

# Water knowledge



## **Coupled modeling of groundwater and surface water for renaturation planning in the National Park Lower Odra**

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1. The problem and the task
2. Method of coupling groundwater (FEFLOW) –  
surface water (MIKE 11)
3. Model application for the National Park

# 1. The problem and the task



**The National Park „Unteres Odertal“ is located along the Odra River between Hohenssaten and Mescherin/Staffelde.**

**The area amounts to 10.500 ha.**

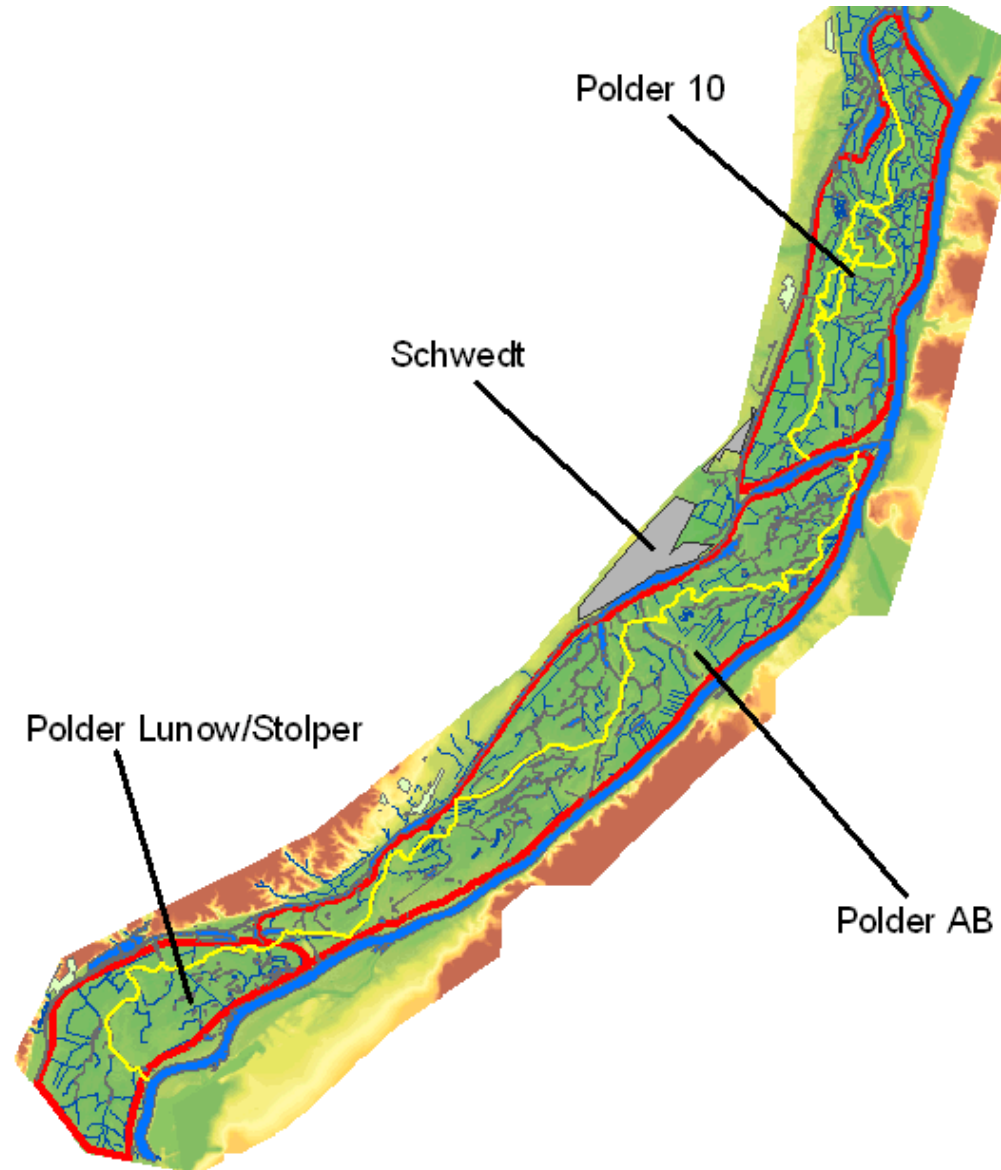


**On the Polish side there is the polish Landscape Protection Park Unteres Odertal (Park Krajobrazowy Dolina Dolnej Odry) with 6.000 ha.**

**Study area:**

**polders at German side of the park**





**For the National Park a series of measures has been planned, to improve the aquatic environment in the managed inundation area along the Odra river, above others:**

- **prolongation of flooding periods in Spring time**
- **construction of a parallel river through the park as far as possible employing existing small water courses**

**Major questions:**

**How the planned measures work, how do they have to be managed, what are the environmental and socio-economic impacts?**

**→ For impact analysis: coupled surface water groundwater model!**

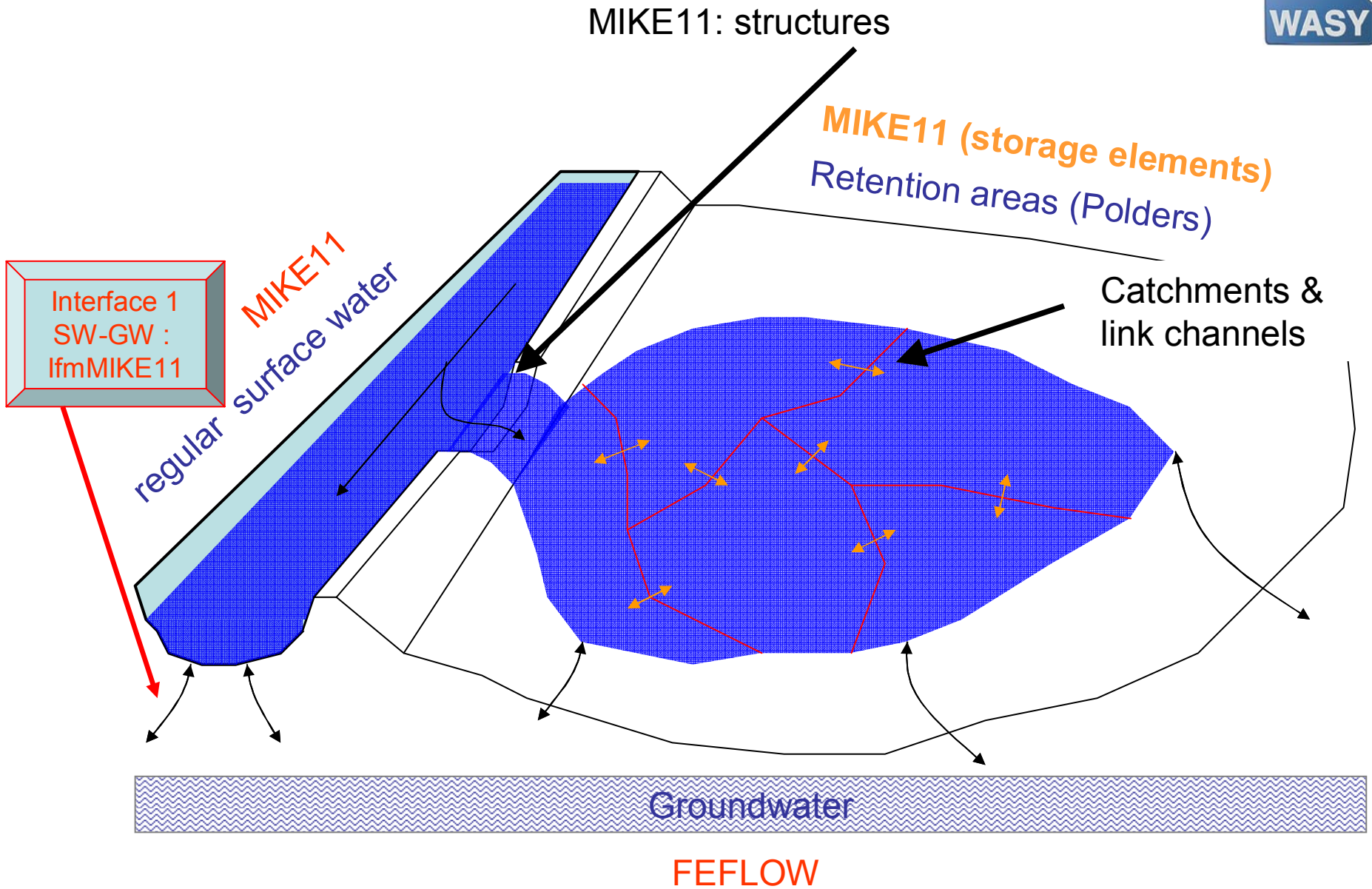
## 2. Coupled surface water groundwater model



### **Basics:**

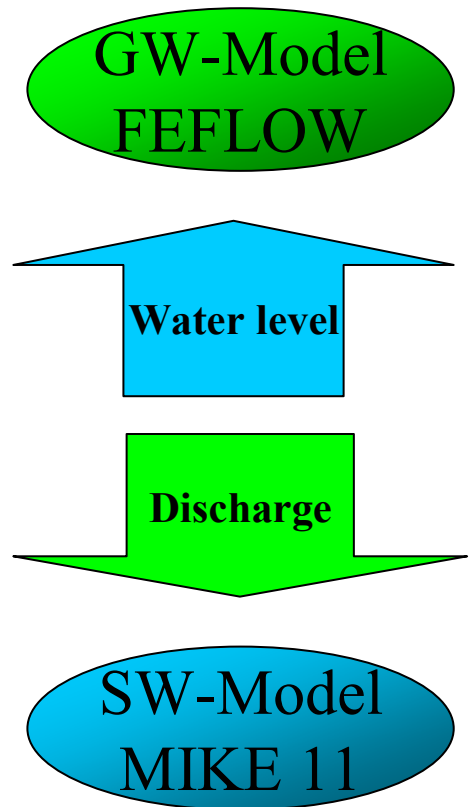
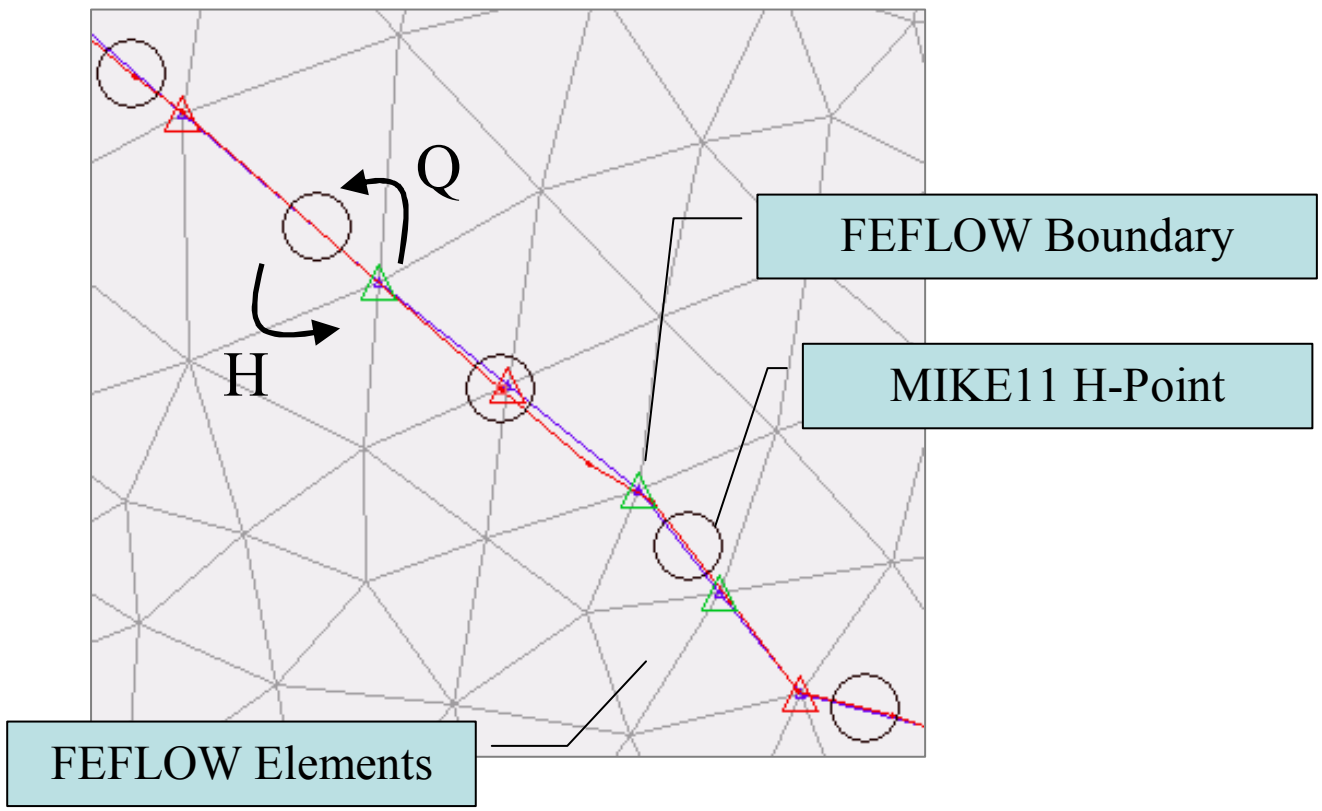
**Groundwater model → FEFLOW (WASY)**

**Surface water model → MIKE 11 (DHI)**





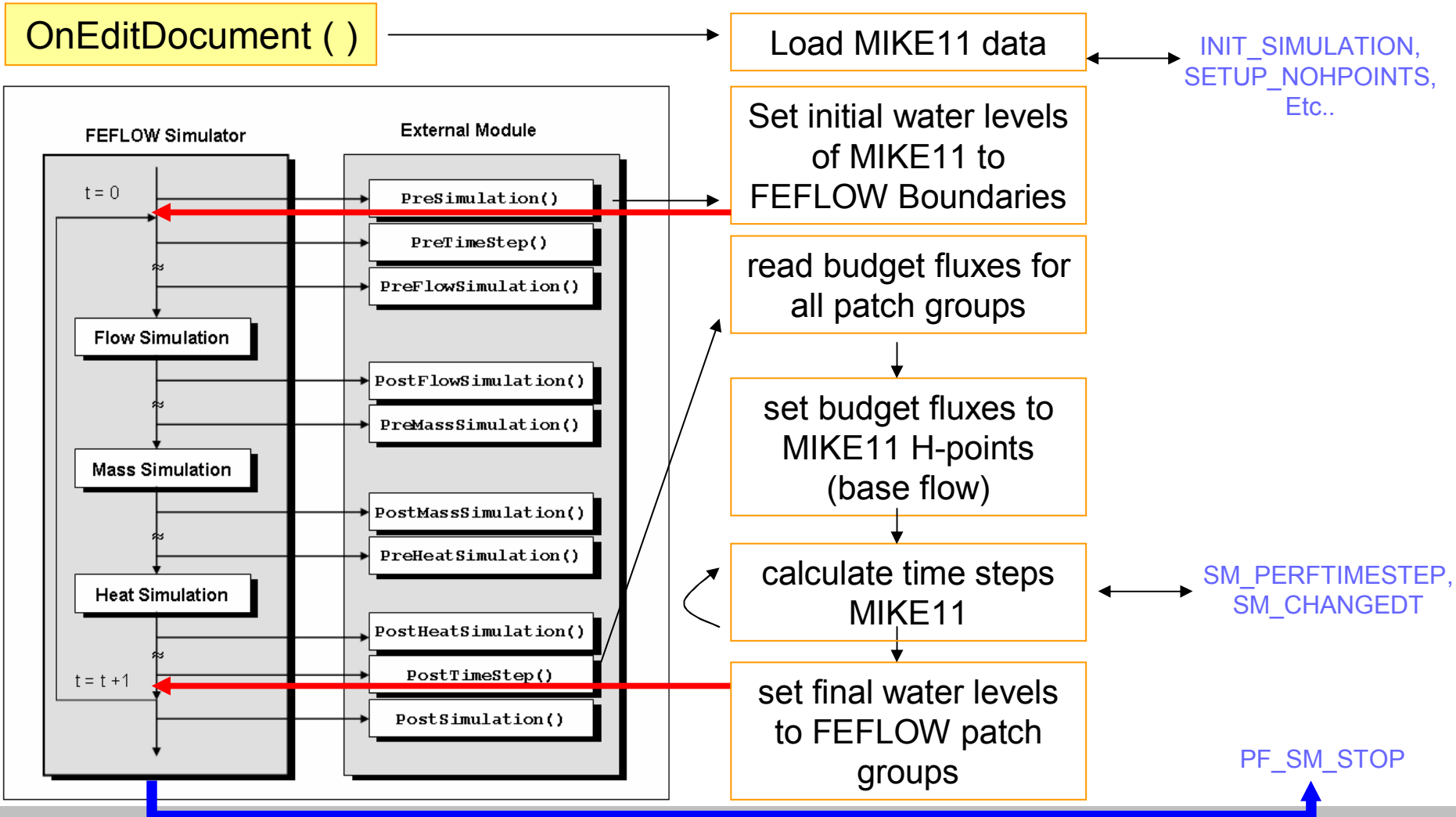
# Description of the Interface IfmMIKE11 : Principle of the coupling





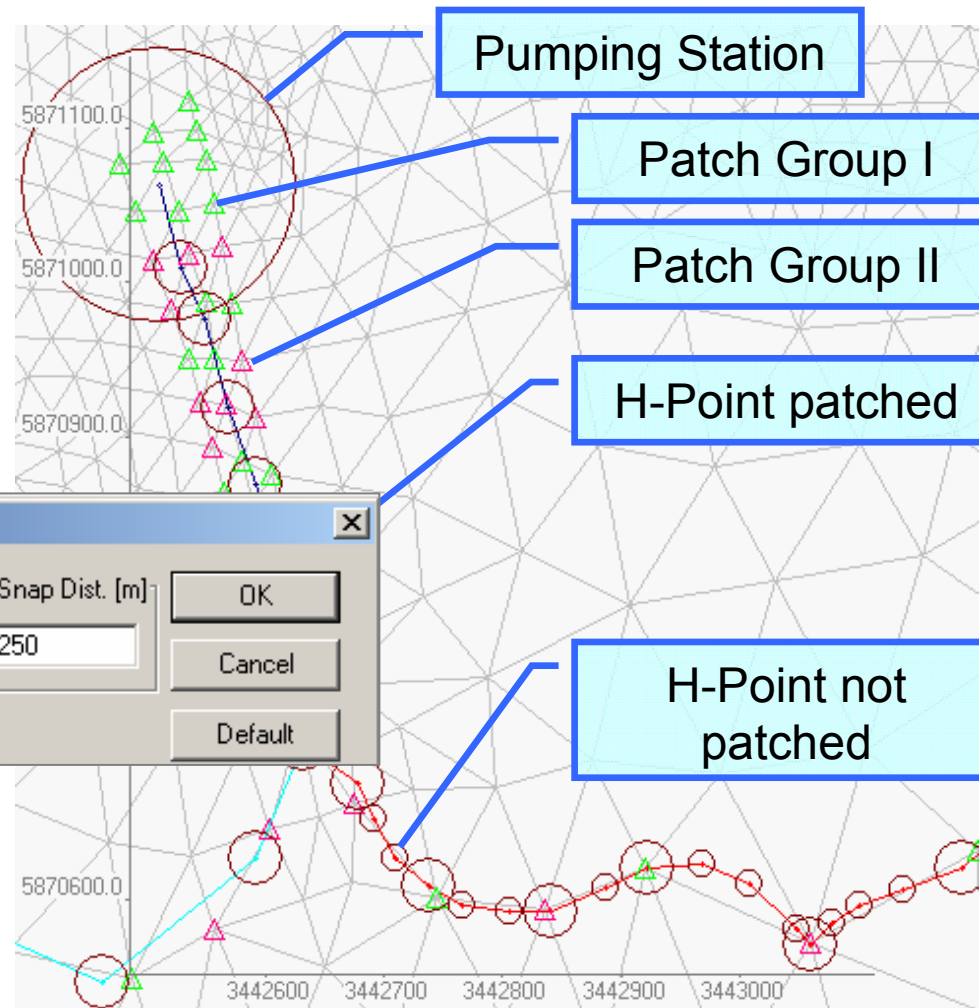
# Coupling: IFM Call-Backs

m11dll.dll



# Description of the Interface IfmMIKE11 : general patching

- ⇒ Observation Point Groups
- ⇒ Automatically



**Properties Simulation IFM MIKE11 Dialog**

Patch Option

Automatic (selected) | use only Transfers

Automatic

Obs. Groups

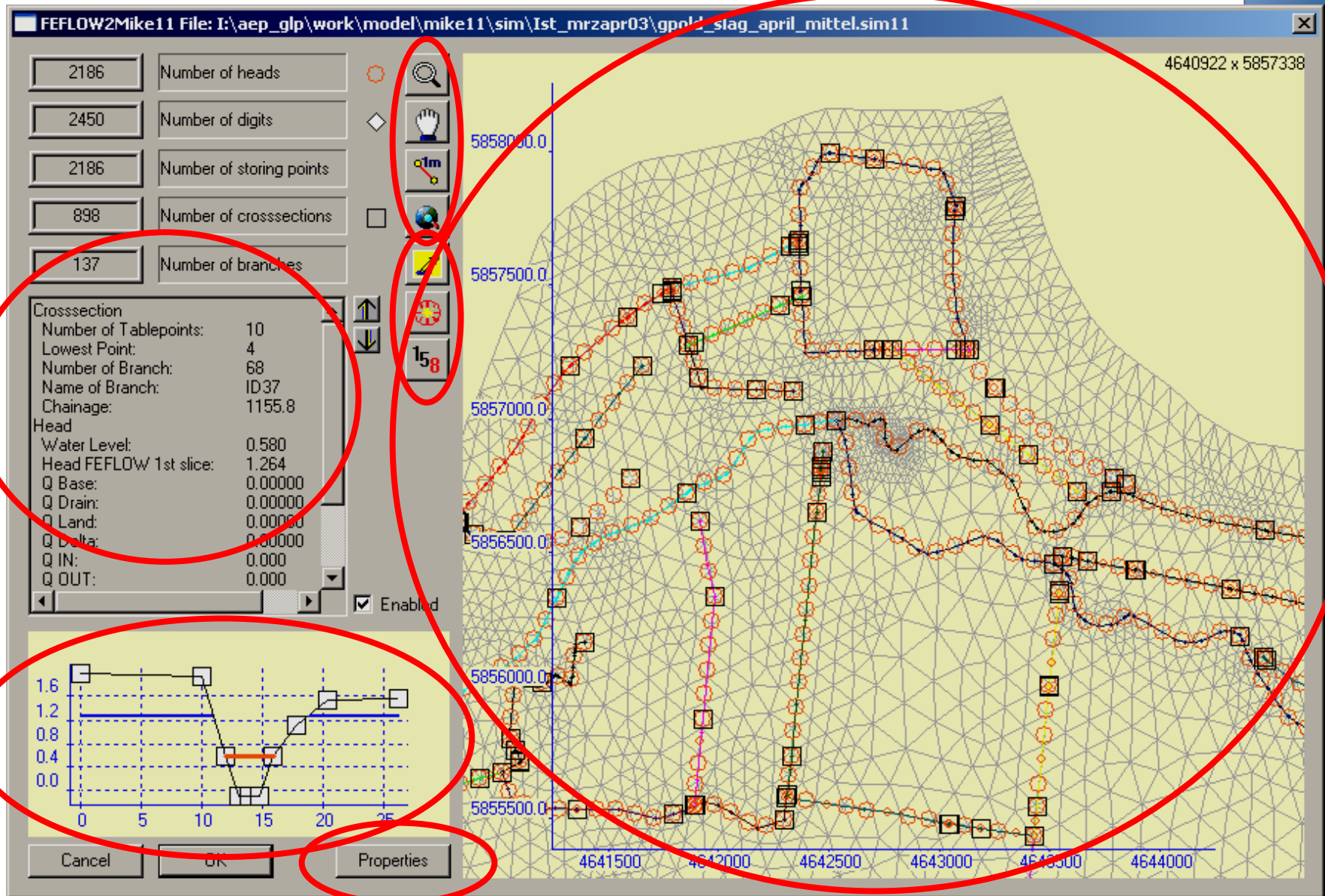
Snap Dist. [m]: 250

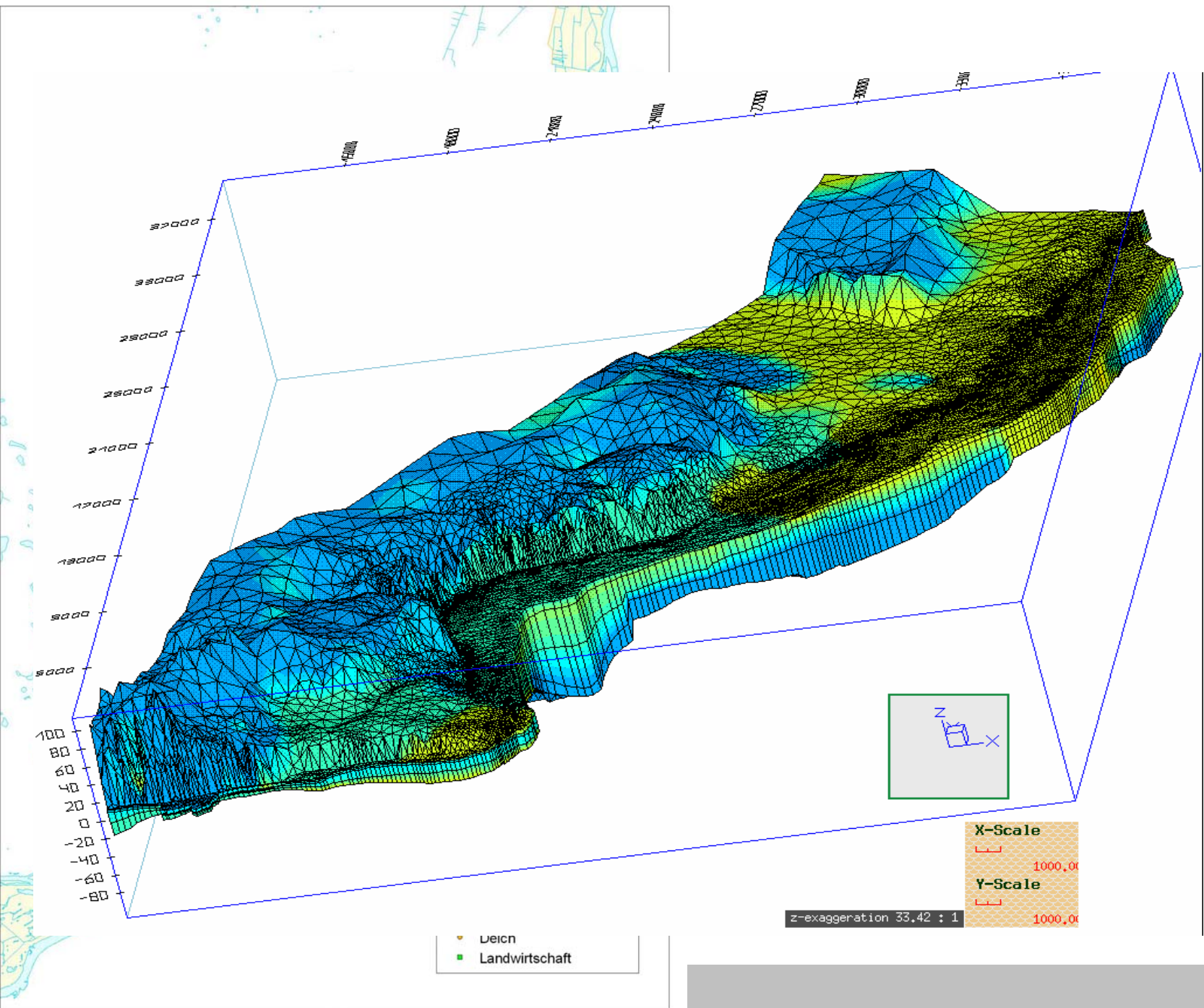
OK

Cancel

Default

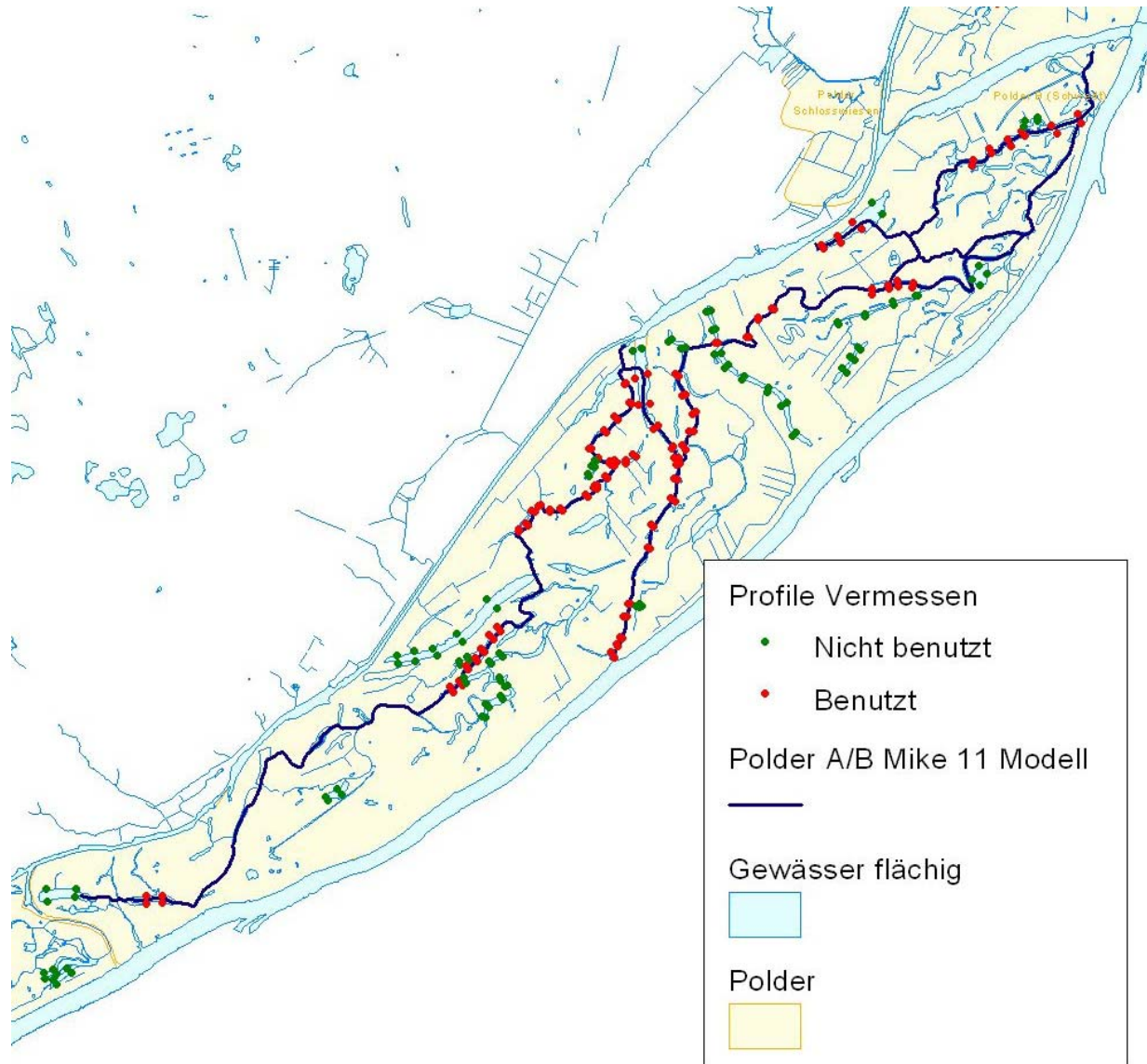
# Verification of spatial assignment (GUI)



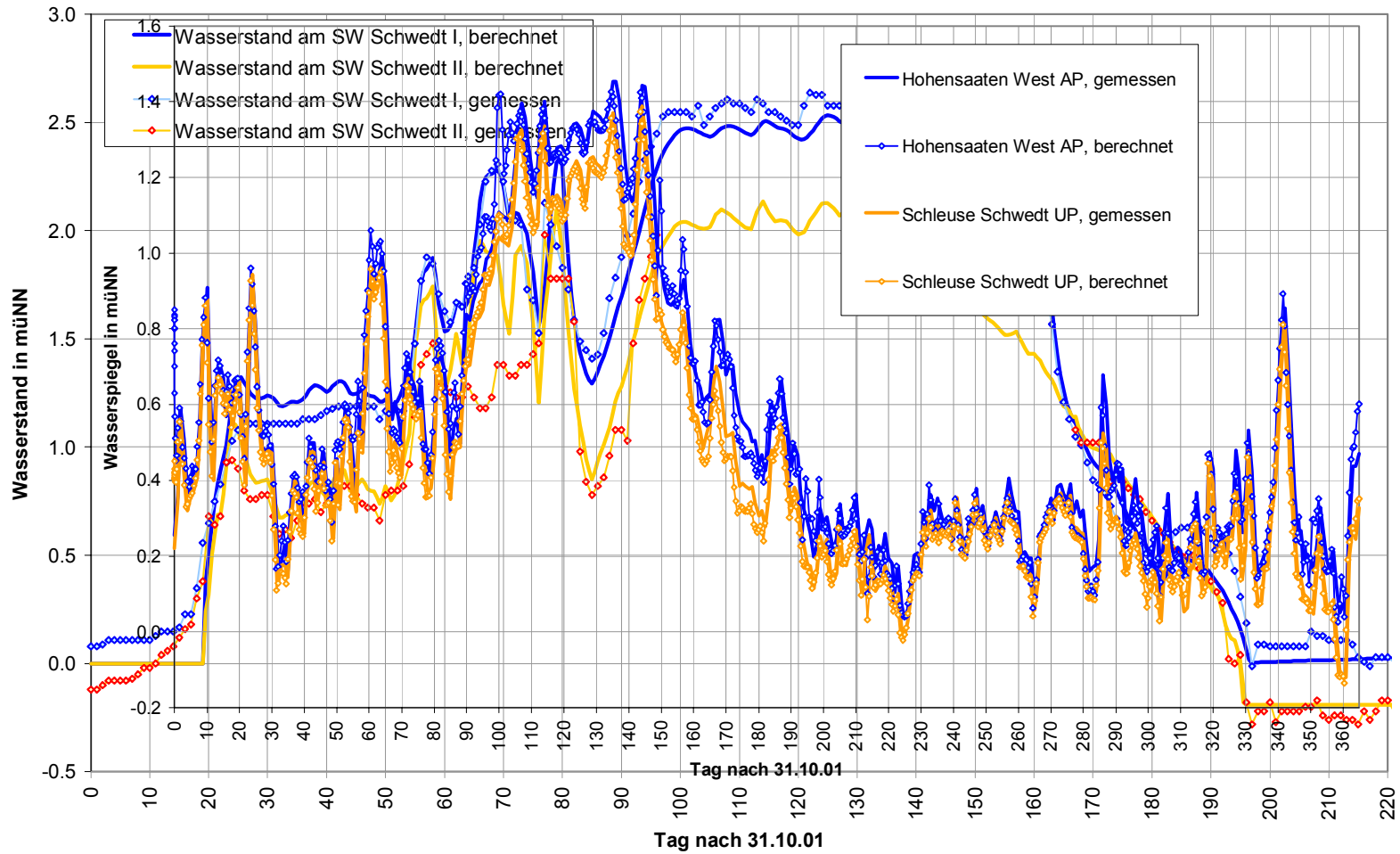




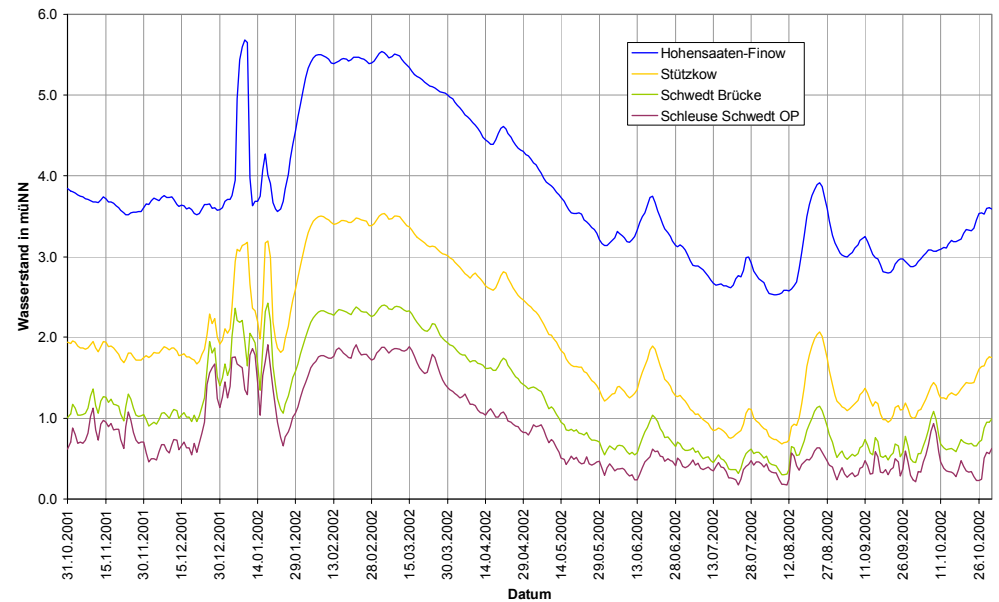
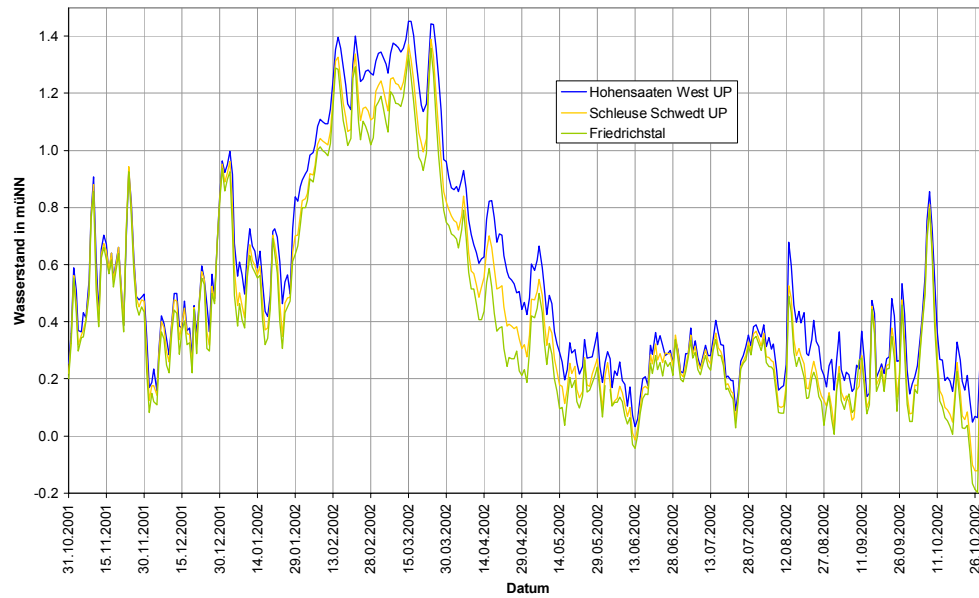
# Part of MIKE 11 model



# Calibration



## 2. Model application for the National Park





## 2. Model application for the National Park



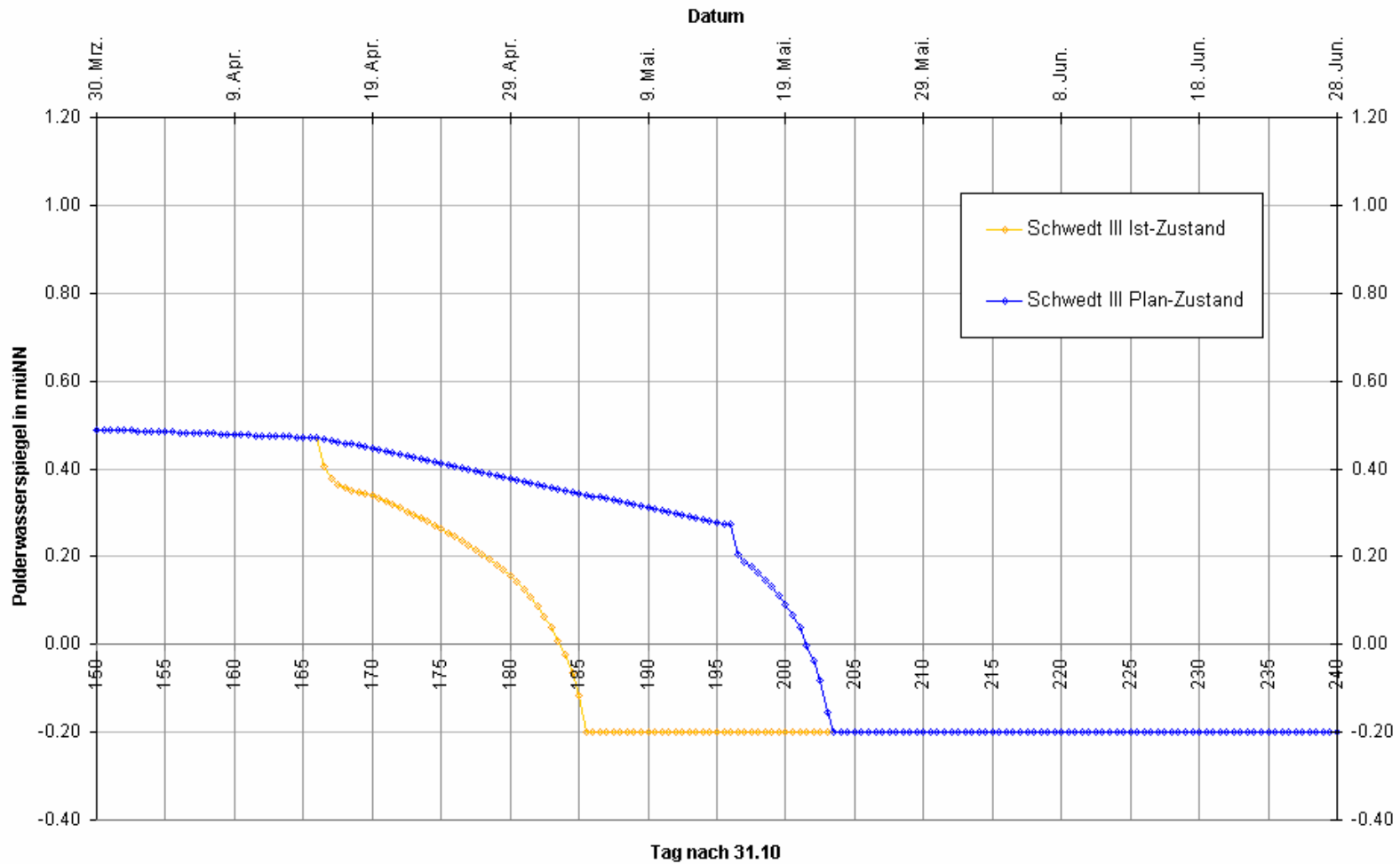
Variation of hydrological boundary conditions (Odra, groundwater recharge,..)

Above others

- monthly mean flow
- mean high flow

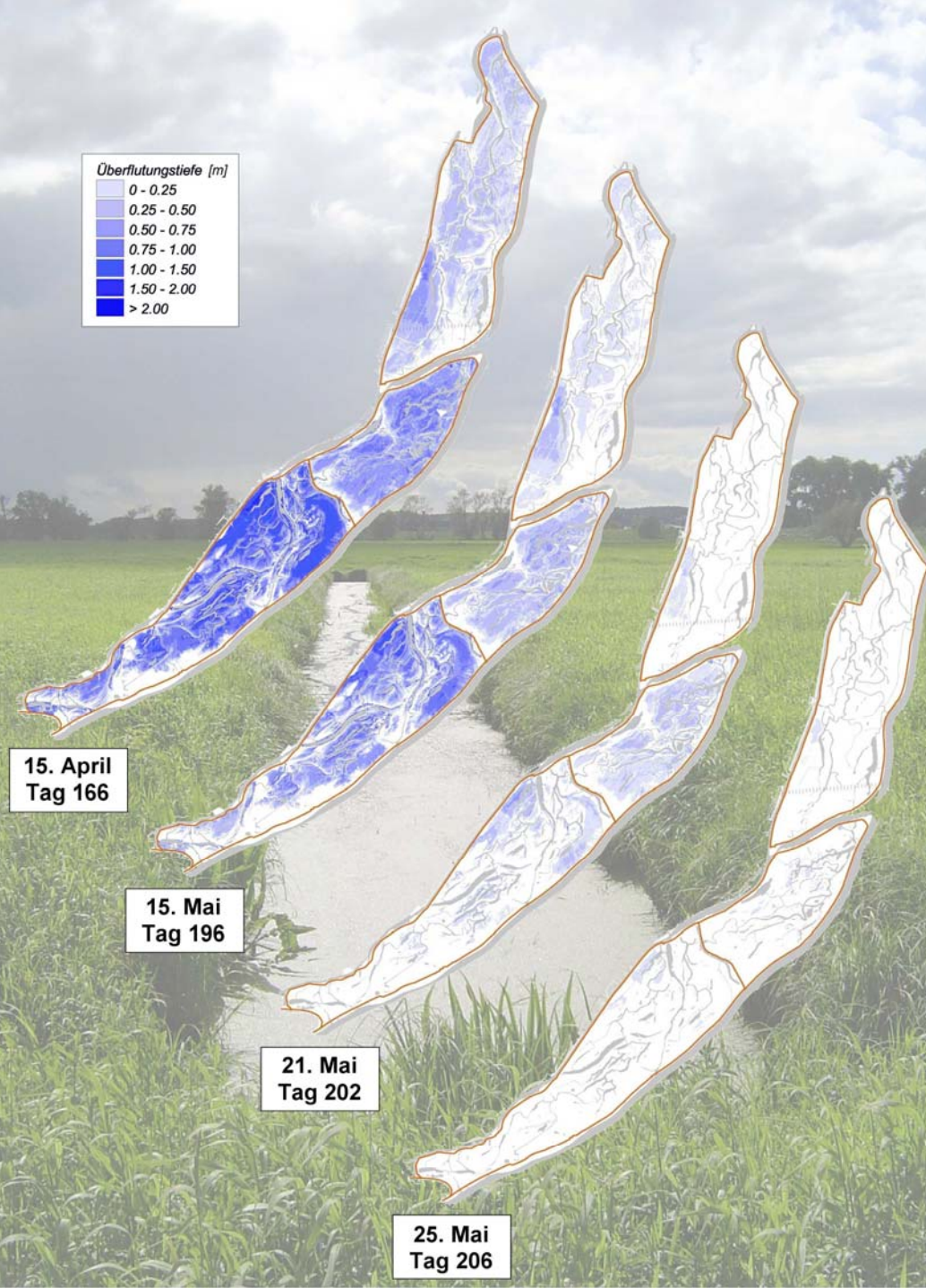
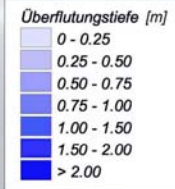
Part I: Prolongation of flooding

# Results: Water table Polder 10 (mean flow)



# Results

Flooding of polders



15.04.

15.05.

21.05.

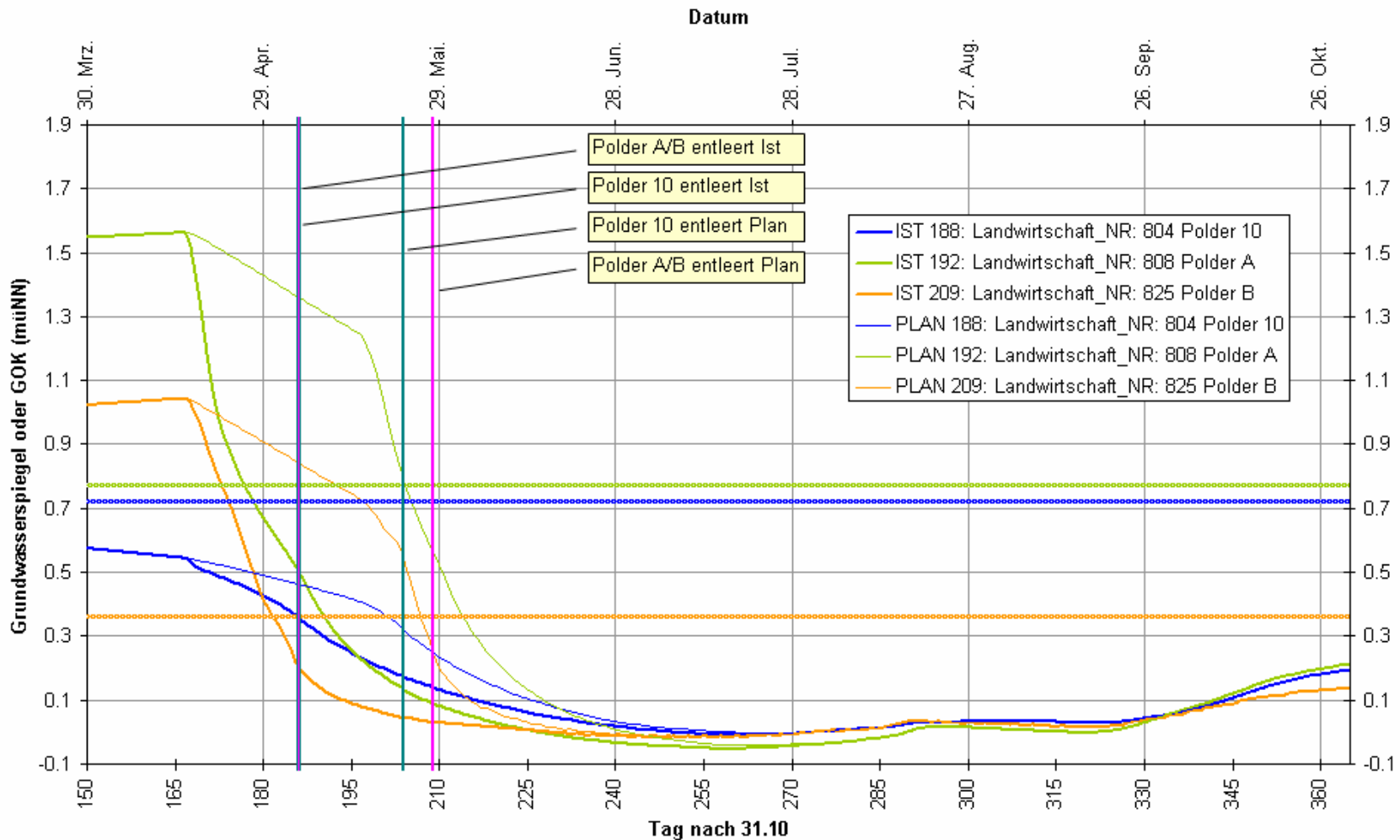
25.05.

15. April  
Tag 166

15. Mai  
Tag 196

21. Mai  
Tag 202

25. Mai  
Tag 206



**Groundwater tables at conflict points agriculture = major impact!**

## 2. Model application for the National Park



Part II: Principle study on parallel water course

# Flooded

4800%  
90%

Parallellauf



Bauwerke



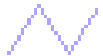
Strassen



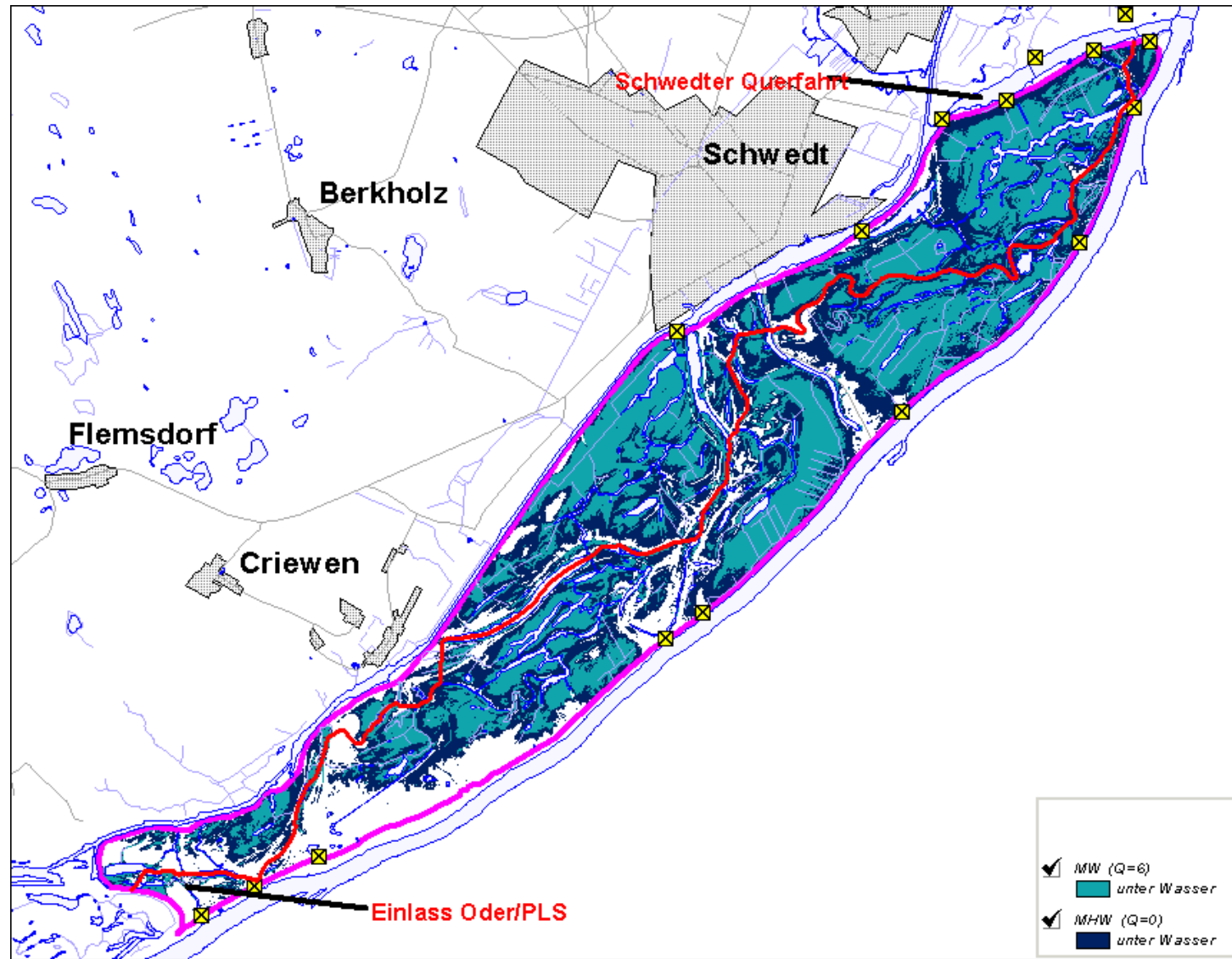
Gewässer (poly)



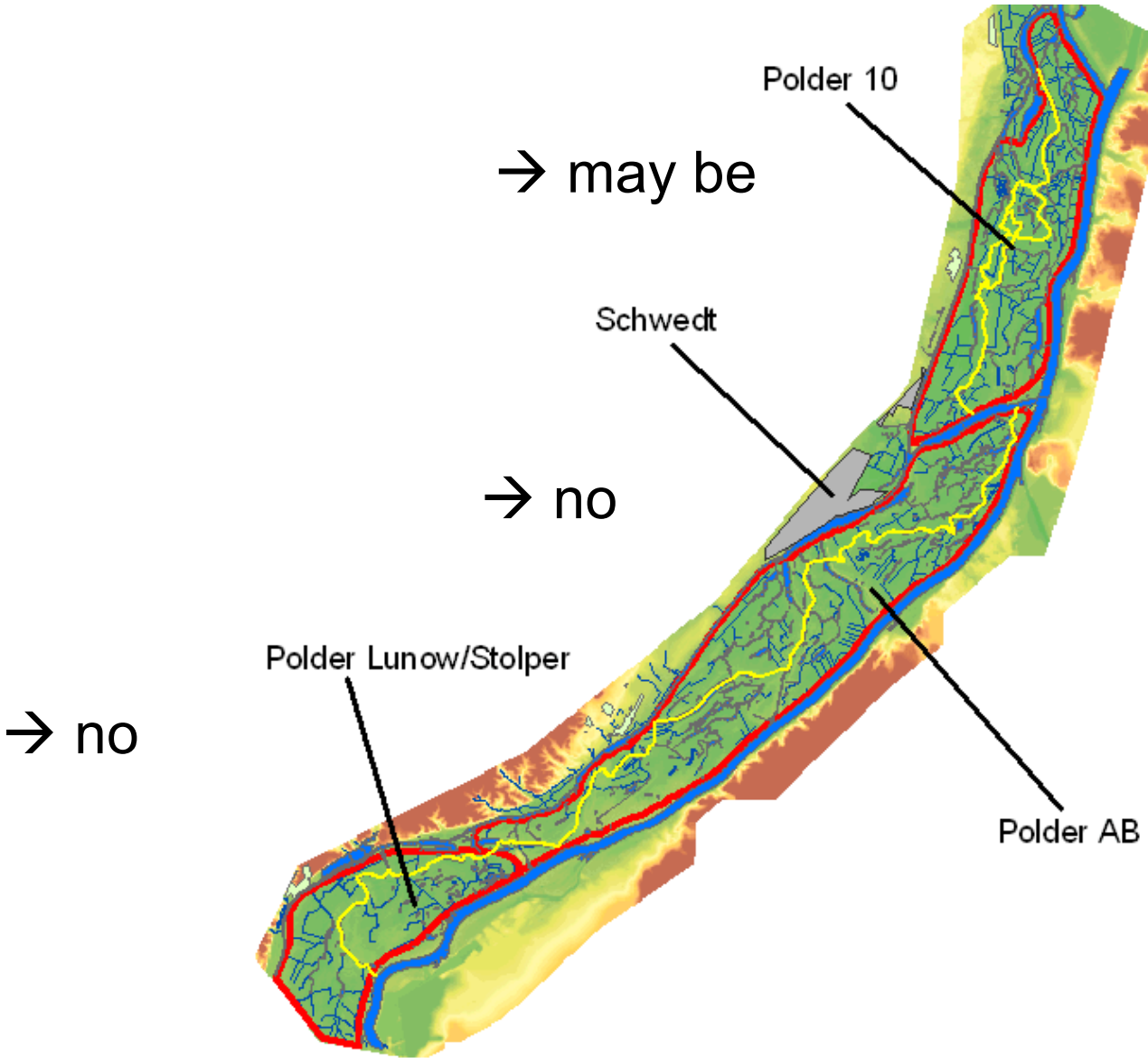
Gewässer (lin)



Orte



# Part II: Principle study on parallel water course



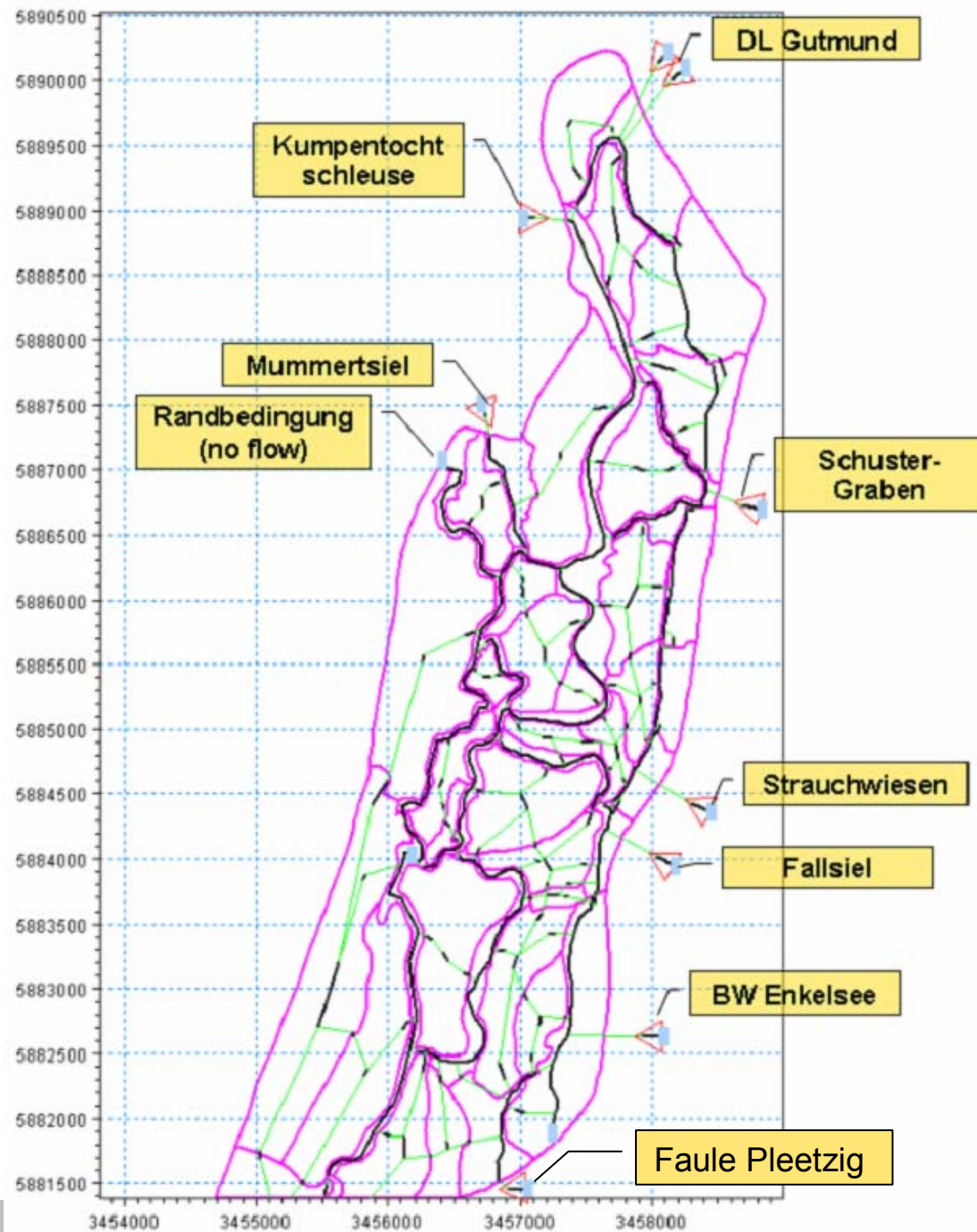


## 2. Model application for the National Park

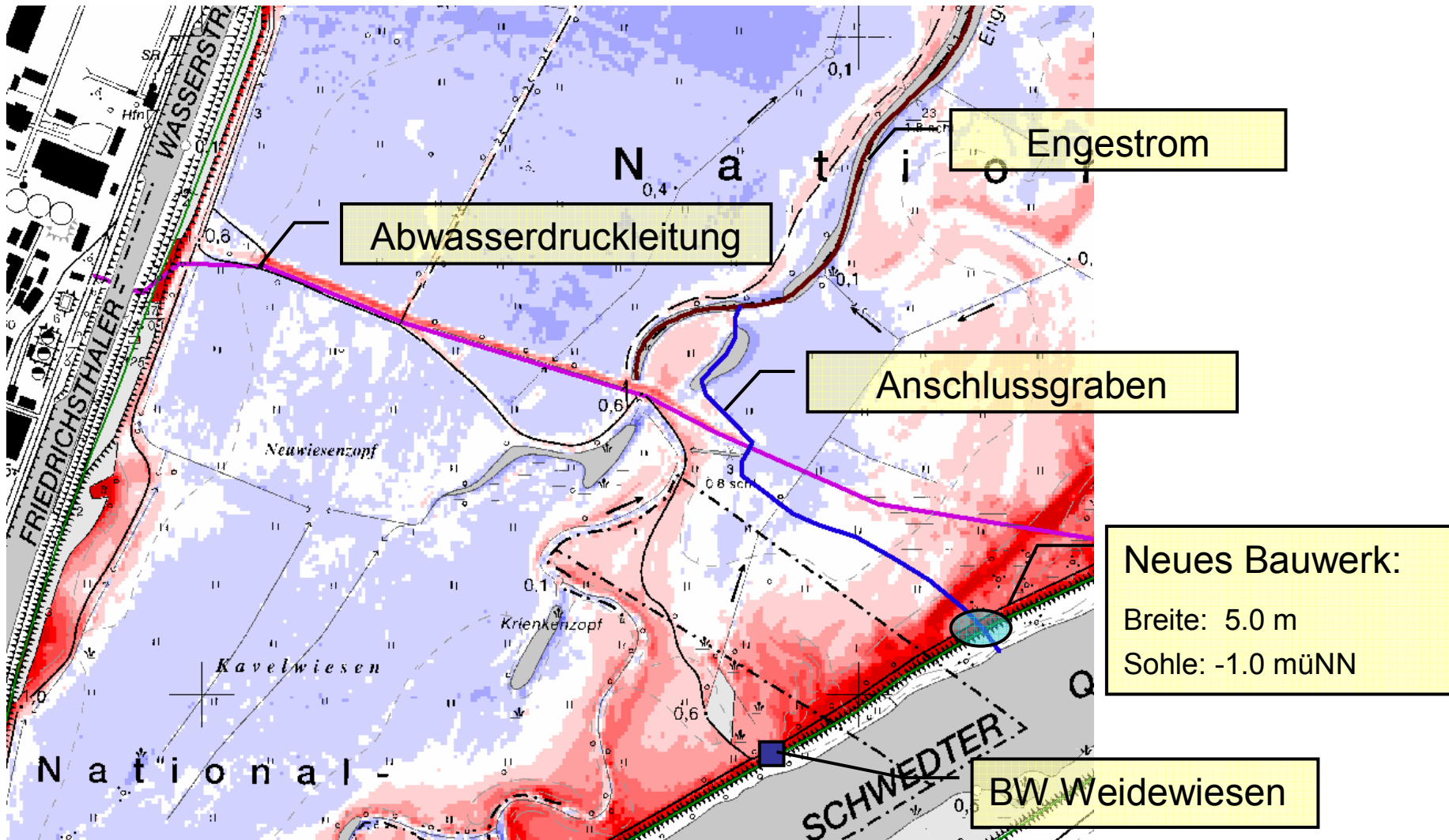


Part III: Planning parallel river Polder 10

# Polder 10 with weirs



# Planning variants for the parallel river

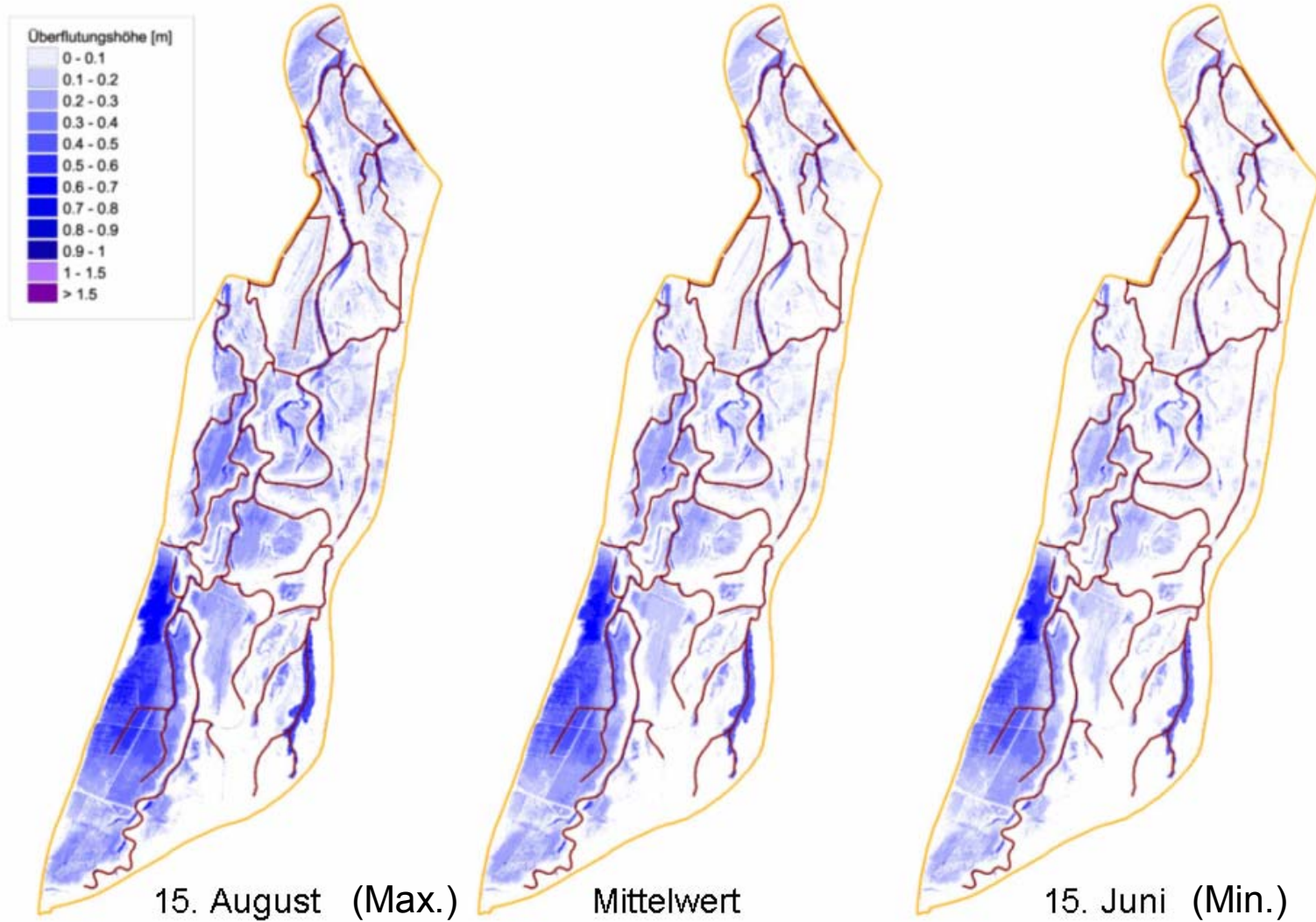


Mean flow at MW (Odra)      Objective PEPL  $\sim 15 \text{ m}^3/\text{s}$ )

- Variant 1: mean  $4,99 \text{ m}^3/\text{s}$ , max.  $6,88 \text{ m}^3/\text{s}$
- Variant 2: mean  $2,56 \text{ m}^3/\text{s}$ , max.  $4,35 \text{ m}^3/\text{s}$
- Variant 3: mean  $3,11 \text{ m}^3/\text{s}$ , max.  $4,10 \text{ m}^3/\text{s}$
- **Variant 4: mean  $7,2 \text{ m}^3/\text{s}$ , max.  $10,7 \text{ m}^3/\text{s}$**

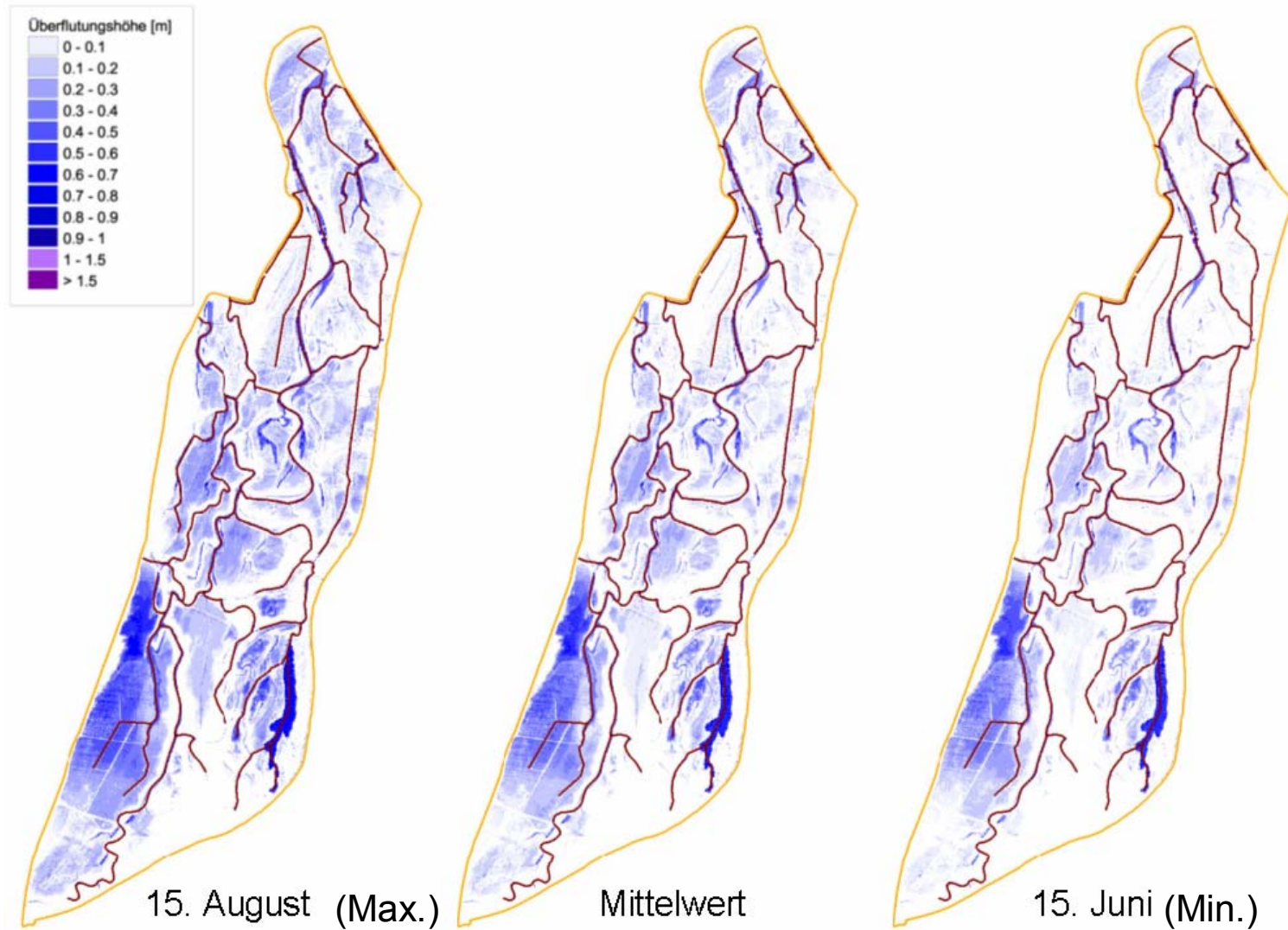
—————>      No dedicated parallel river!

# Flooded areas Variant 1 (MW)





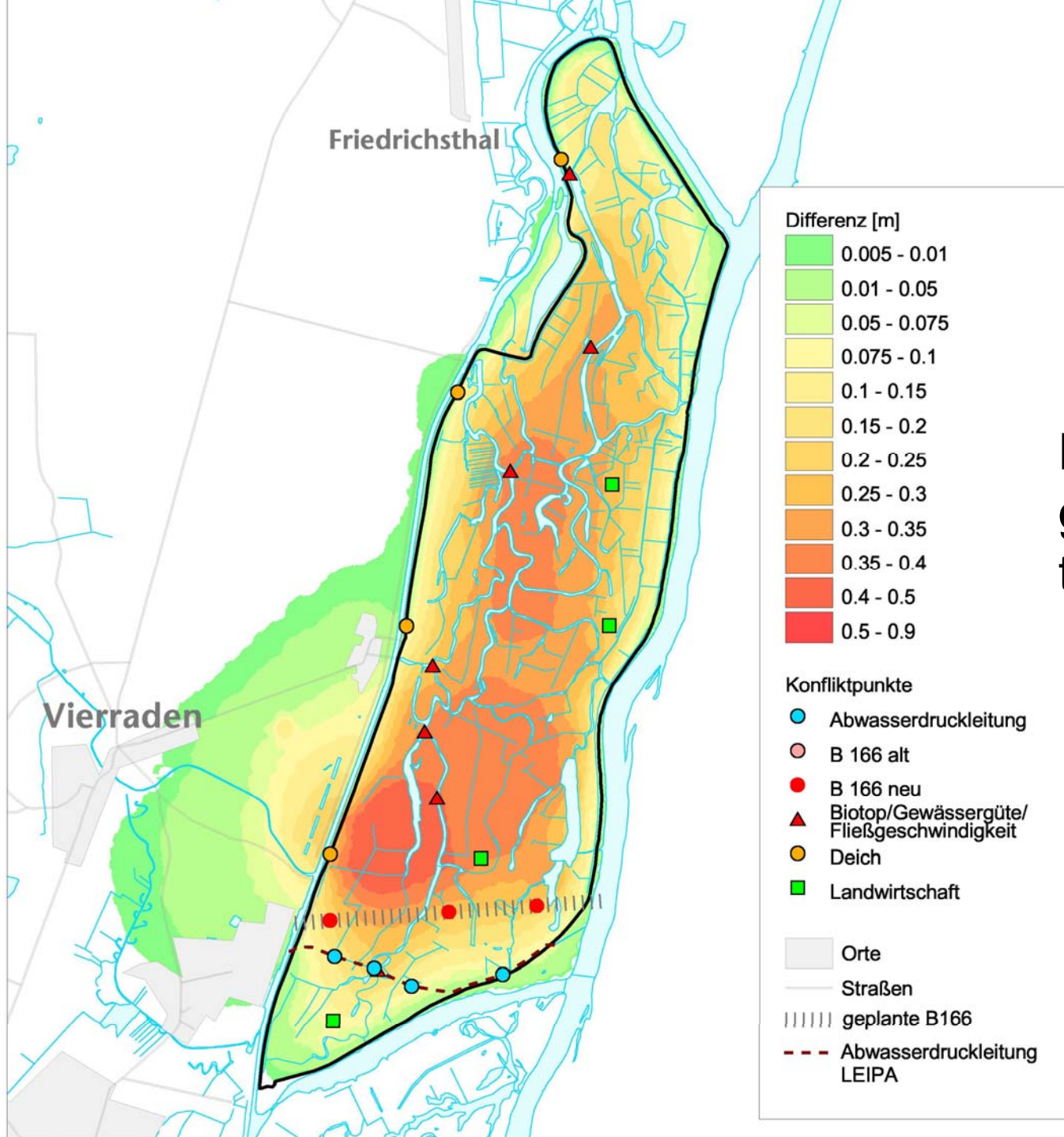
# Flooded areas Variant 4 (MW)



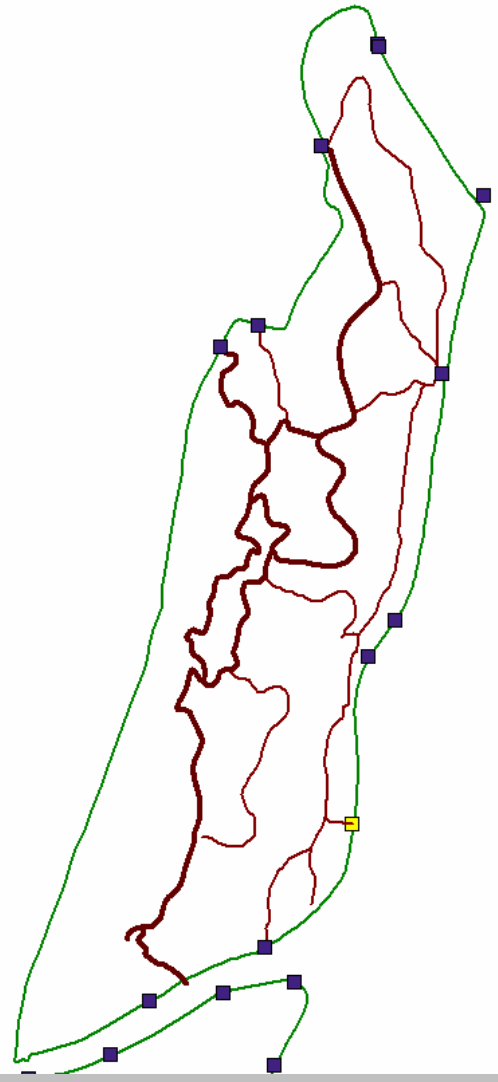
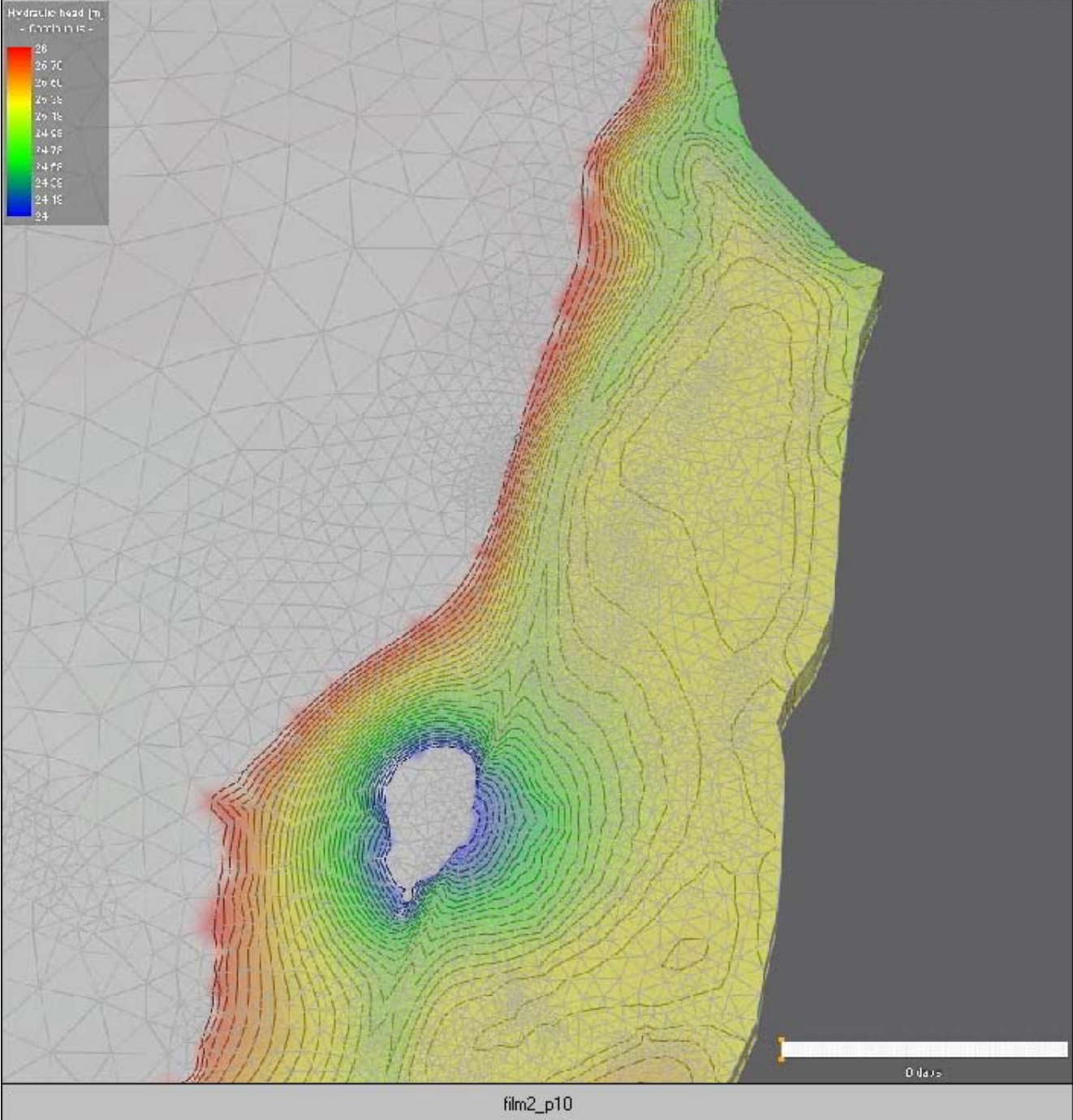
## Comparison of variants

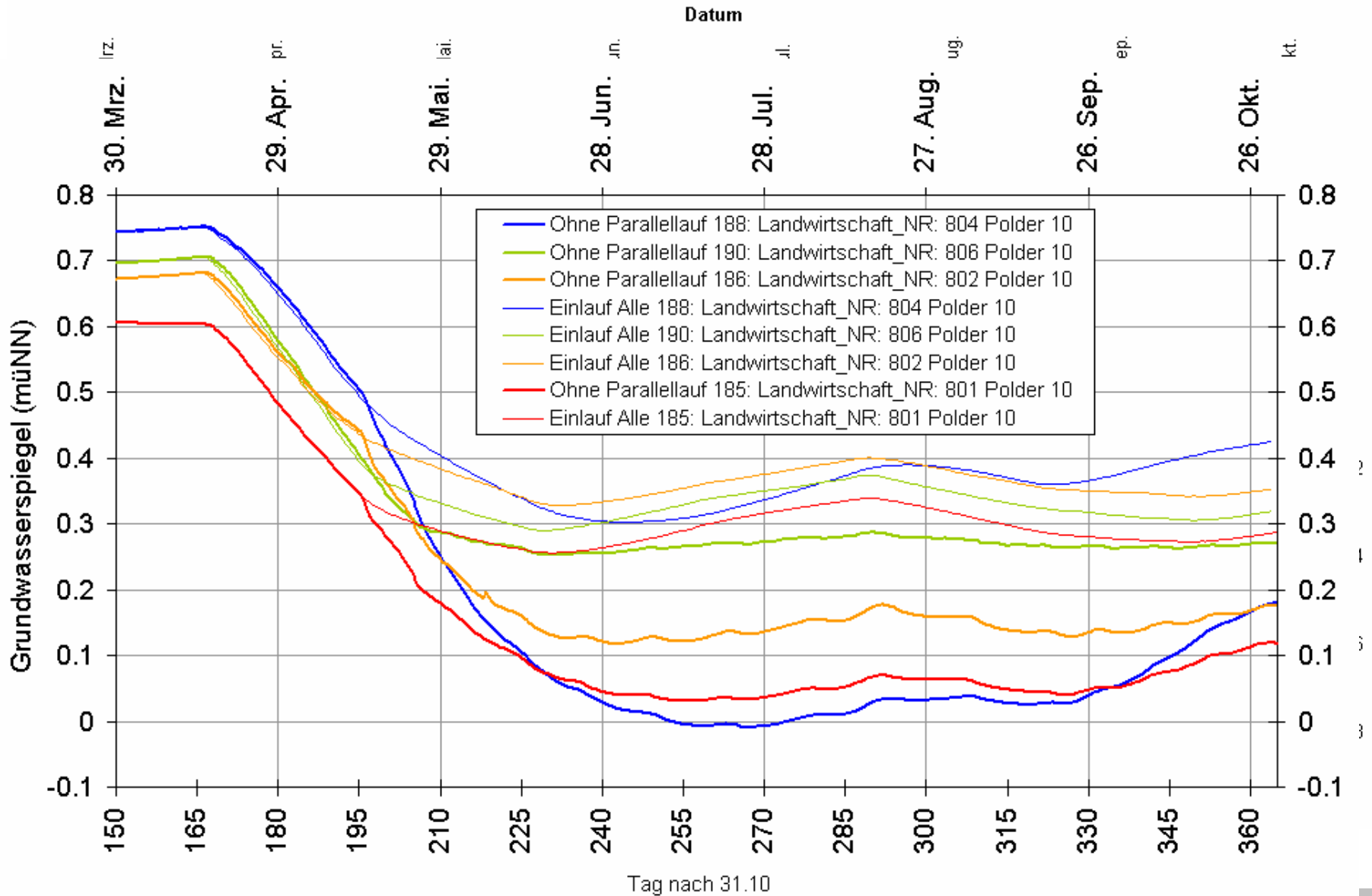
	<b>Not flooded (ha)</b>	<b>flooded (ha)</b>	<b>% flooded</b>
<b>Var 1 (MW)</b>	998,0	773,4	43,7
<b>Var 2 (MW)</b>	1 080,0	691,3	39,0
<b>Var 3 (MW)</b>	9 49,6	821,7	46,4
<b>Var 4 (MW)</b>	1 033,4	738,0	41,7
<b>Var 4 (MNW)</b>	1 593,4	178,0	10,0



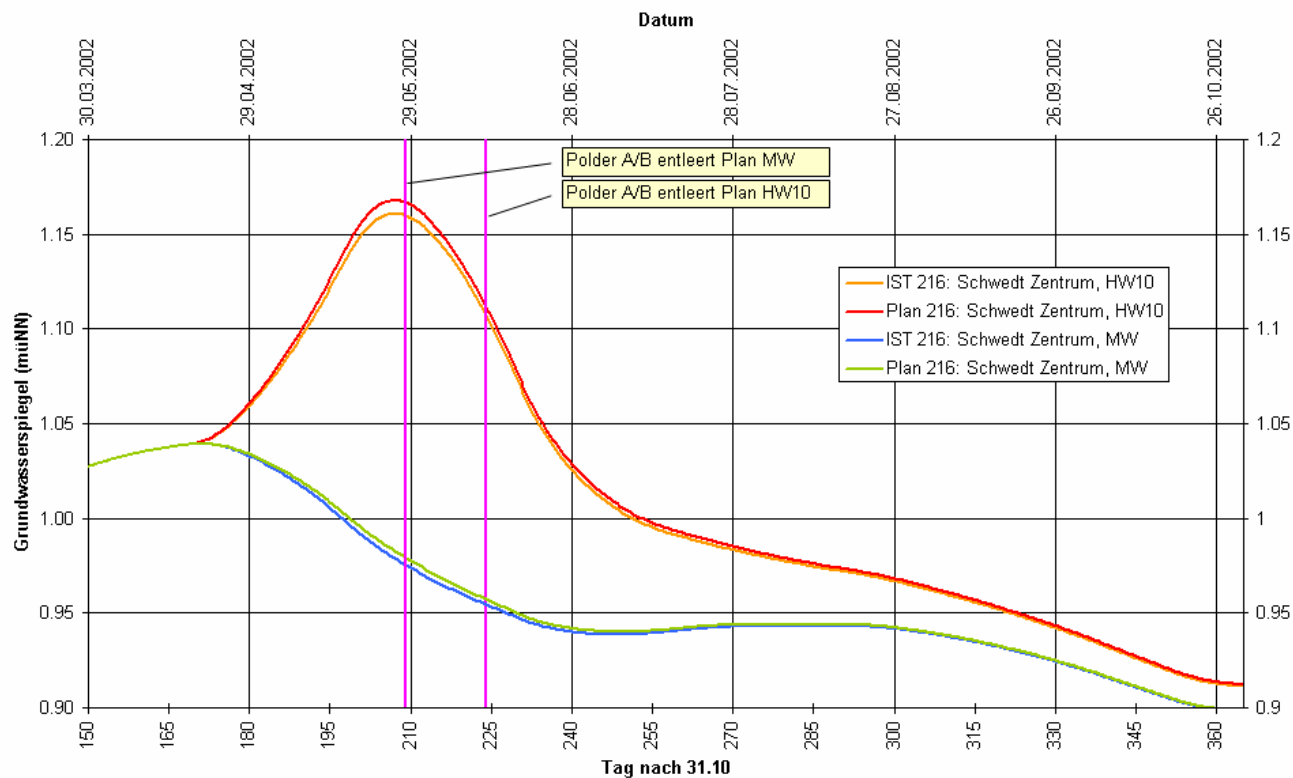
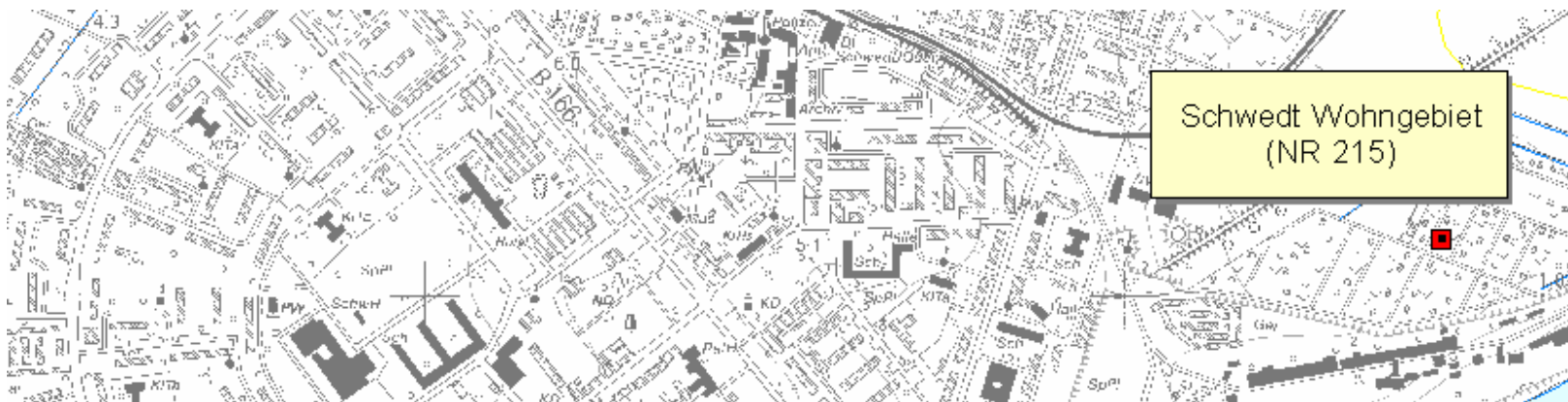


# Difference groundwater table









Potenzieller Konflikt	Bewertung	Kommentar
Güte Oberflächenwasser	potenziell gering betroffen	primär abhängig von klimatischen und Abflussverhältnissen
Sedimentation und Stoffeintrag	Kaum Veränderungen gegenüber Ist-Zustand	Sedimentation unterstützt, sofern sie relevant ist, auentypische Prozesse
Güte Grundwasser	nicht betroffen	
Wassernutzungen	nicht betroffen	
Deiche	nicht signifikant betroffen	potenzielle Auswirkungen auf Deichpflege und –unterhaltung
Bebauung Schwedt <b>Altlasten Hafen</b>	nicht betroffen	<b>(Stellungnahme 29.09.2005)</b>
Sonstige Bauwerke, Objekte	kaum betroffen	eingeschränkte Zugänglichkeit
Leitungstrassen	kaum betroffen	wenig eingeschränkte Zugänglichkeit <b>(Stellungnahme 13.10.2005)</b>
Touristisches Wegenetz	kaum betroffen	eingeschränkte Zugänglichkeit nur in geringem Maße
<b>Landwirtschaft</b>	<b>stark betroffen</b>	stark eingeschränkte Bewirtschaftbarkeit der Flächen, voraussichtlich bereichsweise (oder total) Flächenangabe, ggf. Ertragseinbußen
Wasserbilanz	kaum betroffen	Veränderungen der Abflussverhältnisse Oder / HFW und damit der Wasserbilanz sind vernachlässigbar
Rückstaupunkt	kaum betroffen	Veränderungen des Rückstaupunktes bewegen sich im Rahmen des aktuellen Rückstaupunktes bei Winterflutung





**Thank you for your attention!**