operation costs

H = high, L = low, M= medium.

D. Environmental Monitoring Plan

209. A program of monitoring will be required to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by Civil Contractors will be conducted by the DC, and overseen by MC, on behalf of Implementing Agency. Monitoring during operation stage will be conducted by the Operating Agency.

210. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

211. Regular control and inspection of the future WWTP in Mestia is needed to guarantee its long term and sustainable operation. The following table includes physical and chemical analyses to be carried out. Trained personnel and a laboratory are required.

212. The following table shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies various monitoring activities to be conducted. It describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 10: Environmental Monitoring Plan

Mitigation measures	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Construction Phase					
• All construction related mitigation measures	Implementation on site	All construction sites	Observations on/off site; CC records; interviews with people and workers	Weekly	DC
• All design related mitigation measures	Inclusion in the project design	-	Design review	As needed	MC
• Mestiachala water quality during construction of headworks	Turbidity, Coli form, E-Coli	headworks site - downstream (50m)	Compare with base values Turbidity: 25 NTU Coli form: 100 MPN E-coli: 30 MPN	Before, during and after construction (3x2 samples)	DC
Operation					
Long Term Surveys					
• Conduct Mestiachala water quality monitoring (raw water)	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride Magnesium, Sodium Zinc, Iron, Total coli form, E-coli, BOD	1 sample from head works, 1 sample at WTP before treatment	Comparison with the base values (sep-10) and GoG Surface Water Norms[5]	Quarterly 4x2 samples/year	UWSCG
• Conduct Tsrniashi water quality monitoring (raw water)	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride Magnesium, Sodium	1 sample from head works, 1 sample at WTP before treatment	Comparison with the base values (sep-10) and GoG Surface Water Norms[6]	Quarterly 4x2 samples/year	UWSCG

[5] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG (Annex 3)
[6] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG (Annex 3)

Mitigation measures	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
	Zinc, Iron, Total coli form, E-coli, BOD				
• Conduct treated water quality monitoring	Same as above	1 sample after treatment	GoG drinking water regulation (footnote 7)	Monthly 1x12 samples/year	UWSCG
• Develop & implement water quality monitoring program for distribution system[7]	Parameters as per footnote 7	Monitoring locations as per footnote 7	GoG drinking water regulation (footnote 7)	Frequency as per footnote 7	UWSCG
• WWTP quality monitoring	BOD_5, COD, Nitrogen, Phosphorus	WWTP inflow	To compare with design criteria	weekly	UWSCG
• WWTP quality monitoring	Oxygen	WWTP aeration tank		daily	UWSCG
• WWTP quality monitoring	Sludge volume	WWTP aeration tank		daily	UWSCG
• WWTP quality monitoring	Dry matter contents	WWTP aeration tank		Thrice per week	UWSCG
• WWTP quality monitoring	Dry matter contents of return sludge	WWTP aeration tank		Weekly	UWSCG
• WWTP quality monitoring	Microscopical analysis	WWTP aeration tank		Twice per week	UWSCG
• WWTP quality monitoring	Temperature, pH, suspended solids	outflow	to compare with permission	daily	UWSCG
• WWTP quality monitoring	BOD_5, COD, NH4-N, NO_3-N, P_{total}	outflow	to compare with permission	weekly	UWSCG
• WWTP quality monitoring	NO_2-N	outflow		monthly	UWSCG
• WWTP quality monitoring	temperature, pH	sludge treatment		daily	UWSCG
• WWTP quality monitoring	dry matter contents	sludge treatment		monthly	UWSCG
• WWTP quality monitoring	loss on ignition	sludge treatment		monthly	UWSCG
• WWTP quality monitoring	sludge gas	sludge treatment		daily	UWSCG
• WWTP quality monitoring	sludge production (watered, de-watered)	sludge treatment		as required	UWSCG
• WWTP quality monitoring	energy consumption	WWTP		daily	UWSCG

[7] Schedule N7 of Technical Regulation on Drinking Water, 2007, Ministry of Labor, Health and Social Welfare, GoG (Annex 4)

E. Costing and Budget

213. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal construction contract, so there are no additional costs to be included in the EMP. Costs of design-related mitigation measures (such as construction of laboratory) are included in the budgets for the civil works. The fencing of source to protect from entry of animals is included here.

214. Monitoring of implementation of mitigation measures by contractor during construction will be conducted by Environmental Management Specialist of DC. The review of design and contract to check the inclusion of all design-related mitigation measures will be conducted by Environmental Specialist of MC.

215. Costs of Mestiachala flow monitoring in the lean season as suggested in this IEE, are not included here separately as these will be part of detailed investigation and surveys costs, which are included in the project costs already. The cost of Mestiachala water quality monitoring during construction, which is to be conducted by Design Consultant (DC), is included in the EMP costs.

216. Long-term water quality surveys are proposed in operation phase. Periodic source water quality, raw and treated water quality at WTP is to be conducted through an external laboratory, the cost of which is included in the EMP cost (Table 11). Water quality monitoring in distribution system will be conducted in the laboratory of UWSCG, which will be constructed as part of the subproject, and therefore no separate costs are included.

217. Services for physical and chemical monitoring of the WWTP are included in the tender. Costs were not calculated in this report.

Table 11: Environmental Management Costs

Item	Quantity	Unit Cost	Total Cost
Implementation of EMP (1 year)		*US $*	*US $*
Environmental Management Specialist (DC)	2 months	2,500[8]	5,000
Environmental Specialist (MC)	0.25 months	2,500	625
Fencing around the source	30 m	LS	3,000
OPE (travel, per diem, surveys/interviews, reporting, etc)	LS	10,000	10,000
Mestiachala water quality during construction of headworks	6 samples	50	300
Total			*18,925*
Water Quality Monitoring (long-term)			
Source water quality – headworks, costs per year	4 samples	500	2,000
Raw water quality at WTP, costs per year	4 samples	500	2,000
Treated water quality at WTP, costs per year	12 samples	500	6,000
Tsrniashi source water quality	4 samples	500	2,000
Total			*12,000/year*

[8] Unit cost of domestic consultants include fee, travel, accommodation and subsistence

VII. RECOMMENDATIONS AND CONCLUSION

A. Recommendation

218. The environmental impacts of the all infrastructure elements proposed in the water supply improvement and waste water system subproject in Mestia has been assessed and described in the previous sections of this document. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

219. Mitigation measures were discussed with engineering specialists, and some measures have been already been included in the designs. This means that the number of impacts and their significance has already been reduced by the design. These include:

(i) Locating the transmission mains within ROW of existing roads to minimize the need to acquire private land and related resettlement issues
(ii) Locating WTP and reservoir on government lands
(iii) Inclusion of water laboratory and disinfection facility to avoid public health risk due to delivery of unsafe water into distribution system
(iv) The odour emission components of the WWTP are the inflow, the screens and the aerated grit chambers. As a mitigation measure these components will be covered.
(v) The noise emission components of the WWTP are the blower, the pumps and the overflow weirs. As a mitigation measure the blower and the pumps will be covered. Overflow weirs are constructed in a manner that covering is also possible if required.

220. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. Appropriate avoidances/mitigation/enhancement measures have been suggested for the likely impacts that are identified. Appropriate monitoring measures to guarantee the long term and sustainable operation of the WWTP are presented in a monitoring plan.

221. When operating the WWTP, the main collector and its associated sewage system will have overall beneficial impacts to human health and the environment as it will provide the inhabitants of Mestia with a new sanitation system and also will contribute to better water quality of Mestiachala River due to long-term and sustainable waste water treatment.

222. One of the main concerns was to establish the sustainability of source during lean flow season, to meet both the project demand and downstream minimum environmental flow. Monitoring conducted in September, 2010 (which is neither peak nor lean season) indicated there is adequate flow, however to ensure the sustainability of lean season flow the following measures are suggested:

(i) Conducting flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability
(ii) Releasing minimum ecological flow (1/3rd of total flow) downstream all times; this means that the flow in the river shall not be less than 0.11 m^3/sec
(iii) In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow

223. During the construction phase, impacts mainly arise from construction in the river bed, generation of dust from soil excavation and refilling; and from the disturbance to residents, traffic and important buildings by the construction work. These are common impacts associated with the construction processes, and there are well developed methods for their mitigation. Various measures are suggested including:

(i) Measures to minimize disturbance in river during construction such as conducting the work during low flow and avoiding fish breeding season etc.
(ii) Utilizing surplus/waste soil for beneficial purposes
(iii) Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc)
(iv) Providing prior public information and planning the work in consultation
(v) Avoiding night time construction activities
(vi) Conducting transmission main (headworks to WTP) work in segments, and completing entire work (excavation, pipe laying and refilling) of a segment in a day

224. Although limited, this environmental assessment process also identified opportunities for environmental enhancement. Certain measures suggested in this regard include:

(i) Employing the local people in construction work as much as possible to provide them with a short-term economic gain
(ii) Employing local people in operation and maintenance of the new systems

225. Most facilities will operate with routine maintenance, which should not affect the environment. Measures have been suggested to avoid risk of source contamination from wildlife or cattle use and a source water quality surveillance program.

226. The main beneficiaries of the improved system will be the citizens of Mestia, who will be provided with a constant supply of good quality water and a save disposal of waste water, which serves a greater proportion of the population, including urban poor (and tourists as well). This will improve the quality of life of people as well as raising standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

227. The benefits will be further enhanced by the new sewage system and WWTP.

228. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged.

229. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project.

230. The recommendation of this IEE process is that all mitigation, enhancement and monitoring activities proposed here and through the parallel process of Resettlement Planning shall be implemented in full. This is essential to ensure that the environmental impacts are successfully mitigated; this is the responsibility of UWSCG.

B. Conclusion

231. The environmental impacts of the proposed water supply and sewage treatment subproject in Mestia have been assessed by the Initial Environmental Examination reported in this document.

232. The overall conclusion of the IEE is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

233. There are no uncertainties in the analysis; thus there is no need for further study such as EIA.

ANNEX 1

Photographs of Project Sites

Mestiachala River future intake

Tsrniashi Source

future WWTP site

Lanchavli Reservoir

River crossing

Site for WWTP

River crossing water network

WTP – site and high level reservoir site

Access road to WWTP

Site for WWTP

ANNEX 2

LTD "United Water Supply Company of Georgia"

Public Hearing for the Mestia Subproject of the Georgia Urban Services Improvement Investment Program
Environmental and Social Assessment for Improvement and New Construction of Water Supply and Sanitation Facilities in Mestia

Protocol

Mestia 11.04.11

Public Hearing Participants:

1. Tinatin Zhizhiashivli - Head of Environmental Protection and Quality Control Department "UWSCG" LTD
2. Jürgen Meyer - Environment Expert " KOCKS GMBH Consulting Engineers"
3. Nugzar Ardazishvili - Director "Municipal Project" LTD
4. Alexander Mikiashvili Engineer "Municipal Project" LTD
5. Gocha Gvarliani – Chairman of Mestia Council
6. Maizer Japaridze - Mestia Service Center Manager "UWSCG " LTD

Public Hearing Attendees from Mestia local population:

1. Jemal Ratiani – Head of Military Department in Mestia
2. Nestor Pirtckhelani - Unemployed
3. Vitali Margani – Head of Mestia Rescue Service Center
4. Mikheil Ratiani –Mestia Forest Section Ranger
5. Arsena Paliani – Unemployed
6. Alexandre Khergiani – Unemployed
7. Kapiton Jorjoliani – Svaneti Tower Historical Inheritance Association
8. Gocha Khorguani – Chairman of Spatial Planning and Infrastructure Committee, Local Council Member
9. Zaur Khergiani - Pensioner
10. Jemal Khergiani - Unemployed
11. Piruzi Pilpani – Mestia Municipality Council, Chief of Department
12. Akaki Japaridze – Deputy of Mestia Municipality Attorney
13. Zaira Vezdeni – Head of Mestia Registration Office
14. Lela Shatirishvili – Resettlement Expert; International Consultant

Issues

Environmental and Social Assessment for Improvement and New construction of water Supply and Sanitation Facilities in Mestia has been presented by means of a Power Point presentation by the Head of UWSCG Environmental Protection and Quality Control Department Tinatin Zhizhiashvili

After the presentation attendees had the opportunity ask questions.

Following questions were asked:

Nr.	Questions	Answers
1	Fire protection. How many Hydrants are there? How is it ensured that there is enough fire water?	There are two reservoirs designed to be especially reserved for fire water. Hydrants will be implemented at regular distances from each other. Distances in between hydrants will be 300 m.
2	How General design and especially water intake determined? How will the water be taken from the river.	General design was determined within the Feasibility Study which was conducted prior to the design. Water intake will be e designed by means of a Tyrolean weir. Design of Tyrolean weir was shortly explained within the project.
3	Will every house be connected to drinking water and waste water?	Every house will be connected. For drinking Water and for waste water individual connections have to be implemented 1m after the private property boundary fence, hence the connection within the plot has to be implemented by the respective owner.
4	How will water be distributed?	There will be a definition of water zones. Within this zones water network is implemented. Every house can e connected.
5	There will be impacts on properties. How will this be handled?	People whose property will be impacted will be informed and compensated. This is part of the resettlement action plan.

No special comments or proposals, related to Environmental Aspects had been emerged from attendant population.

Appendix 3

General Requirements: Regulation of Water Composition and Features in Reservoirs According to Water Use Categories (Appendix 1 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

	Water Use Category			
			Fishery Purposes	
Indexes	**For potable-economic purposes of the population**	**For economic-household purposes of the population**	**The highest and first categories**	**The Second Category**
1	**2**	**3**	**4**	**5**
	The increase of the composition of the suspended particles is allowed for no more than:			
Suspended particles	0,25 mg/l	0,75 mg/l	0,25 mg/l	0,75 mg/l
	For the rivers containing 30 mg/l natural suspended particles during the lowest water level the increase of the composition of these particles is allowed within 5 %.			
	If the sewage waters contain suspended particles with sedimentation velocity not exceeding 0,2 mm/sec, their disposal into reservoirs (lakes) is banned and if the velocity exceeds 0.4 mm/sec – in rivers (channels)			
Floating mixtures (substances)	Layers of oil products, oils and fats and other mixtures should not be visible on the water surface			
Color	Should not be visible in water column:		Water should not gain strange color	
	20 cm	10 cm		
Odor, taste	Water should not gain odor and taste exceeding 1 score in intensity, which could be observed:		Water should not render fish products strange odor and taste	
	directly, after further chlorinating or other treatment	directly		
Temperature	The summer temperature of water should not increase for more than 30 C as a result of sewage water discharge in comparison with the average monthly temperature of the hottest month for the recent 10 years		The water temperature should not increase for more than 50 C in comparison with the natural temperature of the reservoir. In addition, in water objects where cold water fishes (salmon and whitefish) are present: 200 C in summer and 50 C in winter and for other water objects 280 C in summer and 80 C in winter	
Reaction (pH)	Should not exceed 6,5 - 8,5			
Water Mineralization	Not exceeding 1000 mg/l, of which: chlorides -350 mg/l, sulphates -500 mg/l	Standards are applied according to the above “taste” indexes	Standards are applied according to the taxation of the fishery water objects	

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Oxygen in water	Should not be less in any water period:			
	4 mg/l	4 mg/l	6 mg/l	6 mg/l
BOD At 20°C should not exceed:	3 mg/l	6 mg/l	3 mg/l	6mg/l
COD Should not exceed	15 mg/l	30 mg/l		
Disease causing	Water should not contain disease causing elements – viable helminth eggs, oncospheres of tenidia and viable protozoa cysts of pathogenic intestines			
Lactose positive intestine bacillus	1 in 10000	1 in 5000		
Coliphages not exceeding	1 in 100 l	1 in 100		
Water toxicity			Should not have severe toxic impact on test-objects at the points of discharge of the sewage waters into the water objects. The water from the water object at the control cross section should not have chronic toxic impact on test-objects	

Maximum Permissible Concentrations of the Contaminant Substances in Reservoirs According to Water Use Categories (Appendix 2 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

S. No	Ingredient name	Hazard class	For potable-economic-household water use reservoirs		For fishery water use reservoirs	
			Limited indexes of harmfulness	Maximum Permissible Concentration mg/l	Limited indexes of harmfulness	Maximum Permissible Concentration mg/l
1	2	3	4	5	6	7
1.	amine nitrogen	3	sanitary-toxicological	0,39	toxicological	0,39
2.	aluminum	2	sanitary-toxicological	0,5	sanitary-toxicological	0,5
3.	barium	2	sanitary-toxicological	0,1	organoleptic	2,0
4.	beryl	1	sanitary-toxicological	0,0002	sanitary-toxicological	0,0002
5.	boron	2	sanitary-toxicological	0,5	toxicological	10,0
6.	arsenic	2	sanitary-toxicological	0,05	toxicological	0,05
7.	vanadium	3	sanitary-toxicological	0,1	toxicological	0,001
8.	quicksilver	1	sanitary-toxicological	0,0005	toxicological	0,00001(should not
9.	tungsten	2	sanitary-toxicological	0,005	toxicological	be)
10.	zinc	3	general sanitary	1,0	toxicological	0,0008
11.	cadmium	2	sanitary-toxicological	0,001	toxicological	0,01
12.	cobalt	2	sanitary-toxicological	0,1	toxicological	0,005
13.	caprolactam	4	general sanitary	1,0	general sanitary	0,01
14.	magnesium	3	organoleptic	0,1	toxicological	1,0
15.	molybdenum	2	sanitary-toxicological	0,25	toxicological	0,01
16.	nitrates	3	sanitary-toxicological	45,0	sanitary-toxicological	0,012
17.	nitrites	2	sanitary-toxicological	3,3	toxicological	40,0
18.	nickel	3	sanitary-toxicological	0,1	toxicological	0,08
19.	iron	3	organoleptic	0,3	toxicological	0,01
20.	selenium	2	sanitary-toxicological	0,001	toxicological	0,005
21.	copper	3	organoleptic	1,0	toxicological	0,0016
22.	sulphates	4	organoleptic	500	sanitary-toxicological	0,001 100,0

(Legislative Herald of Georgia 18.12.2007. art. N 179 1973)

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of Justice of Georgia
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Decree N 349/N of The Ministry of Labor, Health and Social Affairs of Georgia
December 17, 2007

About Approval of Technical Regulation of Drinking Water

According to "The Public Health Law", "V" sub-paragraph of the article #3 and the first paragraph of the article #23, I give order:

1. To approve the enclosed 'Technical Regulation of Drinking Water".
2. The decree comes into force from the date of publication.

D. Tkeshelashvili

Technical Regulation of Drinking Water

Article **1. General provisions**

1. The Technical Regulation is made on the basis of the Law of Georgia about "Public Health", recommendations of the World Health Organization, European directions, regional characteristics of the country and climate-geographical conditions and sets the safe sanitary norms of human being for drinking water.

2. Liabilities by this Technical regulation should cover the following:

a) Natural or treated water, which is used for drinking, in food and other domestic purposes, in spite of origin and the supply method (distribution network, tank or cistern, bottle or container);

b) Water, which is used in food-stuffs or food-stuff products.

3. Liabilities by this Technical regulation should not cover the following:

a) Curing-mineral waters;

b) Medical water and water with other special targets;

c) Drinking water supplied by some individual source, the capacity of which 10m3/per day serves less than 50 persons not included in commercial or public network.

d) Natural mineral waters, where the mineralization exceeds 1500 mg/L.

4. The following characteristics and their normative size are defined by the Technical Regulation of drinking water:

a) Organoleptic characteristics;

b) Microbiological, inframicrobiological and parasitological characteristics;

c) Chemical characteristics (general characteristics, inorganic and organic substance);

d) Characteristics of radiative safety;

e) Standards of harmful chemical substance, as a result of water treatment;

5. The compliance tests defined by the Technical Regulation, must be carried out as follows:

a) In cases of water distribution systems inside buildings and storehouses, directly from the tap that supplies water to the consumers;

b) In cases of tanks and cisterns from the delivery point;

c) In cases of canning in the bottling point of water and in the selling point;

d) At the point of usage in those enterprises involved with food-stuffs and food products;

6. Any organization implementing the supply service of drinking water, despite the organizational-legal structure and departmental subordination, is liable to carry out the control and monitoring of compliance of drinking water with the defined characteristics under the Technical Regulation; providing accessibility of information and collected data.

7. In cases where the required standards are not met under the Technical Regulation, the supplier of drinking water is liable to carry out appropriate measures, including report to relevant organs, urgent analysis of pollution reasons, restriction of water usage and other measures for the safety of population.

Article 2. Sanitary Requirements on Drinking Water

1. Drinking water must be safe from the epidemical and radiative point of view and by chemical composition; Drinking water must have benevolent organoleptic characteristics.

2. Quality of drinking water must be in compliance with the sanitary standards under this Technical Regulation.

3. The organoleptic characteristics of drinking water must be in compliance with the requirements in the schedule N 1:

Schedule N1

Index	Measuring unit	Standard not more than:
Smell	Numbers	2
Taste	Numbers	2
Coloration	Degree	15
Turbidity	Turbidity unit (by	3,5

	formazin) or mg/L (by kaolin)	 2

4. The existence of outer membrane and water organisms seen with the naked eye is not allowed in drinking water.

5. The following analysis in the schedule #2 (according to the reason) must be carried out for detection and elimination in case of deterioration of organoleptic characteristics of drinking water:

Schedule N2

Index	Measuring unit	Standard not more than:
Sulphate (SO_4^{2-})	mg/L	250
Chloride (Cl^-)	mg/L	250
Oil products, total	mg/L	0,1
Surfactant substance anionoactive	mg/L	0,5
Rigidity	mg–eq./L	7–10
Calcium (Ca)	mg/L	140
Magnesium (Mg)	mg/L	85
Sodium(na)	mg/L	200
Zinc (Zn^{2+}),	mg/L	3,0
Iron (Fe, total),	mg/L	0,3

6. Epidemical safety of drinking water is defined by microbiological, inframicrobiological and parasitological characteristics in accordance with the given standards in the schedule #3.

Schedule N 3

Index	Measuring unit	Standard
Mezophilic aerobes and facultative anaerobes	Colony forming unit/ML 37^0 C 22^0 C	Not more than: 20 100
Total coliformic bacterias	Amount of bacteria in 300 ML	not allowed
E. coli	Amount of bacteria in 300ML	not allowed
Pathogenic microorganisms, including Salmonella	In 100 ML	not allowed
Coliform	Negative colony forming unit in 100ML	not allowed
Pseudomonas aerugiosa (only for pre- aliquoted)	In 250ML	not allowed

Streptococus faecalis	In 250LM	not allowed
Lamblia cysts	Amount of cysts in 50L	not allowed
Dysentery (amoebiasis) cysts	Amount of cysts in 50L	not allowed

7. Amount of mezophilic aerobes and facultative anaerobes must not exceed 100 colony forming unit in 1 ML in case of flood and other natural calamities.

8. Amount of mezophilic aerobes and facultative anaerobes and standards of total coliformic bacteria must not exceed in 95% of tests during 12 months in the water intake points of the water line network.

9. Definition of total coliformic bacterias and E. coli is implemented in the three parallel 100-100 ML tests.

10. Definition of lamblia cysts and Dysentery (amoebiasis) cysts is implemented in the water supply systems of surface sources.

11. Chemical composition of drinking water must satisfy requirements in the schedule #4.

Schedule N 4

Index	Measuring unit	Standard not more than:
Common characteristics		
Hydrogen index	PH	6-9
Permanganate oxidation	mg O_2/L	3,0
Total mineralization (dry remains) mg/L		1000–1500
Nonorganic substance		
Barium (Ba^{2+})	mg/L	0,7
Boron (B,total)	mg/L	0,5
Arsenic (As,total)	mg/L	0,01
Quicksilver (Hg, nonorganic),	mg/L	0,006
Cadmium (Cd, total)	mg/L	0,003
Mangan (Mn, total)	mg/L	0.4
Milobden (Mo, total)	mg/L	0,07
Nickel(Ni, total)	mg/L	0,07
Nitrate(short impact by $NO^-_{3)}$	mg/L	50
Nitrite (long impact by $NO^-_{2)}$	mg/L	0,2
Selenium(Se, total)	mg/L	0,01
Copper(Cu, total)	mg/L	2,0
Lead (Pb, total)	mg/L	0,01
Flourine (F^-)	mg/L	0,7
Chromium (Cr^{6+})	mg/L	0,05
Antimony(Sb)	mg/L	0,02
Cyanide(CN^-)	mg/L	0,07
Organic substance		
Total content of pesticides	mg/L	0,05

12. The control and monitoring must be implemented only on those pesticides, which can be contained in the water supply source. Together with this, the accordance of index must be defined individually for each pesticide and standard of aldrin, dieldrin, hectochlore and heptachlor epoxide content must be 0,030 microgram in Liter.

13. The following pesticides, their metabolites and products of reaction and dissolution are regulated for the provision of safety of drinking water:

a) Organic insecticides;
b) Organic herbicides;
c) Organic fungicides;
d) Organic nematocides;
e) Organic acaricides;
f) Organic alhycides;
g) Organic rodenticides;
h) Organic slymicides;
i) Similar products (including growth regulators).

14. Content of those harmful substances which occur in the water supply sources as a result of economic activity (not listed in the schedule #4), must not exceed quality standards set by the Ministry of Labor, Health and Social Affairs.

15. Radiative safety of drinking water is defined by the accordance of total α and β– radioactive characteristics with the standards in the schedule #5.

Schedule N 5

Index	Measuring unit	Standard not more than:
Total α– radio-activity	bk/L	0,1
Total β –radio-activity	bk/L	1,0

16. Identification of radionuclide in water is implemented in case of exceeding of total radio-activity standards. Estimation of revealed concentrates is implemented according to the radiative safety regulations.

17. Content of harmful chemical substance in the process of water treatment in the water supply system must be in compliance with the requirements given in the schedule #6. Together with this, the index of control is defined according to the concrete treatment technology.

Schedule N 6

Index	Measuring unit	Not more than:

Chlorine remains free	mg/L	0,3 –0,5
Chlorine remains connected	mg/L	0,8–1,2
Chloroform (during chloration)	mg/L	0,3
Ozone remains	mg/L	0,3
Aluminium (Al^{3+})	mg/L	0,1
Formaldehyde (during ozonization)	mg/L	0,05
Acrylamide	mg/L	0,0005
Active silicate acid (with Si)	mg/L ^{3}	10
Polyphosphate (according to PO^{3}_{4-})	mg/L	3,5

18. Duration of the chlorine contact with water during deactivation with free chlorine-no less than 30 minutes, with connecting chlorine-no less than 60 minutes.

19. The total concentration must not exceed 1,2 mg/L during simultaneous content of free and connected chlorine in drinking water.

20. The control of the ozone remains is implemented after mixing box; The contact of ozone with water-no less than 12 minutes.

21. In case of detection of several chemical substances in drinking water, which are regulated by the same limitative index, total correlation of each must not exceed 1 with the utmost admissible concentration.

Article 3. The Internal Control and Monitoring of Drinking Water

1. The internal control and monitoring of drinking water is implemented by the supplier.

2. The definition characteristics of drinking water and amount of research tests must be in compliance with the requirements in the schedule #7.

3. During the analysis of microbiological and organoleptic characteristics, the water samples are taken once in month in the distribution system of water supply, which supplies water to 20 000 residents.

4. With coordination of the competent state organs, the enhanced control regime must be implemented in case of flood and other natural calamities.

Schedul

e N7

	Number of samples per year/no less than				
Index	Number of consumers connected to the water supply system (thousand consumers)				
	Ground source			Surface source	
	Up to 20	20–100	More than 100	More than 100	More than 100
Microbiological	12	24	365	365	365

Parasitology	(is not implementing)			4	4
Organoleptic	12	24	365	365	365
General characteristics	4	6	12	12	24
Nonorganic and organic substances	1	1	1	4	12
Radiological	1	1	1	1	1
Index/ Connected to the technology of water treatment	Chlorine remains, ozone remains (no less than one in an hour), reagent remains (no less than one in shift				

5. The necessary control samples which must be taken after the repair of the distribution network and other maintenance are not included in the amount of samples defined in the second item.

6. In case of detection of total coliformic bacteria and E. coli in the sample of drinking water, it is necessary to define them urgently in the secondary sample. Chloride, nitrites and nitrates must be defined simultaneously for detection of pollution reasons.

7. In case of detection of total coliformic bacteria and E. coli in the secondary sample, the analysis of water is implemented according to the existence of pathogenic bacterium of intestinal group and (or) streptococus faecalis.

8. All the samples from the ground and surface water supply lines require definition of organoleptic characteristics (except samples for the analysis of neutralizing reagents).

9. The laboratory analysis must be implemented according to the following criteria for the routine monitoring:

a) Organoleptic: smell, taste, coloration, turbidity;

b)Microbiological: Mezophilic aerobes and facultative anaerobes, total coliformic bacterias E.coli ;

c) Chemical: PH, nitrogen forms (ammonia, nitrate, nitrite), chlorides, rustiness, chlorine remains.

Article 4. The State Control of Drinking Water

1. The scheme of the state control and monitoring of drinking water, sequence, characteristics for definition and amount of samples are defined according to the law of the relevant state controlling unit.

2. The samples of drinking water must be taken in accredited independent laboratory in compliance with the law.