TOPSOIL Governance Case Study:
"Dealing with groundwater abstractions and artificial recharge in saline environments"

Background: TOPSOIL wants to improve groundwater management by taking a focused look at all aspects from sampling and modelling geological characteristics to understanding legal and organisational contexts, stakeholder involvement, financial barriers etc. Work package 6 deals with best governance practice emphasising the relations and interactions of legislative and institutional frames but also relevant issues about stakeholders, funding etc.

Purpose: For this purpose, partners are invited to document cases with a central issue they want to solve (Step 1). These case studies will be commented by TOPSOIL partners from other countries, providing insight on the situation from different perspectives: "What would the case look like, if I had this case study in my area?" (Step 2) The results will be discussed (e.g. at a transnational Challenge Workshop), and synthesised into road-maps for tackling central challenges in groundwater management (Step3).

This document presents two case studies affiliated with the two Belgian pilots BE1 and BE2. BE1 investigates the fresh-saline distribution of the coastal area; BE2 seeks for solutions to increase the freshwater availability in this saline environment.

The document will be sent to selected and interested TOPSOIL partners, so that they can carry out Step 2 (see above), and comment on the case study under the headline "How would this be approached in my country / region?"

If you have got any question on how to use this document or how to respond to it, please feel free to contact the contact person in your country who was involved its development:.

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Facts on BE1 en BE2

An overview on these pilots has been provided on the TOPSOIL website:

https://northsearegion.eu/topsoil/pilot-areas/be-1/

https://northsearegion.eu/topsoil/pilot-areas/be-2/

1. Management issue – simplified

- Major challenge?

  Abstraction without causing saline intrusion (saline intrusion is the replacement of fresh groundwater by water that has a high salt content).
  Adaption of legislation to artificial recharge on a small scale (farm level).

- Major Solution?
  A good licensing policy, compliance and enforcement

- Major Obstacles?
  - *Abstractions in saline environment: decision framework based on risk assessment*
  - *Artificial recharge in saline environment: legislation was designed for large recharge systems used for drinking water production. To allow smaller systems to operate (farm level) an adaptation of legislation is necessary. Today, legislation demands an intensive and expensive monitoring program. What is acceptable taking into account European legislation?*

2. Management issue – expanded

- For a building project located 150 m from an estuary with saline water, a large amount of groundwater is extracted (dewatering for construction purposes). The abstraction causes saline intrusion (horizontally). When is the impact (displacement of the fresh-salt water interface) acceptable ? If not, which measures could be taken bearing in mind the BATNEEC principle? Investigation of the behaviour of the fresh-salt water interface can be done by groundwater modelling. Density dependent groundwater modelling is not widely known and expensive. When is a density dependent groundwater model needed? Who is responsible for the modelling, government or applicant? Monitoring of fresh-salt water distribution can be done by EM measurements in borehole wells, which is expensive. What are minimum monitoring requirements?

- A farmer uses phreatic groundwater for irrigation of field vegetables or as drinking water for cattle. The fresh-salt water interface is located 15 m below surface level. His groundwater wells have a depth of 10 m. There is a risk of upconing of the fresh-salt water interface. He wants to use surface water during winter for artificial recharge of the phreatic aquifer. According to the applicable legislation a piezometric network must be installed 6 months before start of infiltration. Surface water must also be analysed 3 times on a large number of

parameters (pesticides, nutrients, …) before start of infiltration. The analysis must be repeated every 3 months during artificial recharge.

Options for solving the problem

Technical solutions:

- *Building project*
    - *Re-infiltration of extracted groundwater in the area between construction pit and estuary*
    - *Sheet piling between construction pit and estuary*

Legislation changes

- *Farmer*
    - *Adaptation of legislation to small scale infiltration systems*

Obstacles to implement the solutions:

- Building project
    - Measures are expensive
    - Higher extraction rates when re-infiltrating abstracted groundwater
    - Open space needed for implementing measures
    - sheet piles cause a permanent obstruction for groundwater flow towards the estuary
- farmer
    - variation of surface water quality during the year
    - legislation not adapted to small systems for artificial recharge; what are minimum requirements to allow this kind of systems?

3. Questions to TOPSOIL partners

The following question are asked to you as responders to this case study:

1. *How big is the problem of saline intrusion in your country? Does it occur in large areas or in a limited number of locations?*
2. *What is the policy? How do you manage the coastal aquifer/saline aquifer?*
3. *When is saline intrusion considered to be a problem? Is a temporary displacement of the fresh-salt water interface allowed (horizontally/vertically)?*
4. *What kind of methods have already been advocated for the control of saline intrusion? What is the pragmatic and cheapest solution to control saline intrusion?*
5. *Is your legislation adapted to small scale artificial recharge projects?*
6. *What are the conditions to grant a permit for the aforementioned groundwater activities?*
    1. *When does someone need to apply for a licence and what kind of information is needed (e.g. model results)?*
    2. *What kind of information and tools (e.g. modelling) do you use or provide when assessing an application for authorisation?*
    3. *What are the licence conditions ? (abstraction rate, duration of the licence, monitoring requirements, …)*
7. *Do you have an enforcement strategy when someone causes saline intrusion?*
8. *Who are good persons to contact on these issues?*

9. *Any specific references (including page-numbers…) you would recommend?*