

Fairway Rehabilitation and Maintenance Master Plan

- Danube and its navigable tributaries

EU Strategy for the Danube Region,

Priority Area 1a – To improve mobility and multimodality: inland waterways

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This document represents an update of the Fairway Rehabilitation and Maintenance Master Plan, as first elaborated in 2014 within the framework of the EU Strategy for the Danube Region, Priority Area 1a on Inland Waterways, and in cooperation with the NEWADA duo project. The compilation and analysis of the data was performed by the PA1a Technical Secretariat, in close coordination with the PA1a Steering Group Members and its observers, including environmental stakeholders, as well as the Danube waterway managers.

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1. Executive summary

Unstable and unpredictable fairway conditions along the Danube lead to cargo vessels that are not optimally loaded. This results in unreliable logistics chains and transport prices per transported tonne that are too high to be competitive. For the passenger shipping industry, unstable fairway conditions may prevent voyages from being carried out as planned, resulting in additional costs for cruise operators and an overall loss of image. Apart from structural river engineering works on a limited number of strategic waterway bottlenecks, **proper fairway maintenance helps in securing stable fairway conditions** for waterway operators and their customers.

In 2012, a majority of the Transport Ministers of the Danube Region signed a declaration expressing their commitment towards the implementation of effective waterway maintenance measures ("Luxemburg Declaration", 2012). This Fairway Rehabilitation and Maintenance Master Plan for the Danube and its navigable tributaries represents an update of the first version of the Master Plan from 2014, in order to reflect the status of implementation to date and to incorporate newly emerged issues, changed framework conditions as well as transnational trends. This Fairway Rehabilitation and Maintenance Master Plan for the Danube and its navigable tributaries is addressed at the Ministers of Transport of the Danube Region. It highlights national needs and short- to medium-term measures in order to ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries legal framework (especially the TEN-T Regulation, the AGN and the Belgrade Convention) and along the lines of the Luxemburg Declaration.

In 2014, when the Master Plan was originally drafted, the waterway management experts represented in "NEWADA duo" recommended a minimum Level of Service related to fairway depth for the Danube and its navigable tributaries of **2.50 m at Low Navigable Water Level** (LNWL or ENR /Etiage navigable et de regularisation)¹. Germany, Bosnia and Herzegovina and Ukraine were not partners in the NEWADA duo project and consequently have not formally agreed on the common minimum Levels of Service developed in this project.

This Master Plan includes an overview of existing critical waterway sections or locations and defines – for each riparian state – the key issues and remaining needs for action, which are necessary in order to reach the different target Levels of Service. For the main part, the data provided in this document are based on the statements and data inputs by the competent waterway administrations.

This Master Plan also estimates the required investment costs and operational costs per country in order to achieve their respective target Levels of Service, based on the circumstances of the last years. Unforeseen extreme weather events and floods require specific measures and additional budget. The waterway management authorities governing the Danube and its navigable tributaries have estimated annual **operational costs of about 36.3 million EUR** in order to bridge the gap between the current status quo in fairway maintenance and management and the different target Levels of Service. Additional investments are needed for **dredging equipment**, **riverbed surveying and fairway marking equipment**. In terms of regional distribution, the majority of investments will be needed on the Lower Danube (particularly Romania and Bulgaria).

¹ NEWADA duo project, implemented between 2012 and 2014, was co-funded by the South-East Europe Transnational Cooperation Programme and dealt with integrated waterway management.



2. Introduction

2.1 Main purpose of the Fairway Rehabilitation and Maintenance Master Plan

The Danube waterway serves as a backbone for the Danube Region and its economy. Competitive transport services on the Danube highly depend on the provision of minimum fairway parameters. As large parts of the Danube are free-flowing, efforts to eliminate infrastructure bottlenecks not only require structural river engineering measures but also – and of even higher importance – effective and continuous waterway maintenance.

The Danube and its navigable tributaries are a living and dynamic waterway system with continuous changes in the morphology of the riverbed, either in the form of sedimentation or erosion. This document therefore also has a living and dynamic character. The contents are to be monitored and updated in the framework of the PA1a Steering Group and in coordination with the Danube Commission on a regular basis.

This Fairway Rehabilitation and Maintenance Master Plan for the Danube and its navigable tributaries represents the second version of this document. It updates the first Master Plan from 2014 in order to reflect the status of implementation to date and to incorporate newly emerged issues, changed framework conditions as well as transnational trends (e.g. accelerated digitalisation or climate change).

Since 2014, several of the measures proposed in the Master Plan have been implemented in various transnational and national implementation projects and several necessary investments have been made, in many cases with the support of EU co-financing. This updated Master Plan builds on the progress made so far. It includes an overview of existing critical waterway sections or locations, and specifies the national needs and short- to medium-term measures in order to ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries. This updated version of the document also includes a transnational chapter that identifies the most important measures that have to be addressed jointly.

With regard to the current legal framework and transnational agreements, this Master Plan forms the strategic framework for the coming years in the field of waterway management and sets the direction for the needs for action in the Danube region. It is designed to provide a basis for coordinated actions on a transnational level. Waterway management authorities of the Danube riparian countries should continue the harmonisation of their operation and maintenance strategies with priority given to critical bottlenecks.

2.2 How the Master Plan was developed

In 2012, a majority of the Transport Ministers of the Danube Region signed a declaration expressing their commitment towards the implementation of effective waterway maintenance measures ("Luxemburg Declaration", 2012).

As navigation problems remained to exist on critical sections, the PA1a Steering Group sent out an Appeal for the implementation of the Luxemburg Declaration to the respective Transport Ministers in February 2014, announcing the elaboration of the first Fairway Rehabilitation and Maintenance Master Plan. The first version of the Master Plan was prepared on the basis of information provided by the responsible waterway administrations along the Danube, which at that time were united in



the "NEWADA duo" project, the Network of Danube Waterway Administrations². Additional data (notably for Germany, Bosnia and Herzegovina as well as Ukraine³) were acquired though the Steering Group Members of Priority Area 1a. The Fairway Rehabilitation and Maintenance Master Plan was subsequently endorsed by 10 riparian states during the Danube Ministers Meeting in Brussels on 3rd December 2014.

The implementation status of the Master Plan has since been monitored by the Priority Area Coordinators via National Action Plans. The action plans are updated continuously for monitoring and documentation purpose. They follow a harmonized structure in order to provide an overview of actions taken/foreseen along the Danube and to support the planning of budgets and activities. From 2015 to 2021, contents for Austria, Slovakia, Hungary, Croatia, Romania and Bulgaria were provided in the framework of the CEF-financed FAIRway Danube project. On the basis of these National Action Plans, the Danube Ministers of Transport drew regular Ministerial Conclusions in the years 2016, 2018 and 2020.

After seven years of implementation, the waterway management authorities are still confronted with numerous challenges, some of which are new. For this reason, the Master Plan has been updated in 2021. The data provided in this document are again based on the statements and data inputs of the competent waterway administrations and Ministries of Transport along the Danube and its navigable tributaries. The final draft of this document was discussed and acknowledged within the framework of the PA1a Steering Group, including important observers to the Steering Group.

2.3 Key definitions

Fairway Maintenance Cycle

A river such as the Danube is a living system with continuous changes to the riverbed and its morphology. Locations of critical fairway sections can therefore change from week to week and from year to year. A typical "fairway maintenance cycle" should therefore be first and foremost based on continuous monitoring of the fairway. Each of the process steps in this cycle fulfils specific purposes which are interdependent: The availability of skilled staff, up-to-date sounding, marking and dredging equipment, efficient methods for data collection and tools for targeted information transmission to the users of the waterway are all prerequisites for efficient and effective waterway maintenance on the Danube and its navigable tributaries.

² NEWADA duo, implemented between 2012 and 2014, was co-funded by the South-East Europe Transnational Cooperation Programme and dealt with integrated waterway management. NEWADA duo assessed current and future maintenance activities as well as the needs to fulfil a common minimum level of service.

³ These countries were not partners in the NEWADA duo project.





Fig. 1: Fairway maintenance cycle (Source: viadonau)

In this Master Plan, the status of maintenance works and the needs for additional action in the different riparian countries will be presented according to these four phases of the fairway maintenance cycle.

Structural and new engineering projects, as well as navigational limitations due to bridge clearances and lock dimensions are not part of this Master Plan, as they do not directly relate to fairway maintenance activities.

Types of critical locations

Critical locations with a very dynamic morphological behaviour are of top priority for maintenance measures. A distinction needs to be made between critical locations with **fords** and **lateral sedimentation**. Fords are thereby given the highest priority, as such shallow areas usually extend over the entire width of the fairway (as opposed to locations with lateral sediment accumulations).

Recommended minimum Levels of Service

Notwithstanding the provisions of the TEN-T Regulation (1315/2013), the "European Agreement on Main Inland Waterways of International Importance" (AGN) and the "Recommendations on Minimum Requirements for Standard Fairway Parameters, Hydrotechnical and Other Improvements on the Danube" published by the Danube Commission, the waterway management



experts represented in the NEWADA duo project recommended different minimum Levels of Service for the different phases in the waterway maintenance cycle. The recommended minimum Level of Service related to fairway depth for the Danube and its navigable tributaries was thereby defined as 2.50 m at Low Navigable Water Level (LNWL or ENR /Etiage navigable et de regularisation)⁴. In some river sections however, e.g. in Germany⁵, Slovakia and Hungary, this target is not valid, as it is not achievable by stream regulation and maintenance measures due to physical preconditions. This aspect remains valid throughout this document.

The prioritisation of critical locations as to needed maintenance and rehabilitation interventions is based on the principle of "continuity", by which we understand the proactive establishment of the continuous availability of minimum fairway parameters, i.e. the creation of a "deep fairway channel" as a priority measure before the beginning of the annual low water season. As many transport activities take place over a long transport distance on the Danube – showing a mean transport distance between 600 and 700 km –, the weakest critical location determines the capacity of the entire stretch. This principle has to be translated into the maintenance philosophy and activities.

⁴ Fairway depth of 2.50 m at Low Navigable Water Level (ENR), i.e. on 94% (343 days) of the year, calculated on the basis of the discharge observed over a period of 30 years with the exception of ice periods.

Fairway width (range of values accounts for different curve radii):

^{• 40} to 80 m in Austria

^{• 60} to 100 m in Slovakia and Slovakian-Hungarian border section

^{• 80} to 120 m in Hungary

^{• 80} m in Croatia, Serbia, Romania and Bulgaria (including border sections) – no range for curve radii as there is usually no passing of vessels/convoys in bends on these sections

⁵ Germany was not a project partner in NEWADA duo and thus did not agree to the recommended minimum Levels of Service.



3. Country sections

With 10 riparian states and 2,414 navigable river-kilometres, the Danube is not only the most international river in the world but also shows a large variety in nautical, hydrological and hydro-morphological characteristics. Some parts are compounded stretches and large parts of the Danube are free-flowing. These circumstances have far-reaching impacts on the maintenance activities required by the Danube riparian states.

3.1 General characteristics of the Danube

According to the Danube Commission, the Danube can broadly be divided into three main sections (Upper, Central and Lower Danube) with different nautical characteristics.

	Upper Danube Kelheim – Gönyű	Central Danube Gönyű – Turnu-Severin	Lower Danube Turnu-Severin – Sulina
Length of section	624 km	860 km	931 km
River-km	2,414.72-1,791.33	1,791.33-931.00	931.00-0.00
Ø gradient per km	~ 37 cm	~ 8 cm	~ 4 cm
Height of fall	~ 232 m	~ 68 m	~ 39 m
Upstream travel speed of vessels	9–13 km/h	9–13 km/h	11–15 km/h
Downstream travel speed of vessels	16–18 km/h	18–20 km/h	18–20 km/h

Fig. 2: Nautical characteristics of the different Danube sections (Source: viadonau, Danube Commission)

The hydrological and hydro-morphological characteristics of the Danube, together with river engineering interventions, determine the nautical situation on the waterway. Figure 3 depicts the maximum possible dimensions of vessels and convoys on the Danube waterway from Kelheim in Germany to the Black Sea related to waterway classes as defined by the UNECE.





Fig. 3: Maximum possible dimensions of convoys on the Danube waterway according to UNECE waterway classes (Source: viadonau)

3.2 Location of critical sectors

The detailed location of critical sectors as well as the status of maintenance works for the different riparian countries is described in detail in the following chapters.



Germany

DE 1 Characteristics of the Danube waterway

The German Federal Waterway Danube proceeds from Kelheim at river-km 2,414 to Jochenstein at river-km 2,202. About one third (72 km) of this stretch are free-flowing (including river engineering structures), 66% (140 km) are made up of backwater sections of 6 barrages with locks. On the last 20 km downstream of Passau, the Danube is a border river between Austria and Germany. The upper Danube is characterized by sudden changes in water levels with maximum values in summer (snow melting in the Alps, atmospheric precipitation) and low water levels in winter. Due to the confluence of the river Isar in Deggendorf, the average Danube slope abruptly increases from 0.1‰ to 0.3‰, which additionally increases the effects of sediment transport (bed load and suspended load). In the free-flowing section between Straubing and Vilshofen the minimum fairway depth of 2.5 m as defined by NEWADA duo cannot be achieved by stream regulation and fairway maintenance. In this section the objective of fairway maintenance is to provide a fairway depth of 2.0 m related to LNWL (in Germany: RNW)⁶.

Responsible for fairway maintenance / data provided by	Federal Waterways and Shipping Administration (WSV)
Number / length of critical locations of high priority	3 / 71.8 km (34% of national stretch, that is the free-flowing section Straubing - Vilshofen)
Target value: Fairway depth	Impounded section Kelheim – Straubing: 2.9 m Free flowing section Straubing – Vilshofen: 2.0 m Impounded section Vilshofen – Jochenstein: 2.7 m
Main issues in waterway maintenance – high priorities	Sediment management: Dredging and concerted insertion in the free-flowing section Emptying of silting basins in all sections Riverbed stabilization via scour backfill and river bank protection measures
	Maintenance of river regulation measures (groynes etc.) and hydraulic engineering structures (locks, weirs etc.)
Annual operating costs for needed actions ⁷	Dredging costs: approx. 2,000.000 EUR (as per 2018, cf. action plan 2019)

DE 2 Fairway maintenance basic data

⁶ Germany was not a project partner in NEWADA duo and thus did not agree to the recommended minimum Levels of Service.

⁷ Operation and maintenance works are mandatory tasks (sovereign duties) of the Federal Waterways and Shipping Administration (WSV). Due to in-house efforts, an assignment of tangible costs per need area is not possible. The table only contains definable costs (i.e. tendered dredging works). Actual costs are in fact substantially larger.



DE 3 Critical locations

Location / Length (km) River-km (from / to) Length		right bank / left bank	Name of sector / location	
				2,321.7
2,311.5	2,282.5	29.0	DE / DE	Bogen railway bridge – Deggendorf
2,282.5	2,249.9	32.6	DE / DE	Deggendorf – Vilshofen (backwater Kachlet)

Germany: Overview of Critical Locations





DE 4 Overview of action points

DE 4.1. Monitoring

Monitoring of the fairway is conducted annually. Every two years, the navigable water beyond the fairway is additionally recorded. These measurements (survey for several purposes) are performed by the sounding vessel "Kepler" via trifold multibeam echosounder. Additional surveying is executed after special incidents (e.g. floods, naval accidents) as well as in the context of development measures. Such measurements are conducted by means of multiple single beams mounted on a frame (work boats "Laber" and "Regen") and via a double-headed multibeam echosounder (sounding vessel "Tangens"), respectively.

For the **monitoring of water levels** automatic gauging stations are available for the entire German Danube. Data is transferred regularly via landline (back-up: GPRS). In the area of monitoring there is no additional need for action.

DE 4.2. Planning

Based on an EU-funded variant study (cf. 2007-DE-18050-S: 'Independent variant research on the development of the Danube between Straubing and Vilshofen '), policy-makers finally decided to upgrade the free-flowing section from Straubing to Vilshofen by implementing solely river regulation measures (i.e. without lock/storage) according to variant A (of the above-mentioned study) and to immediately realize flood protection measures. Due to the mutual dependencies and interactions, a joint approach of the German Federal Government and the Free State of Bavaria was agreed, meaning that both projects shall be approved within one common approval procedure.

The global project "Development of the Danube between Straubing and Vilshofen" comprises the upgrade of the federal waterway section in order to improve shipping conditions and, in parallel, to enhance the degree of flood protection, both in two subsections. The plan approval decision for the first subsection between Straubing and Deggendorf is final and conclusive. As regards subsection 2 (between Deggendorf and Vilshofen), the plan approval procedure was initiated in November 2018. Public participation (hearing procedure) took place in 2020/21. Further hearings are scheduled in 2022 due to changes of plan.

The concrete target for improving shipping conditions is the increase in draught by at least 2 dm at low water discharge (RNQ). Moreover, fairway maintenance, sediment management (incl. progressive bed erosion), safety and ease of shipping (incl. nautical difficulties and hazard spots) are to be optimized. As regards optimization of maintenance, it is expected to have fewer (but larger) dredging locations because of enhanced river regulation. However, the impact of the numerous landscape management measures with large amounts of easily mobilised material will most likely lead to additional dredging works. Please note that this project description is for information purposes only, as hydraulic engineering measures are no topic of this Master Plan.

Concerning concrete maintenance measures (dredging), the recorded surveying data (application Qinsy) is imported to the specific evaluation software of the federal waterways and shipping administration (e.g. Timpan, HyDAP, and in the near future PAUSS) in order to calculate cubage of sedimentation, to prepare planning documents, and to specify boundary conditions for tendering the required works. These tools are also used to support performance review (inspection and approval). Moreover, the monitoring software BauMaGs collects the amount of dredged material as well as the relocation of bed load in federal inland waterways. Each year dredging statistics and charts are prepared ex-post for documentation purposes and to set up the future sediment management (lessons learned, identification of critical locations).



DE 4.3. Execution

Dredging activities depend on sounding results (cf. 4.2) and statistics of the previous years. 90% of dredging works are awarded to expert companies by way of public invitations to tender. In 2018, about 150,000 m³ of sediment have been dredged and reinserted annually in the German Danube section, thereof approx. 45,000 m³ in the free-flowing section (cf. action plan 2019).

	Key issues	Need for action
DE 01	10% of dredging works are conducted by WSV itself, while 90% are tendered. The latter is arranged via framework contracts to allow for a rapid start of work.	Preserve a certain percentage of execution by the authority itself in order to keep professional expertise, skilled staff, autonomy, and the capacity to act in emergency situations

DE 4.4 Information

Current water levels (15-min-values available from low water up to floods) and **forecasts** (floods: provision by Bavaria up to 48h, low and middle water: provision by WSV up to 96h) are available online: <u>https://www.pegelonline.wsv.de</u>, <u>http://www.hochwasserzentralen.de</u>, <u>www.elwis.de</u>

Information on fairway depths/restrictions is provided regularly after survey and at short notice in case of special incidents (e.g. floods, naval accidents). Current fairway information is available by Notices to skippers. IENCs are available and updated once a year (including fairway information, but no bathymetric IENCs). Publication is done via ELWIS (<u>www.elwis.de</u>), apps for smartphones, e-mail news service and at locks (score board, display panel).

DE 5 Ecological status/potential and ecological compatibility of maintenance measures

The main stretch of the German Danube is impounded and therefore declared as heavily modified water body (HMWB) while the free-flowing section between Straubing and Vilshofen is designated as natural water body. The ecological potential of the 4 heavily modified surface water bodies is moderate. The status of the biological quality element fish is actually good in one water body downstream Vilshofen. Concerning benthic invertebrates, the status is also good for the 2 water bodies between Vilshofen and the border to Austria. The ecological status of both surface water bodies in the free-flowing section Straubing–Vilshofen is also moderate altogether, though the status of the biological quality elements fish, benthic invertebrates and phytoplankton is actually good. Merely phytobenthos (macrophytes) are still classified as moderate. That is why there are no entries in the programme of measures (WFD) dealing with hydromorphology. Measures focus for example on direct and diffuse discharges, which have an impact on phytobenthos.

Maintenance works are executed under environmental law (Federal Nature Conservation Act) and in accordance with the Federal Waterways Act. The corresponding measures in federal waterways do not require special permissions or exemptions under water law, but have to consider the objectives of the WFD as well as all significant flood protection issues by mutual agreement with the water resources management administration. Maintenance measures are neither impacts in terms of environmental law nor projects/plans in terms of environmental impact assessment or FFH Directive because the approved state is only restored. Naturally, the respective issues have to be considered but no special permission or exemption is needed. The same release with regard to formal requirements exists for species conservation law.



However, the Waterways and Shipping Office Danube MDK presents annually (usually in February) all planned dredging measures to institutions and stakeholders from water resources management, fishery and nature conservation in order to achieve mutual agreement. In addition, unscheduled dredging works are conducted as sovereign tasks to maintain safety and ease of shipping.



Austria

AT 1 Characteristics of the Danube waterway

22% of the 350.5 km of the Austrian Danube are free-flowing (including river engineering structures like groynes and training walls), 78% are backwater sections of ten hydroelectric river power plants. The Danube in Austria shows the characteristics of an alpine river with a complex "winter-nival" hydrologic regime and maximum discharge values between March and August. The mean slope of about 0.45% (measured at medium water levels) results in high flow velocities in the two free-flowing sections. This produces continuous changes of the riverbed due to sediment transport (bed load or suspended matter, predominantly gravel), either in the form of sedimentation or erosion, which poses the main nautical problems. The trajectory of the navigation fairway is normally not subject to change due to the narrow cross-section of the river and the numerous river engineering structures. The majority of maintenance activities are performed on a high level of quality, the needs for action mainly refer to their further enhancement.

Responsible for fairway maintenance / data provided by	viadonau– Österreichische Wasserstraßen-Gesellschaft mbH (state owned)
Number / overall length of critical locations of high priority	39 / 36.2 km (10.3% of national stretch) 4 cross-border critical locations with Slovakia
Medium length of critical locations	920 metres (variation 300 - 1,500 metres)
Main issues in waterway maintenance – high priorities	Support customer-friendly information provision, amendment of the dredging contracts, ecological sediment management (dynamic river bed stabilisation), further development of WAMS (digitalisation: interaction infrastructure – vessel) and the system for remote monitoring of fairway marking
Annual operating cost for needed actions	Operational costs / year: 5 000 000 EUR (for surveying, hydrological services, water level forecast, marking and dredging)

AT 2 Fairway maintenance basic data

AT 3 Critical locations

Location / Length (km)		Right bank/ Name of co.	Name of contar / location	
River-km	(from / to)	Length	Left bank	
2,031.30	2,030.60	0.70	AT / AT	Grimsing
2,028.20	2,027.50	0.70	AT / AT	Aggsbach-Markt
2,026.30	2,025.40	0.90	AT / AT	Aggsbach
2,025.20	2,024.40	0.80	AT / AT	Aggstein
2,022.80	2,021.90	0.90	AT / AT	Schwallenbach
2,020.50	2,019.40	1.10	AT / AT	Hinterhaus
2,019.40	2,018.50	0.90	AT / AT	Hofarnsdorf (Spitz)
2,018.20	2,017.20	1.00	AT / AT	Bacharnsdorf



2,016.80	2,016.20	0.60	AT / AT	Wösendorf
2,014.60	2,013.50	1.10	AT / AT	Weißenkirchen
2,010.30	2,008.80	1.50	AT / AT	Dürnstein
2,005.90	2,005.20	0.70	AT / AT	Rothenhof
1,918.40	1,918.10	0.30	AT / AT	Albern
1,917.30	1,916.30	1.00	AT / AT	Lobau
1,916.10	1,915.50	0.60	AT / AT	Zahnetgrund
1,912.40	1,911.50	0.90	AT / AT	Buchenau (ford)
1,911.50	1,910.70	0.80	AT / AT	Buchenau (left bank)
1,910.40	1,909.80	0.60	AT / AT	Kuhstand
1,908.50	1,907.70	0.80	AT / AT	Fischamend
1,907.20	1,906.50	0.70	AT / AT	Pfarrgraben
1,906.10	1,905.10	1.00	AT / AT	Fischamündung
1,902.70	1,902.10	0.60	AT / AT	Orth (left bank)
1,901.90	1,901.10	0.80	AT / AT	Orth (right bank)
1,899.00	1,897.80	1.20	AT / AT	Regelsbrunn
1,897.20	1,895.90	1.30	AT / AT	Rote Werd
1,893.40	1,891.70	1.70	AT / AT	Petronell-Witzelsdorf
1,891.20	1,890.00	1.20	AT / AT	Rübenhaufen
1,890.00	1,888.70	1.30	AT / AT	Schwalbeninsel
1,888.60	1,887.60	1.00	AT / AT	Treuschütt
1,887.60	1,886.10	1.50	AT / AT	Bad Deutsch-Altenburg
1,886.10	1,885.00	1.10	AT / AT	Schanzl
1,885.00	1,883.90	1.10	AT / AT	Hainburg (ford)
1,883.90	1,883.20	0.70	AT / AT	Hainburg (left bank)
1,883.20	1,882.40	0.80	AT / AT	Röthelstein (left bank)
1,881.90	1,880.90	1.00	AT / AT	Röthelstein (right bank)
1,879.80	1,879.00	0.80	AT / SK	Wendeplatz Theben
1,878.50	1,877.40	1.10	AT / SK	Theben
1,875.70	1,875.10	0.60	AT / SK	Käsmacher
1,873.50	1,872.70	0.80	AT / SK	Grenze (border AT / SK)







AT 4 Overview of action points

AT 4.1. Monitoring

The **monitoring of the fairway** is conducted regularly with single-beam equipment (free-flowing sections and impounded sections as well as port entrances, almost every month) and multi-beam equipment (most important critical locations in both free-flowing sections on a monthly basis, both free-flowing sections in their entirety twice a year and impounded sections in their entirety every three years on average). Dredging sites are monitored per default before and after the



interventions; in the case of larger cubatures, intermediate measurements may be conducted. The monitoring of fairway conditions is undertaken by viadonau in close cooperation with the Navigation Surveillance. Monitoring of backwater sections is undertaken by viadonau in cooperation with Verbund Hydro Power as the operator of hydropower plants on the Danube. Concerning riverbed monitoring, no urgent needs are identified.

For the **monitoring of water levels** automatic gauging stations are available on both free-flowing sections, the density of stations is sufficient. Data is transferred by GPRS, for some stations also via landline.

Fairway marking is remotely monitored and additionally supervised once a week by the Navigation Surveillance during regular monitoring tours. Adjustments and improvements to the underlying system will be necessary in order to enhance the reliability of remote monitoring stations.

	Key issues	Need for action
AT 01	System for remote monitoring of the buoy position is not performing reliably	Support the improvement of the system for remote monitoring of the buoy position, and integration of the position data into Inland ECDIS as user information

AT 4.2. Planning

Based on the monitoring, continuous prioritisation of critical areas for dredging is undertaken by viadonau in cooperation with the Navigation Surveillance/Supreme Navigation Authority. By proactive dredging of those areas before the low water period, critical situations shall be minimized. Each year in late summer, a prioritisation of dredging interventions at the most critical locations is conducted. The coordination and planning of measures in the common stretches with Germany and Slovakia is done in the two Transboundary Water Commissions. Already years ago, viadonau set up a planning and analysis tool, the Waterway Asset Management Tool (WAMS), which has been continuously expanded ever since. In the coming years, further (analysis) functions will be implemented, including - among others - the integration of additional information from and about commercial navigation (vessel data such as draught or speed, etc.).

	Key issues	Need for action
AT 02	Further exploiting the possibilities of analysis of key parameters of the interface waterway infrastructure – operating vessels as a basis for planning	Support the further development of the national waterway asset management system (WAMS)

AT 4.3. Execution

Dredging activities according to the prioritisation of dredging interventions at critical locations are contracted out by viadonau, partly by means of long-term framework contracts and partly through short-term assignments. The amount of dredged material is strongly dependent on the development of discharge during the year (low and high-water periods). Over the past years, the adaptation of river engineering structures in the two free-flowing sections resolved most critical locations, which has greatly reduced the annual dredging effort and associated costs. The current



system of framework contracts will be continued, but the scope of the contracts will be amended to include activities for dredging of two bedload traps and the operation of adjustable infrastructure elements, in addition to regular maintenance dredging.

In addition to conventional maintenance dredging, further possibilities are currently examined in order to better cope with different extreme weather conditions (e.g. long and severe low water periods) due to climate change. As a first step towards climate resilient infrastructure new flexible and adaptive infrastructure elements will be tested under real life conditions in the free-flowing section to the East of Vienna.

Marking activities fall under the responsibility of viadonau; all sovereign tasks remain with the Supreme Navigation Authority (within the Ministry of Climate Action). In contrast to the Lower Danube countries, no marking plan is implemented for the Austrian stretch of the Danube as the trajectory of the fairway is fixed to a high degree due to the narrow width of the Upper Danube. The Navigation Surveillance conducts weekly monitoring tours and in case navigation signs are missing or should be relocated, this information is registered in the Austrian marking database. viadonau then implements the required changes along the fairway with the marking equipment available (two non-motorised barges, one old pusher vessel and another pusher vessel currently under construction). The current technical resources (marking equipment) are updated and enlarged in order to create a redundant and more effective marking system along the entire Austrian Danube stretch. By February 2018, all steel buoys were exchanged for new ones made of polyethylene. All buoys are equipped with respective modules for the remote control of the buoys' positioning by means of satellite positioning. Any changes in the fairway marking are regularly published in the IENCs and transmitted to boatmasters. In the future, the buoys' position data will be made available to the users (see key issue AT 01).

	Key issues	Need for action
AT 03	Create redundant and more effective waterway marking system	Support acquisition of modern pusher for efficient marking operations
AT 04	Exploit the possibilities of flexible and climate resilient infrastructure elements	Set-up and test new, flexible and adaptive infrastructure elements under real life conditions in order to ensure and improve navigability at extreme low water levels

AT 4.4. Information

For ten water gauging stations, actual **water levels** are available via internet and the official Notices to Skippers (1x/hour). Of the four reference gauging stations for free-flowing sections (Wachau valley and section east of Vienna), for two gauges five-day **forecasts** are provided in addition. The quality of the water level forecast has to be improved.

Information on fairway depths at critical locations in both free-flowing sections is provided once an hour on the basis of the most recent bathymetric riverbed surveys. Detailed maps (trackplots) of riverbed surveying results for the most critical locations are published at least once a month. Publication is done via the Austrian RIS website

<u>https://www.doris.bmk.gv.at/fahrwasserinformation/seichtstellen</u> or <u>www.viadonau.org/furten</u>, an app for smartphones, an e-mail news service and at locks.



Since 2019, depth information is also published in the bathymetric Inland ENCs for the entire Austrian Danube stretch, the IENCs for the two free-flowing sections are updated on a monthly basis.

	Key issues	Need for action
AT 05	Inaccurate water level forecast	Support improvement of water level forecast
AT 06	Continuously evaluate and further improve interface between infrastructure managers and waterway users	Support customer-friendly processing and dissemination of information, in particular integration of information in ECDIS

AT 5 Ecological status/potential and ecological compatibility of maintenance measures

Apart from the two free-flowing stretches of the Danube in the Wachau and east of Vienna, which are classified as "natural water bodies", the main parts of the Danube in Austria are impounded and therefore classified as a "heavily modified water body" (HMWB). All impounded sections have moderate ecological potential, whereas the ecological status of the natural water body in the Wachau is assessed as poor and the status of the section east of Vienna as good.

Maintenance works are executed in the framework of navigation law (Wasserstraßengesetz BGBI. I Nr.177/2004), water law (Grundsatzgenehmigungsbescheid "Regulierungsmaßnahmen zur Verbesserung der Schifffahrtsverhältnisse auf der Donau stromab des KW Freudenau" of 14th August 2003) and the National Park Act (BGBI. I Nr. 17/1997). The environmental permits that need to be obtained in regular intervals foresee periods throughout the year where dredging activities are not allowed due to ecological reasons (e.g. fish spawning seasons).

The project study, which provides the basis for the permits "Erhaltungsmaßnahmen außerhalb der zentralen Fahrrinne östlich von Wien auf dem Gebiet des Nationalparks Donau-Auen – Strom-km 1915.00 bis 1880.00" was developed in close cooperation with involved key stakeholders. The project study systematically analyses the impacts of maintenance activities on natural species, taking into account opinions drawn up by official experts on nature conservation and water ecology.

For years, a lot of money has been spent on ecological sediment management during operation. The elevated sediment in the free-flowing section to the East of Vienna is dumped further upstream (about 20 km), at increased cost (around 1 500 000 EUR annually), and thus remains in the river system for longer and contributes to the dynamic stabilisation of the river bed (fighting sole erosion processes). This approach is one of the main principles of waterway management in Austria.



Slovakia

SK 1 Characteristics of the Danube waterway

On most of the 172 km (rkm 1880,2 – 1708,2), the Slovakian Danube is a border river, comprising of 7.5 km border with Austria, a 22.5 km long national section and 142 km with Hungary. 159 km (92%) are not impounded and thus prone to changes in the riverbed. The Gabčíkovo hydropower plant influences navigation conditions upstream until Bratislava. At Danube rkm 1852.90 the Gabčíkovo Canal starts with a length of 38.40 km; the canal rejoins the Danube downstream at rkm 1811.00. Less than a third of the Slovak Danube is considered part of the Upper Danube, characterised as an alpine river with an average height difference of 0.5 meters per kilometre. Gönyű/Klížska Nemá is the starting point of the Central Danube, where the slope declines and the Danube gradually changes into a lowland river. The river bed mostly consists of gravel.

On the common Danube stretch with Austria, both waterway administrations are conducting monitoring and maintenance works; all plans are discussed in the AT-SK Transboundary Water Commission. The common Danube stretch with HU is divided into two sections (rkm 1811-1791 Szap-Gönyű and rkm 1791-1708 Gönyű-Szob). Slovak Water Management Enterprise and the Water Directorate of Hungary are responsible for one of these sections every other year (rotation principle). Issues of maintenance are discussed in the HU-SK Transboundary Water Commission Danube subcommittee.

Responsible for fairway maintenance / data provided by	SVP (Slovak Water Management Enterprise – state owned); SVP branch Bratislava is responsible for administration of the Danube waterway
Number / overall length of critical locations of high priority	23 / 14.9 km (8.6% of national stretch) 3 cross-border critical locations with Austria (2.2 km) 18 cross-border critical locations with Hungary (12.2 km)
Medium length of critical locations	650 metres (variation 200 – 1,800 metres)
Main issues in waterway maintenance – high priorities	Insufficient and/or old equipment; shortage of qualified staff
Annual operating cost for needed actions	Operational costs / year: approx. 2 560 000 EUR (for surveying and marking activities as well as dredging interventions)

SK 2 Fairway maintenance basic data



SK 3 Critical Locations

Location / Length (km)		right bank /	Name of conter / logation	
River-km	(from / to)	Length	left bank	
1,879.80	1,879.00	0.80	AT / SK	Theben
1,875.70	1,875.10	0.60	AT / SK	Käsmacher
1,873.50	1,872.70	0.80	AT / SK	Border AT / SK
1,871.00	1,870.70	0.30	SK / SK	Lanfranconi
1,863.90	1,863.70	0.20	SK / SK	Zemnik
1,808.10	1,807.60	0.50	HU / SK	Medved'ov
1,799.00	1,798.30	0.70	HU / SK	Číčov
1,797.40	1,796.60	0.80	HU / SK	Vének 3
1,796.30	1,795.90	0.40	HU / SK	Vének 2
1,795.90	1,795.30	0.60	HU / SK	Vének 1
1,794.00	1,793.30	0.70	HU / SK	Klížska Nemá 2
1,792.20	1,791.50	0.70	HU / SK	Klížska Nemá 1
1,789.20	1,788.30	0.90	HU / SK	Veľké Kosihy 2
1,786.70	1,785.90	0.80	HU / SK	Veľké Kosihy 1
1,764.30	1,764.00	0.30	HU / SK	Komárno
1,757.10	1,756.70	0.40	HU / SK	Patince 2
1,754.30	1,754.10	0.20	HU / SK	Patince 1
1,740.20	1,739.80	0.40	HU / SK	Kravany
1,735.50	1,733.70	1.80	HU / SK	Čenkov
1,732.60	1,732.20	0.40	HU / SK	Mužla
1,726.00	1,724.70	1.30	HU / SK	Obid
1,714.40	1,713.90	0.50	HU / SK	Hron sutok
1,711.50	1,710.70,	0.80	HU / SK	Chľaba



Slovakia: Overview of Critical Locations



SK 4 Overview of action points

SK 4.1. Monitoring

Monitoring of the fairway is done by means of single-beam as well as multi-beam equipment, depending on the needed level of detail. As of 2018, a modern surveying vessel with multi-beam surveying equipment is available to SVP. At least once a year all critical locations along the SK Danube as well as the Gabčíkovo Canal are surveyed. If needed, intermediate surveys of critical bottlenecks are undertaken, but critical sections are not monitored separately as a standard



procedure. All monitoring, including the reservoir upstream of Gabčíkovo (monitored every 2-3 years) is done by SVP. The different monitoring tasks are undertaken by different SVP departments. In the medium to long term, the substitution of the old vessel with single-beam equipment with a modern vessel with multi-beam equipment will be necessary.

Water levels are monitored by five automatic gauges along the Slovak Danube, owned and operated by the Slovak Hydrometeorological Institute (SHMÚ). In general, the network of water gauges is considered sufficiently dense, however, the installation of additional water gauges at the most critical locations (e.g. Čenkov (HU: Nyergesújfalu)) are to be considered in order to improve data basis directly at the critical location rather than the reference gauge.

Fairway marking is supervised once a year before adjusting the fairway marks according to a yearly plan. Navigation signals are controlled on a weekly basis during the regular marking tours. The marking vessel is also equipped with an echo-sounder, so the marking tours serve as quick checks of the fairway as well. There are no major issues regarding monitoring of fairway marking.

	Key issues	Need for action
SK 01	Insufficient number of skilled staff to monitor the fairway	Secure education and provision of well- trained staff in the short, medium and long term

SK 4.2. Planning

Coordination and planning of measures in the common stretches with Austria and Hungary is done in the two Transboundary Water Commissions. Yearly interventions ("Dredging project of the Danube") are planned and amended by working groups of the border commissions in spring. Desired waterway parameters and fairway marks for the Slovak Danube stretch are determined in the "Fairway Project", which is the basis for yearly dredging interventions. Prioritizing of dredging interventions is preliminarily done according to financial parameters. An analysis of the effectiveness of dredging interventions is based on pre- and post-monitoring.

In recent years, a national Waterway Asset Management System (WAMS) was procured to improve the systematic storage of hydrological and hydrographical data and facilitate access and analysis of data.

	Key issues	Need for action
SK 04	Inefficient planning and information provision procedures	Support further development of the existing waterway management tool (WAMS)
SK 05	Different coordinate systems used for measurements in border stretches are an impediment to efficient planning	Support cross-border harmonisation of monitoring standards, as well as exchange and synchronisation of data



SK 4.3. Execution

Dredging activities are executed by SVP according to the yearly dredging plan. On average, 150,000 m^3 per year are dredged.

Marking activities are carried out under the responsibility of SVP. Fairway marks are adjusted once a year according to an annual plan that is approved by the State Navigation Authority. Fairway marks and traffic signals are used to compensate for dredging interventions that are not feasible due to limited budget resources. In 2019, SVP procured a modern, multi-functional marking vessel, equipped with an echo-sounder. However, the second marking vessel operated by SVP is nearing its service life expectancy. Additionally, the old marking vessel would not be equipped to manipulate modern AIS AtoNs. As of 2021, eight AIS AtoNs are deployed in pilot operation along the SK Danube.

	Key issues	Need for action
SK 06	Old marking fleet and equipment	Support acquisition of up-to-date marking vessel(s) (incl. small speed boat for fast reactions) with suitable equipment
20	Insufficient number of floating and coastal signals, including AIS AtoNs	Support acquisition of intelligent marking system, including AIS AtoNs and virtual buoys
SKC	No automated system available for the monitoring of buoy position and the dissemination of marking information	Support the establishment of an automated monitoring system, including the dissemination of current marking information
SK 08	Old dredging equipment	Support acquisition of up-to-date dredging equipment
SK 09	Lack of staff,resulting in missing flexibility in case of urgencies (related to dredging activities)	Secure education and provision of well- trained staff in the short, medium and long term
SK 10	Frequent need to adjust fairway marking as substitution for dredging activities	Support implementation of semi- automated marking plans based on a common Fairway Management System

SK 4.4. Information

The State Hydro Meteorological institute of Slovakia is responsible for **water level information**. Information is provided and available every hour on the national website of the institute.

Water level forecast are provided daily by the Slovak Hydro Meteorological Institute, forecasts are provided for two days in advance for important water gauges.

Information on **water depths** is provided by the Transport Authority (Division of Inland Navigation) based on information from SVP. Online information is not provided automatically.

There are ten bridges on the Slovak section of the Danube. Five of them connect Slovakia and Hungary. The clearance under bridges is important information for the shipping industry.



	Key issues	Need for action
K 11	User information should be provided customer-friendly using established river information portals	Support customer-friendly processing and dissemination of information
N	Bathymetric data is not available in the IENCs	Support the upgrade of IENCs with bathymetric information
Insufficient user information regarding the clearance under bridges		Support acquisition of sensors to measure vertical bridge clearance

SK 5 Ecological status/potential and ecological compatibility of maintenance measures

The Danube river stretch in the Slovak Republic is divided into three surface water bodies, one of which has been designated as heavily modified water body (HMWB) and two as natural water bodies. All three sections have either moderate ecological status or potential (for the HMWB). The River Basin Management Plan identifies inland navigation on the Danube as a sector responsible for significant hydromorphological pressures. The Gabčíkovo Canal as fourth water body is of course classified as artificial and has good ecological potential.

Most of the Danube in Slovakia is protected under the EU Habitats Directive which needs to be considered.

Maintenance works are executed in the framework of inland navigation law (Zákon o vnútrozemskej plavbe č. 338/2000 Z.z) and in the framework of water law (Zákon o vodách 364/2004 Z.z.), where it is mentioned that SVP as the waterway administration is responsible for the maintenance of the fairway and waterway in Slovakia. Most of the Danube in Slovakia is protected under the EU Habitats Directive, which is also to be considered.

According to the Act No. 338/2000 Coll. on Inland Navigation, SVP is the only enterprise which is authorized and responsible to perform fairway marking and works related to marking and dredging. The Slovak Ministry of Environment approves the "Plan of dredging works" for one year. If dredging occurs in or near protected areas such as Natura 2000 sites and if the dredged material is stored on the banks of the Danube and these sites are located in protected areas, additional permits from the competent organisations are required. The only actual permit that is needed for dredging activities is issued by the Transport Authority, who publishes Notices to Skippers for the time period of any dredging works. These notices ensure navigation safety and are published on the website of the Transport Authority.



Hungary

HU 1 Characteristics of the Danube waterway

The Danube has formed a common spindle-shaped alluvial cone with the Váh River, stretching from Bratislava to Komárno, where the majority of sediments is deposited. The 417 km long Hungarian stretch of the Danube shows the morphological transition from an alpine to a lowland river, although the alpine run-off character is still preserved further downstream. At the end of the large alluvial cone at around river km 1,810, the Danube slope abruptly decreases from 0.35% to 0.17% and then, at the mouth of the Mosoni Danube at Gönyű to 0.10%. In the stretch from the mouth of the Little Danube at Komárno down to Budapest, the slope decreases further to 0.07%. The average river width increases from Gönyű (about 300m) to about 400m downstream. Upstream, the riverbed consists of mainly gravel and is getting increasingly sandy going downstream. The worst navigational bottlenecks though, caused by a bigger lack of fairway depth, cannot be removed by usual maintenance works, as these sections have andesite or rocky bottoms (as is the case at Nyergesújfalu or Dömös). The riverbed is comparatively stable, albeit riverbed degradation is in progress, especially downstream of the Bős (= Gabčíkovo) power plant. In Hungary, no power plant is operated on the Danube river.

The common Danube stretch with SK is divided into two sections (rkm 1811-1791 Szap-Gönyű and rkm 1791-1708 Gönyű-Szob). The Water Directorates of HU and SK are responsible for one of these sections every other year (rotation principle). Issues of maintenance are discussed in the HU-SK Transboundary Water Commission Danube subcommittee.

Responsible for fairway maintenance / data provided by	General Directorate for Water (OVF), which has three regional organizations (Water Directorates, VIZIGs) for waterway maintenance on the Danube:
	ÉDUVIZIG - North-Transdanubian Water Directorate (1,811-1,708 rkm) – common HU/SK stretch
	KDVVIZIG - Middle-Danube-Valley Water Directorate (1,708-1,560 rkm)
	ADUVIZIG - Lower-Danube-Valley Water Directorate (1,560-1,433 rkm)
Number / length of critical	49 / 35.1 km (9.3% of national stretch)
locations of high priority	(18 of them shared with SK)
Medium length of critical locations	approx. 800 metres (ranging from 100 metres to 1,900 metres)
Main issues in waterway maintenance – high priorities	Financing of waterway maintenance and financial backup for emergency situations are assured by the Ministry of the Interior
Annual operating cost for needed actions	Operational costs / year: 1 500 000 EUR (for surveying, marking activities and information purposes; dredging excluded)

HU 2 Fairway maintenance basic data



HU 3 Critical Locations

Location / Length		(km)	right bank /	Name of sector / location
River-km	(from / to)	Length	left bank	
1,808.10	1,807.60	0.50	HU / SK	Medve gázló
1,799.00	1,798.70	0.30	HU / SK	Csicsó gázló
1,797.40	1,796.60	0.80	HU / SK	Vének felső (3) gázló
1,796.30	1,795.50	0.80	HU / SK	Vének középső (2) gázló
1,795.50	1,795.20	0.30	HU / SK	Vének also (1) szűkület
1,793.90	1,793.30	0.60	HU / SK	Kolozsnéma (2) felső szűkület
1,792.10	1,791.60	0.50	HU / SK	Kolozsnéma (1) alsó
1,789.20	1,788.30	0.90	HU / SK	Nagykeszi (2) felső
1.786.70	1,785.90	0.80	HU / SK	Nagykeszi (1) alsó
1,764.30	1,764.00	0.30	HU / SK	Komárom gázló
1,757.10	1,756.70	0.40	HU / SK	Pat felső (2) gázló
1,754.30	1,754.10	0.20	HU / SK	Pat alsó (1) gázló
1,740.20	1,739.80	0.40	HU / SK	Karva gázló
1,735.20	1,733.30	1.90	HU / SK	Nyerges gázló
1,732.60	1,732.20	0.40	HU / SK	Muzsla gázló
1,726.00	1,724.40	1.60	HU / SK	Ebed gázló
1,714.40	1,713.90	0.50	HU / SK	Garam-torkolat gázló
1,711.50	1,710.70	0.80	HU / SK	Helemba gázló
1,701.20	1,700.60	0.60	HU / HU	Dömös felső gázló
1,698.70	1,697.70	1.00	HU / HU	Dömös alsó gázló
1,695.80	1,695.50	0.30	HU / HU	Nagymaros gázló
1,694.70	1,694.60	0.10	HU / HU	Visegrád gázló
1,682.80	1,682.30	0.50	HU / HU	Vác felső szűkület
1,681.00	1,679.80	1.20	HU / HU	Vác szűkület
1,675.50	1,675.30	0.20	HU / HU	Sződliget szűkület
1,667.80	1,666.40	1.40	HU / HU	Göd gázló
1,660.00	1,659.70	0.30	HU / HU	Megyeri-híd szűkület
1,653.00	1,651.30	1.70	HU / HU	Budapest (Árpád-híd) gázló
1,638.60	1,637.10	1.50	HU / HU	Budafok gázló
1,623.70	1,622.50	1.20	HU / HU	Százhalombatta szűkület
1,619.10	1,618.20	0.90	HU / HU	Dunafüred szűkület
1,616.70	1,616.30	0.40	HU / HU	Ercsi szűkület
1,615.60	1,615.30	0.30	HU / HU	Ercsi alsó szűkület
1,591.80	1,591.30	0.50	HU / HU	Kulcs felső szűkület
1,590.50	1,590.10	0.40	HU / HU	Kulcs gázló
1,580.20	1,579.90	0.30	HU / HU	Dunaújváros szűkület
1,569.80	1,569.00	0.80	HU / HU	Baracs szűkület
1,567.30	1,566.20	1.10	HU / HU	Kisapostag szűkület
1,560.80	1,560.60	0.20	HU / HU	Dunaföldvár felső gázló
1,559.70	1,559.40	0.30	HU / HU	Dunaföldvár gázló és szűkület
1,558.00	1,557.20	0.80	HU / HU	Solt gázló és szűkület



1,555.80	1,554.60	1.20	HU / HU	Solt alsó gázló és szűkület
1,551.50	1,551.00	0.50	HU / HU	Bölcske
1,541.00	1,540.00	1.00	HU / HU	Ordas
1,522.00	1,520.80	1.20	HU / HU	Baráka gázló és szűkület
1,515.80	1,514.80	1.00	HU / HU	Gerjen
1,513.00	1,511.90	1.10	HU / HU	Kovácspuszta
1,510.00	1,509.40	0.60	HU / HU	Fajsz felső
1,451.20	1,450.70	0.50	HU / HU	Mohács

Hungary: Overview of Critical Locations





HU 4 Overview of action points

HU 4.1. Monitoring

The **monitoring of the fairway** on the HU/SK common section is conducted every year, alternately by Hungary and Slovakia, according to the regime described under HU 1. The surveying results are exchanged between the two countries. The complete Hungarian section is monitored every fifth year according to the OVF riverbed survey plan. Bathymetric surveys are carried out with the multibeam survey vessel Garda, which was purchased in the Fairway Danube project. The other multibeam equipment available to the VIZIGs is outdated. All bottlenecks are measured one time per year and the critical ones 2 times per year. Single-beam equipment is also available to the VIZIGs.

Concerning the **monitoring of the water levels**, the density of gauging stations is sufficient, although in some stretches, more stations would be advantageous.

The **marking of the fairway** is monitored by means of weekly marking trips which serve the purpose of basic monitoring and monitoring of the fairway marking itself. Site supervision is done by the VIZIGs. At cross-border sections, this is performed in turn with the neighbouring country. As the floating signalisation is often hit by passing vessels, the weekly marking trips are not sufficient to monitor the marking of the fairway. Remote monitoring of the buoys would be more efficient.

	Key issues	Need for action
HU 01	Partly outdated surveying equipment	Support acquisition of up-to-date multi- beam sensor(s)
HU 02	Weekly marking trips are not sufficient to monitor the marking	Support the replacement of the existing signalisation with AIS AtoNs to remotely control the buoys' positioning

HU 4.2. Planning

The **planning of monitoring, execution and information activities** is primarily based on bilateral agreements with Austria, Slovakia, Croatia and Serbia. An annual work plan (as well as agreements on fairway marking) exists only for the common sector of Hungary and Slovakia. It is elaborated by each country taking yearly turns and approved by the Border Commissions. In recent years a national Waterway Asset Management System (WAMS) was procured to support internal planning procedures.

	Key issues	Need for action
HU 03	Inefficient planning and information provision procedures	Support further development of the existing waterway management tool (WAMS)



HU 4.3. Execution

Dredging activities are under the responsibility of the Regional Water Directorates (VIZIGs). Currently, dredging equipment (floating dredger) is only available to one Water Directorate (ADUVIZIG) and is used for the purpose of dredging the authority's port. For dredging of the fairway, the VIZIGs would have to conduct public procurement procedures to outsource this service. Since 2013, no dredging activities have been performed in the fairway. As mentioned in point HU1, some fords cannot be removed by conventional dredging methods; their removal requires complex planning, which is why the works would have to be part of infrastructure investments rather than annual work plans⁸. The possibility of carrying out dredging, if necessary, should be established. Dredged material must be reloaded into the riverbed at locations to be determined according to environmental requirements⁹.

The three VIZIGs are responsible for **fairway marking** which is done according to a signalling plan which is updated after every riverbed survey but at least once a year. The marking plans are approved by OVF for all VIZIGs and approved by the shipping authority. Annual fairway marking meetings are held between the shipping authority and the VIZIGs. As the riverbed is rather stable, major fairway relocations are not undertaken often. In recent years, the Hungarian marking equipment and entire marking system is being modernised, co-financed by the CEF project "Improving fairway marking system on the Hungarian Danube section of the Rhine-Danube corridor 2014-HU-TMC-0605-W" (vessels, coastal and floating signalisation, including AIS AtoNs). The marking of the fairway is monitored on a weekly basis in all three Hungarian Danube sections.

Additionally, OVF is responsible for **icebreaking** on the Danube from rkm 1811 to 1433. The currently available equipment for this activity is about 50 years old.

	Key issues	Need for action
HU 04	Icebreaking cannot be performed at low water levels	Support acquisition of modern, multi- functional ice breakers
HU 05	Insufficient budget available to perform dredging activities	Supports the allocation of sufficient budget to allow for dredging interventions

HU 4.4.Information

Water level information is transmitted twice a day via NAVINFO radio and online (<u>www.hydroinfo.hu</u>). Water level forecasts for 6 days are also available online on the same website for 18 gauging stations on the Danube. The central operational organization responsible for water level forecasts in Hungary is the Hydrological Forecasting Service (HHFS) operating within OVF. Information on forecasted and measured values are available in tabular and graphical form. The relatively lower accuracy of the forecast for the first two gauges downstream of the Gabčíkovo hydropower plant

⁸ Such possible projects are outside the scope of this Master Plan and require specific permits, environmental monitoring during the planning and implementation process. The Master Plan does not propose the implementation of hydraulic engineering measures and, above all, does not propose any specific river engineering projects.

⁹ For further details, reference is made to the main outcomes of the project "Danube Sediment Management - Restoration of the Sediment Balance in the Danube River".



clearly shows the unpredictable effect of its operation. Fortunately, this effect is already negligible at Budapest and downstream. Overall, the Hungarian hydrological forecast is of very high quality.

Information on fairway depths below 2.7m is published once a day on <u>www.hydroinfo.hu</u>. On the Danube FIS Portal site plans (surveying results) with ENR-related depths are available.

	Key issues	Need for action
HU 06	User information should be provided customer-friendly using established river information portals	Support customer-friendly processing and dissemination of information, including IENCs
HU 07	Insufficient user information regarding the clearance under bridges	Support the calculation of vertical bridge clearance (e.g. laser scanner and hydrologic modelling)

HU 5 Ecological status/potential and ecological compatibility of maintenance measures

The Hungarian section of the Danube is divided into 7 sections. The main stretch of the Hungarian Danube is declared as "Heavily modified water bodies" with mostly moderate or worse ecological potential. Only a section downstream of Budapest of 72 km has good ecological potential. The two Natural Water Bodies upstream of Budapest are classified to have moderate ecological status. Also, the whole Hungarian river stretch except at Budapest is covered by Natura 2000 sites. There are also bank filtered drinking water sources along the whole Hungarian river stretch.

Maintenance works are executed in the framework of Act. No. XLII of 2000 on water transport and regulation No. 17/2002. of the ministry for environment and water. According to the regulation, fairway maintenance activities shall be based on an activity plan, which is prepared by the waterway administration each year by the end of March, and has to be approved by the competent regional water authority.



Croatia

HR 1 Characteristics of the Danube waterway and its navigable tributaries

The Croatian **Danube** is 137.6 km long and solely consists of free-flowing sections. As part of the Central Danube it is considered as a lowland river with an average height difference of about 8 cm per kilometre. Therefore, no power plants were built along the Croatian Danube. The riverbed consists of mostly sand. As this Danube section is shared with Serbia, the Ministries of both countries have signed the bilateral Agreement on navigation on IWWs and their technical maintenance on October 13th, 2009, in Belgrade, as a platform for technical actions. The Interstate HR/SRB Commission for the implementation of the Bilateral Agreement was founded in 2010. The governments have named the members of the Commission, which had the first session on 14th of October 2010, where two joint expert groups were established: Joint expert group for waterway marking and Joint expert groups are comprised of four members per country. The first tasks of the joint expert groups included the drafting of the Regulations on waterway marking as well as the Regulations on technical maintenance and monitoring of the waterway conditions.

Out of the 330 km of river **Drava**, only 198.6 km are navigable. From the mouth up to 70.0 km, the Drava is an international inland waterway with free navigation for all flags. The river section from its mouth to the international port of Osijek is classified as international waterway class IV (rkm 0.00 – rkm 14.00). From rkm 70.0 to 196.8, the Drava is an interstate inland waterway between Croatia and Hungary. This is the section with navigation of lower intensity.

Out of the total length of the **Sava** in Croatia, the river is navigable on a length of 383.2 km – from Račinovci to Sisak (rkm 210.8 to rkm 594). This is also the section that is classified as international waterway class IV according the AGN Agreement. From the border with Serbia (Račinovci) to Jasenovac, the Sava river waterway is the joint stretch with Bosnia and Herzegovina (304.4 km). Upstream of Jasenovac, the Sava is completely on the territory of Croatia.

The **Kupa** river is on the territory of Croatia with its entire length of 297 km. 100 km of river Kupa represent the state border with neighbouring Slovenia. The total navigable length of the Kupa is 5.9 km.

The river **Una** has a total length of 212 km, of which 139 km are on the territory of Croatia (of which 130 km form the state border with Bosnia and Hercegovina). A stretch of 15 km of the Una is classified as inland waterway, out of which 4 km are classified as Class II and 11 km as Class I.

Responsible for fairway maintenance / data provided by	Ministry of the Sea, Transport and Infrastructure (MMPI)
Number / length of critical locations of high priority	Danube: 17 / 85 km (62% of stretch of the Danube River); all locations are cross-border locations shared with Serbia
	Sava: 20 / 58.8 (15.34 % of the Sava River)
	Drava: 3 / 6.5 km (46.23% of national stretch classified as international class IV)
Medium length of critical locations	Danube: 4,900 metres (variation 800 – 9,800 metres)

HR 2 Fairway maintenance basic data



	Sava: 2,000 metres (variation 500 – 8,000 metres) Drava: 1,500 metres (variation 500 – 4,000 metres)
Main issues in waterway maintenance – high priorities	Lack of qualified personnel, high number of critical locations, insufficient technical capacity of dredging firms to provide sufficient maintenance which leads to high operational costs, riverbed instability leads to occurrence of frequent maintenance of same river sections
Annual operating cost for needed actions	Operational costs / year: approx. 4 000 000 EUR

HR 3 Critical Locations

Danube

Location / Length (km)		right bank /	Name of costor / location	
River-km (from / to)		Length	left bank	
1,429.00	1,425.00	4.00	HR / RS	Bezdan
1,424.20	1,414.40	9.80	HR / RS	Siga - Kazuk
1,408.20	1,400.00	8.20	HR / RS	Apatin
1,397.20	1,389.00	8.20	HR / RS	Židovski Rukavac
1,388.80	1,382.00	6.80	HR / RS	Drava confluence
1,381.40	1,378.20	3.20	HR / RS	Aljmaš
1,376.80	1,373.40	3.40	HR / RS	Staklar
1,371.40	1,366.40	5.00	HR / RS	Erdut
1,366.20	1,361.40	4.80	HR / RS	Bogojevo
1,357.00	1,351.00	6.00	HR / RS	Dalj
1,348.60	1,343.60	5.00	HR / RS	Borovo 1
1,340.60	1,338.00	2.60	HR / RS	Borovo 2
1,332.00	1,325.00	7.00	HR / RS	Vukovar
1,324.00	1,320.00	4.00	HR / RS	Sotin
1,315.40	1,314.60	0.80	HR / RS	Opatovac
1,311.40	1,307.60	3.80	HR / RS	Mohovo
1,302.00	1,300.00	2.00	HR / RS	llok - Bačka Palanka

Sava River

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to) Length				
210.80	212.70	1.90	BA / HR	Račinovci
220.00	228.00	8.00	BA / HR	Gunja
310.00	311.30	1.30	BA / HR	Savulje – Slavonski Šamac
322.00	329.00	7.00	BA / HR	Jaruge – Novi Grad
374.00	382.00	8.00	BA / HR	Migalovci
394.00	395.00	1.00	BA / HR	Grlić
426.50	427.00	0.50	BA / HR	Davor – Vrbas confluence
429.00	431.00	2.00	BA / HR	Davor Mlature
445.50	449.50	4.00	BA / HR	Dolina



451.00	452.00	1.00	BA / HR	Mačkovac
463.00	466.00	3.00	BA / HR	Stara Gradiška
523.00	528.00	5.00	HR / HR	Višnjica
540.80	542.30	1.50	HR / HR	Puska
549.20	550.20	1.00	HR / HR	Lonja 1
551.80	556.00	4.20	HR / HR	Lonja - Strmen
559.90	560.70	0.80	HR / HR	Bobovac
565.00	565.60	0.60	HR / HR	Kratečko
571.00	577.00	6.00	HR / HR	Gušće – Galdovo
580.00	582.00	2.00	HR / HR	Blinjski kut
587.00	588.10	1.10	HR / HR	Crnac

Drava River

Location / Length (km)			right bank /	Name of contor (location
River-km (from / to) Leng		Length	left bank	
0.00	0.50	0.50	HR / HR	Drava mouth
4.00	6.00	2.00	HR / HR	4 th to 6 th
8.00	12.00	4.00	HR / HR	8 th to 12 th
15.00	19.00	4.00	HR / HR	15 th to 19 th


Croatia: Overview of Critical Locations



HR 4 Overview of action points

HR 4.1. Monitoring

Monitoring of the fairway on the Danube, Drava and Sava rivers is performed by the Ministry of the Sea, Transport and Infrastructure (MMPI) and done according to an annual work plan. Surveying is performed as bathymetric surveying of the riverbed and the navigation structures.



Monitoring of the fairway is performed as follows:

- Regular monitoring of the fairway is performed approximately every two weeks by means of single-beam technology as part of the regular marking tours (with marking vessels) in order to control fairway dimensions, critical locations for navigation and the positioning of navigation marks. Results are published via notices to skippers by the competent harbour master's office on the following web page: <u>https://mmpi.gov.hr/more-86/unutarnjaplovidba-rijecni-promet/priopcenja-za-brodarce/10403;</u>
- 2. Detailed riverbed surveying is performed when required on specific sections in order to determine the detailed riverbed morphology. Surveying is performed either with multi-beam technology as surveying of the whole surface of the critical riverbed section, or with single-beam technology by means of cross-section profiles and intermediate profiles;
- 3. Annual underwater surveying on the joint Croatian/Serbian Danube river stretch is done with single-beam equipment. In accordance with above stated facts about the cooperation with Serbia, annual surveying is performed alternately by both countries in order to define the navigation conditions and possible changes in the waterway and the fairway.

Monitoring of fairways that are not marked is performed minimum once a year. The post-processing of recorded data and the provision of this information on user information portals is carried out by MMPI through its employees. The shortage of qualified staff to conduct the monitoring activities and the post-processing of surveying data is the biggest issue, as is the technological development, since the existing equipment will also be outdated in a few years.

Water levels are measured by means of modern, automatic gauging stations. Currently, nine gauging stations along the Danube transmit water level information on an hourly basis. The MMPI currently is in possession of four gauging stations. The Croatian Meteorological and Hydrological Service – DHMZ is the owner and operator of the existing five gauges that were recently modernised. All nine gauges are interconnected in one joint gauging network in Croatia that is owned, maintained and operated by DHMZ. MMPI and DMHZ in cooperation are providing regular services of the gauges and have ensured automatic transmission all collected hydraulic data.

DHMZ also provides daily flow measurements for Batina, Aljmaš, Dalj, Vukovar and Ilok. Data are stored digitally, checked and archived. The current water level information is published on several user information portals. The density of the gauging network is considered sufficient at the moment, but the continued maintenance of the gauging equipment must be ensured. All other existing gauges in Croatia on the Drava and Sava river are owned, maintained and operated by DHMZ.

The **marking of the fairway** on Croatian rivers is monitored usually once per week. No major issues arise in the field of monitoring fairway marking.

	Key issues	Need for action
HR 01	Need for monitoring of the shallow sections and remote monitoring due to unreachability with current surveying vessel	Support retrofit and acquisition of remotely controlled aquatic and river drones
HR 02	Insufficient number of skilled staff	Secure education and provision of well- trained staff in the short, medium and long term



HR 4.2. Planning

Planning of monitoring, execution and information activities is based on survey results and expert assessments which result in annual work plans established by the Ministry of the Sea, Transport and Infrastructure (MMPI). The work plans are approved by the Harbour Master's offices and the inland waterway sector.

In recent years, a national Waterway Asset Management System (WAMS) was procured to improve the link between the surveying and marking departments.

	Key issues	Need for action
HR 03	Insufficient and hardly predictable financial backings	Secure predictable and sufficient financial means for waterway maintenance
HR 04	Inefficient internal procedures with WAMOS/WAMS systems as regards basic operations	Support the further development of the WAMOS/WAMS System
	Insufficient data storage and analysis facilities	Support acquisition of adequate IT tools (hardware and software)
HR 05	Insufficient fairway status data and lack of quality data base that contains historical information regarding fairway surveys (in navigational and biological sense)	Implementation of monitoring activities that will provide sufficient data for the development of technical documentation in order to resolve navigational bottlenecks

HR 4.3. Execution

MMPI does not have the necessary equipment or the staff to perform **dredging activities**. Dredging is contracted out and performed, depending on the situation in the fairway. When insufficient depths in the fairway are discovered, an inspector from the relevant captaincy is delegating a dredging intervention order after which MMPI is obligated to start the dredging activity via the contractor that is under annual dredging contract. Information from regular patrols or fairway users also plays an important role in determining the status of the fairway. All excavated material is reinserted into the river. Annually, sediment in a range of 40,000 – 70,000 m³ is being dredged (average amounts from 2017 to 2021 for the Danube, Sava and Drava River).

Marking activities are under the responsibility of MMPI in cooperation with the Harbour Master's Office. It is done according to the rules in the *Ordinance on the waterway marking system and navigation safety facilities*. Marks are adjusted after high water levels and periods with ice. Decisions for the Danube river are taken jointly with Serbia. Major changes in the waterway are published in Notices to Skippers. Due to the cross-section of the Danube in Croatia, realignments of the fairway are only possible to a very limited extent. Smaller changes in the marking are made on a regular basis. In recent years, a new marking vessel was procured which is operated on the Danube. Two new marking vessels to be operated on the Sava and Drava rivers are currently under construction (expected to be delivered by the end of 2023).

As identified in the tables under ''HR 3 - Critical Locations'', there is currently a high number of bottlenecks in Croatia that present obstacles for safe and reliable navigation. On the other hand,



there are some critical locations in Croatia where riverbed instability leads to the occurrence of frequent repeated maintenance which undermines the dredging effects.

In Croatia there are only few companies that can perform dredging. These companies are often under much pressure due to the work-load. This situation is leading to high maintenance costs due to unfavourable supply and demand ratio.

	Key issues	Need for action
HR 06	High maintenance costs	Development of adequate technical solutions in order to improve fairway stability (capital dredging on critical locations in the upcoming period of 10 years)
		Investigate "working with nature" approaches for the resolution of navigational bottlenecks

HR 4.4. Information

The National Hydro-Meteorological Institute is responsible for data collection and publication. **Water level information** is measured every hour and updated on their website. Information provided via Notice to Skippers is updated daily. Water level forecasts are available on https://www.vodniputovi.hr/en/services/waterlevels/.

Water level forecasts are calculated for four days in advance for the three gauges: Batina (rkm 1424.6), Aljmaš (rkm 1380.27) and Vukovar (rkm 1333.36), serving as indicator for critical locations. In the future, it is possible to extend the forecasts to gauges near critical bottlenecks.

Information on fairway depths is available and published but needs to be developed further.

	Key issues	Need for action
HR 06	Low number of water level forecasts near critical bottlenecks	Support the further development of the water level forecast (geographical extension and continued quality improvements)

HR 5 Ecological status/potential and ecological compatibility of maintenance measures

According to the River Basin Management Plan (RBMP) 2021, the water bodies on the Danube River in Croatia aren't designated as HMWBs and there are no hydropower plants built along the section. The ecological status of the water body reaching from the Croatian-Hungarian border to the Drava-Danube confluence is assessed as poor. Downstream of the Drava-Danube confluence to the Croatian-Serbian border the ecological status of the water body is assessed as bad.

The Sava has several sections designated as HMWB, others are natural water bodies. The ecological status varies from moderate to poor; the ecological potential of all HMWB is moderate or worse. The same assessment applies to the Drava. Large parts of the Drava, Sava and Danube are protected by nature conservation law. The Croatian Danube for example is covered by Natura 2000 and Ramsar sites and is part of the Nature Park Kopački Rit and the Biosphere Reserve Mura-



Drava-Danube. The related conservation management regimes are to be considered when designing and implementing fairway maintenance and rehabilitation measures.

Maintenance works are executed in the framework of navigation law ("Zakon o plovidbi i lukama unutarnjih voda", official gazette nr. 109/2007, 132/2007, 51A/2013, 152/2014 and 118/2018), Regulation on technical maintenance of waterways ("Pravilnik o tehničkom održavanju vodnih putova", official gazette nr. 62/2009, 136/2012, 41/2017 and 50/2019) and in accordance with the applicable technical regulations in the field of construction, spatial planning and environmental protection, and water management relating to maintenance works on constructions which are used for the improvement of navigation conditions.

The Annual Maintenance Program is prepared based on the maintenance studies, annual detailed surveying data, information about the changes in the waterway and data about the execution of works from previous years. When the Program is adopted, the Assessment Study of main impact for the ecological network (which is done by official experts on nature conservation and water ecology) must be provided to the Ministry of Economy and Sustainable development. The Assessment Study contains proposed measures to mitigate adverse impacts of planned activities and a program for monitoring and reporting of planned activities. If the proposed mitigation measures / alternatives are eliminating negative effects, the competent authority (Ministry of Economy and Sustainable development or Department of Spatial Planning, Environment and Nature Protection in the competent county) issues their conclusions and approval of the procedure.



Serbia

RS 1 Characteristics of the Danube waterway and its navigable tributaries

The length of the Danube River in Serbia is 588 km, out of which 137 km are a joint stretch with Croatia; 229 km are a joint stretch with Romania, while 222 km are a national stretch. Part of the Danube River between Bezdan and Belgrade is a free-flowing section, while the Danube downstream of Belgrade is under the influence of the Iron Gate reservoir (backwater section). The river bed consists of mostly sand. The two hydropower plants, Iron Gate I (km 943) and Iron Gate II (km 863), form a reservoir, which is among the largest in Europe and helps to provide favourable navigation conditions downstream of Belgrade. The reservoir of the Iron Gate I dam extends to Belgrade (km 1,170) during high and average waters and to Novi Sad (km 1,255) during low waters. Low water periods are not affecting navigation in the reservoir; during extreme water periods, the reservoir needs to be partly emptied, which in most cases does not cause any obstacles to navigation.

Important tributaries to the Danube in Serbia are the international waterway of the Sava River (the Sava River in Serbia is 211 km long, including the joint stretch of the river with Bosnia and Herzegovina from rkm 178 to rkm 211) and the interstate waterway of the Tisza River (164 km in Serbia).

In recent years, the implementation of structural river training and dredging works on the Danube and the Sava, accompanied by ecological monitoring and extensive stakeholder management, has largely resolved the critical locations on the purely national stretches of the Danube and the Sava. Regular monitoring and minor physical interventions (dredging) will still be necessary in the future. These critical locations are no longer listed in the list below.

Responsible for fairway maintenance / data provided by	PLOVPUT (Directorate for Inland Waterways within the Ministry of Construction, Transport and Infrastructure)
Number / length of critical locations of high priority	Danube: 17 / 85 km (14.5% of national stretch of the Danube River), all 17 bottlenecks are cross-border locations with Croatia Sava: 1 / 6 km (2.8% of the national stretch of the Sava River), the critical location is a cross-border location with Bosnia and Herzegovina
Medium length of critical locations	Danube: 4,900 metres (variation 800 – 9,800 metres) Sava: 600 meters
Main issues in waterway maintenance – high priorities	Budget restrictions impede necessary dredging works on the most critical locations and other necessary maintenance activities Insufficient and/or old equipment
Annual operating cost for needed actions	Operational costs / year: approx. 2 000 000 EUR

RS 2 Fairway maintenance basic data (Danube and Sava)



RS 3 Critical Locations

Danube

Location / Length (km)		right bank /	Name of agetar (lagation	
River-km	(from / to)	Length	left bank	
1,429.00	1,425.00	4.00	HR / RS	Bezdan
1,424.20	1,414.40	9.80	HR / RS	Siga - Kazuk
1,408.20	1,400.00	8.20	HR / RS	Apatin
1,397.20	1,389.00	8.20	HR / RS	Čivutski Rukavac
1,388.80	1,382.00	6.80	HR / RS	Drava confluence
1,381.40	1,378.20	3.20	HR / RS	Aljmaš
1,376.80	1,373.40	3.40	HR / RS	Staklar
1,371.40	1,366.40	5.00	HR / RS	Erdut
1,366.20	1,361.40	4.80	HR / RS	Bogojevo
1,357.00	1,351.00	6.00	HR / RS	Dalj
1,348.60	1,343.60	5.00	HR / RS	Borovo 1
1,340.60	1,338.00	2.60	HR / RS	Borovo 2
1,332.00	1,325.00	7.00	HR / RS	Vukovar
1,324.00	1,320.00	4.00	HR / RS	Sotin
1,315.40	1,314.60	0.80	HR / RS	Opatovac
1,311.40	1,307.60	3.80	HR / RS	Mohovo
1,302.00	1,300.00	2.00	HR / RS	Bačka Palanka

Sava River

Location / Length (km)			right bank /	Name of costor (location
River-km (from / to) Length		left bank		
177.00	183.00	6.00	BA / RS	Drina confluence







RS 4 Overview of action points

RS 4.1. Monitoring

Monitoring of the fairway on the Danube, Tisza and Sava Rivers is performed by the Directorate for Inland Waterways PLOVPUT, who holds a hydrographic database of the last 50 years. Single-beam and multi-beam equipment is available. Hydrographic surveys of the free-flowing sections are performed each year in spring/summer. Critical sections may be surveyed more than once a year,



if necessary; success control is performed after dredging activities. The HR-RS border section is monitored by Croatia and Serbia, taking turns. The joint section of the Danube River between Serbia and Romania, which is under the direct influence of the regime of work of Iron Gate I and Iron Gate II, is currently monitored once in four years. Monitoring of sections without regulated fairways is performed twice a year. Additional monitoring of the riverbed is performed by marking vessels (echo-sounder). As of spring 2022, the procurement of a state-of-the-art surveying vessel with multibeam equipment is under preparation. There is no need for additional surveying vessels.

Water levels are monitored using automatic gauging stations, available on the Danube, the Tisza and the Sava. The density of the gauging network on the Danube and the Sava is sufficient; an upgrade (technical) of the gauging stations is under preparation (as of 2021). The gauging network on the Tisza is not sufficient and also in need of upgrading.

	Key issues	Need for action
RS 01	Limited budget for monitoring activities	Secure sufficient operational budget for regular hydrographic surveying Enforce cooperation with AVP on joint stretch and improve data exchange
RS 02	Insufficient number of skilled staff	Secure education and provision of well- trained staff in the short, medium and long term Facilitate different geographical organization of surveying teams to allow more effective and efficient performances Enable expert exchange with other Danube waterway administrations
RS 03	Insufficient number of automatic gauging stations on the Tisza and old gauging equipment along all waterways	Support acquisition and operation of additional gauging stations and upgrade of existing network

The marking of the fairway is monitored twice per month.

RS 4.2. Planning

Planning of monitoring, execution and information activities is based on a bilateral agreement on surveying and maintenance between Croatia and Serbia. The joint section with Romania is covered by the Interstate Commission for the Iron Gate. These discussions form the basis for the annual maintenance and marking plan of PLOVPUT, which covers Danube, Tisza and Sava, and is approved by the Ministry. Maintenance activities can only be executed, if budget is granted by the Government. This has to be negotiated annually.

RS 4.3. Execution

Dredging activities are executed by PLOVPUT based on the annual plan, but depending on the fact whether financial means are provided by the Government each year. Dredged material is deposited again in the river.



The implementation of structural river training and dredging works on the Danube and the Sava outside the scope of the Fairway Rehabilitation and Maintenance Master Plan has largely resolved the critical locations on the purely national stretches of the Danube and the Sava, reducing the necessary dredging volumes per year.

Marking activities are undertaken by PLOVPUT. There is a joint annual marking plan with Croatia. Romania and Serbia have separate marking plans, which are harmonised. As of spring 2022, the procurement of a state-of-the-art multi-functional marking vessel is under preparation. The marking system (signalisation) on the entire Danube has been upgraded in recent years and is sufficient, including AIS AtoNs. As of 2021, the marking system of the Sava river is being upgraded, the marking system on the Tisza is considered insufficient.

	Key issues	Need for action
Further absence of budget for dredging activities will lead to deterioration of navigation conditions on the border section with Croatia, while the cost-benefit ratio of these activities is very favourable		Secure sufficient and predictable financial means
RS 05	Old marking system on the Tisza	Support acquisition of up-to-date marking vessels and buoys
RS 06	Inefficiencies due to missing comprehensive database and web tool for navigation aids	Support development of a web application for marking activities on the Danube and its tributaries integrating Croatia and Romania
RS 07	Limited number of skilled personnel and inability to employ new staff due to Government regulation and restrictions	Secure education and provision of well- trained staff in the short, medium and long term

RS 4.4. Information

Information on water levels is provided daily by the Hydro-Meteorological Institute, which is responsible for data collection and publication of meteorological information under <u>http://www.hidmet.gov.rs/eng/prognoza/prognoza voda.php</u>. **Forecasts** are available for two or four days (depending on the gauge) for seven gauges on the Danube, three on the Sava and three on the Tisza. The accuracy of the forecast should be improved by extensive hydrological modelling.

Information on fairway depths is published on the website of Plovput and the Danube FIS Portal every second week or as needed during low water periods. There are no major issues related to information on fairway depths.

	Key issues	Need for action
RS 08	The low number of gauging stations results in incomplete water level information and lead to inaccurate forecasts	Support acquisition and operation of additional gauging stations.



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0	
RS	

Water level forecast is of insufficient quality and currently covers only

Improving the quality and geographical coverage of the forecast

RS 5 Ecological status/potential and ecological compatibility of maintenance measures

The ecological status of the Danube waterbody in the Republic of Serbia is identified within the DRBMP as moderate in the upper stretch to moderate to worse in the middle and lower stretch.

The Sava in Serbia is partly classified as HMWB with moderate ecological potential, while the majority of the Sava in Serbia is a natural water body with moderate ecological status. Part of the river is under nature conservation status.

Due to the absence of budget for maintenance dredging activities, fairway maintenance activities are usually limited to hydrographic surveying activities and waterway marking activities, with no effect on the environment. Nevertheless, a few dredging activities are performed at the most critical sectors if required, following the basic principles of waterway and environmental protection. The dredged sediment is dumped again in the river, in line with the adopted sediment balance principle.



Bosnia and Herzegovina

BA 1 Characteristics of the Sava waterway

All together the River Sava is 945 km long and drains 95,719 km² of surface area. The 337 km of the Bosnia and Herzegovina Sava follows the joint border with Croatia for 304 rkm and is shared with Serbia for about 32.8 rkm after the border triangle. The River Sava is categorized as an International Waterway of class III from Sisak to Slavonski Brod and almost continuously of class IV until Belgrade. Nevertheless, a Feasibility Study identified many sections of the river that not fulfil the minimum requirements for navigation. Results of the study were preliminary designs and cost estimations for the necessary engineering interventions in the waterway to return the River Sava to Class Va and/or Class IV.

Basic documents are the *Framework Agreement on the Sava River Basin*, for the coordination of the implementation of which the International Sava River Basin Commission was established, and the *Strategy on implementation of the Framework Agreement on the Sava River Basin*.

The Ministry of Communications and Transport of Bosnia and Herzegovina signed an "Agreement between the Government of the Republic of Croatia and the Council of ministers of Bosnia and Herzegovina on inland waterways navigation, its signalling and maintenance". On basis of this Agreement, the Rule Book for marking of the fairway on the Sava river waterway has been signed by Bosnia and Croatia. According to the Rule Book, Bosnia and Herzegovina marks the fairway from rkm 343 to rkm 211 on the Bosnian and Croatian fairway, and from rkm 211 to rkm 178 for the Bosnian part of the fairway.

Also, an agreement between the Government of Republic of Serbia and the Council of ministers of Bosnia and Herzegovina on inland waterways navigation and its technical maintenance has been signed. A common implementation body consisting of the representatives of Bosnia and Herzegovina and Republic of Serbia shall work on the preparation of the Rule Book for maintenance of the common fairway on the river Sava.

Responsible for fairway maintenance / data provided by	Currently there is no agency on state level which is responsible for maintenance
Number / length of critical locations of high priority	No data provided
Medium length of critical locations	No data provided
Fairway depth of 2.5 m in 2012	No data provided
Main issues in waterway maintenance – high priorities	No data provided
Annual operating cost for needed actions	300,000 - 500,000 EUR for maintenance of the signalling system for the period

BA 2 Fairway maintenance basic data



Location / Length (km)			right bank/	Nome of contary (location
River-km (from / to)		Length	left bank	Name of sector / location
177.80	187.40	9.60	BA / RS	
189.20	202.50	13.30	BA / RS	
202.50	225.10	22.60	BA / RS&HR	
225.10	260.70	35.60	BA / HR	
260.70	306.80	46.10	BA / HR	
306.80	331.50	24.70	BA / HR	
364.40	395.50	31.10	BA / HR	
417.10	445.70	28.60	BA / HR	
445.70	459.90	14.20	BA / HR	
459.90	480.40	20.50	BA / HR	
480.40	511.80	31.40	BA / HR	

BA 3 Critical Locations (Sava)





Bosnia and Herzegovina: Overview of Critical Locations

BA 4 Overview of action points

BA 4.1. Monitoring

Currently, there is no agency on the state level, which is responsible for maintenance of the fairway in Bosnia and Herzegovina.

BA 4.2. Planning

See description above.



BA 4.3. Execution

The fairway of the Sava River in Bosnia and Herzegovina should be rehabilitated to IV/Va navigable class to enable better navigation conditions along the Sava River.

Bosnia and Herzegovina should introduce activities on monitoring, planning and execution of fairway maintenance works after completion of construction works on rehabilitation of the Sava river fairway.

The fairway signalling system is currently maintained and supervised according to the contracts which Bosnia and Herzegovina (Ministry of communications and transport of BiH) has signed with Croatia for maintenance and supervision of the signalling system of the Sava river fairway from rkm 343 to rkm 211 on BiH and Croatian fairway/river banks, and from rkm 211 to rkm 178 for the BiH part of the fairway/river bank (the same sections as agreed between Bosnia and Herzegovina and Croatia for marking of the fairway). The signalling follows the marking scheme issued by the Sava Commission, additionally, bilateral agreements with Croatia are conducted concerning the marking scheme.

BA 4.4. Information

Information activities should be introduced after completion of construction works on rehabilitation of the Sava river fairway.

BA 5 Ecological status/potential and ecological compatibility of maintenance measures

For the assessment of the ecological status/potential, reference is made to the Croatian chapter, as there is no data from Bosnia and Hercegovina. Such data should be collected before any measures are planned, so filling data gaps should be a priority.

No physical interventions are conducted in the Sava waterway by any authority of Bosnia and Hercegovina; marking activities have no effect on the environment.



Romania

R0 1 Characteristics of the Danube waterway

The Romanian waterway network consists of the main branch of the Romanian Danube with its outlets to the Black Sea at Sulina (1,075 km) and via the Danube – Black Sea Canal (100 km). In the period of low water levels, navigation runs through the alternative route on the Borcea branch, between rkm 345 and rkm 240. Therefore, the waterway network maintained by Romania sums up to 1,253 km

<u>Danube</u>

There are locks positioned at river km 943 and 863 (Iron Gates). Under certain circumstances, the operation of the power plants can influence the daily variations of the water level (low frequent situations with slight increase over 1m/day). The Romanian sector of the Danube can be divided into three distinct sectors, according to their flow regime: a backwater sector of the Iron Gate locks (rkm 1,075 to rkm 863), a free-flowing sector (rkm 863 to rkm 175), and a free flowing – maritime sector (rkm 175 to rkm 0). The sector from rkm 1,075 to 845.5 is a cross-border section with Serbia, from rkm 845.5 to 375 with Bulgaria, between rkm 134.14 and 133.59 with Moldova and between rkm 133.95 and 79.64 (start of the Chilia branch) with Ukraine. Only the sectors between rkm 375 and rkm 134.14 and between rkm 79.64 and rkm 0 are solely on Romanian territory. Bulgaria and Romania agreed on splitting the responsibility for the joint cross-border section (based on a bilateral agreement from 1955) to ensure minimum fairway depth on the joint border stretch. While Bulgaria is responsible for fairway maintenance between rkm 610 and 375, Romania is in charge of the sector between rkm 845.5 and 610. According to the AGN, the Romanian Danube sector from 1,075 km to 0 km is Class VII. Most of the river banks are not reinforced along the Lower Danube. The stretch is characterized by highly intensive morphological changes of the riverbed and undermining banks; the riverbed consists of mostly sand. An example for this is the occurrence of critical sectors, where the river moves large quantities of sediments on a daily basis. Regarding discharge, it is observed that the most likely period in which navigation problems appear is between July and October.

Navigable Canals

The Danube-Black Sea Canal (DBSC) is specified as Class VI with its northern branch Poarta Alba-Midia Năvodari Canal (PAMNC) specified as class V. On the Danube-Black Sea Canal there are twin locks located in the Cernavoda and Agigea area. The area between Murfatlar and Agigea is characterized by high banks with high potential for landslides due to unfinished works since the opening of navigation. On the Poarta Alba-Midia Năvodari Canal there are also twin locks in the Ovidiu and Năvodari area. The same potential for landslides is characteristic of the area upstream of the Ovidiu locks.

Responsible for fairway maintenance / data provided by	Administration of the Lower Danube (AFDJ) and Administration of the Navigable Canals (ACN)	
Number / length of critical locations of high priority	Danube: 38 / 90.6 km (8.9% of national stretch, incl. side branches) Navigable Canals: 5 / 5.5 km	
Medium length of critical locations	2,520 metres (variation 500 – 4,500 metres)	

R0 2 Fairway maintenance basic data



Main issues in waterway maintenance – high priorities	Insufficient operational budget for regular maintenance activities
Annual operating cost for needed actions	AFDJ: Operations costs / year: approx. 10 000 000 EUR ACN: Operational costs / year: approx. 6 000 000 EUR (incl. maintenance of lock infrastructure)

RO 3 Critical Locations

Location / Length (km)		right		
River-km (from / to)		Length	bank / left bank	Name of sector / location
840.00	838.00	2.00	BG / RO	Garla Mare
823.00	818.00	5.00	BG / RO	Salcia
785.00	783.00	2.00	BG / RO	Bogdan Secian
764.00	759.00	5.00	BG / RO	Dobrina
678.00	675.00	3.00	BG / RO	Bechet
633.00	626.00	7.00	BG / RO	Corabia
617.00	610.00	7.00	BG / RO	Calnovat
Critical lo	cations betw	veen rkm 6	610 and rkm	n 375 fall under the responsibility of Bulgaria.
345.00	342.00	3.00	R0 / R0	Caragheorghe-Turcescu
337.00	336.00	1.00	R0 / R0	Lebada
326.00	325.00	1.00	R0 / R0	Marleanu
323.00	322.00	1.00	R0 / R0	Fermecatu amonte
318.00	317.00	1.00	R0 / R0	Fermecatu aval
309.00	304.50	4.50	R0 / R0	Cochirleni
297.00	295.00	2.00	R0 / R0	Cernavoda
292.00	288.50	3.50	R0 / R0	Seimeni
281.00	279.00	2.00	R0 / R0	Capidava
276.50	274.50	2.00	R0 / R0	Albanesti
252.00	250.00	2.00	R0 / R0	Harsova
245.00	242.00	3.00	R0 / R0	Giurgeni-Vadu Oii
197.00	195.00	2.00	R0 / R0	Gropeni
192.00	188.00	4.00	R0 / R0	Dunarea Veche
155.00	153.00	2.00	R0 / R0	Galati (Siret aval)
137.00	135.20	1.80	R0 / R0	Prut amonte (Mm72+1000 - Mm74)
118.50	113.00	5.50	RO / UA	Reni aval (Mm 61+500 - Mm 63)
107.40	103.70	3.70	RO / UA	Isaccea amonte (Mm 56 - Mm 57+3/4)
98.20	94.50	3.70	RO / UA	Isaccea aval (Mm 51 - Mm 53)
75.90	74.10	1.80	R0 / R0	Tulcea amonte (Mm 40 – Mm 41+730)
57.40	55.60	1.80	R0 / R0	Partizani (Mm 30 – Mm 31)
-7.70	-9.00	1.30	R0 / R0	Bara Sulina
24.00	21.00	3.00	R0 / R0	Borcea Branch: Bordusani
64.50	64.00	0.50	R0 / R0	Danube Black-Sea Canal: Cernavoda canal
64.00	63.00	1.00	RO / RO	Danube Black-Sea Canal: Cernavoda canal2
38.00	36.00	2.00	RO / RO	Danube Black-Sea Canal: Medgidia



2.00	1.00	1.00	R0 / R0	Poarta Albă-Midia Năvodari Canal: Năvodari
5.00	4.00	1.00	R0 / R0	Poarta Albă-Midia Năvodari Canal: Luminita
64.00	63.00	1.00	RO / RO	Macin Branch: Piatra Frecatei
43.00	42.00	1.00	R0 / R0	Macin Branch: Bedeloiu
26.00	25.00	1.00	RO / RO	Macin Branch: Carcaliu

Romania: Overview of Critical Locations





RO 4 Overview of action points

RO 4.1. Monitoring

Monitoring of the fairway is done by means of monthly surveys with mainly multi-beam but also single-beam equipment, according to the annual work plan and with a higher frequency if needed. There is a good and permanent collaboration between Romania and Serbia as well as between Romania and Bulgaria regarding the monitoring of the fairway (exchange of surveying data). On the RS-RO border stretch the left side of the fairway is monitored by Serbia and the right side by Romania. With Bulgaria the responsibilities are split as described above; critical locations are periodically monitored jointly (e.g. Belene area). In recent years, a state-of-the-art surveying vessel with multi-beam technology has been acquired by AFDJ. Nevertheless, the equipment of the other surveying boats is outdated and in need of renewal. ACN acquired a state-of-the-art single-beam sounder in 2017; but has no access to multi-beam technology.

Water levels are monitored by means of 28 partly automatic water gauging stations. ACN owns and operates 8 automatic and 8 classical gauges. The density of the gauging network is currently insufficient and several gauging stations are not yet automated.

Fairway marking is monitored during monthly and sometimes even weekly travels with specialized marking vessels, during which also basic information about the status of the fairway is gathered.

	Key issues	Need for action
R0 01	Partly outdated surveying equipment	Support acquisition of up-to-date sounding equipment, in particular sensors (incl. possibly drones), to raise the quality of surveying data
R0 02	Insufficient number of automatic gauging stations	Support acquisition of additional automatic gauging stations, especially for critical sections
RO 03	Lack of equipment for the monitoring of the canal banks (DBSC and PAMNC)	Support acquisition of up-to-date aerial monitoring device (drone)
RO 04	Lack of equipment to monitor the physical and chemical quality of water (related to the fairway)	Support acquisition of sensors measuring turbidity, sedimentation and chemical components of the water

RO 4.2. Planning of monitoring, execution and information activities

An **annual work plan** sets out the number, type and location of signals, dredging areas and dredging periods. Also, the fairway monitoring is conducted according to this work plan and in line with the agreements made in the joint working group meetings of hydrology, hydrography, signalisation and dredging works departments (once or twice a year). Plans are made based on the analysis of measurements and statistical data. Depending on the morphological development of sectors additional measures are taken. The monitoring plans are in line with the existing strategic documents and with Danube Commission recommendations. In the planning activities Romania



coordinates with Bulgaria and Serbia. Marking plans are verified and renewed monthly and updated daily in critical situations.

In recent years, a Waterway Management System (WAMS) was acquired which enables systematic and consolidated storage of different hydrological and hydrographical data and supports various internal planning and information provision steps. In the interest of the ongoing digitalisation of the tasks of waterway management, the functions of this tool are to be extended in the future.

In recent years, a digital terrain model was established for roughly 500 km on the Romanian-Bulgarian border section. As such models create the basis for quality forecast information and other internal services, the geographical coverage would have to be extended and the model continuously improved.

	Key issues	Need for action
R0 05	Inefficient planning and information provision procedures	Support further development of the existing waterway management tool (WAMS)
R0 06	Lack of a comprehensive digital terrain model	Support extension of the digital terrain model as a basis for planning and other services (e.g. wl forecast, calculation of LNWL)
RO 07	Statistical Low Navigable Water Levels are not available for all major gauges	Improve methodology for the calculation of the LNWL and extension to other gauges

RO 4.3. Execution

Dredging activities are conducted within the responsibility of AFDJ. For the maritime Danube a maritime dredger is available, the equipment is outdated. As of 2021, dredging works at the fluvial Danube are contracted out (framework contracts for several years). During the financing period 2014-2020 AFDJ commissioned three fluvial dredgers, one of which was delivered in 2019, making the administration less dependent on external contractors. Nevertheless, not all dredging works will be carried out by the administrations themselves. The amount of dredged material accounts for about 1,446,723 m³/year (mean value 2017-2020). The dredged material is deposited again in the riverbed. The areas for the discharge of the dredged material are agreed annually with the National Administration Romanian Waters, according to the provisions of art. 33 paragraph (6) of the water law. Priority is given to critical areas, difficult passages or areas of recent events to ensure the navigation depth. Dredging activities are usually realized before low water periods, following a proactive approach.

Marking activities concentrate on critical points mainly in relation to extreme water levels. Free flowing sections are marked by buoys with a distance of three kilometres on average. The alignment of the fairway is published weekly and available daily via signalling bulletin. Navigational marks are updated daily. Since 2019, a new marking vessel is deployed on the Danube sector between rkm 845.5 and rkm 610; the other marking vessels are nearing their technical life expectancy and the entire marking system is outdated. At least three marking vessels need to be deployed along the Romanian Danube in order to reduce reaction and intervention times.



	Key issues	Need for action
R0 08	Lack of dredging equipment for the maritime Danube	Support acquisition of (maritime) dredging equipment
RO 09	Lack of specialized personnel to operate the dredgers	Support the training of specialized personnel for dredging operations
RO 10	Lack of efficient vessels and special equipment for marking (e.g. specialised vessel for the maintenance of the coastal signalisation)	Support acquisition of state-of-the-art vessels equipped with advanced machines to perform marking operations
	Insufficient number of buoys, including AIS AtoNs	Support acquisition of intelligent marking system, including AIS AtoNs
R0 11	No automated system available for the monitoring of buoy position and the dissemination of marking information	Support the establishment of an automated monitoring system, including the dissemination of current marking information

RO 4.4. Information

Data regarding **water levels** and water temperature is gathered and provided for the users for 36 gauging stations at least on a daily basis. Additionally, a hydro-meteorological bulletin and a forecast for 48 hours related to three ports are published each day. Meteorological information is available once per day for the gauging station areas.

Water level forecasts are provided daily by AFDJ and ACN in cooperation with the Romanian National Institute for Hydrology and Water Management (INHGA) for 18 gauging stations along the Danube for seven days in advance and for the next three days in advance for all 8 stations along the navigable canals.

Information on fairway depths is available at a 10 cm scaling daily. Bathymetrical IENCs do not exist. The surveying results are published on user information portals as needed.

		Key issues	Need for action
RO 12		No water level forecast covering the entire Romanian Danube	Support geographical extension of the existing forecast to further gauges and continuous improvement of the forecast quality
13		User information should be provided customer-friendly using established river information portals	Support customer-friendly processing and dissemination of information
R(Bathymetric data is not available in the IENCs	Support the upgrade of IENCs with bathymetric information



RO 14	Insufficient number and quality of weather stations	Support improvement of meteorological information
RO 15	Insufficient user information regarding the clearance under bridges	Support acquisition of sensors to measure vertical bridge clearance

RO 5 Ecological status/potential and ecological compatibility of maintenance measures

On the Romanian territory the waterway is divided into the riverine Danube, from entering the country to Braila and the maritime Danube from Braila to its mouth in the Black Sea. Additionally, two artificial water bodies, the Danube - Black Sea Canal (DBSC) and Poarta Alba - Midia - Năvodari Canal (PAMNC), provide a connection with the Black Sea.

According to the Danube River Basin Management Plan – Update 2021, the ecological status/ ecological potential of the Romanian Danube water bodies are as follows: for Iron Gates I, Iron Gates II, Iron Gates II - Chiciu, Chiciu - Isaccea and Isaccea – Sulina, which are heavily modified water bodies (HMWB), the ecological potential is assessed as moderate. Regarding the Chilia and Sf. Gheorghe branches which are natural water bodies, the ecological status is assessed as good. In addition, the artificial water bodies Danube - Black Sea Canal (DBSC) and Poarta Alba - Midia -Năvodari Canal (PAMNC) are assessed in good potential.

The Romanian sector of the Danube is covered by 32 sites of the Natura 2000 Network,14 SCI (Habitats Directive) and 18 SPA (Birds Directive).

For any kind of dredging interventions in the Romanian Danube sectors, as well as for dredging in the navigable canals, permits have to be acquired (Environmental licence/Autorizația no. 284 din 13.11.2013). The Environmental Protection Agency issues permits for dredging to be carried out in different river sectors (e.g. for the Giurgiu branch of AFDJ or the Galati branch). The permits are not issued individually for each dredging operation, but must be renewed at regular intervals and depend on the dredging technology.

For dredging in the Danube Delta an additional permit has to be acquired from the Administration of the Danube Delta Biosphere Reserve (Environmental licence/Autorizația no. 1154 din 25.02.2013). It allows the dredging at selected critical locations in the Danube Delta and the discharge of the dredged material in pre-selected discharge areas.

To monitor the water quality during dredging activities, AFDJ plans to use sensors to monitor the chemical and physical condition of the water (see key issue R0 04).

As dredging activities can lead to large quantities of suspended sediment that might pose a risk to especially sensitive ecological areas, including habitats for sturgeon and other migratory fish, in the vicinity of the dredging activities, real-time monitoring of suspended sediment levels is being considered by the Romanian waterway administrations that would require respective sensors (see key issue RO 04), but would allow the temporary suspension of dredging activities until the conditions return to normal¹⁰.

¹⁰ Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document No. 36 on Exemptions to the Environmental Objectives according to Article 4(7).



Bulgaria

BG 1 Characteristics of the Danube waterway

The common Danube stretch of Bulgaria and Romania reaches 471 km from the western Bulgarian border at rkm 845.5 until Silistra in the east. Bulgaria and Romania agreed on splitting the responsibility for the joint cross-border section (based on a bilateral agreement from 1955) to ensure minimum fairway depth on the joint border stretch. From rkm 610 to rkm 375, Bulgaria is responsible for waterway rehabilitation and maintenance. In the Bulgarian-Romanian section, the Danube is a typical lowland free-flowing river (66% of the common stretch), it becomes shallower and broader further downstream and has a big seasonal difference of water levels (> 9m). The width of the riverbed varies form 600-720 m, while the river banks are steep, in some places up to 150m. The water discharge is not so much influenced by the tributaries, but, especially in the upper sections, directly dependent on the operation mode of the hydrotechnical complex Iron Gates and characterised by large daily fluctuations (up to >1m). Due to the active hydro-morphological processes in this river section, the riverbed constantly changes its geometrical and hydrological parameters. Sediment transport (mostly sand) and depth erosion are intense.

Responsible for fairway maintenance / data provided by	EAEMDR – Executive Agency "Exploration and Maintenance of the Danube River" (subsidiary of the Ministry of Transport, secondary manager of the budget)	
Number / length of critical locations of high priority	29 / 86 km (36% of the stretch under Bulgarian responsibility)	
	all locations are cross-border locations shared with Romania	
Medium length of critical locations	2,900 metres (variation 2,000 – 5,000 metres) The extent of the bottlenecks is indicated very generously, as a larger area must be monitored regularly.	
Main issues in waterway maintenance – high priorities	Insufficient number of skilled staff and insufficient budget for rehabilitation and maintenance	
Annual operating cost for needed actions	Operational costs / year: approx. 4 500 000 EUR	

BG 2 Fairway maintenance basic data

BG 3 Critical Locations

Locat	ion / Length (km)	1	right bank /	Name of costor / logation
River-km (from / to)		Length	left bank	Name of Sector / location
609.00	607.00	2.00	BG / RO	Somovit
591.00	589.00	2.00	BG / RO	Lakyt Island
586.00	584.00	2.00	BG / RO	Palets Island
576.00	573.00	3.00	BG / RO	G. Byrzina Island
569.00	567.00	2.00	BG / RO	Milka Island
565.00	563.00	2.00	BG / RO	Belene Island
562.00	559.00	3.00	BG / RO	Kondur Island



557.00	554.00	3.00	BG / RO	Svishtov
547.00	544.00	3.00	BG / RO	Vardim Island
543.00	540.00	3.00	BG / RO	Gyska Island
538.00	535.00	3.00	BG / RO	Yantra river
533.00	530.00	3.00	BG / RO	km 533.000 - 530.000
523.00	520.00	3.00	BG / RO	Batin Island
518.00	514.00	4.00	BG / RO	Stylpishte
513.00	510.00	3.00	BG / RO	Kama island
507.00	504.00	3.00	BG / RO	Dinu Island
491.00	486.00	5.00	BG / RO	Dunav Most
476.00	472.00	4.00	BG / RO	Gostin Island
463.00	460.00	3.00	BG / RO	Mishka Island
458.00	455.00	3.00	BG / RO	Bryshlian Island
439.00	436.00	3.00	BG / RO	Radetski Island
428.00	425.00	3.00	BG / RO	Kosui Island 2
425.00	422.00	3.00	BG / RO	Kosui Island
422.00	420.00	2.00	BG / RO	Dunavets
414.00	410.00	4.00	BG / RO	Albina Island
407.00	405.00	2.00	BG / RO	Garvan Island
401.00	398.00	3.00	BG / RO	Vereshti Island
394.00	390.00	4.00	BG / RO	Vetren Island
385.00	382.00	3.00	BG / RO	Chaika Island



Bulgaria: Overview of Critical Locations



BG 4 Overview of action points

BG 4.1. Monitoring

Monitoring of the fairway is executed based on an annual work plan established by EAEMDR. In some areas, Romania and Bulgaria execute common monitoring based on the work plan elaborated by an inter-ministerial committee (see "Planning"), e.g. in the critical Belene area. Two state-of-theart surveying vessels with multi-beam equipment are available to EAEMDR since 2018. These vessels operate with multi-beam equipment which is no longer produced by the manufacturer;



equipment malfunctions may not be repaired in the future. In critical sections, detailed river bed surveying is performed at least once a year but basically as needed, with multi-beam technology. The area of the two bridges (Ruse-Guirgiu and Vidin-Calafat) is surveyed twice a year during high and low water periods. Basic monitoring of the fairway condition using single-beam echosounders and, of course, the monitoring of the **fairway marking** is conducted as part of regular monitoring cruises with the marking vessels about four times a month, more often during low water periods. That way, the critical sections are monitored at a high intensity.

Water levels and water temperature are measured by nineteen automatic gauging stations, nine of which are outdated, high-maintenance and some parts are no longer manufactured. The information is submitted every 15 minutes to a database.

	Key issues	Need for action
BG 01	Partly outdated measuring equipment and inability to secure repairs	Support acquisition of up-to-date monitoring equipment, in particular sensors (incl. possibly ACDP, MB sensor)
BG 02	Old automatic gauging network	Support acquisition of new or upgrade of existing gauging stations
BG 03	Limited number of skilled personnel	Secure education and provision of well- trained staff in the short, medium and long term

BG 4.2. Planning

The **planning of monitoring, execution and information activities** is based on an agreement on maintenance and improvement of the Danube River between Romania and Bulgaria endorsed in 1955. A joint Bulgarian-Romanian Commission for Maintenance and Improvement of the Fairway was established. This Commission prepares annual monitoring and maintenance action plans. Based on these, EAEMDR elaborates annual work plans for monitoring and fairway maintenance interventions. A catalogue of the critical sections has also been prepared. The decisions about possible interventions are based on monitoring results, water level forecasts or information received from waterway users. The assessment of the measures is undertaken as well.

In recent years, a Waterway Management System (WAMS) was acquired which enables systematic and consolidated storage of different hydrological and hydrographical data and supports various internal planning and information provision steps. In the interest of the ongoing digitalisation of the tasks of waterway management, the functions of this tool are to be extended in the future.

	Key issues	Need for action
BG 04	Inefficient planning and information provision procedures	Support further development of the existing waterway management tool (WAMS)



BG 4.3. Execution

As a general principle, the option of **fairway marking** should always be exploited to the maximum before taking any physical actions. Marking activities are one of the main concerns of EAEMDR. The fairway alignment is adapted about 50 times a year. One modern multifunctional marking vessel is currently available for regular marking operations; the second marking vessel which is required to cover the entire stretch of the Danube managed by the EAEMDR in an acceptable time and to improve response time is nearing its service life expectancy. There are currently between 20 to 30 AIS AtoNs in operation on the Bulgarian part of the Danube, but their technology is becoming outdated.

In recent years, the EAEMDR has relied on third parties to carry out the necessary **dredging activities** on the Danube. By means of framework contracts, more than 850 000 m³ sediment were dredged and reinserted into the Danube in the period 2018-2020. EAEMDR additionally owns own dredging equipment and barges for transportation of the dredged material. The available equipment is particularly suitable for larger interventions. However, the most important point will be to have the necessary budgetary means available in the long term and annually to perform dredging operations.

	Key issues	Need for action
BG 05	Lack of dredging equipment for quick interventions	Support acquisition of up-to-date self- propelled dredging equipment
BG 06	Large number of interventions bring disruptions to shipping and the environment	Support implementation of capital dredging to reduce the number of needed interventions
BG 07	Insufficient budget for dredging interventions	Secure budget resources for maintenance dredging operations
3	Insufficient number of buoys, including AIS AtoNs	Support acquisition of intelligent marking system, including AIS AtoNs
BG 08	No automated system available for the monitoring of buoy position data and the dissemination of marking information	Support the establishment of an automated monitoring system, including the dissemination of current marking information
BG 09	Lack of efficient marking vessels and special equipment for marking	Support acquisition of state-of-the-art vessel equipped with advanced machines to perform marking operations
BG 10	Limited number of skilled personnel (regarding fairway marking and dredging)	Secure education and provision of well- trained staff in the short, medium and long term



BG 4.4. Information

Nine electronic displays facing the river inform about **water levels, water and air temperature** at nine automatic gauging stations. The information is published on a daily basis on the EAEMDR website. **Water level forecasts** are available for the following gauges: Ruse, Silistra, Oryahovo, Nikopol and Svishtov, serving as indicator for the most important critical locations. The forecast is provided in cooperation with the Romanian National Institute for Hydrology and Water Management (INHGA) for seven days in advance (https://www.appd-bg.org/exploration#data_hydro-bg).

Information on fairway depths of critical sections is published online once a day. Schemes of critical areas can also be found on the Agency's website, which are based on regular hydrographic measurements.

Notice to Skippers inform about changes in navigational conditions and the alignment of the fairway. In addition, a bulletin, based on the NtS is prepared and published on the website of EAEMDR. A Hydro-meteorological bulletin is available on the web site as well.

If needed, particularly during low water periods, the marking ship stays in the most critical sections to assist the skippers.

	Key issues	Need for action
BG 11	User information, incl. IENCs, should be provided customer-friendly using established river information portals	Support customer-friendly processing and dissemination of information, incl. bathymetric IENCs

BG 5 Ecological status/potential and ecological compatibility of maintenance measures

The whole Bulgarian stretch of the Danube River is classified as Heavily Modified Water Body with moderate ecological potential. About 60% of the Bulgarian Danube is covered in total by 19 Natura 2000 sites and is therefore protected under the EU Nature Directives.

After the tentative plan for dredging activities for the coming year is prepared in autumn/winter, this plan is sent to the Ministry of Environment and Water for basic approval. During the year, before actual dredging is performed, EAEMDR notifies the Danube Basin Directorate (an entity inside the Ministry of Environment and Water) about the location of the dredging activities and the area where the sediment will be deposited again. Apart from the Srébarna Biosphere Reserve downstream of Silistra, EAEMDR can carry out dredging in the waterway. Consideration must be given to fish habitats and critical times (especially spawning times) when planning dredging operations.



Moldova

MD 1 Characteristics of the Danube waterway

The Danube stretch of Moldova is only about 500 metres long and is restricted to the port area of Giurgiulesti.

MD 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	Fairway administration and maintenance of the Danube waterway in Moldova is carried out by the Romanian AFDJ on the basis of a bilateral agreement
Number / length of critical locations of high priority	There are no critical locations.
Medium length of critical locations	-
Main issues in waterway maintenance – high priorities	None
Annual operating cost for needed actions	None

MD 3 Critical Locations

There are no critical locations in Moldova.

MD 4 Overview of action points

There is no need for action.

MD 5 Ecological status/potential and ecological compatibility of maintenance measures

From the side of Moldova, no particular assessment of the ecological status/potential is available for the border section of the Danube between Moldova and Romania. From the side of Romania, data on this river stretch is available. The Danube is classified as HMWB with moderate or worse ecological potential.

Since there are no critical sections on the short stretch of the Danube, there is no need for rehabilitation or maintenance works.



Ukraine

UA 1 Characteristics of the Danube waterway

The Kiliya branch is one of the natural branches of the Danube delta that connects the Ukrainian river ports of Izmail and Kiliya to the Black Sea. The length of the Danube navigation route by natural free-flowing channels is 172.36 km, which passes as follows:

- border with Moldova to the cape Ismail Chatal (72 43 mm / rkm 133.59 79.64) joint border stretch (maritime stretch) with Romania; 4 critical locations
- the cape Ismail Chatal to Vylkove (43 mm 20.55 km¹¹ / rkm 116.00 18.00 Chilia branch)
 the mouth Kilijske; 13 critical locations

This section is a natural deep-water stretch with two-way vessel traffic (width at the bottom is 120 m).

- Vilkovo to the beginning of the mouth Bystre (Starostambulske) (20.55 11 km / km 18.00 11.00)
- the entrance to the sea approach channel (11 1.57 km)
- sea approach channel (1.57 -1.85 km)

The section of the Danube from Cape Izmail Chatal to the Black Sea is, in accordance with the List of the Navigational Characteristics of Main European Inland Waterways of International Importance ("Blue Book") of the UNECE, defined as the E80-09 waterway.

Maintenance of the common stretch between Romania and Ukraine from Reni to Kilia mouth is provided by Romania in accordance with Article 8 of the Belgrade convention (1948) and according to the Danube Commission's Plan of major works aimed at achieving the recommended dimensions of the fairway, hydrotechnical engineering and other structures on the Danube River.

State enterprise "USPA - Ukrainian Sea Ports Authority" is responsible for both capital interventions (implementation of the new project for reconstruction of the Ukrainian fairway) and maintanence of the existing depths and is providing regular dredging works by means of its own dredging fleet. In 2021, dredging was conducted by means of the trailing suction hopper dredger "Ingulskii" (Damen shipyard design).

UA 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	The State Enterprise «Ukrainian Sea Ports Authority» of the Ministry of Infrastructure of Ukraine
Number / length of critical locations of high priority	17 / 37 km (21.5% of stretch of the national and common stretch of the Danube river)
Medium length of critical locations	2,200 metres (variation 500 – 3,700 metres)

¹¹ The countdown of river kilometers of the mouth Kilijske starts from the mouth Bystre '0'.



Main issues in waterway maintenance – high priorities	Ensuring compliance with the international environmental conventions and bilateral agreements with Romania, namely Espoo Convention, in order to implement a new project.
Annual operating cost for needed actions	Considering that only maintenance dredging is currently being conducted on the sea approach channel in accordance with the annual sedimentation volume of 470,000 m ³ , approx. 1 500 000 EUR are needed (status 2021).

UA 3 Critical Locations

Danube

Location / Length (km)			right bank /	Name of contar / logation
River-km (from / to)		Length	left bank	
117.00	116.10	0.90	RO / UA	Lata Crapina Shoal
116.70	113.50	3.20	RO / UA	Reni
107.40	103.70	3.70	RO / UA	Isaccea
88.90	85.80	3.10	RO / UA	Skunda Shoal

Chilia and Bystroe

Location / Length (km)		right bank /	Name of contar / location	
River-km	(from / to)	Length	left bank	
115.00	112.50	2.50	RO / UA	Mouth Kilijske
76.50	76.00	0.50	RO / UA	Kislitskiy Island (upstream)
74.00	72.00	2.00	UA / UA	Malyy Tataru Shoal
70.00	68.50	1.50	UA / UA	Malyy Tataru Island (downstream)
65.80	64.00	1.80	UA / UA	Bol'shoy Daller Shoal
63.00	61.00	2.00	UA / UA	Bol'shoy Daller Island (downstream)
53.00	51.20	1.80	RO / UA	Katen'ka Shoal
49.30	46.50	2.80	RO / UA	Kilijskiy Shoal
38.30	36.40	1.90	RO / UA	Salmanovskiy Shoal
32.50	30.00	2.50	RO / UA	Yermakov Island (upstream)
29.70	27.30	2.40	RO / UA	Yermakovskiy Shoal
25.50	22.00	3.50	RO / UA	Yermakov Island (downstream)
11.00	10.00	1.00	RO / UA	Bystroe / Starostambulsk bifurcation





Ukraine: Overview of Critical Locations

UA 4 Overview of action points

UA 4.1. Monitoring

Monitoring of the fairway consist of sounding works to collect data on the riverbed and the water depth for navigation activities as well as for establishing and maintaining updated river navigation charts. The works are regularly performed by the State Institution "Derzhhydrographiya".

Water levels observation on the Ukrainian part of the Danube River on a regular basis is performed by the units of the Hydrometeorological Center of Ukraine on the 6 water level gauges.



UA 4.2. Planning

The Ukrainian Sea Ports Authority – USPA is responsible for the planning of rehabilitation and maintenance activities. There are no key issues regarding the planning of waterway management measures.

Ukraine provides all the necessary conditions with regards to the safety of navigation in accordance with EU standards and international requirements for TEN-T transport corridors, namely: round-theclock monitoring, provision of information services through RIS, AIS, AtoNs systems, provision of the pilotage.

UA 4.3. Execution

Fairway marking: The Ukrainian part of the Danube is equipped with the aids to navigation which are maintained in a proper condition as required by the Danube Commission (Instructions for Placement of Floating Signs on the Danube River). In case the aids to navigation are out of service, the repair works are conducted within the shortest possible time.

Starting from June 2014 only maintenance **dredging activities** are performed on a limited section, namely on the sea approach channel. Mentioned works are carried out to ensure the safety of navigation, to support navigation parameters of the channel and to prevent accidents. In order to ensure maintenance of the waterway, USPA during 2020-2021 performed operational dredging works on the sea approach channel of the deep-water navigable route on the Ukrainian part of the Danube delta by means of its own dredging equipment. Comprehensive environmental monitoring was continued during the operation in the sea approach channel under the general direction of the State Environmental Authority.

Works on the section of the Danube River - namely dredging river shallow sections located along the state border with Romania - are carried out as works in transboundary waters. These are regulated by the bilateral agreements between the governments of Ukraine and Romania on the Ukrainian-Romanian State Border Cooperation and Mutual Assistance on Border Issues (signed on 17.06.2003, entered into force on 12.05.2004) and the Agreement between the Government of Ukraine and the Government of Romania on Cooperation in the Field of Water Management in Transboundary Waters (signed on 30.09.1997, entered into force on 28.01.1999).

Within the measures included in the roadmap, developed to bring the project of Construction of a deep-water navigable route Danube-Black Sea in the Ukrainian part of the delta into full compliance with the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) and implementation of a large-scale reconstruction project on the Ukrainian part of the Danube delta Ukrainian Sea Ports Authority has undertaken further steps for the implementation.

The new project consists of three stages and foresees the creation of the waterway for the navigation of vessels with a draft of 7.2 m, width of 17 m and length of 125 m.

In 2020/2021 public hearings were held, as well as consultations with the Romanian side, and a technical specification has been developed for additional environmental studies and procedures, taking into account comments on public hearings and consultations, including in transboundary consultations. The implementation of this project will help restore the sustainable operation of the ports of the Danube region of Ukraine, in particular Reni and Ust-Dunaisk and their transit potential, increase cargo flows from the countries of the Mediterranean basin, South and Southeast Asia through the territory of Ukraine. The implementation of the project will contribute to better integration of Ukraine into the Rhine-Danube Corridor.



	Key issues	Need for action
UA 01	Maintenance of the waterway	Ensuring compliance with the international environmental conventions (Espoo Convention - Convention on Environmental Impact Assessment in Transboundary Context) and bilateral agreements with Romania

UA 4.4.Information

Information on fairway depths, detected navigational hazards, performance of navigational equipment is constantly brought to the attention of skippers upon detecting changes in fairway marking.

Bringing information to skippers is performed by means of publication in the Notices to Mariners of Ukraine and transfer of navigational warnings in the NAVTEX system.

UA 5 Ecological status/potential and ecological compatibility of maintenance measures

For Ukraine, information on the ecological status according to the DRBMP 2021 is missing. All three water bodies of the Danube are "Natural Water Bodies".

The lower section of the Ukrainian Danube is part of the Danube Biosphere Reserve protected by Ukrainian legislation and by the UNESCO (Danube Delta Biosphere Reserve). Conservation objectives have to be respected.



4. Transnational issues

Need for coordinated actions

In recent years, the waterway management authorities along the Danube have cooperated very closely. Data and experience are regularly exchanged, joint acquisitions were made and various harmonisation efforts were undertaken, while national sovereign responsibilities remain untouched. There are three major topics that can only be addressed together: the need to harmonise waterway-related data as a basis for various other services, the expectations of the shipping industry of a certain level of service in terms of the provision of fairway information and the consequences of climate change for the use of the Danube as a waterway.

Overview of action points

Centralised platform for harmonised waterway-related data

In recent years, there has been a focus on improving and harmonising the quality of hydrological and hydrographic data, exchanging these data and sharing them among waterway managers as a basis for waterway monitoring, reporting activities and the provision of user information. These efforts resulted in a centralised platform, the so-called **WAMOS System**, during the last funding period, where such data is collected in a harmonised format and of similar quality. The data can be analysed and processed and is equally available to all other waterway administrations. The potential of this platform needs to be expanded in the future. Currently, data is collected and shared among the following countries: Austria, Slovakia, Hungary, Croatia, Serbia, Romania and Bulgaria. An extension to other countries is conceivable in the future but currently not concretely planned. It is emphasised that the WAMOS system is not a user information platform, but a monitoring and analysis tool available to the waterway users. For this purpose, from June 2022 the system EuRIS (European River Information Services) will be operational at European level, which was developed within the RIS COMEX project.

	Key issues	Need for action
Transnational 01	Waterway-related data was largely collected in a decentralised manner and with varying data quality	Support the further development of the Waterway Monitoring System (WAMOS) as centralised platform for the monitoring and analysis of waterway related data

Harmonised Fairway Information Services

Currently, various national and transnational **user information platforms** are in operation to provide up-to-date fairway information services to the waterway users. With the Danube FIS Portal (<u>https://www.danubeportal.com/</u>), an important step towards a common and harmonised publication of fairway-related information was implemented for the majority of the Danube riparian states; the Danube FIS Portal is operated in addition to the national platforms of the individual Danube riparian states. Currently, the following countries provide information via the Danube FIS



Portal: Austria, Slovakia, Hungary, Croatia, Serbia, Romania and Bulgaria. A Service Level Agreement on the update frequency and quality of data on the FIS Portal was concluded among the Network of Danube Waterway Administrations (from the above listed countries) in 2019. Within the RIS COMEX project the system EuRIS (European River Information Services) is developed at European level, which will go operational in June 2022.

This situation, which has evolved over the years, is however still inefficient for both waterway users and waterway administrations, as each portal means operation costs and substantial efforts to keep the platforms up-to-date.

	Key issues	Need for action
Transnational 02	User information is provided in very different quality and frequency Large variety of different national and transnational user information platforms	Support the provision of harmonised user information of the same quality and regularity in all countries (e.g. bathymetric IENCs or high-quality water level forecasts) and accelerate the collective use of one single transnational system as single point of information for the waterway users

Concerted approach to managing the impacts of climate change

Climate change poses unprecedented challenges for waterway operators. The actual effects of climate change on the future flow regime of the Danube and its navigable tributaries, and subsequently on waterway management, are still insufficiently researched. Precipitation patterns are complex and uncertain; climate change will affect different regions at different rates. Therefore, there is great uncertainty about the long-term seasonal and geographical outlook, which makes it difficult to develop adaptation strategies and estimate the resources needed for maintenance. Two general approaches shall be developed: firstly, reduce confidence intervals and close knowledge deficits, especially regarding the expected effects of climate change. Secondly, flexible and adaptive infrastructure management approaches shall be developed that can cope with a wide range of possible climate change effects in particular by applying nature-based solutions.

	Key issues	Need for action
Transnational 03	Great uncertainty in the assessment of climate change impacts on waterway management	Support science and research in reducing knowledge deficits in the assessment of climate change impacts for all parts of the Danube
Transnational 04	Lack of adaptation strategies for dealing with extreme events and changed flow regimes	Support the development of flexible adaptation strategies for dealing with changing conditions, in cooperation with the users of the waterway


5. Environmental issues

Apart from the impact of navigation and infrastructure-related laws on rehabilitation and maintenance activities, further legislation related to aspects such as forests, fishery, flood risk and environment need to be considered.

New river engineering projects to develop the waterway as well as structural measures to remove navigation-relevant restrictions are not part of this Master Plan, as they do not directly relate to fairway maintenance (cf. 2.3). Nevertheless, also in the context of waterway maintenance and rehabilitation, official notifications/consultation, mutual agreement or permits from the competent national authorities are required in relation to water law, nature conservation law and (in some countries) national park law.

The authorities responsible for issuing these environmental permits adhere to the objectives of the legal instruments of the European Union, such as the Water Framework Directive (2000/60/EC (WFD)), the Environmental Impact Assessment Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC), the latter two underpinning the NATURA 2000 network. Further relevant Directives are the Strategic Environmental Impact Assessment Directive (2001/42/EC), the Flood Risk Management Directive (2007/60/EC), the Drinking Water Directive (2020/2184/EU) and the Public Participation Directive (2003/35/EC), as well as corresponding national legal instruments.

Implications of the EU Water Framework Directive (WFD) (2000/60/EC)

The Water Framework Directive requires Member States in Article 4(1)(a) (i) to "implement the necessary measures to prevent deterioration of the status of all bodies of surface water". This so-called "non-deterioration principle" is of particular relevance in the context of waterway management. Article 4(1)(a) (ii) and (iii) further requires Member States to protect, enhance (and restore) all bodies of surface water in order to reach or keep the good chemical status and the good ecological status (or ecological potential, if the water body is classified as heavily modified or artificial) by 2015. Exemptions from these objectives are possible under certain conditions. An assessment of the situation and measures towards the achievement of these goals must be laid down in River Basin Management Plans (RBMP). As these goals were not achieved for all water bodies by 2015, updates of the RBMP were foreseen in 2015 and 2021. The International Commission for the Protection of the Danube River Basin Management Plan (DRBM) by the end of 2021¹².

The DRBMP addresses the key issues requiring joint actions on the basin-wide level (Part A) and states that "inland navigation can contribute to making transport more environmentally sustainable, particularly where it can act as a substitute for road transport. It can, however, significantly influence river ecosystems, potentially jeopardizing the goals of the WFD." This potential conflict is recognised by the River Commissions, which initiated the cross-sectoral Joint Statement process as a result, and the waterway administrations alike. According to the Danube River Basin Management Plan 2021-2027, 67% of the entire Danube are classified as heavily modified water bodies (HMWB). The navigable canals (DBSC and PAMNC) are of course artificial water bodies.

Based on practical experience of the waterway administrations, maintenance activities do not have significant negative influence on the status of a waterway in the majority of cases. However, in cases

¹² <u>https://www.icpdr.org/main/publications/danube-river-basin-management-plan-drbmp-update-2021</u>



where maintenance activities are liable to cause deterioration of the water status or put at risk the achievement of environmental objectives, they may only be authorised when all conditions under the exemption of article 4(7) WFD are met¹³:

(a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

(b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;

(c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

(d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

The involvement of authorities (and stakeholders) concerned with the implementation of the WFD is therefore necessary. The country chapters therefore contain information on the procedures to be followed and the authorities to be involved by the waterway managers prior to physical interventions (dredging).

The Common Implementation Strategy for the Water Framework Directive (2000/60/EC), **Guidance Document No 36 on Exemptions to the Environmental Objectives according to Article 4(7)**¹⁴, provides further guidance to waterway managers and stakeholders in the implementation of article 4(7) of the WFD.

The map below displays the ecological status and ecological potential of the Danube and its navigable tributaries, according to the Danube River Basin Management Plan/Update 2021.

Implications of the Habitats Directive and other nature protected areas or species

The Birds and Habitats Directives contain a comparable non-deterioration principle as laid down in the Water Framework Directive, as they aim to ensure the survival of Europe's most endangered and vulnerable species and ecosystems. Based on the provisions of the Birds and Habitats Directives Member States must additionally undertake positive management measures to ensure that populations and habitats are maintained in or restored to a favourable conservation status (FCS).

Natura 2000 sites are not excluded from further infrastructural development (or regular maintenance activities). Planned projects need to be assessed regarding their impact on existing genetics, species and ecosystem diversity and, if necessary, rejected or accepted with conditions.

As it is the case within the Water Framework Directive, maintenance activities are usually not seen as "project", as defined by the Habitats Directive. Thus, a full environmental impact assessment is only necessary in exceptional cases. However, if a maintenance measure might have a significant influence as regards the objectives of the Habitats Directive, an assessment has to be performed. In this case, basically the same (but strongly simplified) procedures apply as within a standard impact assessment. For further guidance on the application of the Birds and Habitats Directives in navigation related

 $^{^{13}}$ Which is subject also to the provisions of Art. 4(8) and 4(9).

¹⁴ https://circabc.europa.eu/sd/a/e0352ec3-9f3b-4d91-bdbb-939185be3e89/CIS_Guidance_Article_4_7_FINAL.PDF



activities, a reference is made to the **Guidance Document on Inland Waterway Transport and Natura 2000**¹⁵, issued by the European Commission's Directorate-General for Environment in 2018.

Parts of the Danube and its floodplains have other types of nature protection status such as National Park, Biosphere Reserve or national protection schemes. The management objectives and obligations of these types of reserves are also to be respected.

The Danube River Basin Management Plan Update 2021 underlines the importance of sturgeon conservation as a flagship undertaking of the 15 parties to the ICPDR and contains an up-to-date map of sturgeon habitats. These habitats and additional habitats that might be identified in the future must not be deteriorated by fairway maintenance and rehabilitation works.

Application of the Joint Statement principles

In October 2007, a "Joint Statement on Inland Navigation and Environmental Sustainability in the Danube River Basin" was concluded by the ICPDR, the Danube Commission and the International Sava Commission. The Joint Statement is in essence aimed at finding the balance between GES, FCS and GNS (as required by the WFD, the Birds and Habitats Directives and the TEN-T Regulation respectively). The statement provides integrative guiding principles and criteria for the planning and implementation of waterway projects with a strong focus on future river engineering projects on the Danube and its navigable tributaries. It opts for an interdisciplinary planning approach and the establishment of a "common language" across all disciplines involved in the process.

The Joint Statement (...) "addresses, first of all, structural interventions and measures on rivers serving inland waterway transport; non-structural measures will also have to be undertaken to successfully upgrade and sustain inland waterway transport economically. (...) Full respect of the existing legal framework, including all relevant transport and environment legislation (national legislation, EU directives and international requirements), is a precondition for any activity in the Danube region."

Some of the most important principles included in the Joint Statement refer to the **early involvement of key stakeholders** and the **creation of a transparent planning process based on comprehensive data**. The Master Plan as such and the continuous updates of national action plans have been also created for this reason. In the years after 2007, the responsible government authorities and interest groups met regularly to discuss the progress achieved so far and how to improve the application of the Joint Statement in waterway projects.

Activities on the Fairway Rehabilitation and Maintenance Master Plan have also been presented in the framework of these regular meetings, as well as in the context of the interdisciplinary PA1a Steering Group meetings of the European Union Strategy for the Danube Region.

The rehabilitation and maintenance measures and activities monitored within the context of the Master Plan (surveying, fairway relocation, dredging and better information) have the character of reversible interventions, as recommended by the Joint Statement. Effects of measures are monitored and – if relevant – adapted in the context of the national permitting processes.

¹⁵ https://op.europa.eu/en/publication-detail/-/publication/6c766acc-8d84-11e9-9369-01aa75ed71a1



Sediment management

The DTP Danube Sediment project (<u>www.interreg-danube.eu/approved-projects/danubesediment</u>) discovered that only around 10% of the Danube shows a dynamic balance between sedimentation and erosion while over half of the Danube River shows a tendency to erosion. Among the drivers for this trend are navigation measures. The Sediment Manual for Stakeholders issued by the project contains expert recommendations for intelligent dredging and feeding management such as refeeding of the dredged sediments to mitigate riverbed incision by transferring the sediments upstream or downstream to areas where sediments are missing, respectively the water depth is large enough; a bedload trap to intercept bedload before it reaches shallow sections and to gather sediment for further bedload management, or adding (external) coarser sediments.



To be Products

Ecological Status and Ecological Potential of Surface Water Bodies

DRBMP Update 2021 - MAP 23



This ICPDR product is based on national information provided by the Contracting Parties to the ICPDR (AT, BA, BG, CZ, DE, HR, HU, MD, ME, RO, RS, SI, SK, UA) and CH. EuroGlobalikap data from EuroGeographics was used for all national borders except for AL, BA, ME where the data from the ESR World Countries was used; Shuttle Radar Topographics was used for all national borders except for AL, BA, ME where the data from the ESR World Countries was used; Shuttle Radar Topographics was used for all national borders except for AL, BA, ME where the data from the European Commission (Joint Research Center) was used for the outer border of the DRED of AL, IT, ME and PL.

Vienna, November 2021



6. Synthesis of key issues

Since the endorsement of the Master Plan in 2014, significant steps have been taken for its implementation. More than 75 million EUR have been invested, partly through EU co-financed projects within the Connecting Europe Facility, the national Operational Programmes and the Instrument for Pre-Accession (IPA). The operative use of this new equipment for targeted rehabilitation and maintenance measures has gradually improved the physical fairway conditions as well as the information situation for the waterway users in several countries.

Despite this fact, the past years of Master Plan implementation have also shown that lack of equipment and digitalisation leads to inefficient processes in waterway management. Complementing the new equipment (e.g. monitoring equipment, monitored Aids to Navigation, multi-functional dredging equipment), upgrading information systems where required and securing sufficient and regular operational budgets at the national level remain to be the key challenges for the next years. This problem is exacerbated by staff shortages and (partly caused by) lack of sufficient yearly budgets. This Master Plan therefore estimates the required operational costs per country in order to achieve their respective target Levels of Service, based on the circumstances of the last years. Unforeseen extreme weather events and floods require specific measures and additional budget. Compliance with environmental legislation and policies also requires specific attention.

The waterway management authorities governing the Danube and its navigable tributaries have estimated **annual operational costs of more than 36.3 million EUR** in order to bridge the gap between the current status quo in fairway maintenance and management and the different target Levels of Service. Additional investments are needed for **dredging equipment**, **riverbed surveying and fairway marking equipment**. In terms of regional distribution, the majority of investments will be needed on the Lower Danube (particularly Romania and Bulgaria).

Costs included in the following table only relate to needs identified for waterway maintenance and management activities to preserve/restore an already approved state. River engineering projects to develop the waterway as well as structural measures to remove navigational limitations (also due to bridge clearances and lock dimensions) are not part of this Master Plan, as they do not directly relate to fairway maintenance (cf. 2.3). Therefore, the costs for such projects planned or ongoing in the various Danube riparian countries are excluded in this report. The focus of this report lies on annual efforts for routine or day-to-day fairway maintenance activities in each riparian country, in order to reach their different target Levels of Service.

In a more detailed way, the tables provided on the following page specify the identified annual operational costs by need areas and Danube countries.

Operational costs, approx. annual expenditures 2016-2020

	Countries	Germany	Austria	Slovakia	Hungary	Croatia	Serbia	Bosnia and Herzegovina	Romania	Bulgaria	Ukraine	
Need areas	countries		viadonau	SVD			Blowput	Theregoving		EAEMDR		
Neeu areas		VV S V	viauoriau	375	UVF		Ριονραί		AFDJ + ACN	EAEIVIDK	USPA	
Minimum fairway parameters (depth / width)		2 000 000	2 400 000 ²	1 700 000	-	900 000		-	3 900 000	$2\ 000\ 000^4$		
Surveying of the riverbed		-	850 000	100 000	100 000	23 000		-	900 000	125 000		
Water level gauges		-	1 000 000 ³	-	-	10 000	able	-	-	50 000 ⁵	able	
Marking of the fairway		-	740 000	500 000	600 000	116 000	vaila	too little data	3 800 000	250 000	vaila	
Availability of locks / lock chambers		-	-	-	-	-	ta a	-	4 500 000	-	ta a	
Information on water levels and forecasts		-	120 000	-	too little data	30 000 (DHMZ)	e da	-	-	50 000 ⁵	e da	
Information on fairway depths		-	-	-	too little data	-	littl	-	-	7 000	littl	
Information on marking plans		-	-	-	too little data	-	too	-	-	7 000	too	
Meteorological information					-	5 000 (DHMZ)		-	-	50 000 ⁵		
Other needs		-		-	-	-		-	100 000	20 000		
Sum		2 000 000	5 110 000	2 300 000	700 000	1 084 000	ХХ	xx	13 200 000	2 559 000	ХХ	

¹ Operation and maintenance works are mandatory tasks (sovereign duties) of the Federal Waterways and Shipping Administration (WSV). Due to in-house efforts an assignment of tangible costs and budget requirements per need area is not possible. The sums above only comprise all definable costs; actual costs are in fact substantially larger. For sovereign tasks all necessary investments are by default covered by federal budgets. Information on water levels and forecasts as well as meteorological information is provided in legal and administrative cooperation with Free State of Bavaria (Water Resources Management Administration), German Federal Institute of Hydrology (BfG) and German Weather Service (DWD).

² This amount includes only dredging expenditures, not the additional expenditures resulting from dumping the excavated material further upstream (approx. 1 500 000 annually).

³ This amount includes also hydrological services for the purpose of flood protection.

⁴ This amount applies only to the years 2018-2020, as before no dredging was conducted.

⁵ Annually approx 150 000 EUR for wl gauges, information on wl and forecast, meteorological information.

Operational costs, approx. annual budget needs

Operational costs, approx. annual budget needs												
Countries	Germany	Austria	Slovakia	Hungary	Croatia	Serbia	Bosnia and Herzegovina	Romania	Bulgaria	Ukraine		
Need areas	WSV ¹	viadonau	SVP	OVF	MMPI + DHMZ	Plovput		AFDJ + ACN	EAEMDR	USPA		
Minimum fairway parameters (depth / width)	2 000 000	2 300 000 ²	1 700 000	not defined			-	6 000 000	3 225 000	1 500 000		
Surveying of the riverbed	-	850 000	260 000		3 965 000		-	1 300 000	400 000	too little data		
Water level gauges	-	$1\ 000\ 000^3$	-				-	-	75 000	too little data		
Marking of the fairway	-	730 000	600 000				500 000	4 000 000	600 000	too little data		
Availability of locks / lock chambers	-	-	-		-	2 000 000	-	4 500 000	-	-		
Information on water levels and forecasts	-	120 000	-	1 500 000 ⁴	30 000 (DHMZ)	2 000 000	-	-	75 000	too little data		
Information on fairway depths	-	-	-		-	- -) -	-	-	15 000	too little data		
Information on marking plans	-	-	-	5 000	-		-	-	15 000	too little data		
Meteorological information	-	-	-		5 000 (DHMZ)		-	-	75 000	-		
Other needs	-	-	-		-		-	200 000	20 000	-		
Sum	2 000 000	1 700 000	2 560 000	1 500 000	4 000 000	2 000 000	500 000	16 000 000	4 500 000	1 500 000		

¹ Operation and maintenance works are mandatory tasks (sovereign duties) of the Federal Waterways and Shipping Administration (WSV). Due to in-house efforts an assignment of tangible costs and budget requirements per need area is not possible. The sums above only comprise all definable costs; actual costs are in fact substantially larger. For sovereign tasks all necessary investments are by default covered by federal budgets. Information on water levels and forecasts as well as meteorological information is provided in legal and administrative cooperation with Free State of Bavaria (Water Resources Management Administration), German Federal Institute of Hydrology (BfG) and German Weather Service (DWD).

² This amount includes only dredging expenditures, not the additional expenditures resulting from dumping the excavated material further upstream (approx. 1 500 000 annually).

³ This amount includes also hydrological services for the purpose of flood protection.

⁴ For surveying, marking activities and information purposes; dredging excluded.





Overview of most critical locations along the Danube and its navigable tributaries



7. Co-funding perspectives

The political and executing authorities of the Danube riparian countries are advised to use European funds of the forthcoming programming period 2021-2027 to tackle the needs identified in the previous chapters of this Master Plan, in parallel to continuing the maintenance activities that are already being executed now.

The **Connecting Europe Facility** (CEF) offered possibilities for financial support by the European Union related to studies, pilots and equipment. Maintenance activities as such are <u>not</u> eligible, as they are and will remain a national responsibility. In the past financing period, only a few projects for surveying, monitoring, marking and multifunctional dredging equipment were co-funded in the frame of the **European Structural and Investment Funds (ESIF)**.

Within the current financing period, the **Connecting Europe Facility (CEF 2)** provides financial support for "ensuring year-round navigability e.g. by means of hydrological services, ice-breaking facilities and capital dredging" and "automation of waterway infrastructure (e.g. locks, weirs/dams, bridges) to improve its operation and monitoring". Detailed conditions are described in the Regulations concerning the trans-European transport networks and the Connecting Europe Facility as well as the respective calls for proposals. Given appropriate programming, additional opportunities for European co-funding might be seized within the EU funding schemes such as the **Cohesion Fund** and the **Western Balkans Investment Framework (WBIF)**. The **European Investment Bank (EIB)** has been giving loans for transport infrastructure projects also in the area of inland waterways.