WATER AUDIT REPORT

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1 Introduction

1.1 Scope

The main objective of this Water Audit Report is to present the current status analysis and assessment of the current situation of water supply generally in Korca municipality and specifically in villages where SaveSafeWater have been implemented.

1.2 Methodology

The methodology followed for the preparation of the report is based information taken from Korca Water Supply and Sewerage Company, reports and audits form Water Regulatory Entity, and also questionnaires and methodology given in work packages of Interreg-IPA CBC, Greece – Albania programme.

2 Network's current (operation, control and monitoring) status

Below will be presented the current situation of the water supply network for the villages where the Safe Water project has been implemented, such as: Shamoll, Malavec, Qatrom, Sheqeras and Kicnik.

2.1 Shamoll and Malavec villages

The village of Shamoll is part of the Bulgarec Administrative Unit of the Korca Municipality, located approx. 9 km north of the town of Korca, at an altitude of about 820m above sea level. It has a population of 800 inhabitants according to the official registry data.

The village of Malavec is also part of the Bulgarec Administrative Unit of the Korca Municipality, approx. 6 km in north of the town of Korce, at an altitude of about 838 m above sea level. It has a population of 310 inhabitants according to the official registry data.

The implementation of SaveWater project in 2019 in this villages have improved significantly the water supply network. In this two villages the interventions have been done on Transmission Lines and Distribution Networks. The implementation of this project has caused the shutdown of the existing water supply system which was depreciated and out of standards.

Project has built a new water supply transmission line and reduce water losses caused due to pipeline bursts and made possible the water supply for the first time to 75 families in the village of Malavec. These interventions have been a step forward towards providing 24-hour hygienically clean water to the inhabitants of the villages of Shamoll and Malavec, in Korca Municipality.

The connection point to the Korça City network is at a distance of approx. 5000ml with HDPE DN 90mm pipeline, PN16 (according to the existing pipeline standard of this network). At this length of the pipeline have been left a tributary which continue to the village of Malavec. The transmission line from the branching to the village of Malavec has a length of approx. 1500ml HDPE, DN 90mm, PN16.

The project made possible a new internal network in both villages as well as the water connection points for all the houses. These networks have 90mm, 63mm and 32mm HDPE piping and 20mm RC, PN16 connection points.

Figures below show the plan of internal transmission line for both Shamoll and Malavec villages.

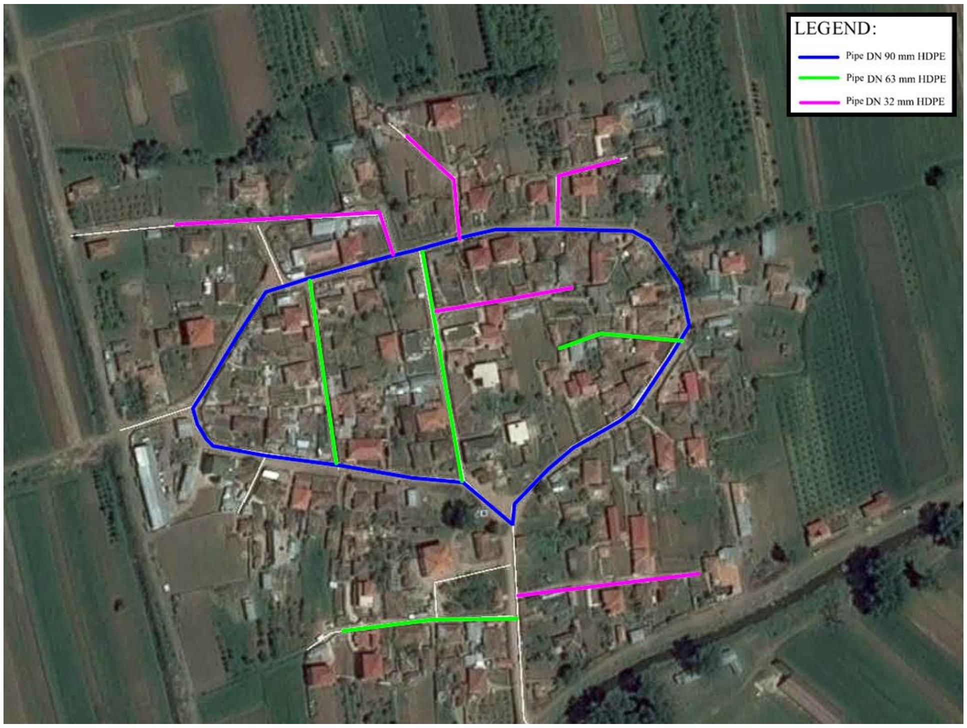


Figure 1. Shamoll village Internal Water Supply Network Line Plan

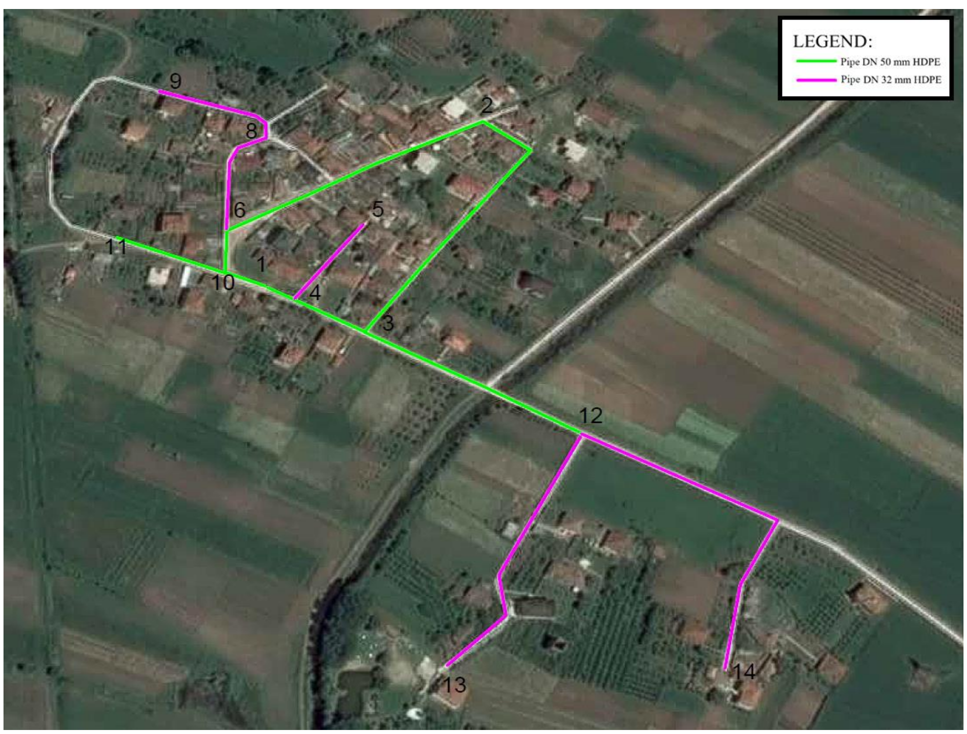


Figure 2. Malavec village Internal Water Supply Network Line Plan

2.2 Qatrom village

The village of Qatrom is part of the Drenova Administrative Unit of the Korca Municipality, located approx. 5 km in southwest of the town of Korca, at an altitude of about 853m above sea level. It has a population of 858 inhabitants according to the official registry data.

In Qatom village it's also been done the construction of the new internal water supply network, that extends from the connection point with the main Vithkuq-Korça transmission line (Q= 30-40 l/s) to the connection points with the village facilities. This network is constructed with 75mm, 50mm and 32mm HDPE pipes and 20mm RC, PN16 connection points.

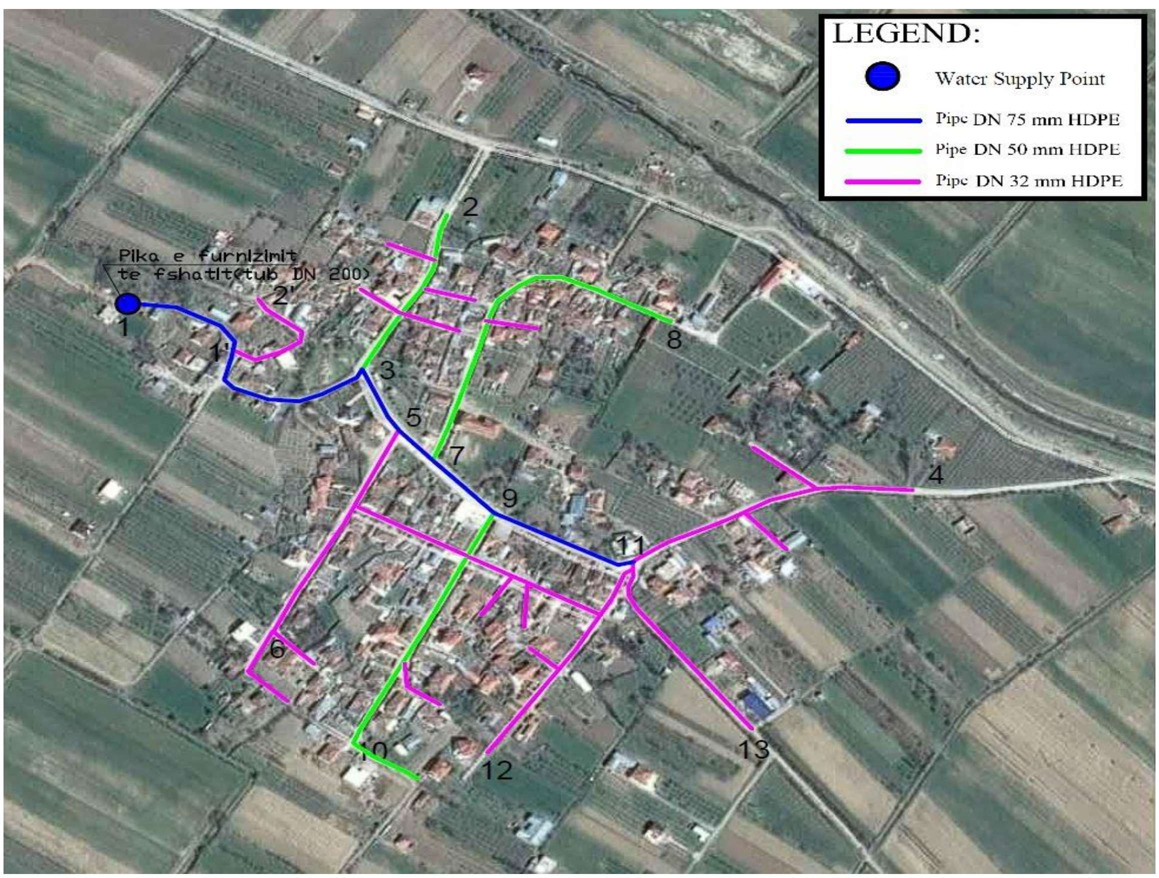


Figure 3. Qatrom Village transmission line and the internal water supply network

2.3 Kishinik and Podgorie villages

Kishinik and Podgorie villages are part of Vreshtas Administrative Unit and are located approx. 30 km in north of Korca city at an altitude of about 927m. The total population, by including both villages, is approx. 5000 inhabitants.

Before the implementation of project, partial water supply has been provided for Podgorie village but was missing water supply for the Kishniku area. Now the water supply network in this villages is in good condition, a new intake structure have been built near the pumping station that is also rehabilitated, a new storage tank with 100m3 volume has been built behind the pumping station that is supplied with water for intake structure by the 90mm PN10 pipe. The rehabilitation of the pumping station has improved the water supply for Podgorie village by installing a new pump with Q= 50m3/h.

Also, the external main line with mechanical lift, at 156m altitude and 2647m length, provide water for the Podgorie water storage. This line has a high pressure, therefore pipeline with DJ= 140mm and PN= 20atm are installed.

In order to ensure the water supply of the reservoir in Kishnik village a new well with mechanical lifting have been constructed along the main outer line. This well operate in such a quota as to provide self-leakage to the Kishniku reservoir. The supply line of Kishnik reservoir is with pipeline DJ= 90mm PN= 10atm.

For Kishnik village the internal water supply network is with pipes D= 50mm that are laid at each house, meanwhile the main supply pipeline is D= 50mm and is being supplied with mechanical lift from the hill.

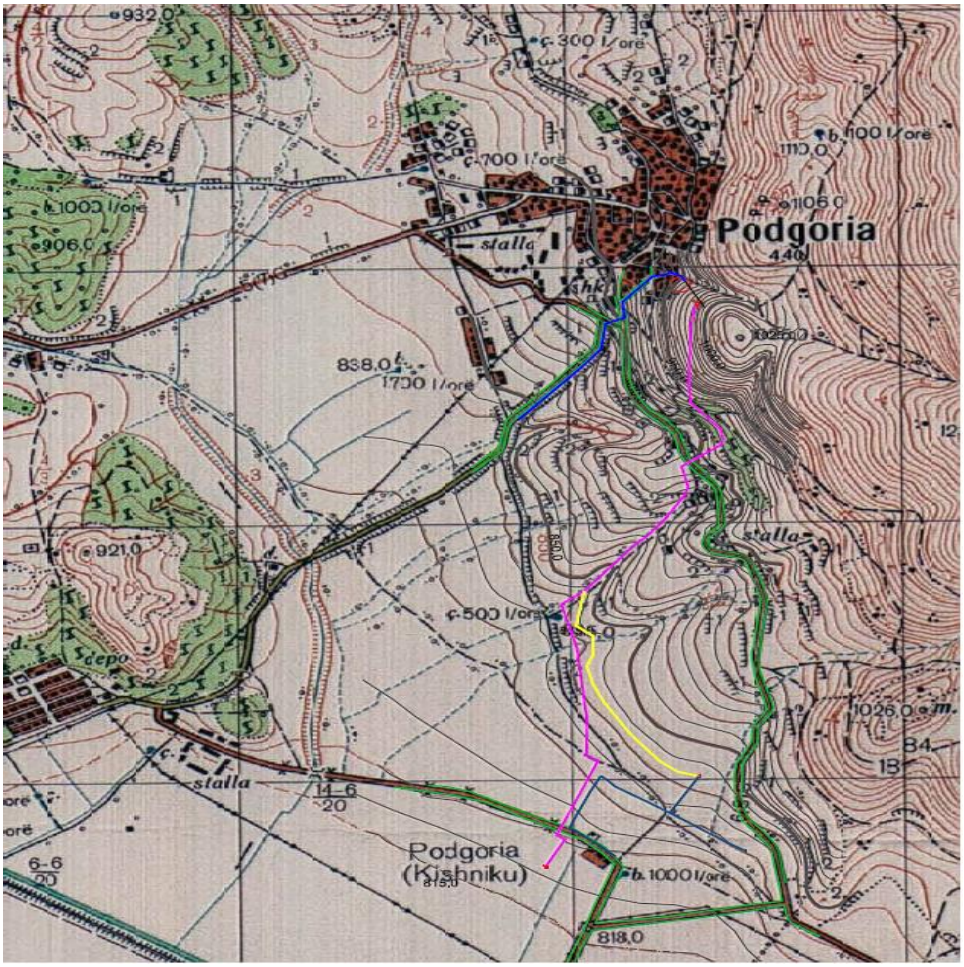


Figure 4. Transmission line of water supply network and location of pumping station and water storage in Kishnik and Podgorie Villages

2.4 Sheqeras Village

The village is located in north-east of the town of Maliq at an altitude of 815 m and about 22 km away from city of Korca. Sheqeras village is part of Vreshatas Adminstrative Unit and have approx. 2500 inhabitants.

The old water supply system of Sheqeras village was depended by two drilling wells located about 1 km north of Sovjan village. Both wells have guaranteed a flow of 5 l / sec. The water was collected at a pumping station and transmitted to the Sheqeras Water Storage by a 4 KW pump. Water from the Sheqeras village storage is distributed to the village through 3 pumps. Two 7.5 KW pumps and a 2.2 KW pump. This system have not guaranteed the water supply of the village for 24 hours and at the same time had a high cost as a result of big amount of electricity consumption.

The solution was given by the Save Water Project, with the construction of the 200 m3 water storage in the hills of Sovjan, that have minimize the costs with the self-leakage water supply system that does not depend on electricity (partly) and this supply system had also decrease the number of defects. The water depot has been built at 880m quota providing a height of 65m from the lowest point in the village. The depot volume is 200 m3. For the operation of this scheme a transmitting line Ø 100 has been built from the Sovjan Pumping Station to the water storage and a transmitting line Ø 110 from the water storage to the Sheqeras Water Supply Line. The new scheme guarantee full water supply of the village at an amount of 170 l/resident per day.

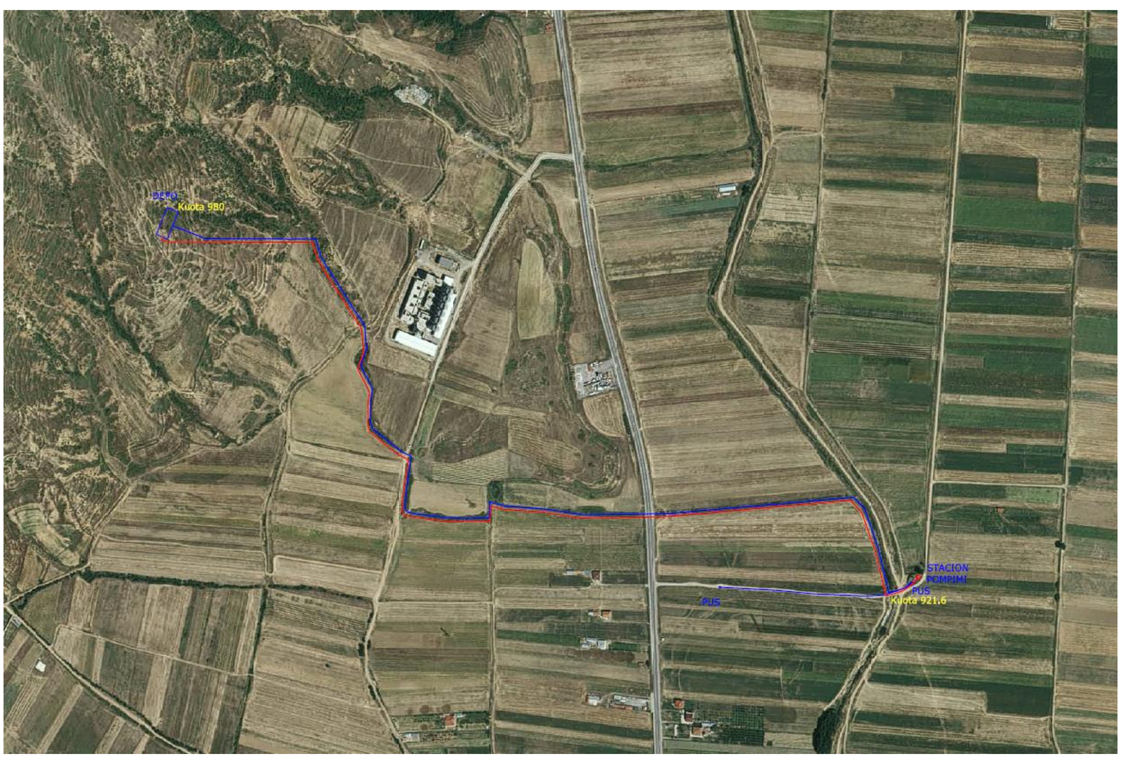


Figure 4. Sheqeras Village transmission line of water supply network and location of water storage.

2.5 General Indicators

- Total population served = *approx. 8700 inhabitants*
- Total area covered (Km2) = *approx. 2.869 km^2*
- Total pipes' length (Km) = *approx.* 26.87 km
- Mean altitude (m) = *810 – 970 m*
- Mean operating pressure (atm) = *10 – 20 atm*
- Types of pipes (material, diameters, lengths) = *HDPE, Ø140 – Ø20*
- Age of pipes (per material, diameter) = *1 – 10 years old*
- No. of service connections = *approx. 3135 connections*
- Billing Period = *Monthly*
- River Basin where water is taken from = *Mountain springs*

Table 1. Main sources for drinking water supply in Korca Region

Location (name of source)	Water flow (Litre/second)	Source Spring/Well
Turan – Korçë	300	Well
Vreshtas – Podgorie	8	Well
Sheqeras – Korçë	4.5	Well
Bulgarec – Korçë	100	Well
Vloçisht – Korçë	3	Well
Vithkuq- Korçë 2 km West of Greluos quarter	30-40	Spring
Centre of Kapshtica village	10-14	Spring

2.6 Issues and the maintenance of system

Main issues that might occur during the operation of the system are related to leakage that might show from any damage of the pipes, problems in connection points etc. There are possible problems during the winter in the frost period when temperatures drop below 0 grade. During this period the water might freeze and cause cracks in the pipes.

There is a Specific Maintenance Sector in Water and Sewerage Company of Korca which has 5 Teams Specialized in fast defect repairs, part of team involved in rural area repairs.

In the rural areas, where the network pressure is low, the teams are acting only after the moment the leakage become visible. The information about the leakage comes also from the inhabitants / customers and depending on the area, the repair time consists max a 1-2 hour (varies from the type of damage).

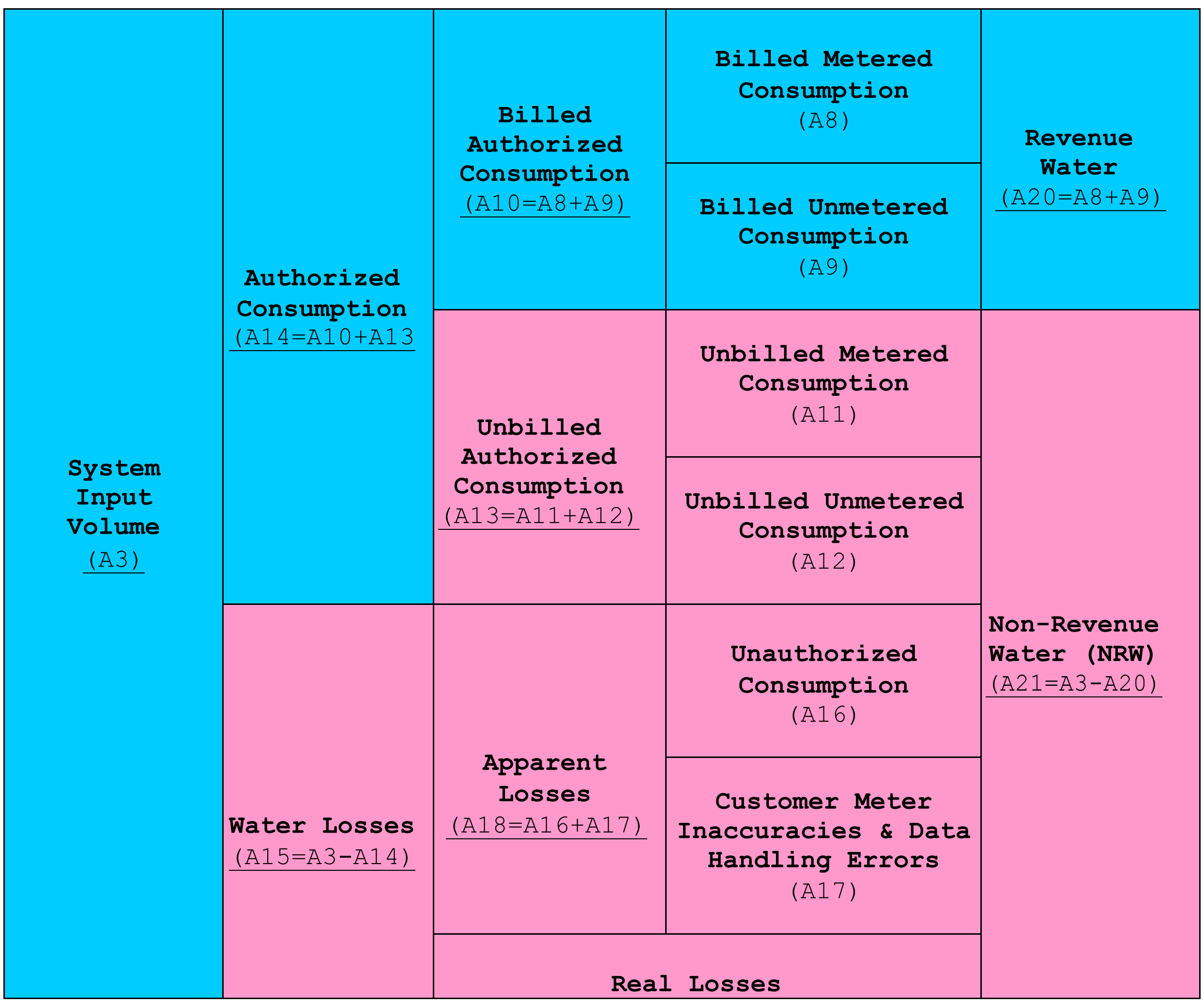
There are seasonal variations in water consumption, for example if we refer to the data of 2017, the third trimester (the summer season) has the biggest water consumption. As we are talking about a rural area, people use the water for irrigation also. During this time of the year, the population increases partly because of tourism but also the migrant population returns for vacation (most of them during August)

There is also a big consumption during the winter time, is case of low temperatures (December / January or January / February) people tend to live the tap partly open in order not to have problems with the freezing phenomenon.

There are several procedures followed on leakage repairs, simple cases and emergency ones. A Maintenance Operation Manual had been prepared and published internally from the Maintenance Department of the Company, according which the specialized team acts during the issues.

3 Water Balance assessment for the water distribution network

The International Standard IWA Water Balance is a useful tool of "best practice" (Figure 2) (Lambert, 1999). The IWA WB is a diagnostic approach, well acknowledged, which has been implemented in cases all around the world. It estimates NRW values and allocate the water volume which enters the water distribution network to its uses (several kinds of consumption or water losses).



		(A19=A15-A18)	

Table 2. The Standard International IWA Water Balance (Lambert, 1999)

The principal components definitions of the IWA WB are the following (Lambert, 1999; Farley and Trow, 2003):

- System input volume: is the annual volume input to that part of the water supply system.

- Authorized consumption: is the annual volume of metered and/or non-metered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so. It includes water exported, and leaks and overflows after the point of customer metering.

- Non-revenue water (NRW): is the difference between system input volume and billed authorized consumption. The procedure for calculating the water balance and the water components assessment not generating revenues, is based primarily on the unauthorized consumption and apparent losses assessment procedure. The deduction of these water volumes from the non-revenue water volume gives the real losses. The Non-Revenue Water consists of unbilled authorized consumption and water losses.

- Unbilled Authorized Consumption: includes items such as fire-fighting, flushing of mains and sewers, cleaning of suppliers' storage tanks, water taken from hydrants, water used for cleaning streets, watering of municipal gardens, public fountains, frost protection, water, building, etc. These can be billed or unbilled, metered or unmetered, according to the practice of Water Utility.

- Apparent Losses: consist of the unauthorized consumption (theft and illegal use) and the metering errors. Calculations of these volumes are preferably based on structured sampling tests or estimated by a robust local procedure. When quoted as a percentage of system input volume, apparent losses can range from 0-10% for direct pressure systems, or even more for systems with customer storage tanks. Apparent losses can be influenced by social and cultural factors, political influences and financial factors, and often require organizational changes in the system. As such they are more difficult to address and are usually part of a medium-to long-term action plan within a water loss strategy.
- Unauthorized consumption: occurs to a greater or less extent in most systems worldwide, but in reasonably well managed systems it should not exceed 1% of system input volume. This component of apparent losses is generally associated with misuse of fire hydrants and fire service connections, illegal connections, meters vandalized and corruption of the people who record the measurements (developing countries).

- Customer metering errors include: (a) Random errors due to accounting procedures – differences between dates of source meter reading and customer meter readings, misread meters, incorrect estimates for stopped meters, adjustments to original meter readings, improper calculations, computer programming errors, etc.; (b) Systematic errors due to under-registration or over-registration of customer meters.

- Real losses: are the annual water volumes lost through all types of leaks, bursts and overflows on mains, service reservoirs and service connections, up to the point of customer meter. When leakage data are available, real losses can be estimated by performing the “bottom up” approach. Real losses consist of (Alegre et al., 2006):

- Real losses on raw water mains and at the treatment works;
- Leakage on transmission and/or distribution mains;
- Leakage and overflows at transmission and/or distribution storage tanks; and
- Leakage on service connections up to the measurement point.

Following the Water Balance methodology, in the table below will be presented the situation of the water balance in Korca Municipality,

<table>
<tr>
<td rowspan="7">System Input Volume
3,200,000 m3</td>
<td rowspan="4">Authorized Consumption
2,600,000 m3</td>
<td rowspan="2">Billed Authorized Consumption
2,560,000 m^3</td>
<td>Billed Metered Consumption
2,400,000 m^3</td>
<td rowspan="2">Revenue Water
2,560,000 m^3</td>
</tr>
<tr>
<td>Billed Unmetered Consumption
160,000</td>
</tr>
<tr>
<td rowspan="2">Unbilled Authorized Consumption
40,000 m^3</td>
<td>Unbilled Metered Consumption
40,000 m^3</td>
<td rowspan="5">Non-Revenue Water (NRW)
640,000 m^3</td>
</tr>
<tr>
<td>Unbilled Unmetered Consumption
N/A</td>
</tr>
<tr>
<td rowspan="3">Water Losses
600,000</td>
<td rowspan="2">Apparent Losses
40,000 m^3</td>
<td>Unauthorized Consumption
32,000 m^3</td>
</tr>
<tr>
<td>Customer Meter Inaccuracies & Data Handling Errors
8,000 m^3</td>
</tr>
<tr>
<td colspan="2">Real Losses</td>
</tr>
</table>

		560,000 m^3	

Table 3. Korca municipality Water Balance

4 Performance Indicators

IWA has recorded 170 performance indicators (Alegre et al, 2006). The performance indicators consist of general indicators providing an overview of the efficiency and effectiveness and detailed indicators dealing with specific aspects of the utility functionally. They are divided in 6 groups:

- Water resources (WR);
- Personnel (Pe);
- Quality of Services (QS);
- Operational (Op);
- Physical (Ph); and
- Economic and Financial (Fi).

The list of the 170 PIs, their formulas and units can be found at the WB/PI Calc-UTH (attached). 232 variables are used to calculate the 170 PIs.

- NRW by volume (Fi46) (%) = 41.08 %
- NRW by cost (Fi47) (%) = 0.52 %
- Water Losses per connection (Op23) = (m3/connection/year) 73 m3/connection/year
- Water Losses per mains length (Op24) = (m3/Km/year) N/A
- Apparent Losses (Op25) (%) = N/A

- Apparent Losses per SIV (Op26) (%) =

- Real Losses per connection (Op27) = 438,034
  (lit/connection/day when system is pressurized)

- Real Losses per mains length (Op28) = 39,058,000
  (lit/km/day when system is pressurized)

- UARL = N/A

- ILI = N/A

- ALI = N/A