BACKGROUND PAPER FOR THE STRATEGIC ENVIRONMENTAL ASSESSMENT OF THE VARIANTS OF THE STRUCTURAL MEASURES FOR THE IMPROVEMENT OF THE NAVIGABILITY AND THE REHABILITATION OF THE SIDE ARMS OF THE DANUBE SECTION BETWEEN SAP AND SZOB

Draft Environmental Report
for discussion with the Slovak Party

Commissioned by

Hungarian Section of the Steering Committee of the Hungarian-Slovak Joint Working Group for the Preparation of the Strategic Environmental Assessment

Ministry of Environment and Water,

December 2009

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LIST OF ABBREVIATIONS

DISR	Danube Information and Emergency System
DMR	Danube/Main/Rhine (DMR) waterway
EAFRD	European Agricultural Fund for Rural Development
EEOP	Environment and Energy Operational Programme
EiC	Env-in-Cent Consulting Ltd.
EU	European Union
ICJ	International Court of Justice
ICPDR	International Commission for the Protection of the Danube River
NAIADES	Navigation and Inland Waterway Action and Development in Europe
NBMS	National Biodiversity Monitoring System
NCCS	National Climate Change Strategy
NDPC	National Development Policy Concept
NEP	National Environmental Programme
NHDP	New Hungary Development Plan
NHRDP	New Hungary Rural Development Programme
NIENW	National Inspectorate for Environment, Nature and Water
NMVOC	non-methane volatile organic carbons
NRDPC	National Regional Development Policy Concept
NSDS	National Sustainable Development Strategy
SCI	Sites of Community Importance
SEA	Strategic Environmental Assessment
SPA	Special Protection Area
TEN	Trans European Network
TOP	Transport Operational Programme
WFD	Water Framework Directive

INTRODUCTION

According to the agreement of the Governmental Delegations of the Slovak Republic and the Republic of Hungary in 2007 in the course of the implementation of the Judgement of the International Court of Justice (ICJ) made on 25th September, 1997 in the case concerning the Gabčíkovo-Nagymaros Project, the two Parties agreed that a **joint Strategic Environmental Assessment (SEA) procedure shall be conducted** in order to undertake an assessment on the variants of technical solutions (*hereinafter* proposed interventions and measures). The assessment will be governed by a joint Hungarian-Slovak Steering Committee, appointed by the two Parties. The **Parties have also agreed that the preparations of background matters necessary for carrying out the assessment (background papers, proposals, ex ante evaluations and other documents) will be elaborated separately by the two Parties.** According to its Statute the role of the joint Steering Committee is to harmonise the efforts of the two sides.

The present **draft of the SEA Environmental Report** on the variants of the structural measures for the improvement of the navigability and the rehabilitation of the side arms of the Danube section between Sap and Szob) is a Hungarian proposal, the main objectives of which are the following:

- to give information regarding the working process of the Hungarian Strategic Environmental Assessment for the Slovak Party,
- to present the possibility for the Slovak Party to make comments and proposals on the completed elements of the SEA Environmental Report, and
- to engage the Slovak Party in the determination of inter-boundary impacts and the compensating and reconstructing SEA proposals.

In parallel with the conciliation with the Slovak Party the domestic public consultation of the Environmental Report and the proposed measures will be assured in accordance with subsection (3) of Paragraph 7 of the Hungarian 2/2005 (I.11.) SEA Government Decree (hereinafter SEA Decree). During the domestic procedure, the document, in accordance with subsection (3) of Paragraph 8 of the SEA Decree, will also be sent *among others* to the National Inspectorate for Environment, Nature and Water and the Hungarian National Council on the Environment. The planned measures and environmental assessment will be completed by taking the Slovak and Hungarian comments and proposals into consideration.

1. ELABORATION PROCESS OF THE ENVIRONMENTAL REPORT

1.1 Background information

1.1.1. The scope and the legal background of the Strategic Environmental Assessment

The Hungarian section of the SEA Steering Committee, **as the responsible planning authority,** officially initiated the **preparation of the Environmental Report and the Strategic Environmental Assessment (SEA)** in accordance with the 2001/24/EC Directive and the 2/2005 (I.11.) Government Decree addressed to the National Inspectorate for Environment, Nature and Water (NIENW) on 8th June 2009. The Hungarian Section of the SEA Steering Committee submitted the draft content of the SEA according to subsections (1) - (6) of Paragraph 7 of the SEA Decree to the NIENW for approval, and the document was, with some minor amendments, approved by the NIENW. **This Environmental Report was elaborated by taking into account the suggestions of the NIENW.**

The scope of the SEA is the examination **of the variants of interventions for the improvement of the river navigation possibilities in the Danube section between Sap and Szob** and the technical solutions for the rehabilitation process in the side-arms.

As the SEA, which is prepared for the evaluation of the technical solutions related to the implementation of the Judgement in the case of the Gabčíkovo-Nagymaros Project, is affected by subsection (2) of Paragraph 1 of the SEA Decree, **the elaboration of a strategic environmental assessment is therefore obligatory**. It is necessary for the implementation of the SEA process and the Water Framework Directive that the River Basin Management Plans (RBMPs) regarding the affected Danube sections shall expressly include those technical solutions and measures which are related to the implementation of the Judgement of The Hague.

1.1.2. Main characteristics, the mission and the main objectives of the Strategic Environmental Assessment

The SEA process will be conducted in accordance with the implementation process concerning the Judgement of the International Court of Justice at The Hague with regard to the Gabčíkovo-Nagymaros Project. **The main objective of the Strategic Environmental Assessment is to perform the scientific analysis of extensive and complex technical-environmental interventions regarding the implementation of the Judgement of the International Court of Justice at The Hague. The assessment, based on scientific and technical approaches, must also consider environmental, social, economic and sustainability criteria, and must provide a complex, systematic and transparent evaluation in order to give assistance to the decision process**, particularly by taking the environmental objectives of the Water Framework Directive into consideration.

According to the sustainable development policy of the EU the **Strategic Environmental Assessment is an instrument of proactive environmental protection;** it shows the interventions and measures with their possible environmental risks even at the strategic phase of the programming process. The starting point of the elaboration of the SEA is that the **measures and technical solutions** (and all the complementary measures in the fields of nature conservation, improvement of river navigation etc.) proposed for the implementation of the Judgement of the International Court of Justice at The Hague **should also be useful in environmental terms** and the adverse impacts on the individual environmental elements and systems should be minimised.

The SEA shall be considered as a tool of proposal. The **ultimate objective of the SEA** developed for the Danube section between Sap and Szob **is to compile an Environmental Report that provides feasible proposals in order to improve the environmental performance of the solutions and measures and to enforce sustainable development in the given region.** Consequently, the mission of the SEA is to give assistance to the planners, decision-makers and the participants of the implementation process and to improve the environmental performance of the solutions and measures, to promote the implementation of the environmental policy objectives and to help avoid possible expensive future corrections by the formulation of well-founded decisions.

1.2. Main conditions of the elaboration process of the Strategic Environmental Assessment

1.2.1. Characteristic of the planning process of the measures related to the Judgement of the International Court of Justice at The Hague

The elaboration, conciliation and modification process of the proposed interventions and measures at the Danube section between Sap and Szob regarding the implementation of the Judgement of the International Court of Justice at The Hague has fundamentally determined the working schedule of the SEA process. The following main factors and aspects can determine the elaboration of the Environmental Report:

- The strict time schedule for elaborating the proposed interventions and measures and the delay of the elaboration process of River Basin Management Plans **have significantly decreased the possible time-period for the elaboration of the present environmental assessment**.
- The possible positive impacts of the proposed interventions and measures in the side-arms may improve the recreational and touristic utilization of the riverside areas. Whereas, **the completion of the SEA assessments is more difficult because several essential local strategic documents are missing** (for example local rural development and enterprise promotion strategies, local sustainability programmes etc.)
- Regarding the improvement of navigability (in the total Danube section of Hungary), **intensive professional consultations and constructive debates have been initiated in some special scientific areas (such as water management, navigation,**

environmental protection). These consultations, e.g. the standpoint[1] of the Hungarian National Council on the Environment in particular, have led to a consensus that has **fully influenced the proposed interventions and the present version of the SEA**.

1.2.2. Management of the elaboration and consultation process of the SEA

The elaboration process of the Strategic Environmental Assessment is conducted by an independent group of experts i.e. the SEA Evaluation Panel. The work of the SEA Evaluation Panel is co-ordinated by the Env-in-Cent Environmental Consulting Ltd (EiC). The members of the SEA Evaluation Panel have general and specific professional competencies in the fields of water management, ecology, biology, environmental economics, rural development, environmental policy and sustainable development. The public participation and consultation will be organized by the Bureau of the Gabčíkovo-Nagymaros Interdepartmental Committee allocated to the Hungarian Ministry of Environment and Water.

1.2.3. Relations to other strategic assessment processes

The proposed interventions and measures connected to the implementation process of the Judgement of The ICJ are closely linked to other conceptional works in the field of River Basin Management Planning and the improvement of river navigation. In the elaboration process of the present Environmental Report the following strategic environmental assessment processes, presently under development, were taken into consideration:

- the Strategic Environmental Assessment of the River Basin Management Plans in accordance with the Water Framework Directive,
- the Strategic Environmental Assessment of the proposed interventions for the rehabilitation of the Szigetköz and
- the Environmental Assessment on the Programme of the improvement of the navigability of the Danube section between Szob and the Southern state boundaries.

1.3. The impacts of proposals made in the course of the elaboration process on the planned measures

This chapter will be elaborated following the conclusion of the partnership consultation process and the consideration of its proposals.

[1] Hungarian National Council on the Environment : Standpoint on the proposals regarding the improvement of the navigation in the Hungarian Danube section. 16th November, 2009.

1.4. Stakeholders' involvement in the elaboration process of the Environmental Report

1.4.1. The concept of the professional and public consultation process

The legal framework of the public consultation is provided by the Aarhus Convention and Espoo Convention as well as certain Hungarian legislative provisions and the SEA Decree in particular. The concept is worked out in accordance with the requirements and principles of these regulations. **The process of public consultation is organized by the Ministry of Environment and Water with the co-operation of the Hungarian Section of the SEA Steering Committee and the SEA Evaluation Panel.** The main elements of the public consultation process are the following:

- **Access to information:** The public documents are available at the special homepage of the Ministry of Environment and Water (www.bosnagymaros.hu). All the information generated during the Assessment is available for the public at this homepage, and can be judged by everyone, at every stage of the work. The different opinions will be appraised by the experts of the SEA Evaluation Panel. The key documents will be sent on paper or CD by mail on request for those having no access to the internet.
- **Providing information for the public through the press:** In accordance with Subsection (5) of Paragraph 8 of the SEA Decree after the completion of the Environmental Report, a press release shall be organised and an advertisement shall be published in a national newspaper by the Ministry of Environment and Water.
- **Direct questions:** The most important professional, representative and non-governmental organizations of environmental protection are to be informed by a direct e-mail at the beginning of the consultation process of the environmental assessment.
- **Public debate of SEA Environmental Report: Partnership Conference:** The document of the Strategic Environmental Assessment shall be conciliated at a Partnership Conference. The number of participants may be around 20-50 organisations and institutions. The opinions and comments on the documents can be either made orally at the Conference, or in written form and can be transmitted either through the homepage or sent by mail. The oral comments will be recorded in the Protocol.
- **Hungarian National Council on the Environment:** The Hungarian Section of the SEA Steering Committee initiates the discussion of the Environmental Report by the National Council on the Environment.
- **The evaluation process of the considerations of public debate:** The documents received will be processed and will be taken into consideration by the participants of the assessment at the final development of the document. Each comment, either in oral or in written form, will be answered in written form in relation to both the comment and also concerning the way it was taken into consideration.

1.4.2. Involvement of the authorities for environmental protection

This chapter will be elaborated following the conclusion of the partnership consultation process.

1.4.3. Involvement of the public concerned

This chapter will be elaborated following the conclusion of the partnership consultation process.

1.4.4. Comments and their consideration

This chapter will be elaborated following the conclusion of the partnership consultation process.

1.5. Methods applied in the Strategic Environmental Assessment

1.5.1. General introduction of the methodology issues of environmental and sustainability evaluation

In our approach SEA is not only a 'green mirror' i.e. a tool for the evaluation and screening of the measures in environmental and sustainability aspects, but also a 'green engine', namely a tool for determining the elaboration, implementation and monitoring processes of the measures in environmental and sustainability aspects. These criteria can be fulfilled if the methods applied examine **the extent of integration of the relevant sustainability and environmental objectives into the planned measures.**

The applied SEA methods are based on the GRDP Handbook[2] and provide an evaluation-analysis framework able to explore the direct and indirect impacts of the planned measures on the environment, the possible environmental changes derived from these impacts, the characteristics and extent of the impacts and the possible ways of preventing or reducing the harmful impacts or damages. The methodology of evaluation is based on the formerly developed[3] and applied[4] approach that measures planned for the implementation of the Judgement of the International Court of Justice at The Hague shall be **evaluated in a uniform evaluation scheme for environmental performance and sustainability.** In the

[2] Handbook on SEA for Cohesion Policy 2007-2013, Greening Regional Development Programmes Network February 2006, Exeter, UK

[3] Pálvölgyi T., Tombácz E. (2004) Methodology for the Strategic Environmental Assessment for Regional Development. National Society of Conservationists, Budapest,

Fleischer T., Szlávik J., Baranyi R., Branner F., Nagypál N., Füle M., Kósi K. Pálvölgyi T., Princz-Jakovits T., Szlávik P. (2005) Strategic Environmental Assessment of the Hungarian Transport Policy. Közlekedéstudományi Szemle LV. évfolyam 2. szám, 47-55

[4] Strategic Environmental Assessment of the New Hungary Rural Development Strategy and Plan PriceWaterhouseCoopers Kft. and Env-in-Cent Ltd. 2006,

Strategic Environmental Assessment of the Fisheries Operational Programme. Env-in-Cent Ltd. 2007

Strategic Environmental Assessment of the Development Strategy and Plan of the Balaton Region. VÁTI Plc. and Env-in-Cent Ltd. 2008

Strategic Environmental Assessment of the Regional Operational Programmes. VÁTI Plc. és Env-in-Cent Ltsd 2008

elaboration of the methodology of this assessment, the international SEA documents on water resources management and development are also taken into consideration[5].

The environmental performance and sustainability of the proposed interventions and measures are examined through the following methods:

1. The aspects of the **evaluation of environmental performance and sustainability (see below)** were determined based on the relevant environmental policy documents[6], which are suitable for the evaluation of the proposed interventions and measures in connection with the improvement of navigability and the ecological development of the side-arms. This set of objectives takes not only the environmental priorities of prevention, re-cycling (re-use) and disposal into account, but also the relevant natural, social and economic aspects of sustainable development.
2. The proposed interventions and measures (see Chapter 3) were compared to the environmental performance and sustainability aspects by a collective evaluation of the experts, where the environmental performance of each measure was characterized by values between -2 and +2.

2 points	when the proposed interventions and measures promote the fulfilment of the objective in a definite, direct, and significant way
1 point	when the proposed interventions and measures promote the fulfilment of the objective in an indirect and non-significant way
0 point	when the proposed interventions and measures promote the fulfilment of the objective in a neutral way
NR	when the proposed interventions and measures are not related to the fulfilment of the objective
?	when the impacts of the proposed interventions and measures cannot be judged
PR	“possible risk”, when the indirect impacts of the proposed interventions and measures mean environmental or ecological risk for the fulfilment of the objective
-1 point	when the proposed interventions and measures mean a non-significant or indirect risk for the fulfilment of the objective
-2 points	when the proposed interventions and measures mean a definite, direct and significant risk for the fulfilment of the objective

The results of the evaluation of environmental performance and sustainability will be presented in Chapter 4.3.

3. We shall note that this evaluation method does not serve as a general judgement on the environmental performance of the different measures. It – complying with the proposal-formulating features of the SEA – draws attention with its negative values to those environmental aspects, where the environmental aspects of the proposed interventions and measures should be represented in a more definite way (for example in the case of

[5] Strategic Environmental Assessment Draft Practical Guidance for Practitioners on How to Take Account of Water, SNIFFER (on behalf of the Environment and Heritage Service and the Scottish Environment Protection Agency, 2008,

Strategic Environmental Assessment and Integrated Water Resources Management and Development Economic and Sector Work Environment Department World Bank, 2007

Strategic Environmental Assessment and Climate Change: Guidance for Practitioners, 2007, UK Climate Change Programme

[6] National Environmental Programme II and III., National Regional Development Policy Concept, National Waste Management Plan, National Sustainable Development Strategy, National Climate Change Strategy

technical plans of construction, documents of environmental authorization etc.). Namely, **these methods do not seek to place the priorities and objectives into the dimension of 'environment friendly – environment damaging', rather it shall be used as a planning tool for decision making at strategic level,** and would aim to provide clear guidelines for integrating the environmental and sustainability aspects into the different interventions. The **scientific examinations** based on objective indicators, monitoring and modelling methods **cannot be replaced** by the evaluation of environmental performance and sustainability, but they can attract attention to the importance of different analyses and areas of research.

In the case of assessment of the impacts on the surface waters and the groundwater the following information was considered:

- objective analyses (i.e. modelling results) completed during the elaboration of the interventions,
- information from the planning process concerning the fulfilment and justification of WFD requirements

The chapters of the Environmental Report regarding the impacts on the surface waters and the groundwater shall contain the evaluation results on environmental performance taken by different experts regarding the examination of different natural elements, influencing factors and different systems. In addition, it is recommended that **those objective evaluations (for example modelling results) which were taken during the development process of the interventions be used.** In these sections, we perform evaluations regarding the fulfilment of the WFD requirements, which can confirm the realization of the special conditions required by the WFD.

In the course of the assessment of environmental performance and sustainability the following indicators were used:

- guidelines formulated by the group of experts in the framework of the Common Implementation Strategy of the EU Water Framework Directive,
- planning studies developed in England, Germany and the US regarding the assurance of the conditions of sustainable inland navigation,
- international guidelines on the elaboration of Strategic Environmental Assessment documents and the published Environmental Reports on River Basin Management Planning processes,
- guidelines for the 4.7. test of the WFD,
- guidelines for the tests determined by paragraphs 6(3) and 6(4) of the Habitats Directive, and
- guidelines elaborated on the preparation for the possible impacts of climate change on inland navigation.

1.5.2. Evaluation criteria of environmental performance and sustainability

1) The relations between the proposed interventions and measures and the improvement of the navigability and the general objectives of regional sustainability

S1 PROMOTING THE MARKETING OF THE REGIONAL PRODUCTS IN LOCAL AND INTERNATIONAL MARKETS
It should promote the **development of local small and medium enterprises**, the **marketing possibilities of the Hungarian products**, the improvement of the competitiveness at local and international markets and the improvement of the use of Hungarian raw materials.

S2 ENSURING THE CONSERVATION OF THE LOCAL POPULATION OF THE REGION
It should promote the local **employment** and the touristic features and appeal of the region

S3 ENSURING THE SOCIAL COHESION AND THE IMPROVEMENT OF THE DIFFERENTLY DEVELOPED RURAL AREAS OF THE DANUBE REGION
It should contribute to the **improvement of the living circumstances of the rural population of the Danube region**, action aimed at relieving poverty and the betterment of socially disadvantaged groups

S4 CONTRIBUTION TO THE MODERNIZATION OF THE INFRASTRUCTURE OF NAVIGATION
It should contribute to the **modernization of vehicles, the establishment and modernization of harbours and logistics centres** and to promote the **change of transportation methods (modal split)**

S5 CONTRIBUTION TO THE ADAPTATION TO CLIMATE CHANGE
It should contribute to reducing the risks of extreme weather events (for example floods and storms) regarding both ecological (side-arms) and navigability aspects

S6 REDUCING THE WATERWAY TRANSPORTATION COSTS

S7 MINIMIZING THE SOCIAL (EXTERNAL) COSTS OF THE PROPOSED INTERVENTIONS

S8 MINIMIZING THE CROSS-CONTAMINATION BETWEEN DIFFERENT ENVIRONMENTAL SYSTEMS
The proposed interventions and measures should not injure the values and interests of other communities (i.e. the neighbouring regions of the affected Danube section); they should not lead to an increase in territorial differences.

2. The impacts of the proposed interventions and measures and the improvement of the navigability on the environment and nature

AIR

E1 IMPROVING THE CONDITIONS OF NAVIGABILITY MAY DECREASE THE **LOCAL** AIR POLLUTION AND NOISE POLLUTION
local impacts of waterway traffic (CO, NOx and PM10 emissions) on the local state of air quality and noise burden

E2 IMPROVING THE CONDITIONS OF NAVIGABILITY MAY DECREASE THE **REGIONAL** AIR POLLUTION
impacts of waterway traffic as a change of transportation methods (modal split) on the emissions of road transporting vehicles (CO, NOx and PM10 emissions)

E3 IMPROVING THE CONDITIONS OF NAVIGABILITY MAY DECREASE THE EMISSION OF GREENHOUSE GASES
impacts of waterway traffic as a change of transportation methods (modal split) on the emissions of road transporting vehicles (CO2 and CH4 emissions)

SURFACE AND GROUNDWATER, RIVER BED, SOIL

E4 CONTRIBUTION TO THE PROTECTION OF THE QUALITY AND QUANTITY OF **SURFACE WATERS**

E5 CONTRIBUTION TO THE PROTECTION OF THE QUALITY AND QUANTITY OF **GROUNDWATER** (SUBSURFACE DRINKING WATER SOURCES)
impacts on the bank-filtered wells, on the protection of the aquifers and on the yield of river side wells

E6 WILL NOT INCREASE EROSION PROCESSES
dredging of river beds contributes to the surfacing process of the local erosion bases (ledges), thus deepening can start a new realignment process in the previous section

E7 FAVOURABLE IMPACTS ON RIVERBED STABILITY
the buildings and constructions by the river-banks and the structure of the curves of the connected sections should be protected; the durability of the facilities should be improved

E8 IMPROVING THE PREVENTION OF HAVARIA-TYPE DISASTERS AFFECTING WATER QUALITY
improving the fairway attenuates the risk of havaries

E9 IMPROVING THE LOCAL WATER MANAGEMENT PROCESSES
for example, protection against inland waters, water supply, irrigation, etc. Presumably, the proposed interventions and measures will not have significant impacts on the protection against inland waters, water replacement or irrigation.

E10 IMPROVING THE FLOOD-PREVENTION AND TRANSPORTING THE ICE
receiving the flood waves and transporting the ice and bed load

E11 PREVENTING THE DEPRESSION OF GROUNDWATER LEVEL
depression of groundwater level, the drying process and the separation of side-arms as a result of riverbed erosion

E12 PREVENTING THE INCREASE OF WASTE DISPOSAL EFFECTED BY NAVIGATION
for example, refuse oil, non-dangerous industrial waste, communal waste of harbours

E13 PREVENTING RIVERBED EROSION RESULTING FROM SHIP PROPELLERS
The water is accelerated during the operation of the propeller. The acceleration increases by the decrease of the distance between the riverbed and the ship's keel. The movement of bed load is increased by the acceleration of the water.

ENVIRONMENT, FLORA AND FAUNA, LANDSCAPE

E14 IMPROVING THE CONDITION OF WETLAND HABITATS AND THE PROTECTION AND CONSERVATION OF BIODIVERSITY
Impacts on the protection and conservation of the natural conditions in aquatic ecosystems and wetland and overland habitats connected directly to aquatic ecosystems; conservation and improvement of biodiversity at community or local level

E15 MINIMIZING THE SPATIAL AND TEMPORAL NEGATIVE IMPACTS OF ANTHROPOGENIC ORIGIN ON THE AQUATIC ECOLOGICAL SYSTEMS AND WETLAND HABITATS

E16 CONTRIBUTION TO THE PROTECTION AND CONSERVATION OF PROMINENT BOTANICAL AND ZOOLOGICAL VALUES AND FORESTS
Impacts on the presence and endangerment of protected, habitat-specific botanical and zoological values in the side-arms, islands and flood-plains

E17 CONTRIBUTION TO THE PROTECTION AND CONSERVATION OF PROMINENT ICHTHYOLOGICAL VALUES

E18 IMPROVING THE PROTECTION AND CONSERVATION OF LANDSCAPE VALUES AND LIVING HABITAT STRUCTURES
The protection and conservation of the landscape impacts of the river in the natural and built environment, the natural and landscape values

2. THE ENVIRONMENTAL CONDITION OF THE DANUBE SECTION BETWEEN SAP AND SZOB

2.1. Evaluation of the environmental conditions

In this chapter we summarize the status of the air, water and riverbed as well as the conditions of the flora and fauna in the area of the examined Danube section.

Status of surface and groundwater

The assessments regarding the status of surface waters and groundwaters are detailed in the documents of River Basin Management Plans for the water bodies above Gönyű and the section between Gönyű and Szob, thus these are not repeated in this evaluation. The classifications according to the River Basin Management Plans are summarized in Chapter 4.1.1.

Quality of air

Hungary is among the moderately polluted regions of Europe according to the air quality data. Based on the results of a survey carried out in the areas near the Danube section between Sap and Szob, it can be stated that the **nitrogen-dioxide concentration** exceeds the air pollution limiting values in the neighbouring zones of the towns of Győr, Komárom and Esztergom. In the mid 1990's a Programme for Intersectional Measures on the Protection of the Air Quality was realized for the areas near the river-bend of the Danube (the zone of the towns of Esztergom, Lábatlan, Komárom, and Nyergesújfalu). The gas programme conducted at county-level and the different environmental investments of industrial enterprises have resulted in only partial results. Nevertheless, dust pollution has decreased significantly following the installation of the electro-filters at the cement-industrial plants of Lábatlan, and a decrease is expected as a result of the modernization of the Dorog-Esztergom power plant. The emission of non-conventional air pollutants is significant in the case of the dissolvent emission of the Magyar Suzuki Corporation in Esztergom. The air pollution level derived from different diffuse sources – for example airborne ashes, refuse dumps, red sludge reservoirs and non-recultivated extraction fields – is also significant in the area of Komárom-Esztergom County. As a consequence of the special atmospheric conditions the air pollution originating in Slovakia (paper plant and power plant in Sturovo) affects the region of Komárom-Esztergom County. The concentration of nitrogen-dioxide is the highest in the town of Esztergom.

The **sulphur-dioxide concentration** has slightly increased in recent years in the neighbouring area of the towns of Esztergom, Győr and Lábatlan. This process should be observed in the future, as this pollutant can cause special harmful impacts; for example, in the form of acidic rain, it can endanger the environment, may cause illnesses of the

respiratory tract and is the main component of winter smog. In spite of this increasing process, the level of sulphur-dioxide has not yet reached the critical level in the region.

Main features of the riverbed[7]

The Danube section below Sap **cannot be considered as a natural water flow**, as it was modified by the high water river training processes carried out in the 19th century, and the low-flow and mean-flow regulations in later decades. Significant morphological impacts resulted from the sediment retaining impact of the series of dams built in the German and Austrian section of the Danube; the situation being worsened by the significant increase in dredging during the second half of the 20th century. These interventions have led to a significant bed incision process. The structure of the ford sections has also been changed, namely, earlier the ford material was formed by the bed-load transported by the river while, at present, it is formed by the rearranging of the materials of the riverbed.

The first 20 km long section below Sap – the lower reach of the Hungarian Upper Danube (between 1850-1791 rkm) – flows through a large alluvial fan, formed due to a sharp break in the slope near Gönyű. During the centuries, **several side-arms and islands were formed in this section, which made perfect conditions for the formation of long-lasting fords**. The Danube section between Gönyű and the constriction at Visegrád (1695 rkm) may be considered as transitional. The lowland features become more typical (in such parameters as topographic features of the river valley, the riverbed pattern and the flow regime features), but are also determined by the weir impact of the Visegrád breakthrough. As a result of this impact seven fords can be found in the 40 km long section above the breakthrough gate, the formation of which was also influenced by the confluences of the river Hron and the Ipel. There are endangered riverbank lines with high river walls in the region, which represents a danger of severe collapse (near Gönyű, Nyergesújfalu and Esztergom).

Nature conservation, flora and fauna

In the area of the Danube section between Sap and Szob there are four areas, which are under the Natura 2000 network, denoted as **Special Areas of Conservation:**

- Börzsöny Mountains (HUDI20008),
- Alsó-Ipoly-völgy (Lower Ipel Valley) (HUDI20026),
- Pilis and Visegrád Mountains (HUDI20039),
- Danube and Danube floodplain (HUDI20034),

Three areas are **Special Protection Areas:**

- Börzsöny and Visegrád Mountains (HUDI10002),
- Gerecse Mountains (HUDI10003),
- Öreg Lake at the town of Tata (HUDI10006).

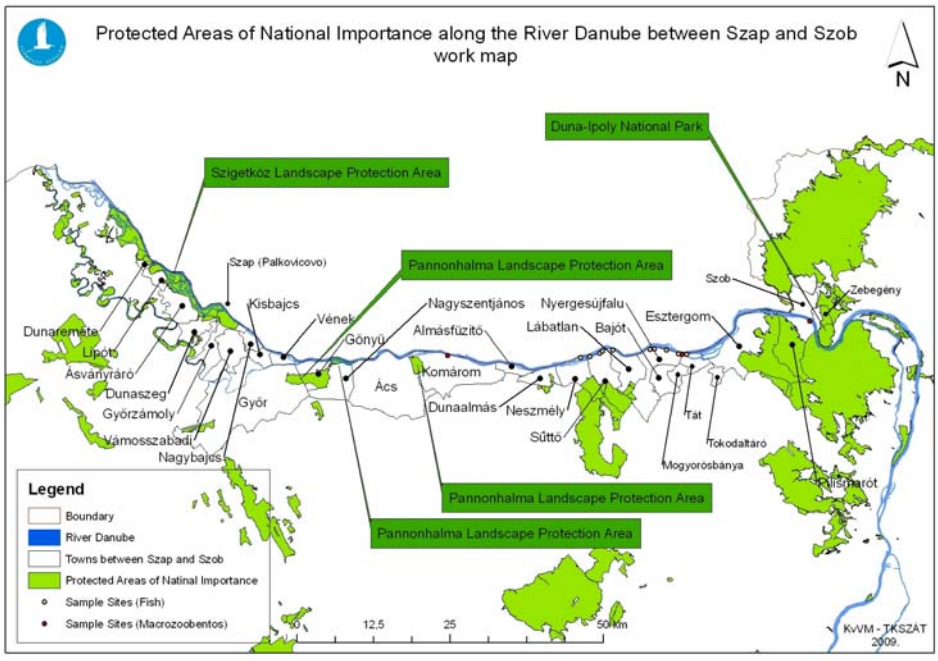
[7] Based on VITUKI, 2007. Study to establish the project entitled: “Improvement of the Navigability of the Danube”

The Danube section examined is bordered by four **Special Areas of Conservation:**

- Duna-Ipoly National Park,
- Herkályi Forest,
- Erebe Islands,
- Chalky-sandy plain of Kisalföld.

The whole area of the Danube section examined is under the protection of the Natura 2000 nature conservation network. A Habitats Directive squarely determines that the main objective of the designation of Natura 2000 areas is not to hinder economic growth and to form closed reserves, where all human activities are forbidden. In the areas under Natura 2000 network, some defined activities of production may be practiced, if they can be harmonized with nature conservation. Conservation should exclusively be assured for those species and habitats, for which the area was designated. The majority of the natural and ecological values of the riverine areas are centred in the island and side-arm system of the river.

Figure 1. Protected areas of Natural Importance along the River Danube between Sap and Szob



Source: Ministry for Environment and Water

There are 18 islands and side-arms in the Danube section between Sap and Szob, where the permitted land-use activities are dependent on their natural features. The forests of Nagy-Erebe-Macska Island and side-arm are strictly protected forest reserves, where no timber production exists. The habitats of the Szőnyi Island and side-arm are under protection, but it is not a protected forest reserve (the reassignment of the area should be taken into consideration). The right side of the side-arm is a popular recreation area for

anglers, but this activity does not cause negative impacts on the flora and the fauna of the islands. The gravel bars near the Helemba Island have also significant natural value. The total area of Patkó Island is designated to be used exclusively for nature conservation activities. The area of the Monostori Island may be used for recreational activities, but for the protection of the water extracting wells in the central areas of the island the protection of the soil and the groundwater should be assured.

The Ramsar Convention on Wetlands of International Importance establishes international cooperation for the conservation and wise use of wetlands and their resources, with regard mainly to wetland habitats for water birds. The sandy area near Gönyű is one of the Ramsar areas.

The Danube section between Sap and Szob are in the territory of the Pannonhalma Protected Area and the Gerecse Protected Area, which areas are very rich in specific natural and landscape values. The main objective of the Protected Areas is to protect and conserve landscape and natural values of high importance. A huge black poplar tree (*Populus nigra*) situated in the Macska Island has special natural value. In the area of the side-arms – mainly at the eastern end of the islands – an important population of almond-leaved willow scrubs (*Polygono hydropiperi-Salicetum triandrae*) can be found. In the deeper, muddy areas of the islands a huge population of willow groves (Leucojo aestivi-Salicetum albae) grow, which jungle-like population can be found in the western part of the Macska Island.

An ecological assessment evaluating the flora, fauna and habitats of the Danube section between Sap and Szob[8] makes the following statements:

- As elements of water quality, phytoplankton composition and biomass primarily indicate eutrophication. Assessment of water quality according to the Water Framework Directive (WFD) requires at least four sampling dates per year; one measurement is therefore non-conclusive for classification using phytoplankton. Both chlorophyll-a and phytoplankton biomass concentration remain at low levels and fall into water quality class I. in the Sap – Szob section.
- For assessment of the ecological status, a modular system was used consisting of an index for organic pollution and an index for general degradation. The assessment of the ecological status indicated “good ecological status” at 60% of the sites along the whole stretch of the Danube. In the Sap – Szob section, all of the sites were evaluated as “good”.
- A true classification of the biological integrity of the fish fauna in the Danube, or even the sample sites, cannot be made by using data from just one day’s sampling. However, based on the classification by European Fish Index (EFI) and Fish Index of Austria (FIA), a rough indication of the ecological status can be made. The fish assessment indicated “moderate ecological status” at most of the sites along the whole stretch of the Danube. In the Sap – Gönyű section 2 sites (Medvedov and Szob) were evaluated. The ecological

[8] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (r.km 1811-1708)”

status was “good” and “bad” at Medvedov and “good” and “moderate” at Szob according to the EFI and FIA respectively.

2.2. The main driving forces influencing the environmental condition

The objective of this chapter is to identify the main driving forces and tendencies, which may influence the environmental and ecological status of the Danube area and, in addition, may determine the efficiency of the implementation of the proposed interventions and measures. Those phenomena, correlations and tendencies are to be described by the exploration of the driving forces, which are outside the range of the local planning and organizational issues of the proposed interventions and measures.

European and domestic efforts on the improvement of the navigability of the Danube

The improvement of the waterway between the North Sea and the Black Sea has been officially determined by the European Union as a development plan of significant importance: this is designated as Corridor VII of the Pan-European Transport network. **Improving the conditions of navigability** and assuring the navigability conditions in certain periods of the year, and complying with the environmental regulations **are among the most important priorities of the EU Transport Policy.** The main objective of the European inland waterway transport policy, among others, is to establish the conditions for the minimum draught level (at least 2.50 m) in all sections.

Intensive preparatory examinations are being conducted at the end of 2009, in order to improve the navigability of the whole navigable section of the Danube. This project has been initiated by the EU and is supported from the financial sources of the Community. The main objective of these examinations is to assure the draught level specified or suggested by international arrangements of the planned variants, but there are also certain variants in which the narrower width of the waterway is determined by modern traffic regulation methods. An **EU guideline[9] is under elaboration for the consideration of the environmental and sustainability aspects of this planning project,** which is intended to be published by the end of 2009. In the framework of the Priority Project[10] co-financed by the EU a project was commenced in 2009 in Hungary bearing the title “Studies on the improvement of the navigability on the Danube” which deals with the possible methods of improving the navigability of the Danube section between Szob and the Southern state border. This project sets out the details up to the preparation level needed for the completion of the executive plans. It deals with the planning process and the Environmental Impacts Assessment (EIA) of the proposed interventions improving navigability and also includes the Strategic Environmental Assessment (SEA) of the assorted variants.

The interventions proposed for the improvement of navigability *may have* negative impacts on the ecological status of the Danube. In connection with the improvement of

[9] EU PLATINA Project (DG-TREN). Platform for the Implementation of NAIADES (www.naiades.info/platina)
[10] Improvement of the navigability on the Danube. TEN-T EA Priority Project 18,2007-HU-18090-S (www.tentea.ec.europa.eu)

the inland navigation fairway in the Danube River Basin it is a key starting point to state that the whole **Hungarian Danube section has outstanding natural values** (for detailed information see Chapter 4.2.3.). The proposed interventions (in the whole Hungarian Danube section, not only between Sap and Szob) should be planned in such a way, that the natural values of the Danube catchment area should be protected. Therefore, **in the course of the planning process, the water traffic and transport policy of the EU regarding the Danube should be enforced circumspectly, by the making of a multicriterial balance of the different alternatives, and bearing in mind the environmental, economic and social aspects.**

Proposal 1.	1) The interventions proposing the improvement of the navigability of the Danube should be harmonized within the framework of international and European agreements 2) The methods in order to assure, to improve and to maintain the conditions of sustainable inland navigation are under elaboration for the Danube Basin. These methods should be used during the realization process of the interventions improving navigability. **The principle of precaution should be considered, the interventions should be made gradually and should be divided into short, pilot sections**.

The ecological impacts of the interventions improving navigability are closely connected to the dimensions of the waterway (depth, width). The national requirements for the parameters of the waterway are laid down by the 17/2002 (III. 7) Decree of the Ministry of Transport and Water. **According to the opinion of the SEA Panel, the present Hungarian requirements regarding the parameters of the waterway are more stringent than the requirements suggested by the international agreement.**

Regarding the improvement of navigability as a motivating factor, the evaluation of the following **two economic aspects** is also needed:

- The proposed improvement of the conditions of navigability may result in savings on transporting costs, but a large element of these savings will be realized in other Member States and third countries, which also use the waterway. **Thus, it is important to achieve that an important portion of the investment, environmental and maintenance costs will be covered by the EU or shared, according to rate of use, among those countries that benefit from the waterway.** This idea is justified by the fact that the incision of the Danube riverbed and the deterioration of the navigability and ecological status are generated mainly by the barrages and reservoirs built in the upper catchment areas of the Danube, by decreasing the sediment transport of the river.
- The **macro-economic importance** of the increasing demand for Danube waterway transport **in Hungary** is uncertain. The relationship between the expected composition of inland waterway transport and the national priorities for the improvement of the national economy has not been properly determined and there is no available information regarding the impacts of Danube waterway transport on domestic employment and competitiveness. It may be expected that the improvement of navigability will not have significant impacts on the national economy of Hungary. The economic analysis will be

significantly important in such cases, where inland waterway transport may be used as an alternative method in the place of road transport.

Proposal 2.	The present and future demand for waterway transport should be evaluated at national and international level, the impacts of waterway transport on employment, competitiveness and regional cohesion processes should be explored. These investigations should be extended for other transport methods, as well.

Local efforts on the land-use issues in the area of side-arms

Most of the settlements situated along the Danube section between Sap and Szob **consider the improvement of navigability and water sports as local development possibilities.** The unilateral, exclusively tourism-centred development of the areas along the riverbank may lead to several environmental impacts. The reconstruction of ports, the development of the infrastructure of services and the organization of special touristic programmes in the riverbank area may lead to the increase of communal waste and wastewater. Developments of the touristic infrastructure will involve the development of the road system leading to the tourist attractions, which may increase the traffic burden. The motorised water sports may cause direct environmental damage, and ultimately, the contamination of the water of the main river branch and the side-arms of the Danube may discourage the tourists.

It is important that the local plans for land use, regarding the floodplains in particular, should emphasize the importance of environment-friendly farming methods and the development of new conditions for floodplain farming, reconstruction of the natural flora of catchment areas and floodplains, and the re-connection of natural floodplains. In addition to the evident ecological advantages, by these measures the flood danger of the lower sections and the extreme flow regimes can be reduced, thus, environmentally friendly land use may contribute to protection against flood and summer droughts.

Proposal 3.	In the course of the authorization process of the local plans for land use and the environmental authorization of touristic and infrastructural developments the following aspects should be taken into consideration: a) the manifestation of the ecological self-regulating mechanisms should be considered. b) in the course of forestation the native species should be preferred, and the existing natural forests and woodland should be protected.

It is also important to create a balance between the interests of local governments and the entrepreneurs to assure environmentally friendly, nature conserving development methods (for example ecological, rural and bicyclist tourism) of the areas along the riverbank. (The impacts on land-use and spatial structure are detailed in Chapter 4.2.9.)

Other important driving forces

Another important factor is the **bed incision process of the Hungarian Danube section,** which reduces the low flow water levels. The main reason for this process is that the sediment is not carried towards Hungary by the Danube, which is caused by the barrages along the upper sections of the Danube. These barrages block a significant amount of the

bed load transport. This deficiency is compensated from the riverbed in the section downstream of Gabčíkovo, which has caused continuous incision of the riverbed. As a result of the bed incision, the degradation process of the side-arms has increased and the groundwater level has decreased, which has resulted in adverse conditions for the bank filtered drinking water wells, and also those ecosystems whose existence depends on the groundwater level (for example the forests at Gönyű). In order to abate these adverse processes some technical interventions should be put in place even if the interventions regarding the improvement of navigability will not be implemented.

The problem of climate change also means an important long-term motivating factor (see detailed information in Chapter 4.2.2.) According to certain estimations the low flow water discharges of the Danube may decrease by 15-30% compared to the present level by the period between 2025 and 2030.

3. INTRODUCTION OF THE PROPOSED INTERVENTIONS AND MEASURES CONCERNING THE IMPLEMENTATION PROCESS OF THE JUDGEMENT OF THE INTERNATIONAL COURT OF JUSTICE AT THE HAGUE

3.1. Description of the proposed interventions and measures

Three different technical interventions were considered in the Danube section between Sap and Szob. Each variant was proposed with several different but connected interventions to be realized in the main river branch of the Danube, in the section between 1811-1708 rkm. With regard to the rehabilitation of the side-arms, the three variants assume the same interventions, thus, the interventions for the rehabilitation of the side-arms are detailed following the introduction of the different variants (Chapter 3.1.4.) The technical parameters of the interventions are detailed in Annex 1. The plan of the variants of interventions for the improvement of the navigability of the Danube section between Sap and Szob and the technical solutions for the rehabilitation process in the side-arms takes into consideration the following: the Belgrade Convention (1948), the Recommendations of the Danube Commission (1988), the AGN Agreement (1996), the Decision No. 1692/96/EC of the European Parliament and the Council (1996) and the Joint Statement on the Navigation and Environmental Sustainability in the Danube Basin (2007) of the ICPDR, the Danube Commission and the International Sava River Basin Commission.

3.1.1. First variant of interventions: “VITUKI Base-1”

According to the first variant, entitled “VITUKI Base-1”[11] the improvement of the parameters of the waterway are to be realized by dredging, the construction of spur-dykes and guiding walls and the supplementation or reduction of spur-dykes. This variant assures navigability for vessels with a 2.50 m draught, the width of the waterway being 120-150 m. The planned interventions were elaborated for the conditions of the riverbed between 2005 and 2007. It should be noted that the changes to the riverbed may change the extent of the interventions.

Interventions in the Danube section between Sap and Gönyű (1811-1793 rkm)

The appropriate conditions of navigability in the section between Sap and Gyönyű may be assured **by the complex regulation of the section**, not by the separate elimination of the shallow fords and bottlenecks.

[11] For details see the VITUKI, 2007: Study to establish the project entitled: “Improvement of the Navigability of the Danube” 7th September 2007., http://www.vituki.hu

At the **bottleneck of Patkósziget** a longitudinal bar projects into the waterway on the Slovak side by 30-50 m, its width being 40-50 cm. This gravel bar may be eliminated by dredging. At the **bottleneck at Medve** the width of the waterway may be broadened by the shortening of a spur-dyke and the completion of another spur-dyke and by a 400 m long by about 1 m wide dredging operation. At the **bottleneck at Szőgye,** between the sections of 1800.3 -1799.7 rkm, widening should be carried out on the convex side and in the waterway near the right bank for about a 600 m long section and 20-30m width. Below this, also on the convex side, between sections 1799.1-1798.7 rkm, widening should be carried out along a section about 400 m long by 20-30m width, in the waterway near the left bank. The thickness of the gravel dredging is about 50 cm.

For the regulation of the **bottleneck at Csicsó** – considering the results of former experimental models and plans – the supplementing of the spur-dyke in the right bank, and the construction of a guiding wall is needed. In order to assure the 120 m wide waterway a gravel bar should be dredged in the left bank between sections 1797.76-1786.60 rkm, along an average width of 60 m. The waterway courses next to the left bank at the section of the **bottleneck at Vének**, between 1796.5-1795.6 rkm. On the right convex side of the bend (next to Kolera Island) deposition creates a bottleneck. Another bottleneck was formed along the left bank between 1794.8-1795.2 rkm. According to the proposed regulation plan, between 1796.5-1795.6 rkm dredging should be carried out along the right bank of the waterway, and a spur-dyke should be reduced by 50 m and another by 20 m on the Slovak side; also between 1795.2-1794.4 rkm a dredging process should be executed on the left bank and two dredging operations on the right bank. The predicted amount of the dredging is 74,000 m^3 gravel.

The waterway is very close to the left bank and forms a great bow from the confluence of the Mosoni-Danube to the section at 1791.5 rkm. There is a guiding wall on the right side of the riverbed, which is connected to the bank by cross-dykes. A part of the area is a silted island. For the dredging processes at the **upper bottleneck at Gönyű** a detailed dredging plan was elaborated. The amount of the dredging is 10,200 m^3. The sediment picked up near Sap is deposited at the **lower ford at Gönyű**. According to the actual record of the riverbed survey a shallow ford was formed in this section. This navigation block has already been dredged; but as a result of the permanent sedimentation, regular gravel dredging processes should be carried out in the future.

Interventions in the Danube section between Gönyű and Szob (1793-1708 rkm)

The **interventions** improving the parameters of the waterway **may be planned separately** in this Danube section.

The elimination of the **ford at Szőny** may be carried out by dredging. Other river training works (apart from to the present guiding wall) should not be built because of the mooring places. The expected amount of the dredging is 10,000 m^3. The **ford at Almásfüzitő** is limited in extent, having a 1 dm shortfall in depth, which could be removed by a single dredging process. The expected amount of the dredging is 7,000 m^3. The **bottleneck at**

Karva is also of a limited extent, having a 1 dm shortfall in depth, which again could be cleared by a single dredging process. The expected amount of the dredging is 7,000 m^3.

The most dangerous shallow ford of the section between Gönyű and Szob is the **ford at Nyerges** in terms of navigability, as the riverbed is uneven, its bed being rocky-marly with marly peaks. According to the mathematical model used in the examination of the variants, the clearing process in this rocky-marly ford will have a relatively slight impact on the low flow water level, the deepening of the water level will be only 2.5-3 cm. As a result of the dredging process, the maximum value of the decrease of medium velocity will be only 7 cm/s. The planned intervention will be the dredging of the marly-rocky riverbed between 1735.1–1733.7 rkm. The expected amount of dredging is 21,000 m^3. The highest shallow ford of this section is the ford at Nyerges. The improvement of the **bottleneck at Nyerges** is closely connected to the ford of Nyerges. The material of the bottleneck is marl and marly gravel. In addition to dredging, the lower tip of the Nyerges Island should be protected. The improvement of the bottleneck and the connected measures for the protection of the tip of the island on the left bank should be carried out by the incorporation of 4,000 m^3 of stone, and by the dredging of the shallow ford (marl and marly-gravel), the expected amount from which being 4,000 m^3.

The main material of the **ford at Ebed** is gravelly-marl and coarse gravel.

It can be projected from the hydraulic tests that dredging of the ford will assure the good conditions of the waterway, it moderately reduces the water level, and the increase in the extent of the cross section will not result in a harmful decrease of the flow velocity. The proposed intervention is the dredging of the ford, its expected amount being 13,000 m^3. As a result of the hydraulic tests, the dredging of the **ford at Istenhegy** will assure the good conditions of the waterway, it moderately reduces the water level, and the increase in the extent of the cross section will not result in a harmful decrease of the flow velocity. The proposed intervention is the dredging of the ford, its expected amount being 31,000 m^3.

According to the hydraulic tests, by dredging the **ford at Garamkövesd** the projected results may come about. The impacts related to the sinking of the water level are relatively limited and the increase in the extent of the cross section will not result in a harmful decrease of the flow velocity. The dredging is actually a riverbed-cleaning process, its expected amount being 13,000 m^3. The material of the **ford at Helemba Island** is marl. According to the former examinations and the mathematical model mentioned in the case of the ford at Nyerges, dredging is seen as the best method for the regulation of this shallow ford. The expected amount of the planned dredging is 40,000 m^3. The supplementing of the riverbed is also needed at the closure of the side-arm by the use of 15,000 m^3 of stone.

Table 1. The summary of the quantity parameters of the interventions of variant "VITUKI Base-1"

Section between Sap and Gönyű	
Dredging of fords in total	152,100 m^3
Refurbishment of river training works	57,500 m^3
Demolition of present spur-dykes	34,700 m^3
Demolition of present guiding walls	83,600 m^3

Predicted amount of regular dredging for maintenance per year	100 – 150,000 m^3

Section between Gönyű and Szob	
Dredging of fords in total	148,000 m^3
of which rocky-marly riverbed material	*78,000 m^3*
Refurbishment of river training works	35,000 m^3
Reconstruction of stone structures	37,300 m^3
Demolition of stone structures	10,000 m^3

Other features of the variant "VITUKI Base-1"

According to the results of the examinations of the different alternative interventions on the Danube section between Sap and Szob, and the one-dimensioned mathematical model of VITUKI, the depth of the river needed for the good parameters of the waterway may be assured by the realization of the proposed interventions. As a result of the mathematical model, the increase of the extent of the cross section **will result in about a 2-3 cm drop of the water level at low flow**. The highest decrease of flood velocity will be only 7 cm/s. According to experience gained, in order to assure the good conditions of the waterway, the different river training works should be maintained and the evolution of waterway bottlenecks should be prevented in the future, which would involve an estimated amount of about 100-150 thousand m^3 dredging of shallow fords per year. Certain changes of the riverbed structure may occur in the future in the Gönyű section, which can occasion the construction of some new river training works in the future.

3.1.2. Second variant of interventions: "VITUKI Base-2"

According to the second variant[12] the improvement of the parameters of the waterway are to be realized by dredging, the construction of spur-dykes or guiding walls and the supplementation or reduction of spur-dykes. Additionally in order to prevent the deepening of the riverbed gravel filling is planned. This variant assures navigability for vessels with a 2.50 m draught, the width of the waterway being 120-150 m. The planned interventions were elaborated for the conditions of the riverbed between 2005 and 2007. It should be noted that the changes of the riverbed may change the extent of the interventions.

Interventions in the Danube section between Sap and Gönyű (1811-1793 rkm)

In this section, the variant "VITUKI Base-2" uses the same interventions as were introduced in variant "VITUKI Base-1" (see Chapter 3.1.1.), therefore, these interventions should not be repeated. However, the variant "VITUKI Base-2" – in addition to dredging and the construction of river training works for improving the parameters of the waterway – **makes an effort to prevent the deepening of the riverbed. This would be realized by gravel filling at certain places using gravel of a defined amount and granulation type.** The predicted amount of this process is about 150-200 thousand m^3 of gravel per year.

[12] For details see the VITUKI, 2007: Study to establish the project entitled: "Improvement of the Navigability of the Danube" 7th September 2007., http://www.vituki.hu

In order to maintain the good condition of the waterway, in addition to the proposed interventions, the regular maintenance works (construction of river training works, dredging) should be undertaken.

Interventions in the Danube section between Gönyű and Szob (1793-1708 rkm)

The **ford at Nyerges**, the **bottleneck at Nyerges**, and the **fords at Ebed and Istenhegy** may be eliminated by the construction of spur-dykes and guiding walls. At the **ford at Szőny,** river training works should not be applied because of the special local conditions. In the case of the **ford at Almásfűzitő, the bottleneck at Karva and the fords at Garamkövesd and Helemba Island** variant "VITUKI Base-2" uses the riverbed cleaning process mentioned in the first variant.

At the **ford at Nyerges,** the building of two spur-dykes (13,200 m^3) may ensure the correct water level at low water. However, according to the results of the model, by the construction of these dykes the maximum shortfall in the depth of about 80 cm will not be eliminated, but will only be decreased by 10-15 cm. A conclusion of the model is that the increase of flood velocity will reach the value of 50 cm/s in the bottleneck, this value added to the present velocity of 1.4 m/s will result in nearly 2 m/s, which can generate the dissolution of the non-marly material of the riverbed. This bottleneck will result in a maximum of a 15 cm decrease in the water level, thus, the depth needed for good navigability conditions may only be assured by 65-70 cm of dredging.

At the **bottleneck at Nyerges** through the building of a spur-dyke (6,600 m^3) and a guiding wall (24,000 m^3) and by the narrowing of the riverbed and the protection of the lower tip of the Nyergesi Island, the increase of the water level may be assured for low water conditions. At the **ford at Ebed** the wide and shallow riverbed is presently narrowed, and the water level is increased by three spur-dykes (40 thousand m^3) on the right bank. According to the former examinations, the attainable increase of the water level is only 15-20 cm, which is only half of the amount required. As a consequence, additional gravel dredging should be carried out to a depth of 15-20 cm. At the **ford at Istenhegy,** the wide and shallow riverbed is presently narrowed and the water level is increased by four spur-dykes (60 thousand m^3) on the right bank.

Table 2. The summary of the quantity parameters of the interventions of variant "VITUKI Base-2"

Section between Sap and Gönyű	
Dredging of shallow fords in total	152,100 m^3
Refurbishment of river training works	57,500 m^3
Demolition of present spur-dykes	34,700 m^3
Demolition of present guiding walls	83,600 m^3
Predicted amount of regular dredging for maintenance per year	150,000 m^3
Replacement of riverbed material near Sap	200,000 m^3

Section between Gönyű and Szob	
Dredging of shallow fords in total	77,000 m^3
of which rocky-marly riverbed material	40,000 m^3
Refurbishment of river training works	159,400 m^3

Reconstruction of stone structures	37,300 m^3
Demolition of stone structures [13]	10,000 m^3

Other features of the variant "VITUKI Base-2"

According to the results of the examinations of the different variants on the Danube section between Sap and Szob, and the one-dimensional mathematical model of VITUKI, the depth of the river needed for the good parameters of the waterway may be assured by the realization of the proposed interventions. The exceptions to this are the shallow fords at Nyerges, Ebed and Istenhegy. **In the case of these fords, in spite of the use of the structures planned by the variant "VITUKI Base-2" the shortfall in the depth will also be significant,** and, in certain places the average flood velocity will be decreased by 50 cm/s. In these locations the variant "VITUKI Base-1" should be realized.

3.1.3. Third variant of interventions: "Realignment of the navigation channel"

According to the variant of "Realignment of the navigation channel"[14] the improvement of the parameters of the waterway are to be realized by dredging, the re-drawing and correcting of the waterway, and by narrowing the waterway by buoyage. This variant assures the traffic for vessels with a draught of 2.50 m, the width of the waterway being 100-150 m. It should be noted that this variant, as far as the technical plan is concerned, has not been elaborated at similar level, than in the case of variants "VITUKI Base-1" and "VITUKI Base-2". The assessment of environmental performance and sustainability of this variant has been completed on the basis of the study referred to above.

Interventions in the Danube section between Sap and Szob (1811-1708 rkm)

In the **section of Nyerges I.** (1735.5-1733.7 rkm) the draught of the vessels is limited by rocky peaks, the shortfall in the depth being 9 dm. The width of the waterway is 100 m, independently from the water flow level. In order to assure the 2.50 m draught and 100 m width for the vessels, the interventions needed may be significantly smaller than in the case where a width of 150 m is required. In accordance with the recommendations of the Danube Commission, the minimum width in shallow fords with a rocky riverbed is 100 m. This variant suggests the creation of a 100 m wide waterway by dredging, along the present line, without a re-drawing of the waterway.

In the section of the **ford at Helemba Island** (1711.3-1710.7 rkm) the draught of the vessels are limited by rocky peaks and by the shortfall in the depth of 8 dm in the case of navigational low flow. The width of the waterway is 100 m, apart from the water flow level. In order to assure the 2.50 m draught and 100 m width for the vessels, the interventions may be significantly smaller than in the case of assuring the width of 150 m. In accordance with the recommendations of the Danube Commission, the minimum width in shallow fords with a

[13] As a result of the decrease of low water levels, in the upper part of the section up to the area near Almásfüzitő, the height of the present intallations should be reduced slightly by demolition

[14] For details see in the study of Zsolt Gerencsér: "Improvement of the parameters of waterway in the Danube section between Sap and Szob, by regulating methods at minimum level" May, 2009 – www.bosnagymaros.hu

rocky riverbed is 100 m. This variant suggests the creation of a 100 m wide waterway by dredging, along the present line, without the re-drawing of the waterway.

In the section of the **ford at Garamkövesd (**1714.3-1713.9 rkm) by a re-drawing of the waterway, the waterway may be corrected and it may be located to that part of the riverbed, where the minimum depth is at least 30 dm. Therefore, the width of the waterway may be about 110-120 m, which can be increased up to 150 m during the greater part of the year. Construction works will probably not be needed. In the course of the detailed planning process the necessity of dredging should be considered.

The areas with a depth of 27-30 dm in the section of the **ford at Istenhegy** (1722.3 - 1721.8 rkm) should be adjusted jointly by the regulation of the ford at Istenhegy. In the section between 1724.0-1722.2 rkm, dredging should be carried out over a 150 m width, along the line of the present waterway, based on the detailed records of the riverbed survey. The re-drawing of the waterway is needed in the section between 1722.3 -1721.8 rkm. As a result, a 100 m wide waterway may be created, which can be increased up to 150 m during the greater part of the year.

The **bottleneck at the Ipel confluence** (1708.2-1708.0 rkm) is only 200 m long and blocks the encounter of certain vessels only at low water periods. The section below the bottleneck is wide and straight, thus, it does not significantly block navigation. Therefore, if the parameters of the bottleneck do not deteriorate, structures will probably not be needed in order to modify the parameters of the waterway. The re-drawing of the waterway is not needed.

In the section of the **ford at Ebed** (1726-1724.7 rkm) dredging should be carried out along the present line of the waterway to a width of 150 m. According to the record of the riverbed survey, in the section between 1726.7-1726 rkm there are areas of the waterway with shallow sections, therefore the regulation of these areas should be carried out jointly with the ford at Ebed.

In the section of Nyerges II. (1732.4-1731,9 rkm) dredging should be carried out along a 150 m width, in the present line of the waterway. In the sections of **Karva** (1740.1-1739.7 rkm), **Almásfüzitő** (1757.1-1756.7 rkm) and **Komárom** (1764.3 -1764.0 rkm) a 150 m wide, 27 dm deep waterway may be assured by the modification of the location of the waterway.

In the section of the **ford at Kolozsnéma** (1792.1-1791.8 rkm) a shallow ford was noted in the September of 2004, which was dredged in May 2005. The shallow ford appeared again in the September of 2005, but was observed only on two days between the end of 2006 and the October of 2008. The location of the waterway is mainly determined by the spur-dyke of the left bank at 1791.7 rkm. As a result of the spur-dyke a bar has been developing as a result of the increased sediment deposition, therefore the width of the waterway is decreased by this bar on the right bank. The maximum width of the waterway may only be assured by dredging. As this is a transition section, this variant recommends the formation of a 100 m wide waterway.

In the course of the planning process those areas should also be examined, which are not declared as shallow fords (namely in the sections at 1790.3; 1710; 1709 rkm); in these sections dredging works should be projected, only if needed. The regulation of **bottlenecks at Csicsó and Vének** (at 1797.40 -1796.70 and 1796.30 -1795.30 rkm) is recommended to be carried out jointly. At present, there is no need for intervention. **In the section between 1799.20 -1798.80 rkm, where the formation of shallow fords is suspected,** a bottleneck was formed in 2009 but one which did not lack depth. This bottleneck is only 400 m long, and does not block the waterway. The waterway should be maintained at a 100 m width. The section of the ford at Medve (1806.2-1806 rkm) may not be qualified as a shallow ford according to the parameters of the waterway, therefore its regulation is not needed at present.

Other features of the variant "Realignment of the navigation channel"

The plans of this variant were not elaborated in such a detailed form as the former two variants. The third variant ensures a narrower waterway at the low flow water level period, therefore the **two-way waterway traffic should be restricted in the bottlenecks.** According to the present navigation practice these restrictions **may slightly increase the average period of passing through the bottlenecks,** thus, they will not cause significant increase in transport costs.[15] The possible increase of the waterway traffic will not cause a significant increase in extra time and cost. According to navigation practice two-way traffic is not prevalent even in those sections where the parameters of the width were appropriate. The investment costs of this variant are low, but the costs of replacement and reconstruction of the existing river training works – which are mostly in a bad state as a result of the lack of maintenance – are not included.

For the technical realization of the variant "Realignment of the navigation channel" **modern techniques should be used, different from the present Hungarian dredging methods, especially in the case of shallow fords constituted of hard, marly riverbed materials.** In the case of both the traditional and modern dredging technologies in use, the preciseness of the horizontal and altitude measurements should be improved by the use of Global Positioning System (GPS), particularly in the case of the ford at Nyergesújfalu. In order to ensure the further improvement of navigability and the better utilization of the waterway the fairway marking and ford monitoring systems should be reviewed. By these processes selection among the various proposed interventions and the determination of their extent may be determined.

3.1.4. Interventions for the rehabilitation of the side-arms

As mentioned earlier, the proposed interventions in the side-arms are to be the same in the case of all the three alternatives. The most important interventions are the following:

The river **ecosystem at Tát has significant importance,** it is a significant habitat in the section between Sap and Szob. After its rehabilitation it may be an important fish-cradle and

[15] Bartus Gábor, Fucskó József, Kis András és Ungvári Gábor: Cost-Benefit Analysis of the Alternatives Related to the Gabčíkovo-Nagymaros Barrage System Plan. Hungarian Centre of Environmental Economics, 2009

also a feeding place for several bird species. The water supply of the habitat may be assured by the proposed interventions for the most part of the year and this may improve the sustainability and the biological activity. The rehabilitation may improve the water quality in the side-arm, which can protect the future subsurface drinking water sources.

A line of bars, which is situated below the **Helemba Islands,** is one of the most important and internationally significant spawning grounds of the Danube. The rehabilitation of the side-arm system is particularly actuated by the prevention of sediment deposition and the compensation of the disturbing impacts of the interventions.

The limited deepening of the riverbed near the **Nagy Erebe Islands** and the connected side-arm system may improve the conditions of the wintering places for different fish species.

Table 3. Main features of the regulations in the side-arms

Name of intervention	**Place of intervention (rkm)**	**Main features of the intervention,** the method of regulation, the length of the affected river section, the area of the intervention, etc.
Táti Island and side-arms	1728.1-1721.8	opening of the upper closures of the side-arms up to DB 2004 level, dredging of 252,404 m^3 of silt and 34,958 m^3 of gravel
Helemba–Déda-Törpe Islands and side-arms	1713.0-1710.3	no dredging is needed in the Helemba side-arm, dredging of 4,060 m^3 of silt and 42,274 m^3 of gravel in the Déda side-arm, dredging 8,544 m^3 of silt and 27,794 m^3 of gravel in the Törpe side-arm
Nagy Erebe Islands and side-arms	1789.5-1785.5	opening of the closures of the side-arms up to DB 2004 level, dredging of 8,917 m^3 of silt and 5,794 m^3 of gravel

3.2. Relationship between the interventions and the River Basin Management Planning process

Generally, the results of plans of new infrastructural interventions should be used during the planning process of the River Basin Management Plans. In the case of those interventions and investments having a high risk of negative impacts on the conditions of natural water bodies the main function of the River Basin Management Plans is to check that Article 4.7 Test of the WFD was carried out by the planners, and that they have drawn the correct conclusions in accordance with the results of the analysis. **The planners of new infrastructural interventions and investments shall take all such information from the River Basin Management Plans that is connected to the status of those water bodies, which may have negative impacts caused by the proposed interventions.**

The River Basin Management Plans should not carry out detailed examinations regarding the new infrastructural interventions – for example improvement of navigability – which may have negative impacts on the status of water bodies. These examinations and analyses are very expensive and labour-intensive. Generally, it can be stated, that such examinations have not been conducted in the development process of River Basin Management Plans even in other Member States and the analyses and examinations remained mainly at the strategic level. If there is no concrete plan for the new infrastructural interventions and

investments, the River Basin Management Plan shall make statements only on the basis of the estimations of special experts.

In accordance with the WFD, a River Basin Management Plan shall contain only summarized information on the different topics, but the sources of the detailed information should be referenced. Experience concerning public debates on River Basin Management Plans is that the stakeholders would like to obtain more detailed information concerning the plans, which the summarizing character of the plans does not offer. The detailed information may only be found in background papers. Detailed information regarding the plans for the improvement of navigability was not present in several cases in different public forums related to River Basin Management Plans. In the River Basin Management Plans a short summary should be written on the proposed interventions and investments that improve navigability; the planners of the navigability plans shall provide detailed information regarding these planning processes. **The planners of navigability plans shall provide information for the planners of River Basin Management Plans concerning the planned interventions and their possible impacts and about the results of environmental assessments and the results of the WFD Article 4.7 Test, in particular.**

We remark, that – although not required by the SEA Decree – **if the special tests determined by the WFD are conducted during the planning process of the different alternatives of the proposed interventions, it may improve the professional utilization of the SEA documents.**

Proposal 4.	In the framework of the confirmation process of the proposed technical solutions the following examinations shall be taken in accordance with the WFD criteria: a) examinations to be undertaken for the qualification (for example revising as heavily modified water body) of the water body (Art. 4.3. test), b) the confirmation of moderate, less stringent environmental objectives (Art. 4.5. test) c) the socio-economic and environmental feasibility of the planned technical solutions and measures (Art. 4.7. test)

3.3. Relationship between the measures and the relevant European Community and national policies

3.3.1. Water (protection) policy of the European Union

The objectives and the measures of the EU water protection policy are determined and obligated by the Water Framework Directive. The regulations of the Water Framework Directive are the main criteria and tools of the water protection policy. The feasibility of those projects which may improve the main parameters of waterways is significantly determined by the specifications of the Water Framework Directive. A project, the objective of which is to improve navigability, shall be realized if the analyses determined by Paragraph 7 of Article 4 of the Water Framework Directive are conducted by the planners (i.e. 4.7 test), and it is confirmed that the interventions or investments are in compliance with the requirements concerned (see in Chapter 3.2.).

The European Commission's experts, during special meetings regarding the improvement of the navigability of the Danube, have drawn attention to the fact that the Commission will monitor new infrastructural investments – including new investments improving navigability – in order to ascertain that they are in compliance with the River Basin Management Plans and the requirements of Paragraph 7 of Article 4 of the Water Framework Directive. They have also emphasized that the examinations determined by Paragraph 3 and 4 of Article 6 of the Habitats Directive should also be conducted (see Chapter 4.2.6.). They have also attracted attention to the fact that Paragraph 7 of Article 4 of the Water Framework Directive determines strict conditions for the realization of new investments with sustainable water management features. The following facts and criteria shall be confirmed:

- in environmental aspects there are no better technical solutions,
- the cancellation of the proposed intervention or investment would injure public interest, or, the economic benefits of the realization of the proposed intervention or investment would exceed the ecological benefits which could be achieved by its cancellation,
- all measures are to be taken, which may reduce the negative environmental impacts,
- the main parameters of the intervention or investment and the reasons for its realization were formerly introduced in the River Basin Management Plans,
- the interventions will not have negative impacts on other water bodies and the realization of other environmental objectives.

3.3.2. European and Hungarian energy policies and specific policies in relation to renewable energy sources

European policies regarding the development of renewable energy sources

According to the 2001/77/EC Directive on the promotion of electricity produced from renewable energy, the European Union made progress towards achieving the 21% target by 2010, which is equivalent to the national indicative target of 12 % regarding the gross national energy consumption. Pursuant to the Directive, all Member States should be required to set and make progress towards achieving national indicative targets for the fulfilment of the Community target. **The methods used to achieve the national indicative targets, i.e. the share of different energy sources, should be determined at Member State level.** Thus, each Member State can determine the most convenient method for achieving the indicative targets.

The need for the moderation being global climate change, the European Union, in December 2008, set out an ambitious target. According to this objective, the European Union is to make progress towards achieving the 20% target of overall share of energy from renewable sources by 2020. These objectives were laid down in the 2009/28/EC Directive. Member States – similarly to former regulations supporting the use of renewable energy sources – shall determine their strategies and action plans according to their possible sources, geographical conditions and other relevant aspects. The Directive – except for the

special rules for bio-fuels used in transportation processes – does not differentiate between possible methods and has no preference for any methods of renewable energy production.

Financial support for the investments is guaranteed by the European Union, mainly from the Cohesion Funds and Structural Funds, but there are special institutions – for example the Strategic Energy Technology Plan, the Framework Programme for Research and Technological Development and the Programme of Intelligent Energy for Europe – which can give financial support for research and technology transfer processes.

The role of the renewable energy sources in the Hungarian energy policy

In accordance with the 2001/77/EC Directive Hungary determined to achieve the national indicative target of 3.6 % by 2010 which should be fulfilled (at the date of the determination of the national indicative target the actual share was about 0.5% in Hungary).

The national renewable energy action plan should be established in 2010 in accordance with the requirements of the 2009/28/EC Directive. The principles of this action plan are determined by the 40/2008 Resolution of the Hungarian Parliament which defines the energy policy for the period of 2008-2020. In this Resolution Parliament calls upon the Government *to establish an energy policy and prepare the strategy for increasing the use of renewable energy sources in accordance with the requirements of the European Union*, *taking into consideration the natural and economic conditions of Hungary, the capacity of the population and the principles of cost minimizing and sustainability. The strategy should also contribute to the objectives of decreasing the emission of greenhouse gases in Hungary*. This Resolution has not defined any concrete directions in the field of the use of renewable energy sources. Parallel to the elaboration process of this Parliament Resolution a working paper was also elaborated by the competent Ministry, on the strategy of increasing the share of the use of renewable energy sources. This working paper, however, has not been determined as an official document by either the Government or by Parliament.

In the aspects of the present SEA paper, only water energy would be relevant among the renewable energy sources. However, the share of water energy will not be significant in the domestic renewable energy use over the long term, as water energy shares only 14.4 PJ potential (meaning less than 1%) from the estimated overall domestic value of renewable energy sources potential (2600-2700 PJ). According to the estimates of the energetic department, the share of water energy from the 163 PJ potential, which can be utilized by 2020, may be only about 1 PJ value. The strict European environmental law – for example the rules and regulations regarding the protection of river ecosystems, natural values and water quality standards – make the increase of the share of water energy production more difficult.

3.3.3. European and Hungarian transport policies. The planned measures of the Trans-European Transport Network.

International commitments on the improvement of river navigability

Transport by inland waterways is regulated by the legal rules of the European Union and other international commitments. The main rights and obligations concerning the Danube, as an international waterway are determined by the *Belgrade Convention* (Convention Regarding the Regime of Navigation on the Danube). The Convention, which has been a matter of re-codification for years, regulates that the Danubian member states shall maintain their sections of the Danube in a navigable condition for river-going vessels, to carry out the works necessary for the maintenance and improvement of navigation conditions. The concrete parameters (such as the depth, the width and the availability) of the waterway have not been defined by the Convention. These parameters are drawn up by the Danube Commission, the executive body of the Convention.

The European Agreement on Main Inland Waterways of International Importance (hereinafter *AGN Agreement*) was adopted in Geneva, on 19th January 1996, under the aegis of the United Nations Economic Commission for Europe, which determines that the Danube is a part of the European International waterway system (marked by E-80). Annex III of the AGN Agreement sets out the minimum technical and operational characteristics of inland waterways of international importance. Section 2 of Article 11 of Decision No 1692/96/EC of the European Parliament and the Council repeats the requirements of the AGN Agreement, thus it can be considered as *acquis communautaire*.

Transport development programmes of the European Union

Since 1990, the EU has devoted significant consideration to the development of the standardization of the traffic and transporting infrastructure (TEN programmes). The main objectives of these programmes are to establish a platform for the identity of interests for the Member States and to give financial support for the common development processes.

The TEN-T projects (Trans-European Transport Network) include all modes of transport and organised by axis and corridors. The Danube/Main/Rhine (DMR) waterway system is called Corridor VII. A basic principle of the programme is that this corridor contains several shallow fords and bottlenecks. The programme does not recommend any methods for the elimination of these bottlenecks and does not define any obligations, but the national governments have preferred the river control methods for the development of the waterway. In Hungary the Ministry of Economy and Transport has commissioned the consortium lead by VITUKI to elaborate the supporting study “Improvement of the navigability of the Danube” with a 50% EU contribution, in order to fulfil the criteria relevant for class VI/b by the methods of traditional river training.

The development of inland navigation in the European Union is also supported by the NAIADES (Navigation and Inland Waterway Action and Development in Europe). The main objective of this programme in addition to the development of waterways is to improve the

communication, informatics, markets, and the fleet and to assist in special vocational training courses to increase the educational level of the human resource.

The domestic regulations on river navigation

The basic principle of the Hungarian regulations is Governmental Decree No. 151/2000, which declares the statements of the AGN Agreement. The detailed parameters of the regulation are proclaimed by the 17/2002 (III.7.) Decree of the Ministry of Transport and Water on "registering the navigable waterways or canals and waterways or canals, which can be made navigable". The Decree has accepted the recommendations of the Danube Commission, for example the minimum dimension of the waterway level must be ensured compared to the water level of water discharges with a 94% durability, or when the Danube is classified into class VI/b (between 1812 and 1641 rkm) and class VI/c (between 1641 and 1433 rkm). The Decree unambiguously contains the reference that the recommendations of the Danube Commission are to be applied during the establishment process of the waterway.

It is important to mention that the standpoint of the Hungarian National Council on the Environment considers the recommendation of the Danube Commission on the 94% durability of the design discharges too high (the minimum dimensions of the waterway must be based on the water discharges with a 94% durability)

3.3.4. European and Hungarian policies on environmental protection and nature conservation

The environmental policy of the European Union has been determined since 1973 by the environmental action plans, which involve the key elements of the nature conservation policy. Between 2001 and 2010, the Sixth Environment Action Programme is in force. The **nature conservation policy of the Community** is based on two directives of crucial importance:

- the **Birds Directive** (79/409/EEC) on the conservation of wild birds, which lays down the principles of the determination of Special Protection Areas (SPAs), and
- the **Habitats Directive** (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora, which lays down the principles of the determination of Special Areas of Conservation (SAC).

The Natura 2000 network of the European Union for nature conservation is based on these two directives and is comprised of Special Areas of Conservation and additionally incorporates Special Protection Areas designated by Member States. The Community has determined principal restrictions for the modification and intervention of the good environmental conditions of the Natura 2000 areas. Although the main objective of the environmental policy of the EU is the protection of wild habitats and species it also takes measures on special management processes on environmental protection, which should be carried out by the Member States. The objective of these activities is to maintain the affected habitats and species in good condition, or, in the event of deterioration, to adopt conservation measures involving appropriate management plans and other measures, if needed, which correspond to the ecological requirements of the natural habitat types, and the species. The conservation objectives should be met while taking account of economic, social, cultural, regional and recreational requirements. It is for the Member States to establish the most

appropriate methods and instruments for implementing the directives and for achieving the conservation objectives of Natura 2000 sites.

The Natura 2000 network refers to the community nature conservation and environmental protection aspects at regional level. It has great significance in the arrangements of the legal debate concerning the investments of the Gabčíkovo-Nagymaros Project, as several areas under the protection of the Natura 2000 network are affected by the project. In relation to the Natura 2000 areas the community law sets out the necessary protecting provisions for active management on the one hand, and absolute restrictions and limitations on the other. According to the community law, the Natura 2000 network is defined as "common European heritage" and it is declared that the protection of different areas and the integrity of the whole network is the common responsibility of the Member States. Meanwhile, the Member States shall provide for both the appropriate environmental and legal protection of the Natura 2000 area.

One of the main fields affected by the Community environmental law is **nature conservation**, which has direct impacts on the realization of the Gabčíkovo-Nagymaros Project. The **priority of protecting targets** is one of the most important aspects of the objectives on nature conservation. The **Hungarian policy on nature conservation** is determined by the community law, which means that the Member States should adopt all of the different international agreements integrated into the Community law, such as the following agreements: The Convention on Wetlands of International Importance especially as Waterfowl Habitat i.e. Ramsar Convention (Ramsar, 1971); Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979); Convention on the Conservation of Migratory Species and Wild Animals (Bonn, 1979); the Convention on Biological Diversity (Rio de Janeiro, 1992); Convention on Cooperation for the Protection and Sustainable Use of the Danube River (Sofia, 1994).

The share of areas under the Natura 2000 network is 21% of the total territory of Hungary and 50% of them are under national protection. After Hungary's accession to the European Union, it was obligatory **to determine appropriate management plans** and other measures for the areas under the Natura 2000 network and to implement the **habitat reconstruction programmes** specified by the two directives of the Community on environmental protection and nature conservation. The adoption and harmonization of the environmental laws and regulations of the Community have not created any legal or institutional problems in Hungary, as there are regulations that are more stringent and measures already in Hungarian law. However, in other respects, the integration of the environmental protection aspects into the agricultural and rural development policies involves a more serious challenge for the policy makers.

3.3.5. Relationship between the proposed interventions and the document "Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin"

The Joint Statement of ICPDR, Danube Commission, and International Sava River Basin Commission contains recommendations for the improvement of the conditions for inland

waterway transport in consistency with the criteria of environmental sustainability. The recommendations cover the integrated planning principles and the criteria for river engineering.

The EC supports the implementation of the recommendations of the Joint Statement among others through the financing of the PLATINA project and establishing the Working Group on Rivers initiated by DG ENV and DG TREN.

The consistency of the planning process of the measures with the recommendations of the Joint Statement is assessed in Table 4.

Table 4. Recommendations of the Joint Statement for the principles of integrated planning, and implementation of those for the planning of measures to improve the navigability of the Danube between Szap and Szob

1. Integrated planning principles

Recommendations for the Joint Statement	Consistency of the planning process with the recommendations
Establish interdisciplinary planning teams involving key stakeholders, including Ministries responsible for transport, for water management and environment, waterway administrations, representatives of protected areas, local authorities, non-governmental organizations, tourism, scientific institutions and independent (international) experts.	The planning process is consistent.
Define joint planning objectives.	The planning process is consistent
Set-up a transparent planning process (information/participation) based on comprehensive data and including the environmental benchmarks and current standards required for Strategic Environmental Assessment (SEA – for qualifying plans, programmes and policies) and for Environmental Impact Assessment (EIA – for projects).	According to the Work Plan the planning process will be consistent
Ensure the comparability of alternatives and assess the feasibility of a plan (including the costs and benefits) and/or project (including a reflection of the status quo, alternatives and nonstructural measures as well as environmental and resource costs).	The planning process is consistent
Assess if the IWT project has a basin wide/transboundary impact.	The planning process is consistent
Inform and consult the international river commissions in the Danube river basin (ICPDR, Danube Commission, International Sava River Basin Commission) before deciding on new developments, as well as other possibly affected countries..	According to the Work Plan the planning process will be consistent.
Respect the Danube River Basin Management Plan 2009, including its Joint Programme of Measures, and the respective sub-basin and national river basin management plans and programmes of measures as the basis for integrated planning and implementation of IWT infrastructure projects, in the meantime respecting already existing environmental legislation requirements.	According to the Work Plan the planning process will be consistent
Define and ensure the prerequisites and goals of IWT as well as river/floodplain ecological integrity, followed by a consideration of the need to prevent deterioration, possible mitigation and/or restoration measures to achieve all environmental requirements.	According to the Work Plan the planning process will be consistent
Ensure that there are no technically viable, environmentally better and not disproportionally costly alternative means to achieve the required objective, in line with the requirements of Article 4(7) of the EU WFD.	According to the Work Plan the planning process will be consistent.
Seek to avoid or, if this is not possible, to minimize the impacts of structural/hydraulic engineering interventions in the river system through mitigation and/or restoration, giving preference to reversible interventions.	According to the Work Plan the planning process will be consistent
Ensure that, when planning navigation projects, the issue and respective effects of climate change are taken into account.	According to the Work Plan the planning process will be

Recommendations for the Joint Statement	Consistency of the planning process with the recommendations
	consistent
Use of best practice measures to improve navigation	The planning process is consistent
Carry out a priority ranking of possible measures to ensure the best possible environmental as well as navigation development effect and use of financial resources.	According to the Work Plan the planning process will be consistent
Ensure flexible funding conditions for projects to enable integrated planning (including the involvement of all stakeholder groups) and adaptive implementation as well as monitoring.	According to the Work Plan the planning process will be consistent
Monitor the effects of measures and – if relevant- adapt them.	According to the Work Plan the planning process will be consistent

2. Criteria for river engineering

Recommendations for the Joint Statement	Consistency of the planning process with the recommendations
Use a case-by-case approach which considers both the ecological requirements for river sections and the basin-wide scale and the strategic requirements of IWT at the basin-wide scale when deciding on adequate fairway width and depth.	The planners are intended to follow this recommendation.
'Working with nature' wherever possible through implementation of measures according to given natural river-morphological processes following the principle of minimum or temporary engineering intervention,	According to the Work Plan the planning process will be consistent
Integrated design of regulation structures, equally regarding hydraulic, morphological and ecological criteria,	The planning process is consistent.
Implementation of measures in an adaptive form (e.g. river bed stabilisation by granulometric bed improvement, low water regulation by groynes),	According to the Work Plan the results of the planning process will be consistent
Optimal use of the potential for river restoration (e.g. river banks restoration) and side channel reconnection.	The planning process is consistent
Ensuring that flood water levels are not exacerbated and, ideally, are reduced.	The planning process is consistent

3.4. Relationship of the proposed interventions and measures to other relevant plans, programmes and strategies

3.4.1. National Sustainable Development Strategy (NSDS)

The National Sustainable Development Strategy[16] (hereinafter NSDS) which was adopted in 2007, as well as the Member State Report, which introduces the implementation of the EU's Sustainable Development Strategy are relevant to the proposed interventions and measures regarding the Danube in the following fields:

[16] 100/2007. (XI.12.) Resolution of the Hungarian Parliament on the planning and conciliation issues of the long-term sustainability development of the Hungarian Republic

According to the **NSDS the proper balance of the water flowing capacity of the rivers is a key issue, as the possible occurrence of floods and the dangerous impacts caused by the seasonal variations of flows (water scarcity) are increasing.** Other possible risks on the aquifers can be generated by the more frequent occurrence of summer droughts and the summer deficit in average precipitation. A main objective of the NSDS is to implement proper measures to decrease both the risk of floods and water scarcity.

The following specific objectives of the NSDS should be emphasised: the conservation of natural ecosystems, measures to be taken in order to reduce the risks of climate change and measures for the development of sustainable water management methods. By the realization of these objectives production using water saving patterns and the preservation of the subsurface drinking water sources for future generations may be achieved, the contamination of aquifers may be avoided and the appropriate living conditions may be assured for the natural habitats. **The most important objective of the NSDS is that, beyond the quantity and quality requirements, the complex water management and sustainable development of different catchment areas – including inshore retention – should gradually be implemented, by the support of the Community and domestic regulations in compliance with the Water Framework Directive as the main document of the EU's water policy.**

The improvement of the navigability of the Danube is not affected by the NSDS. Nevertheless, **the following measures of the NSDS may have direct or indirect consequences on the river navigation effected by the interventions planned on the Danube:**

- measures for the maintenance of the good status of natural waters by the use of River Basin Management Planning methods.
- measures for decreasing water pollution by contaminant materials and sewage waste, minimising the danger of pollution by chemical waste.
- measures for the protection and rehabilitation of water and wetland habitats, assuring the proper level of water supply, and the achievement of good ecological status in accordance with the EU provisions.
- increasing the safety conditions in the event of floods. The runoff should be secured in the event of floods by the help of flood risk maps and the "space for the river" principle. (It should be noted, that in Hungary it is difficult to assure such a level of water retention that could decrease the flood levels in long sections along the Danube.)

3.4.2. National Climate Change Strategy (NCCS)

According to the National Climate Change Strategy[17] (hereinafter NCCS) **climate change is among the greatest challenges and risks which endangers the Hungarian national economy on the whole.** Three main directions of Hungary's medium-term climate policy are determined by the NCCS:

[17] 29/2008. (III.20.) Resolution of the Hungarian Parliament on the National Climate Change Strategy

- the determination of measures to be implemented in accordance with the international and EU requirements in order to mitigate and **reduce the emission of greenhouse gases**;
- the determination of the main elements for the protection against the unavoidable ecologic and social-economic impacts of climate change, and the main aspects regarding the **improvement of adaptability**; and finally,
- the improvement of climate-consciousness thinking and behaviour throughout the whole of society.

As mentioned **by the NCCS the emission of greenhouse gases of transport origin may be decreased by the improvement of waterway transport methods.**

In the subject of preparations for the adaptation to the impacts of climate change, the NCCS emphasizes that both the quantity and the quality of Hungary's subsurface drinking water sources may be changed as a consequence of the climate change. In water quantity aspects, the longer periods of the summer droughts and the floods and inland water can cause serious problems. In water quality aspects, the self-purification processes may be worsened as a result of the decreasing quantity of water. The decomposition process of polluting materials may slow down, which can cause harmful impacts on water quality. The importance of freshwater stock will increase over the coming decades, thus, it will play a strategic role in Europe and all over the world. In this aspect, the role of groundwater stock will have increasingly significant importance.

3.4.3. National Environmental Programme (NEP)

The National Environmental Programme (hereinafter NEP) is a framework for the medium-term planning period, which determines the priorities and objectives of the Hungarian environmental policy for a six-year period, but it also plans the long term aspects of environmental issues. The NEP focuses on those environmental objectives and their implementing measures necessary for the development of society as a whole and the economy, in a comprehensive and unified way, with regard to the different regional and social features.

The **promotion of Hungary's sustainable development strategy is among the main objectives** of the Third NEP (2009-2014)[18], the measures co-ordinated by the social and economic possibilities should be determined, **emphasizing the importance of the principles of partnership, decentralization and subsidiarity**. According to the Programme, several affairs should be resolved by co-operation with the neighbouring countries. **The questions regarding the navigability of the Danube and the water quantity problems connected to the diversion of the Danube in the Szigetköz Reach can be solved through the co-operation of the countries concerned.** The proposed technical interventions and measures on the Danube may be connected directly or indirectly to the following NEP-III objectives:

[18] Third National Environmental Programme is under Parliament debate (November, 2009)

In the framework of the Climate Change Action Plan:

- Determination of the possible alternative methods for the development of waterway traffic and transport, having regard to the protection of natural values and ecologic rehabilitation activities. The most important measure to be implemented in this objective is the support of the development of ports in order to improve waterway transport methods.
- Surveying the ecologic and cost-efficient alternatives to waterway traffic and transport, having regard to the protection and conservation of the riverside ecosystems, the conservation of ecological corridors and the good status of natural waters, as determined in the Water Framework Directive.
- Examination of the climate change and water management issues in an integrated way, in the fields of water supply, utilization of water energy, irrigation and improvement of the quality of drinking water.

In the framework of the Action Plan for the Protection and Sustainable Use of Water:

In compliance with the suggestions of the NEP-III the problems determined by River Basin Management Plans should be solved at local level. However, there are certain interventions which should be taken in the whole catchment area of the river concerned, and there are special issues (such as barrages on the Danube and tributaries and ecological issues regarding the navigability of the Danube) which are connected to the Danube and involve more countries. The proposed technical interventions and measures on the Danube may be connected to the following NEP-III objectives:

- The protection of the quantity and quality of the subsurface drinking water sources; inshore retention and the assuring of water reserves as issues of water management; enforcing the principles of prohibition of damages, equitable share and polluter-pays-principle considering territorial sovereignty in the cases of international co-operation for the subsurface drinking water source management; moderating the impacts of floods by maintaining good ecological status criteria.

Local water management is one of the parts of the Action Plan, in which framework the main measures are the development of a flood protection system along the Danube and the risk management of floods.

Regarding the **essential tasks and directions in regional co-operation with the neighbouring countries** the NEP lays stress on the importance of co-operation in the fields of water management and the use of the agreements on bordering rivers. According to the NEP it is important to improve Hungarian participation in the framework of the International Danube River Protection Convention and its executive body, the International Commission for the Protection of the Danube River (ICPDR).

3.4.4. New Hungary Development Plan (NHDP)

The main objective of the New Hungary Development Plan (2007-2013) is to expand employment and to create the appropriate conditions for permanent economic growth and the improvement of Hungary's competitiveness. In compliance with its main objectives six

areas of significant importance were determined for development through financial support from national and Community sources, namely in the field of economy, transport, reforms in society, environment, energy sector, and rural development. The NHDP is a strategic planning document, to which different operational programmes (OPs) are connected. **The proposed interventions and measures examined by the present SEA document are connected to the measures of the Transport Operational Programme (TOP) and the Environment and Energy Operational Programme (EEOP).**

The number of processes endangering the environment has increased over the last few decades. The occurrence of extreme flows, the contamination of our waters originating in the neighbouring countries, and large-scale human interventions have become more frequent. Thus, **according to the NHDP the safety of the environment has become a strategic objective, which can be solved by international co-operation with the neighbouring countries.**

The priorities of the NHDP are in compliance with the improvement of navigability and the environmental conditions, as the plan includes measures regarding the development of waterways, environmental conditions, the methods of water management, flood protection, the protection of the quantity and quality of our natural waters, the protection against pollution (protection of water bodies, drinking water sources, recultivation of waste disposal areas and environmental compensation) and the official measures to be taken for the implementation of the Water Framework Directive.

In order to achieve the above-mentioned priorities, such objectives were determined in the NHDP, which can improve the waterway infrastructure and promote the reasonable and better use of the Danube/Main/Rhine waterway system. It improves not only the public waterway traffic, but also increases the share of waterway transport. As is remarked in the NHDP, for the realization of this improvement process the safe conditions of navigability and the development and modernization of the flood protection system should be assured along the total Hungarian section of the Danube. In relation to the achievement of good ecological status special river basin management and integrated water use management methods should be implemented, in accordance with the requirements of the Water Framework Directive.

3.4.5. New Hungary Rural Development Programme (NHRDP)

The New Hungary Rural Development Programme has been in force since 2007. It determines the measures and interventions that may assure the improvement of the competitiveness of the agricultural sector and ensure the protection of the environment and the countryside (protection of the natural and built rural landscapes). The financial resources of the Programme are provided by the European Agricultural Fund for Rural Development (EAFRD) to an amount of 1,300 billion HUF.

In the thematic analysis of the situation, in the section “Environment and land use” it is stated, that half of the current flood protection system does not completely comply with the requirements. The Programme ensures the development of River Basin Management Plans.

The priorities of the programme support the collective investments for water regulation, in the case of the elimination of water damages and the regulation of excess inland water it supports the development and the improvement of agricultural water use methods and the construction of installations for water management, if they are in compliance with the Water Framework Directive and the criteria of sustainable development, and in addition, they have all the legal permissions, do not have negative impacts on the subsurface drinking water sources and have a positive water balance. The Programme – in connection with the development of the infrastructure of agriculture – designates the Lower Szigetköz, the Southern Danube Valley and the Southern Pest regions as areas under the regional water management system.

3.4.6. National Forestry Strategy

The role of forest and timber has become more significant in Hungary both in social and economic aspects, as society has come to recognize their importance. The following aspects, which have already been verified by legal rules should be emphasized:

- the conservation of forest ecosystems plays an important role in nature conservation, environmental protection and in the improvement of the quality of human life,
- the use of the forests for nature conservation and recreational activities, their use for the production of renewable timber and other products; forests can be regarded as renewable and reusable resources,
- the environmental and economic role of wildlife management and hunting is increasing,
- the environment-friendly material of timber will be an essential raw material.

According to the objectives of the National Forestry Programme[19] the share of forests and other wooded land should be increased from the present 22.5% to 25% in the future. Besides the increase of the quantity, the quality features of the Hungarian forests should also be improved by the use of **nature-friendly forest management** methods.

In the area of the Danube section examined by the present SEA document, the share of **natural forests** is relatively low, while the share of **semi-natural forests** is higher. The floodplain areas are covered mainly by **wood plantations**, but these plantations can be considered as natural forests, because they consist of mainly selected poplar and willow species, which are spreading towards the grasslands.

The main element of the National Forestry Strategy is **sustainable forest management,** the main **task** of which is to establish, protect and conserve the stability of forest ecosystems. Its main **objective** is to harmonize the main functions (for example functions on nature conservation, environmental protection, social, recreational and producing functions) of the forests with the ecological features and the needs of society.

The European Union has also developed its Forestry Strategy, converting the specific issues of the Common Agricultural Policy of 1992, thus, the role of reforestation and forest renewal has become more emphasised. The role of forests and woodland has significant

[19] 1110/2004. (X.27.) Resolution of the Hungarian Parliament on the plan for realization of the National Forestry Strategy between 2006 and 2015.

importance, not only in nature and landscape conservation, but also in CO_2 absorption aspects.

3.4.7. National Regional Development Policy Concept (NRDPC) and National Development Policy Concept (NDPC)

The National Regional Development Policy Concept (NRDPC)[20] (2005) determined the objectives, directions, principles and framework of Hungary's regional development. **The area situated along the Danube was determined as an integrated region with national importance** by the NRDPC; the repairing of the sustainability was determined as a medium-term regional strategic objective prior to 2013. This objective was adopted by the National Development Policy Concept (NDPC)[21] (2005) which laid down the basic aspects of the NHDP.

National Regional Development Policy Concept (NRDPC)

The regional objective determined by the NDPC is to ensure the sustainable development of the area situated along the Danube. This may be realized by the rehabilitation of the Danube section in Hungary, assuring the navigability of the waterway and establishing environmentally friendly methods of transportation. This to be done **in such a way, that the aspects of agricultural production, fisheries, forestry and wildlife management, water management as well as the development of eco-tourism and infrastructure should be harmonized with the natural, cultural and ecological objectives.** These objectives are in compliance with the objectives of the EU Water Framework Directive, i.e. the improvement of the sustainable use of water and the long-term conservation of the subsurface drinking water sources which aspects should be taken into consideration in the realization of the technical solutions and measures determined by the Judgement of the International Court of Justice at The Hague. The **following NRDPC objectives and measures should be considered relevant** in the framework of the present SEA document:

- ensuring the connections between the main branch of the Danube and its side-arm system, the conservation of the natural and landscape values, the areas under the Natura 2000 network and biodiversity in the whole of the region;
- ensuring the navigability of the waterway – as a part of Corridor VII. of the Trans-European waterway – complying with the criteria of the European requirements, the development of the environment friendly transport methods and logistic systems, which may improve the connections between the regions along the Danube;
- the development of a national concept on Danube regulation in accordance with the provisions of the EU's Trans-European Transport Network in regard to the regulation of the Danube;

[20] 97/2005. (XII.25.) Resolution of the Hungarian Parliament on the National Regional Development Policy Concept

[21] 97/2005. (XII.25.) Resolution of the Hungarian Parliament on the National Regional Development Policy Concept

- the elaboration of River Basin Management Plans by the co-operation of the Danubian states by 2008-2009;
- the improvement of the Danube Information and Emergency System;
- improving the efficiency of the resource management systems of the aquifer;
- the conservation, protection and reconstruction of water habitats by the reconstruction of floodplains and oxbow lakes and the rehabilitation of the protected areas;
- the protection against water pollution and water damage by the establishment of the infrastructure of wastewater management systems.

The integrated management of the negative impacts in the event of extreme conditions (such as inland water, floods and summer droughts) at regional or river basin-level are among the general objectives of the NRDPC, with special regard to the environmentally endangered areas near the state border, and the Szigetköz Reach of the Danube in particular. Another objective is the development of safe conditions for navigability by the modernization of the fleet and the reconstruction of the domestic ports, in accordance with the EU standards. It can be stated, that the proposed interventions and measures connected to the realization of the Judgement of the International Court of Justice at The Hague are in compliance with the priorities and objectives of the NRDPC.

National Development Policy Concept (NDPC)

The NDPC is the **long-term (15 years) development concept of Hungary**, which formed a basis for the NHDP. According to the NDPC, the key solution for the sustainable development of the different regions of Hungary is **the co-ordination of the ecological features and the transport corridor aspects of the Danube**. The priorities relating to the Danube are the same as provided by the NRDPC. It is emphasized in the NDPC that relying on the integrated river basin management, all the measures, activities and interventions should be co-ordinated, planned and implemented by the participation of partners, which may improve protection against water damage and also improve water management, and furthermore may influence the quantity, quality and ecological status of natural waters. The conservation and protection of the natural and cultural values, regions, landscapes and biodiversity of the areas along the Danube are also important.

According to the NDPC the comprehensive development of the Danube, especially the development of transport and traffic, is essential. In this aspect, the main objective is to establish a homogenous waterway in the German, Austrian, Slovak, Slovak-Hungarian and Hungarian sections of the Danube, which can improve the release of the bottleneck conditions of railway and road transport, and can also increase the share of touristic water traffic. **These objectives shall be realized by considering all the ecological aspects.**

4. ASSESSMENT OF THE ENVIRONMENTAL AND SUSTAINABILITY IMPACTS OF THE PROPOSED INTERVENTIONS AND MEASURES

4.1. The direct and indirect environmental impacts of the proposed interventions on the status of surface and groundwaters

The status of surface and groundwaters are defined and discussed by the definitions and methodology used in the Water Framework Directive. According to the Framework Directive:

- the good status of surface waters should be achieved by the good chemical and good ecological status,
- the good status of groundwaters should be achieved by the good quantitative status and good chemical status.

The good quantitative status and hydro-morphological conditions of surface waters should also be ensured; however, they are not determined by the above definition, because the ecological status of natural waters can be good only if their quantitative status and hydro-morphological status are also good.

4.1.1. Impacts on the status of surface waters

The chemical status of the Danube water has achieved "qood" status along the section between Gönyű and Szob, according to Hungary's River Basin Management Plan. During the process of construction, the material of the riverbed may be disturbed and may cause a periodic deterioration of the water quality, but its extent will not be so great as to need intervention. **The proposed interventions will not have significant impacts on the current chemical status of the river**, thus, we agree with the planners that they have not considered the possible impacts on the chemical status of the Danube.

The chemical status of the Danube water is failing to achieve "good" status along the section between Sap and Gönyű, according to Hungary's River Basin Management Plan. The proposed interventions will not worsen the current chemical status of the river, thus, we agree with the planners that they have not considered the impacts on the chemical status of the Danube**.** The proposed interventions will not obstruct the achievement of the good chemical status.

The ecological status of the Danube water is failing to achieve "good" status along the section between Sap and Szob, according to Hungary's River Basin Management Plan. The proposed interventions may have negative impacts on the ecological status of the river (for detail see Chapter 4.2.6.).

4.1.2. Impacts on the status of groundwaters

The proposed interventions improving the parameters of the waterway **may have negative impacts on the quantitative status and the chemical status of the groundwaters in the Danube section between Sap and Szob**. These impacts may endanger the present and the future subsurface drinking water sources in the area of the section. Therefore, the examination of the impacts of the proposed interventions on these resources should be carried out in the course of the planning process, and, in addition, the making of plans for special interventions for the cessation of the negative impacts is also significantly important.

Impacts of spur-dykes and guiding walls

The siltation process caused by the river training works may affect the decrease of water abstraction and the deterioration of the water quality of the bank filtered wells. The impact of spur-dykes and guiding walls on the bed level needs to be carefully explored. The slight increase of the water level may marginally improve the water supply.

Impacts of dredging

Dredging may initiate damage to the filtering and transporting media, which have important functions in the bank filtering process in the hydro-geologic protecting area of the subsurface drinking water source . As a result of dredging the water transporting capacity of the aquifer is reduced which may decrease the water abstraction of the wells along the riverbank. The clearing of the mostly silted top layer may increase infiltration. In such cases, the water quality may be worsened because the biologic filtering layer would be damaged and its regeneration would take a long period. As a result of dredging a new infiltration regime may be developed below the shallow fords. This process may cause siltation, which reduces the water abstraction of the wells. The siltation may decrease or increase the water quality of the wells. The risk of deterioration of water quality may decrease because, according to Hungary's River Basin Management Plan, the chemical status of the Danube is good in this section and, in all probability, is not likely to be worsened.

Proposal 5.	**1. In order to estimate the impacts on the** subsurface drinking water sources **complex hydraulic and biochemical processes should be examined both above and beneath the surface.** For this process *in situ* examinations and the use of mathematical models are needed, which should be conducted during the planning process. The results of the examinations and the measures taken for the protection against possible negative impacts or for reducing them should be detailed in the environmental authorization process. 2. In the case of the variant "*Realignment of the Navigation Channel*" similar examinations should be conducted regarding sediment transport and riverbed stability, as in the case of the improvement of the navigability of the Danube section between Szob and the Southern state border.

The examinations on the impacts on the subsurface drinking water sources should be carried out in accordance with the planners' aspects. According to the planners the following aspects are the most important factors of bank-filtering conditions:

- the change of the active riverbed surface and the depth of layers,
- siltation and clogging,
- changes of the water level on the riverbank,
- the place of the intervention related to the protection system, and
- the extent of the intervention (in the case of dredging the area and the depth of dredging, in the case of guiding walls the number and size of river training works).

Those impacts were regarded as significant on the subsurface drinking water sources for the compensation of which extra interventions should be taken.

There are five shallow fords in the section between Sap and Szob the regulation of which may have an influence on subsurface drinking water sources. Three of the seven of the affected water abstraction sites are currently working (Győr-Szőgye, Tát, Prímás Island) and four are future subsurface drinking water sources (Nagybajcs-East, Nagybajcs-West, Vének, Táti Island). Some of these water abstraction sites are affected by more interventions: for example, the regulation of the fords at Csicsó and Vének in the case of variant "VITUKI Base-2", where the proposed gravel filling may have impacts on the aquifer of this area. The refurbishment of the guiding walls at the ford at Csicsó may affect the subsurface drinking water source of Győr-Szőgye and Vének. The abstraction site of Prímás Island may be affected by the regulation of the ford at Ebed – construction of guiding walls according to variant "VITUKI Base-2" – and the ford at Istenhegy.

The subsurface water a**bstraction sites along the section may be affected differently**. This is dependent on the location of the proposed interventions, i.e. if the planned dredging or the river training structure is inside the protecting area of the drinking water sources (the risk is higher) or if it is outside. **More significant interventions are planned to be carried out in the area of the subsurface drinking water sources at Győr-Szőgye, Véneki and Táti Island.** In the case of the abstraction site of Prímás Island , the dredging is planned outside the protected zone, but directly next to it (at the ford at Ebed the last river training structure is 200 m distant from the protection zone.). **Thus, this water abstraction site should be regarded as highly affected.** The abstraction site at Nagybajcs may be affected as a result of gravel filling proposed by the variant "VITUKI Base-2". **The impacts of these interventions would be hard to determine, as they depend on several different factors (for example the exact place, the amount and the granular structure of gravel filling, conditions of flow and sediment transport) which could be determined only by the detailed plans.**

Proposal 6.	1) For the determination of the amount, the gravel structure and the exact place of the gravel filling a **detailed physical model examination** should be carried out prior to the elaboration of the authorization plan. 2) After finishing the gravel filling the monitoring of the sediment transport should be carried out.

The most frequent intervention in this section is the dredging of the shallow fords, which may result in the reduction of the thickness of the aquifer layer. This process **may result in risk inside the protection zone of Táti Island;** in all of the other cases the interventions are

planned outside the protection zones, with varying distances. In several cases the shallow fords are planned to be complemented by guiding walls, which may result in the increase of siltation near these structures.

In the plans of the proposed interventions all examinations and surveys, which should be carried out in order to protect the subsurface drinking water sources, were defined by the planners. **In our opinion, these examinations are necessary to be conducted by all means available.** It should also be emphasized that the planners, considering that there is no available information to make estimations on the possible impacts without the results of special examinations and surveys, have raised all the issues which may have negative effects on the conditions of the subsurface drinking water sources, apart from the degree of these impacts.

4.1.3. Impacts on the status of habitats connected to surface waters

The natural and ecological values of the area along the river are concentrated mainly in its inshore zones, side-arm and island system Thus, the issues of ecological rehabilitation should be determined for this area. The length of the side-arm system represents 164 km of the 417 km of the length of the total Hungarian Danube section.[22] **The changes in the features of sediment transport, the closures and the siltation of the side-arms have resulted in severe changes in the wetland habitats** because of the fact that the functioning of the ecosystems of wetland habitats are influenced by the dynamics of the flow regime and sediment transport.

The surface water flows have significant importance in the conservation of water and wetland habitats and the exchange processes between surface water and ground waters are also important. In the case of wetland habitats all economic and social activities should be carried out in such a way that may secure the long-lasting existence of all the protected objects.

In all river hydro-systems there are basic interactions between the land and the river. These transition zones, and their dynamic changes resulting from the fluctuation of water levels represent the most significant ecological value of the floodplains; they also play an important role in the functional processes, such as production, degradation, food stocks and the food chain. Considering these aspects the **most important objectives of integrated river management** are the following:

- the conservation of the landscape function of the river both in the natural and artificial landscape;
- the conservation of the natural conditions of the flow regime in order to secure the appropriate conditions of the riverbank and riverbed habitats, in the event of the regulation of water and riverbed conditions the environmental damage should be minimised.;

[22] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007. Chapter 3.3.1.3., 122.p

- the conservation or improvement of the natural or close to natural status of water and wetland ecosystems.[23]

Certain areas of the side-arms, the overflow areas and the low-lying islands, are covered by water during the significant part of the year. In these areas aquatic and marshy plant populations grow. **Some of these populations are under protection, for example pleustonic plant communities (such as duckweed) and of the plant communities sedge, rush, reed, reed-grass, willow and poplar forest.** Certain side-arms and islands may be utilized exclusively for nature conservation and environmentally-friendly water sport activities.[24]

The interventions of the *main branch* may endanger the conservation of the wetland habitats of the riverbank and may cause heavy disturbance for the species living there, the extent of which is currently unknown. However, it should be mentioned that the proposed interventions improving the parameters of the waterway may result in changes of the water level only of the order of centimetres. The siltation resulting from dredging and the river training construction works may change the infiltration processes in short sections. Nevertheless, at present **there exist no results from scientific research and monitoring on the future ecological impacts of these relatively minor changes** caused by the extreme sensitivity of the populations of wetland habitats.

Dredging, river bed reconstruction, demolition of closures carried out in the side-arms, in order to change the water of stagnant water bodies and improve water quality, **may significantly improve the conservation status of the wetlands, in the case of all the three variants.** By the help of certain rehabilitation measures and interventions the hydro-morphologic conditions, essential for the conservation and development of the wetland habitats and their populations of the Danube, may be restored. The unique and diverse features of these wetland habitats are key elements of biodiversity.

Proposal 7.	*Prior to* the environmental permitting procedures of the proposed interventions the following aspect should be taken into consideration: (a) **Are the proposed interventions for the improvement of navigability in compliance with the requirements** of Paragraphs 3., 7., 8 and 9 of Article 4 of the Water Framework Directive and Paragraphs 3 and 4 of Article 6 of the Habitats Directive **in ecological aspects?** (b) **What complex and permanent future impacts should to be considered as a result of the proposed interventions** for the improvement of navigability **in the present ecological status of the Hungarian Danube section?**

4.1.4. Impacts on the status of the riverbed

In the short term the proposed interventions improving the parameters of the waterway may result in slight (2-3 cm) changes of the water level only. The **bed incision process of the Hungarian Danube section,** generated mainly by the barrages and reservoirs built in the upper catchment areas of the Danube and the long-term maintenance dredging,

[23] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007. Chapter 3.1.3. , 115. p

[24] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (r.km 1811-1708)”. Chapter 6. , 19-21. pp.

however, may result in the lowering of bed levels with detrimental effects on groundwater levels, floodplain habitats and inshore zones. Considering the severe lack of bed load at the confluence of the Danube and the tailrace canal, **a sediment management plan should be elaborated** identifying reaches with disturbed equilibrium of sedimentation, deposition and transport.

The siltation resulting from dredging and the river training construction works may change the infiltration processes in short sections, but it may not cause the decrease of groundwater level. Thus, the proposed interventions will not have impacts on the soil even in situations where the groundwater level is near the surface.

In addition, **the water may be accelerated by the propellers of the vessels, which may lead to the erosion of the riverbed in the waterway to an unknown extent.**

Proposal 8.	Long-term evolution of the river bed profile associated with measures should be studied intensively using latest technologies, e.g. bed load transport models in order to establish a sediment management plan The ecological impact of measures should be evaluated by taking into account relevant EU experiences.

4.1.5. Impacts on the status of flood protection

The proposed interventions for the improvement of the parameters of the waterway and for rehabilitation in the main branch and the side-arm system – except for the opening of the closures in the side-arms – may have impacts only during the low flow water regime. In the case of the medium and high water regime the impacts will not be significant. **In the process of opening the closures of the side-arms the river training works should be built in such a way so that the transport of ice is not blocked.**

In the framework of the Environment and Energy Operational Programme - the “State owned development of flood protection” programme (KEOP–2009–2.1.1.) significant development projects will be conducted in the period between 2009 and 2010. Their main objectives are to improve safety aspects of flood protection and decrease the risk of floods, according to best practice, by state financed developments along the River Tisza, the Danube and their tributaries.

The amount of the financial resources proposed for the preparations for flood protection projects will be 37.5 thousand million HUF, for the total area of the country. The amount of the financial resources available for the realization of these projects will be 79.63 thousand million HUF, for the total area of the country, for the period between 2009 and 2010. In the framework of these projects the following flood protection measures may be supported:

- Measures and technical interventions for the conservation and improvement of the flow regime in, and the flowing conditions of, the riverbed in the case of medium and high water level;
- Construction, development and reconstruction of flood prevention dykes;
- Interventions for the stability of the riverbed, the reparation of the unsafe sections;
- Development and reconstruction of flood protecting forest belts;

- Reconstruction of supporting walls;
- Construction and reconstruction of cross-dykes;
- Development of the infrastructure of the flood protection system (developments in telecommunication and informatics and the road system).

There are certain areas in the Danube section above Szob where the main flood protection system should be developed, thus, new projects may be initiated in this section with the support of the financial resources mentioned above.

Proposal 9.	The realization process of proposed interventions for the improvement of the parameters of the waterway and for rehabilitation in the main branch and the side-arm system should be harmonized with the construction works for the development of flood protection.

4.2. The direct and indirect environmental impacts of the proposed interventions and measures on other environmental elements and environmental systems

4.2.1. Impacts on the quality of air

The impacts on the air were examined in the assessment of the environmental performance according to three aspects:

- the local impacts of waterway traffic (CO, NO_x and PM10 emissions) on the local air quality and noise burden,
- impacts of waterway traffic as a change of transportation methods (modal split) on the emissions of other traffic emissions
- impacts of waterway traffic as a change of transportation methods (modal split) on the emissions of greenhouse gases (CO_2 and NMVOC emissions)

It can be stated that in the case of all the three variants the **increased waterway traffic will result in a moderate deterioration of the local air quality and an increase in the noise pollution of the riverbank.**

In the side-arms the features of the recreational use will determine the local air quality so **a deterioration of air quality and an increased level of CO_2 may be a potential risk.** If the developments along the riverbank are connected to motorised water sports or if they generate investments in infrastructure and traffic (for example building yacht ports, aqua-parks, touristic attractions and programmes, etc.), the quality of air may be worsened.

Proposal 10.	The use of a life-cycle approach is suggested for those examinations, the objective of which is to explore the impacts of the change from railway to waterway transport, on the emissions of air pollutants (generated in areas outside the waterway).

Waterway cargo transport will probably not be the alternative to road transport in the Hungarian Danube section, it will rather be an alternative to railway cargo transport. In this aspect, it **cannot be predicted whether the change from railway transport to waterway**

transport will have positive impacts on the quality of air or not (in total and according to a life cycle approach). But it is obvious that **the improvement of waterway transport** – as a consequence of its more favourable fuel efficiency features (CO_2 emission/tonne-km) – **will moderate the emission of greenhouse gases.**

4.2.2. Impacts related to climate change

The annual mean temperature has increased by more than 0.5°C **in certain areas of Hungary** over the last twenty years, while the share of intensive precipitation in the annual precipitation total has also increased. Floods, summer droughts and heat waves have become more frequent in Hungary. **The annual precipitation has decreased significantly during the 20th century**, mainly in the spring period: the share of the seasonal amount of precipitation in spring is only 75% of the amounts seen in the early years of the century. It should be emphasized that the decrease of precipitation is the largest in the North-Western parts of Hungary, including the area of the Danube section between Sap and Szob.

According to a recent study[25] based on the results of a VAHAVA Research Project (VAHAVA is the Hungarian abbreviation of 'Changes – Impacts – Responses') the seasonal warming in the Carpathian Basin may be between 0.1-0.5°C by 2050 (supposing that the emission of greenhouse gases remains at the same level), and a greater increase of temperature of +1.5°C may be predicted for the autumn season. In total, the annual increase of temperature is expected to be +0.7°C. According to the results, the amount of summer precipitation could decrease by 25-35%. The examinations predict the increase of winter precipitation (with an uncertain share), but it may mostly be in the form of winter rains, as temperature for the most part will be above zero.

Water, as a natural resource, is closely connected to the climate and is determined by the stability of the weather. This means that, at the same place, excess water can cause problems during one period, while problems may be caused by the lack of water at another time. **In the Danube section concerned it can be presently observed that the straggling of smaller water flows and the decrease in the groundwater level may cause damage in both the water and wetland habitats.**

There is a special feature of the impacts of climate change on the natural waters in Hungary, namely, that **precipitation shows an increase in the winter period, while it decreases in the summer period. This applies to the whole catchment area of the Danube.** As a result of warming, the snowfall period is reduced in the winter, meaning that winter precipitation is increased, but a reduced share falls in the form of snow. The amount of ice in the rivers and lakes may also decrease as a result of warming, which is confirmed by observations over recent decades. Global warming may increase the risk of floods caused by winter precipitation and the snow-melt floods may occur earlier.

[25] Levente Horváth, 2009. Challenges and measures for adaptation in the framework regulation on climate change, National Committee of Sustainable Development

The occurrence and the extent of heavy floods may grow as a result of the **increase of the frequency and intensity of extreme precipitation,** which will probably increase the damage and the costs of protection and reparation.

The decrease of summer precipitation, supplemented by the increase of evaporation raise the frequency and the extent of the **extremely low water levels (at low flow)** and the frequency of **summer droughts**. In Hungary climate change may presumably lead to the decline of the mean runoff, i.e. the renewable water stock of the water courses. According to different scenarios the **low flow water supply of the Danube in the summer period may be lower by 15-30% than present values, by the period between 2025 and 2030.** The reduction of the low flows in the summer period and the warming of the water temperatures may bring about several problems:

- the amount of natural utilizable water stock may decrease,
- the possibilities of water extraction are worsened,
- the conditions of navigability may worsen,
- the self-purification capacity of water courses may deteriorate,
- the flora and the fauna of the watercourses may change,
- the landscape may be degraded.

The low flow water level of the Danube will probably decrease as a result of climate change, therefore the required **technical interventions should be estimated and the river fleet should be modernized** – adapting the vessels to the new, lower water levels – **in order to maintain the sustainability of navigation on the Danube.**

The reduced average runoff in the summer, the longer period of low flows and the warming of the natural waters will **probably increase the length and the frequency of the critical period regarding water quality aspects**. The more intensive global radiation and the increase of water temperature improve the conditions for photosynthesis, enhance the production of organic materials and intensify the eutrophication process. The concentration of oxygen will decrease in the rivers and this process together with the reduction of average water flow in low flow periods will worsen the oxygen balance of natural waters.

Proposal 11.	The impacts of climate change a) on the navigability of the Danube b) on the touristic utilization of the side-arms and c) on the ecological status of the Danube should be examined.

4.2.3. Impacts on the conditions of areas under environmental protection and areas of the Natura 2000 network

The total area of the Hungarian Danube section (except for the section at Budapest), as a continuous water body, and the connected side-arm systems and islands are under the Natura 2000 network. The whole section is part of the national ecological network as core areas or ecological corridors and it is also part of the ecological network of the European Union. The Danube is a determining ecological corridor of the European Union. The Danube

has been functioning as a combination of intercontinental, continental, regional and local corridor for different habitats and species.

In the section between Sap and Szob there are **two SCI areas** (Sites of Community Interest) and **one SPA area** (Special Protection Area)[26]. The SCI areas are: the Danube and its floodplain; the Pilis and the Visegrádi Mountains. The SPA areas are: the Börzsöny and the Visegrádi Mountains. The section above Vének is a part of the Szigetköz SCI and SPA. The total section between Vének and Szob is a part of the Danube and its floodplain SCI.

The area concerned starts at Sap which is situated at the end of the **side-arm system at Bagomér,** thus, it is under protection as a part of the **Szigetköz Protected Area.** The **area below Gönyű (Erebe Island)** is a part of the **Pannonhalma Protected Area.** The riverbank area between Esztergom and Szob is part of the **Duna-Ipoly National Park.** The gravel bars below **Helemba Island** have outstanding natural value in international terms, as this type of habitat is very rare and the valuable fish species living there are disappearing (for example *Zingel zingel, Zingel streber, Gymnocephalus schaetser*).[27]

While a high proportion of the native flora and fauna still exist, a large number of formerly common species show declining populations. **Many taxa have become threatened and are on the Red List due to habitat alterations and loss**.[28]

The dredging of the **side-arms** for nature conservation purposes and the opening of closures **may contribute to the conservation of protected and Natura 2000 areas and, in certain areas, their natural value may be increased**. The deepening of the side- arms and the creation of some deeper holes in the bed are required for an **improvement in the wintering habitats of fish**.[29] Some small scale interventions in the riverbed are needed for ensuring the appropriate conditions and water supply for the water and wetland habitats.

The **possible ecological impacts of interventions in the main branch** (dredging, stone works, spur-dykes, gravel filling) **are mainly negative**.[30] The disturbances resulting from the proposed interventions may have negative ecological impacts[31]. The water and wetland ecosystems are very vulnerable; their ecological balance is very unstable. **As a consequence, small scale interventions may easily upset this balance, which may start a cumulative process of extinction or migration of certain species, which may lead to a decrease of diversity.** The rehabilitation process of the side-arms was planned to compensate for the predicted deterioration of the ecological status in the main river branch. Nevertheless, in the main river branch certain ecosystems may deteriorate which cannot

[26] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (r.km 1811-1708), Chapter 5., 15-16 pp.
[27] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007., Annex, Chapter 9.1., 12-13. p.
[28] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (r.km 1811-1708)” Chapter 3. 3., 12. p.
[29] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (r.km 1811-1708)” Chapter 6.4. , 20-21. pp.
[30] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007., Chapter 11.4., 204-216. p.
[31] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007, Chapter 7.2.2. , 190. p.

develop in the side-arms, for example certain phyto- and zooplankton which can live only in flowing water courses.

(The impacts on the conditions of habitats connected to surface waters are detailed in Chapter 4.1.3.)

Proposal 12.	**We propose the elaboration of special sustainability aspects for those habitats and ecosystems with an outstanding natural value in order to conserve the diversity of the main river branch, the side-arms and the islands.** In these special sustainability aspects it should be emphasized that the touristic and intensive recreational use of protected areas of natural importance and intensive angling activities are not recommended.

4.2.4. Impacts on the forests

In the lower sections of bars and islands and along the banks of the side-arms **willow scrubs** are common with low tree stratum, their composition depending on the quality of soil. In the gravel bars the plant communities of *Rumici crispi-Salicetum purpureae* grow and, in slower sections (where sandy and muddy islands have formed) *Polygono hydropiperi-Salicetum triandrae* plant communities developed.

In lower areas, where the regular inundation period lasts for 1-2 months, **softwood gallery forests** grow**,** with mainly willow and poplar species. In areas that are regularly inundated *Leucojo aestivi-Salicetum albae* plant communities live, while the *Carduo crispi-Populetum nigrae* plant communities are common in the regularly overflowed natural woodland communities. In higher parts of the floodplain, which may be inundated only by huge floods, the *Senecioni sarracenici-Populetum albae plant* communities grow*.*

The islands developed from smaller bars, their banks are bordered by **natural willow scrubs and willow groves,** which represent an important natural value**. The woodland of Erebe-Macska Islands has outstanding natural value.** These forests are specially protected reserves, without sylviculture and may be visited only with permission[32]. In the deep, muddy areas of the island along the side-arm and in the interior parts of the islands, a huge, jungle-like population of willow groves can be found[33]. **The population of almond-leaved willow scrubs also represents an outstanding natural value.** In the willow groves along the banks of the Körtvélyesi and Táti Islands the protected *Vitis sylvestris* occurs. [34].In some of the islands the protected *Aquila pomarina* occurs in addition to the *Anas platyrhynchos, Falco subbuteo, Milvus migrans and Ardea cinerea.*

In the islands **willow and hybrid poplar plantations are grown, which are not favourable in aspects of nature conservation**, because these woods assure a living place for several alien species. Some of these species may become invasive, for example *Acer*

[32] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (rkm 1811-1708)" Chapter 6.4., 21. p.

[33] VITUKI.: Study to the project entitled: "Improvement of the Navigability of the Danube" September, 2007., Annex, Chapter 3.1., 6. p.

[34] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (rkm 1811-1708)" Chapter 6.5. , 21.p.

negundo, Impatiens glandulifera and Solidago gigantea. The replacement of these poplar plantations by native species may increase the natural value of these islands.

The interventions planned for the rehabilitation of the **side-arms** will **improve the ecological status of the floodplain forests in the case of each of the planned variants, thus, the protection of the side-arms will be assured.** Under low flow water level conditions the planned adjustment of the riverbed should be realized in order to assure the water cover and water flow needed for the appropriate ecological status. The demolition of the upper closures and their training works and the dredging of side-arms may improve water quality and the ecological status, which may have positive impacts on the natural condition of forests.

4.2.5. Impacts on the biodiversity

One of the most important objectives of the European Community is the **protection of biodiversity and the conservation of the habitats and species of European importance**. The main object in terms of ecosystem diversity is the conservation of the diversity of species and the structural diversity. Naturally, this could not be realized without the conservation of different habitats, therefore the conservation, protection and rehabilitation of the different populations and their habitats has significant importance.

Landscape diversity has two basic components; it is dependent on the number of ecosystems of a given area on the one hand whilst, on the other, it depends on the number and the relative abundance of habitat types and landscape patches. Landscape diversity is important not only in geographical, ecological and nature conservation aspects, but also in terms of aesthetics. The diversity is determined not only by the natural environment, but also by the socio-economic environment, mainly at regional level. As a consequence, the diversity of land use types should also be taken into consideration.

In the evaluation of natural capital (for example biodiversity) the main aspect is to appraise the potential values of the species, the ecosystem, the landscape, and the natural resources. The **Danube is an important ecological corridor for the native biota**, and is also an **important migration route for the non-native, so-called alien, species.** Some of them may become invasive species, which will endanger the original ecosystems of the given region. The modification of natural habitats may increase the invasion of alien species.

The different features of habitat types in the main branch, in the side-arms and in the islands change dynamically in time and space; this is the main prerequisite for the diversity of the area. By the reconstruction of the processes sustaining the diversity of habitats, the biodiversity may be conserved. The conservation of the biodiversity of natural and nature-related ecological systems is also important because the development of the self-supporting system of ecological network is the basic condition for the conservation of Natura 2000 areas.

As a result of the dredging in the main river branch (stable eupotamon type) the composition of phytoplankton may change: the share and the quantity of biomass of meso-eutrophic and eutrophic species increases as a result of the increased trophity level

(the amount of vegetation nutrients has increased as a result of dredging). The composition and the quantity of the biomass of the phytoplankton can be a good indicator of eutrophication, which can clearly indicate the hydro-morphologic changes of the river. The zoobenthos and the fish fauna is relatively rich, their biomass is relatively small, with mainly rheophilic species. As a consequence of the interventions, the realignment of spawning areas and a change in the conditions of reproduction and the composition of fish population may be expected. **These processes will not improve the conservation of the habitat specific fish fauna.**

There are no direct observations regarding the impacts of navigation on the biota in the Hungarian section of the Danube, but its general negative influence is well known from the literature. According to different sources, the traffic of vessels, specifically the agitating effect of ships' propellers, can lead to a re-suspension of finer sediments, which can **damage the organs of the larvae of many water insects**. The increased turbidity reduces light penetration, which, in turn, decreases the photosynthesis rates of plankton, benthic algae and vascular plant species. The sediment stirred up by the waves increases the muddiness of the water, which may be harmful to the living organisms of the plankton and the feeding of juvenile fish. The waves caused by the traffic of large vessels can **de-root many plant species along riverbanks that are vital for the reproduction of many fish and for the zoobenthos;** the flowing back effect of the large vessels may sweep away the juvenile fish, which increases their mortality rate.[35.] The passing of ships introduces large waves, which can negatively affect fish during their spawning season and their early life stages, **which will cause a significant decrease in the natural reproduction of the fish population.**

In the **side-arms**, as a result of the dominant riverbed morphologic processes, sediment has accumulated. The depth of this sediment layer is only 10-30 cm in some areas (for example in the Véneki, Erebe and Macska Islands), but in other areas the layer of the accumulated sediment is more than two meters (for example in the side-arms at Bácsamagla and Tát). [36] The reduction in the water supply and the increased deposition of floating sediment in the side-arms has altered the eupotamon- and parapotamon-type habitats and the connected ecosystems.

Proposal 13.	1. In the course of the interventions, the water-related status of the flora and the fauna should be conserved, or their ecological value should be improved. **The expansion of terrestrial ecosystem types, the reduction of biodiversity and the increase of the invasive species should be avoided**. 2. The ecological monitoring system of the Danube section between Sap and Szob should be broadened; the biological surveys are constrained to smaller areas and only for a few species at the present. We propose to conduct **a long-lasting monitoring survey in order to assure traceability of the changes of the typical ecosystems and populations.**

A typical problem is the sludge accumulation on the gravel bottom in the deeper areas in the side-arms, because as a result of the silting up process, the breeding and feeding sites of

[35] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (rkm 1811-1708)" Chapter 2.3. , 9.p.

[36] VITUKI.: Study to the project entitled: „Improvement of the Navigability of the Danube" September, 2007.6., pp. 197-199. Annex 7, Chapters 1.2, 2.1, 3.1. 8.1.

several benthic invertebrates and fish species are destroyed. The new sediment layers along the riverbanks provide a good substrate for wetland and terrestrial macrovegetation, or spontaneous forestation.[37]

After the realization of the proposed interventions for nature conservation in the side-arms, the protection of the side-arms and islands will be appropriate and their natural value may possibly improve. Considering that the ecological interventions are the same in each variant, the possible impacts on the landscape and the habitats are positive in each variant.

4.2.6. Impacts on the ecological status of the affected Danube section

The riverbed of the Danube has been deepening permanently as a result of the barrages and reservoirs built in the upper sections of the river and by industrial and maintenance dredging. The low flow water levels in addition, have also been sinking. These two processes may deteriorate the navigability of the river and they cause significant damage in the ecological status of the main branch and its connected wetland habitats, the side-arms and the islands. In addition to the processes mentioned above the decreasing of the groundwater level resulting from the deepening of the riverbed may adversely influence the natural conditions of the water-connected ecosystems. This basically means the degradation of communities (such as changes in biodiversity, the repression and extermination of the native species of flowing water courses and floodplain habitats and the appearance of invasive species). In the low flow periods the mortality of juvenile fish can be observed as a result of the isolation and drying-out of the side-arms; the depth of the riverbed is not an appropriate wintering place for the fish population because of the intensive siltation.[38]

In order to moderate and/or halt the ecological damage, certain ecological interventions should be carried out in compliance with the requirements of the WFD, even if the interventions for the improvement of navigability were not to be realized. The proposed interventions for the improvement of navigability should not generate harmful changes in the state of the environment.[39] The fact that ecological status was taken into consideration during the planning process of the interventions improving navigability, should be demonstrated by the execution of the 4.7 test of the WFD.

Interventions in the side-arms

In order to halt or reduce the ecological damage resulting from the interventions in the main river branch to an acceptable extent, the main target areas of the interventions for rehabilitation are the side-arms and islands with outstanding natural values. **The ecological status of the side-arms and islands of the Danube section between Sap and Szob will probably improve when compared to the present conditions.** The technical solutions of

[37] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (rkm 1811-1708)" Chapter 3.,10.p.

[38] Guti Gábor, 2009. Ecological value and potential of the Danube section between Sap and Szob (rkm 1811-1708)" Chapter 6. , 19-21 pp. and VITUKI study Chapter 7.6.,197-199.pp.

[39] Hungarian National Council on the Environment: Standpoint on the proposals regarding the improvement of the navigation in the Hungarian Danube section. November, 2009.

the proposed interventions were planned for all the three alternatives.[40] The rehabilitation of the side-arms will enlarge the water supply period of the side-arms which can prevent the high mortality of juvenile fish which could be observed as a result of the drying out of the side-arms in low flow periods. The fish mortality may be prevented by the deepening of certain side-arms by the creation of some deep holes and this is required for improving the wintering habitats for fish.

The number of species is relatively high in some of the side-arms in spite of the low habitat diversity level. In nature conservation aspects the most important species are *Gobio albipinnatus*, *Rhodeus sericeus* and the very rare *Abramis ballerus.* On the contrary, in high flow periods the same side-arms have high habitat diversity. The newly formed bars have outstanding value in high flow periods, as these bars are good spawning and living places for rare fish species. These rare habitats, which have outstanding value in ichtyological aspects may be conserved by the dredging processes.

In low flow periods the amount of water supplied from the main branch is very important, this amount may be assured by the demolition of upper closures. This process may solve the existence of the biodiversity of the side-arms, the bars and the islands.

Proposal 14.	In the course of the environmental authorization process of the proposed interventions, it should be required that the interventions and measures for improving the navigability **should be realized in parallel** to the interventions related to the prevention, dissolving or the decreasing of the adverse ecological impacts of the proposed interventions

Interventions in the main river branch

The interventions planned for improving the waterway will possibly have negative impacts on the eupotamon-like habitats and their ecosystems in the main river branch. The proposed interventions may change the composition of the phyto- and zooplankton and the composition of fish populations typical for flowing watercourses. The share of meso-eutrophic and eutrophic species may increase in the phytoplankton and the introduction and the extension of invasive species may also be increased.[41] The dredging of the main branch may result in the degradation of spawning areas and change in the conditions of reproduction.

The variant "VITUKI Base-2" plans for the refilling of the riverbed by 200,000 m^3 material in the main river branch, which may change the habitats and the diversity of the ecosystems typical for this section of the Danube. Nevertheless, it should be mentioned that supplementing the riverbed at appropriate places may have positive impacts on ecological status, as it can decrease the fall in low flow water levels or, incidentally, may increase them. The exact place for supplementation may be determined by the plans, bearing in mind the results of hydraulic models and ecological and subsurface drinking water management protection aspects. Dredging contributes significantly to the bed load deficit. In

[40] VITUKI.: Study to the project entitled: "Improvement of the Navigability of the Danube" September, 2007., Chapter 4., 195-197 pp.
[41] VITUKI.: Study to the project entitled: „Improvement of the Navigability of the Danube" September, 2007., Chapter 7.11. 4.. 214. p.

accordance with the Danube River Basin District Management Plan[42] it is recommended that commercial extraction of sediments be prevented and that material dredged for maintenance be inserted back into the river

It can be concluded that the proposed interventions for the improvement of the waterway will cause significant disturbance (with considerable spatial extent) for the water ecosystems. In the case of disturbances concentrated in the main branch, the rehabilitated side-arms in neighbouring areas of the shallow fords may be functioning as a “sheltering site” or “escape route” for the species disturbed. The time period for the interventions may be between 3 and 5 years, but in certain areas it may continue for 25 years with interventions undertaken twice-yearly.[43] The proposed interventions will cause a medium/permanent disturbance in terms of the time element for the ecological systems during the period of interventions.

4.2.7. Impacts on the conditions of human health and the quality of life

The proposed interventions improving the navigability of the Danube section between Sap and Szob have both direct and indirect impacts on human health. Some of these impacts may induce risk or negative impacts on the health conditions of the population of the region, while other impacts may improve their living conditions.

Impacts of the proposed interventions in the main river branch

As a consequence of the improvement of navigability the emission of some air pollutants and the noise emission may be locally increased which can have slightly disadvantageous impacts on the health and life-quality of the human population of the area. Some interventions – such as the improvement of the fords by dredging and other regulation methods – may be a possible risk for the present and future subsurface drinking water abstraction sites. In a study, which has supported the proposals of the interventions, there are concrete references that the proposed interventions should be realized under strict supervision and in compliance with the legal rules and regulations. In the case of interventions near water abstraction sites, an assessment on environmental impacts should be conducted prior to the planning process. The most important direct impacts on human health are the refuse oil contamination of the vessels and the waste emission connected to the increasing water traffic. **The most significant negative impact may be the bacterial contamination, which emanates from the communal waste and wastewater emission produced by the vessels**. The microbiological contamination means risks to human health, and may decrease the quality of drinking water extracted from the bank-filtered wells.

Impacts of the proposed interventions in the side-arms

Most of the proposed interventions have positive, or significantly positive, impacts on the health and life-quality of the human population. In the course of the ecological rehabilitation

[42] ICPDR (November 2009) Final Draft Danube River Basin District Management Plan, Part A – Basin-wide overview, Version: 8.0 – Final Draft

[43] VITUKI.: Study to the project entitled: “Improvement of the Navigability of the Danube” September, 2007. Chapter 7.2.2, 190. p.

process of the side-arms, the quantity and quality of surface waters may be improved, and the increasing level of recreational possibilities will have positive impacts not only on local inhabitants, but also for other elements of the population. In certain side-arms, where it is permitted by the land-use regulations, the touristic appeal of the area may be improved by the possibilities for technical water sports, the construction of ports for yachts and motorboats, and, on the beaches or riverbanks by touristic sights and special touristic programmes. As a consequence of these possibilities, **the retaining capacity and attractiveness of the area may be strengthened, the life-quality may be improved, but, on the contrary, the air pollution and the quantity of wastes may also be increased.**

Proposal 15.	1. The infrastructure for the treatment of the communal waste and the dangerous waste originating from navigation sources should be determined; the control of the authorities concerned should be intensified. These aspects should be taken into consideration in the environmental permission procedures of ports. 2. In order to decrease the microbiological contaminations, the sewage system should be developed in the settlements situated along the riverbanks

4.2.8. Impacts on the landscape, on its carrying capacity, the natural and cultural landscape resources and the landscape values

The main principle of the **European Landscape Convention**[44] is to achieve sustainable development based on the balanced relations of social demand, economic activities and the environment. The most important objective of the Convention is to improve the protection, the management and the planning of the landscape.

Landscape management is a tool for the development and promotion of traditional production technologies and methods, which can characterize the given land or region. Landscape management uses the natural and cultural landscape values as a resource, in a sustainable way. It has to comply with the local natural conditions, which should not have been modified by the management methods in use, and it shall protect the natural and cultural values and heritage. Landscape management serves the maintenance and conservation of the supporting capacity of the given region, in terms of both the environment and local society. Some of the resources of landscape management can negatively affect the landscape values, for example, certain constructions, which are non-conforming and do not have a local landscape character (spur-dykes).

It is to be feared, that some construction works for river regulation and the infrastructure for the improvement of touristic attractions may contribute to the degradation of **landscape values** and the natural character of the Danube.

The **renewal of the natural resources** may be promoted by parallel interventions, for example, in parallel to improving navigability the increase of the water supply in the side-arms may be undertaken by opening their upper closures. The higher the water surface, the better the microclimatic effects, which may create better ecological status for certain plants. The filtration movement of the water bodies of the side-arms may also assist renewal as the infiltrated water may supply the plants living there. This process may also be advantageous

[44] Act No. CXI./2007 on the Ratification of European Landscape Convention

in the case of the water supply of wetland habitats and it may particularly be important in the conservation of the habitats of specific and particularly protected species.

Figure 2: Spur-dyke on the Danube

Source: www.picasaweb.google.com

Proposal 16.	In areas with significant landscape values, **those touristic developments should be preferred, which takes the landscape protection aspects** into consideration.

4.2.9. Impacts on the land-use and spatial structure

In the case of the area examined by this assessment, the land use and spatial structure have significant importance in terms of landscape diversity and the ecological stability of the landscape, i.e. the functioning of the ecosystems of the region. On the whole, it can be stated, that the **technical solutions of all the three variants may influence land use, while the interventions proposed in the main river branch will not have impacts on the spatial structure**. In the case of the interventions of the variants „VITUKI Base 1" and „VITUKI Base 2" a slight change may occur in the land use, as a result of the construction of river training works, dredging of the riverbed, re-construction of the bars and the building of new spur-dykes. These processes may have negative impacts on the landscape, and in the case of bars, they can influence land-use methods by disturbing the natural vegetation. **For the most part, the proposed interventions are adjusted to the features of the area and will not endanger the landscape characteristics.**

The **rehabilitation of the side-arms may contribute to the improvement of the ecological and socio-economic sustainability of the landscape** in the case of all the variants. The interventions for the rehabilitation of the side-arms may assure the positive

changes of land use and the development of spatial structure by ensuring the natural character and, the conservation of natural species, the conservation of the natural landscape and the development of touristic destinations and attractions. The economic viability of a given region, mainly as a result of the improvement of tourism, may increase. The development process, due to the ecological rehabilitation, may have indirect impacts on the environmental elements and the systems affected. The small scale, improperly installed infrastructural developments which have no landscape character (for example vacation houses, bungalows, ports, piers, etc.) may endanger ecological corridors, which can block the natural functioning of the environment. These barriers should be compensated for by interventions which are directed at improving the landscape. Obviously, the third variant "Realignment of the navigation channel" is the one that is the most considerate towards land-use and spatial structure, as the improvement in navigability will be solved by fewer interventions in the waterway and will not endanger the natural bars. Nevertheless the incidental negative impacts of the building activities on local land-use may easily be moderated.

4.2.10. Impacts on the quality of the environment and the safety of the environment at settlement level

At settlement level the historical values, the interventions influencing the conservation of landscape values and the measures connected to the development of natural and cultural values may have positive impacts. **The positive impacts on environmental quality may be experienced in the settlements along the side-arm system, as a consequence of the proposed ecological rehabilitation process.** Meanwhile, the environmental quality of the settlements may be **influenced by the local air and noise pollution resulting from the increased vessel traffic and those touristic developments in which the supporting and tolerance limit of the environment have not been considered.** This may be compensated for by the modernisation of the shipping fleet following on from the improvement of the waterway.

The elimination of the obstructions in the waterway of the main river branch, dredging and the construction of new spur-dykes will improve the safety of navigation, thus, it may have **positive impacts on environmental safety through protection against the possible havaria-type contaminations.**

4.2.11. Sustainability impacts (impacts on the sustainable social and economic conditions at regional level)

The interventions assuring the environmental, social and economic sustainability of a given region may be considered as positive, if they do not work against each other but by using the local synergies can improve the conditions of the given region.

As a result of the improvement of the navigability of the Danube **favourable impacts may be expected in the spatial structure** of the Danubian region (economic development, improvement of trade and profitability), **but the section examined between Sap and Szob may have less benefits.** Safer and more reliable navigation may establish the appropriate

conditions for the marketing of local products in the domestic and international markets, and may improve the development of the ports and logistics sector. The infrastructure of navigation may also be improved, which can serve to decrease the time and costs of waterway transport, thus, it may have positive impacts on the whole transportation sector. In this aspect all of the three variants may have positive impacts when compared to the present conditions.

The **planned interventions for the ecological rehabilitation of the side-arms may establish good conditions for sustainable regional development, especially if they also improve the development of environmentally-friendly forms of tourism, which is based on local conditions and infrastructure.** The local income generation may also be developed, therefore the social structure of the affected region may also be improved.

The most sustainable and cost-effective alternative is the variant "Realignment of the navigation channel" as it needs the minimum movement of riverbed materials and does not involve building activities, thus, it may be considered as the most cost-effective variant. In addition the maintenance costs are also favourable for this variant, although – as a consequence of the continuous sediment transport – preventive interventions should be taken in all the three variants, but in the case of the other two variants the maintenance of river training works should also be assured.

It should be noted that more accurate assessments should be made on the variant "Realignment of the navigation channel". Similar analyses (like hydraulic modelling) should be conducted than have been completed in the case of variants VITUKI Base-1" and "VITUKI Base-2

4.2.12. Impacts on the renewal and the spatial use of natural resources

The proposed interventions and measures for the ecological rehabilitation of the side-arms will definitely improve the renewal of the natural resources, namely the renewal of the groundwater and surface waters, in the case of all the three variants. The increase in water flow may be a result of the proposed interventions, which will improve the renewal of water and sustainable water management. In the realization process of variants "VITUKI Base-1" and "VITUKI Base-2" the natural ecosystems were not considered to the same extent as the sustainability of renewable resources, but the negative impacts are compensated for by the rehabilitation of the side-arm system.

4.2.13. Impacts of the promotion of environmental consciousness and the principles of sustainable life-style

Most of the proposed interventions and measures are in compliance with the requirements of sustainable development. **However, four sectors and the connected sustainability aspects should be emphasized, namely tourism, fisheries and angling, water management and waste management.**

In Chapter 8. of the VITUKI study, there is a detailed analysis of a questionnaire examination, in which the local governments of the settlements and micro-regions, the

touristic services and the population of the area along the Danube were asked about the development of the region, their opinions concerning the importance of tourism, angling, water sports and recreational activities and on the protection of the natural water abstraction sites. According to the responses, most of the people questioned think that these aspects are very important for the development of the region, and the local governments and the angling groups rely on the touristic and infrastructural development of the region. It can be understood that, as the present level of services is very low, as a result of the proposed improvement of navigability water traffic and tourism may also be improved. **It is important, that in the planning, construction and management processes of the interventions the fact, that the supporting capacity of the region is limited should be taken into consideration. The local ecological and cultural values should be preferred, the regional products should be connected into the local services and, in addition, the use of renewable energy sources should be preferred.**

There is a very important task for the local governments, educational institutions and civil organizations, namely, to draw attention to the **importance of the environment-friendly and sustainable life-style.** It is also important to establish the conditions for social processes, which take environment awareness and responsibility for future generations into consideration. The active element of the local society should be drawn into this process. The most important objectives are the following: environment-friendly transport methods, selective waste collection, development of the sewerage system, water, economic use of water and the maintaining of traditions.

4.2.14. Trans-boundary impacts

For the summarizing of this section, the opinion and proposals of the Slovak Party are needed.

Impacts resulting from the improvement of river navigation

The volume of waterway transport may increase – depending on the demand for transporting facilities – by the realization of the interventions improving navigability on the international waterway of the Danube, if such interventions were also to be carried out by other Danubian states and the technical parameters of the waterway were to be uniform. As waterway transport is mainly used for long distances, as a consequence of the Hungarian developments waterway traffic may increase with the Slovak Republic, Austria, Germany and the Benelux States and, in the South, to Serbia, Romania and Bulgaria. **These countries may have advantageous economic impacts resulting from the increased level of waterway transport.**

Taking into account that there are several bottlenecks – similar to the conditions in Hungary – in the different sections of the Danube (in Germany, in Austria below Vienna, and in the Romanian-Bulgarian section below the Iron Gate), and that the potential of the improvement of the demand on waterway transport is also limited (this means, the potential of waterway transport is determined not only by the parameters of the waterway but also by the quality and the volume of those economic relationships which determine the demand for

waterway transport), the impacts of the above factors may be marginal in the short-term and maybe in their medium-term aspects. (It should be noted that there are various estimations on the expected economic impacts of waterway transport in the literature.)

Impacts resulting from the realization of the proposed interventions

The proposed measures apply to that section of the Danube which forms the state border between the Slovak Republic and the Republic of Hungary. **Thus, all impacts of the proposed interventions and developments are trans-boundary impacts.** The following impacts – as exceptions – may **possibly not affect the Slovak Republic:**

- local impacts on the production, processing and transportation of raw materials in Hungarian territory, for the technical solutions and maintenance of the developments;
- the positive local ecological impacts of the side-arm rehabilitation in the Hungarian side (for example local landscape improvement or improvement of inland tourism) and the negative local impacts (for example extra noise pollution resulting from the increased local traffic of motorised vessels).

4.2.15. Determination of the possible environmental conflicts

The proposed interventions and measures in the main **river branch will probably not generate conflicts** at authority and society level. The proposed interventions may improve the navigability of the river, thus, Hungary will comply with the demands of the EU and national shipping companies and obligations in terms of contract. The rehabilitation of the side-arms is planned to reduce the negative ecological impacts of the interventions and may compensate for the negative effects of the habitat disturbing processes in the main branch.

The **rehabilitation of the side-arms** is essential and should be carried out in parallel with the interventions in the main river branch. In this process, some professional and economic conflicts may be considered. The good ecological status of the side-arms and the increase in the natural values will improve the touristic and recreational potential of the region. As a consequence of this process, the appearance of new investors and touristic services may be expected. In addition to this, the development of the infrastructure and the creation of new employment possibilities are highly needed. Ensuring the balance between ecological and economic advantages is a key aspect. Local governments and authorities should consider that only those investments should be realized whose ecological and environmental damages are lower than the expected economic and social profits.

In the course of land use activities, some conflicts may also occur, which should be managed through the co-operation of local governments, civil organizations and the local society. Different side-arms have different utilization possibilities. In such areas, which have possibilities not only for the development of ports or other touristic and recreational infrastructure (for example camping sites or road system) but also for angling activities, a spatial compromise should be taken between the interests of the local anglers and fishermen and the touristic attractions.

Proposal 17.	The following priorities should be taken into consideration during the planning and authorization process of the developments in the area of the side-arms and their neighbouring vicinities: (a) Establishing local marketing possibilities for locally produced products (b) Preferring eco-tourism instead of mass tourism (c) Supporting services demonstrating landscape values and cultural heritage (d) Development of a bicycle route system

It is important that, in addition to the environmental monitoring, all the information related to the interventions should be shared, and the relevant decision process should be made public for the various groups of stakeholders.

Proposal 18.	We propose that – considering the possible conflicts between navigation, land-use and environmental protection and nature conservation – Local Monitoring Groups should be created by the participation of experts and the civil organizations for the monitoring of the planning, the realization and the operation process of the interventions.

4.3. The overall environmental and sustainability performance of the proposed interventions and measures

In accordance with the methodology and the aspects detailed in Chapter 1.5. the evaluation of environmental performance and sustainability was carried out for the interventions and measures detailed in Chapter 3.1. The results of the evaluation are summarised in Annex 3 and Annex 4. In the following sections we introduce the results of the evaluation.

4.3.1. Environmental risk analysis: identification of the interventions and measures with significantly positive, neutral and negative environmental impacts

In this section we determine the significant positive and negative impacts and summarize the potential risks of the proposed interventions, according to the results of the assessment. It should be noted that the case of legal non-compliance did not emerge during the Strategic Environmental Assessment process of the proposed interventions and measures, thus, the statements of this SEA are not intended for the checking of the legal compliance, but for the comparison of the different intervention variants.

The **most significant positive impacts of the three interventions can be expected in the following fields**, i.e. in these areas all of the three variants have benefits (“Strengths”):

- The interventions planned in the main branch, particularly in the case of variant “VITUKI Base-2”, will have positive impacts on the stability of the riverbed, and improve prevention against flood and ice transport.
- The interventions planned in the side-arms will contribute to the protection of the quality and quantity of surface water bodies.

- The interventions planned in the side-arms will improve the basic conditions of wetland habitats and the protection of biodiversity, and will contribute to the conservation of the outstanding ichtyological values.
- The interventions planned in the side-arms may minimise the anthropogenic disturbances of the water and wetland habitats, and may contribute both to the conservation of outstanding botanical and zoological values and to the forests.
- The interventions planned in the side-arms may improve the preparations for the prevention against the negative impacts of climate change.
- The interventions planned in the side-arms may improve the retaining capacity of the region, the social cohesion and closing-up process – in the case of sustainable local land-use and development of entrepreneurship.
- The improvement of navigability conditions, by improving the waterway transportation facilities, will contribute to the decrease in the emission of greenhouse gases.
- The improvement in navigability conditions can allow the sustainable development of the infrastructure of navigation, which may decrease the costs of waterway transport and may improve the marketing of local products.
- The interventions make definite efforts to decrease social (external) costs, therefore the potential negative social impacts may not occur.

In case of variant "VITUKI Base-1" and variant "VITUKI Base-2" in some fields <u>negative impacts</u> may be expected (with consequences of varying extent):

- The interventions planned in the main branch will have negative impacts on the status of wetland habitats; they will extend the disturbances of anthropogenic origin of water ecosystems and wetland habitats, both temporally and spatially. The extent of these negative impacts is not known at present.
- The interventions planned in the main branch – indirectly and to a small extent – may endanger the outstanding botanical, zoological and ichtyological values, and in addition, may have negative impacts in aspects of the conservation of landscape values and habitat structures.

(It should be noted that these negative impacts are also valid, to a certain extent, for the variant "Realignment of the navigation channel".)

The proposed variants may hold a <u>potential risk</u> in some fields:

- The improvement of the navigability conditions may slightly increase the local air and noise pollution and the emission of dangerous and communal waste originating from navigational sources along the waterway.
- The improvement of the navigability conditions may slightly increase the erosion of the riverbed caused by the water accelerated by vessel propellers.
- All the three variants may have risks (at minimum level) in the aspect of protection of the groundwater. One of the most important and compulsory conditions of the proposed interventions is the protection of the subsurface drinking water sources in order to prevent the possible risks.

- The interventions planned in the side-arms may allow differentiated local land-use (such as tourism, water sports, forestation, floodplain farming activities). The local development plans may involve risks at different levels (depending on whether the sustainability and environmental aspects are considered in local plans or not), for example:
  - the emission of local air pollutants, greenhouse gases, and noise resulting from local traffic;
  - the emission of waste and wastewater as a result of tourism.

It should be noted that the spatial extent of the interventions of the main river branch is relatively low when compared to the total area of the Danube section examined (the total area affected by the proposed interventions is almost 1.6% of the total riverbed in the Sap-Szob Danube section) thus **the interventions will possibly not have significant impacts on the other natural elements (air, water, soil and the artificial environment).**

Nevertheless, the water and wetland ecosystems are very vulnerable; their ecological balance is very unstable. **As a consequence, small scale interventions may easily upset their balance,** which may begin an accelerating process of extinction or migration of certain species which may, in all likelihood, lead to the collapse of diversity. It should also be considered that in the main river branch ecosystems may be affected which cannot develop in the side-arms (for example phyto- and zooplankton and fish populations which can only exist in flowing water courses).

4.3.2. Comparative assessment and cumulative effects of the measures

The improvement of the parameters of the waterway are to be realized both in the variant "VITUKI Base-1" and "VITUKI Base-2" by dredging, the construction of spur-dykes and training walls and by the supplementation or reduction of spur-dykes. Both variants assure traffic for vessels with a 2.50 m draught, the width of the waterway being 120-150 m.

Variant "VITUKI Base-2", in addition to the construction of river training works and dredging to improve the navigability conditions of the waterway, involves efforts to prevent the erosion of the riverbed by gravel supplementation in defined places using a certain gravel combination. The planned amount of gravel supplementation is around 150-200 thousand m^3.

The third variant is the "Realignment of the navigation channel" by which the improvement of the parameters of the waterway is to be realized by dredging, the re-drawing, correction and narrowing of the waterway. This variant assures traffic for vessels having a 2.50 m draught, the width of the waterway being less than in the other two variants - between 100-130 m.

As a result of the assessment of the three variants, it may be definitely stated, that the **largest interventions are planned in the main branch by variant "VITUKI Base-1", therefore this variant holds the greatest risk that the proposed interventions to improve the navigability of the waterway will have negative impacts on the habitats affected and on the aquifers.**

It may also be stated, that the third variant **"Realignment of the navigation channel" holds the minimum risks in ecological and environmental terms,** as the optimization of navigability is planned by the least intrustive construction works, when compared to the other two variants.

Variant "VITUKI Base-2" is a transition between the two other variants as regards environmental features, in some aspects it has advantages, in others it has disadvantages when compared to the other two variants. It may be important that in this variant gravel supplementation is planned. The planning process will be jointly conducted by nature conservationists and will take the results of hydrodynamic modelling and wetlands into account.

(The interventions proposed for the rehabilitation of the side-arms are the same in the case of each variant, thus they are not detailed in this comparative assessment.)

4.3.3. Possible environmental risks in the event of the cancellation of the proposed measures

For this section the opinion and proposals of the Slovak party are needed.

The proposed technical interventions and measures should be realized in the main river and in the side-arms. **The extensive implementation of dredging processes is necessary for ichthyologic reasons; the depth of the riverbed under present siltation conditions is not convenient for the wintering period[45].**. As a result of the proposed interventions the water supply of the side-arms will be increased and can maintain the good ecological status of the water and can assure shelter and habitation for those species unsettled by disturbances in the main river branch. The proposed interventions may also improve the rehabilitation of wetland habitats and the conservation of biodiversity and the natural landscape values.

[45] VITUKI, 2007. Study to the project entitled: "Improvement of the Navigability of the Danube"

5. PROPOSED INTERVENTIONS AND MEASURES IMPROVING THE ENVIRONMENTAL PERFORMANCE AND SUSTAINABILITY

In this chapter we summarize and systematize the proposals presented in the previous chapters of the Environmental Report, accordingly, we do not make any new proposals in this chapter. (The number in brackets before the proposal is the number of the proposal.)

5.1. Proposals on the interventions and measures improving sustainability (new measures)

1(2) The methods in order to assure, to improve and to maintain the conditions of sustainable inland navigation are under elaboration for the Danube Basin. These methods should be used during the realization process of the interventions improving navigability. The principle of precaution should be considered, the interventions should be made gradually and should be divided into short, pilot sections.

4 In the framework of the confirmation process of the proposed technical solutions the following examinations shall be taken in accordance with the WFD criteria:
   a) examinations to be undertaken for the qualification (for example revising as heavily modified water body) of the water body (Art. 4.3. test),
   b) the confirmation of moderate, less stringent environmental objectives (Art. 4.5. test)
   c) the socio-economic and environmental feasibility of the planned technical solutions and measures (Art. 4.7. test)

8 Long-term evolution of the river bed profile associated with measures should be studied intensively using latest technologies, e.g. bed load transport models in order to establish a sediment management plan. The ecological impact of measures should be evaluated by taking into account relevant EU experiences.

9 The realization process of proposed interventions for the improvement of the parameters of the waterway and for rehabilitation in the main branch and the side-arm system should be harmonized with the construction works for the development of flood protection.

12 We propose the elaboration of special sustainability aspects for those habitats and ecosystems with an outstanding natural value in order to conserve the diversity of the main river branch, the side-arms and the islands. In these special sustainability aspects it should be emphasized that the touristic and intensive recreational use of protected areas of natural importance and intensive angling activities are not recommended.

13(2) The ecological monitoring system of the Danube section between Sap and Szob should be broadened; the biological surveys are constrained to smaller areas and only for a few species at the present. We propose to conduct a long-lasting monitoring survey in order to assure traceability of the changes of the typical ecosystems and populations.

18 We propose that – considering the possible conflicts between navigation, land-use and environmental protection and nature conservation – Local Monitoring Groups should be created by the participation of experts and the civil organizations for the monitoring of the planning, the realization and the operation process of the interventions.

19 The monitoring system should be elaborated in accordance with the requirements of the WFD, and it is proposed to supplement this by including indicators on nature conservation, landscape protection and environmental protection. In the elaboration of this monitoring system, the obligations of international and national legal rules (for example Convention on Biological Diversity Agreement, Habitats Directive, Birds Directive, Natura 2000, Ramsar Convention) should also be taken into consideration.

5.2. Proposals on reducing the possible impacts (compensating measures)

3 In the course of the authorization process of the local plans for land use and the environmental authorization of touristic and infrastructural developments the following aspects should be taken into consideration:
a) the manifestation of the ecological self-regulating mechanisms should be considered.
b) in the course of forestation the native species should be preferred, and the existing natural forests and woodland should be protected

5(1) In order to estimate the impacts on the subsurface drinking water sources complex hydraulic and biochemical processes should be examined both above and beneath the surface. For this process in situ examinations and the use of mathematical models are needed, which should be conducted during the planning process. The results of the examinations and the measures taken for the protection against possible negative impacts or for reducing them should be detailed in the environmental authorization process.

5(2) In the case of the variant ”Realignment of the Navigation Channel” similar examinations should be conducted regarding sediment transport and riverbed stability, as in the case of the improvement of the navigability of the Danube section between Szob and the Southern state border.

6(1) For the determination of the amount, the gravel structure and the exact place of the gravel filling a detailed physical model examination should be carried out prior to the elaboration of the authorization plan.

6(2) After finishing the gravel filling the monitoring of the sediment transport should be carried out.

7 Prior to the environmental permitting procedures of the proposed interventions the following aspect should be taken into consideration:
(a) Are the proposed interventions for the improvement of navigability in compliance with the requirements of Paragraphs 3., 7., 8 and 9 of Article 4 of the Water Framework Directive and the Paragraph 3 and 4 of Article 6 of the Habitats Directive in ecological aspects?
(b) What complex and permanent future impacts should to be considered as a result of the proposed interventions for the improvement of navigability in the present ecological status of the Hungarian Danube section?

13(1) In the course of the interventions, the water-related status of the flora and the fauna should be conserved, or their ecological value should be improved. The expansion of terrestrial ecosystem types, the reduction of biodiversity and the increase of the invasive species should be avoided.

14 In the course of the environmental authorization process of the proposed interventions, it should be required that the interventions and measures for improving the navigability should be realized in parallel to the interventions related to the prevention, dissolving or the decreasing of the adverse ecological impacts of the proposed interventions

15(1) The infrastructure for the treatment of the communal waste and the dangerous waste originating from navigation sources should be determined; the control of the authorities concerned should be intensified. These aspects should be taken into consideration in the environmental permission procedures of ports.

15(2) In order to decrease the microbiological contaminations, the sewage system should be developed in the settlements situated along the riverbanks

16 In areas with significant landscape values, those touristic developments should be preferred, which takes the landscape protection aspects into consideration.

17 The following priorities should be taken into consideration during the planning and authorization process of the developments in the area of the side-arms and their neighbouring vicinities:
(a) Establishing local marketing possibilities for locally produced products
(b) Preferring eco-tourism instead of mass tourism
(c) Supporting services demonstrating landscape values and cultural heritage
(d) Development of a bicycle route system

5.3. Measures for other strategic documents

1(1) The interventions proposing the improvement of the navigability of the Danube should be harmonized in the framework of international and European agreements

2 The present and future demand for waterway transport should be evaluated at national and international level, the impacts of waterway transport on employment, competitiveness and regional cohesion processes should be explored. These investigations should be extended for other transport methods, as well.

10 The use of a life-cycle approach is suggested for those examinations, the objective of which is to explore the impacts of the change from railway to waterway transport, on the emissions of air pollutants (generated in areas outside the waterway).

11 The impacts of climate change
a) on the navigability of the Danube
b) on the touristic utilization of the side-arms and
c) on the ecological status of the Danube
should be examined.

5.4. Proposals for the monitoring system and indicators

For the monitoring and assessment of the proposed interventions and measures in the Danube section between Sap and Szob **we propose the elaboration of monitoring and indicator systems which considers the following aspects:**

- All the data and information pertaining to the results, the benefits and the costs and negative impacts should be published.
- The intensity of data collection and data processing should be determined in relation to the severity of the predicted, calculated and justified impacts.
- In order to minimise costs and improve the efficiency of data collection and data processing the formerly elaborated databases and monitoring results should be used where possible.
- As the interventions affect those areas (water management, water quality, natural values, habitats) the control of which is regulated by European and national legal rules, these legal rules should be taken into consideration in the monitoring process.

In respect of the monitoring of interventions the most important starting point is the monitoring system recommended by the Water Framework Directive. As the monitoring process covers most of the impacts of the interventions for improving navigability, it is also important to make efforts to engage in this process – i.e. the measuring process, collection and processing of the data base and its evaluation – the activities of other professional organizations (such as national parks and environmental directorates) as well as those responsible for hydrologic observations.

There are three main objectives on the collection and evaluation of natural-environmental indicators in connection with the improvement of the navigability of the Danube:

- to share information on environmental problems in order to give information to the decision makers responsible for estimating the seriousness of the given problem;
- to support policy makers by exploring the primary causes of the environmental burden or the negative impacts which endanger natural values;
- to explore the impacts of the transport and waterway development policies.

Proposal 19.	The monitoring system should be elaborated in accordance with the requirements of the WFD, and it is proposed to supplement this by including indicators on nature conservation, landscape protection and environmental protection. In the elaboration of this monitoring system, the obligations of international and national legal rules (for example Convention on Biological Diversity Agreement, Habitats Directive, Birds Directive, Natura 2000, Ramsar Convention) should also be taken into consideration.

In accordance with the above mentioned aspects and objectives we propose the monitoring of the following indicators (other indicators may also be derived from the decision process between the interventions, the construction and the other examinations connected to the construction such as the Strategic Environmental Assessment).

Table 5. Indicator core established for the traceability of the environmental impacts of the proposed interventions

Factors	Data / Indicator	Source of Data / Indicator	Comments
Quality of the waterway	depth, width, availability	responsible state institutions and authorities for water and transport	On the basis of these three groups of data a cost-benefit analysis should be carried out for the determination of the economically operated waterway
Transporting output of navigation	volume of the transported goods	EuroStat	
Investment and maintenance costs of the waterway	investment and maintenance costs	state and institutional budgets	
Conditions of the valuable/protected natural environment in general	according to the methodology of National Biodiversity Monitoring System	National Biodiversity Monitoring System	
Status of the wetland habitats	special indicators for WFD monitoring, the methodology and the monitoring institution should be determined		
Impacts of side-arm rehabilitation	special indicators for demonstration of the ecological improvements resulting from the rehabilitation and the increased anthropogenic impacts resulting from the rehabilitation process; the methodology and the monitoring institution should be determined		

6. EXECUTIVE (NON-TECHNICAL) SUMMARY

This chapter will be elaborated at a later date.

ANNEXES

Annex 1. Technical parameters of the intervention variants.

Technical parameters of the variant "VITUKI Base-1"

Name of intervention	Place of intervention (rkm)	Main features of the intervention, the method of regulation, the length of the affected river section, the area of the intervention, etc.
Bottleneck at Patkósziget	1807.8-1807.7	Dredging of a gravel bar to a 30-50 m width and 40-50 cm depth.
Bottleneck at Medve	1806.6-1806.2	The shortening of a spur-dyke, the completion of another spur-dyke, and gravel dredging on a section 400 m long and about 1 m deep.
Bottleneck at Szőgye	1800.4-1798.7	Between 1800.3-1799.7 rkm, widening, about 600 m long in the waterway near the right bank, at about 20-30 m width; between 1799.1-1798.7 rkm widening, about 400 m long, in the waterway near the left bank, at about 20-30 m width. The thickness of the gravel dredging is about 50 cm.
Bottleneck at Csicsó	1797.6-1796.6	Dredging of a gravel bar on the left bank between at an average width of 60 m.
Bottleneck at Vének	1796.5-1794.4	Between 1796.5-1795.6 rkm dredging and the reduction of a spur-dyke by 50 m and another by 20 m in the Slovak side; and between 1795.2-1794.4 rkm dredging process on the left bank and two dredging operations on the right bank. The predicted amount of the dredging is 74,000 m^3 gravel.
Upper bottleneck at Gönyű	1792.2-1791,7	Dredging of 10,200 m^3 gravel, as riverbed cleaning.
Lower ford at Gönyű	1789.0-1788.4	Assuring the waterway by dredging (the affected Danube section is about 600 m long and the area of intervention is about 2.4 hectares).
Ford at Szőny	1764.3-1763.9	Dredging of 10,000 m3
Ford at Almásfüzitő	1757.0-1756.6	Dredging of 7,000 m3 as riverbed cleaning.
Bottleneck at Karva	1740,0-1739.7	Dredging of 7,000 m3 as riverbed cleaning.
Ford at Nyerges	1735,1-1733.7	Dredging of marly-rocky riverbed, 21,000 m3
Bottleneck at Nyerges	1732.9-1732.3	Protection of the tip of the island on the left bank by 4,000 m3 stone, and dredging of 4,000 m3 marl, marly gravel as riverbed cleaning.
Ford at Ebed	1728.1-1724.0	Dredging of 13,000 m3 shallow ford.
Ford at Istenhegy	1724.0-1722.0	Dredging of 31,000 m3 shallow ford.
Ford at Garamkövesd	1714.5-1713.9	Dredging of 13,000 m3 as riverbed cleaning.
Ford at Helemba Island	1713.1-1709.9	Dredging of 40,000 m3 shallow ford and at the closure of the side-arm, an overlay of the riverbed by 15,000 m3 stone.

Technical parameters of the variant „VITUKI Base-2"

Name of intervention	Place of intervention (rkm)	Main features of the intervention, the method of regulation, the length of the affected river section, the area of the intervention, etc.
Bottleneck at Patkósziget	1807.8-1807.7	Dredging of a gravel bar in 30-50 m width and 40-50 cm depth.
Bottleneck at Medve	1806.6-1806.2	The shortening of a spur-dyke, the completion of another spur-dyke, and gravel dredging 400 m long and about 1 m deep.
Bottleneck at Szőgye	1800.4-1798.7	Between 1800.3-1799.7 rkm, widening, about 600 m long in the waterway near the right bank, with about 20-30 m width; between 1799.1-1798.7 rkm widening, about 400 m long, in the waterway near the left bank, with about 20-30 m width. The thickness of the gravel dredging being about 50 cm.
Bottleneck at Csicsó	1797.6-1796.6	Dredging of a gravel bar on the left bank between with an average width of 60 m.
Bottleneck at Vének	1796.5-1794.4	Between 1796.5-1795.6 rkm dredging , and the reduction of a spur-dyke by 50 m and another by 20 m in the Slovak side; and between 1795.2-1794.4 rkm dredging process on the left bank and two dredging operations on the right bank. The predicted amount of the dredging is 74,000 m^3 gravel.
Gravel supplementation in the section between Sap and Gönyű		The replacement of the riverbed material by 200,000 m3 or gravel per year. For the determination of the amount, the gravel structure and the exact place of the gravel supplementation a detailed model examination should be carried out
Upper bottleneck at Gönyű	1792.2-1791.7	Dredging of 10,200 m^3 gravel, as riverbed cleaning.
Lower ford at Gönyű	1789.0-1788.4	Assuring waterway by dredging (the affected Danube section is about 600 m long and the area of intervention is about 2.4 hectares).
Ford at Szőny	1764.3-1763.9	Dredging of 10,000 m3
Ford at Almásfüzitő	1757.0-1756.6	Dredging of 7,000 m3 as riverbed cleaning.
Bottleneck at Karva	1740.0-1739.7	Dredging of 7,000 m3 as riverbed cleaning.
Ford at Nyerges	1735.1-1733.7	Building of two spur-dykes (13,200 m3).
Bottleneck at Nyerges	1732.9-1732.3	Building of one spur-dyke (6,600 m3) and a training wall (24,000 m3).
Ford at Ebed	1728.1-1724.0	Building of three spur-dykes on the right bank by 40,000 m3 of stone.
Ford at Istenhegy	1724.0-1722.0	Building of four spur-dykes by 60,000 m3 of stone.
Ford at Garamkövesd	1714.5-1713.9	Dredging of 13,000 m3 as riverbed cleaning.
Ford at Helemba Island	1713.1-1709.9	Dredging of 40,000 m3 shallow ford and at the closure of the side-arm an overlay of the riverbed by 15,000 m3 stone.

Technical parameters of the variant "Realignment of the Navigation Channel"

Name of intervention	Place of intervention (rkm)	Main features of the intervention
Ford at Nyerges I.	1735.5-1733.7	Creation of a 100 m wide waterway by dredging, along the present line, without the re-drawing of the waterway. Area of intervention: 8.7 hectares, length of the affected Danube section: 920 m.
Ford at Helemba	1711.3-17107	Creation of a 100 m wide waterway by dredging, along the present line, without the re-drawing of the waterway. Area of intervention: 2.2 hectares, length of the affected Danube section: 740 m.
Garamkövesd	1714.3-1713.9	Correction of the waterway by re-drawing. The width of the waterway is 100 m. There is no need for technical interventions. The length of the affected waterway is about 2,400 m.
Istenhegy	1722.3-1721.8	Creation of a 150 m wide waterway by dredging. Area of intervention: 10.1 hectares, length of the affected Danube section: 1,900 m.
Ipoly confluence	1708.2-1708.0	The re-drawing of the waterway and technical interventions are not needed.
Ebed	1726-1724.7	Creation of a 150 m wide waterway by dredging. Area of intervention: 8.5 hectares, length of the affected Danube section: 2,800 m.
Nyerges II.	1732.4-1731.9	Creation of a 150 m wide waterway by dredging. Area of intervention: 7.7 hectares, length of the affected Danube section: 450 m
Karva	1740.1-1739.7	150 m wide waterway should be assured by the re-drawing of the waterway. Technical interventions are not needed.
Almásfüzitő	1757.1-1756.7	150 m wide waterway should be assured by the re-drawing of the waterway. Technical interventions are not needed.
Komárom	1764.3-1764.0	150 m wide waterway should be assured by the re-drawing of the waterway, by avoiding the greater part of the bar, by dredging of the area with a depth deficit. Area of intervention: 1.3 hectares, length of the affected Danube section: 210 m.
Kolozsnéma	1792.1-1791.8	Creation of a 100 m wide waterway by dredging. Area of intervention: 0.4 hectares, length of the affected Danube section: 270 m.
Other areas with depth deficit (not reported as shallow fords)	1790.3; 1710; 1709	Dredging of the areas with a depth deficit in the fairway. Area of intervention: 2.4 hectares, length of the affected Danube section: 550 m.
Bottlenecks at Csicsó and Vének	1797.4-1796.7 1796.3-1795.3	The waterway should be maintained at a 100 m width. Interventions are not needed at present.
Bottleneck	1799.2-1798.8	The waterway should be maintained at a 100 m width. Interventions are not needed at present.
Bridge at Medve	1806.2-1806	Interventions are not needed at present. According to its parameters it should not be qualified as a shallow ford.

Annex 2: Environmental evaluation matrix of the planned measures

Measures in Sap - Szob Danube section		***Criteria of environmental performance assessment***																	
		AIR			***SURFACE AND GROUND WATER, RIVER BED, SOIL***										***FLORA, FAUNA, LANDSCAPE***				
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18
		improving the conditions of navigability may decrease the local air pollution and noise pollution	improving the conditions of navigability may decrease the regional air pollution	improving the conditions of navigability may decrease the emission of greenhouse gases	contribution to the protection of the quality and quantity of surface waters	contribution to the protection of the quality and quantity of groundwater (drinking water bases)	will not increase erosion processes	favourable impacts on river-bed stability	improving the prevention of havaria-type disasters affecting water quality	improving the local water management processes	improving the flood-prevention and transporting the ice	preventing the depression of groundwater level	preventing the increase of waste disposal effected by navigation	preventing river-bed erosion resulting from agitated water	improving the condition of wetland habitats and the protection and conservation of biodiversity	minimizing the spatial and temporal negative impacts of anthropogenic origin on the aquatic ecological	contribution to the protection and conservation of prominent botanical and zoological values and forests	contribution to the protection and conservation of prominent ichthyological values	improving the protection and conservation of landscape values and living habitat structures
Variant VITUKI Base-1	main channel	-1	?	1	NR	PR	NR	1	1	NR	1	NR	-1	-1	-1	-1	NR	-1	-1
Variant VITUKI Base-2	main channel	-1	?	1	NR	PR	NR	2	0	NR	1	NR	-1	-1	-2	-2	-1	-1	-1
Variant "realignment of the navigation channel"	main channel	-1	?	1	NR	PR	NR	?	0	NR	1	NR	-1	-1	NR	NR	NR	NR	NR
Side arms (rehabilitation measures)	side arms	PR	NR	PR	2	NR	NR	NR	NR	NR	NR	NR	PR	NR	2	1	1	2	1

Legend is shown in Chapter 1.5.1.

Annex 3: Sustainability evaluation matrix of the planned measures

Measures in Sap - Szob Danube section		***Criteria of sustainability assessment***							
		S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
		promoting the marketing of the regional products in local and international markets	ensuring the conservation of the local population of the region	ensuring the social cohesion and the improvement of the differently developed rural areas of the Danube area	contribution to the modernization of the infrastructure of navigation	contribution to the adaptation to climate change	reducing the waterway transportation costs	minimizing the social (external) costs of the proposed interventions	minimizing the cross-contamination between different environmental systems
Variant VITUKI Base-1	main channel	1	NR	NR	1	?	1	2	NR
Variant VITUKI Base-2	main channel	1	NR	NR	1	?	1	2	NR
Variant "realignment of the navigation channel"	main channel	1	NR	NR	1	?	1	2	NR
Side arms (rehabilitation measures)	side arms	NR	1	1	1	1	NR	?	NR

Legend is shown in Chapter 1.5.1.

BACKGROUND PAPER FOR THE STRATEGIC ENVIRONMENTAL ASSESSMENT OF THE VARIANTS OF THE STRUCTURAL MEASURES FOR THE IMPROVEMENT OF THE NAVIGABILITY AND THE REHABILITATION OF THE SIDE ARMS OF THE DANUBE SECTION BETWEEN SAP AND SZOB

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