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Vulnerability assessment of embankments and bridges exposed to flooding hazards

D6.1 Integration of Inventory of critical infrastructure as an operational layer in the existing GIS platforms

Project Information

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VEILIGHEIDSREGIO ZUID-HOLLAND ZUID	Netherlands
INGEO BV	Netherlands
ZAVOD ZA GRADBENISTVO SLOVENIJE	Slovenia
Uprava Republike Slovenije za zaščito in reševanje	Slovenia

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Executive Summary

This deliverable is a record of developed separate operational GIS layers for selected case study areas which are integrated into GIS platforms of City of Karlovac and Safety Region South Holland.

Keywords: critical infrastructure assets, categorization, GIS layers, risk maps.

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1 Case study: City of Karlovac, Croatia

For the City of Karlovac following GIS layers have been developed and integrated into the GIS Karlovac https://gis.karlovac.hr/gis :

1. Critical assets
    - Health care institution, School, Kindergarten, Nursing home, Industry, Landfill, Wastewater treatment plant, Citizen shelter, Bridges, Riverbanks
2. High probability of flood occurrence (return period 25 years)
    - Flood map
    - Flooded transport infrastructure
    - Highway
    - Regional road
    - Local road
    - Railway
    - Buildings (flooded, flooded (1 floor), not flooded) (including population)
    - Vulnerability analysis for riverbanks and bridges
    - Bridges
    - Riverbanks
3. Medium probability of flood occurrence (return period 100 years)
    - Flood map
    - Flooded transport infrastructure
    - Highway
    - Regional road
    - Local road
    - Railway
    - Buildings (flooded, flooded (1 floor), not flooded) (including population)
    - Vulnerability analysis for riverbanks and bridges
    - Bridges
    - Riverbanks
4. Low probability of flood occurrence (return period 1000 years)
    - Flood map
    - Flooded transport infrastructure
    - Highway
    - Regional road
    - Local road
    - Railway
    - Buildings (flooded, flooded (1 floor), not flooded) (including population)
    - Vulnerability analysis for riverbanks and bridges
    - Bridges
    - Riverbanks

Examples of GIS layers developed for GIS Karlovac:

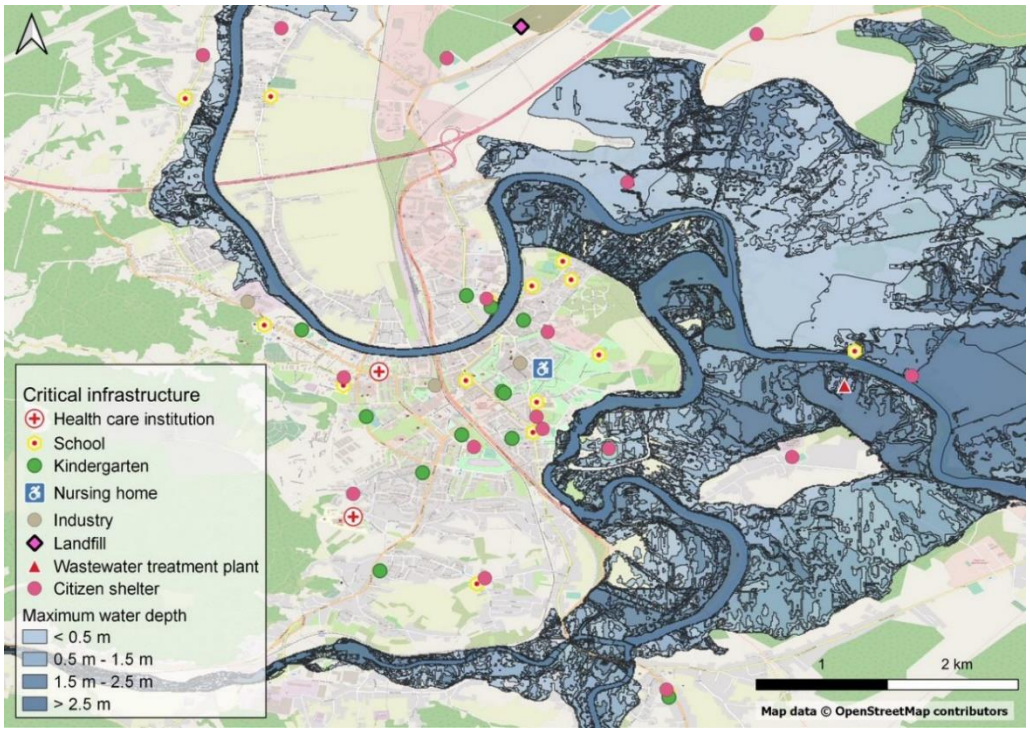

Figure 1 Critical infrastructure and locations of shelters for evacuation of population overlapped with flood map for high probability of flood occurrence (return period 25 years)

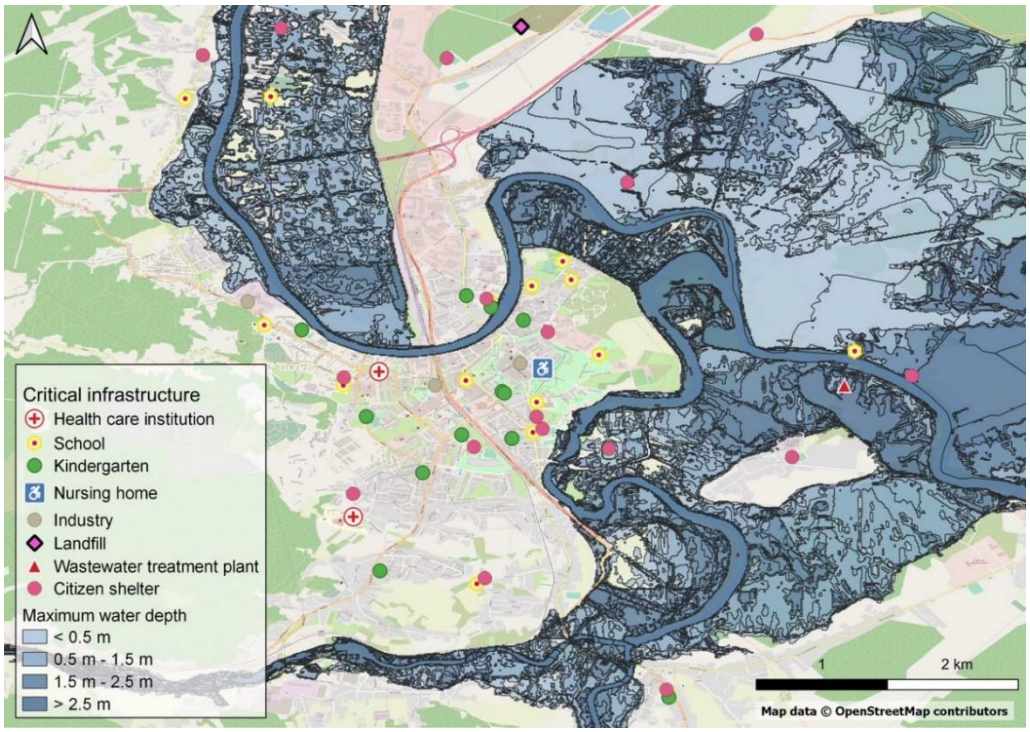

Figure 2 Critical infrastructure and locations of shelters for evacuation of population overlapped with flood map for medium probability of flood occurrence (return period 100 years)

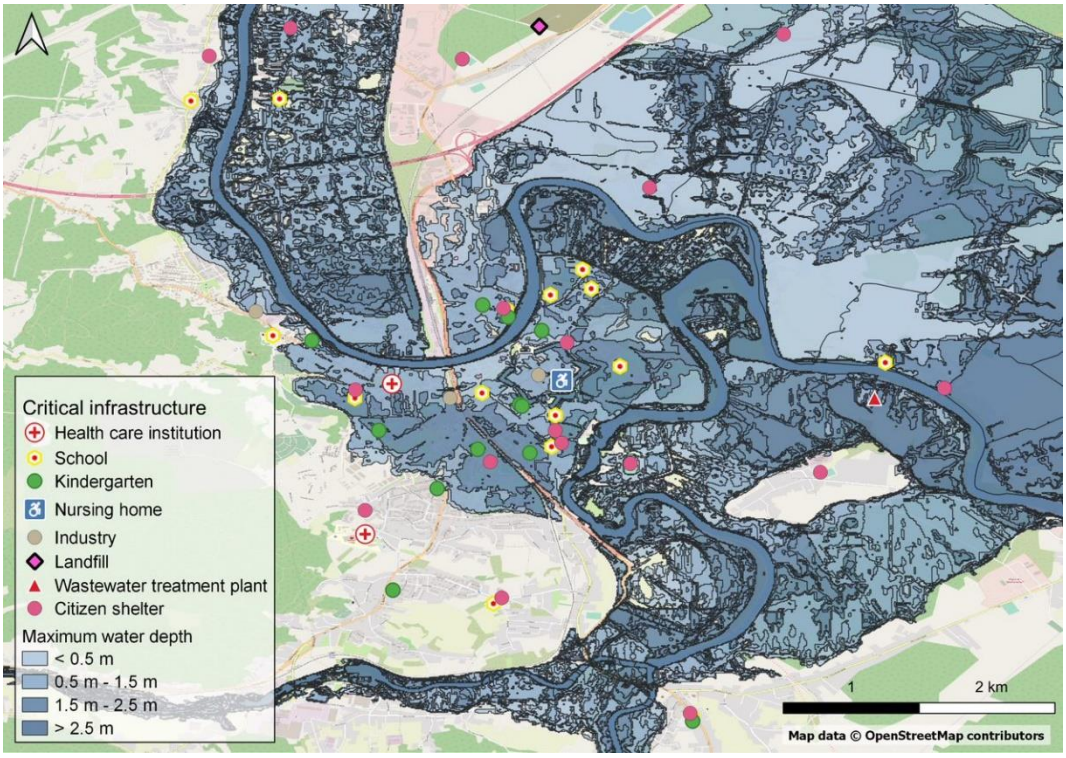

Figure 3 Critical infrastructure and locations of shelters for evacuation of population overlapped with flood map for low probability of flood occurrence (return period 1000 years)

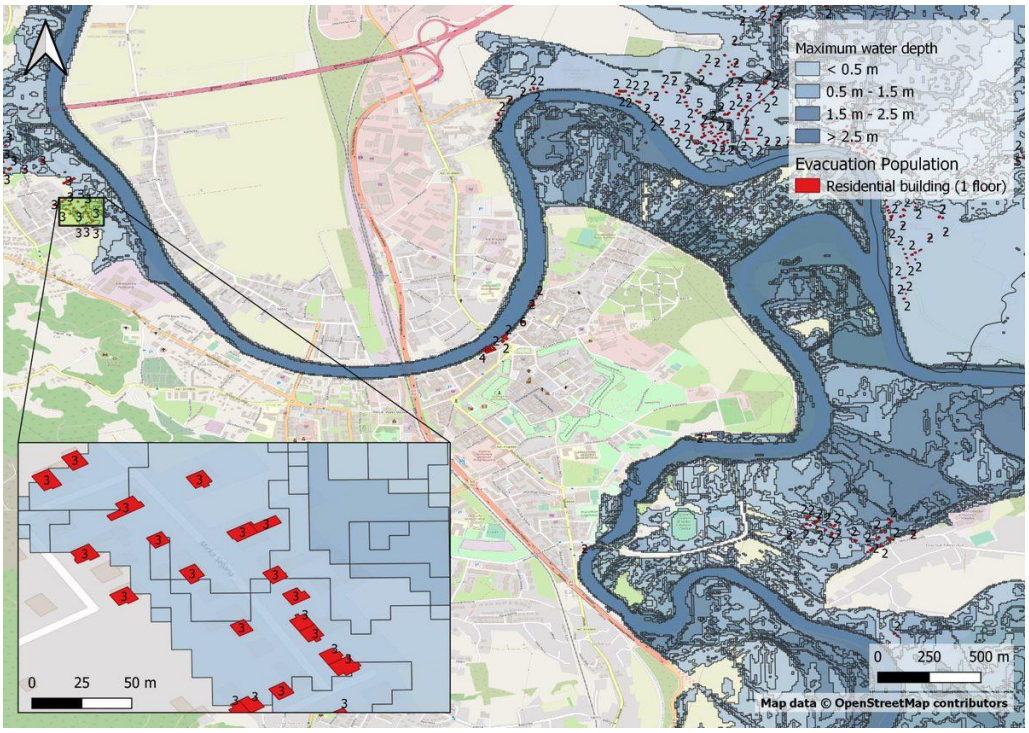

Figure 4 Population flood risk map - Flood map for high probability of flood occurrence (Croatian Waters, 2019) overlapped with low rise buildings (red) and number of residents

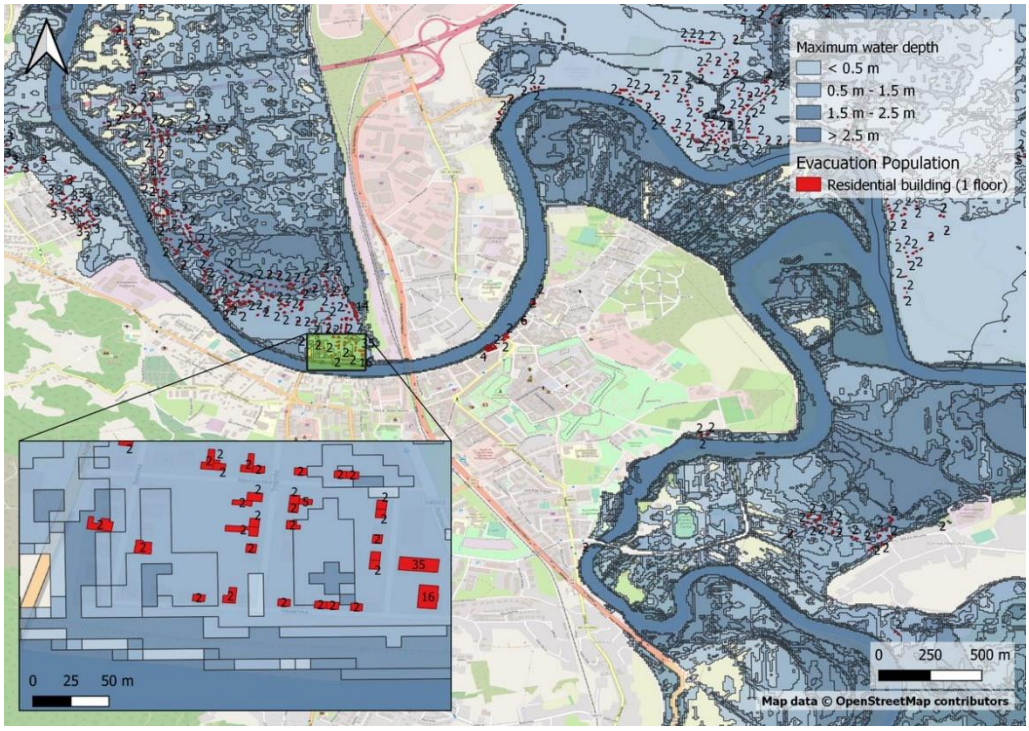

Figure 5 Population flood risk map - Flood map for medium probability of flood occurrence (Croatian Waters, 2019) overlapped with low rise buildings (red) and number of residents

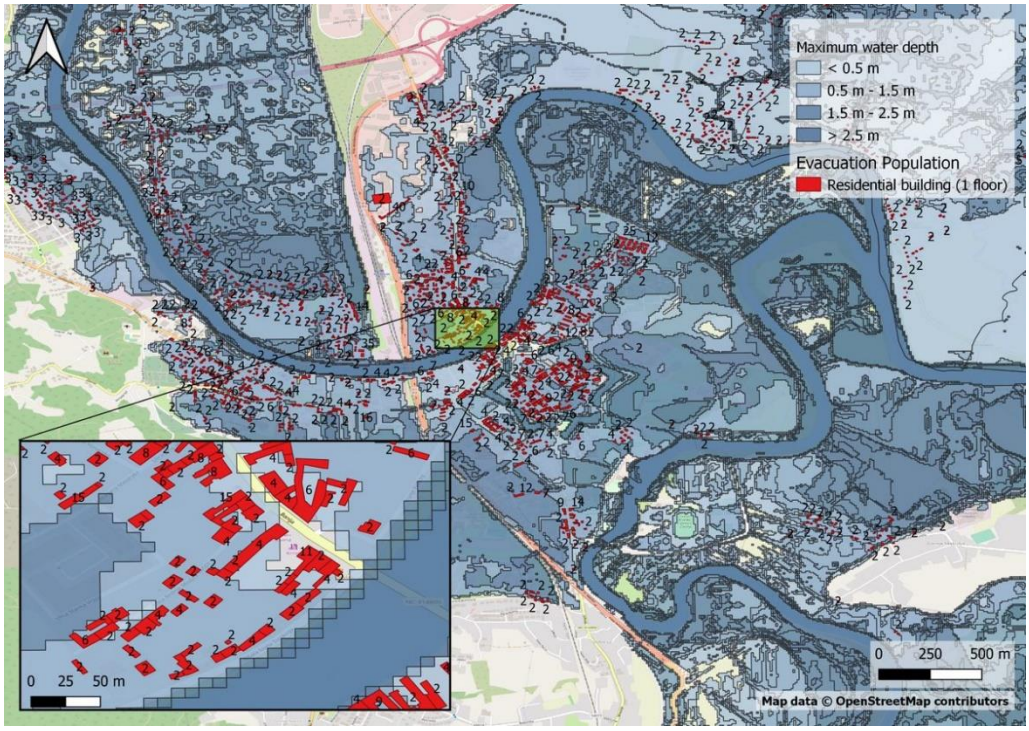

Figure 6 Population flood risk map - Flood map for low probability of flood occurrence (Croatian Waters, 2019) overlapped with low rise buildings (red) and number of residents

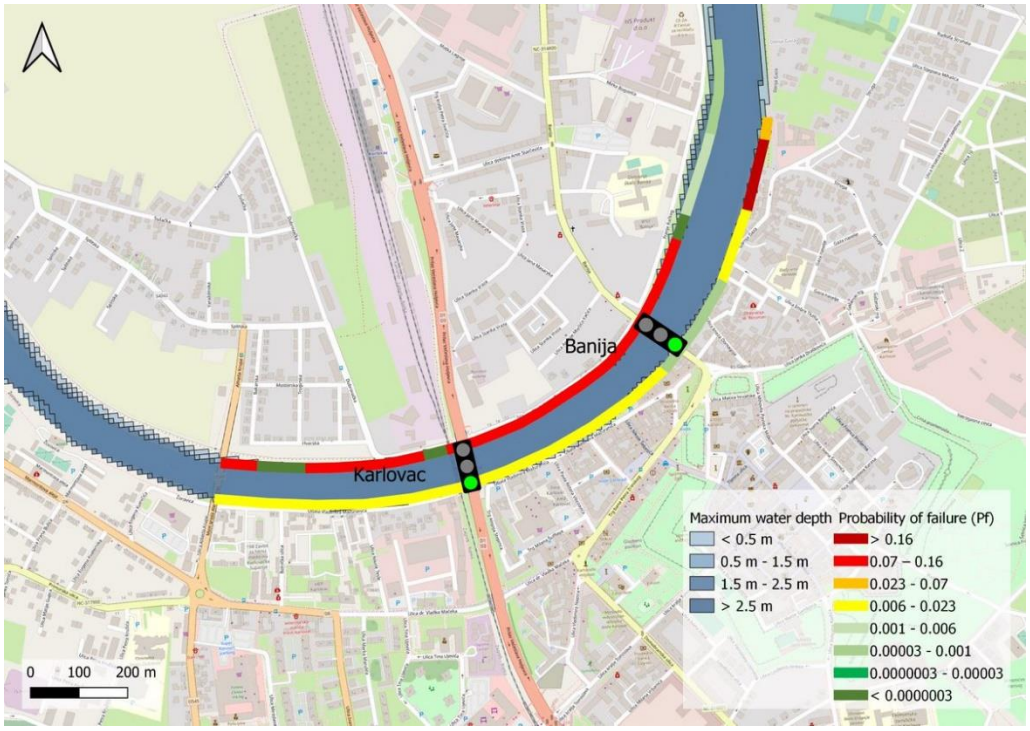

Figure 7 Results of the vulnerability analysis for embankments and bridges for high probability of flood occurrence (return period 25 years)

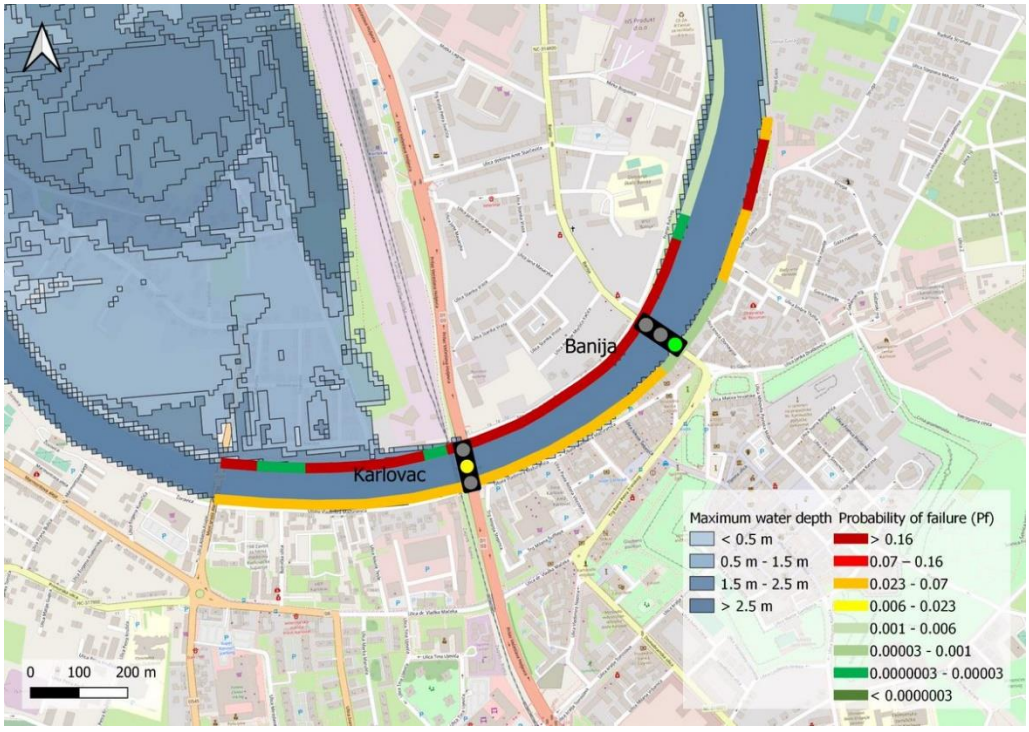

Figure 8 Results of the vulnerability analysis for embankments and bridges for medium probability of flood occurrence (return period 100 years)

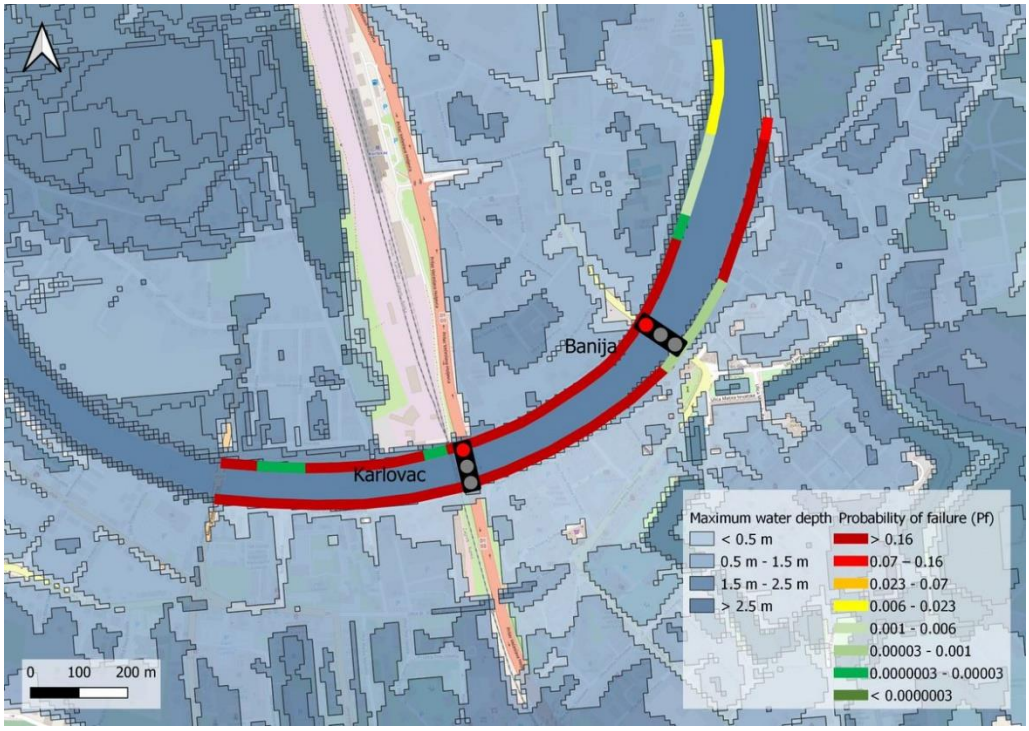

Figure 9 Results of the vulnerability analysis for embankments and bridges for low probability of flood occurrence (return period 1000 years)

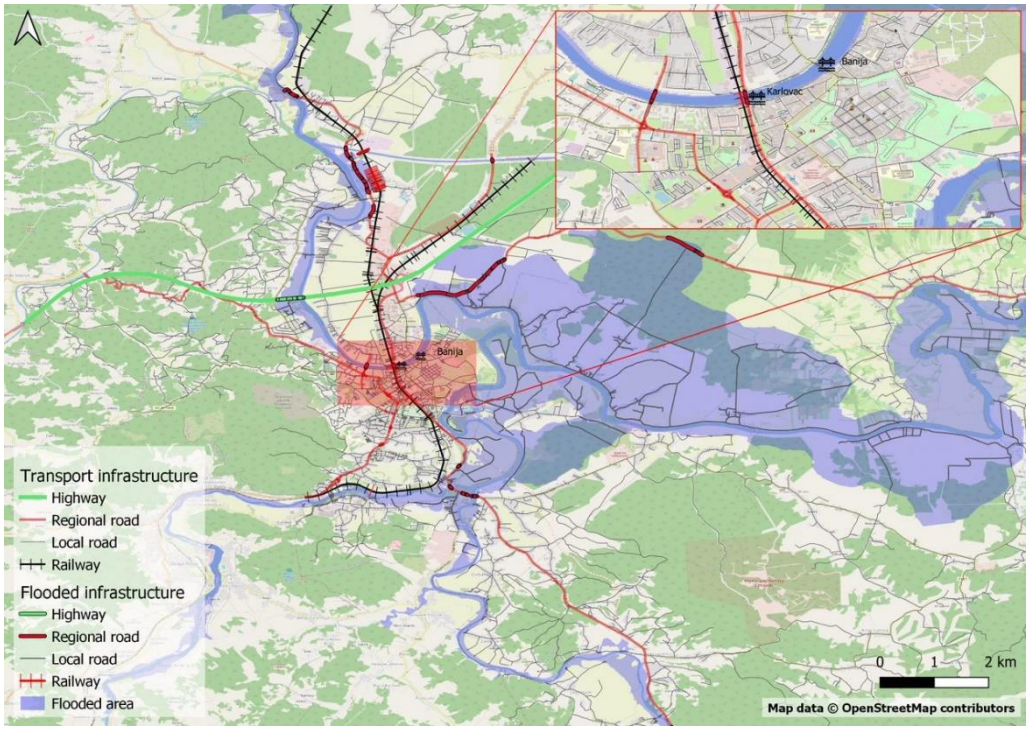

Figure 10 Flooded roads for high probability of flood occurrence (return period 25 years)

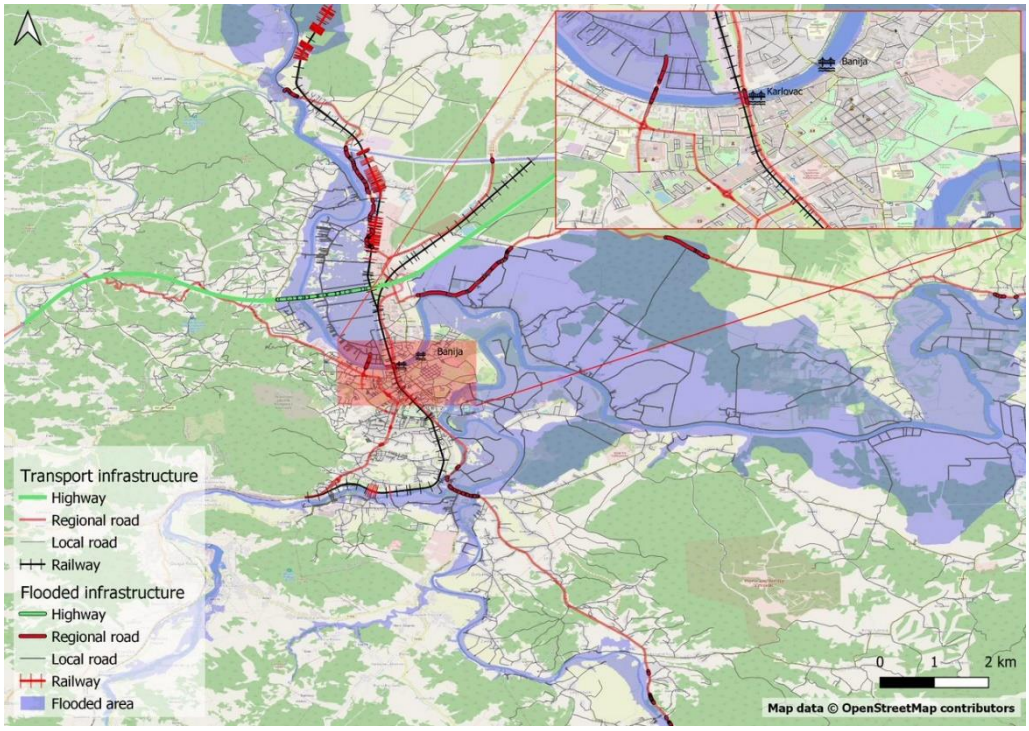

Figure 11 Flooded roads for medium probability of flood occurrence (return period 100 years)

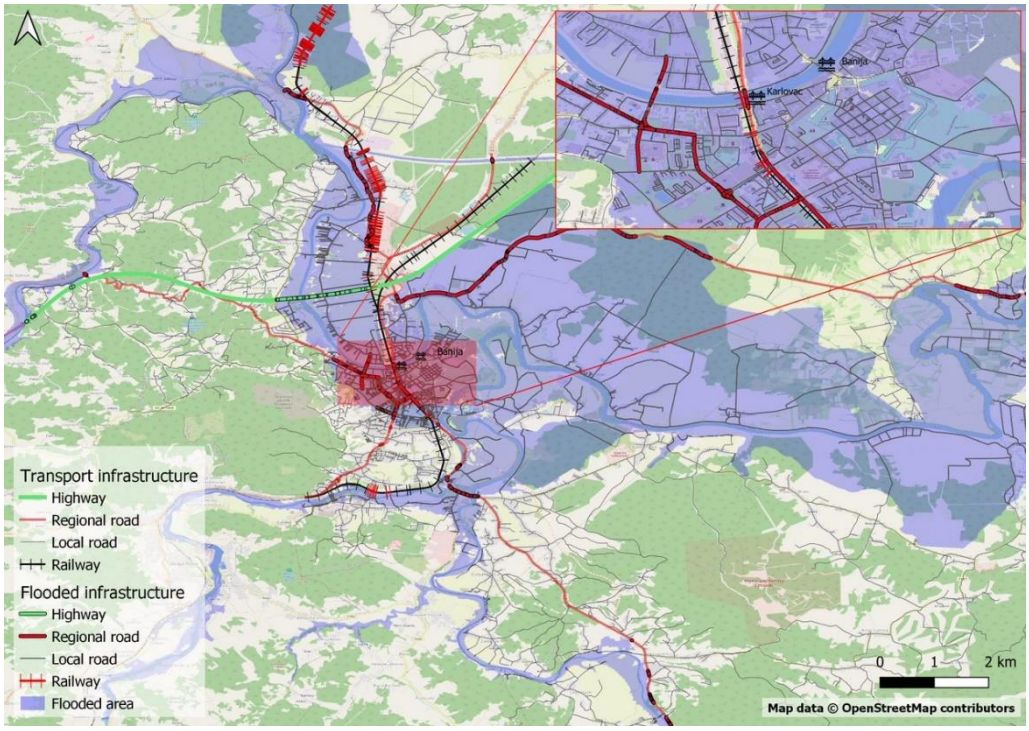

Figure 12 Flooded roads for low probability of flood occurrence (return period 1000 years)

2 Case study: Oostmolendijk, the Netherlands

For the Civil Protection Agency in the Region South Holland (VRZHZ) in the Netherlands following GIS layers have been developed and integrated into the GIS platform GIS VRZHZ :

1. High probability of flood occurrence (return period 4,000 years)
   - Vulnerability analysis for embankments
2. Medium probability of flood occurrence (return period 40,000 years)
   - Vulnerability analysis for embankments
3. Low probability of flood occurrence (return period 400,000 years)
   - Vulnerability analysis for embankments
4. Evacuation maps for 3 different flood scenarios

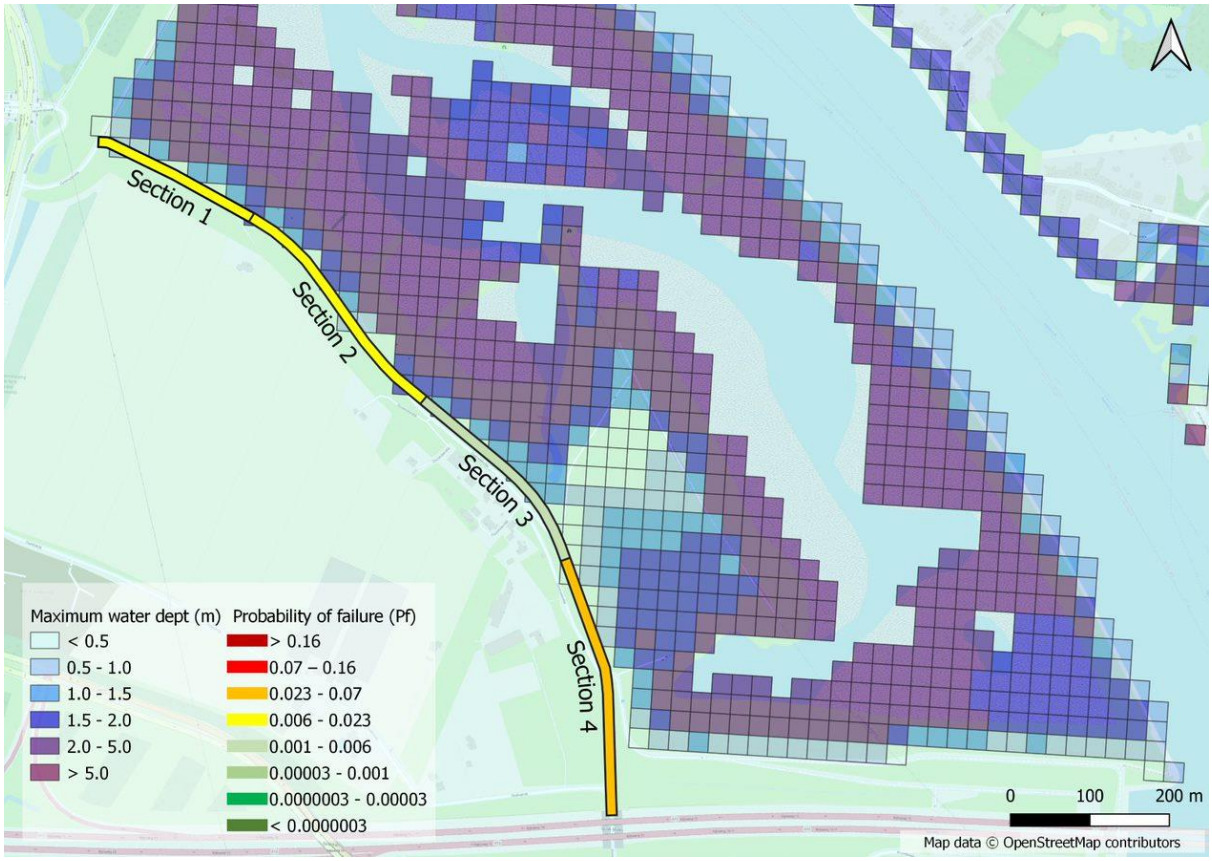

Figure 13 Oostmolendijk vulnerability divided in Sections 1 to 4 at for flood return period 100 years

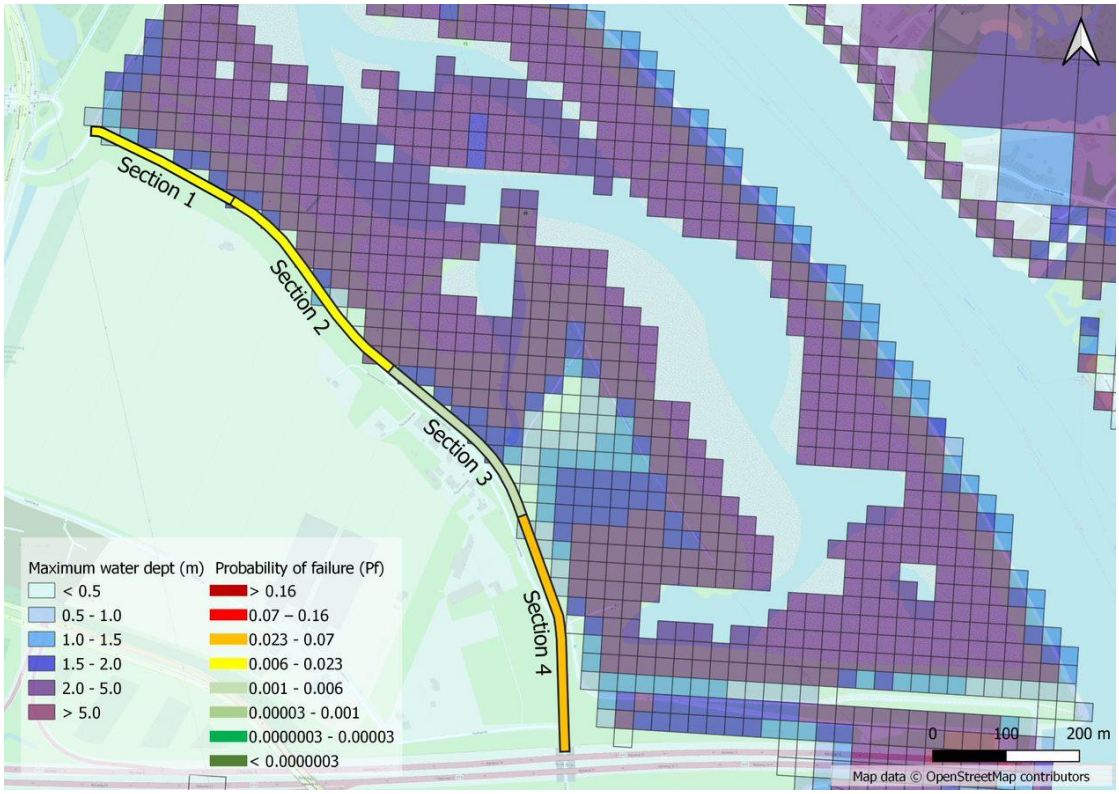

Figure 14 Oostmolendijk vulnerability divided in Sections 1 to 4 at for flood return period 1000 years

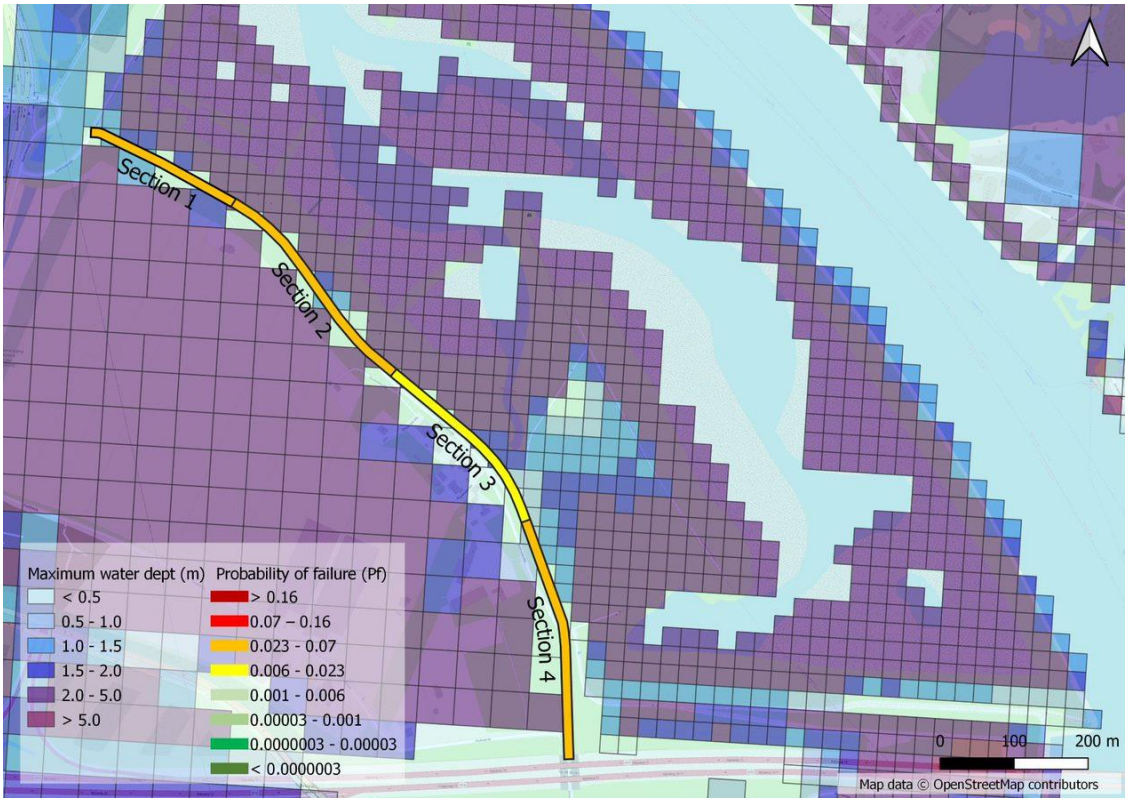

Figure 15 Oostmolendijk vulnerability divided in Sections 1 to 4 at for flood return period of 100.000 years

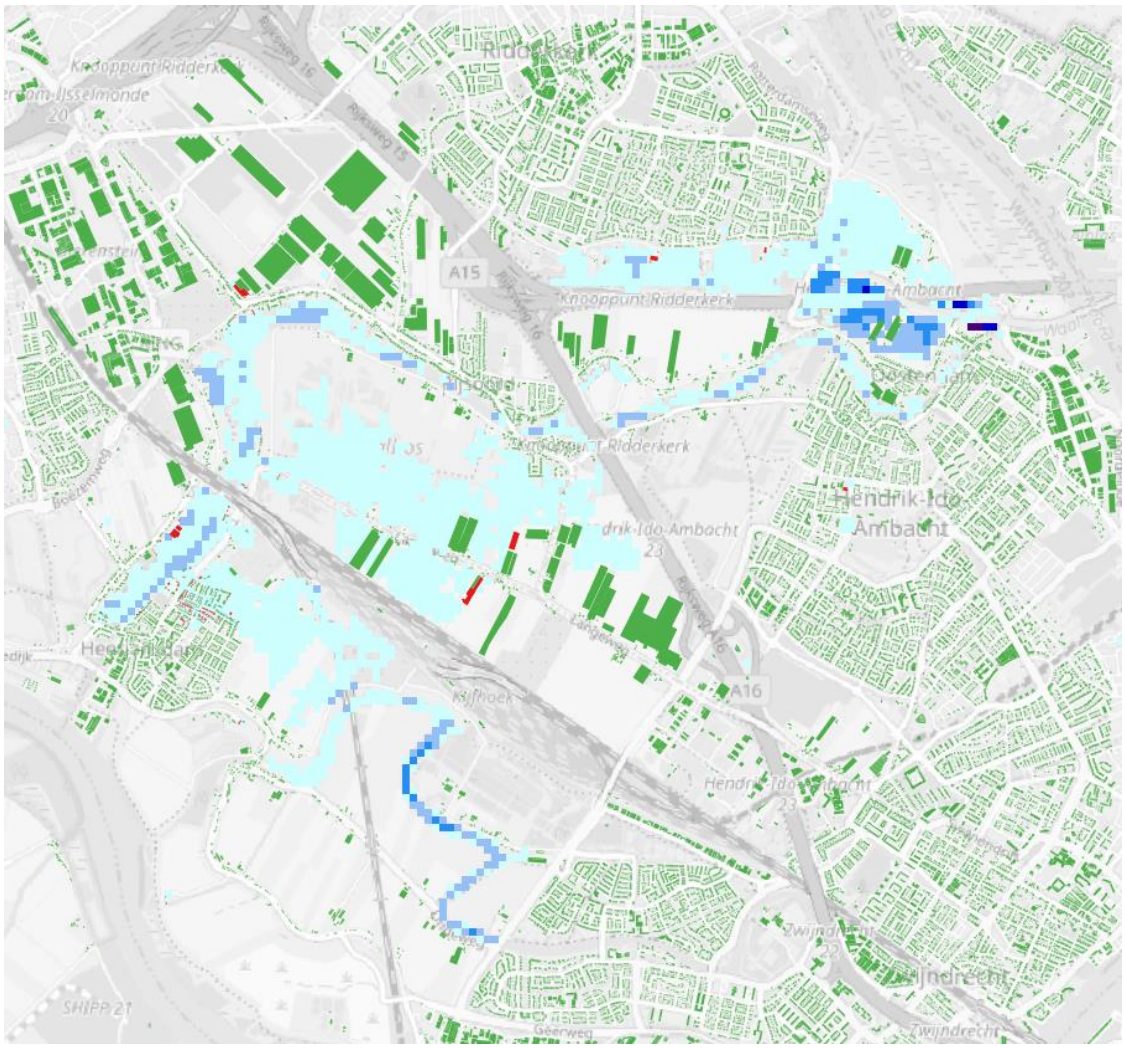

Figure 16 Prediction of buildings which need to be evacuated (red colour) and which do not need to be evacuated (green colour) for the flood scenario 1:4,000

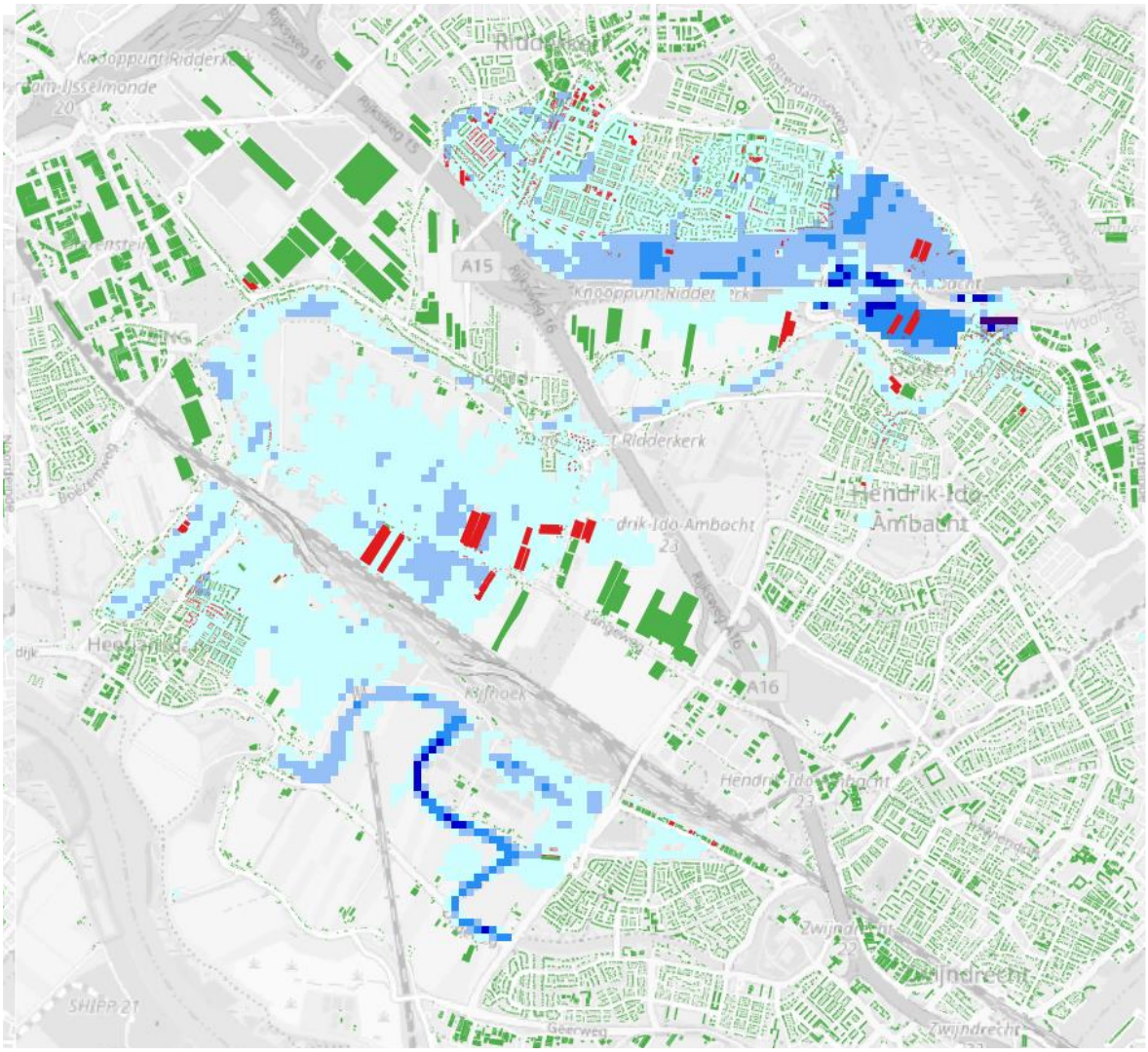

Figure 17 Prediction of buildings which need to be evacuated (red colour) and which do not need to be evacuated (green colour) for the flood scenario 1:40,000

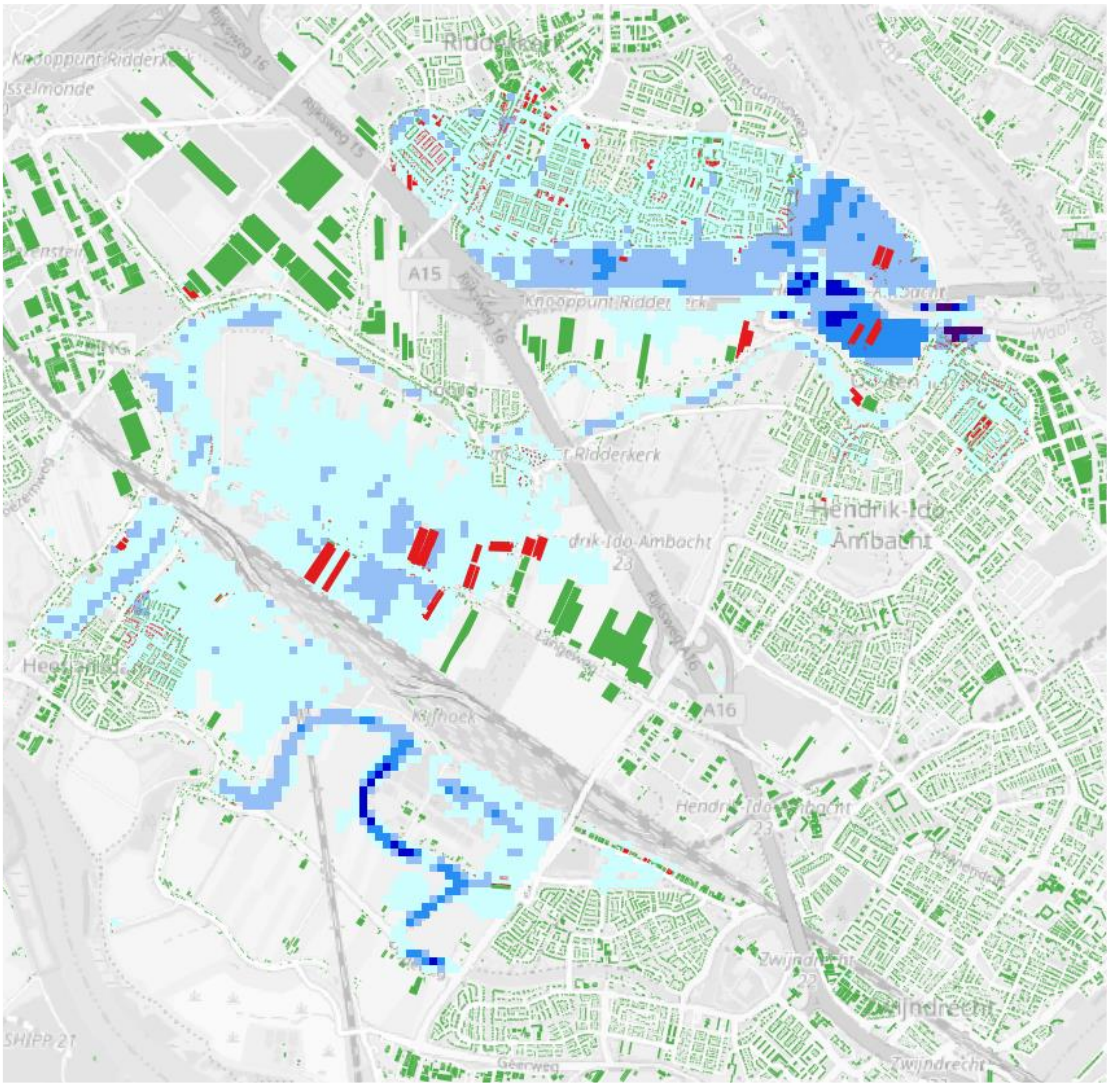

Figure 18 Prediction of buildings which need to be evacuated (red colour) and which do not need to be evacuated (green colour) for the flood scenario 1:400,000

3 References

Croatian Waters, 'Water area management plan 2022 – 2027', Flood risk management, Preliminary Flood Risk Assessment 2018.', published July 2019

Skaric Palic, S., Stipanovic, I. (2022), oVERFLOw Deliverable 5.2 Report on risk forecasting tool applied on case study areas