



Project funded by the
EUROPEAN UNION



Common borders. Common solutions.

A Scientific Network for Earthquake, Landslide and Flood Hazard Prevention

Flood Hazard and Risk Mapping in Romania –
Danube PFRA&hazard and risk mapping

PhD Prof. Mary-Jeanne ADLER, Scientific Director

Acknowledgments:

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and Hellenic National funds

within the context of the

Black Sea Basin Joint Operational Programme 2007-2013

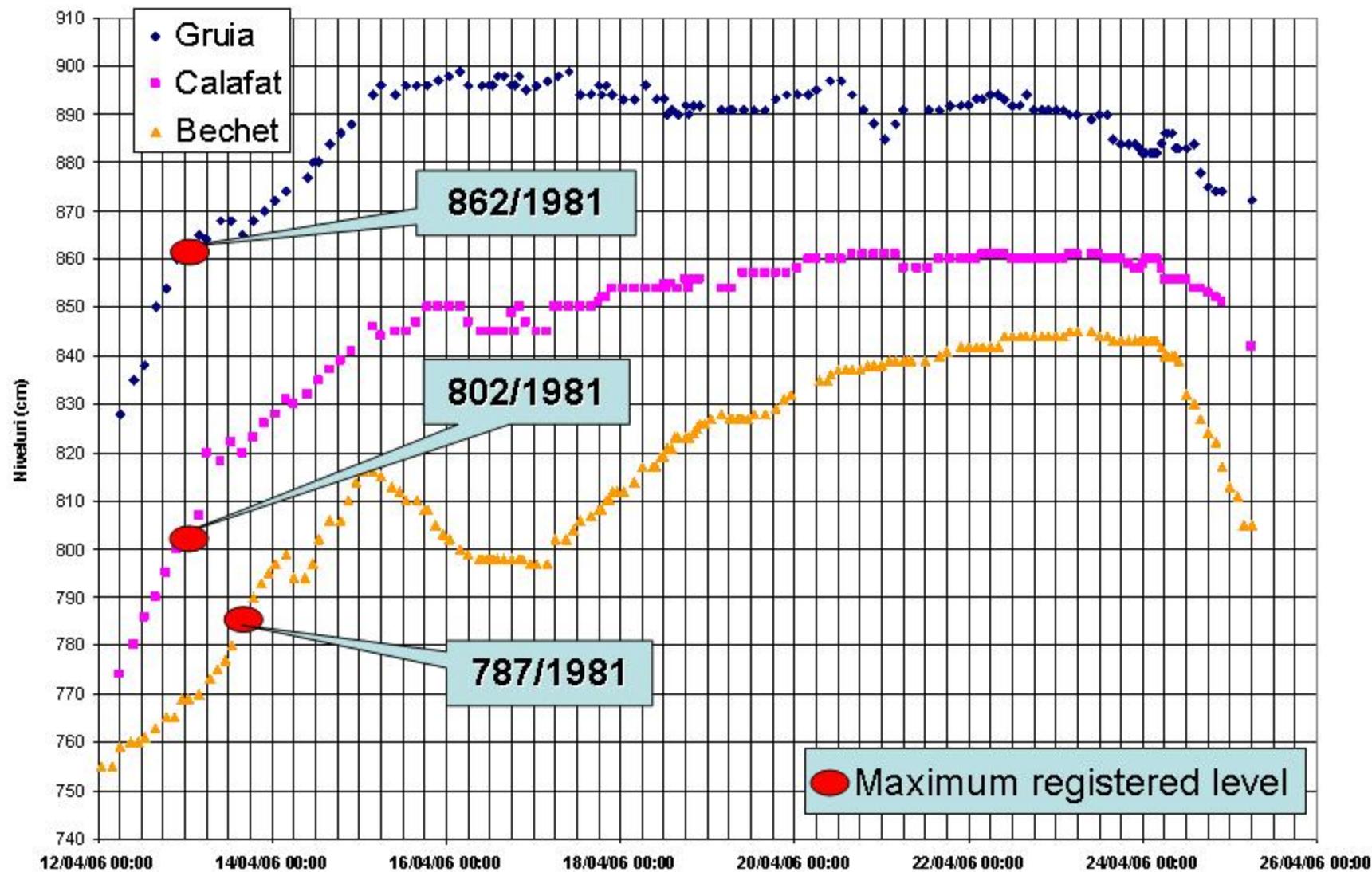




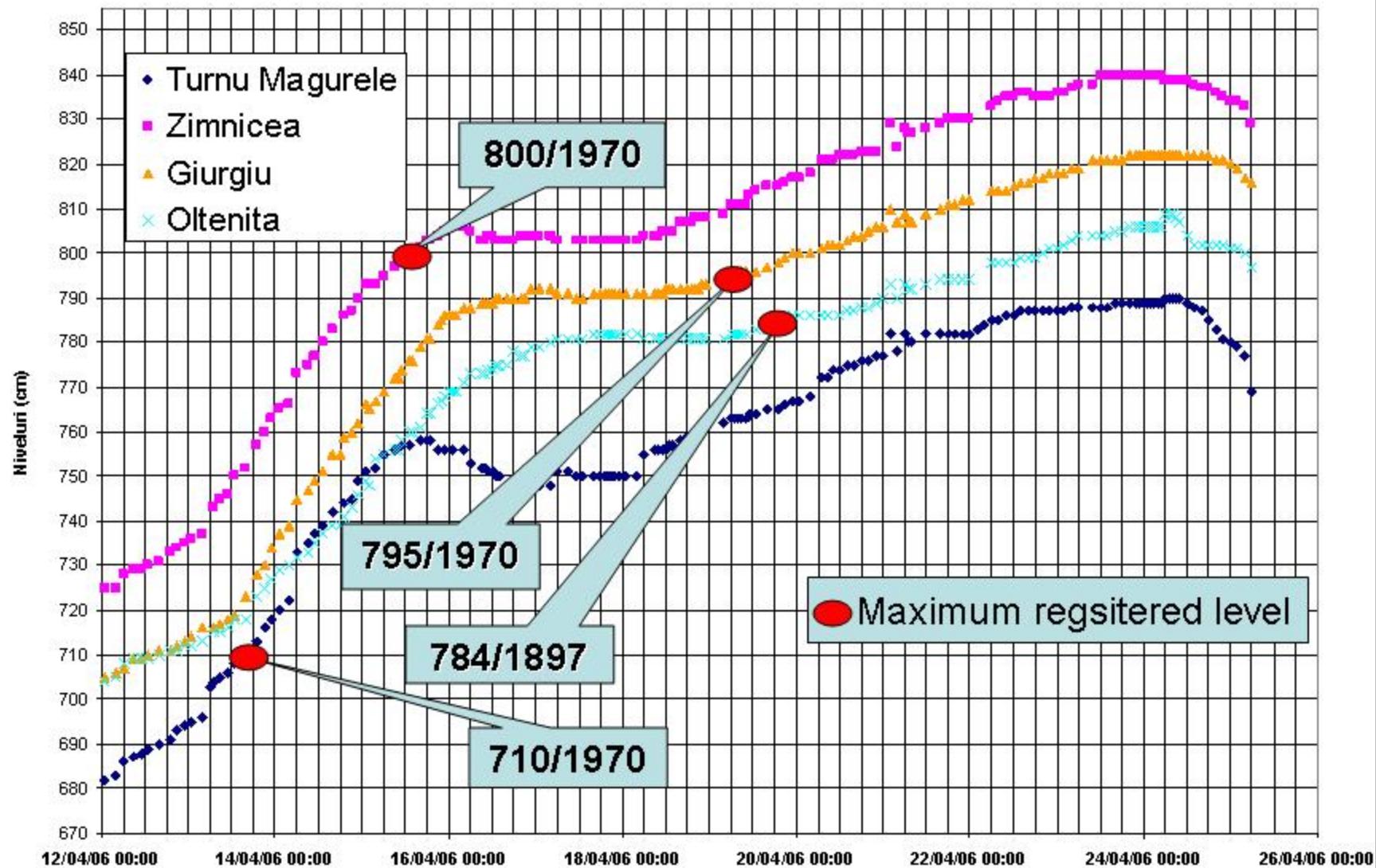
Flood Presentation content

- Historical events analysis on the Danube-PFRA – hazard and risk mapping
 - 1.Hazard and risk mapping at large scale of Danube – part I
 - 2.Small basins hazard and risk maps in Dobrodgea area – part II – Ovidius University team

Level values on Danube at Gruia-Calafat-Bechet during the period April 12-25, 2006

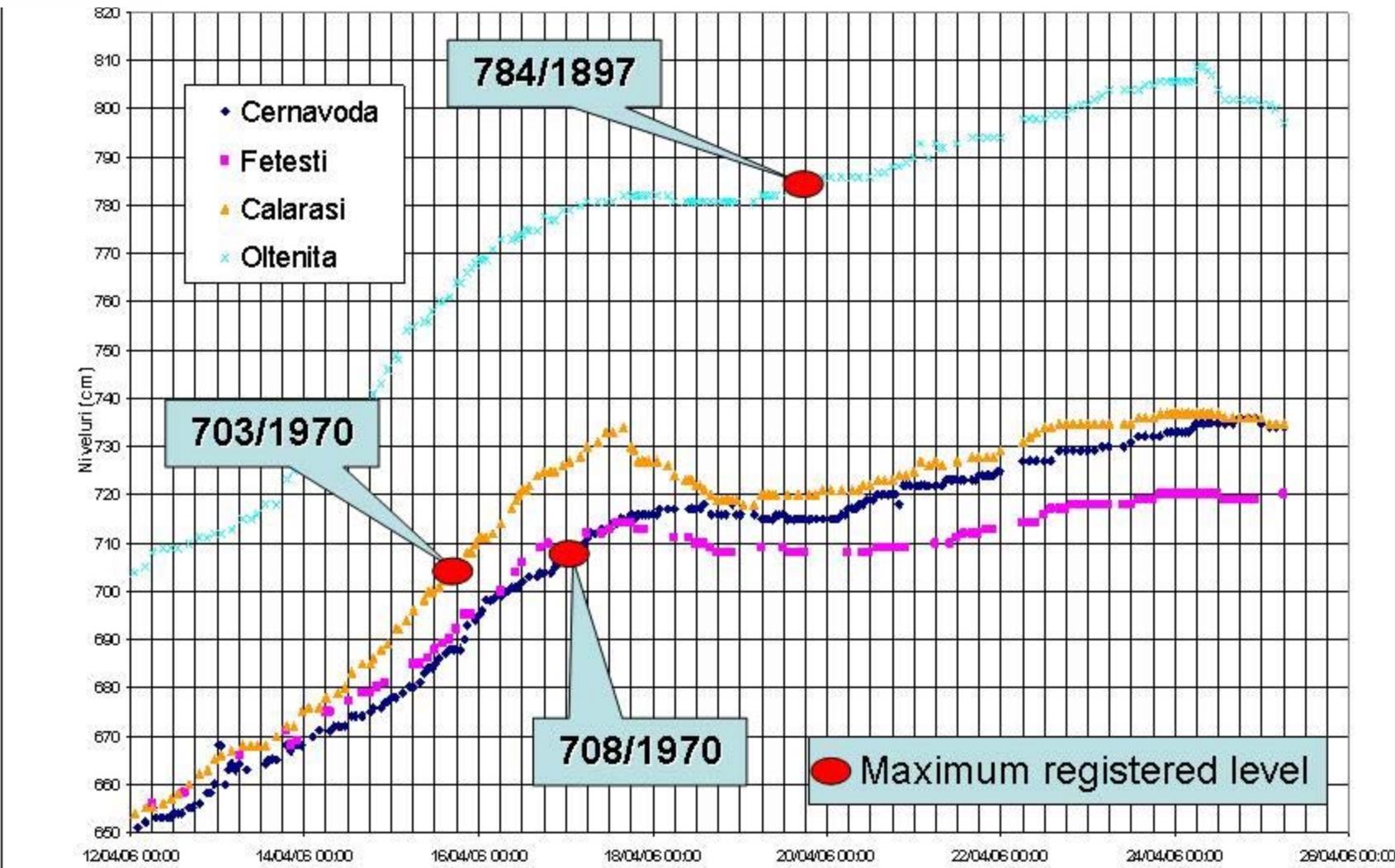


Level values on Danube at Turnu Magurele, Zimnicea, Giurgiu and Oltenita during the period April 12-25, 2006

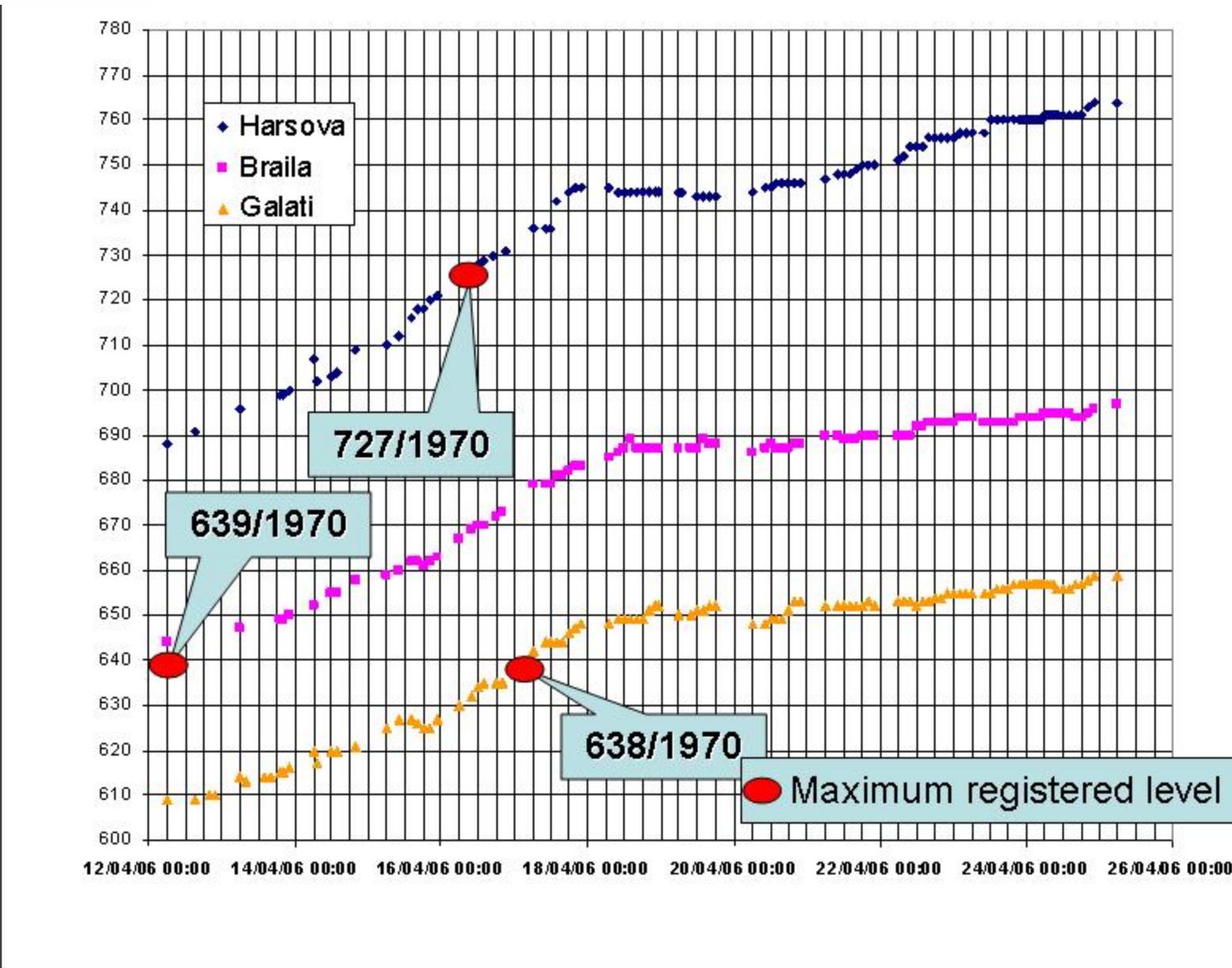




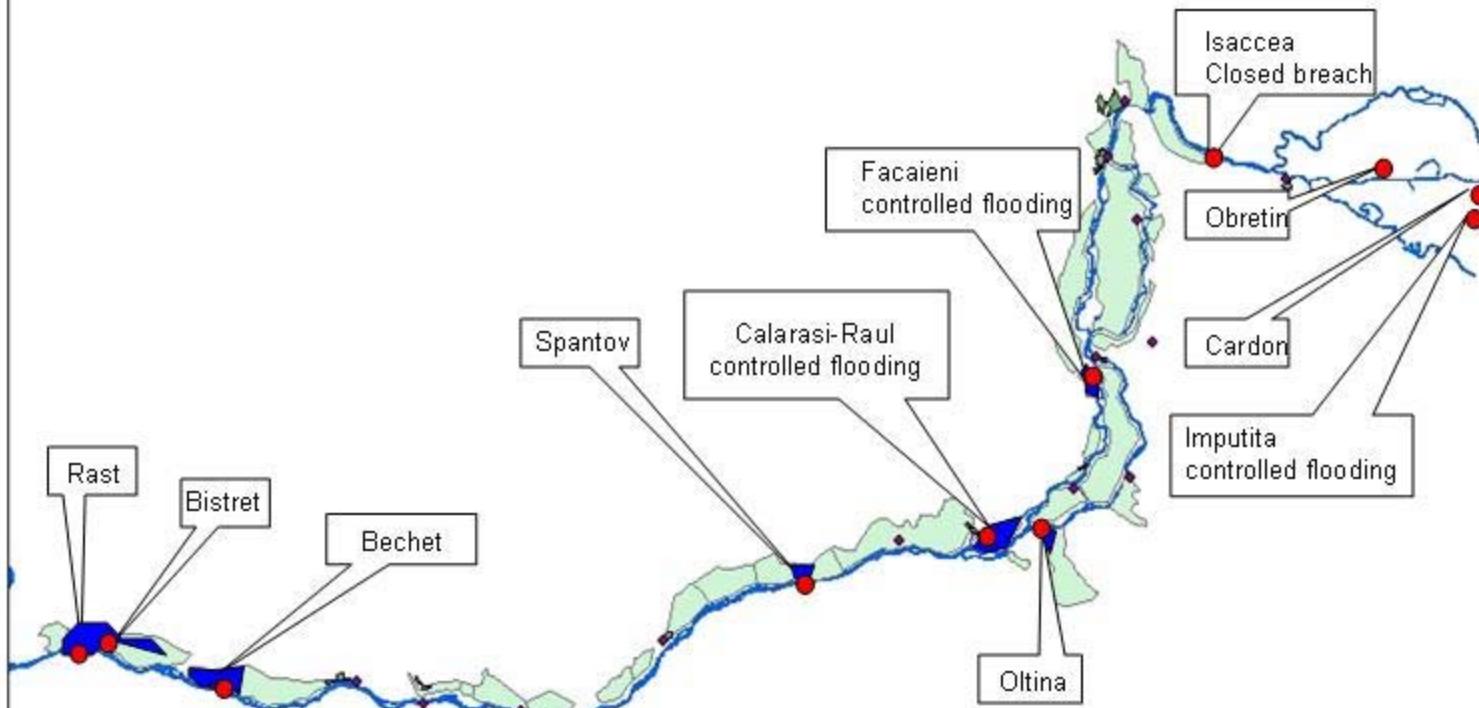
Level values on Danube at Oltenita, Calarasi, Cernavoda and Fetesti during the period April 12-25, 2006



Level values on Danube at Harsova, Braila and Galati during the period 12-25.04.2006

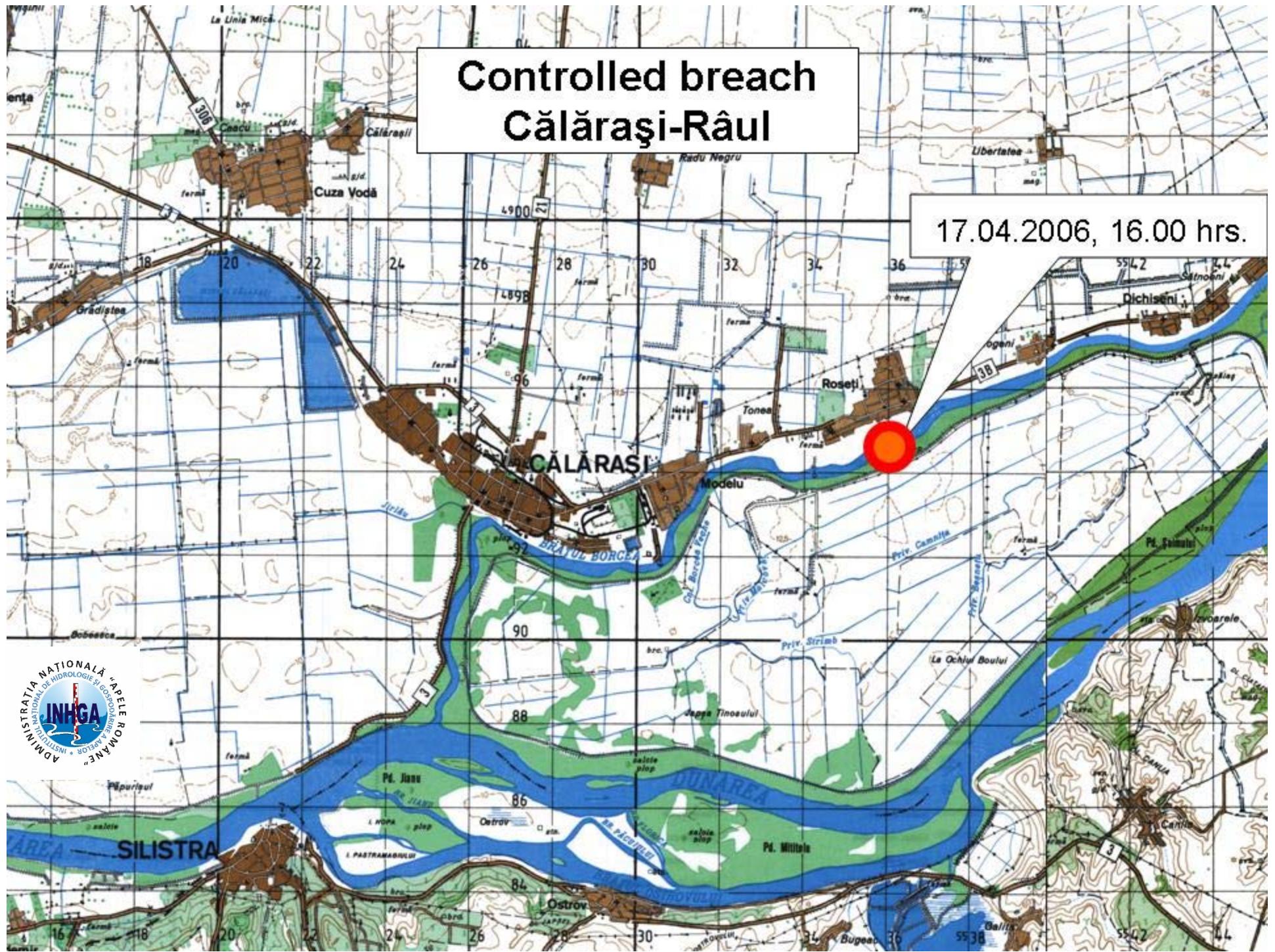


Danube's dike breaches -2006-



Controlled breach Călărași-Râul

17.04.2006, 16.00 hrs.



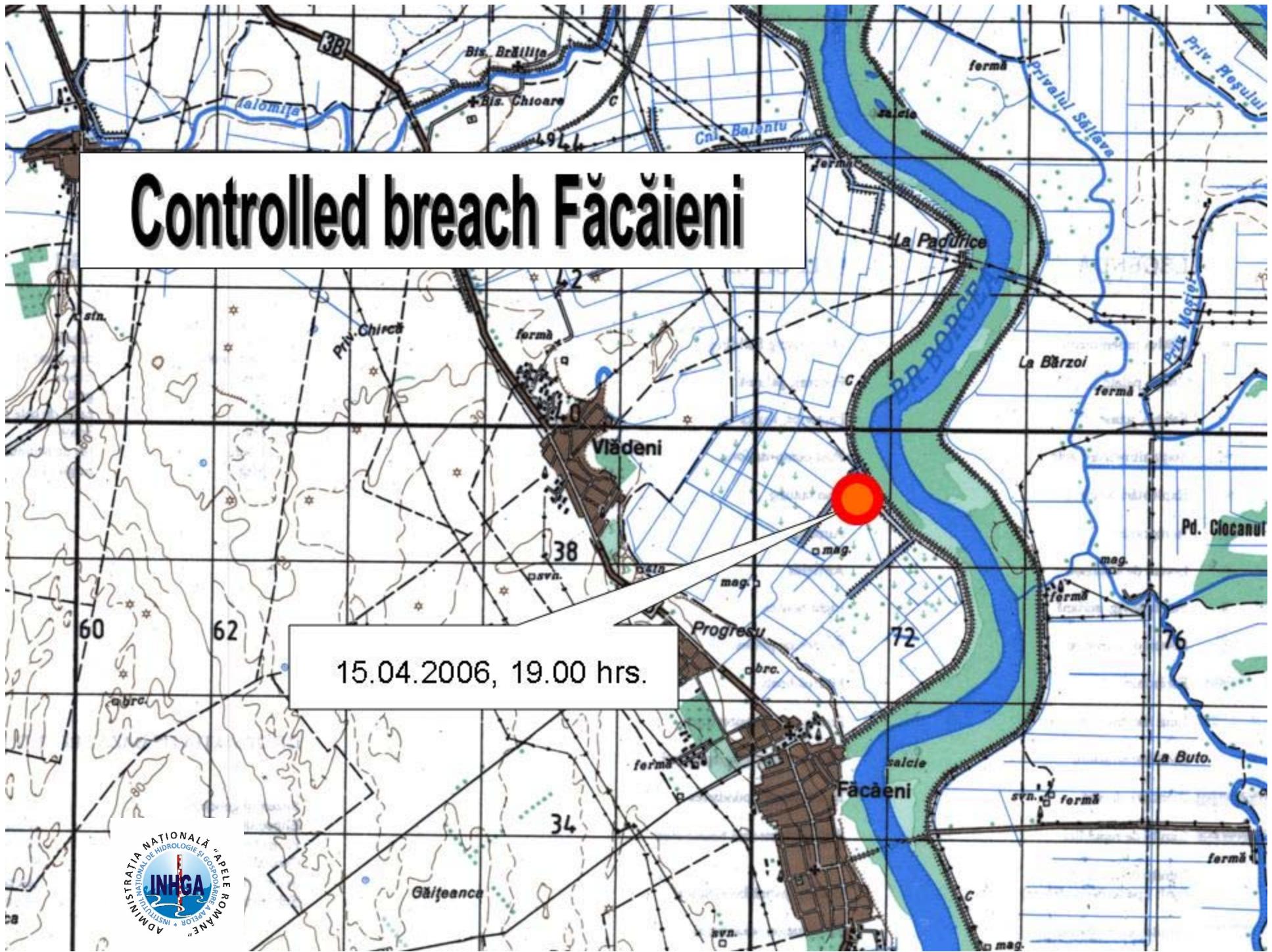
A topographic map showing a coastal area with several towns labeled: Orlovka, Vermă, mag., salcie, stine, and stn. A red circle marks the location of the breach. A white box contains the text "Isaccea breach". Another white box contains the date and time: "10.04.2006, 11.00 hrs.".

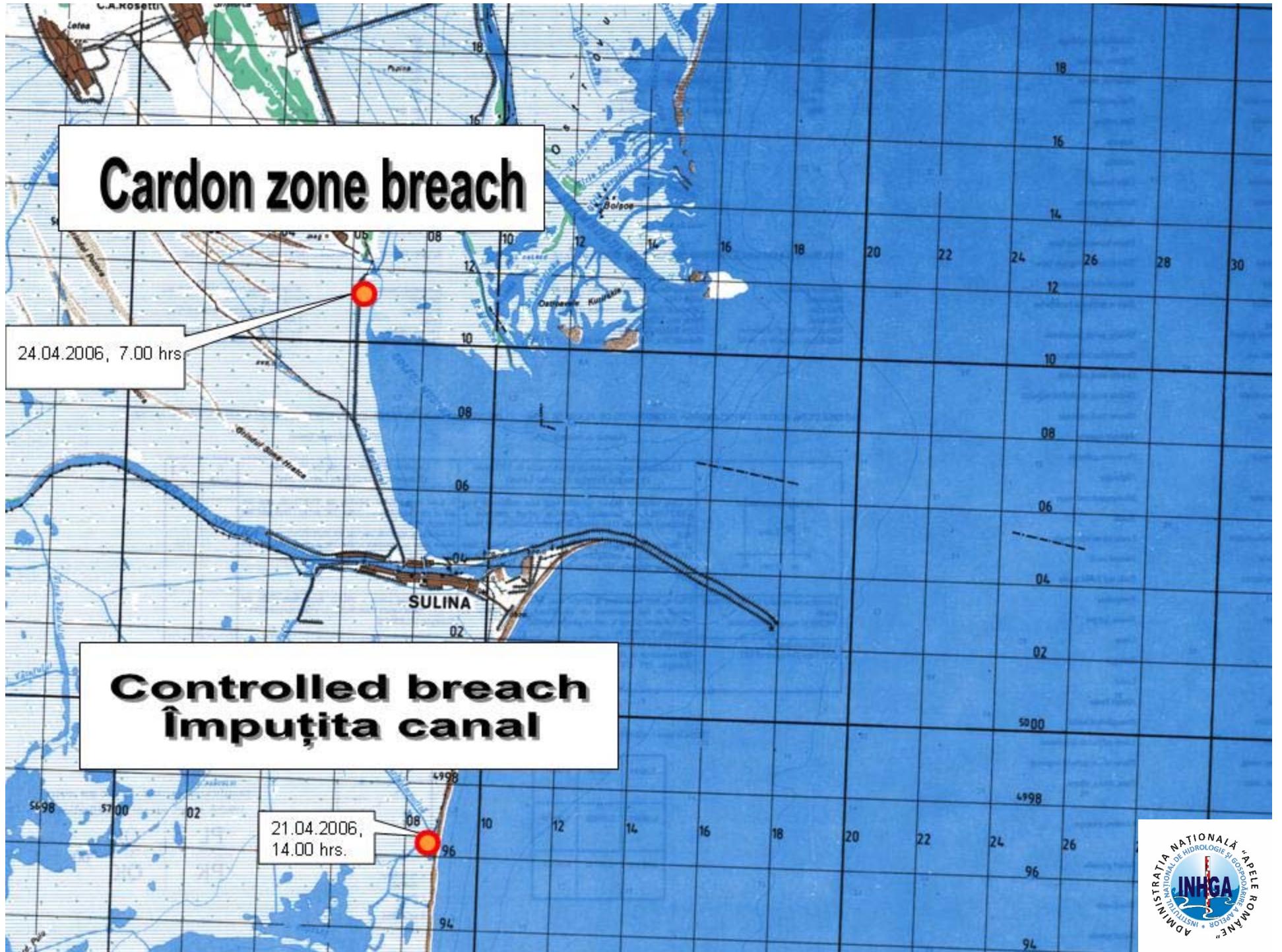
Isaccea breach

10.04.2006, 11.00
hrs.

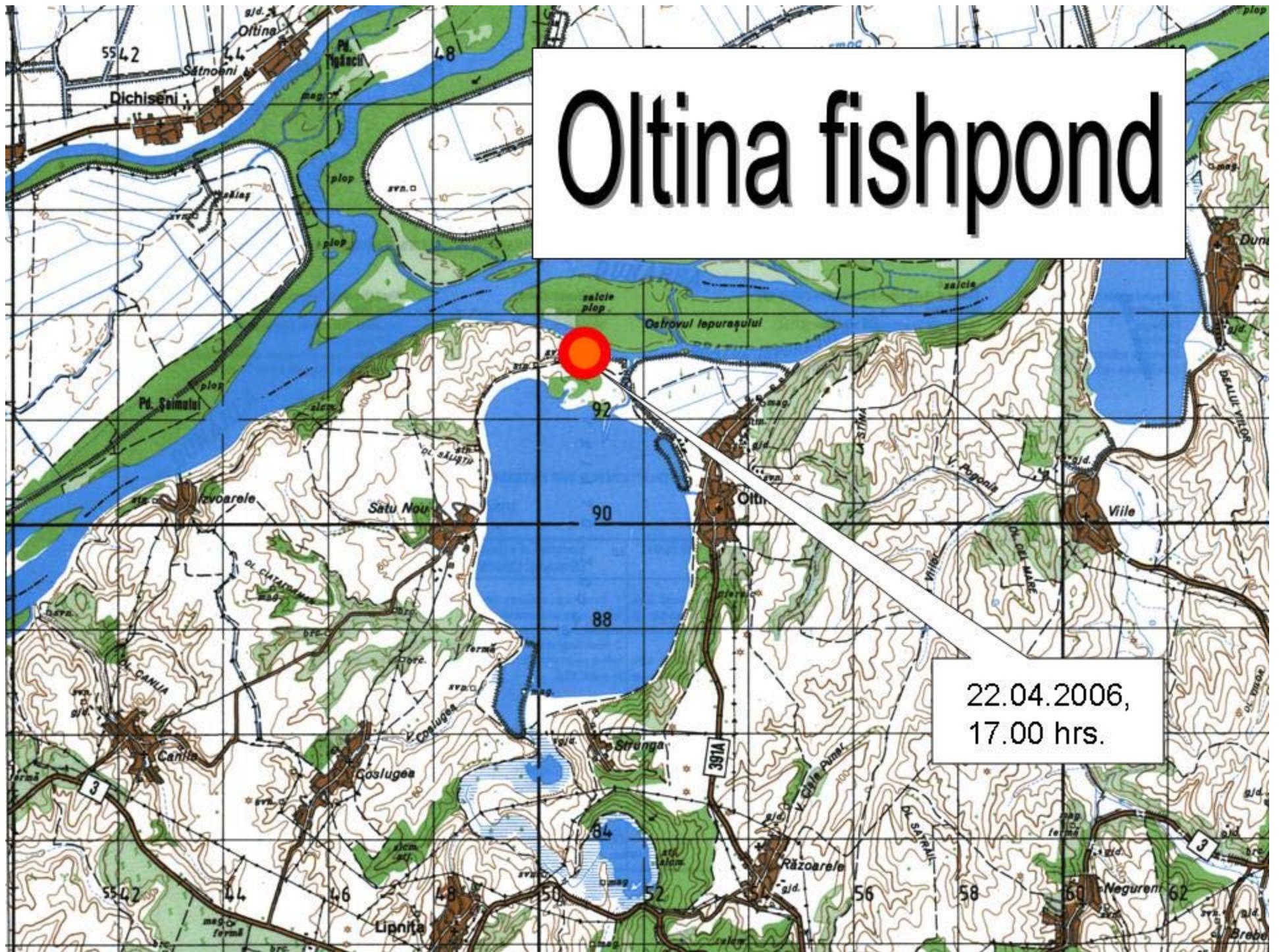
Controlled breach Făcăieni

15.04.2006, 19.00 hrs.





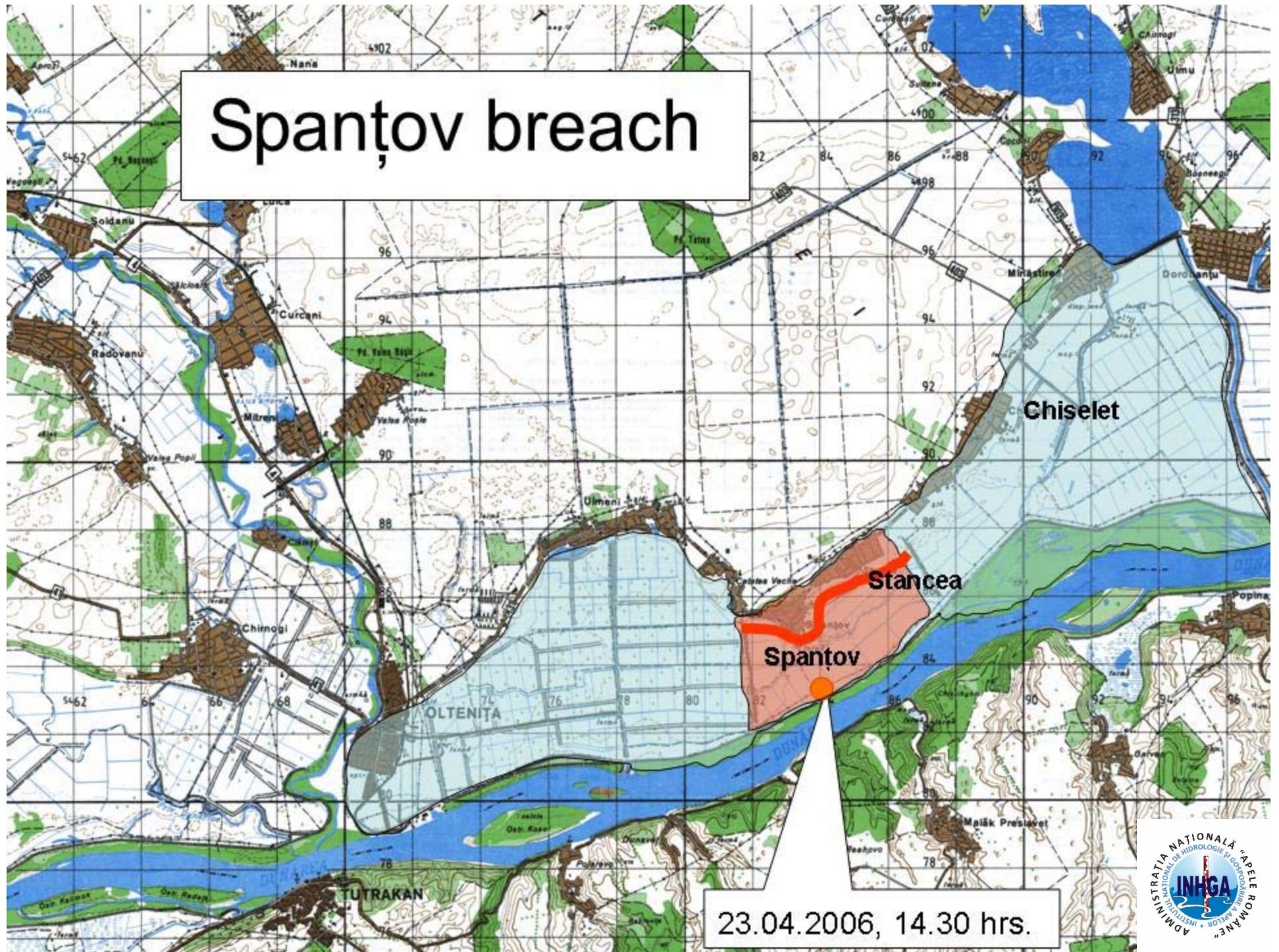
Oltina fishpond



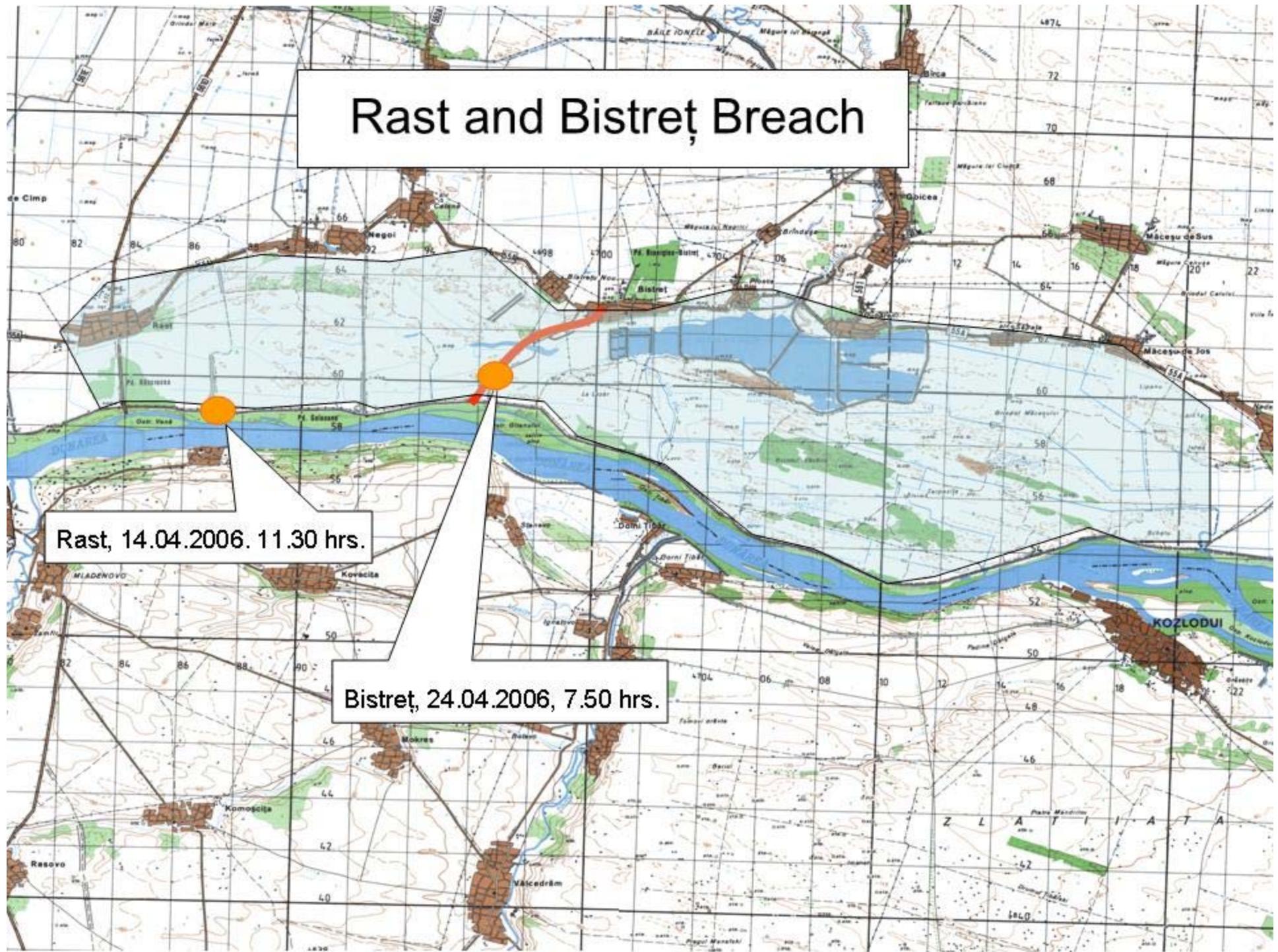
Obretin fishpond

20.04.2006, 12.00 hrs.

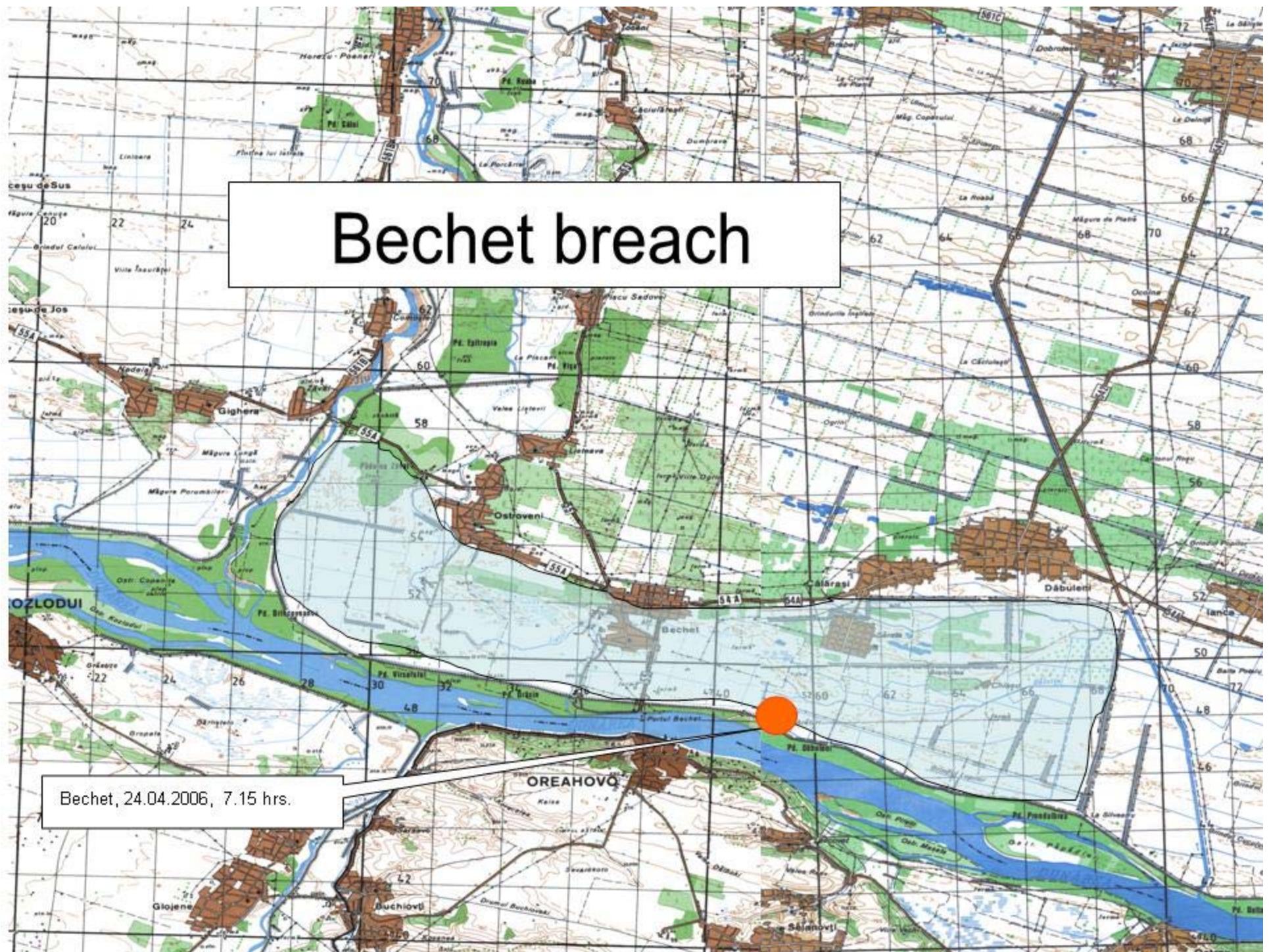
Spanțov breach



Rast and Bistretă Breach

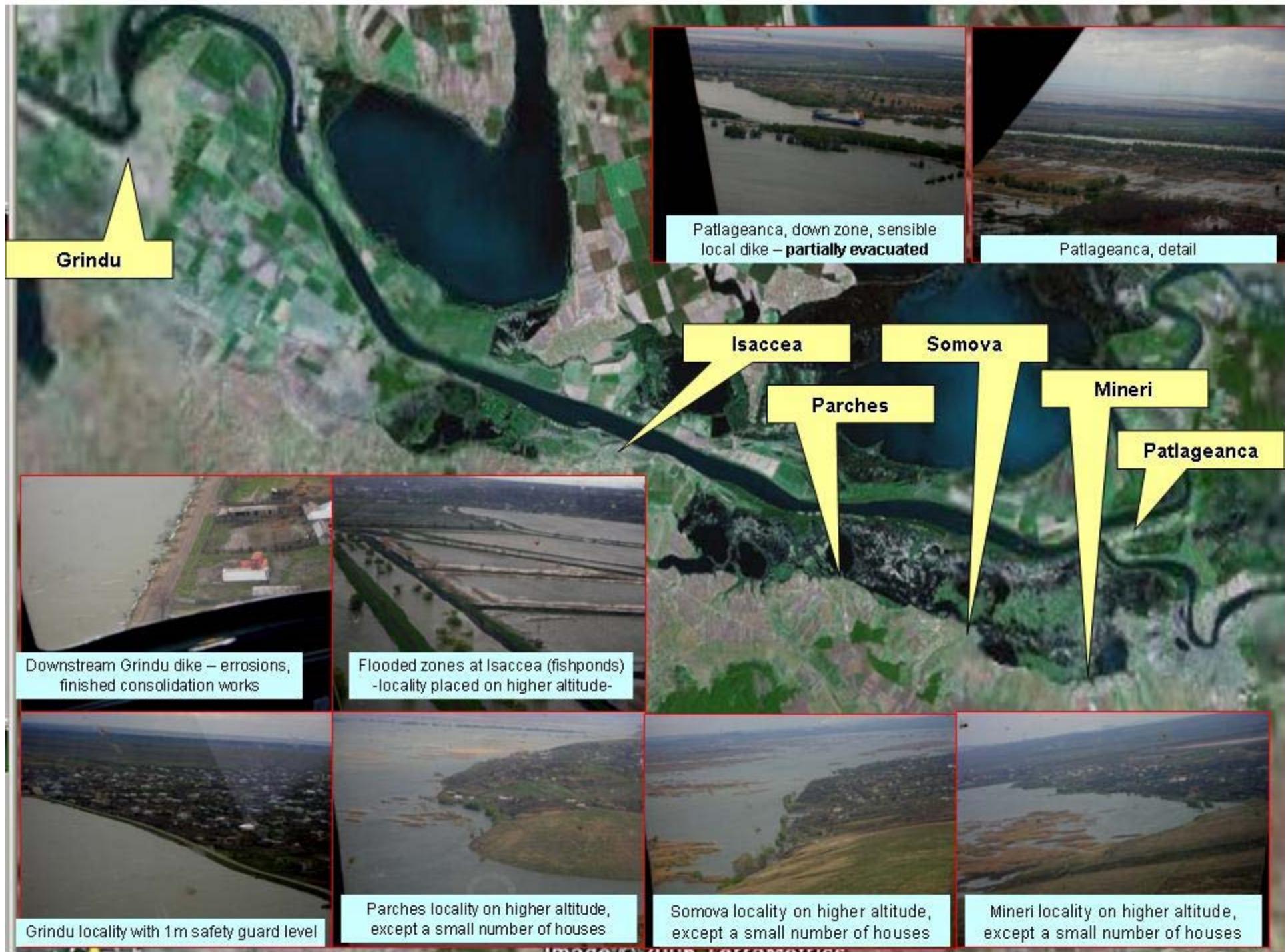


Bechet breach











**ISACCEA
13.04.2006**

Isaccea zone, closed breach dike
It's necessary to continue consolidation
works





Damages situation produced by raised levels on the Danube 25.04.2006



TOTAL DAMAGES

I. POPULATION

- 9516 evacuated people

- 491 houses destroyed

- 2987 affected houses and households

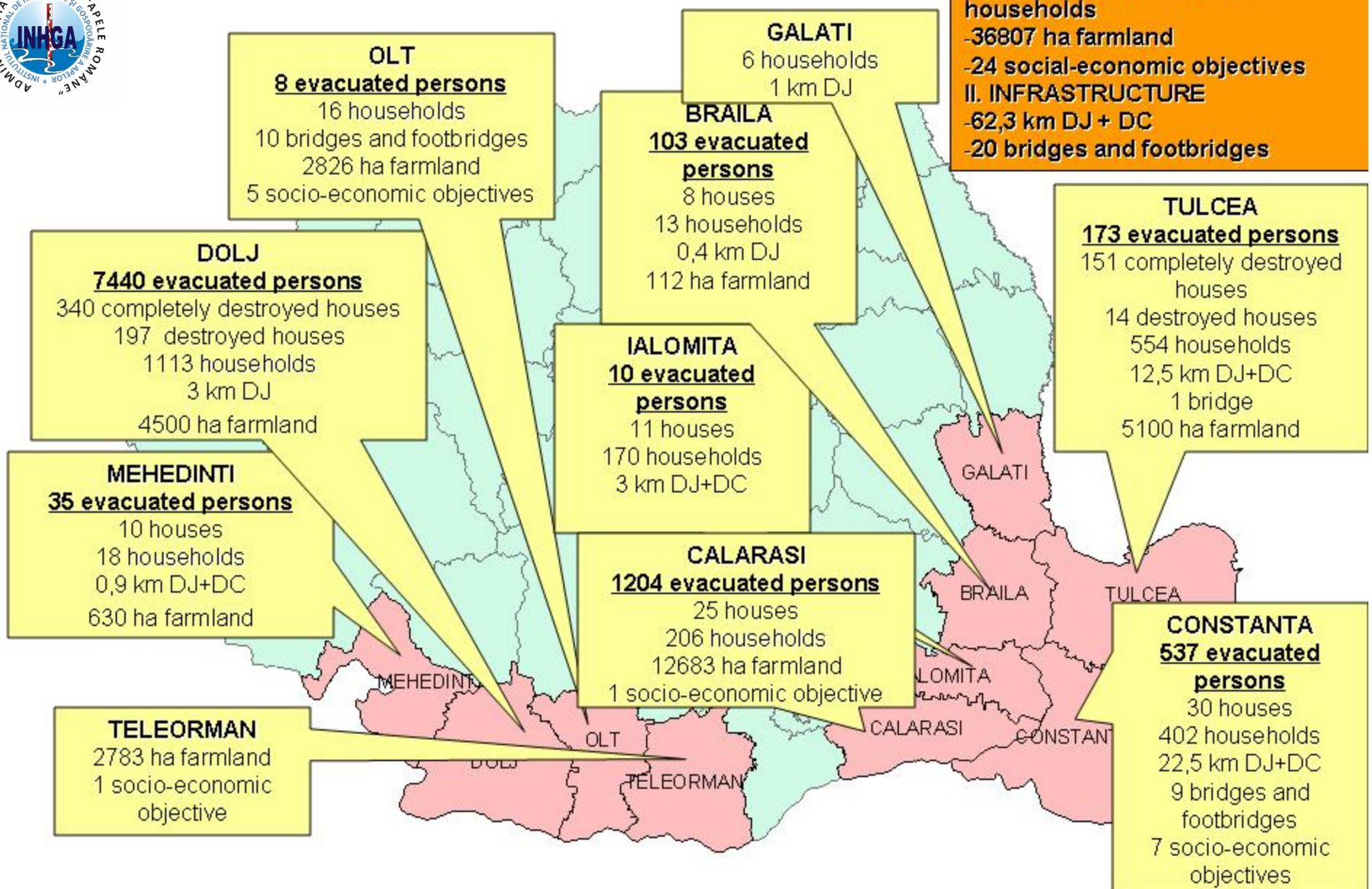
- 36807 ha farmland

- 24 social-economic objectives

II. INFRASTRUCTURE

- 62,3 km DJ + DC

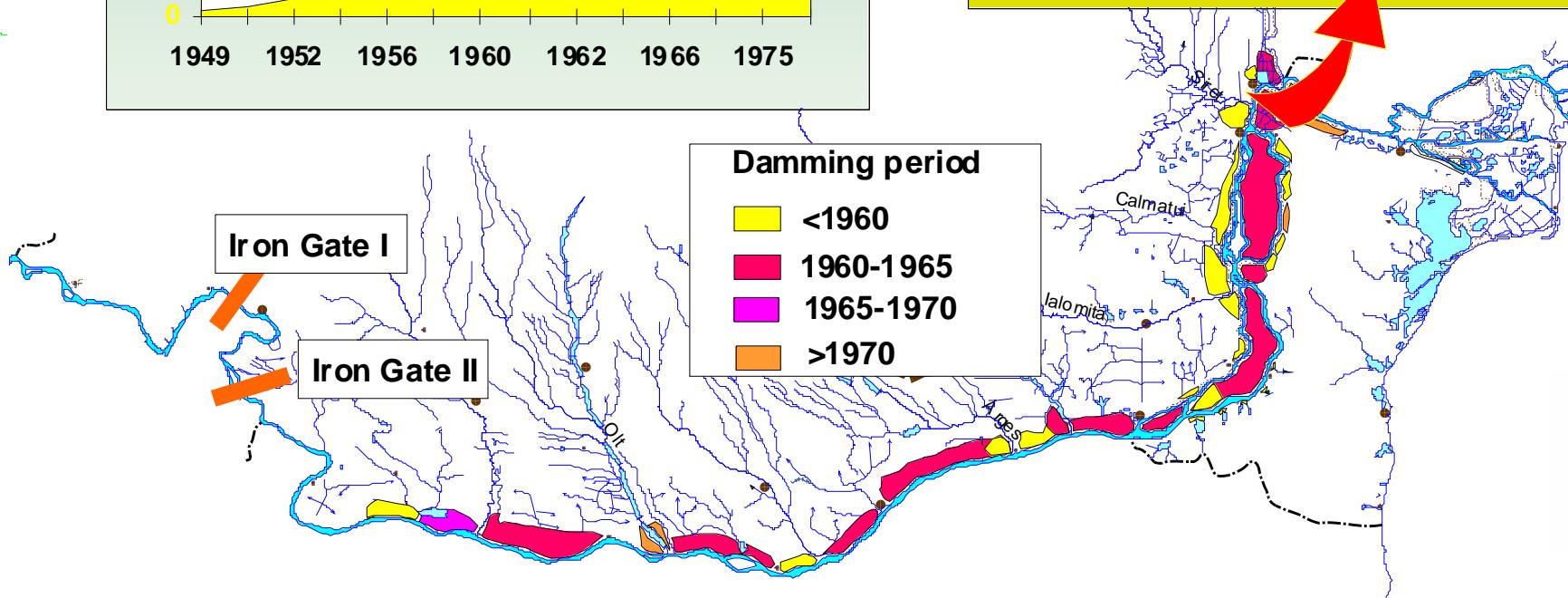
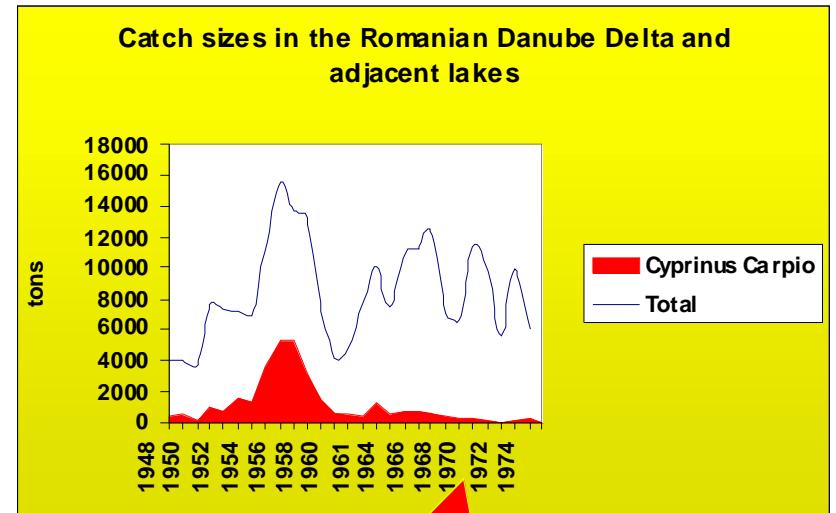
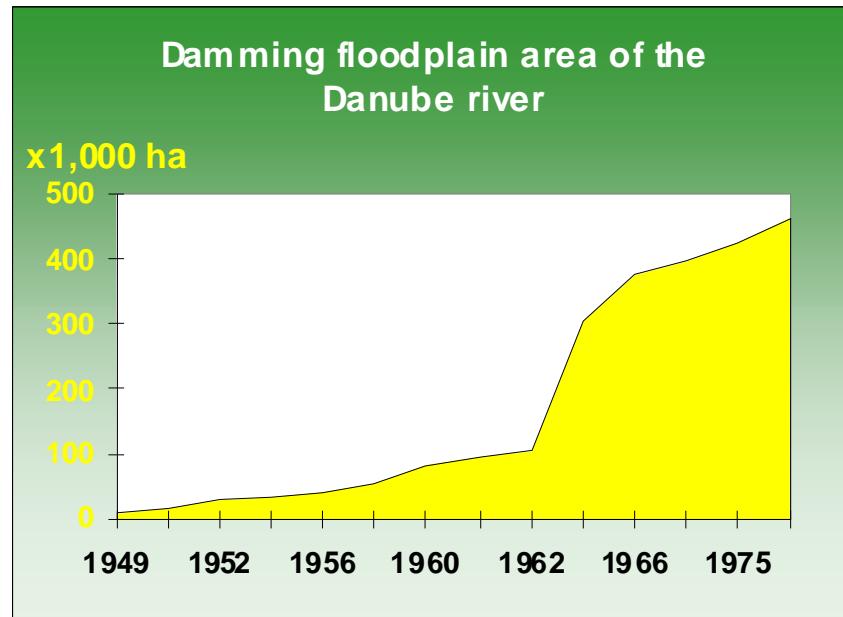
- 20 bridges and footbridges



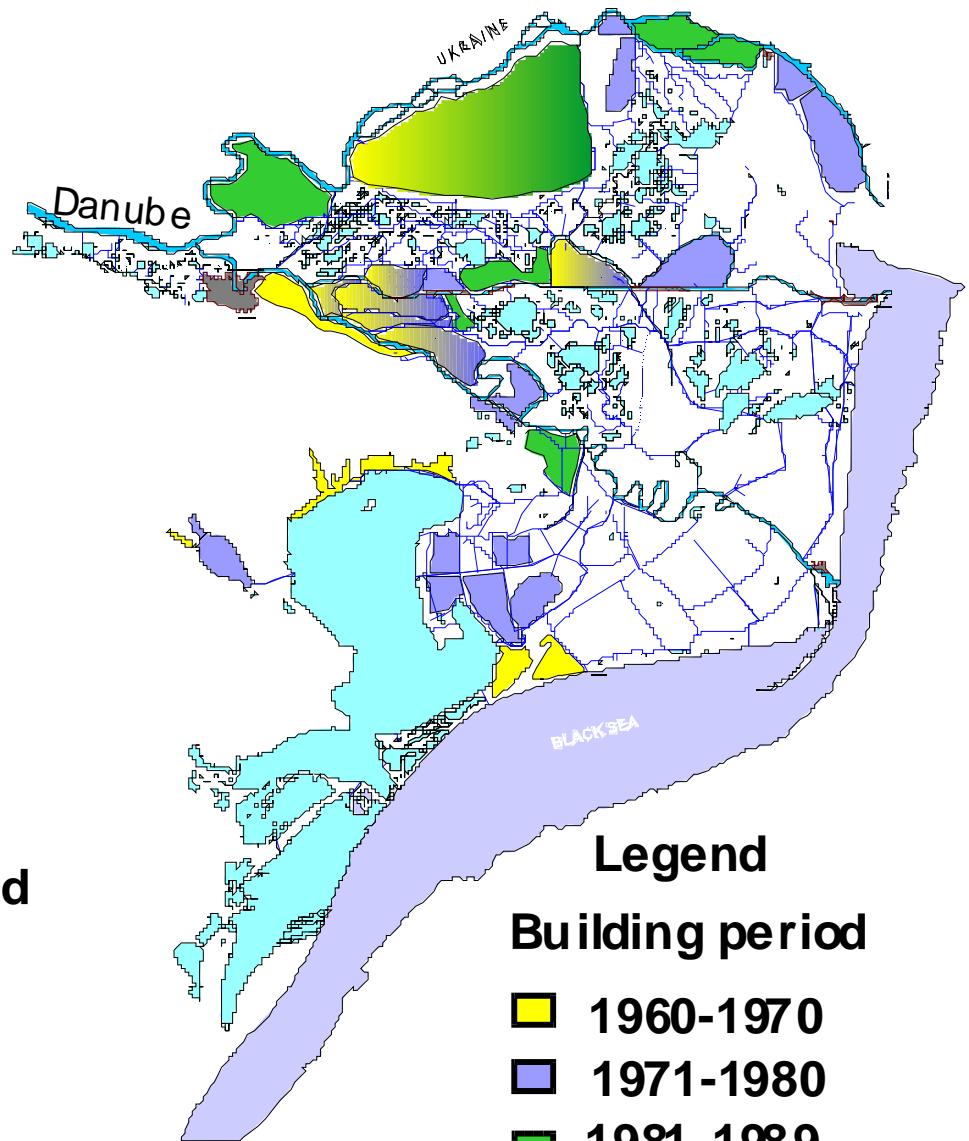
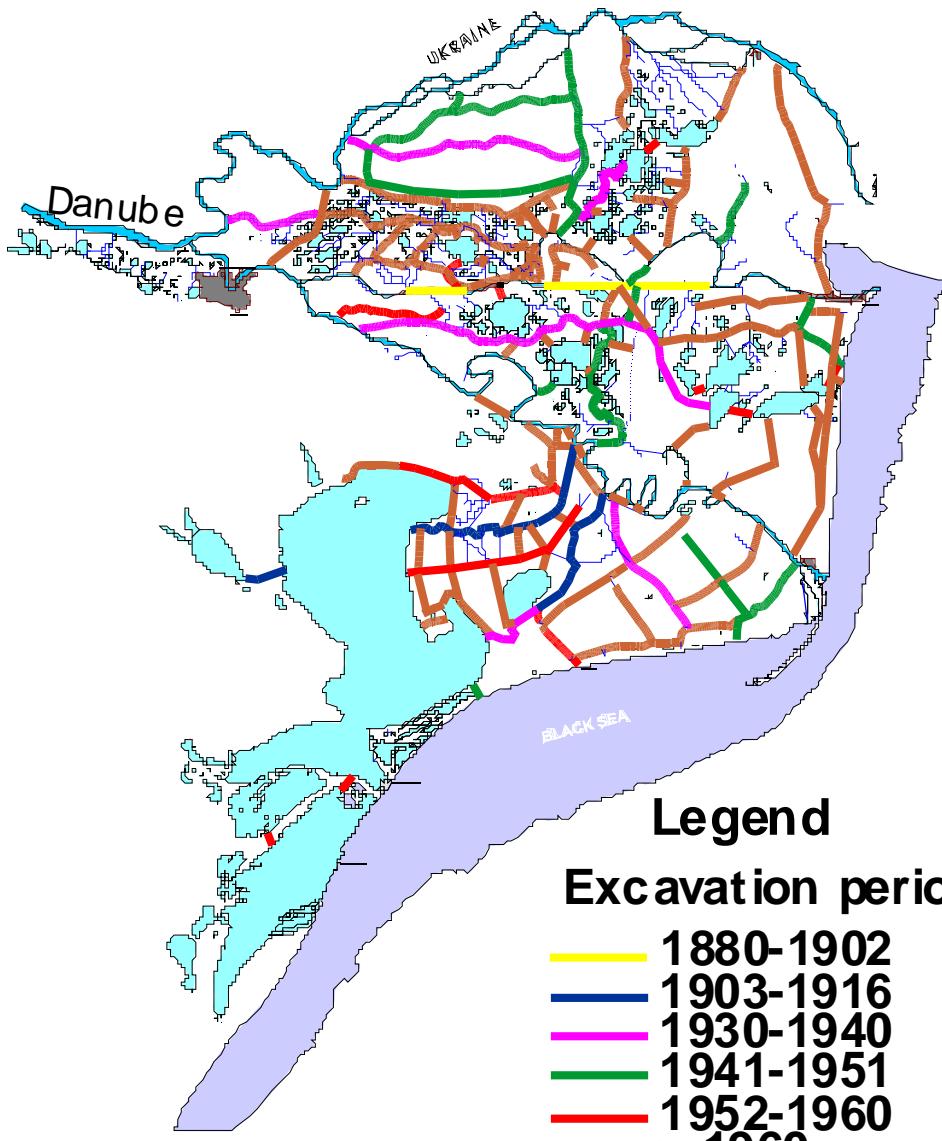
DAMMING FLOODPLAIN UPSTREAM THE DELTA

DAMMING OF DANUBE RIVER FLOODPLAIN

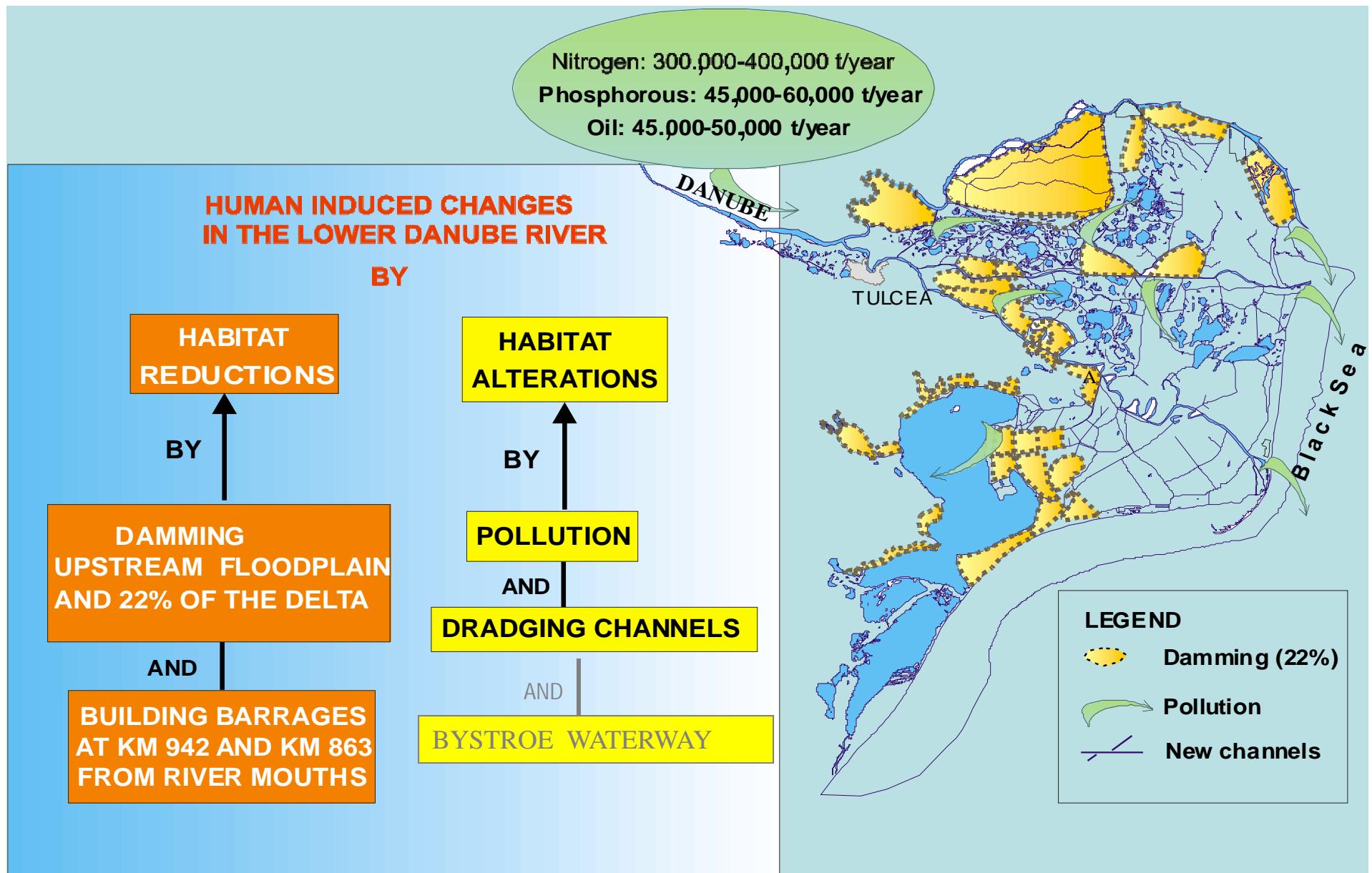
IMPACT ON DANUBE DELTA's FISHERY



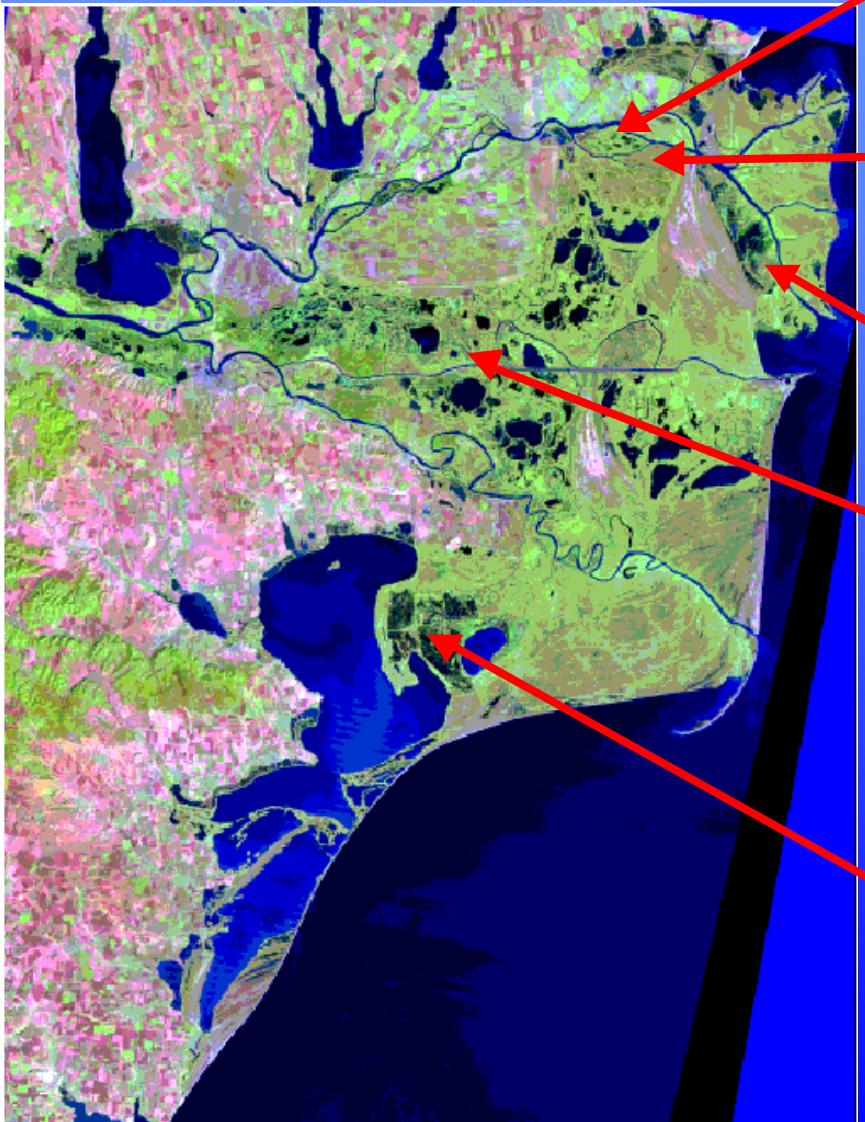
DAMMING AND CHANNEL EXCAVATIONS



HUMAN INDUCED CHANGES IN THE DANUBE DELTA



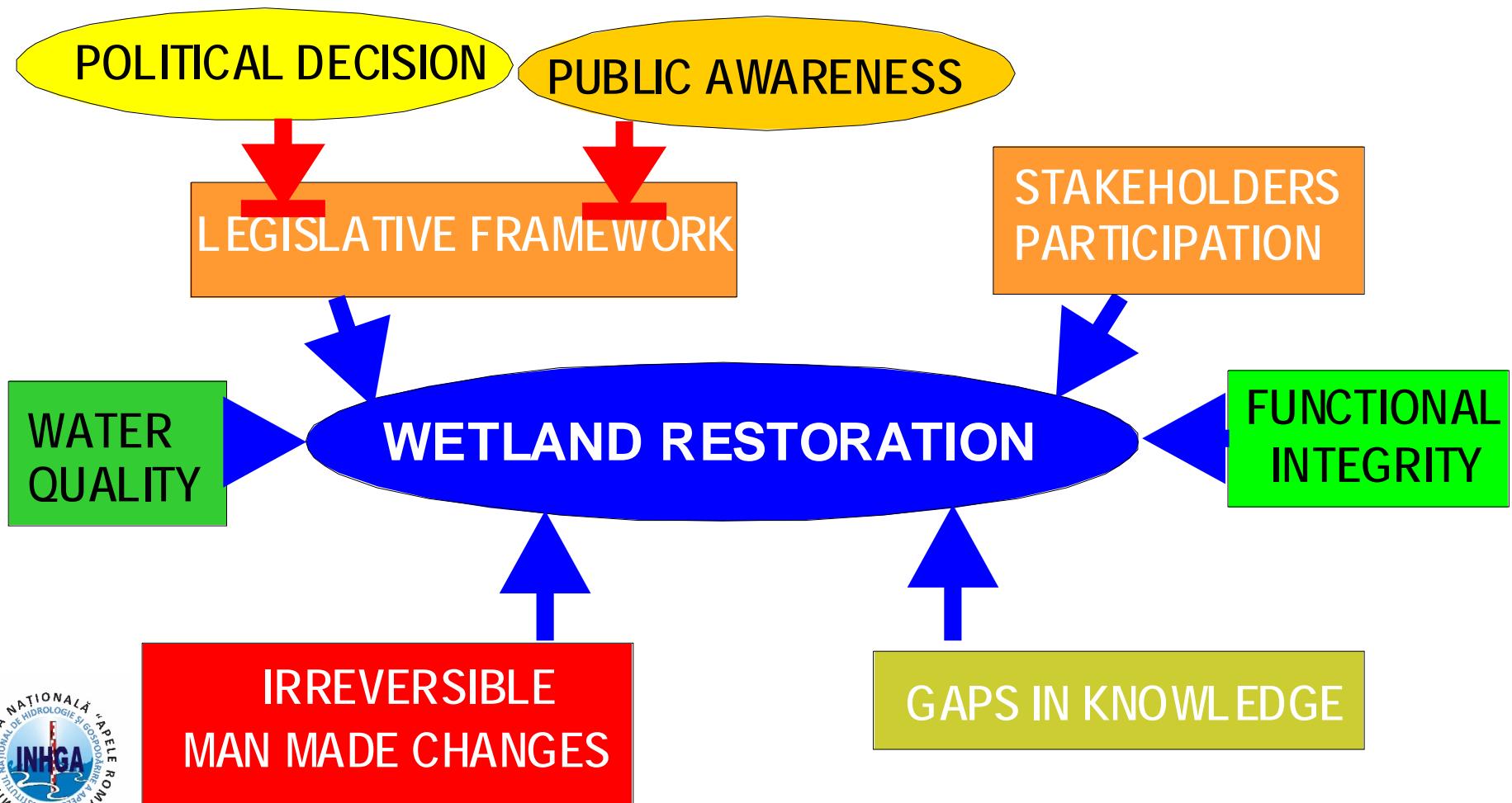
Implemented and ongoing Restoration Works in the Danube Delta



In 1994 Babina (2,100 ha),
- agricultural polder -
in 1996 Cernovca(1,580 ha)
- agricultural polder -
in 2000 Popina(3,600 ha)
- fishpond -
in 2002 Fortuna (2,115 ha) -
- agricultural polder -

Prospective areas to be restored
Holbina - Dunavat(5,630 ha)
- fishponds -
TOTAL: 15,025 ha

ENCOUNTERED CONSTRAINTS FOR RESTORATION



How to calculate the inundation?

Danube Floodrisk WP3 HARM

1. Generate a flood event of a given probability
 - Statistical method → $Q_{33\%}$, $Q_{1\%}$, $Q_{0.1\%}$ (Annual Maximum Series)
 - Generate a flood wave of a given (33%, 1%, 0.1%) probability
 - Based on simulated daily discharges or
 - Synthetic floods based on clustering of registered floods

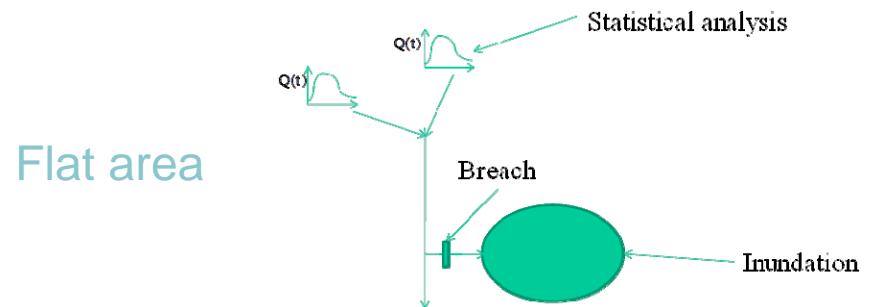


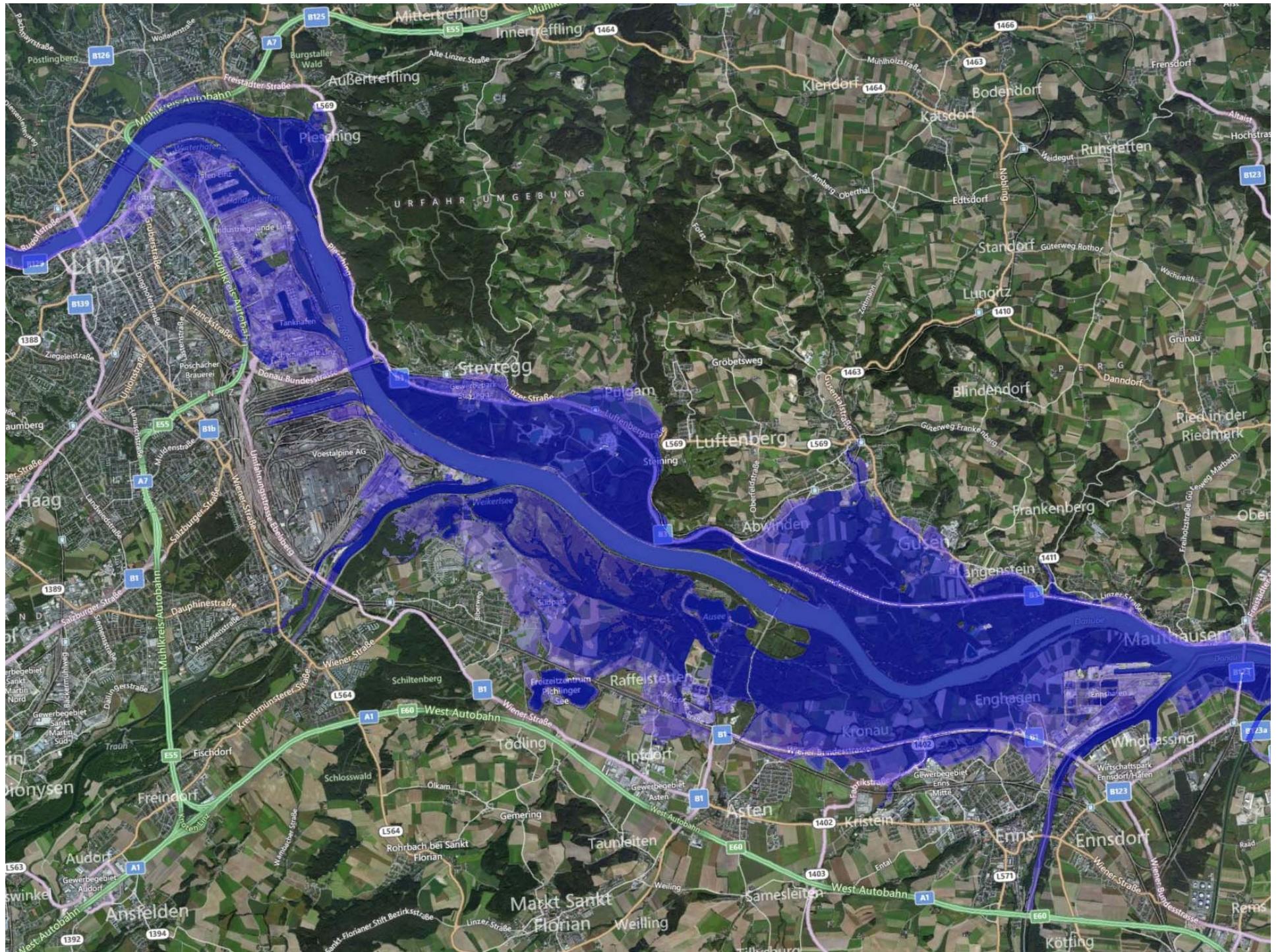
Generate a flood event of a given probability

How to calculate the inundation?

WP3 HARM

1. Generate a flood event of a given probability
 - Statistical method $\rightarrow Q_{33\%}, Q_{1\%}, Q_{0.1\%}$ (Annual Maximum Series)
 - Generate a flood wave of a given (33%, 1%, 0.1%) probability
 - Based on simulated daily discharges or
 - Synthetic floods based on clustering of registered floods
2. Calculate the inundation
 - Steady state backwater curve calculation (1D or 2D)
 - Unsteady flood wave transformation (1D or 2D) and dyke breach simulation

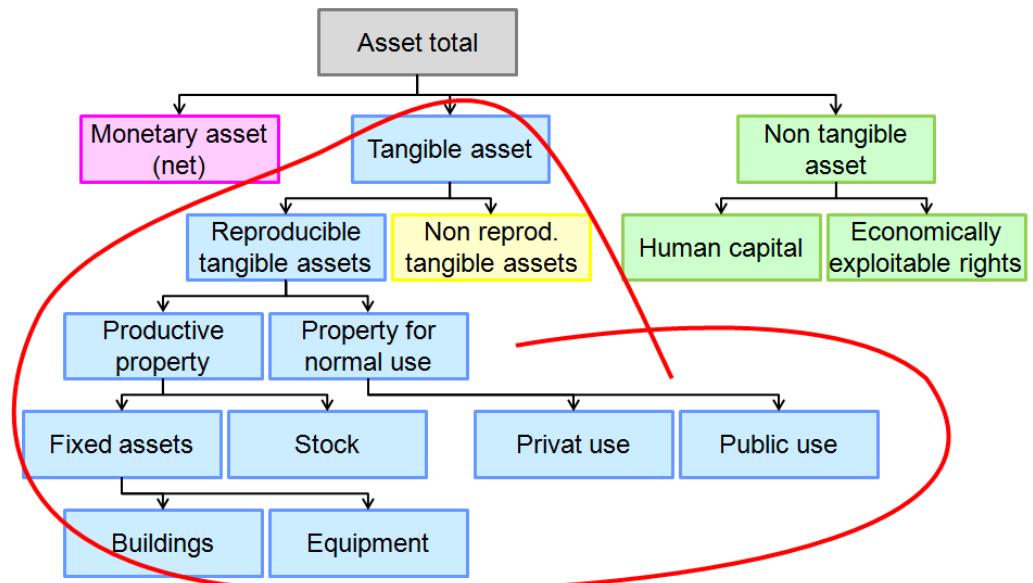




Damage assessment

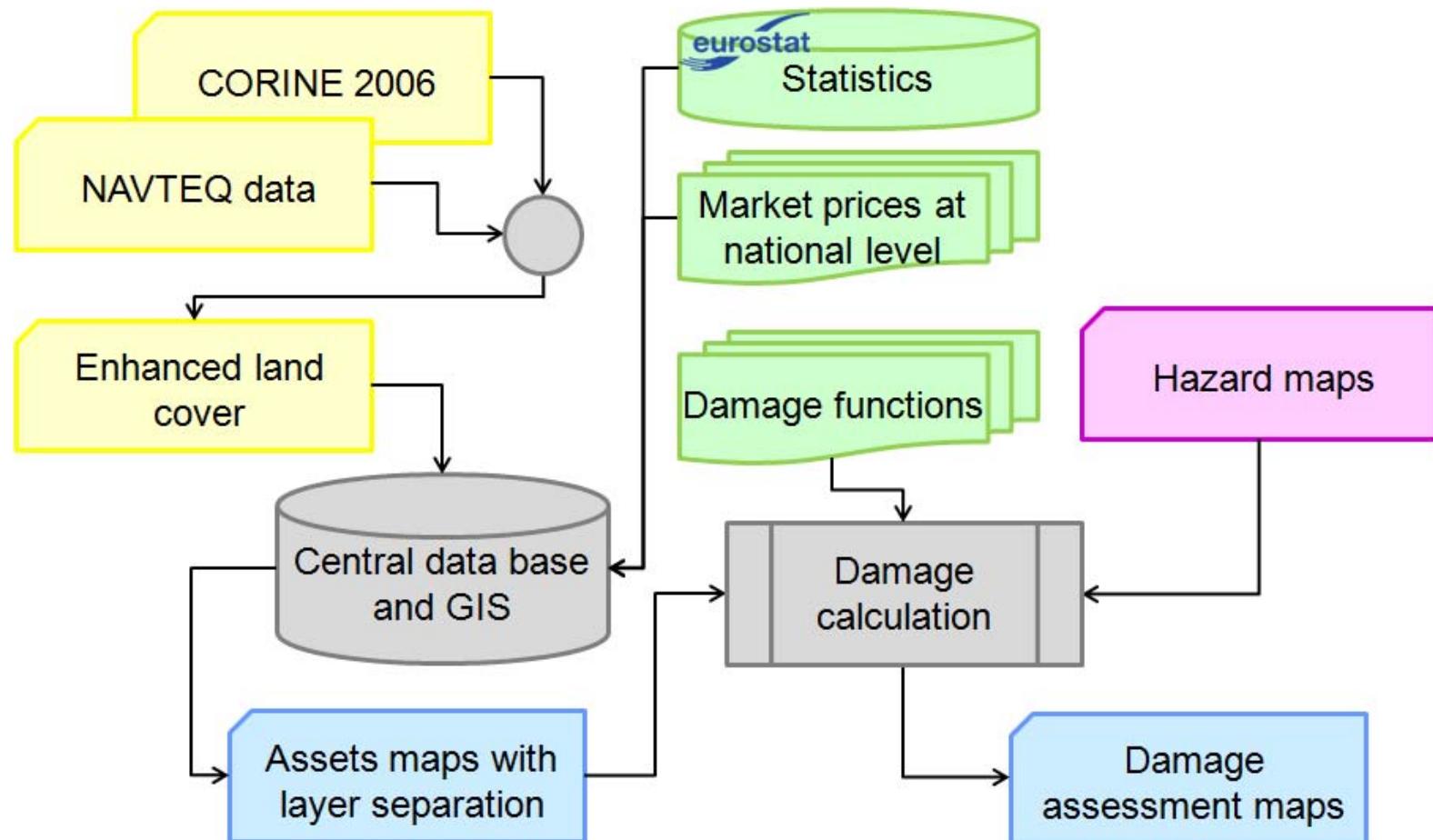
Assumptions:

- Only direct assets (tangible)
- Net concept (no restoration costs or insured assets)
- No costs of ground included
- No external planning costs included (i.e. building permits)
- Population to be located at place of living



Source: M. Frenkel & K.D. John, 1999 (modified)

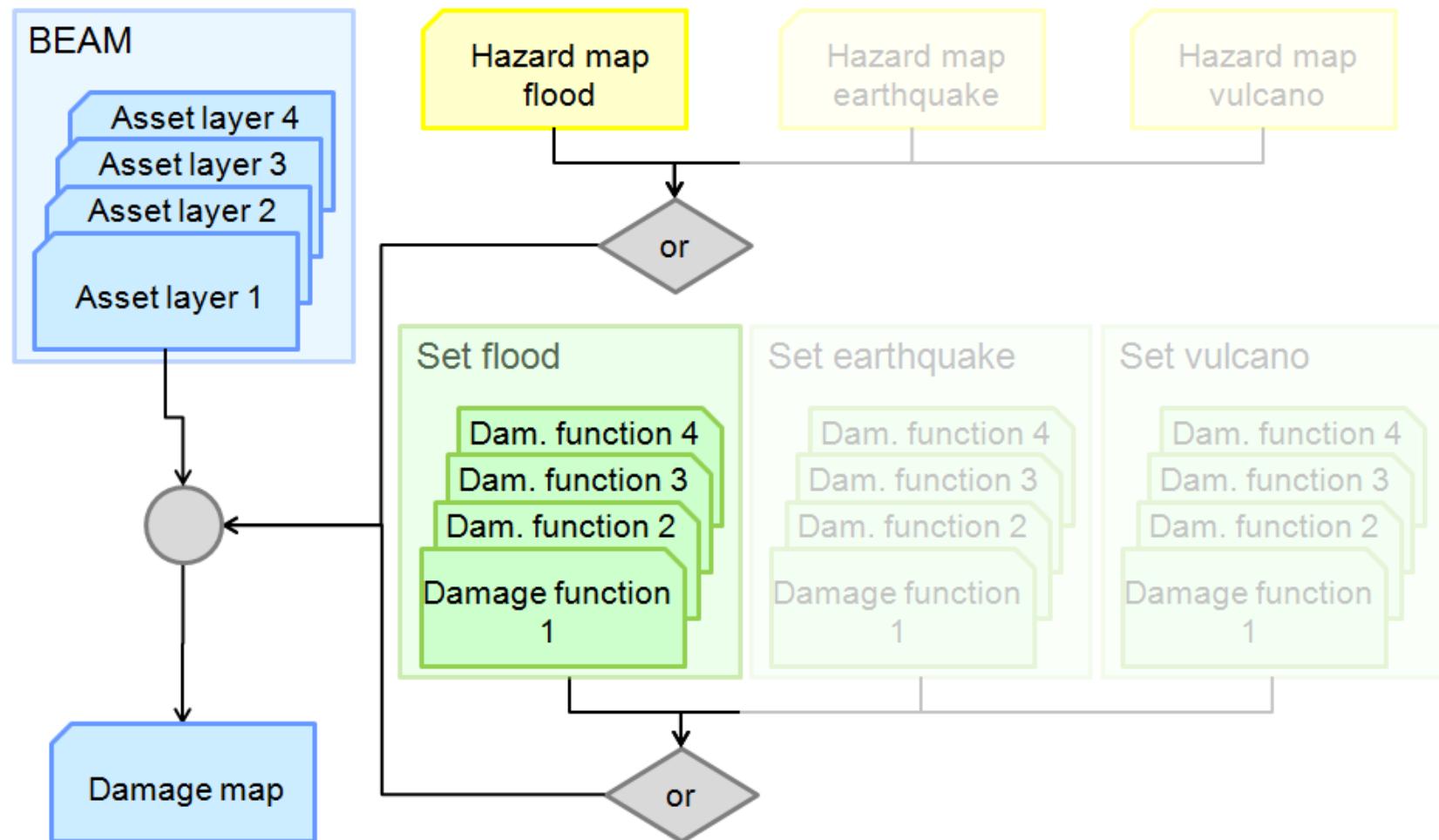
Assets calculation: processing



Assets map: scale

	Makro-scale $< 1: 100 000$	Meso-scale	Micro-scale $> 1: 10 000$
Land use	CORINE land cover, global vector data sets	Enhanced EO-data, national data sets	Catastre
Socialeconomic data	Eurostats and national statistics	Regional and community statistics	Field data acquisition, geomarketing data
Damage functions	Synthetic functions (Event analysis, expert knowledge)	-	Field data acquisition

Damage assessment calculation

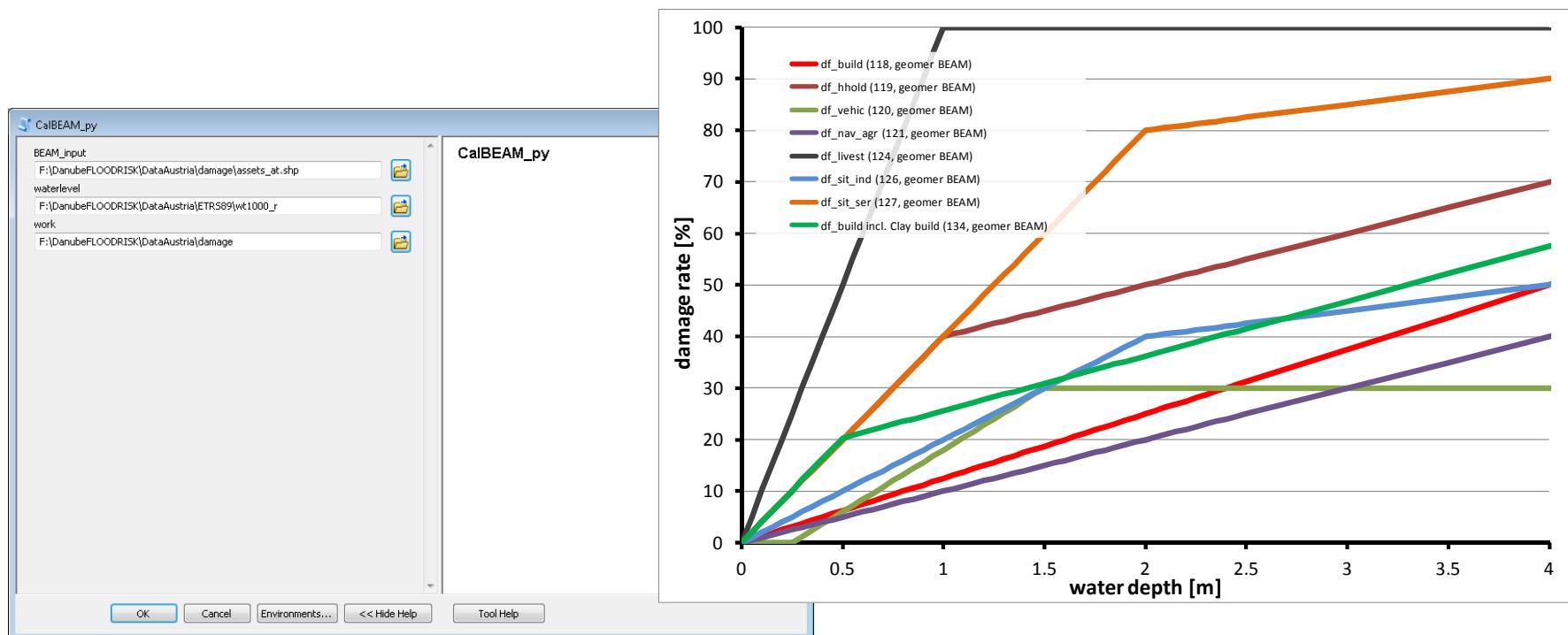


Assets map: available output layers

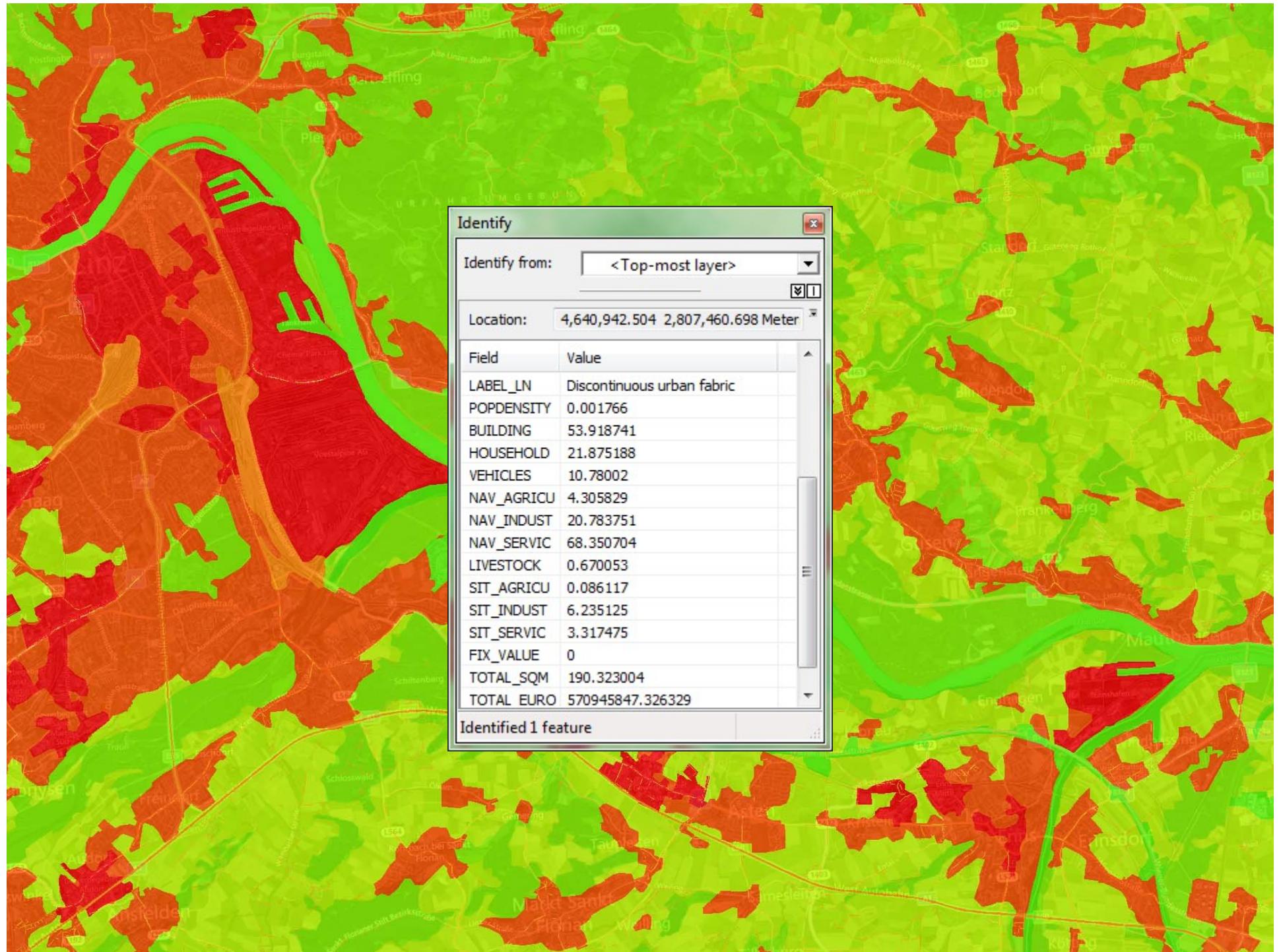
Settlement	Pre-dominant Land Use	Damage Potential Class	r	g	b	C	M	Y	K	
			high	medium	low	high	medium	low	high	
Affected population	Industry	high	192	91	117	25	64	54	0	
		medium	201	133	150	21	48	41	0	
		low	244	143	169	4	44	34	0	
Settlement mobile (household)	Settlement/ Residential	high	237	28	36	7	89	68	0	
		medium	247	160	132	3	37	48	0	
		low	252	210	193	1	18	24	0	
Settlement immobile (buildings)	Forestry/ Agriculture	high	255	229	54	0	10	79	0	
		low	255	247	143	0	3	44	0	
Vehicles: cars	Others	high	152	230	0	40	10	100	0	
		low	209	255	115	18	0	55	0	
Vehicles: motorcycles		high								
		low								

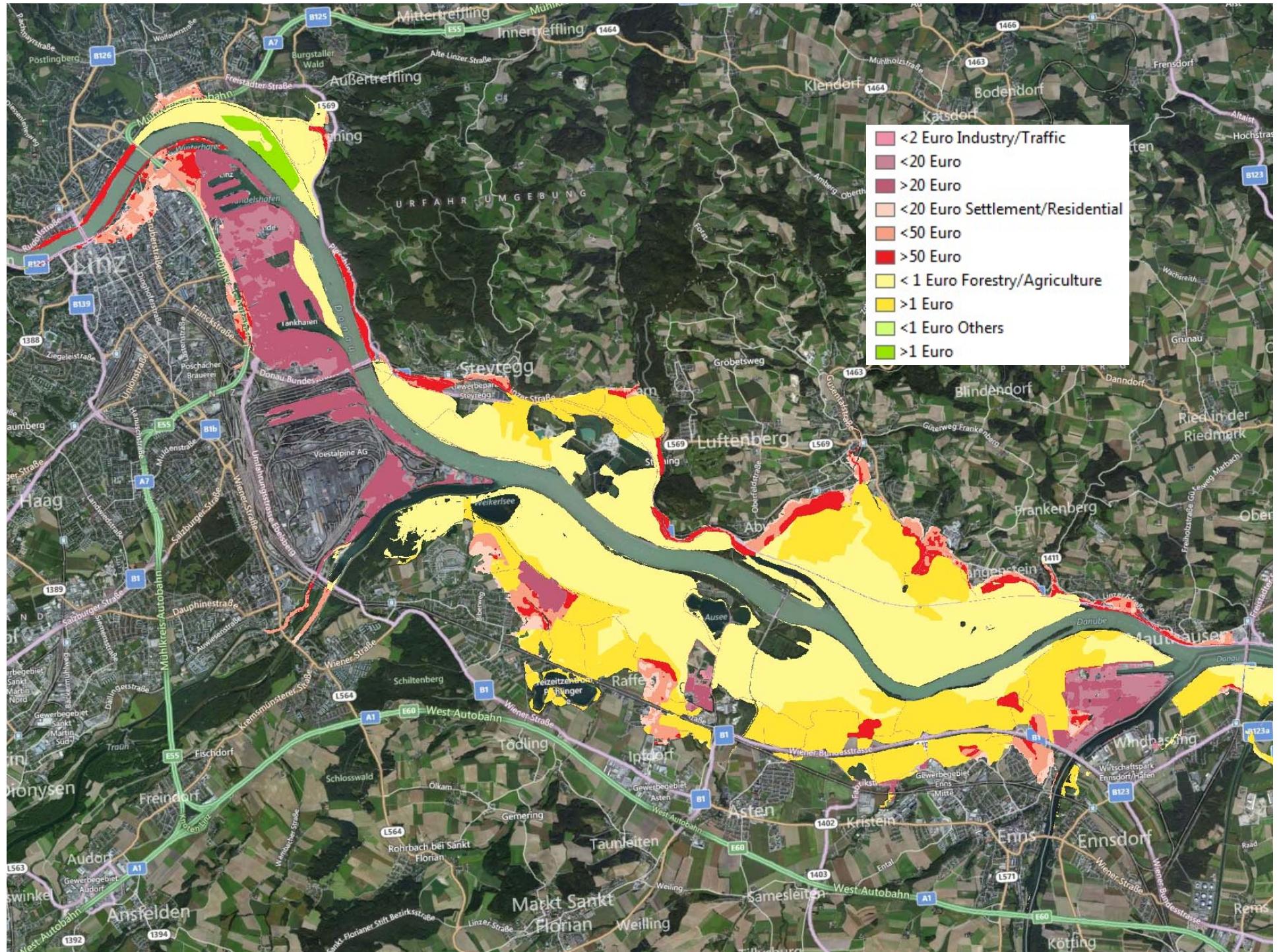
Application of selected of damage functions

- Set of one damage function per assets layer
- Automation of calculation process











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Results according to the EU Com.

CONSENSUS among the members of the scientific community involved in Flood Disaster mitigation regarding:

- **Harmonization of METHODOLOGY** for flood hazard...in order to create a network of partners working on the same problem sharing competencies.
- **DATA harmonization including METADATA creation.**
- **DATA collection and SHARING**
- **COOPERATION in all four steps** of the Disaster Management cycle (“harmonization” is a pre-requisite)

