

icpdr

Workshop II – Bucharest, June 25-26, 2007

„Improvement of IWT through structural measures
(ecology-sensitive maintenance and upgrading of the waterway, the
embankments and river habitats)“



Stauhaltung Gamsheim, Oberrhein (Quelle: Die Binnenschifffahrt
Fließende Straßen - Lebendige Ströme, H. Ringhand (Hg.), S. 239, 1992)



Bayerische Donau (Foto: Bernhart)



Dynamic river system



Foto: Schneider

Dynamic river system: Bank erosion ...



Foto: Schneider

Dynamic river system: Bank erosion ...



Foto: Schneider

Sediment deposition → Pioneer habitat



Foto: Schneider

Structural measures in such a sensitive system ?



Foto: Natur und Umwelt, 2-05

Relevant ship types ?



Foto: Bernhart

The bigger the better ?



Foto: Verhaaven

Ship type: Convoi with 4 barges

(Quelle: Rhein-Main-Donau AG, Baubericht 1977)



„Im Vordergrund links eine Probestrecke mit Asphaltaußenhautdichtung, ...“

„Die neuen Flußseitendämme der Staustufe Geisling begleiten die Donau beidseitig auf eine Länge von rd. 11 bzw. 13 km, ...“

**Danube in Bavaria:
River barrage Geisling**



Ship type: Convoi with 4 barges

(Quelle: RMD Baubericht 1989)



**Danube in Bavaria:
River barrage Straubing**

Riprap: Technic and nature in harmony ?

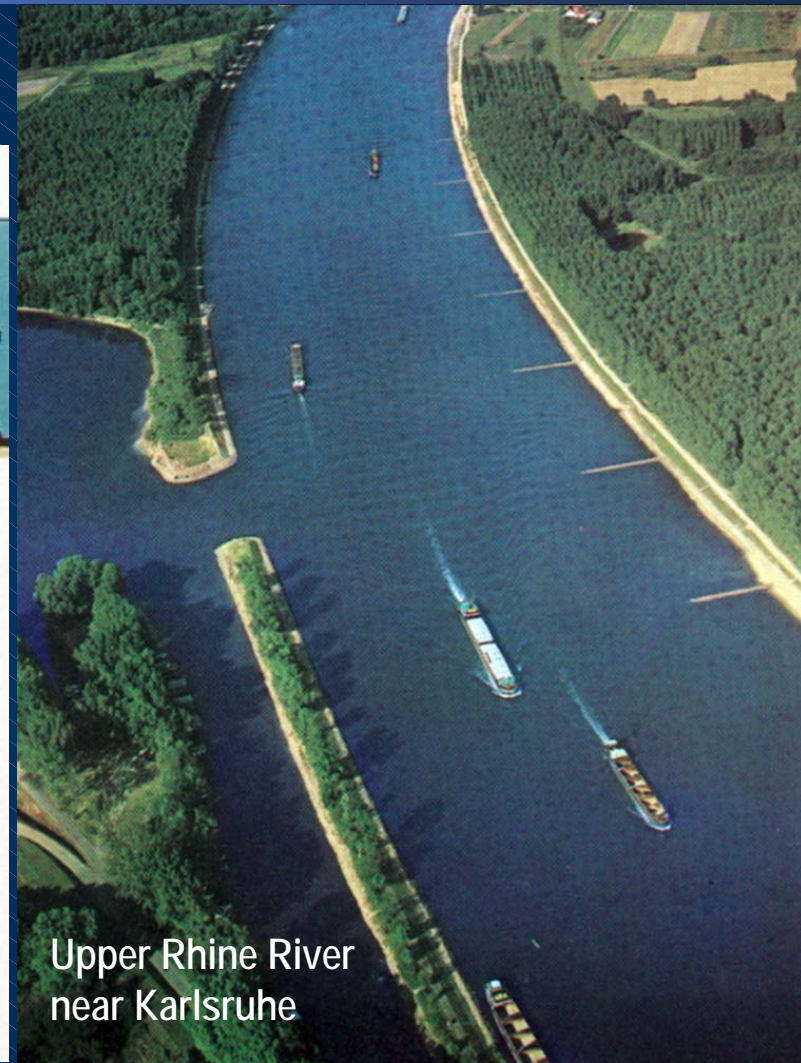
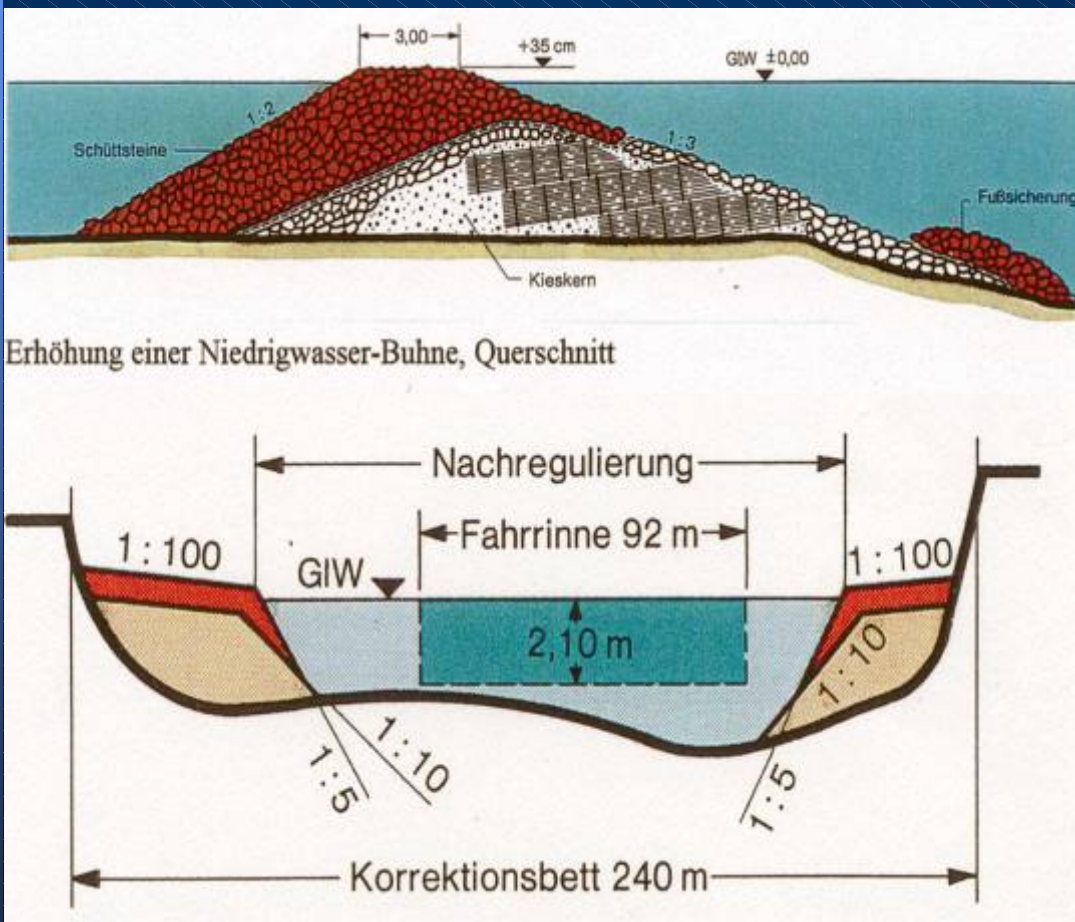
River barrage Straubing



Foto: Bernhart

Linear regulation of the embankments: Great loss of habitat structures

(Quelle: „Ausbau des Rheins“;
Hg.: Baufirmen, WSD Südwest, WSD West, 1977)

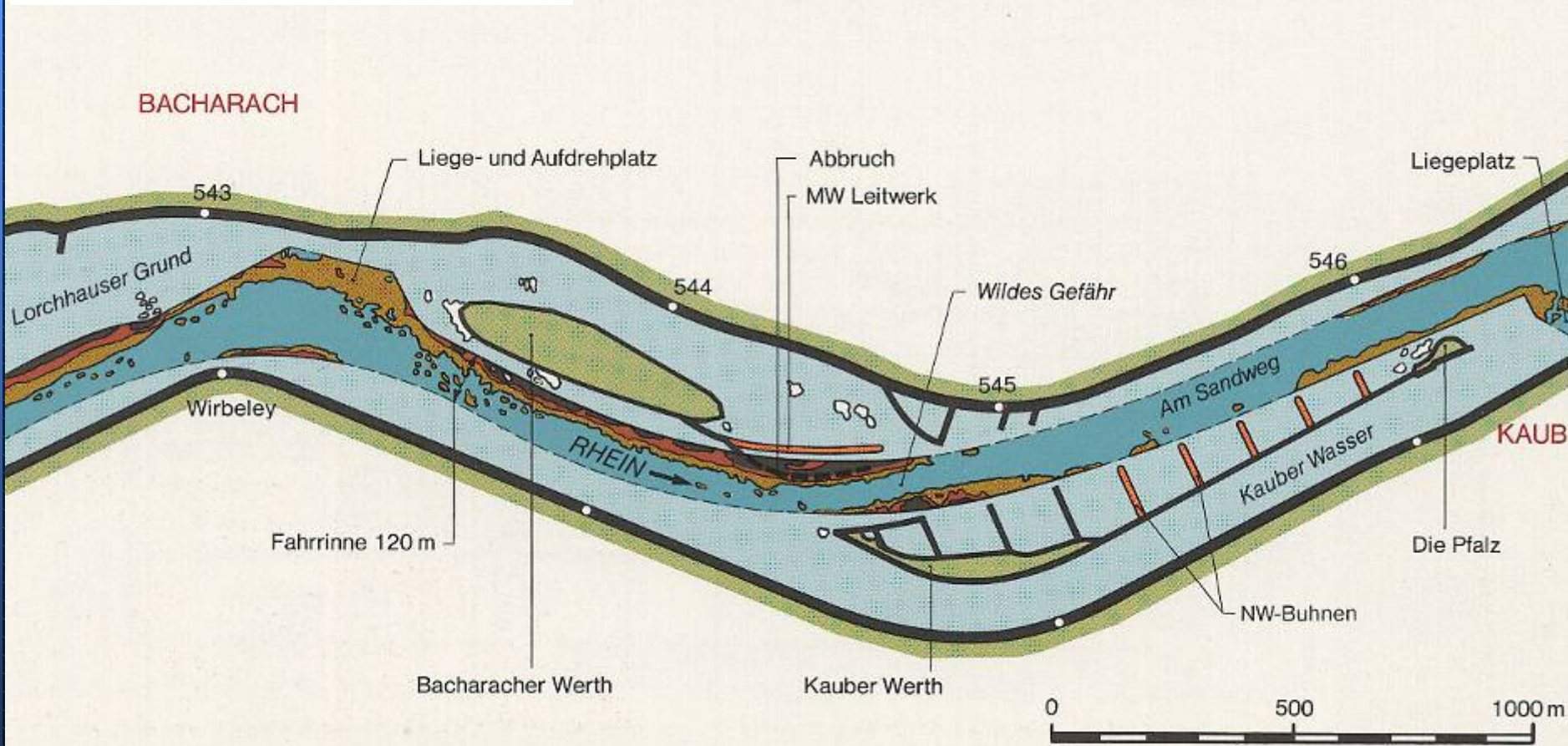


Upper Rhine River
near Karlsruhe

Structures in the river bed may upgrade the waterway

(Quelle: Ausbau des Rheins; Hg.: Baufirmen, WSD Südwest, WSD West, 1977)

Middle Rhine between Bacharach and Kaub

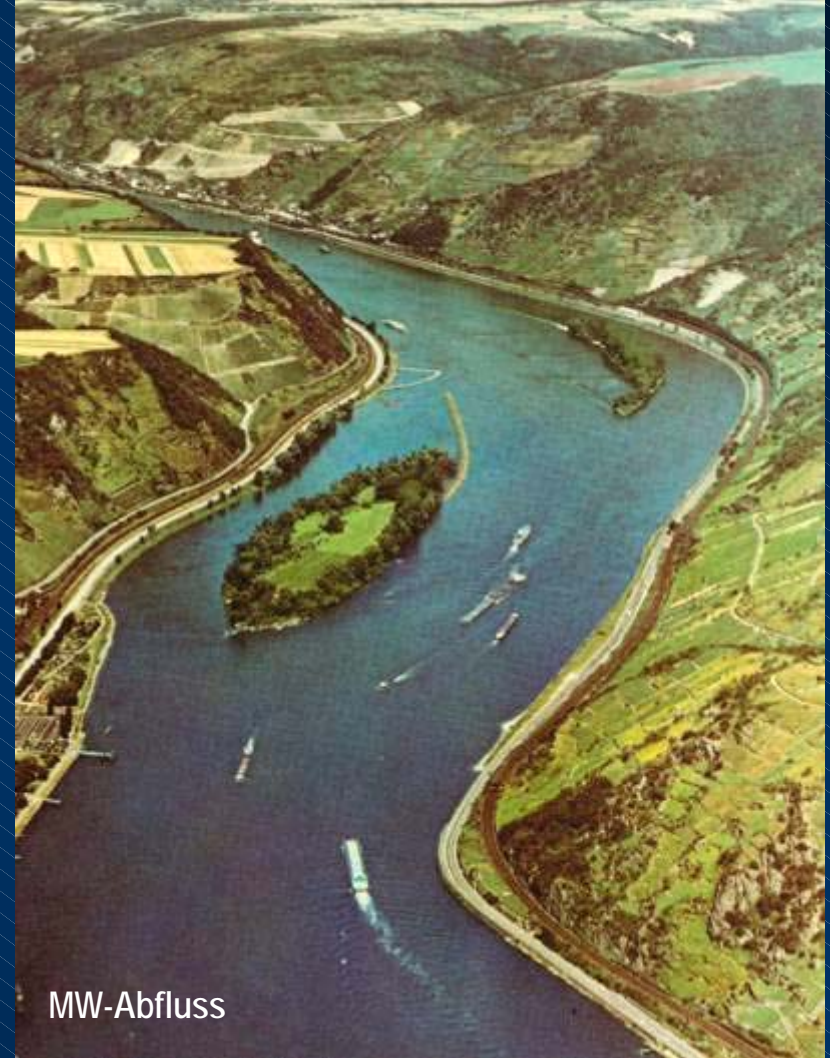


Middle Rhine between Bacharach and Kaub

(Quelle: Ausbau des Rheins; Hg.: Baufirmen, WSD Südwest , WSD West, 1977)



NW-Regulierung



MW-Abfluss

Future development: Conflict or consensus ?

Water policy demand according to the EU Water Framework Directive (22.12.2000):

Define and implement necessary measures to achieve at least a good water status !

this goal requires:

- good ecological conditions of the rivers

and therefrom results not only

- the need of protection

but also

- the demand for improvement

of the river systems !



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Dies führt dazu, dass der Fluss nicht mehr ausschließlich im Hinblick auf seine Funktion als Wasserstrasse ausgebaut werden kann, sondern für alle seine Aufgaben den Anforderungen der Ökologie genügen muss.

Demzufolge müssen gewisse Konsequenzen für das Wasserstraßennetz berücksichtigt werden:

- Das vorhandene Netz wird nur sehr beschränkt ausgebaut werden können um neue Gebiete für den Transport auf dem Wasser zu erschließen. Berücksichtigt man die für den Bau neuer Infrastruktur notwendige Zeit, steht für die untersuchte Frist bis 2020 das bestehende Netz faktisch bereits fest.
- Gleichmaßen wird es eben nur mit sehr großen Anstrengungen gelingen, die Merkmale der vorhandenen Wasserstrassen (Breite und Tiefe) abzuändern.

Future situation in waterway traffic ...

„Der Behälterverkehr entwickelt sich zum bestimmenden Marktsegment ...“

(Zitat: „Schiffe der Zukunft“, ZKR, 2002, S. 26)



Foto: Bernhart

Futura Carrier system: Katamaran type

(Quelle: <http://www.new-logistics.de>)



Basisauswahl
Containerschiffe

Länge:	110,00 m	Länge:	85,90 m
Breite:	11,45 m	Breite:	11,45 m
Tiefgang:	3,50 m	Tiefgang:	3,50 m
DWT:	3000 t	DWT:	2450 t
TEU (4 Lagen):	220	TEU (4 Lagen):	150

Future situation in waterway traffic ...

Ship type with good shallow water ride characteristics

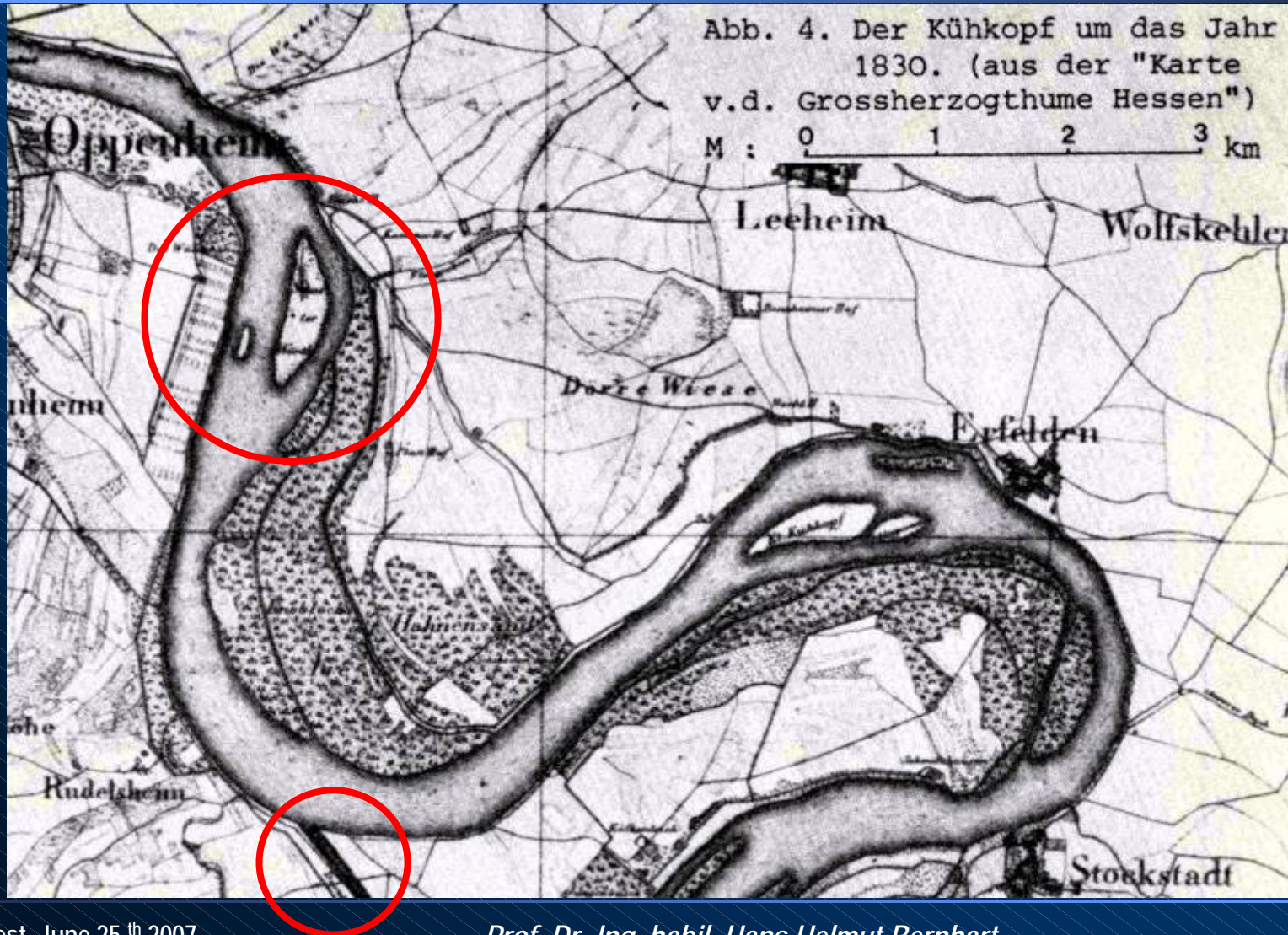


How to achieve an improvement of the water depth ? Linear structural measures ?



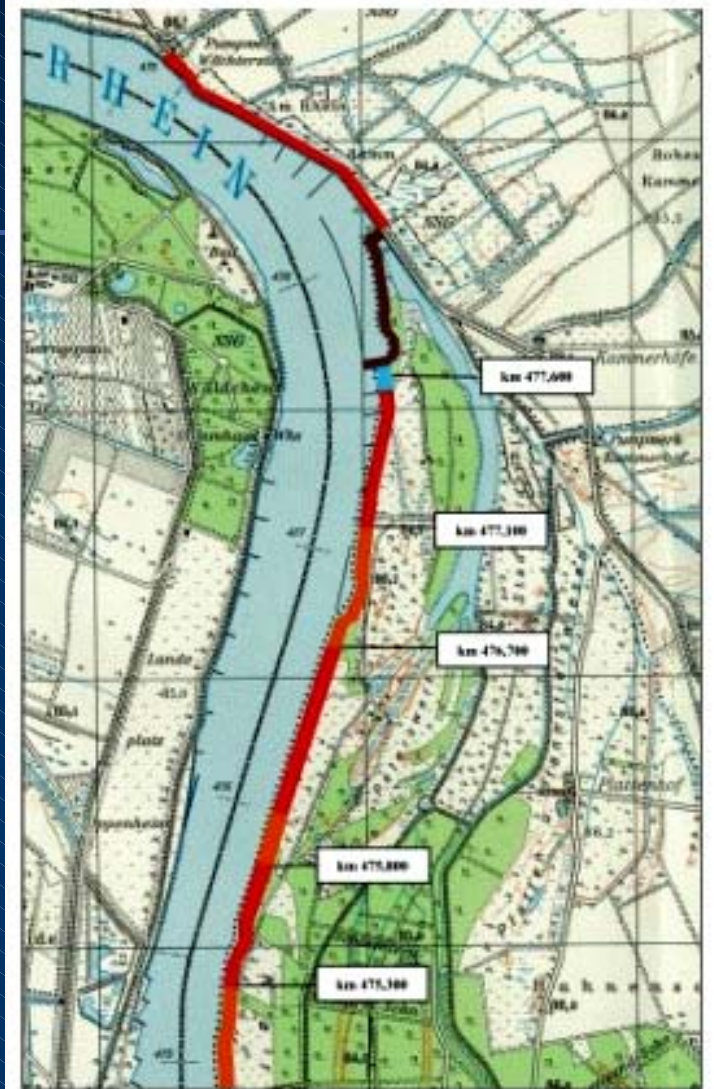
Ecology: Not feasible !

Upper Rhine River : Kühkopf area (near Mainz)



Upper Rhine River: Sidearms in the Kühkopf area cut off due to deposition of sediment





- Legend:**
- riprap
 - riprap with willow trees
 - sedimentation
 - silted up

Linear riprap without hydraulic needs



Foto: Bernhart

Linear riprap without hydraulic needs: Sedimentation in front of the riprap



Foto: Bernhart

Natural embankment in the same river stretch



Foto: Bernhart

Ecology needs a dynamic system with a great variety of habitat structures



Flachwasserbereiche = „Kinderstube“ der Fische

Foto: Petters-Raskop

How to achieve an improvement of the water depth ?

Local structural measures: Groynes, Leitwerk



Groynes in the river Elbe



Foto: Leyer

Groynes in the river Elbe after repair works



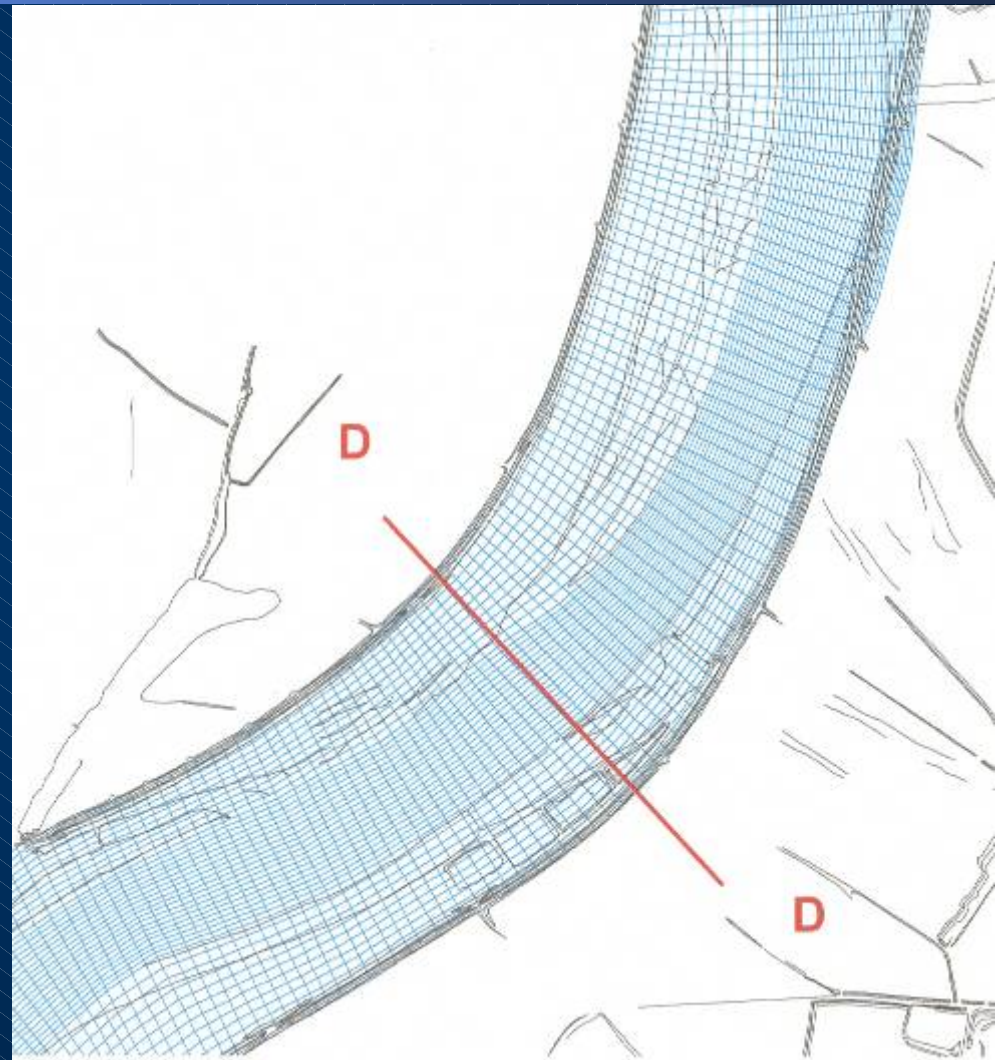
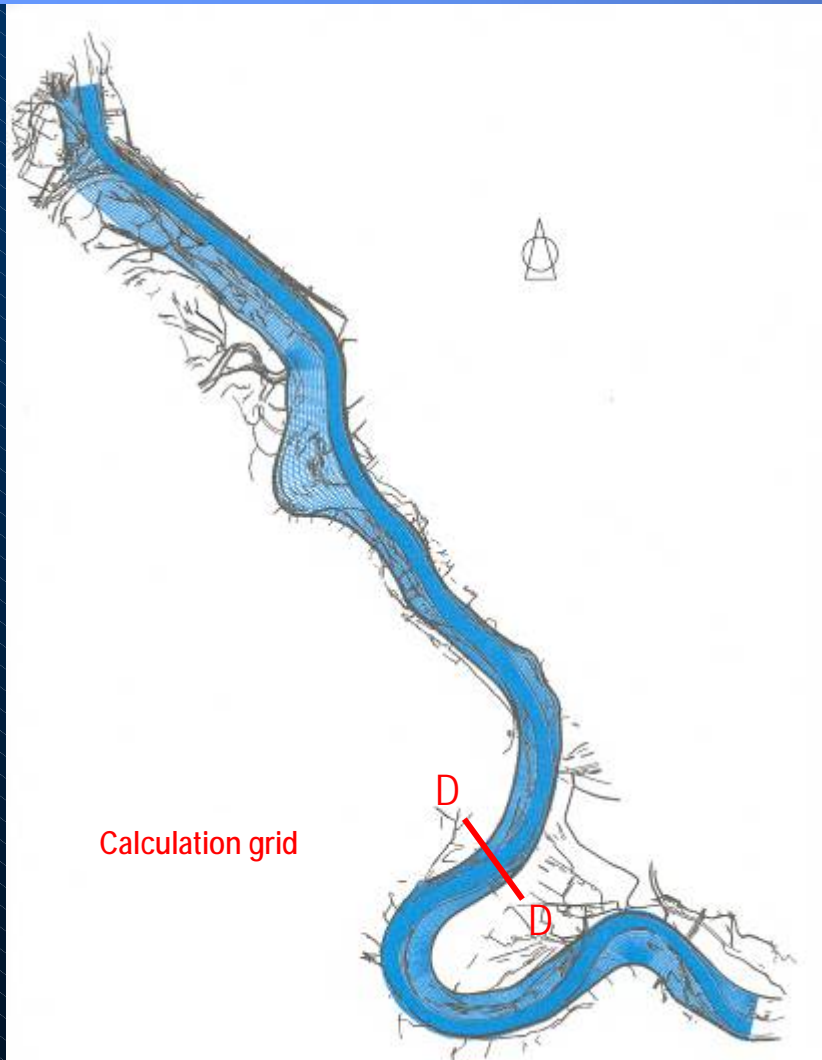
Foto: Bernhart

Groynes in the river Elbe

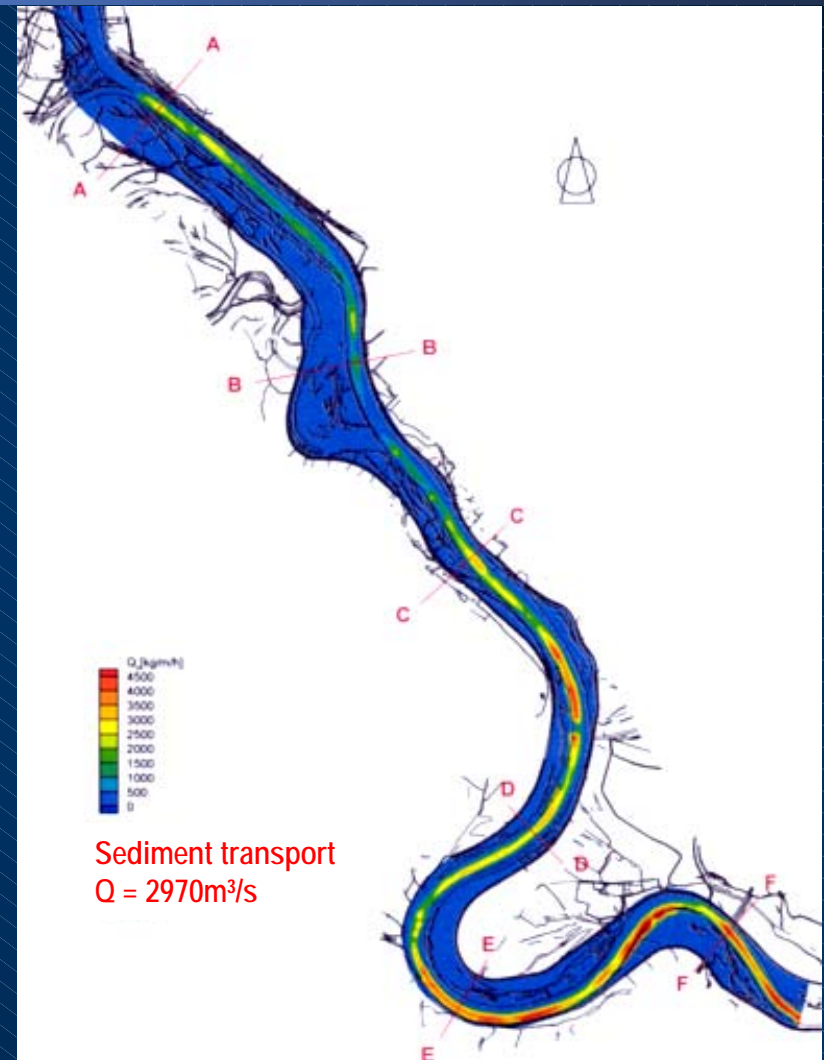
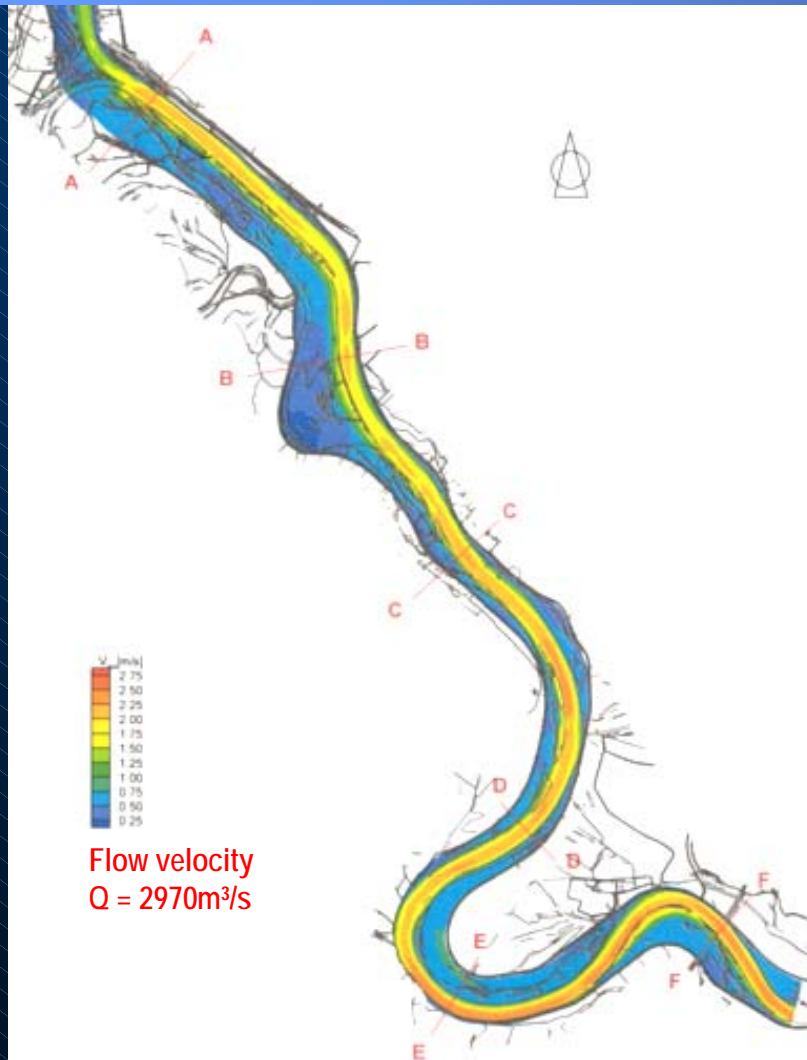


Foto: Bernhart

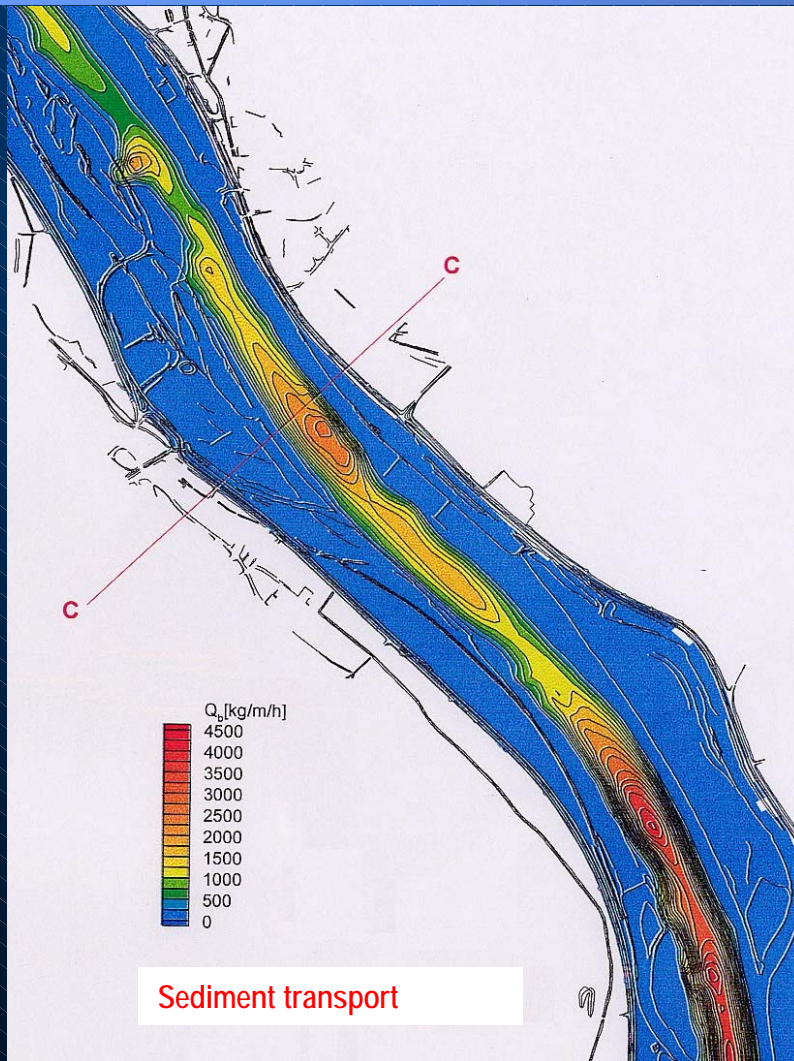
2-dimensional mathematical modelling



2-dimensional mathematical modelling



Dynamic behaviour of the river bed



New Danube Bridge at Vidin-Calafat

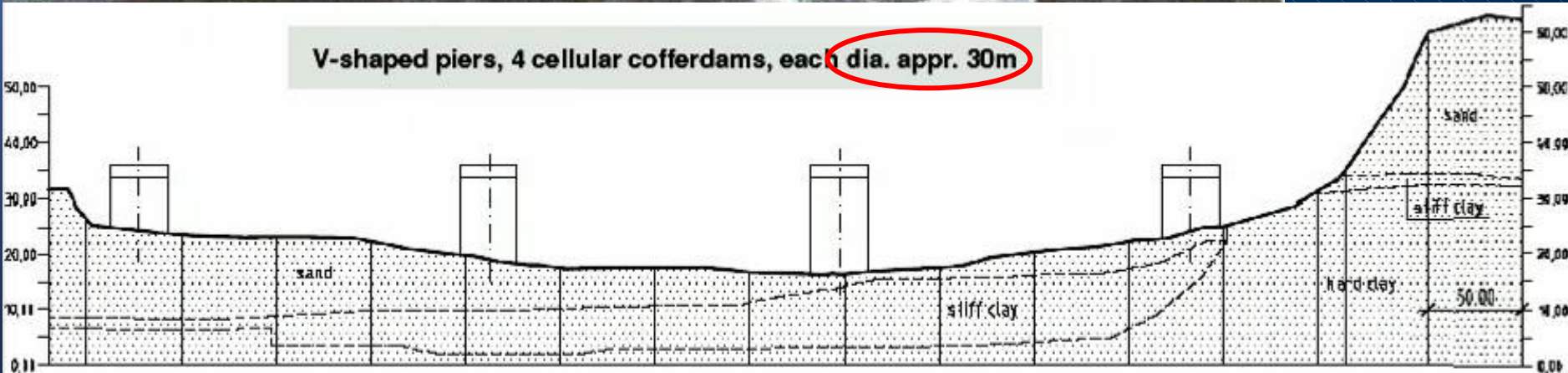


Danube-Bridge Vidin-Calafat: Proposed Design

Quelle: Zeitung
„24 tshassa“,
03.10.2006



V-shaped piers, 4 cellular cofferdams, each dia. appr. 30m



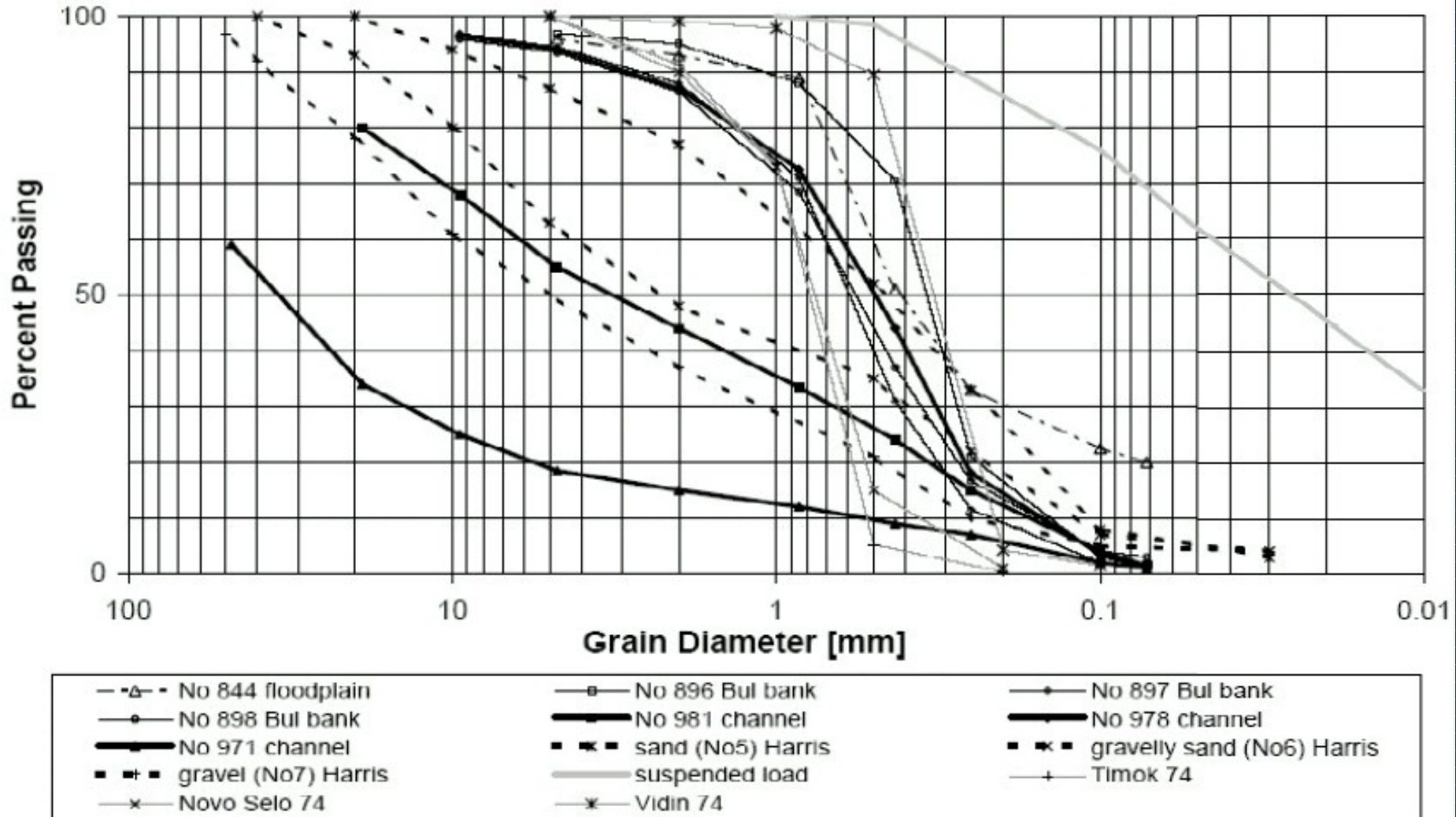
Result of Model Studies

IEMC-SCOTT WILSON, IBERINSA, FLINT & NEILL,
HYDRO GLOBAL CONSULT „Hydraulic model
investigations" Final report, August, 2004, Photo 2, p. 19



Grain size distribution

Ministry of Transport and Communication, Republic of Bulgaria, KfW, RRI, GUS, GEOPLANPROEKT „Geotechnical and Hydro-technical Studies“ Final report, June 2001, Figure 6.4-3, p. 6-12



Danube Bridge Ruse-Giurgiu

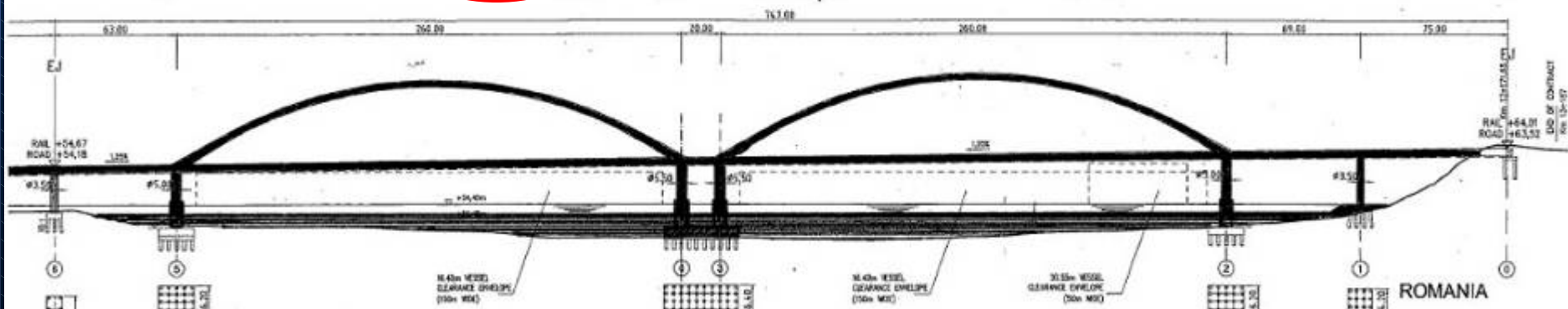


Foto: Tsolev

Danube-Bridge Vidin-Calafat: Alternative Design

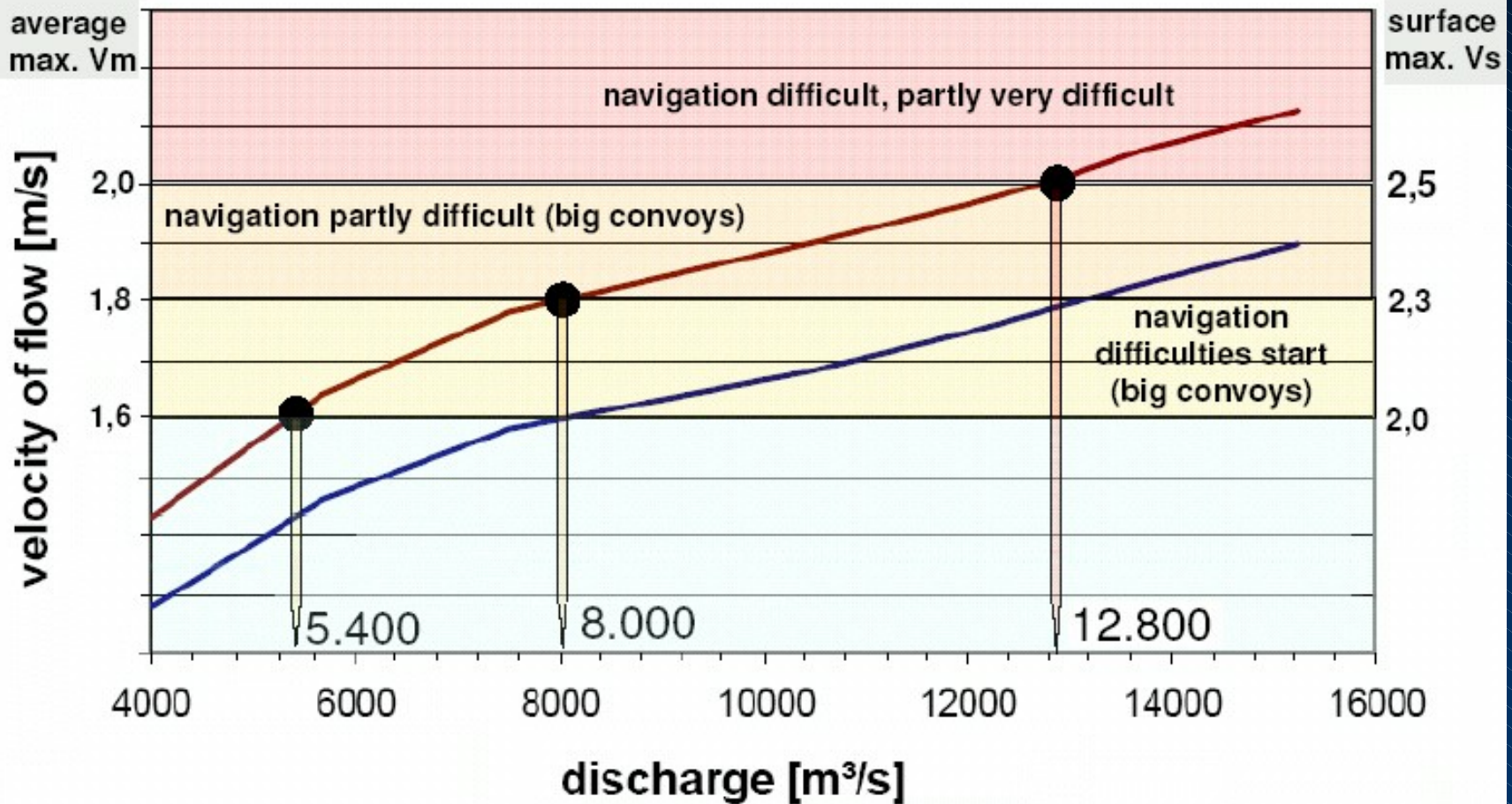


4 rows of 2 circular piers **dia. 5m**



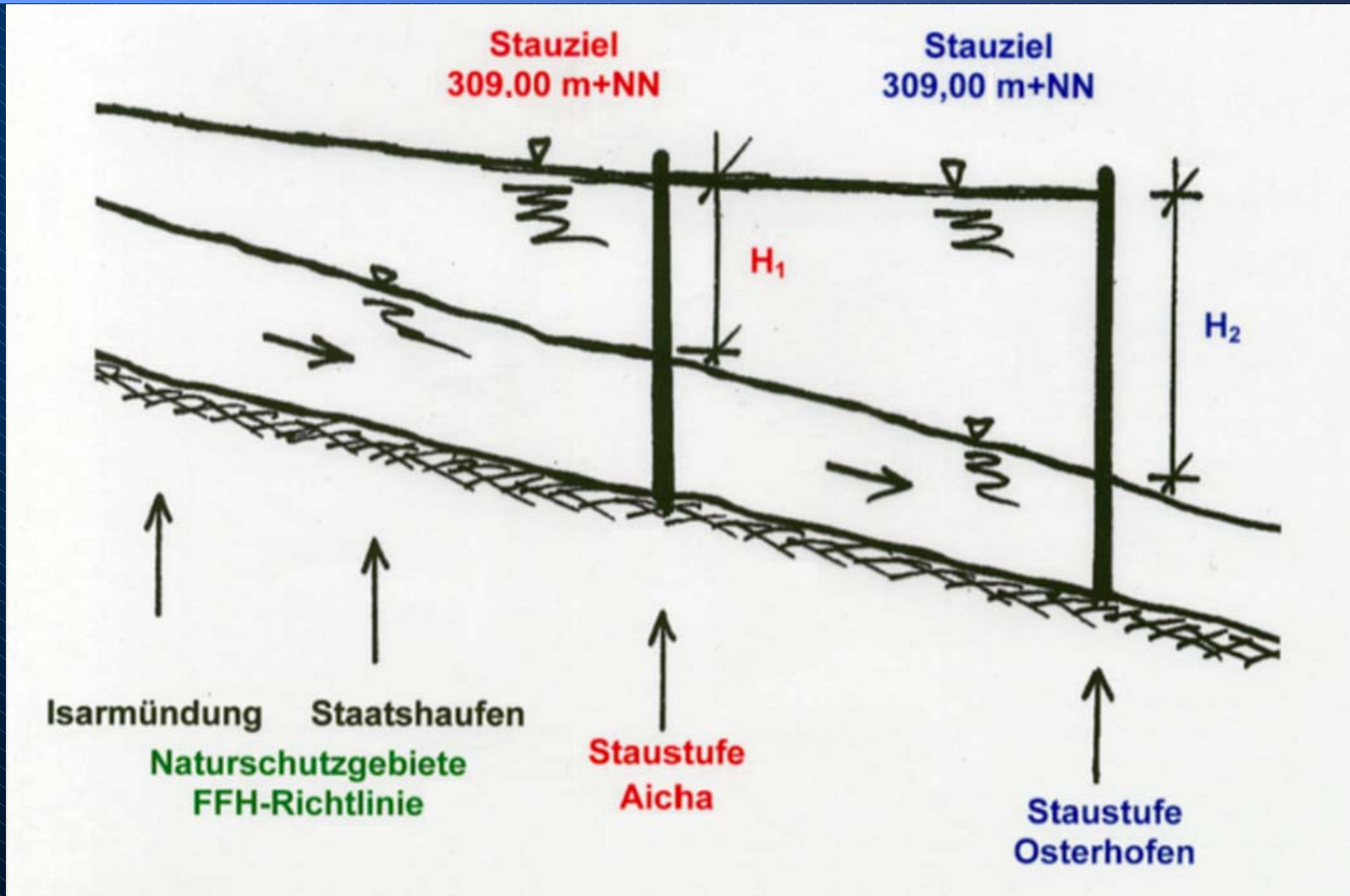
Flow velocities in the bridge area

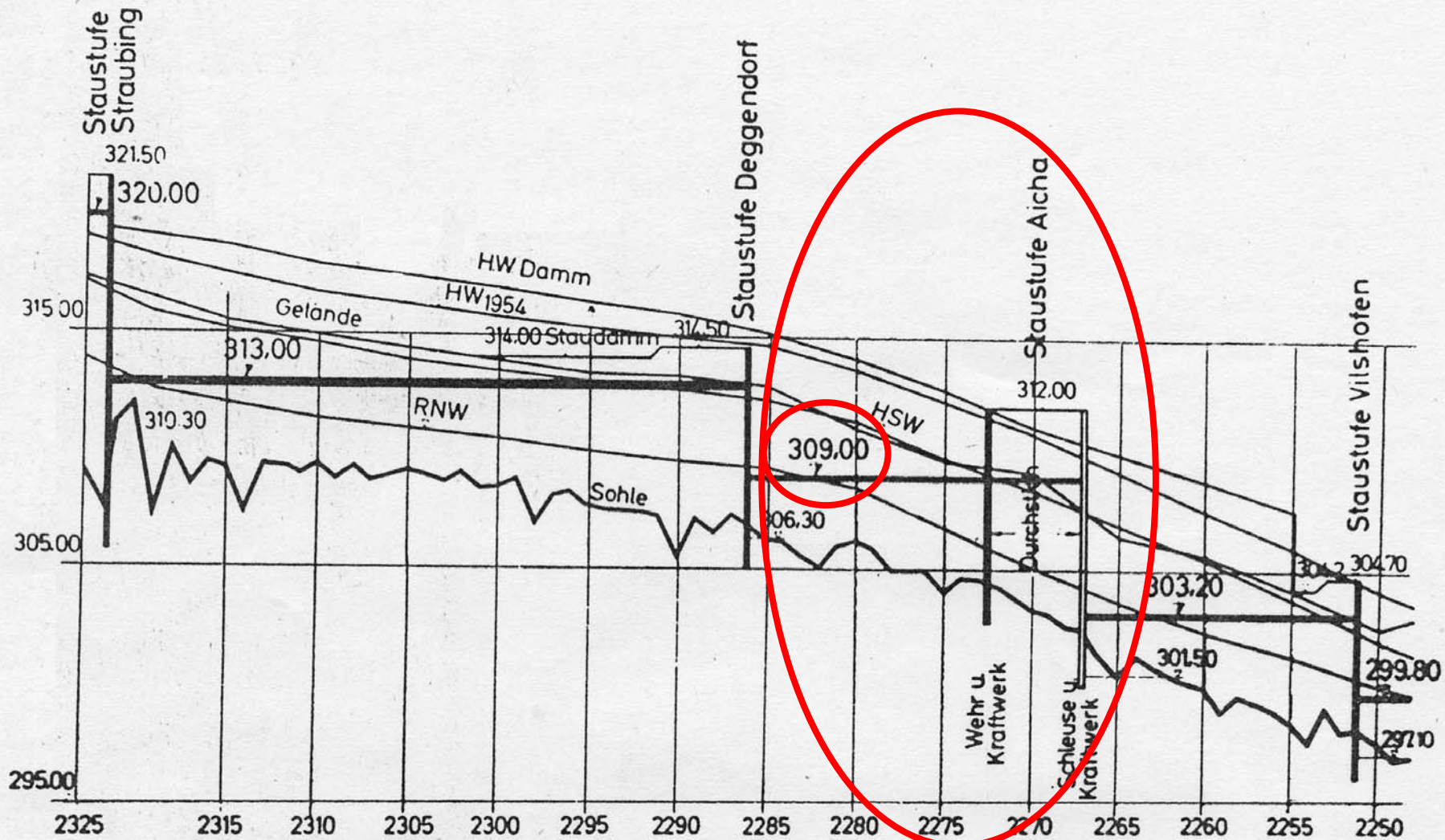
highest navigable WL: 34,4 maBL - corresponding Q: 15.000 cbm/s
lowest navigable WL: 26,42 maBL - corresponding Q: 2.500 cbm/s





Afflux and backwater effect is the same ...





Rhein-Main-Donau AG
MÜNCHEN
1965

Höhenplan Straubing-Vilshofen

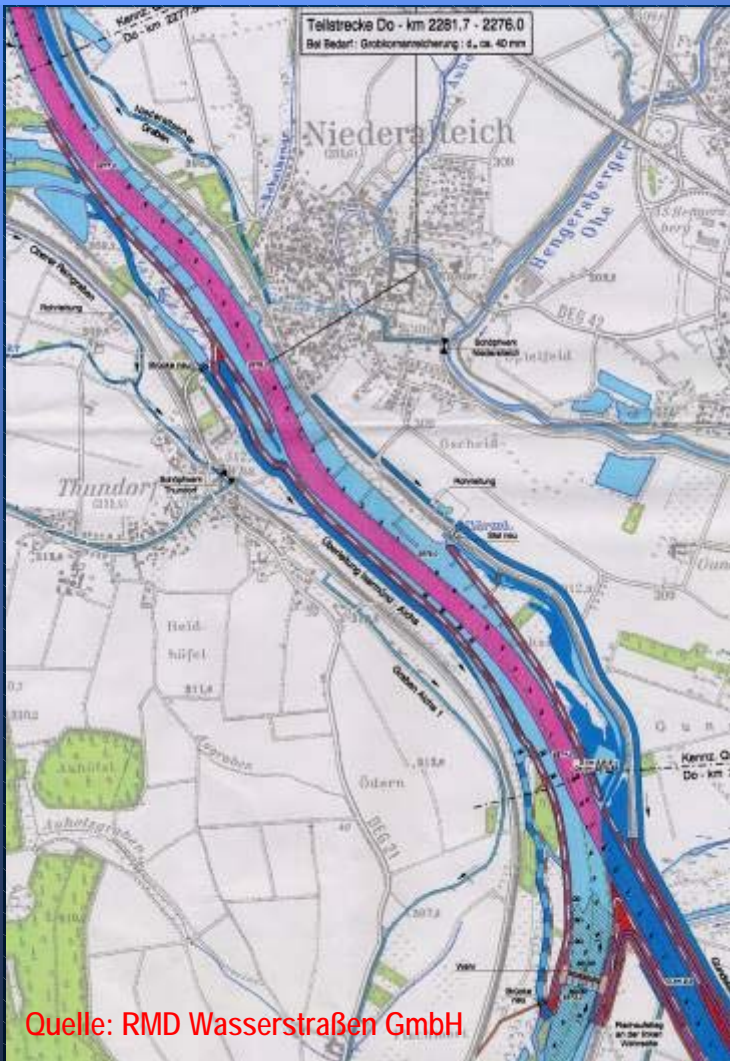
Mühlhamer Schleife: Would be cut off



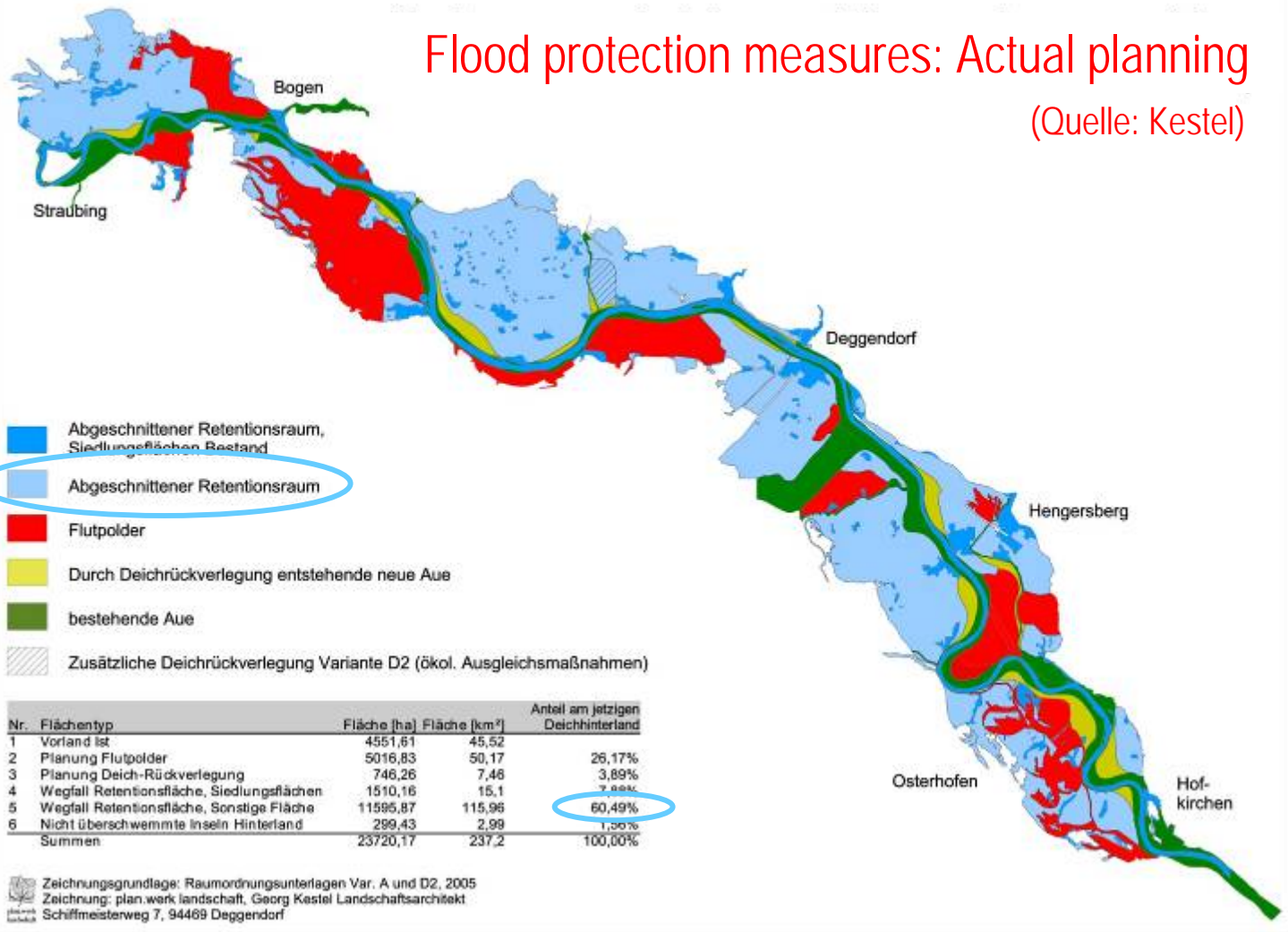
Luftbild: Ammer

Danube in Bavaria: River barrage Aicha

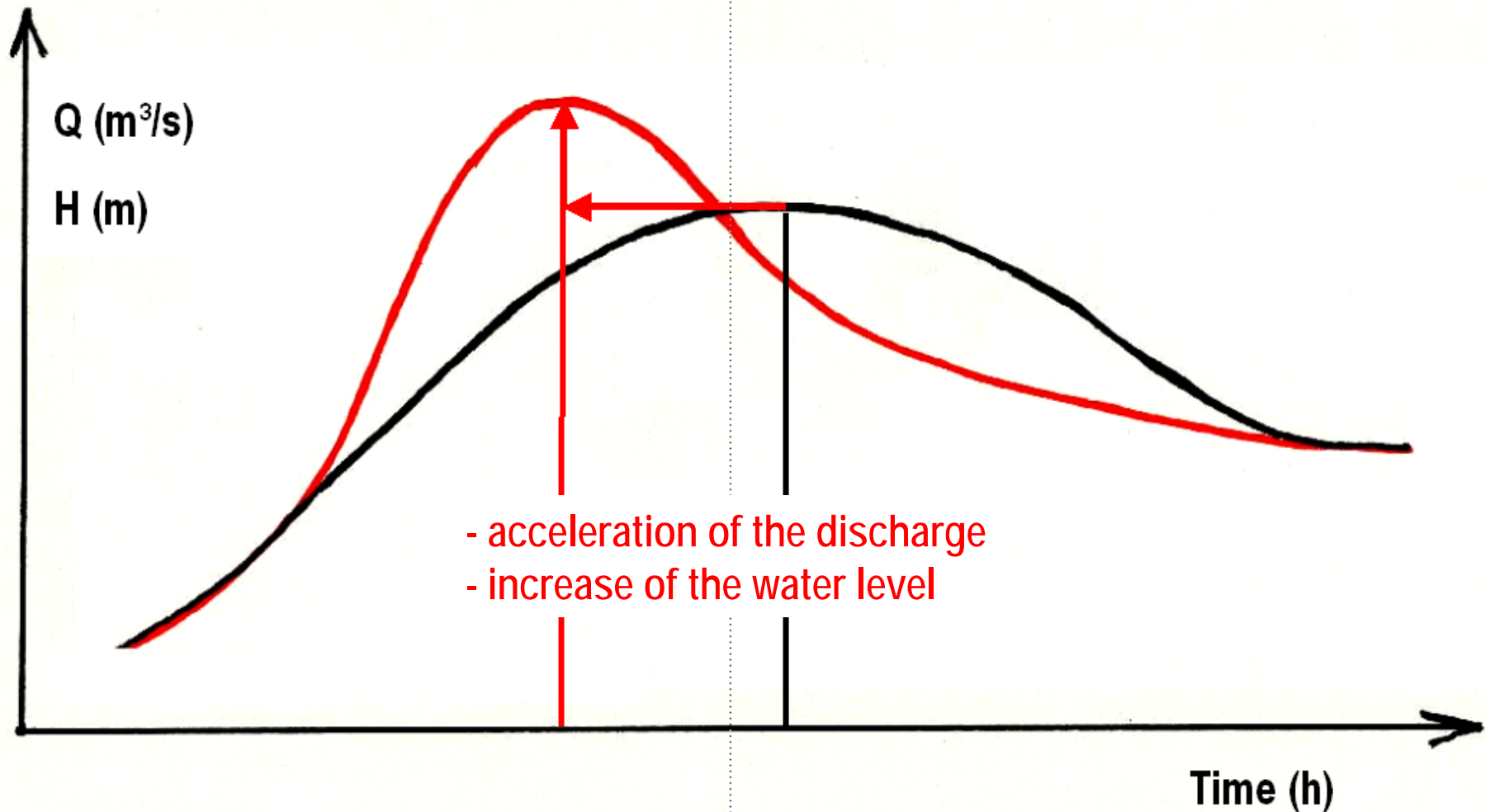
Mouth of the river Isar: Nature reserve !



Loss of retention area → increase of flood problems



Aggravation of flood problems



Alternative solution with structural measures



Danube in Bavaria

Foto: Bernhart

Alternative solution with structural measures

Danube in Bavaria



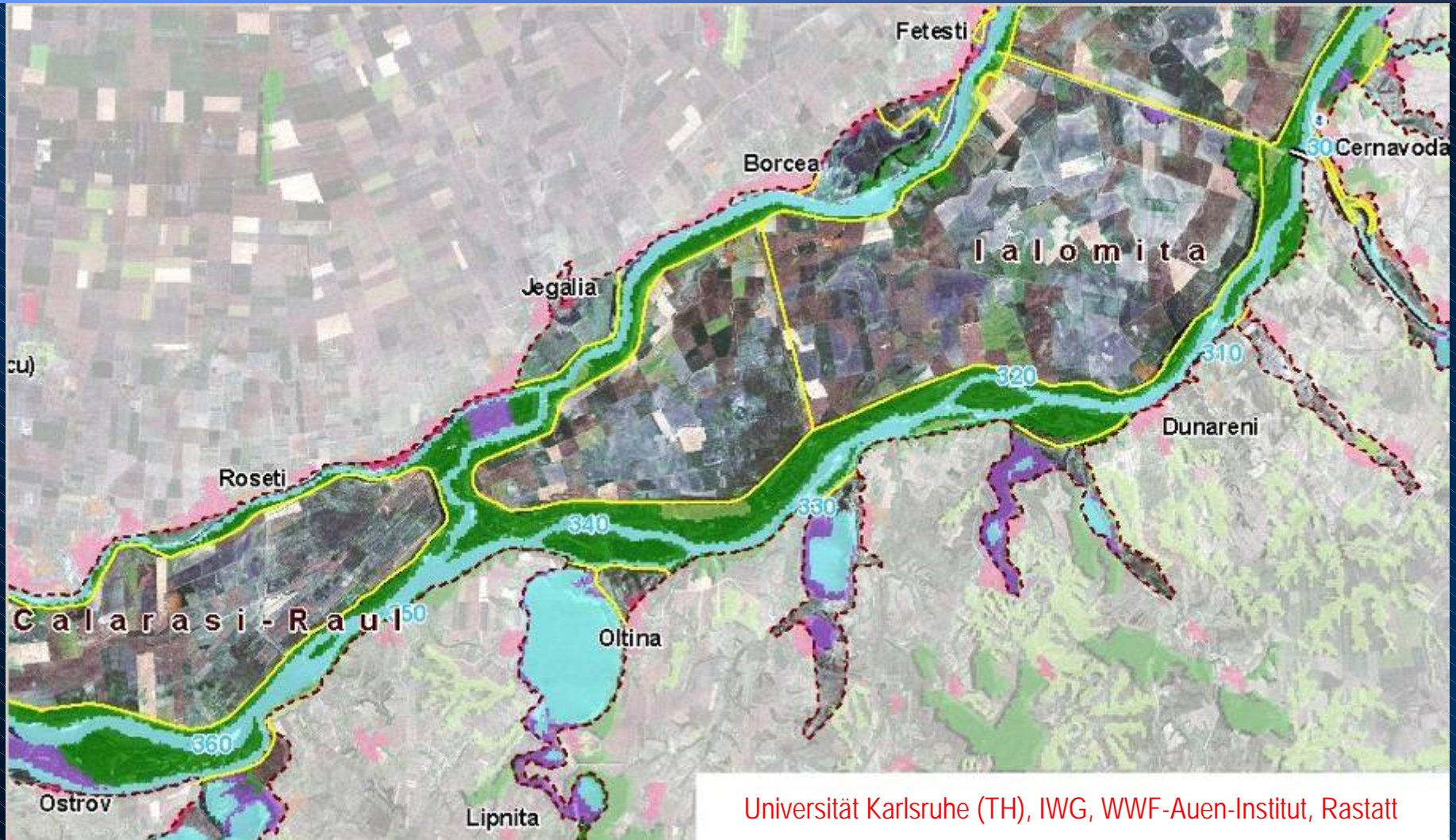
Foto: Bernhart

Integrated project preserving the river dynamics



Foto: Schneider

Including the regeneration of flood plains



Dynamic river systems with flood plains combine ecological needs and flood protection



Foto: Lötsch

Waterways of the future: Living rivers ...

(Danube at Dürnstein / Wachau)

Thank you for your attention !



Foto: Bernhart