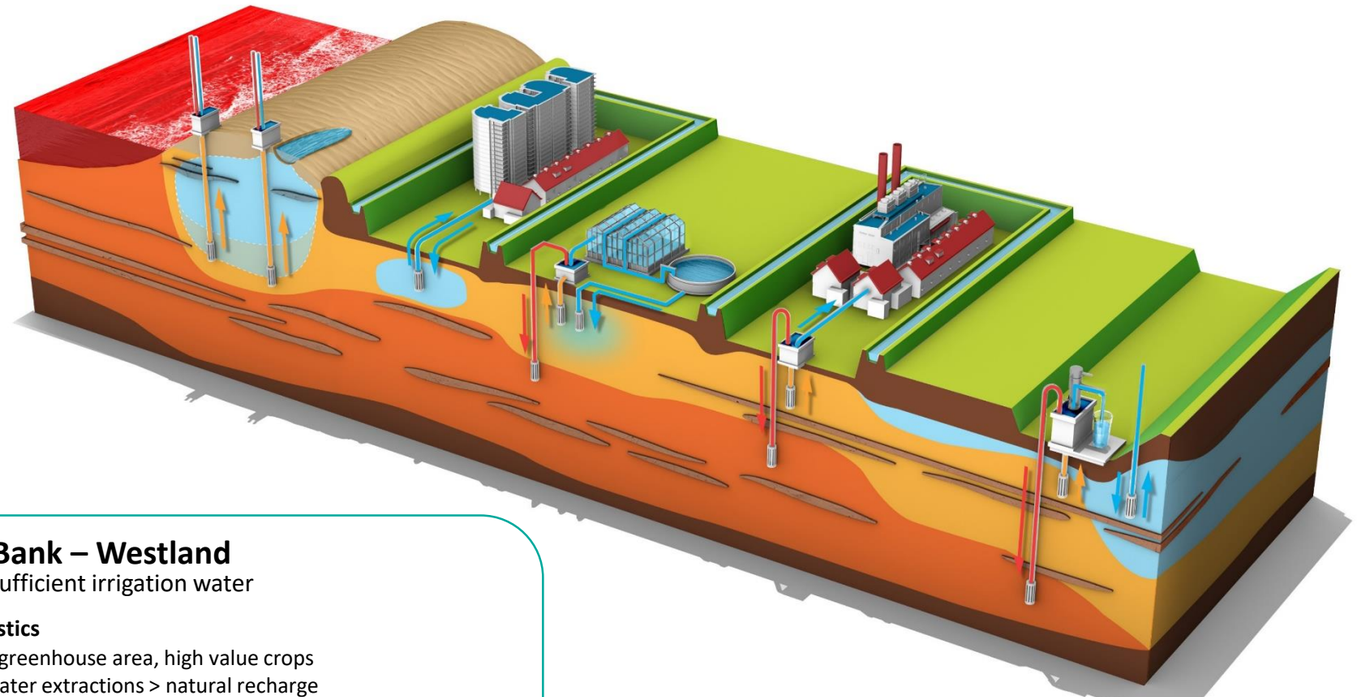
COASTAR in The Netherlands
COastal Aquifer STorage And Recovery

Close the water gap between water supply and demand in space and time

Prevent salinization by using brackish groundwater for fresh water production



Water Bank – Westland
Towards sufficient irrigation water

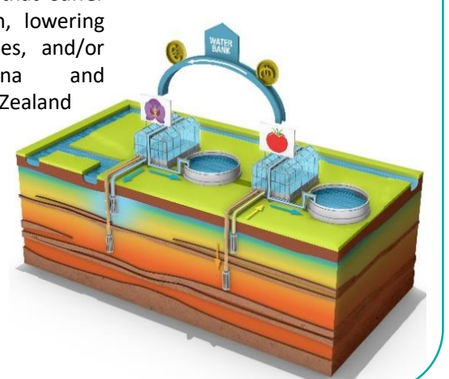
Characteristics
- 3000 ha. greenhouse area, high value crops
- Groundwater extractions > natural recharge
- Brackish aquifer, desalinated groundwater used for irrigation
- Year-round precipitation meets irrigation demand
- 30 hectares pilot: Prominent tomatoes

Challenges
- Aquifer salinization due to groundwater extractions and deep-well infiltration of membrane concentrate

COASTAR solutions
- Balance aquifer recharge and extraction by infiltrating precipitation surplus
- Aquifer management through water banking: (financially) promote infiltration, pay-per-use for groundwater extractions

Similar areas

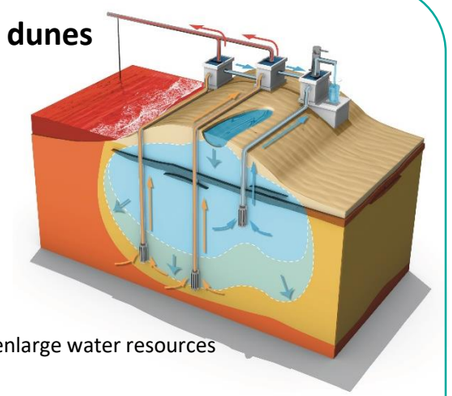
Aquifers world-wide that suffer from overexploitation, lowering of groundwater tables, and/or salinization. Arizona and California (USA), New Zealand



Animation

Report

Brackish water extraction coastal dunes
Drinking water company Dunea



Characteristics
- Important area for drinking water supply
- Sandy ridge between sea and hinterland
- Fresh groundwater lens in saline subsurface
- Robust existing system of river water infiltration and extraction fresh groundwater

Challenges
- Increasing drinking water demand and wish to enlarge water resources
- Sea level rise

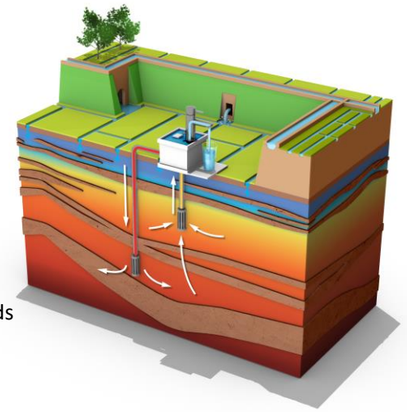
COASTAR solutions
- Infiltration of fresh river water
- Extraction fresh groundwater for drinking water
- Extraction brackish groundwater (new source)
- Enlarging freshwater lens: larger bridging period in case of calamities
- Protection hinterland from future salinization

Similar areas

Small Developing Island States, Italy: Adriatic coastal zone, USA: East coast, Tunisia, Spain, Denmark, Belgium, Dar es Salaam (Tanzania)

More information

Brackish groundwater exploitation low-lying polders
Drinking water and desalinisation for agriculture



Characteristics
- Low lying saline areas
- Shallow brackish groundwater and brackish ditches
- Agriculture

Challenges
- Autonomous salinization
- Increasing salt damage agricultural crops
- Increase freshwater shortages in dry periods
- Increasing drinking water demand

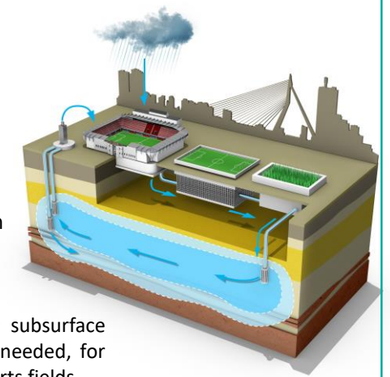
COASTAR solutions
- Reverse osmosis on brackish groundwater
- Brackish groundwater as source for drinking water
- Decrease seepage, salt load and eutrophication
- Decrease salt damage crops polder and its environment

Similar areas

Netherlands: polders, Deltas: Yellow river (China), Nile (Egypt), Mississippi (USA), Mekong (Vietnam), Po (Italy), Ganges-Brahmaputra (Bangladesh)

Urban Water Buffers
CITIES2RECHARGE stores rainwater in the subsurface

Characteristics
- Smart water storage in urban areas
- Optimatization of operation



Challenges
- Increasing urban water demand
- Increasing freshwater shortages in dry periods

COASTAR solutions

Excess rainwater is infiltrated into the subsurface and pumped up again as soon as it is needed, for example for landscaping or watering sports fields.

Similar areas

Urban areas

More information

Deltares KWR ARCADIS ALLIED WATERS

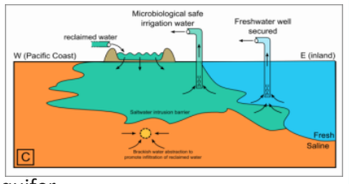
Contact: info@coastar.nl
Website: COASTAR.nl

Where can COASTAR be applied?

COASTAR aims for large-scale use of the subsurface to store freshwater for industrial, domestic and agricultural use, including using brackish water for freshwater production.

Benefits can be achieved by combining water supply with other functions, such as preventing land subsidence and flooding or strengthening coastal defences

Reuse of municipal wastewater Mexico



Characteristics
- Coastal alluvial plain
- Seawater intrusion
- Over-exploitation of coastal aquifer
- Production of high value crops for export market

Challenges
- Lack of fresh irrigation water
- 1000 hectares taken out of production
- Reduced crop production, economic losses, jobs at stake

COASTAR solutions
- Treated municipal wastewater as additional water source
- Soil aquifer treatment for microbiologically safe irrigation water
- Underground storage to enable large-scale reuse of wastewater

Similar areas
Baja California (Mexico), California (USA), Chile, Australia

Land reclamation and industrial areas Singapore

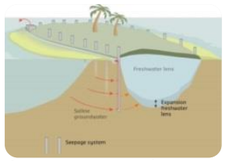
Characteristics
- Industrial area
- Lack of space for above ground storage of freshwater
- Reclaimed land with freshwater infiltration; potential for industries to become self-sufficient in terms of supply

Challenges
- Reduction in groundwater replenishment due to built-up areas on the reclaimed land

COASTAR solutions
- Use of existing infrastructure to infiltrate water
- Design of water resources management system for operational purposes

Similar areas
Hong Kong, Macau, Taipei, Maasvlakte (the Netherlands), UAE, Qatar, Gujarat (India)

Small Islands

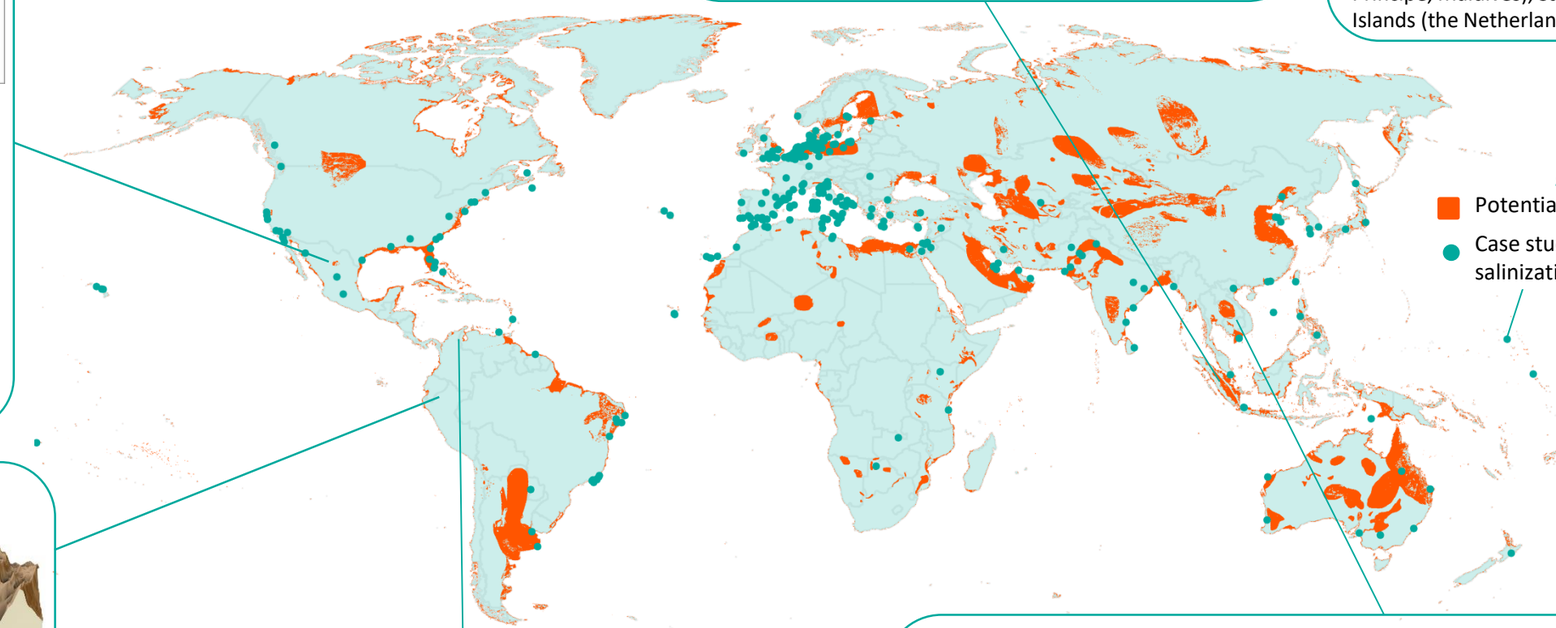


Characteristics
- High population density and isolated from large land masses
- Self-sufficient freshwater supply is necessary: rely on rainwater harvesting and on groundwater
- Lack of space for aboveground freshwater storage

Challenges
- Sea level rise and increased saltwater intrusion
- Increasing water demand
- More extreme droughts

COASTAR solutions
- Combination of coastal defence and water supply
- Underground water storage in combination with desalinization of brackish groundwater (SeepCap)

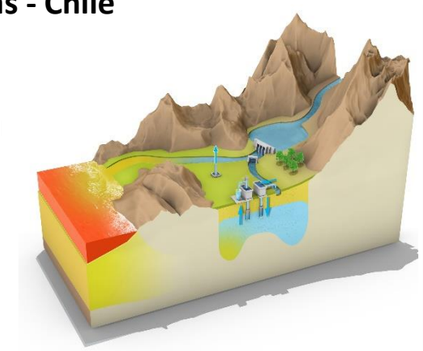
Similar areas
Small Island Developing States (e.g. São Tomé and Príncipe, Maldives), San Andrés (Colombia), Wadden Islands (the Netherlands, Germany)



Potential areas for COASTAR

Case studies with groundwater salinization issues

Water scare areas - Chile



Characteristics
- Water is used for domestic, irrigation, and mining uses
- Precipitation surplus in the rainy season
- Severe droughts and water scarcity; brackish groundwater

Challenges
- Shortage of freshwater for irrigation and domestic use

COASTAR solutions
- Infiltration of precipitation surplus
- Extraction and use of brackish groundwater

Similar areas
South Africa, Colombia, USA: East coast, Florida, California

Large cities in coastal areas - Colombia

Characteristics
- Large urban coastal areas
- Shallow fresh-salt groundwater interface
- Precipitation surplus in the rainy season causes flooding
- Frequent and severe droughts affects water supply

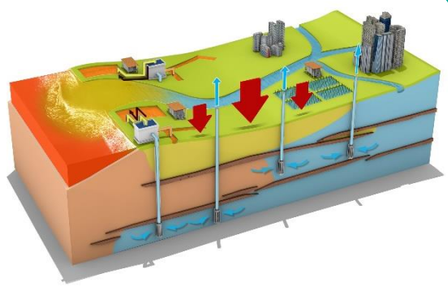
Challenges
- Sea level rise and saltwater intrusion
- Floods in the rainy season, water scarcity in dry season
- Increasing water demand

COASTAR solutions
- Infiltration of precipitation surplus
- Extraction and use of brackish groundwater
- Prevention of flooding

Similar areas
Jakarta (Indonesia), São Paulo (Brazil), Buenos Aires (Argentina), Miami (USA)

Improving water management techniques in the banana sector

Agricultural areas - Vietnam



Characteristics
- Small-scale agriculture, including shrimp farming
- Intense shallow groundwater abstractions
- Surface water and groundwater are mainly salty
- Large precipitation surplus in the rainy season
- Thick shallow clay layer prevents infiltration

Challenges
- Increasing water demand
- Land subsidence
- Lowering of water table due to abstractions

COASTAR solutions
- Aquifer storage and recovery: precipitation surplus injected into the brackish/saline aquifers

Similar areas
Mississippi (USA), Myanmar, Mozambique, Deltas: Po (Italy), Nile (Egypt), Ganges-Brahmaputra(Bangladesh)

Freshwater availability in Mekong Delta

Deltares KWR ARCADIS ALLIED WATERS

Contact: info@coastar.nl
Website: COASTAR.nl