

The abstraction of brackish water

FRESHMAN project

Increasing freshwater availability in the coastal zone

Dunea supplies drinking water to 1.3 million customers in the city of The Hague and surrounding areas. Population is growing and thus drinking water demands are increasing, urging Dunea to develop alternative water resources, such as brackish groundwater. Brackish groundwater is an excellent feed water for reverse osmosis (RO) membranes, and can be desalinated at acceptable (energy) costs. Extraction of brackish groundwater not only provides an additional water source, but may also result in expansion of the freshwater storage in the dunes, Dunea's strategic water reserve. These combined benefits of brackish water abstraction are referred to as the Freshman concept.

Project scope and deliverables

The **central objective** is to demonstrate that brackish groundwater abstraction in (sandy) coastal zones can be an effective climate adaptation measure:

- Creating a new source of drinking water
- Creating a buffer for extreme drought.

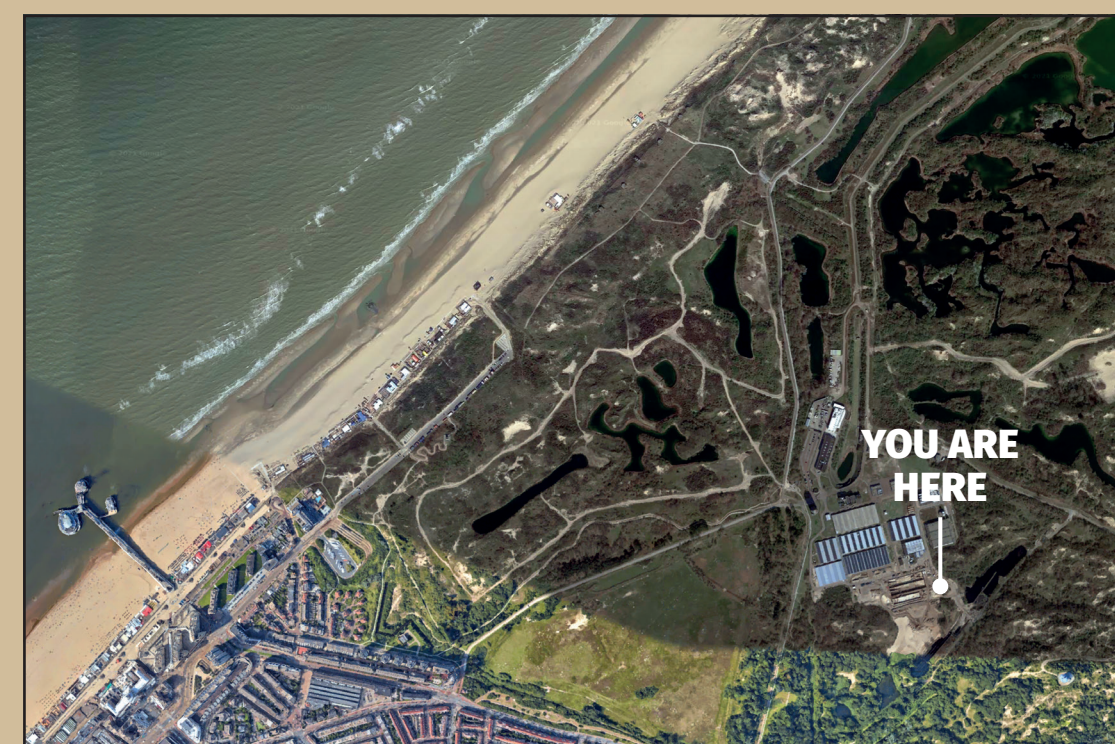
Key actions to achieve the objectives:

- Abstraction of brackish groundwater (by deep wells)
- Monitoring the growth of the freshwater lens
- Monitoring environmental impacts of the abstraction
- Purification of the brackish water to drinking water
- Communication and dissemination of the results.

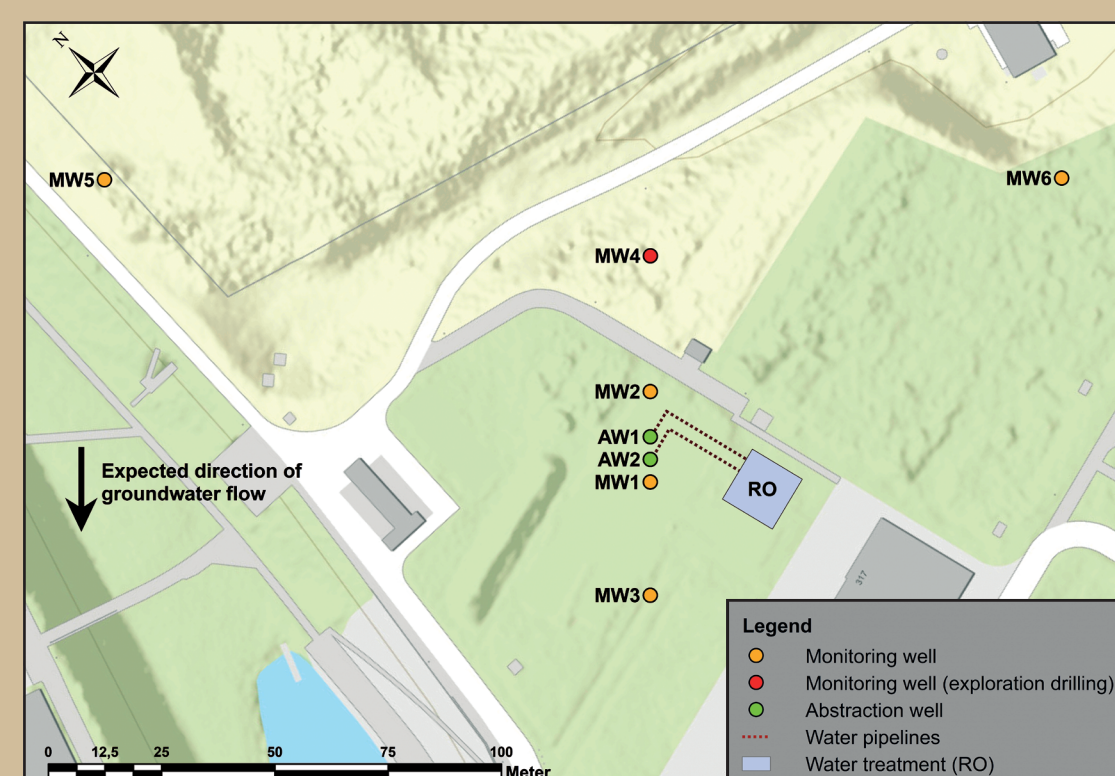
Field validation of the Freshman concept:

- Production of 88.000 m3 drinking water per year (sufficient for 2000 inhabitants)
- Growth of the freshwater lens in the pilot area by 5-10 meter
- Dissemination of the results to the general public and the scientific community
- Assessment of replication potential in other coastal zones (EU and world-wide).

Location

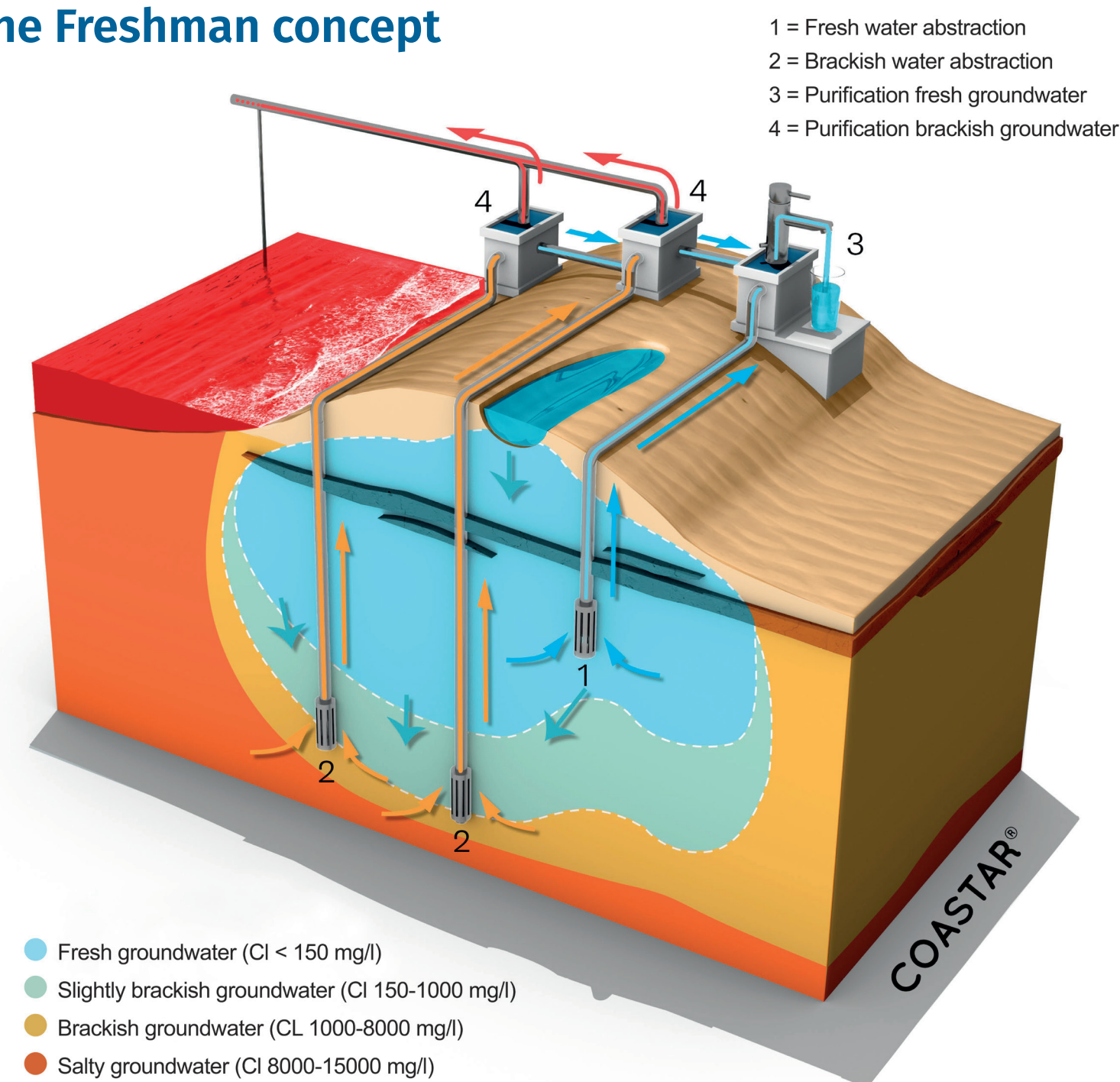


Aerial view of the pilot location, situated in the coastal dunes of The Hague



Showing two abstraction wells (AW1 and AW2) and six monitoring wells (MW1-6).

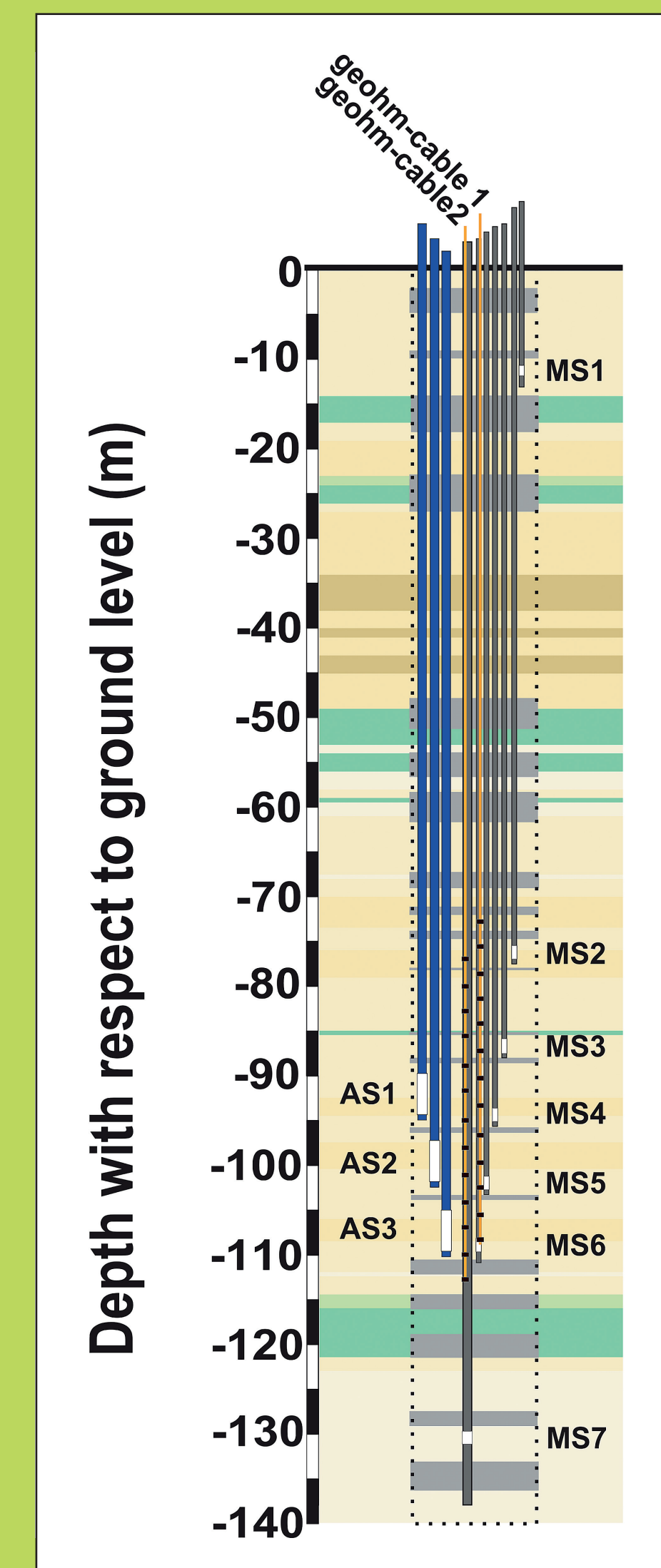
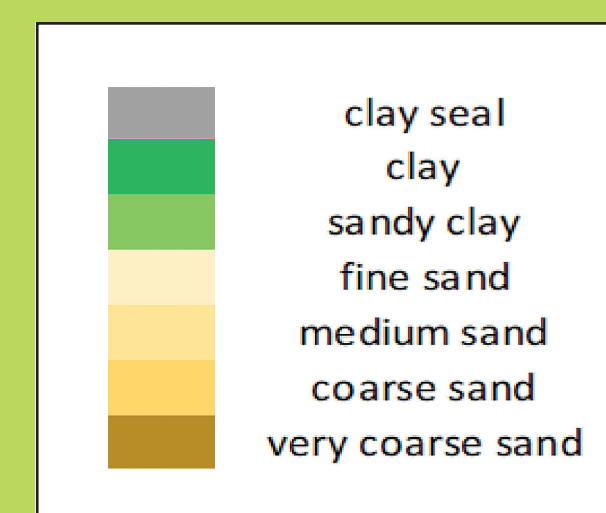
The Freshman concept



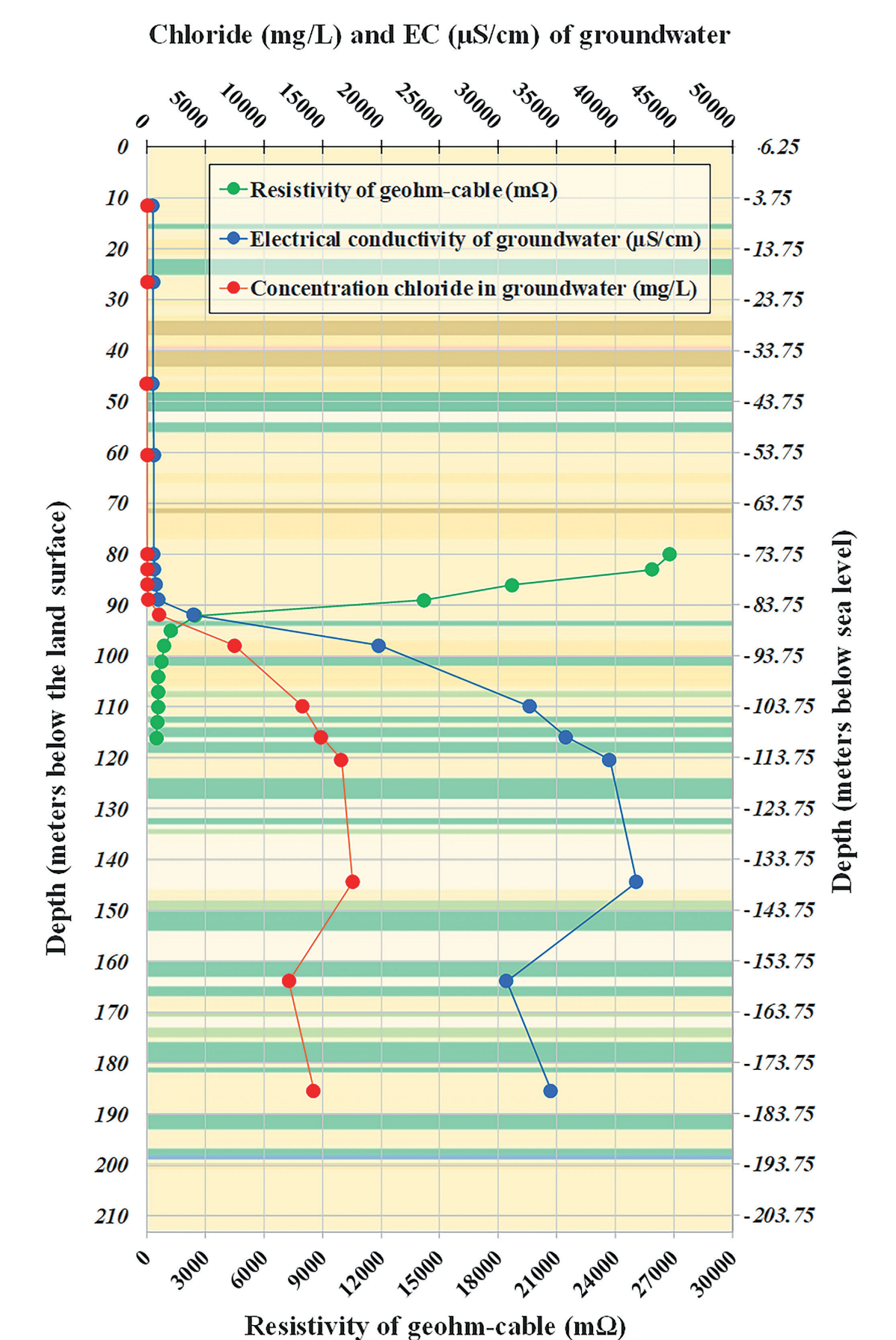
1. Abstraction of deep fresh groundwater in the coastal dunes leads to upconing of brackish groundwater and to salinization of the well.
2. Abstraction of brackish groundwater leads to downconing of the interface between fresh and brackish water, increasing the volume of the freshwater lens and protecting the deep freshwater well from salinization. In fact, both wells can be operated at the same time, if properly engineered.
3. The freshwater is purified to drinking water with conventional techniques. The freshwater produced by the RO is mixed with the drinking water from step 3 (blue arrows).
4. The brackish water is converted to fresh water by reverse osmosis (RO). The concentrate produced by the RO is discharged to the North Sea (red arrows).

Overview of the abstraction well

Schematic overview of the brackish groundwater abstraction well, with three abstraction screens (AS1-3) and seven monitoring screens (MS1-7).



Vertical profile of chloride and related physical parameters (monitoring well 4)



The vertical profile of the chloride concentration in the exploration well was used to determine the position of the abstraction filters in the abstraction well.



More information:
www.dunea.nl/algemeen/life-freshman

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Coordinating beneficiary:



Associated beneficiaries:

