“NETWORK OF DANUBE WATERWAY ADMINISTRATIONS” – data & user orientation

SOUTH EAST EUROPE TRANSNATIONAL COOPERATION PROGRAMME

STATUS QUO REPORT ON SHALLOW SECTION INFORMATION

O.3.2.1 – O.3.2.7

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LIST OF ABBREVIATIONS

ABBR	ABBREVIATION

1 SCOPE OF DOCUMENT

Hydrographic (bathymetric) survey is the process of gathering information about navigable waterways for various purposes such as: safe navigation, dredging, planning of the engineering works, etc.

The hydrographic survey of international navigable waterways in Serbia is the task that is performed by Directorate for Inland Waterways “Plovput”. Survey on the Danube, Sava, and Tisza rivers are being performed annually.

Gathered data is being used for detailed analysis of navigation conditions of waterways. Stretches of the river, where Danube Commission recommendations (Table 1) are not fulfilled are then identified as critical and different short-term and long-term measures are being proposed.

TABLE 1 FAIRWAY DIMENSIONS PER DANUBE COMMISSION RECCOMENDATIONS

	Free flowing section	Backwater section
Fairway width (m)	180 m Rocky bottom 100m Bend 200m	180 m Rocky bottom 100m Bend 200m
Fairway depth (m)	2.5m	3.5m
Bend radius (m)	1000m (esp. 750m)	1000m (esp. 750m)
Bridge clearance (m) Width Height	 Upstream Drava River Confluence 100 m Downstream Drava River Confluence 150m 9.5m	 150m 10m

2 DEFINITION

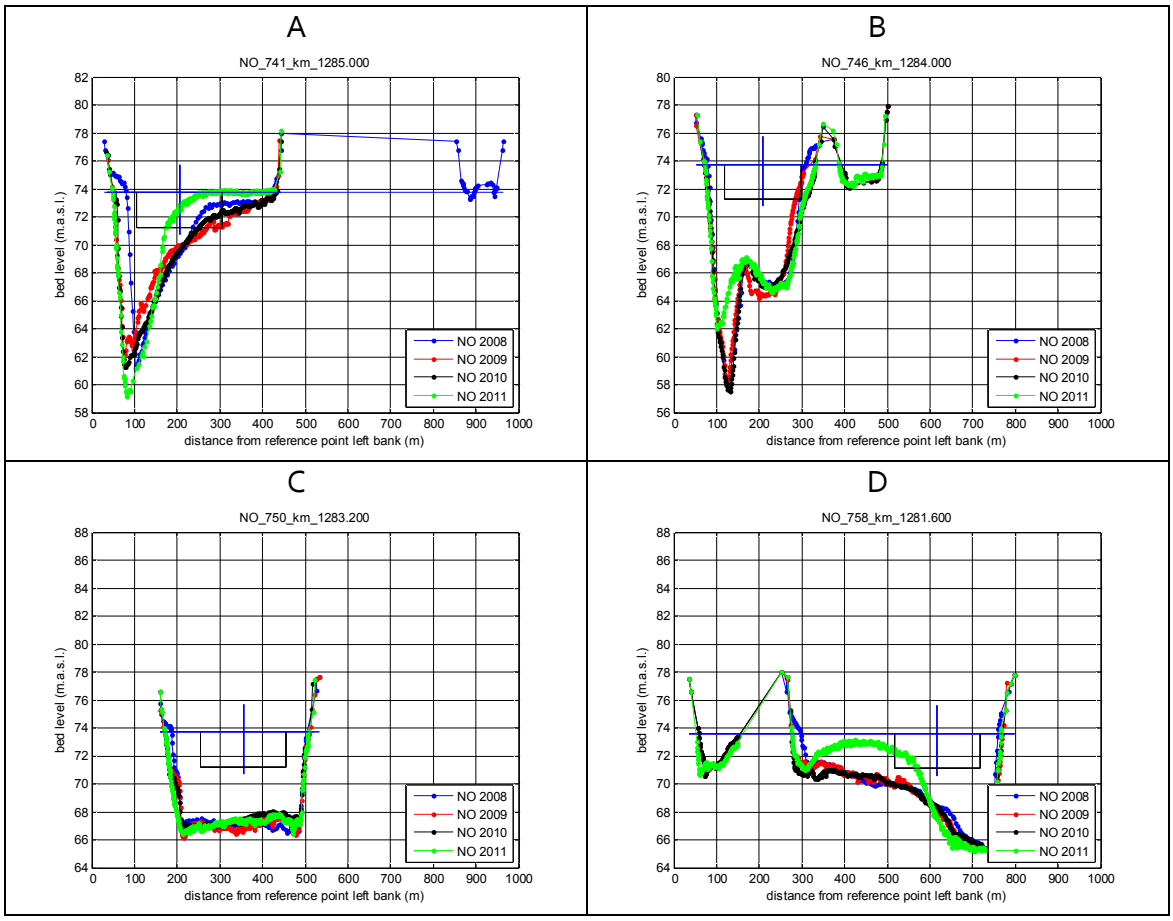
2.1. Definition of shallow section;

Due to its morphology, Danube River in Serbia does not have *shellow sections*, but **critical sectors**, and throughout the text that term will be used for the sections of the river where Danube Commission Recommendations were not fulfilled.

Danube River in Serbia is characterized with sufficient depths, but due to large number of islands and sandbars required fairway width is not always fulfilled.

Before river sector is announced critical, latest surveys are analyzed along with existing ones for each surveyed profile in order to define if profile is dynamic or not, and how much is its dynamicity impacting fairway, Figure 1.

FIGURE 1 CRITICAL SECTOR SUSEK - CROSS-SECTIONAL ANALYSIS



After this initial waterway analyses, fairway is being realigned, and only then critical sectors can be announced as such.

2.2. Type of shallow section;

Critical sectors on the Serbian part of the Danube River are located on the free-flowing sections of the river.

Critical sectors were defined within the project “Preparation of Documentation for River Training Works on the Danube River in Serbia’, funded through IPA 2010. Within this project, new low navigation levels were defined using the cross-sectional information provided by Plovput (cross-sections every 200m). 1D hydraulic model was developed, and provided very accurate water level information for all profiles used in the model. Using this information and historic profile data it was possible to define dynamic profiles, as well as stabile profiles which are not providing sufficient width and depth for navigational purposes.

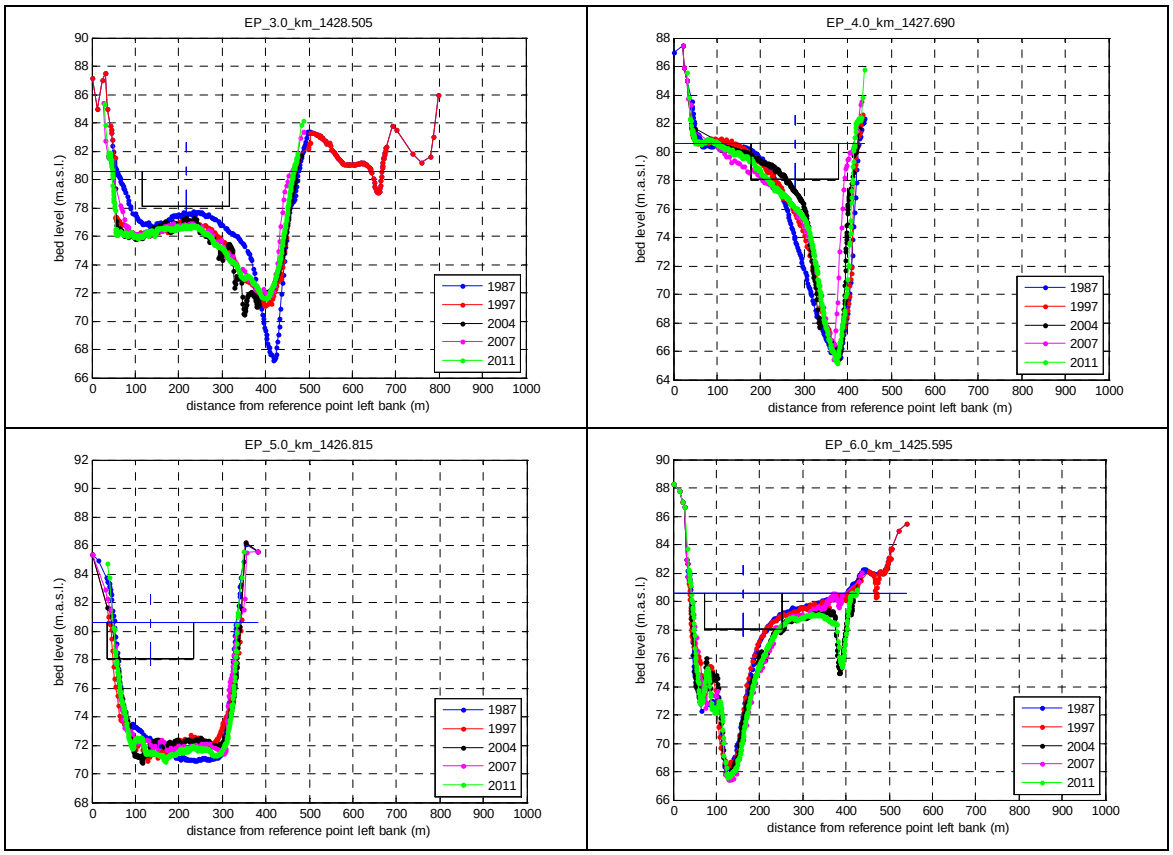
2.3. List of shallow sections along the national waterways

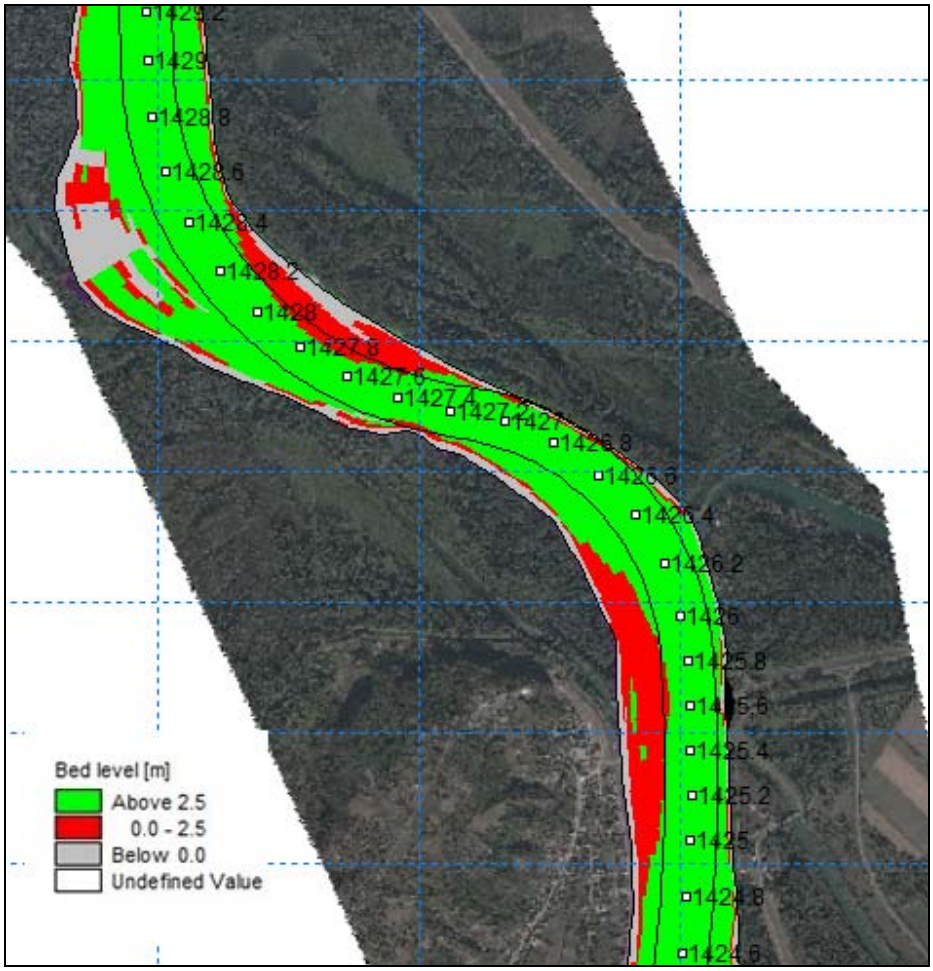
Liar and main characteristics of critical sectors on Serbian stretch of the Danube River can be found on following pages.

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Bezdan**				**Priority:**	Prioritisation process under assessment
Waterway:	Danube					
Location:	from km:	1,429.00	to km:	1,425.00	length:	4.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		

Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bezdan**			
Location:	km:	1,425.59	bank:	left bank
Distance to critical location:	1.41 km			
LNWL* (= ENR):	80.54 m.a.s.l.			
LNQ:**	1180 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

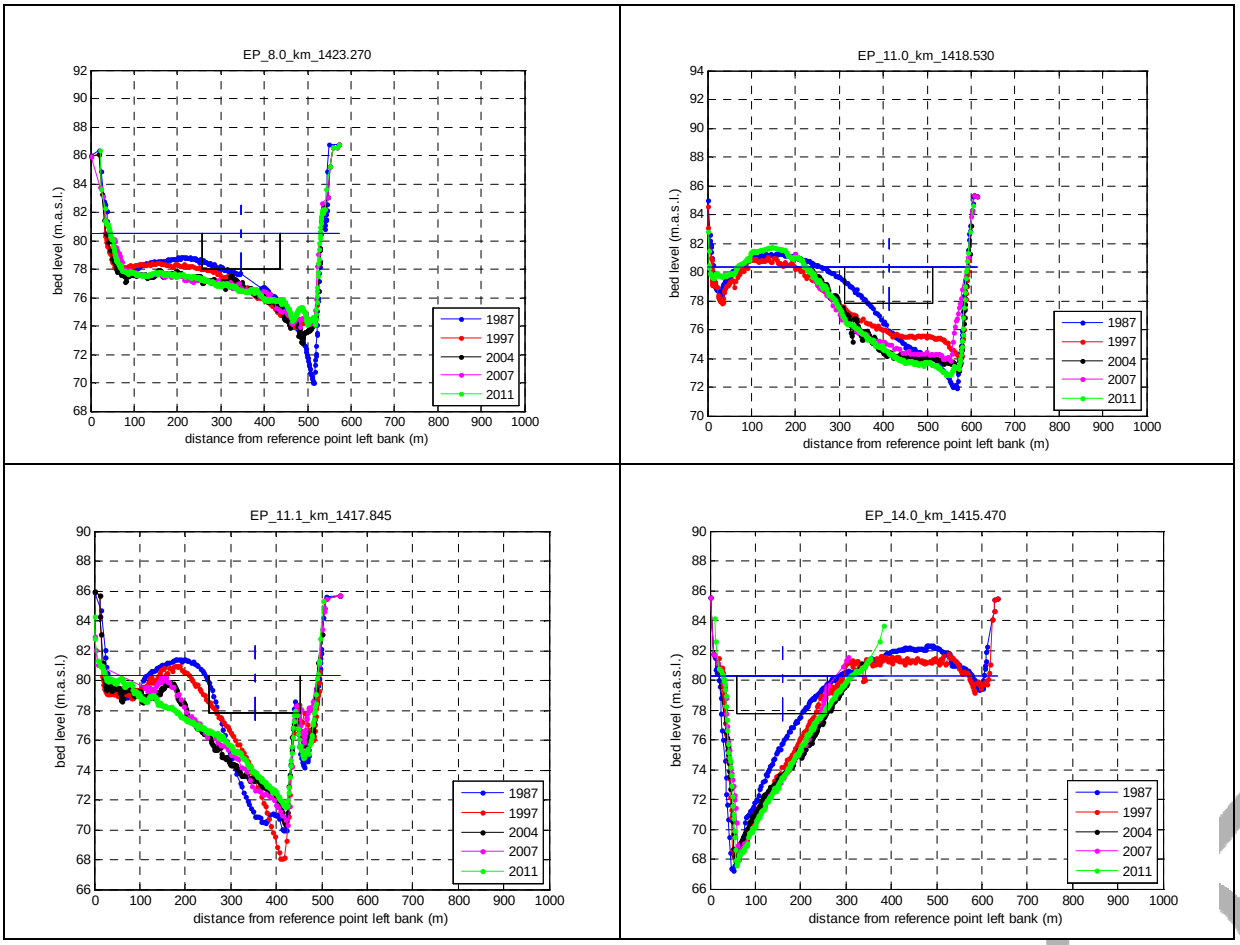
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

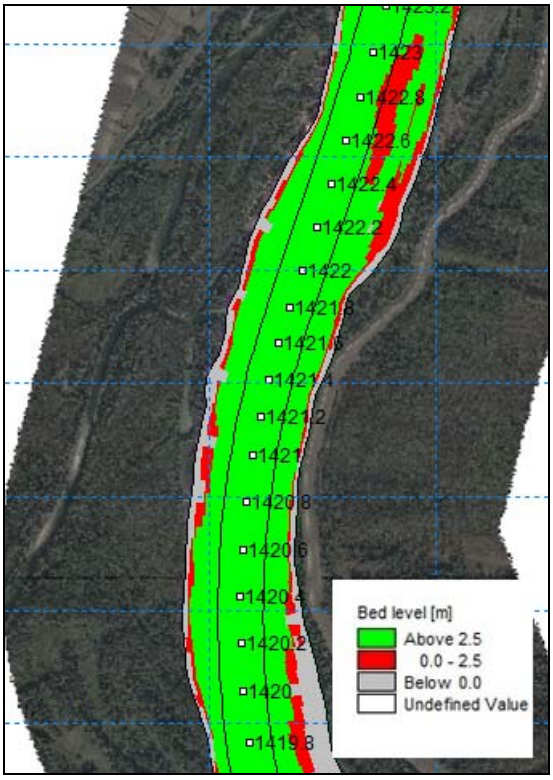
end of document

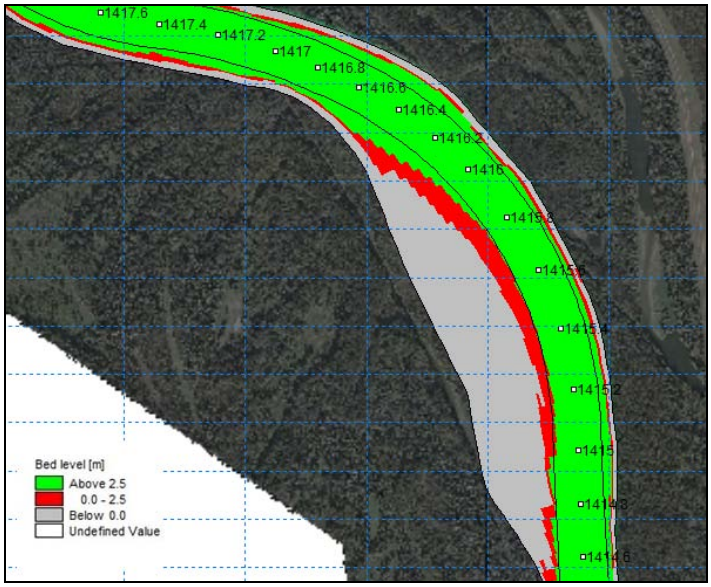
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Siga - Kazuk**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,424.20	to km:	1,414.40	length:	9.80 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	

		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bezdan**			
Location:	km:	1,425.59	bank:	left bank
Distance to critical location:	6.29 km			
LNWL* (= ENR):	80.54 m.a.s.l.			
LNQ:**	1180 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

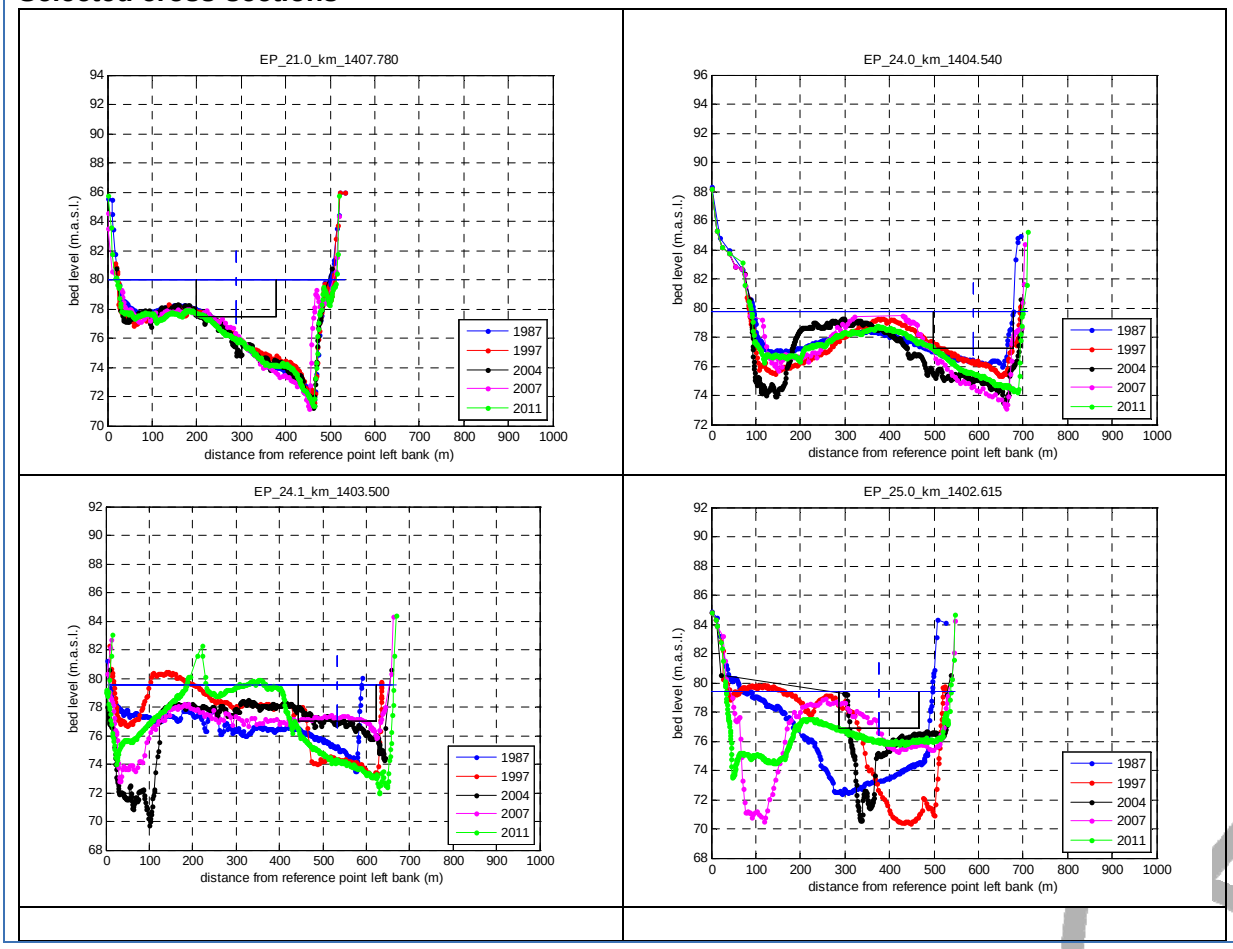
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

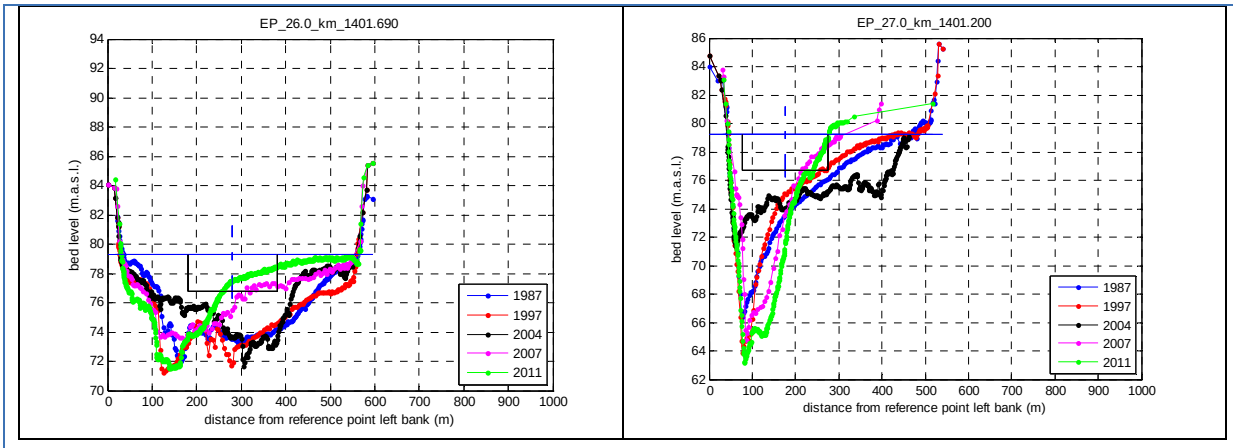
end of document

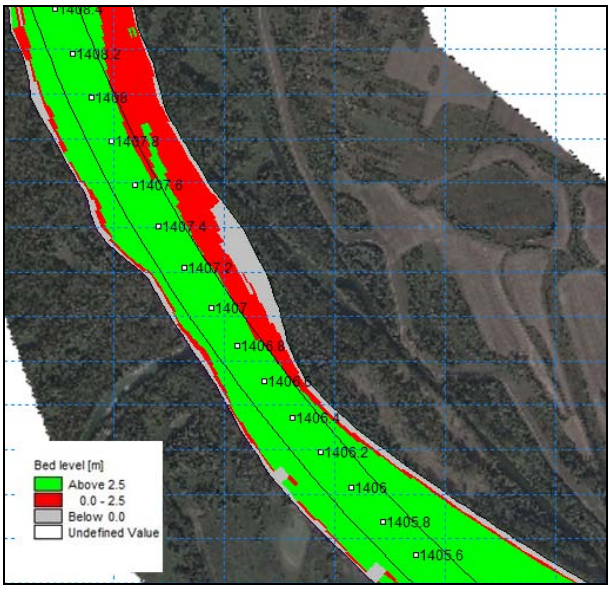
DATA SHEET: CRITICAL FAIRWAY LOCATION

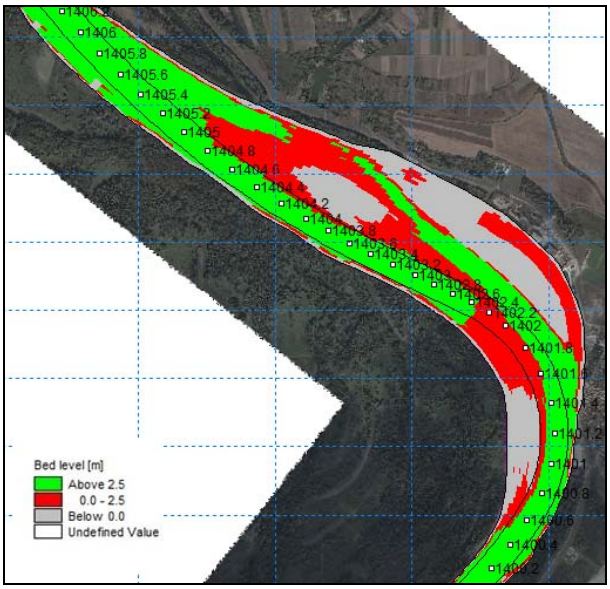
Name:	**Apatin**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,408.20	to km:	1,400.00	length:	8.20 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

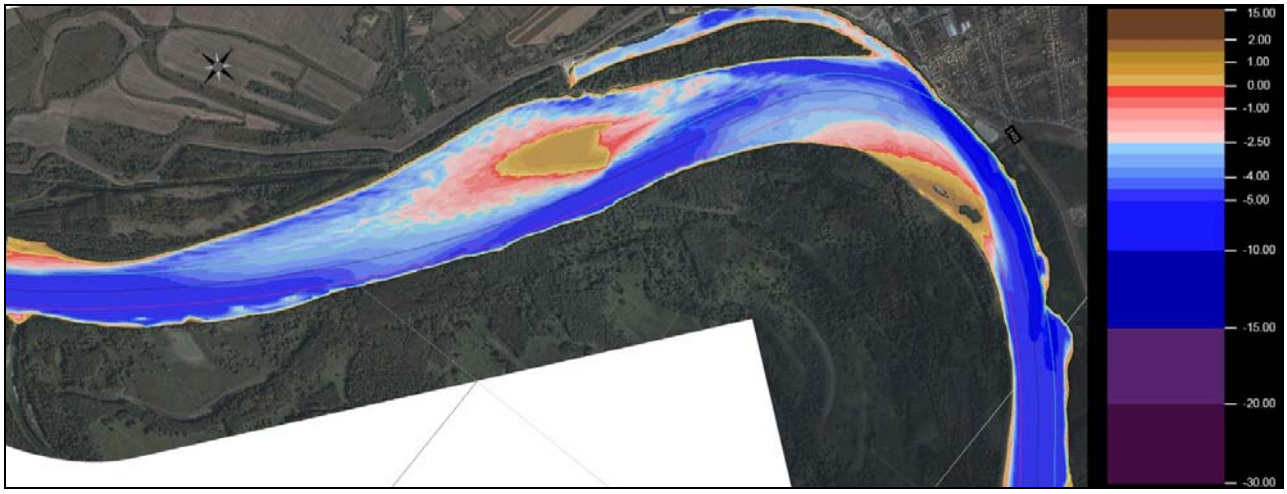
Selected cross-sections




EP_26.0_km_1401.690
bed level (m.a.s.l.)
distance from reference point left bank (m)
1987
1997
2004
2007
2011
EP_27.0_km_1401.200
bed level (m.a.s.l.)
distance from reference point left bank (m)
1987
1997
2004
2007
2011


Bed level [m]
Above 2.5
0.0 - 2.5
Below 0.0
Undefined Value


Bed level [m]
Above 2.5
0.0 - 2.5
Below 0.0
Undefined Value


15.00
2.00
1.00
0.00
-1.00
-2.50
-4.00
-5.00
-10.00
-15.00
-20.00
-30.00

Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Apatin**			
Location:	km:	1,401.90	bank:	left bank
Distance to critical location:	2.20 km			
LNL* (= ENR):	79.31 m.a.s.l.			
LNQ:**	1180 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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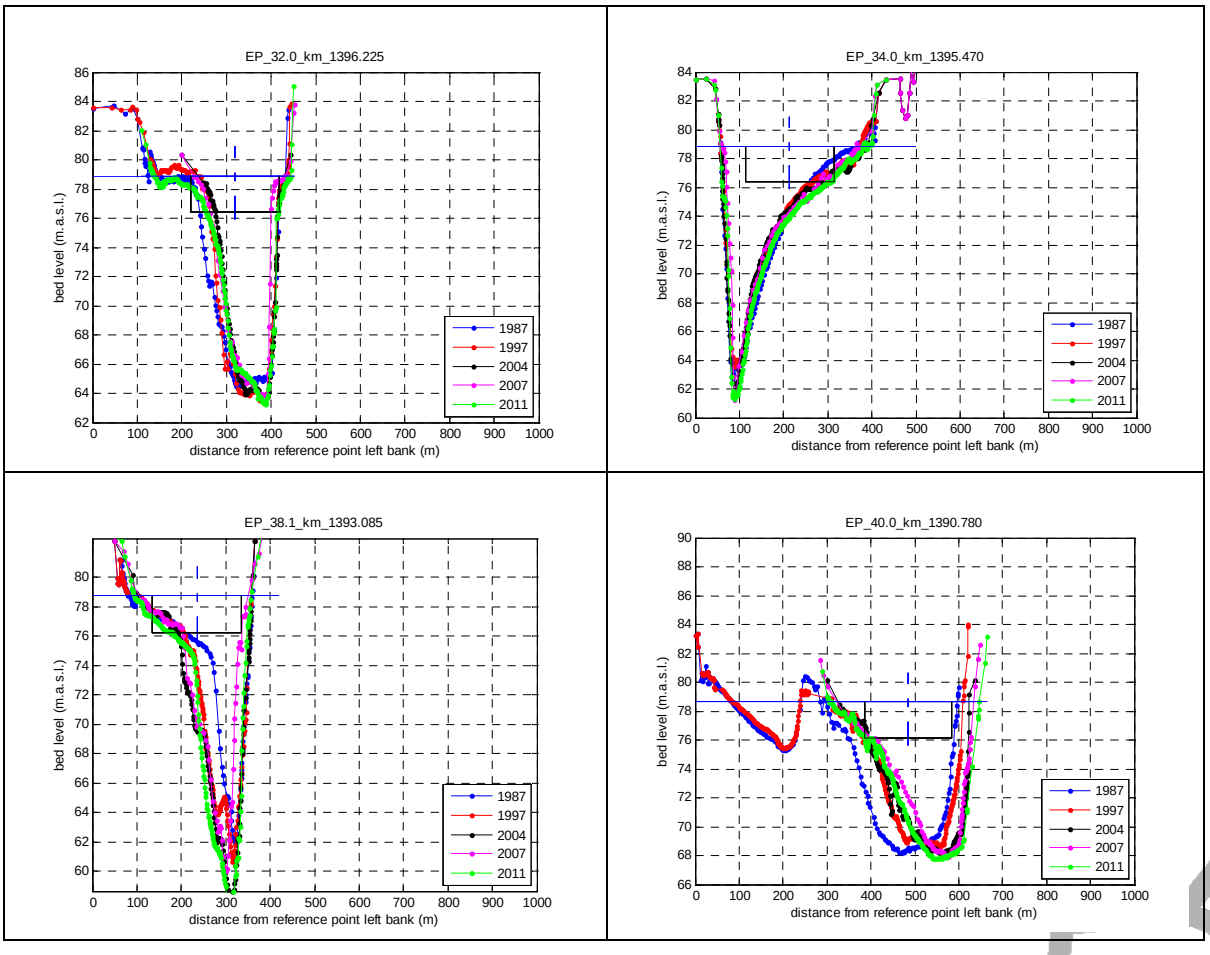
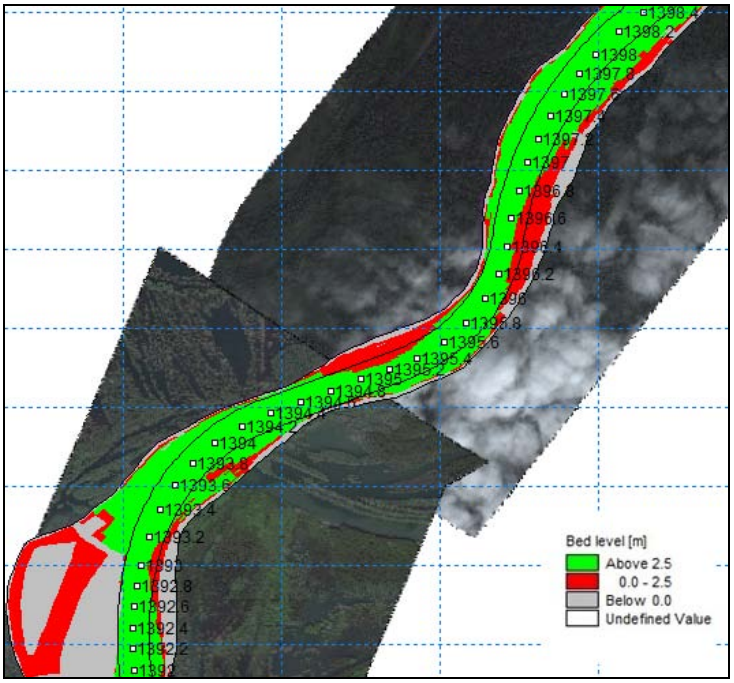
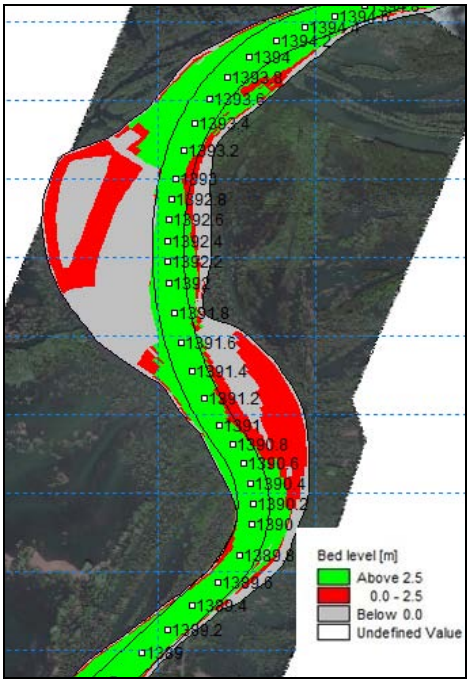
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Čivutski rukavac**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,397.20	to km:	1,389.00	length:	8.20 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	

		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Apatin**			
Location:	km:	1,401.90	bank:	left bank
Distance to critical location:	8.80 km			
LNL* (= ENR):	79.31 m.a.s.l.			
LNQ:**	1180 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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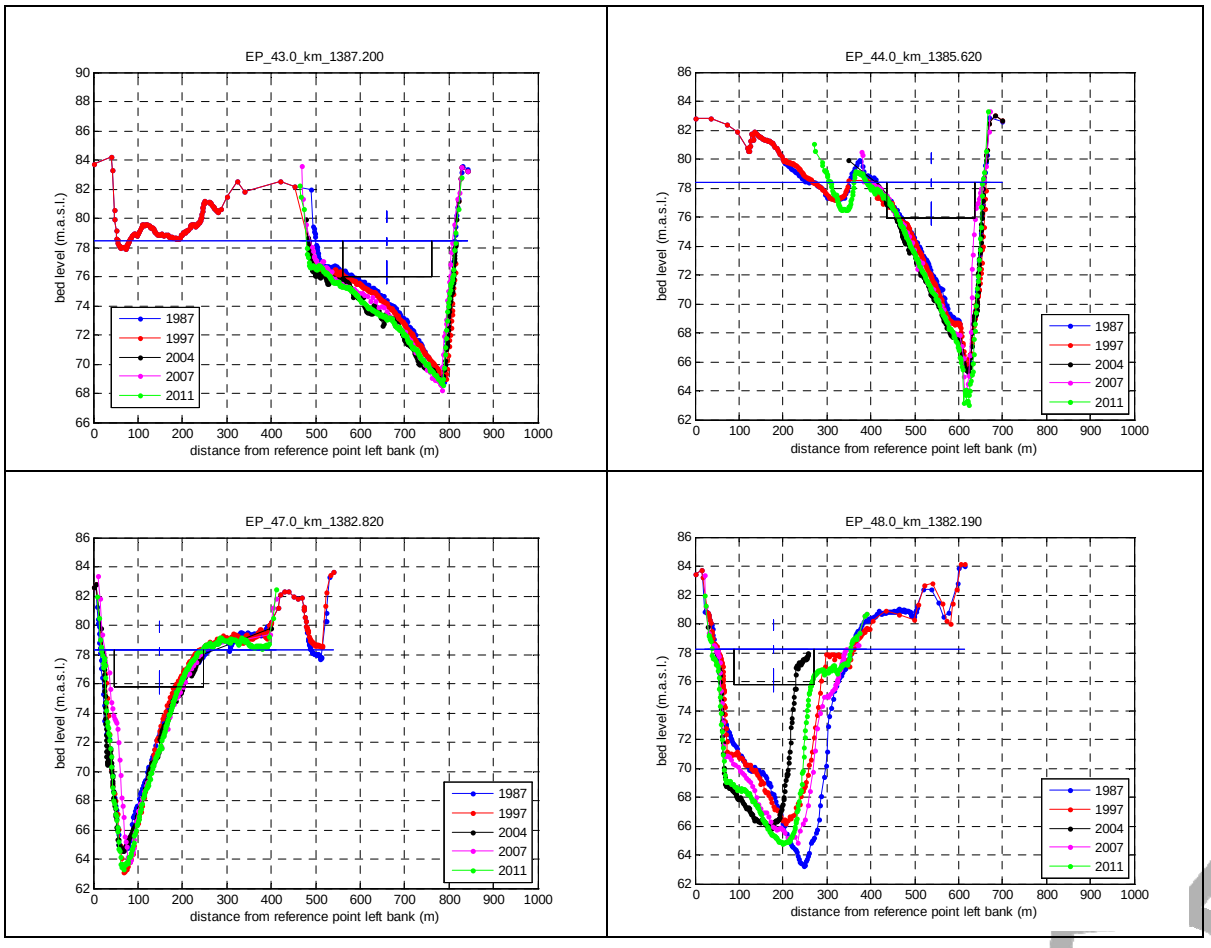
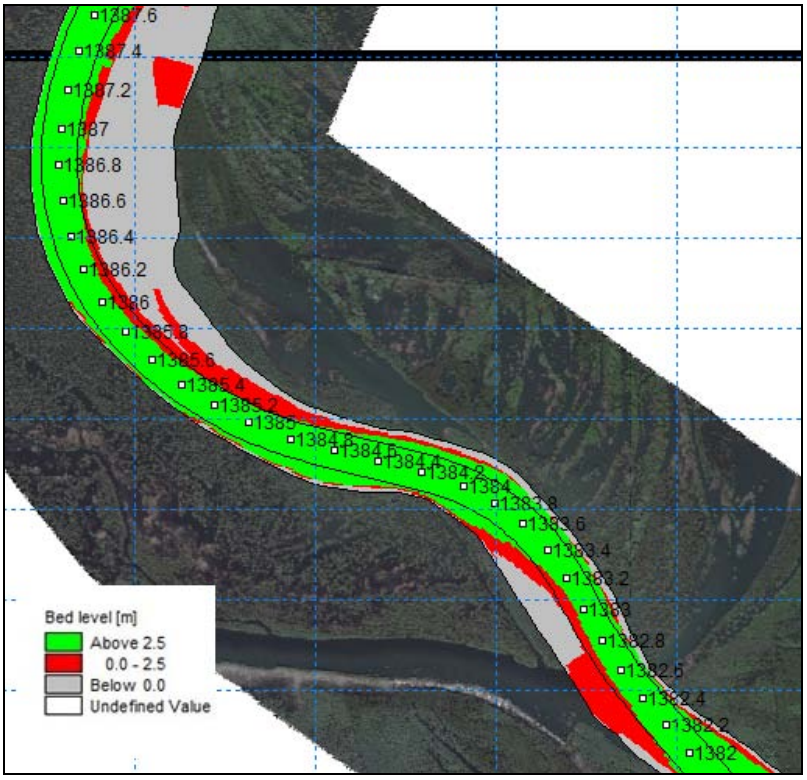
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Drava confluence**				**Priority:**	Prioritisation process under assessment
Waterway:	Danube					
Location:	from km:	1,388.80	to km:	1,382.00	length:	6.80 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be		One-time dredging works	
		Repeated dredging works	

eliminated; tick one or more boxes)		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Apatin**			
Location:	km:	1,401.90	bank:	left bank
Distance to critical location:	16.50 km			
LNL* (= ENR):	79.31 m.a.s.l.			
LNQ:**	1180 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

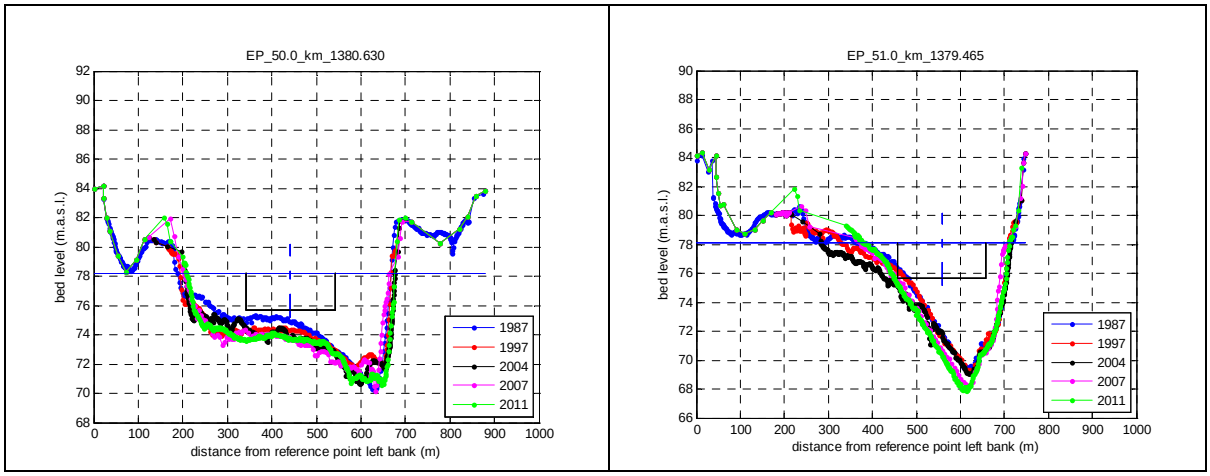
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

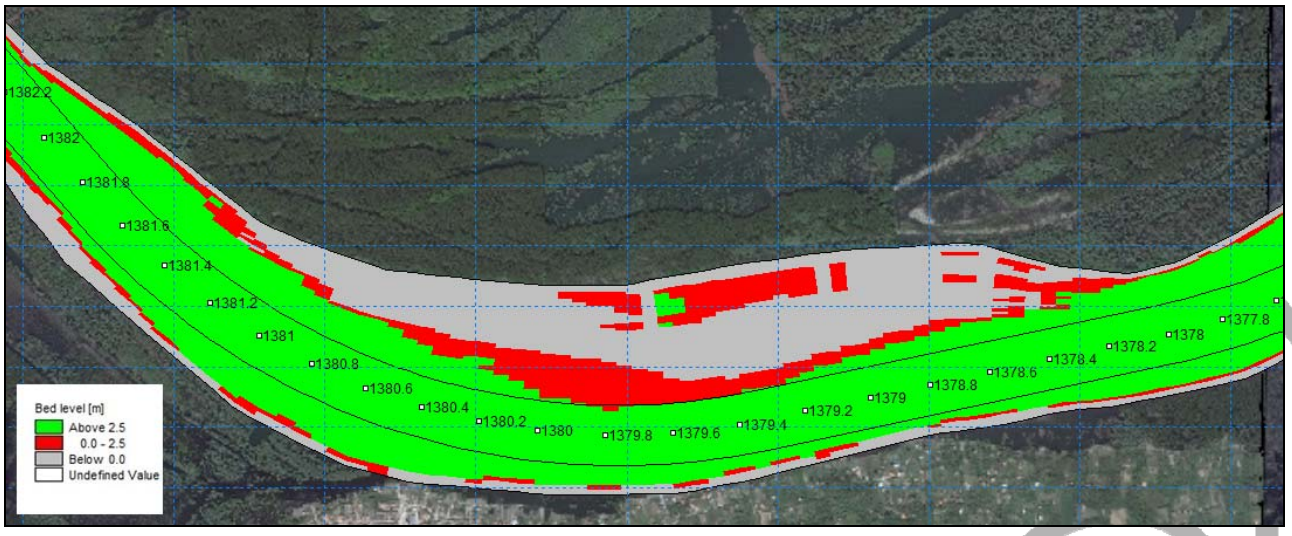
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Aljmaš**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,381.40	to km:	1,378.20	length:	3.20 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	12.55 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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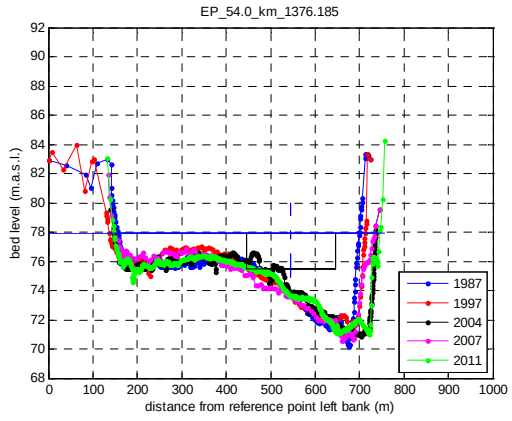
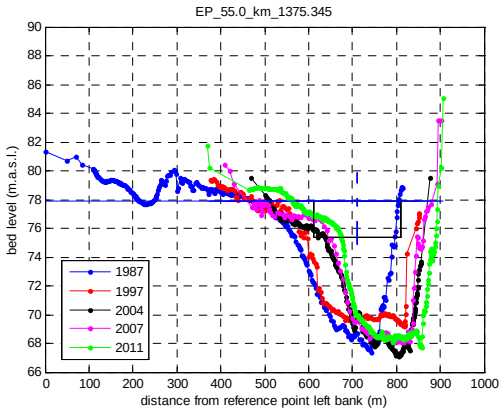
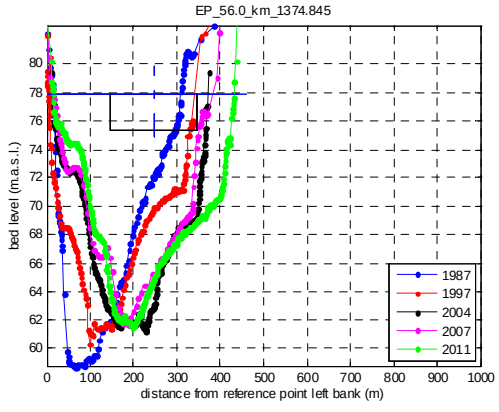
DATA SHEET: CRITICAL FAIRWAY LOCATION

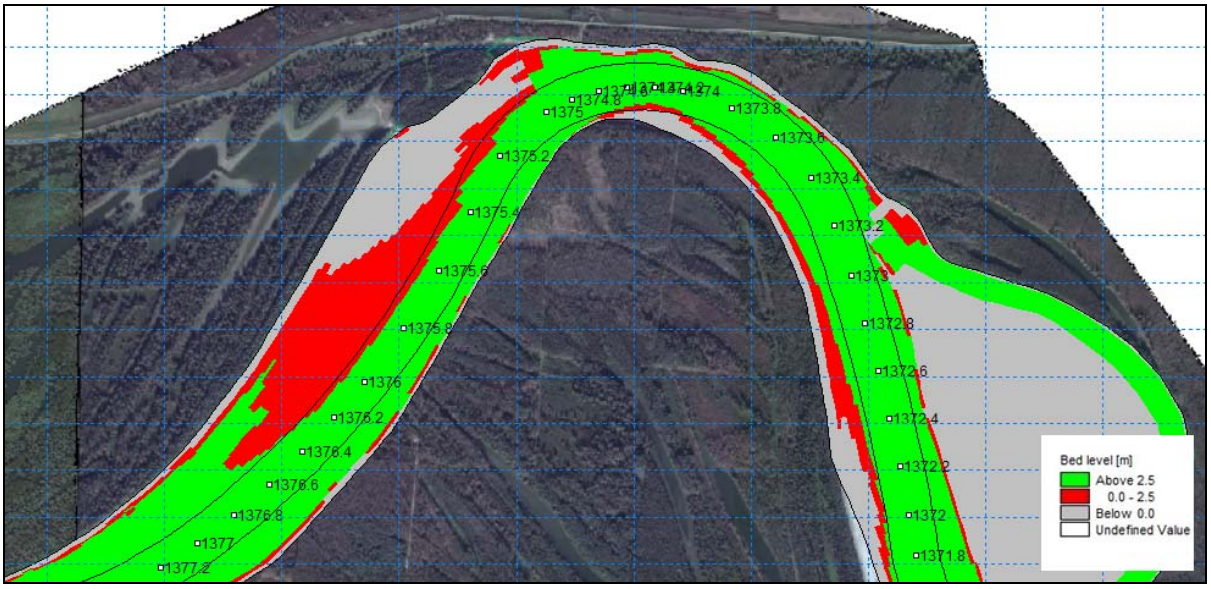
Name:	**Staklar**				**Priority:**	Prioritisation process under assessment
Waterway:	Danube					
Location:	from km:	1,376.80	to km:	1,373.40	length:	3.40 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections









Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress

Indicative interventions:	N/A
Cost estimation for elimination:	N/A
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"
Project planned / ongoing:	
Comments on the necessity for eliminating this critical location:	

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	7.85 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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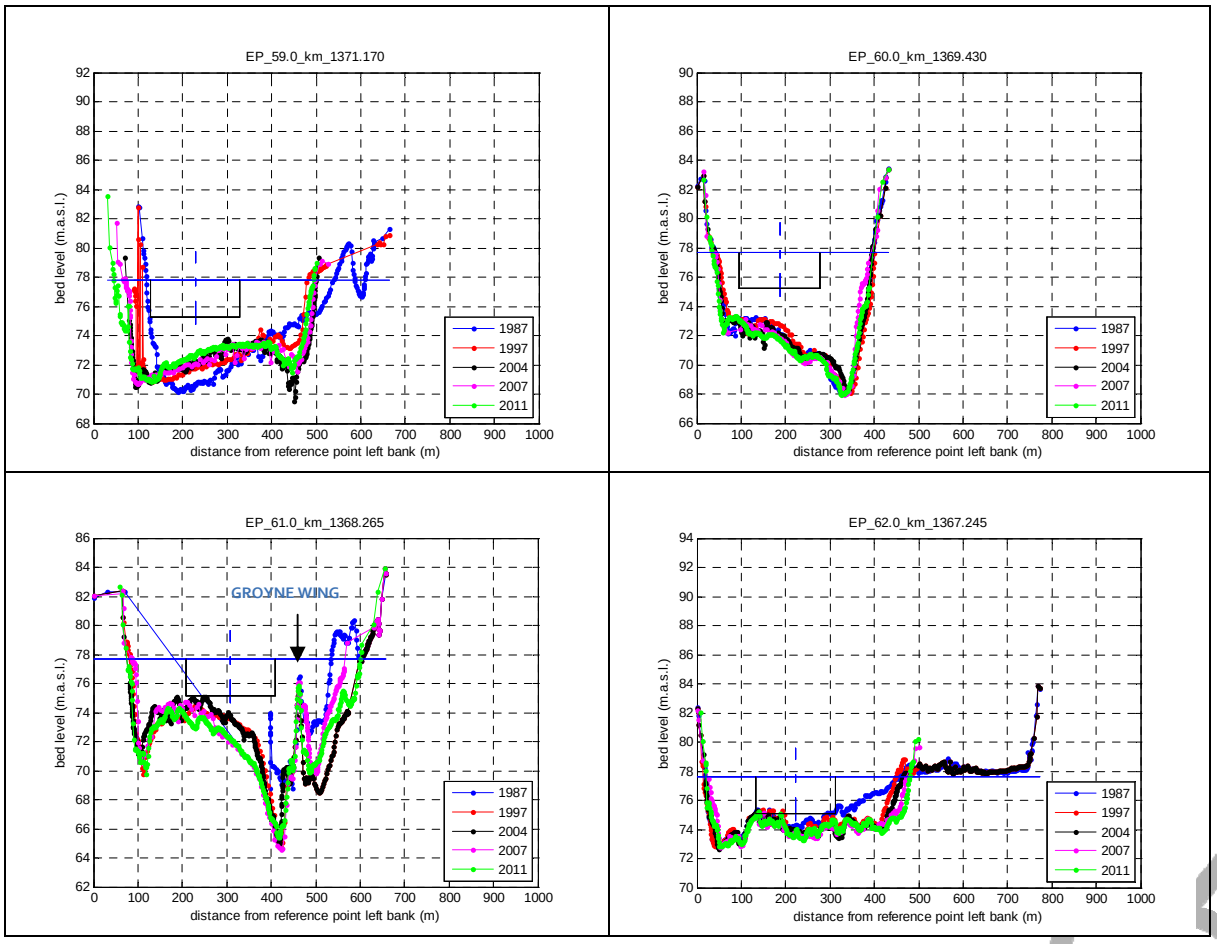
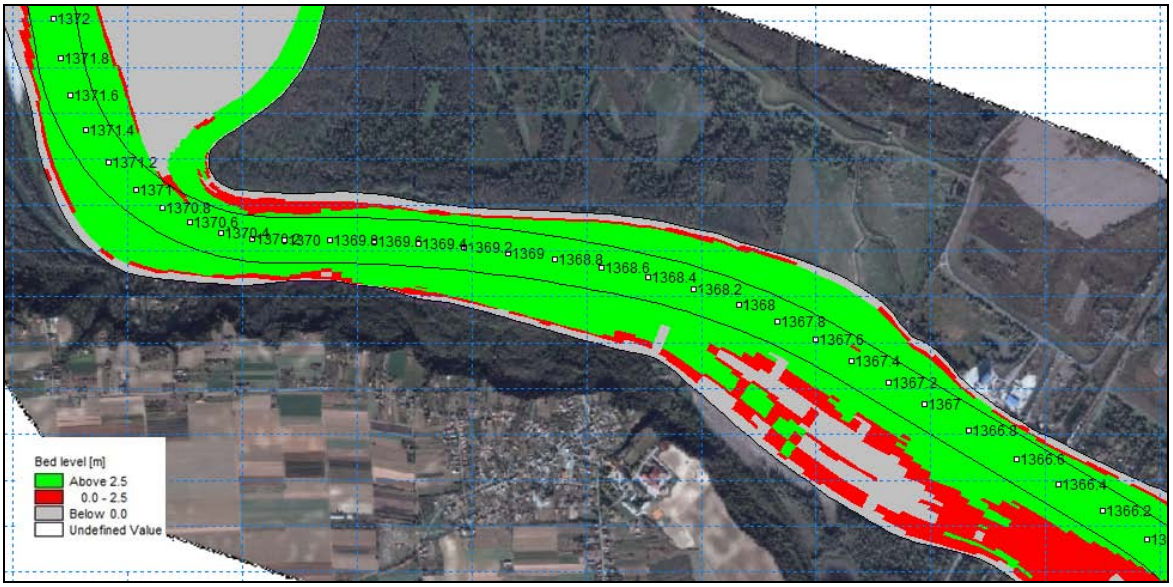
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Erdut**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,371.40	to km:	1,366.40	length:	5.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress

Indicative interventions:	N/A
Cost estimation for elimination:	N/A
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"
Project planned / ongoing:	
Comments on the necessity for eliminating this critical location:	

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	1.65 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

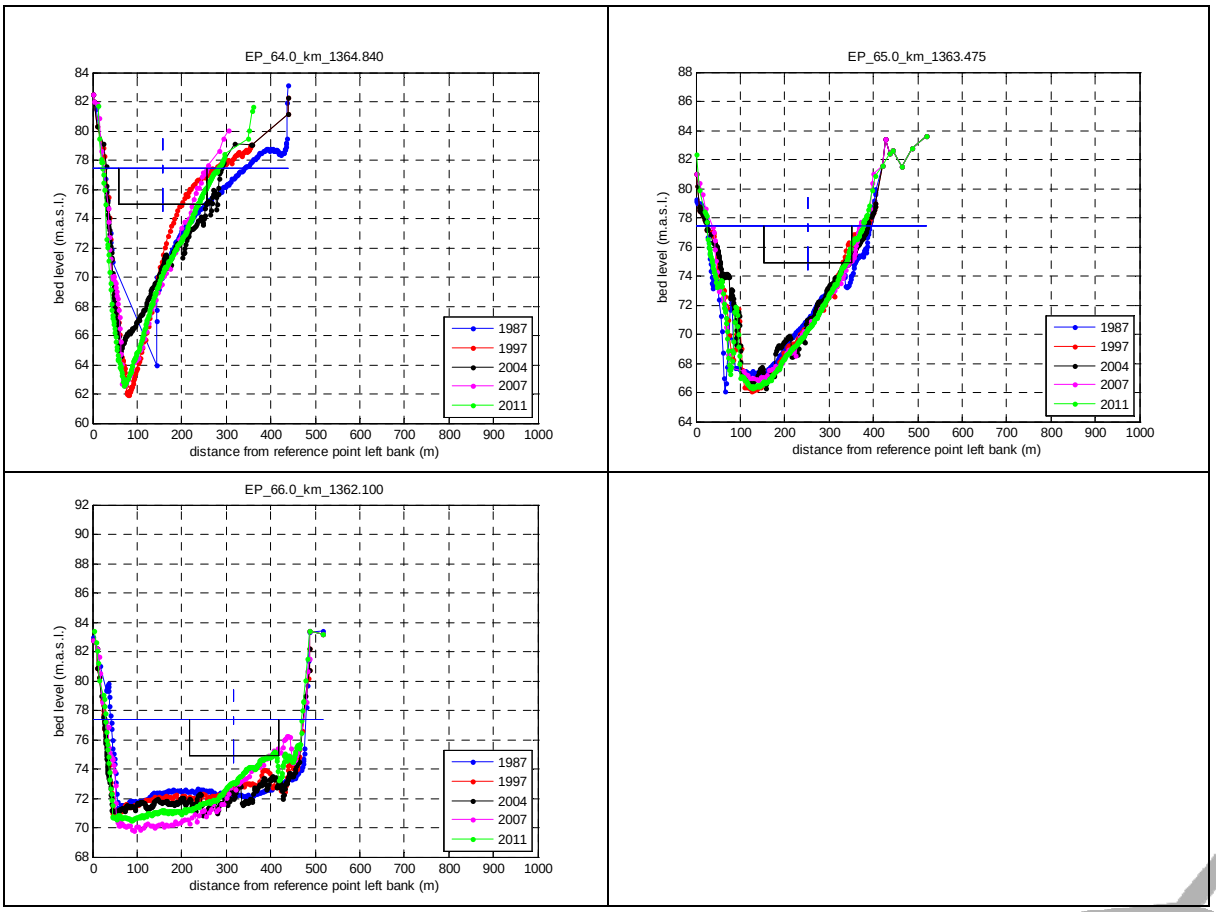
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

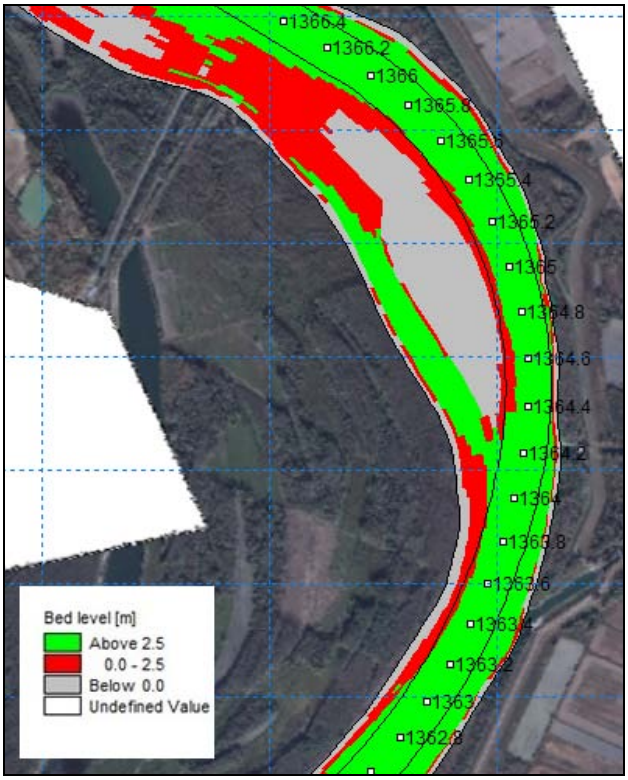
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Bogojevo**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,366.20	to km:	1,361.40	length:	4.80 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be		One-time dredging works	
		Repeated dredging works	

eliminated; tick one or more boxes)		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	3.45 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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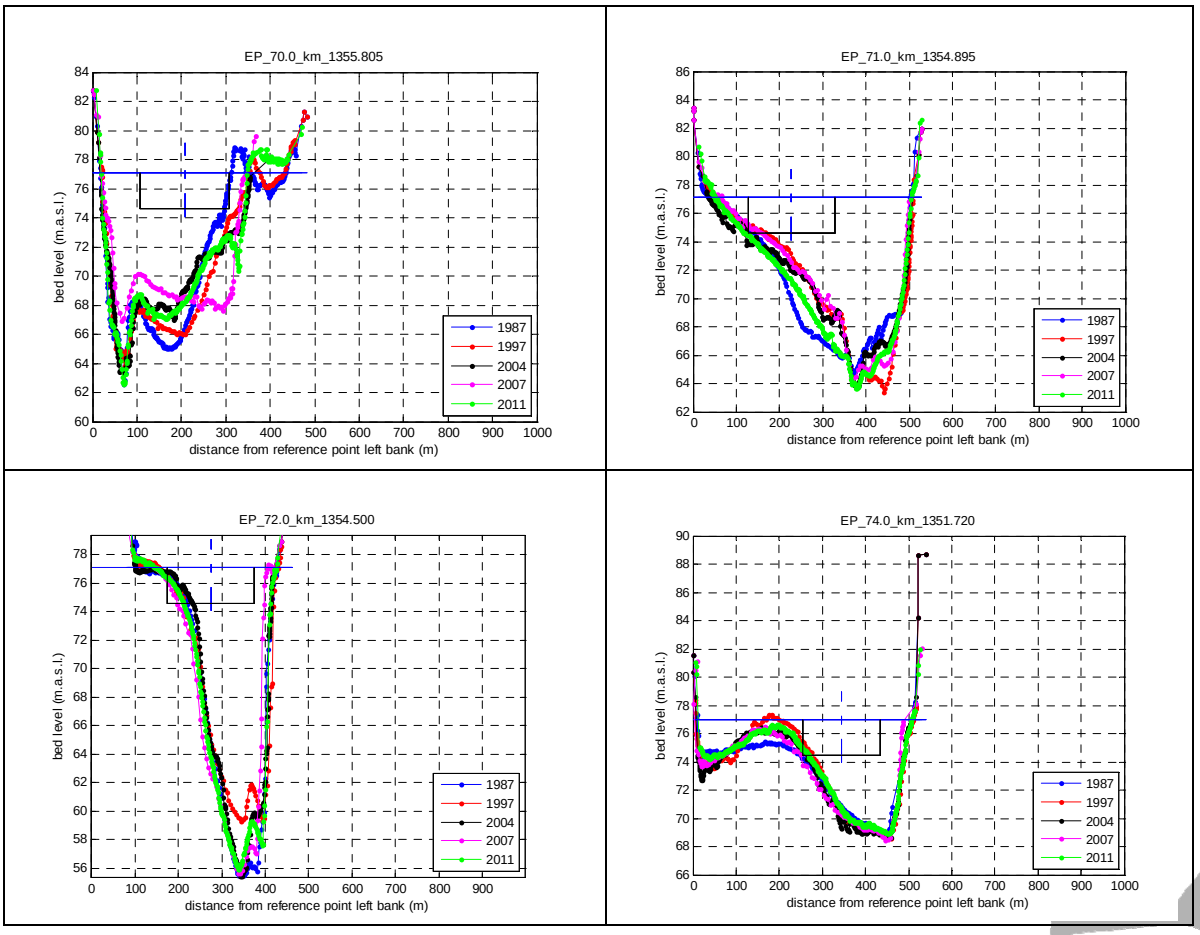
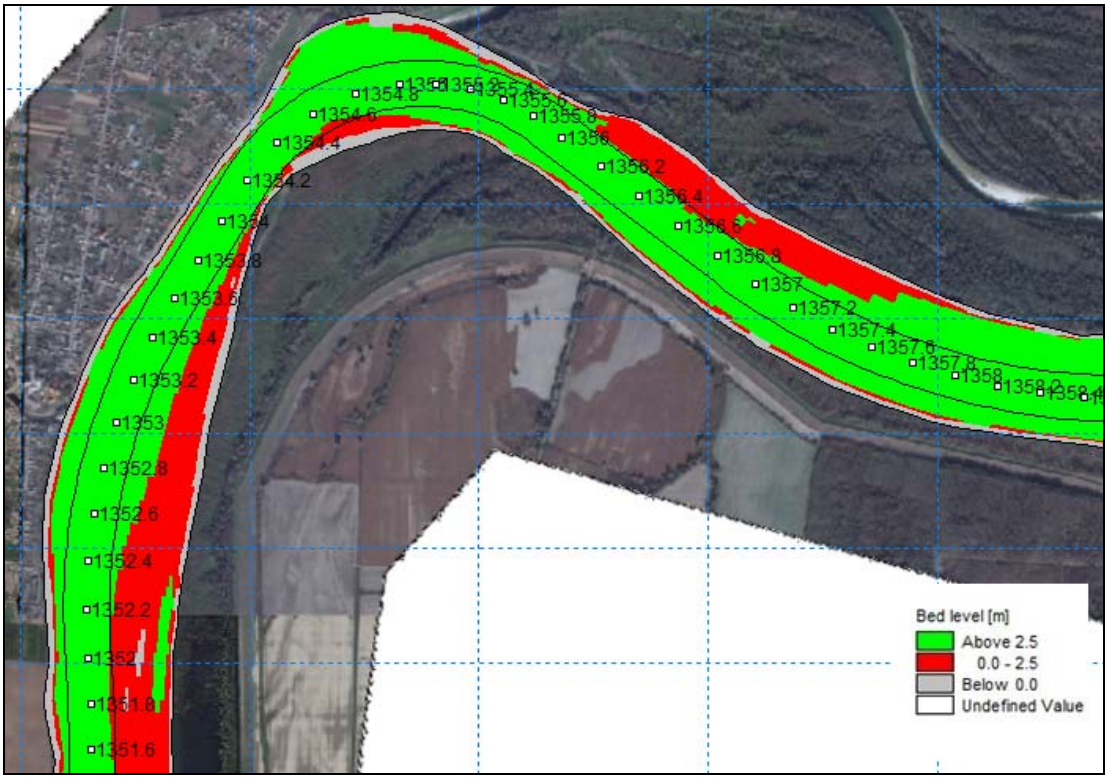
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Dalj**				**Priority:**	Prioritisation process under assessment
Waterway:	Danube					
Location:	from km:	1,357.00	to km:	1,351.00	length:	6.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be		One-time dredging works	
		Repeated dredging works	

eliminated; tick one or more boxes)		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	13.25 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

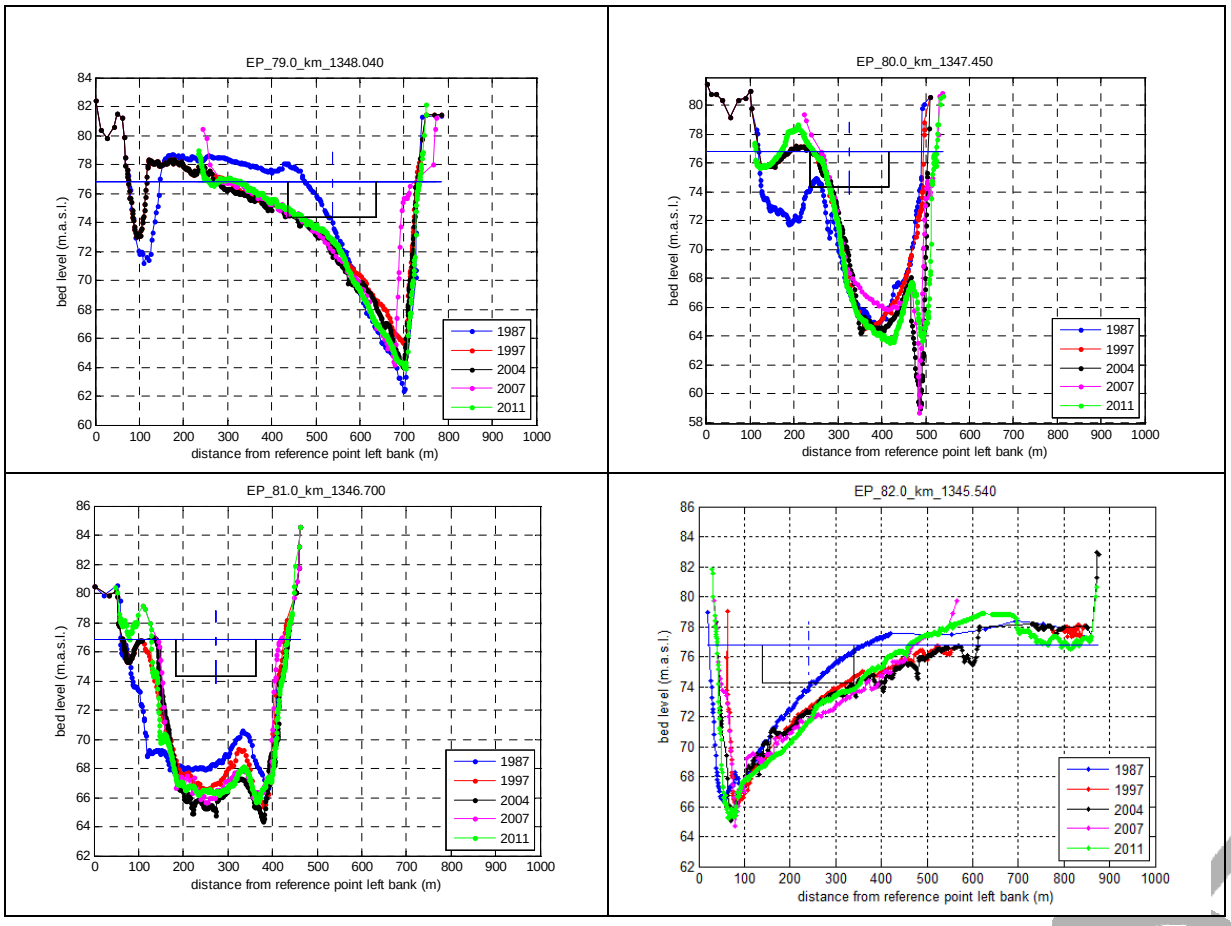
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

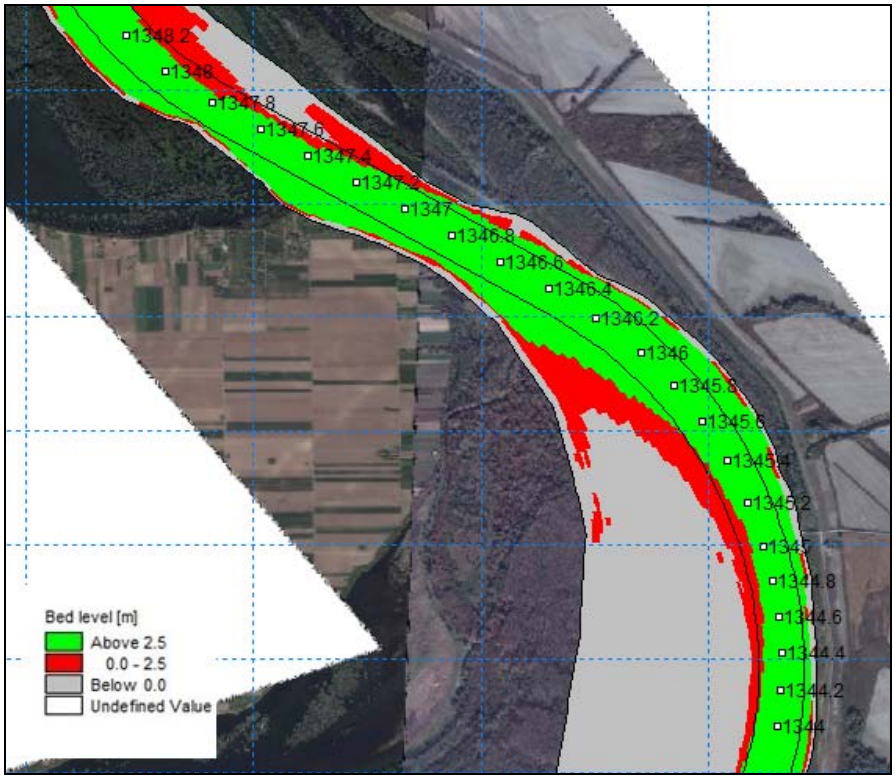
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Borovo 1**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,348.60	to km:	1,343.60	length:	5.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	

		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	21.15 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

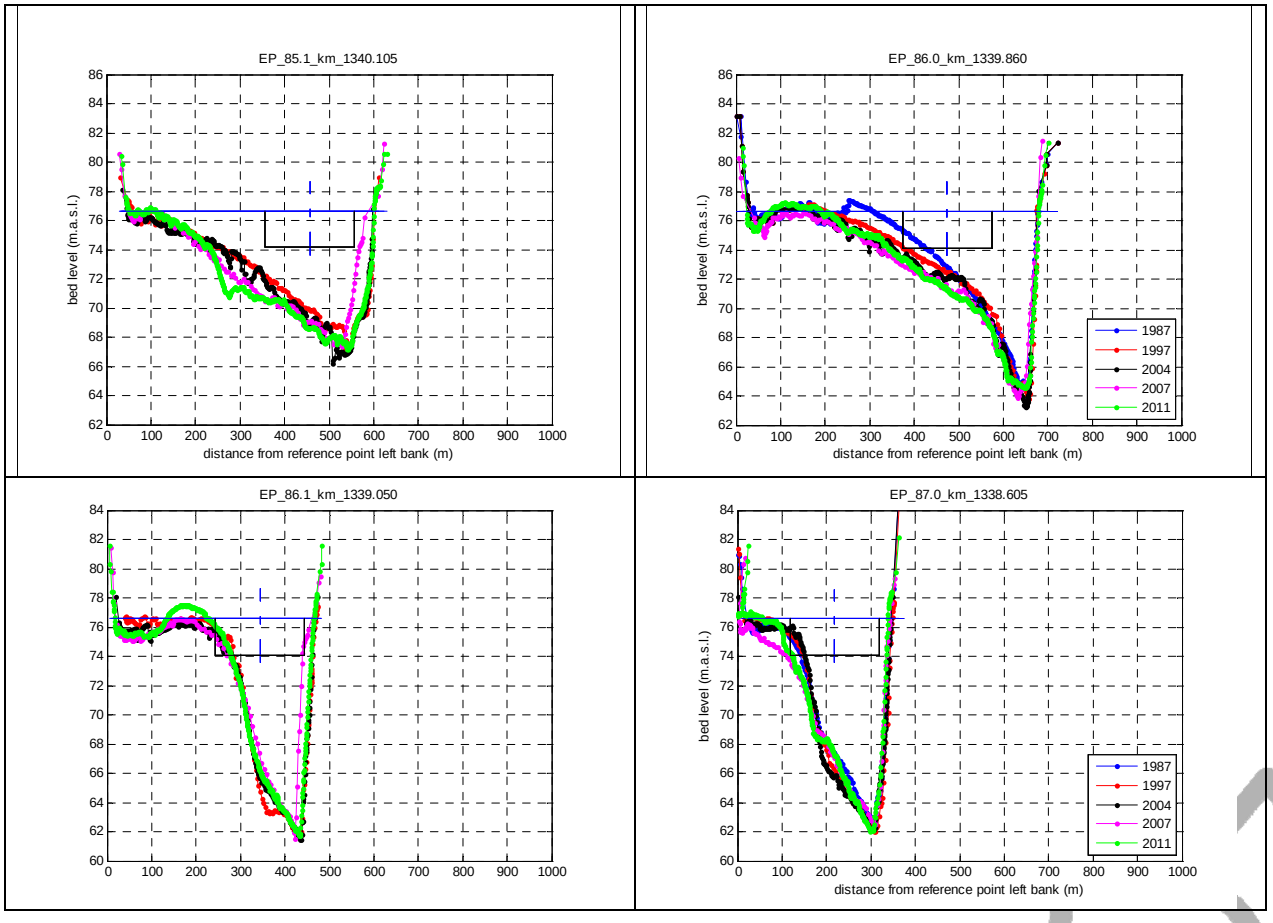
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

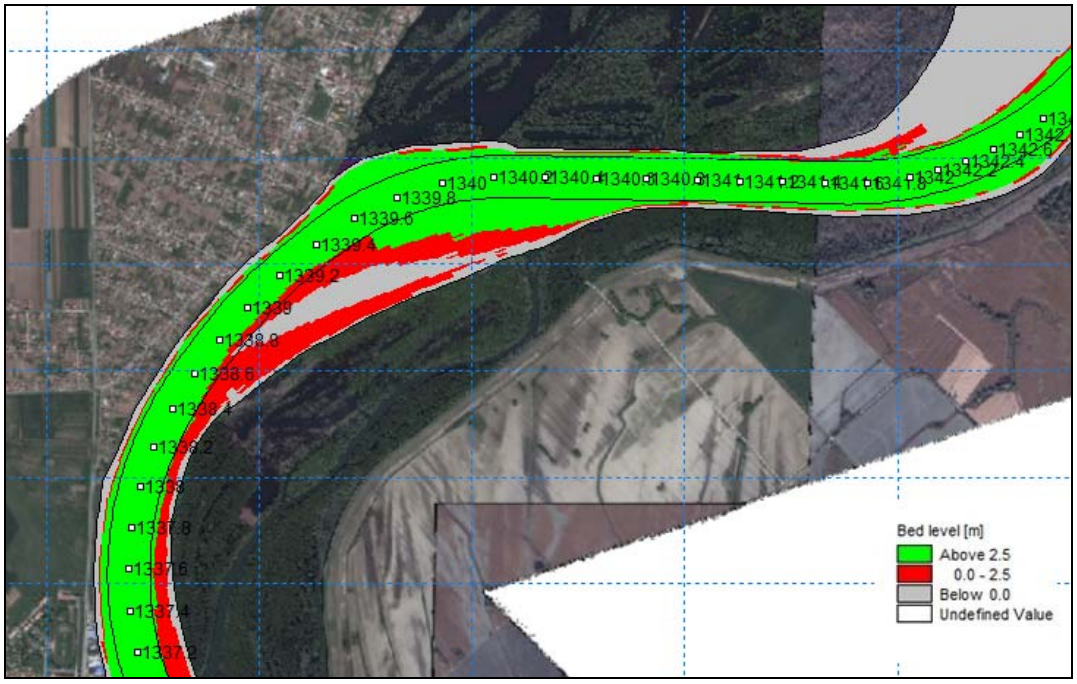
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Borovo 2**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,340.60	to km:	1,338.00	length:	2.60 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	

		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bogojevo**			
Location:	km:	1,367.25	bank:	left bank
Distance to critical location:	27.95 km			
LNL* (= ENR):	77.57 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

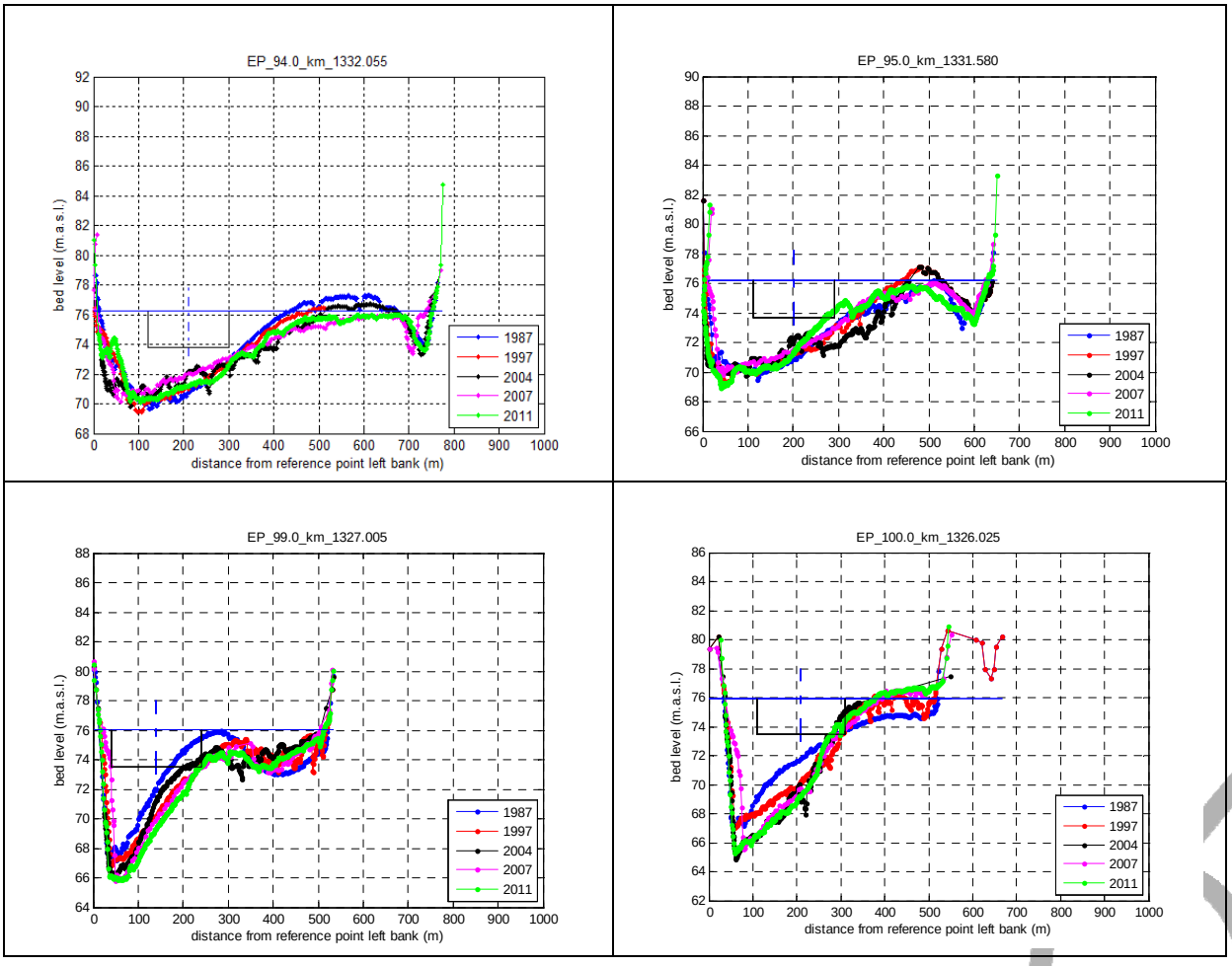
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

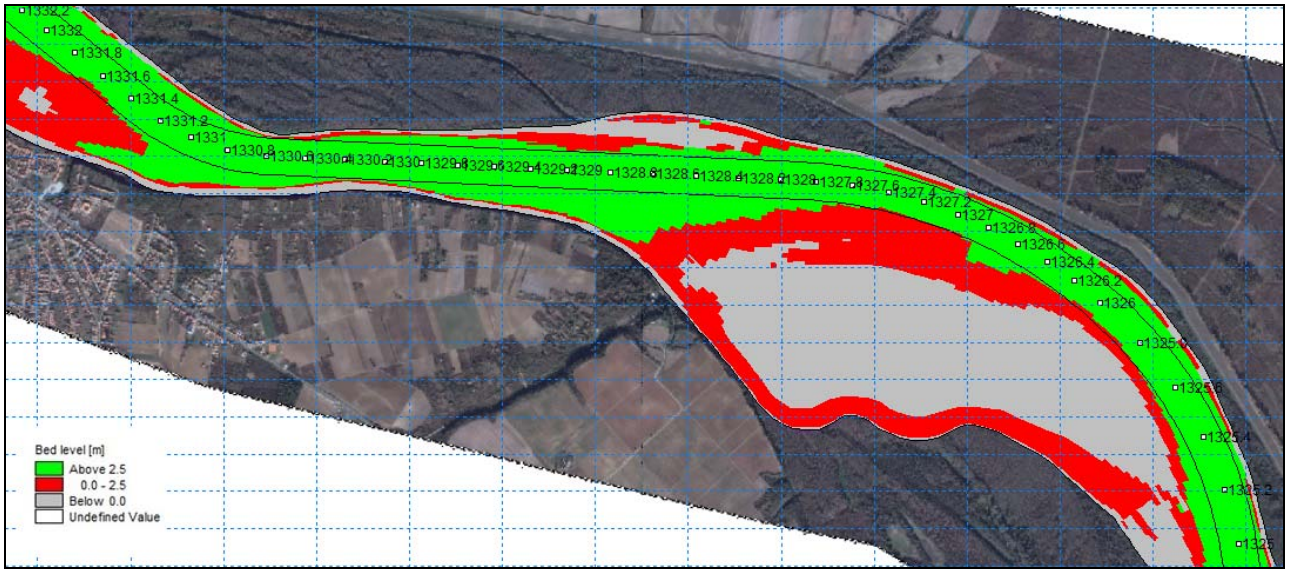
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Vukovar**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,332.00	to km:	1,325.00	length:	7.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress

Indicative interventions:	N/A
Cost estimation for elimination:	N/A
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"
Project planned / ongoing:	
Comments on the necessity for eliminating this critical location:	

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	29.94 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

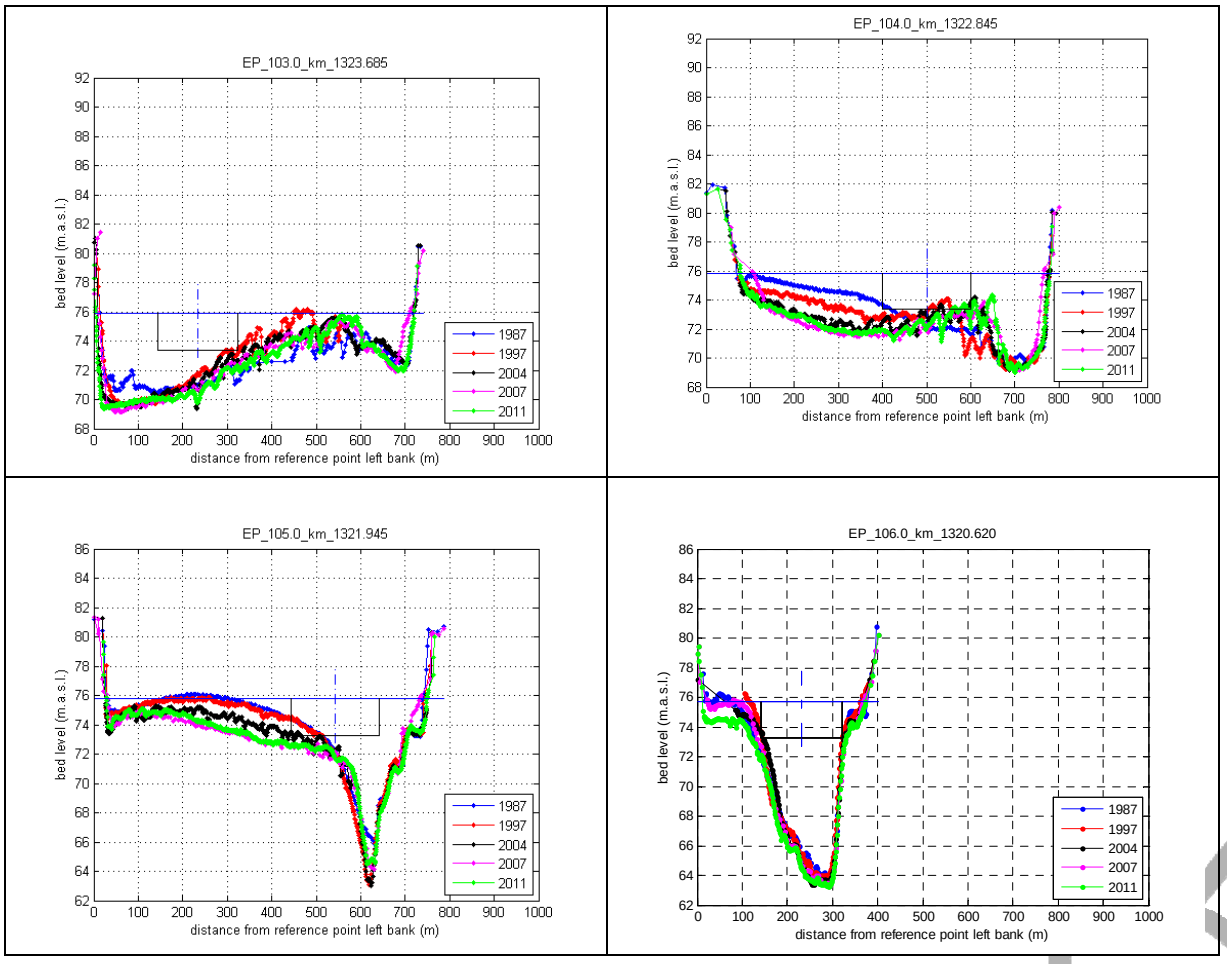
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

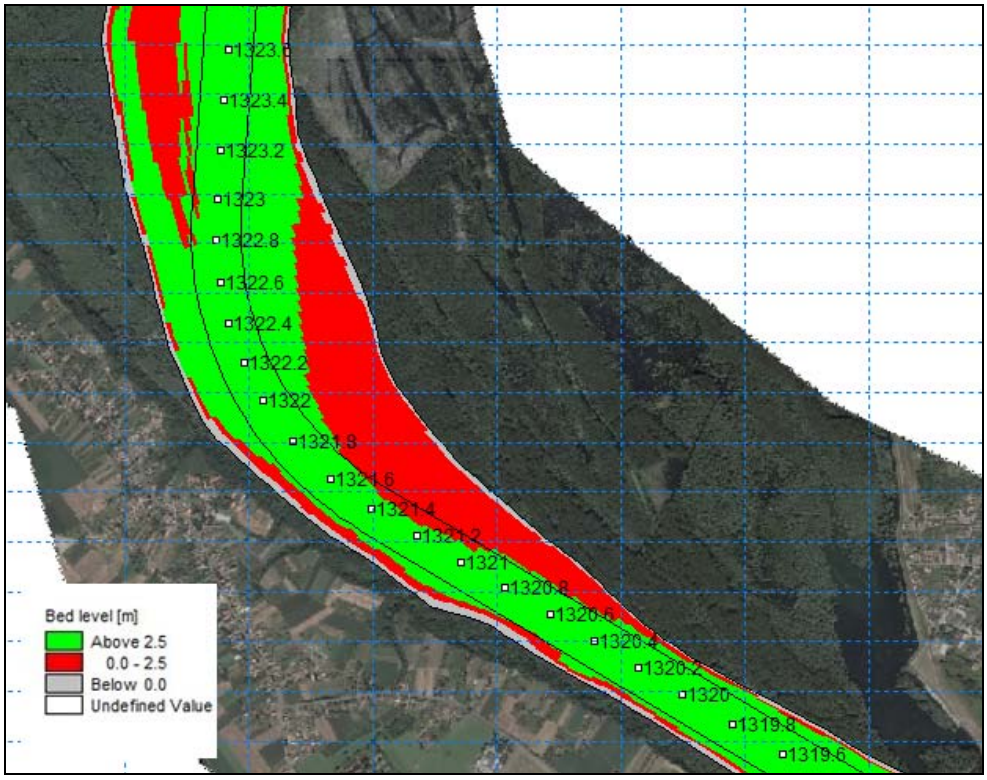
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Sotin**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,324.00	to km:	1,320.00	length:	4.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be		One-time dredging works	
		Repeated dredging works	

eliminated; tick one or more boxes)		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	23.44 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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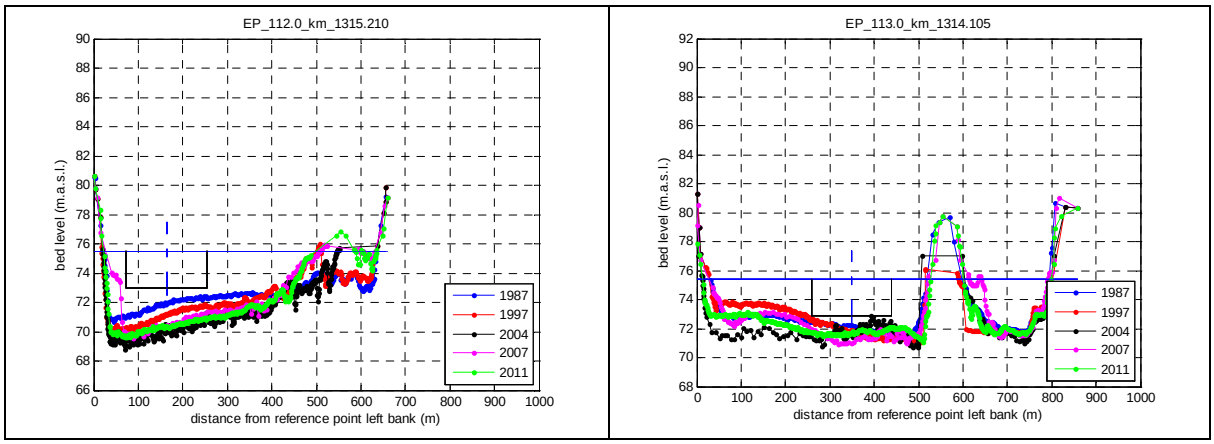
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Opatovac**				**Priority:**	Prioritisation process under assessment
Waterway:	Danube					
Location:	from km:	1,315.40	to km:	1,314.60	length:	0.80 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Gravel					
Visualisation:	September 2012.					

Selected cross-sections



Kind of obstacle: (tick one or more boxes)			
		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	

Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 100 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	16.44 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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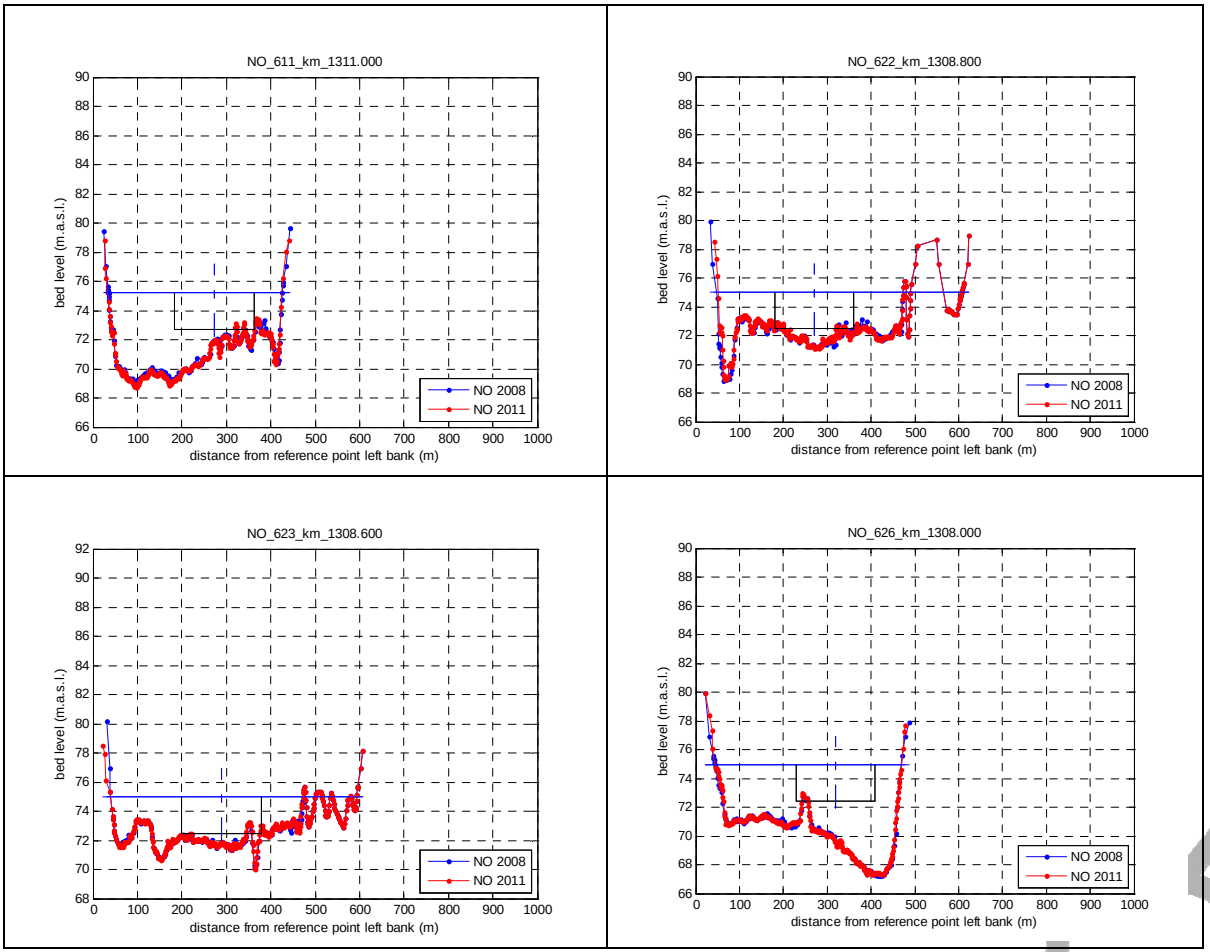
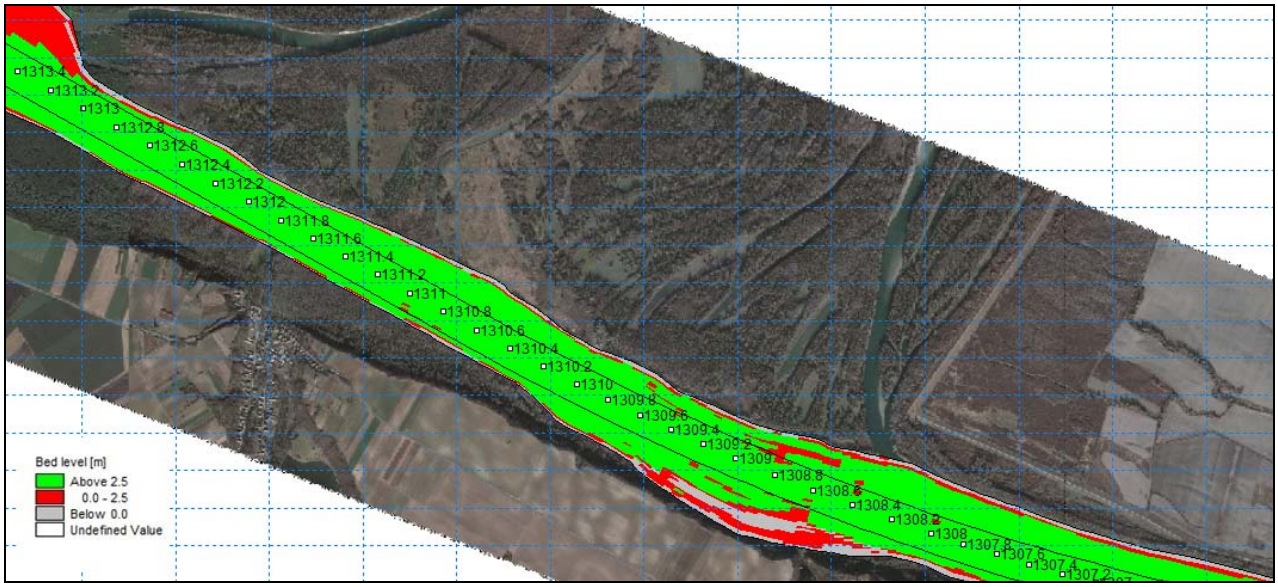
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Mohovo**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,311.40	to km:	1,307.60	length:	3.80 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Gravel					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 100 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress

Indicative interventions:	N/A
Cost estimation for elimination:	N/A
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“
Project planned / ongoing:	
Comments on the necessity for eliminating this critical location:	

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	10.94 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

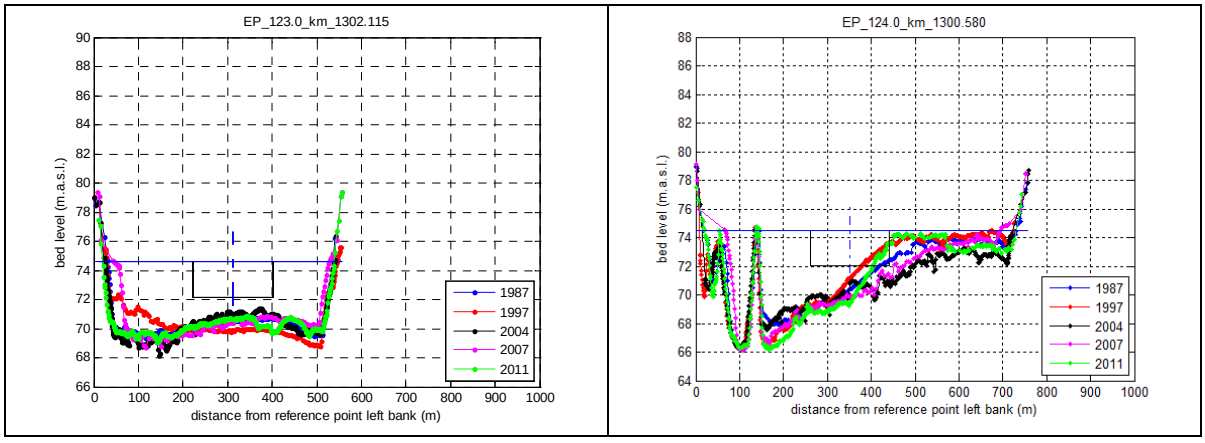
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

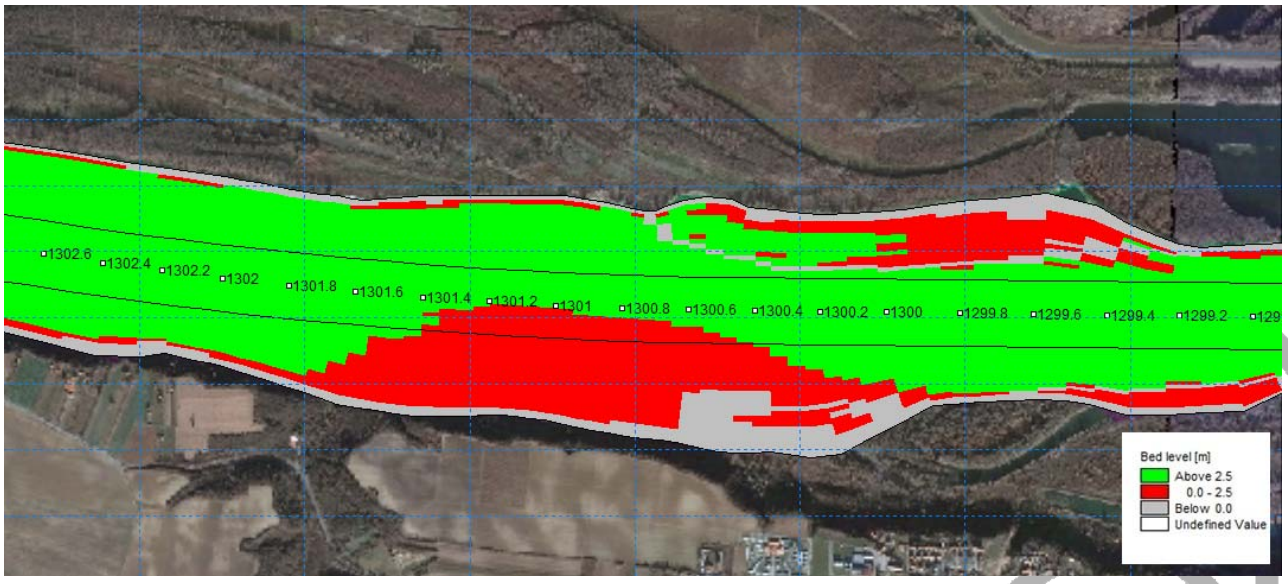
end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Bačka Palanka**				**Priority:**	
					Prioritisation process under assessment	
Waterway:	Danube					
Location:	from km:	1,302.00	to km:	1,300.00	length:	2.00 km
	right bank:	CRO	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections





Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Process of evaluation of different options is in progress
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Feasibility study available since 2012, prepared under the EU IPA 2010 project “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“		
Project planned / ongoing:			
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	2.44 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

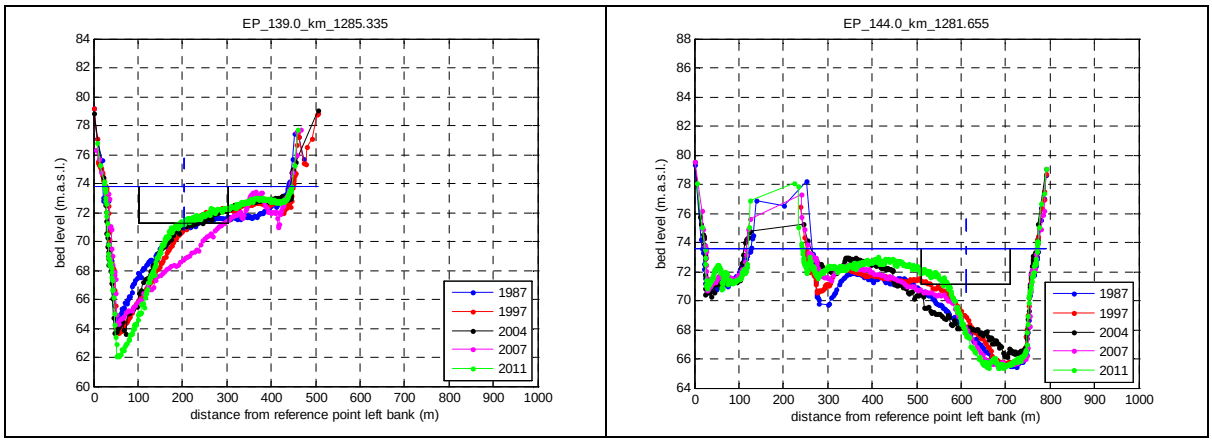
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

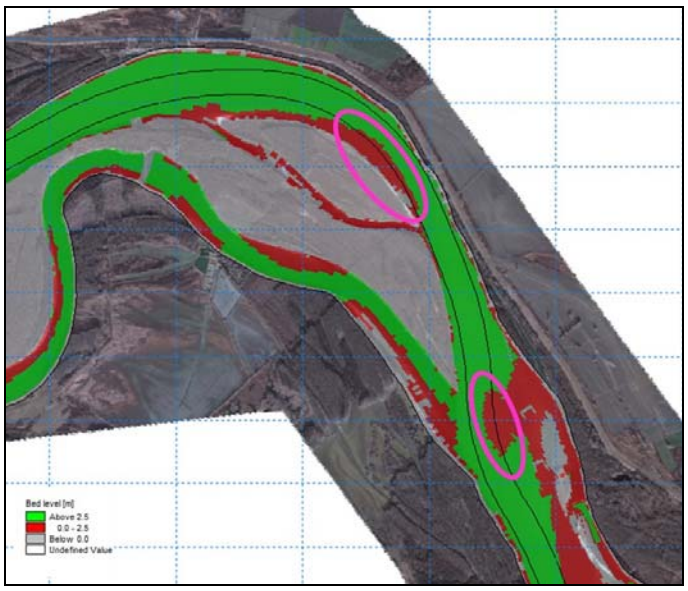
end of document

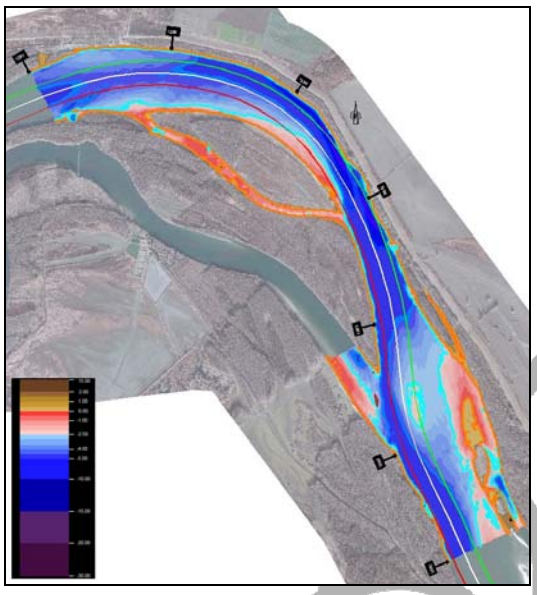
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Susek**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,287.00	to km:	1,281.00	length:	6.00 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
	x	Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
		Other:	
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:	EU IPA 2013 Project "River Training and Dredging Works on the Danube River" - execution 2014 - 2016		
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Bačka Palanka**			
Location:	km:	1,298.56	bank:	left bank
Distance to critical location:	14.56 km			
LNL* (= ENR):	74.44 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

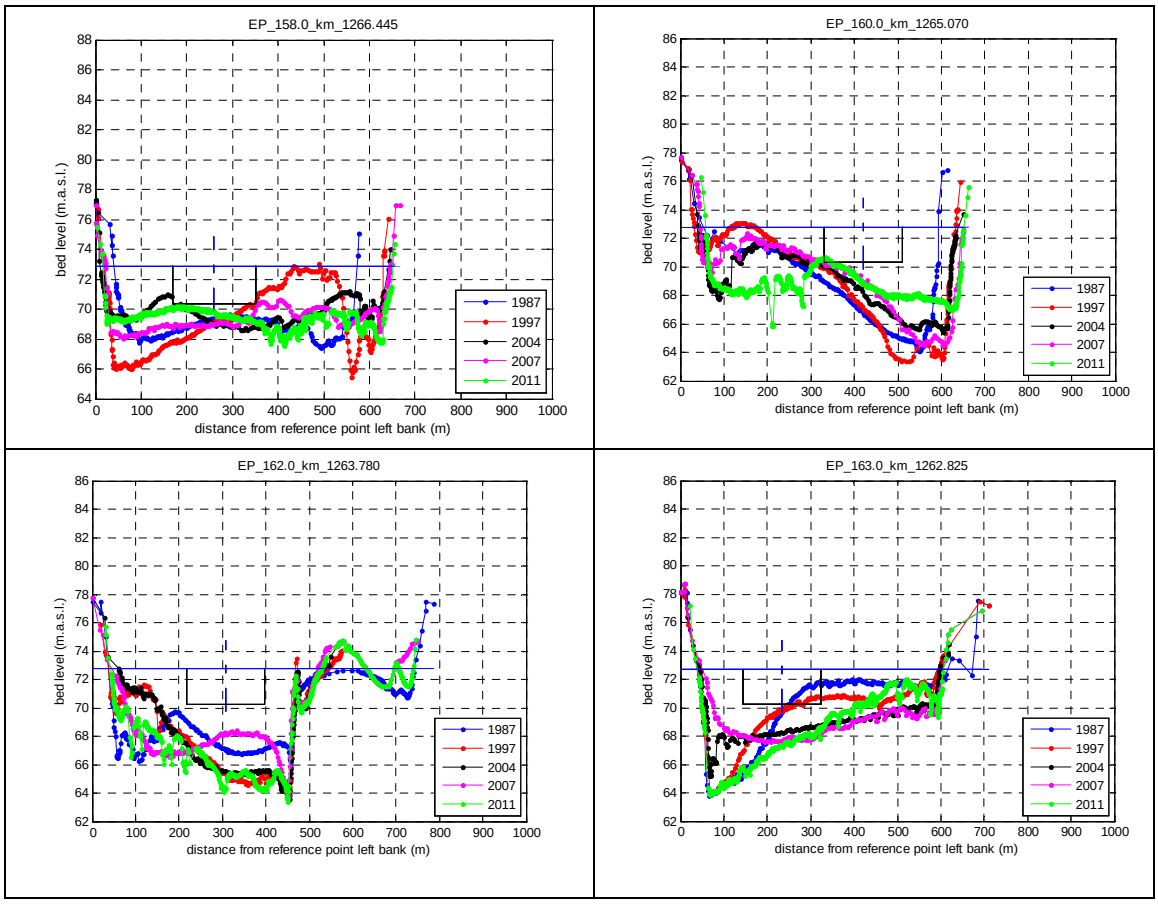
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

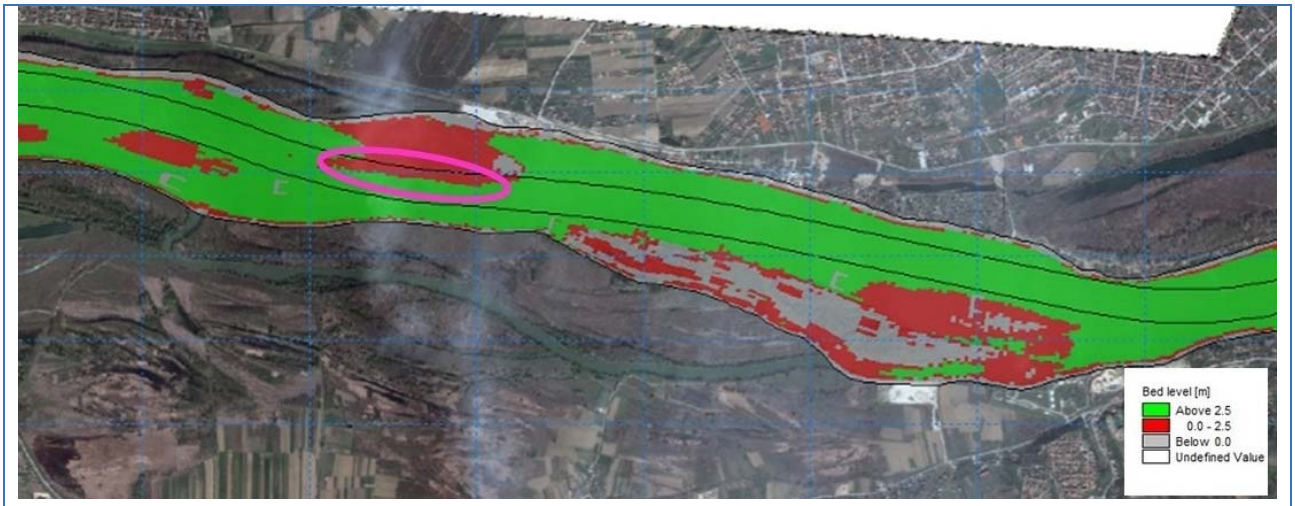
end of document

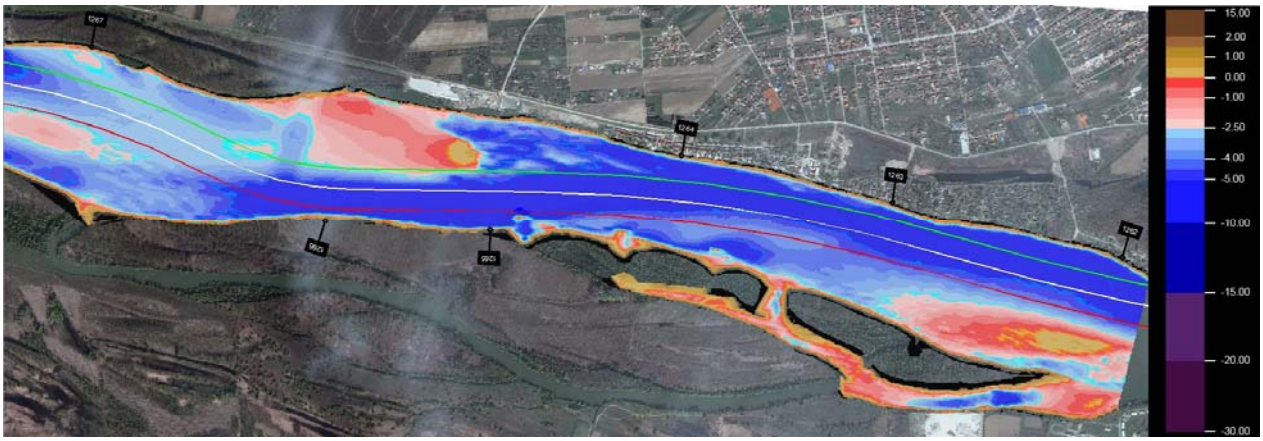
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Futog**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,267.40	to km:	1,261.60	length:	5.80 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m		

Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
	x	Repeated dredging works	
		Realignment of the fairway (buoys)	
	x	River engineering works (groynes, training walls, bottom sills etc.)	
		Other:	
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:	EU IPA 2013 Project "River Training and Dredging Works on the Danube River" - execution 2014 - 2016		
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Novi Sad**			
Location:	km:	1,254.98	bank:	left bank
Distance to critical location:	9.52 km			
LNL* (= ENR):	72.30 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

end of document

DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Novi Sad**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,255.40	to km:	1,254.20	length:	1.20 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Kind of obstacle: (tick one or more boxes)		Depth	
		Width	
		Radius	

		Height	
		Traffic regulation	
	x	Other	Insufficient fairway width: narrow navigation span of the temporary bridge "Bosko Perosevic" of 90 m
Shortcomings:	Reduced fairway width		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	
	x	Other:	Construction of new bridge
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:			
Project planned / ongoing:	Ongoing - new Zezelj Bridge is currently under construction		
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Novi Sad**			
Location:	km:	1,254.98	bank:	left bank
Distance to critical location:	0.18 km			
LNL* (= ENR):	72.30 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

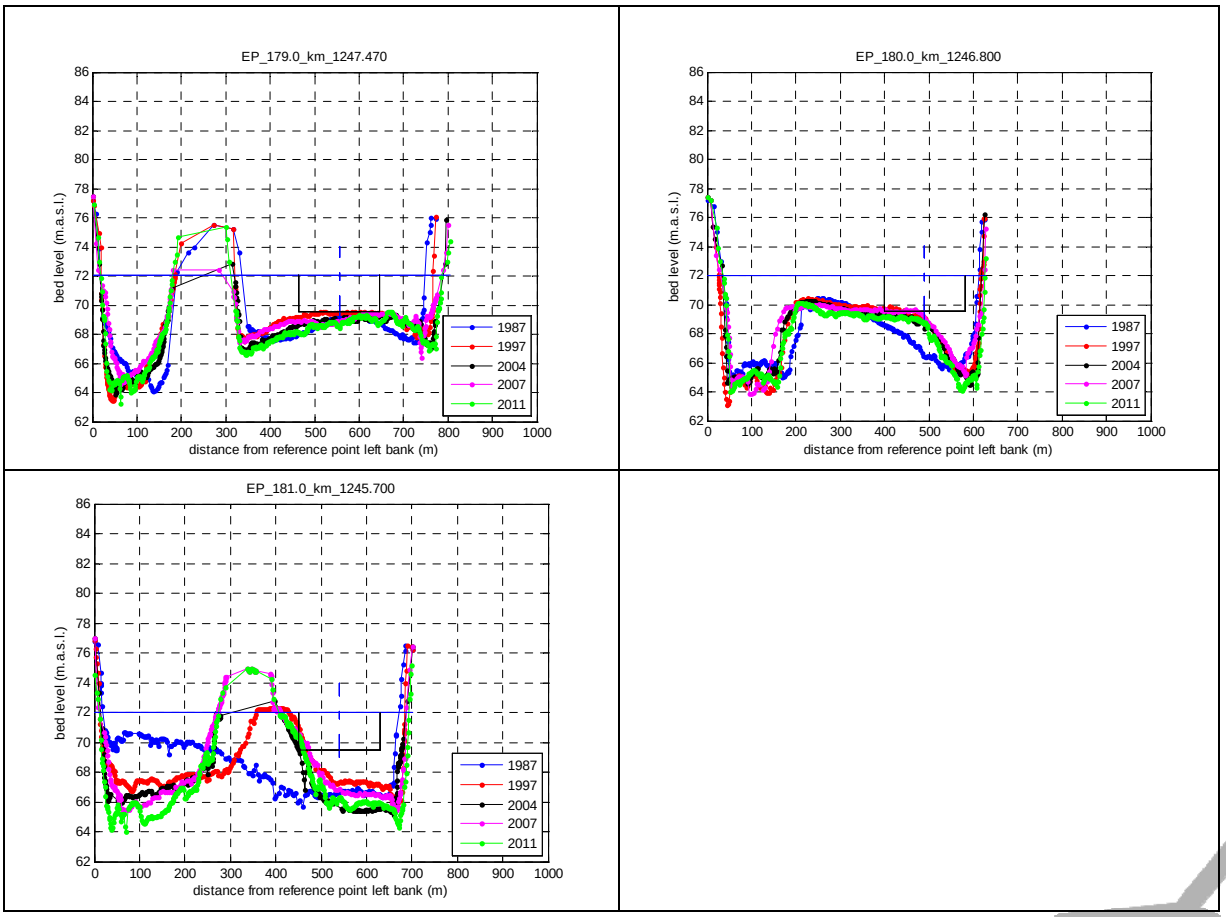
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

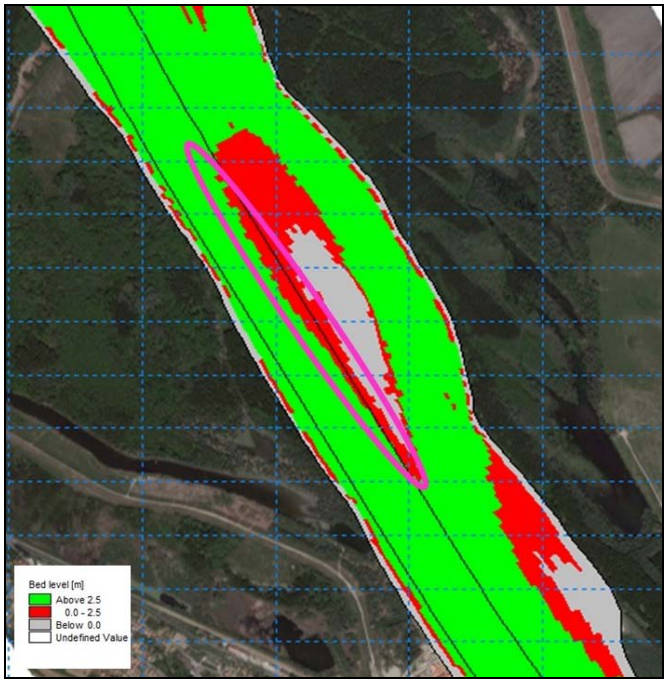
end of document

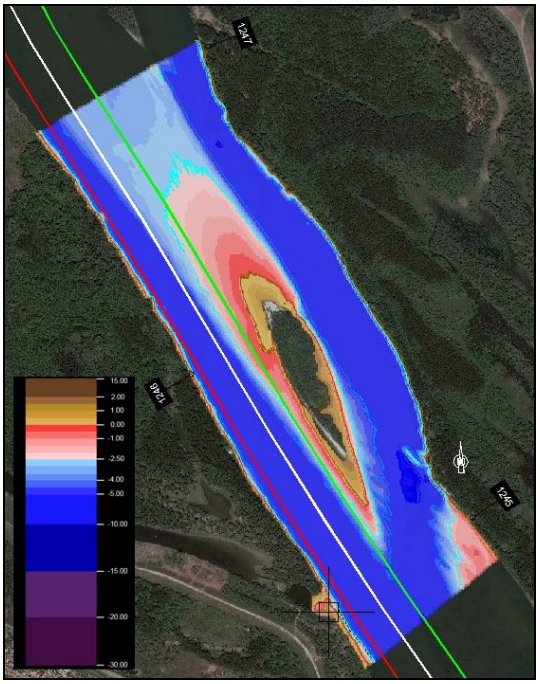
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Arankina ada**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,247.00	to km:	1,244.80	length:	2.20 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
	x	Repeated dredging works	
		Realignment of the fairway (buoys)	
		River engineering works (groynes, training walls, bottom sills etc.)	

		Other:	
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project – “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“		
Project planned / ongoing:	EU IPA 2013 Project “River Training and Dredging Works on the Danube River“ - execution 2014 - 2016		
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Novi Sad**			
Location:	km:	1,254.98	bank:	left bank
Distance to critical location:	9.08 km			
LNL* (= ENR):	72.30 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

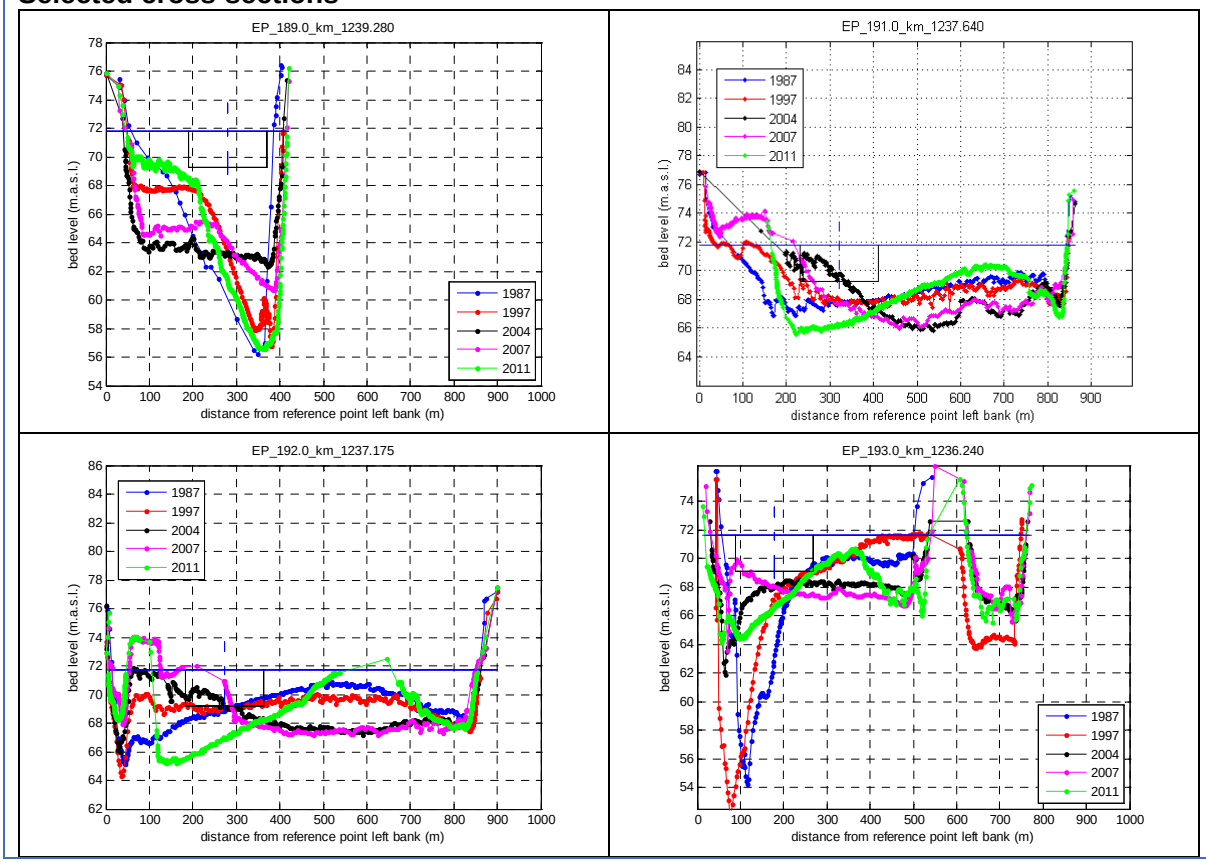
** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

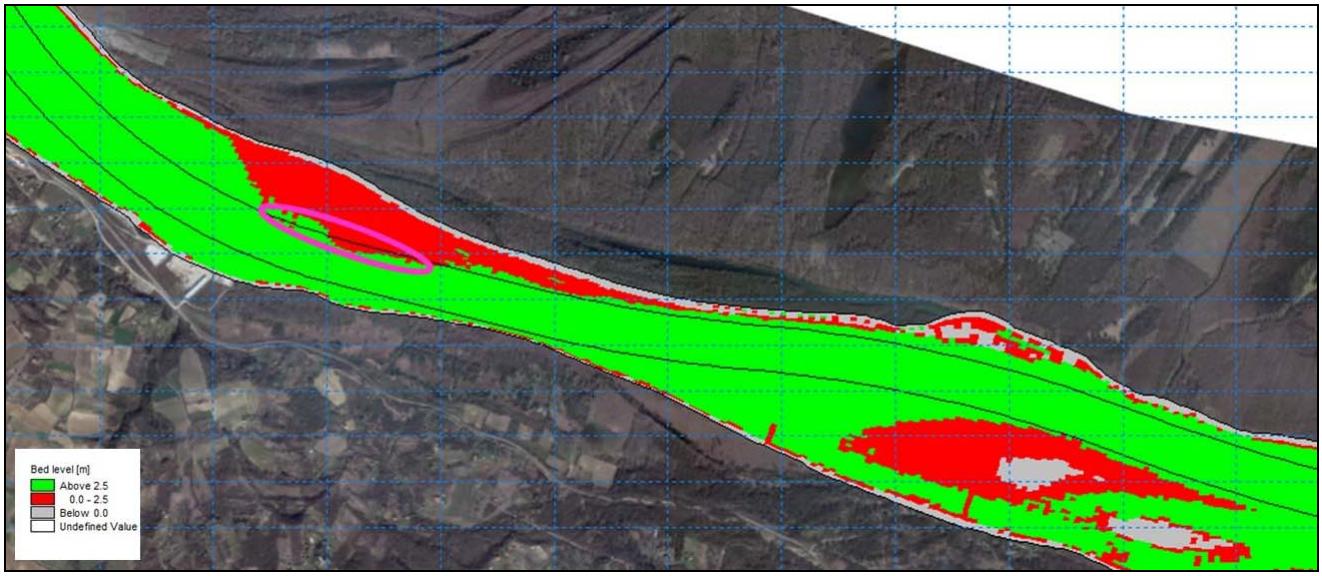
end of document

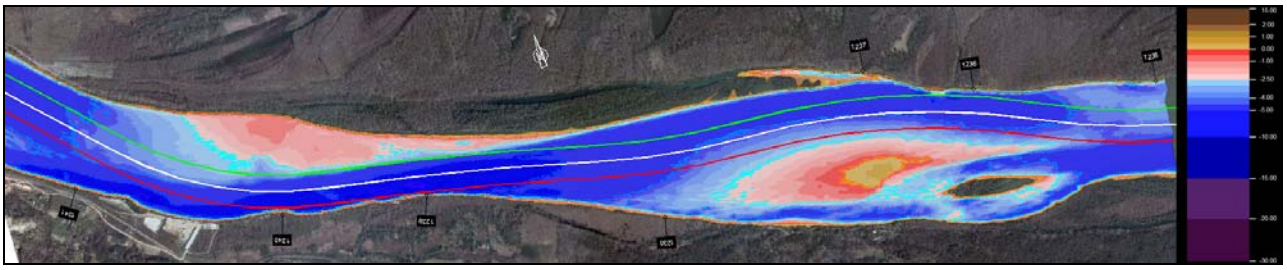
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Čortanovci**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,241.60	to km:	1,235.00	length:	6.60 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m		
Elimination of		One-time dredging works	

shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)	**x**	Repeated dredging works	
		Realignment of the fairway (buoys)	
	x	River engineering works (groynes, training walls, bottom sills etc.)	
		Other:	
Indicative interventions:	N/A		
Cost estimation for elimination:	N/A		
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"		
Project planned / ongoing:	EU IPA 2013 Project "River Training and Dredging Works on the Danube River" - execution 2014 - 2016		
Comments on the necessity for eliminating this critical location:			

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Novi Sad**			
Location:	km:	1,254.98	bank:	left bank
Distance to critical location:	16.68 km			
LNL* (= ENR):	72.30 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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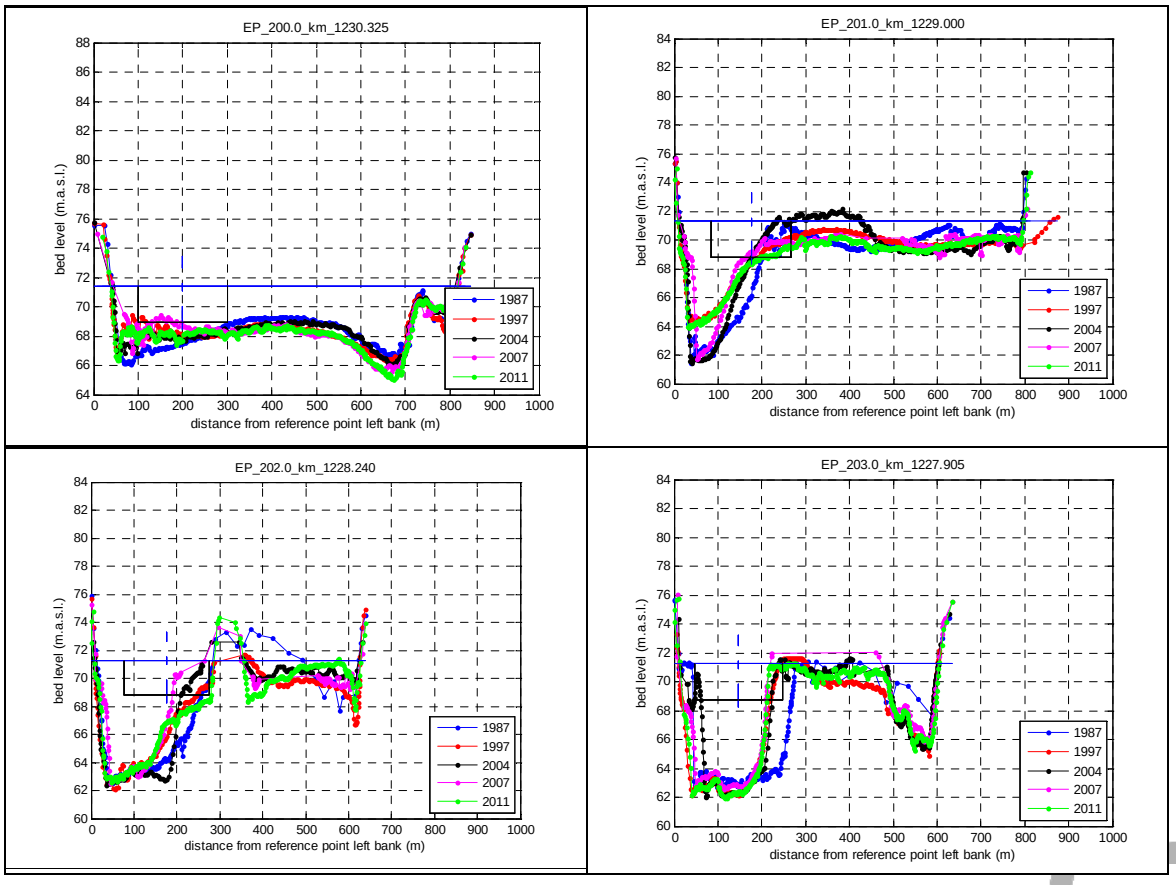
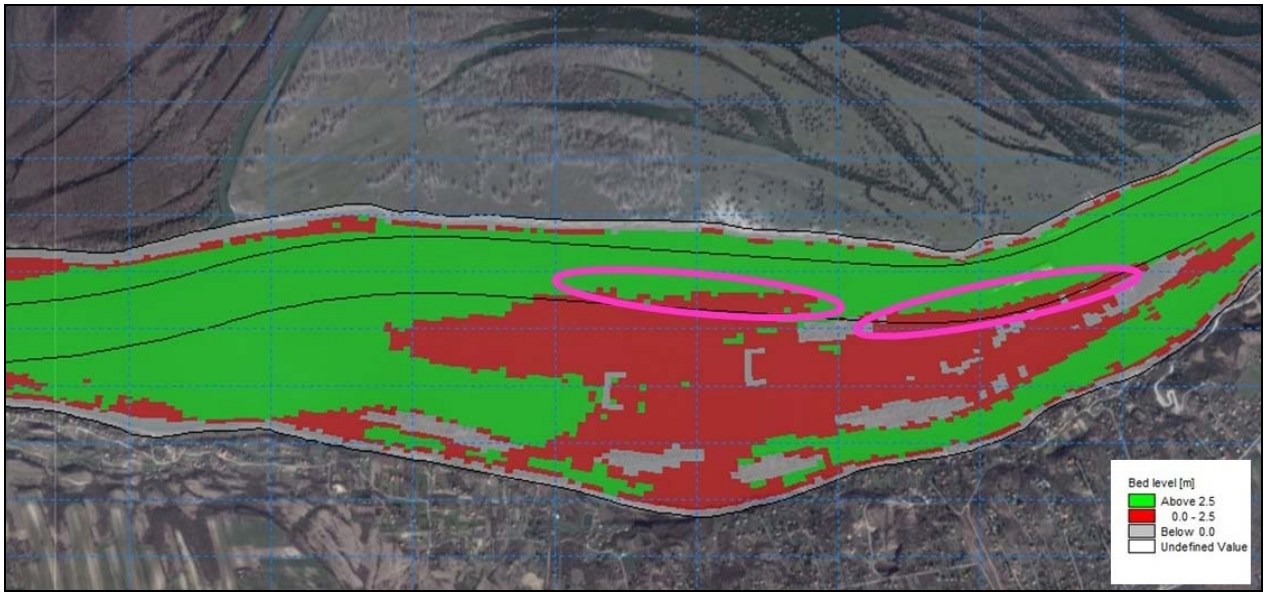
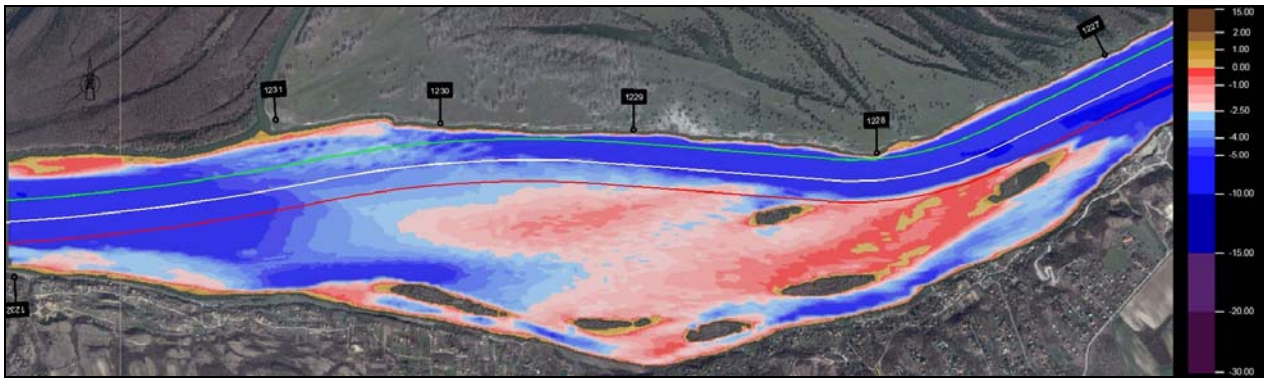
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Beška**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,232.00	to km:	1,226.60	length:	5.40 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected cross-sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR);		

	Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 180 m	
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works
	x	Repeated dredging works
		Realignment of the fairway (buoys)
		River engineering works (groynes, training walls, bottom sills etc.)
		Other:
Indicative interventions:	N/A	
Cost estimation for elimination:	N/A	
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project “Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River“	
Project planned / ongoing:	EU IPA 2013 Project “River Training and Dredging Works on the Danube River“ - execution 2014 - 2016	
Comments on the necessity for eliminating this critical location:		

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Slankamen**			
Location:	km:	1,216.02	bank:	left bank
Distance to critical location:	13.28 km			
LNL* (= ENR):	70.85 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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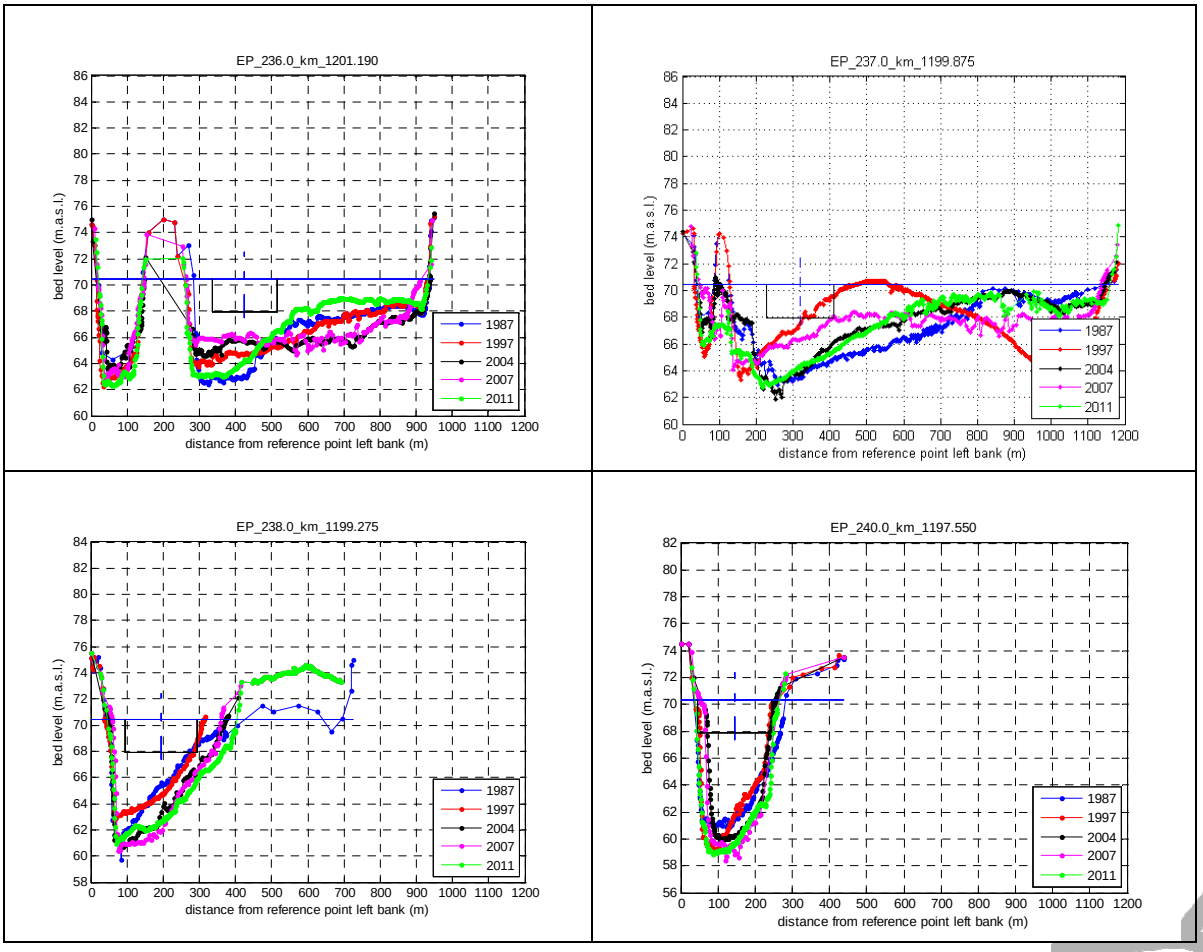
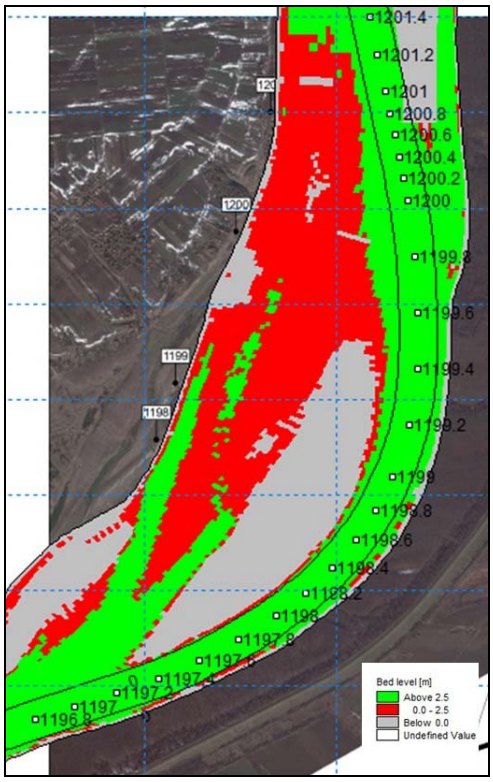
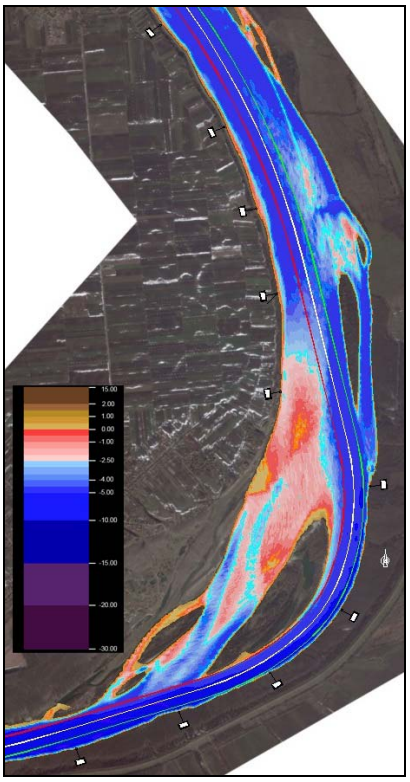
DATA SHEET: CRITICAL FAIRWAY LOCATION

Name:	**Preliv**				**Priority:**	
					1	
Waterway:	Danube					
Location:	from km:	1,207.00	to km:	1,195.00	length:	12.00 km
	right bank:	SRB	left bank:	SRB		
Riverbed:	Sand					
Visualisation:	September 2012.					

Selected EP cross-sections







Kind of obstacle: (tick one or more boxes)		Depth	
	x	Width	reduced fairway width
		Radius	
		Height	
		Traffic regulation	
		Other	
Shortcomings:	Reduced fairway width at low navigation level (LNL / ENR); Target value: Fairway depth H = 2.50 m at LNL; Fairway width B = 200 m		
Elimination of shortcomings: (how might these shortcomings be eliminated; tick one or more boxes)		One-time dredging works	
		Repeated dredging works	
		Realignment of the fairway (buoys)	

	x	River engineering works (groynes, training walls, bottom sills etc.)
		Other:
Indicative interventions:	N/A	
Cost estimation for elimination:	N/A	
Documentation available:	Main design available since 2013, prepared under the EU IPA 2010 project – "Preparation of Documentation for River Training and Dredging Works on Selected Sectors along the Danube River"	
Project planned / ongoing:	EU IPA 2013 Project "River Training and Dredging Works on the Danube River" - execution 2014 - 2016	
Comments on the necessity for eliminating this critical location:		

INFORMATION ON REFERENCE WATER GAUGE

Name:	**Slankamen**			
Location:	km:	1,216.02	bank:	left bank
Distance to critical location:	15.02 km			
LNL* (= ENR):	70.85 m.a.s.l.			
LNQ:**	1435 m^3/sec			
Reference period for calculation of LNWL + LNQ:	1981–2010			

* LNL = low navigation level (= ENR) - water level derived from the rating curve, defined for all navigable sections of the river, defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

** LNQ = low navigable discharge - discharge (expressed in m^3/sec) defined by the 94% duration of discharges over the 30 year period, on days without ice (defined by Danube Commission)

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3 TECHNICAL ASPECTS

3.1. Shallow section monitoring

3.1.1. Monitoring interval

Directorate for Inland Waterways PLOVPUT is in charge of hydrographic survey of international waterways on territory of the Republic of Serbia. It covers rivers Danube, Sava, and Tisza, overall almost 1000km of waterways.

3.1.2. Surveying/monitoring methods

Due to their morphological differences each of these rivers are surveyed in different spatial and time interval. Danube River is surveyed every year at profiles on 200m distance, Tisza River on profiles at approximately 1000m distance, and Sava River, depending on current situation, on profiles which are on 200m (50m) distance, only sectors critical for navigation. On each of these rivers cross-sections of gauging stations are being surveyed, as well as profiles upstream and downstream from bridges.

Surveys are being performed using singlebeam equipment. Multibeam is used only in cases when smaller area needs to be analyzed.

3.1.3. Equipment

For the hydrographic survey Plovput uses two vessels:

- Speedboat– 5.4 m long, with engine power 37kW, (Figure 2).
- MB “EHO II” – engine power 2x62kW, with auxiliary engine 8kW, (Figure 3);

Speedboat is equipped with 2000kHz transducer, with echo-sounder ODOM Echotrack CV-100. and portable equipment for single beam measurements. Precision of the echo-sounder is 1cm +/- 0.1% of measured depth.

MB “EHO II” is equipped with 200kHz transducer, with echo-sounder Navi Sound RESON 200.

FIGURE 2 SPEEDBOAT

FIGURE 3: MB "EHO II"

Two global positioning systems (GPS) are being used, depending on the vessel where they are installed:

- Marimatech GPS-RTK with precision of +/- 20cm,
- Trimble DGPS-RTK 5700 with precision of +/- 2cm.

The reference coordinate system used for all geographical data in Serbia is the State Geographical Coordinate System (Gauss–Krüger Zone 7).

Since April 2001, Plovput is equipped with Atlas's Fansweep 20 multibeam survey system. It has been used for the detailed survey of critical river sections. It is mounted on the MB "EHO II" vessel.

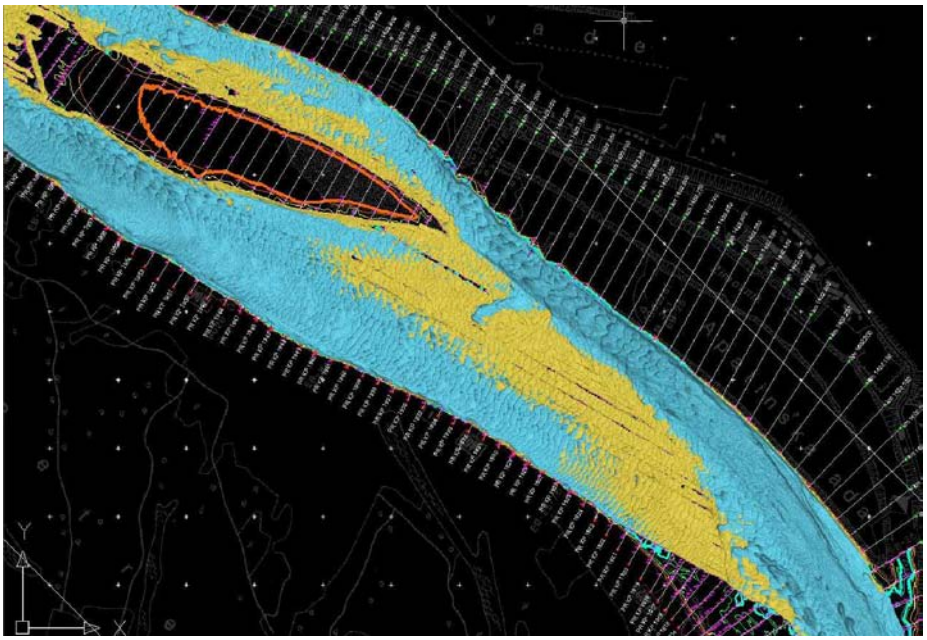

FIGURE 4 EXAMPLE OF MULTIBEAM SURVEY

3.1.4. Workflow description

Before the beginning of survey, coordinates of benchmark points of cross-sections are entered into the specialized software. Survey tracks follow those predefined profiles.

Depth (z) and location data (x, y) are transferred to the specialized software for hydrographic survey – “Masterchart”. The software synchronizes data constantly, so that the boat location is known in real time.

Information on the speed of sound in water is determined using the information provided by the SVP (sound velocity profiler) device. Differential GPS station is mounted on the solid ground, at the reference point with known geographic coordinates. The base station is connected with the boat by radio signal, sending information on differential correction, providing the required accuracy for the performed survey.

Depth information is obtained using the time necessary for ultrasound waves to travel from the echo-sounder to the river bottom and back. Two sounders are mounted on the boat. One is set to send the signal, and another to receive it. Such system provides depth measurements of 30cm below the eco-sounder, and 50 cm below the water surface. This setup is of importance for surveys in shallow waters.

Data on depth and location are synchronized in real-time, and information stored in ASCII format in the form of x, y (position) and z (depth) coordinates.

Water stages are measured and updated every couple of hours, in relation to the reference point.

After completion of the surveys, the quality control is being performed, spikes removed, and data stored into the database with cleaned x, y, z coordinates for each of the cross sections.

3.2. Publication of shallow section information (current situation)

3.2.1. Publishing location

After performed quality control, collected data are stored into the database. Establishment of the cross-sectional database is of a great importance for analysis of navigable waterways in Serbia. This database, developed completely by Plovput's engineers, is in use for almost 15 years, (Figure 5).

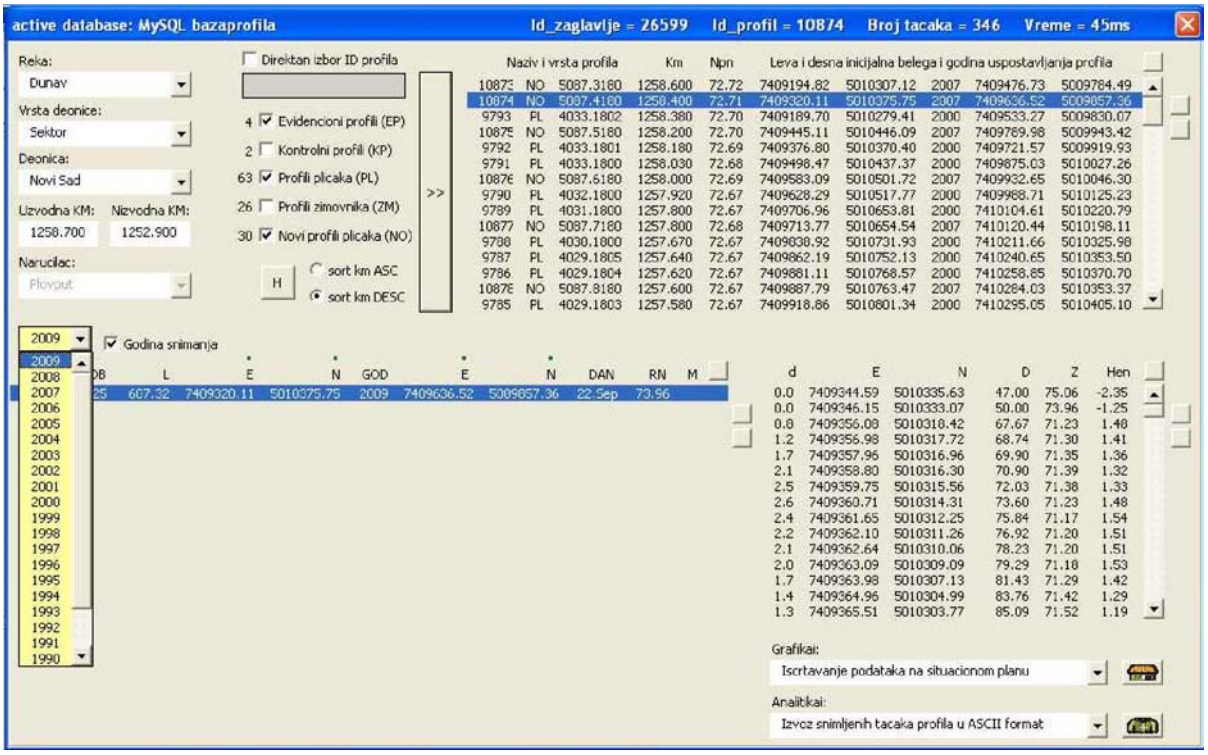

FIGURE 5: CROSS-SECTIONAL DATABASE INTERFACE

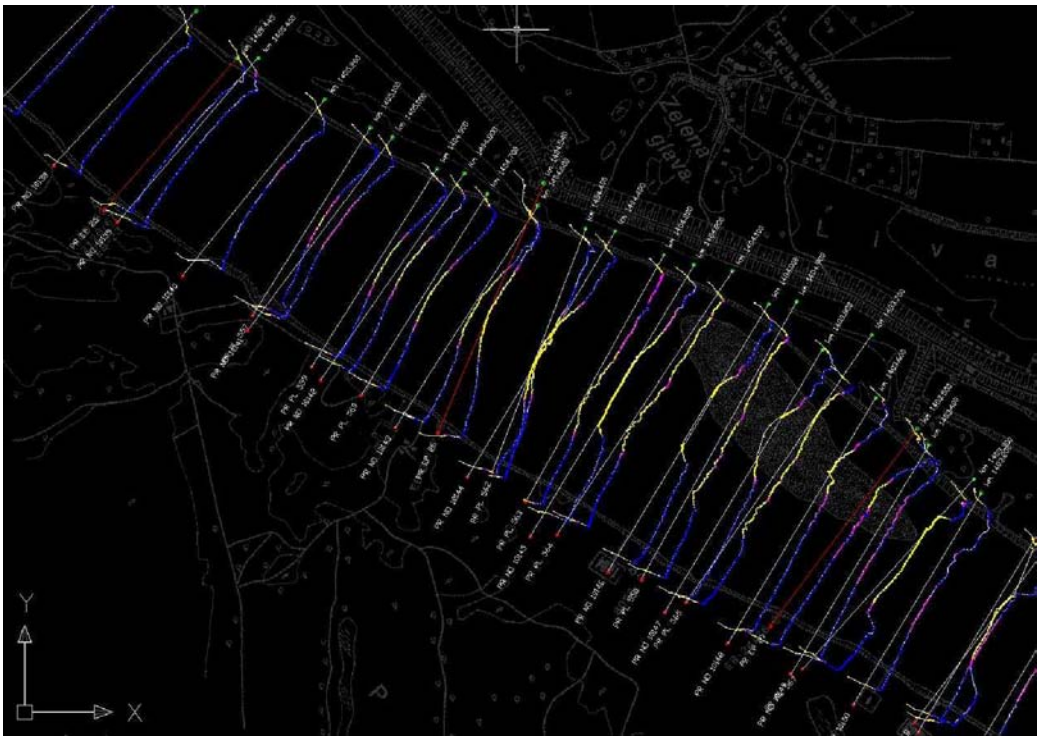

FIGURE 6. ANALYSIS OF CRITICAL SECTOR

This database provides necessary information for the analysis of the condition of the waterway (Figure 6), comparison of cross-sectional data surveyed in different years (Figure 7), etc.

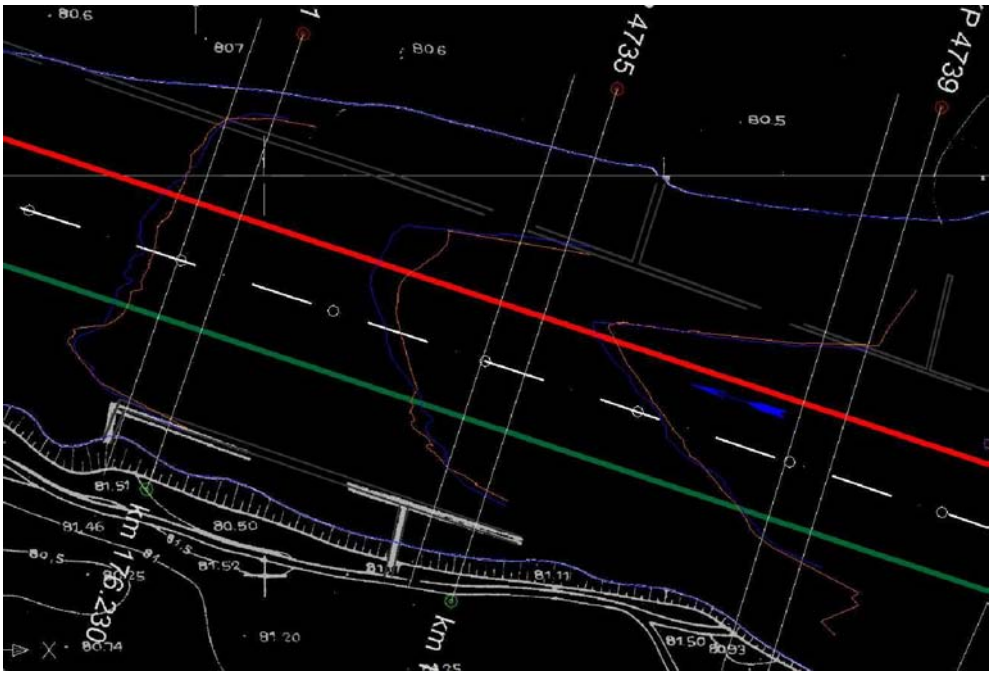

FIGURE 7: COMPARISON OF SURVEYED CROSS-SECTIONS (SAVA RIVER, SURVEYS 2004 AND 2009)

In case of critical sectors, such as Apatin, surveys are performed several times per year, depending on hydrological conditions, Figure 8. Profiles are then surveyed in distance of 50m-100m, depending on their position relative to critical part of the sector.

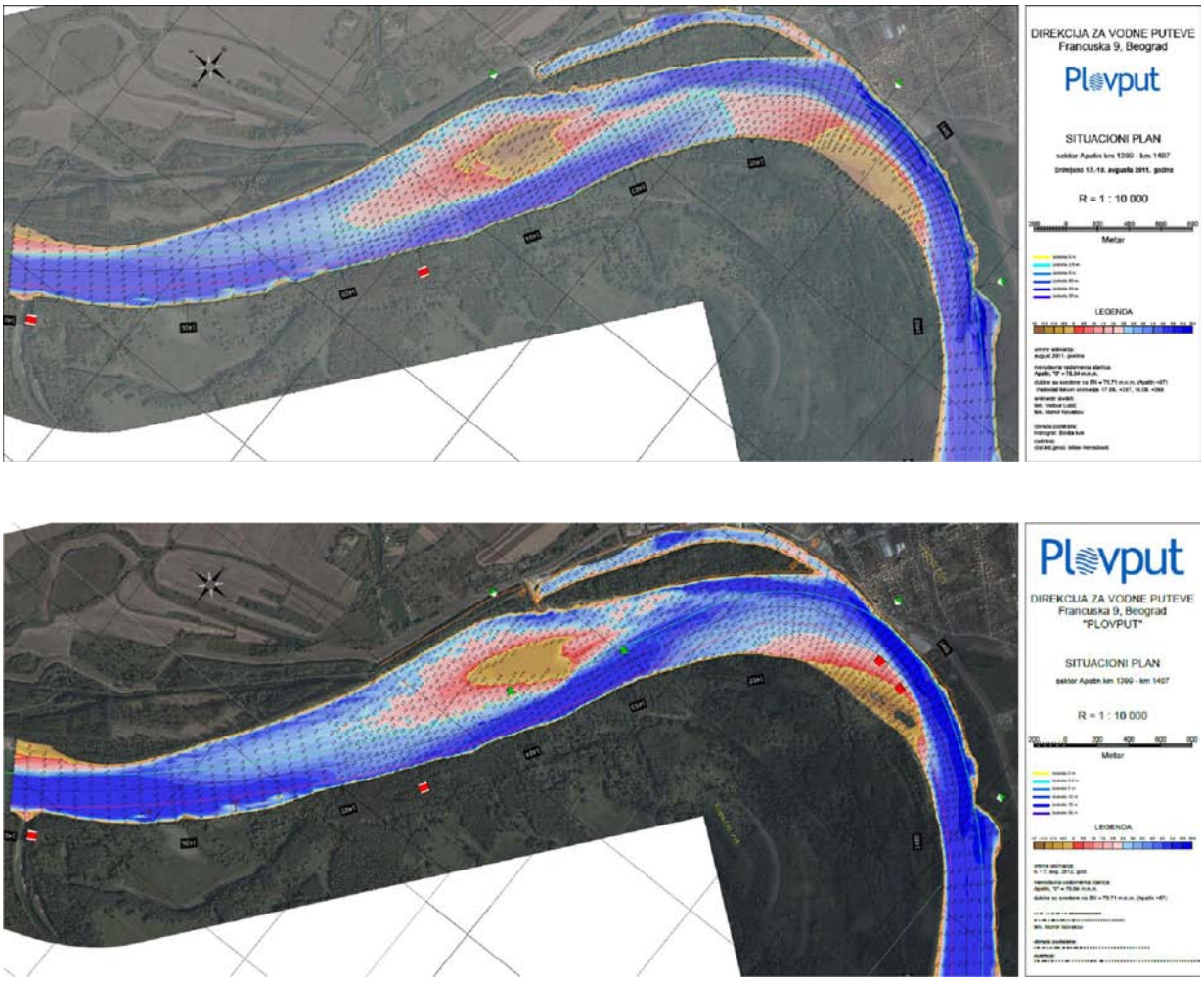

FIGURE 8 SURVEY OF CRITICAL SECTOR

3.2.2. Publication form

Surveyed data are being published in form of layouts, (Figure 8) and are made available to Port Captains who issue Notices to Skippers.

3.2.3. Data processing

Data processing was presented in Chapter 3.2.1..

3.2.4. Update interval

Hydrographical survey of sector Apatin, as most critical sector is being performed depending on hydrological conditions, as both, low and high waters, as well as ice occurrence influence changes in critical sectors.

In case of the extremely low water levels, and their longer duration, navigation is difficult to perform and in many cases vessels were navigating with reduced draught. In those cases daily information on status of the fairway is of critical importance for fairway users.

On joint sector with Croatia, Plovput, in cooperation with the Agency for Inland Waterways from Croatia, performs site visits to critical sectors, with representatives from the regional offices Apatin and Vukovar, and port captains from Apatin and Vukovar. On those occasions fairway depths are measured using the available on board instruments. This was particularly pronounced in November and December of 2011, when the water level was below ENR. During that time, the available depth of the fairway was less than 2.5m, with the available width of about 100m.

On Serbian sector of the Danube River Plovput performs similar measurements. Reports on measured dimensions (which included depth in the middle and at the edges of fairway, and the width) of the fairway of the Danube River were, on daily basis, available on the Plovput's web site, Figure 9.

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Република Србија

ИЗВЕШТАЈ О МЕРЕЊУ РАСПОЛОЖИВИХ ДИМЕНЗИЈА ПЛОВНОГ ПУТА РЕКЕ ДУНАВ

у периоду 13.-15.12.2011.године[1]

ркм	Пловна ознака	Дубина (dm)			Ширина (m)
		Десна ивица ⇒	Средина ⇒⇐	Лева ивица ⇐	
Датум:	**водомерна станица**	**Бездан**	**Апатин**		
14.12.2011.	**водостај (cm)**	**14**	**60**		
1364+400		35	100		150
1375+300			90	28	150
Датум:	**водомерна станица**	**Бездан**	**Апатин**		
13.12.2011.	**водостај (cm)**	**16**	**60**		
1382+600		33	90		140
1383+200		24	100		160
1393+000			100	27	140
1395+500		35	70		170
1401+800	види напомену	24	25		250
1402+400	види напомену		25	25	250

FIGURE 9 REPORT ON MEASURED FAIRWAY DIMENSIONS OF THE DANUBE RIVER

3.2.5. Legal aspects of publication

Since only information (Notices to Skippers) published by Port Captains is official information, info available on Plovput's site is for informational purposes, there is no legal aspect of data publication, at this moment.

3.2.6. Feed-back from users

There is not feedback from the users on critical sector information on Serbian stretch of the Danube River. At this moment, that information is only available to Port Masters.

4 COOPERATION

4.1. Cooperation between the countries in a common sector (shallow section)

There is several agreements on transboundary waters:

Rivers	Riparian countries	Treaties	Year of establishment
Danube, Tisza	Serbia Hungary	Agreement between the governments of the FPR of Yugoslavia and the PR of Hungary regarding water management issues	1955
Danube, Begej, Tamis, and other rivers in Banat region	Serbia Romania	Agreement between the governments of FPR of Yugoslavia and the PR of Romania concerning water engineering issues related to boundary and transboundary systems and watercourses	1955
Danube (Iron Gate)	Serbia Romania	Several agreements and conventions governing the construction, operation and maintenance of the Hydro Power and Navigation System "Iron Gate"	1963, 1964, 1967, 1976, 1977, 1987, and 1998.
Nisava, Timok	Serbia Bulgaria	Agreement between the governments of the FPR of Yugoslavia and the PR of Bulgaria concerning water management issues	1958
Danube	Serbia Croatia	Agreement between the governments of Republic of Serbia and Republic of Croatia concerning the navigation on navigable waterways, their marking and maintenance	2010

4.2. Cooperation with other institutions

Plovput has very good cooperation with other governmental institutions. Cooperation with Republic Hydrometeorological Service of Serbia is very important. Since 2007 daily information on water stages and discharges, as well as 4 day forecasts are being made available to Plovput. Data are provided both by email and RSS feed.

4.3. Cooperation with other departments, internal workflow

Directorate for Inland Waterways has 101 employees, and as such is relatively small institution. All information, produced by any of departments is in any given moment on disposal to all other.

end of document