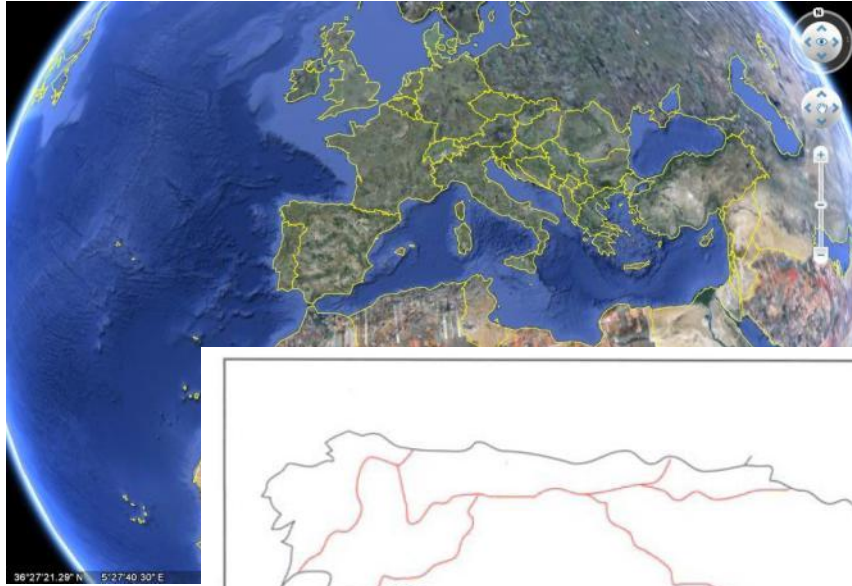


***Technologies to manage water
scarcity and groundwater
vulnerability in a Mediterranean
delta area***

Jorge Molinero
Director Water and Soils
Amphos 21 (WssTP)

A²¹ Introduction



95 coastal aquifers in Spain
45 have “local” problems of saline intrusion
21 have “generalized” problems

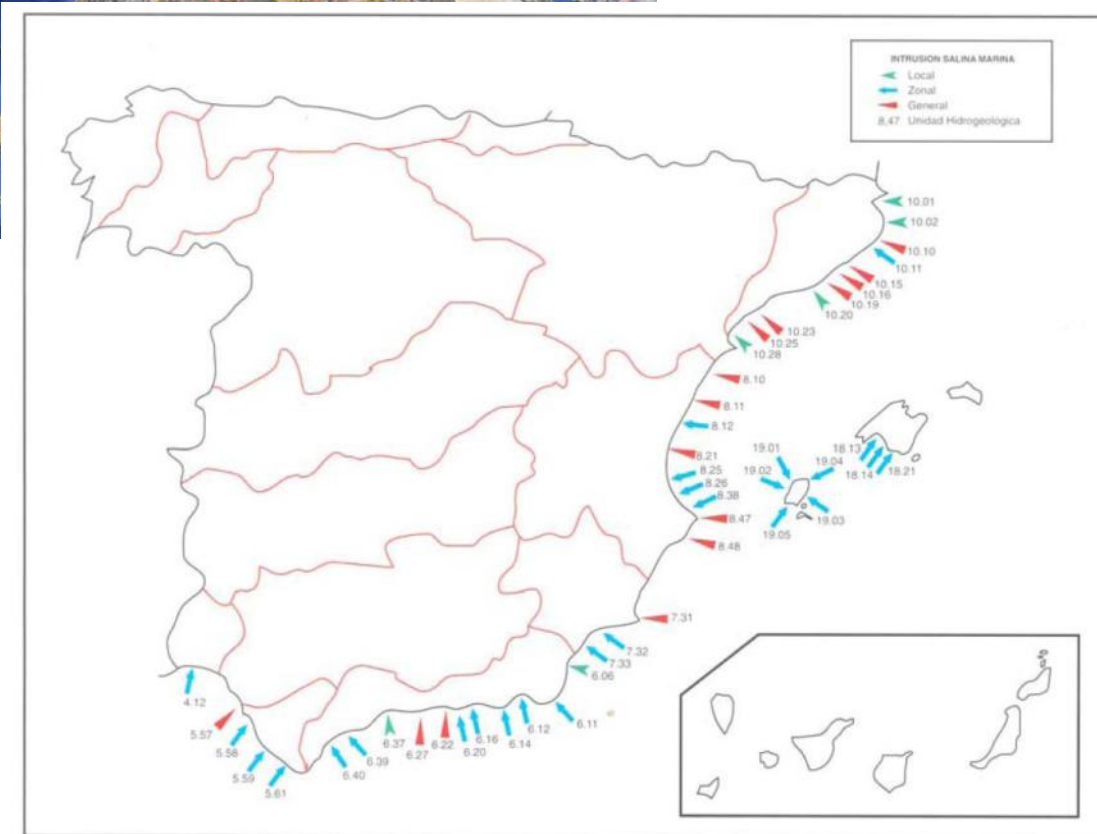
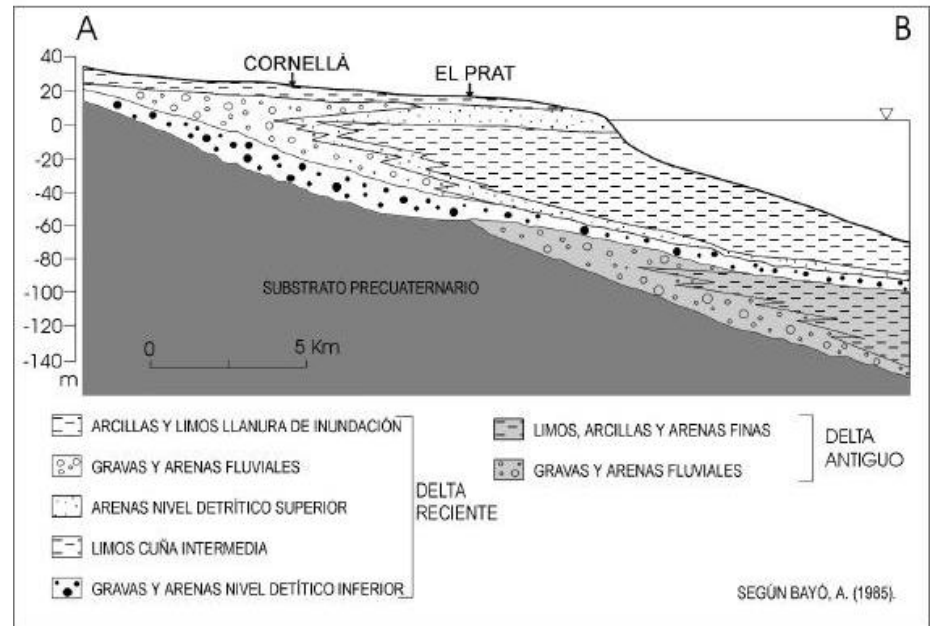
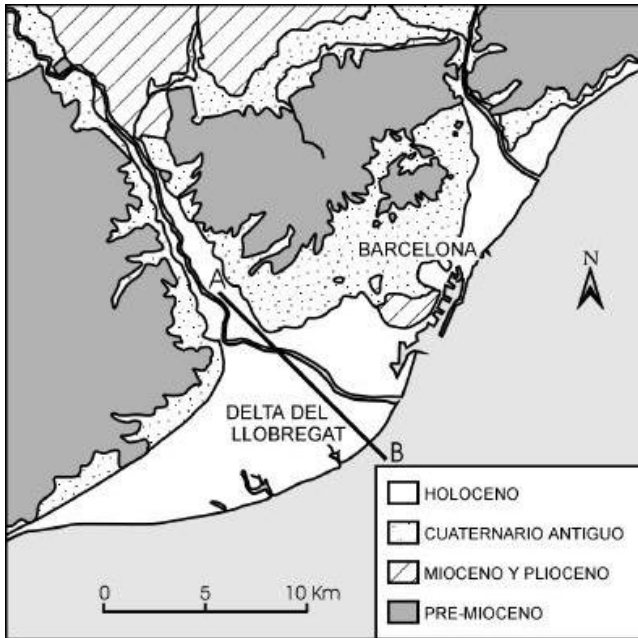


Fig. 10. Problemas de intrusión marina.

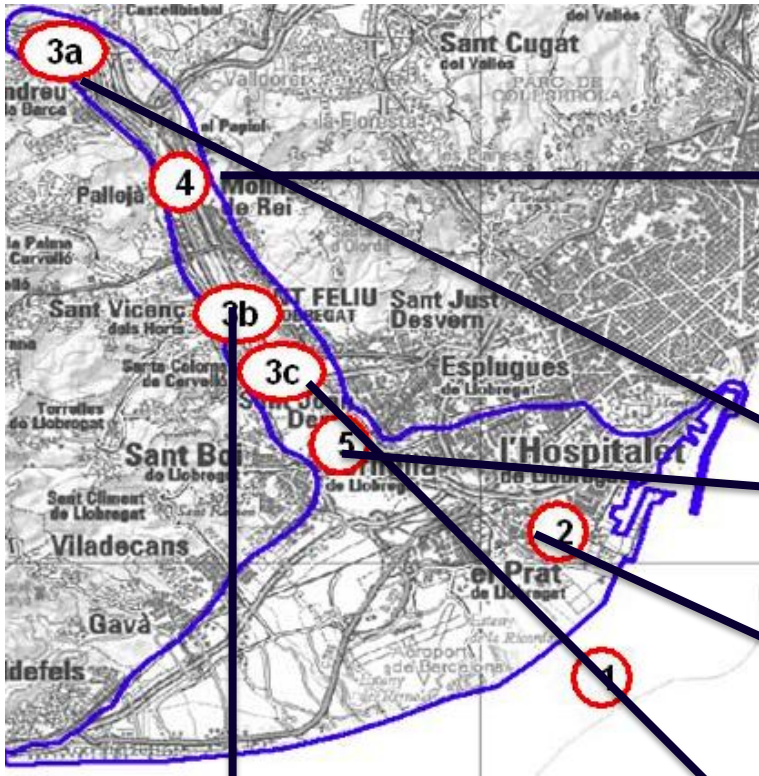
The problem is concentrated in the Mediterranean coast:

- 1) Agriculture
- 2) Tourism
- 3) Large cities

A²¹ Introduction



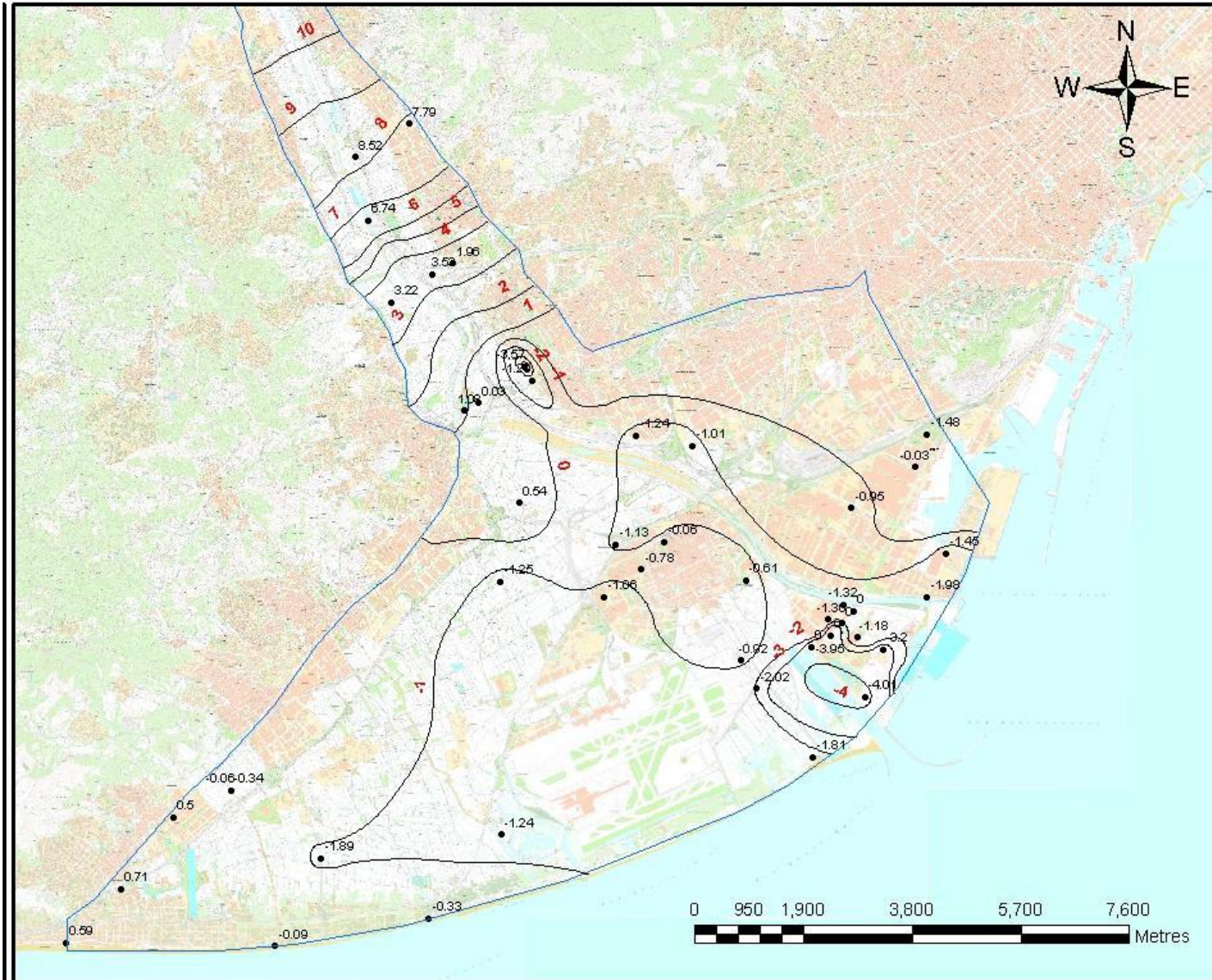
Key management tools for the aquifer



The last drought period

May 2008

May 2009



The main challenge: marine intrusion

Chloride concentrations 2007

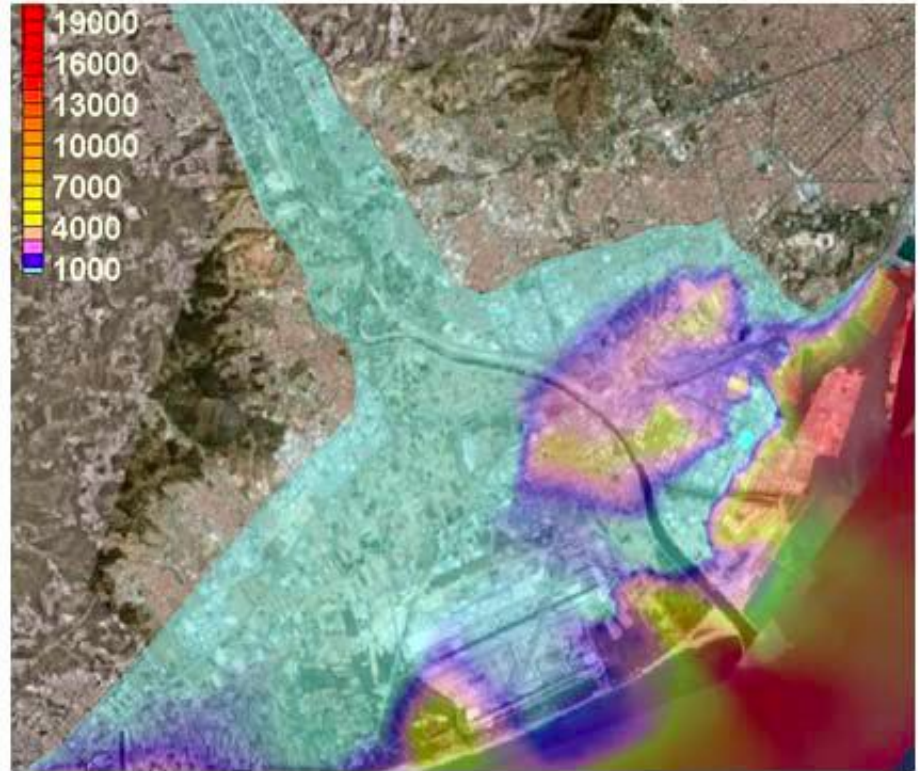
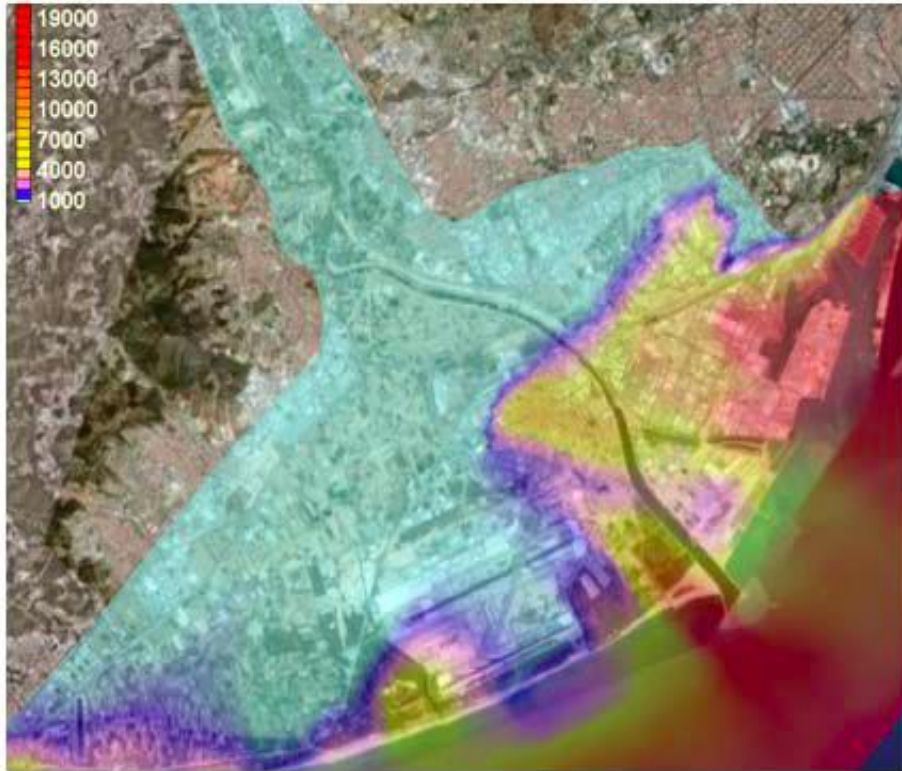


Solution: the Hydraulic Barrier

A 21

Year 2036 – without barrier

Year 2036 – with barrier



Solution: the Hydraulic Barrier



Phase 1 (Pilot): 3 wells
03/2007

Phase 2 – 7 wells
09/2009

Phase 2 – 4 wells
08/2009

El Prat Sewage
Treatment
Plant

A²¹ Description of the hydraulic Barrier (I)

El Prat Sewage Treatment Plant

Secondary

Terciary

Lagoons and River

Injection to the aquifer

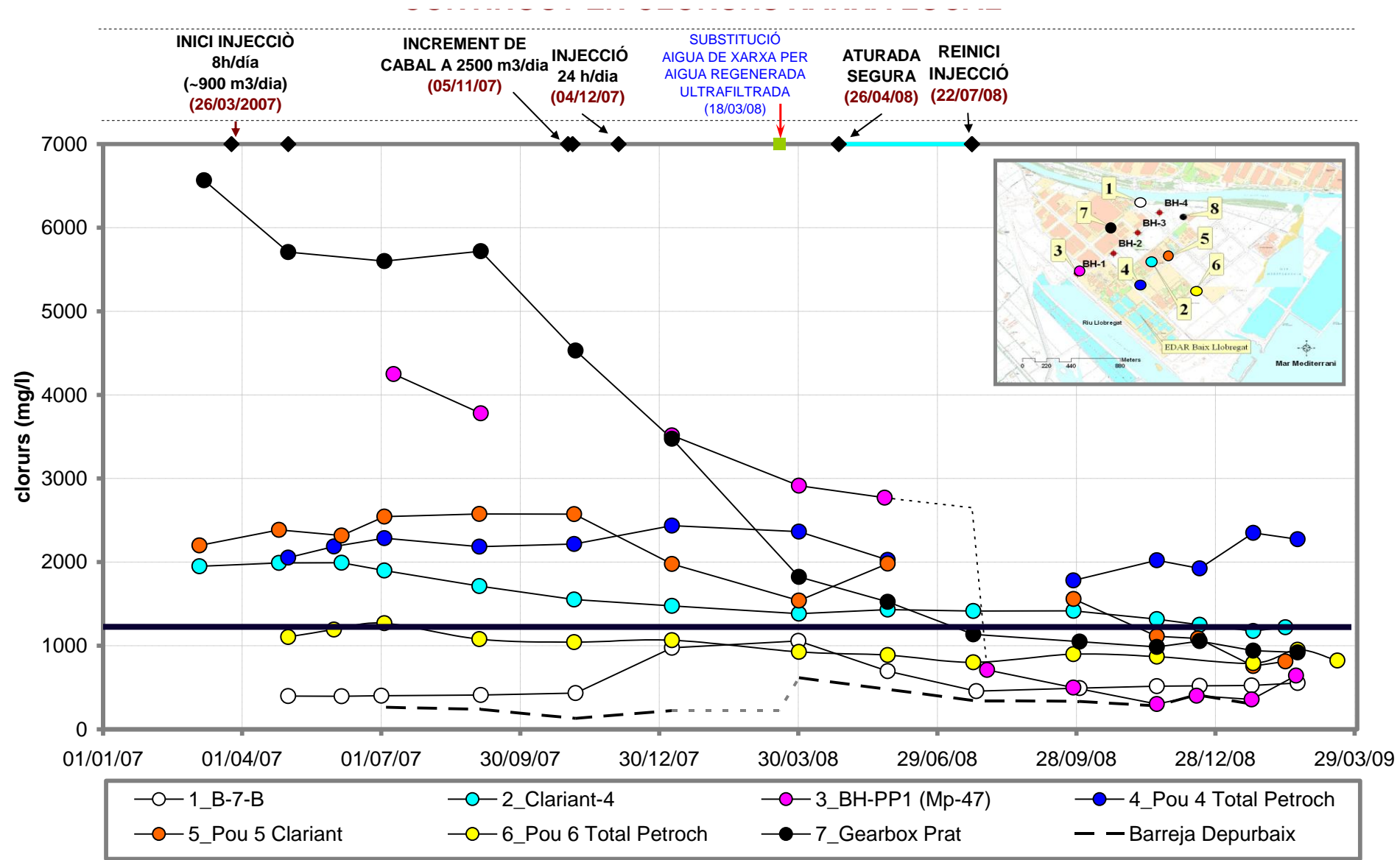
Desinfection

Osmosis

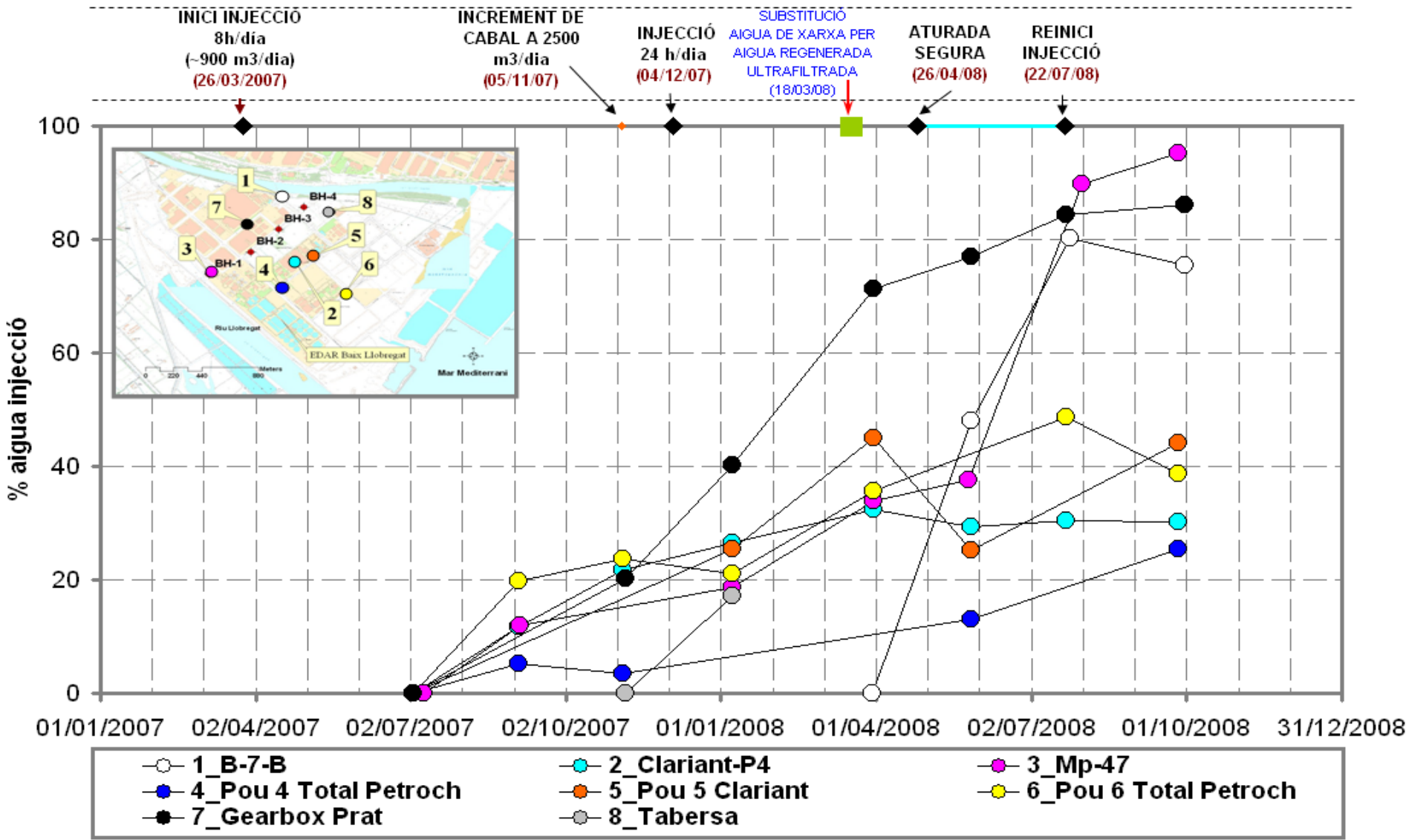
Ultrafiltration



Performance Evaluation (Chloride evolution)

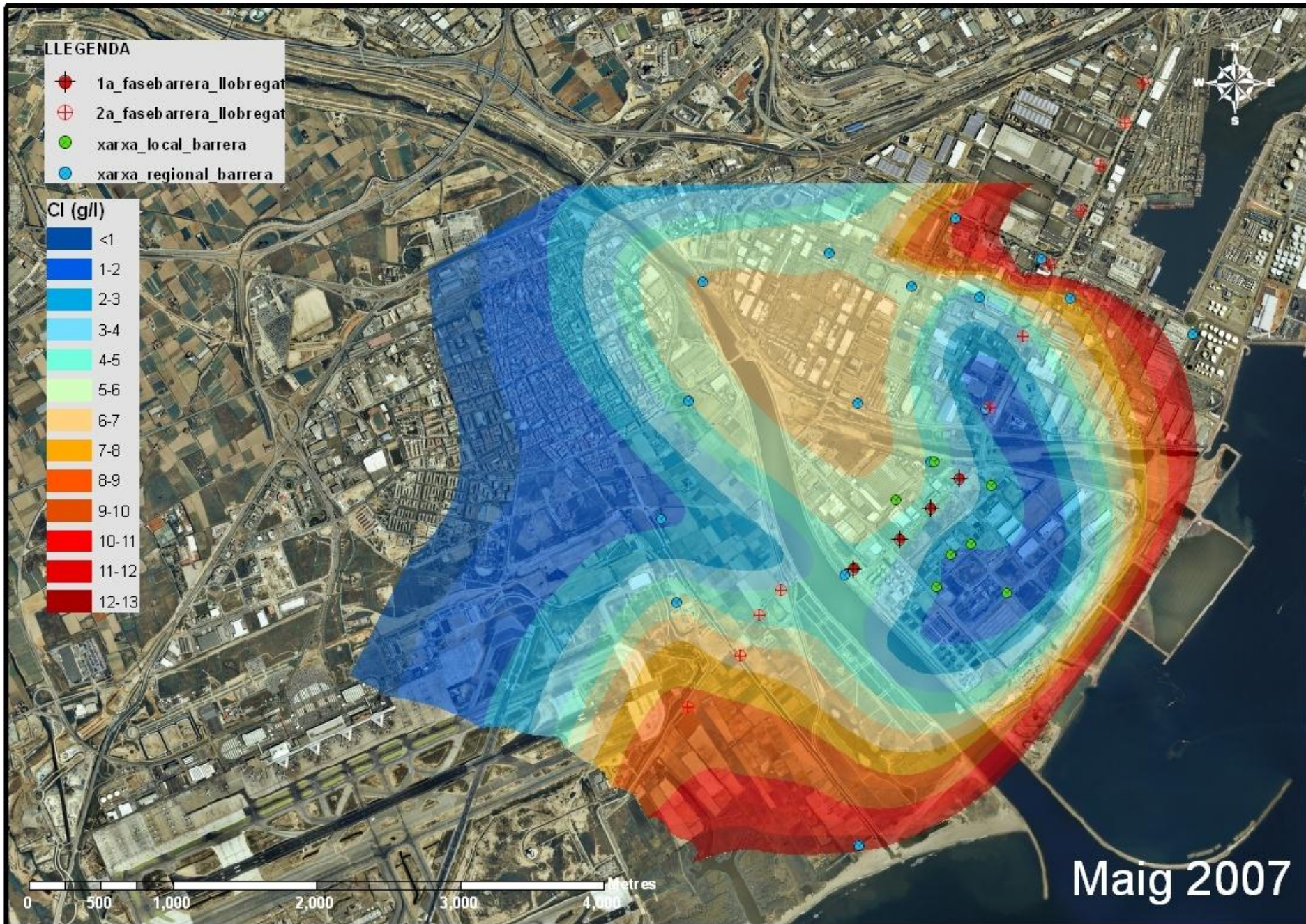


Performance Evaluation (% injection water)



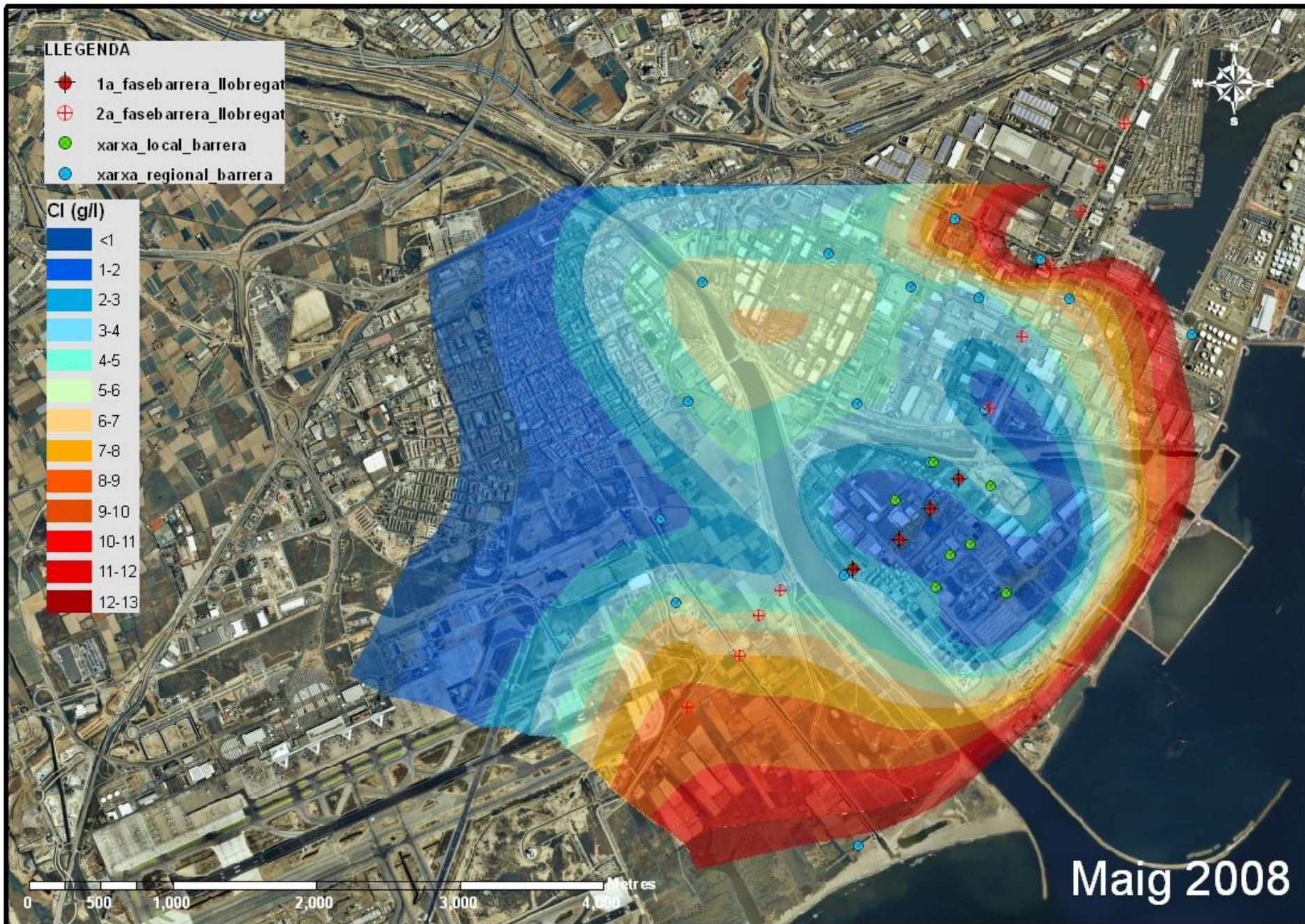
A²¹ Performance Evaluation / Time = 0 year (May 2007)

01

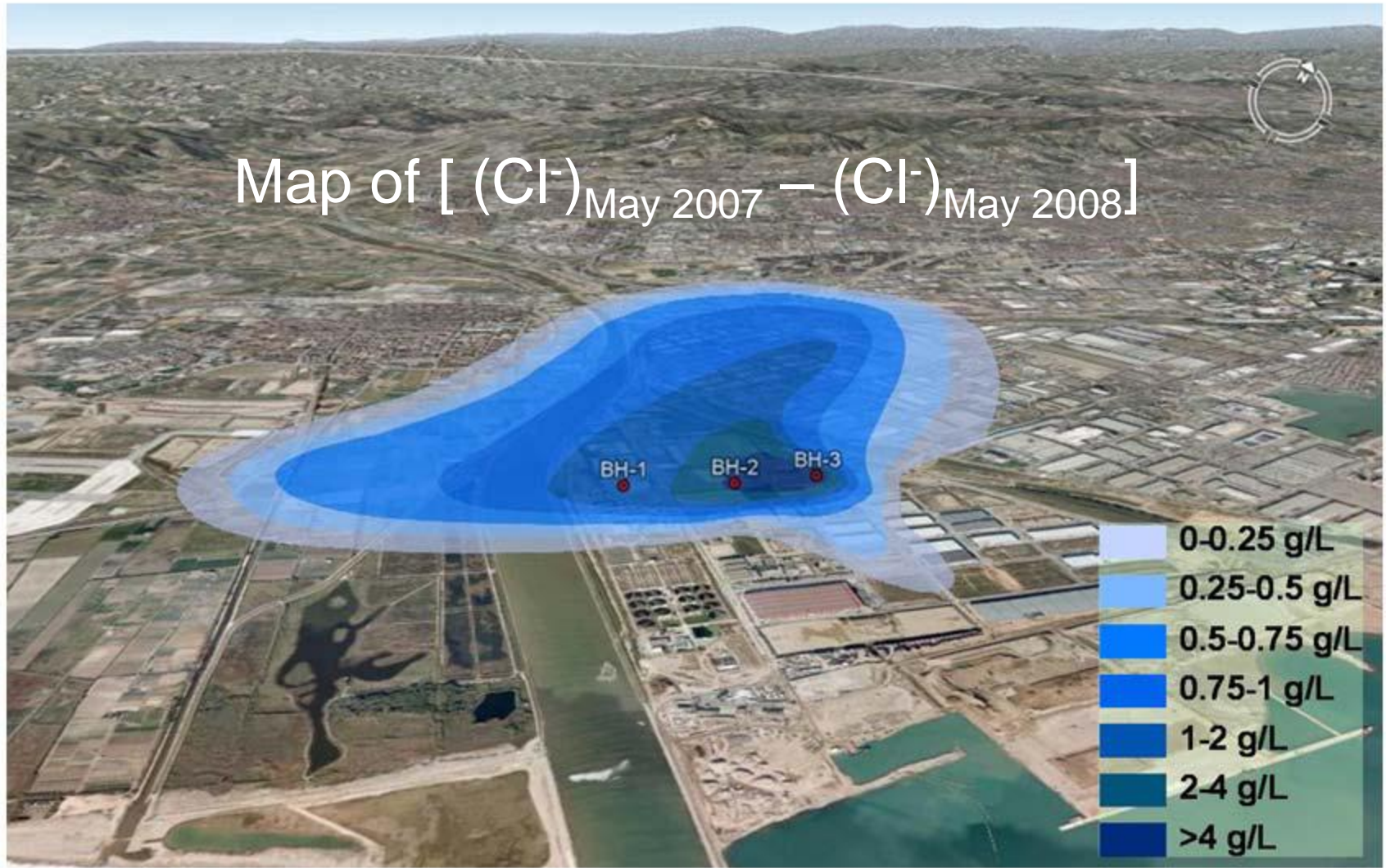


A² Performance Evaluation / Time = 1 year (May 2008)

01



A⁺ Impact of 1 year of Pilot Phase (2007-2008)



Conclusions

- Groundwater can be strategically managed in big cities of the Mediterranean area. Aquifers can be intensively used during dry periods and recharged after droughts.
- River scarification, infiltration ponds, injection wells and hydraulic barriers against marine intrusion are proved technologies.
- Hydraulic barriers allow intensive use of groundwater resources minimizing the risk of marine intrusion. A demonstrative project in Barcelona was successfully implemented by using reclaimed water.

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THANKS !