The Revitalization of Some Old Projects for the Creation of New Waterways in Romania

Altan Abdulamit[1*)], Chemal Abdulamit[2]

[1*)] Technical University of Civil Engineering Bucharest, Romania; e-mail: altan1961@yahoo.com; ORCID: 0000-0001-9689-4923
[2)] S.C AQUA PROCIV PROIECT S.R.L., Cluj-Napoca, Bucharest branch, Romania; e-mail: cabdulamit@gmail.com

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Abstract

The article presents some aspects regarding the updating of some older studies for the navigation on the Arges river, a tributary of the Danube river in Southern Romania. The new waterways are planned to connect Bucharest, the capital city of the country with Danube river. The initial project was conceived in the 1980s, but was abandoned immediately after the 1990s. More than 30 years after its abandonment, the complex hydraulic development scheme was proposed to be updated, in order to provide a series of water uses that will ensure the sustainable development of the area: Navigation; the new waterways will be part of the VII Pan European Corridor, the main river infrastructure artery of the European Union; Production of electricity from renewable sources in the planned HPPs of the hydraulic facilities; Flood protection of 11 localities, lifeline and industrial facilities etc; Aquaculture; Irrigation; Tourism, leisure etc. Extended studies and investigations were performed for the assessment of the health status of the existing works and the safety conditions to be fulfilled by the the re-designed structures as well as a large number of scenarios using hydraulic computations and models. The paper shows how the updated project was modernized and improved to comply with the current European requirements for environmental protection, biodiversity, energy, sustainable development etc.

Keywords: waterways, canal, locks, harbor

1. Introduction

The realization of the water link from Bucharest to the Danube has been of interest since the end of the 19th century. In 1929, the Romanian Parliament adopted the "Law for the Construction of the Argeş-Bucharest-Danube Canal". The economic recession from 1930 - 1933 and the situation preceding WWII did not allow the start of the planned project.

After 1960, new studies were drawn up regarding the water link from Bucharest to the Danube. Since the floods from 1970 - 1980 caused major damage, in May 1982 studies and documentation were drawn up for the development of the Argeş River. In July 1984, it was decided to connect the Municipality of Bucharest with the Danube on the rivers Argeş and Dâmboviţa. The project was developed to include two waterways (Figure 1):

The Argeş navigation canal is developed along the course of the Argeş river, between Danube (km 0 + 500, (Oltenița port) and km 73 + 000, 1 Decembrie port, South of Bucharest (L circa 72,50 km). It has a N-E orientation, bypassing Bucharest in the South. The head drops on the navigation sectors were designed as hydrotechnical nodes with chutes, at a normal retention elevation (NRE) of 13.0 m, equally distributed for each of the 4 nodes.

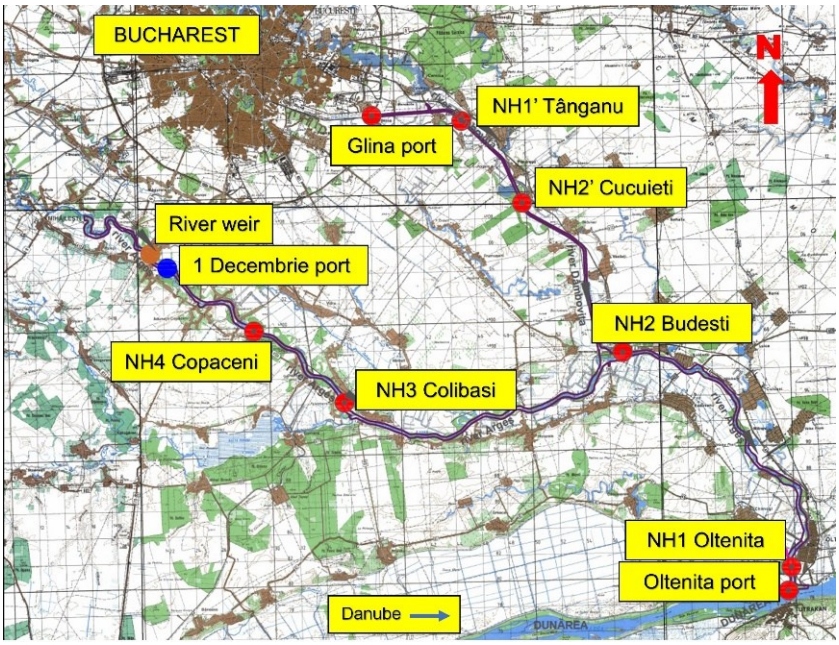

Fig. 1. Bucharest – Danube Canal. General layout of the project

The Dâmboviţa navigation canal, which will be realized by developing the lower course of the Dâmboviţa river, downstream of the bridge on the Bucharest ring, on the sector between the port of Bucharest - Glina and the town of Budeşti, where it flows into the Argeş canal. The connection with the Argeş canal is located upstream of NH2 Budeşti. The length of the waterway on the Dâmboviţa river, between the port of Bucharest-Glina and Budeşti, is 31 km, with a head difference of 14.60 m, via two hydrotechnical nodes: NH1' Tânganu, upstream and NH2' Cucuieţi, downstream.

In the year 1986, works began on the "Argeş River Development for Navigation, Irrigation and Other Uses" and in 1988 on the Dâmboviţa River. In January 1990, when the works on both canals, Argeş and Dâmboviţa were progressing quite well, the financial resources were halted, so was the whole project.

2. Why Revitalize an Old Project?

The reopening and completion of the old project for building the navigation canals Argeş and Dâmboviţa is required mainly due to the advanced stage of the accomplished works, as well as the major importance of economic and social benefits namely:

- Navigation, connecting the capital city, Bucharest, with the Danube. The new waterways will give direct access to the largest Black Sea port, Constanţa, to the main cities along the Danube and to the European waterways network. The VII Pan European corridor corresponds to the route of the Danube River (Nürnberg - Viena - Bratislava - Budapest - Belgrad - Drobeta Turnu Severin - Vidin/Calafat - Giurgiu/Ruse - Galaţi - Black Sea), completed with the Rhine - Main Canal and the Danube - Black Sea Canal (Figure 2). It represents the main river infrastructure artery of the European Union. Taking into account the current regional situation, the navigation project becomes of strategic interest for the European Union [1].

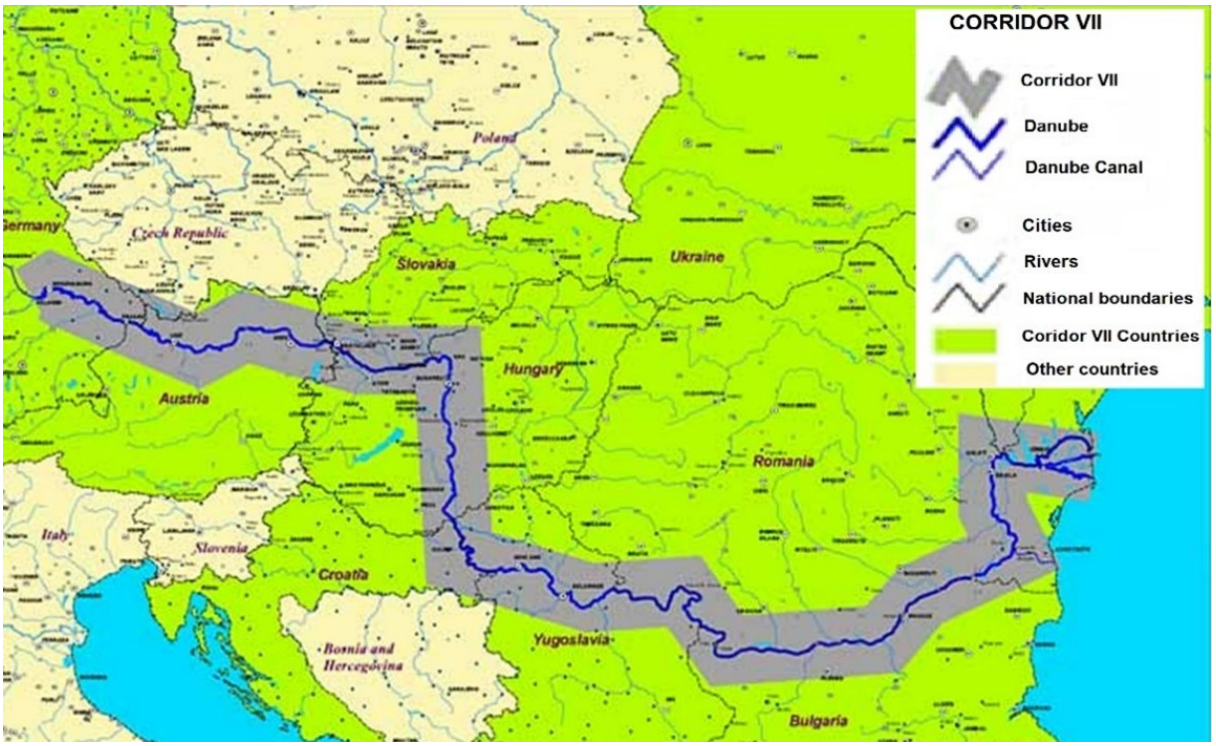

Fig. 2. The VII Pan European corridor.

- Hydroelectricity production. Approx. 120 GWh/year of renewable electricity in the hydropower plants associated with the hydrotechnical nodes of the development scheme.
- Flood protection for 11 localities, some 9,800 households, cca. 50,000 ha of land, 378 km of roads, 5 km of railways and 126 socio-economic objectives.
- Water supply and irrigation of neighbouring area, irrigation of approx. 50,000 ha, drainage of approx. 30,000 ha;
- Possibility of aquaculture on an area of approx. 1,250 ha;
- Social benefits - by ensuring in the area the conditions for the development of objectives and related activities, the creation of logistics areas and industrial parks, the increase of the economic potential of the riverine localities, including new jobs, as well as the development of tourism.

3. Brief Project Information

The planned waterways have a length of 73 km on Argeş river with a head drop of 53 m through 4 hydrotechnical nodes, while the canal on Dâmboviţa river will have a length of 31 km with a head drop of 14.60 m, through 2 hydrotechnical nodes (Figures 3, 4).

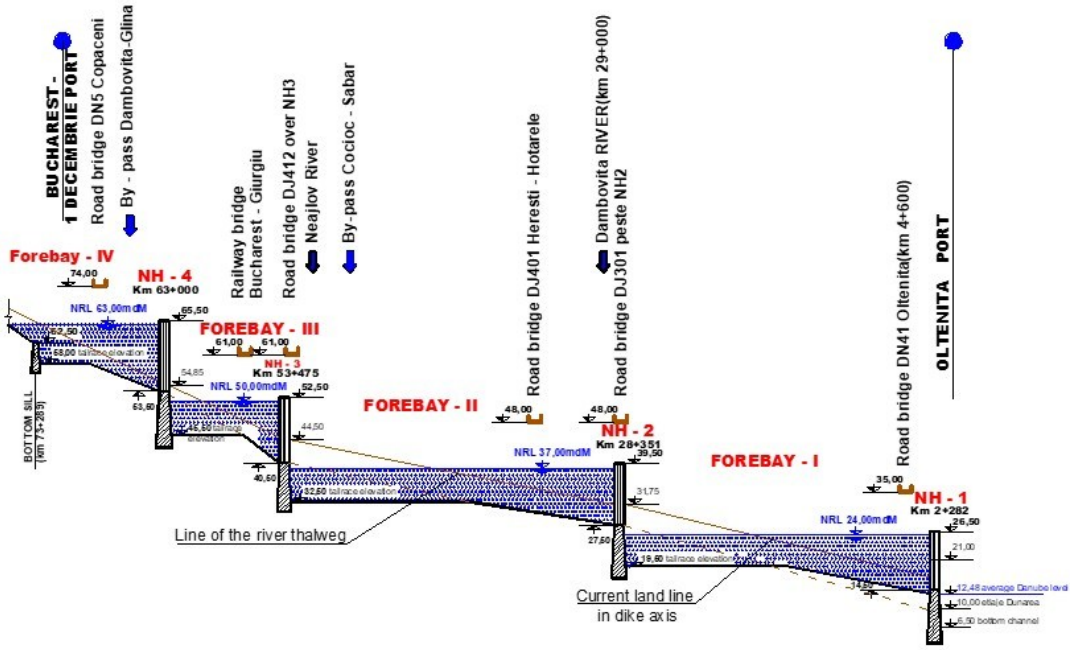

Fig. 3. Argeş river engineering scheme. Longitudinal profile.

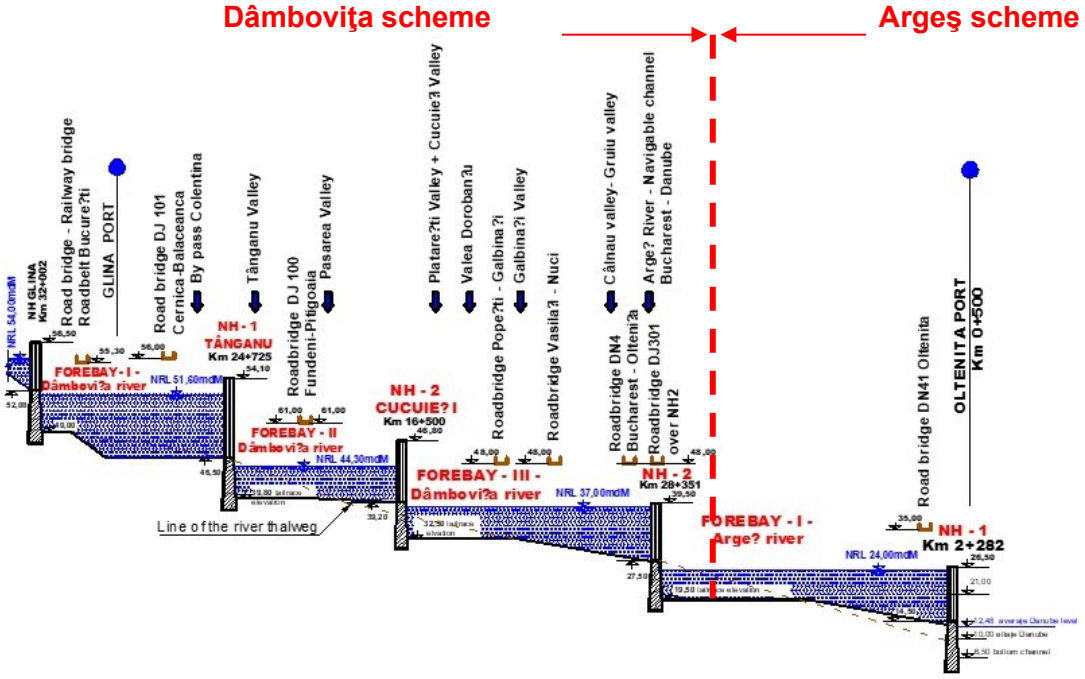

Fig. 4. Dâmboviţa river engineering scheme. Longitudinal profile.

The cross sections of the canals are usually trapezoidal with a base width of 80.0 m on Argeş and 40.0 m on Dâmboviţa, with a minimum depth of 4.50 m. The embankments are made from the material excavated for the river engineering works, provided with defense, protection and waterproofing works (Figure 5).

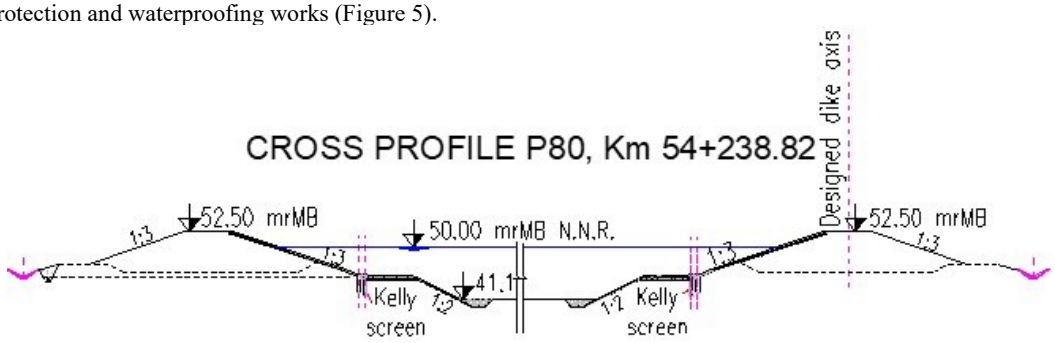

Fig. 5. Characteristic cross-sections on canal sectors with embankments.

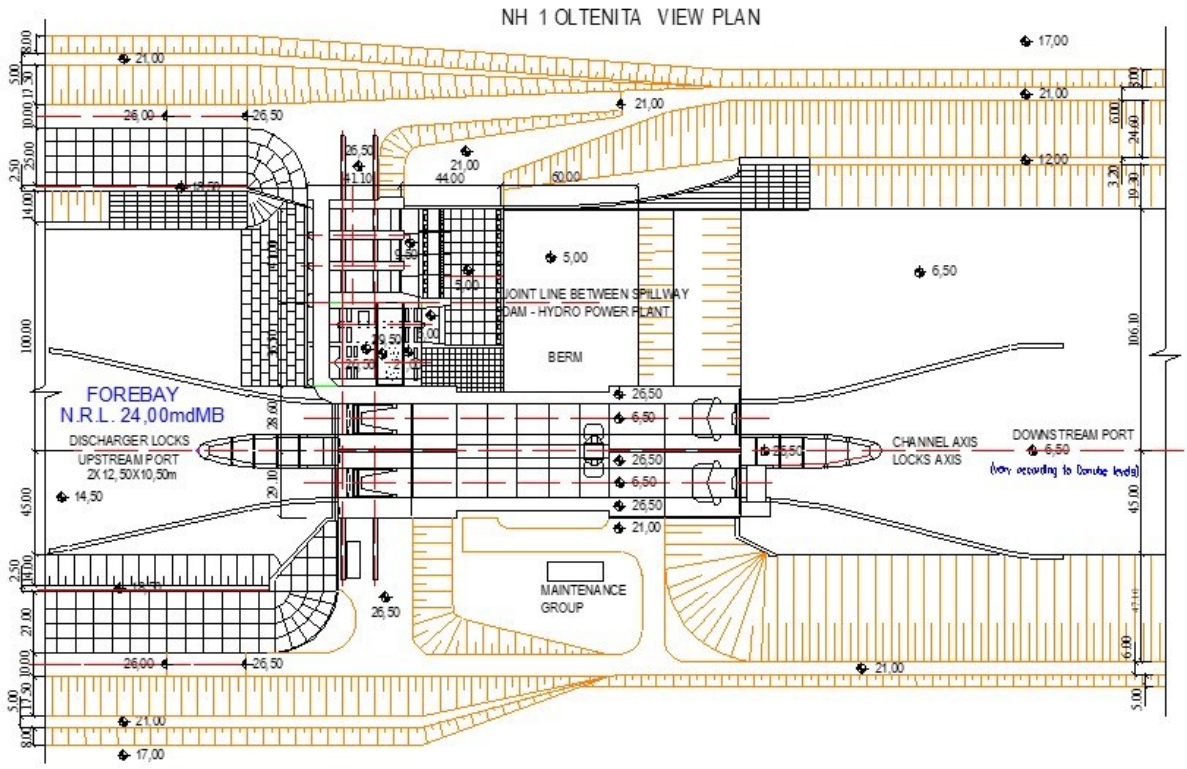

Fig. 6. NH1 Oltenița, plan view.

The planned hydrotechnical nodes include the following structures: gated weirs (navigation dams), micro hydropower stations, navigation locks (double locks at the Argeş canal). Therefore, the 2 schemes will have a total number of 6 complex systems of navigation dams and locks, combined with an equal number of micro-hydropower stations. Each lock will have its own operational ports. Figure 6 presents the plan view of such a complex system of navigation dams and locks for NH1, Oltenița.

4. The Possibility of Capitalizing on Already Completed Works

When the execution of the works for the complex developments on the Argeş and Dâmbovița rivers stopped in January 1990 and the project was abandoned, an important volume of works were already being carried out:

- 73% of the total volume of excavations;
- 69% of the total volume of embankments;
- 39% of the amount of concrete;
- 46% of the total surface of grout curtains;
- 36% of the total area of embankment slope protections;
- 24% of the total amount of hydromechanical equipment;
- over 80% of the infrastructure of the platforms of the Oltenița and Bucharest ports, the road bridges and the railway bridge from Grădiştea on the Argeş canal, the crossings of power lines and pipelines over the engineered river.
- the most difficult works to be executed were also in advanced phases of execution, i.e. the outposts related to hydrotechnical nodes, foundations of hydrotechnical nodes (locks, weirs, mico-hydropower stations) etc.

Figures 7, 8 present the existing situation of the works on the planned waterways, abandoned in 1990.

Fig. 7. NH3 Colibași on Argeş canal, downstream view of the existing works.

Fig. 8. NH Tânganu on Dâmboviţa canal, downstream view of the existing works.

Since a series of works have been carried out up to a certain stage, it was decided to renew the abandoned project and to complete the whole scheme and to connect it to the main European navigation corridor.

For this purpose, the existing works were investigated through expert reports. Expert level assessments allowed the specialists to propose solutions to provide reliability to the whole navigation project [2].

In the case of hydrotechnical nodes, the necessary completion, remedial or repair work was considered, which are usually required when the execution is resumed in case of suspension of the execution for long periods (treatment of the surfaces on which concreting is resumed, verification of reinforcement and additional reinforcement, anchors, checking the sealing elements etc) (Figure 9).

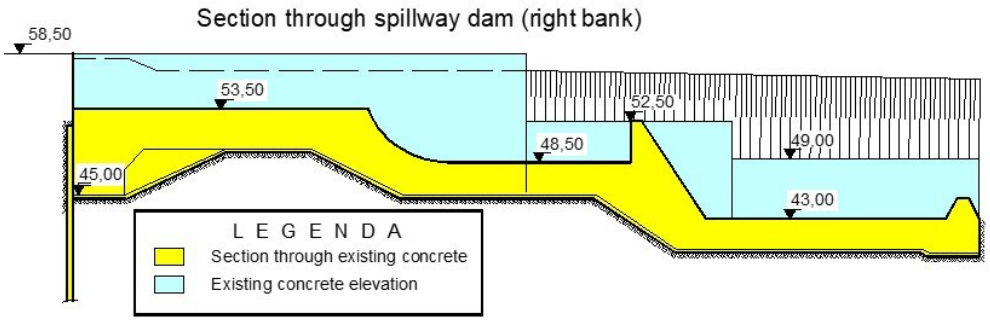

Fig. 9. NH 4 Copăceni. Navigation dam cross section, showing the existing and the remaining works.

5. Adapting the Old Project to Present Day's Safety and Environmental Requirements

In the re-design process, the actual Romanian standards, norms and guidelines were used according to international and national good engineering practice in the field of hydrotechnical constructions. Also, the good practices and recommendations contained in the technical bulletins of the International Commission on Large Dams (ICOLD) were taken into consideration.

All these provisions relating to the re-designed works are part of the owner's construction quality system, according to the Romanian Constructions Quality Law (No. 95/1995) [3].

New design standards were used for the safety assessments of the hydraulic structures, in static and dynamic conditions. The renewed earthquake design technical norms were also used, considering the latest European provisions and also the latest earthquake events recorded in Romania [4].

By carrying out the hydraulic computations in the new re-designed situation, the compliance of the proposed works with the new National Strategy for Flood Risk Management for medium and long term was checked. Thus, some new additional works were proposed to make the whole project to comply to the above-mentioned constraints [5].

The project is adapted to all the European environmental and water requirements. Water Framework Directive (2000/60/EC), Floods Directive (2007/60/EC), EU Biodiversity Strategy for 2030 etc. are some of the most important provisions that have to be taken into account in the process of project promotion [6].

In accordance with the provisions of the Europe 2020 strategy for the reduction of CO2 emissions for road vehicles, it is necessary to transfer a segment of freight transport from road transport to rail and inland waterways, in parallel with the other proposed measures.

In accordance with EU Regulation 1315/2013, in which priority TEN-T corridors are defined, at the level of the European Union, the Rhine-Danube Corridor on which the project is being developed connects Strasbourg and Mannheim by means of two parallel axes in the south of Germany, one along the river Main and the Danube, and the other through Stuttgart and Munich, with a branch to Prague and Zilina, to the Slovak-Ukrainian border, through Austria, Slovakia and Hungary, to the Romanian ports of Constanţa and Galaţi.

6. Conclusion

The initial project for creating new waterways in Bucharest area was conceived in the 1980s but was abandoned immediately after the 1990s.

The paper presents some aspects regarding the updating of some older studies for the navigation on the Argeş river, a tributary of the Danube River in Southern Romania.

The new waterways are planned to connect Bucharest, the capital city of the country, with Danube River.

More than 30 years after its abandonment, the complex hydraulic development scheme was proposed to be updated, based on complex studies on the assessment of the health status of the existing works, safety and hydraulic computations as well as compliance with the actual European water and environment directives and strategies.

Acknowledgments

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