WAMOS

Catalogue of Required Data

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1. Introduction

This document sets out the required data sets to operate WAMOS. The reader of this document will get a clear picture on the information required to operate this system in terms of scope, quality and intended update frequency.

In first place the Catalogue of Required Data depicts the current minimum set of data which is intended to be exchanged through national WAMS systems and trans-national systems such as the D4D-Portal. All waterway administrations agree on the described data sets and their general properties e.g. sources, update frequency, single attributes.

All data sets described within chapter 2.2. are agreed to be provided by the involved waterway management authorities, ideally through national WAMS instances or transnational systems. Therefore the participating waterway authorities are provided with this description of needed data sets for WAMOS. They are supposed to take it up during the conception and development of the national WAMS systems.

In addition the document shall serve as important basis for the requirement specification and subsequent implementation of WAMOS. The current version of the document shall be seen as agreed. Minor modifications that serve the specified functionalities of WAMOS may be made in coordination with the FAIRway Danube partners, the contractor for supervision and the contractor for software development, but only until the acceptance of a prototype.

This document gives an overview over different data topics and should clarify questions like:

- Relevance of the data set
- Data structure
- Extent of the data set
- Assumptions and constraints

The first column of each data set defines the information source of the attribute by using the following abbreviations.

(ENC) -Inland ENCs
(NtS) -Notices to Skippers
(WA) -Waterway Administration
(RIS) -RIS-Index

If not stated differently the source of information also specifies the interpretation of the attribute (in terms of value ranges and validity).

Each attribute is annotated with M= Mandatory, O=Optional and C=Conditional. This information states if the attribute is required or optional from a WAMOS point of view.

1.1. General guidelines for data exchange

Provide homogeneous data sets

Interfaces for data exchange use data structures as defined in the following chapters and are applicable for all involved countries. Each participating authority will provide the data as commonly agreed. Deviations have to be communicated and are only accepted if all project partners agree and the overall functionality of the system is guaranteed in an efficient way.

Ideally datasets are provided in a common coordinate system (WGS84) as described below. For visualisation purposes data may be transformed to a common projection system (Web Mercator) within WAMOS. This means that both coordinate systems are an accepted choice for most data deliveries. Map and feature services that are only displayed in the client shall provide their maps in the projected coordinate system (Web Mercator). This allows the display of this information without additional processing. Features which have to be stored and processed in WAMOS shall be transferred in the geodetic coordinate system (WGS84).

Regarding vertical coordinate systems the EVRF2007 is the preferred height reference. Most standards (NtS, RIS-Index) support several vertical references (NAP, Metres above Adriatic Sea, etc.) and therefore WAMOS will also accept other established height references. In order to make data comparable an agreement on a single vertical reference (absolute and relative) is required for each bottleneck. The only constraint using different vertical reference systems is that only one height reference system (absolute and relative) should be used per bottleneck.

Align workflows and data processing

Common (or equivalent) standards for data cleaning, processing and quality control and assurance are most important. Continuous improvements and the alignment of procedures have been issue to several common projects (Newada and IRIS projects), are on-going (FAIRway Danube, RIS COMEX, Danube STREAM) and will also be followed up in future. Within FAIRway Danube especially the workflows related to surveying, marking and water level forecasts will be aligned.

Clear responsibilities and common view of the data sets

The Danube constitutes a state border over long distances. Responsibilities for water level gauges are clearly defined for each gauge.

However, neighbouring countries who share a border stretch, may both submit surveying results, fairway availability, rehabilitation and maintenance measures, etc. In order to assure acceptance and to reduce border issues the participating countries agree on a clear distribution of responsibilities at border stretches:

From rkm	To rkm	country	responsible
2223.2	2201.5	DE/AT	AT (as long as DE does not join)
1880.0	1872.7	AT/SK	AT
1811.0	1750	SK/HU	SK
1750	1708.3	SK/HU	HU
1296	1433	HR/RS	RS
1075	846	RS/RO	RS
845	610	BG/RO	RO
610	375	BG/RO	BG

Taking responsibility for a shared border stretch means to coordinate regular interaction between the neighbouring countries and to frequently check conformance, quality and availability of shared data. But both countries are responsible to provide relevant data.

Language and Names

The default language of WAMOS is English. All names, comments, and other textual attributes have to be in English language. If available (e.g. in Inland ENCs) the name in the national language shall be provided as well. The GUI (Graphical User Interface) itself and enumeration values shall be also available in the national languages.

Use common standards and available systems

WAMOS will be used to integrate data from different sources. In order to assure the acceptance of the system and the usability for the end user, exchanged data shall always be maintained at the source and needs to be updated as soon as a new data is available. Only in a view cases, data sets may be maintained within WAMOS (e.g. gauge zero transformed to EVRF2007) or collected by national WAMS and published via WAMOS interfaces (stretches, critical sections, fairway availability). This is particularly the case for data as stored in the RIS Index[1], whose constant identifiers to uniquely identify objects shall be used. Other examples for available sources are national web services for water level measurements or the marking database. And an established, commonly used standard is the Inland ENC format.

1.2. Data availability

In this chapter the current state of data availability for each data set and country is shown. It depicts the result of the WAMOS Data Workshop (Vienna, 28.02.2017) and national discussions on the data availability.

Table 1 assigns each data set to a possible data source and defines their availability.

Data Source	Data Set	Version	Availability	Comment
RIS-INDEX	Waterway Gauge, Distance Marks	ERDMS[2]	½	The data in the (ERDMS) RIS-Index has to be provided in the necessary quality.
Inland ENC (D4D Portal)	Waterway area, Waterway axis, (Distance Marks)	Edition (2.3 or higher)	✔	Some adaptations might be needed e.g. connectivity at borders. The D4D portal[3] could be used to retrieve information.
NtS	Gauge measurements	4.0	✔	Services for all gauges, relevant for inland waterway transport, available
National Waterway Administrations	Fairway dimensions, Fairway depth, Referenced Data, Bottleneck, Sounding results, Rehabilitation and Maintenance Measures	v1.0	-	Depending on the current status of the Waterway Administration some systems have to be developed to provide all data sets. (Critical) Locations, Sections have to be defined and unique IDs have to be developed.
Commercial	Background Map	-	✔	Commercial services available.
Other	Marking Database Natura2000[4] D4D portal [5]	-	✔	Both datasets are available as web service

Table 1: WAMOS data sources

[1] http://www.ris.eu/library/expert_groups/ris_index
[2] https://webgate.ec.europa.eu/RIS/EUERDMS_WEB/user/home/
[3] http://at.d4d-portal.info/
[4] http://ec.europa.eu/environment/nature/natura2000/access_data/index_en.htm
[5] http://at.d4d-portal.info/

Table 2 gives an overview over the current state of data availability in the participating countries.

Legend:

(Describes entries in the table 2 entries)

✔	Data set is currently available in sufficient quality and will be provided by a national WAMS, otherwise the source is indicated.
19	Data set is currently not available but will be available once the national WAMS is in place (02/2019).
½	Data set is available but there are some issues e.g. other institution responsible.
X	Data is currently not available and it is not planned to provide this dataset in future.
?	Unknown, has to be discussed.

Table 2: WAMOS data availability

Dataset / quality		AT		SK		HU		HR		RS		BG		RO	
2.1.1. Background map (IENCs)	Quality	✔	IENC edition 2.3; English names for BUAARE, bridge, lokbsn encoded	✔	IENC Edition 2.1 but will be 2.3 soon (final phase).	✔	IENC Edition 2.1, CEF Project HERO (RSOE) to upgrade to 2.3. by the end of 2017	✔	Serbian IENCs 2.3	✔	IENC edition 2.3	✔	IENC Edition 2.1 but will be 2.3 in the next release	✔	ENC Edition 2.1 but will be 2.3 in the next release
	Frequency	✔	8 - 10 IENC Updates per year	✔	last update 2013, planned yearly	✔	last official update 2009 and 2014 at the D4D portal; yearly updates planned	✔	last update 30.12.2016. (once per year)	✔		✔	up to 4 updates /month	✔	periodically, after every inspection tour between 1075 - Black Sea, elsewhere: at least once per year
	Availability	✔	D4D Portal: Danube	✔	D4D Portal: Danube	✔	D4D Portal: Danube	✔	D4D Portal: Serbian IENCs	✔	D4D Portal: Danube, Sava, Tisa	✔	D4D Portal: Danube	✔	D4D Portal: Danube, Borcea Branch, Macin branch, Sfantu Gheorghe Branch, Danube & Sulina channel, Danube-Black Sea Canal, Porta Alba-Midia Navodari Canal, (Chilia branch planned)
2.1.2. Marking database (WMS/WFS)	Quality	✔	location and CEVNI code, EPSG:3857 - Web Mercator	✔	IENCS contain marks and are sufficiently up to date (SVP verifies position), at the moment only textural description "project fairway marking"	19		✔	location and CEVNI code, EPSG:3857 - Web Mercator	✔	location and CEVNI code, EPSG:3857 - Web Mercator	✔	IENCs are most up to date and include date of applicability	✔	IENCs are up to date but date of applicability is not encoded yet. Internal DB: LINUX format without lat, lon
	Frequency	✔	fully up-to-date (prescribed and effective position of buoys)	✔	marking plans at border stretches valid for 2 years, updated yearly, buoys hardly change	19	yearly updates	✔	fully up-to-date (prescribed and effective position of buoys); AVP has about 40 buoys, only 2 or 3 change slightly every year	✔		✔		✔	monthly updates
	Availability	✔	national GIS System and IENCs	✔	Common Marking Database, to be connected by 06/2019; IENCs might be a better source	19	at the moment: digital marking plans (shp); Common Marking Database, to be connected by 06/2019	✔	Common Marking Database; national shore application (Newada duo); IENCs; xls file and Sava Commission Database	✔	Common Marking Database	✔	Common Marking Database, national Marking Database and IENCs	19	Common Marking Database: available for the Danube; ACN will be connected by 06/2019; IENCs available
2.1.3. Waterway area (IENCs)	Quality	✔	see 3.1.1.	✔		✔	see 3.1.1.	✔				✔		✔	
	Frequency	✔		✔		✔		✔				✔	updates after side scan sonars are required as the coastline changes frequently	✔	
	Availability	✔	wtware is available	✔	SEAARE is available	✔	wtware is available	✔				✔	wtware is at the moment not encoded but SEAARE is	✔	wtware is at the moment not encoded but SEAARE is
2.1.4. Waterway Gauge (RIS-Index)	Quality	✔	9 gauges, gauge zero relates to metres above Adriatic Sea	½	5 gauges responsibility of SHMU, are included in the RIS Index with characteristic water levels and gauge zero (values don't coincide with FIS Portal and fis.slovris.sk)	✔	27 gauges with reference water levels and gauge zero points are included in the RIS Index. Gauge zero relates to Baltic Sea.	✔	5 gauges, gauge zero relates to metres above Adriatic Sea; 4 new gauges will be added within FAIRway Danube	✔	25 gauges in the RIS-Index, which include all reference gauges; gauge zero and characteristic water levels included	½	6 gauges in the RIS-Index (include the reference gauges Svistov, Ruse and Silistra), new gauges will be added within FAIRway Danube, reference water levels and gauge zero is missing in the RIS Index	½	23 gauges, RIS index available, new gauges will be within FAIRway Danube; reference water levels are currently not specified, gauge zero always relates to Black Sea - Sulina

	Frequency	✔	latest RIS index update 2017	½	latest RIS index update 2014	✔	latest RIS index update 2014, update is currently prepared	✔	latest RIS index update 2016, next update scheduled for 2018	✔	latest RIS index update 2017	½	latest RIS index update 2014, update is currently prepared	½	latest RIS index update 2014, update is currently prepared
	Availability	✔	ERDMS	✔	ERDMS	✔	ERDMS (RSOE is responsible)	✔	ERDMS, Reference water levels, gauge zero to be added within Danube Stream	✔	ERDMS	✔	ERDMS	✔	ERDMS
2.1.5. Gauge measurements (NtS)	Quality	✔	NtS 4.0; forecast available for 5 days at Wildungsmauer and Kienstock	½	NtS 3.0, 4.0 under development by transport authority within RIS COMEX, forecast for one day, internally for 2 days for Devin by SHMU	½	NtS 3.0	✔	NtS 4.0, forecast will be available for Batina (rkm 1424,6), Aljmas (rkm 1380,27) and Vukovar (rkm 1333,36)	✔	forecast available	✔		✔	NtS 3.0, will be NtS 4.0
	Frequency	✔	Every 15 min.	½	1 per day (6am), verify the possibility to provide it more frequently (every hour via NtS)	✔	hourly	19	currently once per day, planned every hour	✔		✔	Every 15 min.	½	Data is available (once per day), once per hour for automatic gauges
	Availability	✔	national NtS Web Service (DoRIS)	½	Information would be available 1 per hour but one per day in NtS format	✔	NtS format, OVF (based on agreement)	✔	national NtS Web Service	✔	national NtS Web Service	✔		19	web service in place (AFDJ), ACN planned
2.1.6. Waterway Axis (IENCs)	Quality	✔	middle of the waterway	✔	middle of the fairway	✔	middle of the waterway	✔	middle of the fairway	✔	middle of the fairway	✔	a common wtwxs between BG/RO needs to be established	✔	a common wtwxs between BG/RO needs to be established
	Frequency	✔	changes rarely	✔	changes rarely	✔		✔	updated every 3 to 4 years in coordination with RS	✔	updated every 3 to 4 years in coordination with HR	✔	changes about 10 times a year	✔	update planned
	Availability	✔	IENCs (D4D Portal)	✔	IENCs (D4D Portal)	✔	wtwaxs available	✔	IENCs (D4D Portal)	✔	IENCs (D4D Portal)	✔	IENCs	✔	IENCs
2.1.7. Distance Marks (IENCs and RIS Index)	Quality	✔	IENCs and RIS Index coincide	✔	IENCs and RIS Index coincide	✔	dismar along waterway axis are included in the RIS Index and IENCs, which also include dismar ashore.	½	IENCs and RIS Index don't coincide (It is necessary to update RIS index with hectometre data from Serbian IENCs)	✔		½	distance marks along fairway axis: RIS Index and IENCs don't match, IENCs are more up to date	½	distance marks along fairway axis: RIS Index and IENCs don't match, IENCs are more up to date
	Frequency	✔	update if required (rarely)	✔	update if required (rarely)	✔	update if required (rarely)	✔	update if required (rarely)	✔		½	distance marks along fairway axis change about 10 times a year	½	
	Availability	✔	for each hectometre: left, right and centre (virtual)	✔	each kilometre lateral and each hectometre in the centre	✔	RSOE is responsible	½	for each hectometre: centre (virtual)	✔		½	every kilometre	½	every kilometre
2.1.8. Referenced Data	Quality	✔	sections (East of Vienna, Wachau) and stretches are clearly defined		3 sections: AT/SK, SK, SK/HU; most critical location within these sections remain always the same	½	2 stretches: HU/SK, HU; sections: 3 water directorates (SK/HU - Györ, Budapest, Baja), but more reference water gauges.	x	Definition of sections is not necessary as the critical bottlenecks remain the same and it is sufficient to report these bottlenecks			19	sections are not yet used but may be defined in line with the applicability area of reference gauges. Definition will we done step by step, reflecting the outcomes of bottleneck statistics	19	Sectors: Romanian and common sector. Sections in line with administrations: Turnu Severin, Giurgiu, Calarasi, Braila, Galati, Sulina, DBSC. At the canal sections are still to be defined.
	Frequency	✔	update if required (rarely)			x	Sections are not yet used for statistical purposes. As the decisive bottlenecks stay the same, single bottlenecks are reported.								
	Availability	✔	national GIS System / IENCs												

2.2.1. Fairway dimensions	Quality	✔	LOS 1 and 2 are not aligned with neighbouring countries, as they are not available there	✔	LOS1 is reported but not represented in maps, the information if the deep fairway channel is close to the red or green buoy is provided	✔	only one fairway (LOS 3) but not in Baja (the buoys mark the fairway, but will be developed with new ENCs)	✔	LOS1 is reported (available depth) but not represented in maps, LOS3 is coordinated with neighbouring countries, a restricted width is marked with buoys			✔	a deep fairway channel (LOS1) may only be introduced if the frequency of surveys can be increased.	✔	could try it for some sectors (more stable fairway or at pilot sectors)
	Frequency	✔	if required	✔	if required	✔		✔	rarely			✔		✔	
	Availability	✔	national GIS	✔	LOS 3 Dataset in national GIS available	✔	LOS 3 available in GIS	✔	LOS 3			✔	only LOS 3, AutoCAD and IENCs	✔	only LOS 3, in IENCs
2.2.2. Bottlenecks	Quality	✔	resare information is available, shallow sections are also maintained in national GIS (conformity between the two sources has to be checked)	✔	resare information is available (covers the fairway)	✔	available in new IENCs	✔	polygons (resare) in the IENCs indicate the position of critical sections			19		19	
	Frequency	✔	updates are hardly necessary but are done if situation on site requires	✔	updates are hardly necessary but are done if situation on site requires	✔	some move and some don't, update every year (with a new measurement)	✔	min once per year			19		19	
	Availability	19	national GIS / IENCs - to be adapted	19	national GIS / IENCs - to be adapted	19	national GIS / IENCs - to be adapted	19	dwg files/ IENCs - to be adapted			19	will be introduced soon	19	not in IENC files (no caution area, no resare)
2.2.3. Sounding results	Quality	✔	Quality controlled data available, height reference: metres above Adriatic Sea or LNWL	✔	single beam, will be multi beam within FAIRway, Referenced to LNWL	½	Single beam and multi beam (depending on the capacity of multi beam vessel), will be improved within FAIRway Danube; if single beam measurements are used a way to produce a suitable cloud of points has to be figured out. Baltic sea (LNWL)	½	Quality controlled, single beam data is available, they are interpolated and a digital terrain model is calculated, height reference: metres above Adriatic Sea or LNWL, Multi beam is coming			½	at the moment single beam in absolute altitude related to Baltic Sea; relative depth referenced to gauge zero	½	Single beam, Multi beam; relative depth related to gauge 0 of the reference gauge which might be located several kilometres away(absolute altitude is not available)
	Frequency	✔	monthly, depending on critical location	✔	1-2 x per year	✔	once per year	✔	SB once per year on control profiles, MB most critical location min once per year			19	2018 and 2019: three most critical sections 5 times per year with multi beam	✔	depends on critical location, 5 times per year for 17 most critical locations
	Availability	✔	national GIS	19		19		19				19		19	
2.2.4. Available fairway depths	Quality	✔	for 8 shallow sections, some attributes need to be added to national Web service	✔	FIS Portal calculates depth based on depth available at LNWL over LOS3; SHMU assesses the available fairway depths for two widths, if it the fairway width at the critical location is wide enough	✔	FIS Portal Calculates depth based on depth available at ENR	✔	FIS Portal Calculates depth based on depth available at ENR	✔	referenced to LNWL	½	result of the latest marking trip (echo sounder), shall include information from surveying results in future as well, referenced to gauge 0	½	result of latest survey or marking trip (last information), referenced to gauge 0
	Frequency	✔	Update as soon as a new surveying result has been assessed (several times a month)	✔	Update as soon as a new surveying result has been assessed (1-2 times a year)	✔		✔		✔		✔		✔	

	Availability	19	DoRIS web service to be adapted	19	no web service in place	19	FIS Portal and hydroinfo.hu (water directorate is responsible for both), no web service in place	19	no web service in place	19	already at FIS Portal, web service in place	19	already at FIS Portal, no web service yet	19	already at FIS Portal, web service in place
2.2.5. Rehabilitation and Maintenance Measures	Quality	19	surveying, dredging, marking: does not correspond to DRC yet but all attributes are available	19	information already submitted for action plans	19		19				19		19	Surveying, , dredging
	Frequency	19	as required (daily)	19		19		19				19		19	
	Availability	19	Surveying, Dredging: national WAMS, Marking: national GIS	19		19	not available yet, information on activities available but no geographic representation.	19				19	information on activities available but no geographic representation	19	information on activities available but no geographic representation
2.2.6. Waterway profiles	Quality	✔		✔	profiles are used internally and have only been included in IENCs for a pilot stretch within IRIS III for water level model	✔		✔		✔		x	waterway profiles are not available as there is currently not use to have them	x	
	Frequency	✔	every hectometre	✔	about 50 metres (depending on characteristics)	✔	every hectometre	✔	every 200m control profiles and every 50 m on bottlenecks	✔	every 200m control profiles and every 50 m on bottlenecks	x		x	
	Availability	✔	part of the IENCs	✔	not in IENCs	19	part of the IENCs (End of 2017)	✔	dwg, dxf, txt	✔	dwg, dxf, txt	x		x	
2.2.7. Water Level Reference	Quality	✔	actual characteristic water levels relate to the period 1981 – 2010	✔	characteristic water levels are calculated (SHMU); differences between AT and SK exist	✔	used as reference for surveying and for marking plans	✔	actual characteristic water levels relate to the period 1981 – 2010	✔	actual characteristic water levels relate to the period 1981 – 2010	x	Official values of the Danube Commission are available for reference gauges. However, gauge 0 is used as reference due to unsuitable LNWL values. LNWL recalculation activity is ongoing.	x	Official values of the Danube Commission are available for reference gauges. However, gauge 0 is used as reference due to unsuitable LNWL values. LNWL recalculation activity is ongoing.
	Frequency	✔	a recalculation is done every 10 years or after substantial riverbed changes (e.g. construction of a hydro-power plant)	✔	depends on characteristic of river (50m, 1km, …)	✔	every Kilometre, connected to the distance mark along waterway axis	✔		✔	official values for each river-kilometre, LNWL values are available for every 200 m	x		x	
	Availability	✔	official values for each river-kilometre and water level gauges are publically available, calculated values are available for every 25 m	✔		✔		✔	official values for each river-kilometre, LNWL values are available for every 200 m	✔		x		x	

2. Overview on required data

The following chapter is subdivided in "Information to be gathered from available sources", including data that can mainly be extracted out of Inland ENCs, commercial products or RIS services as the Notice to Skippers (NtS). The second group of data consists of data sets which will ideally be provided by the national WAMS and are described in chapter 2.2 Information to be provided by national authorities, ideally through WAMS.

2.1. Information to be gathered from available sources

2.1.1. Background map (BM)

Description:

Display background information for orientation and navigation purposes.
Possible data sources are for example commercial products like BingMaps or GoogleMaps.

Topographic map:

Typical content should include information of topographic maps:

- Height information,
- Vegetation, build up areas, Cities, Roads, Rivers …

Imagery (Orthophoto or Satellite) layer:

Usage of a commonly used coordinate system to support the quick display and reprojection of the provided information

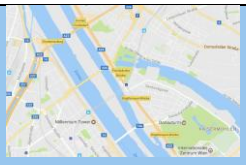
Inland ENC-Maps:

As a further information source inland *ENC-charts* shall be available for display as background information. Preferred information source is the already harmonized D4D web map service. This information shall be used to navigate in the map by identifying cities and infrastructure elements.

Natura 2000:

Natura 2000 areas can be used as background information to identify sensitive areas.

Possible data source: http://natura2000.eea.europa.eu.

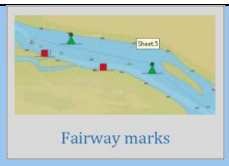


Coverage	**Danube, Danube – Black Sea Canal, Sava Homogenous visual representation covering the whole Danube region**
Coordinate System	**EPSG:3857 (Web Mercator)**
Vertical Coordinate	**None**
Required update rate	**IENCs: Once per year (as frequent as situation on site requires) Others: beyond our influence**
Format	**Geospatial web service (WMS, WMTS, TMS)**
Sources	**Will be provided by third party public or commercial service e.g.: Google, https://www.d4d-portal.info, http://natura2000.eea.europa.eu**
Geometry	**georeferenced images**

2.1.2. Fairway Marks (FM)

Inland ENC markings shall be integrated using geospatial web services. It provides additional information about the position of the fairway and shall be compared with other related information (riverbed survey, fairway).

The data will be directly integrated from the D4D Portal and shall be conform to the definition in the inland ENC Encoding guide chapter "O - Buoys, Beacons and Daymarks, Notice Marks".



Coverage	**Danube, Danube-Black Sea Canal**
Coordinate System	**Preferred: EPSG:3857 - Web Mercator** (EPSG: 4326 - WGS84)
Vertical Coordinate	**None**
Update Frequency	**daily, if available**
Format	**WFS - IENC**
Sources	**D4D-Portal (All participating countries)**
Geometry	**Point**

Data set quality:

- Datasets should be stable (geometries and attributes should not change if not necessary) in order to be able to detect and track changes.

The following abbreviations names and descriptions are taken from the Inland ENC feature catalogue

BCNISD-Beacon, isolated danger (MARITIME/Hydro feature)

A beacon, is a prominent specially constructed object forming a conspicuous mark as a fixed aid to navigation or for use in hydrographic survey (IHO Dictionary, S-32, 5th Edition, 420). An isolated danger beacon is a beacon erected on an isolated danger of limited extent, which has navigable water all around it. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BCNLAT - Beacon, lateral (MARITIME/Hydro feature)

A beacon, is a prominent specially constructed object forming a conspicuous mark as a fixed aid to navigation or for use in hydrographic survey (IHO Dictionary, S-32, 5th Edition, 420). A lateral beacon, is used to indicate the port or starboard hand side of the route to be followed. They are generally used for well defined channels and are used in conjunction with a conventional direction of buoyage. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

bcnlat - Beacon, lateral (IENC feature)

A beacon, is a prominent specially constructed object forming a conspicuous mark as a fixed aid to navigation or for use in hydrographic survey (IHO Dictionary, S-32, 5th Edition, 420). A lateral beacon, is used to indicate the port or starboard hand side of the route to be followed. They are generally used for well defined channels and are used in conjunction with a conventional direction of buoyage. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BOYCAR - Buoy, cardinal (MARITIME/Hydro feature)

A buoy, is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes. (IHO Dictionary S-32 5th Edition, 565).A cardinal buoy, is used in conjunction with the compass to indicate where the mariner may find the best navigable water. It is placed in one of the four quadrants (North, East, South and West), bounded by inter-cardinal bearings from the point marked. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BOYISD - Buoy, isolated danger (MARITIME/Hydro feature)

A buoy is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes. (IHO Dictionary S-32 5th Edition, 565). An isolated danger buoy is a buoy moored on or above an isolated danger of limited extent, which has navigable water all around it. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BOYLAT - Buoy, lateral (MARITIME/Hydro feature)
A buoy, is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes. (IHO Dictionary, S-32, 5th Edition, 565). A lateral buoy, is used to indicate the port or starboard hand side of the route to be followed. They are generally used for well defined channels and are used in conjunction with a conventional direction of buoyage. (UKHO NP 735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BOYSAW - Buoy, safe water (MARITIME/Hydro feature)
A buoy, is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes. (IHO Dictionary, S-32, 5th Edition, 565). A safe water buoy, is used to indicate that there is navigable water around the mark. (UKHO NP735, 5th Edition)

Datastructure as defined in the Inland ENC Encoding Guide

BOYSPP - Buoy, special purpose/general (MARITIME/Hydro feature)
A buoy, is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes. (IHO Dictionary, S-32, 5th Edition, 565). A special purpose buoy, is primarily used to indicate an area or feature, the nature of which is apparent from reference to a chart, Sailing Directions or Notices to Mariners. (UKHO NP 735, 5th Edition). Buoy in general: A buoy, whose appearance or purpose is not adequately known.

Datastructure as defined in the Inland ENC Encoding Guide

DAYMAR – Daymark (MARITIME/Hydro feature)
The identifying characteristics of an aid to navigation which serve to facilitate its recognition against a daylight viewing background. On those structures that do not by themselves present an adequate viewing area to be seen at the required distance, the aid is made more visible by affixing a daymark to the structure. A daymark so affixed has a distinctive colour and shape depending on the purpose of the aid. (IHO Dictionary, S-32, 5th Edition, 1248)

Datastructure as defined in the Inland ENC Encoding Guide

daymar – Daymark (IENC feature)
The identifying characteristics of an aid to navigation which serve to facilitate its recognition against a daylight viewing background. On those structures that do not by themselves present an adequate viewing area to be seen at the required distance, the aid is made more visible by affixing a daymark to the structure. A daymark so affixed has a distinctive colour and shape depending on the purpose of the aid. (IHO Dictionary, S-32, 5th Edition, 1248)

Datastructure as defined in the Inland ENC Encoding Guide

LIGHTS- Light (MARITIME/Hydro feature)
A luminous or lighted aid to navigation. (Adapted from IHO Dictionary, S-32, 5th Edition, 2766)

Datastructure as defined in the Inland ENC Encoding Guide

RTPBCN- Radar transponder beacon (MARITIME/Hydro feature)
A transponder beacon, transmitting a coded signal on radar frequency, permitting an interrogating craft to determine the bearing and range of the transponder. Also called racon. (IHO Dictionary, S-32, 5th Edition, 4137)
Datastructure as defined in the Inland ENC Encoding Guide

TOPMAR- Topmark (MARITIME/Hydro feature)
A characteristic shape secured at the top of a buoy, or beacon, to aid in its identification. (IHO Dictionary, S-32, 5th Edition, 5548)
Datastructure as defined in the Inland ENC Encoding Guide

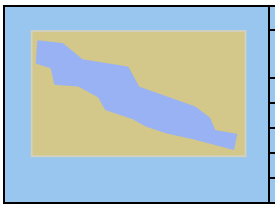
notmrk- Notice mark (IENC feature)
A signboard used to indicate prohibitions, regulations, restrictions, recommendations and general information which apply to a waterway or a section of a waterway
Datastructure as defined in the Inland ENC Encoding Guide

2.1.3. Waterway area (NWA)

This information shall provide the necessary information to display the relevant water bodies and derive geometries if needed (e.g. for Bottlenecks, Sections and Stretches). The information shall ideally be provided by the Inland ENC feature wtware. If wtware is not available SEAARE may be used.

An area in which uniform general information of the waterway exists.

(Inland ENC Harmonization Group, 2011)



Coverage	**Danube, Danube-Black Sea Canal, Sava**
Coordinate System	**Preferred: EPSG:3857 - Web Mercator** (EPSG: 4326 - WGS84))
Vertical Coordinate	**None**
Update Frequency	**Once per year (as frequent as situation on site requires)**
Format	**WMS/WFS - IENC**
Sources	**D4D-Portal (All participating countries)**
Geometry	**Polygon**

Data set quality:

- Harmonized and connected river geometries to neighbouring countries.
- Update replaces one or more cells, matching with the Inland ENCs (usually of 10km).
- Geometry covers the whole navigatable river. The polygon will be splitted at relevant sections according to Inland ENC cells. This data can be retrieved from the feature SEAARE (named water area) or the wtware (An area in which uniform general information of the waterway exists) depending on the availability.

Waterway area data:

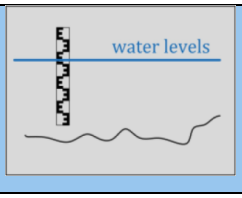
T.	Attribute Names	Interface Attribute	Type	Values	Example
ENC	**catccl**	catccl	Enum.	Category of CEMT class. "UNECE" Resolution No. 30 of 12 November 1992 As defined in the IENC FeatureCatalogue Edition 2.3.	1
ENC	**dirimp**	dirimp	Enum.	Direction of impact As defined in the IENC FeatureCatalogue Edition 2.3.	1

2.1.4. Waterway gauge (G)

This layer contains all gauges with their position and describing attributes.
Attributes of gauges will be taken from the RIS Index, which already contains the relevant information. FAIRway Danube partners will be required to update the RIS Index information related to water level gauges if necessary. It is preferred to transform all gauge zero points to a common vertical reference point (EVRF 2007[6]), if accuracy deviations are acceptable (see data set quality). The transformed gauge zero may not be stored within the RIS Index but if added via the GUI of WAMOS, it replaces the gauge zero referenced to a national vertical reference.

Official LNWL are available for each gauge in line with the Danube Commission stipulations. A change in the methodology of LNWL calculation may be reflected as soon as it is officially accepted.

A waterway gauge is an instrument for measuring water levels. Waterway gauges provide the actual water level information to calculate actual depths and vertical clearances, taking into account the sloped nature of river water surfaces (inland ENC Harmonisation Group, 2014)



Coverage	Danube, Danube-Black Sea Canal, Sava
Coordinate System	EPSG: 4326 (WGS84)
Vertical Coordinate	Preferred:(EVRF2007)[7]
Update Frequency	Quarterly updates/manually
Format	Xls - RIS-Index
Sources	ERDMS
Geometry	None (attributive: lat,long)

Data set quality:

- The x,y position of the gauge should be accurate to +-5 meter.
- The gauge zero point (z coordinate) tolerance should be smaller than 10 cm.
- All relevant gauges have to be maintained in the RIS-Index to allow universal usability of the information.

Gauges data:

T.	Attribute Names	Interface Attribute	Type	Values	Example
RIS	**ISRS_code (M)**	risindex	String (20)	ISRS location code (RIS Index) UN Country code (2 letters, alphanumerical) Location code (3 letters, alphanumerical) Fairway section code (5 digits, alphanumerical) Object Reference Code (5 digits, alphanumerical) Fairway section hectometre (5 digits, numerical)	ATHIA00001G001218792
RIS	**CountryCode (M)**	unloccc	Enum.	The country code consists of two letters and is defined in ISO standard 3166-1. The official list of country codes is published at http://www.unece.org/cefact/locode/service/country.htm	AT
RIS	**Function (M)**	objfunc	String(10)	The purpose of the function code is to establish an unambiguous link between the “Object Class” of objects in Inland ECDIS and the objects in the RIS Index. The function code enables a grouping of objects with a similar function (e.g. bridge) in RIS applications (e.g. Notices to Skippers). The Function is restricted to the values of the "function code" element in the RIS index of this encoding guide.	wtwgag

[6] http://www.crs-geo.eu/nn_124396/crseu/EN/CRS__Description/crs-national__node.html?__nnn=true

[7] http://georepository.com/datum_5215/European-Vertical-Reference-Frame-2007.html

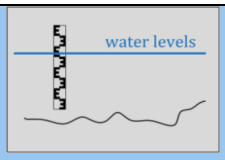
RIS	**objname (M)**	objname	String	Name of the gauge	Achleiten
RIS	**Position_code (O)**	unloccc	Enum.	position code of object related to the fairway LB – left bank RB – right bank	LB
RIS	**lat (M)**	lat	Double	The latitude coordinate has to be provided in WGS 84 format. In the RIS Index the decimal format shall be utilised with a precision of 6 decimal digits. Dot should be the comma separator.	16.123456
RIS	**lon (M)**	lon	Double	The longitude coordinate has to be provided in WGS 84 format. In the RIS Index the decimal format shall be utilised with a precision of 6 decimal digits. Dot should be the comma separator.	45.123456
RIS	**applicability from rhm (C)**	applicabilityfromkm	Integer	Each gauge has an area, where the information from this gauge is applicable. The starting point of this area can be entered here. (5 digits) ➢ This information has to be provided, if it exists (if a berth has a name, for example)	21465
RIS	**applicability to rhm (C)**	applicabilitytokm	Integer	Each gauge has an area, where the information from this gauge is applicable. The end point of this area can be entered here. (5 digits) ➢ This information has to be provided, if it exists (if a berth has a name, for example)	21440
RIS	**Reference level 1 code (C)**	reflevel1code	Enum.	Normally there are several reference water levels defined for each waterway, e.g. a low water level, a medium water level and a high water level. The definitions and the abbreviations or codes of these reference water levels vary from waterway to waterway. The codes should be in line with the NtS reference_code table. LDC – Low water level Danube Commission (also known as LNW – Low Navigable Water Level) MW – Medium Water Level HDC – High water level Danube Commission (also known as HNW – High Navigable Water Level)	LDC
RIS	**Reference level 1 value (C)**	reflevel1value	Integer	The value, which is displayed by the gauge at the reference water level 1 has to be provided in [cm].	221
RIS	**Reference level 2 code**	reflevel2code	Enum	Is used to provide the information on medium water level. The codes should be in line with the NtS reference_code table.	MW

	(C)			<table><tr><td>LDC</td><td>Low water level Danube Commission (also known as LNW – Low Navigable Water Level)</td></tr><tr><td>MW</td><td>Medium Water Level</td></tr><tr><td>HDC</td><td>High water level Danube Commission (also known as HNW – High Navigable Water Level)</td></tr></table>	
RIS	**Reference level 2 value (C)**	reflevel2value	Integer	The value, which is displayed by the gauge at the reference water level 2 has to be provided in [cm].	338
RIS	**Reference level 3 code (C)**	reflevel3code	Enum	E.g. HDC for high water level (Danube Commission). Is used to provide the information on medium water level. This Information should be in line with the NtS reference_code table. <table><tr><td>LDC</td><td>Low water level Danube Commission (also known as LNW – Low Navigable Water Level)</td></tr><tr><td>MW</td><td>Medium Water Level</td></tr><tr><td>HDC</td><td>High water level Danube Commission (also known as HNW – High Navigable Water Level)</td></tr></table>	HDC
RIS	**Reference level 3 value (C)**	reflevel3value	Integer	The value, which is displayed by the gauge at the reference water level 2 has to be provided in [cm]	628
RIS	**Zero point (M)**	zeropoint	Double	The height of the zero point of the gauge above a geodetic reference has to be entered in [cm]. If the zero point of the gauge is e.g. Adriatic sea level, “0” has to be entered. If the zero point of the gauge is e.g. the bottom of the riverbed, which is 235 m above Adriatic sea, “23500” has to be entered.	24912
RIS	**Geod. ref. (C)**	geodref	Enum	The geodetic reference of the zero point of the gauge as defined by the RIS index. (e.g. ADR, NAP)	NAP
RIS	**Start date for applicability of the data set (C)**		Date	If the data of a specific object is only applicable in a specified period (e.g. due to replacement, building, other changes), the dates have to be entered here. This attribute gives information if the object (record) is valid. It is recommended to assign each record a starting date. In case an object (record)	12.04.2017

				gets invalid, an end date needs to be provided (se end date for applicability of the data set). This method ensured that ISRS Location Codes are kept in the records, so (historical) statistics analysis can be performed. It also ensures that ISRS Location Codes are not assigned multiple times.	
RIS	**End date for applicability of the data set (C)**		Date	If the data of a specific object is only applicable in a specified period (e.g. due to replacement, building, other changes), the dates have to be entered here.	31.12.2100
RIS	**Date_Info (M)**	lastmod	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be entered here.	12.04.2017 12:15:20
RIS	**Source (M)**	source	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	Viadonau

2.1.5. Gauge measurements (GM)

The gauge measurements relate to its gauges. They are used to display diagrams which show the current water levels or calculate fairway availability. Validated and approved measures will replace raw data sets in the database assuring correct long term calculations.
WAMOS will validate raw data, so that only valid raw data are stored in the database.



Coverage	Danube, Danube-Black Sea Canal
Coordinate System	None
Vertical Coordinate	None
Update Frequency	Raw data: 15 minutes Validated data: yearly
Format	Raw data: NtS 4.0/WRM, Validated data: CSV
Sources	Web service of all participating countries
Geometry	None

Data set quality:
There are two different versions of this data set:

- Raw data, which is directly provided by the gauge sensors. This dataset has to be conforming to NtS 4.0 WRM messages and may contain more attributes as stated below. (Please refer to the interface specifications and examples). This raw data will be sent automatically and roughly quality checked by WAMOS to ensure data quality of the stored values.
- Quality checked, approved data sets which have been confirmed by the waterway administration. This data set is exchanged manually for an entire year.

Gauge measurements:

T.	Attribute Names	Interface Attribute	Type	Values	Example
NtS WA	**fk_gauge_id (M)**	id	String	Foreign key to related gauge. The reference of the NtS is the isrs_code of the gauge.	ATHIA00001G001218792
NtS WA	**from (M)**	from	String (64)	Sender (System) of the message	via donau
NtS WA	**originator (M)**	originator	String (64)	Originator (initiator) of the information in this message	via donau
NtS WA	**country_code (M)**	country_code	Enum (2)	Country where message is valid Enumeration values as defined in the NtS XSD.	AT
NtS WA	**language_code (M)**	language_code	Enum (2)	Original language used in the textual info. (contents) Enumeration values as defined in the NtS XSD	DE
NtS WA	**date_issue (M)**	date_issue	DateTime	Date and time of publication including time zone (yyyy-mm-ddThh:mm+hh:mm)	2017-03-04T12:15:20+02:00
NtS WA	**Reference code**	reference_code	Enum (4)	Values as defined in the NtS reference_code_enum.	ZPG

	(M)				
NtS WA	**value** **(M)**	value	Double	Water level value in cm	250
NtS WA	**predicted** **(M)**	predicted	Boolean	Defines if a value is a predictions or live data.	False
NtS WA	**measure_code** **(M)**	measure_code	Enum.	Kind of water related information DIS - (Discharge) WAL – (Water Level) Enumeration values as defined in the NtS XSD	WAL
NtS WA	**measure_date** **(M)**	measure date	DateTime	Date and Time of measurement or predicted value including time zone	13.04.2017 12:15:20
NtS WA	**Unit** **(M)**	unit	Enum.	Unit of the water related value discharge should be provided in m^3/s Water Level value should be provided in cm Enumeration values as defined in the NtS XSD	cm
NtS WA	**value_min** **(C)**	value_min	Double	Lowest value of confidence interval needed for predictions. Besides predicted water levels the confidence interval may also be used to state the uncertainty of published least sounded depth and vertical clearance information. ➢ This information has to be provided, if it exists (if a berth has a name, for example)	240
NtS WA	**value_max** **(C)**	value_max	Double	Highest value of confidence interval needed for predictions Besides predicted water levels the confidence interval may also be used to state the uncertainty of published least sounded depth and vertical clearance information. ➢ This information has to be provided, if it exists (if a berth has a name, for example)	260
NtS WA	**Date_Info** **(M)**	date_issue	DateTime	In case data changed (e.g. name or dimensions of an object); the change date has to be entered here.	12.04.2017 12:15:20

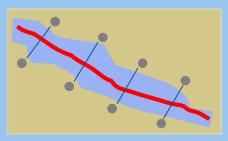
2.1.6. Waterway axis (WA)

The waterway axis depicts the centreline of the waterway. The waterway axis should be a harmonized data set covering the whole Danube River.

The waterway axis can be defined by e.g.:

- the middle line of a fairway,
- the middle line of a waterway (the waterway covers the entire area of a river or a canal)

(inland ENC Harmonisation Group, 2014)



Coverage	**Danube**
Coordinate System	**Preferred: EPSG:3857 - Web Mercator** (EPSG: 4326 (WGS84))
Vertical Coordinate	**None**
Update Frequency	**Once per year (as frequent as situation on site requires)**
Format	**WFS - IENC**
Sources	**D4D-Portal**
Geometry	**Line**

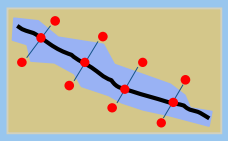
Data set quality:

- Data set is harmonized and connected to waterway axis of neighbouring countries.
- Depicts the centreline of the fairway in an accuracy of +- 0.5 meters.
- Data update replaces the data of the current ENC cell
- The geometry of the waterway axis depicts the centreline of the waterway

Waterway axis data:

T.	Attribute Names	Type	Values	Example
ENC	**OBJNAM (M)**	String	public name of the waterway	Danube
ENC	**NOBJNM (O)**	String	Object name in national language	Donau

2.1.7. Distance marks (RHM):



Coverage	Danube
Coordinate System	Preferred: EPSG:3857 - Web Mercator (EPSG: 4326 (WGS84))
Vertical Coordinate	None
Update Frequency	Once per year (as frequent as situation on site requires)
Format	WFS - IENC, RIS-Index
Sources	D4D-Portal / ERDMS
Geometry	Point /RIS-Index

This data set consists of hectometre points positioned every 100 meters on the left and right riverside as well as virtual points on the centre of the fairway.

A distance mark indicates the distance measured from an origin and consists of either a solid visible structure or a distinct location without special installation. Usually found on canals and rivers.
(inland ENC Harmonisation Group, 2014)

Data set quality:

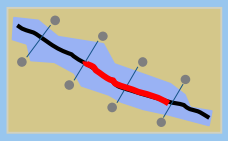
- Every 100 meters the data set includes a river hectometre measure point from the left-, right riverside and the imaginary river hectometre value at the centre of the fairway.
- Physically installed distance marks will be collected from the Inland ENC
- Virtual hectometre points and the ISRS location code, which is needed to reference data, will be taken from the RIS Index

T.	Attribute Names	Type	Values	Example
RIS ENC	**CountryCode (M)**	Enum.	The country code consists of two letters and is defined in ISO standard 3166-1. The official list of country codes is published at http://www.unece.org/cefact/locode/service/country.htm	AT
RIS, ENC	**UNLOCODE (C)**	String	reference to the RIS Index (c= if dataset provided by RIS-Index)	XXX
RIS ENC	**FW_CODE (C)**	String	(c= if dataset provided by RIS-Index)	00001
RIS ENC	**OBJECT_CODE (C)**	String	(c= if dataset provided by RIS-Index) Value: 00000 — Usage: Used for Distance Mark along Waterway Axis Value: dismx — Usage: Used for visible marks whereas x is a number from 0 to 9 (first encoded visible mark at hectometre gets 0 this number is incremented for additional marks to allow unique ISRS Location Codes for visible marks)	00000
RIS ENC	**HECTOM (M)**	String	river hectometre value	18879
RIS ENC	**ISRS Location Code (C)**	String	(c= if dataset provided by RIS-Index)	ATXXX000010000018879
WAMOS	**function (M)**	Enum.	The purpose of the function code is to establish an unambiguous link between the “Object Class” of	dismar

<table>
<tr><td></td><td></td><td></td><td>objects in Inland ECDIS and the objects in the RIS Index.<table><tr><th>Value</th><th>Usage</th></tr><tr><td>dismar</td><td>Distance Mark along Waterway Axis (distance mark not physically installed)</td></tr><tr><td>dismar_2</td><td>visible mark, pole</td></tr><tr><td>dismar_3</td><td>visible mark, board</td></tr><tr><td>dismar_4</td><td>visible mark, unknown shape</td></tr></table></td><td></td></tr>
<tr><td>RIS, ENC</td><td>lat (M)</td><td>Double</td><td>Coordinate of the centre of the object</td><td>48.1658</td></tr>
<tr><td>RIS ENC</td><td>lon (M)</td><td>Double</td><td>Coordinate of the centre of the object</td><td>16.9874</td></tr>
<tr><td>RIS</td><td>Position_code (M)</td><td>Enum.</td><td>Defines the position of the Distance marks.<table><tr><th>Value</th><th>Meaning (EN)</th></tr><tr><td>LE</td><td>left</td></tr><tr><td>MI</td><td>middle</td></tr><tr><td>RI</td><td>right</td></tr><tr><td>LB</td><td>left bank</td></tr><tr><td>RB</td><td>right bank</td></tr></table></td><td>LE</td></tr>
<tr><td>ENC</td><td>CATDIS (C)</td><td>Enum.</td><td>1 distance mark not physically installed,
2 visible mark, pole
3 visible mark, board</td><td>1</td></tr>
<tr><td>RIS ENC</td><td>Related ENCs (M)</td><td>String</td><td>Name of the ENC the information is based on.</td><td>2W7D1870</td></tr>
</table>

2.2. Information to be provided by national authorities, ideally through WAMS

2.2.1.Sections and Stretches (SN)



Coverage	**Danube**
Coordinate System	**Preferred: EPSG:3857 - Web Mercator** (EPSG: 4326 (WGS84))
Vertical Coordinate	**None**
Update Frequency	**Once per year (as frequent as situation on site requires)**
Format	**xml**
Sources	**National WAMS**
Geometry	**None (attributive ISRS from and to)**

This data set consists of well known locations along the Danube River as sections and stretches.

- The positions of these events are defined by the RIS-Index as well as the centre coordinate of the object.
- Information on linear locations can be described in more detail by defining the ISRS location code from and ISRS location code to as well as the object name.

Data set quality:

- This dataset contains sections and stretches
- Streches do need to be defined (but do not change, can be defined once)
- Sections are optional

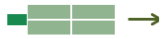
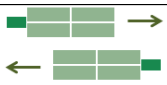
T.	Attribute Names	Type	Values	Example
WA	**ID**	String	<Country_Code>_<Type of section>_<Count>	AT_Section_12
WA	**function (M)**	String	The purpose of the function code is to establish an unambiguous link between the "Object Class" of objects in Inland ECDIS and the objects in the RIS Index. • Stretch • Section	stretch
WA	**start rhm (O)**	String	ISRS location code (lower).	ATXXX000010000019900
WA	**end rhm (O)**	String	ISRS location code (upper).	ATXXX000010000020100
WA	**Object name (M)**	Sting	Name of the location.	Krems
WA	**NOBJNM (O)**	String	Object name in national language	Krems
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be entered here.	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'.	viadonau

2.2.2. Fairway dimensions (F)

The fairway consists of geometric representations of the navigable channel and denotes the designated area with different Levels of Service (LOS).

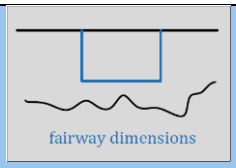
- Level of Service 1: Deep fairway channel for a pushed convoy as foreseen by the respective waterway class downstream in oneway traffic (as defined in the Fairway Rehabilitation and Maintenance Master Plan[8])
- Level of Service 2: for a pushed convoy as foreseen by the respective waterway class downstream passing a single vessel upstream
- Level of Service 3: two passing pushed convoys as foreseen by the respective waterway class LOS

As an example for a class VIb waterway this would mean:

LOS1		4-unit pushed convoy downstream in oneway traffic
LOS2		4-unit pushed convoy downstream and passing single vessel upstream
LOS3		Two 4-unit pushed convoys passing

[8] Fairway depth of 2.5 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

The fairway has to be harmonized over the whole Danube River to allow smooth visualization and processing. The data set includes one dataset for each service level.



Coverage	**Danube**
Coordinate System	**EPSG:4326 (WGS84)** EPSG:3857 - Web Mercator
Vertical Coordinate	**None**
Update Frequency	**As frequent as situation on site requires (monthly to annually, more Frequently on the Lower Danube)**
Format	**XML**
Sources	**National WAMS of all participating countries**
Geometry	**Polygon**

Data set quality:

- Harmonized and connected fairways to neighbouring countries.
- Smooth change of width by changing LOS standards.
- Digitalisation of the fairway boundaries with the accuracy of +-0.5 meter.
- Digitalisation of all LOS as polygons. LOS 3 is mandatory LOS 2 and 3 are optional
- Update replaces the data of the current LOS Level of the current Inland ENC cell.

Fairway dimensions provided by National WAMS:

T.	Attribute Names	Type	Values	Example
WA	**service_level (M)**	Enum.	1- (LOS 1 as defined in the fairway rehabilitation and maintenance masterplan [9]), 2- (optional) 3 - Fairway as defined by the Electronic Navigational Charts (ENCs)	1
WA	**Min. width (M)**	String	Min. width of the fairway for the specified LOS in [m]	80
WA	**Max. width (M)**	String	Max. width of the fairway for the specified LOS in [m]	100
WA	**depth (M)**	Integer	depth required for the specified LOS in[cm]	250
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be entered here.	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	viadonau

[9]Fairway depth of 2.5 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):

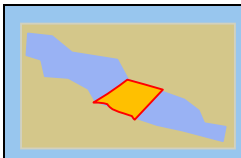
- 40 to 80 m in Austria
- 60 to 100 m in Slovakia and Slovakian-Hungarian border section
- 80 to 120 m in Hungary
- 80 m in Croatia, Serbia, Romania and Bulgaria (including border sections) – no range for curve radii as there is usually no passing of vessels/convoys in bends on these sections

2.2.3.Bottlenecks (BN)

Areas with fords (side arms) and lateral sedimentations are in the most cases bottlenecks, and will be identified, and managed within the national WAMS systems. The harmonized data set will be shared and used in WAMOS for visualisations and analytic purposes. Bottlenecks are described through the same attributes as "sections of limited depth", as defined in the IENC Encoding Guide, edition 2.3.6. and are complemented with additional information.

Caution area: Generally, an area where the skipper has to be made aware of circumstances influencing the safety of navigation. (Inland ENC Harmonisation Group, 2014)

Section of Limited Depth: Generally, a short section of a waterway with limited depth and well known to skippers as of high relevance for safety, also by shipping companies as the reference for the planning of the draught of vessels. (Inland ENC Harmonisation Group, 2014)



Coverage	**Lateral sedimentations and fords on the Danube River, Danube-Black Sea Canal**
Coordinate System	**EPSG:4326 (WGS84)**
Vertical Coordinate	**None**
Update Frequency	**As frequent as situation on site requires (monthly to annually, more frequent on the Lower Danube)**
Format	**XML**
Sources	**Lateral sedimentations and fords of national WAMS**
Geometry	**XML**

Data set quality:

- Depicts a sector of the waterway with restricted fairway parameters, in this case limited fairway depth and/or width
- Only one vertical depth reference (absolute and relative) shall be used per bottleneck
- WAMOS will create the geometry for the bottlenecks internally using the geometry of the waterway area.
- All datetime values in both requests and responses are passed with timezone information, either as a local datetime string (e.g. *2018-04-26T13:15:00+02:00*) or as a UTC datetime string (e.g. *2018-04-26T11:15:00Z*).
- Elements that are both nillable and have the minOccurs="0" attribute can be either omitted or passed in as <element xsi:nil="true"/>. Array elements of that kind may also be passed in as empty elements.

The <bottleneck_id> element is used to specify the requested bottleneck IDs. It is interpreted in the following way:

- If the element is omitted, xsi:nil, or empty, information on all bottlenecks is returned.
- If one or more <string> elements are passed in
    - If all bottleneck IDs are known to the system, information on the specified bottlenecks is returned.
    - If at least one of the Ids is not known to the System, error e120 is returned. The details message should contain details about the unknown bottleneck IDs

Bottleneck IDs have to be specified in the form *{Country Code}_{Type of section}_{Internal Id}*, e.g. *AT_Bottleneck_74*

The services return information on bottlenecks marked as "relevant" only. Therefore, a request specifying a bottleneck_id may return the information on that bottleneck at one time, while at another time the same request may result in an empty result set.

The <ISRS> element is used to specify stretches for which bottleneck information is requested.

The requested stretches are defined via ISRS Location Codes, which are defined in the RIS Index Encoding Guide. ISRS Location Codes must have 20 digits and are composed from their country code (2 digits), location code (3 digits), fairway section code, object reference code, and the hectometer (5 digits each). The country code, fairway section code, and hectometer are used to identify a river hectometer of a stretch. The location code and object reference code are filled with arbitrary letters or digits. A ISRS Location Code valid as river hectometer is e.g. ATXXX000010000018000 which defines hectometer 18000 on Austria's river Danube (fairway section 00001).

The <ISRS> element is interpreted in the following way:

- If the element is omitted, xsi:nil, or empty, information on all bottlenecks is returned.
- If one or more <ISRSPair> elements are passed in, only information on bottlenecks intersecting with one of these stretches is returned. Each <ISRSPair> element is handled as follows:

    - If only the <fromISRS> element is specified, information on the bottleneck that intersects with this hectometer is returned.
    - If both the <fromISRS> and the <toISRS> elements are specified, they specify the beginning and end of a stretch for which bottleneck data is requested. Information on all bottlenecks, that intersect with the stretch, is returned.
- If multiple <ISRSPair> elements are passed in, and a bottleneck intersects with more than one stretch, the bottleneck is added to the result set only once.
- All ISRS codes passed in are validated against the ISRS Location Code format. If at least one ISRS code is not a valid ISRS Location Code, error e120 is returned. The details message should contain details about the invalid ISRS codes.

The ISRS pairs may be passed in with the fromISRS value less than the toISRS value, or vice versa. The services will order the values of the pair as required for calculation. This avoids ambiguities that might result from the upstream hectometer counting on river Danube.

Requested period

The <period> element is used to specify the date range for which to retrieve bottleneck information and fairway availability data, as well as to provide the interval of the measures of the fairway availability data. It is handled in the following way:

Data range

Both WAMOS bottleneck services can be used to retrieve current and historic bottleneck data. The elements <Date_start> and <Date_end> within the <period> element determine, if historic or current information is returned, or both:

- If the <period> element is omitted, xsi:nil, or contains no period (both <Date_start> and <Date_end> elements omitted), current bottleneck data is returned.
- If the <period> element is present and contains at least the <Date_start> or the <Date_end> element, information on historic and/or current bottleneck data is returned for the specified period. According to the values passed in, the range is calculated as follows:
    - If both dates are passed in, these values specify the start and end date of the requested period.
    - If <Date_start> is omitted, the start date is set to the minimum waterlevel measure date. For Austria this is 4 months before the current date.
    - If <Date_end> is omitted, the end date is unbounded which means that also future (forecasted) values will be returned.

According to the specified period, historic and/or current data is used to build the result set:

- For the current and future part of the range, or if no period is specified, the bottleneck information is built from the **current** values.
- For the past part of the range, the bottleneck information is built from the **historic** values.
- If a period contains both a past and a current/future part, **historic** and **current** values are used to build the result.

Interval

The <Value_interval> element within the <period> element defines the interval (in minutes) between the waterlevel values, which the FairwayAvailabilityService uses to build the <EffectiveFairwayAvailability> elements of each bottleneck:

- If the <Value_interval> element is not specified, the default interval is used to select the waterlevel values. For Austria, the default interval is 15 minutes for measured, and 60 minutes for forecasted values.
- If the <Value_interval> element is provided,
    - if it is a positive multiple of 15 minutes, this value is used as the interval between waterlevel values, both for measured and forecasted values.
    - if it is any other number, error e120 is returned.

The <Value_interval> element has no meaning for the BottleneckService. If it is passed in with this service, it is ignored.

Resulting data

If **current** data is requested, both services calculate the resulting bottleneck information from the current bottleneck values. Moreover, the FairwayAvailabilityService includes <EffectiveFairwayAvailability> elements calculated from the waterlevels **currently measured** at, or **forecasted** for, the reference gauge. If specified, the <Value_interval> is applied.

If **historic** data is requested, the resulting bottleneck information of both services is calculated from the historic bottleneck values within the specified date range. The FairwayAvailabilityService, moreover, includes <EffectiveFairwayAvailability> elements calculated from the waterlevels **historically measured** at the reference gauge. If specified, the <Value_interval> is applied. Historic forecasted values are not included into the result set. Before generating the data, the service estimates the requested value count. If the count exceeds a certain threshold, error e310 (too many results) is returned. The threshold for Austria currently is10000 <EffectiveFairwayAvailability> elements, resulting in appx. 5 MB of response data, but may be increased in the future.

Bottleneck Data:

T.	Attribute Names	Type	Values	Example
WA	**bottleneck_id (M)**	String	<Country Code>_<Type of section>_<Internal Id>	AT_Bottleneck_12
WA	**fk_g_fid (M)**	String	ISRS code of gauge. Foreign key to reference gauge (see ch. 3.1.1)	ATHIA00001G001218792
WA (ENC)	**OBJNAM (O)**	String	Name of the bottleneck (caution area)	Shallow water area Regelsbrunn
ENC	**NOBJNM (O)**	String	Object name in national language	Furt Regelsbrunn
WA	**from_ISRS (M)**	String	ISRS Location Code from	ATXXX000010000019435
WA	**to_ISRS (M)**	String	ISRS Location Code to	ATXXX000010000019723
WA	**rb_lb (O)**	String	Defines the ISO_3166-1country codes for the countries of the right and left riverbed separated by an underline "_".	AT_SK
WA	**riverbed (O)**	Enum.	Multiselect of different riverbed materials: • Gravel, • Rocky, • Stone, • Andesite, • Sleazy andesite, • Sandy gravel, • Marl, • Sand • Sandy gravel, • Sarmatian limestone, • sandstone peaks • Rough sandy gravel	Gravel
WA	**responsible_country (O)**	Enum.	The responsible country code consists of two letters and is defined	AT

			in ISO standard 3166-1. The official list of country codes is published at http://www.unece.org/cefact/locode/service/country.htm changing responsibilities need a change in the data set	
WA	**revisiting_time (O)**	String	Defines the interval of riverbed surveys recommended for that particular area in [months]. e.g. 6, indicates that after six months the area needs to be surveyed again, resulting in 2 riverbed surveys per year.	6
WA	**SURTYP (O)**	Enum.	Survey Type • Multibeam • Singlebeam • ADCP • Inspection tour	Singlebeam
WA	**Coverage (O)**	Enum.	If single beam: - Cross profiles - Longitudinal profiles If multi beam: coverage: - Fairway - River If ADCP: - Cross profiles - Longitudinal profiles If Inspection tour - Cross profiles - Longitudinal profiles - River banks	Cross profiles
WA	**Limiting factor (O)**	Enum	Main limiting factor at the bottleneck, e.g. frequently limited depth at a ford or frequently limited with due to lateral sedimentation or curve radius caused by narrow river bend. If depth and with and/or curve radius is limited at the same time, the dominating limiting factor shall be indicated. 1 – depth 2 – width 3 – curve radius	depth
WA	**Depth_reference (M)**	Enum.	Code for the depth reference of the riverbed survey: • 1- LDC	LDC/LNW

			• 2 -LNW • 2- ZPG • 3-… code in line with the RIS Index This information describes the reference level for all data related to bottlenecks.	
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be provided here (automatically by the system).	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	Viadonau
WA	**AdditionalData (O)**	Complex type	This element can be used to transfer additional information (e.g. key="Maintenance_status" value="dredge")	

Content of the element "AdditionalData"

This Attribute is optional and can occure several times extending the available Attributes.

WA	**Key (M)**	string	Name of additional data element.	Maintenance
WA	**Value(M)**	string	Value of additional data element	dredge

2.2.4.Sounding results (SR)

This data set includes the quality checked and cleaned riverbed survey data. Depending on the riverbed stretch the survey frequency will change. The data set covers at least the bottleneck.

Coverage	Critical sections
Coordinate System	EPSG:4326 (WGS84)
Vertical Coordinate	LNWL / (EVRF2007)[10][11]
Update Frequency	Depending on bottleneck.
Format	CSV including Metadata encoded in the filename
Sources	National WAMS of all participating countries
Geometry	Points

Data set quality:

- Bottlenecks have to be surveyed regularly depending on the needs of the specific section with multibeam sensors. For each Sounding result only one reference height (Absolute altitude or relative depth) shall be available. Otherwise the Sounding result data set has to be divided.
- The measure point density should be approximately 1 meter.
- Only quality checked and harmonized data will be exchanged.
- Metadata will be stored in the Filename of the sounding result dataset in the format: <Date><Area>_<Type>_<Vertical Reference> (example 20170517_LOB_F_MB_ADR_WGS84)
- Each sounding result has to have a related Rehabilitation and Maintenance measures "survey" representation stating additional details about the survey.
  Per default, the extent of the sounding results is delimited by the available sounding result measure points. In some circumstances (e.g. bridge piers), this boundary might not be sufficient and may lead to imprecise results. Here a more precise optional geometry file can be uploaded. This file shall have (besides the file extension) the same name and location as the sounding result and shall contain a projection (.prj) file defining the coordinate system.

Sounding Result Data:

T.	Attribute Names	Type	Values	Example
WA	**x (M)**	Double	Cleaned X coordinates	12.5454
WA	**y (M)**	Double	Cleaned Y coordinates	45.56546
WA	**depth (M)**	Double	Absolute altitude or relative depth of the river related to the depth reference indicated in the metadata in meters	207.75

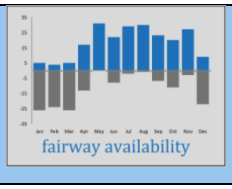
[10] http://georepository.com/datum_5215/European-Vertical-Reference-Frame-2007.html

[11] http://geodezie.utcb.ro/files/geos/publicatii/Articol_EVRF2007_2010.pdf

2.2.5.Available fairway depths (AF)

This data set extends the Bottlenecks data set with temporal data describing the condition of the specific area. "Available fairway" is used to calculate the number of days per month/quarter/year with a fairway depth below a targeted depth, over a defined width, in line with the fairway dimensions of different Levels of Service. The calculation uses the attribute "minimum depth" and "minimum width" of the bottleneck as well as the Gauge Measurements to calculate the available fairway depth.

The information provided is related to Bottlenecks but can be aggregated to higher levels using defined sections and stretches (see Stretches and Sections).



Coverage	(Bottlenecks)
Coordinate System	None
Vertical Coordinate	None
Update Frequency	Daily provision by Waterway Authority
Format	XML
Sources	National WAMS of all participating countries
Geometry	None

Data set quality:

- The availability value of the day depends on the daily mean water level and the results of the latest riverbed survey.
- The source gauge measurements have to be already filtered and corrected when calculating the availability. Therefore WAMOS will check the retrieved values for plausibility before integrating them into the system.
- Missing values will be marked as "not available"
- LOS-Level will be calculated automatically by WAMOS.
- Each bottleneck can be provided with min depth and min width. This information should have an accuracy of +-15-20 cm.

Fairway availability

T.	Attribute Names	Type	Values	Example
WA	**fk_bn_fid (M)**	String	Foreign key of the bottleneck. This ID identifies the bottleneck uniquely and will be stable over the lifetime of this location	AT_Bottleneck_12
WA	**SURDAT (M)**	Date	Surveying date (DD.MM.YYYY)	12.04.2017
WA	**POSITION (O)**	Enum.	Position of the shallowest surveyed point (within LOS1) • Red buoy • Green buoy • Right bank • Left bank • Middle • All (whole fairway)	Red buoy
WA	**Reference_values (C)**	Complex type	This element may occur several times including several sub-elements with information on reference depth/width.	
WA	**AdditionalData (O)**	Complex type	This element can be used to transfer additional information (e.g. key="Maintenance_status" value="dredge")	
WA	**Critical (C)**	Boolean	Indicate if the state of the bottleneck is critical or not.	True

Depends on source	**Bottleneck_PDFs (C)**	Complex type	This element may occur several times including several sub-elements with Bottleneck PDF information as specified below	
WA or WAMOS	**Effective_fairway_availability (C)**	Complex type	This element may occur several times including several sub-elements with information on actual/forecasted depth/width/water level	
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be provided here (automatically by the system).	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	viadonau

Content of the element "Reference_values".
The element may occur up to three times including different available depth/width values for the three different levels of service

WA	**fairway_depth (C)**	Integer	Shallowest surveyed point. Depth with reference to "depth reference" (e.g. LNW, ZPG) indicated in the bottleneck data set (cm). This information is needed for the calculation of the fairway availability at a certain water level. ➢ At least one value (either depth or width or curve radius) is mandatory.	250
WA	**fairway_width (C)**	Integer	Minimum width of the fairway at the bottleneck (m) ➢ At least one value (either depth or width or curve radius) is mandatory.	80
WA	**fairway_radius (C)**	Integer	Minimum curve radius of the fairway at bottleneck (m) ➢ At least one value (either depth or width or curve radius) is mandatory.	750
WA	**Shallowest_spot_Lat (O)**	Double	Coordinate of the most critical shallowest point, which is decisive for navigation.	12.4545
WA	**Shallowest_spot_Lon (O)**	Double	Coordinate of the most critical shallowest point, which is decisive for navigation.	45.45485
WA	**Level_of_Service (C)**	Enum.	Level of Service corresponding to the provided available depth/width/curve values: • LoS1 • LoS2 • LoS3	LoS1

Content of the element "AdditionalData"

This Attribute is optional and can occure several times extending the available Attributes.

WA	**Key (M)**	string	Name of additional data element.	Maintenance
WA	**Value(M)**	string	Value of additional data element	dredge

Content of the element "Bottleneck_PDFs"
In general Bottleneck PDFs include a PDF map of the bottleneck showing the background map, the waterway area, the extent of the fairway (LOS1, LOS2, LOS3), the sounding result, depth contours, the shallowest spots within the different Levels of Service using a harmonized template or a PDF map of the bottleneck as provided by the local competent authority.

WA or WA MOS	**ProfilePdfFilename (M)**	String	Name of the PDF-file of the depth profile	Furt Regelsbrunn.pdf
WA or WA MOS	**ProfilePdfURL (M)**	String	URL, where the PDF-file can be loaded from	http://www.doris.bmvit.gv.at/fileadmin/doris_iframe/furten/Furt Regelsbrunn.pdf
WA or WA MOS	**PDF_Generation_Date (M)**	DateTime	Time the shallow section pdf was published by the source	12.04.2017 12:15:20
WA or WA MOS	**Source (M)**	String	The source of the respect tive PDF is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	viadonau

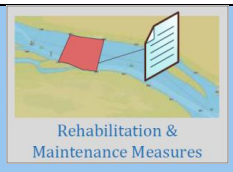
Content of the element "Effective_fairway_availability":
The element may occur several times including different available depth/width/water level values for different timestamps for different levels of service

T.	Attribute Names	Type	Values	Example
WA MOS or WA	**Available_depth_value (C)**	Integer	Minimum available water depth at the given Measure_date in cm. ➢ At least one value (either depth or width or water level) is mandatory.	250
WA MOS or WA	**Available_width_value (C)**	Integer	Minimum available width of the fairway at the given Measure_date in cm. ➢ At least one value (either depth or width or water level) is mandatory.	8000
WA	**Water_level_value (C)**	Integer	Water level at the reference gauge station at the given Measure_date in cm. ➢ At least one value (either depth or width or water level) is mandatory.	274
WA MOS or WA	**Measure_date (M)**	DateTime	Date and time for when the available width and/or depth and/or water level is provided.	13.04.2017 08:30:00
WA MOS or WA	**Measure_type (M)**	Enum.	Information on how the provided available depth/width/water level values have been created. Possible options are: • Measured (based on actual measured water level) • Forecasted (based on forecasted water level) • Minimum guaranteed (based on minimum	Measured

			guaranteed depth set out by the authorities)	
WA	**Source (M)**	String	The source of the provided available depth/width/water level values is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	viadonau
WA	**Level_of_Service (C)**	Enum.	Level of Service of the provided available depth/width values: • LoS1 • LoS2 • LoS3	LoS1
WA	**Forecast_generation_time (C)**	DateTime	Date and time the available width/depth/water level forecast was made (the time the model was running resulting in the forecasted values) – for forecasts this element is mandatory, for other measure_types it is not provided	12.04.2017 12:15:20
WA	**Value_lifetime (C)**	DateTime	Time when the provided available depth/width/water level values are not actual any more (time until when a measured value may be considered as 'actual' or time until when a forecast is considered as outdated)	12.04.2017 23:15:00

2.2.6. Rehabilitation and maintenance measures (RMM)

This data set will be maintained in the national WAMS systems.



Coverage	**Danube, Danube-Black Sea Canal, Sava**
Coordinate System	**Preferred: EPSG:3857 - Web Mercator** (EPSG: 4326 (WGS84))
Vertical Coordinate	**None**
Update Frequency	**Life link update as in current system**
Format	**WFS**
Sources	**National WAMS of all participating countries**
Geometry	**XML / CSV**

Rehabilitation and maintenance measures data:

The data listed below consists of the basic attributes relevant for all types of measures. Each measure type may include further attributes which are stated below in a separate table.

T.	Attribute Names	Type	Values	Example
WA	**ID (M)**	Long	Unique id of the measure	5643546834
WA	**from_ISRS_location (M)**	String	River hectometre from.	ATHIA00001G0012187 92
WA	**to_ISRS_location (M)**	String	River hectometre to.	ATHIA00001G0012197 92
WA	**type (M)**	Enum.	Dredging, Surveying, Marking, Change of river engineering structures, Other	Dredging
WA	**status (M)**	Enum.	planned, active, completed,	completed
WA	**start (M)**	DateTime	Beginning of measure	10.04.2017 12:15:20
WA	**end (M)**	DateTime	End of measure	12.04.2017 12:15:20
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be entered here.	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	Viadonau

Dredging

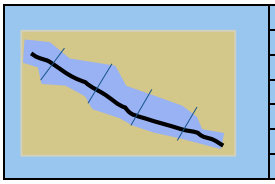
T.	Attribute Names	Type	Values	Example
WA	**volume** **(M)**	Double	Amount of relocated material in m^3.	23234
WA	**Material** **(M)**	Enum.	Multiselect of different riverbed materials: • Gravel, • Rocky, • Stone, • Andesite, • Sleazy andesite, • Sandy gravel, • Marl, • Sand • Sandy gravel, • Sarmatian limestone, • sandstone peaks Rough sandy gravel	Gravel
WA	**Utilisation** **(M)**	Enum.	Recirculation, Extraction	Recirculation
WA	**from_ISRS_recirculation** **(C)**	String	Recirculation kilometre from.	ATHIA00001G00121 8792
WA	**to_ISRS_recirculation** **(C)**	String	Recirculation kilometre to.	ATHIA00001G00121 8892
WA	**Permits** **(M)**	Boolean	Yes / No. Required permits obtained	Yes
WA	**Permit_reference** **(M)**	String	Name of the permit	
WA	**Main conditions of the permit** **(O)**	String	Short description of the permit.	• A maximum of 50 % of dredged gravel may be used for structuring measures (river banks, islands), the rest is to be dumped into the river • After high waters sediment in ford areas has to be removed as fast as possible at a width of 80/100 m • As far as possible, ecological aspects shall be accounted for when planning single measures • Dredging measures shall be kept to a minimum

Surveying:

T.	Attribute Names	Type	Values	Example
WA	**fk_bn_fid (M)**	String	Foreign key of the bottleneck. This ID identifies the bottleneck uniquely and will be stable over the lifetime of this location	AT_Bottleneck_12
WA	**SURDAT (M)**	Date	Surveying date(full date)	12.04.2017
WA	**SURTYP (M)**	Enum.	Survey Type: • Multibeam, • Singlebeam • ADCP • Inspection tour	Singlebeam
WA	**Coverage (C)**	Enum.	If single beam: - Cross profiles - Longitudinal profiles If multi beam: coverage: - Fairway - River If ADCP: - Cross profiles - Longitudinal profiles If Inspection tour - Cross profiles - Longitudinal profiles - River banks	
WA	**Coverage 2 (C)**	double	If single beam: Density of profiles in metres	1
WA	**Quality (M)**	Enum.	Height reference used during riverbed survey: – RTK – RTK corrected with installed fixed points – Modelled Reference Water Level for at least each kilometre – Modelled Reference Water Level for less than each kilometre – Defined reference water level at reference gauge	RTK corrected with installed fixed points

Marking:
See chapter 2.1.2 Fairway Marks (FM).

2.2.7. Waterway Profiles (WP) (optional)



Coverage	Danube, Danube-Black Sea Canal, Sava
Coordinate System	None
Vertical Coordinate	None
Update Frequency	Every 10 years
Format	XML
Sources	National WAMS of all participating countries
Geometry	Line (waterway profile)

These water level characteristics are used as reference when precise calculation of the availability is needed or waterlevels are interpolated.

The geometry of the waterway profiles can be used to calculate riverbed profiles for the specified location.

Water Level Reference data:

T.	Attribute Names	Type	Values	Example
WA	**rhm**	double	postion of the value	1000.0
WA	**lnwl (C)**	Integer	Low Navigable Water Level of the specific gauge in cm. ➔ mandatory if available	250
WA	**mwl (O)**	Integer	Mean Water Level of the specific gauge in cm.	280
WA	**hnwl (O)**	Integer	Highest Navigable Water Level of the specific gauge in cm.	310
WA	**fe30 (O)**	Integer	Maximum flood elevation 30 years in cm.	390
WA	**fe100 (O)**	Integer	Maximum flood elevation 100 years in cm.	410
WA	**valid_from (C)**	DateTime	Start of the validity period. Mandatory if a water characteristic (LNWL HNWL etc) is defined.	12.04.2017 00:00:01
WA	**valid_to (C)**	DateTime	End of the validity period Mandatory if a water characteristic (LNWL HNWL etc) is defined.	12.04.2027 23:59:59
WA	**Date_Info (M)**	DateTime	In case data changed (e.g. name or dimensions of an object), the change date has to be entered here.	12.04.2017 12:15:20
WA	**Source (M)**	String	The source of the respective entry is listed in this column. The (short version of the) organization name is provided in plain text. E.g. 'viadonau'	Viadonau

3. References

inland ENC Harmonisation Group. (2014, 6). *IENC Product Specification 2.3* . Retrieved from http://ienc.openecdis.org/files/IENC%20Encoding%20Guide%20-%20Edition%202.3.6.pdf

Inland ENC Harmonization Group. (2011, 06 07). *IENC Feature Catalogue.* Retrieved 05 18, 2017, from http://ienc.openecdis.org/files/IENC_FC_23.pdf