

Team 05 Presentation 3

Presentation 3: Results of the 2nd week



Erasmus+



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



VRIJE
UNIVERSITEIT
BRUSSEL



WARSAW UNIVERSITY
OF TECHNOLOGY



Newcastle
University



Brandenburgische
Technische Universität
Cottbus - Senftenberg





Climate Change Impact Assessment

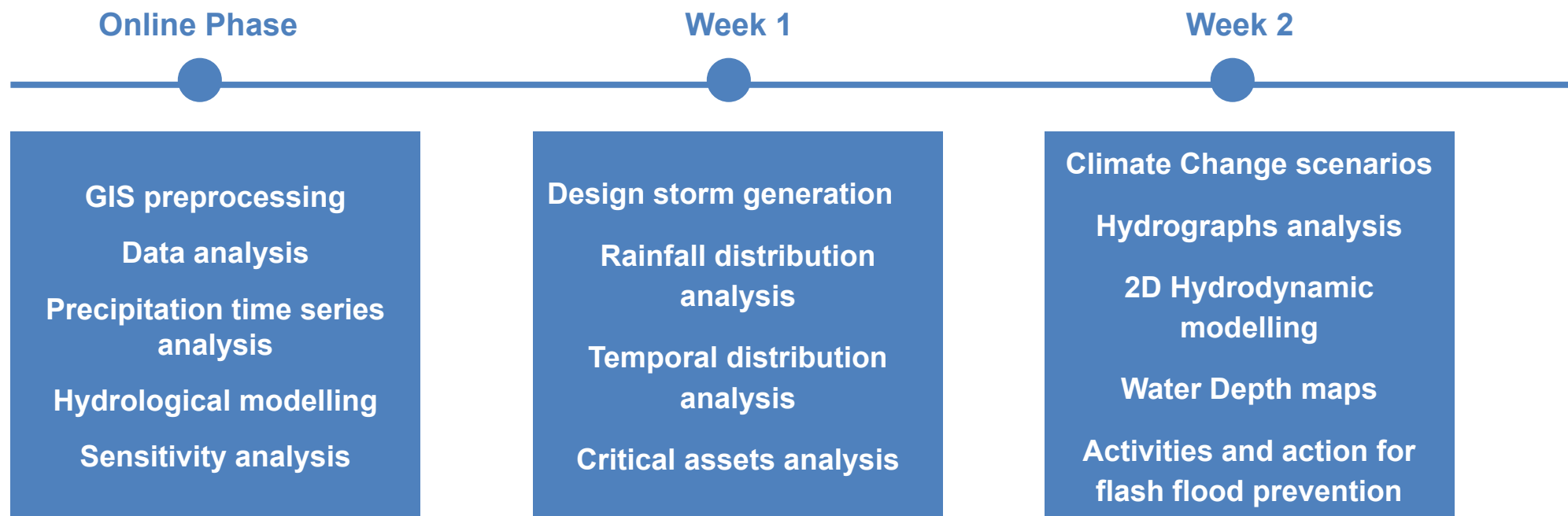
Cathy BRUCHER - Nadia SADIKI - Abdelatif FEL - Nathan SOARES - Alexandre CHABAH - Mamadou CISSE -
Rupesh Kumar MISHRA - Alex DE LA CRUZ - Maximilien BOURCIER - Julie BIRLOUET

With the support of
Marine SHLEWET - Frank MOLKENTHIN



Catchment Ahr - Team 05 Presentation

Work plan





Catchment Ahr - Team 05 Presentation

Climate Change Scenarios

- KOSTRA-DWD Report: up to **20% increase** in precipitation intensity
- Base scenario: 24h
- Rating Curve: **400 m³/s** -> 6 m

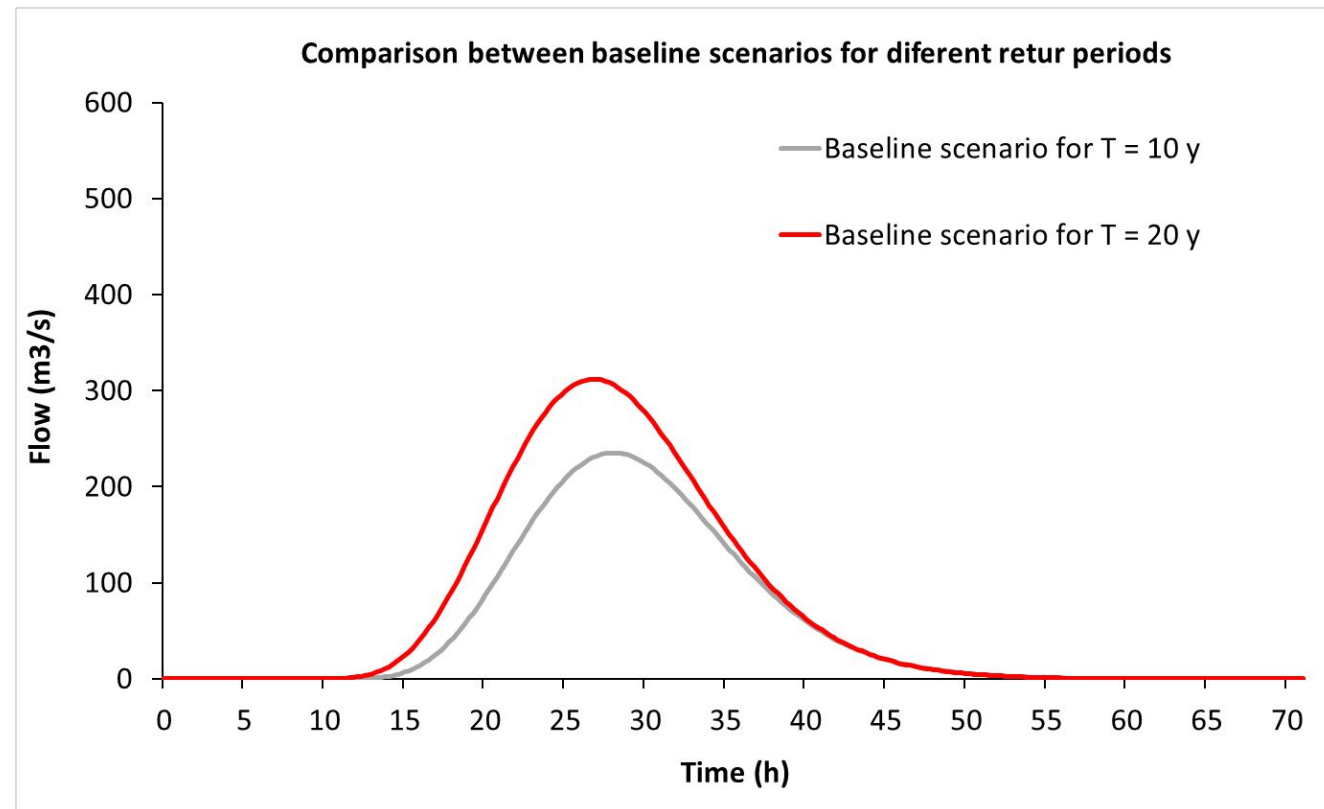
Intensity	Duration	Return Period
2%	6h	10y
5%	12h	20y
10%	24h	-
20%	-	-



Catchment Ahr - Team 05 Presentation

Hydrologic Modelling - Base Scenario

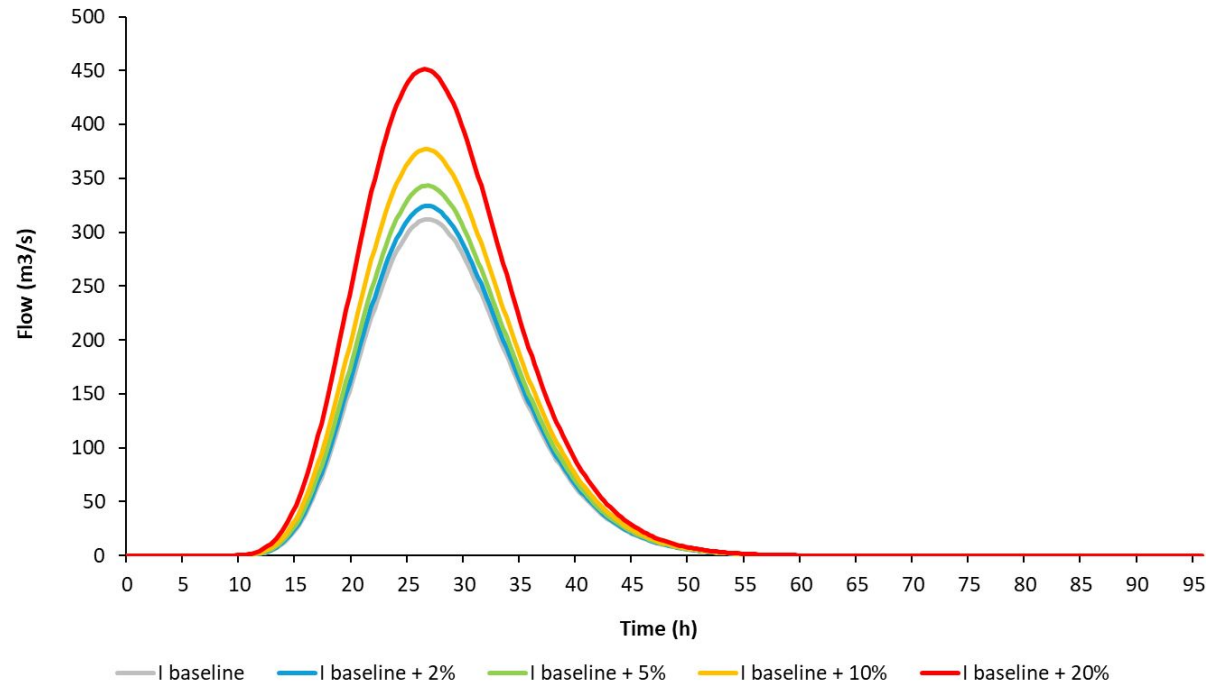
Scenario	Total discharge volume		Discharge peak	
	V total (m ³)	Increment (%)	Q max (m ³ /s)	Increment (%)
T = 10 y	1,35E+07	-	235,4	-
T = 20 y	1,81E+07	34,7	312,1	32,6



Catchment Ahr - Team 05 Presentation

Hydrologic Modelling - Increased Intensity

Discharge hydrograph for different storm intensities (T = 20y)



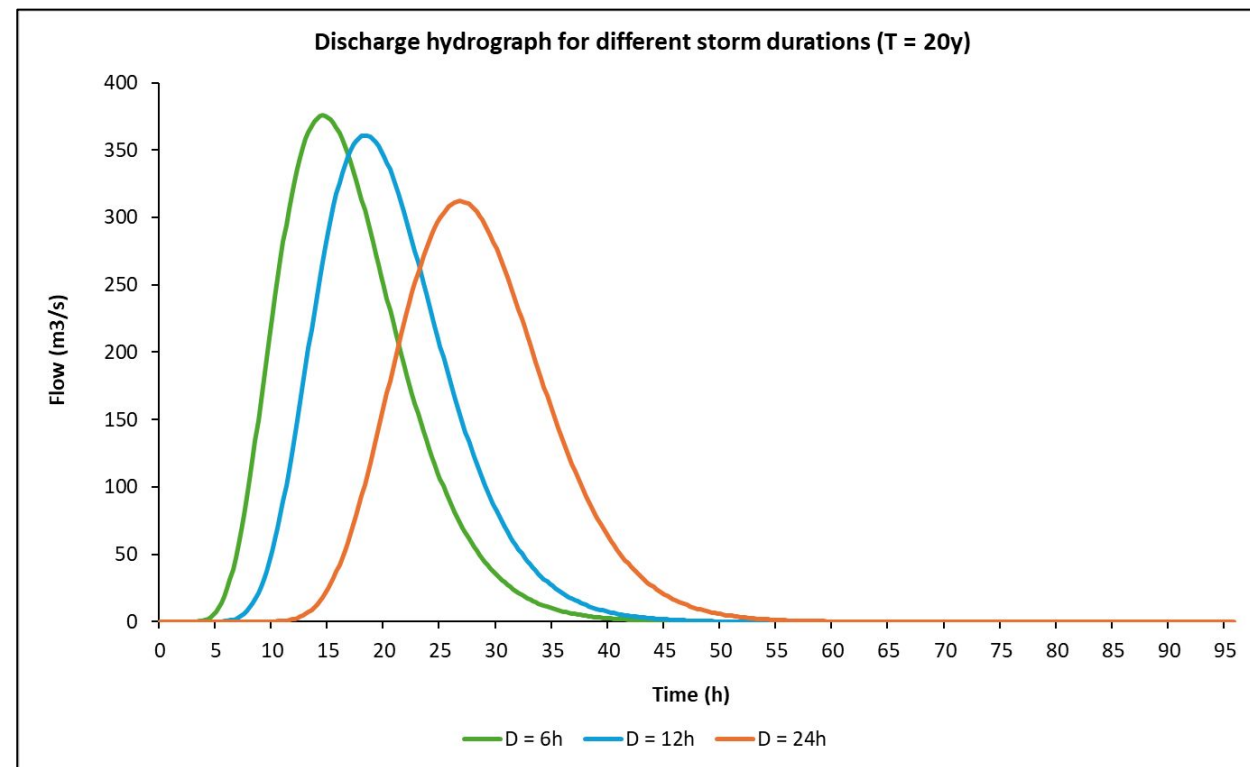
Scenario	Total discharge volume		Discharge peak	
	V total (m³)	Increment (%)	Q max (m³/s)	Increment (%)
I baseline	1,81E+07	-	312,1	-
I baseline + 2%	1,89E+07	4,0	324,2	3,9
I baseline + 5%	2,00E+07	10,3	343,2	10,0
I baseline + 10%	2,20E+07	21,5	376,8	20,7
I baseline + 20%	2,66E+07	46,3	451,3	44,6



Catchment Ahr - Team 05 Presentation

Hydrologic Modelling - Decreased Duration

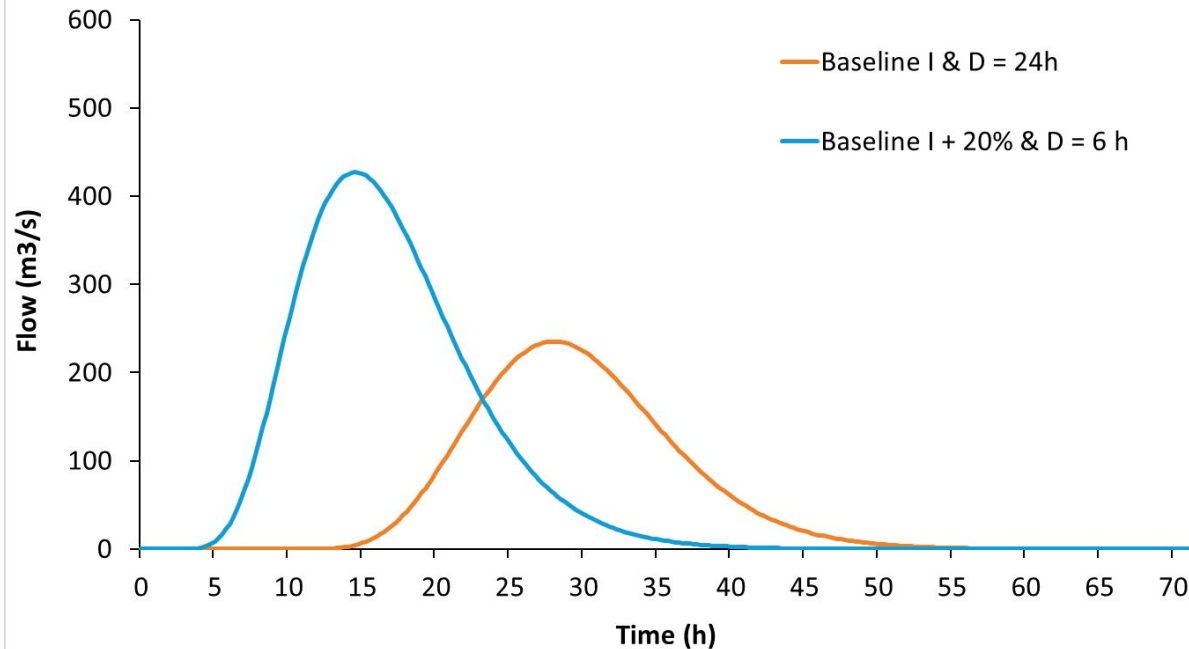
Scenario	Q max (m ³ /s)	Peak Time (h)
D = 6h	375,6	15
D = 12h	360,8	18,25
D = 24h	312,1	26



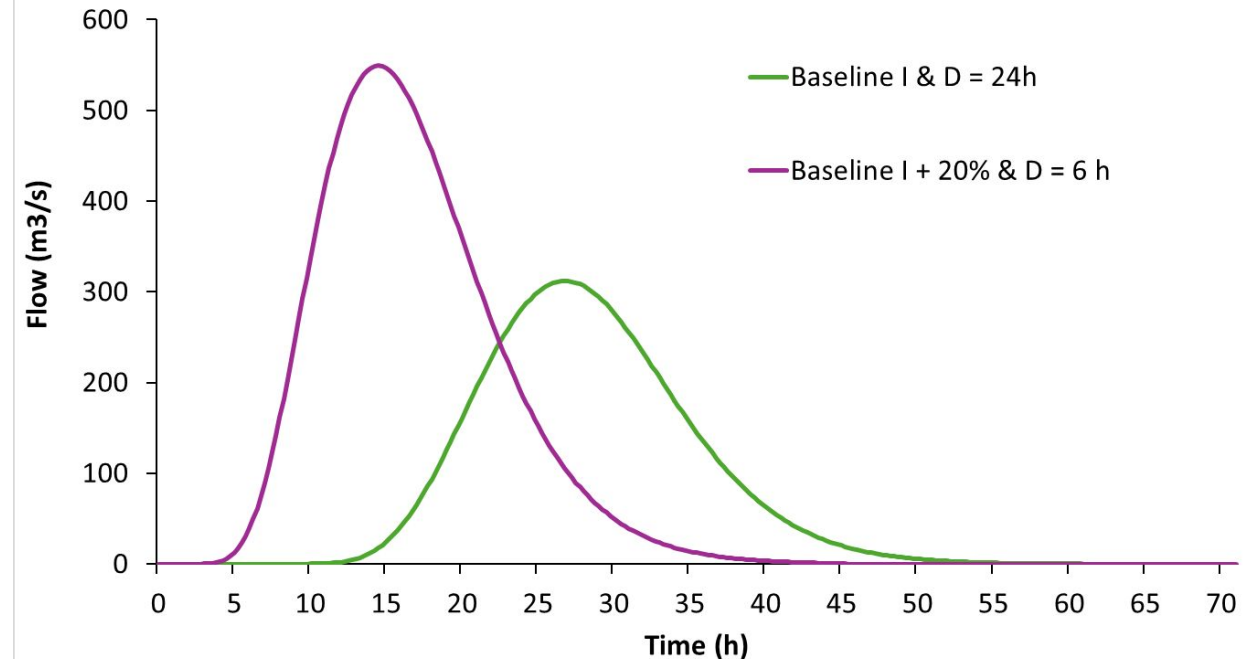
Catchment Ahr - Team 05 Presentation

Hydrologic Modelling - Increased Intensity and Decreased Duration

Discharge hydrograph for different storm scenarios (T = 10y)



Discharge hydrograph for different storm scenarios (T = 20y)

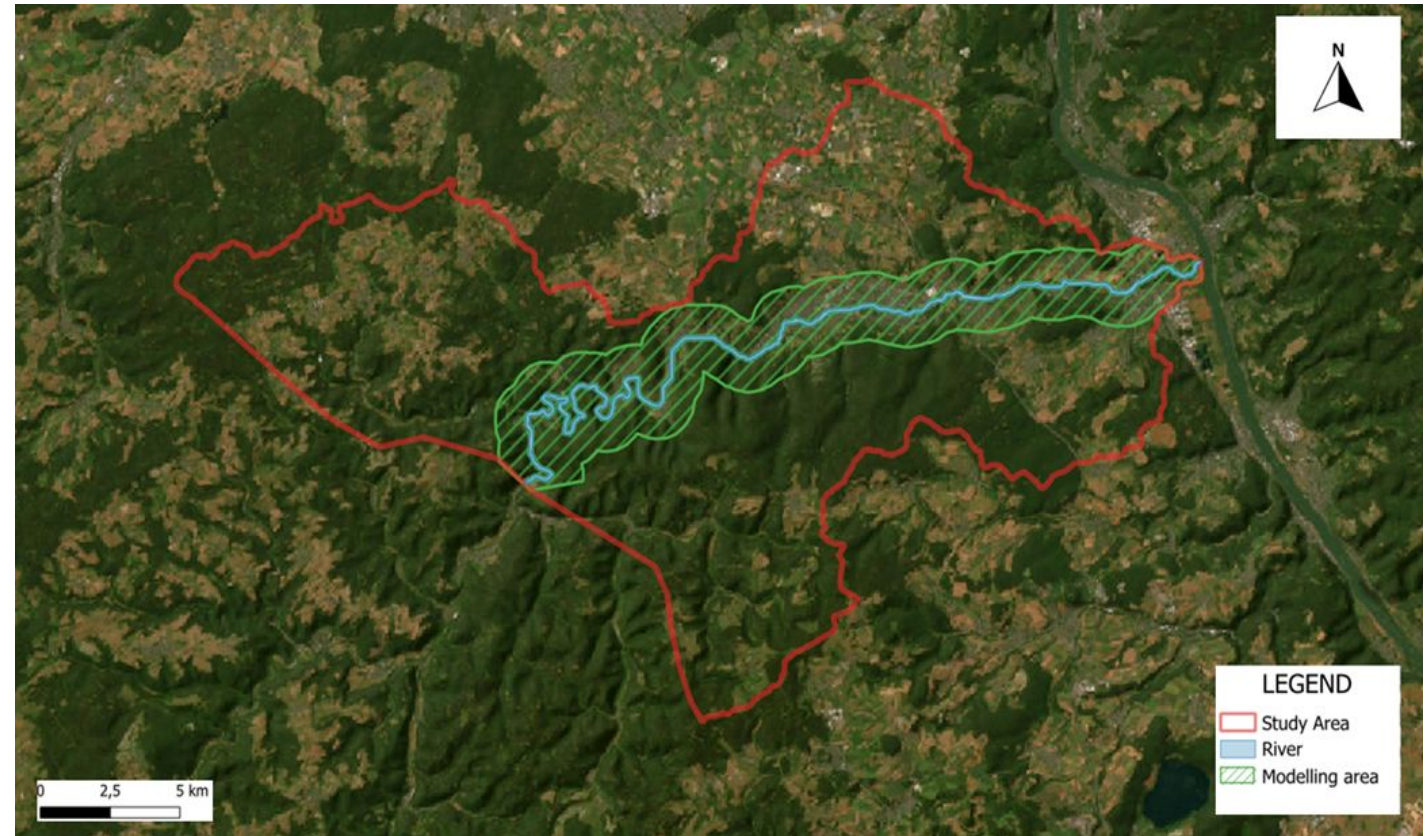
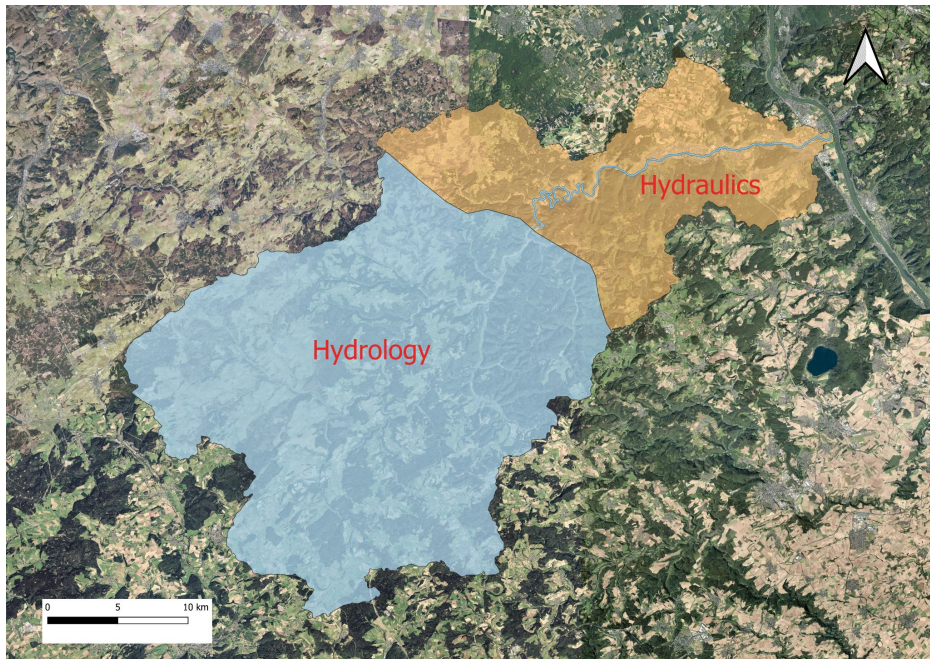


Catchment Ahr - Team 05 Presentation



2D Hydrodynamic Model

- Study Area



01.03.2024

Presentation 3

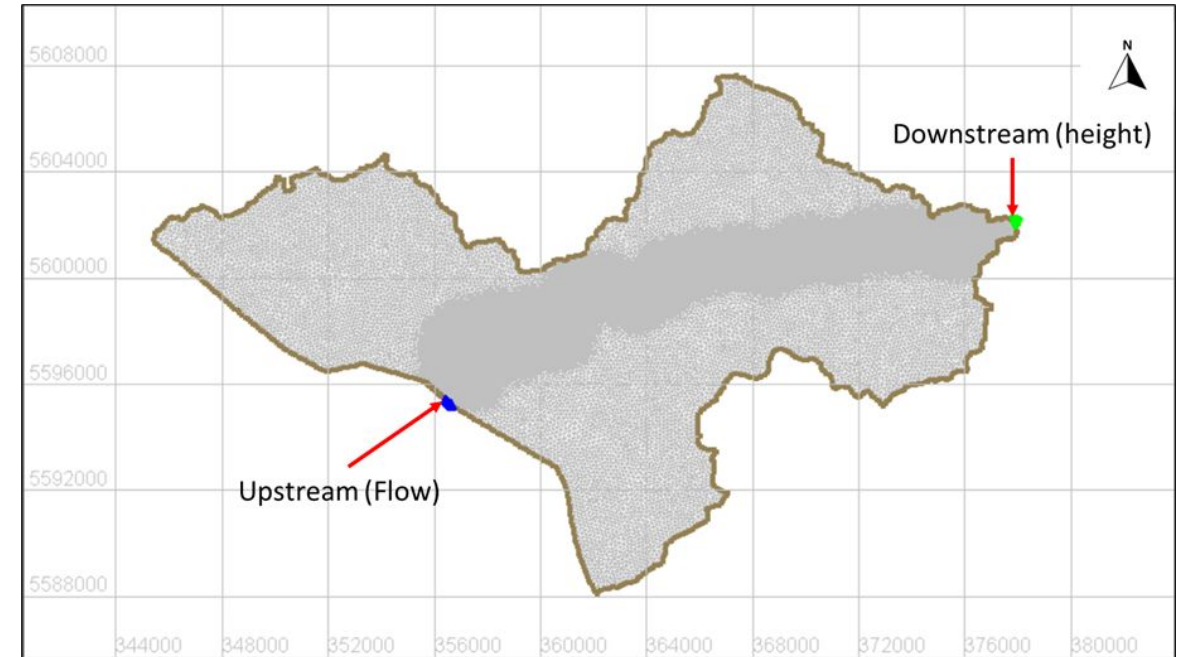
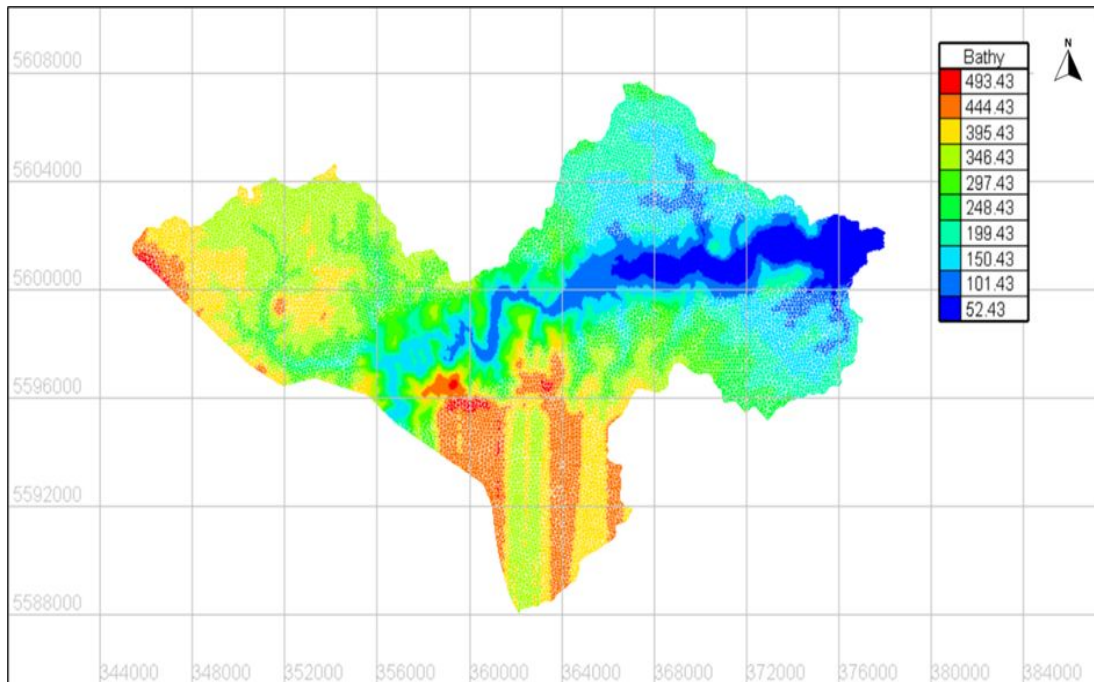
Team 05 9

Catchment Ahr - Team 05 Presentation



2D Hydrodynamic Model

- Model set up



The characteristics of the mesh are shown below.

- 25 m for the minor bed;
- 50 m for the floodplain;
- 150 m for the rest of the study area.

Assumption : Steady state

- Mean flow = $8 \text{ m}^3/\text{s}$;
- maximum speed = $1.5 \text{ m}^3/\text{s}$;
- Water level at 1 m;
- Coefficient of friction 40.

01.03.2024

Presentation 3

Team 05 10



Erasmus+



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



VRIJE
UNIVERSITEIT
BRUSSEL



WARSAW UNIVERSITY
OF TECHNOLOGY



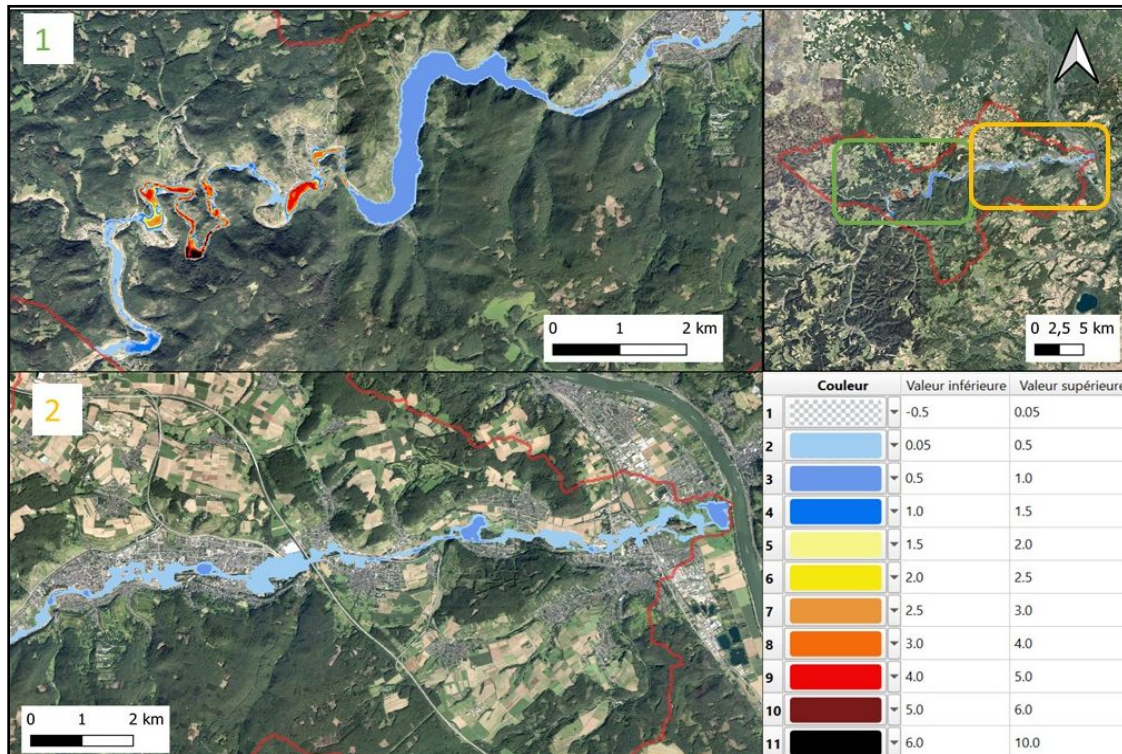
Brandenburgische
Technische Universität
Cottbus - Senftenberg



Catchment Ahr - Team 05 Presentation

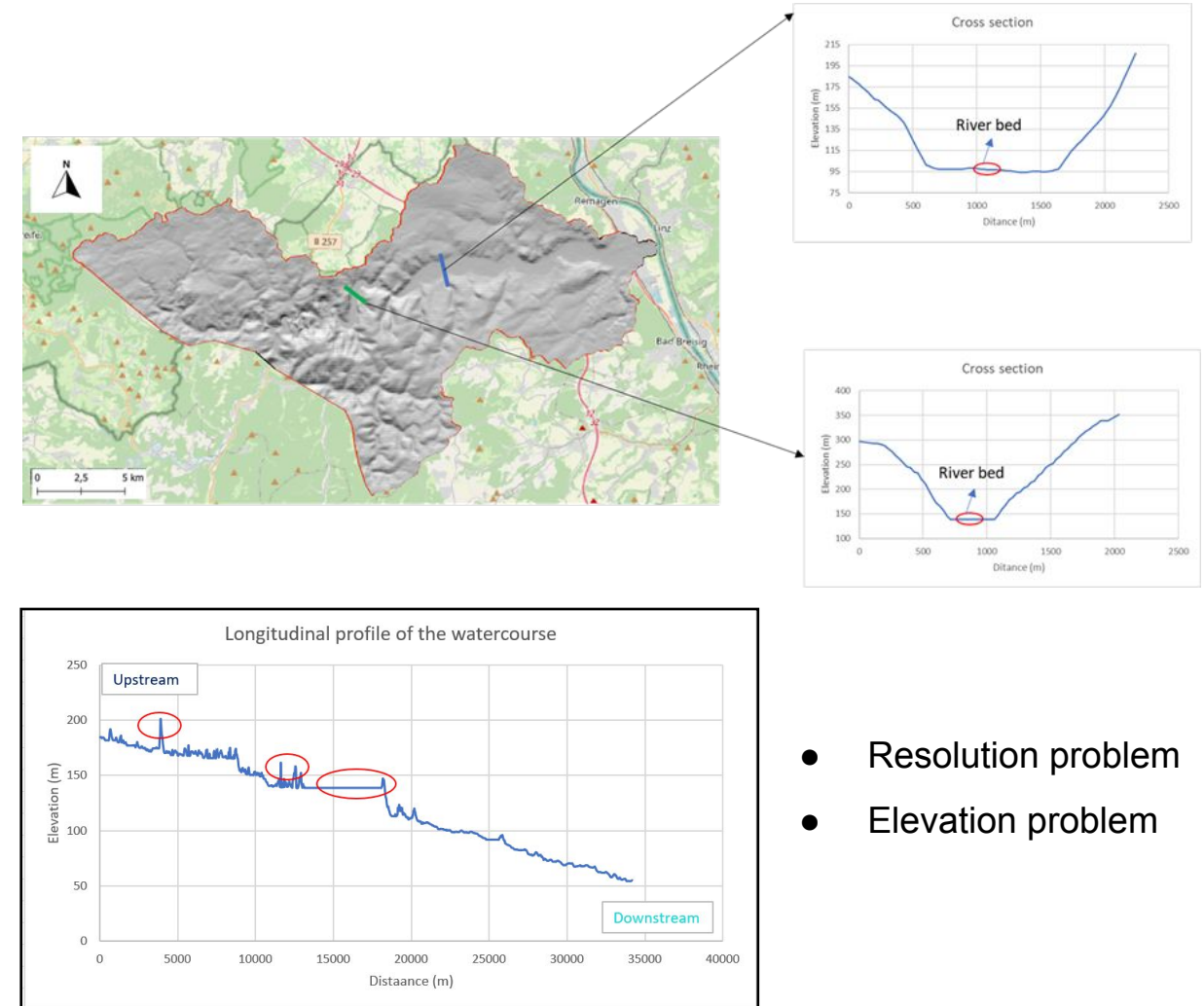
2D Hydrodynamic Model :

- Model results and limitations



01.03.2024

Presentation 3



- Resolution problem
- Elevation problem

Team 05 11

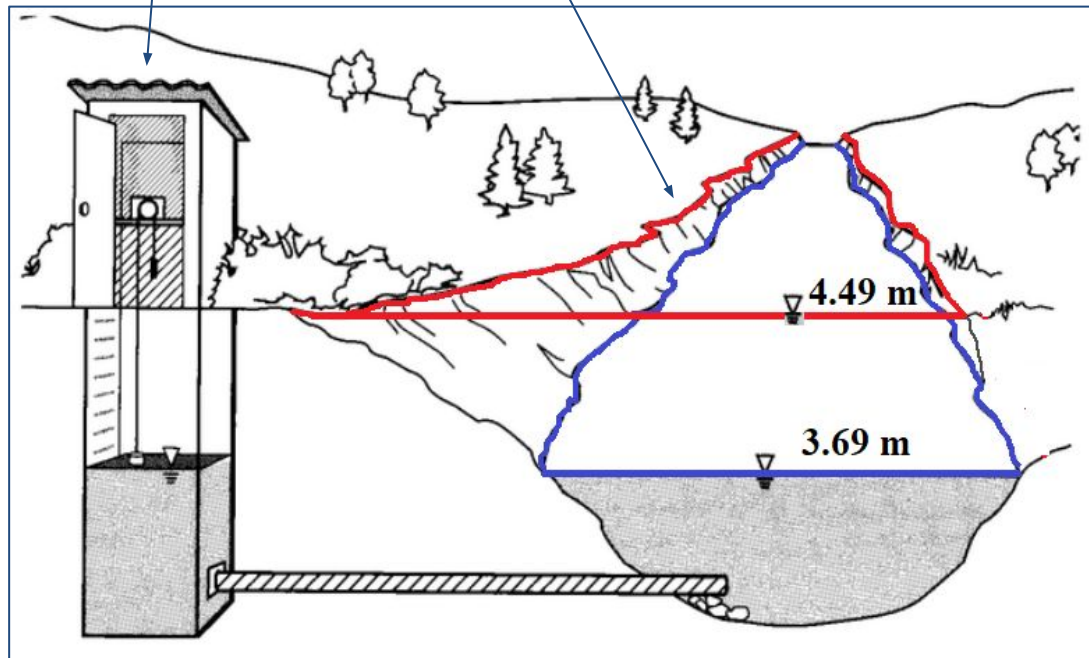
Catchment Ahr - Team 05 Presentation



Water Level Maps

Altenahr Gauge

Reference water depths



Discharge from hydrological model and corresponding water levels from rating curve at Altenahr gauge

Scenario	Altenahr	
	Q [m ³ /s]	Water Depth [m]
Baseline_10Y_RP_D24H	235	3.70
Baseline_20Y_RP_D24H	312	4.70

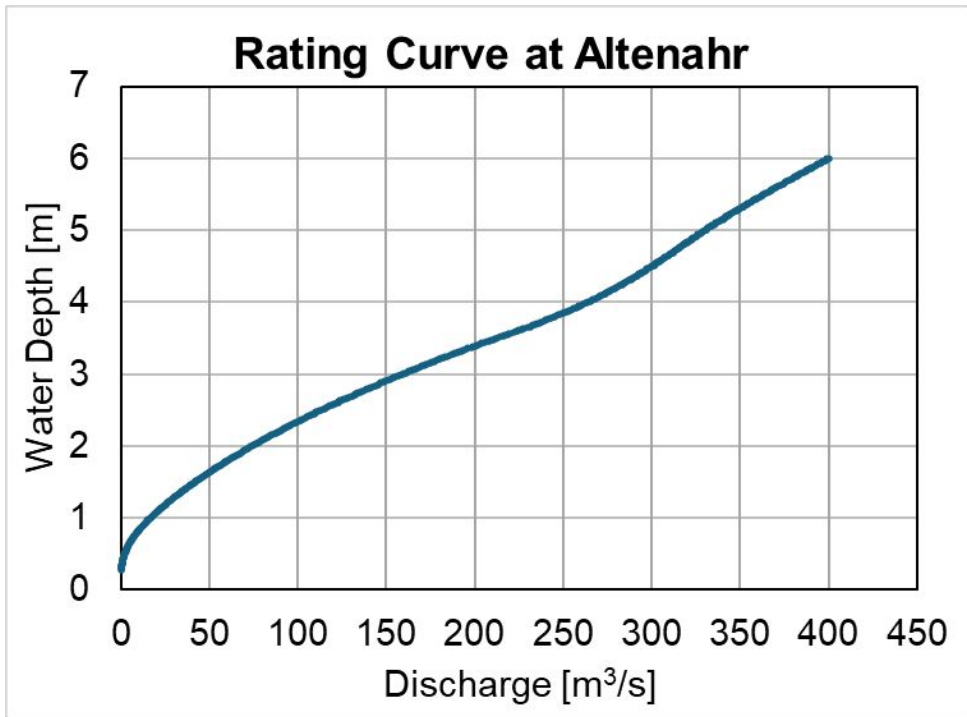
Reference water levels at Altenahr gauge station from the study report (2023)
(Reference: [Water Management Administration of Rhineland-Palatinate](#))

Scenario Approximation	Altenahr	
	Q [m ³ /s]	Water Depth [m]
Baseline_10Y_RP_D24H	234	3.69
Baseline_20Y_RP_D24H	299	4.49

Catchment Ahr - Team 05 Presentation



Water Level Maps



Discharge from hydrological model and corresponding water levels from rating curve at Altenahr gauge

Scenario	Altenahr	
	Q [m³/s]	Water Depth [m]
Baseline_10Y_RP_D24H	235	3.70
Baseline_20Y_RP_D24H	312	4.70
Baseline_D6H	281	4.22
Baseline + 10%_RI	292	4.37
Baseline + 20%_RI	353	5.35
Baseline + 10%_RI_D6H	350	5.31

Scenario approximation with the study report (2023)

(Reference: [Water Management Administration of Rhineland-Palatinate](#))

Scenario Approximation	Altenahr	
	Q [m³/s]	Water Depth [m]
Baseline_10Y_RP_D24H	234	3.69
Baseline_20Y_RP_D24H	299	4.49
Baseline_D6H	272	4.10
Baseline + 10%_RI	299	4.49
Baseline + 20%_RI	341	5.17
Baseline + 10%_RI_D6H	341	5.17

01.03.2024

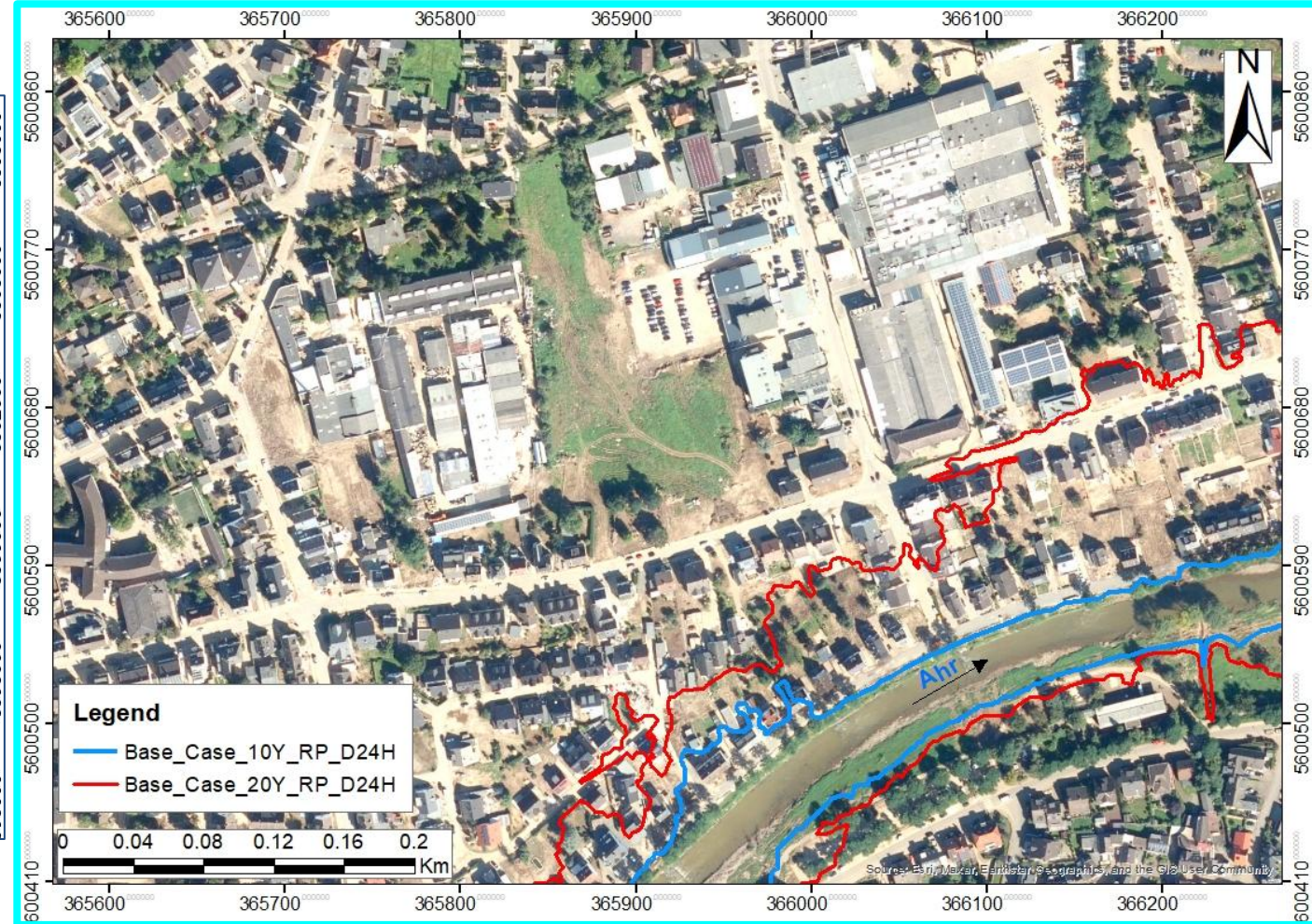
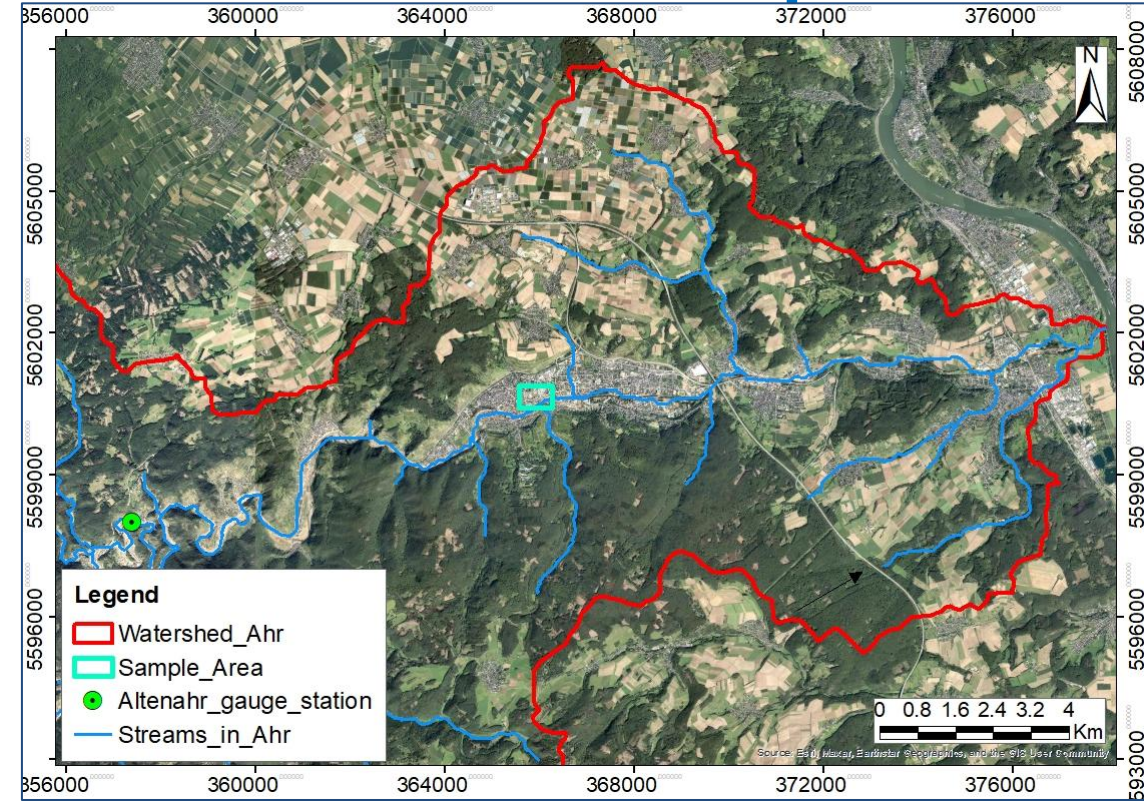
Presentation 3

Team 05 13

Catchment Ahr - Team 05 Presentation



Base Water Level Map



01.03.2024

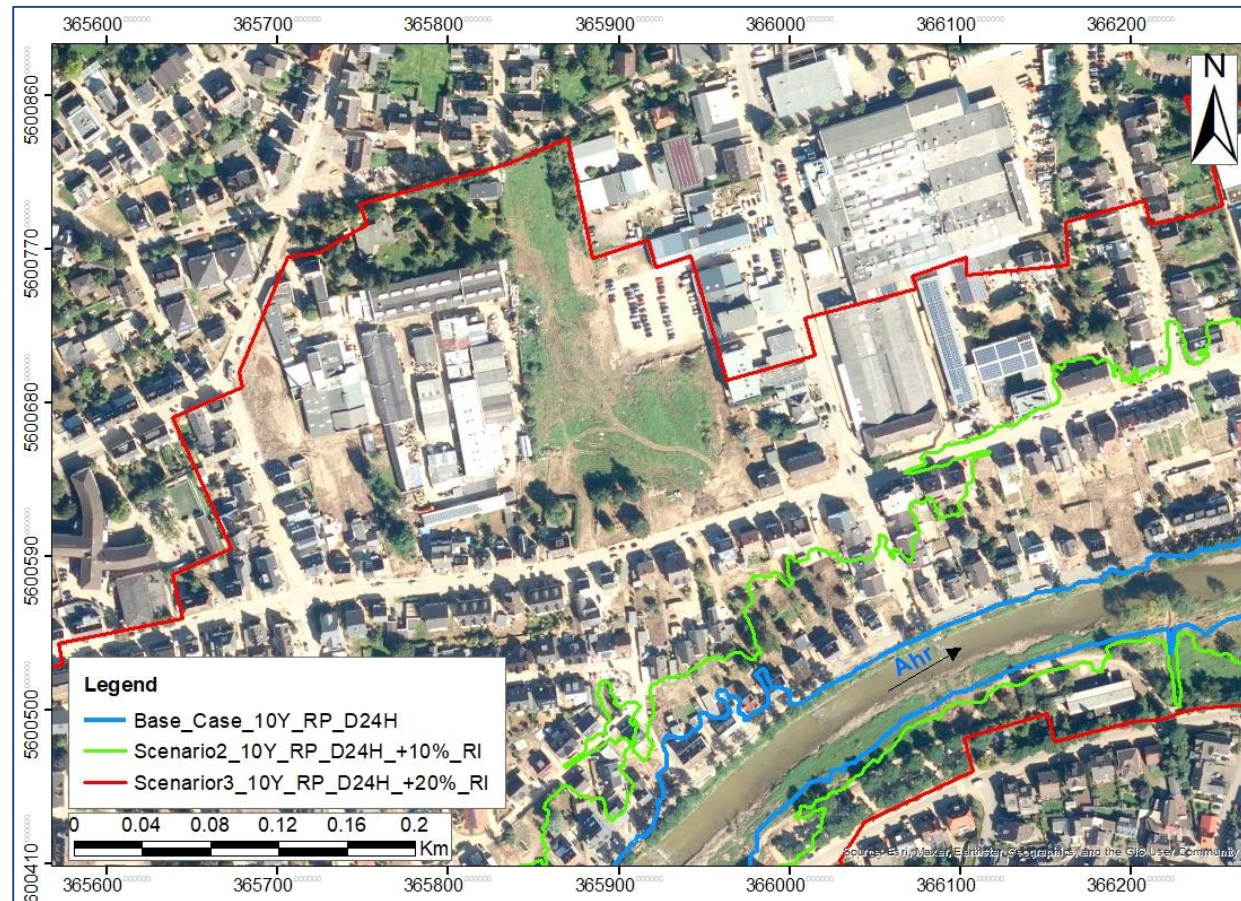
Presentation 3

Team 05 14

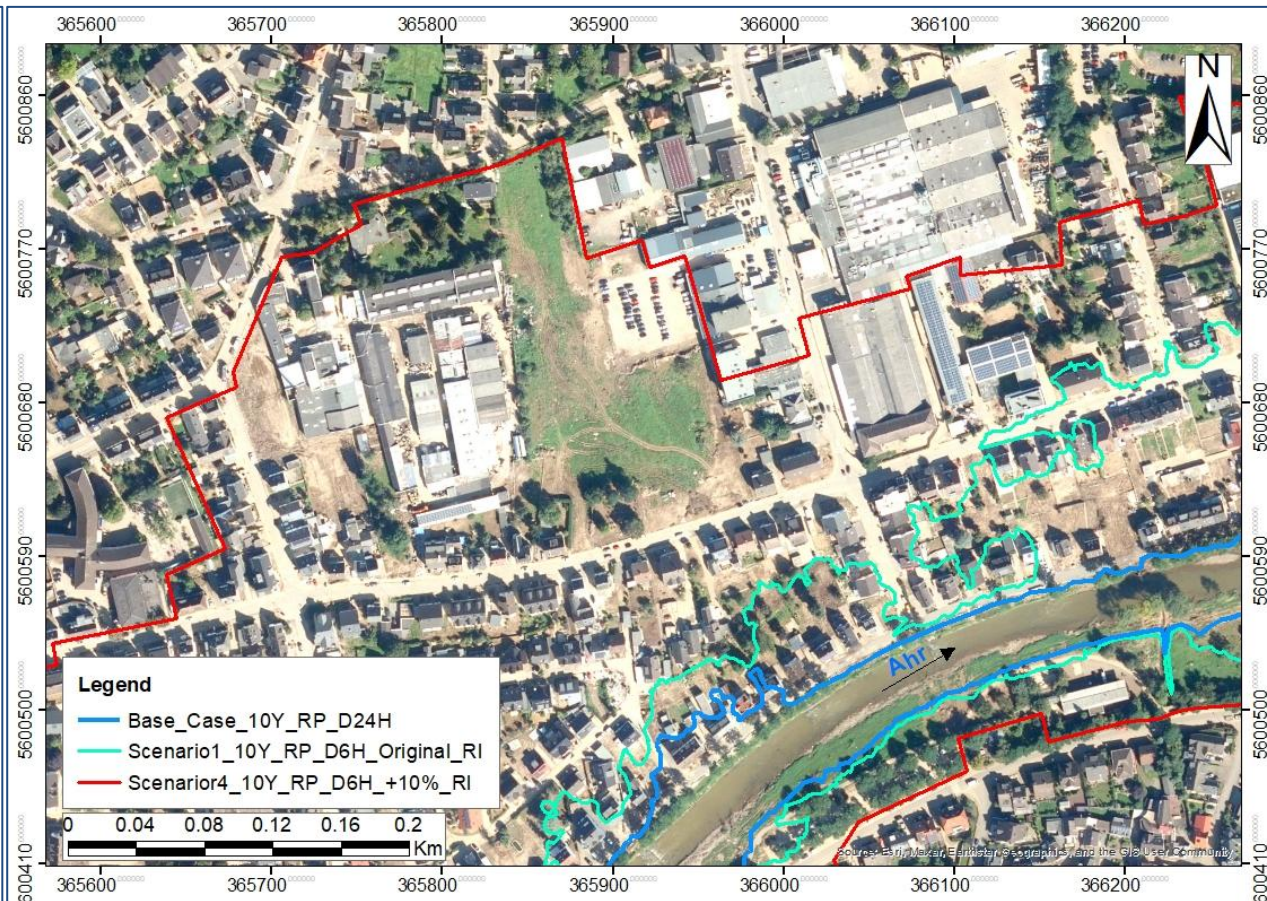
Catchment Ahr - Team 05 Presentation

Increased Intensity

Short Duration and Increased Intensity



01.03.2024



Presentation 3

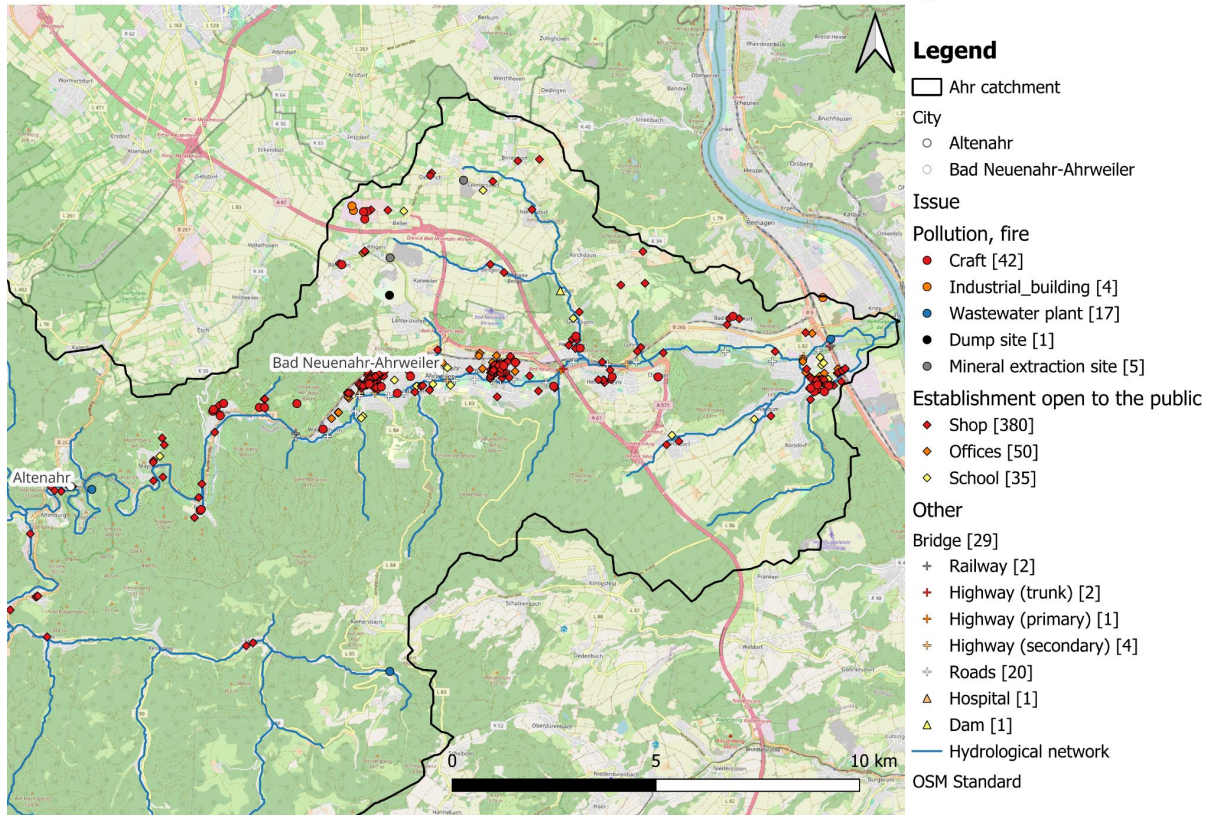
Team 05 15

Catchment Ahr - Team 05 Presentation



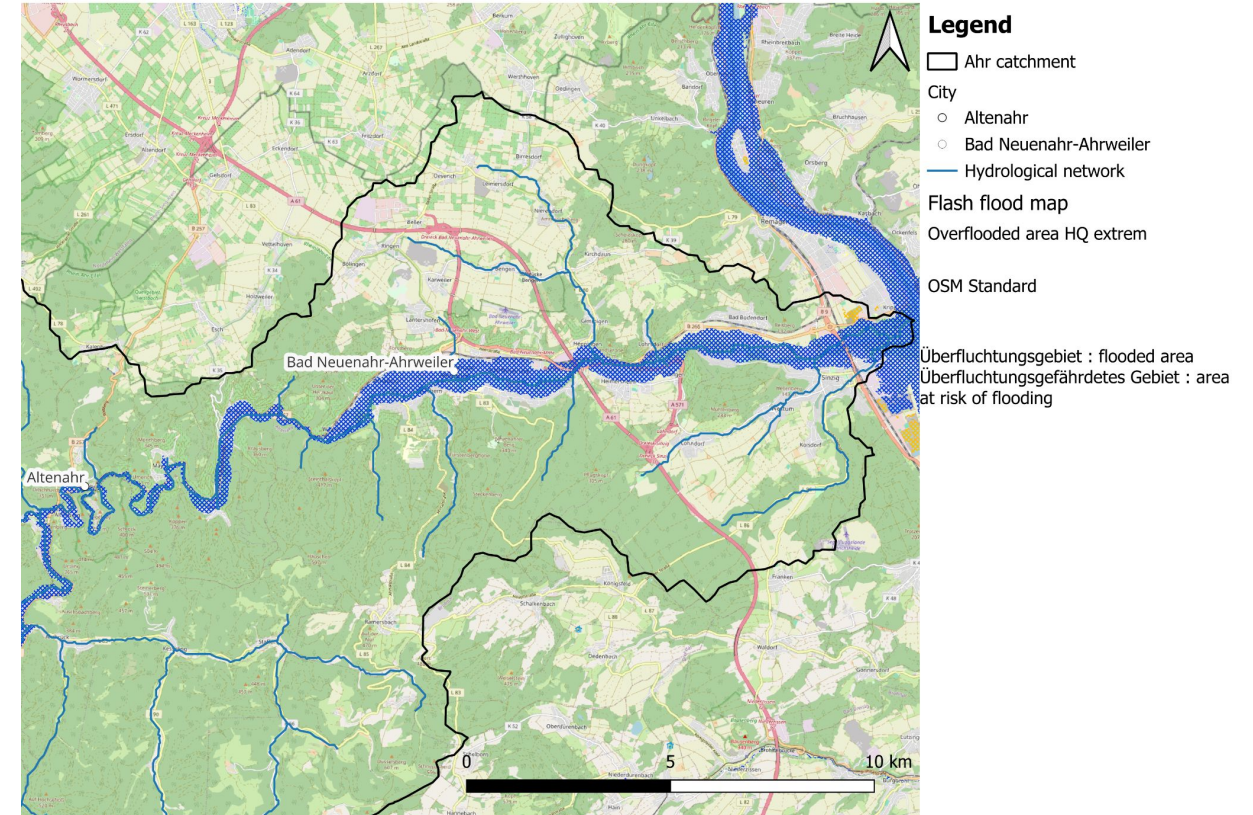
Critical assets mapping

Issues in the Ahr catchment (zone of interest).



01.03.2024

Hazard in the Ahr catchment (zone of interest).

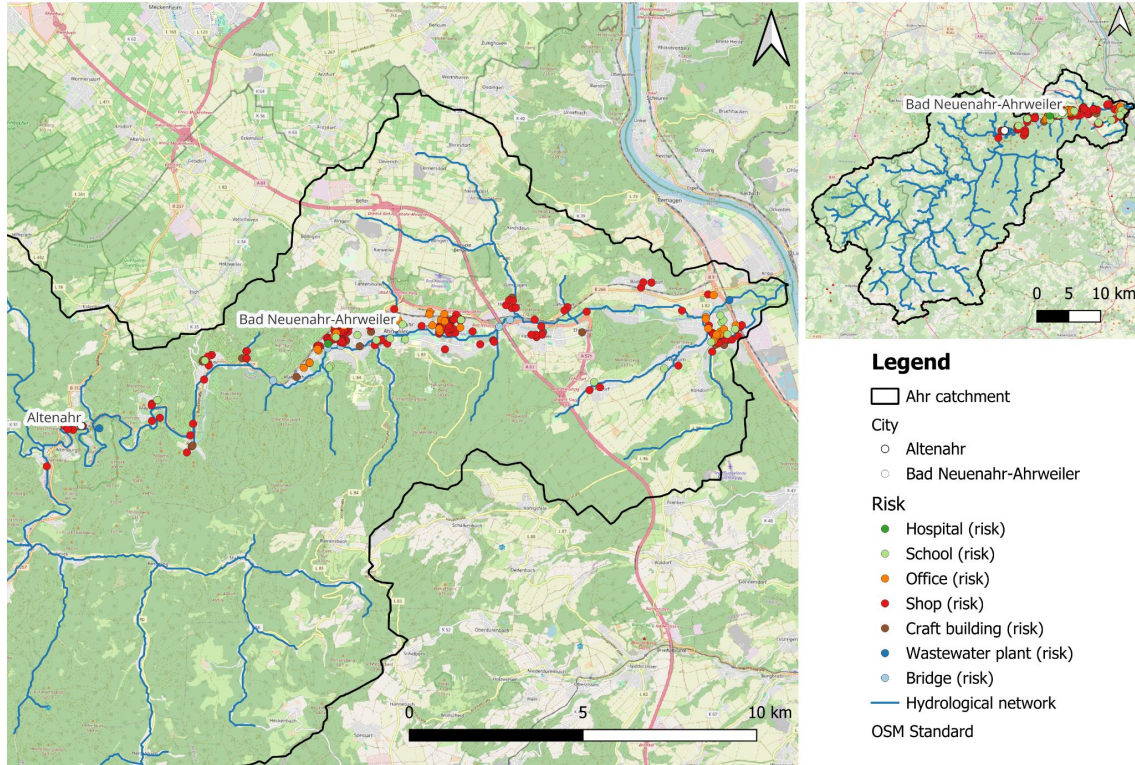


Presentation 3

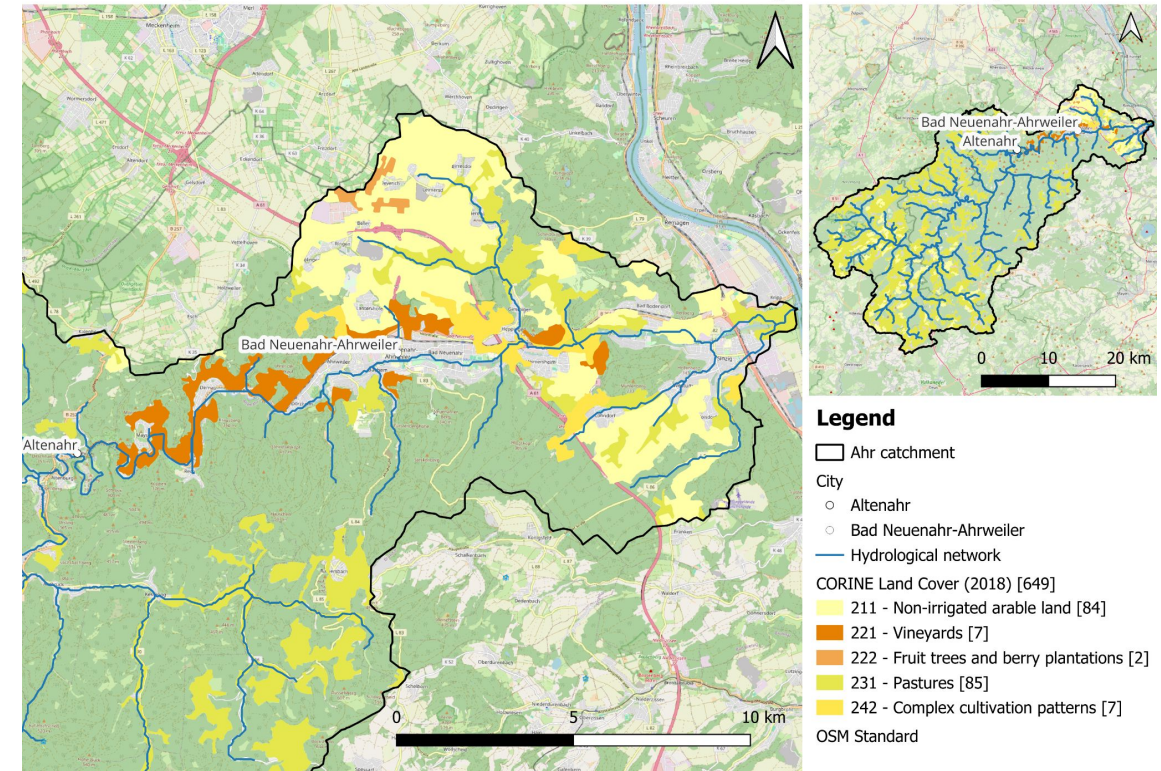
Team 05 16

Catchment Ahr - Team 05 Presentation

Risks in the Ahr catchment (zone of interest).



Agricultural land cover in the Ahr catchment (zone of interest).





Catchment Ahr - Team 05 Presentation

Solution/Risk Management Options

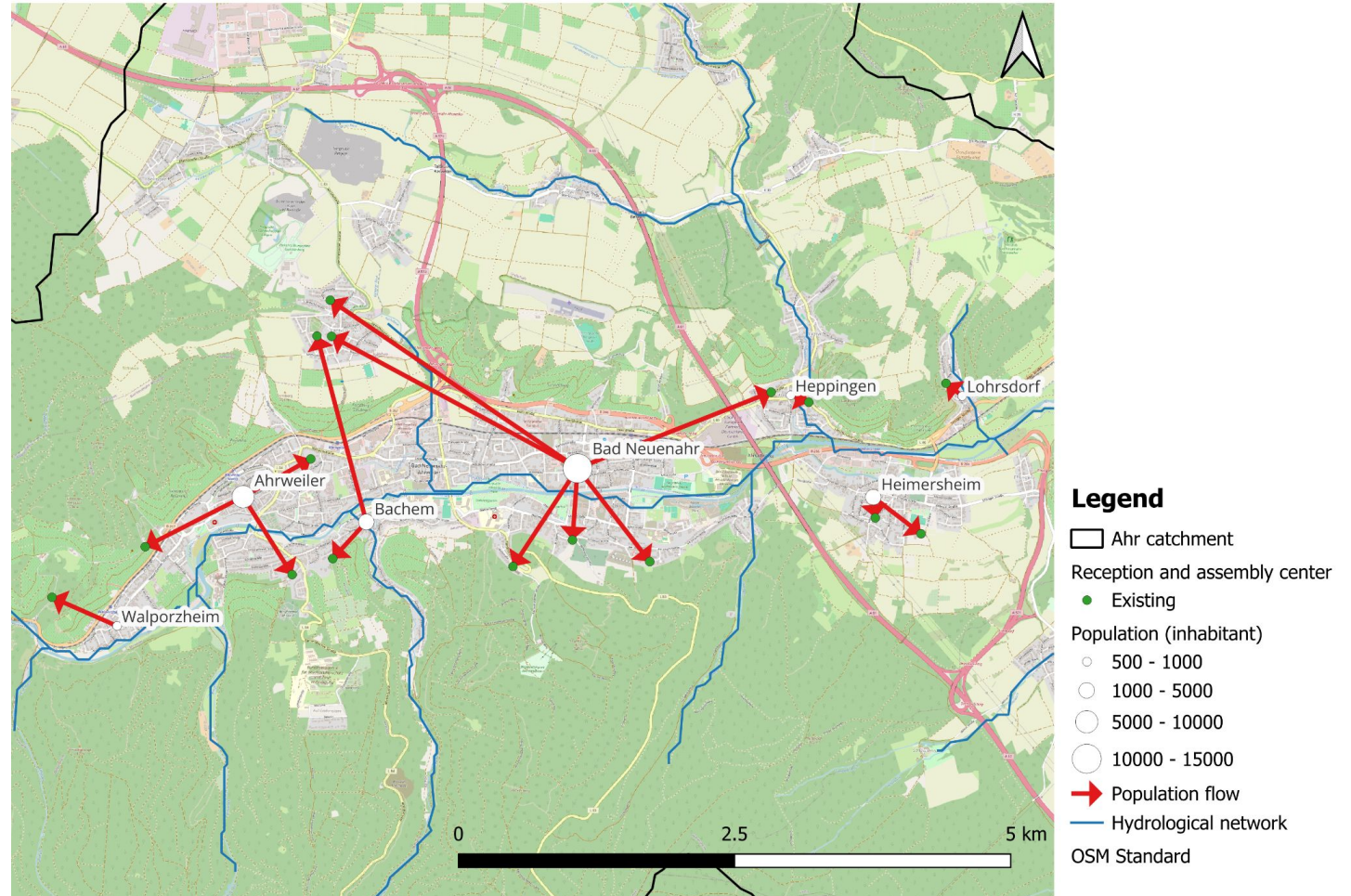
- Vulnerable areas based on the critical assets analysis
- Some solutions are not effective (retention basins, flood control basins)
- Renaturing watercourses

Catchment Ahr - Team 05 Presentation

Solution for security

- Communication
- Reception centers

Reception and assembly center in the Ahr catchment (zone of interest).



01.03.2024

Presentation 3

Team 05 19



Catchment Ahr - Team 05 Presentation

Conclusions

- Climate change effects are **impactful** and cannot be neglected.
- Hydrological model is simple and carries **uncertainties**.
- Data availability → limitation
- Model is suitable for preliminary analysis.



Thanks for listening!

Any questions?