FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

European Commission

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Open Workshop
Fostering inclusive and sustainable economic growth, employment and decent work (SDG#8) through ICT job creation tools for ensuring water security (SDG#6)

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Groundwater Modelling Platforms for Optimising Groundawater Management in Malta History, Challenges and Opportunities

EIP Water Online Market Place
Matchmaking for water Innovation
MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)

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USGS science for a changing world

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Taken from: http://stories.undp.org/cultivating-change-in-

Introduction

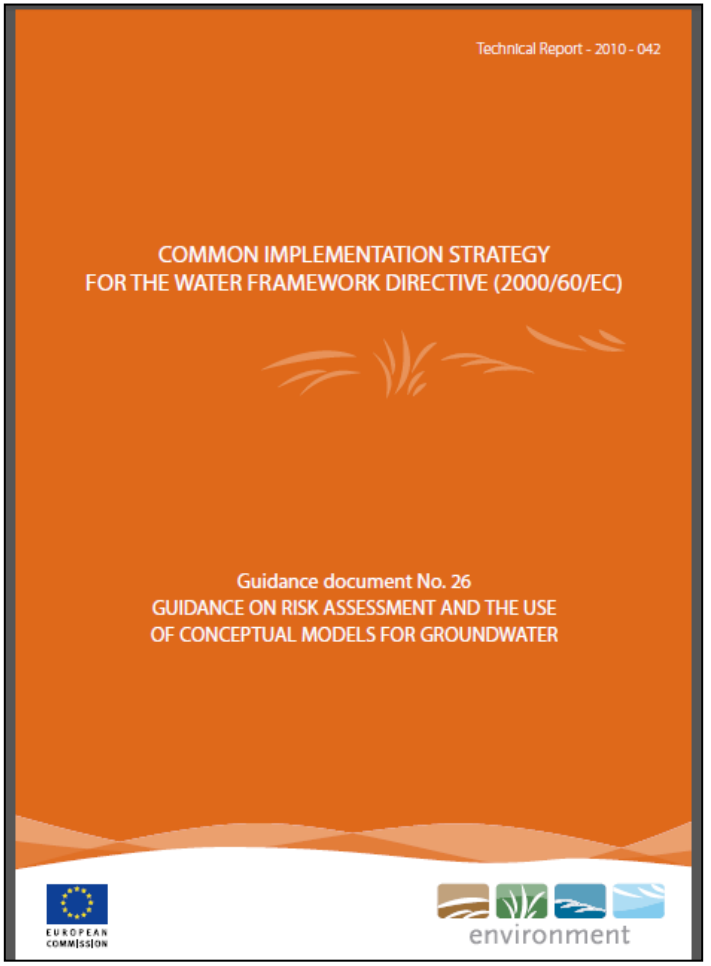
Models are tools that can enable the better management of water resources.

Why?

Provide the basis for reliable decisions in groundwater risk assessment and management.

WFD CIS Guidance Document No 26

Guidance on risk assessment and the use of conceptual models for groundwater



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Context (1)

The climate of the Maltese islands can typically be described as semi-arid Mediterranean. Mean annual rainfall amounts to 550mm, and natural losses due to evapotranspiration are estimated to exceed the 60% level.

This low natural availability of water resources is further compounded by the fact that the islands' have the highest population density in the EU - leading to a high demand for water resources.

This situation induces high pressures on the islands' natural water resources - namely groundwater bodies, which has historically led to overabstraction - resulting in the intrusion of sea-water.

Context (2)

Groundwater occurs in highly heterogenous carbonate aquifer formations - the Upper and Lower Coralline Formations.

The two aquifer formations are separated by less permeable formations (Blue Clay and Globigerina Limestone) giving rise to:

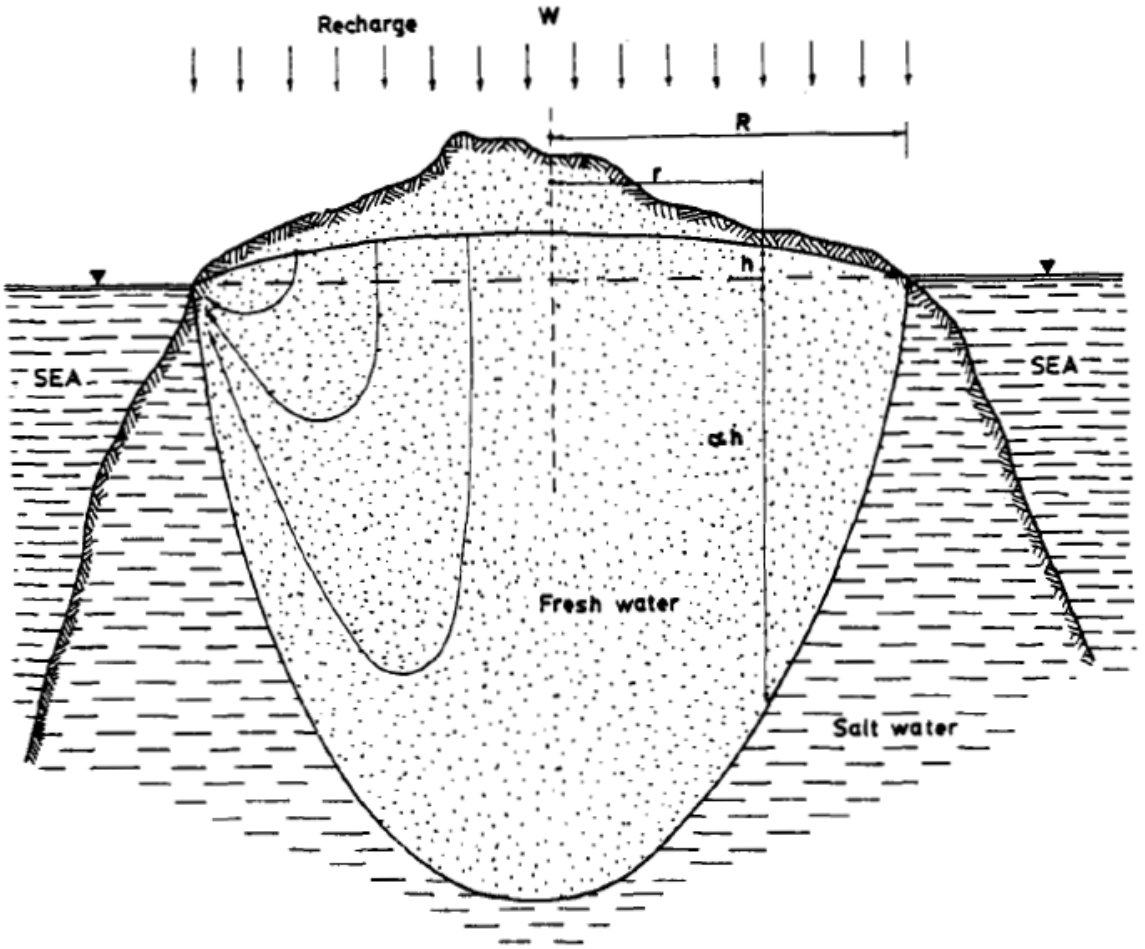
(i) Perched aquifer systems in the Upper Coralline Limestone above the Blue Clay formation, and

(ii) Mean Sea Level aquifer system in the Lower Coralline Limestone.

The sea-level aquifer systems take the shape of a freshwater lens floating on the denser sea-water - and is therefore highly vulnerable to sea-water intrusion.

History (1)

Conceptual Understanding:



History (3)

First numerical groundwater body model in Malta was developed by BRGM (1992) as part of a comprehensive study on the freshwater resources in Malta.

The scope of the study was limited to the Mean Sea Level and Perched aquifers in Malta.

Main interesting results from this study included:

- the association of aquifer safe yield with groundwater abstraction infrastructure,
- the estimation of aquifer storage capacity at around 40x the mean annual recharge, and
- an estimation of subsurface groundwater outflow at the coast.

Challenges (1)

The EU's Water Framework Directive requires the achievement of good status (quantitative and qualitative) in all water bodies.

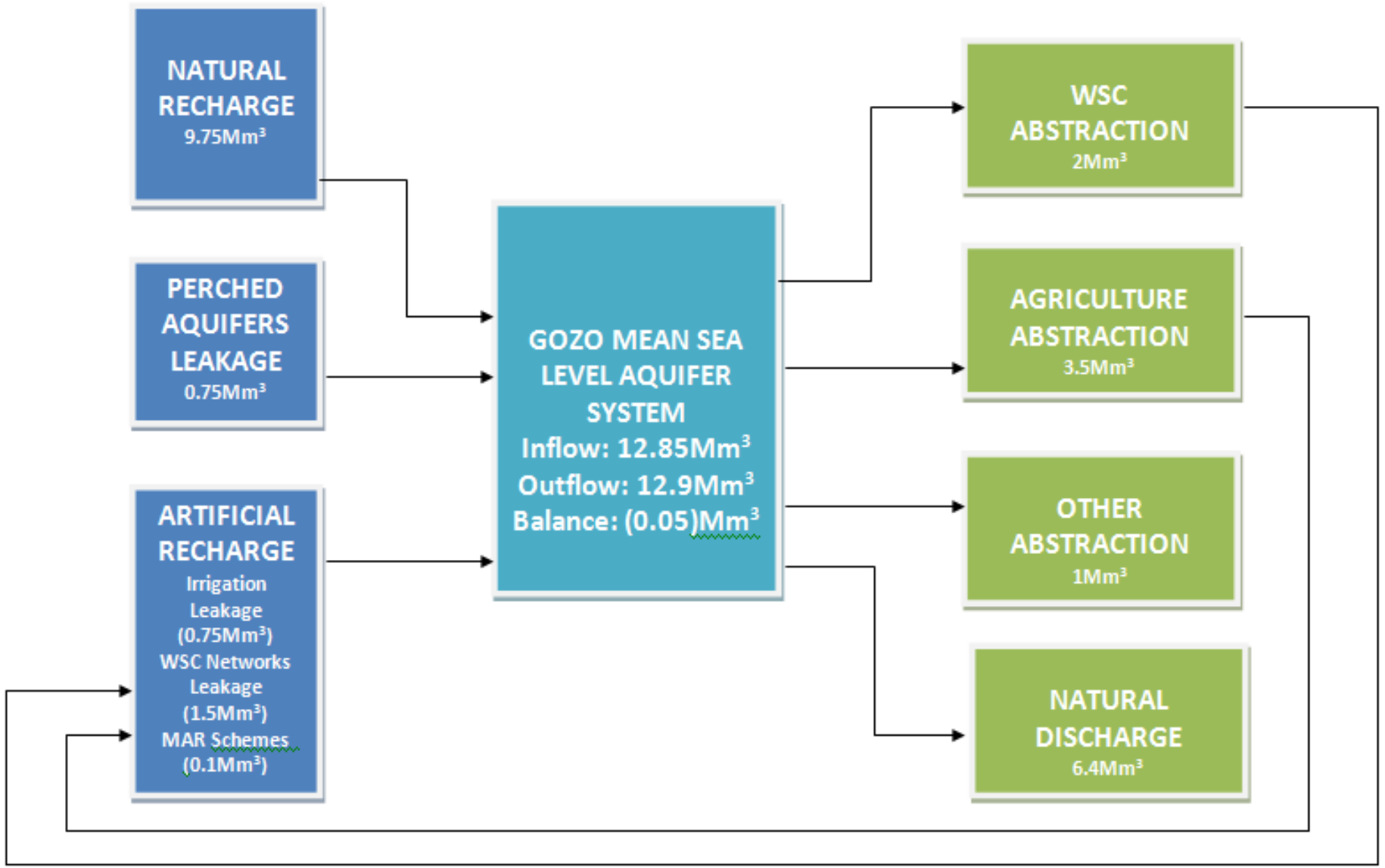
In the case of good groundwater quantitative status this needs to be assessed through:

(i) Water levels in monitoring wells

(ii) Water balance

Water balance calculations for the MSLA in Gozo still have a high level of uncertainty in certain parameters.

Challenges (2)



Challenges (3)

Numerical models of the groundwater body can help reduce uncertainty in water balance parameters:

- Inflows to the groundwater body
- Natural outflows from the groundwater body
- Storage capacity of the groundwater body (hence its resilience in drought periods).

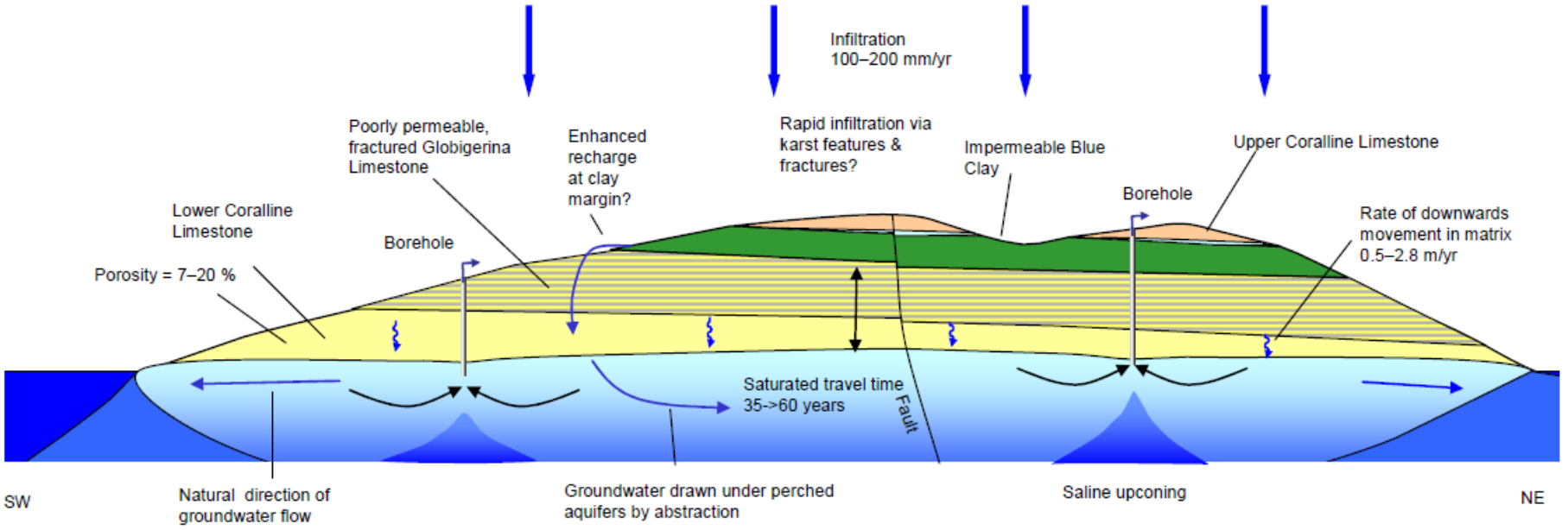
Also, numerical models can take into account the spatial and temporal variability of abstraction and therefore indicate areas of local overabstraction, which can lead to sea-water intrusion.

A higher level of protection to the body of groundwater.

Challenges (4)

Numerical models can also integrate different groundwater bodies in a single comprehensive (multi-layered) model.

This will allow a more comprehensive assessment of groundwater management on the island.



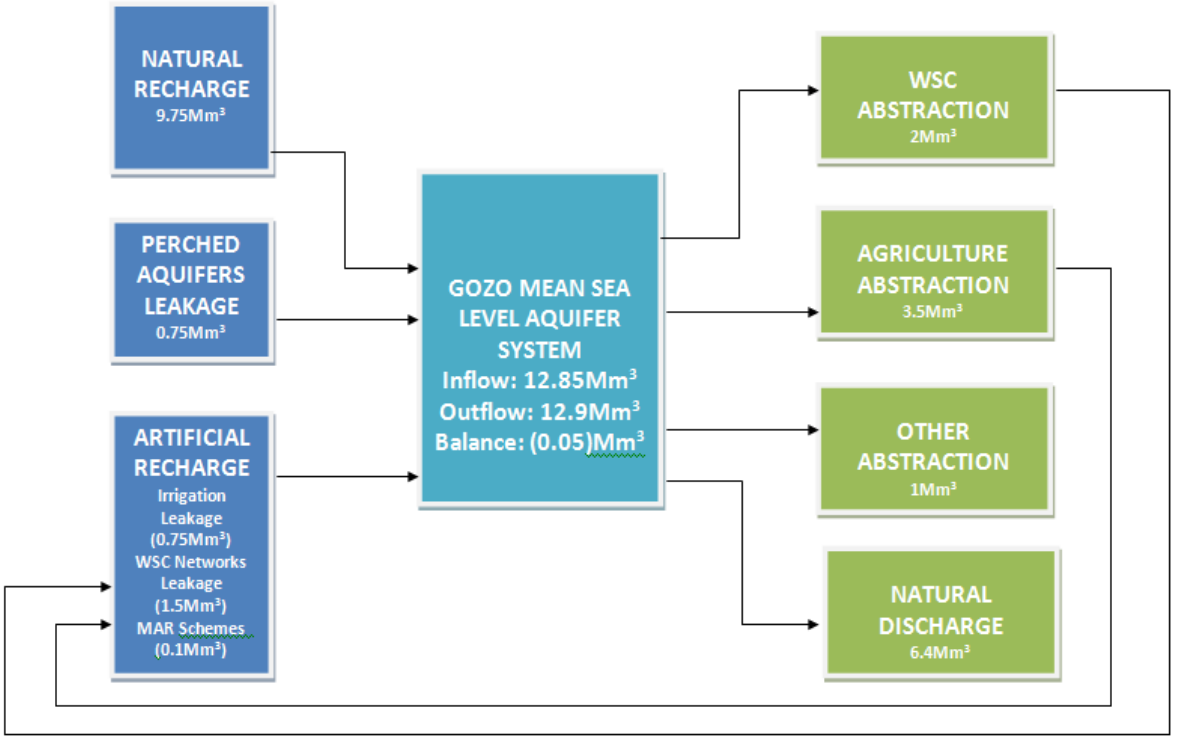
Opportunities (1)

What role can FREEWAT have?

Main direct benefit is the development of a numerical water model which can (initially) support groundwater quantitative status assessments in the Gozo Mean Sea Level aquifer system.

Increased reliability in status assessments

Increased protection to the groundwater body



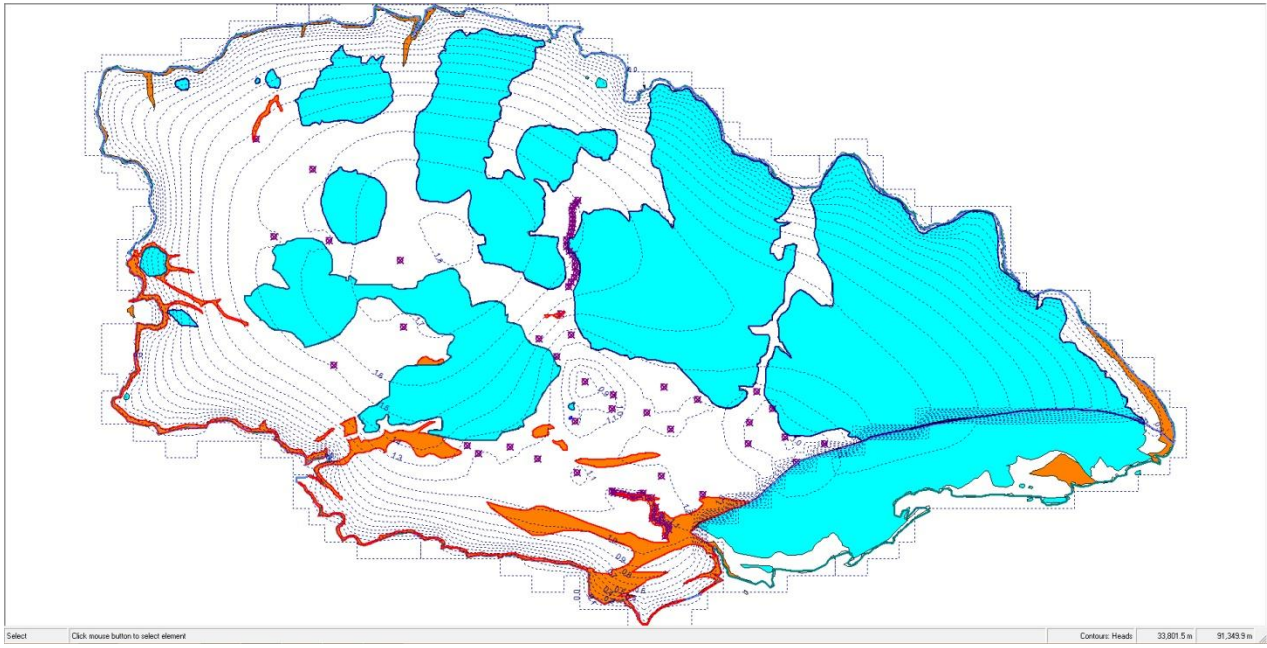
Opportunities (2)

FREEWAT can also be instrumental for the prior assessment of different water management scenarios:

- Impact of MAR schemes

- Impact of different abstraction strategies

- Impact of climate change

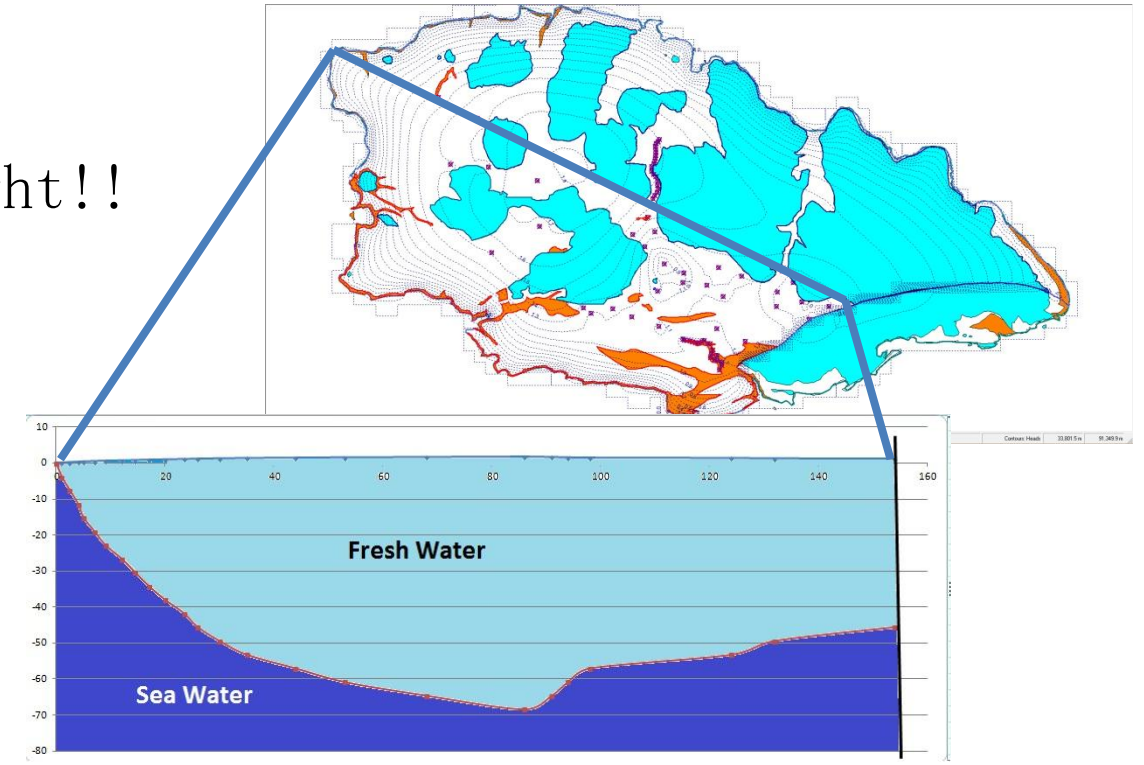


Opportunities (3)

Numerical models can also support public engagement activities.

Visualisations can help stakeholders understand better how the saturated zone functions.

Bringing groundwater in sight!!



Conclusion

Models are a tool, NOT a solution.

Reliable models need reliable data – therefore model development must be accompanied by the development of monitoring networks and an increased understanding of the hydro-geological environment.

BUT – Good numerical models of groundwater bodies can be important tool to assess status conditions, the impact of aquifer management measures and the future response of the aquifer system.

This is of particular relevance to the implementation process of the EU's Water Framework Directive.

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Thank-you for your attention

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