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Maintenance and development of the Dutch Rhine

Margriet Schoor, Rijkswaterstaat

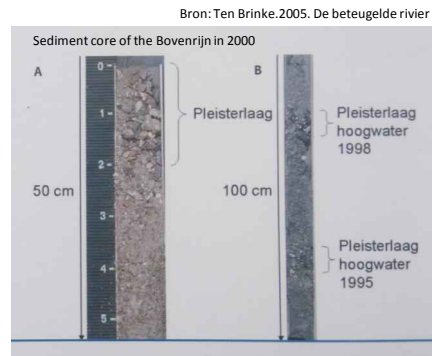
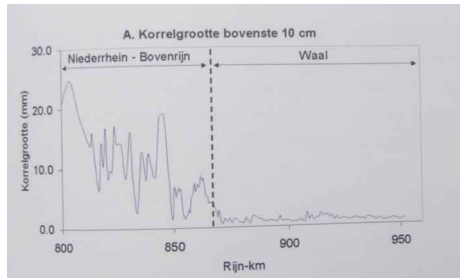
- River bed sediments
- Shipping and sediment
- Sediment management



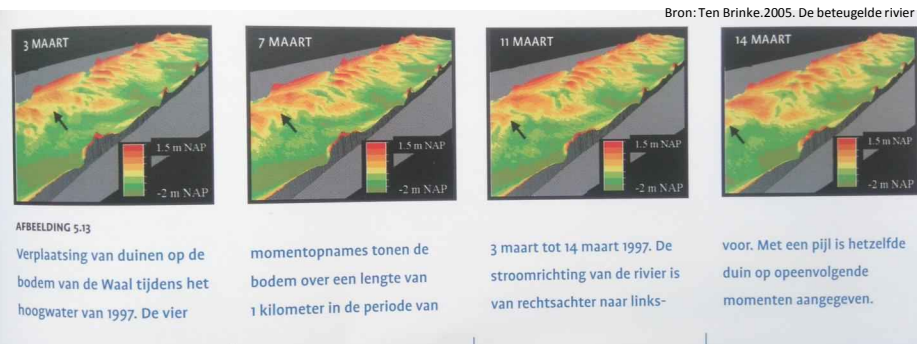
A constrained river with groynes



A riverbed of sand and fine gravel



Moving dunes on the river bed



Dune hight: 1,5 – 2 m during high water
Becomes lower in time



High water & sediment

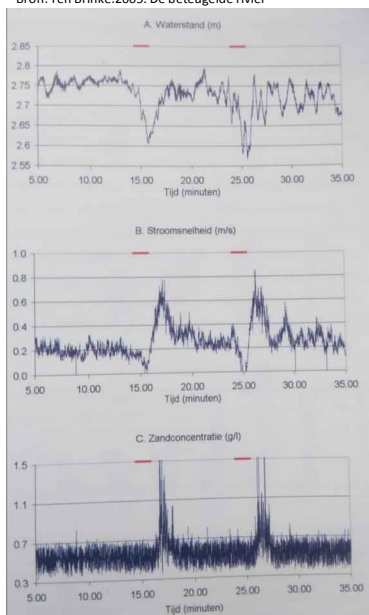
During high water, sand is deposited in groyne fields



1998 © Kees Nuijten



Bron: Ten Brinke.2005. De betegelde rivier



Ships & sediment -1-

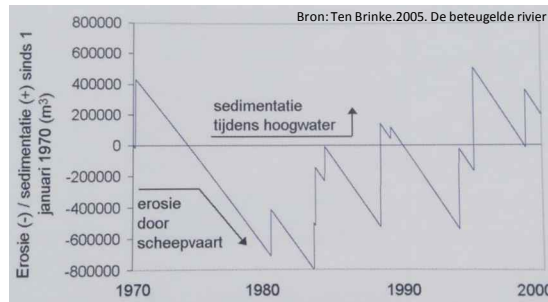
In groyne fields ships passages lead to:

- A. Lowering of the water level
- B. Increase in flow velocity
- C. Peaks in sand concentration

So ships make the sand move from the groyne fields to the river bed



equilibrium in groyne field

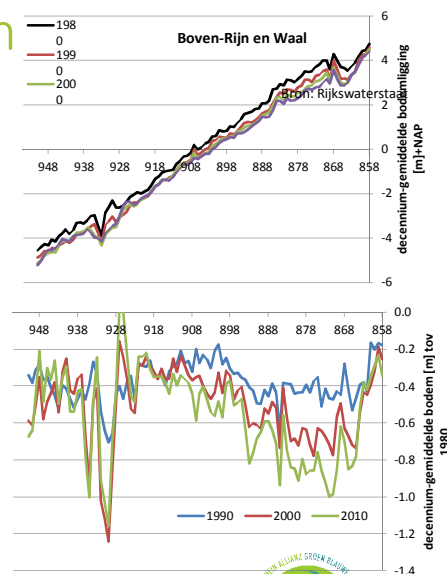


1. Over time in the groine fields, sedimentation during floods and erosion by ships are in equilibrium sinds 1850
2. The riverbed is eroding (het verhaal van de rivier).



River bed erosion

Boven Rijn 2 cm/jr
 Tiel 1 cm/jr
 Zaltbommel 0 cm/jr



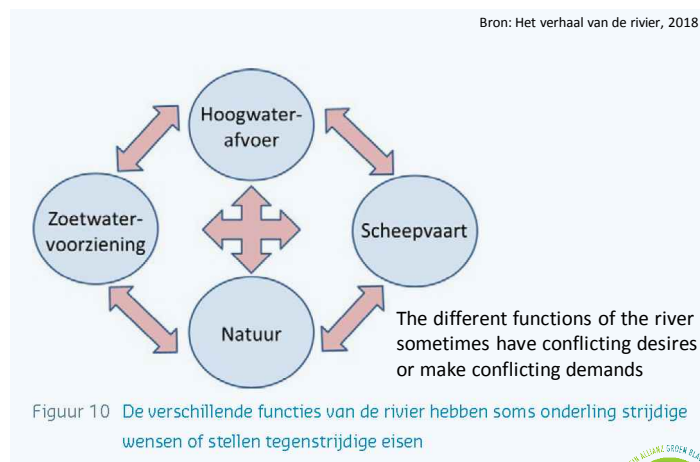
Ships and sediment -2-

At low water: ships plow the river bed



River maintenance

Bron: Het verhaal van de rivier, 2018



Standards for navigation depth

Bron: L. Jans *et al* 2018

Vaarweg	Vaarwegklasse	Zone I: Vaargeul	Zone II: Vaarweg buiten de vaargeul
Bovenrijn en Waal	Klasse VIb (Tb=2,0 m)	OLR-2,80 m ¹	80 cm ondieper dan zone I
Pannerdens kanaal	Klasse Vb (Tb=1,8 m)	OLR-2,80 m	100 cm ondieper dan zone I
Nederrijn en Lek	Klasse Vb (Tb=1,8 m)	OLR-2,80 m ²	100 cm ondieper dan zone I
IJssel	Klasse Va (Tb=1,8 m)	OLR-2,50 m ³	70 cm ondieper dan zone I

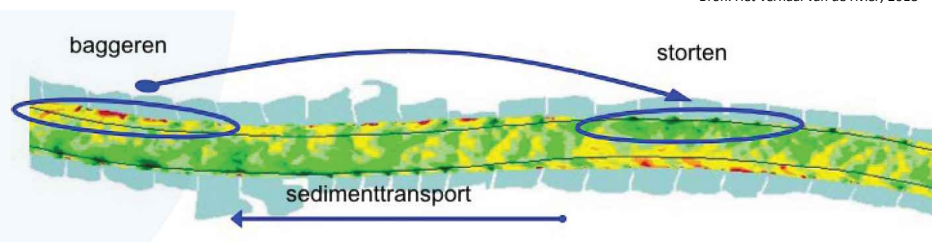
OLR = overeengekomen lage waterstand (5% low water)

- Dredging contract to keep the navigation depth within the standards
- Every 2 weeks control surveys of the river bed height
- As less as possible (€)



Sediment management

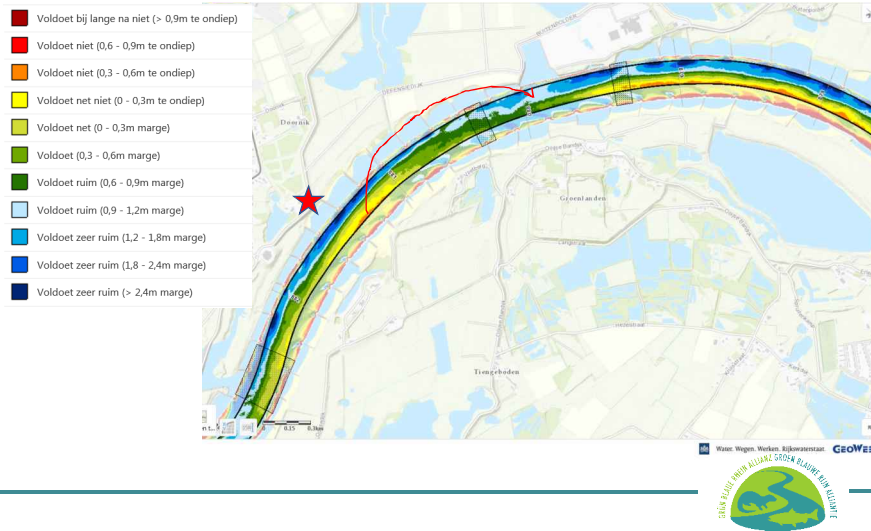
Bron: Het verhaal van de rivier, 2018



Dredging and upstream returning
To prevent ongoing river bed erosion
Also 'plowing' the river bed (€)
No dredging zones (cables and pipes)



Sediment management near De Sprok



Sediment management & fish

- The river bed consist of fine gravel and sand
- The bed sediment is moving due to
 - natural sediment transport
 - Ship induced sediment transport
 - Sediment management
- The river bed is probably not a good habitat for benthic fauna
- What about the fish?

