



Fig. 6&7, The open canal and aqueducts

Besides the main buildings, within the hydrosystem, numerous facilities were built for irrigation and drying, the road traffic and the exploitation, facilities for the protection from the torrential waters and erosion, and the river flows have been regulated.

3.3 The network of underground pipes

From the land of water occupying the main canals, the water enters an underground pipe with larger dimensions, which is then divided into pipe bounds of smaller dimensions. These pipes with smaller dimension tubes, are called the II order and III order.

3.4 Facilities of irrigation

The facilities for irrigation comprise aluminum tubing with a standard length, which are connected among themselves and form the required length, in which they are set to spray water distribution across the surface of the earth in the form of rain.

The lands included within this system are light soils that absorb water quickly, but have a smaller water capacity and soils that absorb water slowly, but have greater water capacity.



Fig.8, Details of irrigation from the Iber field

Iber irrigation system is semi-stationary, so it is partially deployed underground, while the carrier is partially above the ground. It is imperative that every user should know and possess the technique of using the system, so, that this system is used successfully for irrigation [3].

With the construction of the great dam of "Ujeman" in the "Iber" river basin, the accumulated Iber waters form the largest manmade lake, which have a volume of 370 million cubic meters, of which about 20,000 hectares are irrigated, within the "Iber" system approximately 65 million m³ will be used [1].

The canals, which convey water from the basin compensatory, of the "Privodrica" dam are wide in "Iber" with a length of 150 km, from which the water is taken in certain countries, irrigated and with the help of stationary or mobile pumping aggregates, water pressure (pressure) are inserted into the underground pipe network, while in those places where the canal has sufficient domination (over 30 m) on the surface for irrigation is issued in underground pipe bounds and are found under natural pressure.

From the land of water occupying the main canals, the water enters an underground pipe with the largest dimension (pipe order I), which is divided into pipe bounds with small dimensions (with the pipe order II and III). These pipes have diameters of 800 mm (order I) in 125mm wide (order III).

Facilities for irrigation comprise aluminum tubing with standard length (6m), who are related to the properties and form the required length, in which the sprayed water is distributed across the surface of the earth, in the form of rain [1].

4 Results

According to the research done, the quality of the infrastructure assets of the accumulation and Water transportation canal is in a bad condition and needs rehabilitation, and also the protection against accidental blockages, pollution, and other causes to this disorder [3]. Water losses are high in the transmission systems and can be reduced, significantly, with a relatively low cost. Despite this, the mudslides, debris, and animals that end up in these unprotected canals of the "Iber – Lepenc" and the pollution from the surrounding areas and streets, all jeopardize the reliability and quality of the industrial Water supply [4]. Bacteriological and chemical pollution, as well as, waste, are also evident.

Based on the results from the research done, we can that:

4.1 Dams – are in an acceptable condition. The main issue relates to the supervision and monitoring of dams, things that were cut in between, since 1997. Based on the examination, the dam has deviated, except for the part where the part of the reduction can be seen with a naked eye, some concrete parts are damaged or missing.



Fig. 9, Current status of a partially restored canal

Parts in the upper or lower leakage are generally in a good condition. The increased vegetation is the main concern. A gate of the discharged canal is not in function. The maintenance of the gallery is at the appropriate level and the accumulation which has increased the sedimentation, is considered a phenomenon[10].

4.2 Distributor canal—almost 30 years have passed, since the construction of the distributive canals, where their current situation consists of a huge loss of Water, due to the ageing of the amortization structure. Physical damages have caused losses, where we see large cracks, which are measured up to 0.50m. The main infrastructural objects of the canal, such as, tunnels and siphons have not been rehabilitated and the damages can be easily seen in these structures, which are done because of the aging, as well as, physical injuries, which represent a potential risk, in the future, for the normal functioning of the canal [5]. The maintenance of buildings, in emergency cases, is not at the right level. In some parts, the erosion soil is easily seen. As a result, the final point of the canal reaches up to 60%, of which half are due to the mismanagement of Water (this includes the issuance of larger quantities of Water than needed) and the other half are due to the factors that we have mentioned above. Starting from the open canal with

a trapeze shape, the canal passes through the U-Profile cutting rectangular, which as a holder starts with a distance of 12.00m in frame. The walls of the canal, on the upper side, are made of a reinforced concrete with 0.30x0.30m dimensions, at a distance of 2.80m. The walls and floor are made of reinforced concrete with a thickness level $t=40.00\text{cm}$, the filling of the trench with Water, depends on the issuance and spending, as well as, the needs of hydro-meteorological conditions. You can easily observe the surface degradation, from the inside, as well as, minor damages in the wall, hanging at a Water level.



Fig.10, Current status of a partially restored canal

This level reaches the Water with low temperatures, due to freezing, the concrete structure gets damaged and, with time, it may face bigger damages with larger consequences (Foto 2&3). Due to freezing and external Water flow, the pillar holders may also get damaged. The damages are evident and, mostly, in the protective layer of armor, where we can easily notice a reinforced degradation[6].

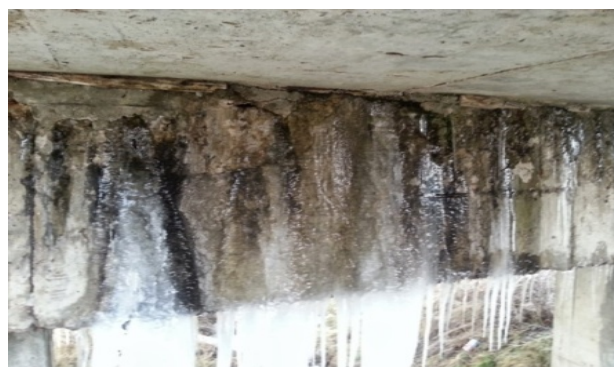


Fig. 11, The damage of pilar holders and canals from freezing and water loss

4.3 Properties and the environmental impact

In many cases, the construction waste materials and various types of solid waste are disposed in uncultivated areas, near the Iber – Lepenc canal, which pollute the soil on the shore of the canal, with metal components and oil. Deforestation, fire, and wood diseases have an impact on the forest cover and soil stability[7]. Many of the houses are built on agricultural land within the perimeter of irrigation. Property problems and the recreation of land registry are underway, but, in the meantime, the ownership of some plots of land is insecure. The usage of pesticides and artificial fertilizers are, also, representatives of local sources of pollution. All of these contamination levels, significantly, exceed the EU thresholds. As a result, the "Sitnica" river is polluted with heavy metals, suspended solid matters, sulphate, nitrate, and chlorine. It is, in fact, the most polluted river, in Kosovo, thus, this pollution has an impact on the "Iber" river, to the point of confluence [8].

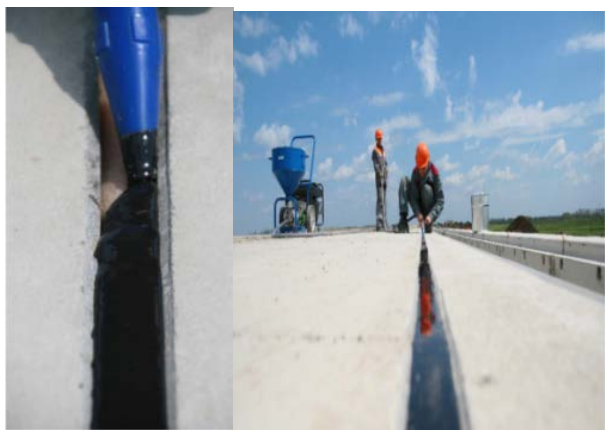


Fig.12&13, The rehabilitation canal with Fuga materials

5 Discussion and Conclusion

In order of preventing the risks for the future generations, the old infrastructure needs the first repair. Repairs on aqueducts, canals with the form of trapeze, joints and drainage canals, have given positive impacts on the water supply of the request of the economic operators. Therefore, the repairs made within time, result positively. The water quality, in the storage, is considered as good, but during the transmission, throughout the canals, we were able to find pollution, which, are mostly caused from the human factor and the other ones from the rainfall and snow. The main problem in the water distribution is the technical loss of water, this happens as a result of the depreciated system, where

the repairs have not made key facilities in a professional way, while using modern technology. The greatest losses are seen in the distribution canals, which are composed in Table 4.

Table. 4, The details of the distributive composition canals

Type of Structure	Amount	Height (m)
Open Canals of Type "A"		18 913.85
Closed Canals of Type "B"		11 645.96
Open Canals of Types "B" and "E"		2 086.44
Closed Canals "C"		1 355.96
Siphons	11	3 506.58
Aqueducts	20	2 321.58
Tunels	14	9 487.95
Partition Structures	3	90.15
Passing Structures		1 117.33
Total		49 185.84

The greatest losses are in the distributive canals. These structures are built of concrete. The length of the open canals, aqueducts, and cross-overs from the starting point of the canal, are approximately 24500m. The length of the canal with a trapeze shape is 18913.85m, where, up to this moment, 80% have been rehabilitated, of which the failure of modern material technology is easily noted, specifically in the material joints (see picture 9,10&11).

Pictures show the rehabilitation of the canals, but the failure of the joint materials can be easily seen. According to the research done, we have found out that the material used is of new technology. We have found the adequate materials for these issues, such as, Fix-O-Flex – the German manufacturer. With the introduction of this material, the biggest bulk of flows is eliminated. Other facilities are in poor conditions, where we can find Water loss and in certain parts, even the normal Water supply is in danger. Out of all the damaged buildings, the aqueducts are also included, where there is a need of the general overhaul, as soon as possible. In these objects, we can observe a huge Water loss, as a result of the degradation of materials and depreciation. Physical damages are as a result of the terminal side, from the purpose of the Water flow. These impairments have a total length of 50cm. After all of the constructive rehabilitation of the

aqueduct, the anti-corrosive protection should be done, with anti-corrosion, paint, with two concrete surface actions, which have been cleaned, previously, with high-pressure Water.

6 Recommendations

Based on the studies of this project, our recommendations are listed, as below: our recommendations are listed, as below:

- The rehabilitation of special facilities, such as, aqueducts, tunnels, and siphons;
- The rehabilitation of un-restored residuals with a trapeze canal shape and the rehabilitation of joints;
- Drainage maintenance;
- Property definition, as well as, the removal of wild occupations along the canal;
- The structural construction for protecting various earth slides;
- Property usage along the canal, by cultivating fruit nuts or sweet fruits;
- The usage of landfills for fish farming;
- The implementation of mini hydro-power plants will small capacities 0.5-1.0 MW;
- The implementation of the Mihaliq basin;
- The implementation of the digital management system – SCADA;
- The implementation of the second part of the “Lepenci” project[3];

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