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bouw

NEA
a member of Panteia

CRUP
inland navigation development centre

International Sava River Basin Commission

Pre-Feasibility Study

for
Rehabilitation and Development of the Sava River Waterway

Final Report – final version

English version
March 2007

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Sava Commission
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Att. Mr. Z. Milkovic
Deputy Secretary for Navigation

date	your reference	reference
March 16, 2007	Pre-Feasibility Study Sava River	SER2.1/L-110

handled by	telephone	Subject
R.A. Zanetti		Submission of final report

Dear Mr. Milkovic,

Herewith we have the pleasure to submit to you five (5) copies of the **Final Version** of the **Report – Prefeasibility Study for the Rehabilitation and Development of the Sava River Waterway.**

This report has taken into account the information received through various interviews with the stakeholders in the IWT sector and potential key players. In addition, the comments received on the draft version of this report have been incorporated.

We would like to express our sincere appreciation for the support that we have received from the Sava Commission and the beneficiaries to complete our tasks and obligations during the execution of this challenging project.

Sincerely Yours,

R.A. Zanetti
Project Manager

Enclosures:
Final Report (5 copies)
Electronic version - PDF format

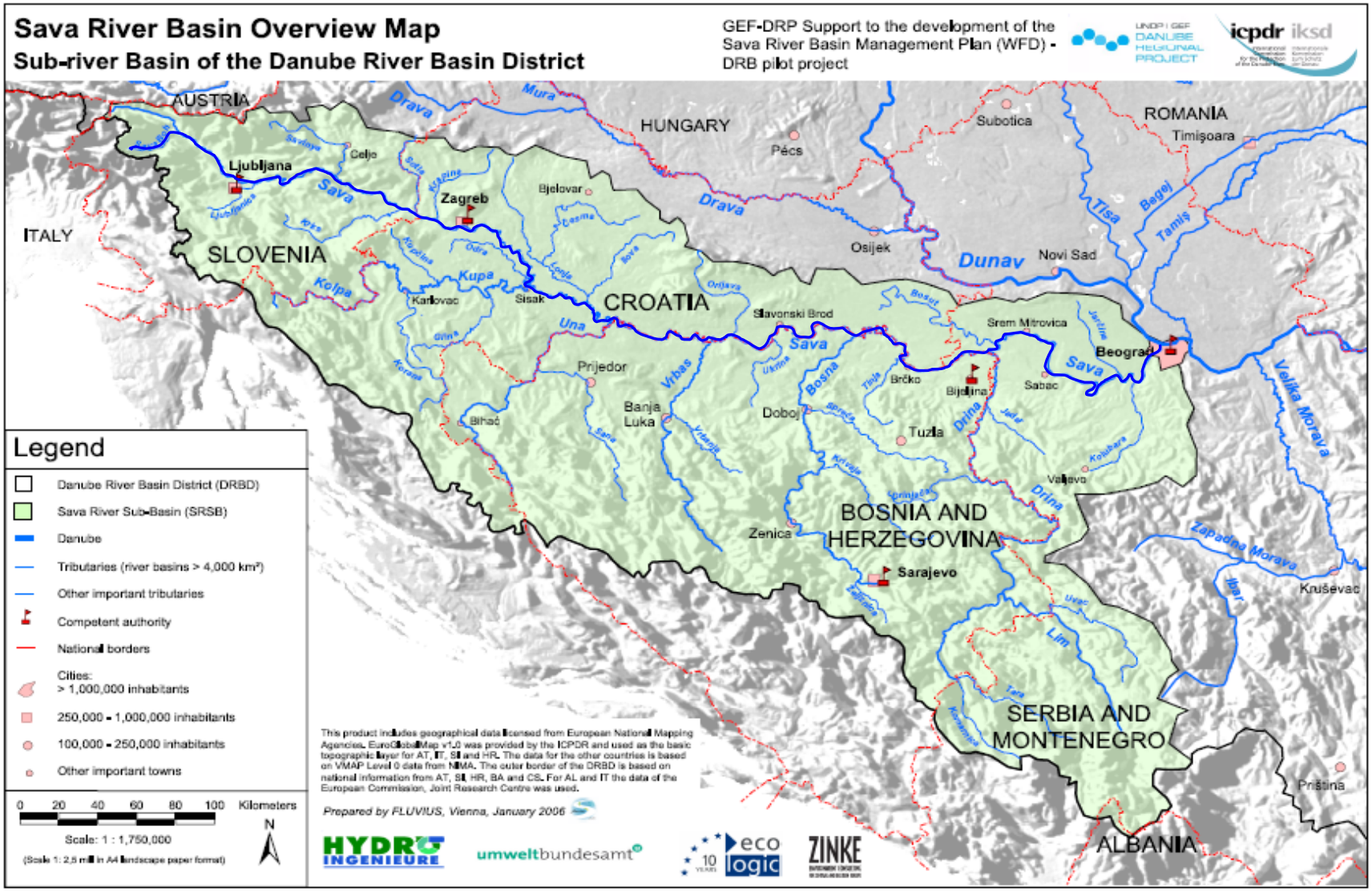

Sava River Basin Overview Map
Sub-river Basin of the Danube River Basin District
GEF-DRP Support to the development of the Sava River Basin Management Plan (WFD) - DRB pilot project
AUSTRIA
HUNGARY
ROMANIA
ITALY
SLOVENIA
CROATIA
BOSNIA AND HERZEGOVINA
SERBIA AND MONTENEGRO
ALBANIA
Ljubljana
Zagreb
Celje
Bjelovar
Pécs
Subotica
Timişoara
Osijek
Novi Sad
Beograd
Karlovac
Sisak
Slavonski Brod
Srem Mitrovica
Prijedor
Banja Luka
Bihać
Doboj
Brčko
Bijeljina
Sabac
Tuzla
Zenica
Sarajevo
Valjevo
Kruševac
Priština
Drava
Mura
Sava
Kupa
Kolpa
Una
Vrbas
Bosna
Drina
Tisa
Begej
Tamiš
Dunav
Velika Morava
Zapadna Morava
Ibar
Lim
Legend
Danube River Basin District (DRBD)
Sava River Sub-Basin (SRSB)
Danube
Tributaries (river basins > 4,000 km²)
Other important tributaries
Competent authority
National borders
Cities:
> 1,000,000 inhabitants
250,000 - 1,000,000 inhabitants
100,000 - 250,000 inhabitants
Other important towns
0 20 40 60 80 100 Kilometers
Scale: 1 : 1,750,000
(Scale 1: 2,5 mill in A4 landscape paper format)
N
This product includes geographical data licensed from European National Mapping Agencies. EuroGlobeMap v1.0 was provided by the ICPDR and used as the basic topographic layer for AT, IT, SI and HR. The data for the other countries is based on VMAP Level 0 data from NIMA. The outer border of the DRBD is based on national information from AT, SI, HR, BA and CS. For AL and IT the data of the European Commission, Joint Research Centre was used.
Prepared by FLUVIUS, Vienna, January 2006
HYDRO INGENIEURE
umweltbundesamt
eco logic
ZINKE

Table of Content:

List of Annexes:

List of Tables:

List of Figures:

GLOSSARY

AGC	= European Agreement on Main International Railway Lines
AGN	= European Agreement on Main Inland Waterways for International Importance
AGR	= European Agreement on Main International Traffic Arteries
AGTC	= European Agreement on important International Combined Transport Lines and Related Installations
AIS	= Automatic Identification System
BOD-5	= Biological Oxygen Demand
BoQ	= Bill of Quantities
CCNR	= Central Commission for Navigation of the Rhine
C-E	= main international (waterways)
CEE	= Central and Eastern Europe
CEMT	= Conférence Européenne des Ministres des Transports – (ECMT)
COD	= Chemical Oxygen Demand (measure of total organic content)
COMPRIS	= Consortium Operational Management Platform River Information Services
Consortium	= Witteveen+Bos in association with NEA and CRUP
DS	= Downstream
DORIS	= Donau River Information Services
EA	= Executing Agency
EAR	= European Agency for Reconstruction
EBRD	= European Bank for Reconstruction and Development
EC	= European Commission
ECDIS	= Electronic Chart and Display Information System
ECMT	= European Conference of Ministers of Transport
EDI	= Electronic Data Interchange
EIA	= Environmental Impact Assessment
EIB	= European Investment Bank
EIRR	= Economic Internal Rate Return
ENC	= Electronic Navigation Chart
EU	= European Union
EUR	= Euro
FASRB	= Framework Agreement Sava River Basin
FRY	= Former Republic of Yugoslavia
FSRY	= Former Socialistic Republic of Yugoslavia
GDP	= Gross Domestic Product
ha	= hectare (10,000 m^2)
ICT	= Information and Communication Technologies
IALA	= International Organisation on Marine Aids to Navigation and Light house
ICPDR	= International Commission for Protection of the Danube River
IMO	= International Maritime Organisation
IRIS	= Implementation of River Information Services
IWT	= Inland Waterway Transport
JRB	= Yugoslav Shipping Company
Jugoregistar	= Yugoslav Vessel Registration Bureau
km	= kilometer
LB	= Left Bank
M	= Million
MoCI	= Ministry of Capital Investments in Serbia
NEAP	= National Environmental Action Plan
NEP	= National Environmental Policy
PIANC	= Permanent International Association of Navigation Congresses
PMO	= Port Masters Office/Port Master Office
RB	= Right Bank
REBIS	= Regional and Economic Balkan Infrastructure Study
RIS	= River Information Services
SITC	= Standard International Transport Code
TEN	= Trans European Network
TEU	= Twenty foot Equivalent Unit
t	= tonne
tkm	= tonne kilometer

ToR	= Terms of Reference
TREN	= Transport European Network
UN	= United Nations
UN/ECE	= United Nations / Economic Committee for Europe
UNMIK	= United Nations Interim Administration Mission in Kosovo
UNOPS	= United Nations Office for Project Services
US	= Upstream
WB	= World Bank
WFD	= Water Framework Directive

1 SUMMARY AND CONCLUSIONS

1.1 Framework

- The Sava used to be an important lifeline in the former Yugoslavia and was regularly used for Inland Waterway Transport. However, the break-up of Yugoslavia and the economic decline in the 80's and 90's caused a strong decrease of transport and navigation on the Sava. In the present day, the Sava is hardly used for river transport. Other transport modes are (slowly) recovering but Inland Waterway Transport is still at a low level. Reasons for this situation might be amongst others:
  - lack of maintenance and investments, resulting in poor quality of infrastructure;
  - poor intermodal connections with road and railway;
  - damaged port and river infrastructure is endangering safe navigation;
  - the present low level of economic development because of the war (1990) along the Sava resulting in low cargo demand/ supply.
- In other parts of Europe, Inland Waterway Transport has proven to be a competitive transport mode, environmentally friendly and reducing congestion on densely used roads. Inland Waterway Transport might also be a viable transport mode for the Sava, connecting the economies of Slovenia, Croatia, Bosnia and Herzegovina and Serbia.
- The International Sava River Basin Commission (ISRBC) has recognized the possibilities for river transport on the Sava. One of its strategic targets, mutually agreed upon by all members of the ISRBC is to establish an international navigation regime on the Sava.
- Considering above aspects, the ISRBC on behalf of the Ministry of Sea, Tourism, Transport and Development of the Republic of Croatia (the investor of this Pre-Feasibility Study) has prepared the Terms of Reference of this Pre-Feasibility Study for the rehabilitation and improvement of the Sava River Waterway. Main beneficiaries are the Ministry of Sea, Tourism, Transport and Development of the Republic of Croatia and the ISRBC itself.
- The Consortium of Witteveen+Bos and NEA submitted their proposal for execution of consultancy services for the Pre-Feasibility Study for Rehabilitation and Development of the Sava River Waterway on December 7, 2006. The contract between the Consortium and Sava Commission was signed on December 14, by Mr. Komatina, secretary of the Sava Commission and Mr. R.A. Zanetti on behalf of Witteveen+Bos, the leader of the Consortium, in the presence of representatives of the Sava Commission and the Consortium.
- The accepted and agreed starting date was December 24, 2006.

- This Pre-Feasibility Study has been prepared for the period 2006 – 2026 based on the Terms of Reference, Consultant's technical proposal, the Inception Report (submitted in January 2007), discussions and meetings with IWT key players and stakeholders, as well as the information and comments received from the beneficiaries.

- Subject of the study is the rehabilitation and development of the Sava, to class IV according to the decision on the Detailed Parameters for Waterway Classification on the Sava River (Sava Commission 2006), UN/ECE, Geneva 1996. Hereinafter, where Class IV is mentioned reference is made to Class IV of the Sava Commission classification.
- The Sava, with a total length of 945 km, is a tributary of the Danube that takes her rice in the North-Western part of Slovenia and flows into the Danube in Belgrade in Serbia at km 0. The Sava connects the former Yugoslav Republics of Slovenia, Croatia, Bosnia - Herzegovina and Serbia. The Sava is navigable from Belgrade to Sisak in Croatia over a length of 586 km. Figure 1.1 gives an overview of the Sava River basin.

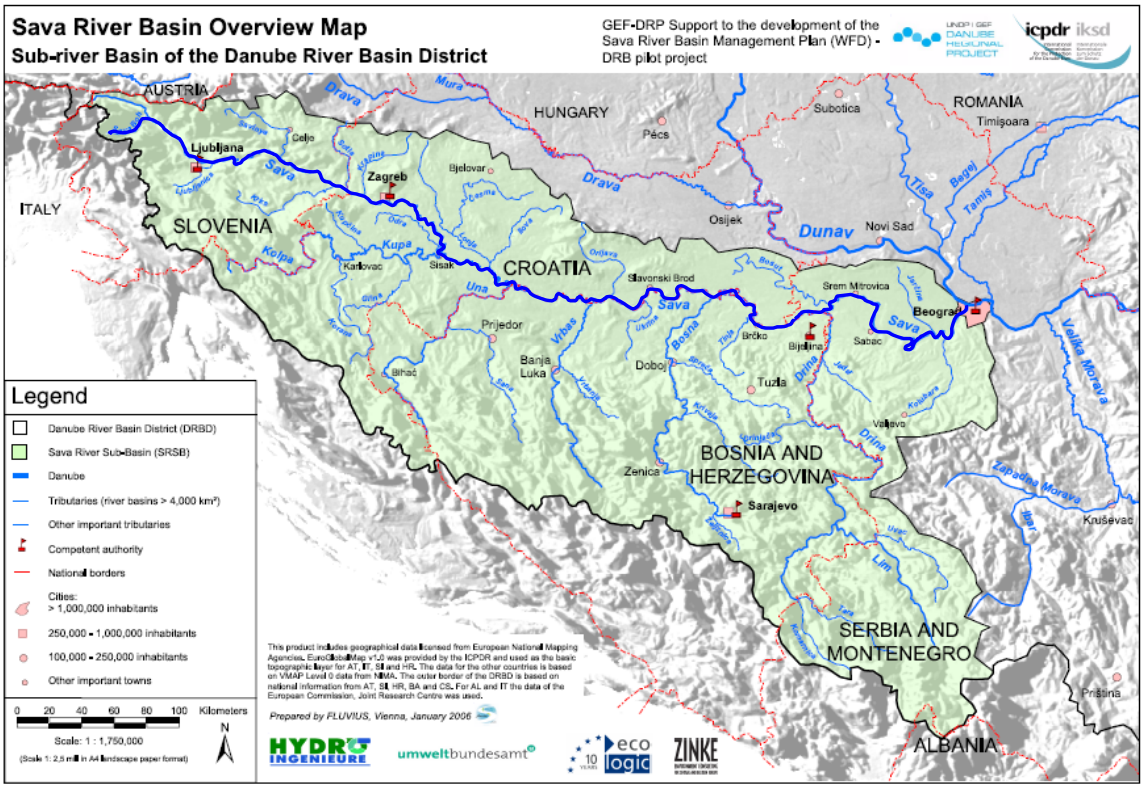


Figure1.1 Sava River Basin overview

- The classification (UN/ECE, Geneva 1996) of the Sava is presented in Table 1.1.

Table 1.1 Classification of the Sava

Section of the Sava		Length (km)	Classification (class)	Tonnage
Downstream chainage (km)	**Upstream chainage (km)**			
0 Belgrade	305.7 Slavonski Šamac	305.7	IV	1,000 – 1,500 t
305.7 Slavonski Šamac	330.2 Oprisavci	24.5	III	470 – 700 t
330.2 Oprisavci	363.2 Slavonski Brod-grad	33.0	IV	1,000 – 1,500 t
363.2 Slavonski Brod-grad	583.0 Sisak	219.8	III	470 – 700 t
583.0 Sisak	651.0 Rugvica	68.0	II	500 – 630 t

- During the course of the Pre-Feasibility Study information, data, maps, reports and bulletins have been collected and consulted, by approaching ministries, institutes, authorities and private companies as presented in Table 1.2.

Table 1.2 Ministries, institutes and companies contacted

Ministry of Sea, Tourism, Transport and Development – Republic of Croatia
Ministry of Transport – Republic of Slovenia
The Ministry of Capital Investments of Serbia – Department of Transport
The Agency for Inland Waterways in Croatia
Port Master Office Sisak
Port Master Office Slavonski Brod
Port Authorities of Sisak
Port Authorities of Slavonski Brod
Joint Stock Company Cargo Transport Centre „Luka Samac“
Public Company “Luka Brcko”
The Sava Commission
Croatian Register of Shipping
Shipping company Laurion
Shipping company Dunavski Lloyd
Valjaonica Cijevi Sisak
INA Industry Nafta Croatia

- This Pre-Feasibility report presents the findings, considerations, calculations, assumptions and results of the activities Consortium has carried out during the project period. In addition, the comments received on the draft version of the Final Report have been discussed and incorporated.
- After this introductory Chapter 1, Consortium presents in Chapter 2 the potential cargo on the Sava. Chapter 3 deals with the improvement of the Sava on the stretch Brcko – Sisak, while Chapter 4 provides details on the ports and the port developments. Chapter 5 handles the Environmental Review while Chapter 6 elaborates on the institutional and legal aspects related to Inland Waterway Transport in the Sava riparian states. Finally, Chapter 7 presents the Cost Benefit Analysis (CBA).
- Various annexes have been added to each chapter in order to provide additional information. Separately a literature list (Annex 8) is presented.

1.2 Beneficiaries and parties involved

- The beneficiaries of the implementation of the proposed projects within this Pre-Feasibility Study do not include only the transport sector but also sectors such as environment, infrastructure, water resources (flood control, drainage and water supply), energy, tourism and recreation.
- Other direct beneficiaries will be the river users, being the companies transporting the goods from one port to another within the Sava riparian states and the international companies importing, exporting and transiting cargo, private sector organisations, like shipping companies (national and international), marinas and boating facilities.

1.3 Objectives

- The objective of this study is to promote and enhance navigation on the Sava bringing it up to a Class IV. Consequently, a Pre-Feasibility Study for Rehabilitation and Development of the Sava River Waterway up to Class IV has been prepared. The Terms of Reference is enclosed as Annex 1.1. The Pre-Feasibility study has to provide a strategy for the development of Sava as a viable transport axe, taking into account the economic development of the region, environmental impacts and relevant socio-economic factors.
- The development of the Sava has to comply with the main objectives of the Sava River Basin Framework Agreement, being:
  - resuming navigation on the Sava and tributaries;
  - promoting integrated water quality management and preservation of ecosystems;

- coordinating protection against hazards (flooding, drought, pollution);
- supporting sustainable, environmentally and socially responsible economic development.

- The results of this Pre-Feasibility Study will be the basis for the beneficiaries to initiate further development of the Sava and initiate sequel activities amongst others establishing a development policy for the Sava, start Feasibility Studies, apply for international funding, enhance private investments, public private partnerships, etc.
- The results of this Pre-Feasibility Study have to provide input for the Croatian National IPA Operating Program for Transport for the period 2007 - 2013.

1.4 Transport and traffic

- The traffic and cargo forecast calculated for the period 2006 – 2026 used in this Pre-Feasibility Study is based on the results of the interviews held with the key players on the Sava. This forecast is the basis for the preparation of proposals to upgrade, improve and modify the infrastructure of the Sava and is used for the cost benefit analysis.
- The cargo forecast for the ports of Sisak (oil terminal and port along the Kupa river), Slavonski Brod, Bosanski Brod and Samac for each commodity in the Sava stretch km 202 up km 587 (Sisak) has been prepared together with three economic growth scenarios, being the low growth scenario, medium growth and high growth scenario, as presented in Table 1.3.

Table 1.3 Forecasts for ports Sisak, Slavonski Brod, Bosanski Brod and Samac

	low growth scenario				medium growth scenario				high growth scenario			
	1,000 tons		million tonkm		1,000 tons		million tonkm		1,000 tons		million tonkm	
	2011	2026	2011	2026	2011	2026	2011	2026	2011	2026	2011	2026
Sisak	415	601	304	440	845	1,716	527	989	1,360	2,838	785	1,621
Sl. brod	910	1,684	747	1,486	1,510	2,557	1,322	2,239	2,120	4,152	1,907	3,733
B.brod	0	0	0	0	0	600	0	180	200	1,400	60	420
Samac	1,371	1,986	578	836	1,888	3,162	770	1,290	2,404	4,650	962	1,861
Total	2,696	4,271	1,628	2,763	4,243	7,966	2,619	4,697	6,084	13,040	3,714	7,635

- The transport scenarios are based on two infrastructure scenarios and the three economic growth scenarios. The Status Quo infrastructure scenario means that the present situation in the river will not change (remains class III), being the reference scenario. The other scenario is the Sava improvement up to class IV.
- Per cargo flow the mean transport distance has been prepared to calculate the tonkms.
- Per cargo flow the alternative modes of transport road and rail have been considered.

1.5 Definition of projects

- In this report only the improvement of the Sava to a Class IV waterway has been evaluated. Use has been made of the detailed study carried out by the Croatian company VPB (within Croatian Waters). It is understood from deliberations with the Sava Commission and the Inland Waterway Agency of Croatia that further improvement is not feasible due to the natural characteristics of the river.
- Main focus has been the improvement of the Sava in Croatia and Bosnia. For Serbia the recently completed Master Plan for Restoration of Inland Waterway Transport in Serbia has shown that improvement of the Sava to class Va in Serbia is highly feasible.
- In Slovenia the development of the 20 km river stretch from Slovenian – Croatian border till Brezice has a special status. Moreover, the development and operation of Hydro Electric Power plants are of major importance, as well as the use of the Sava River as part of the intermodal chain for the industries in Novo Mesto.
- Figure 1.2 indicates the four main locations where navigation problems occur with the (specifically) 95% occurrence water level line.
- Upgrading is considered for the section upstream of Brcko up to Sisak from class III to class IV.

- The projects proposed for implementation in Serbia (reference is made to the Serbian IWT Master Plan 2006) regarding the ports and the Inland Waterway system, have been omitted from this Pre-Feasibility Study are not included in the Cost Benefit Analysis (CBA).
- The proposed projects vary from dredging and the construction of river training works and bank protection works, to the implementation of river information services, construction of new bridges and upgrading of aids to navigation.

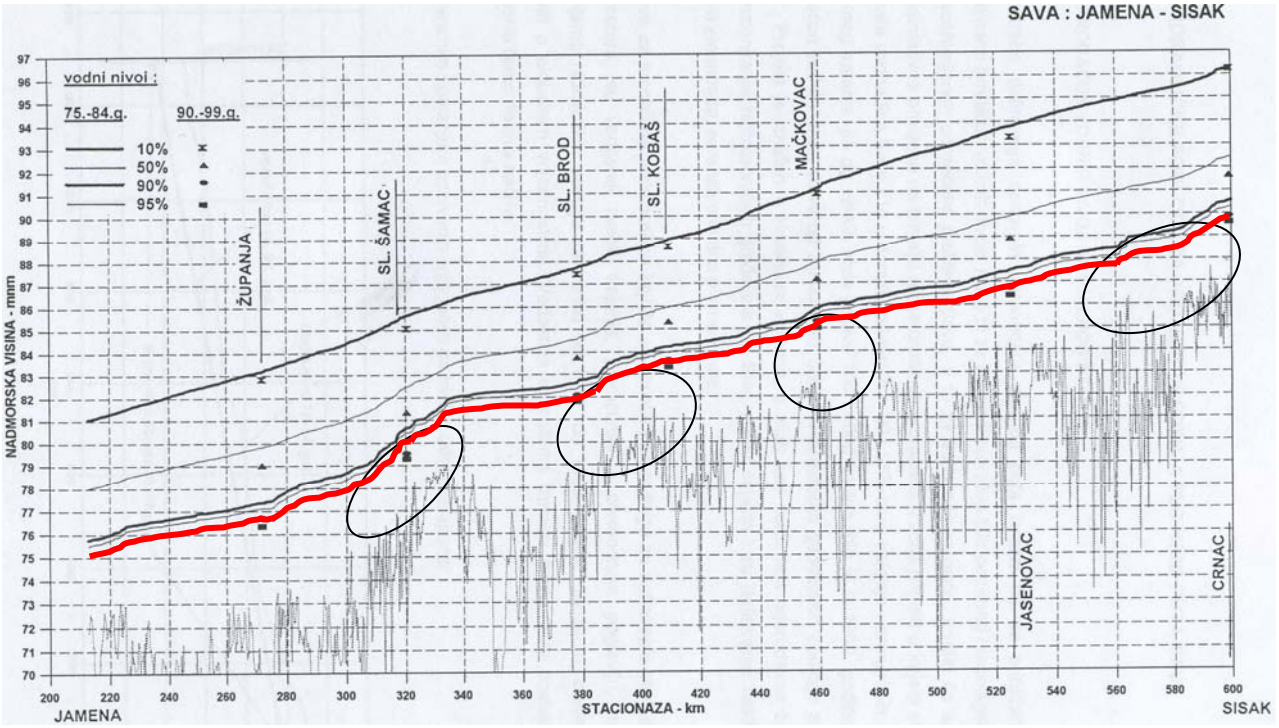


Figure 1.2 Longitudinal profile with characteristic water levels

- A water level decrease is occurring along the entire length of the Sava in Croatia and Bosnia and Herzegovina, with a maximum decrease of the average water level at one location with 105 cm. The water level decrease is probably caused by excessive and uncontrolled dredging.
- From Figure 1.2 shallow locations were identified around Slavonski Samac, Slavonski Brod and Slavonski Kobas, Mackova and downstream of Crnac. These locations, depending of the size and draft of the vessels might be difficult to pass for vessels.

1.6 Costs

- The total construction costs are about 40.2 million Euro (excl. contingencies and costs for project realization) for the implementation of the proposed projects (class IV) for the Sava stretch km 202.5 up to km 587.50, with related annual maintenance costs of 2.1 million Euro.
- The majority of these costs relate to the dredging and training works. Other projects include the implementation of river bend improvement, marking and signalling and bridge construction. Details are presented in Table 1.4.

1.7 Implementation of projects

- The implementation of the projects is divided into three categories, being very urgent, urgent and less urgent, depending on the level of increase of safety and the availability to use it as a mode of transport.
- The upgrading of the Sava is assumed to be completed by the year 2011.

Table 1.4 Cost for the proposed works (Euro)

Project description			A. Construction costs (Euro)	Additional costs		D. Investment Costs (A+B+C)	Yearly maintenance (Euro)
#	Chainage	Description		B. Contingencies (10% of A)	C. Project realization (15% of A+B)		
DTW1	202.5 225.1	Execute dredging works to improve Sava fairway depth in Section I	1,190,000	119,000	196,350	1,505,350	297,500
DTW2	225.1 260.7	Execute dredging and training works to improve Sava fairway depth in Section II	60,000	6,000	9,900	75,900	3,000
DTW3	260.7 306.8	Execute dredging and training works to improve Sava fairway depth in Section III	600,000	60,000	99,000	759,000	30,000
DTW4	306.8 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV	5,620,000	562,000	927,300	7,109,300	182,600
DTW5	331.5 364.4	Execute dredging and training works to improve Sava fairway depth in Section V	50,000	5,000	8,250	63,250	2,500
DTW6	364.4 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI	3,540,000	354,000	584,100	4,478,100	120,700
DTW7	395.5 417.1	Execute training works to improve Sava fairway depth in Section VII	0	0	0	0	0
DTW8	417.1 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII	420,000	42,000	69,300	531,300	21,000
DTW9	445.7 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX	110,000	11,000	18,150	139,150	5,500
DTW10	459.9 480.4	Execute dredging and training works to improve Sava fairway depth in Section X	10,000	1,000	1,650	12,650	500
DTW11	480.4 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI	90,000	9,000	14,850	113,850	4,500
DTW12	511.8 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII	4,940,000	494,000	815,100	6,249,100	134,600
DTW13	546.8 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII	8,490,000	849,000	1,400,850	10,739,850	246,200
DTW14	568.8 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV	3,190,000	319,000	526,350	4,035,350	134,000
RB1	480.4 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI	187,500	18,750	30,938	237,188	9,375
RB2	511.8 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII	562,500	56,250	92,813	711,563	28,125
RB3	546.8 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII	375,000	37,500	61,875	474,375	18,750
RB4	568.8 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV	187,500	18,750	30,938	237,188	9,375
M1	207 335	Upgrading of the marking system and maintenance in arrear for the section S. Border - Oprisavci	416,667	*Investments have been calculated according to schedule provided by the Inland Waterway Agency*		416,667	208,333
M2	335 651	Upgrading of the marking system and maintenance in arrear for the section Oprisavci - Sisak	138,889			138,889	222,222
B1	511.3	Replacement of the Jasenovac bridge to guarantee minimum vertical clearance	10,000,000	1,000,000	1,650,000	12,650,000	375,000
		Total costs	**40,178,056**	**4,017,806**	**6,629,379**	**50,825,241**	**2,053,780**

1.8 Cost Benefit Analysis

- The costs and benefits analysis (CBA) has been based on the different scenarios w.r.t. economic growth of the Sava riparian states and of the proposed improvement package of the Sava.
- The potential benefits of the Sava capacity expansion consist of:
  - Direct economic benefits for existing users;
  - Direct economic benefits for potential new users;
  - Indirect economic benefits;
  - External benefits.
- It is assumed that in the period 2016-2026 only annual maintenance costs will be necessary, at the level of the last years in the period 2007-2016.
- Cost and benefits are calculated in constant prices (price level 2006).
- The total costs of the entire improvement package is about 66 million Euro, which equals respectively 50 million Euro with a 5% interest rate, 41 million Euro using a 10% rate and only 34 million Euro using a discount rate of 15% rate.

- Up to 2011 benefits are 0 as the infrastructure improvements are not yet implemented. Real benefits can only be expected in 2011 and later on. Benefits then rise very quickly to impressive heights. Table 1.5 shows the summary of some key data.

Table 1.5 Summary benefit statistics (mln Euro)

	Low growth	Medium Growth	High growth
Total cumulated benefits	190.0	220.0	532.6
Net value of benefits (5%)	102.6	116.6	280.9
Net value of benefits (10%)	59.7	66.6	159.7
Net value of benefits (15%)	37.0	40.7	97.0

- However, it seems perfectly possible that economic initiatives are sensible at the time of investigation, but investments will not take place after all, because some circumstances have changed, which could not be foreseen at the time that the plans existed.
- As most of the plans of companies and ports will have to be realised only after the year 2011 it seems prudent to take the possibility of a 'break-off' of economic activities into account. This has been done and the consequences have been calculated with a realisation probability of 100%, 80% or 60 %. This is presented in Table 1.6.

Table 1.6 Indicators financial performance depending on the realisation probability of identified transport potentials

Realisation probability	Indicator	Low growth rate	Medium growth rate	High growth rate
100%	Nett present value cash flow (15%) in EUR	3.2 million	27.5 million	74.0 million
100%	EIRR	17%	27%	34%
80%	Nett present value cash flow (15%) in EUR	-4.1 million	15.2 million	51.5 million
80%	EIRR	13%	22%	32%
60%	Nett present value cash flow (15%) in EUR	-11.5 million	3.0 million	29.2 million
60%	EIRR	8%	17%	25%

- With a 60% probability that the identified transport potentials are realised the internal rate of return of the proposed Sava improvement project is still higher than 15% (cut-off rate) in both the high and medium growth variant. The low growth scenario reaches for a 60% realisation probability only an EIRR of 8%.

1.9 Institutional and legal aspects

- The Sava Commission must develop solid decisions and the implementation of these decisions must be guaranteed;
- The development of the Sava should besides the IWT sector also include the improvement of the environment as this will (in) directly also improve/enhance IWT;
- the Sava Commission should play a major role in establishing decisions to safeguard, develop, enhance and maintain an integrated development in the Sava basin considering flood management, water scarcity, renewable energy sources and production (hydro power energy), water ecosystem, flora and fauna, spatial planning, tourism and recreation and navigation;
- The Sava riparian states must be willing to provide cash and kind for the implementation of the decisions as released by the Sava Commission; the same holds for regular maintenance of waterway(s), IWT structures, terminals and fleet;
- The Sava riparian states must adapt their existing institutions dealing with IWT, in a way that via a phased approach at the end these reformed institutions work together properly, also with the Sava Commission;
- All Sava riparian states must develop transport policy plans, based on realistic cargo flows;
- Tariff setting must be developed in a way that economic costs prevail, so that intermodal transport can develop and competition between the modes can grow;

- In all Sava riparian states the IWT-related tasks, as done by both the public and private sectors, must develop in a way that can be expected in a market driven economy;
- Standards for ship building and ship design should follow international standards; the outdated and obsolete elements of the existing (old) fleet must be sanitised/scrapped;
- Navigable channels in the Sava basin waterways must be developed and maintained in a way that the Sava Commission classification system is followed;
- More in particular, for at least the medium term, attention must be given to the transport of dangerous commodities, to the safety of the IWT sector in all aspects (safety of cargo, navigation, crew, environment) and to sustainable developments.

1.10 Environment

- The ongoing sand and gravel mining has caused over the past 10 to 15 years a drop of the average water level of the Sava at certain locations of about one meter. This decrease in water level might have a considerable impact on the environment (ground water table and agriculture) directly along the Sava. Regulations are being put in place to mitigate this event.
- The impact of the proposed works to be implemented has been considered and an Environmental review has been prepared. Mitigation measures and secondary effects have been dealt with.
- Economic benefits related to the improvement of the environment have not been calculated. This would be more appropriate and is recommended to be executed during the execution of a Feasibility Study or detailed design study.
- The project is feasible as designed, based on the results in this preliminary phase, but with strict implementation of mitigating measures prescribed by future EIA.
- EIA should specially focus on the identification, quantification and assessment of hydraulics, river morphology, soil and water (existing pollutant must be listed, intervention should not effect existing water quality) and nature protection effects (existing flora and fauna, areas which are important for birds).
- In special protected areas like Lonjsko Polje, forests which are depending on water level, and swamp areas around Sava river basin EIA should focus in more detail on nature and habitat protective mitigation measures. In addition to that, special attention should be paid to natural landscape and cultural history and archaeology preservation in smaller segments within future intervention area.
- Agriculture and recreation activities could have a significant impact on the environment, which have to be quantified in follow up studies. An integrated approach towards the Sava River basin development regarding water management, transport, energy and ecology is required and has to be supported by the Sava Riparian States, with a major role of the Sava Commission.
- Existing water infrastructure improvements and the implementation of Hydro Electric Power plants should follow most environmentally friendly solutions.
- Future EIA should be developed according local legal requirements (Slovenia, Croatia, Serbia and Bosnia and Herzegovina), but also taking into consideration the EU Directives requirements with special attention on the elaboration of the Water Framework Directive for the Sava River Basin.

1.11 Evaluation and conclusion

- Based on the fact that the Sava part of the European inland waterway network and has major attention of the EU, the projects identified to be executed as very urgent and urgent are proposed for implementation.
- The following aspects are of utmost importance for further implementation of the projects and improvement of the Sava as a reliable transport mode:
    - Integral approach to the Sava:

- The development of the Sava for navigation should be considered on a river basin level and includes therefore all Sava riparian states. The Sava Commission should therefore play a major role in the preparation and coordination of projects.
- The ongoing water level decrease and bed level degradation might have far stretching consequences for the river basin. Any improvements of the Sava should aim at stopping or reducing this process. Projects to improve navigation conditions might contribute to this and this combination of effects might increase the feasibility of the proposed works;
- Future and existing Hydro Electric Power Plants should be implemented with provisions for navigation and with fish ladders.

- Environmental Impact Assessment

- The preparation of an EIA for any works to be implemented is of utmost importance. It is understood that initial steps are taken towards the preparation of an EIA. Hydraulic calculations, carried out as part the preliminary design report, have shown that the proposed works do not cause additional water level decrease.
- However, a morphological analysis has not been carried out yet. When morphological processes are considered it might show that the proposed dredging and training works will lead to further deepening of the Sava, which is not favourable from an environmental point of view. Mitigation measures will be required.
- The EU Water Framework Directive (Slovenia has to adhere to it as EU member country) should be taken into account by all Sava Riparian States.

- Traffic simulation

- There are 24 river bends in the Sava which have a radius that is too small for two way traffic. Out of these 24 river bends, 11 river bends have a radius smaller than acceptable, even for one way traffic.
- However from local experts it is understood that class IV categorized vessels are passing these bends. Based on the available information it is not possible to indicate if safe passing of these bends is possible. Therefore, detailed traffic (computer) simulations are recommended during the following stages of project implementation.

- Cooperation between the Sava riparian states and Sava Commission

- A successful development of the Sava as a competitive, regional transport mode highly depends on the cooperation between the riparian countries.
- Furthermore, aspects like traffic management, maintenance of the marking system, etc. are all aspects that need to be covered with common dedication.
- The Sava Commission is to be the key player in further development of the Sava not only for navigation purposes, but also for an integrated development approach including spatial planning, water management / flood control, lack of water, irrigation, flora and fauna, renewable energy, tourism and recreation and navigation

- The proposed package of measures for the expansion of the trajectory between Brcko and Sisak to a class IV waterway, seems to be a project with a clear positive financial result. The investment seems to sound.
- The fact that apparently many distinct companies, authorities and individual experts see interesting possibilities of the proposed activities along the Sava is a very positive fact and a stimulation to improve the Sava up to class IV.

Annex 1
TERMS OF REFERENCE

PREPARATION OF THE PRE-FEASIBILITY STUDY FOR REHABILITATION AND DEVELOPMENT OF THE SAVA RIVER WATERWAY

1 BACKGROUND

1.1 Beneficiaries

Beneficiary are the Republic of Croatia and the International Sava River Basin Commission (ISRBC).

1.2 Beneficiary Institutions

The beneficiary institutions are the Ministry of the Sea, Tourism, Transport and Development of Republic of Croatia and the Secretariat of the International Sava River Basin Commission (ISRBC).

1.3 Contracting Authority

The contracting authority is the International Sava River Basin Commission (ISRBC).

1.4 Relevant background

The Sava is presently largely underused, river transport being limited to scarce traffic on small river sections of the Sava. The waterway transport was actively used in the past (prior to the break-up of the FSR of Yugoslavia) and was provided with important means with respect to operation of the inland waterway system as well as the allocation of budgets and investments by governmental authorities.

The river Sava is navigable over a stretch of 586 km flow (starting from the confluence with the Danube) and links the economies of the 4 Sava riparian states of Slovenia, Croatia, Bosnia and Herzegovina and Serbia. Based on the existing and/or planned construction of the traffic infrastructure that links the river Sava with several ports on Adriatic, the existence of port infrastructure along the river Sava and the connection with the Danube, the river Sava provides advantages for intensifying further development of the river transport.

Despite of its natural advantages, during the last 15 years, the river Sava waterway system has been neglected and its current state-of-condition is poor due to many external, but also internal factors. During said period, the economical development in the Sava basin mainly decreased and the maintenance of the river Sava waterway system was at a low level.

In parallel to this situation, due to the decrease of the industrial production and the economic problems the region is facing, the waterway transport on the river Sava, but also for the other modes of transport, reached a low level and presently suffers from the serious lack of financial resources for investments and maintenance operations.

It is also very important to remark that the full potentials of the water transport were not adequately used in past as well, which can be illustrated by fact that water transport in EU countries has risen for 12% during period of 1970-1998 (source: EUROSTAT, ECMT[1]), while water transport in countries of Central and Eastern Europe has declined for 20% during period of 1990-1998 (source: ECMT). The Sava waterway transport was actually the most endangered mode of transport due to the severe damages of the infrastructure and the presence of remained unexploded devices resulting from the rocket attacks on port and river infrastructure.

The damaged infrastructure and presence of unexploded devices do not present just a constant threat to the potentially very hazardous consequences with respect in context of navigation, but also endanger the environment.

It should be remarked that the waterway transport is not the only factor that shows decline, but the cargo throughput at the ports has also declined seriously, while the passenger traffic on the river Sava is completely negligible.

[1] European Conference of Ministers of Transport

1.5 Related programmes and other donor activities

In preparing the Pre-feasibility Study, the Consultant should take into due consideration studies, completed or planned, that may have an impact on or interface with this project. The consultant should ensure that a synergy is created between all projects and avoid duplication of activities.

Documentation related to this includes:

The Master Plan and Feasibility Study - Inland Water Transport for Serbia (Sava River rkm 207.0 – 0.0, English and Serbian language);

Preliminary and Detailed Design of the eight critical sections (Croatian language):

- Sisak - Jasenovac rkm 584.4 - 528.1;
- Davor rkm 439.5 - 408.6;
- Slavonski Šamac rkm 323.8 - 296.6;
- Županja rkm 262.3 - 257.6;
- Slavonski Brod rkm 387.9 - 364.9;
- Slavonski Kobaš rkm 397.9 - 394.8;
- Stara Gradiška rkm 464.2 - 446.5;
- Gunja rkm 218.7 - 210.6,

Preliminary Design of the Sava River waterway and regulation for the mean water level Sisak - Račinovci, rkm 583.0 - 203.3 (Croatian language);

Hydrographic measurement of the Sava riverbed from the rkm 225.0 - 0.0.

Croatian National Strategy for the ISPA Program-Transport Sector (December 2004)

2 DESCRIPTION OF THE ASSIGNMENT

2.1 Global objective

The global objective of the project is to build up a river Sava waterway system as a consistent, part of an inter-modal transport chain and an economically sound transport system. The existing waterway is to be used as a cheap, safe and environmentally friendly mode of transport. This project shall be designed to catalyse investments in and along the river Sava waterway system from the Slovenian border to the confluence with the Danube, including the following tributaries:

- Kolubara River rkm 5.0 – 0.0;
- Drina River rkm 15.0 – 0.0;
- Bosna River rkm 5.0 – 0.0;
- Vrbas River rkm 3.0 – 0.0;
- Una River rkm 15.0 – 0.0;
- Kupa River rkm 5.0 – 0.0.

2.2 Specific objectives

The specific objective of the contract is to prepare the Pre-feasibility Study for rehabilitation and development of the Sava River Waterway on the level of minimum Class IV for the period up to the year 2026.

3 ASSUMPTIONS & RISKS

3.1 Assumptions underlying the project intervention

- There is sufficient interest amongst international and local Consultants to bid for this contract.
- The existing legislation and regulations are sufficiently clear to allow the commissioning and acceptance of the works by the Contracting Authority.
- The consultant will obtain the required permits timely with the support of the local authorities.
- Strong commitment and the agreement reached with the local authorities and institutes concerning the implementation of the project.
- Contacts made with the authorities of neighboring countries (Croatia, Bosnia and Herzegovina and Serbia) suffice to implement the project smoothly.

3.2 Risks

The following risks can affect the project if occurring:

- Sava Riparian Authorities not fully co-operational in administrative matters during the implementation of the project (permits and approvals, visas, taxation issues);
- Delays in performance of works by the Consultant;

4 REQUESTED SERVICES

4.1 Assessment of the traffic on the Sava River waterway

The Consultant shall review available historic traffic data, to evaluate the present and potential traffic considering a minimum investment strategy. The traffic shall be described by origin and destination, nature of goods transported, seasonality, including passenger transport and nautical tourism all on Pre-feasibility level.

4.2 Proposition of scenarios

The Consultant shall analyse the recent trends of transport development in the Croatia and on the Sava riparian countries. Based upon economic growth scenarios for the country and regions, the Consultant shall propose different waterway transport development scenarios corresponding the horizon year 2026.

The changes in inland waterway shipping services shall be assessed and the potential role of each port in domestic, sub-regional and international transport development evaluated. Alternative development options shall be mentioned, given the ongoing development in transport modes.

4.3 Traffic generation and diversion

Plans to improve Road and Railway infrastructures, representing competitive alternatives to fluvial transport on specific types of cargoes shall in particular be considered. The Consultant shall then estimate the expected traffic to be generated by the planned facility improvements and the split of traffic (modal split) for the river Sava (and its tributaries) and its ports, taking into account GDP figures for the period up to the year 2026.

4.4 Options for improvement of the Sava River waterway

Based on the investigations of the existing transport network and planned improvements, the Consultant shall assess the required capacity of the Sava River waterway system to cope with the demand over the period 2007 to 2012 and 2013 to 2026 including as well as the requirements of:

- Improvement,
- Rehabilitation,
- Upgrading,
- New structures.

Construction cost estimates for each option shall be assessed. Capital and maintenance costs shall be estimated. All on Pre-feasibility level and using the 2007 price level.

4.5 Evaluation of the costs and benefits of the projects

The Consultant shall based upon the economic vessel and port operating costs with and without proposed improvement at a Pre-feasibility level calculate the benefits and the Economic Internal Rate of Return for the period (up to 2026).The Consultant shall take into consideration the impact of the Project on economy development in the Region and to identify potential benefits for the different types of industries. The objective of the evaluation is to set up priorities and draw a first time schedule of implementation.

The Consultant shall use ECOFIN method for the evaluation of the costs and benefits of the projects.

4.6 Environmental aspects

The Consultant shall make an inventory of the environmental impact of the proposed projects.

4.7 Socio – economic developments

The Consultant shall make an inventory of the socio-economic impact of the proposed works.

4.8 Recommended Options and Projects

The Consultant should prioritise considered options and projects through a multi-criteria analysis grid including:

- economic and financial parameters,
- rapidity of implementation,
- visibility and sustainability,
- impact on socio-economic development,
- environmental impacts,
- other parameters considered as useful.

The Consultant shall then recommend the most suitable option for the horizon to the year 2026.

4.9 Proposal preparation

The Consultant should prepare and add to his offer a detailed staffing and activity schedule to implement the required services. The services shall not commence without the prior written consent of the contracting authority.

4.10 Required outputs

This project shall be designed to catalyse investments in the Sava River waterway from Slovenian border including tributaries and to enable the contracting authority and the beneficiary institutions to launch further activities. The outputs of the project (Pre-feasibility Study) shall be used as input for the programming of the Croatian National IPA Operating Program for Transport 2007-2013.

5 EXPERTS PROFILE

5.1 Number of requested experts per category and number of man days per expert

The following experts required for the execution of the services:

a. Category 1 expert:
   IWT Expert/Project Manager, with a civil engineering or transport engineering background, available for 50 working days of inputs.

b. Category 2 expert:
   Traffic and transport expert, available for 20 working days,

c. Category 2 expert:
   Transport Economist, available for 20 working days,

d. Category 2 expert:
   Environmental Expert, available for 10 working days.

e. Category 3 experts:
   National experts, with a total of 100 working days with IWT related expertise.

5.2 Profile required

The IWT Expert/Project Manager - (university M.Sc. degree – Civil or Transport Engineer) responsible for overall management of the project is expected to have preferably 10 years of appropriate experience in studies preferably in the inland waterway sector, in providing consulting services for project preparation, feasibility studies, designing of master plan study for transport studies and or projects. Relevant experience in the region including experience in other CEE countries will be an asset;

Traffic and Transport Expert - (university degree –Transport/ Civil Engineer) responsible for traffic analysis, measurements and capacity assessment. Should have preferably 10 years of international experience including experience in the preparation of traffic and transport studies of similar projects prepared for international institutions.

Transport Economist - (university degree – Economy) responsible for financial, economic and cost-benefit analysis. Should have preferably 10 years of international experience including experience in the preparation of economic analysis of transport studies or similar projects prepared for international institutions.

Environmental Expert - (university degree – Environment/Civil/Transport Engineer) responsible for the preparation of the assessment of the environmental impact. Should have preferably 10 years of international experience including experience in the preparation of EIAs for transport studies or similar projects prepared for international institutions during last 5 years.

All above mentioned experts must be experienced in preparing the similar studies for Projects financed by the EU funds such as CARDS, PHARE, IPA.

Other experts - the Consultant shall select and hire other experts as required according to the profiles identified in these Terms of Reference.

The following experts are foreseen:

- Civil works expert;
- Transport and Traffic expert;
- Transport economist;
- Environmentalist;
- Socio-economist;
- Financial expert;
- Costing engineer;
- Other required expert and supporting staff.

All experts must be independent and free from conflicts of interest in the responsibilities accorded to them.

Evaluation of experts-In its offer, the Consultant shall include the CVs of key experts. CVs for other experts are not examined prior to the signature of the contract. They should not be included in offer.

5.3 Reporting language

The reporting language will be English and Croatian.

5.4 Working Language

Working languages are English and Croatian.

6 BUDGET AND INCIDENTAL EXPENDITURE

The total available budget for the supervision contract is € 170,000.

The Consultant is to propose a breakdown in working days of individual experts comprising international, local and experts from riparian countries.

7 LOCATION AND DURATION

7.1 Starting period

It is envisaged that the services will commence in December 2006.

7.2 Project duration and milestones

The project duration is 12 weeks from the commencement date, but the draft feasibility Study report has to be submitted within 8 weeks of the commencement date.

Details are presented in Annex 2 to Request for Services.

7.3 Location of assignment

The location of the assignment will be Zagreb in Croatia. The Consultant will be required to attend meetings with representatives of all relevant beneficiary institutions as well as with the contracting authority. His offer should take this into account.

Visits to the various authorities in Croatia, Slovenia, Bosnia and Herzegovina and Serbia have to be included in the technical and financial offer.

8 REPORTING

8.1 Report to be prepared

- a brief inception report with planning and activity and staffing schedule;
- draft Pre-feasibility study report;
- final Pre-feasibility study report.

8.2 Language

All documents will be prepared both in the English language and the Croatian language.

8.3 Submission/comments timing

The Consultant is requested to submit to Contracting Authority the reports according to the following schedule (see Annex 2):

- Inception Report within 2 (two) weeks from the commencement date;
- draft Pre-feasibility Study report within 7 (seven) weeks from the commencement date;
- final Pre-feasibility Study report within 11 (eleven) weeks from the commencement date, taking into account 2 weeks for the Contracting Authority to evaluate and comment the draft report.

8.4 Approval of reporting

The officials assigned by the Croatian Ministry of the Sea, Tourism, Transport and Development will approve the reporting. The approval of the final report in which the comments of the Croatian Ministry will be incorporated will be given within 4 weeks after its submission.

8.5 Number of Reports

All reports should be submitted in five hard copies (in Croatian and English language) and one electronic version to the Secretariat of the Sava Commission by e-mail to zmilkovic@savacommission.org.

9 ADMINISTRATIVE INFORMATION

The contract period and Scope of Work may be extended by the Sava Commission if necessary, during the course of the Study. Any contractual and financial consequences regarding these changes will be communicated in writing and have to be agreed upon between the Sava Commission and the Consultant.

The Consultant will have to provide his own office space. He is expected to equip himself with computer equipment.

All costs related to the travelling (international and local), visits to institutions and authorities within the project area, board and lodging, office rental and operation and maintenance costs, reporting costs, computer and printing costs, translation costs, medical insurance and any other incidental expenditures should be included in the daily unit rates of each expert.

2 POTENTIAL TRANSPORT ON THE SAVA

2.1 Introduction

Plans for upgrading of the Sava have been considered for the section upstream of Brcko up to Sisak. Downstream of Brcko the Sava is a class IV waterway and upstream of Brcko a class III waterway. The upgrade of Sava includes an upgrade from class III to class IV. The classification of a waterway as class III means that in 65% of the days ships with a loading capacity of 1,000 tons can use this waterway with a 100% load. The other 35% of the days the waterway is navigable for these ships but with less load. The classification as class IV is similar concerning ships with a loading capacity of 1,500 tons. Information from the interviews revealed that nowadays the criteria for class III respectively class IV are not always met.

- **The present situation**

Transport on the Sava (including Croatia, Bosnia Herzegovina and Serbia) was around 9.5 million tons in 1982 and decreased to 5.7 million tons in 1990 (Lit. 70). The war of 1992 – 1995 destroyed a lot of the economic activities and the river (and port) infrastructure. For this reason the cargo handled in ports of the Serbian part of the Sava was down to less than 25 thousand tons (Lit. 71) and in ports in Bosnia Herzegovina and Croatia down to less than 1 million tons. A closer look at the latter ports for a more recent year gives the following figures for the ports of Sisak, Slavonski Brod and Samac.

- **Port of Sisak (the oil terminal of Crnac)**

In the past years (2001 – 2005) the terminal received between 160 and 220 thousand tons of crude oil shipped from the port of Slavonski Brod oil terminal at Ruscica. There are no other activities.

- **Port of Sisak (along the river Kupa)**

The only activity is the unloading of a few thousand tons of sand and gravel from dredging activities.

- **Port of Slavonski Brod**

The main activity at present in the port area is the unloading of sand and gravel from dredging activities. This amounts to 432 thousand tons in 2003, 546 thousand tons in 2004 and even 2,206 thousand tons in 2005 (Lit. 69). At the oil terminal (Ruscica) 160 – 220 thousand tons of crude oil is loaded for Sisak. Other activities amount to 0 tons in 2003, 23 thousand tons in 2004 and 14 thousand tons in 2005.

- **Port of Samac**

According to information received in interviews the transhipment in this port (in 2005 / 2006) amounts to some 17 thousand tons per year.

- **Port of Brcko**

According to information received in interviews the transhipment in this port (in 2006) amounts to some 80 thousand tons.

The upgrading of the Sava to class IV as described above will have effect on:

- the ecological system of the Sava area;
- the navigability.

This chapter of the report concerns the effects on navigability and therefore on transport by inland waterway. Upgrading of the Sava to class IV means that within the sector of the Sava between Sisak and Brcko ship movements will be possible with larger ships that are with a loading capacity of 1,500 instead of 1,000 tons. That also means that the costs of transport by ship may be expected to become lower and that consequently a change from the other modes (road and rail) to inland waterway could become feasible from an economic point of view.

Though inland waterway is an important mode for certain goods (solid and liquid bulk, containers, etc) and on certain relations (depending on the need for and availability of access and egress transport, more than 200 – 500 km), it is not a necessary mode. The meaning of this is that upgrading a waterway is not a satisfactory condition to improve economic activities or to attract

new economic activities that will use or produce goods that have to be transported by inland waterway. On the other hand it is likely that these economic activities will use or seek those transport opportunities.

In one of the next sections the benefits of these effects in money terms are calculated. At that stage it is of importance to know when the upgrading of the Sava will be completed and when the benefits will be due. It is expected that the upgrading of the Sava will be completed in 2011 and therefore benefits will be due starting in 2012.

As final horizon year 2026 has been chosen, meaning that benefits will be calculated for the period 2012 up to 2026, in total 15 years. Benefits will also exist after 2026 but the net present value (NPV) of the benefits will decrease to less significant amounts dependent on the used depreciation rate. Five forecast years have been chosen: 2011, 2016, 2021 and 2026.

The question to be answered in this chapter is:

What effects in terms of transported tons and ton kilometers per inland waterway will the upgrade of the Sava have for the forecast years 2011, 2016, 2021 and 2026?

2.2 Methodology

A known and frequently used method to estimate the effects of such an infrastructure improvement has the following research sequence:

- Good description of transport by all modes;
- Good description of economic activities;
- Known relation between transport and economic activities;
- Detailed forecast for economic activities per region;
- Resulting forecast total transport;
- marginal changes in economic activities give changes in transport;
- Development transport sectors: time, cost for rail, road and inland waterway;
- Modal split: results in demand for inland waterway.

This approach could be followed to forecast the demand for transport on the Sava and to estimate the effects of the upgrading, if not the present economic situation would make this impossible. Due to the war there exists a deteriorated economic and transport situation. It is meaningless to describe the present economic and transport situation to base any forecast upon. Further it is hardly known how the regional economy, relevant for the Sava area, will develop. Transport models are not adequate in this situation.

For this reason another approach had to be taken. During the project it became known to the Consortium that there are economic actors in the region with well developed ideas for the economic future of the region and the possibilities of transport on the Sava. Of course these ideas (though well developed) have to be considered with care. But these implicitly encompass all functionalities of a transport model: present situation, expected economic growth, expected infrastructure changes, etc.

Forecasts are per definition unreliable. No one knows what will happen in the future, assumptions are made and estimates are deduced from expectations regarding the development of socio economic and other parameters like:

- when will Croatia join the European Union;
- what effect will that have on economic activities and trade and transport;
- what will be the growth of GDP in the study area and outside the study area;
- which sectors contribute to growth of GDP;
- which regions will benefit bets from economic growth, etc.

For this reason it is common use to develop more than one scenario for the socio economic development. In this study three scenarios are distinguished: low growth, medium growth and high growth.

In recent EU studies the following mean forecasts (2005 – 2030) for GDP have been used for Croatia, Bosnia and Herzegovina and Serbia:

- Low: 2.8% per year;
- Medium: 3.6% per year;
- High: 4.4% per year.

Based on these scenarios the yearly growth figures for GDP as presented in Table 2.1 have been selected for this study.

Table 2.1 GDP growth percentages per year for five periods between 2006 and 2030

	2006 - 2010	2011 - 2015	2016 - 2020	2021 - 2025	2026 - 2030
low	3.5	3.0	2.5	2.0	1.5
medium	4.5	4.0	3.5	3.0	2.5
high	6.0	5.5	4.5	3.5	3.0

The following methodology has been used to make the forecasts.

- **Defining the study area**

The upgrading of the Sava to class IV means that within the sector of the Sava between Sisak and Brcko and in relation with this sector ship movements will be possible with larger ships. This means that only (potential) transport to and from the ports of Sisak, Slavonski Brod, Bosanski Brod and Samac will benefit from the upgrading. Transport to and from other ports like Brcko or further downstream the Sava is only relevant as far as the transport is related to the first mentioned group of ports upstream. For this reason it is only relevant to establish the effects on transport related to this group: Sisak, Slavonski Brod, Bosanski Brod and Samac.

- **Interviews with key players**

The key players that have knowledge about the (potential) transport to and from the ports of Sisak, Slavonski Brod, Bosanski Brod, Samac and Brcko have been selected for interviews. These interviews provided information about the expected development of economic activities and transport volumes by inland waterway relevant for the Sava. For instance, one key player has knowledge about a refinery to be upgraded to a larger capacity and expects a large share of the input and output of the refinery to be transported by inland waterway.

- **Interpretation by Consortium**

The Consortium added its own insight and experience if and when those expectations could come true. If the information was such that it was clear that the increase in transport by inland waterway could be reached within years the expectations have been used as best estimate for 2011 for all scenarios. On the other hand if it was unclear if and when the expectations could be reached the best estimates for all years in the low scenario have been set to 0 and the expected volumes have only been used as best estimate for 2026 in the high scenario. The volumes for the reference scenario and the other forecast years have then been deduced.

- **Further development using GDP figures**

Once a forecast had been set for one of the forecast years and no information was available for years thereafter growth of GDP (per scenario) has been used, with an elasticity of 1.

- **Other information**

Not only the volumes of transported tons in the future years are of importance. Also the mean distances of the transports are needed to calculate the tonkms to be used to calculate benefits. Though distances can be determined rather accurate it must be understood that best estimates are sufficient. Remember that tons are estimated with a wide margin and also cost figures per ton km (in the years 2012 and later) are best estimates.

The distances to Central and Western Europe have in the first instance been estimated without the Danube – Sava channel (Vukovar – Samac). To establish the effect of the channel on the benefits some separate calculations have been made; these are reported in chapter 7. Only effects on

tonkms and cost per ton km have been assumed. Therefore this exercise cannot be seen as a complete benefit analysis of the construction of the channel.

To calculate the differences (or benefits) between the cost per ton km in the present situation and in the updated situation also a best guess of the feasible alternative transport modes are of importance. All forecasts are based on the assumption that the Sava is upgraded to class IV. The alternative transport modes are the modes that would be used in case the Sava is not upgraded. The alternative modes are road and rail, as well as inland waterway class III.

- **Results**

The results are an overview of the expected transports by inland waterway in terms of tons and tonkms:

- Per port: Sisak, Slavonski Brod, Bosanski Brod, Samac;
- Per port the expected cargo flows;
- Per cargo flow estimates for:
  - Forecast years 2011, 2016, 2021 and 2026;
  - Scenario low, reference and high;
  - Mean distance of transports;
  - Alternative modes.

Transport related to maintenance of the waterway (dredging activities) will not be considered as transport that would require a higher standard waterway. This kind of transport will be neglected for the CBA. This kind of transport can be of interest if capacity problems exist (e.g. at locks).

Transport related to mining (sand and gravel) could be considered for the CBA. However since no reliable information has been received this has been left out of this pre-feasibility study.

2.3 Forecasts per port

In this section a description and account is given about how the estimates for future transport by inland waterway have been deduced.

2.3.1 Sisak

The estimates for the port of Sisak are based on interviews with:

- Port of Sisak;
- Dunavski Lloyd;
- Oil company INA;
- Steel plant Zeljezara;
- Port Master Office Sisak.

In the interviews six types of possible transport by inland waterway have been identified:

- Crude oil;
- Refinery products;
- Steels coils & Steel pipes;
- Fertilizers;
- Cokes;
- Grain.

- **Crude oil**

In the recent past there was and there still is a relative stable transport flow of crude oil by inland waterway from Slavonski Brod to Sisak (INA refinery) of 150 – 220 thousand tons per year. As the oil wells (near Slavonski Brod) have limited reserves it is expected that this flow will last a limited time. Since no indication has been given when the well will fall dry estimates have been differentiated by the scenarios.

The estimates for the low scenario are 0 tons in all forecast years, for the reference scenario 160 thousand tons in 2011 and decreasing to 0 tons in 2016 and for the high scenario 160 thousand tons in 2011 and 2016 and then decreasing to 0 tons in 2021.

The distance to calculate the tonkms is 220 km. The alternative is inland navigation class III.

- **Refinery products**

At present the refinery products are transported by rail and truck to oil depots or directly to end users in Croatia. Research has shown according to INA that in the present situation transport by inland waterway is not a feasible alternative (too expensive, cumbersome and inconvenient).

The refinery in Sisak is not only supplied by inland waterway, but the main supply is by pipeline. The refinery is being upgraded and modernized to a capacity of eventually 3.2 million tons per year. If the Sava is upgraded to class IV and if the inland waterway develops to a reliable product, inland waterway will become a feasible alternative for rail and truck. Depending on transport rates and destinations a share of even 1 million tons is foreseen to be transported by inland waterway. Given that this is highly speculative the estimates have been differentiated by the scenarios.

The estimates for the low scenario are set to 0 tons for all forecast years. For the reference scenario the estimates are 0 tons in 2011, 200 thousand tons in 2016, 350 thousand tons in 2021 and 500 thousand tons in 2026. For the high scenario the estimates are 250 thousand tons in 2011, steadily increasing to 1 million tons in 2026.

Since the INA oil depot in Osijek will be closed it is expected that the future destinations will partly be further than the present ones. A mean distance of 330 km (1.5 * distance to Slavonski Brod) is anticipated. The alternative modes are rail (50%) and road (50%). For the alternative modes the mean distance is set at 0.9 * 330 = 297 km.

- **Steel coils & steel pipes**

Not far from Sisak is the steel plant Zeljezara. The plant was bought five years ago by a Russian company that could not meet its contractual obligations and had to end its activities. At present the plant operates on a very low level of about 30 thousand tons, while it can do 100 thousand tons per year. It is expected that the new owner (per 1 April 2007) will invest so that in five years time the plant will reach its full capacity. Two production lines will then exist:

- Production line 1:
  - Input 100 thousand tons of steel coils (of which 50 thousand tons by inland navigation) from Smederevo;
  - Output 100 thousand ton of steel pipes (of which 50 thousand tons by inland navigation) to East and Mid Europe.
- Production line 2:
  - Input 450 thousand tons of scrap (of which 100 thousand tons by inland navigation) from Belgrade;
  - Output 450 thousand tons of steel pipes (of which 450 thousand tons by inland navigation) to East and Mid Europe.

The estimates of the transport by inland waterway of steel coils are therefore as follows:

- Steel coils from Smederevo in 2011:
  - Low scenario 30 thousand tons;
  - Medium scenario 50 thousand tons;
  - High scenario 50 thousand tons.
- Scrap from Belgrade:
  - Low scenario 50 thousand tons;
  - Medium scenario 75 thousand tons;
  - High scenario 100 thousand tons.
- Steel pipes to East and Mid Europe:
  - Low scenario 225 thousand tons;
  - Medium scenario 340 thousand tons;
  - High scenario 450 thousand tons.

The volumes for the other forecast years are based on the volumes in 2011 and the changes in GDP.

The transport distance to Smederevo is about 630 km. The alternative mode is rail (100%), with a distance of 0.9 * 630 km is 567 km. The scrap originates from Belgrade; therefore a distance of 580 km has been taken. The alternative modes are rail (50%) and road (50%) with a distance of 0.9 * 580 is 522 km. The steel pipes have destinations in East and Mid Europe. The mean distance has been estimated to be 65 % to Eastern Europe (800 km) and 35% to Western Europe (1000 km) and is 870 km. The alternative mode is inland waterway class III (100%).

- **Fertilizer**

The state owned fertilizer plant Petrokemija in Kutina (near Sisak) once had a capacity of 1.5 million tons per year. This has now been reduced to a maximum of 1 million tons. The raw materials to make the fertilizer are transported to the factory by rail from the sea ports. It is not expected that this will become a market for inland waterway. Some 150 thousand of the produced fertilizer is transported to Bosnia by rail and road and 750 thousand tons to Slavonia by rail and road. About 100 thousand tons is destined for export; it is transported by rail to Osijek and from there by inland waterway on the Danube to end users. Dunavski Lloyd is not positive of capturing any of these loads to be transported via the Sava. For this reason the potential transport is set to zero tons in all scenarios.

- **Cokes**

Recently it became known that the Swedish company EUREKA wants to start an ethanol plant at the industrial area of the Zeljezara steel plant. The production of ethanol would amount to 80 thousand tons. For this production 300 thousand tons of coal is needed that is anticipated to be transported from Belgrade to Sisak by inland waterway.

Since the intension of the company is still in the planning phase the volume of 300 thousand ton is the best estimate for the high scenario 2011. For the reference and low scenario more prudent estimates of 100 and 200 thousand tons are used. The estimates for the other forecast years are based on the volumes in 2011 and the changes in GDP.

The mean distance of the transported coals is 580 km and the alternative is inland waterway class III.

- **Grain**

About 60 thousand tons of grain is needed per year in the Sisak area. It is grown in Slavonia and is now transported by rail and truck. Dunavski Lloyd reports frequent requests for transport by inland waterway. When the Sava is upgraded it is likely that the grain will be transported by inland waterway, from Slavonski Brod, or even from Zupanja.

In the low scenario the estimate for 2011 for transport by inland waterway is 10 thousand tons, in the reference scenario 20 thousand tons and in the high scenario 50 thousand tons. The estimates for the other forecast years are based on the change in GDP. This results for the low scenario in 14 thousand tons, the reference scenario in 34 thousand tons and for the high scenario in 97 thousand tons in 2026.

The distance of this transport is more than the distance to Slavonski Brod and is set to 250 km. The alternative modes are rail (50%) and road (50%), with a distance of 225 km.

In the Tables 2.2 – 2.4 the estimates for transported tons and the related tonkm are summarized.

Table 2.2 Forecasts for the port of Sisak; low scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Crude oil	-	-	-	-	-	-	-	-
Refinery products	-	-	-	-	-	-	-	-
Steel plant								
. Steel coils	30	35	39	43	19	22	25	27
. Scrap	50	58	66	72	29	34	38	42
. Steel pipes	225	261	295	326	196	227	257	283
Cokes	100	116	131	145	58	67	76	84
Grain	10	12	13	14	3	3	3	4
Sum Sisak	415	481	544	601	304	353	399	440

Table 2.3 Forecasts for the port of Sisak; medium scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Crude oil	160	-	-	-	35	-	-	-
Refinery products	-	200	350	500	-	66	116	165
Steel plant								
. Steel coils	50	61	72	84	32	38	46	53
. Scrap	75	91	108	126	44	53	63	73
. Steel pipes	340	414	491	570	296	360	427	496
Cokes	200	243	289	335	116	141	168	194
Grain	20	24	29	34	5	6	7	8
Sum Sisak	845	1,033	1,340	1,648	527	664	826	989

Table 2.4 Forecasts for the port of Sisak; high scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Crude oil	160	160	-	-	35	35	-	-
Refinery products	250	500	750	1,000	83	165	248	330
Steel plant								
. Steel coils	50	65	81	97	32	41	51	61
. Scrap	100	131	163	193	58	76	94	112
. Steel pipes	450	588	733	871	392	512	638	757
Cokes	300	392	489	580	174	227	283	337
Grain	50	65	81	97	13	16	20	24
Sum Sisak	1,360	1,902	2,297	2,838	785	1,073	1,335	1,621

2.3.2 Slavonski Brod

The Port Authority of Slavonski Brod produced recently a Masterplan which shows a large set of specific port projects. The Port Authorities are in the process of working-out this plan, contacting relevant actors, making LoI with interested companies, investing in port infrastructure (quay, rail track), etc.

The estimates for the port of Slavonski Brod are based on:

- Interview with Port Authority of Slavonski Brod;
- Masterplan Port of Slavonski Brod;
- Port Master Office Slavonski Brod.

Eight types of possible transport by inland waterway have been identified:

- Containers;
- Raw material & Bio diesel;
- Wood & Wood products;
- Steel & Chassis;
- Crude oil.

- **Containers**

In the Masterplan forecasts are given for container transport in 2015, ranging from a few thousand tons in the pessimistic scenario to more than 400 thousand tons in the optimistic scenario. No indication is given what mode is expected to be used.

The estimation for transport of containers by inland waterway has been deduced as follows. In 2016 the estimate for the high scenario is 25% of transport in the optimistic scenario, therefore 100,000 thousand tons. The estimate for 2011 is 50% of 2016. The estimates for the other forecast years are based on the volume in 2016 and the change in GDP. In the low scenario the estimate for 2016 is 20,000 tons and in the reference scenario 50,000 tons. The estimates for the other years are made similar to those for the high scenario.

It is expected that the containers transported by inland waterway through the port of Slavonski Brod will have origins and destinations primarily on a larger distance. The mean distance has been estimated to be 85% to Eastern Europe (800 km) and 35% to Western Europe (1000 km) and is 870 km. The alternative modes are rail (50%) and road (50%), with a distance of 625 km.

- **Raw material & Bio diesel**

The Port authorities have signed a LoI with a potential investor who together with an Austrian partner wants to construct and operate a bio diesel plant in the port area. The volumes mentioned in the interview are:

- In: 150 thousand tons of raw material that comes from China and transported from Constanza via the Danube and the Sava;
- Out: 150 thousand tons of bio diesel for export, mainly to Graz and transported by inland waterway (80%) and rail (20%).

Another potential user for bio diesel might be the Zagreb public transport company. In that case the diesel could well be transported by inland navigation to Sisak.

The 150 thousand tons of raw materials mentioned in the interviews are considered the best estimate for the high scenario 2011. For the reference scenario 100 thousand tons and for the low scenario 50 thousand tons have been taken. The estimates for the other forecast years are based on the volumes in 2011 and the changes in GDP.

Due to the large distance by inland waterway and the assumed costs per ton km for rail and inland waterway the calculated benefits became negative. For this reason the transport of bio diesel by inland waterway to Graz is seen as not feasible.

- **Wood logs & Wood products**

The Port Authorities have signed a LoI with a Belgian company based in Antwerp for the development of a wood processing plant with a capacity of 600 thousand tons. Presently this company is already producing in Croatia and employs 600 people in that plant. The wood logs (originating from Romania, Bulgaria, Serbia and partly from Croatia) are foreseen to be transported by inland waterway. The wood products are expected to be transported partly by inland waterway (400 thousand tons) and partly by rail (200 thousand tons).

The best estimates for transport by inland waterway of wood logs and wood products for 2011 high scenario are respectively 600 thousand tons and 400 thousand tons. For the reference scenario a more prudent estimate is taken of 80% of the volumes in the high scenario and for the low scenario only 60%. The estimates for the other forecasting years are based on the volumes in 2011 and the changes in GDP.

The origins of the transported wood logs cover a wide area. A mean distance of 300 km has been taken. The alternative is inland navigation class III. About the destinations of the wood products no information is given. However, since only inland waterway and rail are considered as transport means it is likely that destinations or larger distances are relevant; a mean distance of 1,000 km has been taken. The alternative mode is inland waterway class III (100%).

- **Steel & chassis**

A foreign company has shown interest to produce chassis for cars. This would require an incoming cargo flow of 300 thousand tons of steel coils from the Ukraine by inland waterway. From the produced chassis 270 thousand tons would go to Hungary and Slovakia by inland waterway and 30 thousand tons by rail to Koper.

The transport of 300 thousand tons of steel coils and 270 thousand tons of chassis are the best estimate for the high scenario 2011. For the reference scenario the estimates have been halved. For the low scenario the estimates for 2011 are set to 0 and for 2016 the volumes of the reference scenario 2011 have been taken. The estimates of the other forecast years are based on the volumes in 2011 (for reference and high scenarios) and on the volume in 2016 (for the low scenario) and the changes in GDP.

Given the origins and destinations of the transported goods the distance of the incoming transport is estimated to be 1.300 km and the alternative is inland waterway class III. The mean distance of the outgoing transports is 900 km and the alternative modes are rail (33%) and road (33%), with a distance of 400 km, as well as inland waterway class III (33%).

- **Crude oil terminal for storage and distribution**

The plans for a crude oil terminal are in an advanced stage. The investor is a London based company and the plans have been made in Croatia. The construction of the terminal could start shortly. It is expected that about 350 thousand tons will be shipped by inland waterway from Russia. The output will be transported by rail or truck to destinations in Bosnia.

Best estimates for 2011 are 250 thousand tons in the low scenario, 300 thousand tons in the reference scenario and 350 thousand tons in the high scenario. The estimates for the other forecasting years are based on the volumes in 2011 and the changes in GDP.

The mean distance of the transports is 1300 km and the alternative is inland waterway class III.

In the Tables 2.5 – 2.7 the estimates for transported tons and the related tonkms are summarized.

Table 2.5 Forecasts for the port of Slavonski Brod; low scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Container	10	20	23	25	9	17	20	22
Bio diesel plant								
. Raw material	50	58	66	72	65	75	85	94
Wood processing								
. Wood	360	417	472	521	108	125	142	156
. Products	240	278	315	348	240	278	315	348
Chassis producing								
. Steel Ukraïne	0	150	170	187	0	195	221	244
. Chassis Hungary	0	135	153	169	0	122	137	152
Crude oil terminal								
. Crude oil Russia	250	290	328	362	325	377	426	471
Sum Slavonski Brod	910	1,348	1,526	1,684	747	1,189	1,346	1,486

Table 2.6 Forecasts for the port of Slavonski Brod; medium scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Container	25	50	59	69	22	44	52	60
Bio diesel plant								
. Raw material	100	122	145	168	130	158	188	218
Wood processing								
. Wood	480	584	694	804	144	175	208	241
. Products	320	389	462	536	320	389	462	536
Chassis producing								
. Steel Ukraïne	150	183	217	251	195	237	282	327
. Chassis Hungary	135	164	195	226	122	148	176	204
Crude oil terminal								
. Crude oil Russia	300	365	434	503	390	475	564	653
Sum Slavonski Brod	1,510	1,857	2,205	2,557	1,322	1,626	1,931	2,239

Table 2.7 Forecasts for the port of Slavonski Brod; high scenario

	1,000 tons				million tonkms			
	2011	**2016**	**2021**	**2026**	**2011**	**2016**	**2021**	**2026**
Container	50	100	125	148	44	87	108	129
Bio diesel plant								
. Raw material	150	196	244	290	195	255	318	377
Wood processing								
. Wood	600	784	977	1,161	180	235	293	348
. Products	400	523	652	774	400	523	652	774
Chassis producing								
. Steel Ukraïne	300	392	489	580	390	510	635	754
. Chassis Hungary	270	353	440	522	243	318	396	470
Crude oil terminal								
. Crude oil Russia	350	457	570	677	455	595	741	880
Sum Slavonski Brod	2,120	2,805	3,496	4,152	1,907	2,522	3,143	3,733

2.3.3 Bosanski Brod

The information about potential inland waterway transport is based on an interview with the Port Master Office Slavonski Brod and recent articles. In the interview it was mentioned that the oil refinery in Bosanski Brod used to handle 300 to 400 thousand tons per year. The refinery was damaged in the war and has not yet been repaired. The technology applied in the refinery is outdated and a complete new refinery should be built. A recent article (23 January 2007) showed that a contract has been signed between the prime minister of Republika Srpska and a Russian company Zarubeznjef of selling the crude oil factory in Brod. The Russian company has accepted that the oil refinery in Bosanski Brod should reach a volume of 4.2 million tons per year.

It can be expected that crude oil will come from Russia by pipeline from the Adriatic. The end products of the refinery were distributed to Bosnia by rail and truck. However, since the capacity of the refinery will increase from less than 400 thousand to more than 4 million tons, it can be expected that part of the production will be transported by inland waterway. Since no other information is available the following estimates have been made:

- Low scenario:
  all years: 0 tons;
- Medium scenario:
  2011: 0 tons;
  2016: 200 thousand tons;
  2021: 400 thousand tons;
  2026: 600 thousand tons;
- High scenario:
  2011: 200 thousand tons;
  2016: 600 thousand tons;
  2021: 1 million tons;
  2026: 1.4 million tons.

The mean distance of the transports of refinery products has been set to 300 km. The alternative modes are rail (50%) and road (50%). The Tables 2.8 to 2.10 summarize the estimated tons and tonkms.

Table 2.8 Forecasts for the port of Bosanski Brod; low scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Refinery								
. Crude oil by pipe								
. Refinery products	-	-	-	-	-	-	-	-
Sum Bosanski Brod	-	-	-	-	-	-	-	-

Table 2.9 Forecasts for the port of Bosanski Brod; medium scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Refinery								
. Crude oil by pipe								
. Refinery products	-	200	400	600	-	60	120	180
Sum Bosanski Brod	-	200	400	600	-	60	120	180

Table 2.10 Forecasts for the port of Bosanski Brod; high scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Refinery								
. Crude oil by pipe								
. Refinery products	200	600	1,000	1,400	60	180	300	420
Sum Bosanski Brod	200	600	1,000	1,400	60	180	300	420

2.3.4 Samac

The information about potential transport by inland waterway via the port of Samac has been gathered in an interview with the Luka Samac (Joint Stock Company Cargo Transport Center). The following types of transport have been identified:

- Prijedor: Iron ore to Romania and Brcko;
- Zenica: Iron ore and Steel products;
- Dervanta: Steel coils and Steel products;
- Banja Luka: Steel coils and Steel products;
- Lukavac: Coal and cokes.

- **Prijedor: Iron ore to Romania and Brcko**

The iron ore mine fields in Prijedor produce about 1.4 million tons per year. Since 2005 700 thousand tons of iron ore are being transported from Prijedor to Samac by train. From Samac 95% (665 thousand tons) continues by train to Vukovar, from where it is loaded on to barges and is shipped to Romania (Galati). The remaining 5% (35 thousand tons) is transported by rail to Brcko. The other 700 thousand tons are transported by rail to Zenica (the Mittal steel plant). When the Sava is upgraded a shift from rail to inland navigation is feasible to occur for Galati.

The estimates for the forecast years are determined as follows. The estimate for the high scenario 2011 is 75% of respectively 665 thousand tons that is 499 thousand tons. For the medium and low scenarios the percentages are 50 and 25. The estimates for the other forecast years are based on these volumes in 2011 and the expected changes in GDP.

The distance of the transports to Vukovar is about 100 km and the alternative mode is rail.

- **Zenica: Iron ore and Steel products**

The steel plant in Zenica has been bought by Mittal Steel (India) and has 7 furnaces. Presently the steel plant is using an electrical furnace for scrap to be melted into iron blocks. The scrap originates from Romania and is shipped by inland waterway along the Danube to Osijek and is then railed to Zenica. The volume is about 200 thousand tons per year. The planning is that the plant should handle about 6 million tons of iron ore and steel products per year. Out of this 20% (1.2 million tons) is foreseen to be transported by inland waterway from Samac.

These 1.2 million tons are a likely estimate for the high scenario 2011. For the medium and low scenario more prudent estimates of respectively 1.0 and 0.8 million tons are taken. The estimates for the other forecast years are based on these volumes in 2011 and the expected changes in GDP.

The relevant mean distance of the transports is set to be 400 km and the alternative mode is rail with a distance of 360 km.

- **Dervanta: Steel coils and Steel products**

The steel plant in Dervanta is owned by Balkan Steel (also owner of the port of Samac). The plant has a throughput of about 120 thousand tons. The input of the plant (120 thousand tons of steel coils) originates from Ukraine and is transported by barge to Belgrade and if the navigability of the Sava allows, further to Samac. In case the navigability does not allow transport by inland navigation, the cargo is shipped to Vukovar or Osijek and from there by rail or truck to Dervanta. The plant is considering an extension of the activities to 240 thousand tons per year.

This throughput of 240 thousand tons is the estimate for the high scenario 2011. For the medium and low scenario the estimates are lower, respectively 75% or 180 thousand tons and 50% or 120 thousand tons. The estimates for the other forecast years are based on these volumes in 2011 and the expected changes in GDP.

The relevant mean distance of the incoming transports (transfer in Belgrade) is set to 305 km and the alternative is inland waterway class III. The mean distance of the outgoing transports (to Austria and Germany) is 1,000 km and the alternative modes are rail (60%) and road (40%), with a distance of 540 km.

- **Banja Luka: Steel coils and Steel products**

In Banja Luka is a cold rolling steel mill with a capacity of 120 thousand tons per year. The mill is presently owned by the government that wants to sell the mill; this would allow further investments and increase of activities. The input of the plant originate from Ukraine by inland waterway along the Danube to Belgrade and if the navigability of the Sava allows, further to Brcko or Samac. In case the navigability does not allow transport by inland navigation, the cargo is shipped to Vukovar or Osijek and from there by rail to Banja Luka. It is not known where the steel products are sent to and by what transport means.

When the Sava is upgraded it is likely that the total volume of 120 thousand tons will be transported along the Sava in larger ships. The estimates for transport of the products in 2011 are 10% of the volume in the low scenario, 30% in the medium scenario and 50% in the high scenario. This is the estimate for 2011 in all scenarios. The estimates for the other forecast years are based on these volumes in 2011 and the expected changes in GDP.

The relevant mean distance of the incoming transports (transfer in Belgrade) is set to 305 km and the alternative is inland waterway class III. The mean distance of the outgoing transports is estimated to be 600 km and the alternative modes are rail (60%) and road (40%), with a distance of 540 km.

- **Lukavac: Coal and cokes**

The plant at Lukavac (a city south of Samac) turns coal into cokes. The present capacity of the plant is 30 thousand tons. The coal is imported from the Ukraine and is transported along the Sava to Samac. The cokes are exported by inland navigation to destinations not known, also along the Sava. In case the navigability does not allow transport by inland navigation, the cargo is shipped to Vukovar and from there to Lukavac.

When the Sava is upgraded it is likely that the total volume of 30 thousand tons will be transported along the Sava in larger ships. This is the estimate for 2011 in all scenarios. The estimates for transport of the products in 2011 are 10% of the volume in the low scenario, 30% in the medium scenario and 50% in the high scenario. This is the estimate for 2011 in all scenarios. The estimates for the other forecast years are based on these volumes in 2011 and the expected changes in GDP.

The mean distance of the coals imported from the Ukraine is 1300 km and the alternative is class III. The mean distance of the exported cokes is estimated to be 500 km and the alternative is inland navigation class III.

The Tables 2.11 to 2.13 summarize the estimated tons and tonkms.

Table 2.11 Forecasts for the port of Samac; low scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Prijedor								
. Ore to Romania	166	193	218	241	17	19	22	24
Zenica	800	927	1,049	1,159	320	371	420	463
Dervanta								
. Steel coils	120	139	157	174	37	42	48	53
. Steel	120	139	157	174	120	139	157	174
Banja Luka								
. Steel coils	120	139	157	174	37	42	48	53
. Products	12	14	16	17	7	8	9	10
Lukavac								
. Coal from Ukraine	30	35	39	43	39	45	51	56
. Cokes	3	3	4	4	2	2	2	2
Sum Samac	1,371	1,590	1,799	1,986	578	670	758	836

Table 2.12 Forecasts for the port of Samac; medium scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Prijedor								
. Ore to Romania	333	405	480	557	33	40	48	56
Zenica	1,000	1,217	1,445	1,675	400	487	578	670
Dervanta								
. Steel coils	180	219	260	302	55	67	79	92
. Steel	180	219	260	302	180	219	260	302
Banja Luka								
. Steel coils	120	146	173	201	37	45	53	61
. Products	36	44	52	60	22	26	31	36
Lukavac								
. Coal from Ukraine	30	37	43	50	39	47	56	65
. Cokes	9	11	13	15	5	5	7	8
Sum Samac	1,888	2,297	2,728	3,162	770	937	1,112	1,290

Table 2.13 Forecasts for the port of Samac; high scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Prijedor								
. Ore to Romania	499	652	812	965	50	65	81	96
Zenica	1,200	1,568	1,955	2,321	480	627	782	929
Dervanta								
. Steel coils	240	314	391	464	73	96	119	142
. Steel	240	314	391	464	240	314	391	464
Banja Luka								
. Steel coils	120	157	195	232	37	48	60	71
. Products	60	78	98	116	36	47	59	70
Lukavac								
. Coal from Ukraine	30	39	49	58	39	51	64	75
. Cokes	15	20	24	29	8	10	12	15
Sum Samac	2,404	3,142	3,915	4,650	962	1,258	1,567	1,861

2.4 Summary of the forecasts

The Tables 2.14 - 2.16 give a summary of the inland waterway transport forecasts for the ports of Sisak, Slavonski Brod, Bosanski Brod and Samac.

Table 2.14 Forecasts for ports Sisak, Slavonski Brod, Bosanski Brod and Samac; Low scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Sisak	415	481	544	601	304	353	399	440
Slavonski Brod	910	1,348	1,526	1,684	747	1,189	1,346	1,486
Bosanski Brod	0	0	0	-	0	0	0	0
Samac	1,371	1,590	1,799	1,986	578	670	758	836
Total	2,696	3,419	3,868	4,271	1,628	2,212	2,502	2,763

Table 2.15 Forecasts for ports Sisak, Slavonski Brod, Bosanski Brod and Samac; Medium scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Sisak	845	1,083	1,399	1,716	527	664	826	989
Slavonski Brod	1,510	1,857	2,205	2,557	1,322	1,626	1,931	2,239
Bosanski Brod	0	200	400	600	0	60	120	180
Samac	1,888	2,297	2,728	3,162	770	937	1,112	1,290
Total	4,243	5,387	6,673	7,966	2,619	3,287	3,990	4,697

Table 2.16 Forecasts for ports Sisak, Slavonski Brod, Bosanski Brod and Samac; High scenario

	1,000 tons				million tonkms			
	2011	2016	2021	2026	2011	2016	2021	2026
Sisak	1,360	1,902	2,297	2,838	785	1,073	1,335	1,621
Slavonski Brod	2,120	2,805	3,496	4,152	1,907	2,522	3,143	3,733
Bosanski Brod	200	600	1,000	1,400	60	180	300	420
Samac	2,404	3,142	3,915	4,650	962	1,258	1,567	1,861
Total	6,084	8,449	10,709	13,040	3,714	5,032	6,345	7,635

2.5 Sand and gravel

These forecasts do not include the transport of gravel and sand from mining activities. To determine the effect on the total transported tons or better on the total tonkms (since these are relevant for the CBA) the following estimate is given. Assume for the low scenario a volume of 1 million tons, for the reference scenario of 2 million tons and for the high scenario of 3 million tons and further assume a mean transport distance of 25 km. The estimate for the low scenario would then become 25 million tonkms, for the reference scenario 50 million tonkms and for the high scenario 75 million tonkms. Compared to the total tonkms estimated for the other transports this would be 1.1 to 1.2 % for all scenarios.

Annex 2.1: Benefits

Road costs	0.0671
Rail costs	0.0301
Costs III	0.0257
Costs IV	0.0209

Sisak	distance	distance road/rail	benefits	% road	% rail	% class III
Crude oil	220		0.0048	0	0	100
Refinery products	330	297	0.0228	50	50	0
Steel plant						
. Steel coils	630	567	0.0062	0	100	0
. Scrap	580	522	0.0228	50	50	0
. Steel pipes	695		0.0048	0	0	100
Coal	580		0.0048	0	0	100
Grain	250	225	0.0228	50	50	0

65% east 35% west
(DS canal)
800 en 500 (+500)
870
695

Slavonski Brod	distance	distance road/rail	benefits	% road	% rail	% class III
Container	695	625	0.0228	50	50	0
Bio diesel plant						
. Raw material Constanza	1300		0.0048	0	0	100
Wood processing						
. Wood	300		0.0048	0	0	100
. Products	1000		0.0048	0	0	100
Chassis producing						
. Steel Ukraïne	1300		0.0048	0	0	100
. Chassis Hungary, Slov	500	400	0.0132	33	33	33
Crude oil terminal						
. Crude oil Russia	1300	625	0.0048	0	0	100

65% east 35% west
(DS canal)
800 en 500 (+500)
870
695 626

Bosanski Brod	distance	distance road/rail	benefits	% road	% rail	% class III
Refinery						
. Crude oil by pipe						
. Refinery products	300	270	0.0228	50	50	0

900 without with DC canal

Samac	distance	distance road/rail	benefits	% road	% rail	% class III
Prijedor						
. Ore to Romania (Galati)	100	100	0.0092	0	100	0
Zenica	400	360	0.0062	0	100	0
Dervanta						
. Steel coils from Ukraine	305		0.0048	0	0	100
. Steel to Austria Germany	600	500	0.0165	40	60	0
Banja Luka						
. Steel coils	305		0.0048	0	0	100
. Products	600	540	0.0195	40	60	0
Lukavac						
. Coal from Ukraine	1300		0.0048	0	0	100
. Cokes to ??	500		0.048	0	0	100

100 further then Hungary

3 IMPROVING THE SAVA SECTION Km 588 – Km 202

3.1 Introduction

3.1.1 Framework

Subject of the study is the rehabilitation and improvement of the Sava. The Sava is a tributary of the Danube and flows from Slovenia through Croatia, Bosnia and Herzegovina and finally flows into the Danube in Serbia. The Sava is navigable from Sisak in Croatia to Belgrade in Serbia over a length of 586 km.

The Sava used to be an important lifeline of the former Yugoslavia and was regularly used for Inland Waterway Transport. However, the break-up of Yugoslavia and the economic decline in the 80's and 90's caused a strong decrease of transport and navigation on the Sava. In the present day the Sava is hardly used for river transport. Other transport modes are (slowly) recovering but Inland Waterway Transport is still at a low level. Reasons for this situation are amongst others:

- lack of maintenance and investments, resulting in poor quality of infrastructure;
- poor intermodal connections with road and railway;
- damaged port and river infrastructure and presence of unexploded ordnance is endangering safe navigation.

In other parts of Europe, Inland Waterway Transport has proven to be a competitive transport mode, environmentally friendly and reducing congestion on densely used roads. Inland Waterway Transport might also be a viable transport mode for the Sava, connecting the economies of Slovenia, Croatia, Bosnia and Herzegovina and Serbia.

The recently established International Sava River Basin Commission (ISRBC) has recognized the possibilities for river transport on the Sava and establishing an international navigation regime on the Sava is one of its strategic targets, mutually agreed upon by all members of the ISRBC.

Considering above aspects, the ISRBC on behalf of the Ministry of Sea, Tourism, Transport and Development of the Republic of Croatia (the investor for this Pre-Feasibility Study) has prepared the Terms of Reference of this Pre-Feasibility Study for the Rehabilitation and Development of the Sava River Waterway. Main beneficiaries are the Ministry of Sea, Tourism, Transport and Development of the Republic of Croatia and the ISRBC itself.

3.1.2 Limitations

In this report only the improvement of the Sava to a class IV waterway will be evaluated, as it is understood from deliberations with the Sava Commission and the Inland Waterway Agency that further improvement should be determined in future through the execution of specific Feasibility Studies. The Sava has various limitations like water depth and sharp river bends.

Main focus of this study is the improvement of the Sava in Croatia and Bosnia and Herzegovina. For Serbia the recently completed Master Plan for Restoration of Inland Waterway Transport in Serbia has shown that improvement of the Sava to class Va in Serbia is highly feasible. An overview of these measures is briefly reported in Annex 3.1.

3.1.3 Objectives

The objectives are:

- to describe the quality and capacity of the Sava for IWT;
- to propose improvement works;
- to estimate the costs of the proposed works and maintenance works;
- to prioritize the proposed works and establish an implementation schedule;
- to determine the feasibility of the improvement works.

3.2 Characteristics of the Sava

3.2.1 Topography

In Annex 3.2 a map of the Sava in Croatia, Bosnia and Herzegovina and Serbia is presented. From this map it can be concluded that the Sava is a typical meandering river with numerous sharp river bend along her course. The average bottom slope of the river is around 4 to 5 e^{-5} m/m which qualifies the Sava as a typical lowland or middle course river.

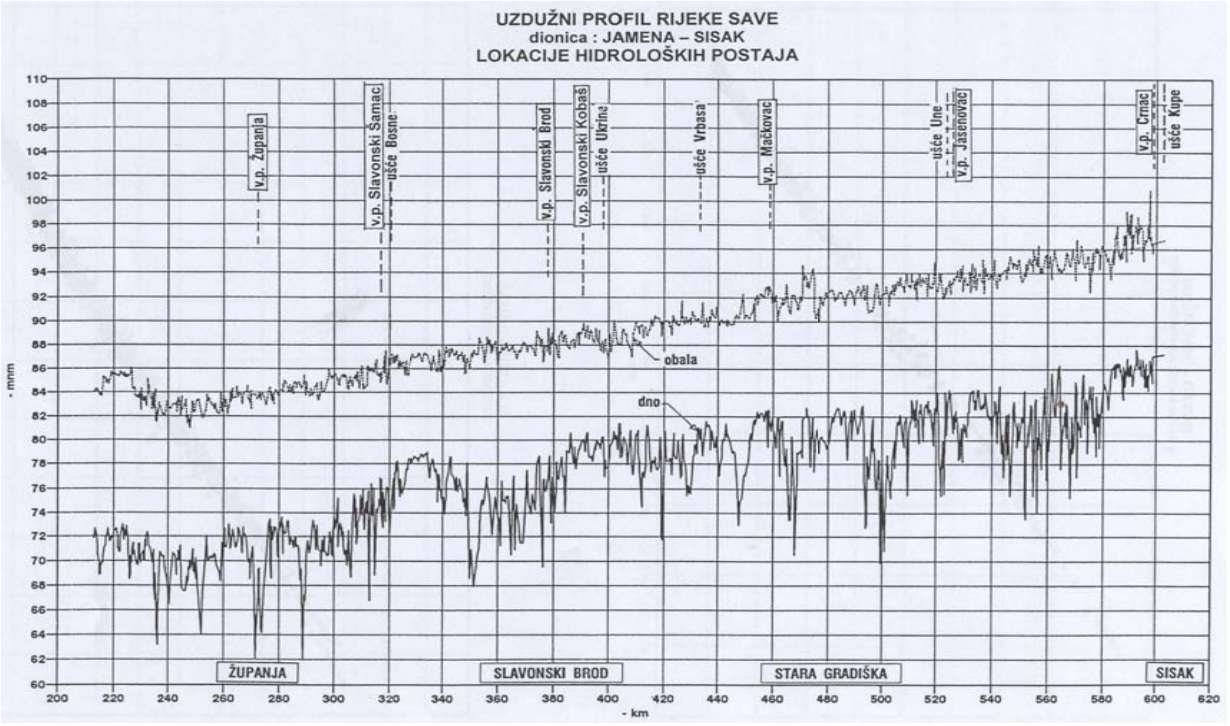


Figure 3.1 Longitudinal profile

Figure 3.1 presents a longitudinal section of the Sava from Jamena (Serbia) to Sisak in Croatia. The lower line represents the river bottom height under the centre axe of the fairway. The bottom height varies significantly, probably due to the sharp river bends but it is likely that also excessive dredging has contributed to the strong bed level variations.

Another characteristic aspect is the presence of natural sills or steps in the river bottom. These sills are located around km 300 – 340, km 380 – 400 and around km 580 – 600. These act as natural dams with lower water depth on top causing difficulties for navigation. On the other hand, these sills also cause a back water curve resulting in higher water depths upstream, which is favourable for navigation.

3.2.2 Hydrographic data

Discharges

The average discharge of the Sava is 384 m^3/s in Crnac (km. 599) at the upstream boundary of the navigable part of the Sava. More downstream near the border with Serbia and Bosnia and Herzegovina the average discharge has more than doubled to 936 m^3/s due to the contributions of many tributaries, amongst others the Kupa, the Una, the Vrbas and the Bosna.

The discharge of the Sava varies considerably along the year, which is illustrated by Figure 3.2 and Figure 3.3. For example the maximum discharge in Crnac in 2005 was around 18 times higher than the minimum discharge. This strongly varying discharge causes difficulties for navigation, during certain time frames there is not sufficient water available to guarantee a minimum required water depth.

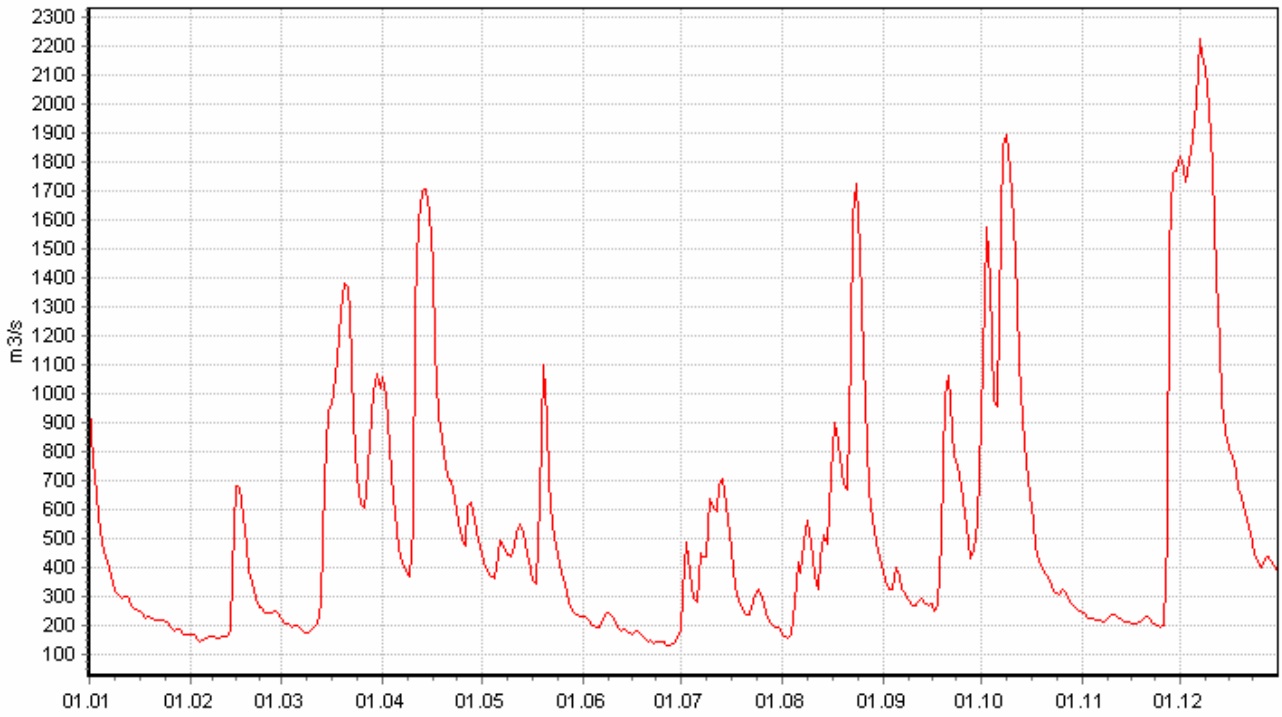


Figure 3.2 Measured discharge for the year 2005 in Crnac (km. 599)

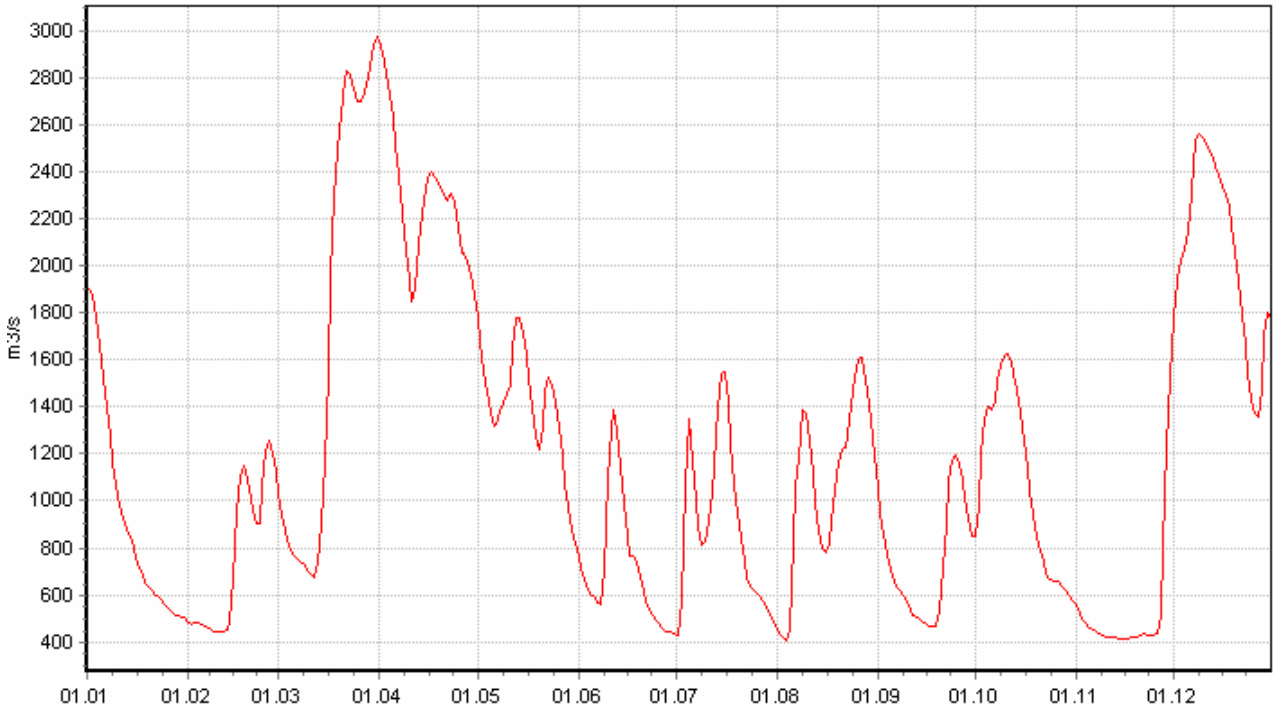


Figure 3.3 Measured discharge for the year 2005 in Zupanja (km. 272)

The rating curves for Zupanja and Crnac are presented in Annex 3.3.

Water levels

As a result of the strongly fluctuating discharge also the water levels (and water depths) strongly vary during the year. Annex 3.4 presents water level registrations for the stations of Crnac and Zupanja which illustrate these fluctuations.

Figure 3.4 presents the longitudinal profile of the Sava with the water levels corresponding with a 1%, 50%, 90% and 95% occurrence. For navigation purposes a minimum water depth, which depends on the category of the waterway, should be available at least 95% of the time. The 95% occurrence level is thick red line in Figure 3.4.

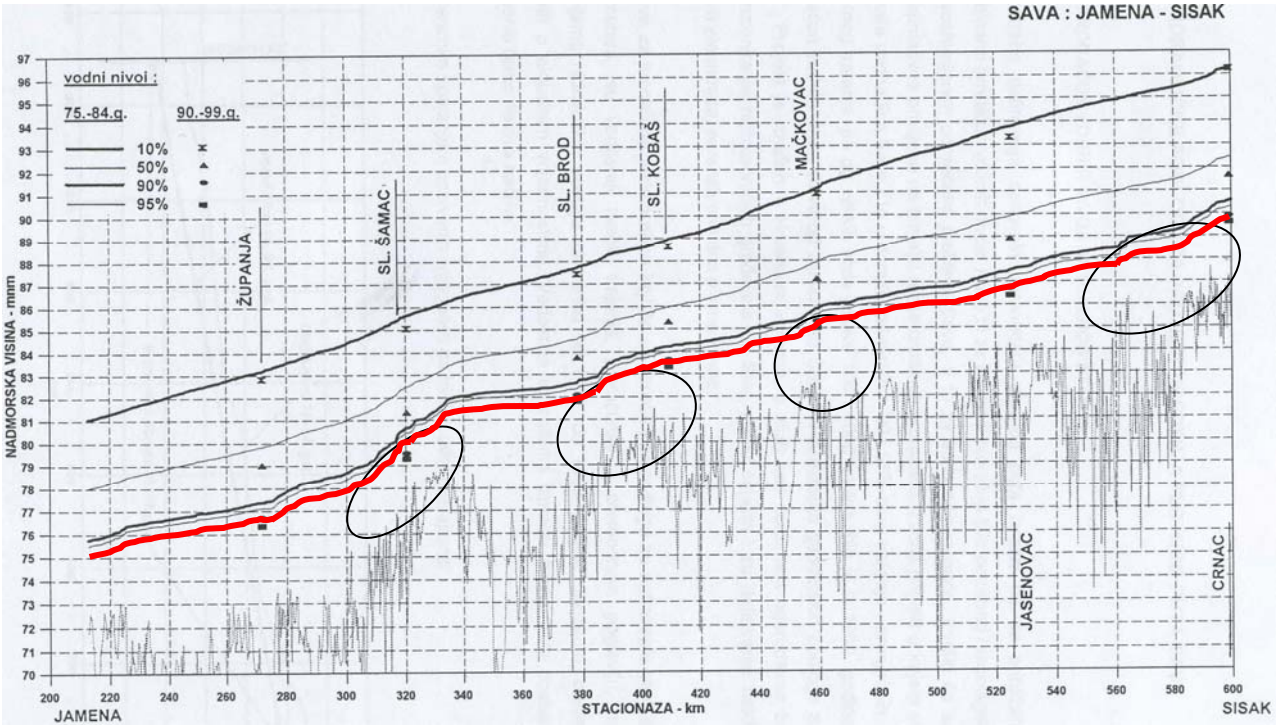


Figure 3.4 Longitudinal profile with characteristic water levels

From Figure 3.4 it can be seen shallow locations are present at a few locations:

- around Slavonski Samac;
- at the stretch between Slavonski Brod and Slavonski Kobas;
- near Mackovac;
- downstream of Crnac.

Depending of the size and draft of the vessels these locations might be difficult to pass for vessels.

The small crosses, triangles, ellipses and rectangulars in Figure 3.4 indicate the water levels for the period 1990 – 1999. The continuous lines refer to the period 1975 – 1984. Comparison between these two shows that the water levels on the Sava have significantly dropped over the last years, which is illustrated in more detail in Table 3.1 to Table 3.3.

Table 3.1 Characteristic water levels for various stations for the period 1975 - 1984

Gauging station	Chainage (km)	H95%		H90%		H50%		H10%	
		cm[1)]	m.n.m	cm[1)]	m.n.m	cm[1)]	m.n.m	cm[1)]	m.n.m
Županja	272	80	77.13	108	77.41	355	79.88	695	83.28
Slavonski Šamac	319	-36	80.34	-10	80.60	172	82.42	487	85.57
Slavonski Brod	377	57	82.37	82	82.62	277	84.57	592	87.72
Slavonski Kobaš	408	127	83.96	152	84.21	328	85.97	627	88.96
Mačkovac	458	197	85.61	221	85.85	428	87.92	753	91.17
Jasenovac	525	40	87.22	68	87.50	309	89.91	696	93.78
Crnac (Sisak)	599	28	90.27	55	90.54	243	92.42	627	96.26

Table 3.2 Characteristic water levels for various stations for the period 1990 - 1999

Gauging station	Chainage (km)	H95%		H90%		H50%		H10%	
		cm[1)]	m.n.m	cm[1)]	m.n.m	cm[1)]	m.n.m	cm[1)]	m.n.m
Županja[2)]	272	7	76.35	45	76.73	277	79.05	656	82.84
Slavonski Šamac	319	-140	79.30	-115	79.55	67	81.37	439	85.09
Slavonski Brod	377	3	81.83	30	82.10	199	83.79	566	87.46
Slavonski Kobaš	408	66	83.35	97	83.66	266	85.35	597	88,66
Mačkovac	458	139	85.03	169	85.33	355	87.19	733	90.97
Jasenovac	525	-41	86.41	-9	86.73	213	88.95	652	93.34
Crnac (Sisak)[2)]	599	-172	89.62	-144	89.90	34	91.68	491	96.25

1) compared to the zero level of the ganging station
2) the elevation of the zero level of these stations has changed. It troubles a fair comparison between the periods 1975 – 1984 and 1990 – 1999. For consistency reasons both stations have been included.

Table 3.3 Differences in characteristic water levels for various stations between the period 1990-1999 and 1975-1984

Gauging station	Chainage (km)	H95%	H90%	H50%	H10%
		cm	cm	cm	cm
Županja	272	-78	-68	-83	-44
Slavonski Šamac	319	-104	-105	-105	-48
Slavonski Brod	377	-54	-52	-78	-26
Slavonski Kobaš	408	-61	-55	-62	-30
Mačkovac	458	-58	-52	-73	-20
Jasenovac	525	-81	-77	-96	-44
Crnac (Sisak)	599	-65	-64	-74	-1

From Table 3.3 it is concluded that a water level decrease is occurring along the entire length of the Sava in Croatia and Bosnia and Herzegovina. The maximum decrease is measured at the Slavonski Samac gauging station where the average water level has decreased with 105 cm.

This water level decrease might lead to significant drying of the Sava river basin as probably the ground water in the basin is related to the water level of the Sava and the water level of the tributaries is determined by the water level of the Sava. It also might cause problems for water intakes, stability of bank protections, dikes, inflow of water into valuable wetland areas etc. The water level depression on the Sava is a serious problem which should be further analysed and should be key element in the Sava River Basin Management.

It is not clear if the water decrease also causes problems for navigation. The dredging has (also) been carried out at shallow locations increasing the water depth locally but causing lowering of the water level in upstream direction. Theoretically, this should have lead to a shift in shallow locations. However, this cannot be confirmed as detailed information of the current and historic navigability of the Sava has not become available to the Consortium.

3.3 Navigation Conditions

3.3.1 Sava Commission Classification

The classification of the Sava for navigation purposes according to the UN/ECE classification is presented in Table 3.4 and in Figure 3.5. Reference is made to Annex 3.5 for a presentation of the detailed characteristics of each navigation class of the Sava Commission classification.

Table 3.4 Classification of the Sava

Section of the Sava		Length (km)	Classification (class)	Tonnage
Downstream chainage (km)	Upstream chainage (km)			
0 Belgrade	305.7 Slavonski Šamac	305.7	IV	1,000 – 1,500 t
305.7 Slavonski Šamac	330.2 Oprisavci	24.5	III	470 – 700 t
330.2 Oprisavci	363.2 Slavonski Brod-grad	33.0	IV	1,000 – 1,500 t
363.2 Slavonski Brod-grad	583.0 Sisak	219.8	III	470 – 700 t
583.0 Sisak	651.0 Rugvica	68.0	II	500 – 630 t

From Slavonski Šamac to the confluence with the Danube in Serbia the Sava is classified as a class IV waterway, in theory accessible for vessels up to 1,500 tons.

The Sava has been included in the AGN agreement as a class IV international waterway. However in the present situation, as can be concluded from Table 3.4, the Sava is not completely accessible for vessels from class IV. The policy of the Croatian government aims at fulfilling the AGN agreement by improving the Sava to a class IV waterway. The present classification of the Sava is presented in Figure 3.5.

3.3.2 Present navigation conditions

From deliberations with the Sava Commission, analyses of the preliminary design report for improvement of the Sava in Croatia to class IV and from deliberations with Dunavski Lloyd, the main shipping company on the Sava in Croatia, it is concluded that there is a navigable fairway off modest quality on the Sava in the present situation.

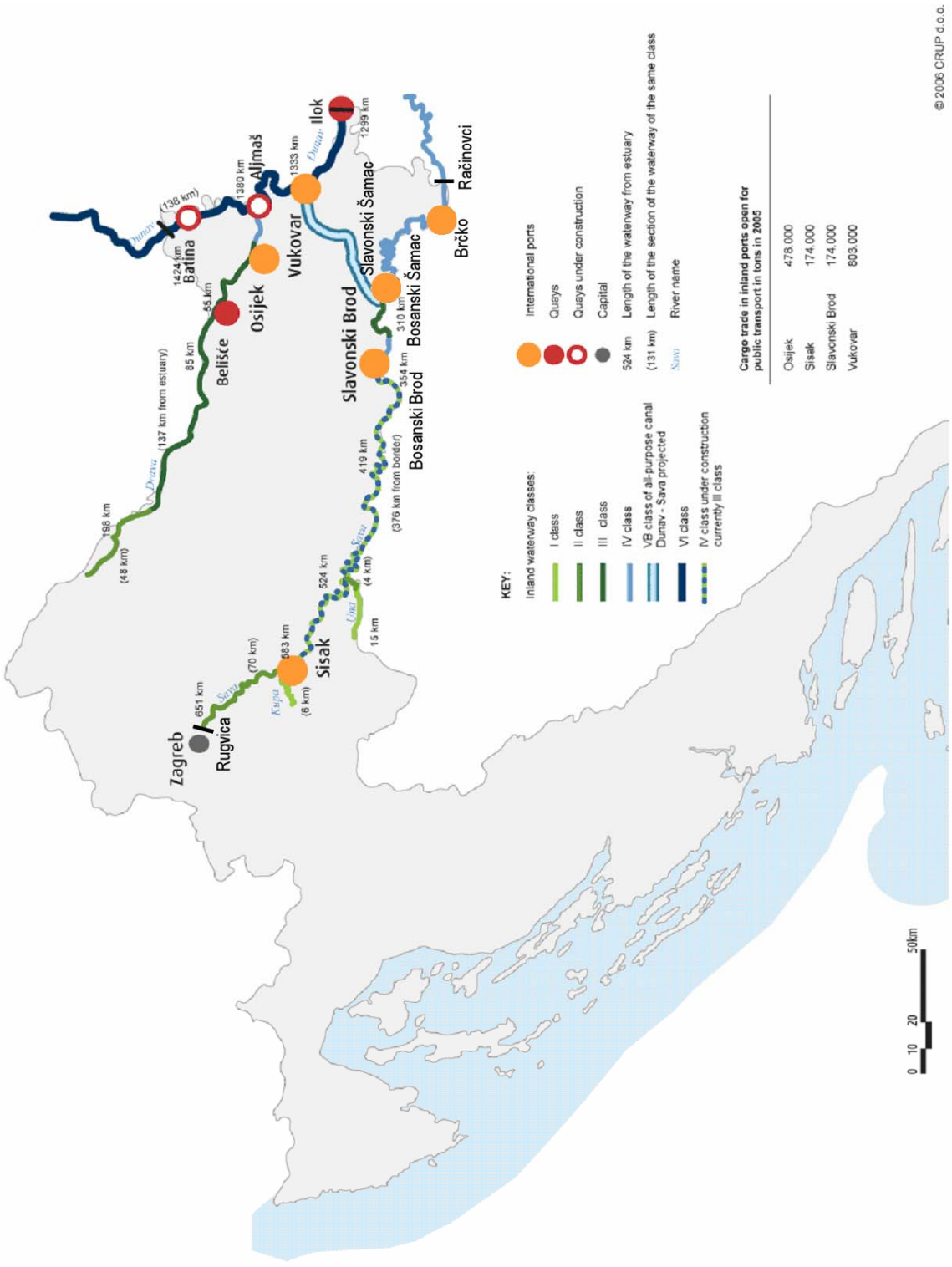
The physical parameters of the Sava cause unfavourable navigation conditions related to:

- limited draft during large periods;
- sharp river bends limiting the length and width of vessels and convoys.

Other problems for navigations are:

- limited width under bridges;
- insufficient marking.

The shallow sections in Serbia and around the Drina confluence make it very difficult to reach Croatia / Bosnia for class IV categorized vessels, presumable for less than 50% of the year. The situation in Croatia is slightly better where category III vessels can navigate with full draft around 65% of the time. Improvement works are required to increase the availability of the fairway for fully loaded vessels and for class IV categorized vessels.



Witteveen+Bos	**Figure 3.5**	REPUBLIC OF CROATIA INLAND WATERWAYS - CURRENT SITUATION REPUBLIKA HRVATSKA PLOVNI PUTOVI - POSTOJEĆE STANJE
INTERNATIONAL SAVA RIVER BASIN COMMISSION		PRE-FEASIBILITY STUDY SAVA RIVER PROJECT MANAGED AND FUNDED BY THE SAVA COMMISSION

3.3.3 Available water depth

The quality of the Sava as a transport mode mostly depends on the availability of sufficient depth for navigation. The Sava Commission applies two standards:

- navigation must be possible with a reduced draft 95% of the time;
- navigation with maximum draft must be possible 65% of the time.

Table 3.5 gives an overview of the current characteristics of the fairway and the required deepening of the fairway to meet the requirements of the current classification. The division in sections has been taken from the preliminary design report for the improvement of the Sava to a class IV waterway.

Table 3.5 Current fairway characteristics of the Sava and required deepening

Section	From km. to km....	Length (km)	Existing Class	Required[1] D65x (m)	Available %	Required[2] D95% (m)	Available %	Required deepening[3]	Length (km)
I	202.5 225.1	22.6	IV	3.5	No data	2.5	No data	No data	5.7
II	225.1 260.7	35.6	IV	3.5	No data	2.5	No data	No data	0.9
III	260.7 306.8	46.1	IV	3.5	No data	2.5	No data	No data	4.8
IV	306.8 331.5	24.7	III	2.2	No data	1.8	No data	No data	10.9
V	331.5 364.4	32.9	IV	3.5	No data	2.5	No data	No data	0.6
VI	364.4 395.5	31.1	III	2.2	No data	1.8	No data	No data	8.5
VII	395.5 417.1	21.6	III	2.2	No data	1.8	No data	No data	0.2
VIII	417.1 445.7	28.6	III	2.2	No data	1.8	No data	No data	4.4
IX	445.7 459.9	14.2	III	2.2	No data	1.8	No data	No data	1.4
X	459.9 480.4	20.5	III	2.2	No data	1.8	No data	No data	0.3
XI	480.4 511.8	31.4	III	2.2	No data	1.8	No data	No data	0.7
XII	511.8 546.8	35.0	III	2.2	No data	1.8	No data	No data	12.8
XIII	546.8 568.8	22.0	III	2.2	No data	1.8	No data	No data	19.6
XIV	568.8 588.2	19.4	III	2.2	No data	1.8	No data	No data	10.3
SUMM	202.5 588.2	385.7							81.1

1) D65% is the required maximum fairway depth according to AGN agreement. This depth has to be available at least 65% of the time. Values are taken from the table in Annex 3.5, but Consortium added 0.2 m for dredging and survey inaccuracies
2) D95% is the required minimum fairway depth according to AGN agreement. This depth has to be available at least 95% of the time. Values are taken from the table in Annex 3.5, but Consortium added 0.2 m for dredging and survey inaccuracies.
3) Average value on this river section

From Table 3.5 it is concluded that detailed information on the current availability of the Sava for navigation is not available. In general it is understood that class III vessels can navigate with full draft around 65% of the time.

3.3.4 River bends

The Sava is a typical middle course, meandering river and numerous river bends are present in the river course. Sharp river bends might form a limitation for navigation as these are difficult to pass for long and wide vessels.

The river bends that might pose difficulties for navigation are presented in Table 3.6.

Table 3.6 Sava River bends km 202.5 – 588.2

Section	From km. to km….	Length (km)	Class	Required1) Rmin (m)	Number of river bends < Rmin	Required2) Rmin, ow	Number of river bends < Rmin, ow
I	202.5 225.1	22.6	IV	360	0	240	0
II	225.1 260.7	35.6	IV	360	0	240	0
III	260.7 306.8	46.1	IV	360	2	240	0
IV	306.8 331.5	24.7	III	300	0	210	0
V	331.5 364.4	32.9	IV	360	0	240	0
VI	364.4 395.5	31.1	III	300	0	210	0
VII	395.5 417.1	21.6	III	300	0	210	0
VIII	417.1 445.7	28.6	III	300	3	210	0
IX	445.7 459.9	14.2	III	300	2	210	0
X	459.9 480.4	20.5	III	300	0	210	0
XI	480.4 511.8	31.4	III	300	4	210	2 (R205=150, R198=180)
XII	511.8 546.8	35.0	III	300	6	210	6 (R232=180, R255=190, R259=200, R266=200, R270=165)
XIII	546.8 568.8	22.0	III	300	5	210	1 (R291=200)
XIV	568.8 588.2	19.4	III	300	2	210	1 R342=200,
SUMM	202.5 588.2	385.7		300	24		9

1) Rmin is the minimum radius for two way traffic. Values have been taken from the table in Annex 5.
2) For river bends with a radius smaller than Rmin, additional width is required for vessels to pass. In the worst case only one way traffic is possible. The absolute minimum radius is approximately 3 times the length of the vessel. This implies an absolute minimum radius of:
3*70 m = 210 m for Class III
3*80 m = 240 m for Class IV

Based on Table 3.6 it is concluded that the sharp river bends are major bottlenecks for navigation. A total of 24 river bends do not fulfil the requirements of the current classification and if one way traffic is imposed in sharp bends, then still 9 bends need to be adapted.

3.3.5 Bridges

There are 9 bridges crossing the Sava in Croatia and between Croatia and Bosnia and Herzegovina. The main dimensions of these bridges are presented in Table 3.7.

Table 3.7 shows that bridges do not hinder navigation for the present classification of the Sava. However, the bridge in Jasenovac and the bridge in Galdovo are rather low if the Sava is to be upgraded to a class IV waterway. However, as upstream of the Galdovo bridge the Sava will not be upgraded for class IV, this bridge does not need to be upgraded.

Table 3.7 Bridges along the Sava

Section	From km. to km....	Class	Bridge name	Chainage	Available width (m)	Required width (m)	Available vert. clearance (m)	Required vert. clearance (m)
I	202.5 225.1	IV	Brčko Brčko	218+377 220+527	130.0 64.0	45	9.43 7.36	7
II	225.1 260.7	IV	Orašje	254+618	130.0	45	8.33	7
III	260.7 306.8	IV	Sl.Šamac	304+875	84.0	45	8.22	7
IV	306.8 331.5	III	-	-	-	45	-	4
V	331.5 364.4	IV	Sl. Brod	364+695	74.0	45	7.65	7
VI	364.4 395.5	III	Sl. Brod (pipeline)	366+650	No data	45	No data	4
VII	395.5 417.1	III	-	-	-	45	-	4
VIII	417.1 445.7	III	-	-	-	45	-	4
IX	445.7 459.9	III	-	-	-	45	-	4
X	459.9 480.4	III	St. Gradiška	460+092	89.0	45	8.22	4
XI	480.4 511.8	III	-	-	-	45	-	4
XII	511.8 546.8	III	Jasenovac Jasenovac	511+288 511+288	110.0 55.0	45	11.93 5.98	4
XIII	546.8 568.8	III	-	-	-	45	-	4
XIV	568.8 588.2	III	Galdovo Crnac	584+684 586+000	49.0 80.0	45	5.19 7.71	4

3.3.6 Marking

In the present situation there is a limited marking system in function on the Sava. Only the most difficult stretches to navigate are marked with buoys but it is understood from the Agency for Inland Waterways in Vukovar that preferably the system has to be extended to cover the entire Sava. Especially on the Bosnian side of the river, a marking system is only in place on the most dangerous sections.

All marking along the Sava is done according to the Ordinance on Inland Waterway Navigation (NN 50/02) and is in line with international standards. Table 3.8 presents the required investments and maintenance costs, while Annex 3.7 provides the details.

Table 3.8 Marking investments and maintenance (Euro)

Section	Year		
	2007	2008	2009
Sisak – Oprisavci	416,667	208,333	208,333
Oprisavci – Serbia	138,889	318,000	222,222

3.4 Improving the Sava to class IV

3.4.1 Preliminary design report

The Croatian Company VPB prepared the preliminary design for the upgrading of the Sava to a class IV from Račinovac at the border with Serbia till Sisak. The project serves various purposes amongst others, flood control through stabilization of the river, prevent further water level decreases and navigation improvements.

The preliminary design report consists of five volumes:

- Book A: General part
- Book B: Hydraulic analysis
- Book C: Fairway project
- Book D: Regulation Projects
- Book E: Summary

The design report is rather detailed for a preliminary design and was only partly available to the Consortium. All data on costs and the designs of the required works have been taken from this report. As indicated before, upgrading of the Sava to a class IV waterway has been the main starting point. If this appears not to be feasible, it can be decided not to upgrade the entire Sava but only partly, for example only the sections that are likely to generate most of the future traffic.

In the following sections the required works and costs are presented.

3.4.2 Required works

Dredging and training works

The locations and sections that need to be improved to upgrade the Sava to a class IV waterway have been indicated in Table 3.9.

Table 3.9 Locations to be improved

	Section	From km. to km….	Length (km)	Length of deepening	% of length	Bends R< 360 m	Bends R< 240 m
Brcko	I	202.5 225.1	22.6	5.7	25	0	0
	II	225.1 260.7	35.6	0.9	3	0	0
Samac	III	260.7 306.8	46.1	4.8	10	2	0
	IV	306.8 331.5	24.7	10.9	45	0	0
S. Brod	V	331.5 364.4	32.9	0.6	2	0	0
	VI	364.4 395.5	31.1	8.5	28	0	0
	VII	395.5 417.1	21.6	0.2	1	0	0
	VIII	417.1 445.7	28.6	4.4	15	3	0
B. Gradiska	IX	445.7 459.9	14.2	1.4	10	2	0
	X	459.9 480.4	20.5	0.3	2	0	0
	XI	480.4 511.8	31.4	0.7	2	4	2
	XII	511.8 546.8	35.0	12.8	37	6	6
	XIII	546.8 568.8	22.0	19.6	89	5	2
Sisak	XIV	568.8 588.2	19.4	10.3	53	2	1
SUMMARY		202.5 588.2	385.7	81.1	23	23	11

Most of the works have to be done upstream of Samac (Section IV) where a shallow section that is currently classified as class III needs to be improved. Furthermore, the sections downstream of Sisak (XI – XIV) need to be improved on a large scale.

To improve the 14 sections of the Sava between the border with Serbia and Sisak in Croatia a variety of works is proposed:

- Construction of groynes to concentrate the flow, causing higher flow velocities in the central part of the river. Higher erosion rates will then cause a deepening of the river;
- Construction of bank protections to avoid erosion caused by new groynes and to protect eroding banks. Due to the water level decrease the Sava is carving itself deeper in the landscape, as a result steep, vulnerable banks occur, see Figure 3.6a and 3.6b.
- Construction of sills on the bottom of the river to increase the water level;
- Rehabilitation of existing groynes and bank protections. The majority of the rehabilitation works are related to the existing bank protection works. The stability of the existing bank protections is threatened because of the continuous water level decrease.
- Dredging to increase the water depth.

Figure 3.6a Bank protection under construction

Figure 3.6b Eroded bank

Table 3.10 summarizes the proposed dredging and training works.

Table 3.10 Proposed dredging and river training projects

#	Chainage	Description	Works				
			groynes	bank protections	Sills	recon. bankpr. & groynes	dredging
DTW1	202.5 -225.1	Execute dredging works to improve Sava fairway depth in Section I					X
DTW2	225.1 -260.7	Execute dredging and training works to improve Sava fairway depth in Section II		X		X	X
DTW3	260.7 -306.8	Execute dredging and training works to improve Sava fairway depth in Section III		X		X	X
DTW4	306.8 - 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV	X	X		X	X
DTW5	331.5 - 364.4	Execute dredging and training works to improve Sava fairway depth in Section V		X		X	X
DTW6	364.4 - 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI	X	X	X	X	X
DTW7	395.5 - 417.1	Execute training works to improve Sava fairway depth in Section VII		X		X	
DTW8	417.1 - 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII		X		X	X
DTW9	445.7 - 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX		X		X	X
DTW10	459.9 - 480.4	Execute dredging and training works to improve Sava fairway depth in Section X		X		X	X
DTW11	480.4 - 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI		X		X	X
DTW12	511.8 - 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII	X	X	X	X	X
DTW13	546.8 - 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII	X	X	X	X	X
DTW14	568.8 - 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV	X	X		X	X

River bends improvements

According to Table 3.6 there are 24 river bends with a radius smaller than 360 m, being the minimum radius for two-way traffic for a class IV waterway. In the preliminary design report improvement of these river bends has not been taken into account. It has been assumed that one-way traffic will be imposed on these sections. Consortium agrees with this approach as bend corrections usually have high costs and large impacts on the environment and also might cause border changes.

For each bend additional marking and traffic signs need to be included and various waiting areas need to be created. The projects proposed to improve river bends are presented in Table 3.11.

Table 3.11 Proposed river bend improvement projects

#	Chainage	Description
RB1	480.4 - 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI
RB2	511.8 - 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII
RB3	546.8 - 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII
RB4	568.8 - 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV

However, there are 11 river bends with a radius smaller than 240 m, the minimum radius for one way traffic. This means that for 11 river bends it will probably not sufficient to pass these bends with class IV vessels, however detailed traffic modelling is required determine the required adaptations. Traffic modelling of the Sava's river bends is highly recommended in the future. Adaptation of the 11 sharp river bends has not been taken into account.

Bridges

From Table 3.12 it can be seen that there are two bridges (in Jasenovac – 5.98 m) which does not dispose of sufficient vertical clearance for a class IV waterway. A clearance of 7 m is required. A clearance of 7 m enables the transport of three layers of containers. According to the traffic and cargo forecast, it is not expected that container transport will start in the near future. However, the bridge needs to be replaced, but is not necessary to do this on a short term. The bridge at Galdovo is also too low (vertical clearance 5.19 m) for a class IV waterway. However, the Sava section upstream of this bridge will remain class III waterway and therefore replacement of this bridge is not included in the works to be implemented.

Table 3.12 Proposed bridge construction projects

#	Chainage	Description
B1	511.3	Replacement of the Jasenovac bridge to guarantee minimum vertical clearance

Marking

The marking system on the Sava has to be extended, especially on the Bosnian / Croatian part of the river. In the present situation only the most dangerous sections have been equipped with a marking system. Furthermore various marks are in a bad condition and need to be overhauled over replaced.

The Agency for Inland Waterways has indicated the following works need to be carried out:

- maintenance in arrear for the entire Sava in Croatia and Bosnia;
- replacement of worn marking signs with modern equipment (lighting with solar charges, signs with reflective paint, LED's, etc.;
- repair of damaged equipment.

According to the data from the Agency for Inland Waterways, the following new equipment needs to be purchased:

- For the Sisak Port Master Office: 47 buoys, 202 marks and 28 spare marks / buoys;
- For the Slavonski Brod Port Master Office: 52 buoys, 165 marks, 32 spare marks / buoys.

The proposed marking related projects are presented in Table 3.13. Annex 3.7 provides details.

Table 3.13 Proposed marking system projects

#	Chainage	Description
M1	207	Upgrading of the marking system and maintenance in arrear for the section Serbian border of Slavonski Brod (Port Master Office Slavonski Brod)
	469	
M2	469	Upgrading of the marking system and maintenance in arrear for the section Oprisavci – Sisak (Port Master Office of Sisak)
	651	

3.4.3 Cost estimates

Construction costs

To determine the construction costs of the improvement of the Sava to a class IV waterway the following assumptions have been made:

1. the construction costs for dredging and training works, projects DTW1 u/i DTW14, have been taken from the preliminary design for the upgrading of the Sava to a class IV from Račinovac at the border with Serbia till Sisak in Croatia;
2. not only navigation benefits from the proposed dredging and training works and therefore only part of the construction costs can be allocated to navigation. The costs are allocated to navigation according to the following system:
   - the construction of new groynes is only done to improve navigation conditions; these costs are completely allocated to navigation;
   - bank protections are usually not required for navigation unless a river section is very dynamic or when bank protections are constructed in combination with groynes. If bank protections are constructed in a section together with groynes, then it has been assumed that the bank protections serve navigation purposes and 100% of the costs are allocated to navigation. Otherwise 0% of the costs is allocated to navigation;
   - the construction of sills is entirely done for navigation purposes; these costs are completely allocated to navigation;
   - dredging costs are completely allocated to navigation.
3. The costs for improvement of the marking system have been obtained from the Agency for Inland Waterways;
4. The costs for the construction of the bridge and traffic guidance in bends have been based on Consortium's experience in similar projects and in the region.
5. Construction costs refer to the amount the contracting authority has to pay a contractor for the construction of the proposed improvement projects;
6. Value added tax has not been included.

The construction costs for the dredging and training works (DTW1 u/i DTW14), river bend improvement projects (RB1 u/i RB4) marking improvement projects (M1 and M2) and the bridge construction projects (B1) are presented in Annex 3.6.1 till Annex 3.6.6.

The total construction costs to improve the Sava to a class IV waterway are estimated at around 40.2 million EURO, divided among the following items:

- dredging and training works (projects DTW1 u/i DTW14): 28.3 million EURO
- river bend improvement (projects RB1 u/i RB): 1.3 million EURO
- marking improvement (projects M1 and M2): 0.6 million EURO
- bridge construction (projects B1): 1.0 million EURO

Maintenance costs

The annual maintenance costs of the proposed projects have been estimated as percentage of the construction costs according to the following assumptions:

1. Dredging and training works:

   - for bank protection and groynes the annual maintenance costs are estimated at 2%;
   - maintenance of sills involves under water inspection and maintenance which is relatively expensive: a value of 4% has been applied;
   - maintenance dredging in sections where training works are constructed is low, as the training works will prevent accretion. For these section 5% maintenance is assumed;
   - it has been assumed that in sections without training works, maintenance dredging is required every 4 years. Consequently, the yearly maintenance is 25%.

   Annual maintenance for the river bend projects is estimated at 5% of the construction costs;

2. Marking System

Data on the maintenance of the marking system has been obtained from the Agency for Inland Waterways;

3. Bridges

The annual maintenance costs for the (non-movable) bridges are estimated at 0.5% of the construction costs.

Annex 3.6 includes the maintenance costs for the proposed projects. A total of 2.1 million EURO is envisaged for the yearly maintenance of the proposed works.

Investment costs

To calculate the investment costs required for the implementation of the projects additional costs need to be included to cover expenses such as contingencies, design, supervision, permitting etc.

The following additional costs have been applied:

- for contingencies: 10% of the construction costs;
- for project realization costs (further deign, tendering, supervision, permitting, etc): 15 % of the construction costs + contingencies.

An overview of the construction, maintenance and investment costs is presented in Table 3.14.

Table 3.14 Costs for the proposed works

Project description			A. Construction costs (EUR)	Additional costs		D. Investment Costs (A+B+C)	Yearly maintenance (EUR)
#	Chainage	Description		B. Contingencies (10% of A)	C. Project realization (15% of A+B)		
DTW1	202.5 225.1	Execute dredging works to improve Sava fairway depth in Section I	1,190,000	119,000	196,350	1,505,350	297,500
DTW2	225.1 260.7	Execute dredging and training works to improve Sava fairway depth in Section II	60,000	6,000	9,900	75,900	3,000
DTW3	260.7 306.8	Execute dredging and training works to improve Sava fairway depth in Section III	600,000	60,000	99,000	759,000	30,000
DTW4	306.8 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV	5,620,000	562,000	927,300	7,109,300	182,600
DTW5	331.5 364.4	Execute dredging and training works to improve Sava fairway depth in Section V	50,000	5,000	8,250	63,250	2,500
DTW6	364.4 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI	3,540,000	354,000	584,100	4,478,100	120,700
DTW7	395.5 417.1	Execute training works to improve Sava fairway depth in Section VII	0	0	0	0	0
DTW8	417.1 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII	420,000	42,000	69,300	531,300	21,000
DTW9	445.7 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX	110,000	11,000	18,150	139,150	5,500
DTW10	459.9 480.4	Execute dredging and training works to improve Sava fairway depth in Section X	10,000	1,000	1,650	12,650	500
DTW11	480.4 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI	90,000	9,000	14,850	113,850	4,500
DTW12	511.8 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII	4,940,000	494,000	815,100	6,249,100	134,600
DTW13	546.8 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII	8,490,000	849,000	1,400,850	10,739,850	246,200
DTW14	568.8 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV	3,190,000	319,000	526,350	4,035,350	134,000
RB1	480.4 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI	187,500	18,750	30,938	237,188	9,375
RB2	511.8 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII	562,500	56,250	92,813	711,563	28,125
RB3	546.8 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII	375,000	37,500	61,875	474,375	18,750
RB4	568.8 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV	187,500	18,750	30,938	237,188	9,375
M1	207 335	Upgrading of the marking system and maintenance in arrear for the section S. Border - Oprisavci	416,667	*Investments have been calculated according to schedule provided by the Inland Waterway Agency*		416,667	208,333
M2	335 651	Upgrading of the marking system and maintenance in arrear for the section Oprisavci - Sisak	138,889			138,889	222,222
B1	511.3	Replacement of the Jasenovac bridge to garantuee minimum vertical clearance	10,000,000	1,000,000	1,650,000	12,650,000	375,000
		Total costs	**40,178,056**	**4,017,806**	**6,629,379**	**50,825,241**	**2,053,780**

The total investment costs (inclusive of contingencies and project realization costs) to upgrade the Sava to a class IV waterway have been estimated at **50.8 million EURO** with an annual maintenance **of 2.1 million EURO.** These costs need to be divided between Croatia and Bosnia and Herzegovina. Improvement of the Sava in Serbia is covered in Annex 3.1.

3.5 Investment schedule

To obtain a realistic work plan for the implementation of the projects a prioritization of the projects has to be made based on the urgency or importance of the projects. A division is made in three types:

- 1st priority: Very urgent projects, execution of these projects will increase safety and the availability of the Sava as a transport mode in the short term.
- 2nd priority: Urgent projects which will enable the development of IWT on the medium term
- 3rd priority: Less urgent projects which will contribute to the long term development of IWT

1st priority: Very urgent projects

When analysing the economic development along the Sava, it is expected that mainly the ports of Slavonski Brod en Brcko have good opportunities for economic growth. To enhance and enable this growth a reliable class IV waterway is essential. The dredging and training works (Project DTW1 u/i DTW5) between the border with Serbia and Slavonski Brod need therefore be executed on a short term, starting from downstream in upstream direction.

Furthermore, the marking system needs to be upgraded over the entire Sava (projects M1 and M2) and safe traffic should be guaranteed in the bends in the upstream part of the Sava (project RB1 u/i RB4).

After the urgent projects have been carried out safe navigation with class IV vessels is possible up to Slavonski Brod and further till Sisak for class III vessels.

2nd priority: Urgent projects

The urgent project of the 2nd priority envisage at improving the entire Sava till Sisak to a class IV waterway as has been included in the AGN agreement. Projects DTW6 u/i DTW14, consisting of various dredging and training to meet the demands of a class IV waterway are included in this category. The sections that create the biggest problems for navigation will be improved first, in line with the preliminary design report.

3rd priority: Less urgent projects

The remaining projects consist of the construction of a new bridge at Jasenovac in the upper part of the Sava to ensure a vertical clearance of 7 m, allowing 3 layers of container transport instead of the current two layers. This is considered as a less urgent projects as full scale development of container transport is not expected on the short term. Replacement of the Jasenovac bridge (project B1) is planned after implementation of the very urgent and urgent projects.

Based on the above argumentation an implementation schedule has been prepared, which is presented in Figure 3.7.

Project description			Year									
#	Chainage	Description	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
DTW1	202.5 225.1	Execute dredging works to improve Sava fairway depth in Section I										
DTW2	225.1 260.7	Execute dredging and training works to improve Sava fairway depth in Section II										
DTW3	260.7 306.8	Execute dredging and training works to improve Sava fairway depth in Section III										
DTW4	306.8 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV										
DTW5	331.5 364.4	Execute dredging and training works to improve Sava fairway depth in Section V										
DTW6	364.4 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI										
DTW7	395.5 417.1	Execute training works to improve Sava fairway depth in Section VII										
DTW8	417.1 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII										
DTW9	445.7 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX										
DTW10	459.9 480.4	Execute dredging and training works to improve Sava fairway depth in Section X										
DTW11	480.4 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI										
DTW12	511.8 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII										
DTW13	546.8 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII										
DTW14	568.8 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV										
RB1	480.4 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI										
RB2	511.8 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII										
RB3	546.8 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII										
RB4	568.8 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV										
M1	207 335	Upgrading of the marking system and maintenance in arrear for the section S. Border - Oprisavci										
M2	335 651	Upgrading of the marking system and maintenance in arrear for the section Oprisavci - Sisak										
B1	511.3	Replacement of the Jasenovac bridge to garantuee minimum vertical clearance										

Figure 3.7 Sava – Implementation schedule for proposed projects

3.6 Recommendations

Consortium would like to stress the following aspects which are of outmost importance for further implementation of the projects and improvement of the Sava as a reliable transport mode:

1) Integral approach to the Sava

The development of the Sava for navigation should be considered on a river basin level. As indicated before, the ongoing water level decrease and bed level degradation might have far stretching consequences for the river basin. Any improvements of the Sava should aim at stopping or reducing this process. Projects to improve navigation conditions might contribute to this and this combination of effects might increase the feasibility of the proposed works.

2) Environmental Impact Assessment

Considering the first recommendation, also the preparation of an Environmental Impact Assessment is of utmost importance. It is understood that the Ministry is taking the initial steps towards the preparation of an EIA. Hydraulic calculations, carried out as part the preliminary design report, have shown that the proposed works do no cause additional water level decrease. However, a morphological analysis has not been carried out yet. When morphological processes are considered it might show that the proposed dredging and training works will lead to further deepening of the Sava, which is not favourable from an environmental point of view.

3) Traffic simulation

There are 24 river bends in the Sava which have a radius that is too small for two way traffic. Out of these 24 river bends, 11 river bends have a radius smaller than acceptable, even for one way traffic. However, from local experts it is understood that class IV categorized vessels are passing these bends. Based on the available information it is not possible to indicate if safe passing of these bends is possible and detailed traffic simulations are recommended during following stages.

4) Cooperation between the riparian countries

A successful development of the Sava as a competitive, regional transport mode highly depends on the cooperation between the riparian countries. Furthermore aspects like traffic management, maintenance of the marking system, etc. are all aspects that need to be covered with common dedication. The Sava Commission is to be the key player in further development of the Sava for navigation purposes.

ANNEX 3.1 THE SAVA IN SERBIA – ABSTRACT FROM THE IWT SERBIA PROJECT

1.1 Introduction

From 2003 till 2006 an EU funded project "Master Plan and Feasibility Study for restoration of IWT in Serbia" has been carried out. This project intended to study and initiate the restoration of IWT in Serbia. The Sava was part of this study from its confluence with the Danube till Jamena at the border with Croatia (km. 207.).

1.2 General

In Serbia the river is currently difficult and dangerous to navigate due to the presence of damaged bridges and unexploded ordnances resulting from the NATO bombings of 1999 and the lack of marking. The river is currently blocked by the debris from the destroyed railway bridge at km 16 and through traffic to and from the Danube is severely restricted. It is understood that some local river transport related to the mining and the transport of sand and gravel takes place in safe areas. The presence of pilots is however required.

The river Sava has been declared an international river, in a similar manner to the river Danube. For that to be effective the river has to offer at least navigation up to class IV standards (vessels up to 1,500 tonnes).

The principal Serbian ports on the river are at Šabac (km 113) and Sremska Mitrovica (km 142).

1.3 Sava - Actual dimensions and status

Discharges

The flow in the Sava is monitored at S. Mitrovica at km 136.4, i.e. downstream of the confluence with the Drina. During flood conditions the discharge exceeds 5,000 m^3/s while it may decrease below 300 m^3/s during low flows. For the Sava and its tributaries, calculated characteristic discharges, based on measured data from the period 1993 - 2003 are presented in Table 1. The percentages in Table 1 refer to the percentage of time that the presented discharge is not exceeded.

Table 1 Sava - Characteristic discharges at Sremska Mitrovica and tributaries within Serbia

			Discharge (m^3/s)						
Station	**River**	**Chainage (km)**	**1%**	**6%**	**10%**	**Mean**	**90%**	**99%**	**Max**
S.Mitrovica	Sava	136.4	260	406	481	1479	2719	3810	5168
Radalj	Drina	85.5	63	74	83	339	675	1182	2768
Beli Brod	Kolubara	39.2	1.1	1.5	1.8	13.3	28.5	96.3	451

Water levels

The backwater effect of Djerdap I is noticed almost up to the town of Šabac at km 105 during low flow. Upstream of Šabac the river is free flowing and the presence of Djerdap I is not noticed.

Near Šabac and the Drina confluence a steep water slope is present, caused by an elevated river bed which acts like a sill. At the Drina confluence this seems to be associated with the presence of large sand and gravel dunes and at Šabac, this might be related to rocky outcrops.

The significant fluctuation of the thalweg level in combination with the large water depth in the outer bends is quite normal in strongly meandering rivers, such as the Sava.

Morphology

Bank erosion has been reported at several locations along the Sava (for details see Volume 11) and the erosion rate is quite significant. It causes alignment changes that may require attention, like at the very dynamic bend near Bosut (km 160). The erosion rate appears to be order of magnitude of 4 meter per year. At such dynamic sections either the river alignment may require stabilization or the fairway alignment will have to be relocated frequently.

Based on a comparison between the cross-sections of 1981/82 and 1998, it can be concluded that the average river bed degradation is approximately 2-3 cm per year during the period in between

the two surveys. The degradation is observed along the entire Sava, except in the reach between approximately km 120 and km 130 that appears to be stable.

Fairway

(i) Alignment

The fairway alignment is presented in Figure 1. In this figure the inverse of the radius of the bends is plotted against the river chainage.

Figure 1 shows that sharp bends are only present in the stretch from Sremska Mitrovica (km 136) until the border with Croatia (km 207). On this stretch navigation is limited, mainly due to the presence of a sharp bend near Bosut (km 160) with a radius of 375 m, which is difficult for Class IV vessels to navigate. Furthermore, four (4) sharp bends are present with a radius between 400 and 750 m.

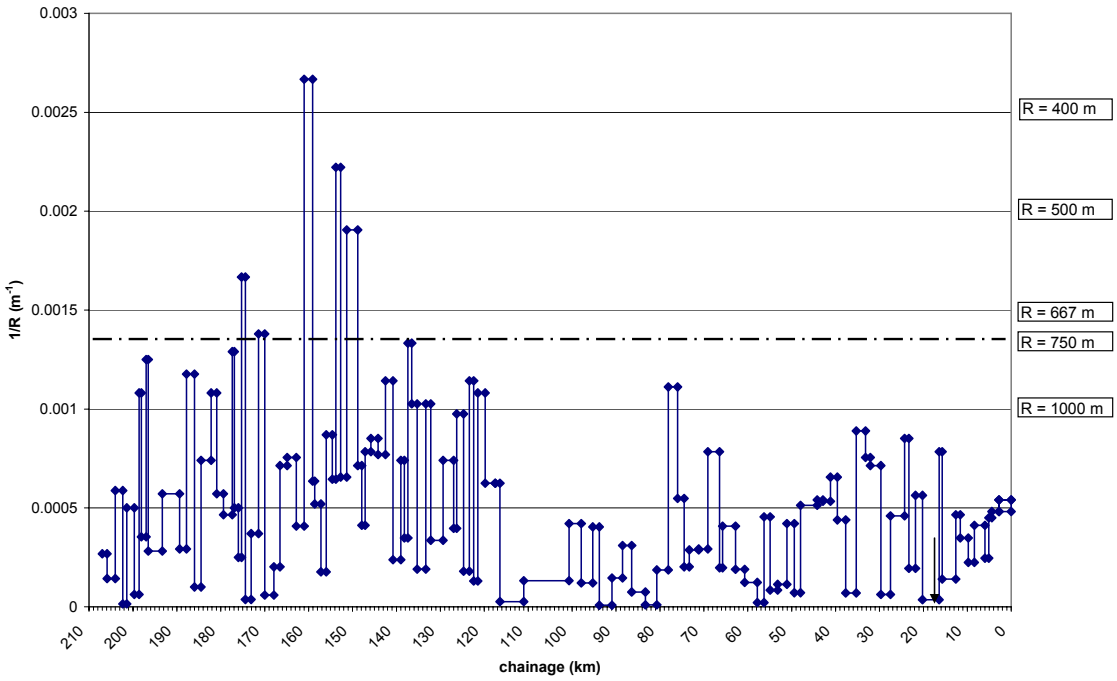


Figure 1 Sava - Curvature

(ii) Available width and depth

The Sava is navigable along its entire length of 207 km within Serbia, from Belgrade to the Croatian border. However, navigation conditions are poor at many river stretches during low flow periods. During 2003 navigation was resumed for a period of 3 months due to shallow water at the Drina Confluence (km 175.4).

In Figure 2.a and Figure 2.b the present fairway conditions are compared to the requirements Plovput currently applies, i.e. a fairway depth of ENR - 2.5 m and a width of 80 m at straight and curved reaches.

Based on the above the following can be mentioned:

- from km 0 till approximately km 70 the river is quite wide and has a fairway width of more than 80 m; also the water depth is sufficient;
- at km 70 a narrow section is present having a width of 60 m and requires attention;
- a long shallow reach downstream of Šabac extending approximately from km 84 to 110 is difficult to pass during lower water levels. Ships that want to pass this stretch need to sail with a draft of approximately 1.8 m or less and even then, only one-lane traffic will be possible. The shallowness may be caused by rocky outcrops or by coarse gravel on the river bed. This may result in a higher risk of damage in case the vessel touches river bed. Because of these outcrops, a steep water surface gradient occurs. Enlargement of the

navigation channel at this reach is likely to reduce this gradient; hence it will induce erosion progressing in upstream direction;

- narrow sections occur between km 130 and 150 for example around km 136 the fairway width is reduced to 70 m;
- sufficient water depth and fairway width are not available on the stretch between km 170 and 180, thus confirming the problems at the Drina confluence, km 175.4. One lane traffic with a draft of 1 m is only possible at this stretch. Combined with the high flow velocities between 0.7 and 2.2 m/s this stretch causes severe problems for navigation;
- between the confluence with the Drina (km 175) and the border with Croatia (km 207), the river is shallow. The minimum available fairway depth varies between 1.3 and 2.4 m.

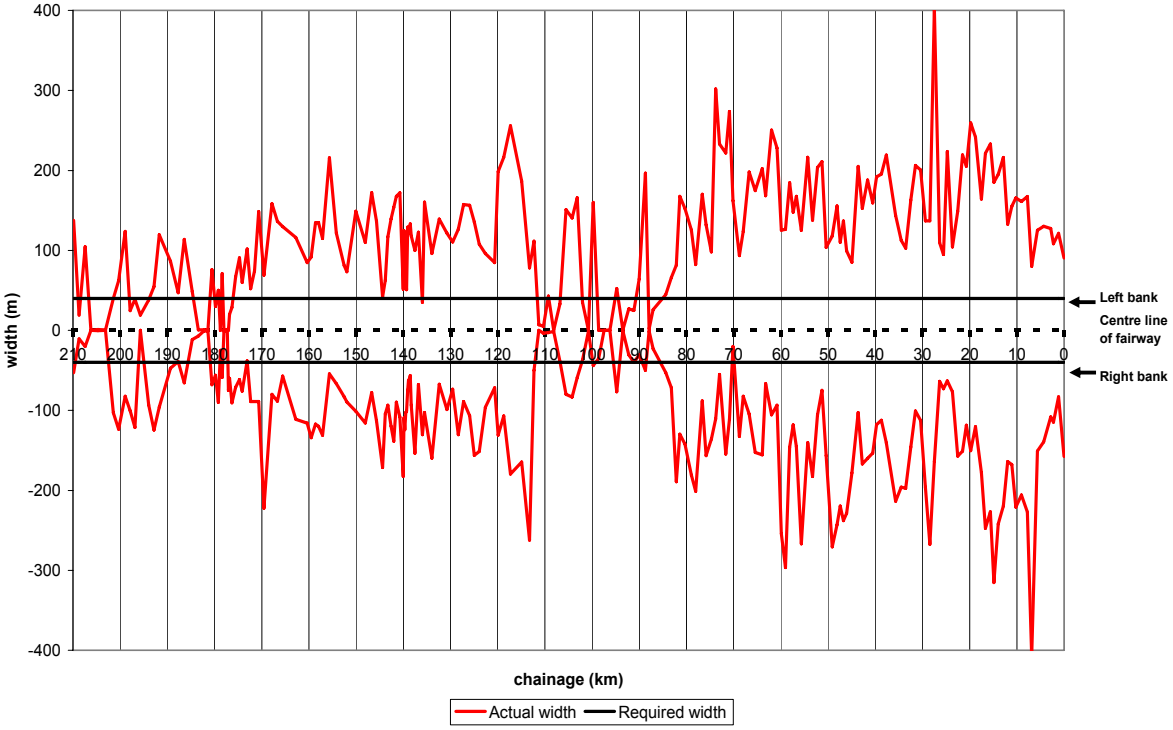


Figure 2.a Sava – Available and required fairway width (at ENR – 2.5 m)

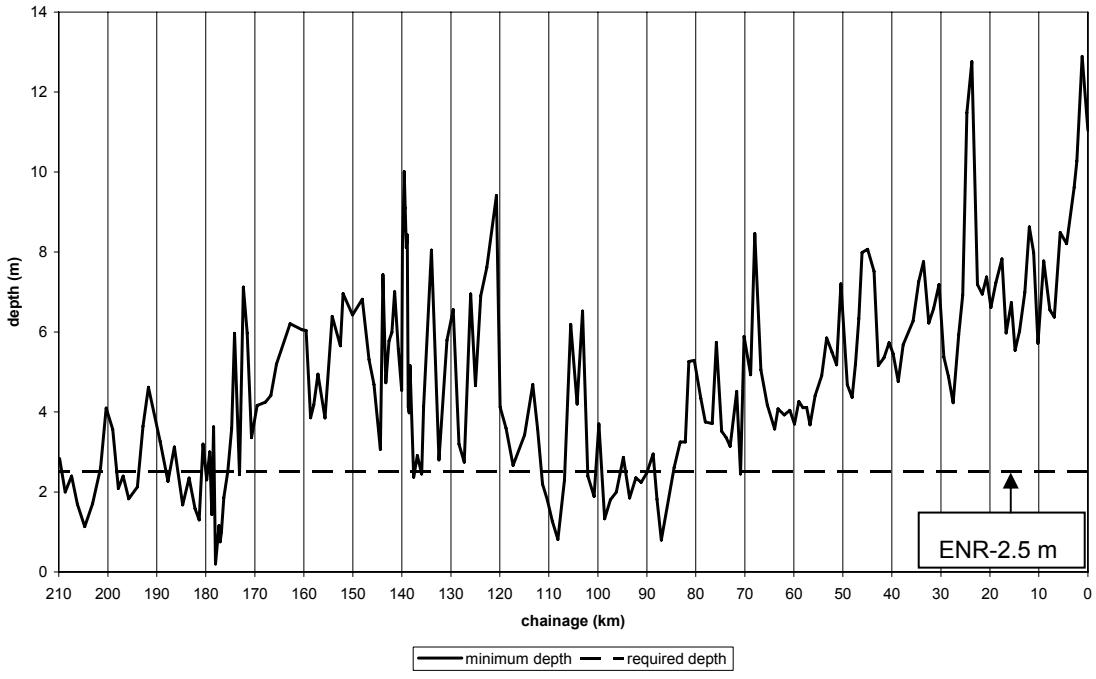


Figure 2.b Sava - Minimum fairway depth

Bridges

The bridges across the Sava are presented in Table 2.

The fairway width underneath the bridges varies between 60 m (the passenger bridge in Sremska Mitrovica - km 136.3) till 261 m (the Brankova road bridge in Belgrade - km 1.0). Therefore, it may be concluded that along the entire length of the Sava two - lane traffic with passing of two barges wide convoys is possible.

The clearance underneath the bridges related to HNN varies between 5.4 m for the Old Šabac road and railway bridge (km 104) and 15.6 m for the new Belgrade railway bridge (km 3). On the middle and lower part of the Sava relatively low bridges are present with clearance heights of 5.4 and 6 m. Therefore, only transport with barges carrying two layers of containers is possible on the Sava, but this is not considered a bottleneck for the development of container transport.

The bridges comply with the CEMT requirements for a Class VIa waterway.

Aids to navigation

Presently, there is no marking system in place except for the section around the damaged Ostružnica railway bridge.

To enable safe and efficient navigation on the Sava a navigation marking system is required. Plovput has already prepared the designs and the marking system will probably be implemented in the year 2006.

With respect to the presently available aids to navigation the following observations have been made:

- from Sremska Mitrovica (km 137) until the Croatian border (km 207) hardly any signs are observed. On the stretch Sremska Mitrovica till Belgrade (km 0) approx. 80% of the signs are present to mark the chainage;
- buoys are hardly observed on the Sava, except in the vicinity of Belgrade. Along the largest part of the river the fairway location is not indicated and also submerged structures are not indicated. As a result navigation on the Sava is rather difficult and even dangerous. The lack of a pilot system makes navigation on the Sava only possible using experienced local navigators;
- crossing signs between successive bends and channel beacons are sporadically present;
- the most recent navigational maps are approx. 30 years old.

Auxiliary facilities

The auxiliary facilities along the Sava are very limited:

- waste collection facilities are not present and the vessels plying the Sava cannot dispose their waste and waste water. Often this is discharged (uncontrolled and untreated) into the Sava, harming the environment;
- traffic management and control is rather difficult on the Sava and also information to skippers is rather limited. With the current traffic density this might not result in a hazardous situation, but with the expected traffic growth the installation of a radio communication system or automatic identification system integrated within River Information Services have to be implemented to increase navigation safety;
- there are no services/facilities to remove floating trees from the river;
- there are no bunkering facilities along the river.

1.4 Sava - Description of bottlenecks

Requirements fairway dimensions

The current required fairway dimensions are somehow unclear and although the Sava has been declared an international waterway, the issue of classification and fairway dimensions will be handled by the recently founded Sava Commission. Consequently to identify bottlenecks on the Sava assumptions with respect to the fairway requirements have to be made. The fairway width considered is 80 m, in line with the requirements applied by Plovput.

Based on the current traffic on the Sava, consisting mainly of self propelled vessels and a convoy of one barge, a Class IV or Va waterway is assumed which might also be sufficient to

accommodate future traffic growth. As the requirements of a Class IV and Va waterway hardly differ (minimum radius of a bend is 400 m for a Class IV waterway and 450 m for a Class Va the width of the fairway only differs 2 m), it has been assumed that the Sava initially has to fulfil the requirements of a Class Va classified waterway.

Considering the requirement for the available depth, the traffic on the Danube has to be considered. The required fairway depth will then be 2.5 m, the same as in the regulations from the Danube Commission.

Consequently the following requirements for a Class Va are applied:

- depth of fairway at ENR: 2.5 m;
- minimum radius of bends: 450 m;
- width of fairway: 80 m.

Listing of bottlenecks

Based on the above mentioned requirements the bottlenecks, presented in Table 3, are identified.

Table 3 Sava - Overview of bottlenecks

Project #	project location	chainage (km.)	description of encountered bottleneck/recommendation
S1.1	Jamena	205.9 - 189.2	Minimum available water depth at fairway location is 1.3 m;
S1.2	Sremska Rača	187.4 – 177.8	Minimum available water depth at fairway location is 1.6 m;
S1.3	Drina Confluence	176.6 - 173.8	(1) Minimum available water depth at fairway location is 0.2 m; (2) Difficult navigation due to inflow from Drina.
S1.4	Sremska Mitrovica	133.0 - 123.9	Minimum available width is 75 m.
S1.5	Klenak	109.8 - 103.5	Minimum available water depth at fairway location is 2.2 m;
S1.6	Šabac	101.9 - 88.3	Minimum available water depth at fairway location is 1.3 m;
S1.7	Podgorička Ada / Kamičak	85.8 - 79.9	Minimum available water depth at fairway location is 0.4 m;
S1.8	Provo	72.9 - 69.7	Minimum available width for navigation is 60 m;
Miscellaneous bottlenecks			
S1.9		207.0 - 0.0	Presence of wrecks might endanger navigation at 3 locations;
S1.10		207.0 - 0.0	Aids to navigation are not present/to be implemented;
S1.11		207.0 - 0.0	River Information Services are not present/to be implemented
S1.12		207.0 - 0.0	Waste collection system is not sufficient to ensure environmental friendly navigation;
S1.13		207.0 - 0.0	Floating trees may endanger navigation.
S2		207.0 - 0.0	Class Vb vessel are not able to sail on the river
S3		207.0 - 0.0	Draft of vessels is limited due to small water depth at lowest navigable water level (ENR)

Bottlenecks from km. 207 - 0 (S1.1 - S1.8)

To fulfil the requirements of a Class Va waterway (see Table 3) a total of 8 bottlenecks (S1.1 - S1.8) are present in the Sava. These are related to insufficient dimensions of the fairway. Furthermore, 7 miscellaneous bottlenecks have been identified, being S1.9 u/i S1.13, S2 and S3.

The stretch upstream of the confluence with the Drina does not provide sufficient depth for navigation and two major bottlenecks have been defined near Jamena (S1.1) and Sremska Rača (S1.2).

More downstream, the most serious bottleneck (S1.3) in the Sava is located at the confluence with the Drina (km 175). The confluence Sava - Drina is a difficult stretch for navigation as the Drina flows into the Sava in a river bend, causing a complex morphological behaviour in the bend and a strong side flow in the stretch where navigation is already difficult. Furthermore, the available width for navigation is only around 50 m for the narrow sections and the available depth at ENR is not sufficient. Combined with the high flow velocities (between 0.7 and 2.2 m/s) this stretch causes severe problems for navigation.

The river stretch round Šabac also shows a few bottlenecks for navigation. (S1.5 - S1.7). At these locations the river bed, consisting of gravel, is rather elevated compared to the surrounding sections. In addition, the river is too shallow at these locations.

In the downstream section from km. 70 till the confluence with the Danube (km. 0) bottlenecks are not present. This section is during low discharges still influenced by the backwater curve of the Djerdap dam, resulting in good conditions for navigation.

Miscellaneous bottlenecks

The most important bottleneck is the absence of a marking and aids to navigation system on the river. In the present situation only experienced captains, with local knowledge can sail the Sava, while international vessels do require pilots on board to sail the Sava.

With regard to the minimum available water depth at ENR the same remark is made for the Sava as has been made for the Danube. Initially a value of 2.5 m is assumed but this value is considered rather limited according to international standards and therefore the limited available water depth is identified as a bottleneck (S2).

In the current situation the Sava is navigable for Class Vb vessels from its confluence with the Danube (km. 0) till km. 70. More upstream, navigation of Vb vessels is hindered by the shallow and narrow bottlenecks as indicated for Class Va vessels, but in addition 5 sharp bends between km. 150 and 175 make navigation of Class Vb vessels difficult. As these convoys are two barges long, a radius of 750 m is required, that is much larger than the minimum allowed radius for class Va vessels (R = 450 m).

Sava Options

For the Sava three options have been developed, being:

- **Option S1: Improving the Sava to a Class Va waterway**

Water depth at ENR:	Width of the fairway:	Minimum radius of bends:
2.5 m	80 m	450 m

The option S1 consists of solving bottlenecks S1.1 u/i S1.13 (See Table 3), thus creating a Class Va international waterway with a depth of 2.5 m at ENR. It is anticipated that a Class Va waterway in first instance will be suitable to accommodate current and future traffic on the Sava. For more details reference is made to section 6.3.1.

Also the miscellaneous bottlenecks related to, among others, navigation aids, River Information Services and waste collection will be taken care of in this option.

- **Option S2: Improving the Sava to a Class Vb waterway - CEMT resolution for a new international waterway**

Water depth at ENR:	Width of the fairway:	Minimum radius of bends:
2.5 m	80 m	750 m

Following the guidelines of the CEMT resolutions 92/2 the Sava can be considered as a new waterway of international importance which should fulfil the requirements of a Class Vb waterway. In that case a 2 barges long convoy would be able to navigate, which can be economic attractive. Therefore this option is proposed as a possible improvement to the system.

- **Option S3: Improving the Sava, minimum water depth 3.5 m**

Water depth at ENR:	Width of the fairway:	Minimum radius of bends:
3.5 m	80 m	450 m

It would be preferable to increase the draft of vessels at ENR for the Sava as well by increasing the water depth at ENR, creating benefits from larger cargo carrying capacity of the individual vessels. The determination of the required increase of the water depth has to be optimized based on the economic feasibility, but also environmental factors have to be considered, as these may form a limitation to increase the water depth. This analysis has not been carried out, but a value of 3.5 m is assumed.

In all of the above mentioned options (S1, S2 and S3) the projects to solve the miscellaneous bottlenecks related to, among others, navigation aids, waste collection and River Information Services (bottleneck no. S1.9 u/i S1.13) have to be considered.

1.5 Sava - Projects and costs

Option S1: Improve the Sava to a Class Va waterway

A total of 13 improvement projects are proposed which require a total investment of 12.6 million Euro. As some of the projects are executed on the border with neighbouring countries, not only Serbia benefits from the implementation of these projects and sharing of costs seems appropriate.

A summary of the costs of the main items is presented in Table 4

Table 4 Option S1 – Overview capital investment and maintenance costs

Item	Capital investment (x 1000 Euro)	Annual maintenance costs (x 1000 Euro)
Dredging and training works	9,828	796
Miscellaneous projects	2,789	335
Total	**12,617**	**1,131**

The majority of the projects to improve the Sava to a Class Va waterway include the implementation of dredging and training works, divided among 8 projects (S1.1. u/i S1.8). The most extensive project is located at the Drina Confluence (project S1.3). The Drina confluence project consists of a large excavation of the right bank of the Drina to widen the mouth of the confluence and the construction of bank protection works and two groynes to fix the dynamic banks and guide the flow. The investments for this project are estimated at 3.9 million Euros. The other identified dredging and training works mainly concern the deepening of the Sava on the river stretch upstream and downstream of Šabac (km 84 to km 110) and between the Drina confluence and the Serbian - Croatian border (km 207).

A total of 5 miscellaneous projects have been defined of which the most extensive are the implementation of a navigation system (marking), upgrade of the waste collection system, implementing River Information Services and the removal of three sunken vessels. The costs for these miscellaneous projects amount to approximately 2.8 million Euro.

The upgrade of the waste collection system is excluded from this amount as these costs are included in the Port Development Plan.

Option S2: Improve the Sava to a Class Vb waterway

In addition to Option S1, the Option S2 includes projects related to four sharp bends with a radius varying from 370 to 725 m that need to be increased to 750 m to enable navigation of Class Vb vessels. The projects result in a drastic increase in costs.

A total of 17 projects are identified requiring an investment of 56.8 million Euros. Similar to Option S1 a sharing of costs between the neighbouring countries seems appropriate.

A summary of the costs of the main items is presented in Table 5.

Table 5 Option S2 – Overview capital investment and maintenance costs

Item	Capital investment (x 1000 Euro)	Annual maintenance costs (x 1000 Euro)
Dredging and training works	53,966	1,374
Miscellaneous projects	2,789	335
Total	**56,755**	**1,709**

The majority of the projects to improve the Sava to a Class Vb waterway include the implementation of dredging and training works and then mainly the projects required to smoothen four sharp river bends between km 170 and km 150 (Project S2.2 u/i S2.5). The smoothening of these 4 bends requires an investment of 16.6 million Euro. By far, the largest project and the most costly one, is the project located at the Drina confluence (Project S2.1). In this option the bend has to be widened with approx. 150 m, to be realized by excavation of a large area on the river banks. Further, the river bank has to be protected by means of bank protection works. The investments for this project are estimated at 31.4 million Euros.

The capital investments for the proposed miscellaneous projects are the same as for Option S1, consisting of 5 miscellaneous projects which amount to approximately 2.8 million Euros. The investment required for the upgrade of the waste collection system is excluded.

Option S3 - Improve the Sava - minimum water depth 3.5 m

Deepening the Sava to a level of ENR - 3.5 m implies that large scale dredging works have to be carried out. Mainly the shallow section around Šabac needs to be deepened between 1 to 2.5 m. The capital investments to realize this deepening are estimated to be 6 or 7 times higher than the deepening to 2.5 m as was foreseen in Option S1. The investments of the dredging and training works will be around 63 million Euros in this Option S3. In addition to the high increase in costs, also the environmental consequences are substantial. A water level decrease of 0.20 - 0.25 m can be expected just upstream of Šabac at average flow conditions and more upstream at the confluence with the Drina still a water level decrease of 0.15 m may occur, according to hydraulic calculations. At lower discharges, this difference is even higher, 0.25 - 0.3 m upstream of Šabac and 0.2 m at the Drina confluence. These values are rather high. From an environmental point of view, and combined with the observed ongoing bed level degradation of the Sava and the high cost involved, it is concluded not to elaborate this option further in the Master Plan. The environmental and morphological consequences are expected to be far too high to justify this option. For any future study regarding the further deepening of the Sava, it strongly recommended to examine if a smaller increase in water depth, e.g. to 2.8 or 3 m, is acceptable from an environmental, hydraulic, morphological and nautical point of view.

Option S1 - Implementation schedule

The proposed implementation scheme for Option S1 is presented in Table 6.

Table 6 Option S1 - Implementation schedule

Project	Year of implementation (20..)																			
	Short term			Medium term							Long term									
	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A. High priority projects																				
Dredging and training works on shallow sections and at the Drina Confluence	x	x																		
Miscellaneous projects	x	x		x	x															
B. Low priority projects																				
Dredging and training works to increase width at narrow sections			x																	

A. High priority projects - short term

The projects to be executed in the short term consist of making the Sava safely navigable by implementing a navigation system, the removal of three sunken vessels and cleaning the river from floating trees (all projects are part of the miscellaneous projects listed in Table 8.5), and by deepening the shallow sections in the Sava. Further the project at the Drina confluence needs to be implemented. To make navigation on the Sava more environmental friendly a waste collection system will be implemented (part of miscellaneous projects in Table 8.5). The total investment for the priority projects amount around 12.3 million Euros. As this amount is rather limited it expected that this can be implemented in two years time starting from 2006.

However, project implementation has not yet started and it is not clear when and if project implementation will start.

B. Low priority projects - short term

The projects with a low priority (dredging of narrow sections) will be executed after the high priority projects have been implemented. These projects will start around 2008. The low priority dredging and training works concern dredging of the remaining locations at Sremska Mitrovica (project S1.4) and Provo (project S1.8).

River Information Services will be realized in 2009 and 2010.

The improvement of the Sava to a Class Va waterway can be implemented on a short term as can be derived from Table 6.

Option S2 - Implementation schedule

The implementation schedule of the projects is presented in Table 7.

Table 7 Option S2 - Implementation schedule

Project	Year of implementation (20..)																			
	Short term			Medium term							Long term									
	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A. High priority projects																				
Dredging and training works at 5 shallow sections and 3 sharp bends including Drina Confluence	x	x	x	x	x															
Miscellaneous projects	x	x	x	x	x															
B. Low priority projects																				
Dredging and training works at 3 narrow sections and 2 remaining less sharp bends						x														

For the implementation of Option S2 it is assumed that more time is required than for the implementation of Option S1, mainly because of the high investment costs of the high priority projects (53.6 million Euros). It is expected that the high priority projects will be implemented on a short and medium term between 2006 and 2010. After completion of these projects, the projects with a lower priority will be implemented on the medium term, probably around 2011 and 2012.

1.6 Economic evaluation

Basis of cost benefit analysis

For the Sava an analysis has been made of costs and benefits based on the selected development scenario and transport strategy.

The Sava is declared an international waterway, therefore the investments and costs incurred to implement one of the strategies cannot be recovered by means of charges levied against users of the system, such as fairway tolls, etc. Consequently, it is necessary to examine whether the transport benefits that would accrue to such users as a result of navigational improvements to the river system, would be sufficient to justify investment recovery from an economic perspective. Therefore, the cost benefit analysis (CBA) will be restricted to the determination of the economic viability.

The transport strategy **Status Quo** is the strategy where it is assumed that no capital investments are taking place till 2025 and this is considered to be the reference base for the CBA. However, it is assumed that maintenance will be carried out to the extend to keep the present status of the system

The transport strategy **International Standards** implies that the Sava will be made suitable for Class Va vessels (Option S1). The transport strategy Highway implies the Sava will be made suitable for Class Vb vessels and depth of 2.5 metres (Option S2).

For the CBA the economic development scenario (and the related freight transport forecasts till the year 2025) **EU Integration** is selected as this is the most probable economic scenario to happen. Under the Isolation economic scenario, it seems unnecessary for the Serbian IWT system to be improved. The Balkan Tiger economic scenario is considered to have a small probability.

The financial and economic feasibility of the proposed projects has been assessed for each of the two transport improvement strategies, being International Standards and Highway and for the economic scenario EU integration.

Capital Investments per transport strategy

The total capital investments required to bring the Sava up to transport strategy **International Standards** per system (except for DTD Hydrosystem up to design standards) are € 14.4 million.

The total capital investments required to bring the Sava up to transport strategy **Highway** are € 59.3 million.

For the two proposed transport strategies only the economic benefits accrued from the change to the modal split of IWT is taken into consideration.

The other possible economic benefit, transport time savings because of the implementation of the transport strategies, is considered to be negligible. Also other indirect cost savings, like less air pollution, have not been taken into account.

Transport schemes are sometimes advocated on the grounds that they will create jobs in assisted areas, which are targeted by government as locations in which additional employment is socially beneficial. Where this applies, the implication is that employment creation is not seen as the criterion by which to appraise schemes but as to an issue additional to the benefits captured by the CBA.

Transport costs saving

To quantify the transport costs savings assumptions have been made from which mode of transport IWT will capture market share. It has been assumed that the Sava will capture her traffic growth completely from the rail market share.

The present cost structure was analysed for the different modes of transport and the actual costs per tonne-km per mode of transport have been determined as follows:

- IWT 0.011 €/t-km;
- Rail 0.027 €/t-km (saving € 0.016 compared to IWT);
- Road 0.052 €/t-km (saving € 0.041 compared to IWT).

It is expected that in due time, the transport costs per mode of transport in Serbia will increase and consequently, that gradually those costs will come to West European levels as experienced at present. This results in the following Serbian transport costs for the year 2025:

- IWT 0.042 €/t-km;
- Rail 0.065 €/t-km (saving € 0.023 compared to IWT);
- Road 0.248 €/t-km (saving € 0.206 compared to IWT).

Cost benefit analysis - transport strategy International Standards

Based on the results of the traffic forecast, the modal split, the selected transport strategy and the cost savings, the cost benefit analysis has been prepared.

The results of the cost-benefit analysis indicate that the investments in the Sava presented in Table 8 are economical feasible. The Economic Internal Rates of Return is above 12% and all Net Present Values are positive.

Table 8 CBA - International Standards - Option S1

Economic criterion	Sava
Total capital investments	14.4 million €
EIRR	47%
NPV (10%)	33.6 million €
NPV (15%)	14.8 million €

Source: Consortium

Cost Benefit Analysis – transport strategy Highway - Option S2

The results of the cost-benefit analysis presented in Table 9 also indicate that also the investments for option S2 are economical feasible

Table 9 CBA per Serbian IWT subsystem - Highway

Economic criterion	Sava
Total capital investments	59.3 million €
EIRR	32%
NPV (10%)	70.7 million €
NPV (15%)	28.4 million €

Source: Consortium

The EIRR for the Sava is lower compared with the International Standards transport strategy and therefore it is proposed to improve the Sava to a Class V waterway in Serbia (Option S1).

ANNEX 3.2 MAP OF THE SAVA

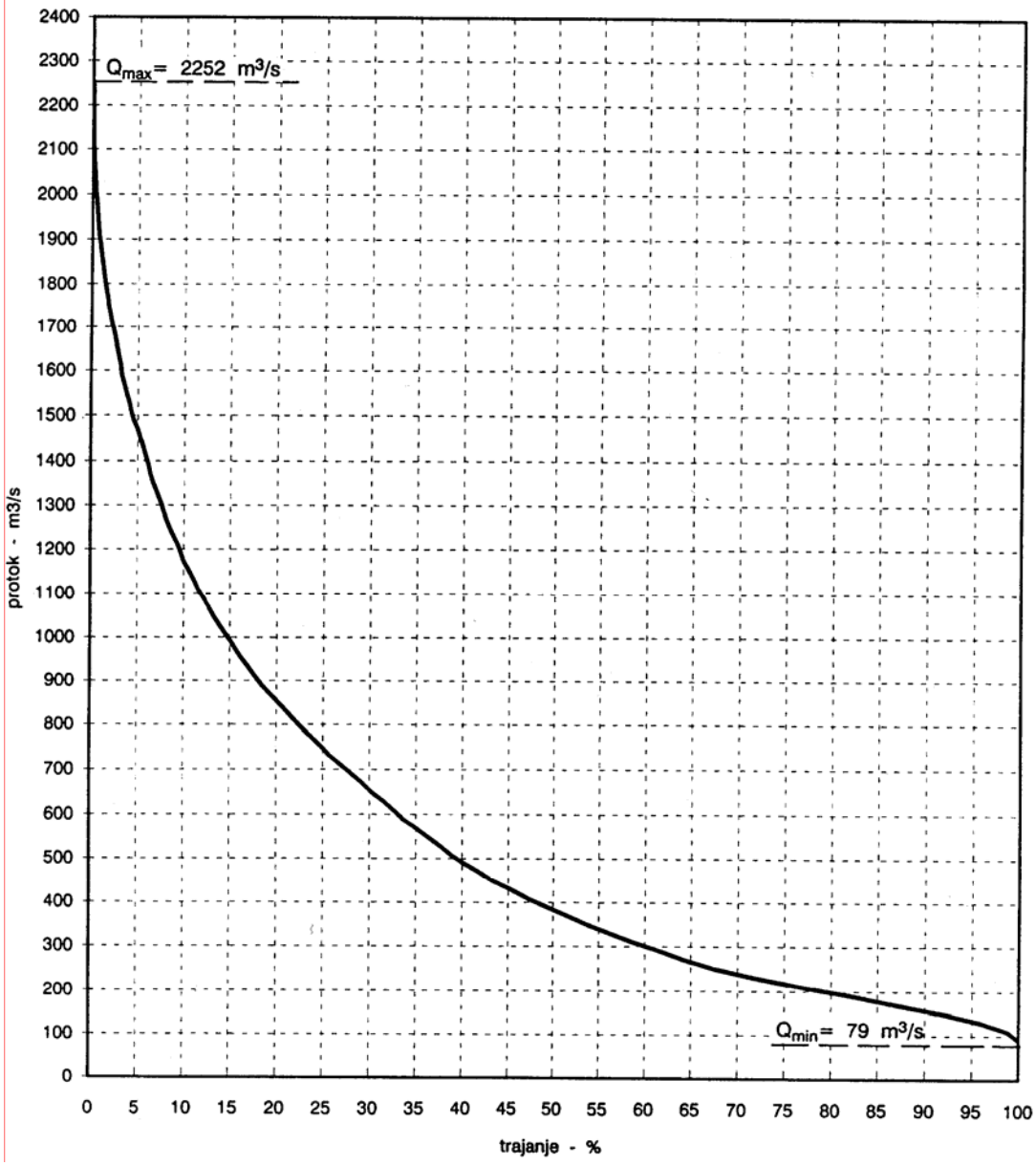
ANNEX 3.3 RATING CURVES FOR CRNAC AND ZUPANJA

SAVA - CRNAC

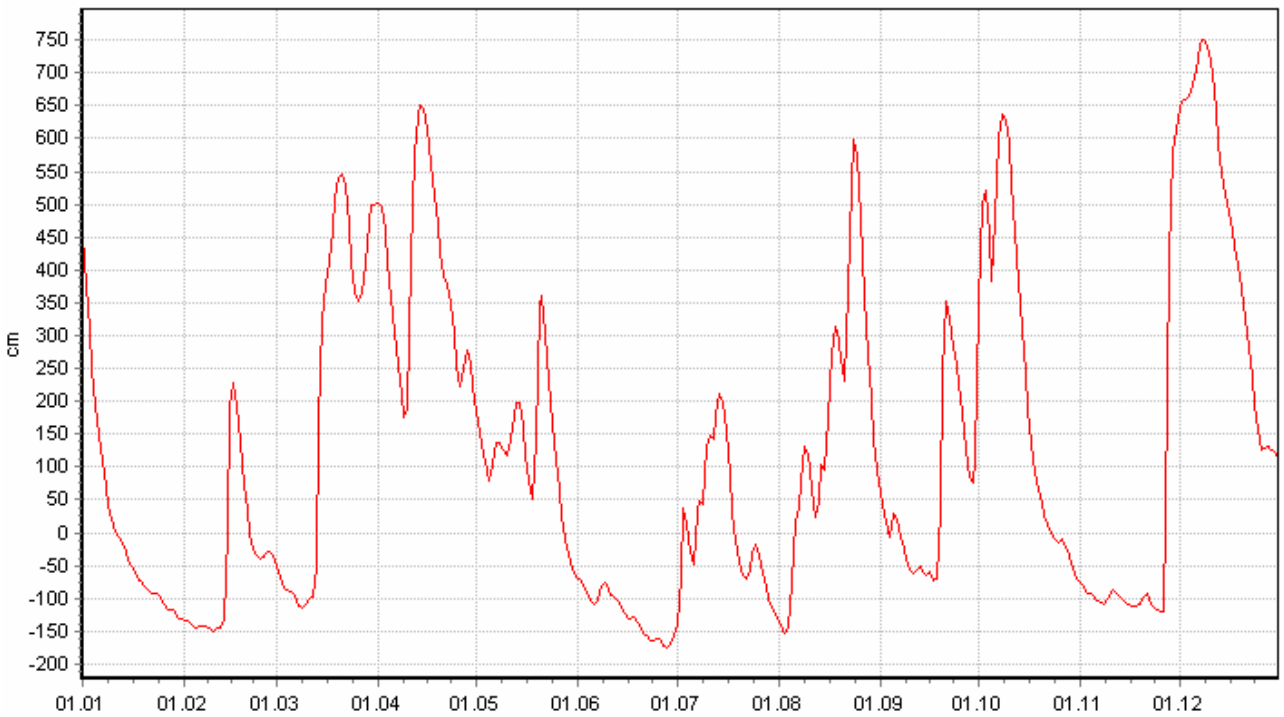
Krivulja trajanja dnevnih protoka

1970. - 1990. god.

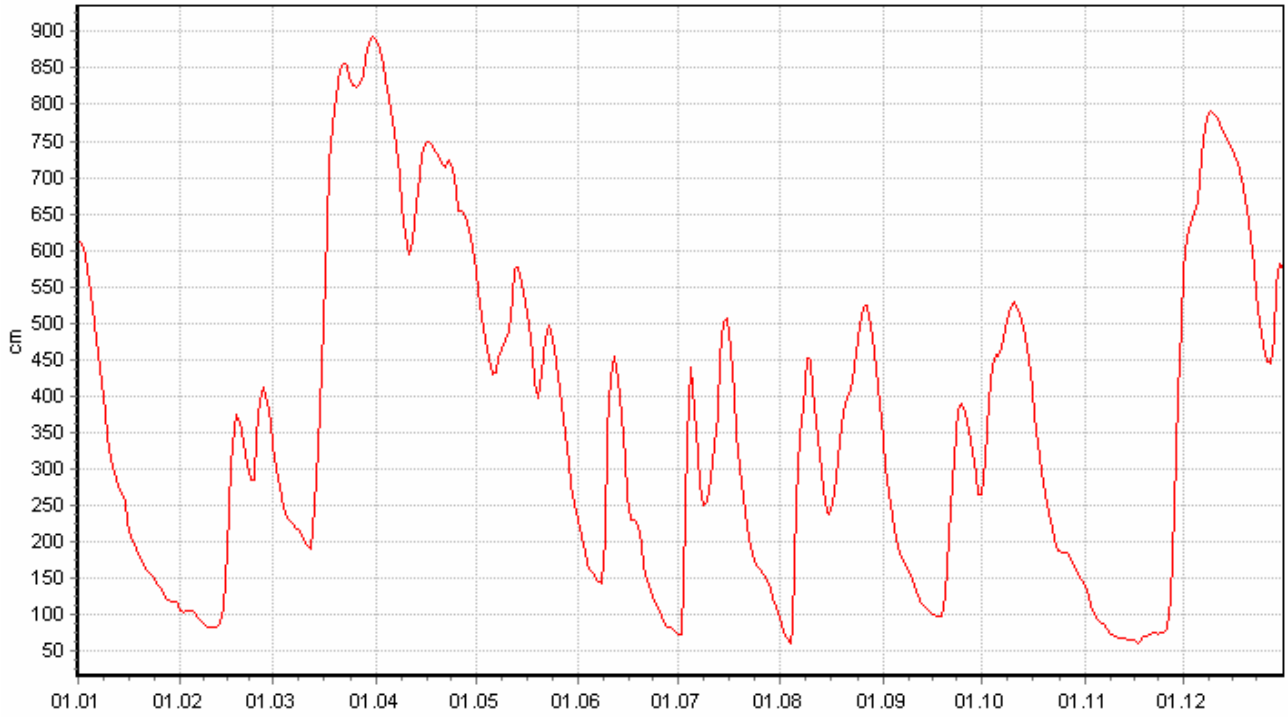
TRAJANJE DNEVNIH PROTOKA			
Trajanje - %	Protoci - m^3/s	Trajanje - %	Protoci - m^3/s
maksimum	2252	50	384
1	1868	60	301
5	1467	70	239
10	1174	75	217
20	855	80	198
25	747	90	158
30	655	95	135
40	492	minimum	79



ANNEX 3.4 WATER LEVEL MEASUREMENTS FOR CRNAC AND ZUPANJA



H/t Crnac (2005)



H/t (Zupanja 2005)

ANNEX 3.5 DETAILED DESIGN PARAMETERS FOR INLAND WATERWAYS

DETAILED PARAMETERS FOR INLAND WATERWAY CLASSIFICATION - "SAVA INITIATIVE"
according to (UN/ECE, GENEVA 1996.)

WATERWAY	IMPORTANCE		REGIONAL					INTERNATIONAL																		
	CLASS		I		II		III	IV			Va			Vb			VIa		VIb		VIc			VII		
	CLASS MARK																									
MOTOR VESSELS AND BARGES	SKETCH	t & s																								
		p																								
	l (m)	t & s	41		57		67 - 70	80-85			95-110			95-110			95-110		120-140		120-140			120-150		
		p						70			76.5-85			76.5-85			76.5-85		76.5-85		76.5-85			76.5-85		
	b (m)	t & s	4.7-5.05		8.2 - 9.0 - 10.1		8.2 - 9.0 - 10.1	9.5			11.4			11.4			11.4		13-15		13-15			15		
		p						9.5			11.4			11.4			11.4		11.4		11-11.4			11-11.4		
	t (m)	t & s	1.4		1.6 - 2.0		1.6 - 2.0	2.5			2.5-2.8			2.5-2.8			2.5-2.8		2.8-3.9		2.80-3.90			3.90 - 4.5		
		p						2.5 - 2.8			2.5-4.5			2.5-4.5			2.5-4.5		2.5-4.5		2.50-4.50			2.50-4.50		
	W (t)	t & s	180		500 - 630		470 -700	1 000 - 1 500			1 500-3 000			1 500-3 000			1 500-3 000		3 000-6 000		3 000-6 000			3 000-6 000		
		p									1 600-3 000			1 600-3 000			1 600-3 000		1 600-3 000		1 600-3 000			1 600-3 000		
PUSHED CONVOYS	CONVOYS							P.1			P.1			P.1.2			P.2.1		P.2.2		P.3.2	P.2.3		P.3.3		
	l (m)						118 - 132	85			95 - 110			172 - 185			95 - 110		185 - 195		195	270 - 280		285		
	b (m)						8.2 - 9.0	9.5			11.4			11.4			22.8		22.8		33	22.8		33-34.2		
	t (m)						1.6 - 2.0	2.5 - 2.8			2.5 - 4.5			2.5 - 4.5			2.5 - 4.5		2.5 - 4.5		2.5 - 4.5			2.5 - 4.5		
	W (t)						1000 - 1200	1250 - 1450			1600 - 3000			3200 - 6000			1600 - 3000		6400 - 12000		9600 - 18000			14500 - 27000		
MAIN CLASS PARAMETERS			Regulated rivers		Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Canals	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers	Regulated rivers	Canalized rivers
	R_{min} (m)		250		250	250 - 450	300	300 - 550	360	360	700	360	360	750	450	450	800	450	450	600	600	750	1000	1000	1200		
	T_{NPVpg} (%); T_{NPVrg} (%)		65; -		65; -	85; 90	65; -	85; 90	65; 95	85; 95	-	65; 95	85; 95	-	65; 95	85; 95	-	65; 95	95; 95	65; 95	95; 95	65; 95	95; 95	95; 95			
DIMENSION OF FAIRWAY	T (m)								2.3		2.2	2.4		2.4	2.4		2.4										
	T_v (m) + Δ		1.3		1.3	1.6	1.6	2	3.3		3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.7	3.7	3.6	3.6	3.8	3.8	3.8	3.8		
	B (m)		35		45		45		55		30	55		35	65		40	75		100		140	120	150			
	B_{zav} (m)	for min l_{sast}	25		35		40		75		40	85		40	95		50	100		120		150	125	170	160		
		for max l_{sast}	35		45		45		75		40	90		45	100		55	120		150		180	125	200	160		
SAFETY CLEARENS BETWEEN VESSEL AND BRIDGE/POWER LINES	H_{most} (m)		3		3		4		7			7			7			9.5	10	9.5	10	9.5	10	9.5	10		
	minB_{most} (m)		35		45		45		45		30	55		35	65		40	75		100		140	120	150			
	H_{kab} (m)	up to 110 kV	15		15	15	15	15	15	15	15	15	15	15	15	15	15	19	19	19	19	19	19	19	19		
		up to 250 kV	15.75		15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	20.40	20.40	20.40	20.40	20.40	20.40	20.40	20.40		
		up to 400 kV	17		17	17	17	17	17	17	17	17	17	17	17	17	17	21.9	21.9	21.9	21.9	21.9	21.9	21.9	21.9		
	H_{nnkab} (m)		12		12	12	12	12	12	12	12	12	12	12	12	12	12	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5		
	B_{kab} (m); B_{nnkab} (m)		B_{kab}; B_{nnkab} = širina rubova pokosa kanala ili udaljenost vanskih stopa obrambenih nasipa kod rijeka iznad VPV + 12.0m																									
DIMENSION OF LOCKS	T_{prev} (m)		1.6		2	2.25	2.5	2.5	3.0			4.0			4.5			4.5		4.5		4.75	4.75	4.75			
	minB_{prev} (m)		10		10		10		10.0 - 12.5			12.5			12 - 25			26		24 - 26		34 - 37	24 - 26	34 - 37			
	minL_{prev} (m)		60		60		70 - 75		90 - 190			115 - 190			190 - 210			230		230		260 - 310	310	310			

l (m) - length
b (m) - beam
t (m) - maximum draught
W (t) - tonnage
t & s - barges and motor vessels
p - pushed unit
Rmin (m) - minimal radius of curvature
TNPVpg (%) - duration of low navigation level (NPV) for navigation including maximum draught (% of navigable days with NPV or higher levels)
TNPVrg (%) - duration of low navigation level (NPV) for navigation including reduced draught (% of navigable days with NPV or higher levels)
T (m) - depth of fairway for navigation with reduced draught (95% duration)
Tv (m) - depth on a level of draught below NPV (with velocity submersion and skew)
Δ (m) - absolute reserve
B (m) - width of waterway in a stream
Bzav (m) -
lsast (m) - dužina merodavnog plovila ili postikivanog sastava

P.1 
P.1.2 
P.2.1 
P.2.2 
P.3.2 
P.2.3 
P.3.3 

H_{most} (m) - vertical clearance under the bridges
minB_{most} (m) - horizontal clearance under the bridge
H_{kab} (m) - vertical clearance under the power lines
H_{nnkab} (m) - vertical clearance under the cables
B_{kab} (m) - horizontal clearance under the power lines
B_{nnkab} (m) - horizontal clearance under the cables
T_{prev} (m) - depth on lock gate
minB_{prev} (m) - minimal width of chamber of lock
minL_{prev} (m) - minimalna dužina prevodnice

ANNEX 3.6 COST ESTIMATE AND BREAKDOWN

Annex 3.6.1 Construction costs dredging and training works (Part 1)

Section				Construction costs dredging & river training works					% allocated to navigation				Construction costs allocated to navigation				
Project	#	From km. to km….	Length (km)	Construction groynes	Construction bank protections	Construction sills	Dredging	Total	Construction groynes	Construction bank protections	Construction sills	Dredging	Construction groynes	Construction bank protections	Construction sills	Dredging	Total
DTW1	I	202.5 225.1	22.6	0	0	0	1,190,000	1,190,000	100%	0%	100%	100%	0	0	0	1,190,000	1,190,000
DTW2	II	225.1 260.7	35.6	0	7,310,000	0	60,000	7,370,000	100%	0%	100%	100%	0	0	0	60,000	60,000
DTW3	III	260.7 306.8	46.1	0	1,030,000	0	600,000	1,630,000	100%	0%	100%	100%	0	0	0	600,000	600,000
DTW4	IV	306.8 331.5	24.7	3,160,000	120,000	0	2,340,000	5,620,000	100%	100%	100%	100%	3,160,000	120,000	0	2,340,000	5,620,000
DTW5	V	331.5 364.4	32.9	0	2,900,000	0	50,000	2,950,000	100%	0%	100%	100%	0	0	0	50,000	50,000
DTW6	VI	364.4 395.5	31.1	1,120,000	750,000	20,000	1,650,000	3,540,000	100%	100%	100%	100%	1,120,000	750,000	20,000	1,650,000	3,540,000
DTW7	VII	395.5 417.1	21.6	0	8,340,000	0	0	8,340,000	100%	0%	100%	100%	0	0	0	0	0
DTW8	VIII	417.1 445.7	28.6	0	7,100,000	0	420,000	7,520,000	100%	0%	100%	100%	0	0	0	420,000	420,000
DTW9	IX	445.7 459.9	14.2	0	3,000,000	0	110,000	3,110,000	100%	0%	100%	100%	0	0	0	110,000	110,000
DTW10	X	459.9 480.4	20.5	0	890,000	0	10,000	900,000	100%	0%	100%	100%	0	0	0	10,000	10,000
DTW11	XI	480.4 511.8	31.4	0	18,120,000	0	90,000	18,210,000	100%	0%	100%	100%	0	0	0	90,000	90,000
DTW12	XII	511.8 546.8	35.0	1,200,000	2,460,000	260,000	1,020,000	4,940,000	100%	100%	100%	100%	1,200,000	2,460,000	260,000	1,020,000	4,940,000
DTW13	XIII	546.8 568.8	22.0	2,860,000	3,080,000	10,000	2,540,000	8,490,000	100%	100%	100%	100%	2,860,000	3,080,000	10,000	2,540,000	8,490,000
DTW14	XIV	568.8 588.2	19.4	630,000	220,000	0	2,340,000	3,190,000	100%	100%	100%	100%	630,000	220,000	0	2,340,000	3,190,000
	TOTAL	202.5 588.2	385.7	8,970,000	55,320,000	290,000	12,420,000	77,000,000					8,970,000	6,630,000	290,000	12,420,000	28,310,000

Notes
1) Data have been taken from the preliminary design report to improve the Sava to class IV (VPB, 2007)
2) VAT is not included
3) Construction costs refer to the amount a contracting authority has to pay a contractor
4) All costs are in EURO
5) Costs are based on standarized unit rates provided by Croatian Waters

Notes
1) Not only navigation benefits from these works and therefore the costs are partly allocated to navigation
2) Construction of groynes = 100% for navigation
3) Bank protection are usually not required for navigation unless a river section is very dynamic or in combination with groynes. If groynes are constructed / repaired, then 100% is allocated to navigation, other wise 0%
4) Construction of sills = 100% for navigation
5) Dredging = 100% for navigation

Annex 3.6.1 Construction costs dredging and training works (Part 2)

Section				Yearly maintenance costs				Maintenance costs allocated to navigation				
Project	#	From km. to km….	Length (km)	Groynes	Bank protections	Sills	Dredging	Groynes	Bank protections	Sills	Dredging	Total
DTW1	I	202.5 225.1	22.6	2%	2%	4%	25%	0	0	0	297,500	297,500
DTW2	II	225.1 260.7	35.6	2%	2%	4%	5%	0	0	0	3,000	3,000
DTW3	III	260.7 306.8	46.1	2%	2%	4%	5%	0	0	0	30,000	30,000
DTW4	IV	306.8 331.5	24.7	2%	2%	4%	5%	63,200	2,400	0	117,000	182,600
DTW5	V	331.5 364.4	32.9	2%	2%	4%	5%	0	0	0	2,500	2,500
DTW6	VI	364.4 395.5	31.1	2%	2%	4%	5%	22,400	15,000	800	82,500	120,700
DTW7	VII	395.5 417.1	21.6	2%	2%	4%	5%	0	0	0	0	0
DTW8	VIII	417.1 445.7	28.6	2%	2%	4%	5%	0	0	0	21,000	21,000
DTW9	IX	445.7 459.9	14.2	2%	2%	4%	5%	0	0	0	5,500	5,500
DTW10	X	459.9 480.4	20.5	2%	2%	4%	5%	0	0	0	500	500
DTW11	XI	480.4 511.8	31.4	2%	2%	4%	5%	0	0	0	4,500	4,500
DTW12	XII	511.8 546.8	35.0	2%	2%	4%	5%	24,000	49,200	10,400	51,000	134,600
DTW13	XIII	546.8 568.8	22.0	2%	2%	4%	5%	57,200	61,600	400	127,000	246,200
DTW14	XIV	568.8 588.2	19.4	2%	2%	4%	5%	12,600	4,400	0	117,000	134,000
	TOTAL	202.5 588.2	385.7					179,400	132,600	11,600	859,000	1,182,600

Notes

1) Yearly maintenance costs have been estimated as a percentage of the construction costs
2) For bank protection and groynes maintenance is estimated at 2%
3) Maintenance of sills involves under water inspection and maintenance which is relatively expensive
A value of 4% is estimated
4) Maintenance dredging in sections where training works are constructed is low, as the training works prevent accretion. For these section 5% maintenance is assumed
5) It has been assumed that in sections without training works, maintenance dredging is required every 4 years.
Consequently the yearly maintenance is 25%

Annex 3.6.2 Costs for river bend improvements

Description				Required works		Costs (Euro)	
Project	Name	Description	From km. to km….	# of waiting areas	additional marking	Construction costs	Yearly maintenance
RB1	River bends Section XI	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI	480.4 511.8	1	5	187,500	9,375
RB2	River bends Section XII	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII	511.8 546.8	3	15	562,500	28,125
RB3	River bends Section XIII	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII	546.8 568.8	2	10	375,000	18,750
RB4	River bends Section XIV	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV	568.8 588.2	1	5	187,500	9,375
Total				7	35	**1,312,500**	**65,625**

Notes
1) The construction costs for a waiting area have been estimated at 20,000 EUR
2) The construction costs for additional marking has been estimated at 1,000 EUR
3) Annual maintenance is estimated at 5% of the construction costs

Annex 3.6.3 Costs for marking improvement projects

Description					Costs	
Project	Name	Description	From km. to km….	Length (km)	Construction costs	Yearly maintenance
M1	Marking	Upgrading of the system and maintenance in arrear	207			
	S. Border - Oprisavci		335	128.0	416,667	208,333
M2	Marking	Upgrading of the system and maintenance in arrear	335			
	Oprisavci - Sisak		651	316.0	138,889	222,222
Total					**555,556**	**430,556**

Notes
1) Data have been taken from the Agency for Inland Water Ways
2) VAT not included
3) For 2008 maintenance of 2,290,000 HRK (≈ 318,000 EUR) is planned for project M2

Annex 3.6.4 Cost of bridge construction works

Description				Costs	
Project	Name	Chainage (km)	Description	Construction	Yearly maintenance
B1	Jasenovac bridge	511.3	Replacement of the Jasenovac bridge to garantuee minimum vertical clearance	10,000,000	50,000
Total				**10,000,000**	**50,000**

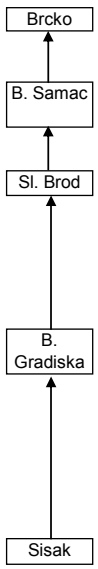
Annex 3.6.5 Cost overview and investment schedule (Part 1)

	Project description			A. Construction costs (EUR)	Additional costs		D. Investment Costs (A+B+C)	Yearly maintenance (EUR)
	#	Chainage	Description		B. Contingencies (10% of A)	C. Project realization (15% of A+B)		
Brcko	DTW1	202.5 225.1	Execute dredging works to improve Sava fairway depth in Section I	1,190,000	119,000	196,350	1,505,350	297,500
	DTW2	225.1 260.7	Execute dredging and training works to improve Sava fairway depth in Section II	60,000	6,000	9,900	75,900	3,000
B. Samac	DTW3	260.7 306.8	Execute dredging and training works to improve Sava fairway depth in Section III	600,000	60,000	99,000	759,000	30,000
	DTW4	306.8 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV	5,620,000	562,000	927,300	7,109,300	182,600
Sl. Brod	DTW5	331.5 364.4	Execute dredging and training works to improve Sava fairway depth in Section V	50,000	5,000	8,250	63,250	2,500
	DTW6	364.4 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI	3,540,000	354,000	584,100	4,478,100	120,700
	DTW7	395.5 417.1	Execute training works to improve Sava fairway depth in Section VII	0	0	0	0	0
	DTW8	417.1 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII	420,000	42,000	69,300	531,300	21,000
	DTW9	445.7 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX	110,000	11,000	18,150	139,150	5,500
B. Gradiska	DTW10	459.9 480.4	Execute dredging and training works to improve Sava fairway depth in Section X	10,000	1,000	1,650	12,650	500
	DTW11	480.4 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI	90,000	9,000	14,850	113,850	4,500
	DTW12	511.8 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII	4,940,000	494,000	815,100	6,249,100	134,600
	DTW13	546.8 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII	8,490,000	849,000	1,400,850	10,739,850	246,200
	DTW14	568.8 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV	3,190,000	319,000	526,350	4,035,350	134,000
Sisak								
	RB1	480.4 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI	187,500	18,750	30,938	237,188	9,375
	RB2	511.8 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII	562,500	56,250	92,813	711,563	28,125
	RB3	546.8 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII	375,000	37,500	61,875	474,375	18,750
	RB4	568.8 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV	187,500	18,750	30,938	237,188	9,375
	M1	207 335	Upgrading of the marking system and maintenance in arrear for the section S. Border - Oprisavci	416,667	*Investments have been calculated according to schedule provided by the Inland Waterway Agency*		416,667	208,333
	M2	335 651	Upgrading of the marking system and maintenance in arrear for the section Oprisavci - Sisak	138,889			138,889	222,222
	B1	511.3	Replacement of the Jasenovac bridge to garantuee minimum vertical clearance	10,000,000	1,000,000	1,650,000	12,650,000	375,000
			Total costs	**40,178,056**	**4,017,806**	**6,629,379**	**50,825,241**	**2,053,780**

Notes

1) In order to determine the costs for the actual implemenation of the projects, additional costs have been included for project realisation and contingencies
2) The project realisation costs will be made in the before project construction works start
3) Project implementation might start in 2007 and construction works might start in 2008
4) Providing an international connection for the ports of Slavonski Brod and Brcko is a key priority. Section I -V have to be improved first, starting from downstream in upstream direction. Thereafter the sections from Slavonski Brod till Sisak will be improved starting with the most critical sections, in the following order: XII, XIII, VI, VIII, XI, XIV, VII, IX, X
5) Construction of waiting areas and additional traffic guidance in river bends has to executed on a short term as it will increase safety for navigation with realtively low investments
6) Improvement of the marking system has a high priority as it will enhance swift and safe navigation on the Sava
7) According to the workplan for improvement of the Sava to Class IV, realisation of the proposed works is practically feasible from 2008 to 2012
8) Replacement of the Jasenovac bridge (project B1) is planned for implementation after implementation of the dredging and training works and the upgrade of the marking system. Till that time only transport with barges carrying two layers of containers is possible on the Sava. This is not considered an initial bottleneck for the development of container transport

Annex 3.6.5 Cost overview and investment schedule (Part 2)



Project description			Year									
#	Chainage	Description	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
DTW1	202.5 225.1	Execute dredging works to improve Sava fairway depth in Section I	196,350	1,309,000	297,500	297,500	297,500	297,500	297,500	297,500	297,500	297,500
DTW2	225.1 260.7	Execute dredging and training works to improve Sava fairway depth in Section II	9,900	66,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
DTW3	260.7 306.8	Execute dredging and training works to improve Sava fairway depth in Section III	99,000	660,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
DTW4	306.8 331.5	Execute dredging and training works to improve Sava fairway depth in Section IV	927,300	6,182,000	182,600	182,600	182,600	182,600	182,600	182,600	182,600	182,600
DTW5	331.5 364.4	Execute dredging and training works to improve Sava fairway depth in Section V	8,250	55,000	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
DTW6	364.4 395.5	Execute dredging and training works to improve Sava fairway depth in Section VI			584,100	3,894,000	120,700	120,700	120,700	120,700	120,700	120,700
DTW7	395.5 417.1	Execute training works to improve Sava fairway depth in Section VII				0	0	0	0	0	0	0
DTW8	417.1 445.7	Execute dredging and training works to improve Sava fairway depth in Section VIII			69,300	462,000	21,000	21,000	21,000	21,000	21,000	21,000
DTW9	445.7 459.9	Execute dredging and training works to improve Sava fairway depth in Section IX				18,150	121,000	5,500	5,500	5,500	5,500	5,500
DTW10	459.9 480.4	Execute dredging and training works to improve Sava fairway depth in Section X				1,650	11,000	500	500	500	500	500
DTW11	480.4 511.8	Execute dredging and training works to improve Sava fairway depth in Section XI			14,850	99,000	4,500	4,500	4,500	4,500	4,500	4,500
DTW12	511.8 546.8	Execute dredging and training works to improve Sava fairway depth in Section XII		815,100	5,434,000	134,600	134,600	134,600	134,600	134,600	134,600	134,600
DTW13	546.8 568.8	Execute dredging and training works to improve Sava fairway depth in Section XIII		1,400,850	9,339,000	246,200	246,200	246,200	246,200	246,200	246,200	246,200
DTW14	568.8 588.2	Execute dredging and training works to improve Sava fairway depth in Section XIV			526,350	3,509,000	134,000	134,000	134,000	134,000	134,000	134,000
RB1	480.4 511.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XI	30,938	206,250	9,375	9,375	9,375	9,375	9,375	9,375	9,375	9,375
RB2	511.8 546.8	Construction of waiting areas and traffic guidance in 6 sharp river bends in Section XII	92,813	618,750	28,125	28,125	28,125	28,125	28,125	28,125	28,125	28,125
RB3	546.8 568.8	Construction of waiting areas and traffic guidance in 2 sharp river bends in Section XIII	61,875	412,500	18,750	18,750	18,750	18,750	18,750	18,750	18,750	18,750
RB4	568.8 588.2	Construction of waiting areas and traffic guidance in 1 sharp river bends in Section XIV	30,938	206,250	9,375	9,375	9,375	9,375	9,375	9,375	9,375	9,375
M1	207 335	Upgrading of the marking system and maintenance in arrear for the section S. Border - Oprisavci	416,667	208,333	208,333	208,333	208,333	208,333	208,333	208,333	208,333	208,333
M2	335 651	Upgrading of the marking system and maintenance in arrear for the section Oprisavci - Sisak	138,889	318,000	222,222	222,222	222,222	222,222	222,222	222,222	222,222	222,222
B1	511.3	Replacement of the Jasenovac bridge to garantuee minimum vertical clearance					1,650,000	11,000,000	375,000	375,000	375,000	375,000
		Total costs	**2,012,919**	**12,458,033**	**16,979,380**	**9,376,380**	**3,454,780**	**12,678,780**	**2,053,780**	**2,053,780**	**2,053,780**	**2,053,780**

ANNEX 3.7 DETAILED COST BREAKDOWN MARKING AND SIGNALLING (year)

Sections of inland waterways to be marked: Sava 207.0 – 586.0km

Division of the marking of Inland Waterway on borderline parts of river

The Sava is partially flowing along the borderline and therefore marking is done jointly by the riparian states.

Regulations for this plan have been arranged in March 2005 in a joint book of regulation.

Croatia and BIH did not yet reach an agreement on marking from 207 – 507 km is planned for 2007. A delegation set up from experts of both countries suggested marking should be divided transversally, with BIH responsible for section Račinovci – Oprisavci (207 – 335 km) on both sides and Croatia from Oprisavci – Jasenovac (335 – 507 km) on both sides.

Till the agreement is reached the right bank of the river is marked only sufficiently for safe shipping. On the remaining exclusively Croatian part of the Sava (507 – 586 km) marking is done on both sides by Croatia.

In case of reaching a different agreement the division of marking can be changed.

Overview of safety objects for marking and signalization by type and number

The table Annex 3.7.1 presents an overview of safety objects for marking and signalization by type and number given also by jurisdiction of Port Master Office.

The execution of marking will continuously be done in the period 01.01.2006 – 31.12.2006.

Marking standards

All inland waterways are being marked according to the Ordinance of Inland Waterway Navigation (NN 50/02).

- navigable path on Sava and Kupa is marked for day/night shipping
- floating marks on Sava and Kupa consist of light and non-light buoys as permanent marks and as temporary buoys
- new shore marks will have reflecting signs
- new km marks will have tables with reflecting colour
- light bodies on new marks with solar charging
- introducing solar technology and LED diodes during renovation
- damaged and worn out markings repair if reasonable, otherwise change with new ones
- contractors have to have at disposal a certain amount of reserve markings and light bodies, especially floating marks
- markings on objects or facilities representing permanent or temporary obstacles to shipping (bridges, cables, sunken objects, ferries, etc) have to be taken care of by their investors or owners
- marking system needs to be technologically upgraded and supplemented in sense of bettering conditions for safe shipping
- IT and communication electronic devices and equipment needs to be ordered and developed in coordination with CRORIS program (Croatian River Information System)

Assuring financial funds

Necessary funds are planned by the Annual program of marking works and the Annual financial plan of the Croatian Agency for Inland Navigation.

Elementary part of this plan is the table of marking by type and number on separate sections of inland waterway together with Information Technologies & communication equipment and devices.

Agency for IWT

Overlook of safety markings for shipping and Information Technologies and electronic devices for control and surveillance.

Table 3.7.1 Marking – Part 1

	TYPE OF MARK/EQUIPMENT	SAVA SISAK pieces	SAVA SL.BROD
A.	**IW MARKINGS**		
A.1.	**Mark buoys**		
A.1.1.	Light buoy	4	8
A.1.2.	Non-light buoy	6	2
A.1.4.	Buoy	37	42
	Total mark buoys	**47**	**52**
A.2.	**Shore marks**		
A.2.1.	Light shore mark	16	8
A.2.2.	Shore sign 1,00 m²	18	15
A.2.3.	Shore sign 1,00 m² with a crossing sign, arrow or additional table	18	10
A.2.4.	Shore sign 1,50 m²	15	8
A.2.5.	Shore sign 1,50 m² with an additional table or arrow	-	-
	Total shore marks	**67**	**41**
A.3.	**Km marks**	**135**	**124**
	TOTAL A:	**249**	**217**
B.	**IT&ELECTRONIC EQUIPMENT FOR SURVEILLANCE&CONTROL**		
B.1.	**FIAS program equipment**		
B.1.1.	Info panels on bridges		
B.1.2.	Communication equipment for buoys		
B.1.3.	Communication equipment for shore light marks		
B.1.4.	Tracking software		
B.2.	**CRORIS program equipment**		
B.2.1.	Base stations AIS (Čvorkovac, Vukovar,		
B.2.2.	Osijek, Opatovac)		
B.2.3.	UHF link (Vukovar skyscraper, Hotel		
B.2.4.	Osijek, Čvorkovac)		
B.2.5.	WLAN link (Opatovac)		
B.2.6.	Software network manager (ZG, VU, OS)		
B.3.	**Other control equipment**		
B.3.1.	Shore marks for positioning buoys in Mohovo canal		
B.3.2.	Radar signs on bridges		
	TOTAL B:		
C.	**OTHER EQUIPMENT (reserve)**		
C.1.	Accumulators	22	56
C.2.	Light bodies	3	20
C.3.	New buoys	2	2
C.4.	Old buoys	-	-
C.5.	Buoys	28	32

Table 3.7.1 Marking – Investment – Sava River - Part 2

Mark of the expences	Type of work/service	Planned expences (gross + PDV) (Kuna)
O.	**Marking of IW**	
	"Services of current and investment maintenance	
OT.	Scanning of IW and current maintenance of marking, equipment & devices:	
OT-3	For Sava, Slavonski Brod Port Master Office	1,050,000
OT-4	For Sava & Kupa, Sisak Port Master Office	1,050,000
	Total OT:	2,100,000
OI.	Investment maintenance of marking, equipment & devices	
OI-3	For Slavonski Brod Port Master Office jurisdiction	100,000
OI-4	For Sisak Port Master Office jurisdiction	90,000
	Total OI:	190,000
	Total :	**2,290,000**
	"Additional investments for other non financial assets	
ON.	Making and upgrading of new water safety objects for marking:	
ON-3	For Slavonski Brod Port Master Office jurisdiction (Oprisavci - Nova Gradiška):	
	- renovation of the system on the right BIH shore of Sava after talks with BIH authorities	600,000
	- upgrading on the left shore	100,000
ON-4	For Sisak Port Master Office jurisdiction (Nova Gradiška - Sisak)	300,000
	Total ON:	1,000,000
	Total :	3,290,000
	TOTAL MARKING CROATIA	3,290,000
	TOTAL MARKING BIH (Oprisavci - Serbian border)	3,000,000
	GRAND TOTAL (O)	6,290,000
C.	**CRORIS system**	
	"Services of current and investment maintenance"	
CO-1	Maintenance of IT&communication devices and devices for shipping control and surveillance of IWT (systems CRORIS&FIAS)	
	Estimated for Sava 30% of 910,000 Kuna	273,000
	Total CO-1:	273,000
	"Additional investments for other non financial assets"	
CN-1	Investments in IT&communication system of tracking IWT traffic and condition of IW	
	Estimated for Sava 30% of 690,000 Kuna	207,000
	Total CN-1:	207,000
	TOTAL C. - CRORIS system Sava River	480,000
	TOTAL - Annual program of marking (Kuna) (O+C)	**6,770,000**

4 PORTS IMPROVEMENT WORKS

4.1 Introduction

The main ports in Croatia along the Sava are the two ports at Sisak (being the port of Sisak along the river Kupa and the port of Crnac (oil terminal)) and of Slavonski Brod (oil terminal at Ruscica).

In Bosnia and Herzegovina (BiH) and the District of Brcko we have respectively the Port of Samac (BiH), port of Bosanski Brod and the port of Brcko (district of Brcko).

In Serbia the ports of Sremska Mitrovica and port of Samac have to be mentioned. The latter however only has a port onshore, but no quay wall where cargo can be (un)loaded.

Besides these ports there are also various terminals where sand and gravel are (un)loaded (like Zupanja in Croatia).

Most of the above mentioned ports have prepared their own Master Plan in view of future economic developments in the region.

Inland ports where cargo is (un)loaded are not present in **Slovenia**. However, it appears that a number of marinas exists and some terminals for (un)loading sand and gravel along the Sava.

The transport strategy of **Croatia** (prepared 1999) indicates clearly that the inland ports have to be part of the European network as ports of combined transports (multi-model nodes). According to this strategy each of the Croatian ports has to prepare its master plan. Till date the Port Authority of Slavonski Brod has prepared their master plan and is in an advance state to complete negotiations with potential investors who will construct and establish their facilities in the port.

In **BIH** the port of Samac has a detailed Master Plan which has been developed in view of the implemented and completed privatization of various industries which might generate cargo for the port. For the port of Bosanski Brod, which basically was an oil terminal with related (un)loading facilities no new plans have been generated. Although recently the government of BiH signed a memorandum of understanding with a Russian oil company to further investigate the feasibility of reviving the plant in view of the privatisation of the oil industry in BiH.

In **Serbia** the ports have been privatised and the government is not anymore in charge of the port developments.

4.2 Ports in Croatia

4.2.1 Croatia – Sisak port

The port of Sisak (along the Kupa river) has been privatised and is owned presently by “Pristanista i Skladista d.d.”

The two ports at Sisak are:

- The port along the river Kupa (left bank km 4,470 – 5,640);
- The crude oil unloading facility (port of Crnac) along the Sava (right bank - km 579.5).

During the pre-war (1990) period the port of Sisak was mainly (un)loading all kind of cargo for:

- the steel plant Zeljezara (10 km from Sisak);
- the fertilizer plant in Kutina;
- the crude oil for the INA refinery (at Crnac).

The two ports at Sisak were combined during the pre-war period the second port in the previous Federal Republic of Yugoslavia, with yearly on average 0.8 to 1.0 million tonnes. In that period fuel (end products) was transported from the Sisak refinery to Pancevo. At Crnac there used to be facilities (a separate terminal) for the handling of fuel.

The port along the river Kupa includes the following facilities:

- quay wall length: 400 meter;
- cranes: two cranes of 5 tons;
- grain silos;
- warehouses.

Sand and gravel handling is the only activity presently performed at the port. The port is allowed to handle up to a maximum of 70,000 tons of sand and gravel per year. The cranes are used to handle the sand and gravel. The port has no rolling stock and warehousing has been partly leased out, while the grain silos are not in use. The port has excellent rail and road connections to the national and international networks.

However, as the port is situated along the tributary Kupa to the Sava, which is a small river with low discharges with various small river bends, the required water depth for a class IV fairway is only available during a limited period of the year.

The crude oil unloading facility (at Crnac), consists presently of a barge with a length of 80 – 100 meter, from where the crude oil is pumped towards the oil tanks onshore on the INA premises.

FUTURE PLANS:

The port of Sisak does not have a Master Plan for future developments. This might have to do with the fact that it is not located along the Sava, that there are a number of bridges in between the Kupa-Sava confluence and the port location and the presence of a number of small river bends. The location of the port does not favour any new developments.

4.2.2 Croatia – Slavonski Brod port

The Port Authorities of Slavonski Brod was established in 1998 based on the Inland water port law.

The Port Authorities have signed LoIs with various companies/industries to start operations in the port area. By the end of February 2007 these companies/industries should have executed their due-diligence studies and the negotiations should then be concluded.

Presently, as a first step the Port Authorities is investing in a vertical quay wall of about 120 meter long, which is almost completed, about 1000 meter upstream of the crude oil terminal (pontoon) at Ruscisa. The railway track to the port and within the port area is under construction.

The main (better said the only) commodities handled in the port area in 2006 were:

- sand and gravel (dredged on the Sava → handled in the port → further transport by truck);
- crude oil (loaded at Ruscica and unloaded in Sisak).

However, the Master Plan development includes the following:

a. bio diesel plant:
   - Cargo in: 150,000 ton of raw material via the Danube and Sava to Sl. Brod.);
   - Cargo out: 150,000 ton of bio diesel for export of which 80% is scheduled for IWT.
b. Wood processing plant (wood logs):
   - Cargo in: 600,000 tons via IWT;
   - Cargo out: 400,000 tons via IWT.
c. Chassis production:
   - Cargo in: 300,000 tons of steel coils from the Ukraine via IWT;
   - Cargo out: 270,000 tons through IWT to Hungary and Slovakia.
d. Nafta terminal
   - Cargo in: 350,000 tons by IWT from Russia;
   - Cargo out: 350,000 tons but only by rail or truck and destined for Bosnia.
e. Cement silos (no IWT transport, only train and truck)
f. Warehousing/storage; mainly truck and rail related.

4.3 Ports in Bosnia and Herzegovina (BiH)

4.3.1 BiH – Bosanski Brod port

The large oil refinery at Bosanski Brod was damaged during the war in 1990 and has not been repaired. The refinery used to handle (unload) about 300,000 – 400,000 tons per year. End products from the plant were transported to the Bosnian hinterland by train/truck. IWT was not used.

The port also used to handle (in small quantities) crude oil originating from Slavonian oil fields which was transported by vessels (crossing the Sava) from Ruscica (Sl. Brod). The port facilities existed of a barge terminal with unloading facilities and pipelines to the tanks of the refinery.

The technology applied in this refinery is outdated. To get the cargo back an entire new refinery has to be built. A Russian oil company has shown interest. The plans presently being studied include a yearly production of about 4.2 million tons.

This is substantially higher than the production pre-war. Increase of the facilities will therefore be required and should be implemented to be able to ship products by IWT.

4.3.2 BiH – Samac port

The port has been privatised and is owned by Balkan Steel (Lichtenstein based). The official name is „Joint Stock Company Cargo Transport Centre Luka Samac“. The port was constructed in the period 1985 – 1990 with the purpose to establish a regional port for the Bosnian heavy industry. The port has been operational for two (2) years only (from 1990-1992). During the war the port was damaged and has not been used. Operation of the port restarted in 2006.

The existing facilities inclusive of the cranes are not operational. The cranes, the warehouse and storage facilities as well as the railway tracks and connection have to be repaired. The port has a 311 meter long quay wall equipped with two cranes (both have to be repaired) of 5 tons capacity.

The port of Samac will gain importance in view of the privatisation of the Bosnian heavy industry which may generate large quantities of bulk cargo to be shipped partly through the Sava, such as:

a. Industry in Prijedor area (iron ore production for export of which yearly 700,000 tons is railed to Vukovar/Osijek and from there shipped to Galati (Romania). A route to Samac and then shipped via the Sava to the Danube would lower the costs considerably. This quantity or at least (part thereof) can be captured by the port of Samac);
b. The steel plant in Zenica (future yearly handling of cargo (in and out) is about 6 million tons, of which about 1,200,000 tons could be captured by IWT and (un)loaded from Samac);
c. Steel plant in Dervanta (future yearly use of steel coils is 240,000 tons which could all be captured by IWT from Samac port, it originates from the Ukraine);
d. Banja Luka steel industries (the steel mill has a yearly capacity of 120,000 tons. Samac might be the port where the cargo can be handled);
e. Lukavac coal-cokes industry: (yearly capacity 30,000 tons).

Beside the above there is also cargo resulting from agriculture, sand and gravel.

4.3.3 District of Brcko – Brcko port

The port is a public company and is owned by Brcko district. The port has an operative shore of about 180 meter (quay wall) sufficient to accommodate 2 large vessels. It has connections with the TEN Corridor X and Corridor VII and is connected with the European railway network.

The port has suffered intensively from the damages caused by the war. Through a grant from the Italian government the port started (ship-shore) operation in 2001. During the period 1973/1974 the port handled about 1 million tons of cargo. This gradually decreased to 774,000 tons in 1984, 70,000 tons in 1990 and in 1991 to 16,000 tons. Then it stopped completely till repair works started. The ship-shore handling upon completion of the repair works increased from 35,000 tons in 2004 to about 80,000 tons in 2006.

The port has the following facilities:

a. 2 portal cranes: 5 and 6 tons capacity respectively;
b. Forklifts: 3 in total;
c. Loaders/dumpers: 1 in total;
d. Open storage space: 6 ha;
e. Closed storage space: 0.8 ha;
f. Railway track: 2.5 km;
g. Overall port area: 14.5 ha.

The port has a customs terminal, a large parking area and also handles sand and gravel.

The future plans of the port include:

- Renovation of the infrastructure, roads and storage capacities;
- Construction of a customs terminal;
- Orientation towards;
- Procurement of transhipment equipment.

The vessels that reach Brcko are up to Europe I barges (1,200 tons) or self propelled of 800 tons.

The privatisation of the port is subject of discussion.

4.4 Ports in Serbia

4.4.1 General

The economic centres in the Serbian hinterland are partly located in the Danube corridor. International cargoes originating from and destined for these centres are transported via the various hinterland modes. Voluminous and relatively cheap import bulk cargoes are mainly using the IWT mode from ports along the Black Sea.

More expensive international cargoes like containers are either transported via Adriatic ports (Koper, Rijeka, Bar) and land modes (rail and road) or via Black Sea ports (Constanza) and the IWT mode. The share of the various modes in the total volumes depends to a large extent on volumes, capacities, transit times, frequencies, services and prices.

Apart from the (intermodal) transport role of IWT ports and terminals related to imports and exports, comparable services are also being provided for the domestic transport flows. The ports do not have a direct relation with any transit flows.

4.4.2 Sabac port

Development plans for the port were made many years ago. As a first phase development a basin has been dredged, but no further developments took place, nor are intended to be implemented. The port in Sabac is not considered for any unloading of cargo resulting from shipping. The port is not equipped with a quay or with quay handling equipment.

A free zone is established at the port. Along the Sava in Sabac the Zorka Industry has its own (un) loading facilities.

4.4.3 Sremska Mitrovica port

The assumptions for the port region development are:

- Sand will remain to be handled, stored and traded in the port;
- The existing vertical quay wall structure will be used basically for other general cargoes;
- Flexible sand and gravel unloading and loading facilities need to be developed with the gradual growth of the general cargo traffic;
- Sremska Mitrovica may play a role in the inter-modal transport flows to and from the Sava hinterland.

Table 4.1 Sremska Mitrovica - Throughput and capacities for non-containerised cargoes (000 tons)

Terminal facility	2025 throughput	2001-02 throughput	2005 capacity	2025 additional required capacity
Luka Leget	202	2	50	152

To accommodate the new port requirements, as presented in Table 4.2, the existing vertical quay wall of 100 m is extended in the direction of the basin with a stretch of 75 m tot a total length of 175 m. Dredging works are required (some 60,000 m^3) to enlarge the basin in front of the projected new quay wall.

Table 4.2 Sremska Mitrovica - new port requirements

Description	unit	number	location
quay cranes (16 tons)	pcs	1	Luka Sr. Mitrovica
quay cranes (25/40 tons)	pcs	0	Luka Sr. Mitrovica
open storage area	ha	0	Luka Sr. Mitrovica
covered storage area	ha	0	Luka Sr. Mitrovica
length vertical quay	m^1	75	Luka Sr. Mitrovica
open storage	tons		sand terminal

4.5 Planned ports (development)

Near Zagreb (at Rugvica) plans were made pre-war (1990) to develop a port for Zagreb area specifically. However, due to the war the plans have been abandoned and new developments have not been initiated yet.

4.6 Facilities for tourist vessels and tourism development

The construction and expansion of the berthing facilities is proposed in various places along the Sava river, either in Croatia, Slovenia, Serbia or Bosnia and Herzegovina.

A waterfront has to be created where vessels can berth to accommodate the cruise tourists. A tourist accommodation area with restaurants, bars, shops, bus and taxi services, information centre is required to provide the services for the visitors.

In this respect small berthing facilities have to be developed at places along the Sava with specific tourist attractions.

4.7 Considerations and requirements for container development

Presently, along the Sava no container shipping takes place. However, when the cargo might pick up and the facilities at various ports are in place the containerization might take place.

In that case a proper location for an initial container handling facility or terminal should be determined. The following conditions and commercial, technical and operational requirements should preferably apply, in line with requirements set by the EU:

- near the main source of containerised import cargoes;
- preferably make use of existing infrastructure and facilities;
- connections to international waterway (Corridor VII) and railway/road network (Corridor X);
- capable of serving vessels used on the Corridor VII waterway in conformity with its class;
- efficient facilities for handling and storage of containers and other combined transport units;
- annual container handling capacity to be at least some 40,000 TEU per year;
- adjacent areas and favourable conditions for port industrial zone (free zone) development;
- conditions for modern and efficient trade and customs procedures including application of IT systems;
- proper ancillary services related to container transport (empties depot, container repair facilities, forwarding services, reefer connections, security services);
- private sector participation in port operations;
- combination with potential Ro-Ro handling facilities;
- reception facilities for the disposal of waste generated on board ships;
- expansion options.

4.8 European guidelines related to terminals for intermodal or combined transport

In the European Agreement on Main Inland Waterways of International Importance (AGN), terminals are considered to be important for international combined transport if these form together with the respective inland waterways and coastal routes a coherent network for combined transport and if these are already used for combined transport.

In Annex II of the Protocol (on combined transport on inland waterways to the European agreement on important international combined transport lines and related installations, AGTC, 1991) no terminals along the Sava River have been listed to fulfil the conditions.

In Annex III of the AGTC 1991 the following technical and operational requirements are listed for terminals in inland ports to become qualified as ports of international importance for international combined transport:

- situated along a main international waterway;
- capable of accommodating vessels or pushed convoys used on the relevant waterway in conformity with its class (including guaranteed draught of at least 2.8 m and desirably 3.5 m, berth length of at least 110 m and bridge clearance equal to that of the adjoining waterways;
- linked to main roads and railway lines, preferably belonging to the network of international roads and railway lines established by AGR, AGC and AGTC;
- annual cargo handling capacity should be in the order of 30,000 to 40,000 TEU per year;
- provide suitable conditions for the development of port industrial zone;
- provide conditions for trade and customs procedures connected to international exchange of goods;
- limit the period between latest time of acceptance of containers and departure of vessels and between arrival of vessels and beginning of unloading of containers to one hour;
- reduce the waiting periods for road vehicles delivering or collecting containers to max. 20 minutes;
- provide reception facilities for the disposal of waste generated on board ships to ensure the protection of the environment;
- provide efficient facilities for handling and storage of containers and other intermodal transport units;
- provide proper ancillary services related to container transport (empties depot, container repair facilities, forwarding services).

4.9 Present situation regarding ownership of port assets

Prior to the 1990's in the former Federal Socialistic Republic of Yugoslavia (FSRY), the ports in the Sava IWT network were socially owned. The initial investments required to develop and operate the ports were made by the central government in those days. Since 1990, like in other East European countries, a programme of transformation of ownership was introduced and implemented for socially owned companies. Presently the ports in the Sava IWT network are in different stages of this process of transformation of ownership.

The privatization process results in general in a situation with the basic infrastructure (port basins, riverbanks, dry port area) owned by the (national or local) government. The right to use the port areas and the relevant riverbank is granted through the government to port operating companies or port operators. In this way privatisation of the port operations takes place.

The port operating companies in the ports in the Sava IWT network are in competition with one another.

Table 4.3 Ownership position of Sava port operating companies (2007)

			cargo handled	
Port	**Ownership position**	**Master Plan**	**present**	**future**
Sisak (Kupa port)	100% privatised	-	oil, sand	oil, sand
Slavonski Brod	100% private	yes	oil	oil, wood, steel, cement
Bosanski Brod	to be privatised (interest of Russian oil company)	-	-	oil, refinery product
Bosanski Samac	100% privatised (Balkan Steel main investor.)	yes	steel coils	steel coils, coal
Brcko	100% district of Brcko	yes	general cargo	steel, general cargo
Sr. Mitrovica	100% privatised (two 50% shareholders)	yes	sand	sand, general cargo

Annex 4.1 - Port of Sisak

Annex 4.1 - Port of Sisak

Annex 4.2 - Port Slavonski Brod

Annex 4.3 - Port of Samac

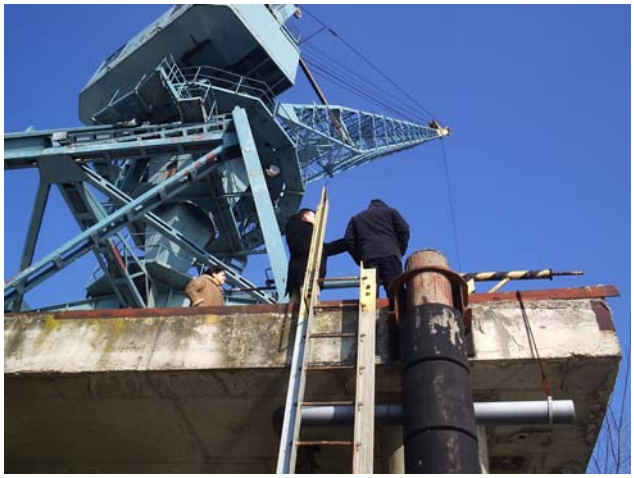
Annex 4.4 - Port of Brcko

Brcko – customs terminal

Annex 4.4 - Port of Brcko

Annex 4.5 – Port of Sremska Mitrovica






Annex 4.6 - Port of Sabac

Dredged harbour basin

Entrance to harbour basin

5 ENVIRONMENTAL REVIEW

5.1 Introduction

The objective of this Pre-Feasibility Study is to promote and enhance navigation on the Sava bringing it up to a Class IV. The Pre-Feasibility study has to provide a strategy for the development of the Sava as a viable transport axe, taking into account the regional economic developments, environmental impacts and relevant socio-economic factors.

This report describes the environmental review of the project. Its main objectives are to make a global inventory of the environmental impacts and the feasibility of the proposed initiative. Although the general strategies for Environmental Impact Assessments (EIA) are followed, the actual study on the aspects of screening and scoping, leading to a primary evaluation of the viability of the project, including recommendations.

Based on the results of the project, it will be decided what the next steps will be.

No public participation has been deemed necessary in this phase of the development.

This report describes the results of the environmental review taking the proposed works scheduled to be implemented into account. The review follows international regulations, specifically the screening and scoping procedures. Section 5.2 describes relevant legislation. Upon this information the environmental screening takes place in section 5.3. The environmental situation in Sava River Basin is described in section 5.4. Environmental aspects of the proposed works are presented in section 5.5. In sections 5.6 and 5.7, an evaluation of the results takes place (scoping), leading to key aspects to be taken into account when further developing the proposed project. Section 5.8 describes mitigating measures and finally, section 5.9 describes the conclusions and recommendations.

The environmental screening and review is focussed on the Sava river stretch (Sisak – Serbian border) were the proposed works will be executed. Protected areas upstream (Slovenia) and downstream (Serbia) do exist and the cross border effects of the proposed works should be considered. However, these have not been included in this environmental review, but should be dealt with in future Feasibility Studies of which EIA should be a part of.

5.2 Relevant regulations

5.2.1 EU regulations

EIA Directive

The EU has laid down its procedures regarding Environmental Impact Assessment (EIA) in the Council Directives 85/337/EEC and 97/11/EC. Member States shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue inter alia, of their nature, size or location are made subject to an assessment with regards to their effects. The EIA Directive defines two classes of projects:

- Annex I projects: Projects listed in Annex I of the EIA Directive shall be made subject to an EIA;
- Annex II projects: Projects of the classes listed in Annex II of the EIA Directive shall be made subject to an assessment, where Member States consider that their characteristics so require. To this end Member States may inter alia specify certain types of projects as being subject to an assessment or may establish the criteria and/or thresholds necessary to determine which of the projects of the classes listed in Annex II of the EIA Directive are to be subject to an EIA.

The EIA will identify, describe and asses in an appropriate manner, the direct and indirect effects of a project on the following factors:

- human beings, fauna and flora;
- soil, water, air, climate and the landscape;
- material assets and the cultural heritage;
- the interaction between the factors mentioned in the first, second and third indents.

The EIA Directive states that the following information needs to be supplied in an EIA report:

1. Description of the project, including in particular:
    - a description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases;
    - a description of the main characteristics of the production processes, for instance, nature and quantity of the materials used;
    - an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed project.
2. An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.
3. A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.
4. A description (this description should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project) of the likely significant effects of the proposed project on the environment resulting from:
    - the existence of the project;
    - the use of natural resources;
    - the emission of pollutants, the creation of nuisances and the elimination of waste;
    - the description by the developer of the forecasting methods used to assess the effects on the environment.
5. A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
6. A non-technical summary of the information provided under the above headings.
7. An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information.

Public participation

Following the Århus Convention, the EU has elaborated on public participation in Directive 2003/35/EC. The objective of this Directive is to contribute to the implementation of the obligations arising under the Århus Convention, in particular by:

- providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment;
- improving the public participation and providing for provisions on access to justice within Council Directives 85/337/EEC and 96/61/EC.

Member States shall ensure that the public is given early and effective opportunities to participate in the preparation and modification or review of the plans or programmes required to be drawn up. To that end, Member States shall ensure that:

- the public is informed, whether by public notices or other appropriate means such as electronic media where available, about any proposals for such plans or programmes or for their modification or review and that relevant information about such proposals is made available to the public including inter alia information about the right to participate in decision-making and about the competent authority to which comments or questions may be submitted;
- the public is entitled to express comments and opinions when all options are open before decisions on the plans and programmes are made;
- in making those decisions, due account shall be taken of the results of the public participation;

- having examined the comments and opinions expressed by the public, the competent authority makes reasonable efforts to inform the public about the decisions taken and the reasons and considerations upon which those decisions are based, including information about the public participation process.

Water Framework Directive

The EU Water Framework Directive (WFD) specifies that the aquatic environment should not further deteriorate and that efforts have to be made (programme of measures) to ensure "good ecological quality" in all natural aquatic ecosystems (surface waters) before the year 2015. Protection and improvement of all surface water bodies is a major aim of the WFD. The WFD states that the best model for a single system of water management is management by river basin - the natural geographical and hydrological unit - instead of according to administrative or political boundaries.

There are a number of objectives in respect of which the quality of water is protected. The key ones are general protection of the aquatic ecology, specific protection of unique and valuable habitats, protection of drinking water resources and protection of bathing water. All these objectives must be integrated for each river basin.

For surface water, the following aspects are relevant:

- ecological protection: A general requirement for ecological protection, and a general minimal chemical standard, was introduced to cover all surface waters. These are the two elements 'good ecological status' and 'good chemical status'. Good ecological status is defined in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics. As no absolute standards for biological quality can be set, because of ecological variability, the controls are specified as allowing only a slight departure from the biological community, which would be expected in conditions of minimal anthropogenic impact. A set of procedures for identifying that point for a given body of water, and establishing particular chemical or hydro morphological standards to achieve it, is provided, together with a system for ensuring that each MS interprets the procedure in a consistent way. The system is somewhat complicated, but this is inevitable given the extent of ecological variability, and the large number of parameters that must be dealt with;
- chemical protection: Good chemical status is defined in terms of compliance with all the quality standards established for chemical substances at European level. The directive also provides a mechanism for renewing these standards and establishing new ones by means of a prioritisation mechanism for hazardous chemicals. This will ensure at least a minimum chemical quality, particularly in relation to very toxic substances;
- other uses: Other uses or objectives for which water is protected apply in specific areas, not everywhere. Therefore, the obvious ways to incorporate them is to designate specific protection zones within the river basin that must meet these different objectives. The overall plan of objectives for the river basin will then require ecological and chemical protection everywhere as a minimum, but where more stringent requirements are needed for particular uses, zones will be established and higher objectives set within time;
- There is one other category of used which does not fit into this picture. It is the set of uses that adversely affect the status of water but which are considered essential on their own terms - they are overriding policy objectives. The key examples are flood protection and essential drinking water supply, and the problem is dealt with by providing derogations from the requirement to achieve good status for these cases, so long as all appropriate mitigation measures are taken. Less clear-cut cases are navigation and power generation, where the activity is open to alternative approaches (transport can be switched to land; other means of power generation can be used). Derogations are provided for those cases also, but subject to three tests: that the alternatives are technically impossible, that they are prohibitively expensive, or that they produce a worse overall environmental result.

For groundwater, the case regarding the chemical status is somewhat different. The presumption in relation to groundwater would broadly be that it should not be polluted at all. For this reason, setting chemical quality standards may not be the best approach, as it gives the impression of an allowed lever of pollution. A very few such standards have been established at European level for particular issues (nitrates, pesticides and biocides), and these must always be adhered to. But for

general protection, a precautionary approach has been chosen. It comprises a prohibition on direct discharge to groundwater, and (to cover indirect discharges) a requirement to monitor groundwater bodies so as to detect changes in chemical composition and to reverse any anthropogenically induced upward pollution trend. Taken together, these should ensure the protection of groundwater from all contamination, according to the principle of minimum anthropogenic impact.

All the essential elements must be set out in a plan for the river basin. The plan is a detailed account of how the objectives set for the river basin (ecological status, quantitative status, chemical status and protected area objectives) are to be reached within the timescale required. The plan will include all the results of the above analysis, the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining 'gap' to meeting these objectives and a set of measures designed to fill the gap. One additional component is that an economic analysis of water use within the river basin must be carried out. This is to enable there to be a rational discussion on the cost-effectiveness of the various possible measures. It is essential that all interested parties are fully involved in this discussion, and indeed in the preparation of the river basin management plan as a whole.

Habitats Directive

A specific additional requirement for environmental assessment arises under Article 6(3) of the Habitats Directive Member States must implement legislation requiring an assessment to be made of any project which is likely to have significant effects on a Natura 2000 site: a Special Protection Area (SPA) designated under Directive 79/409/EED or a Special Area of Conservation (SAC) designated under Directive 92/43/EEC In many cases this assessment can be achieved through the EIA procedure, but in some cases, for example where the project does not fall under either Annex I or Annex II of the EIA Directive, a separate procedure is needed.

Birds Directive

The Birds Directive relates to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the treaty applies. It covers the protection, management and control of these species and lays down rules for their exploitation. It applies to birds, their eggs, nests and habitats. Member States shall take the requisite measures to maintain the population of the species referred to in article 1 of the Birds Directive at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level. Member States shall take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in article 1 of the Birds Directive.

The preservation, maintenance and re-establishment of biotopes and habitats shall include primarily the following measures:

- creation of protected areas;
- upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones;
- re-establishment of destroyed biotopes;
- creation of biotopes.

The species mentioned shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this connection, account shall be taken of:

- species in danger of extinction;
- species vulnerable to specific changes in their habitat;
- species considered rare because of small populations or restricted local distribution;
- other species requiring particular attention for reasons of the specific nature of their habitat.

Trends and variations in population levels shall be taken into account as a background for evaluations. Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this directive applies.

Member States shall take similar measures for regularly occurring migratory species not listed in Annex I, bearing in mind their need for protection in the geographical sea and land area where this directive applies, as regards their breeding, moulting and wintering areas and staging posts along

their migration routes. To this end, member states shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance.

Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this article. Outside these protection areas, member states shall also strive to avoid pollution or deterioration of habitats.

5.2.2 OECD regulations

The Organisation for Economic Co-operation and Development (OECD) has developed Common Approaches on environment and officially supported export credits. Member states of the OECD have to follow these Common Approaches. The general objectives are:

- promoting coherence between policies regarding officially supported export credits and policies for the protection of the environment, including relevant international agreements and conventions, thereby contributing towards sustainable development;
- develop common procedures and processes relating to the environmental review of projects benefiting from officially supported export credits, with a view to achieving equivalence among the measures taken by the Members an to reducing the potential for trade distortion;
- promote good environmental practice and consistent processes for projects benefiting from officially supported export credits, with a view to achieving a high level of environmental protection;
- enhance efficiency of official support procedures by ensuring that the administrative burden for applicants and export credit agencies is commensurate with the environment protection objectives of the common approaches and its recommendations;
- promote a level playing field for officially supported export credits.

For screening purposes, the Common Approaches define three categories:

- Category A: A project is classified as Category A if it has the potential to have significant adverse environmental impacts. These impacts may affect an area broader than the sites or facilities subject to physical works. Category A, in principle, includes projects in sensitive sectors or located in or near sensitive areas. An illustrative list of sensitive sectors and sensitive areas is set out in Annex I of the Common Approaches. For a Category A project Members states should require an EIA. The applicant is responsible for providing such an EIA;
- Category B: A project is classified as Category B if its potential environmental impacts are less adverse than those of Category A projects. Typically, these impacts are site-specific, few if any of them are irreversible, and mitigation measures are more readily available. The scope of an environmental review for a Category B project may vary from project to project. The review should examine the project's potential negative and positive environmental impacts, including measures to prevent, minimise, mitigate, or compensate for adverse impacts ad improve environmental performance;
- Category C: A project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening and classification, no further action is required for a Category C project.

5.2.3 National regulations

5.2.3.1 International Sava River Basin Commission

The Sava Commission through its expert groups establishes guidelines and policy regarding the environmental issues related to the Sava River basin.

When the expert group has agreed to adopt a regulations or directive than this regulations / directive is then forwarded to the Sava riparian state for approval and eventually the implementation. The local regulations have than to be adopted to comply with the recommendations of the expert group of the Sava Commission.

5.2.3.2 Croatia

In Croatia the necessity of implementation of Environmental Assessment Report (EAR) is defined through the Environmental Impact Assessment implementation within a certain scope depending on the particulars of the project.

These kinds of environmental documents are obligatory according to:

- Zakon o zaštiti okoliša / Environmental Protection Act published in «Narodne novine» (Official Gazette – hereinafter referred to as OG) No.82/94, 128/99;
- National Environmental Strategy (OG No. 46/02);
- National Environmental Action Plan (NEAP) (OG No. 46/02).

The present Environmental Protection Act (EPA) regulates environmental protection, with a view to preserving the environment, reducing risks to human health and lives, ensuring and improving the quality of life, to the benefit of both present and future generations. Environmental protection ensures integrated preservation of environmental quality, protection of natural communities, rational use of natural resources and energy in the environmentally soundest manner, as basic conditions for a healthy and sustainable development. Details are presented in Annex 5.3.

5.2.3.3 Bosnia and Herzegovina

In general it can be stated that the laws and regulations regarding environment and related matters are enacted by the Parliament of the Federation of Bosnia and Herzegovina defining the Federal Policy for the period of 10 years, at least, as the integral part of the Environmental Protection Policy aimed at improvement the environment.

The Ministries of Physical Planning and Environment (hereinafter: Ministries) are obliged to coordinate and harmonize their plans in connection with the environmental regulations.

The acts/laws related to the environmental impact assessment procedure required to execute projects in Bosnia and Herzegovina are listed below. It could not be assessed during the project period whether these laws are still being processed within the Bosnia and Herzegovina or whether these laws have already been published and are in force.

5.2.3.4 Serbia

The Republic of Serbia has paid a lot of attention to protect the environment in recent years. Apart from laws, regulations and by-laws that were already ratified in Parliament, the Resolution on Environment Protection Policy in the Federal Republic of Yugoslavia was adopted in 1993 as well as the Resolution on Biodiversity Protection.

An important document in the field of water management is the “Bases of Water Management 2002-2013“, (Ref 22 and 23). The Ministry of Health and Environment Protection, Directorate of Environment Protection, also issued the “Report on the State of Environment for the Year 2000 With Priority Tasks in the Next Period“, Belgrade 2002.

Apart from that, the National Environmental Policy (NEP) is being prepared, as well as the National Environmental Action Plan (NEAP), which was announced in 2004. The entire document has been prepared with the assistance of and in co-operation with the Environmental Capacity Building Programme 2003, an EU-funded project managed by the European Agency for Reconstruction.

Based on the content of the above documents, the tasks (most relevant for the development of the IWT) prioritised by the Republic of Serbia for the coming period are as follows:

- providing conditions to protect the environment;
- enabling sustainable development;
- preserving the existing ecological balance;
- prevention of “dirty technology” import;
- development of wastewater treatment plants;
- resolving serious pollution problems in environment black spots;
- improvement of water supply in rural and urban environment.

The most relevant objectives for the environment protection outlined in the mentioned documents are:

- adoption of systemic laws related to ecology;
- establishing the integral pollution control system;
- adoption of national standards and norms in the field of ecology;
- organisation of environmental monitoring system;
- regulation of handling and use of chemicals;
- concessions for reconstruction programmes;
- rational consumption of energy and natural resources;
- improvement of bilateral co-operation with neighbouring countries;
- application of integral policy and decision-making procedures in all interested sectors, which are to stimulate compatibility and balance in the usage of water resources. the ministry competent for environment protection should prepare instructions related to methods and procedures for making decisions on capital investment works that involve water resources;
- preparation of a methodology to evaluate the water resources and the water management balance;
- develop a long-term programme of surface and ground waters protection;
- improvement of bio-diversity;
- natural heritage protection;
- architectural heritage protection;
- waste control.

The first steps for the preparation of an environment protection outline include:

- capacity building in the environment protection monitoring system, including training, technical assistance, strengthening of institutions and establishing of a ministry competent for integral environment protection, as well as harmonisation of legislation and economic instruments in this field in concert with the EU legislature;
- rehabilitation and technological development of environmental black spots. This is a precondition for the development of the agriculture sector, the economy and in general to achieve sustainable development;
- waste, wastewater and hazardous waste control, including technical assistance;
- protected areas with high bio-diversity and nature protection interest.

Details are presented in Annex 5.3.

5.2.3.5 Slovenia

In Slovenia the necessity of implementation of Environmental Assessment Report (EAR) is obligatory according to:

- Ur.l.RS 41/2004: Zakon o varstvu okolja (ZVO-1) (Environmental protection law);
- Ur.l.RS 20/2006: Zakon o varstvu okolja (ZVO-1A);
- Ur.l.RS 39/2006: Zakon o varstvu okolja. (ZVO-1-UPB1).

ZVO defines the procedure and contents of EAR, define when the revision of EAR is necessary and define the conditions for environmental experts license.

Under the ZVO is Ur.l.RS 78/2006 *(Regulation of environmental intervention for which the EAR is obligatory)* that defines for which environmental interventions the EAR is necessary.

The content of EAR is defined in Ur. l. RS 70/96 Navodilo o metodologiji za izdelavo poročil o vplivih na okolje *(Directive/guidelines of methodology for EAR).*

For specific interventions (when dangerous substances are present) the Pre-safety analysis should be implemented according to Ur.l.RS 88/2005: Uredba o preprečevanju večjih nesreč in zmanjševanju njihovih posledic (Regulation for accident prevention and accident consequences reduction).

The summary of Pre-safety analysis is a part of the EAR.

The Water law (Zakon o vodah (ZV -1 (Ur.l.RS 67/2002)) should be considered in reasonable way, but is not directly connected to EAR.

According to ZVO the estimation of environmental impacts for implementation of planned activities should be part of "Environmental report".

The content of the environmental report is defined in Ur.l.RS 73/2005: Uredba o okoljskem poročilu in podrobnejšem postopku celovite presoje vplivov izvedbe planov na okolje (Regulation of Environmental report and procedure for environmental impact assessment of planned activities).

According to ZVO (Ur.l.RS 41/04, 17/06-avtentična razlaga in 20/06 – ZVO-1 oz. 39/06 – ZVO-UPB1) and *Environmental conservation law* (**Zakonom o ohranjanju narave (Ur.l.RS 56/99, 31/2000, 119/2002, 22/2003, 41/04 – ZON oz. 96/04 – ZON-UPB2))** it is necessary to prepare an Environmental report and additional reports for protected area- elaboration for assessment of acceptability according to:

- Uredbo o okoljskem poročilu in podrobnejšem postopku celovite presoje vplivov izvedbe planov na okolje (Ur.l.RS 73/05) *(Regulation of Environmental report and procedure for environmental impact assessment of planned activities,* and
- **Pravilnikom o presoji sprejemljivosti vplivov izvedbe planov in posegov v naravo na varovana območja (Ur.l.RS 130/04, 53/06) *(Regulation for estimation of impacts of implementation of planned activities in protected areas).***

5.3 Environmental screening

The project aims at making the Sava river navigable for category IV vessels. The maximum size of CEMT class IV vessels is 1,500 tonnes (with a minimum of 1,000 tonnes). The project therefore requires a full EIA, including public participation. This conclusion is justified as follows:

- **International regulations:**
  - Annex I of the EIA Directive includes:
    - Inland waterways and ports for inland-waterway traffic which permit the passage of vessels of over 1,350 tonnes;
    - Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1,350 tonnes;
  - Annex I of the OECD Common Approaches includes:
    - Sea ports and also inland waterways and ports for inland-waterway traffic which permit the passage of vessels of over 1,350 tonnes; trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1,350 tonnes;
    - Projects which are planned to be carried out in sensitive locations or are likely to have a perceptible impact on such locations, even if the project category does not appear in the list. such sensitive locations include National Parks and other protected areas identified by national or international law, and other sensitive locations of international, national or regional importance, such as wetlands, forests with high biodiversity value, areas or archaeological or cultural significance, and areas of importance for indigenous peoples or other vulnerable groups.

- **Croatian Regulations:**
  - Annex I of the Croatian Ordinance/Rule Book on Environmental Impact Assessment (OG No. 59/00, 136/04 and 85/06) includes:
    - Inland water facilities: ports and quays; and waterways (rivers, canals);
    - Structures in national parks and nature parks - roads, transmission lines, water-supply systems.
  - Chapter II "Provisions for enforcement" of the Spatial Plan of Sisačko-Moslavačka County includes the necessity to pay special attention on:
    - All intervention declared as "State Significant" (Sava river waterway) or "County significant";
    - Nature protected park "Lonjsko Polje" (areas around Sisak, Jasenovac, Novska, Kutina, Lipovljani, Popovača, Vel. Ludina) within EIA; there is a requirement to refer to the Spatial Plan of Nature Park "Lonjsko Polje" OG 11/90;
  - Chapter II "Provisions for enforcement" of the Spatial Plan of Nature Park "Lonjsko Polje" - Article 176 demands an obligatory EIA for new waterways rehabilitations on Sava river within "Lonjsko Polje" boundaries;
  - Chapter II "Provisions for enforcement" of the Spatial Plan of Nature Park "Lonjsko Polje" - Articles 14, 93-96, and 143-149 defines the Sava river coastal area (within the nature park boundaries) as "5th Protection zone" arising from the middle water level till the first dam and/or road within Mlaka downstream (there are several other provisions defined for interventions planned within mentioned areas to be assessed in future project documentation);
  - Chapter II "Provisions for enforcement" of the Spatial Plan of Brodsko-Posavska County includes the necessity to pay special attention on all intervention declared as "State Significant" (Sava river waterway) or "County significant".

As to the point of sensitive locations, Croatia has not transposed the Habitats and Birds Directives entirely as of today. They are in the process of developing a National Ecological Network (NEN). No SPAs or SACs are designated at the moment. It is very likely that the Sava River basin will be considered of special importance, as it contains a National Park, including a wetland complex. Some exerts from the report 'Biodiversity of Croatia' (ref. 8):

- Some species highly threatened in Europe are represented with significant populations in Croatia. This is mostly due to the large areas of preserved habitats. There are still large wetland complexes along the lowland Drava and Sava Rivers that are extremely important for the breeding of wetland species. Natural and artificial wetlands, especially carp fishponds, represent internationally important migration and wintering sites for European waterfowl;
- Large wetland areas that are extremely important for biodiversity conservation consist of different wetland habitats. In Croatia, these are mostly represented in the floodplains of large rivers. Among them are three Ramsar sites: Kopaki Rit on the confluence of the Drava and Danube Rivers, Lonjsko Polje along the Sava River as well as the Neretva Delta on the coast;
- Wet grasslands are well represented in northern Croatia where they form parts of large wetland complexes along the lowland rivers, especially along the Sava River. The Lonjsko Polje Nature Park is a Ramsar site with large temporarily flooded pastures where hundreds of horses, pigs and cattle roam freely year round, except for the period when flood water covers this retention area. One threatened species highly dependent on the wet grassland is the fritillary (Fritillaria meleagris).

Besides the above mentioned, there are additional regulations which fall under Sava river sensitive locations management, for example:

- Zakon o proglašenju Parka prirode Lonjsko Polje NN 11/90;
- Uredba o osnivanju Javne ustanove 'Park prirode Lonjsko Polje' NN 36/96.

Recently, the Sava River Ecological Network has been established. The main objectives of the network are:

- preparation overview of biodiversity data, knowledge gaps identified and data processed into harmonised databases;
- development of methodologies for data gathering and data storage harmonised with the requirements of the Birds and Habitats Directives;
- identification of valuable areas for nature conservation;
- identification of provisional ecological network;
- development of knowledge and capacities on the Birds and Habitats Directives and in the establishment and management of ecological corridors.

5.4 Environmental situation in Sava River Basin

5.4.1 General

The Sava is a right side tributary of Danube at Belgrade. It is 945 km long and drains 95,719 km² of surface area, see figure 5.1. It flows through four states: Slovenia, Croatia, Bosnia and Herzegovina (making its northern border) and Serbia. Its source elevation is 1,222 m and has an average discharge of 1,722 m³/s.

The Sava is of great significance in the Danube River Basin because of its outstanding biological and landscape diversity. It hosts the largest complex of alluvial wetlands in the Danube Basin (Posavina - Central Sava Basin) and large lowland forest complexes. The Sava is a unique example of a river where the some of the floodplains are still intact, supporting both flood alleviation and biodiversity.

The most important landscape characteristics are to be found in the Central Sava Basin in Croatia. Here, a mosaic of typical floodplain-type natural and cultural landscapes is a reminder of what used to be along all major Central European rivers.

Four Ramsar sites (Cerkniško jezero, Crna Mlaka, Lonjsko Polje, Obedska Bara) have been designated in the Sava River Basin and numerous important bird and plant areas, protected areas at the national level and Natura 2000 sites are also situated there.

Figure 5.1 Map of Sava River Riparian States

Origin and Length

The Sava is created by two headwaters, Sava Dolinka (left) and Sava Bohinjka (right) that join between the Slovenian towns of Lesce and Radovljica. From there until it joins the Danube at

Belgrade (Figure 5.2.), Serbia, it is 945 km long (of which 206 km are in Serbia). From the source of its longer headwater, Sava Dolinka, in the north-western, Alpine region of Slovenia, it measures 990 km.

Through the Danube, it belongs to the Black Sea drainage basin and represents the Danube's longest right tributary and second longest of all, after Tisa. It was once the longest river flowing completely within former Yugoslavia, but after the break-up of the country in 1991, it now flows through four countries.

Figure 5.2 The confluence of the Sava – Danube at Belgrade

The Sava Bohinika originates under the Komarča Ridge at the altitude of 805 m, from underground sources of the Triglav Lakes Valley and features a 60 m high waterfall ("Slap Savice"), see Figure 5.3. Then it flows through the Ukanc Gorge, where a 3 MW power plant "Savica" is located. From Lake Bohinika if flows as Sava Bohinjka through Bohinjska Bela before it meets the Sava Dolinka near Radovljica.

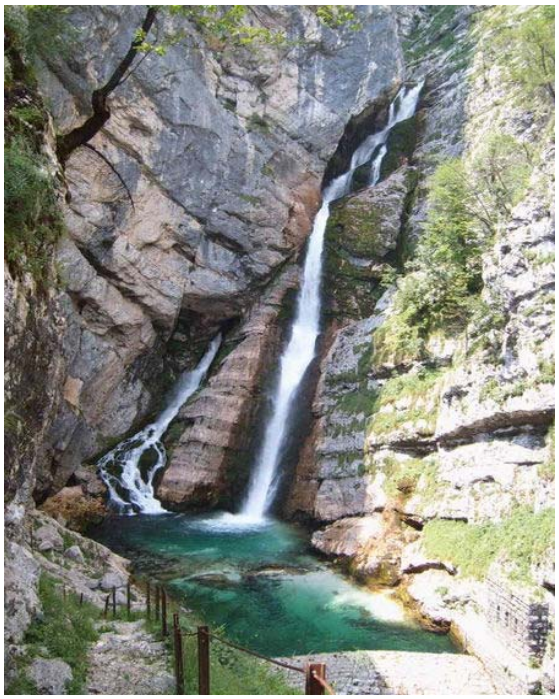


Figure 5.3 Savica Falls, spring of the Savica

Geography

The Sava drains an area of 95,719 km², including 115 km² in northern Albania. Its average discharge at Zagreb, Croatia, is 255 m³/s, while in Belgrade this is amassed to 1,722 m³/s. It gets very deep, up to 28-30 m near the villages of Hrtkovci and Bosut, in Serbia. In Serbia it creates several big river islands (adas), including Podgoričkа ada near Provo and 2.7 km² Ada Ciganlija in Belgrade, the most popular Belgrade resort. The island has been connected to the right bank of the river with three causeways creating an artificial lake called "Lake Sava" with an area of 0.8 km². It is nicknamed "Belgrade Sea" and it is known to attract up to 350,000 visitors daily in the summer season.

The river has high electricity production potential in its upper course, up to 3.2 (including tributaries 4.7) billion kWh, which has not been used until lately. The power plants presented in Table 5.1 exist in the Sava. There are also several hydro-electric plants under construction, of which "Boštanj" has already begun electricity production.

Table 5.1 Slovenia - Power stations on Sava

Part A: Operating							
HE	**Location**			**Power (MWatt)**	**Discharge (m^3/s)**	**Energy production (GWh)**	
Moste	Village Žirovnica			21	13.6	64	
Medvode	Confluence of Sava and Soro near village Medvode (Ljubljana)			26.4	65.2	77	
Vrhovo	Village Radeče			34.2	229	126	
Mavčiče	Valeau of the Sava, downstream of Kranj in village Mavčiče			38	54.5	61	
Part B: Overview of planned HE plants							
HE	**Useful accumulated volume 10^6m^3**	**Allowed water level difference m**	**Upstream water level (m.n.v)**	**Downstream water level (m-n-v)**	**Netto difference in water level m**	**Power factor/discharge $MW/m^3/sec$**	**Status**
Boštanj	1.00	1.00	182.50	174.30	8.20	0.064	built in 05/2006
Blanca	1.39	1.00	174.00	163.30	10.70	0.085	under construction
Krško	1.38	1.00	163.00	153.10	9.90	0.078	start construction in 10/2007
Brežice	3.45	1.10	152.50	142.10	10.40	0.082	start construction in 2009
Mokrice	3.75	1.50	141.50	134.02	7.84	0.058	planned

source: Ministry of Economy - Directorate for Energy
Note: Podatki v tej tabeli so informativni (stanje 2006) in se v času projektiranja spreminjajo

The river bed is not regulated for the most of its length. That causes floods from time to time, which can affect as much as 5,000 km² of mostly very fertile land (Posavina, Sava Valley). In 1981 and April 2006, the Sava flooded lower parts of Belgrade. In 1977 and 1980, both federal and inter-republican agreements were signed about Sava's regulation, which were supposed to regulate its waters to prevent flooding, build new power stations, establish full navigation to Zagreb and ecologically protect its waters, with the final deadline being the year 2000. However, not much was done and Yugoslavia itself broke up in 1991.

East of Ljubljana, the Sava flows through a 90 km long gorge and afterwards the Krško Field (Krško Polje). As the Pannonian Sea receded, the Sava grew longer and longer, carving the Sava Trench (Savski rov) through which it flows to the east. Together with lower courses of Bosnian rivers which became its tributaries, it created huge floodplains. Becoming wide (at Šabac it is 680 m wide, while on its mouth only 280 m), the Sava begins to meander and in history changed course many times, being pushed by the gentle slope of the Pannonian bed to the south and by the force of its many right tributaries to the north. Old riverbeds turned into swamps and ponds known as mrtvaja (dead water) and starača (old water) in Serbian. The best known is one of the biggest ponds in Serbia and one of the biggest wild birds' reservation areas in Europe, Obedska Bara.

Major tributaries

- right tributaries:
  - Slovenia: Sora, Ljubljanica and Krka;
  - Croatia: Kupa and Sunia;
  - Croatian/Bosnian border: Una;
  - Bosnia: Vrbaška, Vrbas, Ukrina, Bosna, Brka, Tinia, Lukovac and Dašnica;
  - Bosnian/Serbian border: Drina;
  - Serbia: Jerez, Kolubara and Topčiderska reka;
- left tributaries:
  - Slovenia: Kokra, Kamniška Bistrica and Savinia;
  - Slovenian/Croatian border: Sotla/Sutla;
  - Croatia: Kaprina, Lonia and Orliava;
  - Serbia: Bosut.

5.4.2 Human beings, fauna and flora

Settlements

The Sava connects three European capitals: Ljubljana in Slovenia, Zagreb in Croatia and Belgrade in Serbia. Even though Ljubljana was built on Sava's tributary Ljubljanica, as the city grew bigger it included existing villages on Sava, like Šrnuče or Zalog, so the Sava now flows through Ljubljana's outskirts (in the same way Sarajevo grew over its principal river Miljacka and urbanized areas around much longer river Bosna to the west). In both Zagreb and Belgrade, it divides old and new parts of the cities (Zagreb-Novi Zagreb, Belgrade-Novi Beograd). After Ljubljana, the Sava flows through Litija and the highly industrialized region of Zasavje, including the cities of Zagorje ob Savi, Trbovlje and Hrastnik, continuing past the important railway junction of Zidani Most, and on to Radeče, Sevnica, Krško, Brežice and Čatež after which it crosses into Croatia. Passing through Zagreb and its suburbs, it continues through Sisak on the mouth of Kupa river, and Jasenovac, where it forms the border between Bosnia and Herzegovina and Croatia, with many dual settlements on both sides of the border: Gradiška/Stara Gradiška, Srbac/Davor, Bosankski Kobaš/Slavonski Kobaš, Bosankski Brod/Slavonski Brod, Bosanski Šamac/Slavonski Šamac, Orašje/Županja and Brčko/Gunja, soon after which it enters Serbia, where important places are Sremska Rača, Sremska Mitrovica, Klenak and Šabac. Then it flows through the Belgrade suburbs of Zabrežje, Obrenovac, Umka and Ostružnica until it finally empties into the Danube in Belgrade.

Navigation & traffic

The Sava is an international waterway and navigable for 593 km, from its confluence with the Danube (km 0.0) until the mouth of the Kupa at Sisak (see Figure 5.4). Smaller crafts can navigate further upstream until Zagreb, but the plans of dredging it to become fully navigable are scrapped. The river is open for international flowing and conditions with regard to available depth are varying according to the meteorological circumstances.

Figure 5.4 The old Port of Sisak

The Sava Valley is also a natural route for land traffic, which includes the railway and highway Belgrade-Zagreb and routes of oil and gas pipelines from Croatia to Serbia. As a result of all this traffic and densely populated and industrialized areas it flows through, the river is very much polluted and not much has been done to improve its conditions.

Tradition

Along the Sava it is many old villages where are houses (see Figure 5.5) made from oak wood and Croatia are trying to protect those villages for the further generations. In Posavina are many archaeological localities like Sćitarjevo (Audantonia) near Zagreb, Sisicium (from Celts, Roman period) in Sisak, then in Slavonski Brod (Village before Romans) and in Županja.

Figure 5.5 Traditional house

Even though the name Sava became very common among (and not only South) Slavs, especially as a form of personal name, either male or female, and got a 'Slavic tone', the river's name is not Slavic but Roman in origin, who called it Savus.

Politics

According to some, the Sava represents the northwestern boundary of the Balkan peninsula. With the changes of the political climate, the boundary also changed. In Yugoslav times it was considered that the whole Sava is the border (thus promoting mutuality among different Yugoslav nations), which placed even parts of Italy (Trieste area) as a part of the Balkan peninsula. After splitting from Yugoslavia, in Slovenia and Croatia this was changed as a policy of shedding off any Yugoslav or Balkan feeling, so the border was set to be the Sava-Kupa line, and then to the Adriatic.

Phytogeographycal position and Climate

The Euro/Siberian - North American region covers all lowland and mountain continental parts of Croatia. The relevant climatic vegetation classifies it also as a forest area. Vast horizontal surface covered, and the interplay of vertical indentations, have resulted in important multifold differences within the area. Based on these differences, the entire area can be divided in two phytogeographycal provinces± Illyrian and Central European.

The **Illyrian province covers** the major part of the continental Croatia. In the climatic context, compared to the Mediterranean zone this area is characterised by a different distribution of precipitations (continental pluviometric regime), lower average annual temperatures, and wider temperature oscillations. Within this province, climatic conditions vary between the lowlands, the hills and the highlands, which are reflected in its vegetations composition.

This is the very basis for differentiation of the three main vegetation belts:

- Lowland belt;
- Highland and subalpin belt;
- Pinus mugo belt.

The **lowland belt** is the lowest vegetation strip of the Illyrian province. The entire area is characterised by temperate continental climate with agreeable summer temperature and abundant summer precipitation. One of the major and most significant zonal forest associations in this belt is the association of sessile oak and common hornbeam, Querco-Carpinetum illyricum, of the Carpinion betuli alliance; order Fagetalia, class Querco- Fagetea. This association flourishes on gentle slopes of lowland terrains, with floristic structure characterised by a large number of species. The association is basically Central European in character, but its elements include a large number of old Illyrian-Balkanic relict species. In most lowland surface the former sessile oak and hornbeam forest stands have been cleared out and their habitats, due to favourable edaphic conditions, and have been converged into agricultural land and various grasslands of the orders Molinio-Arrhentheretea and Festuco-Brometea. The majority of human settlements have developed particularly in this belt.

Zonal habitats within this vegetation belt have developed different vegetation types due to specific ecological conditions – acidophilic sessile oak and sweet chestnut forest - Querco-Castanetum sativae - on deeper, leached soils and silicates. Cutting of these forests has resulted in the development of secondary heats. Dry, warm habitats and shallow carbonate rendzinas, especially on southward and westward facing hills, are favourable for thermophilie forests of the Quercetalia pubescentis order.

Communities of floodplain and wetland habitats are of much greater importance for this vegetation belt. The forests and shrubs of the area, belonging to the orders Salicetalia, Alnetalia and Fagetalia have been driven back by the floodplain and wetland associations of the orders Phragmitetalia, Deschampsitelia and Molinietalia.

Flora, fauna and biodiversity

Croatia has not transported the Habitats, Birds Directives and Natura 2000 entirely as of today. However, the Sava river basin is a very sensitive location and is important for biodiversity conservation. Some species highly threatened in Europe are represented with significant populations in Croatia. This is mostly due to the large areas of preserved habitats. There are still large wetland complexes along the lowland Drava and Sava Rivers that are extremely important for the breeding of wetland species. Natural and artificial wetlands, especially carp fishponds, represent internationally important migration and wintering sites for European waterfowl.

These wetlands consist of different wetland habitats. In Croatia, these are mostly represented in the floodplains of large rivers. Among them are three Ramsar sites: Kopački Rit on the confluence of the Drava and Danube Rivers, Lonjsko Polje in Posavina (figure 5.6) along the Sava River as well as the Neretva Delta on the coast.

In Posavina region still live many birds which are in other part of Europe very rare or disappeared, for example: Common Snipe, Squacco Heron, Spoonbill, White –tailed Sea-eagle, Montague's Harrier, Lesser Spotted Eagle, Little Tern, Cormorant, Purple Heron, Little Egret, Black Stork, Honey buzzard, Black Kite, Corncrake, Common Sandpiper, Whiskered Tern, Little Crake, Spotted Crake, Woodcock, Jack Snipe, Stock Dove etceteras. Threats for the birds in region of Posavina are:

- hunting:
  - hunting and poaching;
  - lack of prey due to over-hunting;
  - poisoning of large carnivores;
- reduction of wet areas:
  - reduction of wetland;
  - melioration of wet areas surrounding wetlands;
  - melioration of extensive wet areas;
  - decline of carp fishponds;

    - burning of reed beds;
    - river management;
    - water pollution;
- forestry:
    - forest management;
    - water management in forests;
- agriculture:
    - intensifying agriculture;
    - abandonment of the traditional agriculture;
    - abandonment of the traditional stock rearing;
    - over fishing;
- collecting eggs or nestlings:
    - collecting eggs or nestlings for food for local people;
    - collecting nestlings for caging;
- tourism:
    - tourism and recreational activities;
    - collecting clams;
- natural causes:
    - marginal population;
    - competition.

It is quite certain that after Croatia has completed the projects CRO-NEN, NATURA 2000 and other new studies (if necessary) new protected areas will be established in the Posavina region.

In the process of developing a National Ecological Network (NEN) it was decided that species to be considered for the process of building-up National ecological network will be:

- NATURA 2000 species occurring in Croatia (Annex I of the Birds Directive and Annex II of the Habitats Directive);
- Red list species in Croatia (Vascular flora, fungi, vertebrates, butterflies and cave invertebrates).

It was necessary to prepare distribution maps for these species. Already available maps have been mostly in paper form (except for some bird species) and they were prepared only for categories of CR, EN and VU. Through the CRONEN project, all distribution maps for red book species have been digitised by the SINP personnel. Some of them have been modified according to new available data. In this way distribution maps (aerial, MTB fields for plants) were obtained, but mostly without detailed data about important sites. Later on these maps have been updated with new data on important sites, collected through the project.

Besides the Red list species, there was a number of NATURA 2000 species that has not been listed as threatened on national level, especially birds. Croatian Ornithological Society prepared distribution maps of The Birds Directive Annex I species regularly occurring in Croatia and not listed as CR, EN or VU in Red data book (for those birds' distribution maps already existed). Maps have been digitised in the SINP and the Atlas of distribution maps of all BD Annex I species regularly occurring in Croatia has been prepared.

Also, the Atlas of distribution maps of HD Annex II species regularly occurring in Croatia has been prepared by the SINP personnel, excluding maps for several species that there was no data available.

The Convention on Biological Diversity and Nature Protection Act regulates obligation of inventory and biodiversity monitoring. Regular monitoring ensures tracking of trends in nature, observing potential threats and determining necessary actions for protection. For ensuring systematic and long-term collecting of data on biodiversity a large number of associates has to be involved. That is the main purpose of National Biodiversity Monitoring System establishment.

Biodiversity monitoring is one of the main tasks of the State Institute for Nature Protection (SINP). In the framework of the CRO-NEN project SINP developed and started the implementation of National Biodiversity Monitoring System (NBMS). The main purpose of this System is to establish a

network of associates, amateurs as well as experts and scientists. Role of the Institute is to ensure coordination between associate groups, to develop methodology and protocols suitable for each group and to process collected data. In the framework of CRO-NEN project basis for this system has been established. The System has to be further developed and improved.

Figure 5.6 The central part of Posavina is protected as Lonjsko Polje

The recent series of great waves in the basin of the Sava drew the attention of the Croatian public to the importance of Lonjsko Polje Nature Park not only as one of the most worthwhile parts of the natural and cultural heritage of Croatia but also as a key region in the entire flood defence system: the flood plain area of Lonjsko Polje Nature Park (the flood water retention zone) can accept the amount of about 1.3 billion cubic metres of Sava waters. This means that the conservation area directly or indirectly shields Zagreb, Karlovci, Sisak and the whole of Posavina downstream from Nova Gradiška. The discharge of 5,500 m^3/s that has in recent times flowed through the Sava would in other European countries have caused a national disaster. For this reason the State Institute for Nature Protection supports the approach of Croatian water board managers, which is now with increasing clarity reliant upon floodplain areas and not on containment of the watercourse through the building of dykes and embankments. In a period of extreme climatic disturbances, to which we have been increasingly exposed in recent times, the preservation of the natural floodplains and – wherever necessary – the creation of flood water retention zones should be the strategic option of Croatia in the upgrading of its flood defence system.

The best flood defence is the prevention of damage through land regulation. This is the recommendation of Holland, a densely populated country that has extensive experience with flooding in Europe. Physical plans must pay attention to potential inundation areas and high-risk areas. The Water Law has to be respected construction in the water domain is not allowed.

This flood has created very good conditions for spawning. For this reason in the coming period the Ranger Service at Lonjsko polje will step up its activities monitoring the anticipated successful spawning of carp and the return of fish into the Sava from the most important spawning site in the Danube basin.

Two Dutch ornithologists, Paul Voskamp and Stef van Rijn, experts in the study of raptor populations, were invited by the Administration of Lonjsko Polje Nature Park and the Ornithology Institute of the Croatian Academy to spend two weeks investigating the number and distribution of Aquila pomarina, (sea eagle). The campaign was carried out in co-operation with Park Rangers, for whom this was a form of training necessary for ongoing monitoring of the state of biodiversity in the park. They were surprised by the fact that they managed to count at least 30 pairs of sea eagles. Since they had the time to investigate only the area north of the Sava, they estimate the population of the whole area to be from 40 to 50 pairs. The conclusion of these ornithologists is that the sea eagle population of Central Posavina has remained stable (Figure 5.7.).

Figure 5.7 The important Croatian sea eagle population still present in Lonjsko Polje Nature Park

The sea eagle is an endangered species that is entered into the Croatian Red Book, and is protected by the Nature Conservation Law, and protected at the international level by the Bonn, Bern and Washington conventions. It nests in Eastern and Southeast Europe. Posavina is the central and most important region for nesting in Croatia. Outside this region, only a few pairs are known to nest. This species depends on mature deciduous trees and grassland rich in amphibians, rodents and small birds. In the floodplain of the Sava, these two conditions are combined: great oak and ash forests that are suitable for nesting, and a traditional agricultural system in which livestock grazes on the flooded pasturelands and meadows around the villages, ensuring a good basis for a rich food chain. The sea eagle is a species that is endangered by intensive use of agricultural soil and a change in the cultivation of arable crops.

In the area of the park the threat is of another nature: the enormous area of the former pasturelands (especially the area of Mokro Polje, parts of Lonjsko Polje north of Lonja) is overgrown with shrubs (mostly neophyte vegetation, particularly bastard indigo, Amorpha fruticosa). This is a consequence of the recent war, because of which the pastureland in the east of the park was not used for years. Also, the area that is regularly mowed has been reduced. The Park Administration is trying to cope with the task of preserving the traditional cultural landscape over the whole area of the park, and in particularly with the need to renovate this kind of landscape in areas in which it has suffered alterations.

5.4.3 Pollution

In the area of Posavina problems exist with pollution of air, soil and water.

Air

The main sources of the air pollution are:

- industry;
- traffic;
- thermal power plants.

Problem with air pollution exists in Zagreb, Karlovac, Sisak, Slavonski Brod, Županja and also cities on the right side of the river Sava in Bosnia and Herzegovina and at the end cities in Serbia. On the top is now city of Sisak because of oil industry. In the near future the same problems may occur in BiH, Bosanski Brod because there are plans for revitalisation of the oil industry.

Soil

The main sources of soil pollution (which also leads to pollution of ground and surface water) are:

- Industry;
- Agriculture;
- wild and illegal waste dump;
- traffic;
- mines and others relicts from the last war.

Soil pollution (except for areas with mines) is not as big an issue as air and water but it is a time to install measures to protect the soil because in Croatia exist many plans for production of "ecological food", which requires clean soil agriculture. Across the Sava river basin the problem of the use of artificial manure and chemical products for plants protection exist.

The recent Croatia action Project of sanitation of waste dump should result in improved quality of water, groundwater and soil and air.

Water

Problems with pollution of the Sava are continuous along its source, being first Slovenia (from Celje and the Nuclear Power Plant Krško), then Croatia with big cities with industry and without serious water purification system (Zagreb, Karlovac, Sisak, Slavonski Brod, Županja) and also cities on the right side of the Sava in Bosnia and Herzegovina and in the lower Sava area in Serbia.

The main contaminators of the Sava within Croatia are:

- Levels of organic pollution are still high in most of the Sava River Basin. The considerable discharge of untreated wastewater from industrial, municipal and agricultural point sources is widespread;
- Nutrient pollution comes mostly from agriculture (artificial manure, many sorts of chemical product for plants protection)and mostly affects still waters, e.g. lakes, ponds, ox-bows which show effects of eutrophication;
- Hydromorphological alterations include the building of dams, weirs, canalisation of rivers and streams, regulation of banks and subsequent disconnection of their floodplains and ox-bows;
- Emission of organic matters is the main problem because it is food source for micro-organisms, and it causes its grow and biochemical oxygen demand. This process makes water improper for water supply and even for recreation;
- Uncontrolled and illegal waste dump;
- Agriculture - artificial manure and many sorts of chemical product for plants protection.

Especially the protection of groundwater is essential, as it is a major source for drinking water. Due to excessive dredging in the past and due to the construction of dams in Slovenia and Croatia, large amounts of sediments have been derived or removed from the river. Measurements in Zagreb in 1996 have shown that the sediment transport in the Sava after construction of the dams is only 10% of the sediment transport before construction of the dam. As a result, the water levels have significantly dropped. Estimates on the value of the water level depression vary between 1 m and 2 m.

The water level decrease has amongst others the following negative effects:

- The groundwater level along the Sava (e.g. in Slavonia - Croatia) must have decreased significantly causing problems for agriculture and environment;
- The stability of numerous bank protections is threatened;
- Bottlenecks for navigation occur at places were not problems before.

5.4.4 More about water quality and groundwater

This paragraph describes available data on pollution of the Sava, as taken from “Water management administration Report of on surface water quality from 19/03/2005".

The water quality evaluation is made according to the required group indicators for general ecological water function evaluation: physical-chemical indicators, oxygen regime, and nutritive substances, biological and microbiological indicators.

Enhanced values for these indicators groups indicate the water quality change.

According to individual group indicators, the actual water quality does not meet the limits at the monitoring stations as given in the table 5.2.

Table 5.2 Monitoring stations where water quality limits are exceeded

	oxygen regime		nutritive substances		biological indicators		microbiological indicators	
	n1	n2	N1	n2	n1	n2	n1	n2
Sava river	18	8	18	15	16	1	18	18
Sava river influents	76	39	76	55	44	17	76	67

n1 – total number of measure stations where testing was carried out
n2 - number of measure stations which do not satisfy required categorisation.

For a more detailed evaluation of ecological water functions and of water usage conditions determination for determined purposes the following groups of indicators are used: heavy metals, hazardous organic compounds and radioactivity. These components are all known for their carcinogenic character. Heavy metals originate from the industry, traffic, communal waste and chemical substances for plant protection.

Hazardous organic components like phenols, Polychlored biphenyl (PCB), easy-evaporated chlorinated hydrocarbons (LHKU), organochlored pesticides, DDT and lindane originate from industrial plants or agricultural enterprises. The biggest amounts of these substances get to surface waters. In these waters they are found in low concentrations but due to a huge bioaccumulation ability in living organisms they can be found in several thousand times bigger concentrations. Specific indicators tests reveal the conditions as given in the table 5.3.

Table 5.3 Specific indicators

	Heavy metals		**Min. oils**		**Total phenols**		**PCB**		**LHKU**		**pesticide**		**DDT**		**Lindane**	
	n1	**n2**	**n1**	**n2**	**n1**	**n2**	**n1**	**n2**	**n1**	**n2**	**n1**	**n2**	**n1**	**n2**	**n1**	**n2**
Sava river	3	3	18	13	3	1	0	0	0	0	0	0	0	0	0	0
Sava river influents	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

n1 - number of measure stations where testing was carried out
n2 - number of measure stations which do not satisfy required categorisation.

The biggest polluters of the Sava are located close to the big cities situated at its banks, like Zagreb, Sisak and Slavonski Brod.

Data on Sava river polluters is fragmented per County and city. For the purpose of this study the framework data on polluters within Zagreb and Brodsko-Posavska County are given. Annex 5.1 contains water quality data for the year 2000, while Annex 5.4 presents details of the counties within Croatia.

5.5 Environmental aspects of the project

5.5.1 Project description

The proposed works consist of:

- construction of guiding bunds to redirect the flow and to flatten sharp beds;
- construction of groynes to concentrate the flow;
- construction of bank protections to avoid erosion caused by new groynes or guiding bunds;
- construction of sills to increase the water level;
- rehabilitation of existing groynes and bank protections.

The works are mainly to be executed between Slavonski Brod and Sisak. The Sava project aims at navigation improvement and improving the situation with regards to the water level drop. Hrvatske Vode now implies strict rules for works in the Sava to prevent further water level decrease. Any works in the Sava have to be evaluated on their effect on the water level. This also holds for the navigation improvement works. A requirement is that the maximum water level decrease (95% duration) is not allowed to be bigger than 5 to 10 cm. For the Environment Review it is assumed that this prerequisite is met.

At this stage of the project, no alternatives have yet been developed. It assumed that this is further investigated in a later phase of the project (e.g. the feasibility study).

Details regarding technical characteristics of the alternatives are described in the sections 5.3 and 5.4.

5.5.2 Environmental effects

In this section a qualitative evaluations is made of the environmental impacts of the project, compared to the 'zero alternative' (i.e. the project will not be developed). Three stages are discerned, being the construction phase, exploitation phase and maintenance phase. Per phase is presented in the tables 5.4, 5.5 and 5.6:

- parameter;
- qualitative comparison with autonomous development;
  - 0 = negligible effect compared with autonomous development;
  - +/++ = better situation then autonomous development;
  - -/-- = worse situation then autonomous development;
- explanation/remarks.

Table 5.4 Environmental impacts during construction

parameter	qualitative comparison	explanation/remarks
human beings	+	employment, activation of construction firms
fauna	--	Loss of the habitat, change of life depending environment elements (oxygen saturation, turbidity, loss of food)
flora	--	Complete destruction of flora along the river banks
soil	-	Possible pollution with oil derivatives (machinery)
water	--	Turbidity, Possible pollution with oil derivatives (machinery), change of water qualities
air	-	gaseous emissions (machinery), dust
climate	-	-
landscape	--	Loss of natural landscapes, entering of unnatural elements (machinery), geometrical elements
material assets	-	Conflict with existing material assets along the river
cultural heritage	0	
interactive aspects	-	Conflict with industrial plants, tourism

Table 5.5 Environmental impacts during exploitation

Parameter	qualitative comparison	explanation/remarks
human beings	+	Trade, better infrastructure connections, development of the industry, development of the coastal areas
Fauna	-	Water pollution, entering of noxious substances, reduction of the populations (fish, birds, etc)
Flora	-	Loss of habitat, development of the resisting species
Soil	-	Possible pollution with oil derivatives and other wastes from machinery and vessels
Water	--	Possible pollution with oil derivatives and other wastes from machinery and vessels)
Air	-	Gaseous emission (machinery, traffic, vessels)
Climate	-	Gaseous emission (machinery, traffic, vessels)
Landscape	-	Loss of natural shape of Sava river bed
Material assets	0	
cultural heritage	0	
interactive aspects	?	All existing activities first must be listed and then interactive aspects can be valued

Table 5.6 Environmental impacts during maintenance

parameter	qualitative comparison	explanation/remarks
human beings	+	employment, activation of construction firms
Fauna	-	Possible pollution with oil derivatives and other wastes from machinery and vessels)
Flora	-	Possible pollution with oil derivatives and other wastes from machinery and vessels)
Soil	0	Possible pollution with oil derivatives and other wastes from machinery and vessels)
Water	-	Possible pollution with oil derivatives and other wastes from machinery and vessels)
Air	-	invalid machinery
Climate	0	
landscape	-	Presence of machinery, unnatural material
Material assets	0	
cultural heritage	0	
interactive aspects		All existing activities first must be listed and then interactive aspects can be valued

5.5.3 Incidents and calamities

Incidents could be caused by the following factors:

- Stranding or clashing within inland transport system could cause uncontrolled outflow of fuel or transported good, which could be hazardous in larger quantities. These effects are assessed as low risk with lower impact and dispersion. If such occur, they should be properly solved under strictly prescribed protection measures. Critical points are harbour entrance/exit, boats interceptions, fuel and other goods loading/unloading and night transport;
- Uncontrolled polluted industrial water discharges can occur, especially around towns Sisak, Kutina and Slavonski Brod from both sides. Special attention should be paid to the pollution coming from petrochemical industry in Kutina, the refinery in Bosanski Brod and from the oil refinery, the thermal power plant and the ironworks in Sisak, because these industries still do not have more waste water treatment than a first mechanical step. Due to mentioned reasons, these points require special mitigation measures and monitoring to be elaborated for flora and fauna within the EIA;
- Towns and villages with direct incident sewerage discharges usually do not have even the first mechanical wastewater treatment level, not to mention biological-chemical treatment. This has a direct impact on Sava river water quality;
- Large scale rainfalls could cause higher confluence of different polluters into the Sava river, especially from industrial, commercial and agricultural manipulative surfaces. Special attention should be paid to pollution from fertilisers, with direct negative effects on groundwater quality. During substantial rainfalls in bigger towns, there could be high pollution from hydrocarbons and other pollutants.

There are possibilities for calamities to occur within the Sava river waterway. The most hazardous calamity would be in the form of incidental oil discharge or effusion. If more than 1,000 - 2,000 tons of oil is spilled it would create pollution for the flora and fauna along the river and on the river banks over a length of 30 - 50 km.

Other forms of calamities could happen due to dispersion of industrial chemicals. It would cause the extinction of river flora and fauna with long lasting revival and remediation.

All calamities, if these occur could also have a huge impact on drinking water sources from groundwater.

5.6 Secondary effects

Positive

The foreword of the White Paper for European Transport Policy from 2001 (ref. 9) outlines some policy guidelines and states the following:

> *'Transport also helps to bring European citizens together, and the Common Transport policy is one of the cornerstones of the building of Europe. However, the warning signs are clear. Congestion, resulting in environmental nuisance and accidents, is getting worse day by day, and penalising both users and economy." And furthermore: "… new network for charging should promote the use of less polluting modes ….'*

From the Policy guidelines of the White Paper the following can be outlined as an indication of the EU policy to develop inland waterway transportation:

> *"A modern transport system must be sustainable from an economic and social as well as an environmental viewpoint.*
>
> *…in 1998 transport sector was blamed for 28% of the emission of CO_2.*
>
> *…inland waterway transport is energy-efficient and quiet and takes up little space.*
>
> *…in terms of energy efficiency and weight of goods which can be moved one kilometre by one litre of fuel, the figure for road haulage is 50 tonnes, for rail haulage 97 tonnes and for inland waterways 127 tonnes" (from ADEME).*
>
> *…apart of anything else, this is a very safe mode of transportation, so it is particularly suitable for transporting dangerous goods, such as chemicals."*

As inland waterway transport is energy-efficient, it contributes to the reduction of CO2 emissions. Furthermore, when an improved regulation and monitoring system is installed and maintained, river transport has lower risks of incidents and calamities in hazardous goods transport. Economical and social aspects of the inland waterway transport are completely positive because they are in line with sustainable development and transport principles.

Improved regulation system gives a chance of better use of river coasts and bottom, in terms of economical and rural development (especially industry, trade, harbour development and agriculture). An increased monitoring system might be beneficial for flora and fauna protection and endangered habitats monitoring. Dredging activities will remove waste from the river bottom that has been uncontrolled discharged in significant amount over the past decades.

Negative

Secondary negative effects would mostly arise from the interventions within the Sava river bed and its coast in the form of flora and fauna devastation and bed morphology modification.

Soil pollution (e.g. with fuel, grease or chemicals) can have a negative impact in a larger area than the direct area where the activities take place, due to dispersion and transport via groundwater and the river itself.

Also during construction there is possible negative impact on the inundation zone and river bed of Sava, due to:

- construction material disposal, material (dirt, construction material, waste) dump forming at inundation zone and in riverbed;
- inundation zone and riverbed damaging due to heavy machinery operating during outflow construction (construction needs to be co-ordinated with appropriate water management company).

Due to shifting workplaces the following impacts could occur:

- functional outflow blocking of Sava;
- Sava River water regime disorder;
- Sava River silting up;
- extended possibility for flooding neighbourhood area.

If significant effects on swamp flora occur, this will have a negative impact on fauna living in swamp area habitat. Larger specimens of fauna will migrate to areas which are not under direct impact of the intervention.

Attributes of the landscape sensitive on the planned intervention are: micro relief appearances, vegetation, cultural-historical elements, surface water, ecological values etc. An impact on mentioned attributes can occur during the construction but it will manifest during utilisation:

- Micro relief appearances – by making an embankment for the need of construction slight changes of the relief will occur at the location of the plant;
- Vegetation – construction activities at the intervention area will cause flora devastation on the surface which will disturb natural landscape appearance (on relatively small area). It is even more emphasised concerning that the location of the plant is within the area defined as particularly valuable region – natural landscape;
- Inside the construction site a significant impact on natural landscape characteristics will occur. The surrounding area will have slight “industrial” landscape changes. But the negative impact could occur in case the works will not be built in accordance with local tradition and ambient, and harmonised with the surrounding landscape structures;
- Impacts to the mentioned attributes may occur during the construction and manifest either during or after construction;
- Anthropogenic predomination in construction zones – mechanisation and objects required for the construction will be present at the intervention area. Structures will have a significant impact on visual landscape quality if these are not adapted to natural characteristics of the area;
- Visual exposure.

During the construction phase of the works negative impacts may occur due to an increase of construction waste, communal and chemical waste in case of improper disposal.

5.7 Environmental scoping

Based on this Environmental Review, the following environmental issues are considered relevant for the development of the project:

- hydraulics:
  - effect on tides;
  - effect on existing water use;
  - effect on self purification of the river Sava.
- river morphology:
  - accent on existing river morphology which must be retained, especially existing canals in river bends;
  - change in river course and morphology should be prevented;
- soil and water:
  - listing of pollutants;
  - intervention should not effect existing water quality;

- nature:
  - existing flora and fauna;
  - areas which are important for birds, especially protected areas;
- Lonjsko polje, forests which are depending on water level and swamp areas;
- landscape (as few intervention as possible on natural landscape);
- cultural history and archaeology;
- shipping (existing bridges, infrastructure;
- agriculture;
- recreation;
- social-economic aspects.

5.8 Mitigating measures

Mitigating measures to be considered in the feasibility and designing phase, in order to obtain the environmentally most-friendly solution include:

- prevention of accidental or deliberate water pollution with oil and other harmful substances from the vessels (inspection authorities);
- one-way traffic system at assigned locations (if not already designed);
- emergency and spill response system (including hardware);
- improved signalling;
- waste reception facilities;
- existing river morphology must be preserved as much as possible;
- all canals, river armbands, and other river forms must be preserved;
- interventions must not influence swamp areas, areas of importance for birds, protected areas and wet forests that depend on the water level;
- interventions must not adulterate existing water quality;
- existing infrastructure elements must be considered (bridges, etc);
- inventory of existing flora and fauna must be made (not only on intervention locations, but also on the areas which are depending on river Sava;
- areas (landfill) for mud from excavation must be determined;
- intervention locations must be organised in phases;
- during construction activities all waste from the bottom should be removed;
- dangerous load (which could endanger existing water quality) should not be carried on the vessels;
- elaboration of an Environmental Monitoring Plan during the EIA and design phase of the project.

5.9 Conclusions and recommendations

5.9.1 Conclusions

The Sava river basin is a very sensitive location and is very important for biodiversity conservation. Based on the available data, the proposed works are feasible, but it is of utmost importance that a full EIA is performed to further analyse the environmental impacts and risks and identify mitigations options to minimise these impacts and risks. The conclusions of the EIA should be strictly followed.

The EIA should especially focus on the identification, quantification and assessment of hydraulics, river morphology, soil and water (existing pollutant must be listed, intervention should not effect existing water quality) and nature protection effects (existing flora and fauna, areas which are important for birds). Cross border effects have to be determined into more detail during the execution of future Feasibility Studies.

In protected areas like Lonjsko polje, forests which are depending on water level, and swamp areas around the Sava river basin the EIA should focus in detail on nature and habitat protective mitigation measures. In addition to that, special attention should be paid to natural landscape and cultural history and archaeology preservation in narrower segments within future intervention area.

Agriculture and recreation activities could have additionally significant impact on the environment, which have to be quantified as more as possible.

5.9.2 Recommendations

The future EIA should be developed according local legal requirements (Slovenia, Croatia, Serbia and Bosnia and Herzegovina), but also taking into consideration EU Directives requirements as specified in section 5.2. This is important because the procedure for local permits issuing has to be fully complied in order to realise the intervention.

Public participation, which is an important issue for the development of the EIA, should preferably already commence during the Feasibility Study, as planned interventions could then be modified and tailored in the early stages of the project.

The EIA should put special attention on the elaboration of WFD Directive for the Sava River Basin as well as all other requirements listed under section 5.7, when assessing negative impacts and prescribing mitigation measures.

Furthermore, it is recommended to including the mitigating measures as identified in this Pre-Feasibility Study (section 5.8) in the list of measures to be further analysed during the following stages of the projects.

Existing water infrastructure improvements should follow most environmentally friendly solutions.

ANNEX 5.1 - BASIN OF THE RIVER SAVA - WATER QUALITY (Year 2000)

River/lake	Nr. of the measuring station	Demanding variety/sort of water	Registered variety/sort			
			Oxygen regime	Nutrients	Microbio. Indicator.	Biologic. Indicator.
SAVA						
Gunja	10000	II	II	III	IV	
Županja niz.	10001	II	II	III	IV	III
Županja uzv.	10002	II	III	III	V	II
utok Bosne niz.	10003	II	II	IV	IV	II
utok Bosne uzv.	10004	II	III	III	IV	II
Slav. Brod niz.	10005	II	II	III	IV	II
Slav. Brod uzv.	10006	II	II	III	IV	II
utok Vrbasa niz.	10007	II	III	IV	IV	II
utok Vrbasa uzv.	10008	II	III	IV	IV	II
ut. Une niz. Košutarice	10009	II	III	III	V	II
utok Une uzv. Jasenovac	10010	II	III	III	IV	II
utok Kupe niz. Lukavec	10011	II	III	III	V	II
Galdovo	10012	III	III	IV	V	
Martinska Ves	10013	III	III	IV	V	II
Oborovo	10014	III	IV	III	V	III
Petruševac	10015	III	II	III	V	II
Jankomir	10016	III	II	III	IV	II
Jesenice	10017	II	II	III	IV	II
KUPA						
Sisak	16001	II	I	II	III	II
Brest	16002	II	I	II	III	
Šišinec	16003	II	I	II	IV	II
Jamnička Kiselica	16004	II	II	IV	IV	II
Rečica	16005	II	II	IV	IV	II
Gornje Pokuplje	16006	II	III	III	IV	II
Kamanje	16007	II	II	III	IV	II
Bubnjarci	16008	II	I	II	III	II
Pribanjci	16009	I	II	III	III	II
KORANA						
Gaza	16329	II	II	III	IV	II
Velemerić	16331	II	II	II	III	II
Veljun	16333	II	II	II	III	II
Slunj	16334	II	II	II	II	II
Bogovlja	16335	I	II	III	III	II
Kordunski Ljeskovac	16337	I	II	III	IV	II
selo Korana	16338	I	I	II	II	I
PLITVIČKA JEZERA						
jezero Kozjak površina	19001	I	II	III	III	I
DOBRA						
Gornje Pokuplje	16571	II	II	II	IV	II
Lešće	16572	II	II	III	III	II
Luke	16581	II	II	II	III	II
MREŽNICA						
most na c. Generalski stol - Perjasica	16454	II	II	III	III	II
Juzbašići	16453	I	II	II	III	II
Mostanje	16451	II	II	III	IV	II
KUPČINA						
Donja Kupčina	16225	II	III	V	V	II
Lazina	16224	II	II	III	V	II
SLUNJČICA						
Slunj-Rastoke	16336	II	I	II	IV	I
ODRA						
Sisak	16220	II	II	II	III	II
UNA						
Donja Suvaja	14004	I	I	I	IV	
Struga	14003	II	I	II	III	
Hrvatska Kostajnica	14002	II	I	II	IV	
most na utoku	14001	II	I	II	III	
GLINA						
Glina	16221	II	I	II	III	
Slana	16223	II	I	II	IV	
SUNJA						
Strmen	16100	II	II	II	III	
SUTLA						
Harmica	18001	II	III	III	IV	II
Zelenjak	18002	I	III	III	IV	II
Prišlin	18003	I	V	V	V	IV
BREGANA						

Bregana	11076	I	II	II	III	II
KRAPINA						
Zaprešić	17001	II	III	IV	IV	III
utok Krapinice	17003	II	III	IV	V	III
Bedekovčina	17004	II	IV	IV	V	III
KRAPINICA						
Zabok	17551	II	IV	V	V	III
Krapina	17552	II	III	V	V	III
ČESMA						
Obedišće	15351	II	IV	V	IV	III
Čazma	15352	II	IV	V	III	III
Česma	15353	I	V	IV	III	III
ILOVA						
nizv. od utoka Kutinice	15220	III	V	V	V	III
V.Vukovje	15221	III	V	IV	III	II
Garešnica	15222	III	III	III	III	
GLOGOVNICA						
Mostari	15371	II	IV	V	IV	III
SPOJNI KANAL ZELINA-LONJA-GLOGOVNICA-ČESMA						
uzvodno od praga u kanalu, kod ventila za Ivanić Grad	15592	II	II	III	III	III
PAKRA						
Lipik	15111	III	III	V	V	
Trebež	15110	II	III	V	IV	
KUTINICA						
prije utoka u Ilovu	15241	II	III	V	IV	
OTERETNI KANAL LONJA-STRUG (LONJA)						
prije utoka u Ilovu	15241	II	III	V	IV	
OTERETNI KANAL LONJA-STRUG (TREBEŽ)						
ustava Trebež	15483	II	III	III	III	
OTERETNI KANAL LONJA-STRUG (STRUG)						
most na cesti Novska-Jasenovac	15484	II	III	IV	IV	
ORLJAVA						
ispod autoceste	13001	II	III	IV	V	II
most u Pleternici	13002	II	III	V	V	
nizvodno od Požege	13003	II	V	V	V	
uzvodno od Požege	13004	II	II	III	IV	
VELIČANKA						
most u Požegi	13500	II	II	III	V	
prije kamenoloma	13501	II	II	III	II	
ŠUMETLICA						
Nova Gradiška	10436	II	V	V	V	
GLOGOVICA						
Sl. Brod, grad	10700	II	IV	V	V	
LONDŽA						
Most u Pleternici	13200	II	II	IV	IV	
BOSUT						
Lipovac	12002	III	IV	IV	III	
Vinkovci nizv.	12001	III	V	V	IV	
Vinkovci uzv.	12000	III	IV	IV	III	III
most na cesti Rokovci-Andrij.	12003	III	IV	IV	III	
BIĐ						
most na c. V. Kop. - Vrpolje	12300	II	V	V	III	
SPAČVA						
Apševci	12100	II	IV	IV	III	
AKUMULACIJA "BAČICA"						
iznad brane - površina	10433	II	III	III	III	
iznad brane - dno	10434	II	II	III	II	

ANNEX 5.2 LIST OF REGULATIONS

- Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment.
- Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.
- Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC – Statement by the Commission
- Directive 2000/60/EC of the European Parliament and of the Council on 23 October 2000 establishing a framework for the Community action in the field of water policy.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
- Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds
- Common Approaches on environment and officially supported export credits (2001), and recommendations of 2003.
- Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2006.
- White Paper - European transport policy for 2010, European Commission, 2001

1. General

- Environmental Declaration in the Republic of Croatia (OG No. 34/92).
- National Environmental Protection Strategy (OG No. 46/02).
- National Environmental Action Plan (OG No. 46/02).
- Environmental Protection Act (OG, No., 82/94 and128/99)
- Regulation on Environmental Information System (OG No.74/99, 79/99)
- Regulation on Conditions for Issuing Permits for Performing Professional Environmental Activities (OG No. 7/97)
- Regulation on Environmental Emission Inventory (OG No.36/96)
- Ordinance on Environmental Impact Assessment (OG No. 59/00, 136/04 and 85/06).
- List of Legal Persons with Granted Approval for Performing Professional Environmental Activities (OG No. 71/05)

2. Physical characteristics

- National Physical Planning Strategy and Program (OG No. 50/99).
- Act of County, City and Municipal areas in Republic of Croatia (OG No. 10/91).
- Physical Planning Act (OG, No. 30/94, 68/98, 35/99, 61/00 and 32/02).
- Mining Act (consolidated text) (OG No. 190/03).
- Construction Act (OG No. 52/99, 75/99, 117/01 i 47/03).
- Public Roads Act (OG No. 100/96, 76/98, 27/01, 114/01 i 65/02).
- Regulation of internal Organisation of State Administration Offices (OG No. 21/02).
- Ordinance of Excessively Use of Public Roads (OG No. 40/00).
- Ordinance of Traffic Signs and Signalisation on Roads (OG No. 39/93).
- Ordinance of Technical Normative for Concrete and Reinforced Concrete (Official Journal No. 11/87).
- Ordinance of technical normative for design and construction building objects (Official Journal No.15/90).
- Ordinance of Technical Requirements for Road Traffic Vehicles (OG No. 92/05),
- Ordinance of Technical Requirements for Design and Construction of Accesses and Entrances to Public Roads (NN 73/98).
- Resolution about Municipalities that can adopt Physical Plan with Decreased Contents (OG No. 163/04).

3. Air

- Air Protection Act (OG No. 178/04)
- Regulation on Limit Values of Pollutant Emissions from Stationary Sources into the Air (OG No. 140/97, 105/02, 108/03, 100/04)
- Regulation on Limit Values of Pollutant Emissions into the Air from a Stationary Source in the Technological Process Of Mineral Wool And Ceramic Fibres Production, and Deadline for Application of Emission Limit Values of Sulphur Oxides (Expressed as SO2) from Combustion Installations, Gas Turbines and Internal Combustion Engines (OG No. 98/05).
- Regulation on Limit Values of Pollutants in Ambient Air (OG No.133/05).
- Regulation on Alert Thresholds of Pollutants in Ambient Air (OG No. 133/05).
- Regulation on Ozone in Ambient Air (OG No. 133/05).
- Regulation on Substances that Depleting the Ozone Layer (OG No. 120/05).
- Ordinance on Issuing Permits or Permission for Pursuit of Activities of Air Quality Monitoring and Monitoring of Emissions from Stationary Sources in Ambient Air (OG No. 79/06).
- Ordinance on Maximal Limits of Concentrations of Harmful Substances in Working Areas Atmosphere and Limit Values (OG No. 92/93).
- Ordinance on Monitoring of Emissions from Stationary Sources in Ambient Air (NN 01/06).
- Ordinance on Air Quality Monitoring (NN 155/05).

4. Water

- National Water Protection Plan (OG No. 8/99)
- National Defense Plan against Floods (OG No. 8/97, 32/97, 43/98, 93/99, 14/03 i 188/03).
- Water Act (OG 107/95 and 150/05).
- Regulation on Water Classification (OG No. 77/98).
- Regulation on Hazardous Substances in Water (OG No. 78/98).
- Ordinance on Extreme Values for Dangerous and Other Substances in Waste Water (OG, No. 40/99, 06/01 and 14/01).
- Ordinance on Health Check for Drinking Water (OG No. 46/94).
- Ordinance on Permit Issue of Hydraulic Requirements, Hydraulic Permissionas and Hydraulic Permits (OG No. 28/96).
- Ordinance on Special Requirements for Legal Entities for Performing Professional Waste Water Activities (OG No. 93/96, 53/97 i 102/97).
- Ordinance of Natural Soda, Natural Welling and Other Waters (OG No. 2/05).
- Ordinance on Establish Sanitary Protection Zones for Water Sources (OG No. 55/02).

5. Soil

- Agricultural Land Act (OG No. 54/94).
- Ordinance on Agriculture Soil Protection from Harmful Substances (OG No. 15/92).

6. Biological and Landscape Diversity

- Strategy and Action Plan on Biodiversity and Landscape Protection (OG No. 81/99)
- Forests Act (OG No. 140/05).
- Nature Protection Act (OG No. 70/05).
- Ordinance on Manifestation Wild Species Protected and Strictly Protected. (OG No. 7/06).
- Ordinance on Bio Types, Bio Maps, Endangered and Rare Bio Types and Measures for Preserving Bio Types (OG No. 7/06).
- Ordinance on Indemnification of Damage Highness Caused by an Illicit Action on Protected Animal Species (OG No. 79/02).

7. Cultural Heritage

- Cultural Heritage Protection and Preservation Act (OG No. 69/99, 151/03 and 157/03).
- Ordinance on Cultural Heritage Register in Republic of Croatia (OG No. 59/00).

8. Noise

- Noise Protection Act (OG No. 20/03).
- Ordinance on Highest Allowed Noise Levels in Working and Living Environment (OG No. 145/04).
- Ordinance on Terms for Organisation for Measuring and Predicting Noise in Workind and Living Areas (OG No. 37/90).

9. Accidents

- Environmental Protection Emergency Plan (OG No. 82/99, 86/99, 12/01).
- Safety at Work Act (OG No. 59/96, 94/96 and 114/03).
- Ordinance on Technical Measures in Safety at Work in Surface Mining (Official Journal No. 18/61, 37/64 i 6/68).
- Ordinance on Safety at Work in Building (Official Journal No. 42/68 i 45/68).
- Ordinance on Safety at Work for Working and Backing Rooms and Areas (NN 6/84 i 42/05).
- Act on Protection against Fire (OG No. 58/93 i 33/05).
- Fire Act (OG No. 106/99, 139/04 i 174/04).
- Ordinance on Making Evaluation of Fire and Tehnological Explosion Risk (OG No. 35/94).
- Ordinance on Content of Fire and Technological Protection (OG No. 35/94).
- Ordinance on Program and Method of Population Training for Protective Procedures in Fire Protection, Fire Fighting and Rescuing of People and Properties Endangered by Fire (NN 61/94).
- Ordinance on Maintenance and Select of Extinguisher (OG No. 35/94).
- Ordinance on Terms for Fire Accesses (OG No. 35/94).
- Flammable Liquids and Gases Act (OG No. 108/95).
- Ordinance on Flammable Liquids (OG No. 54/99).
- Safety at Road Traffic Act (NN 84/92).
- Ordinance on Contents of Regulation for Temporary Workplace (OG No. 45/84).
- Project Control Act (NN 9/00).
- Ordinance on Methods for Handling Obligatory Desinfection, Desinsection and Deratization (OG No. 38/98).
- List of Toxicant for Hygienic Condition, Desinfection, Desinsection, Odour Removal and Decontamination (OG No. 151/02).

10. Waste

- Waste Management Strategy (OG No. 130/05).
- Waste Act (OG No. 178/04 i 111/06).
- Communal Economy Act (OG, No. 26/03 i 178/04).
- Regulation on Unit Charges, Corrective Coefficients and Detailed Criteria and Benchmarks for Determination of Charges for Burdeninig the Environment with Waste (OG No. 71/04).
- Regulation on categories, types and classification of waste with the waste catalogue and the list of hazardous waste (OG No. 50/05).
- Regulation on Transboundary Waste Transit (OG No. 69/06).
- Regulation on Requirements for Handling Hazardous Waste (OG No. 32/98)
- Ordinance on Packaging and Packaging Waste (OG No. 97/05)
- Ordinance on Waste tyred Management (OG No. 40/06).
- Ordinance on Criteria, Methods and Determination of Compensation Amount to Real Estate Owners and Municipalities (OG No. 59/06).
- Ordinance on the Method and Terms for Calculation and Payment of Charges for Burdeninig the Environment with Waste (OG No.95/04)
- Ordinance on the Form, Content and Method of Keeping the Register of Parties Subject to Payment of the Charge for Burdening the Environment with Waste (OG No. 120/04.
- Ordinance on Inquest Register of Legal Entities and Natural Persons for Performing Intermediation in Organisation of Waste Recycling and/or Waste Management and Legal Entities and Natural Persons Performing Import Unhazardous Waste Activities (OG No. 51/06).

- Ordinance of List of Legal Entities and Natural Persons Performing Import Unhazardous Waste Activities (OG No. 1/04).
- Ordinance on Requirements for Handling Waste (OG No.123/97, 112/01).
- Ordinance on Waste Types (OG No. 27/96)
- Instruction on Handling Waste in Medical Care Supply (OG No. 50/00).
- List of Professional Institutions with Authorisation for Reports Issuing on Analyze Physical and Chemical Characteristics of Waste (NN 51/96 i 93/96).

11. International regulations

- Environmental Impact Assessment (EIA) Directive 85/337/EEC (as amended by directive 97/11/EC and by directive 2003/35/EC)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989). Published in OG–IT, No. 3/94, came into force with respect to the Republic of Croatia on 9 May 2000.
- Vienna Convention for the Protection of the Ozone Layer (Vienna 1985)Pursuant the notification on succession, the Republic of Croatia became a party to the Convention on 8 October 1991 (OG- IT 12/93).
- European Landscape Convention (Florence, 2000). Published in OG–IT, No. 12/02, came into force with respect to the Republic of Croatia on 1 March 2004, and the effective date was published in OG-IT 11/04.
- Convention on Long-range Transboundary Air Pollution (Geneva 1979). Pursuant the notification on succession, the Republic of Croatia became a party to the Convention on 8 October 1991 (OG- IT 12/93).
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo 1991). Published in «Narodne novine – Međunarodni ugovori» (Official Gazette – International Treaties, hereinafter referred to as OG–IT), No. 6/96, came into force with respect to the Republic of Croatia on 10 September 1997.
- Montreal Protocol on Substances that Deplete the Ozone Layer. (Montreal 1987). Pursuant the notification on succession, the Republic of Croatia became a party to the Convention on 8 October 1991 (OG- IT 12/93).
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (London 1990).Published in OG–IT, No. 11/93, came into force with respect to the Republic of Croatia on 13 January 1994.
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (Copenhagen 1992). Published in OG–IT, No. 8/96, came into force with respect to the Republic of Croatia on 12 May 1996.
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1997). Published in OG–IT, No. 10/00, came into force with respect to the Republic of Croatia on 7 December 2000, and the effective date was published in OG-IT 14/00.
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (Beijing 1999). Published in OG–IT, No. 12/01, came into force with respect to the Republic of Croatia on 25 April 2002.
- Law on Ratification of the United Nations Framework Convention on Climate Change (Rio de Janeiro 1992). Published in OG–IT, No. 2/96, came into force with respect to the Republic of Croatia on 7 July 1996.
- Kyoto Protocol to the Convention on Climate Change (Kyoto 1999.). The Republic of Croatia signed the Protocol in 1999.

ANNEX 5.3 Details on Sava riparian states regulation

1. Croatia

EIA national regulations

The EPA prescribes the obligatory procedure and contents of an EIA, and defines the conditions for environmental expert's license. Key elements are the following:

- Environmental impact assessment ensures the realisation of prevention principle by co-ordinating and adjusting the proposed development, facility construction or reconstruction, and/or performance of activities (hereinafter referred to as: the development) with the receptive environmental capacity in a given area;
- Environmental impact assessment considers possible adverse impacts of the proposed development on soil, water, sea, air, forests, climate, human health, animals and plants, landscape, physical and cultural values and their interactions, also taking into account other proposed developments and their possible interactions with regard to the existing or proposed developments in the area for which the development's impact is being examined;
- Environmental impact assessment also has to include the evaluation of the proposed development's impact on the environment, i.e. on its respective parts, as well as of environmental protection measures, in order to reduce adverse impacts to the lowest level possible and achieve the highest possible degree of preservation of environmental quality;
- Environmental impact assessment is performed within the scope of preparations for the proposed development i.e. prior to issuing of the site-permit or any other type of permit for developments not requiring issuing of site-permits.

Moreover, under the EPA there is an Ordinance/Rule Book on Environmental Impact Assessment (OG No. 59/00, 136/04 and 85/06) that defines for which environmental interventions an EIA is necessary and its contents (including methodology). This Ordinance is still not harmonised with EIA Directives in view of terminology of documents and scoping. According to the EPA, the estimation of environmental impacts for implementation of planned activities should be part of an "Environmental report" that is actually an EIA or Environmental Protection Elaborate (smaller scope then EIA). In that way the Rule Book makes a difference on a scope of EIA on principles of project to project screening. However, it is still not consistent with the terminology or graduation as in the EIA Directive.

An EIA is obligatory for interventions defined in the List of Interventions that is part of the Rule Book. An EIA is also required for the reconstruction of interventions if no EIA has been carried out and the intervention's surface area, size, production and/or power are being increased and the technological procedure, production programme or the operating power source is being changed. If an EIA has been carried out, a new EIA is required if the intervention's surface area, size, production and/or power are increased by 30% or more.

An EIA is furthermore obligatory for the removal or cessation of operation of interventions for which no EIA procedure has been carried out. If the intervention location is not defined or is not defined in more detail by physical planning documents, also the location selected for the intervention has to be evaluated. The application for performance of EIA for interventions is submitted to the Ministry of Environmental and Physical Planning of the Republic of Croatia. The EIA has to be enclosed to the application before being evaluated by the Commission.

Water Protection

The Water Act (Zakon o vodama (NN 107/95, 150/05)) is not directly connected with EIA and should be considered in a reasonable way. This Act regulates the legal status of water and water estate, the methods and conditions of water management (water use, water protection, regulation of water courses and other water bodies, and protection from adverse effects of water), the method of organising and performing water management tasks and functions, basic conditions for carrying out of water management activities, powers and duties of Government administration and other Government bodies, local authorities and other legal subjects, and other issues of importance to water management. This Act also establishes Croatian Waters (Croatian Waters), being the legal entity in charge of water management tasks (hereinafter referred to as: Croatian Waters).

The provisions of this Act apply to:

- surface and ground terrestrial waters, including the mouths of rivers and canals discharging into the sea, to the demarcation line;
- mineral and thermal waters, except mineral and geothermal waters suitable for extraction of mineral raw material or utilisation of accumulated thermal energy for power purposes, which is regulated by the Act on Mining;
- drinking water sources in the territorial sea;
- sea water, as regards protection against pollution from mainland and island-based sources.

Additional water-related legal requirements:

- National Water Protection Plan (OG No. 8/99);
- National Defence Plan against Floods (OG No. 8/97, 32/97, 43/98, 93/99, 14/03 i 188/03);
- Regulation on Water Classification (OG No. 77/98);
- Regulation on Hazardous Substances in Water (OG No. 78/98) - This Regulation prescribes which substances, and in what quantity, are considered as hazardous substances in the aquatic environment thus obtaining a significant factor for future EIA;
- Ordinance on Extreme Values for Dangerous and Other Substances in Waste Water (OG, No. 40/99, 06/01 and 14/01);
- Ordinance on Permit Issue of Hydraulic Requirements, Hydraulic Permissions and Hydraulic Permits (OG No. 28/96);
- Ordinance on Establishing Sanitary Protection Zones for Water Sources (OG No. 55/02).

Biodiversity and Landscape Protection

The Directive on Conservation of Natural Habitats and Wild Flora and Fauna No. 92/43/EEC is one of the fundamental regulations governing nature conservation in EU countries. The EU member countries are obliged to incorporate the provisions of this Directive into their legislation, and harmonisation of legislation with this Directive is also an obligation of the Republic of Croatia related to the process of EU approximation.

In 2005, a Nature Protection Act (Zakon o zaštiti prirode NN 70/05) was adopted, which integrated all the obligations of the Republic of Croatia towards international agreements where Croatia is a party or a signatory. The Law prescribes that nature protection requirements need to be issued by the competent government authority in the process of natural resource management plans development. These requirements are defined on the basis of expert thematic papers developed by the State Institute for Nature Protection. If the manner or scope of the natural resources use immediately endangers the favourable state of a species or a habitat type, the Minister in charge may restrict or temporarily suspend the use until the threats have been removed, with the consent of the Minister in charge of managing the natural resource in question. In the event that such restrictions are imposed, owners and authorised persons are entitled to compensation proportionate to their loss of income. The compensation amount is defined by mutual agreement. Finally, in accordance with the corresponding regulations of the European Union, the law defines special ecologically important areas, which include habitats of species threatened at national or at the European level. Protection of these areas is ensured by enforcement of prescribed nature protection measures and requirements.

Under this Law, there are several By-laws regulating NATURA 2000 sites:

- Strategy and Action Plan on Biodiversity and Landscape Protection (OG No. 81/99);
- Forests Act (OG No. 140/05);
- Ordinance on Manifestation Wild Species Protected and Strictly Protected. (OG No. 7/06);
- Ordinance on Bio Types, Bio Maps, Endangered and Rare Bio Types and Measures for Preserving Bio Types (OG No. 7/06);
- Ordinance on Indemnification of Damage Highness Caused by an Illicit Action on Protected Animal Species (OG No. 79/02).

Accidents

There are several regulations related to accidents to be considered when assessing environmental impacts:

- Environmental Protection Emergency Plan (OG No. 82/99, 86/99, 12/01);
- Ordinance on Technical Measures in Safety at Work in Surface Mining (Official Journal No. 18/61, 37/64 i 6/68);
- Ordinance on Safety at Work in Building (Official Journal No. 42/68 i 45/68);
- Ordinance on Contents of Regulation for Temporary Workplace (OG No. 45/84);
- Project Control Act (NN 9/00);
- Ordinance on Methods for Handling Obligatory Disinfection, Disinsection and Deratization (OG No. 38/98);
- List of Toxicant for Hygienic Condition, Disinfection, Disinsection, Odour Removal and Decontamination (OG No. 151/02).

2. Bosnia and Herzegovina

Framework Law on Environmental Protection on Entity Level

This Law shall regulate:

- preservation, protection, restoration and improvement of the ecological quality and capacity of environment and of the quality of life;
- measures and conditions for managing, preserving and for rational use of natural resources;
- the framework for legal measures and institutions for the preservation, protection and improvement of environmental protection;
- financing environmental activities and for voluntary measures.

The responsibilities and tasks and duties of the public administration are at different state levels.

In accordance with the principles of cooperation and shared responsibilities the Act creates an adequate framework for and promotes

- the reduction of the utilization, loading and pollution of the environment, the prevention of its impairment, and the improvement and restoration of the damaged environment;
- the protection of human health and the improvement of the environmental conditions of the quality of life;
- the preservation and conservation of natural resources, and their rational, economical management ensuring the renewal of the resources;
- the harmony of the other interests of the entities with the requirements of environmental protection;
- international co-operation in environmental protection;
- initiatives taken by the public and public participation in the activities aimed at the protection of the environment;
- the co-ordination of the functioning of the economy and the integration of social and economic development with environmental requirements;
- the establishment and development of the institutional background of environmental protection.

The scope of the Law shall cover:

- all environmental media (air, water, soil, flora and fauna, landscape, built environment);
- all forms of activities which utilize, load, or pose hazard to or pollute the environment or have an impact on the environment (such as noise, vibration, radiation - with the exception of nuclear radiation, waste, etc.).

LAW ON AIR

This Law contains the technical conditions to prevent or where that is not practicable, to reduce the emissions into the ambient air from anthropogenic activities, which have to respect for production process, on territory of Bosnia and Herzegovina, planning of air quality protection, special emission sources, emission inventory, ambient air quality, monitoring and sanctions for legal and private entities and natural persons.

Measures shall be taken by applying the following principles:

- an integrated approach for the protection of the environment, including air, water and soil, as well as the obligation to minimize emissions as far as possible by using the Best Available Techniques (BAT);
- "polluter pays principle" which ensures that the costs of air pollution abatement are borne by the operators of pollution sources;
- adequate protection of safety and health of workers at work;
- Improvement of the air quality in Bosnia and Herzegovina, and beyond.

The public participation shall be ensured by the competent federal and cantonal authorities in the preparation of land use and development plans and similar plans of such a nature having implications on air quality, in the preparation of Air Quality Policies and Air Quality Action Plans in identification of the localities, by permitting and inspection procedures of emission sources.

LAW ON NATURE PROTECTION

This Law regulates the restoration, protection, conservation and sustainable development of landscape, natural areas, plants, animals and their habitats, minerals and fossils and of other components of the nature within Bosnia and Herzegovina, the competent bodies which will cover nature protection, planning of nature protection, the general and special measures for nature protection, information system, supervision, funding of nature protection and sanctions for legal and natural persons.

The measures for nature protection, prescribed by this Law, shall ensure the basic and further conditions for protection or sustainable development of nature and environment, in particular but without limitation, with regard to:

- Restoration, protection, conservation and sustainable use of ecological balance in nature;
- Restoration, protection, conservation and sustainable use of the renewable natural resources;
- Restoration, protection, conservation and sustainable use of nature and revitalisation of damaged areas and parts of nature;
- Reconstruction of systems for planning, management, information and funding of nature protection;
- Establishing of inter-entity and international cooperation in the field of nature protection;
- Participation of the public in the process of nature protection;
- Realisation of other aims of the nature protection policy;
- Necessary and responsible adaptation of economic and social development to all the existing renewable natural resources;
- Reduction of the utilisation, loading and pollution of species (animals, plants, fungi) and their habitats.

LAW ON WASTE MANAGEMENT

The objective of the present act is to encourage and provide the basic conditions for the prevention of production, recycling and processing of waste for re-use; the extraction of secondary raw materials and possibly of energy thereof; and safe disposal.

The scope of the present act covers:

- All waste categories, with the exception of those which are excluded (see the respective article);
- all kinds of waste management activities, operations and installations;

- waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries;
- liquid waste;
- animal wastes (e.g.: carcass and manure) and other non hazardous materials of a natural origin, which may be utilized for agricultural purposes;
- defused explosives, only in case, if there is no specific legal regulation for such wastes.

LAW ON WATER PROTECTION

This Act shall govern the protection of waters, watersides and water lands: water protection planning and programming, organization, supervision, financing and penalties for each legal and natural person.

Protection of waters, watersides and water lands shall comprise the preservation and adjustment of water quantities, the maintenance of waters, watersides and water lands, and the adoption of decisions on the use and loading of waters.

The objective of the Water Protection Act is to ensure the sustainable use of waters in order to preserve and improve their quality, to ensure the preservation of natural processes and the natural balance of waters, aquatic and semi-aquatic ecosystems and the landscape properties of waters, and – in cooperation with the bodies responsible for water management – to preserve and adjust water quantities for various types of use in order to realise their economic, social and ecological functions.

Subject to the observation of the fundamental principles of environmental and water protection, the protection of waters, watersides and water lands shall be based on:

- integrity of river basins, taking into account the dynamics of waters and natural processes, and the coherence and interdependency of aquatic and semi-aquatic ecosystems in accordance with the river basin approach;
- sustainable use of waters based on ensuring the functionality of natural processes and maintaining the natural balance of aquatic and semi-aquatic ecosystems, and on the long-term protection and rational use of available water resources;
- Prevention of the excessive load on waters and promotion of sustainable use or utilization of waters and waterside and water land;
- Economic evaluation of waters and exercise of the principle of compensation of costs for water use and water pollution;
- Public participation;
- Observation of the best available techniques and new scientific findings on ecology,
- precautionary principle, i. e. where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason to postpone measures aimed at preventing environmental degradation.

As the Territorial base the following has been defined in the act:

- To ensure integrated and consistent water protection and management, while taking into account hydrographic properties and the uniformity and coherence of the water regime, the Danube river basin district and the Adriatic Sea river basin district shall be regarded as the main river basin districts in the territory of Bosnia and Herzegovina;
- The river basin district of this Law shall be divided into the sub-river basins of Una, Sana, Sava, Vrbas, Bosna, Drina, Trebisnjica, Neretva, Cetina and Krka;
- The sub-river basins referred to in the preceding paragraph may be divided into parts of sub-river basins;
- The river basin districts, sub-river basins and parts of sub-river basins shall serve as territorial bases for programming and planning the water protection.

3. Serbia

Legal/Procedural Background

The procedure to prepare a formal EIA in line with international as well as national regulations for the evaluation and assessment of environmental effects is described in the EU legislation: Directive No. 85/337/EEC – OJ No. L175, 05/07/1985, as amended by Directive No. 97/11/EC – OJ No. L073, 14/03/1997, as well as the updated Serbian laws (December 2004), being:

- the Law on Ecological Protection, Official Gazette RS, No 135/04;
- the Law on Estimate of the Influence to the Environment, Official Gazette RS, No 135/04;
- the Law on Strategic Estimate of the Influence to the Environment, Official Gazette RS, No 135/04;
- the Law of Integrated Prevention and Control of Polluting the Environment, Official Gazette RS No 135/04.

In addition, the following Republic and Federal Laws and Regulations of the Serbian legislation have to be taken into account and respected:

- the Law on Hazardous Matters Transport (Official Gazette of the SFRY 27/90);
- the Law on Water Resources (Official Gazette of RS 46/95 and 54/96);
- the Law on Waste Handling and the Rules on Waste Matters of Hazardous Properties (Official Gazette RS 25/96 and 12/95);
- the Law on Allowable Contents of Dangerous and Hazardous Matters in Soil (Official Gazette of RS 23/94);
- the Act on Limit Values of Emission, Mode and Schedule of Measurements in Soil (Official Gazette of RS 30/97);
- the Act on Allowable Noise (Official Gazette RS 54/92), and
- the Act on Hazardous Matters in Water, Hygienic Condition of Water and Water Classification.

In general an EIA procedure has to address the direct and indirect effects of a project regarding:

- flora, fauna and human beings;
- soil, water, air, climate and the landscape;
- material assets and the cultural heritage, and
- the interaction of the above factors.

Furthermore, the information that has to be presented in the EIA should include:

- a description of the project comprising information about the site, design, and size of the project;
- a description of the measures envisaged in order to avoid, reduce, and if possible, remedy significant adverse effects;
- the data required to identify and assess the main effects which the project is likely to have on the environment;
- an outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental effects.

In accordance with the procedures and the requirements of the EU legislation a call for public response to present the projects has to be made and a non-technical summary of the information mentioned above has to be presented.

ANNEX 5.4 Details about Croatian counties along the Sava

Zagreb County

On the basis of data for 2004 from four measure stations, obvious deterioration between locations Sava-Petruševec and Sava-Oborovo are visible.

Following the Zagreb city water protection plan, streams in the City area are classified as category I (of planned water type) from the well to first settlements, while further downstream category II. The exception is Črnec channel which is classified as category III because of the planned waste waters outlet of the future central plant Sesvete-east. The stream water quality within Zagreb city area deviate from planned water type (category) especially at the sections where there are direct outlets from production plants and other activities, communal outlets and temporal direct outlets from households. That is especially pronounced at the measure outlet of Črnec stream, after waste waters outlet from the economic zone of Sesvetski Kraljevec (Pellis and Agroproteinka).

The main causes of possible water pollution are wild, non-controlled waste landfills within water protective and sensitive areas, water-permeable sewerage, industrial plants located and agricultural activity where easily rinsed herbicides are used (e.g. atrazin).

Untreated technological wastewaters are let into natural receivers in the area where there is no public sewerage system. The biggest receiver water quality impact in the Zagreb city area is made by outlets from economic zone Sesvetski Kraljevec where big polluters are located, at small receiver (Pellis, Agroproteinka). That can be seen from the Črnec channel testing results data more than 50% of Zagreb city industry connected to sewerage system lets out untreated water into waste water collectors.

Central WWTP of Zagreb (CUPOVZ) is being constructed in the eastern part of the City within the area of 110 ha at the left Sava bank, before the main drainage channel (GOK) inflow to Sava. From 2004 prior treatment level is in function of 1,000,000 PE capacity. Waste water is temporally let out to the open part of the GOK-a.

Brodsko-Posavska County

Within the project "With cooperation to cleaner Sava", ecological association Zemlja (BEUZ) has made an inventory of most important polluters of River Sava watershed waters in Brodsko-Posavska County. Polluters connected to city drainage systems are not included in the inventory.

In «polluters manual» locations and names are marked respectively names of problematic subjects along with the description of their polluting method. For example, north of Okučani there is a place called Cage where a slaughterhouse with a feedlot is operating owed by Klas Nova Gradiška. Wastewaters are let into Sloboština river without and treatment. Nova Gradiška city sewerage is being let out by drainage system to Šumetlica river. There is a communal waste landfill Prvča very close to Šumetlica from which all the waters end up in Šumetlica by surface water drainage. In Rešetari settlement, east of Nova Gradiška there is a leather factory that lets out its waste waters without any previous treatment to Rešetarica river.

A pig farm in Lužani is the biggest polluter of surface flows in Brodsko-Posavska County which lets out it waste waters to lagoons of 30 ha sizes which are located along special ornithological reserve Jelas polja. With the minimal biological decomposition water is let out to Mrsunja which passes trough protected landscape with its entire length. The farm is located in the water protective zone of pump site Lužani.

Long-lasting lack of environmental concern has made the company Slavonija DI one of the biggest polluters of Brodsko-Posavska County. They pollute by letting out storm and wastewaters to so called black channel by which the organic waste was taken away for years from Impregnating plant polluted by heavy creosote oils. Sewerage system in the company was never sanitised so they continuously pollute the environment even though the plant has been out of function for the last twenty years.

Staro Petrovo Selo Famous milk factory in Staro Petrovo Selo without any waste waters treatment is endangering the living world (if there is any left) of Pokotina stream. Very close there is a pig farm which additionally loads this watercourse of low fluidity. Pokotina flows into Orljava in Lužani.

A new turkey slaughterhouse in Vindon directly pollutes Sava by its waste waters. The wastewater treatment system that exists at the company does not suit the capacities and production. System is not at the sewerage system of Slavonski Brod.

Also the sewerage system of Slavonski Brod ends up on Viju$ very close to the communal waste landfill. It brings along to Sava complete storm water and wastewater of all the city pollutants, the biggest being Đuro Đaković and Josip Benčević hospital.

Zagrebačka County

Underground waters of Sava alluvium are huge, i.e. basic resource for the entire development of Zagreb and gravity area of Zagrebačka County. By underground waters usage of Sava aquifer water supply of bigger neighbouring Krapinsko – Zagorska County is ensured (pump site "Šibice"). Gravelly aquifer layers created in Quarternary are of possible use in water supply and are extending along the whole Sava valley within the area between slopes of Medvednica and Marijagoričko foothills on the north, as well as slopes of Samoborsko gorje and Vukomeričke gorice on the south.

Aquifer layers thickness is generally increasing from wets to east as well as from the valley edges to its middle. Aquifer thickness and underground water level determine usable possibilities of pump sites systems. Aquifer has huge gravely deposits permeability so that the underground water additional nutrition is ensured from Sava river within the entire valley area. Underground waters are fed by underground inflow from surrounding mountains as well as by storm water and surface waters filtering through semi-permeable surface of aquifer layer.

Aquifer cover layer is composed of mainly dust-sandy, at some points clay deposits with average thickness of just a few meters by which sufficient protection from surface pollution infiltration is not ensured.

Within Sava valley area there is a big concentration of inhabitants and industry (big agglomeration areas) and agricultural areas are represented as well so that the problems of this natural resource protection and further usage occur.

Urbanisation, construction of industrial plants close to pump site zones and inappropriate sewerage network have gradually brought to endangering underground water quality in the water intervention area so the biggest part of pump sites situated on the left Sava river bank is excluded from functioning while the conditioning plants have been incorporated at water pump site "Sašnjak".

On other water pump sites, pollution is noticed as well with the warning of deterioration. Usage of bigger water amounts necessary to satisfy necessities within Zagreb and wider region in forthcoming planning period (long-term solution) is expected from "Črnkovec" area which is situated downstream of the central city agglomeration at the right river Sava bank.

Hydro-geological research works at this location have begun at the end of the seventies and have been carried out with occasional interruptions until today. Underground water quality testing has shown that the water generally satisfies the norms but increased values (above MDK) of determined indicators have been determined in various samples (especially at the southeast part of the area and by "Jakuševec" landfill). Apart from that potential hazard at this location for water quality is presented by intensive construction of residential and economic structures, traffic infrastructure development as well as insufficient representation of adequate sewerage drainage.

Huge importance for Zagreb and western parts of Zagrebačka County water supply is presented by pump site Strmec which is endangered upstream by located landfill "Trebež", industrial plants from Samobor and Sveta Nedjelja, Rakovica stream, numerous upstream settlements most of which do not have resolved sewerage system, agricultural areas, pits filled by different waste and roads. Taking into account the importance of these pump sites in future water supply of Zagreb and Zagreb County, special attention has to be given to these areas protection.

Sisačko – Moslavačka County

Hydrological researches within this County area have revealed the areas with underground waters convenient for water supply. The major part of them is covered by unprotected area of aquifer layers with the hazard of all possible resources pollution from the surface.

Smaller parts of potential water supply zone are covered by soil category I. Collision occurs here between possible additional chemicals and of underground unprotected aquifer. This circumstance tells about one agricultural production orientation (unfortunately, in Croatia insufficiently used in practice until now) to so called “healthy food production”, respectively agriculture which is being realised in natural way without any intensive artificial fertilisation and usage of chemical or any other artificial plant protection substances. The first category of soil fertility due to its very good natural physical and chemical characteristics provides a good possibility for that kind of orientation.

Those presumptions are valid also for the major portion of aquifer zone coverage with soil category II and III. Big forest complexes obtain water protective function as well which means that they need to be conserved above all in the borders of present extent, with the orientation on those growing-exploitation models which will improve the natural climatic-zone profile of forest community.

Existing but also the potential water pump sites within the County area should get a determined primary protection by determination of protective area borders.

Brodsko – Posavska County

Within the County area several hydro-geological units can be sorted. According to the vertical line those are two zones. First zone consists of deposits with layers whose physical-chemical characteristics correspond to water supply norms. The Second zone consists of deposits whose temperature passes 20 °C and mineralisation is bigger than 2,000 mg/l.

Within the first zone the following hydro-geological units can be recognised:

- hilly and mountainous area built from the rocks older than tertiary;
- hilly and mountainous area built from the rocks of tertiary and quaternary age;
- lowland built from the rocks of upper pliocene and quaternary.

The first hydro-geological unit consists of eruptive and metamorphous rocks of Palaeozoic age as well as sediment rocks of Mesozoic age. This unit is spatially limited to central Psunj and Dilj-gora parts. Rocks are primarily impermeable while the secondary porosity is connected only to the shallow cracked zone so there are no significant underground water reserves. But there are the wells whose abundance generally do not pass 0.1 l/s. Underground water additional nutrition is happening exclusively by storm water infiltration through cracked surface rocks. The lowland area built out of rocks of upper Pliocene and quaternary extends as a hydro-geological unit along the Sava river and watercourses which belong to the Sava watershed.

Older and younger watercourse deposits are represented in the upstream part. The area built out of massive-grain gravel deposits that pass to fine-grain sandy gravel and gravely sands downstream, and at the final downstream part to sands. Aquifer horizon thickness is varying within wide limits form 5 to 100 m; most frequently from 15 to 30 m. Additional nutrition is done by storm water infiltration or from Sava river. Downstream from the Kupa delta Sava watershed starts to be asymmetric so the right influents have brought big amounts of massive-clastical material whose peripheral part is deposited at the left Sava river bank. A group of massive-clastical material is distributed with the width from 2 to 20 km and creates relatively rich aquifer horizon.

Left Sava influents are smaller rivers so the massive-clastical deposits of their flows are distributed within significantly smaller area, thinner and less pure. Between massive-clastical alluvial deposits, left and right Sava influents mostly swamp and lake sediments have been deposited which consist of clay and dust deposits with thicker or thinner insertions of sandy layers. East from Sl. Brod massive-clastical, mainly sandy sediments form a range of relatively spatial and continuous aquifer horizons. Underground water additional nutrition occurs by storm water infiltration and filtration from Sava.

Between Sava and aquifer horizon there is a direct hydraulic connection so that the additional nutrition depends on the height and duration of Sava water-level. In the first hundred meters of the depth 3 to 5 different clearly exposed aquifer horizons can be noticed which are separated by weakly impermeable deposits. Going from Sava to the north, the thickness of the horizon is reduced and fine fractions portion is increased so that the thickness varies from several tenths of meters to zero. First aquifer horizon is located in the area along Sava on a depth of 5 to 10 m. To

the north, the cover thickness gradually rises so the first aquifer horizon is situated at average depth of app. 30 m. The thickness varies from 10 to 20 m, and closer to Sava it even reaches 40 m.

Underground water additional nutrition is conditioned by filtration through clay inter-layers. As filtration coefficient of clay inter-layers is being reduced with overlapping depth due to deposits compression so the possibility of horizon additional nutrition significantly decreases. According to the terrain categorisation map regarding underground waters usage suitability made for the needs of Spatial plan of former ZO Osijek, in the area of Brodsko-Posavska County two significant areas appropriate for water supplies pump site location can be recognised. Both are located along Sava or close to Sava. The first one is on east from Sl. Brod, and the north border begins at Sava along Ruščica settlement and goes towards northeast, passes south of Zadubravlja, touches southern part of Bicko seloo and Donji Andrijevci, from where it turns towards southeast and passes between Beravci and Gundinci all the way to the County borders out of which it continues to Županja and Bošnjaci.

South border of this zone is Sava watercourse. Second zone is located along Sava watercourse as well which is at the same time also the south zone border. North border begins on the west around 2 km downstream from the Veliki Strug watercourse inflow and continues to the northeast through Pivare settlement from where it goes towards east, south of Visoka Greda and Sičice settlements, and after crossing Rešetarica watercourse turns towards southeast and ends at Sava watercourse east from Davor settlement.

Vukovarsko –Srijemska County

At the Sava river basin area there are big amounts of underground waters so it is especially important to carry out coordination and conditions control of river Sava regarding the protection of aquifer layers of drinking water. Planned water supply pump sites of eastern Slavonia are located within the area. Water quality at the major part of the existing and potential water sources shows increased concentrations of iron, manganese, inorganic ammonia, methane, hydrogen sulphide, arsenic and others. Increased concentrations are the result of sedimentation conditions during aquifer creation. Big negative impact to underground water quality is present during unfavourable state of waste and sanitary waters drainage.

6 INSTITUTIONAL AND LEGAL ASPECTS

6.1 General

The Sava flows through four sovereign states. In its entire basin, its waters are used in a multi functional way, with IWT only as one of the users of the river. IWT is a user, and not a consumer such as irrigation (agriculture) or a notorious polluter when compared with other sectors such as industries and urban areas (process water and waste water discharge).

In a developing society, the number of water using sectors increases and the complexity of water management grows. It urges the need more and more to develop an adequate system of integrated water management. For this, a multi disciplinary approach is needed, combining the pros and cons in an acceptable way leading to sustainable solutions.

In general, all water using sectors require regular attention of managing authorities in the public sector who are established and have been given responsibilities for the concerned sector. This attention can be (in terms of time) rare, regular and frequent. In this respect one can think of the supervision of a flood plain for effective flood control (rare), checking the technical conditions of a flood control structure (regular, yearly), controlling environmental developments on flora and fauna (regular, seasonal), controlling navigability during low discharges (seasonal), checking water quality (frequent, in some cases even every hour), supervising traffic safety (daily patrol), etc.

In case a water-managing authority should with all these aspects, integrated approaches are needed. It means that at the end already existing older (sub) sector oriented institutions must be reformed for the sake of achieving a modern integrated approach, coordinated and implemented by only one solid managing authority. Thereby: the public sector deals with aspects of safety, reliability and efficiency. The management tasks focus on aspects such as control, supervision, maintenance and enforcement. For all this, clear (new) mandates are needed and involved staff must be trained and the human resources potential optimized.

Whereas integrated water management means per definition that more (water using) sectors are involved with both conflicting and parallel interests and more authorities and institutions in the public sector are responsible and accountable, it stands to reason that all relevant water involved authorities must cooperate and combine forces to achieve optimum benefit from natural waterways for a developing society. Again more mandates and more responsibilities are needed. It urges the need for cooperation, (free) exchange of data, combining research etc. Of course, for a successful implementation of modern integrated water management, such an ideal situation cannot be achieved over night. A best practice could be following a phased approach (short, medium, long term) wherein gradually old existing institutions become abandoned and a new efficient management organization is developing.

For the development of IWT as a flourishing sector on the Sava, integrated water management is an absolute must. It will require adaptation on the medium term of the existing institutions who are involved in IWT somehow, and necessitates reform of institutions on the long term. This will become even clearer if one realizes that at the end even spatial planning is a determining factor for developing an efficient and competitive IWT mode.

This is not only recommended to generate an additional cargo flow for the IWRT transport by planning the locations of industries nearby or along waterways, but also to create and develop a better balance between economy and ecology, between prosperity and welfare. It stands to reason that such a situation can only achieved when adequate policies are developed, to be adopted by Parliament. This is a time consuming process, its duration being dependent on political willingness is the country. And of course, things will become even more complicated if inter-basin (international) cooperation is essential. One can expect that such is the case when considering the development of a modern efficient IWT sector in the international Sava basin.

For the time being, on the short term, till all involved institutions have realized and accepted the fact that further adaptations and reform are unavoidable, at least cooperation must be achieved already on the working level by developing professional horizontal contacts between those institutions under different ministries, who presently are all involved in matters related to the IWT sector.

The above approach has determined the contents of this chapter on legal and institutional aspects.

In fact an inventory is planned for the existing situation in all riparian Sava basin countries.

In section 6.2 an inventory is made of the ministries involved in the IWT sector and of the present situation related to the IWT sector in the riparian states.

In section 6.3 the main reasons for organizational and managerial adjustments in the IWT sector are listed, taking into account determining factors in the Sava basin as well such as the expanding EU in the years to come. Also some general proposals are made in terms of phased adaptations of institutions in the short, medium and long term. In addition, a brief inventory is presented on crucial tasks as done today by existing institutions and the way of their implementation in the long term. Doing so, the staff of all existing institutions must have more knowledge and understanding of developments as coordinated by others, at least in the near future. To achieve this training is needed to optimize the potential of human recourses as employed now and in the future in the IWT sector. This chapter ends with section 6.9 where in general terms a route-to-go is elaborated (recommendations).

Bearing in mind that several institutions are in charge of various aspects of IWT, their objectives are dependent on their respective competences. Nevertheless, their mutual objectives are to maintain, promote, develop and improve all aspects of utilization of inland waters, including but not limited to:

- navigability and water transport infrastructure, canals, ports and hydro engineering structures, safety of navigation, technical capability of ships and alike navigation devices;
- water regime, protection against waters, water quality and antipollution protection, erosion control, environmental and other measures for utilization and exploitation of inland waterways and organization of water management, as a part of overall Sava River Basin economy;
- establishing laws, bills, decrees and other regulations and enforcing the law and the regulations.

6.2 Ministries, authorities and organisations directly involved in IWT

6.2.1 General

In this section the main players within the Sava Riparian countries are listed. However, there are also indirectly various institutes and authorities and private companies involved in IWT, such as the Chamber of Commerce, Insurance companies, statistical bureaus, marinas and ports, shipping companies.

The ministries directly involved in IWT are the following:

- Croatia: Ministry of Sea, Tourism, Transport and Development. Specifically the State Secretary for Sea under which the Directorate for Inland Waterway Navigation resorts.
- Bosnia and Herzegovina: Ministry of Communications and Transport on state level. At the same time at the level of entities the Ministry of Transport and Communications in Banja Luka (Republika Srpska) and the Federal Ministry of Transport and Communications in Sarajevo (Federation of BiH) and the transport department of the government of District of Brcko (which is a self-governing administrative unit under the sovereignty of Bosnia and Herzegovina);
- Slovenia: Ministry of Transport, specifically the Maritime Directorate.
- Serbia: Ministry of Capital Investments, specifically the Sector for Water Traffic and Safety of Inland Water Navigation.

This variety in institutional set up of organizations in the Sava River Basin that presently deal with IWT already shows that for a coherent and consistent development and management of the IWT sector, some major changes are needed in most or even all riparian countries.

More specifically, the present situation of IWT related management in the Sava River basin is elaborated in brief hereunder, country by country.

6.2.2 Croatia

In Croatia, within the Ministry of Sea, Tourism, Transport and Development (see Annex 6.1), the Port Master Office registers the vessel movements and monitors the conditions on the Sava and the traffic. Moreover, the Port Master Office handles the captain's licenses and are responsible for the monitoring of the marking and signalling of the fairway. The Port Master Office that is active related to the Sava is the Port Master Office Sisak and the Port Master Office Slavonski Brod.

The Agency for Inland waterways (main office in Vukovar) is responsible for:

- construction and regulation of inland waterways;
- technical maintenance of inland waterways and safety objects of navigation;
- repairing of existing waterways and safety objects of inland navigation, which were damaged by natural disasters and other emergencies, and restoration to navigability level established for waterway concerned;
- marking of waterways and maintenance of safety objects;
- administration and management of inland waterways;
- control and monitoring of traffic and conditions of the waterway.

Any works to be executed related to these responsibilities are tendered. For the commercial dredging activities the approval of the Agency is required.

The port authorities in Sisak and Slavonski Brod are in charge of harbour developments and operation.

The main shipping company is Dunavski Lloyd operating on the Sava and on the Danube.

Another organisation related directly to shipping is the Croatian Register of Shipping (Annex 6.2). This organisation has its head office in Split (for the sea transportation) and a branch office in Zagreb (inland waterway shipping). It is the institution in charge of carrying out expert and technical operations to determine the condition and quality of ships to navigate.

Croatian Waters (Hrvatske Vode) and the Ministry of Agriculture, Forestry and Water management play a role with respect to water management aspects on the Sava.

The Meteorological and Hydrological Service (MHS or DHMZ (in Croatian)) performs expert tasks related to the hydro meteorological support in the field of meteorology and hydrology.

6.2.3 Bosnia and Herzegovina

On **State level** the Ministry of Transport and Communications has the following competences:

- deals with issues of preparation and enforcement of regulations that refer to establishment and functioning of international and inter-entity road, railway, air and pipes transport;
- participates in development of bilateral agreements with all the states that a mutual interest in bilateral transport of goods and passengers exists, and monitors their implementation;
- prepares signing of international contracts and agreements in the area of international transport;
- cooperates with other states and international organizations that Bosnia and Herzegovina is a member of;
- makes agreement on contingent of bilateral and "ECMT" licenses, used in international transport;
- distribute "ECMT" licenses to national transport operators;
- issues licenses to transport operators for international and inter-entity transport of goods and passengers;
- harmonize international and inter-entity schedules and establishes basic principles and coordination of the activities;
- cooperates with states within the Stability Pact in terms of transport;
- cooperates with relevant authorities of the entities and Brcko District of BiH.

Federal level (entity) level of BiH the Federal Ministry of Transport and Communications executes the administrative, professional and other tasks as set out by the laws falling under competence of the Federation in areas of transport and communications, as follows: road transport and public roads, rail, air, maritime, river, lake transport; pipeline transport; safety of roads, railway, air, maritime, river and lake transport; flight control; telecommunications and posts, except for establishment and functioning of the joint and international communication devices; inspection supervision in the field of public roads and road, rail, air, maritime, river and lake transport and other tasks as set out by the laws.

In **Republika Srpska (entity level)** the Ministry of Transport and Communications is responsible for management and other expert works related to activities, road traffic and public roads, railway traffic and safety of railway traffic, air traffic, sea, river and lake traffic, safety of sea, river and lake traffic, reloading services, communication system, radio communications, mail, telegraph and telephone transport, telecommunication, telecommunication infrastructure, radio diffusion system, coordination policy management, inspection supervision of public roads, road traffic, railway traffic. PTT traffic with telecommunications and other works are put under its jurisdictions.

In the **District of Brcko** all transport issues are handled on District level. The marking and signalling of the fairway is executed till date by Croatia; Bosnia and Herzegovina does not have yet such an organisation.

The BIH Register of Shipping has not been established yet, while there is also no shipping company in BiH. Projects are ongoing to enable the establishment of these institutes/organisations.

The water management aspects of the Sava and also the mining concessions regarding to commercial dredging on the Sava are on entity level handled through the competent department within the Ministry of Agriculture, Forestry and Water management.

The ports along the Sava are Samac (Republika Srpska) and Brcko (District of Brcko). The Port Master Office on the Sava exists in Brčko only.

Details are presented in Annex 6.3, 6.4 and 6.5.

6.2.4 Slovenia

In Slovenia the Ministry of Transport – Maritime Directorate (see Annex 6.6) handles the IWT matters. A Slovenian Register of Shipping does not exist. These tasks are being handled by Lloyd's Shipping or other foreign companies.

The Ministry of Environment and Spatial Planning deals with the water management aspects of the Sava and also with the mining concessions related to commercial dredging on the Sava. The 20 km Sava stretch from Croatian / Slovenian border to Brezice is subject to a spatial development plan.

There are presently no commercial ports along the Sava in Slovenia.

6.2.5 Serbia

In Serbia within the Ministry of Capital Investments (MoCI) (see Annex 6.7) the 'Sector for Water Traffic and Safety of Inland Water Navigation', handles directly the IWT aspects. This Sector consists of two divisions exist, e.g.:

- Group for Inland Navigation, which includes the Port Master Offices (PMO);
- Department of Inland Waterways (infrastructure, ports, RIS, dangerous goods, international legislation, transport).

The public companies Plovput and Jugoregistar are also listed within this Department.

(ref.) Plovput

The Public Agency for maintenance and development of inland navigable waterways 'Plovput' is the institution in charge of maintenance and development of inland navigable waterways established by the Decree on the Public Agency for the maintenance and development of inland navigable waterways. The head office is in Belgrade.

(ref.) Yugoslav Ships Registry (Jugoregistar)

The Public Agency 'Yugoslav Register of Inland Navigation Ships (Jugoregistar: is its official legal name) is the institution in charge of carrying out expert and technical operations to determine the condition and quality of ships to navigate. It is established by the Decree on the Public Agency Yugoslav Register of Inland Navigation Ships. The head office is in Belgrade.

In addition, Srbija Vode resorting under the Ministry of Agriculture, Water Resources and Forest plays a role with respect to water management aspects of the Sava, as well as the port organizations (Sabac and Sremska Mitrovica) and the shipping organization JRB sailing the Danube and the Sava.

Republic Hydro Meteorological Institute (RHMI)

The RHMI performs expert tasks related to the hydro meteorological support to river navigation, and the fulfilment of international obligations in the field of meteorology and hydrology'.

6.2.6 International Sava River Basin Commission

The Sava, after disintegration of Yugoslavia (SFRY) has become an international river, shared between the states originally part of the territory of the former SFRY, i.e. Croatia, Bosnia and Herzegovina, Slovenia and Serbia. Under the new circumstances, the need for regulation of the Sava River Basin countries relations was not only recognized by the countries themselves, but also by the international community, present in the region following the wars after the dissolution of the SFRY.

The process known as the Sava Initiative was launched by the Letter of Intent concerning the International Sava Basin Commission Initiative, signed by the Ministers of Foreign Affairs of Croatia, Slovenia and the FR of Yugoslavia and Minister for Civil Affairs and Communications of Bosnia and Herzegovina, in Sarajevo, on 29 November 2001.

The International Sava River Basin Commission – the Sava Commission was established by the Framework Agreement on the Sava River Basin signed by the riparian countries (Republic of Slovenia, Republic of Croatia, Bosnia and Herzegovina and the Federal Republic of Yugoslavia) in Kranjska Gora (Slovenia) on December 03, 2002, after successful completion of negotiations run under the "umbrella" of the Stability Pact for Southeastern Europe.

The Agreement entered into force on December 29, 2004, namely 30 days after the Depositary of the Agreement (Republic of Slovenia) notified the signatories on reception of the last instrument of ratification procedure. Accordingly, the Constitutional Session of the Sava Commission was held on June 27-29, 2005 in the premises of the Croatian Ministry of Sea, Tourism, Transport and Development in Zagreb and the Chairman of the Sava Commission for the three-year mandate and the Deputy Chairman of the Sava Commission were selected.

The International Sava River Basin Commission was established for purpose of implementation of the Framework Agreement, and realization of the mutually agreed goals:

1. establishment of the international navigation regime on the Sava River and its navigable tributaries;
2. establishment of the sustainable water management;
3. undertaking measures for prevention or restriction of danger, as well as elimination of the hazardous impacts of floods, ice, draught and accidents involving substances having negative impacts to waters.

The Agreement also defined the general principles on actions of the Parties, which would cooperate on the basis of sovereign equality, territorial integrity, joint benefit and good will, by mutual respect of the national laws, institutions and organizations, and by acting in accordance with the European Directive 2000/607EC of the EU Parliament and Council dated October 23 2000 (the EU Water Framework Directive).

The tasks of the ISRBC include the following:

1. Coordination:
   - in preparation of an integrated Sava RBM Plan;
   - in establishment of an integrated Information System;
   - in preparation of studies and other strategic documents;
   - of majority of activities in the fields of Navigation and Water Management;
2. Proposition:
   - of the Sava RBM Plan;
   - of priority projects;
3. Decision making in the field of navigation;
4. Cooperation with international and national organizations;
5. Issuing documents and publications.

The ISRBC has been given the international **legal capacity** for:

- Making **decisions** in the field of Navigation;
- Providing **recommendations** on all other issues (i.e. Water Management).

Rules and regulations on shipping in the Sava River basin are being developed by the Sava Commission and are forwarded to the member countries.

With reference to the general remarks under section 6.1. and comparing this with the present situation in the Rhine basin, the Sava Commission is responsible for adequate integrated water management in the Sava River basin and navigation. This is a unique development in Europe and is an excellent starting point to further enhance the Sava Commission activities. This should be fully supported and sustained by and through the Sava riparian states.

Decisions as released by the Sava Commission need adequate supervision and enforcement by the riparian countries. This is (still) a matter of the various riparian countries themselves; in practice this may lead to problems in the future, also because for a consistent and adequate implementation, sufficient resources (staff, money, equipment) is needed on an annual basis. As long as the Sava Commission has no say in this, the development of an efficient and reliable IWT sector must rely on idealism and good willingness of all stakeholders, more in particularly in the public sector. That is not the best guarantee for success!!

6.2.7 Danube Commission

The present Danube Commission (DC) is based on the Belgrade Convention of 1948 and is the international legal instrument governing the Danube navigation. The Sava, being a tributary to the Danube, should therefore take into account the DC regulations.

6.3 Transport Policies in Sava riparian states

6.3.1 General remarks

Within the framework of the UN/ECE – Inland Transport Committee resolutions regarding rules and regulations for IWT are being developed. In this respect, for IWT the classification of waterways and cargo vessels is important, it has been implemented in the Rhine basin and (partly) in the Danube basin. The Sava Commission already has its own classification system for the Sava River Basin.

In 2001, the EU has published its White Transport Policy Paper, exposing the European Transport Policy till 2010. Today, this is a crucial document for any further major development in transport infrastructure on the European continent, also beyond the borders of the EU. These so-called Marco Polo programme, inter modal initiatives and alternatives to road transport are supported, until they become commercially viable. Intermodality will also require rapid introduction of a series of technical measures, particularly on containers, loading units and administrative (transit, cross border) measures. One can also think of just-in-time and door-to-door concepts.

It is expected that finally, all countries in Europe, as far as they are already or will become in the (near) future a member of the EU, will elaborate an own policy transport document based on the

principles and approaches of this EU document. But, a proper and solid transport policy must also be based realistic (phased) cargo flows, technical sanitation and innovation, education and training of skilled staff and labour, etc. Comparison between modes (rail, road, IWT) to stimulate and effectuate (commercial) competition must be based on competitive tariffs, determined by economic costs and NOT by financial costs. It means often that in an ideal situation, old existing protection measures per separate mode (subsidizing systems, shadow pricing, market protection, etc.) per country must be abandoned at the end of the time span of the (transport) policy document.

This is the more so crucial because of the political history of the riparian (Sava) countries, when a command economy dominated. Today, fair competition in a market driven economy can only be achieved if such old (tariff) structures, etc. are given up.

6.3.2 Croatia

The Croatian transport and policy paper has been prepared in 1999 covering the period 2000 – 2010. It covers all modes of transport.

Regarding IWT transport policy for the Sava related developments, the following should be highlighted.

Construction of inland waterways, ports and terminals

Priorities for the construction and regulations of inland waterways are:

- regulation of river Sava in order to upgrade it to class IV on the basis of agreement with Bosnia and Herzegovina until 2005;
- construction of Danube-Sava canal from Vukovar to Šamac with the length of 61.5 km and upgrading to class Vb (for the ships with capacity of 1,850 tons); competition of construction depends on the financing possibilities;
- regulation of river Sava by the construction of multipurpose locks in Županja, Jasenovac and Sisak for the purpose of upgrading the waterway up to Class Vb in the period 2005 - 2020.

Priorities and stages of development of river transport

Priorities for the construction and modernisation of ports and quays are:

- to modernize the existing ports in Sisak, Slavonski Brod, Osijek and Vukovar for the handling of all kinds of cargo in combined transport until 2005 (note: the expression ‘all kinds of cargo’ suggests that presently there is no proper transport policy in force! This is the more so important because in a developing and modernizing society, the transport of dangerous commodities is unavoidable. Fort this, in the shipping sector there are even global norms);
- to build new ports in Vukovar, Vinkovci and Cerna on the (planned and to be constructed) Danube-Sava canal;
- to build a port in Rugvica near Zagreb until 2020.

Investments in river transport

It is planned to invest about one billion Euros in river transport in accordance with the government strategy and policy, for:

- construction of the Danube-Sava canal;
- construction of river ports;
- maintenance of inland waterways;
- maintenance and development of safety system of inland waterways;
- canalization of Sava and Drava rivers;

From the available information it is not clear if also investments are planned for a substantial improvement of navigational aids and aids to navigation, and if extra developments will be developed for the transport on a larger scale of dangerous commodities.

Danube-Sava canal

Construction of Danube-Sava canal, together with the canalization of Drava, Sava and Kupa, would enable for the river transport in the Pannonian region to achieve an important complementary share in overall transport system. This way river transport, with implementation of combined rail-road-river and sea transport would enable efficient connection of Danube region with Adriatic sea and Mediterranean. This is only possible if great attention is given to (global) developments in container transport and in modern intermodal concepts such as door-to-door and just-in-time approaches. Therewith, Republic of Croatia would be able to connect its inland parts in a better and rational way, as well as to include its transport system in a more adequate manner into the international traffic flows.

The overall increase of river traffic, based on a proper cargo flow planning and related transport policy and based on a phased extension of modern industrial sites nearby waterways, will intensify the development of river ports, quay and terminals alongside the entire corridor Danube region-Adriatic, and especially in the area of Eastern Slavonia, Zagreb, Sisak, Rijeka, Ploče, Split, Šibenik and Zadar.

The planned purpose of the Danube-Sava canal is, besides navigation, to ensure an adequate water utilities system, irrigation and flood protection system. Considering the afore mentioned and that the construction of the canal will affect hydrological and other environmental conditions, a comprehensive research and analysis will be required in order to avoid possible negative effects.

6.3.3 Bosnia and Herzegovina

The Medium Term development Strategy PRSP (2004 – 2007) mentions the following regarding the Infrastructure:

Sector Priorities – Infrastructure

Goals:

- Ensure better valorisation of the available natural and geographic conveniences by developing the river transport during 2004-2007;
- Create conditions to utilize the transport capacities of the Sava.

Water Transport and Infrastructure – priorities

- define the legislation and regulations:
  1. adopt the BiH law on Inland and Maritime Navigation;
  2. sign and ratify all existing multilateral and bilateral conventions and agreements and regulate relations with the countries through on the banks of the Sava;
  3. the navigation on the Sava should be internationalized, and appropriate international agreements with the interested countries should be concluded;
- Renew and revitalize the water infrastructure capacities and create conditions for improved safety:
  4. Rebuild the port of Brcko and Bosanski Samac/Samac;
  5. Clean the Sava of mud and deposits by the end of 2006;
  6. Improve the safety and navigability of the Sava;
  7. Modernize the fleet.

The BiH Medium Term Development Strategy PRSP (2004 – 2007) was updated in 2006 and mentions the following in addition to the above, regarding Infrastructure:

- By developing river transport in the future a better valorisation of the advantages of available natural geographical can be obtained;
- The river transport needs to be upgraded up to pre-war levels …… use to be made of the Sava Agreement (read Sava Commission) …… lack of funds impede the development of the river transport;
- To enhance the opening of BiH towards the neighbouring countries international agreements and contracts are required.

6.3.4 Slovenia

In the past a plan was developed for the implementation of the Adriatic – Danube canal. This was an official project made in the FSRY. Preparatory works for implementation had even started, but have not been continued. In the year 2004 the Slovenian government adopted a special development plan for spatial planning along the Sava over a stretch of 20 km, from the Slovenian – Croatian border till Brezice.

The legal system is in place to execute the procedures to achieve this spatial development.

With respect to inland waterways on the Sava in Slovenia the following has to be mentioned:

1. Renewable energy sources: a total of 6 hydro electric power plants (Vrhovo, Bostanj, Blanca, Krsko, Breznice and Mokrice) are scheduled to be implemented of which some already have been constructed or are in operation along the Sava;
2. Locks at these Hydro Electric Power plants are being considered for implementation to ensure safe passage of vessels and for fish;
3. Slovenia is obliged to comply with the WFD when implementing works/structures in the Sava;
4. For the development of international navigation on the Sava, Slovenia is dependent on the developments proposed by Croatia on the stretch Slovenian – Croatian border till Sisak. Various bottlenecks (bridges, sills) and limitations exist on this stretch for navigation.
5. For any development in its section of the Sava an integrated approach of the water management system (flood, lack of water, ground water, etc), energy (hydropower), tourism and recreation and navigation will be required.

6.3.5 Serbia

The IWT part of the Serbian transport policy paper “Transport and Policy” issued in summer 2004 is being elaborated within the MoCI.

Reference is made to reports expressing the transport policy of the EU and the Serbian Government. The mentioned report ‘Transport Policy and Strategy (2004)’] stresses policy themes relevant for ports. These include:

- Encourage adequate, well-regulated, open and competitive markets for goods transport. Improve the quality of transport infrastructure through adequate financing;
- Encourage a development of sustainable transport modes as IWT;
- Provide good international freight transport connections, conditions and services;
- Support the modernisation of the Serbian ports;
- Provide operational and institutional support for combined transport.

A high degree of consistency exists with other related reports, such as:

- Need to integrate river transport in door-to-door transport (inter-modal terminals for bulk commodities and large volumes items such as steel and containers, door-to-door documentation, customs requirements);
- Own dedicated terminals for big customers (steel, grain, sand/gravel exploitation and trading companies);
- Need for port modernisation and better information systems;
- Private sector participation in port operations;
- Location of industrial developments to be related to (river) transport;
- Specialised services for containers;
- Potential for cruise terminals in line with tourism developments;
- Avoid over-investments in order to keep cost for IWT at a competitive level;
- Maintain flexibility in planning and implementation of projects attuned to a Master Plan.

The EU has harmonised most of the inland waterway legislation and embodied it in the so called 'Acquis Communitaire'. This concerns aspects such as market access, transport of dangerous goods, boat masters' certificates and technical prescriptions for vessels. The technical standards applied are often based on those developed by the CCNR in the framework of the Mannheim Convention.

It is envisaged that in the future, the CCNR will continue to function as the technical reference for EU-IWT legislation, whereby the EU will embody the technical rule developed by the CCNR and apply the EU rules throughout its whole territory.

6.4 IWT infrastructure

Waterway hardware

The activities required for the proper maintenance and improvement of the inland waterways and navigable channels include:

- Planning and Design:

  This relates to river training works (construction and dredging works) and landing facilities for the improvement and maintenance of the waterways and navigation channels.

- Implementation and Maintenance of Training Works:

  Separate contracts for the execution of these activities have to be prepared and during the construction phase the input of certain expertise will be required.

- Monitoring:

  The last group of activities related to the maintenance and improvement of the waterways and navigation channels, consists of monitoring the waterways and the impact of the works carried out.

Navigational Aids (on board) and Aids to Navigation (on and along waterway)

The activities related to the system of aids for navigation (and related equipment on board) for day and night navigation in general can be summarized as listed hereunder:

- Buoyage and beacons for waterways- and/or channel marking;
- Publication of navigation (electronic) maps and navigation bulletins;
- Pilotage and Channel patrol;
- Traffic Supervision and Enforcement of traffic rules and regulations;
- Wreck marking and snag removal.

6.5 Organisation of the IWT Sector

The Sava inland waterways comprises transport and navigation, the utilization of waterways, maintenance, marking and protection of inland waterways, ports, anchorages, ships, boats and other navigation devices and inspector's supervision.

The Sava Commission may play the role of organization (public sector) responsible for development of a reliable and safe navigable waterway system. However, barge operators and cargo owners are not yet organized in a way that they can act as a clear counterpart for a waterway managing authority. Because the users of the waterways in the IWT sector inmost cases are representing the private sector in a market oriented economy, it is important that they will organise shortly in a way that they become a reliable and knowledgeable counterpart of the public sector institutions.

Consequently, steering and coordination in the development of a clear IWT-sector control and the development of an efficient and competitive water transport mode remains therefore (still) difficult. Gradual improvement may be achieved step by step, following a phased planning in the short, medium and long term. Such a planning must be based on an official policy which might be developed by the Sava Commission by the relevant expert working group.

6.6 Focus of the IWT Management in the (near) future

Presently, the Sava riparian states are (partly) countries in transition. IWT developments are still uncertain and the future situation is unclear, reason why fundamental changes are difficult to implement. Institutions, dealing with aspects of nautical management, may still function based on the old legislative command driven economy of former Yugoslavia.

Working on the development and the improvement of navigation on the Sava however, cannot wait till all uncertainties are solved, action is immediately needed. A final improved situation must be achieved by adequate policy papers and the integration of institutions; these papers must include the aspect of financing and available resources, and tuned to the decisions of the Sava Commission, the UN/ECE resolutions, the EU-White Transport Papers and also tuned to developments as initiated and coordinated by the Danube Commission. The inventory must focus on:

- a review of domestic legislation of the four Sava riparian states;
- the existence of present institutions;
- the existing practice;
- following international standards and developments as opportune in the Rhine and Danube basin.

Also reference is made to EU requirements for transition countries. From the legislative inventory one can conclude that the laws require updating, but quite a lot of work has already been executed, as the riparian states either joined the EU, or are in the process of entering.

The nautical management of the Sava should be preferably laid in only one (institutional) hand at the end. Issues as the monitoring of the depth of the main channel, the developments and maintenance of aids to navigation, the forecast of discharges and water levels, the location of shoals and limiting depths, the release of IWT bulletins, the control and supervision of shipping traffic should be the responsibility of one organisation (read Sava Commission). Activities can be outsourced, as it is not necessary that the Sava Commission carries out these activities, but that it coordinates these. However, outsourcing means that all riparian countries must provide capacity in cash and kind on a permanent basis. This has to be realized shortly, to provide the Sava Commission the possibility to meet its objectives.

But if the goal should also be in the future ‘the development of efficient competitive navigation’, more tasks should be given to a managing authority. This might include statistics and forecasts of cargo flows, integration of navigation as user with flood management, determining structures needed to concentrate available discharges during the dry season in a way that navigability is not severely hampered, extending patrol services (night navigation), implementing the decisions of the Sava Commission, supervising the transport of POL products and chemicals, in a way that continuous traffic is not hampered.

The Sava Commission should coordinate these issues, and develop efficient navigation in a way that environmental friendly and sustainable (durable) solutions are implemented. If more organisations are active in this respect, these must cooperate adequately (some based in a central office, some are working with field offices where staff must have at least sufficient mandate and resources). The important task of (regular!) inspection should be given to one independent authority.

6.7 Adjustments in the short, medium and long term

To enhance and improve and create efficient Inland Waterway Transport organisational and managerial adjustments in the Sava are required. This is elaborated hereafter, taking into account the three step approach short – medium – long term.

In **the short term,** it is assumed that no severe and fundamental changes are needed. All key players per country should focus on own performance, efficiency, internal and external communication including (free) exchange of reliable (survey/research/traffic) data. Regular (independent and authorized) inspections of vessels and equipment are crucial, including effective enforcement. The outcome of all this must (still) result in a reliable navigability according to the Sava Commission standards, in such a way that safety, environmental control and reliability meet

acceptable levels. Such an outcome must also stimulate a gradual growth in the IWT cargo flows and hopefully in passenger transport (tourism). Anticipating on the future, the education and training of human resources must be considered and developed.

In **the medium term,** it is expected that the Sava Commission will function with more status, mandate and executive power (similar to the CCNR) and that consequently all riparian countries must follow accordingly. This will include institutional adaptation per country to start with and institutional reform later on (or better may be at once). In addition, due to economic developments, traffic will increase and safety and environment become more crucial.

Nautical management is focusing more and more on efficiency and innovation. Traffic rules must be supervised and enforced adequately. Waterway training works and channel conditions must be inspected, surveyed and maintained regularly. Communication- and information systems must be developed, survey data as far as relevant for IWT management (both in the public and private sector) must be exchanged between all involved authorities in all riparian states.

Training of new staff must be taken up adequately; new curriculum should focus on integration of IWT-relevant disciplines and developed for more levels of education. Staff must feel involved in their work and show dedication and spirit. This is only possible if the management of all involved organizations work jointly towards a situation wherein an interesting career planning in both the public and private IWT-sector gradually becomes visible so that youngsters can be (and feel) attracted to the (inter)national world of inland navigation.

In **the long term,** it is assumed that the status and mandate of the Sava Commission are similar to those of the CCNR. Riparian countries are economically and politically integrating in an expanding EU. The EU-directives on environment, energy, water and water management transport will be(come) implemented. Spatial planning and economic developments will focus on modal split, in a way that IWT develops as a serious competitor to rail and road. The Sava (inter)national waterway network becomes an important element in the economic developments in the Danube basin. Technical innovation is stimulated by successful Public-Private-Partnerships (PPPs), creating an efficient and competitive IWT sector. Tourism on waterways becomes important for local and regional economies and thus the development of marinas and cruise facilities.

6.8 Framework conditions for the functioning of the inland waterways transport industry

The adequate functioning of an inland waterway transport industry requires that IWT-operators and their customers will be able to conduct their business and will be able to conclude contracts, as efficiently as possible. The market organisation therefore will have to take place in a market environment that will support the commercial processes as much as possible and will minimize burdens that administrative and regulatory procedures inevitably impose on the market parties.

In general this will mean that it is wise to follow the rule in new markets (like the market of Sava shipping) that procedures and regulations will have to be similar, at least not widely diverging, to procedures elsewhere in the international IWT-industry.

This is more specifically also true for the different fields for which regulations need to be present or need to be made in order to enable the proper functioning of the market, like:

1. Regulations concerning “Inland ship / barge ownership
   a. registration as owner / operator company;
   b. financing fleet (e.g. public regulations with respect to scrapping);
   c. tax / depreciation / incentives – subventions;
   d. insurance.

2. Regulations with regard to the fleet of inland ships
   a. hull certification;
   b. machine certification;
   c. equipment certification;
   d. required records /control bodies in charge.

3. Regulations with regard to IWT-operations
   a. Workforce / Staff:
      - manning (qualification, number of required persons);
      - regulated working conditions;
      - professional education and training – required standards;
      - working conditions, social standards;
      - required records /control bodies in charge.
   b. Navigation:
      - rules;
      - landsite navigation aids &signs;
      - port procedures, lock procedures;
      - security / environment;
      - communication / language;
      - required records /control bodies in charge.
   c. other tasks to be carried out onboard:
      - security / environment;
      - required records /control bodies in charge.

4. Market
   a. Contractual conditions between carrier and cargo consignee (transport order, Bill of Lading etc. – legal frame & standards);
   b. Liability / insurance;
   c. Entry conditions for new operators;
   d. Tariffs/ competition;
   e. Port overtime charges.

5. Cargo
   a. Cargo handling / cargo care;
   b. security / environment;
   c. required records /control bodies in charge.

6. Infrastructure
   a. Charging and tolling of waterways/ locks/ port tariffs;
   b. Access requirements for sailing.

7. Other issues:
   Socio economic circumstances that do not directly relate to the abovementioned topics such as ageing workforce, sector unattractiveness for young people, etc.

To some extent the regulations in above mentioned fields will be determined by the national regulation of each of the Sava riparian states and will not be specific for the inland waterways industry. However, in many instances specific regulations for inland waterways will be needed or specific provisions will have to be made for the industry. In these cases one should, if possible model this regulation on existing examples in the EU. Except, when local or very specific circumstances play a decisive role one could consider using non-standard conditions.

Furthermore, it is to the advantage of the Sava riparian states to keep the market as competitive as possible. In that case customers in the Sava region will benefit the most from the IWT-industry and prices for the service will be kept at low levels. This means that a monopolistic market structure (with one or a few dominating companies determining the market) should be prevented.

In order to ensure this amongst others the entry barriers for the market should not be too high (e.g. obtain permits without too much red tape, using specific river/canal/ lock/ port tariff structures). In addition, structures (open or hidden) price regulation structures should be prohibited or at least prevented as much as possible. This includes of course all policies aiming to “protect” the national IWT industry.

Potential customers are frequently not sufficiently aware of the possibilities of transferring cargo to inland waterways. In this case it may be helpful to try to improve customer knowledge by organising specific promotion actions.

In new inland waterways markets the infrastructural access of customers to the waterways is often not present or needs to be created. Supporting private investments may be considered as a policy that authorities (wanting to promote the IWT industry) may choose.

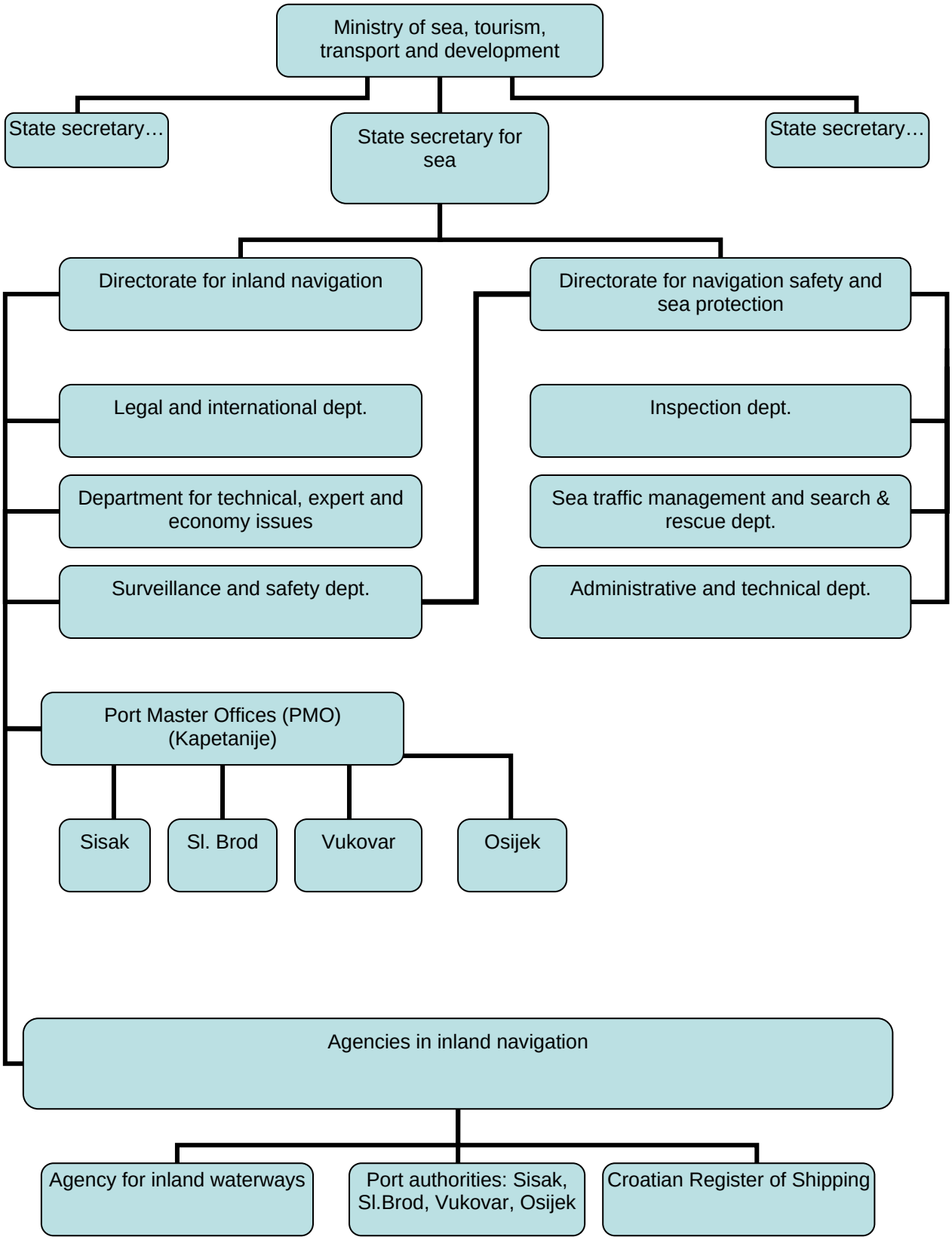
Experience of many countries learns that when the industry sector organizes itself, provided that this type of organisation is not aiming to reduce competition (e.g. like a cartel), it is in general a good thing. This will also be the case for inland waterways transport. Companies can learn from each other and create in this way a platform to communicate as an industry with other industries or the authorities. The establishment of this type of organization in the Sava riparian states should therefore not be looked upon with distrust.

6.9 Recommendations

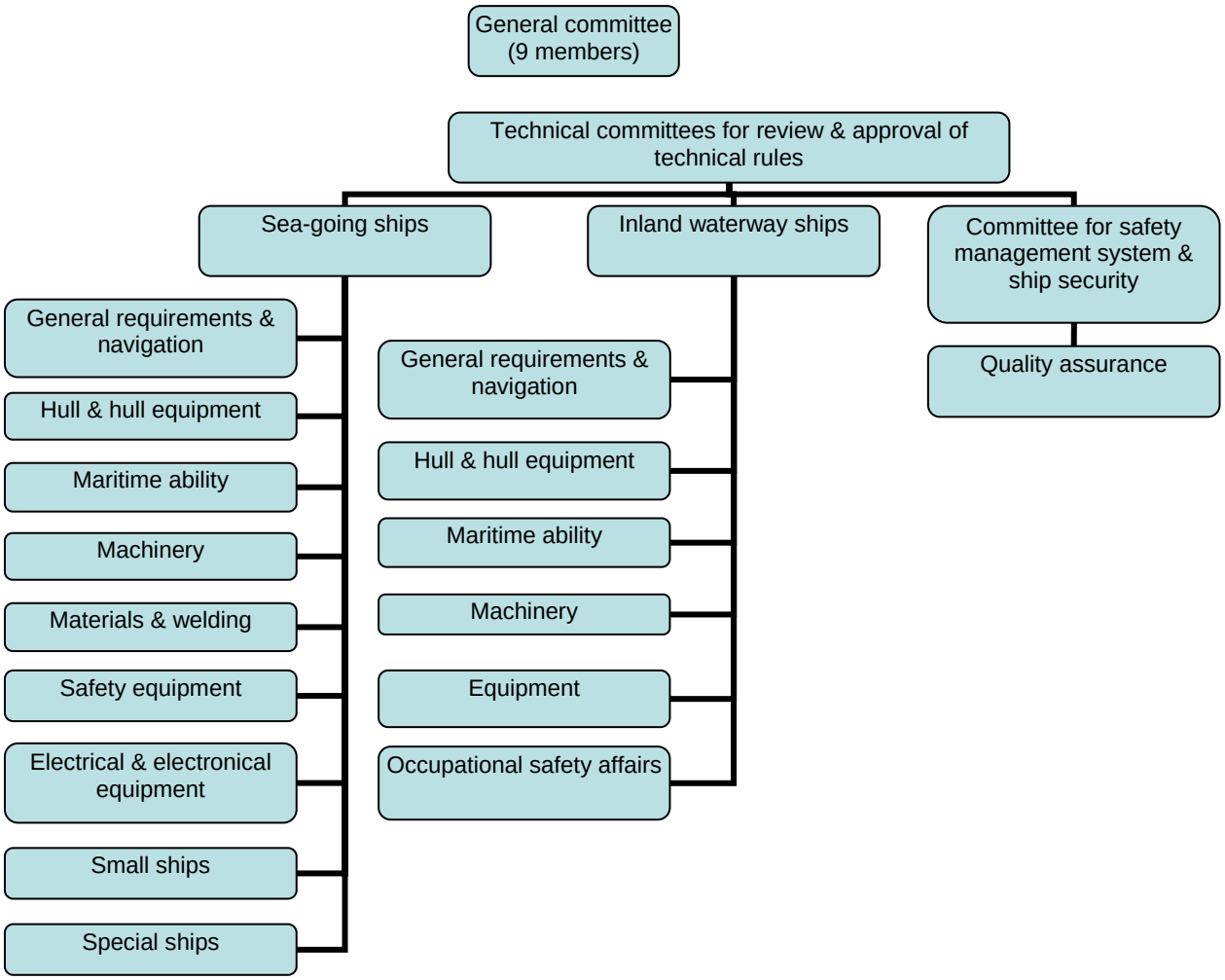
Having taken note of the previous section the following recommendations can already be made.

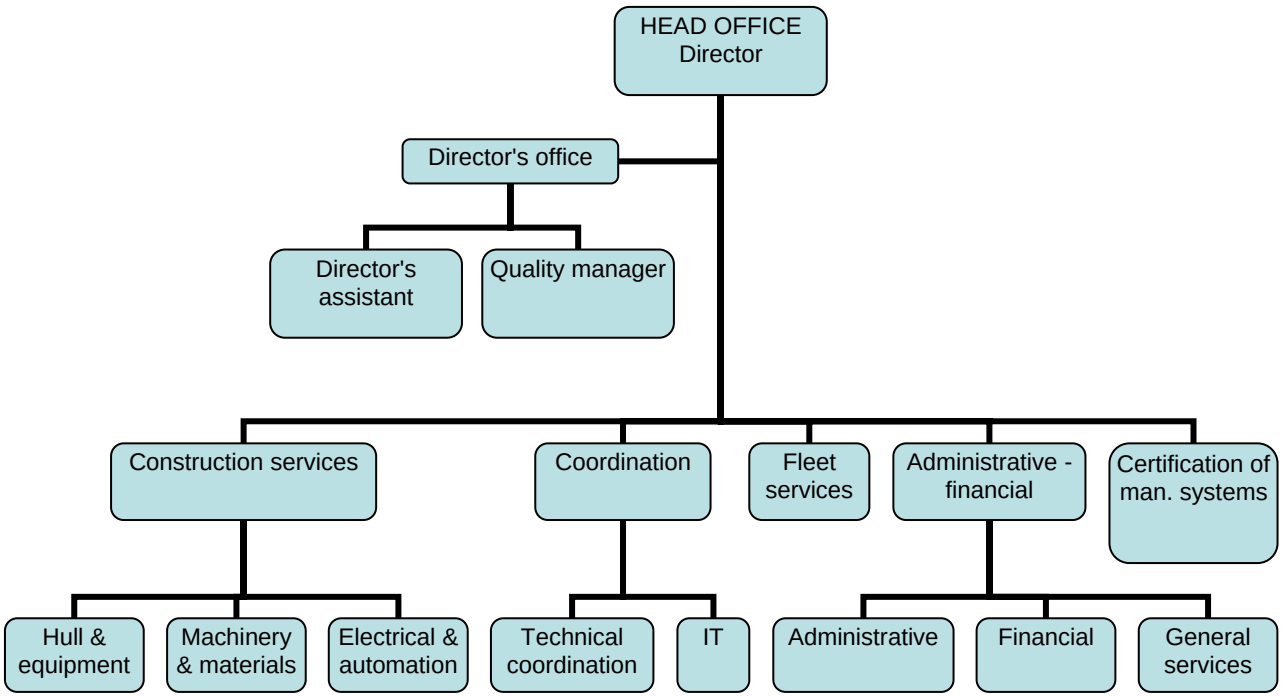
- The Sava Commission must develop solid regulations and the implementation of the Sava Commission decisions must be guaranteed;
- The development of the Sava should besides the IWT sector also include the improvement of the environment as this will (in) directly also improve/enhance IWT;
- the Sava Commission should play a major role in establishing decisions to safeguard, develop, enhance and maintain an integrated development in the Sava basin considering flood management, water scarcity, renewable energy sources and production (hydro power energy), water ecosystem, flora and fauna spatial planning, tourism and recreation and navigation;
- The member countries must be willing to provide cash and kind for the implementation of the decisions as released by the Sava Commission; the same holds for regular maintenance of waterway(s), IWT structures, terminals and fleet;
- The riparian countries must think about adaptations of their existing institutions dealing with IWT, in a way that via a phased approach at the end these reformed institutions work together properly, also with the Sava Commission;
- All riparian countries must develop transport policy plans, based on realistic cargo flows;
- Tariff setting must be developed in a way that economic costs prevail, so that intermodal transport can develop and competition between the modes can grow;
- In all riparian countries the IWT-related tasks, as done by both the public and private sectors, must develop in a way that can be expected in a market driven economy;
- Standards for ship building and ship design should follow international standards; the outdated and obsolete elements of the existing (old) fleet must be sanitised/scrapped;
- Navigable channels in the Sava basin waterways must be developed and maintained in a way that the Sava Commission classification system is followed;
- More in particular, for at least the medium term, attention must be given to the transport of dangerous commodities, to the safety of the IWT sector in all aspects (safety of cargo, navigation, crew, environment) and to sustainable developments.

ANNEX 6.1: CROATIAN MINISTRY OF SEA, TOURISM, TRANSPORT AND DEVELOPMENT



ANNEX 6.2: CROATIAN REGISTER OF SHIPPING - ORGANIGRAM





ANNEX 6.3: BIH – MINISTRY OF TRANSPORT AND COMMUNICATIONS (STATE LEVEL – SARAJEVO)

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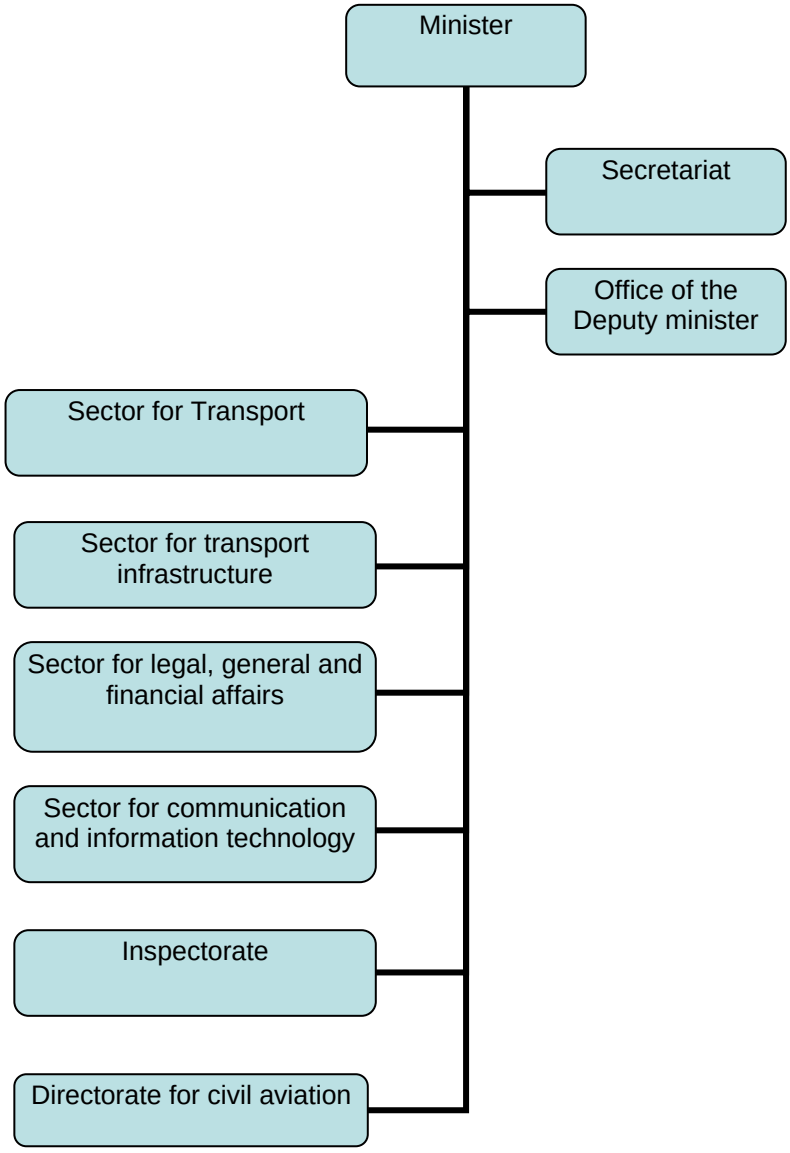
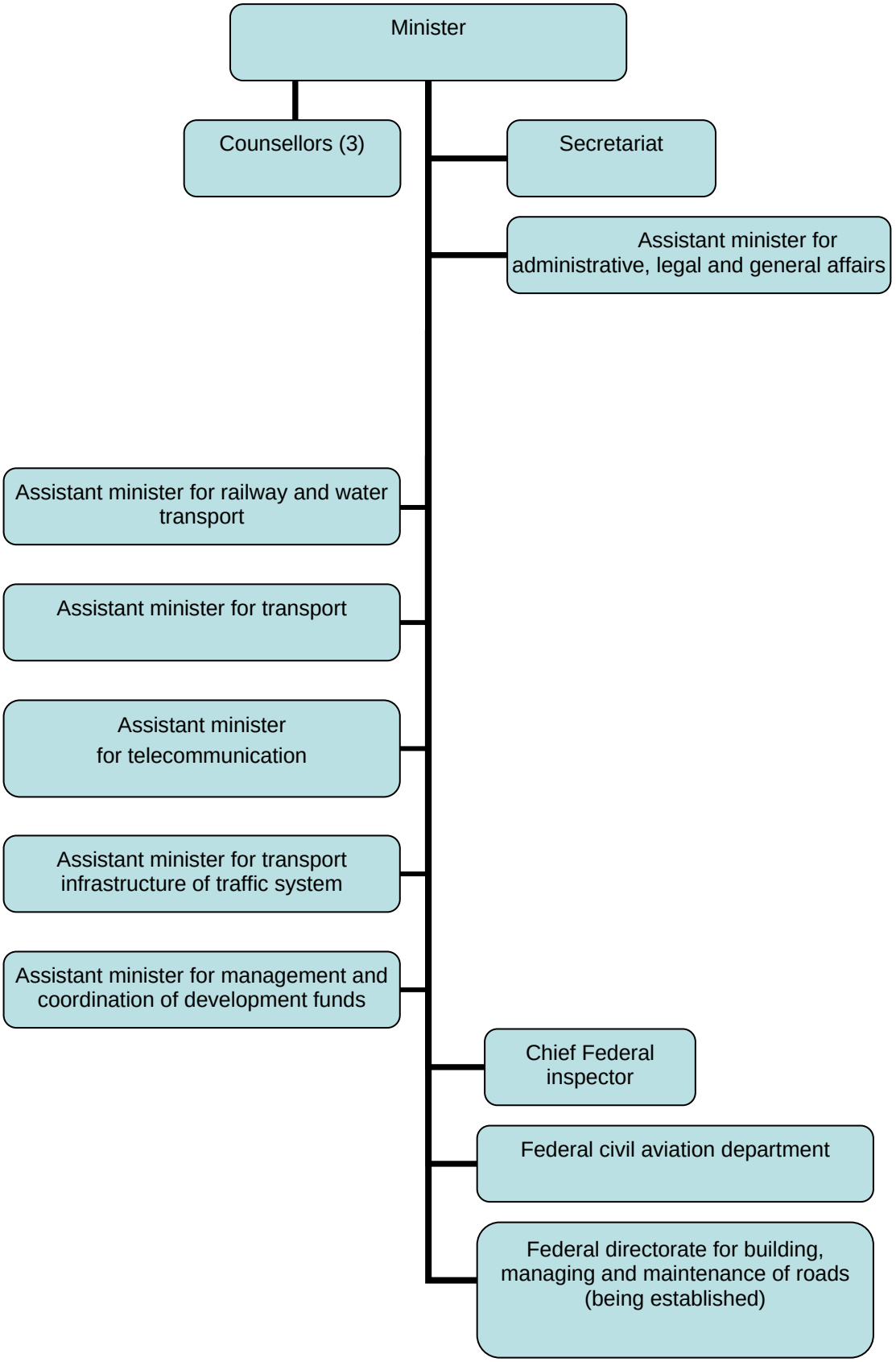
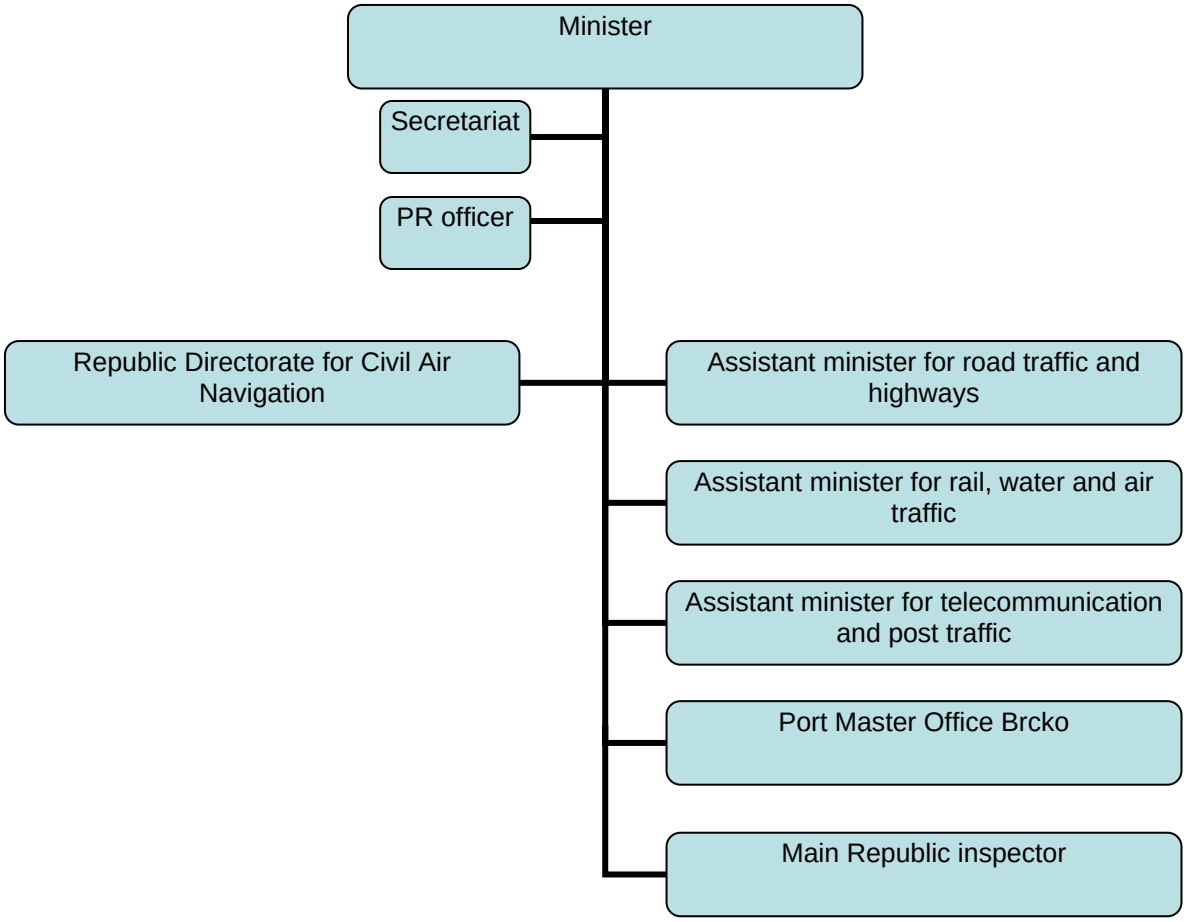


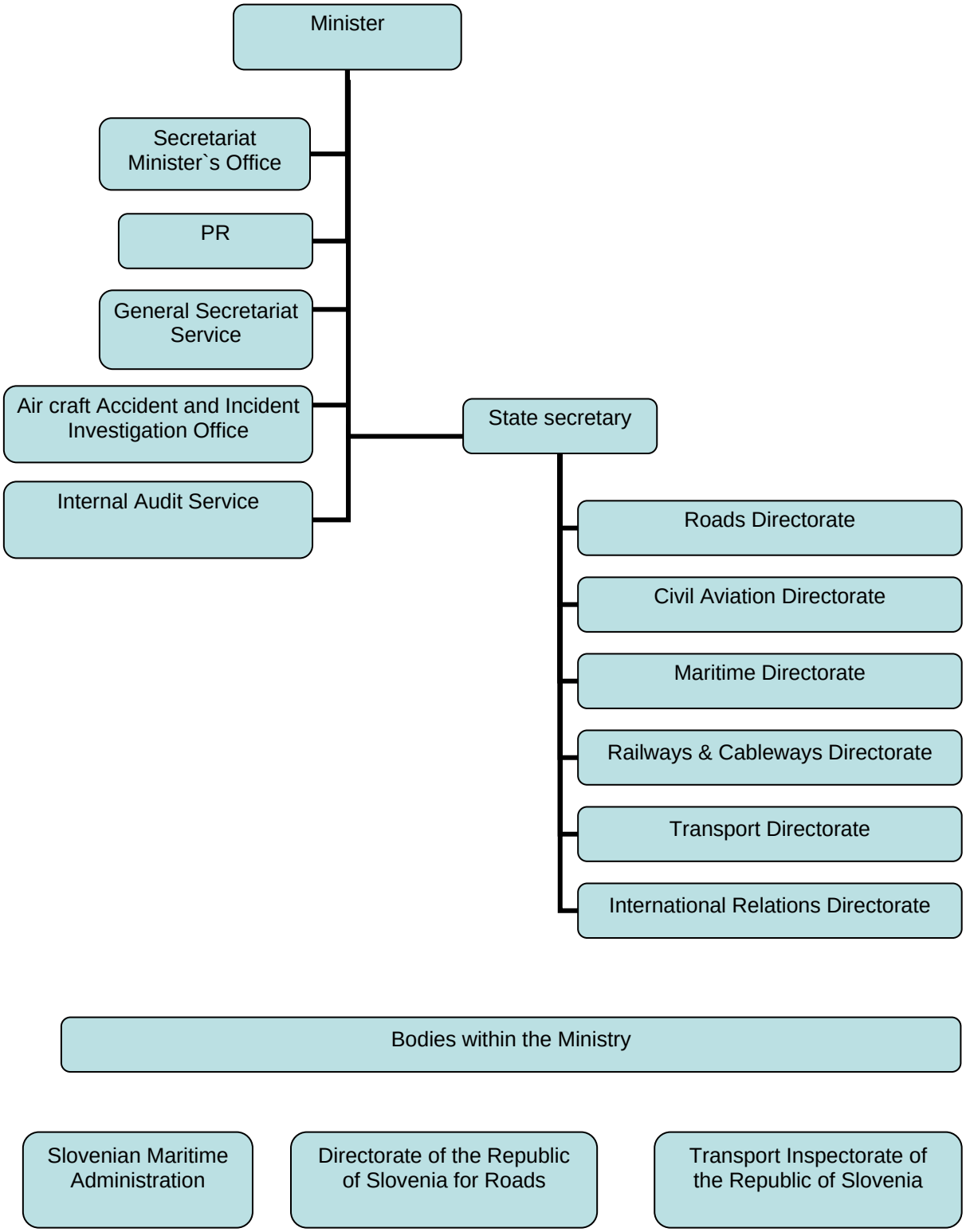
ANNEX 6.4: FEDERATION OF BIH (ENTITY) – FEDERAL MINISTRY OF TRANSPORT AND COMMUNICATIONS



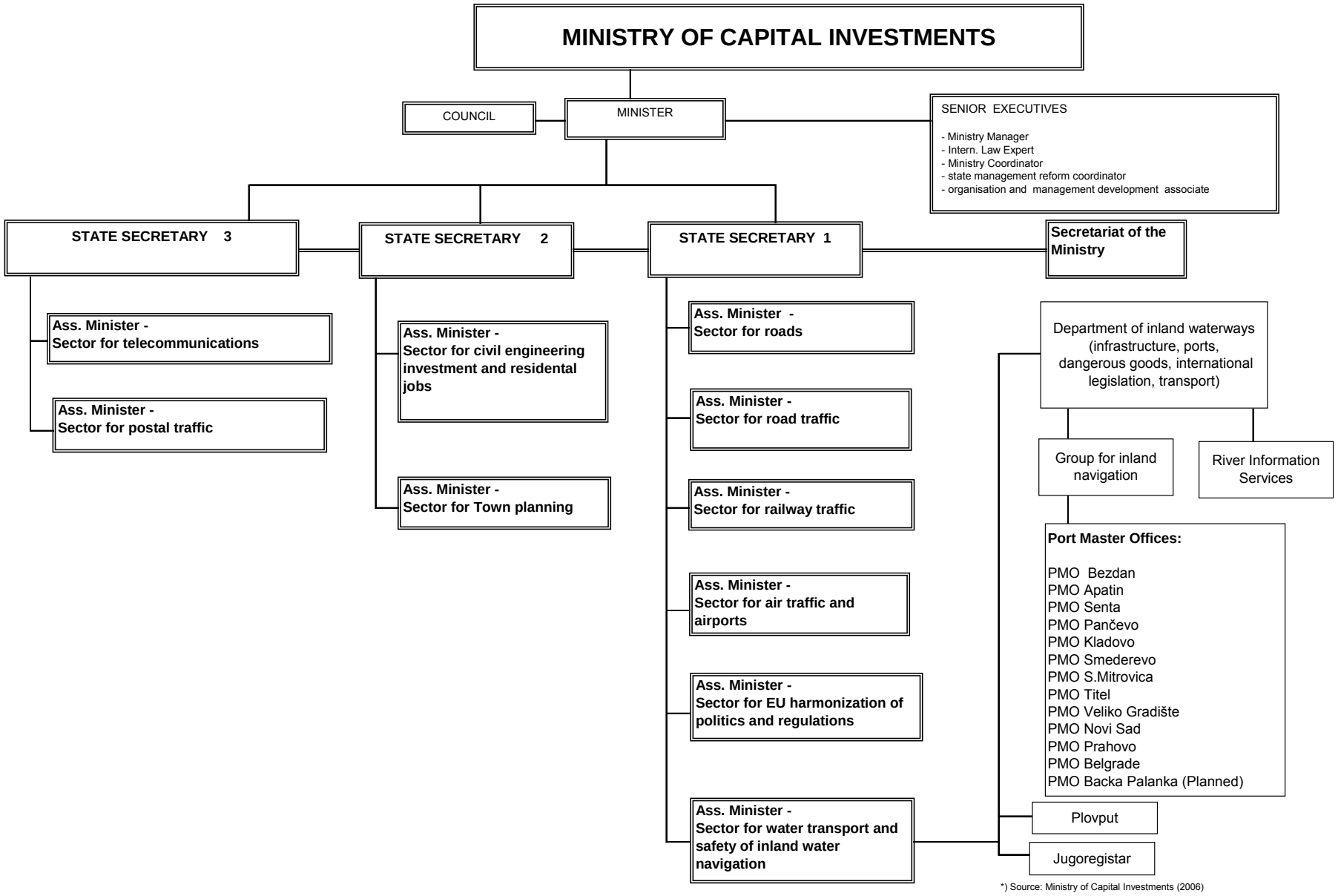
ANNEX 6.5: REPUBLIKA SRPSKA – MINISTRY OF TRANSPORT AND COMMUNICATIONS (ENTITY - BANJA LUKA)



ANNEX 6.6: SLOVENIA – MINISTRY OF TRANSPORT

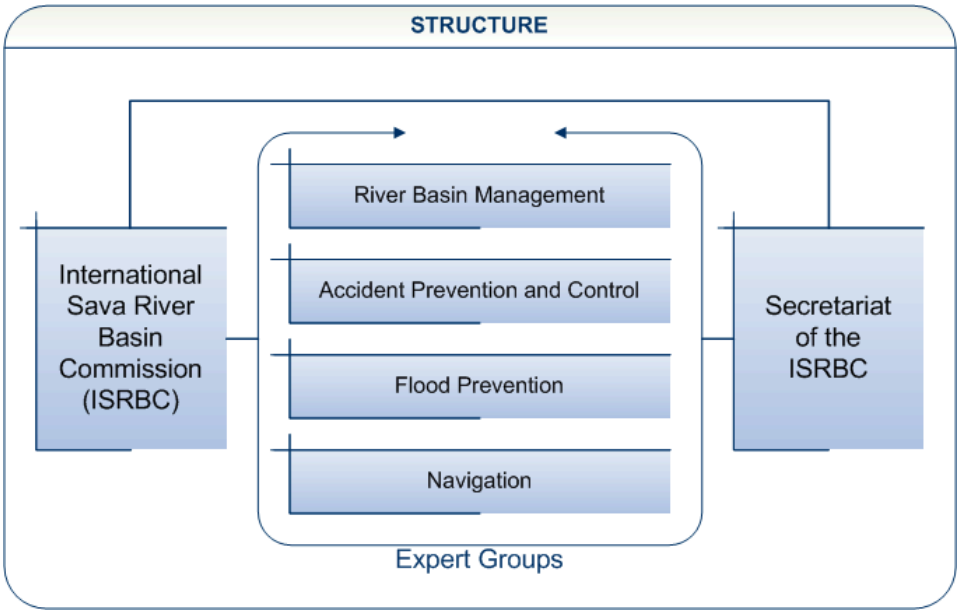


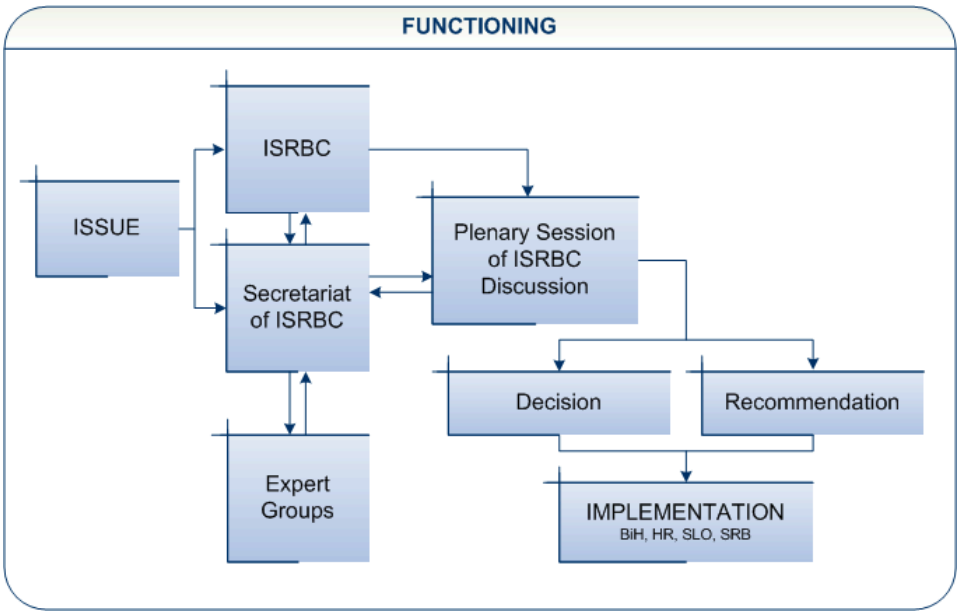
ANNEX 6.7: SERBIA – ORGANIZATION OF MINISTRY OF CAPITAL INVESTMENTS



*) Source: Ministry of Capital Investments (2006)

ANNEX 6.8: INTERNATIONAL SAVA RIVER BASIN COMMISSION





ANNEX 6.8: INTERNATIONAL SAVA RIVER BASIN COMMISSION

Regular activities of the ISRBC:

- Administrative, Legal and Financial Issues
- Development of Joint Plans for the Sava River Basin
- Creation of Development Programs and Action Plans for the Sava River Basin
- Contribution to the Harmonization of Rules and Regulations
- Work on Protocols
- Work of Expert Groups
- Establishment of Integrated Systems for the Sava River Basin
- Cooperation with Organizations and Institutions
- Presentation and Public Participation

Expert Groups of the Sava Commission

1. **Permanent Expert Groups:**

- River Basin Management
- Accident Prevention & Control
- Flood Prevention
- Navigation

2. **Ad-hoc Expert Groups:**

- Hydrological and Hydrometeorological Issues
- GIS
- Legal Issues

Listing of Protocols to be prepared:

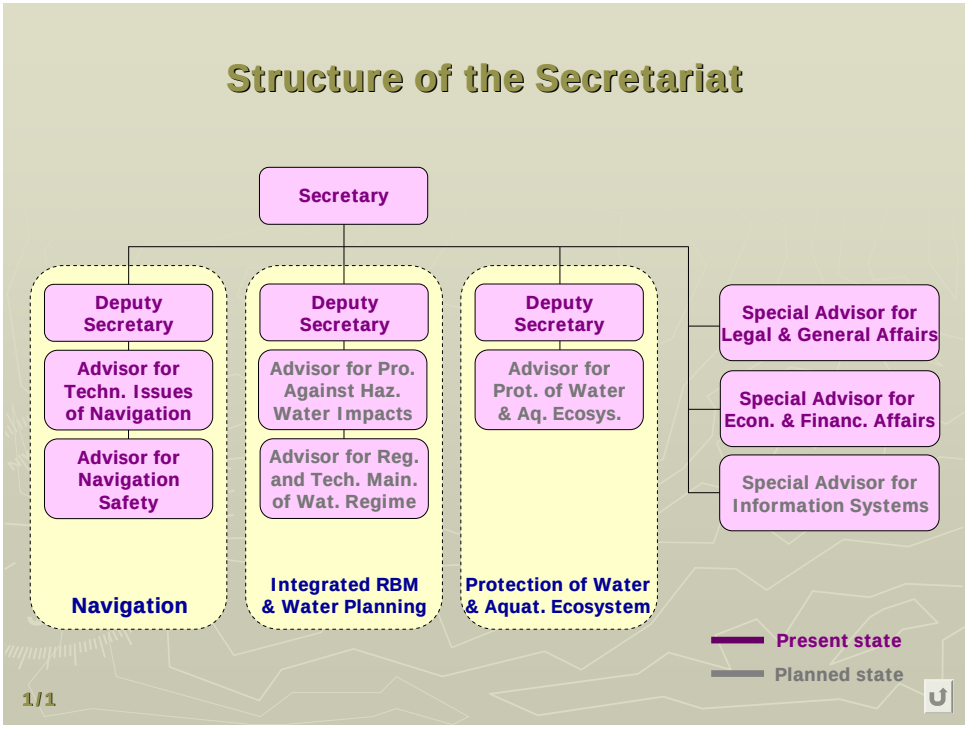
- Transboundary impacts
- Accidental situations
- Prevention of water pollution caused by navigation
- Protection against floods
- Protection against excessive groundwater, erosion, ice, draught and water shortage
- Water use/utilization
- Exploitation of stone, sand, gravel and clay
- Protection and improvement of water quality & quantity
- Protection of aquatic eco-systems

ANNEX 6.8: INTERNATIONAL SAVA RIVER BASIN COMMISSION

Rules and Regulations related to navigation

- Detailed Parameters for Waterway Classification on the Sava River
- Navigation Rules on the Sava River
- Rules for Waterway Marking on the Sava River
- Rules on Minimum Requirements for the Issuance of Boatmaster's Licences on the Sava River
- Rules on Minimum Manning Requirements for the Vessels on the Sava River
- Contribution to the improvement of the EU and UN Rules and Regulations

Structure of the Secretariat



7 COST-BENEFIT ANALYSIS

7.1 Introduction

The costs and benefits analysis (CBA) is based on different scenarios with regard to the development prospects of the economies of Sava riparian states (reflected by different GDP growth rates for the future time periods) and of the implementation of the proposed Sava improvement package of measures, as discussed in previous chapters. The time horizon that will be used in the CBA is 2006-2026.

The different transport scenarios that will be considered are based on 2 infrastructure scenarios and 3 economic growth scenarios. The infrastructure scenarios are: the continuation in the foreseeable future of the present ("status quo") situation in which the Sava between Brcko and Sisak remains for the time being a class III waterway. Obviously this scenario will be used as the reference scenario. The other infrastructure scenario is the scenario wherein the full package of proposed measures to improve the navigation on the Sava will be implemented and the Sava between Brcko and Sisak will be a class IV waterway, allowing larger vessels to access this trajectory of the river.

The Sava improvement scenarios will be combined with the 3 economic growth scenarios that were discussed in chapter 2 namely a low, medium and high growth scenario, which will correspond also to different growth rates for transport volumes. The different economic growth rates reflect both different trends in world and European markets for goods transport as well as possible changes in the political environment in the time period that is looked at. In the case of the present project one could in particular think of the relationship of Croatia (or the other Sava countries) with the EU (isolation, association or membership in case of the corresponding scenarios). The translation of economic growth into transport growth rates that was presented in chapter 2 was derived from European studies that also take planned improvements in the TENT-T network into account, and other transport policy measures.

In section 7.2 a short description of the methodology that was used in the CBA is presented. In section 7.3 the costs of the required investments, connected to the proposed improvements in the Sava until the year 2026 will be examined. In section 7.4 an inventory at the size of the direct economic benefits that are expected in the period 2006-2026 is made.

As mentioned this analysis will distinguish different growth scenarios. In section 7.5 direct costs and benefits using various indicators are compared. Furthermore, different assumptions with respect to the probability of realisation of projects by private parties will be looked at. Finally, this chapter is concluded by presenting some conclusions from the analysis made.

7.2 Methodology

The CBA was carried out in accordance with the guidelines and principles of the European Commission as described in the document "Guide to cost-benefit analyses of investment projects" and European principles, developed in the HEATCO project "Developing Harmonised European Approaches for Transport Costing and Project Assessment.

For the one time investment costs, running costs and revenues a financial model of the money flows of the project was made. Indicators that were used to judge the financial performance of the investments are the net present value (discounted benefits should be higher than costs) and the economic internal rate of return (interest rate that will make the value of discounted future revenues equal to current investment expenditures).

The costs of dredging, bridge construction and maintenance, required to expand the capacity of the Sava to the level of class IV were estimated by the engineers and checked with the local authorities. Subsequently the schedule was expanded to the entire period 2006-2026 by the members of the project team.

The potential benefits of the Sava capacity expansion consist of:

- Direct economic benefits for existing users;
- Direct economic benefits for potential new users;
- Indirect economic benefits;
- External benefits.

The main direct economic benefits are scale advantages (being able to use bigger vessels), which is also very interesting for existing users of inland water ways transport, and modal shift opportunities (moving cargo from road or rail to inland waterways transport).

Other direct economic benefits like time savings (faster transport) that are often mentioned in infrastructure investment projects were too difficult to quantify and moreover (in the case of the proposed Sava-river improvements) probably not very significant.

Via a bottom-up approach (directly approaching candidate companies) the size and geographic characteristics of potential cargo flows that may benefit from operating at a larger scale and/ or modal shift were identified. These outcomes of the field visits were extensively discussed in chapter 2, where the most interesting cargo flows are presented.

The bottom-up approach makes it possible for these cases also to use specific, realistic estimates of number of tonkilometer that may be affected by the Sava improvement project. Using costs calculation models for the various transports the impacts were quantified. The results of this analysis are reported in table 7.1.

Table 7.1 Potential costs saving per tonkilometer (depending on distance) Options to move cargo to inland waterways transport class IV

Origins/ Destinations close to waterway (Costs in EURO)

Options	50 km	350 km	650 km	950 km	1,250 km	1,550 km
IWT class III => IWT class IV	0.014	0.004	0.003	0.003	0.003	0.002
Road => IWT class IV	0.078	0.065	0.057	0.054	0.052	0.050
Rail => IWT class IV	0.043	0.013	0.010	0.010	0.009	0.009

Origins/ Destinations requiring 50 km pre- or end haulage on the road (Costs in EURO)

Options	50 km	350 km	650 km	950 km	1,250 km	1,550 km
IWT class III => IWT class IV	0.016	0.004	0.003	0.003	0.003	0.003
Road => IWT class IV	-0.072	0.044	0.046	0.047	0.046	0.045
Rail => IWT class IV	-0.107	-0.009	-0.001	0.002	0.003	0.004

The size of the advantages (which might also be negative) depends on the precise characteristics of the cargo flows examined (type of cargo, distances, and location with respect to the waterway infrastructure). From the data in table 7.1 it appears that moving cargo to inland waterways class IV vessels in the range of 50 km to1,550 km will result in cost savings provided the locations of the origin and destination are not too far away from (sailable) waterways. When this is not the case rail transport and on short distances also road freight transport may be a better option.

As has been mentioned, for each potential interesting cargo flow the size of tonkms benefits were determined. The reference fleet for the Sava transport is the Danube fleet. Properties of this fleet (and some general economic indicators for Croatia, like wage rates and fuel costs) were used to determine the tonkilometer cost advantages.

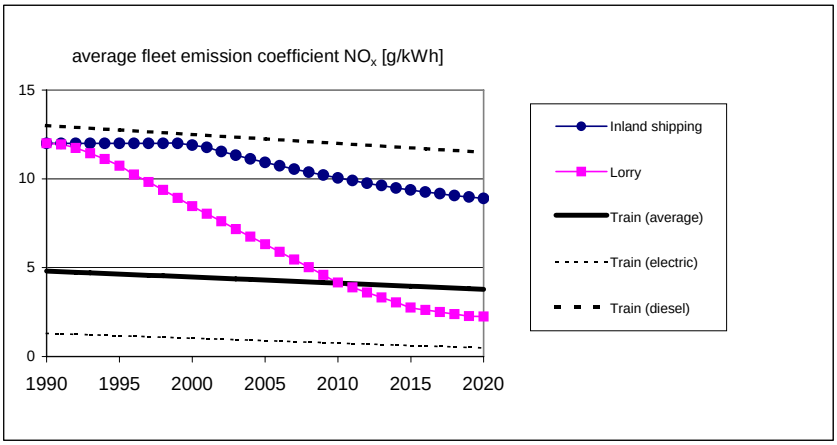
Indirect economic benefits are the benefits that industries experience that make use of the services of inland waterways or industries that supply inland waterways transport with goods or services. The most significant industry that will benefit indirectly from inland waterways is the warehousing and transhipment industries in the various Sava ports. For these industries also specific investments will have to be made in the Sava ports. Such investments will be necessary in order to benefit maximally from the capacity expansion of the waterways.

To estimate the revenues are difficult since many facilities (e.g. warehouses) are multimodal (used also by road freight transport companies or rail freight transport companies). The same type of difficulties, although to a somewhat lesser extent, exists with regard to cost data: some costs can be unambiguously assigned to the inland waterways transport industry, but other costs not. Furthermore, it appears from the fieldwork (port visits) that the investments in the ports will be done by private parties. Given these circumstances it was decided (after some initial attempt to include estimates for the "indirect" costs and revenues) not to include this category in the CBA.

Also it was decided not to include in the CBA the possible environmental cost and benefits (which is the main component of the so called external costs/ benefits). Although external cost estimates for the tonkilometer cost of emissions for the various transport modes can be readily obtained it was, given the possible impact on the environment of the Sava capacity expansion (resulting in the recommendation to carry out an EIA), considered to be somewhat misleading only to report environmental benefits without being able to quantify the (possibly substantial) environmental costs.

Besides one may have some doubts about the "sustainability" of the environmental benefits of inland waterways transport versus other modes In particular given the long time period that is considered, as depicted in the figure 7.1. The figure 7.1 illustrates for a country like the Netherlands how the emissions of NO_x per kWh (traction energy) of heavy lorries, trains (diesel and electric) and inland ships have changed in the last 10 years. Besides, it also illustrates the expectations for the next decade, assuming current EU policies with respect to emission regulations (mainly for lorries, but recently also for barges).

Figure 7.1 Emission factors of NO_x per mode, 1990 – 2020 (Netherlands)



Assumptions: Train: fuel mix train: 30% diesel and 70% electricity; the European Commission has recently proposed to implement the first step of European emission standards for diesel locomotives in 2006/2008 (directive 97/68/EC); these proposed standards and moderate fleet renewal lead to a slight decrease of the diesel NOx emission coefficient.

Figure 7.1 shows NO_x emissions of lorries to decline much faster than those of diesel trains or inland ships. This is caused by two factors. Firstly because of the emission legislation of lorries, which was set up in 1988. In 2008/2009 the Euro 5 standard comes into force. The emission legislation for inland ships from the countries bordering on the Rhine started 1-1-2002. There are still no European emission standards for diesel trains but they are to be expected in the near future. Secondly, the average commercial lifetime of a lorry in the Netherlands is seven years, so the road vehicle fleet is renewed relatively fast compared to diesel locomotives and inland ships, which have a lifetime of 30 to 40 years.

7.3 Project costs

The project costs consist of the dredging works, construction and maintenance costs of the Sava improvements. The investment schedule (in 2006 prices) until the year 2016 was already presented in chapter 3. It is assumed that in the period 2016-2026 only annual maintenance costs will be necessary, at the level of the last years in the period 2007-2016. Costs and benefits are calculated in constant prices (price level 2006).

A complete annual overview of the investment costs for the period 2006-2027 is included in annex 7.1 to this chapter. In figure 7.2 the accumulation of costs is shown graphically.

Figure 7.2 Cumulative investments costs of Sava improvements

The costs presented in figure 7.2 are the raw non-discounted costs. Discounted time series (for interest rates of 5, 10 and 15%) are included in Annex 7.1. The calculated net total costs of the entire improvement package in the period 2006-2026 is about 66 million Euro which equals respectively 50 million Euro with a 5% interest rate, 41 million Euro using a 10% rate and only 34 million Euro using a discount rate of 15% rate.

This cost estimate is lower than the actual sum of the total construction costs and the total maintenance cost of the class IV waterway as presented in Table 3.14 (Chapter 3) because one should make a correction for part of the maintenance cost.

Some waterway maintenance will also be required when it is decided to keep the Sava a class III waterway, and in the project analysis one should only include the additional costs caused by the project, not costs that would be incurred anyhow.

The steep increase of the costs in the first years (see figure 7.2) is followed by a marked decline of the growth in the last part of the period. This reflects the familiar pattern that the expenditure on construction will take place in the first years, while in the last part of the period only maintenance expenditures are incurred.

7.4 The direct economic benefits

For the 3 economic growth variants the benefits were calculated in Euro. The detailed results are contained in Annex 7.2, Annex 7.3 and Annex 7.4 of this chapter. As indicated in section 7.2 the benefits are derived from the tonkilometer forecasts made for each Sava port (see chapter 2). Multiplying the tonkilometers with the potential savings per tonkilometer (see table 7.1) results in a benefit. In figure 7.3 the cumulative benefits for the three economic scenarios are presented.

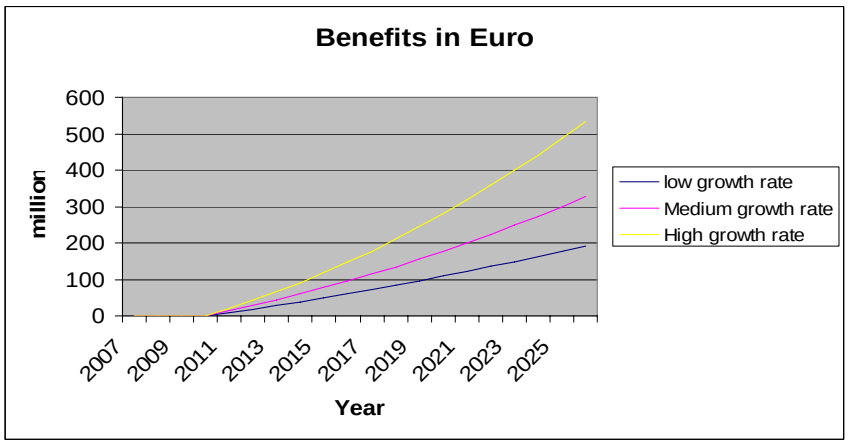


Figure 7.3 Cumulative benefits for the three economic scenarios

In the first part of the Figure 7.3 upto the year 2011 the benefits are 0, simply because the infrastructure improvements are not yet implemented. So real benefits can only be expected in 2011 and later on. However, it appears that benefits then rise very quickly to impressive heights.

The gap between high and low scenarios at the end of the forecasting period is considerable. In table 7.2 some key data are summarised.

Table 7.2 Summary benefit statistics (Euro)

	Low growth	Medium Growth	High growth
Total cumulated benefits	190.0	220.0	532.6
Net value of benefits (5%)	102.6	116.6	280.9
Net value of benefits (10%)	59.7	66.6	159.7
Net value of benefits (15%)	37.0	40.7	97.0

It turns out that there are not really excessive contributions from specific flows or ports to the total benefits; there is wide spread of sources that contribute to the overall benefit estimate. This is a good sign because it shows that many very diverse companies and authorities are confident of the business opportunities that emerge.

Although this approach of benefit determination is straightforward, it tends to consider all the transport potential as identified in chapter 2, as a potential future benefit. The feasibility check that was done in chapter 2 to the determine transport potential only looked at whether or not plans of companies and ports make (economic) sense or not.

However, it seems perfectly possible that initiatives are sensible at the time of investigation, but investments will not take place after all.

This could simply occur because some circumstances have changed, which could not be foreseen at the time that the plans existed. In this respect it is interesting to recall that most of the plans of companies and ports will have to be realised only after the year 2011. This is a long time period, and it seems that it is prudent to take the possibility of a 'break-off' of plans into account. In section 7.5 the consequences of calculating with some break-off probabilities are presented.

7.5 Comparison of project costs and direct economic benefits

In table 7.4 some project financial performance indicators are given for the low, medium and high growth variants. This table is one of the main results of the CBA. The indicators are given for the case that respectively 100%, 80% or 60% of the identified transport potentials will be realised.

Although also calculations were made for smaller interest rates, the 15% rate for discounting was selected as most conforming with the standards of the large international financing institutes, like the World Bank.

In the case of a 100% realisation probability of identified transport potentials the net present value (NPV) of the investments are positive in all growth variants (high present values and internal rates of return higher than 15%). However, in the previous section it has been mentioned that this may perhaps not be a realistic assumption. The experience of other projects indicates that one should accept a lower, perhaps 80 - 60% realisation probability.

From table 7.3 it seems that even with a 60% probability the identified transport potentials are realised the internal rate of return of the proposed Sava improvement project is still higher than 15% in both the high and medium growth variants, although in this case the low growth scenario has only a 8% internal rate of return (and therefore the net present value when discounting with 15% becomes negative).

Table 7.3 Indicators financial performance depending on the realisation probability of identified transport potentials

Realisation probability	Indicator	Low growth rate	Medium growth rate	High growth rate
100%	Nett present value cash flow (15%) in EUR	3.2 million	27.5 million	74.0 million
100%	EIRR	17%	27%	34%
80%	Nett present value cash flow (15%) in EUR	-4.1 million	15.2 million	51.5 million
80%	EIRR	13%	22%	32%
60%	Nett present value cash flow (15%) in EUR	-11.5 million	3.0 million	29.2 million
60%	EIRR	8%	17%	25%

7.6 Conclusions

The proposed package of measures for the expansion of the trajectory between Brcko and Sisak, to a class IV waterway, seems to be a project with a positive financial result. The investment seems to sound. Furthermore, the positive results of the CBA are fairly robust against rather significant adverse effects and high requirements with regard to profitability.

In the medium growth scenario the net present value of the project remains positive although high interest rate were used in the discounting and even significant (up to 49%) break-off probabilities for the identified transport potentials were assumed.

Furthermore, in deriving this result only the direct transport-economic benefits have been taken into account. The indirect benefits from the project have not been taken into account.

It has to be emphasized that these results do not depend on a single or a few dominating transport flows, but that a range of potentially interesting business opportunities were identified in the visits to the ports and companies.

The fact that apparently many distinct companies, authorities and individual experts see interesting possibilities of the proposed activities is encouraging to proceed with the activities to implement the proposed works to obtain a class IV waterway.

ANNEX 7.1 INVESTMENT SCHEDULE IN EURO

Costs in EUR in constant prices (price level 2006)	2007	2008	2009	2010	2011	2012	2013	2016	2021	2026
Dredging and training works to improve Sava fairwaydepth in Section 1	197,417	1,316,114	299,117	299,117	299,117	299,117	299,117	299,117	299,117	299,117
Dredging and training works to improve Sava fairwaydepth in Section II	9,954	66,359	3,016	3,016	3,016	3,016	3,016	3,016	3,016	3,016
Dredging and training works to improve Sava fairwaydepth in Section III	99,538	663,587	30,163	30,163	30,163	30,163	30,163	30,163	30,163	30,163
Dredging and training works to improve Sava fairwaydepth in Section V	932,340	6,215,598	183,592	183,592	183,592	183,592	183,592	183,592	183,592	183,592
Dredging and training works to improve Sava fairwaydepth in Section VI	8,295	55,299	2,514	2,514	2,514	2,514	2,514	2,514	2,514	2,514
Training works to improve Sava fairwaydepth in Section VII	0	0	587,274	3,915,163	121,356	121,356	121,356	121,356	121,356	121,356
Dredging and training works to improve Sava fairwaydepth in Section VIII	0	0	0	0	0	0	0	0	0	0
Dredging and training works to improve Sava fairwaydepth in Section VIII	0	0	69,677	464,511	21,114	21,114	21,114	21,114	21,114	21,114
Dredging and training works to improve Sava fairwaydepth in Section IX	0	0	0	18,249	121,658	5,530	5,530	5,530	5,530	5,530
Dredging and training works to improve Sava fairwaydepth in Section X	0	0	0	1,659	11,060	503	503	503	503	503
Dredging and training works to improve Sava fairwaydepth in Section XI	0	0	14,931	99,538	4,524	4,524	4,524	4,524	4,524	4,524
Dredging and training works to improve Sava fairwaydepth in Section XII	0	819,530	5,463,533	135,332	135,332	135,332	135,332	135,332	135,332	135,332
Dredging and training works to improve Sava fairwaydepth in Section XIII	0	1,408,463	9,389,755	247,538	247,538	247,538	247,538	247,538	247,538	247,538
Dredging and training works to improve Sava fairwaydepth in Section XIV	0	0	529,211	3,528,071	134,728	134,728	134,728	134,728	134,728	134,728
Waiting areas and traffic guidance in 2 sharp river bends in section XI	31,106	207,371	9,426	9,426	9,426	9,426	9,426	9,426	9,426	9,426
Waiting areas and traffic guidance in 6 sharp river bends in section XII	93,317	622,113	28,278	28,278	28,278	28,278	28,278	28,278	28,278	28,278
Waiting areas and traffic guidance in 2 sharp river bends in section XIII	62,211	414,742	18,852	18,852	18,852	18,852	18,852	18,852	18,852	18,852
Waiting areas and traffic guidance in 1 sharp river bends in section XIV	31,106	207,371	9,426	9,426	9,426	9,426	9,426	9,426	9,426	9,426
Marking system and maintenance in arrear for the section S. Border - Oprisavci	418,931	209,465	209,465	209,465	209,465	209,465	209,465	209,465	209,465	209,465
Marking system and maintenance in arrear for the section Oprisavci - Sisak	139,644	319,728	223,430	223,430	223,430	223,430	223,430	223,430	223,430	223,430
Replacement of the Jasenovac bridge	0	0	0	0	1,658,967	11,059,783	377,038	377,038	377,038	377,038
Total costs	2,023,858	12,525,740	17,071,659	9,427,339	3,473,556	12,747,686	2,064,942	2,064,942	2,064,942	2,064,942
Accumulated costs	2,023,858	14,549,598	31,621,257	41,048,596	44,522,152	57,269,838	59,334,780	65,529,606	75,854,315	86,179,024
Maintenance class III (50% class IV maintenance)	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471	1,032,471
Accumulated costs	1,032,471	2,064,942	3,097,413	4,129,884	5,162,355	6,194,826	7,227,296	10,324,709	15,487,064	20,649,418
Net total costs (total costs - class III maintenance)	991,387	11,493,269	16,039,188	8,394,868	2,441,085	11,715,215	1,032,471	1,032,471	1,032,471	7,598,986
Accumulated costs	991,387	12,484,656	28,523,844	36,918,712	39,359,797	51,075,013	52,107,484	55,204,896	60,367,251	65,529,606
Discounted total costs 5%	944,178	10,424,734	13,855,254	6,906,478	1,912,654	8,742,074	733,758	633,848	496,636	389,127
Accumulated costs	944,178	11,368,912	25,224,166	32,130,644	34,043,298	42,785,373	43,519,130	45,517,335	48,261,563	50,411,738
Discounted total costs 10%	901,261	9,498,569	12,050,480	5,733,808	1,515,722	6,612,934	529,821	398,062	247,165	153,470
Accumulated costs	901,261	10,399,830	22,450,310	28,184,118	29,699,839	36,312,773	36,842,594	38,160,180	39,669,149	40,606,100
Discounted total costs 15%	862,076	8,690,562	10,546,027	4,799,793	1,213,651	5,064,811	388,144	255,211	126,885	63,084
Accumulated costs	862,076	9,552,638	20,098,665	24,898,458	26,112,109	31,176,920	31,565,064	32,451,284	33,306,791	33,732,129

ANNEX 7.2 BENEFITS LOW GROWTH SCENARIO

Benefits low growth *(EUR price level 2006)*	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Sum Sisak	0	0	0	0	2,054,451	2,119,906	2,185,361	2,250,815	2,316,270	2,381,725
Sum Slavonski Brod	0	0	0	0	3,664,320	4,033,404	4,402,488	4,771,572	5,140,656	5,509,740
Sum Bosanski Brod	0	0	0	0	0	0	0	0	0	0
Sum Samac	0	0	0	0	3,005,982	3,101,753	3,197,523	3,293,294	3,389,064	3,484,835
Total benefits	0	0	0	0	8,724,753	9,255,062	9,785,372	10,315,681	10,845,990	11,376,300
Cumulated	0	0	0	0	8,724,753	17,979,815	27,765,187	38,080,868	48,926,859	60,303,158
Discounted Benifits 5%	0	0	0	0	6,836,072	6,906,270	6,954,281	6,982,059	6,991,422	6,984,061
Cumulated	0	0	0	0	6,836,072	13,742,342	20,696,623	27,678,682	34,670,104	41,654,166
Discounted benefits 10%	0	0	0	0	5,417,385	5,224,241	5,021,443	4,812,341	4,599,759	4,386,056
Cumulated	0	0	0	0	5,417,385	10,641,627	15,663,070	20,475,411	25,075,170	29,461,226
Discounted benefits 15%	0	0	0	0	4,337,744	4,001,219	3,678,684	3,372,214	3,083,107	2,812,047
Cumulated	0	0	0	0	4,337,744	8,338,963	12,017,647	15,389,861	18,472,969	21,285,016

Benefits low growth *(EUR price level 2006)*	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Sum Sisak	2,444,317	2,506,909	2,569,500	2,632,092	2,694,684	2,750,787	2,806,890	2,862,994	2,919,097	2,975,200
Sum Slavonski Brod	5,654,536	5,799,332	5,944,128	6,088,924	6,233,720	6,363,506	6,493,292	6,623,078	6,752,864	6,882,650
Sum Bosanski Brod	0	0	0	0	0	0	0	0	0	0
Sum Samac	3,576,416	3,667,998	3,759,579	3,851,161	3,942,742	4,024,830	4,106,918	4,189,006	4,271,094	4,353,182
Total benefits	11,675,269	11,974,238	12,273,207	12,572,176	12,871,146	13,139,123	13,407,100	13,675,077	13,943,055	14,211,032
Cumulated	71,978,427	83,952,665	96,225,873	108,798,049	121,669,195	134,808,318	148,215,418	161,890,495	175,833,550	190,044,581
Discounted Benifits 5%	6,826,288	6,667,704	6,508,744	6,349,803	6,191,241	6,019,184	5,849,473	5,682,277	5,517,740	5,355,988
Cumulated	48,480,454	55,148,157	61,656,901	68,006,705	74,197,946	80,217,129	86,066,603	91,748,880	97,266,620	102,622,608
Discounted benefits 10%	4,092,111	3,815,361	3,555,111	3,310,647	3,081,250	2,859,456	2,652,523	2,459,583	2,279,801	2,112,379
Cumulated	33,553,336	37,368,697	40,923,808	44,234,455	47,315,705	50,175,161	52,827,685	55,287,267	57,567,068	59,679,448
Discounted benefits 15%	2,509,520	2,238,071	1,994,739	1,776,809	1,581,793	1,404,109	1,245,867	1,105,016	979,713	868,298
Cumulated	23,794,536	26,032,607	28,027,346	29,804,155	31,385,948	32,790,057	34,035,924	35,140,940	36,120,653	36,988,951

ANNEX 7.3 BENEFITS MEDIUM GROWTH SCENARIO

Benefits medium growth *(EUR price level 2006)*	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Sum Sisak	0	0	0	0	3,448,325	3,556,661	3,664,996	3,773,332	3,881,668	3,990,003
Sum Slavonski Brod	0	0	0	0	6,187,196	6,503,099	6,819,002	7,134,905	7,450,808	7,766,711
Sum Bosanski Brod	0	0	0	0	0	274,080	548,160	822,240	1,096,320	1,370,400
Sum Samac	0	0	0	0	4,130,316	4,309,324	4,488,332	4,667,340	4,846,348	5,025,355
Total benefits	0	0	0	0	10,785,893	10,926,954	11,030,122	11,098,688	11,135,711	11,144,042
Cumulated	0	0	0	0	10,785,893	21,712,847	32,742,969	43,841,657	54,977,368	66,121,409
Discounted Benifits 5%	0	0	0	0	6,985,544	7,115,078	7,216,435	7,292,005	7,344,014	7,374,535
Cumulated	0	0	0	0	6,985,544	14,100,621	21,317,056	28,609,061	35,953,075	43,327,610
Discounted benefits 10%	0	0	0	0	8,547,501	8,265,684	7,964,465	7,649,702	7,326,347	6,998,563
Cumulated	0	0	0	0	8,547,501	16,813,185	24,777,651	32,427,353	39,753,700	46,752,263
Discounted benefits 15%	0	0	0	0	6,844,054	6,330,643	5,834,727	5,360,475	4,910,674	4,487,013
Cumulated	0	0	0	0	6,844,054	13,174,697	19,009,424	24,369,899	29,280,573	33,767,586

Benefits medium growth *(EUR price level 2006)*	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Sum Sisak	4,139,788	4,289,573	4,439,358	4,589,142	4,738,927	4,889,909	5,040,891	5,191,874	5,342,856	5,493,838
Sum Slavonski Brod	8,058,273	8,349,835	8,641,398	8,932,960	9,224,522	9,518,415	9,812,309	10,106,202	10,400,095	10,693,989
Sum Bosanski Brod	1,644,480	1,918,560	2,192,640	2,466,720	2,740,800	3,014,880	3,288,960	3,563,040	3,837,120	4,111,200
Sum Samac	5,214,007	5,402,659	5,591,311	5,779,963	5,968,615	6,158,775	6,348,935	6,539,095	6,729,255	6,919,415
Total benefits	11,141,969	11,114,824	11,064,999	10,994,716	10,906,035	10,803,177	10,685,384	10,554,312	10,411,494	10,258,344
Cumulated	77,263,379	88,378,203	99,443,202	110,437,917	121,343,953	132,147,129	142,832,513	153,386,825	163,798,319	174,056,663
Discounted Benifits 5%	7,417,194	7,439,068	7,442,040	7,427,860	7,398,155	7,355,899	7,300,891	7,234,443	7,157,767	7,071,990
Cumulated	50,744,804	58,183,871	65,625,911	73,053,770	80,451,925	87,807,824	95,108,715	102,343,158	109,500,926	116,572,915
Discounted benefits 10%	6,679,204	6,360,071	6,043,762	5,732,401	5,427,703	5,132,126	4,845,433	4,568,451	4,301,785	4,045,848
Cumulated	53,431,467	59,791,538	65,835,300	71,567,701	76,995,405	82,127,530	86,972,963	91,541,414	95,843,199	99,889,047
Discounted benefits 15%	4,096,076	3,730,784	3,391,098	3,076,553	2,786,370	2,520,083	2,275,857	2,052,467	1,848,633	1,663,054
Cumulated	37,863,662	41,594,446	44,985,544	48,062,097	50,848,467	53,368,550	55,644,407	57,696,874	59,545,507	61,208,561

ANNEX 7.4 BENEFITS HIGH GROWTH SCENARIO

Benefits high growth *(EUR price level 2006)*	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Sum Sisak	0	0	0	0	4,688,565	4,966,069	5,243,572	5,521,076	5,798,580	6,076,084
Sum Slavonski Brod	0	0	0	0	8,831,991	9,458,766	10,085,541	10,712,315	11,339,090	11,965,865
Sum Bosanski Brod	0	0	0	0	1,370,400	1,918,560	2,466,720	3,014,880	3,563,040	4,111,200
Sum Samac	0	0	0	0	5,254,650	5,577,286	5,899,921	6,222,557	6,545,192	6,867,828
Total benefits	0	0	0	0	20,145,606	21,920,680	23,695,754	25,470,828	27,245,902	29,020,976
Cumulated	0	0	0	0	20,145,606	42,066,286	65,762,040	91,232,868	118,478,771	147,499,747
Discounted Benifits 5%	0	0	0	0	15,784,609	16,357,549	16,840,130	17,239,659	17,562,952	17,816,362
Cumulated	0	0	0	0	15,784,609	32,142,158	48,982,288	66,221,948	83,784,899	101,601,261
Discounted benefits 10%	0	0	0	0	12,508,836	12,373,652	12,159,669	11,882,329	11,554,922	11,188,843
Cumulated	0	0	0	0	12,508,836	24,882,489	37,042,157	48,924,487	60,479,409	71,668,252
Discounted benefits 15%	0	0	0	0	10,015,927	9,476,915	8,908,112	8,326,459	7,744,986	7,173,542
Cumulated	0	0	0	0	10,015,927	19,492,842	28,400,953	36,727,412	44,472,398	51,645,940

Benefits high growth *(EUR price level 2006)*	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Sum Sisak	6,333,159	6,590,233	6,847,308	7,104,383	7,361,458	7,637,807	7,914,156	8,190,505	8,466,854	8,743,203
Sum Slavonski Brod	12,555,064	13,144,263	13,733,463	14,322,662	14,911,861	15,471,652	16,031,444	16,591,235	17,151,026	17,710,817
Sum Bosanski Brod	4,659,360	5,207,520	5,755,680	6,303,840	6,852,000	7,400,160	7,948,320	8,496,480	9,044,640	9,592,800
Sum Samac	7,205,999	7,544,171	7,882,343	8,220,515	8,558,687	8,879,980	9,201,273	9,522,566	9,843,859	10,165,152
Total benefits	30,753,582	32,486,188	34,218,794	35,951,400	37,684,005	39,389,599	41,095,192	42,800,786	44,506,379	46,211,973
Cumulated	178,253,329	210,739,517	244,958,311	280,909,710	318,593,716	357,983,314	399,078,507	441,879,292	486,385,672	532,597,644
Discounted Benifits 5%	17,980,983	18,089,525	18,146,957	18,157,900	18,126,651	18,044,829	17,929,696	17,784,611	17,612,686	17,416,806
Cumulated	119,582,244	137,671,769	155,818,726	173,976,625	192,103,276	210,148,105	228,077,801	245,862,412	263,475,098	280,891,904
Discounted benefits 10%	10,778,943	10,351,101	9,911,966	9,467,127	9,021,251	8,572,324	8,130,465	7,698,098	7,277,149	6,869,115
Cumulated	82,447,195	92,798,295	102,710,261	112,177,388	121,198,639	129,770,964	137,901,428	145,599,526	152,876,674	159,745,790
Discounted benefits 15%	6,610,274	6,071,901	5,561,511	5,080,963	4,631,156	4,209,360	3,818,807	3,458,523	3,127,255	2,823,564
Cumulated	58,256,214	64,328,114	69,889,625	74,970,588	79,601,744	83,811,105	87,629,912	91,088,435	94,215,690	97,039,254

ANNEX 8 LITERATURE LIST

LITERATURE LIST

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