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# Project preparation facility

## PPF8

*Updated Environmental  
Impact Assessment Study  
for the Adaptation of the  
Navigational Lock of HPP  
"Djerdap I"*

*Non-Technical summary*



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## 1. INTRODUCTION

The hydropower and navigation system Djerdap I, a complex and multipurpose facility, was built on 943<sup>rd</sup> km of the Danube. According to the Agreement on Construction and Operation signed between the former Yugoslavia and the Federal Republic of Romania, the main structure of the HPP "Djerdap I" was designed and built in such a way that each state has its own navigation lock. The navigation lock of the hydroelectric and navigation system Djerdap I, on Serbia side, has two levels. The usable length of each chamber is 310 m, width 34 m, the maximum difference between the water levels is 30.5 m, which makes it one of the largest in the world.

This navigating lock has been operating continuously since 1970 and has so far carried out about 76,000 transits with about 400.000 vessels and 210 million tons of goods.

The initially installed equipment at the navigation lock was at that time of the most modern design and was maintained particularly carefully. This resulted in multiple extensions of the service life and only a few interruptions in the period of exploitation. Nevertheless, in recent years, the state of equipment has rapidly deteriorated. For this reason, the replacement of the entire equipment without delay has been imposed as an urgent matter.

In 2007 and 2008, the European Agency for Reconstruction (EAR) financed the Development of Project and Bid Documentation for the Revitalization of Serbian Navigation Lock in Djerdap I and Djerdap II (Ref. EuropeAid/123966/D/SER/IU), which was carried out by the Consortium Vitteveen + Bos and Nebest from the Netherlands and Energoprojekt-Hidroinzenjering from Serbia. Within project documentation, which was prepared in compliance with EU standards, a procedure for assessing the environmental impact of the project has been launched. In this context, in accordance with the provisions of the Law on Environmental Impact Assessment ("Official Gazette of RS", no. 135/2004 and 36/09) and other relevant legislation, the Consortium submitted an Application for defining the scope and content of the Study on the Environmental Impact Assessment of the Navigation Lock Revitalization. The content of the Study on the Environmental Impact Assessment for the Navigation Lock was defined by decision no. 353-02-00303/2008-02 of 6 October, 2008, the Ministry of Environment and Spatial Planning of the Republic of Serbia during the mandatory procedure prescribed by the Law on Environmental Impact Assessment ("Official Gazette of RS", no. 135/04, 36/2009).

Approval to the Impact Assessment Study was obtained on October 8, 2009 by the Ministry of Environment and Spatial Planning of the Republic of Serbia, number 353-02-00401/2009-02.

Upon the completion of the above mentioned project and its technical documentation (including the Environmental Impact Assessment Study), most of the planned works on the navigation lock have not been carried out. In the meantime, in order to ensure the safety of the navigation lock, public utility company EPS replaced and revitalized certain parts of the navigation lock (the lower part of the double doors, the working head, the electromechanical equipment of the pump station).

As in the period from 2009 to 2017, public utility company EPS, the Hydroelectric Power Station Djerdap Kladovo Department, performed significant capital works on the navigation lock and thus significantly reduced the scope of works subject to the new project documentation compared to the existing project documentation from 2009, the development of a new, revised Design Project with Feasibility Study was initiated. It is also planned that the Study on the Environmental Impact Assessment would be updated within the PPF8 project, with the support of the Ministry of European Integration.

Based on the the decision number: 353-02-304/2017-16 dated September 27, 2017, the Ministry of Environmental Protection has, pursuant to the application of the Ministry of Construction, Transport and Infrastructure (the project holder), defined the scope and content of the updated Environmental Impact Assessment Study for the adaptation of the navigation lock within the HPP "Djerdap I", so that the Study which was approved in 2009 would be harmonized with the current circumstances and the reduced volume of necessary operations regarding the lock adaptation.

In 2017, the Ministry of Construction, Transport and Infrastructure submitted an application with CEF (Connecting Europe Facility) for granting funds for the adaptation of navigation lock on Djerdap I in the amount of 40% of the total costs. The remaining funds will be provided from the budget of the Republic of Serbia. This project is considered as a priority for the Ministry, due to the increased safety of navigation and the operation of the facility itself. According to the CEF instructions, adaptation works cannot start without the previously approved updated Environmental Impact Assessment Study.



## 2. DESCRIPTION OF THE PLANNED PROJECT SITE

The hydropower and navigation system Djerdap I, a complex and multipurpose facility, was built at the 942-950 km of the Danube from its confluence into the Black Sea. Location of HPP Djerdap 1 is set at the exit of the Danube from the Sipska Gorge (Iron Gate). Building of the dam caused the fall in the speed of the river flow of up to a level of 69.5 m above the sea level. In high waters of the Danube, water slows down to the mouth of the river Nera, i.e. to the entrance to the channel Danube - Tisa - Danube near Banatska Palanka. In case of low water level, the length of the lake is 132 km, it occupies an area of 135 km<sup>2</sup>, while at high water levels, the length of the lake is 264 km and its area is 245 km<sup>2</sup>. The total volume of water is about 2.800.000.000 m<sup>3</sup>. The length of the object per axis is 1227,5 m, in which there are two double-stage locks with a length of 2x310 m and a width of 49.0. The Serbian navigation lock is located on the right bank of the Danube. The axes of the navigation lock are directed at right angle towards the axis of the dam and the distance between them is 915 m.

### Pedological characteristics

Humus-accumulating soils are characteristic in the field of research - rendzina formed on carbonate sediments. The local type called *gajnjaca* is present as a cambisol soil. On sandstone and shale there are brown acid soils, while brown gravel soils are formed on terraced deposits. Brownly loessified sour soil is formed on clay, conglomerates and partly shale. The immediate location of navigation locks mostly consists of hydromorphic soils of alluvial and deluvial deposits.

### Geomorphological characteristics

After the exit from the Djerdap Gorge in the zone of Klodovski Kljuc, river and abrasion terraces can be distinguished. The Kljuc terrace is a spacious lane east of the research area formed from neogen sediments covered with loess and sandy deposits. The aeolian sand in the east is partially lying across the Kladovo terrace. Recent deposits of the Danube appear with occasional interruptions. Proluvial deposits occur at the confluence of torrential currents in the Danube. The larger layers of diluvium were formed in the Sipa (Karatas) zone.

### Geological characteristics

The research area belongs to the Carpathian-Balkans wreath, which is part of a unique geological structure extending through the central and southern Europe. From the Danube, around the Crni Timok valley, the spread is taking the North-South, and then the NW-SE direction. In the lithological terms, the research area has been built by rocks of different composition and different age. Sedimentary rocks dominate, but magmatic rocks are also frequent (both intrusive and effusive), all accompanied by products of contact or regional metamorphism.

## Hydrogeological characteristics

In a wider research area the following types of aquifers may be found:

- Compact type of aquifer formed in the loose sediments of quaternary and neogene age;
- Cracked type of aquifer formed in Albian sandstones and Santonian conglomerates and sandstones;
- Karst aquifer in tectonically isolated parts of Miroc Mountain;
- Poorly water permeable formations of series of schist and Sianian flysch.

## Seismic hazard

Based on the presented maps of seismic hazard, when it comes to soil, the area of Djerdap belongs to the V degree of intensity with the return period of 95 years, i.e. VII-VIII and VIII degree for a return period of 975 years, for the maximum observed intensity of an earthquake. When it comes to the base rock, the PGA values for the return period of 95 years range from 0-0,02, while for a return period of 975 years these values range from 0,06-0,12. Microseismic research in research galleries during the construction of HPP Djerdap I present small values of speed in the rock mass at the entrance sections of the gallery, while somewhat higher values are recorded in the deeper parts of the gallery of  $V = 5000$  m/s. The cross-hole seismic tests, applied at the borders with the deposits, at 22 and 45 m, indicate to the speed values from 3200 to 5000 m/s, and it was found that the rock mass in the river bank area, that is the navigating lock area, is of the best quality compared to the whole area where dam is located.

For the purpose of supplying the main facility HPP Djerdap I with drinking water and fire protection system, a water supply system has been designed using the natural flow of the river Kosovica. The water intake structure is located upstream of the bridge on the main road Kladovo - Tekija, in the river basin of the Kosovica River, and consists of a concrete drain (50 m long) with filter layers and a concrete barrier, dug into the gravel bank of the river Kosovica. Crude water is pumped by concrete pipes ( $\varnothing 1.000$  mm, length 200 m) into the water intake basin of the pumping station.

## Climate characteristics

The climate characteristics of the research area were analyzed on the basis of the information obtained from the Negotin meteorological station (42 m of altitude). It is necessary to emphasize that the climate characteristics of this area are affected by the Carpathians and openness towards the Vlach Region in the east. The whole area is characterized by a continental climate.

### *Air temperature*

Temperature analysis included the period from 1970 to 2016. The average annual air temperature is  $11.7 \pm 0.9$  °C, while the maximum value was 13.5 °C (2008), and the year with the lowest average temperature was 1976 with 9.7 °C. In terms of air temperature, the trend of rise in temperature in the considered period is clearly visible.



The annual temperature time schedule indicates to a gradual increase from January- February (0-1.9 °C) to July-August (23.1-22.4 °C) when the temperature falls until December (1.3 °C).

### *Precipitation*

Annual volumes of precipitation vary in a wide range of 350mm to almost four times higher than 1237 mm, with an average value for the entire considered period of  $655 \pm 174.5$ . The general trend of a slight increase in annual rainfall is the result of two distinct rainy years (2006 and 2014). Regarding the annual precipitation distribution, when it comes to mid-month values of rainfall, they are fairly uniform and generally about 50 mm. The highest values of average monthly rainfall amounts occur in the period May-June, while the lowest precipitation was recorded in January.

### *Air currents*

Morphology of the area, with Djerdap Gorge in the west and openness in the east, makes the west winds the northwest winds dominate. The rarest winds are coming from the south. The speed of the western winds reaches 120 km/h. In addition, higher speeds (over 60km/h) is typical for southwest and northwest winds.

### **Characteristics of the flora**

Even before the construction of the dam, the HPP "Djerdap I" was under anthropogenic influence due to the vicinity of Davidovec and Kladovo, agricultural areas and regional roads. This anthropogenic impact was drastically intensified by the construction of HPP "Djerdap I" and the opening of the border crossing towards Romania. Currently, on the free surfaces of the site there is a park vegetation whose maintenance is under the competence of HPP "Djerdap I". There are many species of different decorative evergreen and deciduous trees and bushes. Although most of the area is well maintained on grassland surfaces, black locust (*Robinia pseudoacacia*), false indigo-bush (*Amorpha fruticosa*) and ailanthus (*Ailanthus altissima*) began to grow along the river and downstream the lock. In addition to these allochthonous species whose spread should be controlled and prevented on all green areas and especially in the territory of the national park, the appearance of wild plums (*Prunus pseudoarmeniaca*), white willow (*Salix alba*) was also established.

In the hinterland of the HPP "Djerdap I", and also in the wider surroundings, in addition to the aforementioned species, there are also field maple (*Acer campestre*), Oriental hornbeam (*Carpinus orientalis*), manna ash (*Fraxinus ornus*), walnut (*Juglans regia*), wild pear (*Pirus piraster*) and white poplar (*Poppulus alba*). Fragmentation of the habitat as a result of anthropogenic impact is typical for this area.

## Fauna of the project location

The area of Djerdap is distinguished by the large number and diversity of the animal world, and according to various sources from the faunist elements, it includes the following:

- **Insects:** Mayflies (Ephemeroptera), (Homoptera), dragonflies (Odonata), butterflies (Lepidoptera), bed bugs (Hemiptera), (Hymenoptera), (Orthoptera), (Diptera).
- **fish:** sturgeon (Acipenseriformes) - beluga (*Huso huso*), sterlet (*Acipenser ruthenus*), fringebarbel sturgeon (*A. nudiiventris*), Danube or Russian sturgeon *A. gueldenstaedti*, starry sturgeon *A. stellatus*, and according to certain authors also Atlantic sturgeon *A. sturio*; harrings (in fact twait shad) (Clupeidae) - danube herring *Alosa caspia* and Black sea herring *Alosa immaculata*; eel (Anguillidae) - *Anguilla anguilla*; trout (Salmonidae) - Danube salmon (*Hucho hucho*), river trout *Salmo* cf. *trutta* i rainbow trout *Oncorhynchus mykiss*, pike (Esocidae) - *Esox lucius*; carp (Cyprinidae) - over 30 species from the order of *Abramis*, *Alburnoides*, *Alburnus*, *Aspius*, *Barbus*, *Blicca*, *Carassius*, *Chondrostoma*, *Ctenopharyngodon*, *Cyprinus*, *Gobio*, *Hypophthalmichthys*, *Idus*, *Leuciscus*, *Pseudorasbora*, *Rutilus* i *Vimba*, catfish (Siluriformes) - common *Silurus glanis* and *Ameiurus melas*, true loaches and river loaches (Cobitidae and Balitoridae) - stone loach *Barbatula barbatula*, Golden spined loach *Sabanjewaia autara*, spined loach *Cobitis taenia* i European weather loach *Misgurnis fossilis*, haddock (Gadiidae) - burbot *Lota lota*, stickleback Gasterosteidae - three-spined stickleback *Gasterosteus aculeatus*, pipe fishes (Symgnathidae) - black-striped pipefish *Syngnathus abaster*, (Percidae) - European perch *Perca fluviatilis*, zander Sander *luciperca*, Volga zander Sander *volgensis*, Zingel *balcanicus* Zingel *zingel*, schraetzer *Gymnocephalus schratseri*, Eurasian ruffe *Gymnocephalus cernuus*, Gobies of the orders of *Proterorhinus* and *Neogobius*, and also Chinese sleeper *Percottus glennii* (Odontobutidae) and pumpkinseed (*Lepomis gibbosus*).
- **Amphibians:** fire salamander *Salamandra salamandra*, southern crested newt *Triturus* spp. and frogs (Salientia) - green *Rana esculenta*, *R. lessonae*, *R. ridibunda*, and brown *R. temporaria*, *R. agilis*, yellow-bellied toad *Bombina variegata* and toads *Hyla arborea*.
- **Reptiles:** forest turtles *Testudo hermanni*, European pond turtle *Emys orbicularis*, lizards (Sauria), water snakes - *Tropidonotus natrix* and *Tropidonotus tessellata*, Aesculapian snake *Elaphe* spp., *Coluber* spp., *Zamenis* spp., as well as horned viper *Vipera ammodytes*;
- **Birds:** about 170 species, out of which the following are of special importance for the Danube ecosystem: cormorants - the great *Phalacrocorax carbo* and small *pygmaeus*, Eurasian coot *Fulica atra*, little egret *Egretta garzetta*, grey heron *Ardea cinerea*, predatory birds (Falconiformes) - especially white-tailed eagle *Heitaetus albicilla*, shorebirds (Charadriidae), black stork *Ciconia nigra*, white stork *Ciconia ciconia*, seagull (Laridae), Terns (Sternidae), mallard *Anas platyrhynchos*, common teal *Anas crecca*, urasian wigeon *Anas penelope*, common pochard *Aythya ferina*, white-eyed pochard *Aythya niroca*, common merganser *Mergus merganser*, pigeons *Columba* spp., owls (Strigiformes), woodpeckers (Picidae), old world warblers (Sylviidae), thrushes (Turdidae), Tits (Paridae) etc.

Out of them, water birds, and especially ducks, wagtails, terns and some species of Charadriiformes spend their winters in large number (over 20.000 birds) in the area of Djerdan accumulation;

- **Mammals:** Insectivora - hedgehogs *Erinaceus concolor*, moles *Talpa europaea*, rodents - voles - field *Microtus arvalis*, water *Arvicola amphibius*, rat *Rattus norvegicus*, squirrel *Sciurus vulgaris*, fat dormouse *Myoxus glis*, muskrat *Fiber zibethicus*, nutria *Myocastor coypus*, bats (Chiroptera), rabbit *Lepus europaeus*, beasts - bear *Ursus arctos*, wolf *Canis lupus*, golden jackal *Canis aureus*, fox *Vulpes vulpes*, Lynx *Lynx*, wild cat *Felis silvestris*, east weasel *Mustela nivalis*, skunk *Mustela putorius*, pine marten *Martes martes*, beech marten *Martes foina*, badger *Meles meles*, otter *Lutra lutra*, even-toed ungulates - chamois *Rupicapra rupicapra*, deer *Cervus elaphus*, roe deer *Capreolus capreolus* and wild boar *Sus scrofa*.

Migratory species of fish important for the Environmental Impact Assessment Study regarding the adaptation of the navigational lock within the Djerdap dam include:

- Anadromous species of sturgeons of genera *Huso* order (beluga *H. huso*) and *Acipenser* (fringebarbel sturgeon *A. nudiiventris*, Danube or Russian sturgeon *A. gueldenstaedti*, starry sturgeon *A. stellatus*, and according to certain authors also Atlantic sturgeon *A. sturio*) (family of sturgeons Acipenseridae) and herrings (in fact twait shad) genus *Alosa* (Danube herring *A. caspia* and Black Sea herring *A. immaculata* (family Clupeidae);
- catadromous eel *Anguilla anguilla* (family of Anguillidae eels).

### Protected natural resources

After review of the Central Register of Protected Natural Resources of the Institute for Nature Conservation of Serbia (Decision no. 019-2777/2 of November 17, 2017), in accordance with the regulations governing the field of nature protection, the Institute states that the area of the Djerdap National Park is at the level III protection regime and is in the scope of: an ecologically significant area of Djerdap ecological network of the Republic of Serbia; Emerald area - Djerdap RS000012; Internationally significant bird area (Important Bird Area, IBA - Djerdap RS041IBA); internationally significant area for plants (Important Plant Area, IPA - Djerdap); the selected area for daily butterflies (Prime Butterfly Area, PBA - Djerdap 05). The area is also located on the list of facilities of the geographic heritage of Serbia.

### Landscape characteristics

Specific features of the area of the Djerdap National Park (IBA, IPA and PBA area and as part of the EMERALD network); special cultural values (the National Park area is located on the Preliminary List for World Cultural and Natural Heritage (UNESCO), sections of the Pan-European Transport Corridor VII, with significant potentials of the international waterway E80 - the Danube with the hydroelectric power plant Djerdap I, diverse cultural values of international importance and important for Danube countries and Serbia: archaeological sites from the Neolithic period (Lepenski Vir), Roman road and bridge in Djerdap and Roman fortifications (Diana and other sunk fortresses of Roman Limes); medieval fortifications (Golubac, Ram, Fetislam) and monasteries;

agricultural and forest resources and ecologically sensitive parts of Djerdap Lake and coastal areas, specific stratigraphic, paleontological, geotectonic, geomorphologic forms, create the special features of the natural and cultural landscape of this area.

### **Immovable cultural property**

In spite of all the mentioned immovable cultural property in the area of Djerdap National Park, there is no immovable cultural property at the navigational lock site. Namely, after inspecting the Central Registry of Immovable Cultural Property, maintained at the Republic Institute for the Protection of Cultural Monuments, the respective Institute conclude, as registered by letter no. 2/2728, dated December 07, 2017 that the navigational lock on Djerdap I is not under the competetion of this Institute, because it is not part of the immovable cultural property of exceptional significance.

### **Settlement, population and infrastructure**

The town of Kladovo is located in the utmost north-east of Serbia, at the foot of the mountain Miroč and in the area called Ključ, named after the great Danube meander at the exit from Đerdap gorge. Kladovo is the center of the municipality called by the same name, which is a part of Bor District. In the early centuries, Kladovo was a fortified city whose remains are located just before the entrance of the today's town. According to the 2011 census, the population of Kladovo is 8.869 people. Today, in Kladovo there is a shipyard, administrative building of the Djerdap I hydroelectric system, a customs house, a new modern health center, Jezero sports hall and Djerdap hotel.

Downstream the Djerdap I dam there is Karatash youth-sports camp, founded at the time of the construction of HPP Djerdap. Following this direction, there are also the settlements called Novi Sip, Davidovac, Kladusnica, Kladovo and Kostol. Since 1991, negative demographic trends have been recorded in all these villages of the municipality of Kladovo (excluding Kladovo and Sipa), according to the official results of the census of the Republic Statistical Office of Serbia, which indicates to a decrease in population primarily as a result of migrations to the center of the municipality.



### 3. PROJECT DESCRIPTION

The main objective of the project is to provide for an uninterrupted development of water transport, ensure the continuity of the waterway and improve reliability and efficiency on the Basic TEN-T network - the Rhine-Danube Corridor.

Specific objectives of the project include:

- Reduction of the number and duration of unplanned delays and interruption of navigation;
- Reduction of duration and expenses of transit and waiting for transit, predictable time of waiting for transit;
- Increased reliability and safety of the operation of navigation lock;
- Extension of the operation period of the equipment and increase of energy efficiency,
- Mitigation of adverse environmental impact on account of:
  - Increasing the volume of water transport, as the most environmentally friendly, which would result in a decrease in road and rail traffic, increase in the reliability of the facility, which is directly related to the reduction of the number of accidents
  - reduced expenses of maintainance due to decreased number and shorter period of interventions
  - Reduction of the required number of workers for servicing, regular maintenance and interventions, modernization of facilities, introduction of modern and quality monitoring that will enable the transition from the principle of periodic and preventive maintenance to the mode of maintenance according to the state of operation;
  - Quality planning of both operation and maintenance.

The hydroelectric and navigation system "Djerdap I" is located on the river Danube (at its 943<sup>rd</sup> km) between the Republic of Serbia and the Republic of Romania. The system consists of an spillway dam in the middle of the river, two subsidiary power plants (one Serbian and one Romanian) in the extension of the spillway dam and two two-stage nagivation locks between each power plant and the adjacent bank. The construction of the HPP system Djerdap I and the subsequent construction of the upstream accumulation lake resulted in a reduction in the waterflow speed at a dam of 35 m. The main purpose of the navigation lock is to enable the continuity of navigation on the Danube, reliable and safe transit.

Therefore, at both banks, s navigation lockhas been constructed with its fore-docks, which allow the vessel to pass from the upper to the lower water and vice versa.

Navigation lock consists of the following units, starting from upstream towards downstream:

- zone of the upper fore-dock,
- upstream (upper) head,
- upstream (upper) chamber,
- middle head,
- command tower,
- downstream (lower) head,
- downstream (lower) chamber,
- zone of downstream fore-dock.

Adaptation of the navigation lock implies following activities:

### ARCHITETURAL PROJECT

**Gondola of the command tower.** The scope of the architectural (craftwork) works intends to replace the built-in (existing) materials which covered the gondola of the command tower and finely-treated interior surfaces (walls, ceilings and floors) and include demounting, insulating, ceramic, flooring, locksmith, aluminum, painting, plumbing and other works.

**Technological premises.** The scope of architectural (craftwork) works envisages the replacement of existing materials used for finishing works on the the interior of technological premises (walls, ceilings and floors) and the dismantling (demolition) of the existing concrete stands for pumps and include isolating, ceramic, locksmith, aluminum, painting and other works.

### CONSTRUCTION PROJECT

**Gondola of the command tower.** Within the construction works on the adaptation of the navigational lock of HPP "Djerdap I", inspection and repair of the supportive steel grate of the gondolla is envisages, as well as a possible replacement of grate parts if the inspection finds that a replacement is necessary. The inspection of this grate was not performed during the field visit of the design team, due to the unsafe access to the grid space.

**Technological premises.** Within the construction works on the adaptation of the navigational lock of HPP "Djerdap I", the adaptation of the technological premises on the coastal and river side of the ship chamber has been envisaged.



## Cable ducts

### *Upstream chamber - coastal side*

The project includes complete removal and storage of the whole existing construction of the cable ducts with their covers, stabilisation of underground construction. Production of a healthy foundation and adoption of new assembling cable and fire-protecting ducts with covers. The project includes construction of a new cable duct and one new duct for fire-protecting pipes along the whole upstream chamber. This solution envisages the removal of the pipes for fire-protection and their installation under the ground, as well as the construction of two new cable ducts.

### *Downstream chamber - coastal side*

The project includes complete removal and storage of the whole existing construction of cable ducts with covers, stabilising of the underground construction, production of a healthy foundations and installation of new assembling cable ducts with covers.

### *Downstream lower head - river side*

Removal and storage of concrete covering panels on the river side of the downstream chamber and lower head, and installation of steel ribbed covers of 1.25x1.25 m and 6/8 mm wide.

## PROJECT OF HYDROTECHNICAL INSTALLATIONS

Dredging of the deposit of the downstream fore-lock. Bathymetric measurements in 2017 found that there is a significant depositing of sediments in the whole location of the fore-dock. The recorded levels of the deposited sediment moved within the normal limits of minimum 31.5 m above the sea to maximum of 35.0 m above the sea. The largest quantity of the suspended material which was equally distributed along the length of the fore-dock reached the level of 33.5 m above the sea.

Despite the significant depositing, the depth of water in the fore-lock is enough for safe and efficient navigation at the lowest level of the lower water (38.57 m above the sea) in the amount of 5.0m on average. However, the bed should reach the level stated in the original project, which is 31.50 m above the sea. According to the present geological and geotechnical research of the soils in the coastal and river area of the Danube, material up to the depth of a few meters (3-4m) consists mostly of finely grained, muddy sands. It is assumed that the same material is suspended at the level of the downstream fore-lock. Taking into account the type of the suspended material, it is possible to apply the following method of dredging for the works in the downstream fore-lock:

- Removal of the deposited sediment from the downstream fore-lock may be done by cutter suction dredger or suction dredger with floating or partly sunk pipeline.

Depositing, i.e. removal of the dredger material into the river floe should be performed at the length of 2 km from the most downstream point of the downstream fore-lock.

Dredging operations:

- Recording the river profiles in the downstream fore-lock;
- Preparation of the terrain (construction of a landfill) for depositing the dredged material in case of depositing to the surface of the terrain in the area of up to 20m wide in the vicinity of the river flow;
- Dredging material up to the required level of the riverbed and transport of the dredged material to the landfill (if it is on the coast) or transport by pipeline by returning to the overflow of the Danube, but not into the area of waterway;
- Final recording of the profile after the dredging for the purpose of controlling.

**Environmental protection.** It is recommended to perform works after a period of high-level waters and beyond the season of fish breeding, which means in the months of July, August and September and also possible but less desirable in June and October. Therefore, works will be carried out in the period of low and medium-level waters.

## PROJECT OF ELECTRIC POWER INSTALLATIONS

**Management system of electrohydraulic drives of doors and covers.** The initial management system solution is based on analogue technique, relay logic, and hardwired connections, where all the functions were predefined and limited by hardware resources. The equipment for the management system of the lock and other systems has been in operation since then, and part of the equipment has been replaced and modernized in the previous period. In order to make navigational lock work with the appropriate level of availability and reliability in the future, it is necessary to adapt the control system equipment.

**Power supply for electro-hydraulic drives for doors and shutters.** The project envisages complete replacement of the existing 6.3 kV voltage cells, all three heads of the lock, as well as rail connections from cells to medium voltage terminals on transformers of 6.3/0.4 kV, and cables for connecting these cells to their power supply (6.3 kV distribution in TS Sip and distribution of 6.3 kV in the power plant). Having in mind the significant distance of the supply source, the project envisages replacement of the existing cell 6.3kV, i.e. installation of a circuit breaker -switch panel on the 6.3 kV side of the transformer. In addition to the local separation function of the transformer from the power source, the microprocessor protection from excessive current of the output towards the transformer is also provided in the cell.

The project envisages a complete replacement of existing 0.4kV voltage distributions, on all three heads of the lock, as well as power cables for supplying newly designed and existing consumers which will remain in operation after the adaptation of the lock.



The project envisages complete replacement of the equipment of the source and distribution of the uninterrupted power system 231 V, 50 Hz, as well as cable connections.

The project envisages complete replacement of the equipment of the source and distribution of DC voltage, as well as all cable connections.

DC power supply will be provided at two voltage levels of 220 V jss and 24 V jss.

The project envisages testing of electrical resistance of the ground, as well as existing installations, after which it is necessary to repair and adapt the existing installations in order to provide characteristics in accordance with the applicable technical regulations. The project envisages the replacement of a complete lightning protection installation, i.e. all lightning conductors placed in the command tower, as a protection against overvoltage caused by lightning.

**Auxiliary systems for electrohydraulic drive doors and shutters.** Measurement of the water level upstream and downstream from the lock, as well as the measurement of the water level in the chambers of the locks, ensure the safe operation of the lock. Water pressure on the door will be prevented if the door is only allowed to operate if the water levels on both sides of the door are approximately equal, i.e. with a defined tolerance of 3 cm.

**Electrohydraulic drive of crane tracks.** Since the height of the crane track on the central head of the vessel is such that it acts as an obstacle to the transit of sea-river ships, there occurred the need to lift the tracks to a maximum height of 3.6m, thus providing for the transit of all ships navigating the Danube. The frequency of such requests for raising and lowering the crane tracks is maximum two times a month.

Crane tracks consist of two independent sections and are lifted in an identical manner, with an electro-hydraulic drive. The existing concept of the electro-hydraulic system is implemented with a partially active synchronization and a system of protection and correction in case passive synchronization is not able to maintain the synchronous movement of the two cylinders due to unforeseen interruptions. The existing hydraulic aggregate is located at the half of the section of the crane track that rises. Next to the aggregate, there is an electricity board for the local control, and on the other hand, a differential mechanical transmitter with two end switches that identify the unauthorized inclination to the left or right.

The position of the ends of the section of the crane track which is being lifted is measured through the cable and the system of the pulley, so that one cable is introduced into the differential transmitter for identifying the inclination to the left and the right. The position of the main remote control is a common command electricity board for both crane tracks located below the crane track somewhere at half the distance between them.

In the newly designed solution, the problem of synchronous motion of the cylinder will be solved through four independent positioning systems (2 + 2), that is, the system is projected with two closed position loops, each with its pace driver on the entire cylinder pace. Synchronization errors will be corrected on-line in real time, through proportional chokes, which, like the original solution, are in Graetz circuit with a high resolution guaranteed by the quality of the pace.

In addition, the newly designed system will have complete security in case of failure of each active link of the electro-hydraulic system in the lifting phase and in the lowering stage. The system is equipped with one-way plunger cylinders, so a proportional choke in Graetz circuit is applied. In case of failure of one pump, the system continues to operate with another pump. Due to the expected low frequency of operation of this installation, it is not necessary for a pump to be 100% in the passive reserve, but both pumps will work simultaneously. In case of failure of one pump, the system is envisaged to continue operating with only one pump with a 50% lower speed potential. The power of the engines designed for pump operation is 11 kW. Disposition of the equipment will be the same as with the existing system.

**Traffic signal system.** The traffic signaling system provides light signals for vessels moving in the following docks and fore-dock zones and in the zone for the entrance and exit of the chamber of the lock. The project envisages replacement of equipment on this system.

**Heating and ventilation system for technological premises and command tower.** For the purpose of air-conditioning in the gondola of the command tower, a package split system and a channel air ducting with a centrifugal fan and blinds with an electric motor drive are planned.

Heating and ventilation of technological rooms and transformer stations on the lower head will be carried out by three-phase air heaters of 42 kW, 36 kW, 21 kW or 18 kW.

The ventilation of these rooms will be provided by centrifugal and axial fans. Switching on the heaters and fans will be provided by the signal contacts in the contact thermometers, which will be placed in the premises. Distribution boards for heaters and fans, with contactors for their putting into operation, will be installed in each of the premises.

**Installation of internal and external lighting.** The project envisages a complete replacement of the internal and external lighting of the lock, including all the systems within their composition.

**Stable firefighting system.** The project envisages the replacement of electrical equipment and installations in the mixing station, cable installations connected to the shutter and mixing station, energy cables providing power supply of the system equipment from the main distribution board, as well as installations of the SCADA system for remote control and monitoring of the system from the command tower.

**External portal cranes.** The project envisages complete replacement and modernization of existing electrical equipment and installations on the crane. In addition to the replacement of electric motors, the replacement of power and control cabinets, a control panel in the crane cabin, wind indicators, as well as all cables, including electric equipment of electrohydraulic pliers, is envisaged.

## PROJECT OF MECHANICAL INSTALLATIONS

**Electro-hydraulic drives of doors and shutters.** The electro-hydraulic drives of the doors and shutters are installed on the coastal and river side of the upper head, the coastal and river side of the middle head and coastal and river side of the lower head. The adaptation of hydraulic equipment as part of the electro-hydraulic drives of the door and shutter of the lock envisages the replacement of the complete existing equipment with a new one, conceived on the volumetric-ballast control with the application of a set of pump aggregate common to all doors and shutters from each of the six technological premises.

**Electro-hydraulic drives of crane tracks.** The crane tracks for the transport of equipment in the machine building and the access plateau on the coastline are lifted using an electro-hydraulic drive. Adaptation of hydraulic equipment within the electro-hydraulic drives of the crane tracks envisages the replacement of the complete existing equipment with a new, with the possibility of active proportional synchronization of the movement of the pistons of the servomotor drives.

**Heating and ventilation system for technological premises and command tower.** The project of mechanical installations includes mechanical equipment for heating and ventilation of technological premises on the upper, middle and lower heads and the equipment for heating and air conditioning of the command tower. The adaptation envisages the replacement of the existing equipment for heating, cooling and ventilation of technological premises and command towers with the addition of automatic operation while maintaining the specified microclimate parameters (temperature).

**Stable firefighting system.** The project of mechanical installations for the adaptation of a stable firefighting system on the navigational lock includes the replacement of the existing mechanical equipment of the mixing station and the complete discharge pipeline distribution with the associated equipment.

**Operational segment closures in the galleries of the middle head.** The project of mechanical installations includes the replacement of hydromechanical equipment of existing operational gallery shutters on the coastal and river side of the middle head.

**Overhaul double doors on the lower head.** The project of mechanical installations includes replacement of hydromechanical equipment of existing overhaul doors on the lower head.

**Electro-hydraulic pliers for manipulating gallery closures.** Electro-hydraulic pliers for manipulating gallery closures are mounted on the coastal and river side of the upper head, the coastal and the river side of the middle head and the river side of the lower head. Adaptation of electro-hydraulic pliers equipment envisages the repair of the pliers construction, the replacement of the electrohydraulic drive and the repair of parts installed on the pliers storage.

**External portal cranes.** Adaptation involves the replacement of equipment and operations on cranes from the river and coastal sides.

## 4. OVERVIEW OF THE CURRENT ENVIRONMENTAL ASPECTS AT THE LOCATION AND ITS SURROUNDINGS

### Air quality

Although measurement of air pollution do not regularly take place, it can be concluded that at the location of Đerdap I certain emissions may occur periodically and are of short-lived nature, originating from potential pollutants including:

- River traffic operated through navigation lock;
- Road traffic operated along the regional roadway in the coastal area and through the hydroelectric facility Đerdap I towards Romania;
- Systems for heating individual households in coastal settlements and tourist facilities-camp Karatas”.

Lacking the data on air quality, qualitatively low emissions of air pollution on the Serbian side of the Danube in the area of HPP "Đerdap I" are presumed based on the following estimates:

- Absence of industrial production;
- Extremely small population density on the right bank of the Danube;
- Length of road network;
- Current intensity of water and road traffic.

However, significant air pollution appears on the Romanian side of the Danube, especially in the city of Turn Severin, located 13 km southeast of the HPP "Đerdap I". The city has a highly developed industrial production. There are no data on the nature and concentration of pollutants, but the products of air pollution emissions are transported by air currents (in particular, locally typical wind *kosava*) exactly to the hydroelectric facility and all settlements downstream of the hydroelectric power plant. Thus, the usual occasional phenomena of air pollution are manifested by unpleasant smells and a cloud of dust which makes deposits on the Serbian side of the Danube.

Environmental protection in the branch of HPP Đerdap in 2016 was carried out according to the defined procedures and other documents of the environmental management system (EMS). Namely, HPP Đerdap, which belongs to the EPS system, has adopted the management system ISO 9000 as well as 14000.

## Surface waters and sediment quality

The assessment of the quality of surface waters has been carried out according to the data on surface water quality monitoring carried out by the Electric Power Industry of Serbia for 2016 and 2017, and according to the Results of Inspection of surface and groundwater quality for 2016 of the Environmental Protection Agency of Serbia.

Based on the above mentioned reports profiles have been selected which are closest to the location of HPP "Djerdap I", namely Tekija and Kladovo from the monitoring of Electric Power Industry of Serbia and Tekija and Brza Palanka from the monitoring of the Environmental Protection Agency of Serbia.

The monitoring carried out by Electric Power Industry of Serbia lasted from September 2016 to June 2017. Four water quality control Danube monitoring campaigns were conducted on each profile, two in 2016 (September and November) and two in 2017 (April and June). Based on the obtained results, the Danube waters on the Tekija profile, according to the Regulation on limit values of pollutants in surface and ground waters and sediment and time period for reaching them (Official Gazette of RS, no. 50/2012), are of II and III class of surface waters quality. The water quality on the Kladovo profile varied to a larger scale according to the same Regulation and ranged from II to IV class in the tested samples. Somewhat worse results on the Kladovo profile - one sample of II class, two samples of III class and one sample of IV class of surface water quality- were expected due to the position of this profile between the two cities, Kladovo on the right bank and Drobeta -Turnu Severin on the left bank of the Danube. Because of such position of the monitoring profile, the pollution caused by wastewaters, primarily municipal ones, does not completely mix with the Danube water up to that point, which results in slightly higher values of pollutants in the obtained samples.

## Sediment quality

The proposed removal of sediment during the adaptation works of HPP Djerdap I will include cleaning sediments in the downstream fore-dock. Estimated amount of sediment that will be cleaned is estimated at 50.513 m<sup>3</sup>, and after the completed works, the bottom level of the bottom of the downstream fore-dock will be 31.50 m above the sea. Preparatory works on the adaptation project of the HPP "Djerdap I" navigation lock included the analysis of the quality of sediments in the downstream fore-dock and its characterization as potential waste. This analysis was carried out by the Water Management Institute Jaroslav Cerni.

Based on the results of the analyses, and according to the Regulation on limit values of pollutants in surface and ground waters and sediment and deadlines for their achievement ("Official Gazette of RS", no. 50/2012), the quality of sediments in the downstream fore-dock is estimated as II class, or slightly polluted sediment. Categorization of sediment in the downstream predpristaniste as non-hazardous waste was performed according to the Rulebook on categories, testing and classification of waste ("Official Gazette of RS", no. 56/2010).

According to the aforementioned Regulation, sediment of Class 2 quality can be disposed of without special environmental protection measures in the area 20m away from the watercourse or as proposed in the Technical Documentation by returning it to the river flow and depositing it in the deeper parts of the river or transporting the material (as a suspension) by the river. Since the sediment is classified as non-hazardous waste, it is possible to dispose of it on landfills.

### Soil quality

Natural characteristics of the soil in the area of the navigation lock of the HPP Djerdap I and its immediate environment were completely changed during the preparation of the terrain for the construction, construction works and exploitation of HPPs (access road, cable channels, railway track, etc.), main road M 25.1 Kladovo - Donji Milanovac, as well as later horticultural landscaping of free surfaces. Basic physical and mechanical soil characteristics (structure, porosity, consistency), chemical composition and microbiological characteristics have been changed. In general, the land is assessed with low grades with low levels of humus content and reduced microbiological activity.

The area covered by the Study is not included in the Program for Systematic Testing of Hazardous and Harmful Substances in the Soil of Serbia carried out by the Institute for Soil and the Institute for Pesticides and Environmental Protection, according to the Regulation on the program for systematic monitoring of soil quality, indicators for assessing the risk of soil degradation and methodology for the development of remediation programs ("Official Gazette of RS", no. 88/2010), so there are no data on the quality and degree of soil contamination, which can only be estimated in the concrete case.

The soil at the respective site is likely to contain slightly increased concentrations of nickel, as well as the major part of RS, due to the specific geochemical composition, although the anthropogenic effect cannot be completely excluded.

The pollution of soil along the main road M 25.1 and the access road has been created by decades of washing off the polluted atmospheric waters from the pavements contaminated after intensive use, due to occasional leaking of lubricants and fuel, depositing of particles released from exhaust gases of vehicles and mechanization, spillage of cargo, wear of tires, asphalt and braking system. In addition to the roads themselves, hazardous organic and inorganic micro-polymers (lead, copper, zinc, petroleum and derivatives, and sporadic and polycyclic aromatic hydrocarbons) are usually detected in the road traffic areas, deposited after several decades of washing off from the pavement, along with herbicides used to destroy weeds. The concentrations of these pollutants are relatively low along moderately frequented roads, such as the main road M 25.1.

## Waste management

The collection of municipal waste in municipalities within the Djerdap National Park (Kladovo, Golubac, Majdanpek) is under the authority of municipal utility companies. Despite the organized collection of waste, the number of smetlista dump has not been reduced. Dump areas with the greatest risk to the environment and human health are those located at distances less than 100 m from the settlement or at distances less than 50 m from the river bank or a spring. The largest number of dumps in the territory of the National Park Djerdap is located in these places, but also along the roads in the traffic belt on the slopes of the road embankment. The direct consequences of non-sanitary disposal are the contamination of soil and groundwater and surface waters with contaminants from the dump.

Having in mind that the closest municipality of Kladovo, whose Public Utility Company Komunalac is in charge of disposal of the municipal waste located in the territory of the Djerdap National Park, this Study will present the requirements regarding the waste management which the municipality of Kladovo should meet.

Decision on communal activities in the municipality of Kladovo ("Official Gazette of the Municipality", no. 13/97, 9/98, 20/02, 6/03, Official Gazette of Kladovo Municipality, no: 3/05, 2/2007, 4/2009), waste regulated management has been legally regulated, as well as other municipal activities including: landscaping and maintaining parks, green and recreational areas, keeping town and settlements in the municipality clean, maintenance of landfills, desingingand maintenance of cemeteries and burials, urban development and maintenance streets, roads and other surfaces used fo traffic, transport of passengers in road traffic, maintenance of public lighting I - other communal activities of local interest. According to the decision of the municipal authorities, JKP public utility municipal company "Komunalac" Kladovo has been operating as a public utility municipal company from June 21, 1991. The activity of the company is the collection and disposal of waste generated in the municipality of Kladovo, and the maintenance of the landfill.

## Noise

At the site of the navigaton lock of the HPP "Đerdap I" system, noise intensity levels have not been measured. A fact which is certain is that the noise produced at the location of the navigation lock can originate from two sources:

1. as a result of the operation of the equipment of the navigation lock and
2. as a result of the operation of the engines of ships that are transmitted through the lock.

While the firstly mentioned source of noise will be reduced to a certain extent by adjusting the navigaton lock and replacing equipment which has been used already for decades, the other will remain on the site of the lock irrespective of the adaptation project, which is the subject of the updated Environmental Impact Assessment Study. When it comes to the first mentioned source of noise at the navigation lock, considered as prevailing, and originating from the operation of ship engines, it can be assumed that in the future the noise levels from this source will be reduced as a result of using of more modern and less noisy ship engines.

### Mutual effects of the stated factors

Summarizing the data on the quality of certain environmental factors, it can be concluded that the quality of the basic environmental factors on the microlocation of the navigation lock is somewhat distorted, but that this is not the consequence of the operation of the lock, but of other anthropogenic activities in the environment.

If we would bring the individual environmental factors on the site into a mutual constellation, we may conclude that there is no significant interaction between the presented elements of the environment in which, as a result of cumulative and/or synergy factors, an increased environmental pollution might arise.





## 5. DESCRIPTION OF POSSIBLE SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PROJECT

### The overall impact of the project to the components of the environment

Based on the average aggregate value of respective factors, it may be concluded that the impacts of the lock adaptation project are extremely low, that they are of weak intensity and present in a limited space, and that all they are time-limited to the phase/period of carrying out the works on the adaptation of the lock (replacement of equipment and operation of mechanization), while the potential impacts during the exploitation or functioning of the lock will not change significantly compared the existing situation (except in terms of increasing safety and security during its operation as a positive trend which will also contribute to the environment).

Positive effect of lock adaptation to the economic development will be especially emphasized, as it goes beyond the local frameworks and gives national importance to the project.

The impact factors will have a limited scope of application in the entire location. Mechanization and transport means will be engaged in the phase of carrying out the lock adaptation works. Emissions of harmful gases in the air and increased noise levels are expected during the operation of these machines. Negative environmental effects cannot be prevented in this case, and preventive measures relate primarily to regular maintenance of machines, higher levels of efficiency of their work and proper treatment of waste arising in the phase of implementation of the adaptation project.

However, if the negative effect of these and other factors is considered as a whole, it should be emphasized that qualitative and quantitative losses in the environment will nevertheless be negligible both spatially and temporally, and limited practically to the site itself. Negative effects will not be significantly reflected in the neighbouring area, and they will only be effective, compared with the existing state, during the adaptation of the facility. The survival of species, or important, vulnerable or rare ecosystems and other natural values will not be challenged, and there will be no significant consequences for the living world and the basic environmental factors.

### Overview of potential impacts

Air, water and soil quality, levels of noise, heat and radiation - Certain negative effects are possible in the phase of carrying out the navigation lock adaptation works. These effects are reflected in the air pollution caused by the manipulation of vehicles and machinery and in the forms of generating dust, creating noise, possible pollution of water and soil on the microlocation of the works. Certain negative effects may also occur in cases of accidents and oil leakage into water, but they are unlikely to happen. The project of the navigation lock adaptation does not produce thermal pollution, nor the occurrence of radiation.

**Health of the population** - Due to the site particularities and the activities planned, there will be no effects on the health of the population. Possible effects resulting in injuries at work may occur during the performance of works. Theoretical possibilities for jeopardizing health and lives in the population may occur only in accidents, namely only when people themselves are present on the spot when an accident happens.

**Meteorological parameters** - The project does not cause any changes of microclimatic characteristics and parameters.

**Flora and fauna** - Impacts on the flora are negligible. Ichthyofauna might be potentially affected in the phase of replacing the equipment and cleaning of sediment. In this context, it is necessary to pay special attention to planning the period of adaptation works in order to minimize such impacts.

**Population, concentration and migrations of people** - The project does not affect the population, concentration and migration of the people.

**Purpose and use of surfaces** - Project implementation does not imply any changes in the purpose of land use on the site.

**Communal infrastructure** - The project will not affect the existing communal infrastructure.

**Preserved natural areas of special values and immovable cultural property** - The project of navigation lock adaptation, although planned in the area of NP Djerdap, will not affect preserved natural areas and immovable cultural property, which was also established by the relevant institutions in charge of nature preservation and protection of immovable cultural property within their findings.

**Spatial characteristics of the area** - Analyzing the intended location of the planned purpose, it was concluded that the planned adaptation project will in no way affect on the wider area of the lock.



## Transboundary Impact

Being a party to the ESPOO Convention (Law on approving the Convention on Environmental Impact Assessment in a Transboundary Context, "Official Gazette of RS - International agreements", no. 102/2007) and Kyiv Protocol (Law approving the Kyoto Protocol to the UN Framework Convention on Climate Change, "Official Gazette of RS", nos. 88/2007 and 38/2009), as well as international treaties referring to the preservation of migratory species (Law approving the Convention on the Conservation of Migratory Species of Wild Animals, "Official Gazette of RS - International agreements", no. 102/2007); and other international agreements; the Republic of Serbia is obliged to inform other countries of the project with potential transboundary effects.

Under the Espoo Convention on Impact Assessment, transboundary impact is defined as: any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party. However, due to the particularities of the specific circumstances:

- This is a project for the adaptation of a facility that has been in operation for decades on the same site, for which the Environmental Impact Assessment Study was conducted in 2009 and which passed the procedure in accordance with the relevant legislation;
- The study represents only the examination of new circumstances resulting from the reduction in the volume of works compared to the adopted 2009 Study, which resulted in the necessity to update the Study.

If this were not the case, it would not even be necessary to deliver the Environmental Impact Assessment Study under the legislation of the Republic of Serbia for the given scope and type of planned operations for the revitalization of the navigation lock;

- Adaptation of navigation lock implies replacement of torn parts and equipment without changing the purpose of the object and its functions;
- Works will be carried out by applying all prevention measures for environmental protection, which should have limited possible negative impacts on the environmental factors assessed in the Study as: little, of local character and minimal spatial dispersion, of temporary character;
- Taking into account also the fact that no possible transboundary impacts have been identified, the authors of the Study consider that a neighboring country with an interest in this project - Romania should be informed of all the circumstances and facts, so that the Study would be addressed with full understanding. Namely, none of the identified negative impacts of the revitalization of the navigation lock of the HPP Djerdap I nor the operations during its exploitation will have any transboundary impact and, therefore, no impact on Romanian protected natural areas: Iron gates ROSCI0206, Danube Course - Bazias - Iron Gates ROSPA0026, Mountains of Almajului Locvei ROSPA0080. The waterway of Danube and its huge flows act as a natural barrier, so any small pollution will be held at firts at the right bank of the Danube, and then very quickly diluted and thus neutralized.

Not any options for depositing the cleaned sediment will have a transboundary impact, and therefore no impact to the already mentioned Romanian protected natural areas. The Danube waterway and the huge flow represent a natural barrier that will prevent the spreading of the overpumped sediment towards the Romanian bank of the Danube in the event of selecting an option of pumping the cleaned sediment into the Danube River and focus its deposition on the right bank. Choosing the second option that implies depositing cleaned sediment on the right bank of the Danube and pumping out drained waters from the landfill into the Danube River, the Danube River waterway and the huge flow of this river will again prevent the impact to the protected natural areas located on the Romanian side. Not only does the huge flow act a barrier, but it also causes significant dilution of the pumped-out drained waters.

Proposed works on the navigation lock revitalization HPP "Djerdap I" as well as its further exploitation will have no effect on the phytocenoses present in the territory of Romania, and the case is similar with the ichthyofauna.



## 6. DESCRIPTION OF ENVIRONMENT PROTECTION MEASURES

In defining the environmental protection measures, it must be borne in mind that the navigational lock, as well as the entire HPP "Djerdap I", is located in the Djerdap National Park in the area that is in the level III protection regime. Environmental protection implies observance of all general measures provided for by the laws and by-laws, the relevant standards and specific conditions of the competent authorities and enterprises, which are incorporated into the project documentation, as well as the measures required by the authors of this Study.

### Measures provided by laws and other regulations

Investor is under obligation to meet all the requirements under the following laws and by-laws:

- Law on Environmental Protection ("Official Gazette of RS", no. 135/2004, 36/2009, 36/2009 - other law, 72/2009 - other law, 43/2011 - decision of Constitutional Court and 14/2016);
- Law on the Assessment of Environmental Effects ("Official Gazette of RS", no. 135/04, 36/09);
- Law on General Administrative Procedure ("Official Gazette of RS", no. 18/2016);
- Law on Strategic Assessment of Environmental Effects ("Official Gazette of RS", nos. 135/04, 88/10);
- Law on Nature Protection ("Official Gazette of RS", no. 36/2009, 88/2010, 91/2010 - correction 14/2016);
- Law on Integrated Prevention and Control of Environmental Pollution ("Official Gazette of RS", no. 135/2004 i 25/2015);
- Law on Waters ("Official Gazette of RS", no. 30/2010, 93/2012 and 101/2016);
- Law on Air Protection ("Official Gazette of RS", no. 36/2009 and 10/2013);
- Law on Protection against Noise in the Environment ("Official Gazette of RS", no. 36/09, 88/10);
- Law on Nature Protection ("Official Gazette of RS", no. 36/2009, 88/2010, 91/2010 - correction and 14/2016);
- Law on Cultural Property ("Official Gazette of RS", no. 71/94, 52/2011 - other laws i 99/2011 - other laws);
- Law on Transport of Hazardous Materials ("Official Gazette of RS", no. 88/2010 and 104/2016 - other laws);
- Law on Chemicals ("Official Gazette of RS", nos. 36/2009, 88/2010, 92/2011, 93/2012 an 25/2015);
- Law on Waste Management ("Official Gazette of RS", no. 36/2009, 88/2010 and 14/2016);



- Law approving the Convention on Environmental Impact Assessment in a Transboundary Context ("Official Gazette of RS - International Agreements", no. 102/2007);
- Law approving the Protocol on the Strategic Environmental Impact Assessment accompanying the Convention on Environmental Impact Assessment in a Transboundary Context ("Official Gazette - International Agreements", no. 1/2010);
- Law on Ionizing Radiation Protection and on Nuclear Safety ("Official Gazette of RS", no. 36/2009 and 93/2012);
- Law on Non-Ionizing Radiation Protection ("Official Gazette of RS", no. 36/09);
- Law on Planning and Consturction ("Official Gazette of RS", no. 72/2009, 81/2009 - corection, 64/2010 - decision of the Constitutional Court, 24/2011, 121/2012, 42/2013- decision of the Constitutional Court, 50/2013- decision of the Constitutional Court, 98/2013- decision of the Consitutional Court, 132/2014 and 145/2014);
- Law on Spatial Planning of the Republic of Serbia from 2010 to 2020 ("Official Gazette of RS", no. 88/10);
- Law on Approving the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters ("Official Gazette of RS", no. 38/09);
- Labour Law ("Official Gazette of RS", nos. 24/2005, 61/2005, 54/2009, 32/2013, 75/2014 and 13/2017 - decision of the Constitutional Court);
- Law on Occupational Health and Safety ("Official Gazette of RS", nos. 101/2005 and 91/2015);
- Law on Fire Protection ("Official Gazette of RS", no. 111/2009 and 20/2015);
- Regulation on the establishment of a list of projects for which an impact assessment is required and a list of projects for which an environmental impact assessment may be required ("Official Gazette of RS", no. 114/08);
- Regulation on water classification ("Official Gazette of RS", nos. 5/68, 33/75);
- Regulation on thresholds of priority substances and priority hazardous substances polluting surface waters and time periods for reaching them ("Official Gazette of RS", no. 24/2014);
- Regulation on waterflows categorization ("Official Gazette of RS", no. 5/68);
- Regulation on thresholds of polluting substances discharge into waters and time periods for reaching them ("Official Gazette of RS", no. 67/2011, 48/2012 and 1/2016);





- Regulation on the monitoring conditions and air quality requirements ("Official Gazette of RS", no. 11/10);
- Regulation on noise indicators, limit values, methods for assessing noise indicators, disturbance and adverse effects of noise in the environment ("Official Gazette of RS", no. 75/2010);
- Rulebook on the content of the application for the need for an impact assessment and the content of the requirements for the determination of the scope and content of the environmental impact assessment study ("Official Gazette of RS", No. 69/05);
- Rulebook on the contents of Environmental Impact Assessment Study ("Official Gazette of RS", no. 135/2004 i 36/2009);
- Rulebook on categories, testing and classification of waste ("Official Gazette of RS",no. 56/10);
- Rulebook on permitted quantities of hazardous and harmful substances in soil and irrigation water and methods of their examination ("Official Gazette of RS", no. 23/94);
- Rulebook on the content of the accident prevention policy and its content and methodology for the safety reports and accident prevention plans ("Official Gazette of RS", no. 41/2010);
- Rulebook on the declaration and protection of strictly protected wild species of plants, animals and fungi ("Official Gazette of RS", no. 5/2010, 47/2011, 32/2016 and 98/2016);
- Rulebook on the content and form of the request for issuing water-related documents, the content of the opinion in the procedure for issuing water-related conditions and the content of the report in the procedure for issuing a water-related permit ("Official Gazette of RS", no. 72/2017);
- Rulebook on reference conditions for surface water types ("Official Gazette of RS", no. 67/11);
- Rulebook on parameters of ecological and chemical status of surface waters and parameters of chemical and quantitative status of groundwaters ("Official Gazette of RS", no. 74/11);
- Rulebook on hazardous substances in waters ("Official Gazette of RS", no. 31/82);
- Rulebook on the method and conditions for measuring the quantity and testing the quality of wastewater and the content of the report on the performed measurements ("Official Gazette of RS", no. 33/2016);
- Rulebook on determining water bodies of surface and groundwater ("Official Gazette of RS", no. 96/10);
- Decision on determining the boundaries of water areas ("Official Gazette of RS", no. 92/2017);



## Measures during the performance of works

### *Air quality protection measures*

Reducing the total emissions of hazardous gases and dusts should be performed by applying the following measures:

- Dust prevention by spraying/spraying using water over a period of dry weather;
- Restricting the number and areas of the sites where works are carried out, as well as the duration of the works;
- Daily cleaning of access roads near the site (removal of soil and sand) to prevent the appearance of dust;
- Controlling the spillage of loose material in vehicles and at the location for the storage of the excavated material;
- Proper selection of construction machines and vehicles for the purchase of modern devices with the lowest emission of exhaust gases;
- Controlling the proper operation of the engine and mechanization, in order to eliminate excessive emissions of exhaust gases.

### *Water quality protection measures*

- Controlled disposal of waste from vessels used for the works on the revitalization of the lock;
- Collecting and refining sanitary, ballast and mud waste water from the vessel;
- Prevention of uncontrolled disposal of solid waste from vessels and collection in local containers on vessels, and further disposal into containers of municipal waste on the coast;
- Implementation of the recommendations of the Danube Commission for the reduction of pollution originating from vessels;
- Monitoring and maintaining proper operation of the vessels and their engines, in order to prevent oil and fuel leakage;
- Regular maintenance and control of the proper operation of construction machines and engines in order to eliminate the possibility of leakage of oil, oil derivatives and machine oil in the water;
- Collection of sanitary wastewater from the facilities intended for the accommodation of personnel (offices, workshops, warehouses), with sealed cesspool, with the necessary discharge of tanks of the competent utility service, as well as cleaning and removal after the completion of works;
- Controlled use of special materials for repairing concrete structures in accordance with the requirements of the manufacturers of these materials and the technical conditions for performance;





- Using high quality crushed stone without addition of soil, in order to reduce the concentration of suspended matter in the river and to perform the rip-rap protection of the upstream fore dock according to the technical performance conditions;
- Cleaning the niche of the working door of the upper head installed by the mammoth pump and evacuating the contents from the niche to the upstream of the Danube in conditions of increased river flow, in order to achieve higher levels of dilution and smaller impact on the quality of the Danube;
- Controlled manipulation of construction machinery in order to reduce the rate of oil derivatives on the concrete surfaces of the lock construction and the prevent oil from reaching atmospheric waters;
- Use of appropriate machinery for the removal of deposits from the downstream fore dock and the lower chamber of the lock in order to prevent the spreading of river deposits containing heavy metals at concentrations higher than the maximum allowed, through the water;
- Removal of waste resulting from cleaning surfaces of metal structures and concrete parts from paint and corrosion residues, as well as sand blasting of metal surfaces and transportation of waste to an appropriate landfill;
- Controlled use of environmentally-friendly coatings and final colors for the protection of metal surfaces from corrosion according to the requirements of the manufacturers of these materials and technical performance conditions;
- Replacement of oil in the complete revitalized system of the electrohydraulic drive of the door and cover in accordance with the existing rules for oil manipulation in HPP Djerdap I with maximum protection measures from any kind of leakage into the environment;



### **Soil quality protection measures**

- The excavated material and the surface humus layer should be separated and temporarily stored in the site in order to be used again after the construction works for the decorating of the environment;
- Remediation of contaminated soil in extreme cases of devastating damage and spreading of significant quantities of waste hazardous substances, derived from oil and oil derivatives;
- Physical removal of the contaminated layer of the soil and transportation to the appropriate landfill, under the conditions of the competent utility service, and its replacement by soil from another site, in case remediation of the polluted land does not yield satisfactory results;
- Define the characteristics of sorbent to be used for spraying small quantities of oil, derivatives, motor oil, hydraulic oil, paints, etc. as well as the manner of application, collection and the procedure of dealing with the collected sorbent;
- Provide crates with sorbent and container for temporary disposal of the collected, used sorbent;
- In case it is determined that the contamination of the land requires remediation, the developer is obliged to perform the adaptation and remediation of the respective area according to the Adaptation and Remediation Project for which the approval of the competent ministry has been obtained;
- A piezometer well should be installed in the area between the main road M-25.1 and the Danube bank to monitor the impact on groundwater regime and indirect monitoring of soil contamination;
- Storage of petroleum products and gas in impermeable double reservoirs with an external tank volume corresponding to the stored volume of oil and gas;
- Fuel storage tanks should be protected from leakage and placed on a impermeable surface, and for cases of accidental spillage absorbent material and fire-fighting equipment should be provided for collection;
- Transport of oil derivatives and hydraulic oil with the approved means of transport, while ensuring constant sanitary control in the transport and usage of these substances;
- Proper selection of locations for permanent landfilling of waste construction materials and waste steel material, resulting from revitalization of the lock, shall be carried out as agreed with the competent utility offices;
- Provide parking spaces for equipment and vehicles involved in construction (eg, impermeable surface);
- Maintenance, fuelling and cleaning of vehicles and equipment should be performed in workshops with respective prevention from leakage;
- Conduct regular maintenance and control of proper functioning of engines of construction machines and trucks in order to prevent the leakage of fuels and lubricants into the ground;

- It is forbidden to take out oil from construction machines and trucks, or repair these on the site in the course of the preceding works and the works regarding the adaptation of the lock facilities;
- A detailed study of the chemical composition of the depositing material in the fore lock of the lock over the entire surface and at various depths, in order to reach the right conclusion about the further treatment of this material.

### ***Waste management measures***

- Creating hazardous waste landfills is prohibited in the national park area;
- Construction site area should be equipped with appropriate residential containers for workers' accommodation, with sanitary facilities for personal hygiene maintenance and chemical mobile toilet cabins, in accordance with the number of engaged workers;
- Provision of sufficient number of marked special containers for the collection and temporary disposal of solid municipal waste, as well as containers, tanks and barrels for different types of solid and liquid hazardous waste resulting from the adaptation of the lock;
- Collection of solid municipal and construction waste exclusively in special containers and entrust the discharge to the competent public utility company;
- Recyclable waste (metal, wood, glass, plastic) should be collected separately and appropriately disposed until handed over to the person authorized or licensed to manage these types of waste;
- Resulting solid potentially hazardous waste (oiled equipment, contaminated soil, sorbent used for oils, sand, paint and metal residues after blasting, paint and protective material containers, separator residue, etc.) is to be classified and collected in appropriate containers and analysed;
- Disposal of liquid hazardous waste (oiled water, hydraulic fluid, used motor and transformer oils, as well as lubricants, etc.) depending on their quantity into the tanks and the attested, marked metal barrels and perform the analysis;
- Application of the further procedure of treatment of solid and liquid hazardous waste in accordance to the results of characterization of waste, and entrust an authorized legal entity with the takeover and final disposal
- Manipulative surfaces and surfaces on which containers, tanks and barrels for temporary disposal of collected waste are to be located shall be made of waterproof materials resistant to oil and oil derivatives and with curbs preventing the discharge of water from such surfaces to the surrounding land;
- Provision of procedures and space for storage and handling of waste, hazardous waste and raw materials (eg. batteries, chemicals, fuels);
- Removal of bulky waste from the niche of the working doors of the upper head and from the grids on the water intake manually and transport to the municipal solid waste landfill;

- Provision of sufficient number of special, mobile containers, according to the number of permanent and temporary workers for collection of solid municipal waste from the site of revitalization and disposal to the municipal landfill as agreed with the competent municipal utility office;
- Optimize the disposal of the depositing material in cooperation with the competent public utility companies;
- Define a detailed method of digging, transporting and disposing of depositing materials from the downstream fore-dock.

### **Noise protection measures**

- Noise level shall not exceed the allowed thresholds provided by the Regulation on noise indicators, threshold values, methods for assessing noise, disturbance and environmental noise pollutants ("Official Gazette of RS", no. 75/2010);
- Prohibition of construction activities at night;
- identification of potentially noise polluted locations in the immediate vicinity of the construction site and use of adequate equipment;
- Proper selection of construction machines and vehicles in order to purchase up-to-date devices with the lowest noise emission and least vibration during operation;
- Regular maintenance of mechanization in the proper condition, in order to minimize noise and vibration.

### **Measures to protect biodiversity**

- The surfaces used during the construction works should be as small as possible and clearly defined in order to preserve the present vegetation as much as possible;
- For the purpose of temporary storage and warehousing certain materials necessary for the execution of works locations which are presently used for disposal of soil and waste should be selected;
- In order to minimize the generation of dust as well as its impact on plants during the transport of sand and other loose materials, it is necessary to use trucks with protective tarps over the load compartment, to clean the access roads on daily basis and to moisten them during dry periods to reduce generation of dust;
- Performing riverbed dredging at the exit of the lock out of the fish breeding season, i.e. in the period from September to March;
- Prohibition of unnecessary removal of vegetation and cutting trees in the area of works, ie. construction sites on the Danube bank, which is not in line with the final horticultural landscaping of the area;

- Adaptation of the lock location and the construction site area on the Danube bank after the completed works, which includes: removal of temporary facilities, objects and materials from the areas used for the execution of works, transport to the selected landfill, biological and mechanical soil consolidation and surface recultivation using biological measures with priority planting of bushes and grass and long-term afforestation;

### ***Flora protection measures***

- Plan out which areas under vegetation and of what size should be used during the various stages of the revitalization of the lock;
- Consider the possibility of multipurpose use of barren surfaces through several phases of works;
- Limit the movement of trucks, working machines and other vehicles to existing roads. In case there are no roads in certain locations, and on the basis of the need to move through this area, temporary roads should be built;
- Avoid removal of trees whenever possible;
- In order to reduce spreading of dust, and therefore its negative effect on both plants and other aspects of the environment, trucks with suitable protective tarps over the load compartment should be used for the transport of raw materials and waste. Also, it is necessary to clean the access roads and, in dry periods, to moisten them in order to reduce the spreading of dust after vehicles pass;
- Upon the completion of the works and removal of all temporary facilities and manipulative surfaces, it is necessary to perform the recultivation and horticultural landscaping of free surfaces in the lock complex in accordance with the special Project.

### ***Measures to restrict negative effects of the adaptation of the lock of the dam Djerdap I***

It is expected that due to the relatively fast, i.e. as short as possible performance of riverbed cleaning due to the measures undertaken to prevent and reduce negative effects of riverbed cleaning on the downstream sections of the Danube, and also due to stronger water currents in that part of the Danube, the siltations would take place to the least possible extent. This should contribute to preserving the areas which represent the natural reproduction areas of the lithophile fish and enabling uninterrupted spawning of these fish species in the spring period with stronger water flows. Having in mind that the spawning periods for certain fish species are as follows:

- Sterlet from April 1 to May 31;
- Danube sturgeon from March 30 to September 30;
- European sturgeon from March 1 to September 30;
- Huchen from March 1 to June 1;
- Riverine brown trout from October 1 to March 1;

- Grayling from March 1 to May 31;
- Northern pike from February 1 to March 31;
- Common barbel, from May 1 to July 15;
- Crucian carp from May 1 to May 31;
- Common carp from April 1 to May 31;
- Tench from April 15 to June 30;
- Catfish from May 1 to June 15;
- Zander and Volga pikeperch from March 1 to April 30;
- Zingel from March 1 to May 15.

It is necessary to plan the works dynamics of mud removal and other activities related to lock in such a way as not to disrupt the normal regime of waters and spawning, i.e. to plan their start after the spawning season, from the end of June onwards. The fishes spawning in autumn and winter (sturgeon and riverine brown trout) are not in the major flow below the first Djerdap dam, and even if they were in the accumulated water above the dam they do not spawn there, and they represent Atlantic, introduced (allochthonous) and invasive specimens, they are not subject to protection measures and not relevant for this Study.

All protective measures shall be undertaken while carrying out the works and conducting the storage of waste materials under the conditions and in the manner provided by the legislation, and upon the completion of works, it would be necessary to clear all the ground around the lock where the warehousing of materials and equipment took place from all kinds of waste, materials and production plants and, if required, to sanate the terrain back to the condition favourable for the life of animals and plants, so that after the works have been finished fauna from the area would return and settle there.

### ***Area protection measures***

- To limit (in terms of space) the size of the construction site;
- To conserve vegetation around the construction site as to the highest possible extent so that it would serve as a visual shelter;
- To adequately organise and maintain the construction site;
- Restore the construction site immediately after the completion of the works.

## Protection measures during exploitation process

### Water and sediment protection measures

In addition to the already mentioned measures for direct protection of waters and sediment from pollution, the following should also be added for the adaptation works during the project exploitation process:

- To monitor ships using lock in order not to discharge waste and ballast water,
- To consider the possibility of constructing a station for receiving these waters.

During the project exploitation period, the planned land protection measures during the project exploitation will also indirectly affect the protection of water and sediment in the same way as during the adaptation works.

### Soil protection measures

- Part of the protection measures implemented during the adaptation of the lock remain and shall be implemented as protection measures during its regular operation;
- Special areas intended for containers, tanks and barrels for temporary disposal of collected waste made of waterproof materials resistant to oil and petroleum products and with curbs preventing the discharge of water to the surrounding ground, shall be used for the same purpose and during the regular operation of the lock;
- To retain sufficient number of marked special containers for the collection and temporary disposal of solid municipal waste, as well as containers and barrels for different types of solid and liquid hazardous waste generated during the maintenance of the lock in its regular operation;
- To collect solid municipal and construction waste exclusively into special containers and entrust the competent public utility service with the discharge of those containers;
- Recyclable waste (metal, wood, glass, plastic) must be collected separately and properly disposed of until handing over to the person authorized or licensed to manage the specified types of waste;
- Solid hazardous waste (oiled equipment, used sorbent for oils, residues of protective agents, paint and their packaging, electronic waste, neon lamps, etc.) should be classified and collected in appropriate containers and analysed;
- To dispose liquid hazardous waste (motor and transformer oils, as well as lubricants, hydraulic fluid, oily water, etc.) into the attested, marked metal barrel and to analyse the waste;
- Align the treatment of solid and liquid hazardous waste with the results of the waste analysis and entrust a legal entity (authorized operator) holding a permit to manage the specified types of waste with its takeover and final disposal;

- Regularly control groundwater from a formed piezometric well for the purpose of verifying the efficiency of the measures taken to protect the land;
- To regularly maintain green and horticultural landscapes in the area of the lock.

### **Accident protection measures**

#### ***Organisational protection measures***

These are general measures which apply and are relevant for timely and effective response in all accidents

- It is necessary to develop an Accident Management Plan, so that each employee knows exactly what his/her obligation is, which must contain at least the following:
  - The method of identifying and recognizing an accidental situation;
  - The tasks and responsibilities of all employees in the case of an accident
  - All information about the accident recovery officer;
  - Notification procedure of the occurrence of the accident
  - Procedure for evacuation of employees and persons present and evacuation routes.
- Create a training program for employees, as well as periodic testing of training for dealing with accident situations;
- Establish a system of adequate sound and visual signaling on the systems and facilities where accidents are possible to happen;
- Notifying competent authorities in the Republic of Serbia of accidental pollution.

#### ***Land protection measures***

These measures provide protection of land both in smaller-scale incidents and in accidents.

- In the area of the national park, hazardous waste landfills are prohibited;
- Construction site should be equipped with appropriate residential containers for workers' accommodation, sanitary facilities for personal hygiene maintenance and chemical mobile toilet cabins, in compliance with the number of engaged workers;
- Provide sufficient number of marked special containers for the collection and temporary disposal of solid municipal waste, as well as containers, tanks and barrels for different types of solid and liquid hazardous waste, generated during the adaptation of the lock;
- Collect solid municipal and construction waste exclusively in specialised containers and entrust the competent public utility service with their discharge;





- Recyclable waste (metal, wood, glass, plastic) needs to be collected separately and properly postponed until handing over the person authorized or licensed to manage the stated types of waste;
- The resulting solid potentially hazardous waste, (oily equipment, contaminated soil, used sorbent for oils, sand and paint after blasting, paint and protective agent containers, separator residue, etc.) are to be classified and collected in appropriate containers and further analysed;
- Liquid hazardous waste (oiled water, hydraulic fluid, used motor and transformer oils, as well as lubricants, etc.) should be disposed in tanks and in an attested, marked metal barrels and further analysed;
- Further process with solid and liquid hazardous waste should be aligned with the results of waste analysis, and the takeover and final disposal should be entrusted to a legal entity (authorized operator) holding a permit to manage these types of waste;
- Operating surfaces and surfaces on which containers, tanks and casks for temporary disposal of collected waste will be located shall be made from waterproof materials resistant to oil and oil derivatives and with curbs preventing the discharge of water to the surrounding land;
- Conduct regular maintenance and ensure proper operation of engines of construction machines and trucks in order to prevent the leakage of fuels and lubricants into the ground;
- It is forbidden to take out oil from construction machinery and trucks, or to repair them at the respective location during previous works and the works on the adaptation of lock facilities;
- Prescribe the characteristics of the sorbent, which will be used for spraying small quantities of oil, derivatives, motor oil, hydraulic oil, paints, etc. as well as the manner of application, collection and procedure with the collected sorbent;
- Provide crates with sorbent and container for temporary disposal of the collected, used sorbent;
- In case it is established that the contamination of land requires remediation, the investor is obliged to perform the adaptation and remediation of the respective area according to the Adaptation and Remediation Project for which the approval of the competent ministry has been obtained;
- A piezometer well should be installed in the area between the main road M-25.1 and the Danube bank to monitor the impact on groundwater system and indirect monitoring of soil contamination;
- In case geological-paleontological or mineralogical-petrochemical objects are found during the performance of works, which are presumed to be natural property, , the contractor is obliged pursuant to Article 99 of the Law on Nature Protection to inform the Ministry in charge of environmental protection and take all precautionary measures so that the natural good would suffer no damage until the arrival of an authorized person;
- Upon the completion of the adaptation, greening and horticulture landscaping of free surfaces within the lock areas by the combination of autochthonous deciduous trees, conifers and ornamental shrubs according to a special Project should be carried out.



### ***Measures of water environment protection***

Protecting the aquatic environment from pollution in an emergency situation is extremely important for the living world of the Danube, due to the possible extent of pollution and negative consequences, and it is one of the obligations assumed by international conventions and treaties. Water and sediment protection measures can generally be divided into two parts.

The first part is the protection against direct pollution due to minor or major accidents on vessels or machinery engaged in the adaptation of the lock which result in the direct discharge of oil and/or petroleum products into the water environment. Protection measures in this case are the same as for any similar accident:

- Lock must have a floating barrier, appropriate vessel, chemicals and equipment for collection, temporary disposal and neutralization of potentially leaked oil and/or derivatives in chambers and fore-locks;
- If it is established in the fore-locks that the oil, petroleum and/or derivatives leak from one of the vessels causing the contamination of water environment, a floating dam must be installed immediately;
- Emergency repair or damage to the vessel leading to an accident must be carried out urgently in order to prevent further contamination of the water environment;
- The vessel from which oil, derivatives or petroleum has leaked must not leave the space enclosed by a floating dam, until the pollution is collected with the appropriate equipment and means;
- Collect the spilled petroleum products from the surface of the water mirror using special catching devices and pump the oily water and derivatives into specialised containers/containers;
- Entrust a legal entity authorized to handle this type of hazardous waste with further treatment of the collected derivatives and oily water;

The second part is the indirect protection of water and sediment through measures of soil protection during the adaptation of the lock. The application of the mentioned soil protection measures by reducing or eliminating soil contamination reduces or eliminates potential pollution of water and sediment caused by the washing off of contaminated soil and dust into the waterflows.

### ***Fire protection measures***

- The adaptation of the lock will completely replace complete mechanical and electrical equipment and installations of the fire protection system, which provides additional security and ensures the maximum reliability of the revitalized fire protection system;
- Ensure continuous operation of the SCADA system for monitoring and remote control of the fire protection system from the command tower;

- The fire control unit should be placed in the command tower so that in the event of its cancellation the captain can take over manual control of the fire protection system;
- The siren and light signaling of the fire alarm must be installed in the control tower and the mixing station;
- The lock is fully covered by a stable fire extinguishing system, while the fire on the vessel is to be extinguished using the equipment of each ship separately;
- In each chamber, the system is divided into three sections, and dimensioned for safe extinguishing of one section, although it is possible to simultaneously extinguish all three sections, that is, the whole chamber of the lock;
- Fire extinguishing in the chamber of the lock is done with monitors placed over a parapet wall, water or a mixture of water and 3% synthetic extract for heavy foam;
- Continuous maintenance of the pumping station Kosovica, water reservoir, mixing station (pumping unit, venturi mixer, dosing electric pump), synthetic extractor tank for heavy foam and 48 monitors in operational condition is required;
- For fire extinguishing in the reservoir of the Kosovica system, it is necessary to have a permanent water reserve of 1,785 m<sup>3</sup>, and the water pressure at the entrance to the mixing station must always be 7,8 bars;
- Monitors with automatic oscillating mechanisms and a foam launcher must have a capacity of 1900l/min and a jet range of up to 44m, with a pressure of 16 bars at the entrance to the foam pitcher;
- In the storage tanks for 3% of synthetic heavy-foam extract must always be provided with its sufficient quantity.

### ***Measures in case of accident***

- It is obligatory to secure a certain amount of absorbents in case of leakage of fuel and lubricants due to collision and malfunction of machines and means of transport during the construction works. In case of spillage, leakage of petroluem, derivatives or oil, as an accident which can occur at all stages of the construction and regular operation of the lock, it is necessary to immediately start recovery of the site, and the waste generated by recovery should be packed in an impermeable barrels with a covers and act in accordance with the Law on Waste Management ("Official Gazette of the RS", nos. 36/2009, 88/2010 and 14/2016); The resulting waste is transferred to an authorized operator holding a permit for hazardous waste management for further treatment, with mandatory records on waste collection; By applying certain preventive protection measures, using the right mechanization, the risk of potential spillage or leakage of petroleum products should be minimized;

- In case of sudden pollution, it is necessary to comply with the planned measures. Changes in the composition and concentration of pollutants in water must be monitored by continuous measurement of water quality;
- In case of leakage of chemicals, the response to the accident includes: informing the responsible person, wearing protective equipment, taking care of the injured (if any), preventing further leakage and emission of chemicals, collecting chemicals and packing as hazardous waste, recovery of the contaminated site;
- Fire extinguishers must be provided at appropriate places, as measures taken against cases of fires of electrical installations. Fire protection must comply with the regulations on fire protection and occupational safety, ie the construction and maintenance of similar plants. In addition, a hydrant network must be provided for throughout the facility, in accordance with the Fire Protection Law ("Official Gazette of RS", no. 111/2009 and 20/2015). In the event of a fire, the following should be undertaken: start of the initial fire fighting steps, stopping the operation of the device on fire and switching off electrical energy, reporting the fire to the firefighting unit, taking all measures to prevent spreading of the fire to adjacent facilities, start evacuation of people from the dangerous part of the facility;
- While reacting in cases of hazard, it is necessary to use adequate protective equipment (protective overalls, shoes, goggles, gloves, masks);
- Installing an alarm system is a very effective measure which can provide an immediate and adequate response in the event of operational failures or an accidents and an effective response to the incidents;

Rescue and first aid operations include: rescue (general), rescue from suffocation risk by inhalation of gases, intoxication induced by inhalation of gas;

After the accident: the Project Holder is obliged to immediately notify the competent authority of the relevant Ministry, or at the latest within 24 hours, about the extraordinary event; The notice shall include information on the circumstances of the incident, the place, the time, the immediate danger to human health and the description of the measures taken; All places where the damage has occurred must be repaired and recovered as soon as possible.

## 7. ENVIRONMENTAL IMPACT MONITORING PROGRAM

### Surface water quality monitoring parameters

Monitoring parameters for surface water quality have been selected to include possible impacts on water quality during the revitalization of the lock of the HPP "Djerdap I", as well as the possible impact during the operation of the lock. In addition to this, the selection of parameters was influenced by the fact that the location of HPP "Djerdap I" is covered with two monitoring stations.

The parameters for the first phase of the monitoring would be: temperature, electrical conductivity, pH, suspended matter, sediment, concentration of dissolved oxygen, % oxygen saturation, BOD5, chemical oxygen consumption (KMnO<sub>4</sub>), chemical oxygen consumption (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), hydrocarbon index C<sub>10</sub>-C<sub>40</sub>, hydrocarbons originating in gasoline C<sub>6</sub>-C<sub>10</sub>, hydrocarbons originating from diesel C<sub>10</sub>-C<sub>28</sub>, arsenic, boron, copper, zinc, chromium, iron, manganese, lead, nickel, cadmium, mercury, solvents.

The parameters for the second phase of the monitoring would be: temperature, electrical conductivity, pH, suspended matter, sediment, concentration of dissolved oxygen, oxygen saturation, BOD5, chemical oxygen consumption (KMnO<sub>4</sub>), chemical oxygen consumption (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), hydrocarbon index C<sub>10</sub>-C<sub>40</sub>, hydrocarbons originating in gasoline C<sub>6</sub>-C<sub>10</sub>, hydrocarbons originating from diesel C<sub>10</sub>-C<sub>28</sub>, arsenic, boron, copper, zinc, chromium, iron, manganese, lead, nickel, cadmium, mercury.

The parameters for monitoring the quality of surface waters, their limit values per classes are defined by the Regulation limit values for pollutants in surface and groundwater and sediment and time periods for their reach (Official Gazette of RS, no. 50/2012) and the Regulation on Limit values of priority and priority hazardous substances polluting surface waters and the time periods for their reach ("Official Gazette of RS", no. 24/2014).

### Sediment quality monitoring parameters

The parameters of the monitoring of the quality of sediment, their limit values and the classification of sediments are defined by the Regulation on limit values of pollutants in surface and ground waters and sediment and time periods for reaching them ("Official Gazette of RS", no. 50/2012).

When carrying out monitoring for status assessment and trend of sediment quality, we should use the Table 8.1. from Annex 3 of Regulation 50/2012, while for assessing the quality of sediment in the cleaning out of sediments from the waterway, Table 8.2. from Annex 3 of Regulation 50/2012 should be used.

The procedure for assessing the status and quality of sediment is given in Annex 3 of Regulation 50/2012.

Parameters and procedures for classification of sediment as waste in case of their disposal at the landfill as well as the respective procedure are defined by the Rulebook on categories, testing and classification of waste ("Official Gazette of RS", no. 56/2010).

In the case of modification of the existing or adoption of new regulations governing the area of quality control of sediment, i.e. categorization of waste, the monitoring of the quality of the sediment should be adapted to the current regulations.

### **Soil and groundwater monitoring parameters**

Soil monitoring is carried out according to the Regulation on the program of systematic monitoring of soil quality, indicators for the assessment of the risk of soil degradation and the methodology for the development of remediation programs (Official Gazette of RS, no. 88/2010). The parameters for monitoring the quality of the soil and at the same time the quality of groundwater would be: groundwater level, electroconductivity, pH, dissolved oxygen concentration, oxygen saturation, BPK5, chemical oxygen consumption (KMnO<sub>4</sub>), chemical oxygen consumption (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), hydrocarbon index C10- C40, hydrocarbons originating in benzene C6-C10, hydrocarbons originating from diesel C10-C28, arsenic, boron, copper, zinc, chromium, iron, manganese, lead, nickel, cadmium, mercury.

### **Places, method and frequency of measurement of the determined parameters**

#### **Surface waters**

Taking into account that the HPP "Djerdap I" is already covered with two monitoring programs, the surface water quality monitoring sites are adapted to give a better picture of the impacts of revitalization work on the Djerdap I lock and during its exploitation. The monitoring of surface water quality should be divided into two phases. The first phase is planned for the period of carrying out works on the revitalization of the lock, while the implementation of the second phase is planned for the period of exploitation of the lock.

The first phase of the monitoring would be carried out once a month during the period of carrying out the works on the revitalization of the lock and would be done at three locations. Planned locations are:

1. at the entrance to the upstream fore-dock HPP "Djerdap I",
2. downstream fore-dock,
3. Chamber of the lock.

Given the planned operation, the sampling at locations 1 and 2 will be carried out uninterruptedly every month, while sampling in the chambers of the lock will be carried out when the chamber is filled with water.

The second phase of monitoring would be carried out quarterly. Planned locations are:

1. At the entrance of the upstream fore-dock of HPP "Djerdap I",
2. Downstream fore-lock.

### ***Monitoring of sediment quality***

In order to obtain the most representative data, the monitoring of the quality of the sediment should be carried out after the completion of all planned works on the revitalization of the lock on the HPP Djerdap I. Monitoring should be carried out at three locations in downstream pre-accession. Two locations are on a route through which the ships move through the lock, one at the entrance to the lock, and the other in the middle of the road through the downstream fore-dock. The third location is at the same height with another location, but at a distance of approximately 25 m from the right bank of the Danube. This arrangement of locations should be maintained by further monitoring of the work of the lock, as it will enable the control of the quality of the sediment, both on the route by which the ships move through fore-dock, where, due to the passage of ships, there is less depositing of the sediment, as well as in the vicinity of the nearby shore where the influence of the ships' passing is less pronounced depositing of sediment is more significant.

After completing the adaptation of the lock and the planned monitoring, further control of the influence of the lock on the quality of the sediment should be carried out once a year in the period of low water. Another point should be added to the monitoring of the work of the lock, which would be located in the upper fore-dock, approximately in the middle of the route by which the ships move through the upstream fore-lock. In case the during the operation of the lock works are planned on clearing out the bottom or the river, it is necessary to coordinate the planned monitoring of the quality of the sediment so that it is carried out before the planned works. In case the obtained test results for one of the parameters exceed the remediation value, as well as in the case of subsequent clearing the river basin of the downstream and upstream fore-locks, it is also necessary to categorize the sediment as waste. In this way, relevant data will be obtained for the cleared out sediment.

### ***Monitoring soil quality and groundwater regime***

The monitoring of soil quality is carried out by monitoring the quality of groundwater as defined in the "Official Gazette of RS", no. 88/2010. For the purpose of conducting monitoring during the execution of works on revitalization of the lock as well as during its exploitation, it is necessary to form a piezometer well between the main road M-25 and the Danube bank at the level of the downstream fore-dock.

Groundwater monitoring should be carried out once a week, while testing the other required parameters should be done once in three months. HPP "Djerdap I" is located in the territory of NP Djerdap, in the zone with third degree of protection. The piezometer must be installed before the start of the works on the revitalization of the lock of HPP "Djerdap I" because it is necessary to perform sampling for the determination of zero state.

### ***Monitoring the effect of works on the fauna***

As it is certain that the adaptation of the lock on the dam Djerdap I will not have a significant effect on any faunistic elements, the monitoring measures during the work and after the completion of the adaptation are practically not required.

Regular monitoring activities carried out by the National Park Djerdap, whose territory is protected by the Djerdap I, will provide an answer to the impact of the adaptation of the lock on the aquatic bird nesting or wintering in the area of the Djerdap I reservoir in the immediate vicinity of the dam.

As far as the fish quantity is concerned, it will be possible to see the actual impact of works on the adaptation of the lock through regular monitoring which, according to Article 17, paragraph 5 of the Law on Protection and Sustainable Use of Fish, National Park Djerdap as a user of the fishing area Djerdap within the national park, is obliged to carry out every third year of the management of that area or through research for the purpose of drafting a new Fisheries Management Program if the adaptation of the lock is carried out at the expiration of the ten-year validity period of the current Program.

### ***Monitoring the impact of works on migratory fish species***

Bearing in mind that the adaptation of the Djerdap I lock will not have any additional impact on the possibility of migrating the sturgeon species (Acipenseridae) and the Clupeidae into the Danube upstream of the Djerdap I dam, it is not necessary to undertake any special monitoring measures of the condition these species during the period of the adaptation of the lock. Measures of regular monitoring of fish stock and regular activity of Djerdap National Park as user of fishing area Djerdap on recording the fishermen's catch according to Article 39 of the Law on the Protection and Sustainable Use of Fish Stock during and after the adaptation of the Djerdap I is to detect individual passages of particular species, but it is expected that such data will be negligent, occasional and the result of extreme randomness, and they would not act to indicate the negative or positive effects of the adaptation of the lock.





## 8. CONCLUSIONS OF THE STUDY

By its Decision number: 353-02-304/2017-16, dated September 27, 2017, based on the application of the Ministry of Construction, Transport and Infrastructure (the project developer), the Ministry of Environmental Protection has determined the scope and content of the updated Environmental Impact Assessment Study for the project for the adaptation of the navigational lock of the HPP "Djerdap I", in order to harmonise the study which was previously approved in 2009 (the Ministry of Environment and Spatial Planning of the Republic of Serbia, number 353-02-00401/2009-02) with the existing circumstances and the reduced volume of necessary interventions on the adaptation of the lock.

Project and other documentation available to the Developer was used for the development of the Study, as well as the requirements of the competent relevant institutions obtained for the needs of the updated study.

Particular attention in the preparation of the Study is devoted to the analysis of the state of the environment at the location where the works are planned, and the adaptation and revitalization of the vessel lock and its wider environment. After analysing the state of the environment and analysing the technical (project) documentation, a multi-criteria evaluation of the possible impacts of the planned activities on the adaptation of the vessel to the components of the environment using the Leopold's matrix was carried out. For evaluation purposes, from a broader list of potential impact factors (threats) that can be expected for this type of intervention in nature, 5 possible factors are identified that actually represent project activities on the object's adaptation. Impact factors were assessed separately for each component of the environment relevant to the scope of this Study, in relation to the magnitude of the impact, the importance of impact, the probability of impact, and the duration of the impact. Also, the physical, biological and socio-cultural characteristics of the environment at the site are separated, and within them a total of 12 components of the environment are defined.

Based on the average cumulative value of the impact factor, it has been concluded that the impacts of the project for adaptation of the lock **are extremely low in appearance**, that they are expressed in low intensity, in a limited space and that all impacts are time-limited to the phase/period of carrying out the work on the adaptation of the lock (replacement of equipment and operation of mechanization), while the potential impacts during the exploitation or functioning of the lock will not be significantly changed in relation to the existing situation (except in terms of increasing safety and security in the work as a positive trend that will also contribute to the environment)

Especially the positive impact on the economic development that will enable the adaptation of the lock will be emphasized. This impact goes beyond the local frameworks of the project because it has a national significance.

The effect of the impact factors will have a limited effect on the entire space of the site. Mechanization and transport means will be engaged in the phase of carrying out the works on the adaptation of the lock. It is expected that during the operation of these machines, there will be emissions of harmful gases in the air, as well as increased noise levels.

Negative environmental effects cannot be effectively prevented in this case, and preventive measures relate primarily to the regular maintenance of machines, greater efficiency of exploitation of their work and proper handling of waste materials that can arise in the phase of implementing the adaptation project. Nevertheless, if the negative effect of these and other factors is considered as a whole, it should be emphasized that qualitative and quantitative losses in the living world will nevertheless be negligible both spatially and temporally practically to the very site.

Negative effects will not be significantly reflected in the surrounding area, and their effect will only be reflected during the adaptation of the facility. The survival of neither species nor significant, sensitive or rare ecosystems and other natural values will be challenged and there will be no significant consequences for the living world and the basic environmental factors.

Under the Espoo Convention on Impact Assessment, transboundary impact is defined as: any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party. However, due to the particularities of the specific circumstances:

1. This is a project for the adaptation of a facility that has been in operation for decades on the same site, for which the Environmental Impact Assessment Study was conducted in 2009 and which passed the procedure in accordance with the relevant legislation;
2. The study represents only the examination of new circumstances resulting from the reduction in the volume of works compared to the adopted 2009 Study, which resulted in the necessity to update the Study. If this were not the case, it would not even be necessary to deliver the Environmental Impact Assessment Study under the legislation of the Republic of Serbia for the given scope and type of planned operations for the revitalization of the navigation lock;
3. Adaptation of navigation lock implies replacement of torn parts and equipment without changing the purpose of the object and its functions;
4. Works will be carried out by applying all prevention measures for environmental protection, which should have limited possible negative impacts on the environmental factors assessed in the Study as: little, of local character and minimal spatial dispersion, of temporary character;

Taking into account also the fact that no possible transboundary impacts have been identified, the authors of the Study consider that a neighboring country with an interest in this project - Romania should be informed of all the circumstances and facts, so that the Study would be addressed with full understanding. Namely, none of the identified negative impacts of the revitalization of the navigation lock of the HPP "Djerdap I" nor the operations during its exploitation will have any transboundary impact and, therefore, no impact on Romanian protected natural areas: Iron gates ROSCI0206, Danube Course - Bazias - Iron Gates ROSPA0026, Mountains of Almajului Locvei ROSPA0080.

The waterway of Danube and its huge flows act as a natural barrier, so any small pollution will be held at firsts at the right bank of the Danube, and then very quickly diluted and thus neutralized. Not any options for depositing the cleaned sediment will have a transboundary impact, and therefore no impact to the already mentioned Romanian protected natural areas. The Danube waterway and the huge flow represent a natural barrier that will prevent the spreading of the pumped sediment towards the Romanian bank of the Danube in the event of selecting an option of pumping the cleaned sediment into the Danube River and focus its deposition on the right bank. Choosing the second option that implies depositing the cleaned sediment on the right bank of the Danube and pumping out drained waters from the landfill into the Danube River, the Danube River waterway and the huge flow of this river will again prevent the impact to the protected natural areas located on the Romanian side.

Not only does the huge flow act a barrier, but it also causes significant dilution of the pumped seepage waters. Proposed works on the navigation lock revitalization HPP "Djerdap I" as well as its further exploitation will have no effect on the phytocenoses present in the territory of Romania, and the case is similar with the ichthyofauna.

Summarizing the possible impacts of the planned projects on nature and the environment, it was concluded that they are acceptable and will be minimized by the application of a large number of enumerated protection measures defined in the Study and with the appropriate environmental monitoring program at the site. It is mainly a preventive approach to protection in order to prevent possible negative environmental impacts.

In this case, it can be concluded that the adverse effects of limited intensity, spatial extent and time duration have been identified.

Taking into account:

- Characteristics of the planned activities on the adaptation of the lock and the existing state of the environment at the site;
- Existing purpose of the space that will not be changed by the realization of the project;
- Results of multi-criteria evaluation of planned activities on the environment;
- Defined environmental protection measures and environmental monitoring program (monitoring).



It is hereby concluded that the navigation lock adaptation project will, in a wider context, achieve certain positive effects on the quality of the environment, as it will facilitate efficient and safe operation of the facility, and that the smaller identified potential negative impacts during construction will not burden the capacity of the space, especially if the defined protection measures are implemented in the implementation phase of the project. For these reasons, it can be concluded that the project cannot be considered as a significant environmental pollutant, that its implementation serves the basic principles of sustainable development and that it complies with the national priority regarding the use of this important facility on the international waterway. Taking all the previously stated into account, we find that the Project in question is fully acceptable from the point of view of possible environmental impacts.

