

**24/03/2023**

Terms of Reference: Feasibility Study for Mtskheta Sewage Water Treatment

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# Project Title

Feasibility Study for Mtskheta Sewage Water Treatment

# Project Description

The city of Mtskheta is the administrative center of Mtskheta Municipality. It is part of one of the historical and utmost Villages of Georgia. The city is located at the junction of the Mtkvari River and the Aragvi River, on both the right bank of the Mtkvari River and Aragvi. The distance between Tbilisi and Mtskheta is 21 km. Its central part is located at the mark of 480-500 m above sea level, and the backyard areas are located at 550-570 m markers. The area of the town is 8.2 km2. The current and historical data of the National Statistics Office of Georgia is as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name / Period | 2018 | 2019 | 2020 | 2021 | 2022 |
| Population | 7,617 | 7,595 | 7,584 | 7,606 | 7,478 |

There is a moderately subtropical climate in Mtskheta. Knows cold winters and hot summers. Historical monuments in the city are included in the UNESCO World Heritage List and preserved.

## Water supply description

Mtskheta water supply is carried out from the Natakhtari headquarters near the city, where the Natakhtari I rising water collection camera and pumping station are located. The filtered water prepared for chlorination in the catchment chamber is met through the Natakhtari Seals and Infiltration Pools. Camera chlorinated water Q=2,000 m3/h, H=100 m, P=800 kWh. The aggregates are pumped into the 8th water den of D=1400 mm in diameter, which leads to the 540 mark reservoirs in Tbilisi.

Upon leaving the Natakhtari I lifting pumping station, a d=500mm intrusion is made on the 8th water, which is soon divided into 3 independent d=200mm, d=300mm and d=400mm highways and connected to the city of Mtskheta. These 3 highways feed the customers of the city of Mtskheta. The city also houses 3 booster pumping stations, which provide water with appropriate pressure to customers living at high levels.

The city has old water supply reservoirs, but due to constructive injuries, they have long been used and the network connecting them is cut from the operating network. Consequently, Mtskheta highways provide water to the population directly on the network.

Water quality is checked in a laboratory located on the territory of the Saguramo headquarters in accordance with the regulations applicable in the country.

## Water consumption and loss data

For accounting for the water consumption of the city of Mtskheta, d=200mm, d=300mm and d=400mm water meters are installed on the Natakhtari headquarters on the highways, one meter per highway, a total of 3 pieces. Counters convey information on the website every 15 minutes with one calf of minute data.

It is interesting to note the e-energy expenditure of pumping 1 m3 of water in Mtskheta, that can be calculated according to the parameters of the aggregates working in the direction of the VIII water supply at the Natakhtari I pumping station:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name / Period | 2021 | 2020 | 2019 | 2018 |
| Water intake, m3 | 2,715,878 | 2,529,500 | 2,250,556 | 2,628,045 |
| E-energy consumption, kW | 1,197,925 | 1,114,309 | 991,427 | 1,105,159 |
| 1 m3 cup expense, kW | **0.44** | **0.44** | **0.44** | **0.42** |

Water consumption costs vary depending on seasonality. During the day, the minimum costs are fixed during the winter period, and the maximum is in summer. These data for 2021 were recorded on February 7th and July 20th, the data of which are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Trunk | Winter Min. Expense, m3/h | Summer Max. Expense, m3/h | Percentage change, % |
| d=200 mm | 50 | 90 | 80% |
| d=300 mm | 166 | 275 | 65% |
| d=400 mm | 45 | 68 | 52% |
| Total: | **261** | **433** | **66%** |

Accordingly, during February 7 and July 20, 2021, the following minimum and maximum costs will be recorded for 24 hours:

|  |  |  |  |
| --- | --- | --- | --- |
| Trunk | Winter Min. Expense, m3/24 h | Summer Max. Expense, m3/24 h | Percentage change, % |
| d=200 mm | 1,190 | 2,150 | 80% |
| d=300 mm | 3,990 | 6,600 | 65% |
| d=400 mm | 1,076 | 1,638 | 52% |
| Total: | **6,256** | **10,388** | **66%** |

Historical data on the intake, losses of the water in Mtskheta according to the years are as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | 2021 m3 | 2020 m3 | 2019 m3 | 2018 m3 |
| Water intake | 2,715,878 | 2,529,500 | 2,250,556 | 2,628,045 |
| Water realization | 1,005,309 | 1,071,267 | 1,125,492 | 1,097,294 |
| Loss | 1,710,569 | 1,458,233 | 1,125,064 | 1,530,752 |
| Loss % | **63%** | **58%** | **50%** | **58%** |

A graphic illustration of water losses by years and percentages is as follows:

## Commercial Information

According to the number of customers, Mtskheta is a small settlement. The information according to the conditions of June 30th2022, is as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Number of numerator users | Number of non-numerical users | Total number of users | share  % |
| Houses | 1,482 | 162 | 1,644 | 50% |
| Buildings | 1,103 | 278 | 1,381 | 42% |
| Budget | 52 | 0 | 52 | 2% |
| Commercial | 214 | 0 | 214 | 7% |
| Total: | **2,851** | **440** | **3,291** | **100%** |

The total number of users can be considered in accordance with the class of the service recipient:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Water and wastewater jointly, quantity | only water, quantity | SEWERAGE only, quantity | Total |
| Houses | 1,607 | 37 | 0 | 1,644 |
| Buildings | 1,370 | 11 | 0 | 1,381 |
| Budget | 51 | 1 | 0 | 52 |
| Commercial | 192 | 21 | 1 | 214 |
| Total: | **3,220** | **70** | **1** | **3,291** |

The city of Mtskheta is part of the Georgian Water and Power Water Supply License Area LLC, therefore, here the Georgian Energy and Water Supply Company sets various consumer tariffs according to the categories 2021-2023:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Numerator 1m3 price, GEL VAT | Consumption of 1 soul per month, including GEL VAT | Numerator 1 soul set consumption per month, m3 |
| Houses | 0.50 | 4.52 | 8.67 |
| Buildings | 0.50 | 4.52 | 8.67 |
| Budget | 6.50 | All metered | All metered |
| Commercial | 6.50 | All metered | All metered |

All commercial and budgetary customers are metered from the moment of the deposit. Some of the individual customers, that is, private houses and buildings, are not metered, respectively, the regulator has set the norm consumption per 1 soul, which is 8.67 m3 per month, that is, 289 liters per 1 person per day. Soul checks are done with the Public Registry.

The tariff set by the regulator includes water supply and sewerage components, respectively, the total tariff is divided into 2 parts:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Price of water only, including GEL VAT | The price of wastewater only, including GEL including VAT | Full tariff price, GEL including VAT |
| Houses | 0.39 | 0.11 | 0.50 |
| Buildings | 0.39 | 0.11 | 0.50 |
| Budget | 5.08 | 1.42 | 6.50 |
| Commercial | 5.08 | 1.42 | 6.50 |

## Future Development

At the current stage, the so-called moratorium is in place in the city of Mtskheta, which imposes restrictions on development. As a result of the investigation, it is determined that the local municipality is actively working on the removal of the moratorium. According to the available data, after the moratorium is lifted, it is highly likely that private houses will be built on the slope of the city, on existing free land plots. The central part of the city is densely built and unlikely to develop, although if any, there will be no obstacle to the throughput of the trunk pipes.

It is necessary to note that the development of slopes will affect the booster pumping stations:

* The area of the Narekavi pumping station - the area of the development is 78,730 m2, which is about 140 plots. Additional water flow will be at an altitude of 70 m at 18 m3/h. A similar addition will result in a change in the parameters of the existing pumping station, as well as the diameter of the station suction pipe.
* The area of the construction area is 52,560 m2, which is about 100 for the plot. Additional water flow will be at 20 m3/h at an altitude of 125 m. A similar addition will result in a change in the parameters of the existing pumping station, as well as the diameter of the station's presser pipe.
* The area between the brick factory settlement and the Gori pumping stations - the area of the development is 390,100 m2, which is about 650 for the plot. The additional water flow for the benchmark is 75 m3/h at an altitude of 60 m. This can be achieved by building a new booster pump station in the vicinity of the water supply debit, or by changing the parameters of the existing pumping station of the brick factory settlement and the pressurizing network.

In total, the water added to the development of the city of Mtskheta is 113 m3/h, which is not an obstacle for the main pipelines of Mtskheta d= 200 mm, d= 300 mm and d= 400 mm, since their throughput is much greater than the expected consumption by current or future development.

It is necessary to note that from 2022 the water supply of the settlement of Mukhati was added to the Mtskheta service center. Like Mtskheta, Mukhati water supply is carried out from the 8th watershed, with d= 273 mm and d= 160 mm highways, on which mechanical regulators are installed.

As a result of the study, it is established that the water supply area of Mukhati includes both private population and commercial facilities. The area of the area is 419,000 m2, which is about enough for 700 plots that have not yet been fully built. The water consumption of the area is calculated based on the prospect in 90 m3/h. According to the hydraulic model, the diameters of the existing highways take into account the prospect of development fully provide the water supply to the oak.

## Sewerage

The total length of the sewerage network in Alaka Mtskheta is 32,390 meters. The network is self-contained without a pumping station and a central treatment plant. A small individual wastewater treatment plant has only a military part. Information about networks is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| N | Diameter, mm | Length, meter | Category |
| 1 | 50 | 44 | Branching |
| 2 | 80 | 35 | Branching |
| 3 | 100 | 1,121 | Branching |
| 4 | 150 | 3,425 | Trunk |
| 5 | 200 | 15,917 | Trunk |
| 6 | 250 | 514 | Trunk |
| 7 | 300 | 6,150 | Trunk |
| 8 | 400 | 3,415 | Trunk |
| 9 | 500 | 1,052 | Trunk |
| 10 | 600 | 208 | Trunk |
| 11 | Concrete | 509 | Water Groove |
| Total: |  | **32,390** |  |

Sewerage networks in the city of Mtskheta have been arranged since ancient times. There is a central collector on which a large part of the population is connected, and it flows into the Aragvi River.

For the rest of the population, the collector bypasses the sewerage flow directly into the Aragvi River, Mtkvari and Narekavi with an existing sewerage network, as well as individually with a sewage network arranged by the population, which is about 143 subscribers. In addition, water flows into the rivers by means of an organized sewage network. In addition, local pits are recorded for 11 houses.

It is necessary to note that in the city of Mtskheta there is a mixed system of watersheds and sanitizer networks:

* K. Gamsakhurdia St.Ucha;
* Arsukidze St.Ucha;
* Near Kakheti Street.
* Sh. RussTavelS. A. Tsereteli Street.
* AghmashenebeliAni N 18a and Aghmashenebeli N20;
* The settlement between D. Aghmashenebeli 2 lanes and Petre Iberi St. Uchs;
* Aghmashenebeli N 106 and N29.

Since there will be some issue of individual connection to wastewater rivers, as well as the solution to the problem of separation of drainage networks, it is possible to plan the construction of a local central treatment plant or pumping wastewater to the centrally collector of Tbilisi, for which it will be necessary to construct the receiving reservoir, pumping station and d=500 mm presser collector at a length of 8 km.

The study in the hydraulic model reveals that the diameters of the trunk network of the wastewater system do not meet the permeability of wastewater and will not encounter a problem in the future in the case of the development of the affected areas.

To fully describe the wastewater, it is necessary to note that there are no wastewater treatment systems in the new water supply area of Mtskheta service center, in particular, in the village of Mukhati and the population is mainly arranged in the so-called pits. If networks are arranged in the future, then there will be 3 possible options for cleaning:

* Build a local treatment plant and spill the purified wastewater into the Mtkvari River.
* If a wastewater pump station d=500 mm presser highway is built in Mtskheta in the direction of Tbilisi collectors, it can be attached.
* If a central treatment plant is built in Mtskheta, it is possible to connect to the collector on the way to the cleaning.