

# Structural measures for the near natural development of the Neckar in Mannheim

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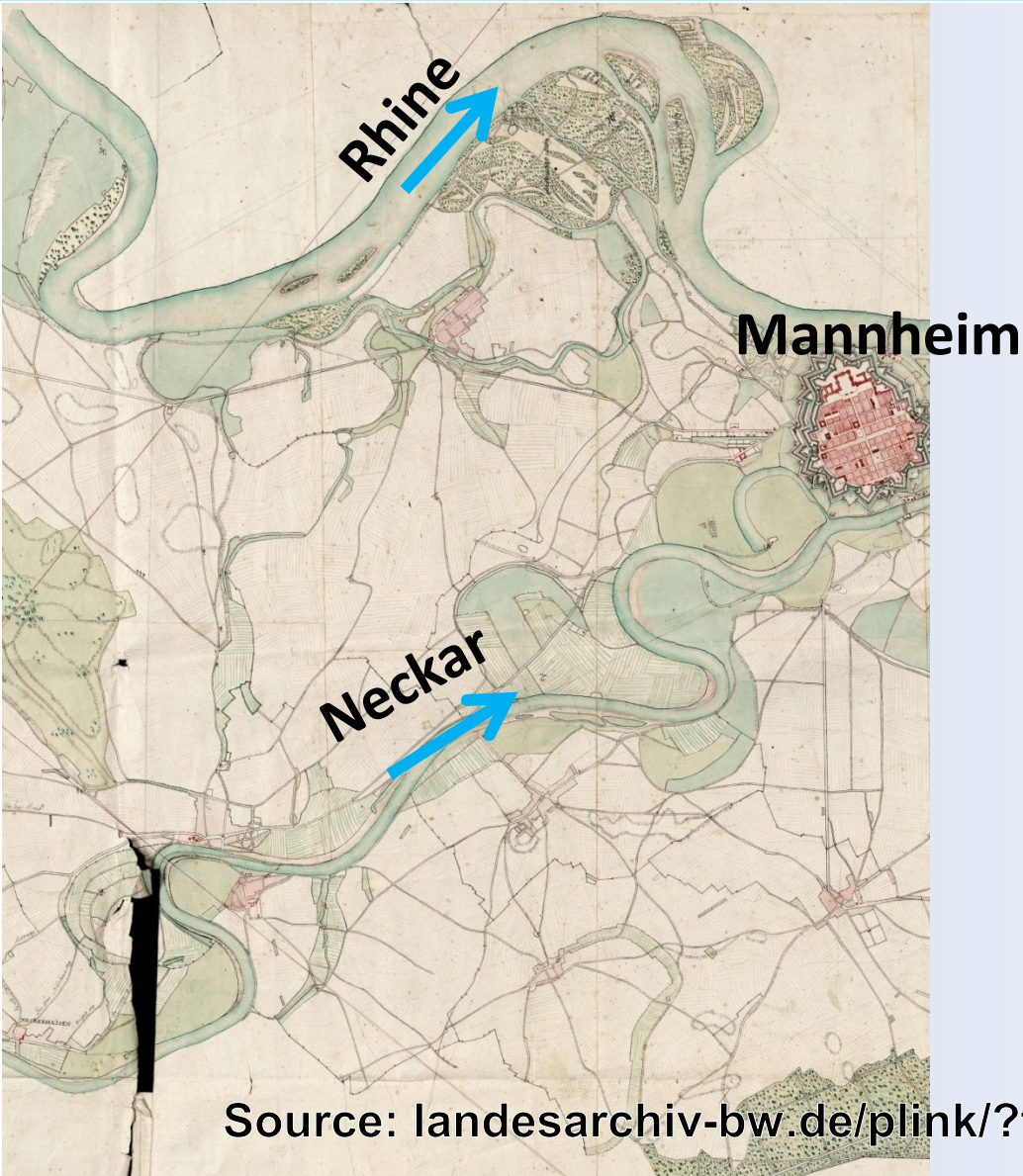
April 15th 2024

# Agenda

- River Neckar
- Situation of the Neckar in Mannheim
- First concepts for structural improvements
- From first sketches to detailed plannings
- Detailed plannings
- Funding of the project
- Preparational works
- Realization of the first project stage „WEST“
- Challenges
- Success of the project
- Next steps

## River Neckar

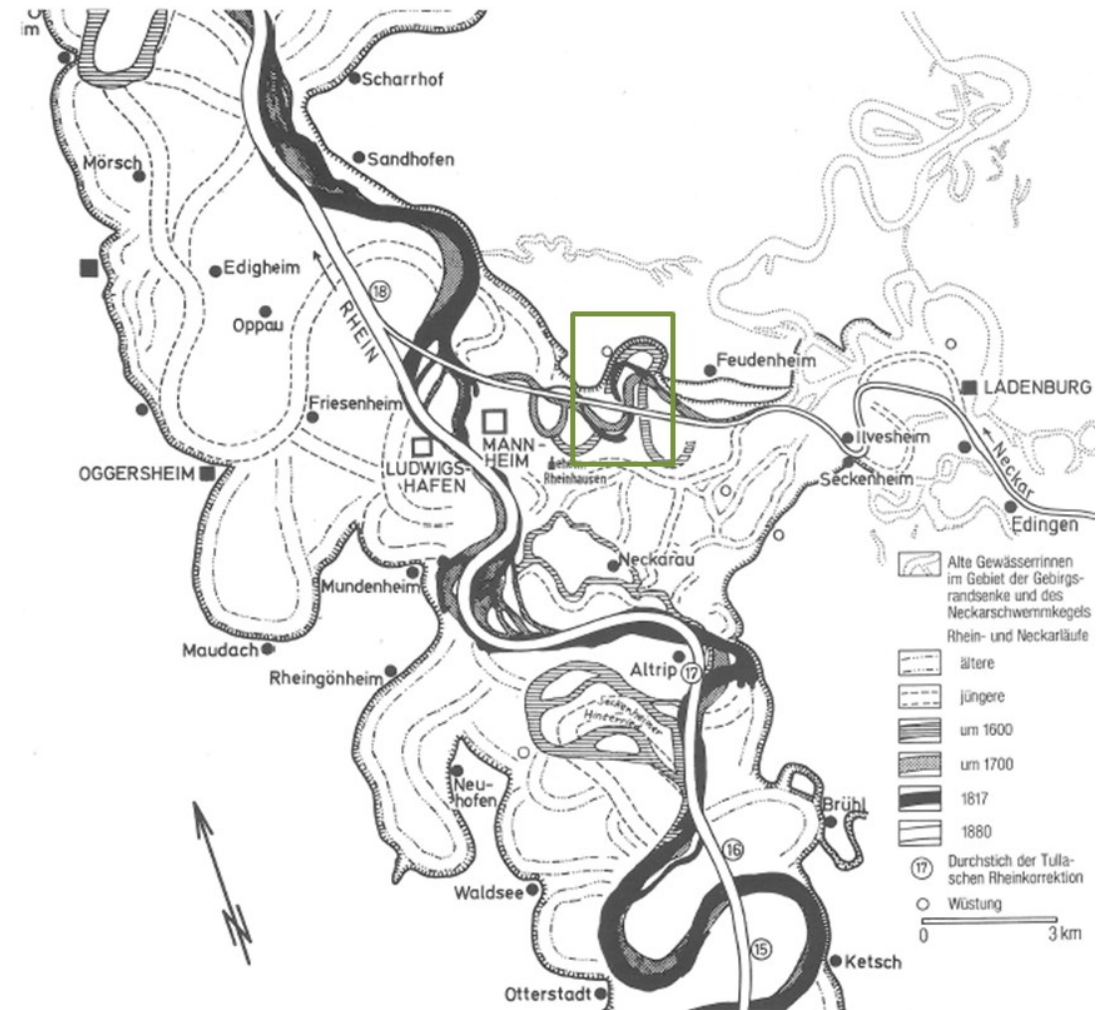
- The Neckar is the fifth largest tributary of the Rhine
- twelfth largest river in Germany
- Initially a typical meandering lowland river
- Mouthes in Mannheim into the Rhine



Source: [landesarchiv-bw.de/plink/?f=4-1723659-1](https://landesarchiv-bw.de/plink/?f=4-1723659-1)

# River Neckar

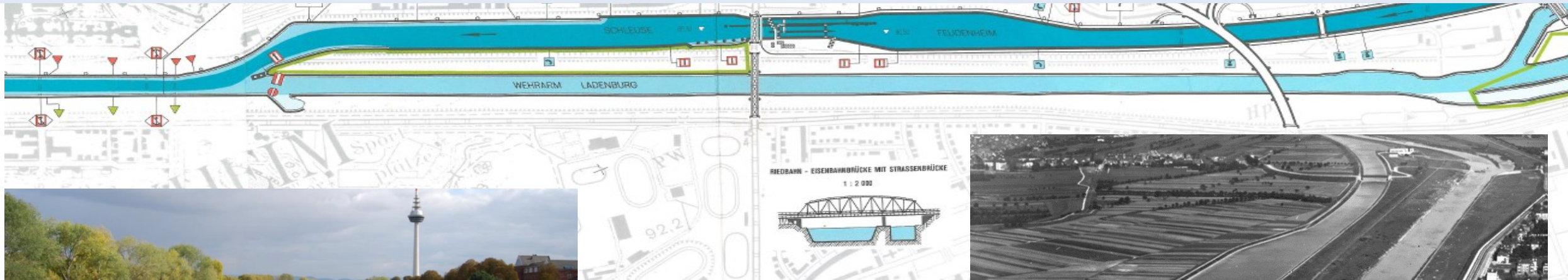
- Correction works have been implemented for many centuries
- Rectification of the Neckar in the project area in the late 18th century!



# River Neckar

- Latest rectification and construction of a shipping channel and hydro power station in 1920's

Source: Verkehrskarte Neckar

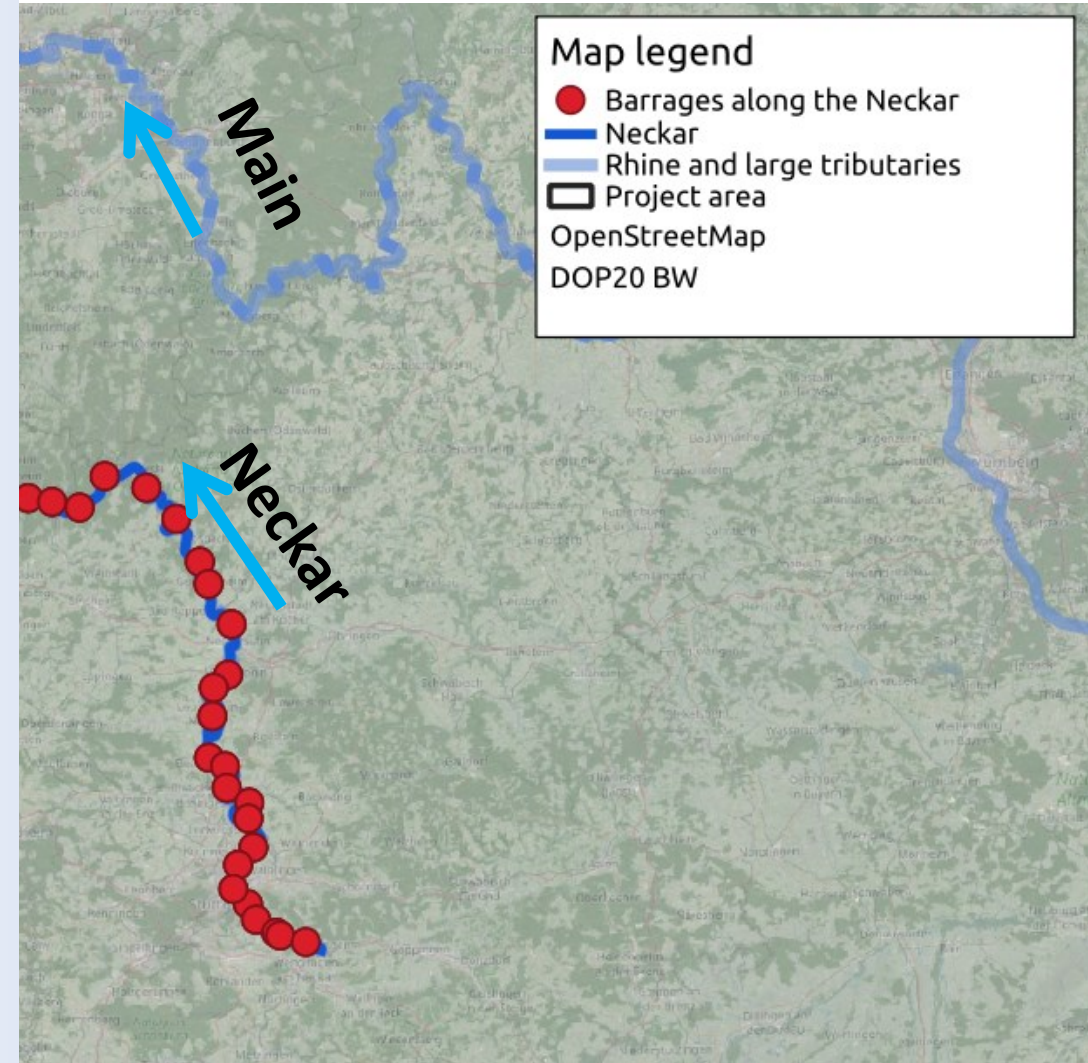


# Situation of the Neckar in Mannheim

- Last free-flowing section is located near Mannheim
- In contrast to the further, upstream course, there are no dams here and no water abstraction for hydropower utilization.

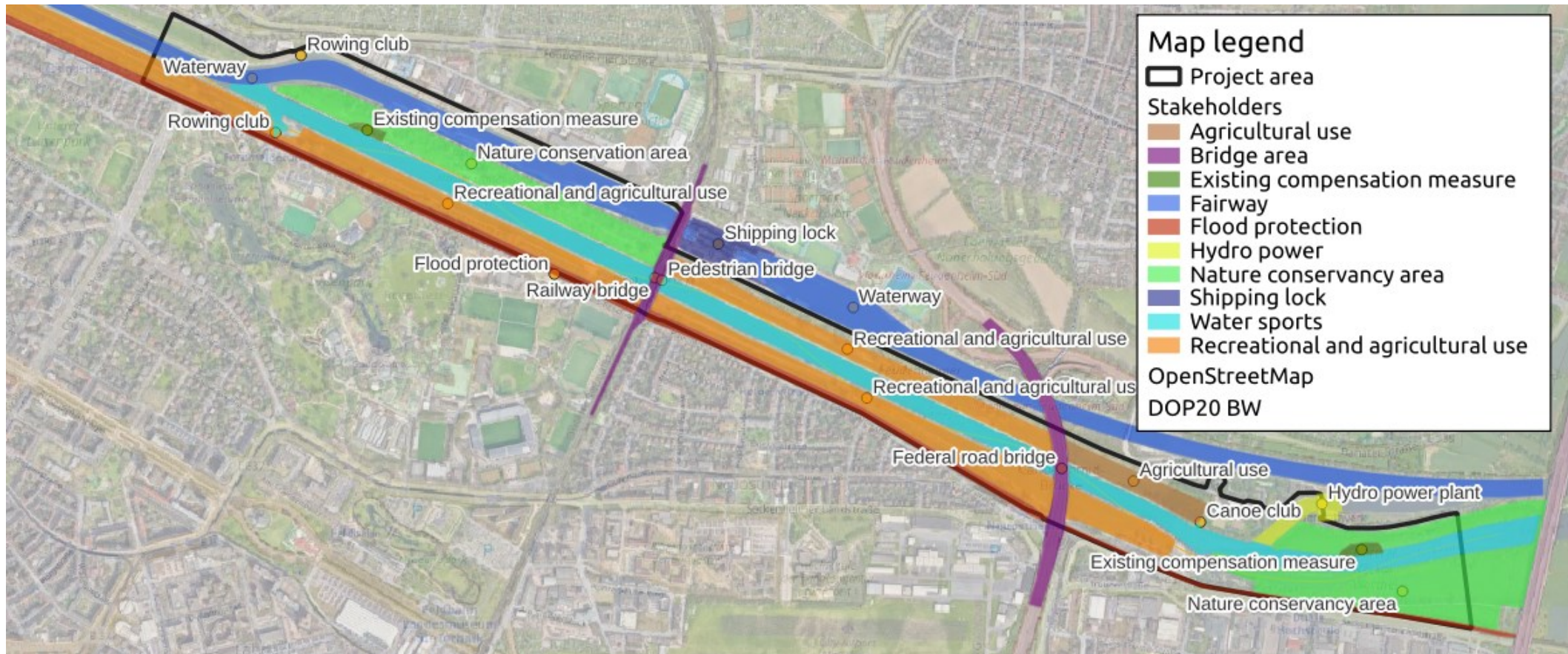
Project area

Rhine



# Situation of the Neckar in Mannheim

- Area of conflict between hydropower operation, flood protection, inland navigation and various uses of the foreland



# First concepts for structural improvements

- In order to improve the hydromorphological characteristics
- to face the European Water Framework Directive
- Identification of protective goals
  - Nature (Fishes and Birds)
  - People of Mannheim (Accessibility, awareness for flowing rivers)
  - High water protection (retention volume)

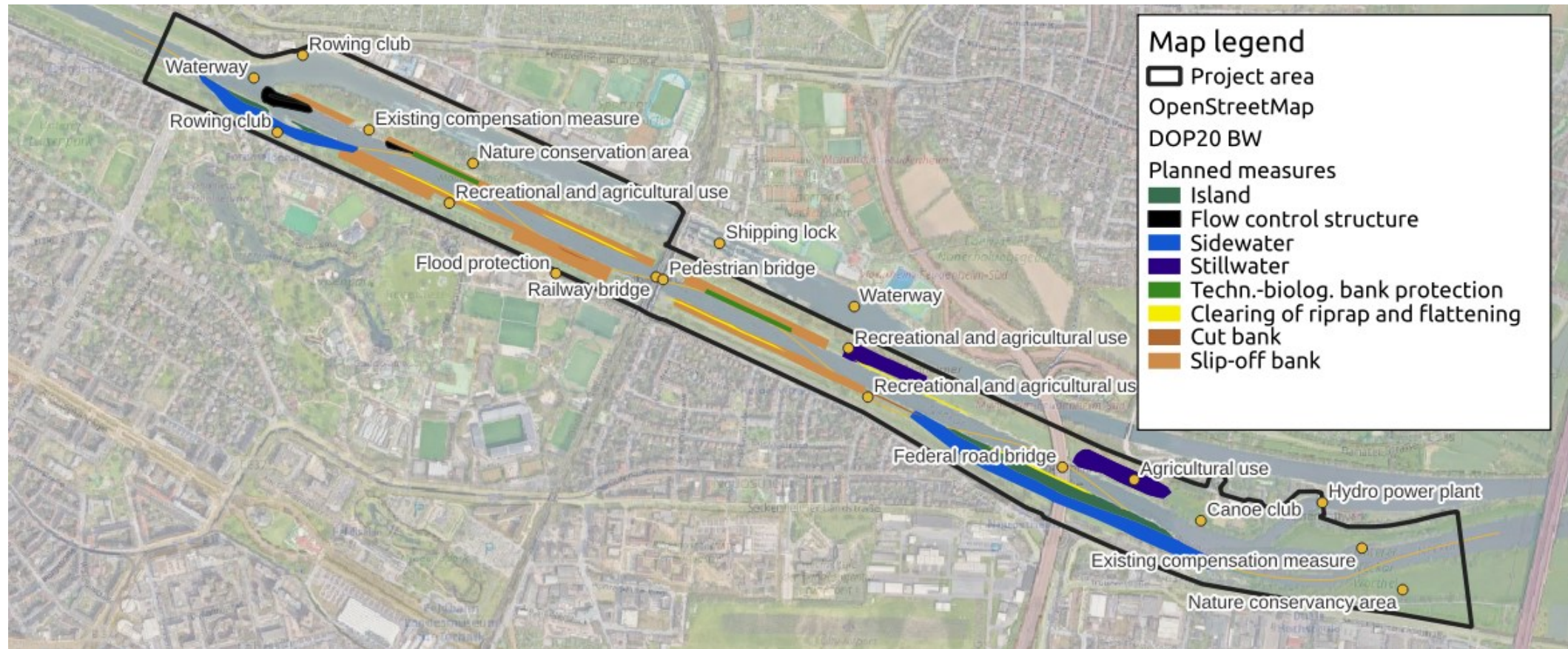


River bank before project start (own picture)



# From first sketches to detailed plannings

- Development of more adapted measures to meet restrictions



# From first sketches to detailed plannings

- Design of measures
  - Clearing the banks of riprap on more than 3 km on both banks
  - Flattening the banks with 1:8 in areas, where people get connected with the river and 1:4 in other areas
  - Creating slide-off and cut banks to give the stream a slighty meandering course
  - Establish flowing sidewaters with protected areas and stillwaters
  - Installation of in-stream measures

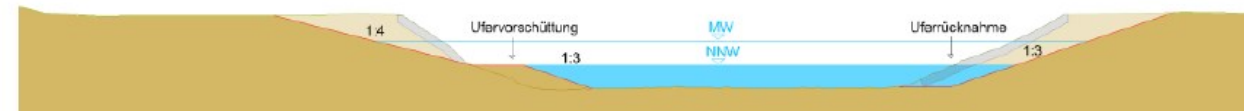
# From first sketches to detailed plannings

- Concept for flattening the banks and create a slightly meandering course

before:



after:

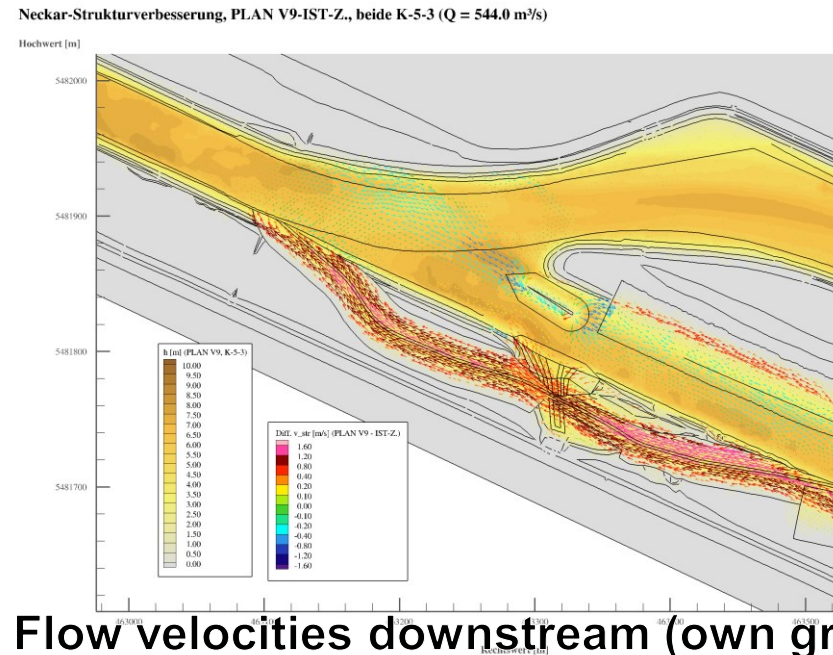
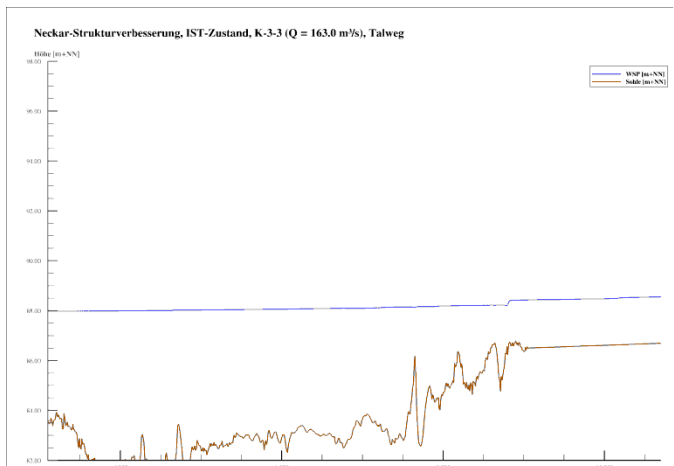


# Detailed plannings

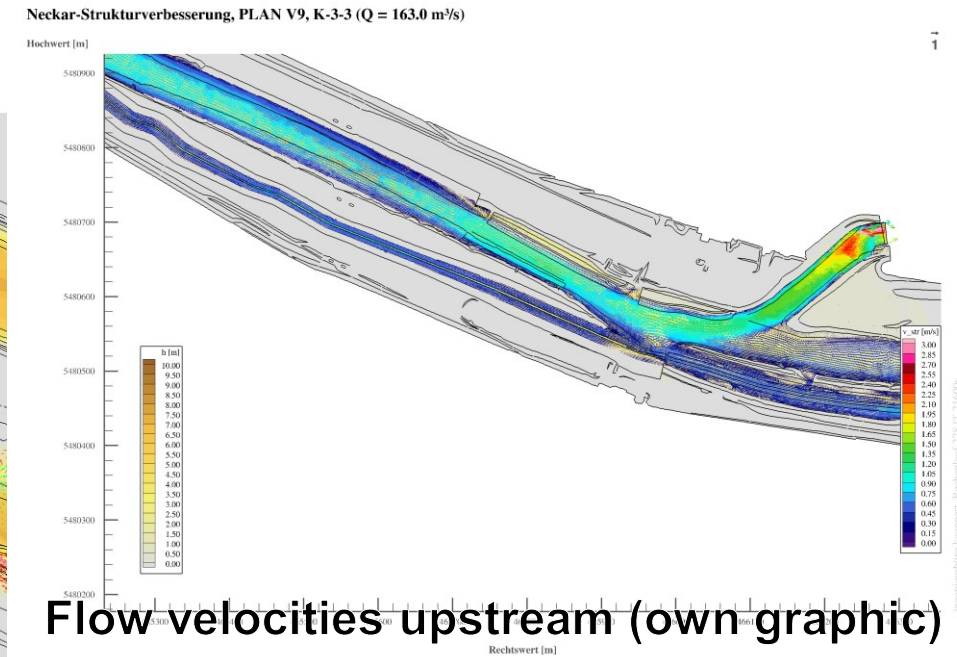
- 3d-Modelling of about 3.5 river kilometers for the original site and design state
- Exploration of explosive ordnance
- Soil investigations
- Etohydraulic design of measures
- Studies and concepts for protection of species within the construction works

# Detailed plannings

- Hydronumerical optimizations with several improved variants
- Hydronumerical studies to investigate possible effects on
  - Shipping
  - Hydro power
  - Recreational use



Flow velocities downstream (own graphic)

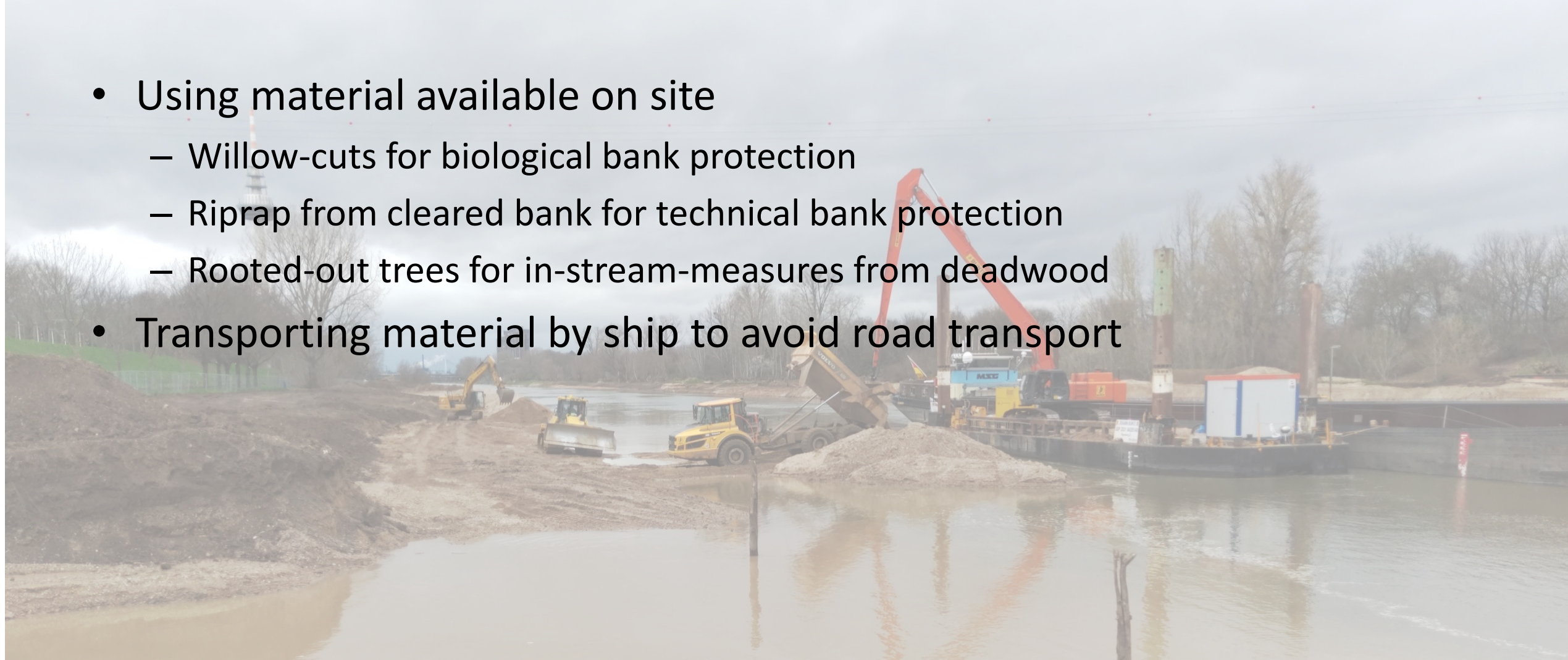


Flow velocities upstream (own graphic)

Calculated surfaces (own graphic)

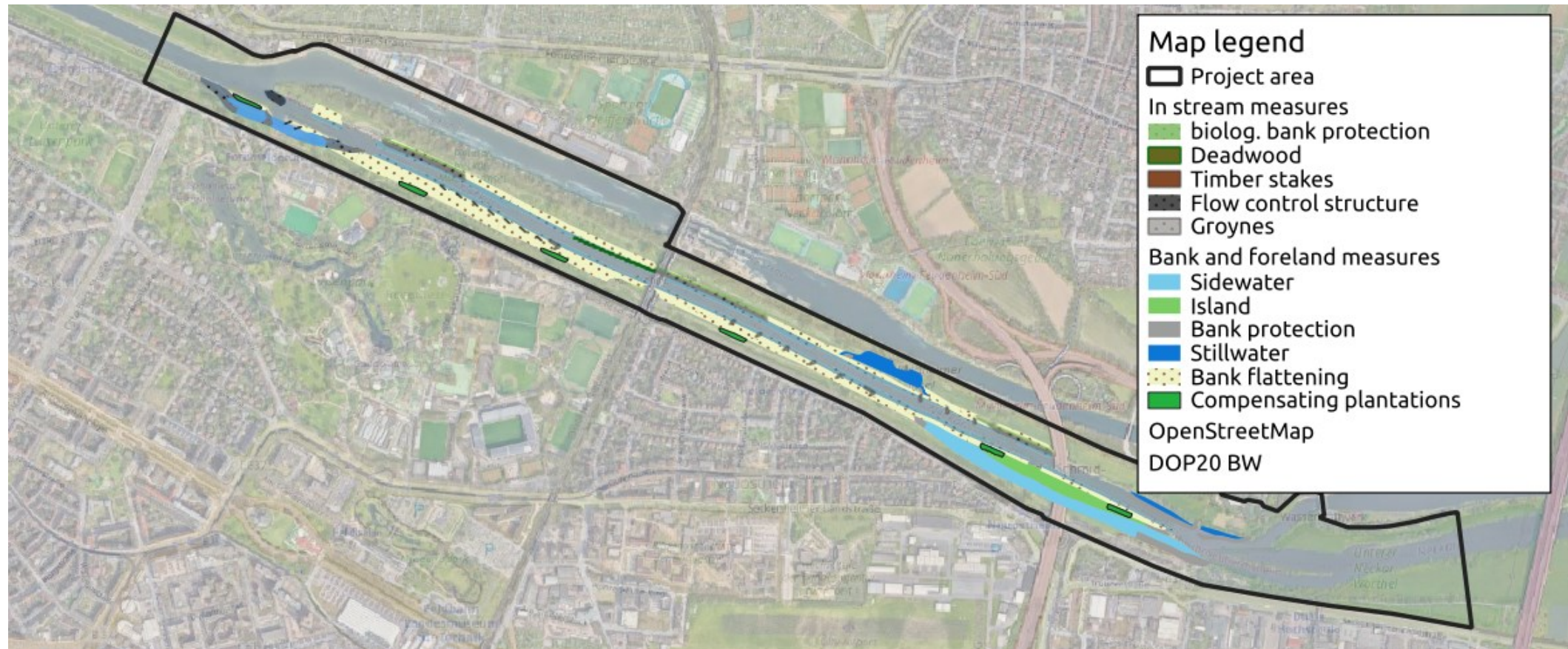
# Detailed plannings – environmental aspects

- Using material available on site
  - Willow-cuts for biological bank protection
  - Riprap from cleared bank for technical bank protection
  - Rooted-out trees for in-stream-measures from deadwood
- Transporting material by ship to avoid road transport



# Detailed plannings

- Development of a final design



# Funding of the project an realization

- About 85% funding from the regional council Regierungspräsidium Karlsruhe
- Funded by a directive to reach the goals of the EU water framework directive
- Realization of the first project stage within a nationwide garden fair, the BUGA23
- Planned realization of the second project stage by the city of Mannheim



Baden-Württemberg

REGIERUNGSPRÄSIDIUM KARLSRUHE



STADT MANNHEIM <sup>2</sup>



# Preparational works

- Measures to protect flora and fauna



Over 7 km protection fence for lizards



Fish evacuation before working on banks und riverbed



Building and installation of birdhouses (BUGA23)

# Preparational works

- Removal of explosive ordnance above and below water



Found shell



Diving for explosive ordnance



Removal of a blind shell



Found anchor



250 kg bomb in the Neckar foreland

# Realization of first project stage „WEST“

- Removal of riprap



Partly cleared river bank



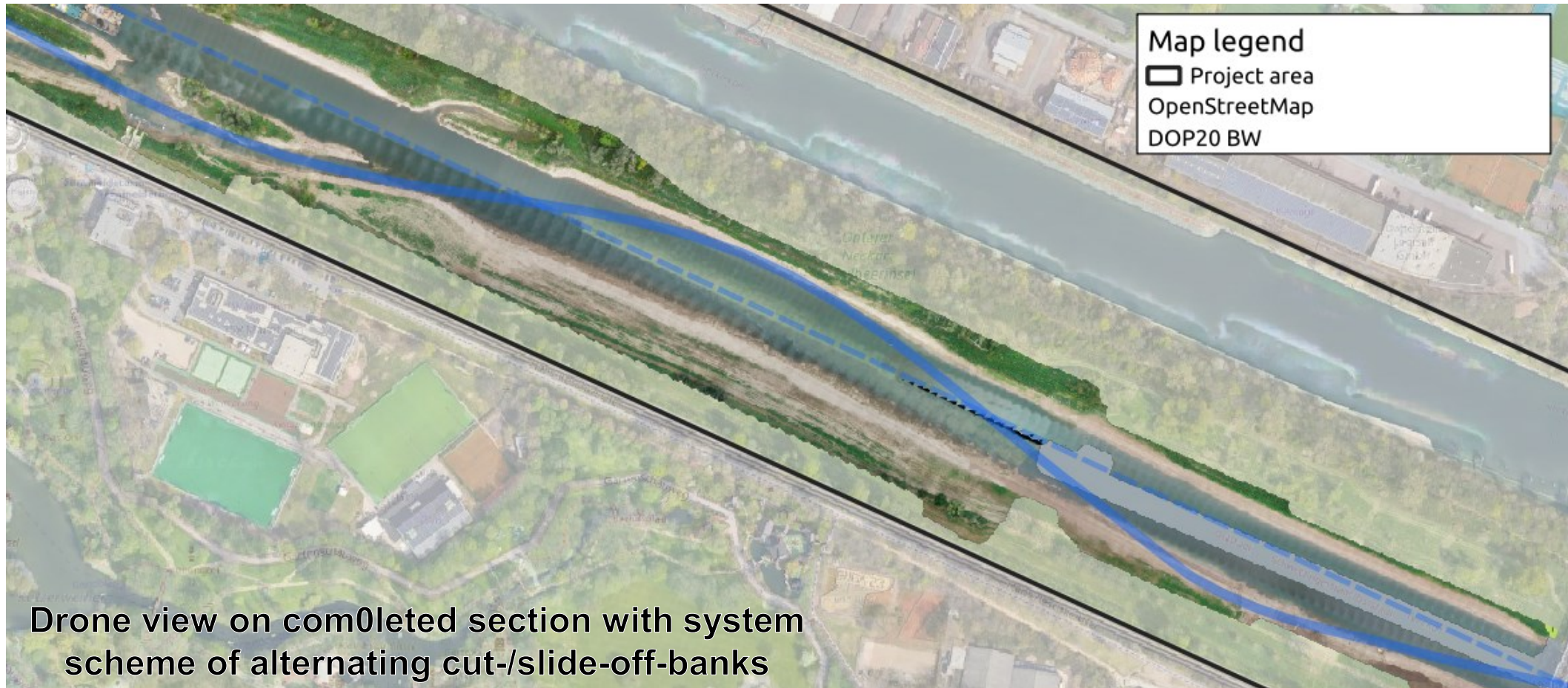
Parallel removal of riprap on both banks



Removed rip rap

# Realization of first project stage „WEST“

- Creating a slightly meandering course



# Realization of first project stage „WEST“

- Creating a slightly meandering course



View at slightly meandering course from downstream



Aerial view at slide-off bank after completion (BUGA23)

# Realization of first project stage „WEST“

- Creating a new sidearm



# Realization of first project stage „WEST“

- Creating a new sidearm



Last work on downstream confluence



Excavation of the sidearm



Opening of the sidearm

# Hydraulic engineering works

- Construction of a flow control structure



Construction of the flow control structure



Flow control structure after completion



# Challenges



# Challenges



Construction sign – dry and wet

# Success of the project

- About 200,000 m<sup>3</sup> of soil has been moved
- About 20,000 m<sup>3</sup> riprap have been cleared from the banks and used as technical bank protection and flow control structure
- Over 100,000 m<sup>3</sup> additional retention volume
- More than 3,600 objects in the foreland and more than 1,500 objects in the river have been investigated within the clearing of ordnance
- For the people of Mannheim, an attractive, near-natural bank with access to the water has been created
- Improving the connection of the people with the Neckar and the awareness of natural waters have

# Success of the project

New side arm with protected islands



Diversified structures



Flattenend river banks



Varying depth areas



## Success of the project

- An increase in the fish and bird population is already evident, and new species have established.
- Whilst the construction work, the local beaver population was able to further establish itself and reproduce.

# Success of the project



Caught eels



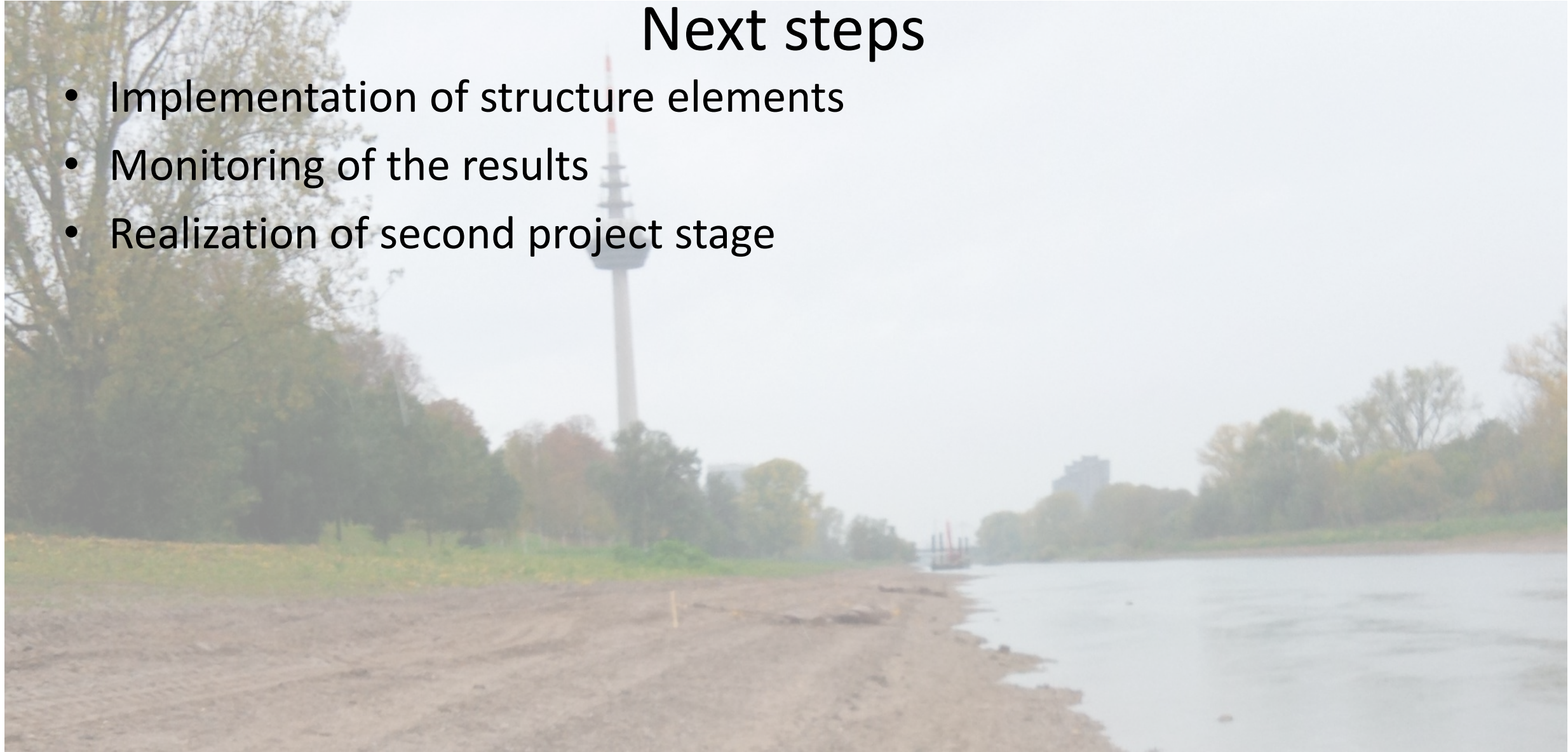
Prospering beaver population (IUS Weibel&Ness)



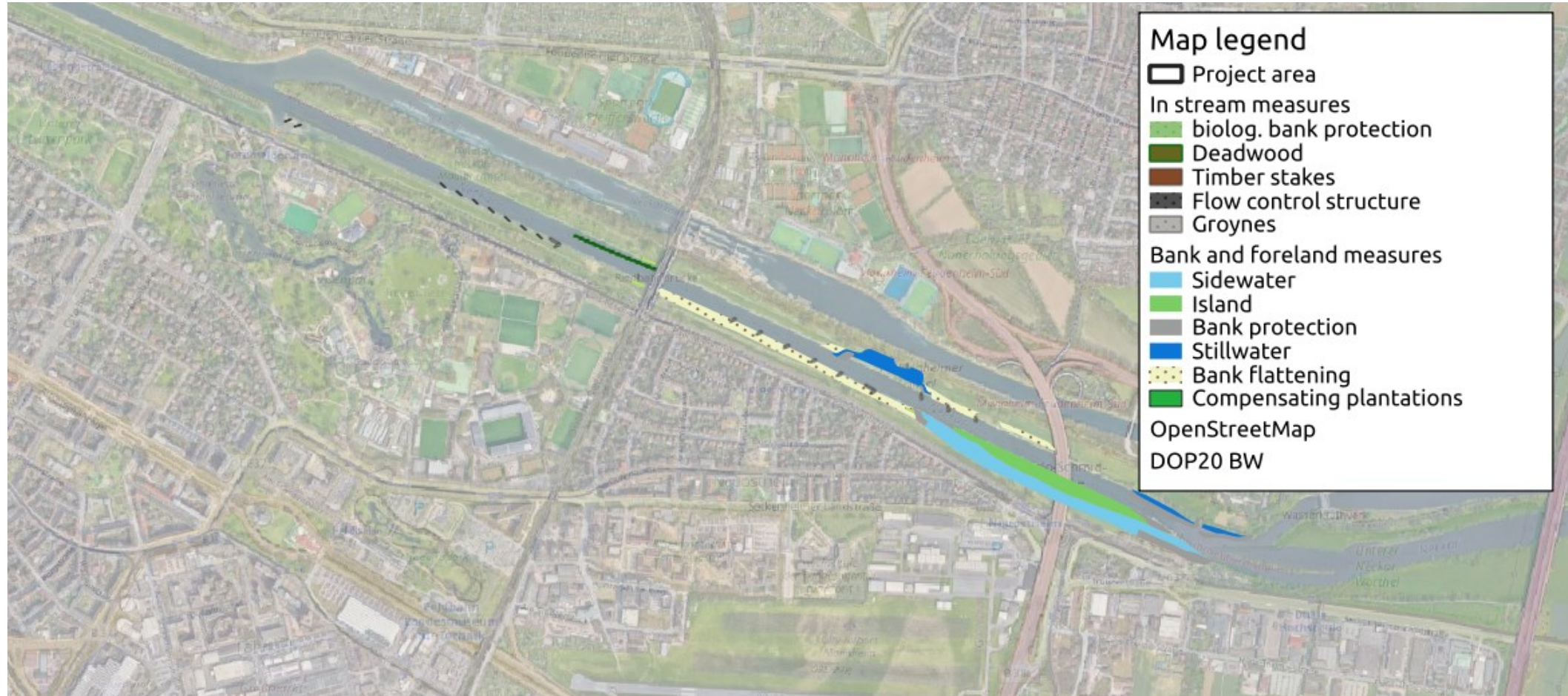
Stork population on protected island

## Next steps

- Implementation of structure elements
- Monitoring of the results
- Realization of second project stage



# Next steps





# Thank you for your attention!

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