PIANC – Inland Navigation Commission
PIANC Working Group 139 (2010 – 2016)

Values of Inland Waterways

Terms of Reference:

The WG should investigate and report on;

i. An overview of these possible additional values and benefits from navigable waterways

ii. Analyze what parameters are determining and creating these values.

iii. What values and benefits can be considered the most important and which of these are related to the physical appearance and the aesthetic impact of the waterway?

iv. Insight into the way these values and benefits are reinforcing or conflicting, what are the quick wins, what measures can be taken to handle conflicting functions and how to improve mutual strengthening of functions would be beneficial?

v. Well illustrated examples of successful developments of waterways in increasing the value of the waterway for society, including indication of the quantitative aspects of these values where available, would be useful.

Our Interpretation and working approach:

Main question: **Which additional values or uses can be identified, how can they provide benefits?**

Main tasks:

- **Overview of additional values** from navigable waterways
- **Analysing of parameters (aspects)** which are able to determine or create values
- Relation to the **physical appearance and aesthetic impact** of waterways
- Insight, which of these values are **reinforcing or conflicting** with each other; what are the quick wins, where are conflict potentials

Methods of **approach**:

- First of all: studying all kinds of literatures and evaluating
- Listing the additional values/benefits and categorizing in terms of aspects/criteria
- Describing best practices

Members of the Working Group

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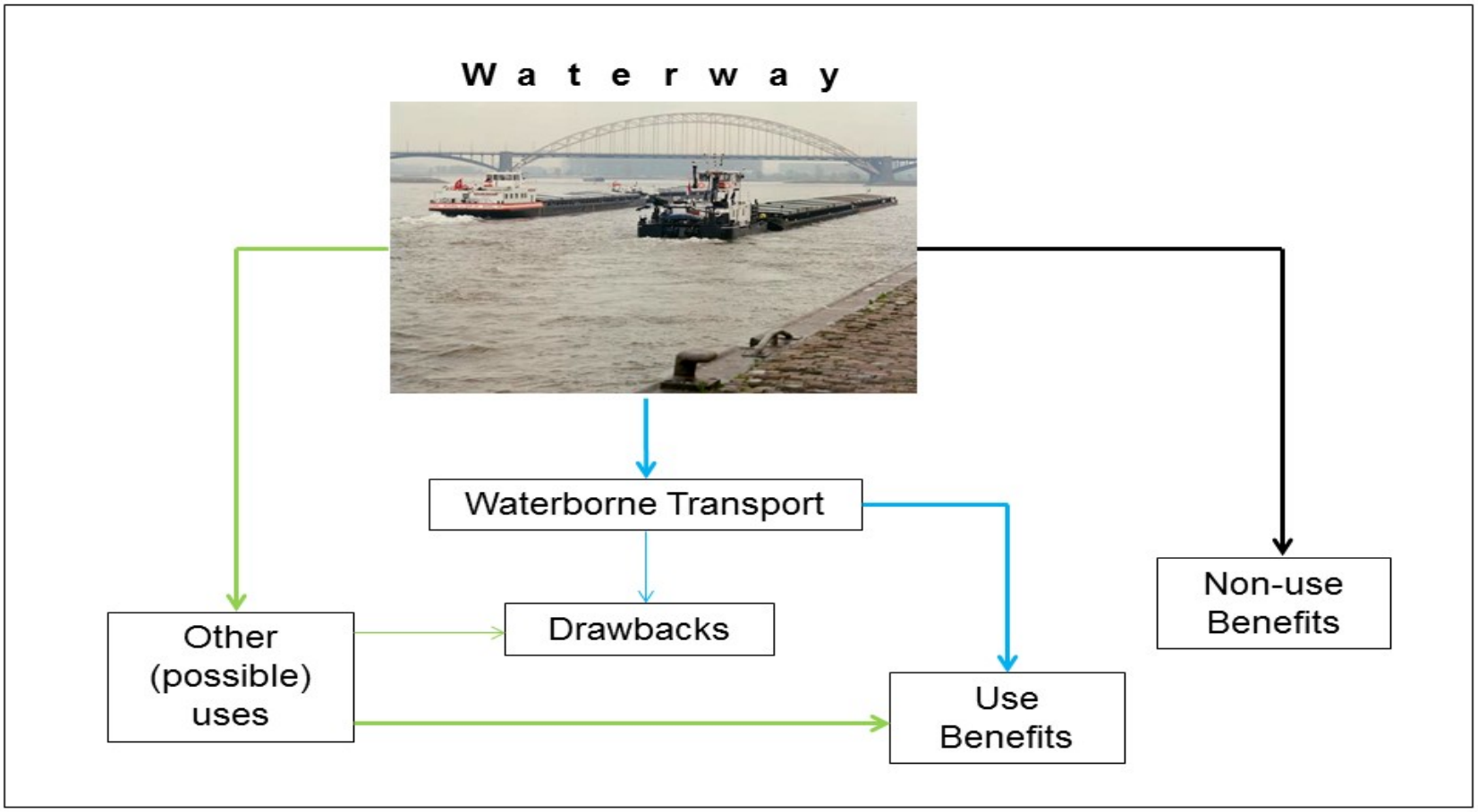
The Working Group's report is dedicated to Glenn Millar, who regrettably died during the preparation of this report. The Working Group commemorates him as a kind, committed and valuable member. Let him live on in these words and paragraphs.

Fifth meeting, USA, 2011, The group visiting Bonneville Dam (Columbia River), together with members of the COPRI group

Eighth meeting, London, 2012, The group visiting Little Venice, the entrance of the Regent's Canal

Uses and benefits of Inland Waterways



Schematic presentation of the values of Inland Waterways

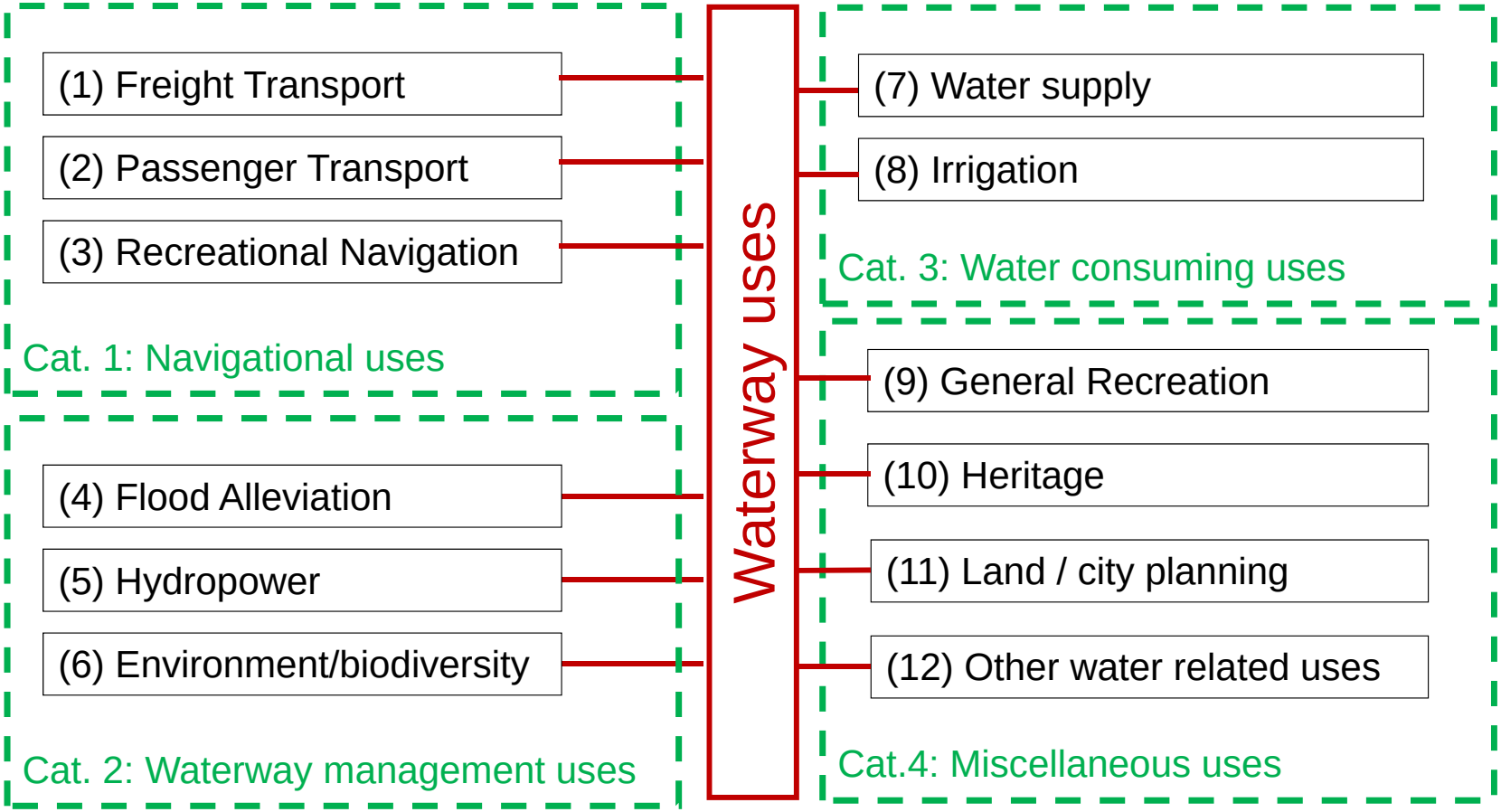
Uses of Inland Waterways

- The Working Group has identified 12 principal USES of the waterway (network), based on:
  - literature review
  - experience of working group members
  - working group discussions

- These 12 principal uses have been classified into 4 categories

The Working Group recognises that it is conceivable that a somewhat different summing up and/or categorisation of the uses is possible. However, the differences with or the deviations from the chosen approach will only be found in details and can therefore not significantly alter the character of this study.

Waterway uses - Overview



RIS

(1) Freight transport

Europe

USA

Dominance of single motor boats

- Rise of extended waterway networks, espacially Europe and USA
- Various ship/waterway classes and ship and goods specialistions
- Mainly: bulk commodities

  liquid/gas products
- Recently increase in container transport

Dominance of push barge combinations

(2) Passenger transport

Scheduled Water bus in Rotterdam

- Resurgence in last decades as alternative to congested and air polluting road traffic
- Offer nowadays includes inter-city passenger ships, water bus/tram, water taxi and ferries
- River-borne passenger transport remains in underdeveloped parts the only way to travel long distances

Water taxi in Buenos Aires

Cable chained Ferry in Elbe valley, Germany

Ferry, Mekong River, Vietnam

(3) Recreational Navigation

River cruising

Commercial and recreational navigation together in a lock

- After WWII, freight transport concentrated on large rivers and waterways
- River cruising and yachting made increasingly use of (some of) these waterways.
- 19th and early 20th century smaller navigation canals abandoned by commercial transport, creating new chances for recreational navigation by small yachts and boats

canoeing / sailing

Yachting/boating

Lake Wannsee in Berlin, Germany

Lake Tonle Sap near Siem Reap, Cambodia

(4) Flood Alleviation

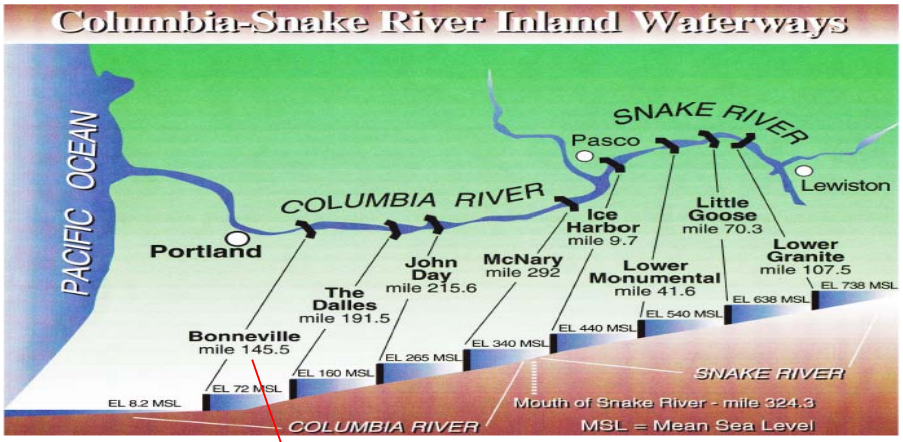
- Floods are natural phenomena occuring periodically at rivers due to hydrological events
- Flood wave hazards are due to high water (inundation) and large flow.
- Use GIS and numerical models to quantify physical effect.
- Connected network(s) instrumental in (partial) flood relief

Recent (2011) Mississippi flooding

Extreme floods on the river Rhine, Germany

(5) Hydropower

1. Impoundment HP



Bonneville dam and lock, and Hydro-power station, Colombia River, USA

An environment-friendly source of electrical energy !

- Depending on local topo-/hydrography, low/moderate head Hydropower possible in natural waterways (rivers).
- Two types of Hydropower:
  - Impoundment HP: dam/ barrage needed + Lock.
  - Diversion HP: Only low head. Dam not necessary.

2. Diversion HP

Run of the River HP

(6) Environment / biodiversity

Inland waterway transport is environment-friendly transport; indirect/direct:

- Alternative to road/rail leading to reduce exhaust gases and noise
- Waterways part of natural aquatic system, with own pro's and contras:
  - habitats for animals and plants, in the water and along its banks
  - linking different aquatic areas
- Challenge is to find right balance between navigation and ecological demands on waterways
- Waterways have high ecological potential; Measures to support biodiversity

Environmental friendly bank structure at Elbe-Luebeck-Canal

Biodiversity enhancement measures

Fish way in Geesthacht, Elbe River, Germany

Animal crossing at canal bank

Shallow water compensation areas

Mittelland Canal, Germany

(7) Water supply

Access to water is precondition for survival of humans and animals. Uses:

- Drinking water/household uses

Water supply works on the Elbe River in Dresden Germany

- Municipal uses

Water works in Hannover, Germany

- Convey (treated) waste water

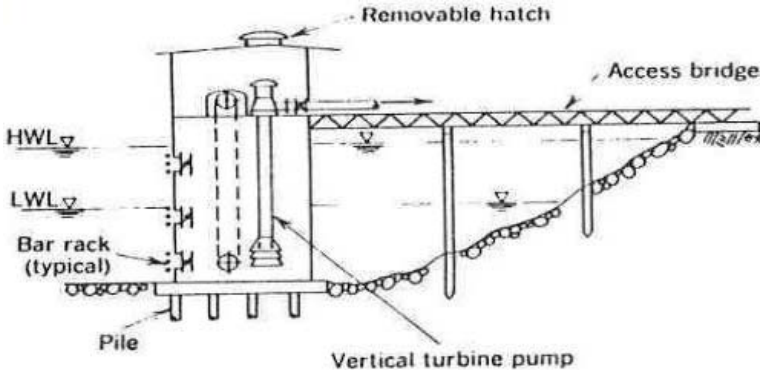
current transports sewage out of the old town of Freiburg, Germany

However, Raw water is still being consumed in some parts of underdeveloped countries.

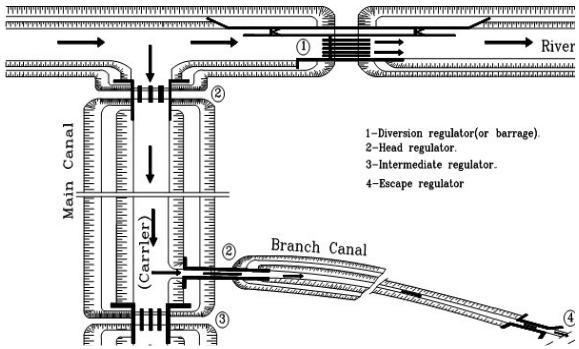
(8) Irrigation

- In arid and semi-arid areas, mostly in developing countries, supplying irrigation water is often the main use of the river.
- In navigation dominated rivers, applying part of its discharge for irrigation can be a beneficial use, provided that it is guaranteed supply of water must be larger than the discharge needed to ensure year (season) -long navigation
- Associated with irrigation networks are agricultural drainage networks

Supply of irrigation water



1. Pipeline Intake Structures



2. Intake with a control structure

Inland waterway in turn offers small and large scale transport of agro-products.

Bringing farm products to the Market, South-East Asia

(9) General Recreation

- The counterpart of recreational navigation is recreation in the surroundings and along the banks of the rivers and waterways.
- Both, being two faces of a coin, are products of modern society: they contribute to the wellbeing of citizens and their social life, as well as to the economical development of the area, region, country.

towpath activities

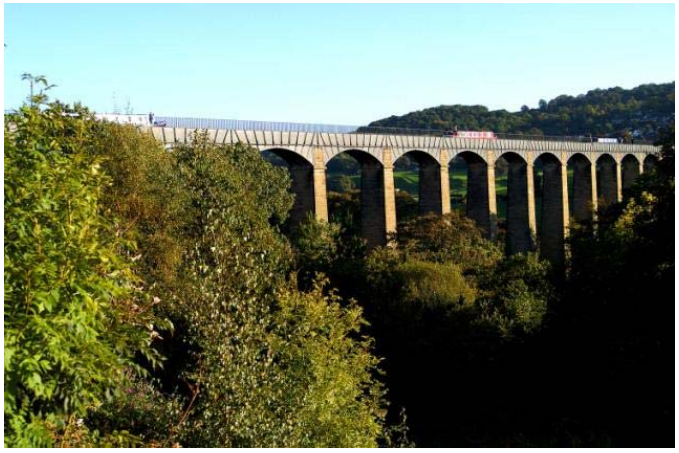
Waterway side paths provide for walking, running, cycling, horse back riding, dogwalking

waterway bank recreation

Navigation and landside recreation at a German inland waterway

Harbour tour in Copenhagen, Denmark

(10) Heritage



Pontcysyllte Aqueduct, Wales

Ancient Egyptian temples, Luxor

- Presently flourishing augmentation of General/navigational recreation.
- Historical development of waterways and their structures:
  - Locks, acquducts, harbours, etc
  - Waterside buildings (pumping stations, water stations, museums).
  - Traditional boats and harbours.
  - Industrial and agricultural landscapes.
- Cultural heritage of prehistoric and ancient human history along rivers (Nile/Egypt)
- UNESCO World heritage sites.
- Coupled with touristic infrastructure and employment and economic regeneration.

Caen Hill lock flight, Devizes, UK

UNESCO World heritage site, Rideau Canal

(11) Land / city planning

Waterfront housing development, Former inner-city port Puerto Madero, Buenos Aires, Argentina

Floating homes, Lake Union, Seattle, Washington, USA

Recent trends:

- Replacing waterway infrastructure that is demolished or unused.
- Waterfront housing and leisure sites towns and cities worldwide.
- Allowing green development, residential areas and water houses.
- Attractive image, waterfront urban development, enhancement of economic value of properties.
- Waterside leisure activities promote employment and local economy.
- The waterway supports transport function of goods as well as residents.
- Besides benefits, care needed to manage adverse (environmental) impacts

Leisure along the waterside, Utrecht, Netherlands

Gloucester docks, London

(12) Other water related uses

Other uses which do not directly fall under above 11 uses include:

- Mining / Quarries, mainly sand and gravel, but sometimes also contained minerals.
- Professional fishing (mainly in side arms, lakes and water impoundments by structures).
- Construction and management of ports, both commercial and for recreation.
- Shipbuilding industries
- Supporting (specialised) businesses.

One should keep in mind that these do not cover the entire range of possibilities. Actually, the possibilities are endless and with evolving society, the uses will change as well.

Mining and quarrying can be dependent on the availability of large volumes of water for processing the minerals, for the transportation of large volumes of minerals or they might be using equipment which is too large to be transported by other modalities (e.g. dredging pontoons). In the case of sand and gravel being mined from the waterway bed, essential conditions are also the availability of the materials to be mined in commercially exploitable quantities and the effect the mining has on the flow and morphological conditions of the river.

Professional fishing can be done in a mobile way, using a fishery ship and a trawl or fishing rods. It can also be done with stationary fishing nets. The waterway needs to be free of obstacles for the use of trawls; for rods there are no specific requirements. Stationary fishing nets can only be placed outside the shipping routes and should be clearly marked.

Ports are related to waterways as eggs to chickens. Or one could argue that ports *are* waterways, but of a special kind. Either way it is a business tied to waterways, often dependent on waterways for hinterland transport or vice versa. Waterways would be useless for transportation if there were no ports to call at.

Shipbuilding is a type of industry which is rather significant for some economies. Most of these docks do not use the waterway at all except for the final delivery of the ship. Nevertheless, a shipbuilder on a certain location is restricted towards its market by the size of the waterway he is connected to. In some cases they actually design their ships on the exact measures of the waterway with a special permit for exceptional transport.

Specialised supply businesses are often businesses close to the water or at the water to provide the various users with fuel, supplies, food, etc. Access from the water and access from the land are the important elements here to take into consideration.

Aspects for evaluation of the uses of Inland Waterways

WATERWAY CHARACTERISTICS

1. Physical aspects of the waterway
2. Operational aspects

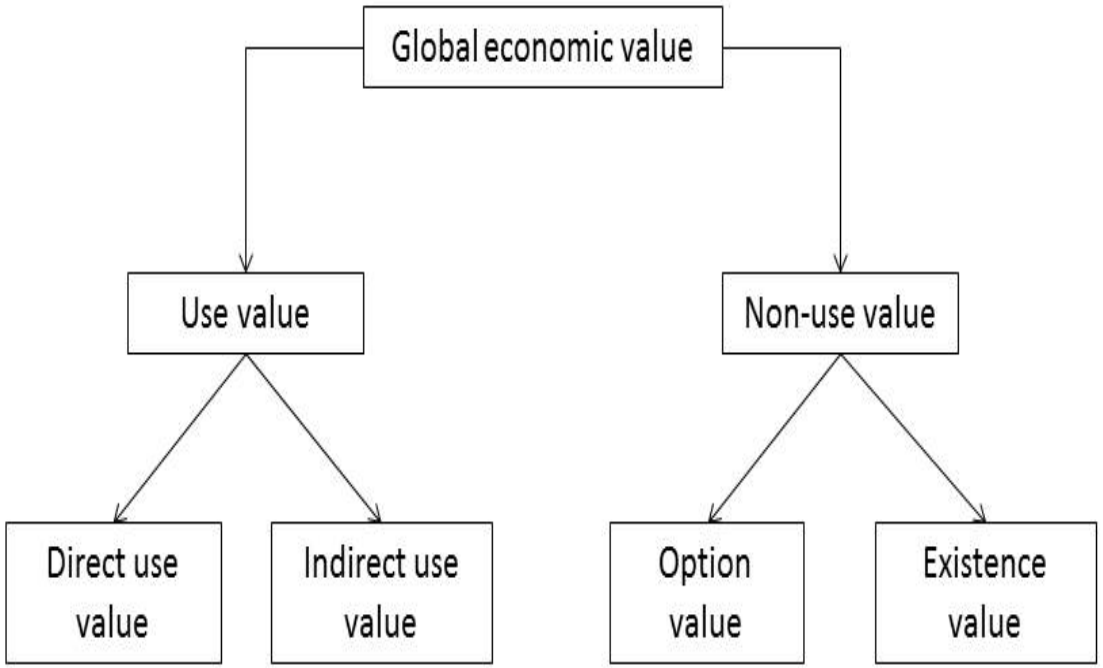
SOCIO-ECONOMIC & ENVIRONMENTAL ASPECTS

3. Economical aspects
4. Environmental aspects
5. Social aspects

DIFFERENTIAL CONSIDERATIONS

6. Interaction
7. Balance of Interest

Quantification of Benefits



- ***Direct use values:*** services used directly by consumers (ex. freight transport, consumptive uses such as drinking water and water for industry)
- ***Indirect use values:*** services that improve the benefits of other productions (ex. shift cargo from the road to the waterway, road congestion alleviation)
- ***Option values*** are derived from preserving the option to use services in the future that may not be used at present, either by oneself (option value) or by others or heirs (heritage value).
- ***Existence values*** refer to the value people may place on knowing that a resource exists even if they never use that resource directly. This kind of value is usually known as existence value (sometimes also called the passive use)

Multi-Use System

- One has to realise that River and Inland Waterway networks are (almost) always exploited in a multi-use manner
- If not at present, it is inevitable they will be in the (near) future
- A number of examples to illustrate this has been incorporated in the report, as shown in following table

List of the cases and the waterway uses covered therein

Case	Waterway uses												
	Freight transport	Passenger transport	Recreational navigation	Flood alleviation	Hydropower	Environment and biodiversity	Water supply	Irrigation	General recreation	Cultural heritage	Land, urban and rural development	Other water related uses	Quantification of benefits
1 Parana River, Argentina	●	●	●		o				o		o	o	
2 Tennessee River Valley	●		o	●	●	●			o			o	
3 Columbia-Snake Waterway system	●		o		●	●		●	o				
4 The Seine-Scheldt project in Flanders, Belgium	●					●			●		●		
5 Main-Danube Canal	●		o	o			●						
6 Ferries in the Netherlands		●											
7 Manifold uses in German semi-natural waterways	o		●			o			●	o			
8 Tourist shipping on the Nile		o	●							o			
9 Tourist shipping port near Luxor		o	●						o		o		
10 Economic impacts of smaller Canadian historical waterways			●						●	o			
11 Room for the River Programme, The Netherlands				●		●							
12 Living on water	o			●								o	
13 Douro River, Portugal			o	●	●								
14 Alternative energy sources for propulsion						●							
15 Complex water regulation in western German waterways	o						●						
16 Elbe Lateral Canal	o						●	●				o	
17 The Erie Canal, USA			o						●	●			
18 Birmingham's waterfront						o			●	o	●		
19 Restoration of the Kenneth & Avon Canal									o	●			
20 Old Dockyards in Ghent, Belgium										●	●	●	
21 Cost-benefit analysis, two projects Upper Seine basin, France	o			o		o							●

● uses which are described in more detail
o other uses

Therefore

For any extensive work on the waterway network
it is essential to apply a comprehensive system-approach:

- Covering entire waterway network or basin,
- based on a long-term vision, and
- taking into account all related interests and stakeholders