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River Training and Dredging Works on Critical Sectors on the Danube River in Serbia

New approach to the Environmental Monitoring



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RESUMEN

El objetivo del proyecto es mejorar las condiciones de navegación en el río Danubio de acuerdo con las disposiciones de políticas y estrategia nacionales serbias respetando las Recomendaciones de la Comisión Internacional para la Protección del Río del Danubio (ICPDR) y los planes de desarrollo del sistema de transporte de la UE con el fin de garantizar un transporte rápido, seguro, fiable y respetuoso con el medio ambiente, así como el mantenimiento de caudales y la movilidad de las personas.

El objetivo de este proyecto es ejecutar seis estructuras de protección, redireccionamiento y control fluvial y trabajos de dragado (cerca de 500.000 m³) en seis (6) sectores críticos a lo largo del río Danubio en Serbia, desde el km 1200+000 hasta el km 1285+000.

Las estructuras de encauzamiento fluvial consisten en un espigón aislado (detached groyne), cuatro espigones laterales (sills) y dos tajamares (chevron) ejecutados en tres sectores críticos. Las obras de dragado se ejecutarán en tres sectores críticos.

El principal beneficiario de las obras es el Ministerio de Construcción, Transporte e Infraestructuras (MCTI) y el Receptor Final, la Dirección de Vías Navegables Interiores. Las obras son cofinanciadas por la UE (85%) y el Ministerio de Hacienda de la República de Serbia (15%). Presupuesto de la Asistencia Técnica (AT): 1.703.500,00 €. Presupuesto de las obras: 7.613.554,78 €.

La Asistencia Técnica durante la construcción y puesta en marcha de las obras está siendo realizada por ACCIONA Ingeniería, bajo estándares FIDIC, y abarca dos componentes:

- Supervisión de las Obras, y
- Monitoreo ambiental.

Las obras están siendo ejecutadas por GROMA HOLD LTD (Bulgaria), en consorcio con Water Management Business Company Regulacije, LLC (República de Serbia) Company for Design Engineering and Construction Kolubara DOO (República de Serbia)

El monitoreo ambiental antes, durante y después de la ejecución de obras de dragado aborda la identificación y evaluación precisa de los efectos ambientales de los trabajos en el campo de la hidromorfología, calidad del agua y los sedimentos y biología, particularmente la ictiofauna por existir poblaciones de *Acipenser ruthenus* (esturión esterlete).

La Asistencia Técnica también incluye la celebración de reuniones periódicas con organizaciones interesadas en el proyecto (Stakeholders Forum), de acuerdo con la política de Buenas Prácticas establecida por el MTCL – Dirección de Vías Acuáticas Interiores. El propósito de la organización del Foro es la creación de un órgano multidisciplinar para la mejora de la calidad del Proyecto, así como el intercambio de información de importancia mutua.

ABSTRACT

The purpose of the Project is improvement of navigation conditions on the Danube River in accordance with the national policy and strategy provisions and with respect to the Danube Commission Recommendations and EU transport system development plans in order to ensure fast, safe, reliable and environmentally friendly transportation, smooth flow and mobility of people.

The Scope of this Project is to execute six river training structures and dredging works (close to 500.000 m³) at six (6) critical sectors along the Danube River in Serbia, from km 1200+000 to km 1285+000.

River training structures consist of one detached groyne, four bottom sills and two chevrons executed on three critical sectors. Dredging works will be executed on three critical sectors.

Main Beneficiary of the works is the Ministry of Construction, Transport and Infrastructures Republic of Serbia and End Recipient, Directorate for Inland Waterways. Works are cofounding by EU (85%). Value of the Technical Assistance Services (TA): 1,703,500.00 €. Value of the Works: 7,613,554.78 €. Contract Authority is Ministry of Finance, Government of the Republic of Serbia, Department for Contracting and Financing of EU Funded Programmes (CFCU).

The Technical Assistance Services during the construction and implementation of the river training and dredging works are needed. This Service, which is being provided by ACCIONA Ingeniería will cover two components:

- Supervision of the Works, and
- Environmental monitoring.

Works are being executed by GROMA HOLD LTD (Bulgaria), in consortium with Water Management Business Company Regulacije, LLC (Republic of Serbia) and Company for Design Engineering and Construction Kolubara DOO (Republic of Serbia)

Environmental monitoring before, during and after execution of river training and dredging works addresses precise identification and evaluation of environmental effects of river training and dredging works in the field of hydromorphology, water and sediment quality and biology.

Regarding the Environmental component, Stakeholders' Forum Meetings are carried out on regular basis in line with the long-term orientation of the MCTI - Directorate for Inland Waterways towards application of the modern concept of inland waterways management, as well as in line with the identified good practice in implementation of similar projects along the Danube River. The purpose of the organization of the Forum is establishment of a multidisciplinary body for the improvement of the quality of the Project, as well as exchange of information of mutual importance.

OBJETIVES

The overall objective of the project can be summarized as follows:

Improvement of navigation conditions on the Danube River in accordance with the national policy and strategy provisions and with the respect to the Danube Commission Recommendations and the EU transport system development plans in order to ensure fast, safe, reliable and environmentally friendly transportation, smooth flow of freight and mobility of people.

To achieve this ambitious objective dredging and river training Works have been designed for six critical locations on the Danube River between Bačka Palanka and Belgrade from km 1200+000 to km 1285+000.



Figure 1. Situation of works in Serbia

Works are been executed under FIDIC Conditions (Red Book -1999) and are cofounding by EU (85%). Final Beneficiary of the works is the Ministry of Construction, Transport and Infrastructures Republic of Serbia and End Recipient, Directorate for Inland Waterways. Works are cofounding by EU (85%). Value of the TA: 1,703,500.00 €. Value of the Works: 7,613,554.78

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REPUBLIC OF SERBIA
MINISTRY OF FINANCE
Department for Contracting and Financing
of EU Funded Programmes
MINISTRY OF CONSTRUCTION,
TRANSPORT AND INFRASTRUCTURE



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ЗА ТЕБЕ

Main indicators of the project

Project data	
Country	Republic of Serbia
Programme	IPA 2013
EU funding rate	85%
Technical Assistance	1,703,500.00 €
Works	7,613,554.78 €

Project parties

Key parties involved in the implementation of this contract and their roles are presented in the following table:

Project party	PRAG role	FIDIC role
CFCU	The Contracting Authority	The Employer
ACCIONA Ingeniería	The Contractor	The Engineer
GROMA HOLD LTD (Bulgaria), in consortium with Water Management Business Company Regulacije, LLC (Republic of Serbia) and Company for Design Engineering and Construction Kolubara DOO (Republic of Serbia)	The Works Contractors	The Contractor
The Ministry of Construction, Transport and Infrastructure	The Final Beneficiary	n/a
Directorate for Inland Waterways (Plovput)	End Recipient	n/a

Parties that also benefit from the results of the project will be Serbian and foreign shipping companies navigating on the Danube River, together with ports, logistic operators and harbour master offices and environmental organizations.

Project description

This environmental monitoring has been developed before the commencement of works (dredging and training works), covering the six critical sectors and extending for some parameters to Bačka Palanka (km 1295) and Zemun (km 1270).

According to the Project Design, approved in 2013, the works must be performed on six critical sectors along the Danube River, following the distribution showed in the table:

Sector Code	Name	Type of Works	Chainage
18	Susek	Dredging A	km 1285+000 – km 1283+950
18		Dredging B	km 1282+650 – km 1282+050
19	Futog	Dredging	km 1266+400 – km 1265+000
19.1		Detached groyne	km 1263+350
19.2		Chevron	km 1262+700
21	Arankina Ada	Dredging	km 1246+600 – km 1245+300
22	Cortanovci	Dredging	km 1240+300 – km 1239+350
22.1		Sill No. 1	km 1237+700
22.2		Sill No. 2	km 1237+150
22.3		Sill No. 3a	km 1236+150
22.4		Sill No. 3b	km 1236+000
23	Beska	Dredging	km 1229+600 – km 1227+400
24.1	Preliv	Chevron No. 1	km 1200+600
24.2		Chevron No. 2	km 1199+800

Table 1. Works according to Project design

Due to the gap of time between the design and the beginning of works executions, new bathymetric surveys were carried out by MCTI - Directorate for Inland Waterways during the summer 2017, showing how the riverbed morphology had changed in most of the critical sectors. The consequence of those changes is the necessity of study and preparation of new drawings calculating new quantities of dredged material and structures.

These adjustments in the quantities are being done along the contract and the consequence is shown in the table below:

Sector	Type of works Project design	Executed works	Designed	Executed
18 - Susek	Dredging A	✓		
	Dredging B	✓		

	Dredging C	✓		
19 - Futog	Dredging	No need	--	--
	Detached groyne	✓		
	Chevron	✓		
21 – Arankina Ada	Dredging	On going		
22 - Čortanovci	Dredging	No need	--	--
	Sill n° 1	✓		
	Sill n° 2	✓		
	Sill n° 3a	✓		
	Sill n° 3b	✓		
23 - Beska	Dredging	On going		
24 - Preliv	Chevron n° 1	✓		
	Chevron n° 2	No need	--	--

Table 2. Works by critical sectors

The Works Contract is being implemented by using FIDIC rules/conditions of contract – RED Book -1999. Works begun on October 2017 and it is scheduled to end in April 2021.



Figure 2. Chevron on Critical sector Preliv

TECHNICAL SUPERVISION

Supervision and Environmental Services Contractor (S&EMC) is acting as the “Engineer” according to FIDIC Conditions, following at the same time the requirements of the relevant legislation of the Republic of Serbia and main European Directives related to Water and Environment.



Figure 3. Chevron on Critical sector Futog

The Technical Supervision comprises in three main phases:

- Phase 1: Inception phase and environmental monitoring before construction;
- Phase 2: Supervision of construction and environmental monitoring during construction phase;
- Phase 3: Defects Notification Period (upon completion of the construction phase) and environmental monitoring after river training and dredging works at each critical sector.



Figure 4. Construction works on Critical sector Čortanovci



Figure 5. Construction works on Critical sector Futog



Figure 6. Construction works on Critical sector Čortanovci

ENVIRONMENTAL SUPERVISION

Performance of environmental monitoring was considered, by Contract Authority, of a crucial importance for the proper implementation of the project since the Project design. The Environmental Monitoring Programme had been already discussed during the elaboration of the EIA and also during the Stakeholders' Forum carried out along that phase.

Within this contract, environmental monitoring has been involved the same three phases.

Environmental monitoring before construction

Analysis of how the works are affecting the environment begun during the Inception Phase, before the start of execution of works. During that phase, the Environmental Team carried out the environmental monitoring, getting base values of the parameters defined within the EIA. The three selected fields to be covered are:

Hydromorphology (water levels, flow velocities, riverbed morphology)

Sediment and water quality (chemical parameters)

Biology indicative species:

- Macrozoobenthos,
- *Limosella Aquatica*,
- Little Ringed Plover (*Charadrius Dubius*),
- Starlet (*Acipenser Ruthenus*).

Report presented the general description of this Serbian stretch of the Danube River and detailed analysis of each critical sector. As said, the main goal of this report is deep in the knowledge of the environment to get the values for future comparison. The literature about this stretch shows that it is not well-known as the Austrian or the Hungarian parts, however, the good work carried out by ICPDR promoting Joint Danube Survey has permitted to get some valuable results that have been included in the Report.

To complete the bibliographic research, three surveys were performed on the six critical sectors, November 2017, February and March 2018 with following results:

Sector	Macrozoobenthos (<i>Unio</i> sp)	Fishes (<i>Acipenser ruthenus</i>)	Plants (<i>Limosella aquatica</i>)
18 - Susek	2	1	0
19 - Futog	0	0	0
21 – Arankina Ada	0	0	0
22 - Čortanovci	0	0	2
23 - Beška	0	4	0
24 - Preliv	1	5	0

Regarding birds, as two target species (*Riparia riparia* and *Charadrius dubius*) are both migrating species, none of the individuals of these species was found during the surveys. Due to winter

conditions, the number of bird species found was very reduced and limited to ubiquitous species.

Considering the recommendations received during the Design Phase, the conditions established in Vojvodina Decision (equivalent to DIA) and the obtained results, the report also presents detailed monitoring activities during the construction phase.



Figure 7. Environmental survey before works

Environmental monitoring during construction

Once works begun on each critical sector, the environment close to the area has been supervised constantly. According to the Contract, status of surrounding environment must be evaluated, following same criteria used for the monitoring before works, each three months.

Additionally, by decision of the Environmental Supervision Team, short analysis of water, birds and plants have been done on monthly basis during the most intense periods of works. To avoid discharge of polluting substances, the vessels were examined once a week, verifying the cleaning on board.

Results obtained during each survey have been compared with the ones that defined the baseline and with the ones obtained in previous surveys during works.

Those monitoring activities have been performed by ACCIONA's environmental experts and specialized experts from Serbian universities, specifically Belgrade University for Phytoplankton and Novi Sad University for fish populations. This engagement permits to get the high standards required by the Contract Authority and the Stakeholders partners.

The results are presented in a report that is approved by Ministry of Finances, Ministry of Transport and Directorate of Inland Waterways. Results are also presented to the Stakeholders members.

At the moment, while writing this article, dredging works are almost completed on the first sector with dredging activities, Susek, and preparatory works in the second sector Arankina Ada are still on going.



Figure 8. Environmental survey during works in critical sector Čortanovci

Environmental monitoring after construction

The finalization of the works on critical sector does not mean the ending of the monitoring surveys. According to established rules in the EIA report and the Decision of the Environmental Authority of Vojvodina Province, the monitoring should continue performing one year more on those sectors with structures and three months on those sectors with only dredging activities. For the first type, a survey has established each six months, which represents two complete monitoring after the works were completed.

In parallel, technical inspections have been done every three months, which represents four complete studies of the critical sectors along this period of one year denominated DNP (Defect Notification Period).

At this moment, environmental monitoring after works has been completed on two critical sectors: Futog and Čortanovci.

Regarding Futog, after one year checking the status of the environment, it is clear that none of the parameters evaluated has suffered any negative effect. Despite the two new structures built on this sector, fish population, mussels or phytoplankton have kept the same conditions that were addressed during the surveys before works.

With respect to Čortanovci, results are similar to Futog, and show that the previous conditions have not been changed. On this sector, during spring and summer seasons, bird population have revealed a high variety of species that have not seemed to be affected by the works.



Figure 9. Environmental monitoring control after works in critical sector Preliv

STAKEHOLDERS FORUMS' MEETINGS

One of the most interesting aspects of how this project is considering the public participation promoted by the EU is the establishment of a Forum of Stakeholders which began to run during the design phase. This Forum, managed by the Directorate of Inland Waterways, currently the End Recipient, has a goal to ensure transparency in the project management. The Forum was created under these basic rules: voluntary, respecting the different points of view and full transparency of the works being implemented.

Due to the deep interest of this project, some of the most relevant Serbian institutions make part of it as Members: Institute for Nature Protection of Vojvodina, the Bird Protection and Study Society of Serbia, the United Fishermen of Serbia, The Ministry of Environment of Serbia. In addition, several international Institutions are also active part of this Forum such as the ICPDR (International Commission for the Protection of Danube River), Danube Commission, WWF, among others. Most of the participants come from the preparation phase, so that their involvement in this phase was considered of great importance and highlight the acceptance of this type of participative events.

All the results obtained during the environmental monitoring (before, during and after works) are presented to the Forum and discussed, which at the end have contributed to enrich the works carried out by the Environmental Team, due to the different points of view of the participants.

Until now, seven Forum meetings have been held since the beginning of the project until March 2020, in which valuable contributions have been debated. The Forum is also an “open door” to present compensatory measures to be carried out in some of the critical sectors. Under this frame, one proposal was done to minimize the accumulative effect that could appear on critical sector Futog due to the presence of six old sills upstream of the area where the chevron and the detached groyne have been built. After a deep technical debate, the Forum concluded the convenience of the implementation of the proposed measure: cleaning of a lateral branch of Danube River, which will serve as nesting area for fishes. The Works Constructor will carry out the design made by Environmental team before spring 2021.



Figure 10. Stakeholders' Forum Meeting – October 2019

CONCLUSIONS

After 40 months of environmental monitoring, the main conclusion is that the performed works have not compromised the environment close to the sites. Thus, and more important, is how the environmental monitoring has been including as main component from the first steps of this project. The decision taken by the Serbian Government during the design process of considering this element as primordial has been, at the end, one of the most important facts of the project. Not only for the environmental monitoring, during works, but also for the importance given by all the participants involved, from the Contract Authority to the Works Contractor. This common way has permitted to follow the environmental rules without consider them as an obstacle, which finally has been beneficial for the environment.

Stakeholders' Forum as independent observer, has forced the supervisor as well as the Contract Authority to show, on regular basis, how the works were advancing and how they were performed. At the end, this has permitted the continuous improvement of environmental monitoring works and the correct safeguard of nature.. This project can be the great opportunity for Republic of Serbia to show how its environmental requirements are at the same level as the strict EU standards.