Development of a web-supported MAR concept for a pilot study in Recife, Brazil

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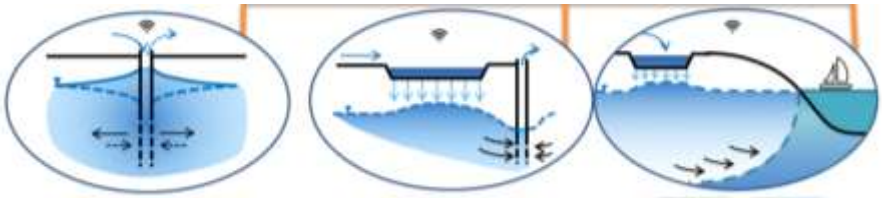
for the SMART Control Projekt funded by:

Managed Aquifer Recharge (MAR)– Concept and Risks

SMARTControl
A Water JPI Project

Reasons for MAR application

- Water scarcity and water quality issues: Storage and Treatment
- Temporal availability of water resources when not required
- Prevention of salt water intrusion
- Protection of groundwater and fresh water ecosystems



Risks when applying MAR

- Public health: e.g. WQ of source water and extracted water
- Technical: e.g. clogging, recovery efficiency, salinization, residence time
- Environmental risks: Climate Change, urban development
- Resources constraints: infrastructure, capacities, etc.

-> Tools and Methodologies are needed for addressing these risk: SMART Control* aims at developing capacities for applying tools (INOWAS Platform)

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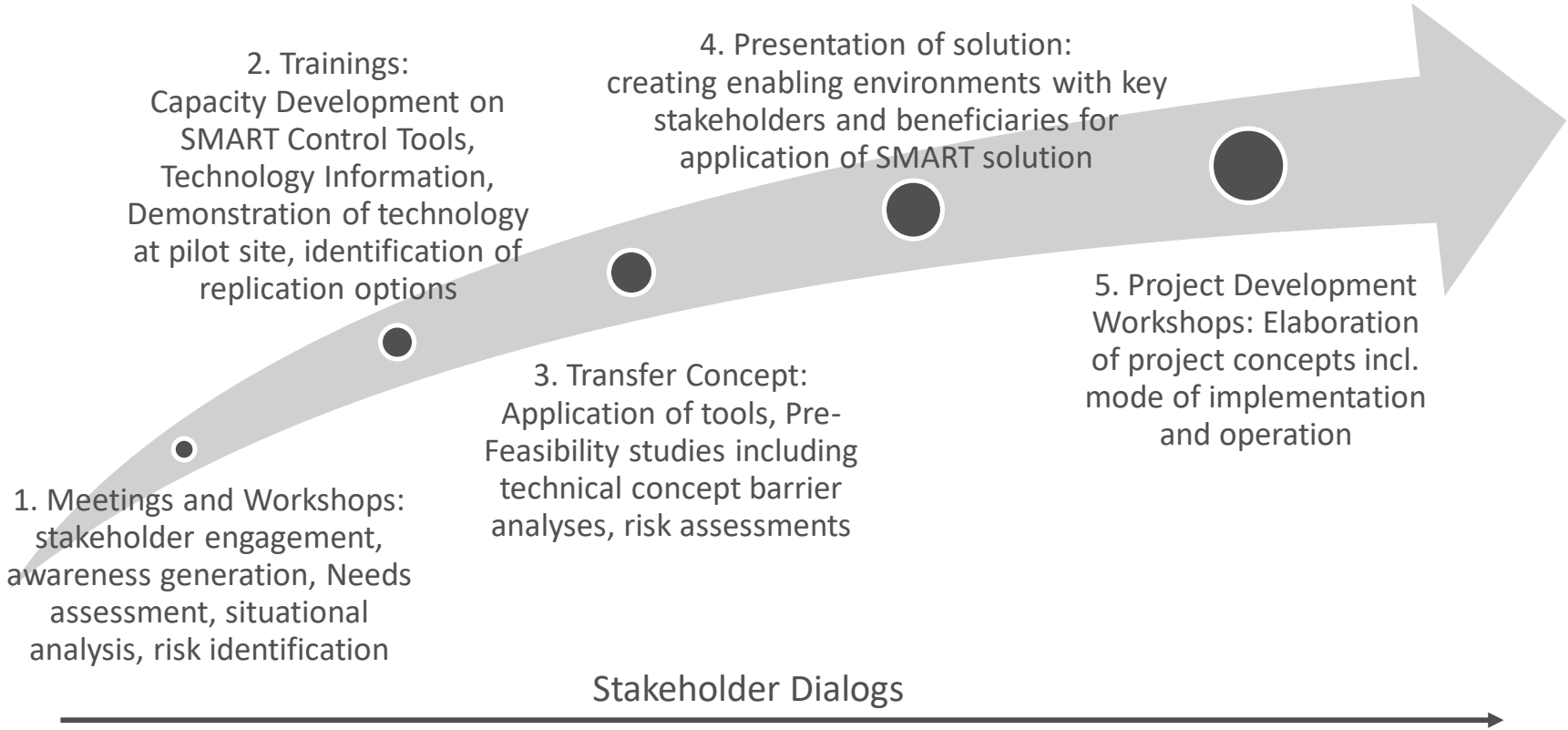
Project duration: 01.02.2019 – 31.01.2021 (possibly extended)

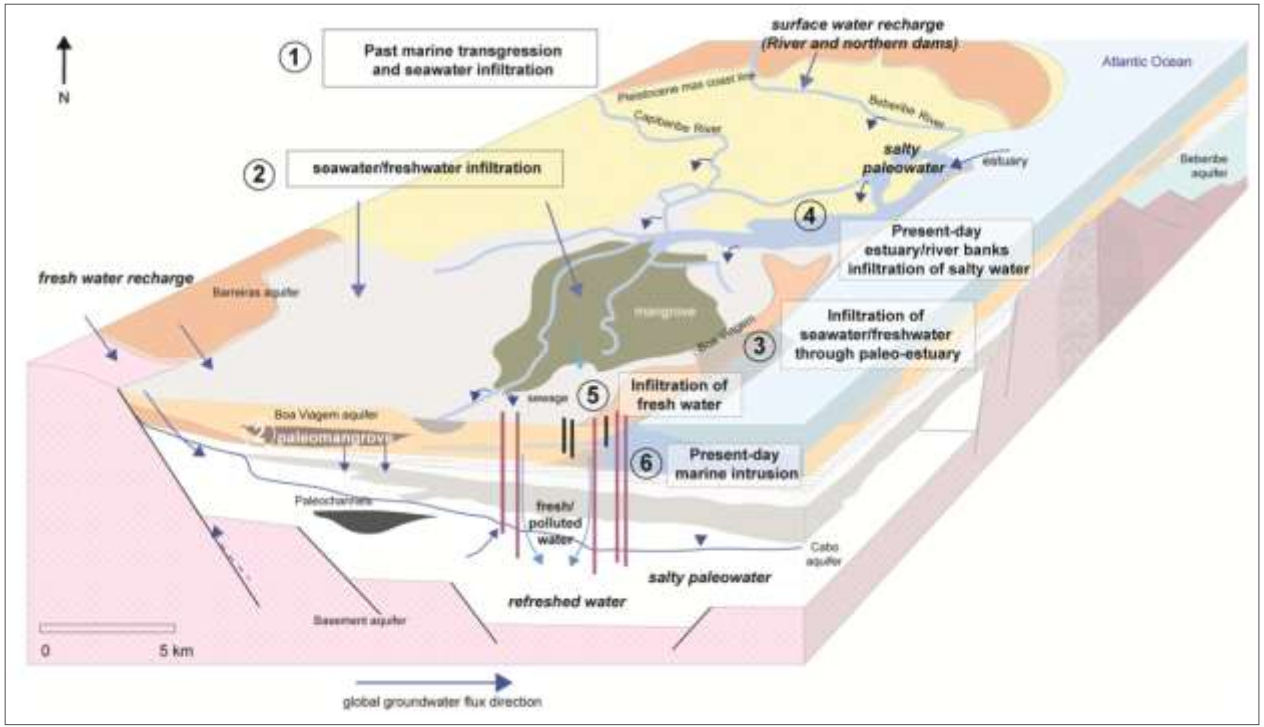
Capacity Development Approach and Solution Development for SMART Control



*based on the UNFCC framwork for technology transfer

Case Study for addressing risks of MAR application: Recife, Brazil

Urbanisation process
Recent droughts
Insufficient public water supply
Illegal private wells
Frequent heavy rain events
Urban flooding
Overexploitation of groundwater resources
Risk of subsidence
Degradation of water quality
Saltwater intrusion



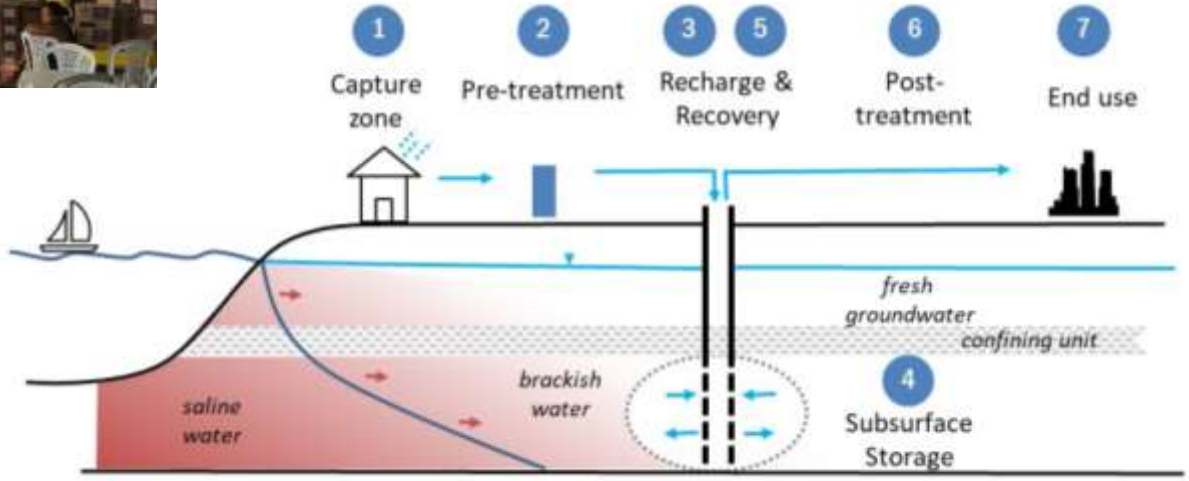
Source: COQUEIRAL Project (Cary et al. 2015)

Pilot Study for Transfer Concept in Recife, Brazil: Public Market

- Roofed market places with RW harvesting system currently under construction
- High demand of fresh water for market related activities
- Saline groundwater due to over extraction

Risks to be addressed:

1 Quantity of collected water
2 WQ of collected rainwater
3 Clogging of infiltration
4 horizontal GW flow
5 efficiency of recovery
6 WQ of recoverdwater
7 public health



Development of Solution* for Afogdos Public Marke in Recife, Brazil

Assessment of technical feasibility of ASR-Coastal

Table 1. Water balance and geohydrological input data for the Technical and Economical Tool

Water balance	Value
Annual water demand	2900 m³ (CSURB 2018)
Annual precipitation	1884 mm (APAC 2018)
Existing rain water harvesting system	Yes
Harvesting area	31,501 m² (CSURB 2018)
Storage capacity	A cistern is planned: 500,000 m³
Geohydrology	**Value**
Aquifer layers	Boa Viagem and Beberibe (Costa *et al.*, 1998)
Electrical conductivity	751 µS/cm (Cary *et al.*, 2015)
Salinity of the groundwater	4024 mg TDS/L
Hydraulic conductivity	1.93 m/d
Groundwater table	93 m BLS
Porosity	0.13
Hydraulic head	26 m BLS (Montenegro *et al.*, 2006)

Application of feasibility tool:

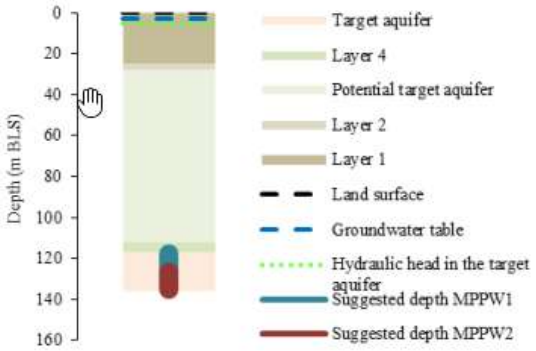


Fig. 4. Visual representation of the subsurface with suggested depths of the MPPW-layers' tops and bottoms. Layer 1 is an unconfined aquifer, the Layers 2 and 4 are aquitards and Layer 4 is another aquifer.

Table 2. Total volumetric water balance for a dry year (yearly)

Parameter	Value
Availability	5930 m³/year
Demand	2900 m³/year
Target Storage Volume (TSV)	340 m³/year
Total freshwater availability to bridge the seasonal/temporal mismatch	3370 m³/year

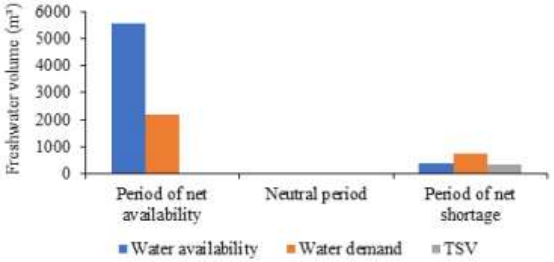


Fig. 3. Target storage volume over time for a dry year

*Conrad, A.C.; März, M. and Chakrabarti, R. Adapted subsurface water solutions across continents: Journal of Water Security 5(0)., 2019 DOI: 10.15544/jws.2019.006.

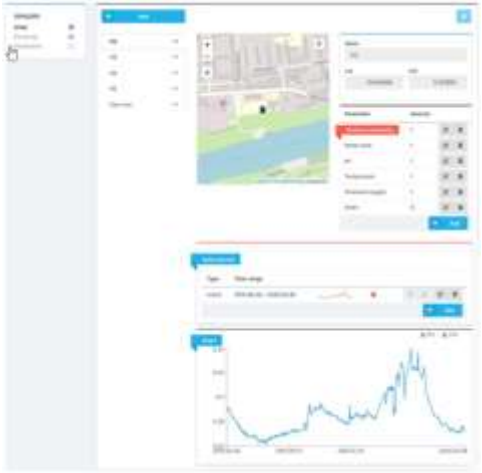
Capacity Building on SMART Control Tools

POWERED BY INOWAS

T1. Initial risk assessment (QMRA, HRT)

Public Health:
Identify risks and efficiently address water quality issues, reduction of DALYS

T2. Real-time monitoring and control



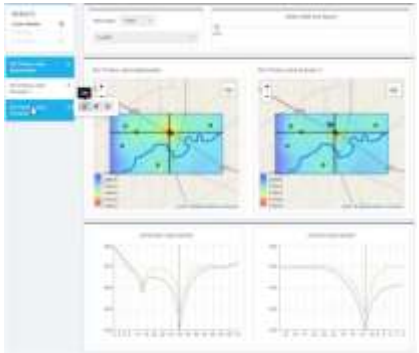
Technical Risks:
Discover operational issues on time

Solve technical problems immediately

T3. Automatic model update and simulations

Resource Constraints:
Quick GW models and scenarios with online interface
Easy access to all information

T4. Predictions for advanced system management



Societal Development:
Assess sustainability impacts of different scenarios

Optimise MAR systems and make them more resilient

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Thanks for your attention, Questions, Comments?

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