

Danida Alumni Network



IAH SOUTH AFRICA



MINISTRY OF FOREIGN AFFAIRS OF DENMARK Danida

1. MARSA: An Introduction



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Centre for Environmental Management

2 May 2024

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water & sanitation

Department: Water and Sanitation REPUBLIC OF SOUTH AFRICA



UNIVERSITY OF THE FREE STATE UNIVERSITEIT VAN DIE VRYSTAAT YUNIVESITHI YA FREISTATA



UFS NATURAL AND AGRICULTURAL SCIENCES

Overview

- The people and their institutions
- The Study Area
- Aims and objectives
- WP1: Column setup[DK]
- WP2: Column setup [SA]
- WP3: Field work
- WP4: Guidelines, etc.
- Last activities
- Way forward



G46092 – August 2014





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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA



UNIVERSITY of the
WESTERN CAPE



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UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

PEOPLE AND INSTITUTIONS



NATURAL AND
AGRICULTURAL SCIENCES

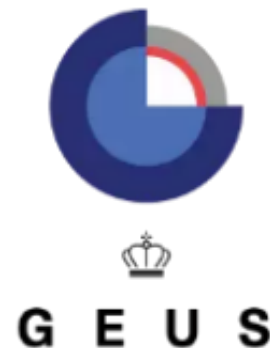
UFS



Tina, Jens, Thokozani, Jan, Bjørn, Ulla, Ricardo, Nicolette, & Sumaya. Photo by Mads.

Geological Survey of Denmark and Greenland [GEUS]

- Jens Aamand
- Bjørn Kaare Jensen
- Ulla E. Bollmann
- Tina B. Beck



Rambøll

- Jan Kürstein
- Mads Terkelsen
- Tina B. Beck



University of the Free State

- Nicolette Vermaak
- Paul Oberholster
- Students:
 - Sivu Mapapu
 - Thendo Mathivha
- Afeefah Williams



Department of Water and Sanitation

- Fanus Fourie
- Awodwa Magingi



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA



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University of the Western Cape

- Thokozani Kanyerere
- Sumaya Clarke
- Malikah van der Schijf [PhD]
- Students:
 - Carlton [B.Sc.Hons. & M.Sc.]
 - Anelkha [B.Sc.Hons. & M.Sc.]
 - Ndubuisi [PhD]
 - Melinda [M.Sc.]
 - Sebastian [M.Sc.]
 - Dean [M.Sc.]
 - Kaine [B.Sc.Hons.]
 - Kaydee [B.Sc.Hons.]



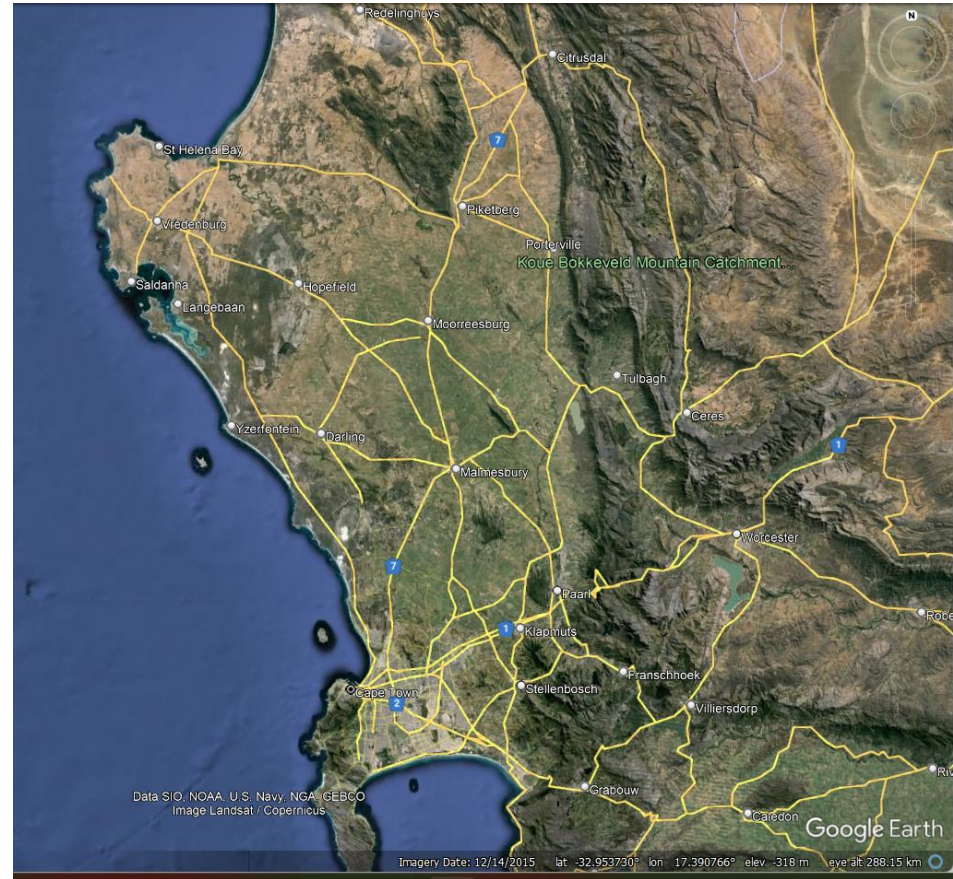
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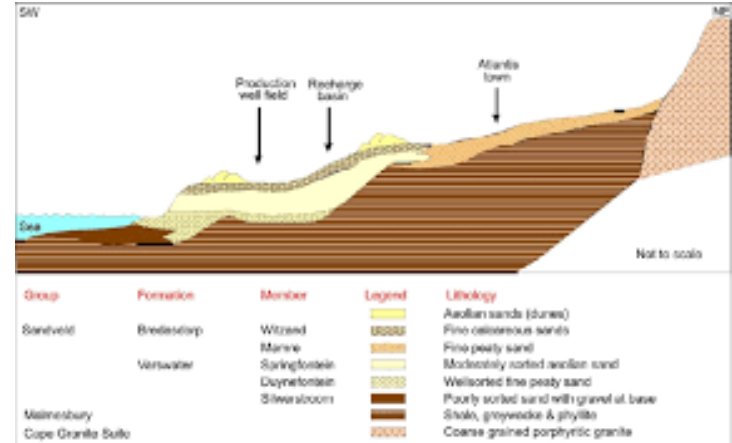
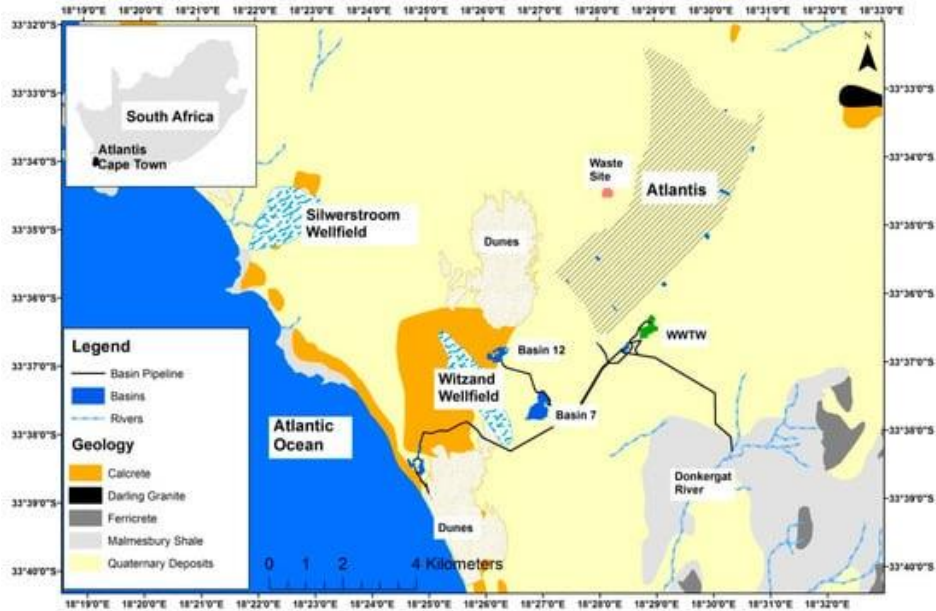
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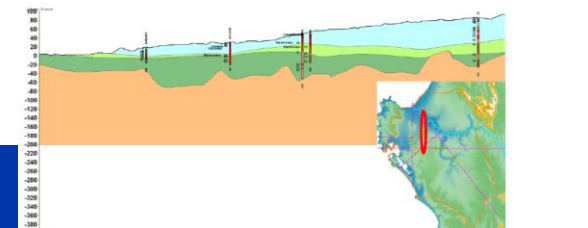
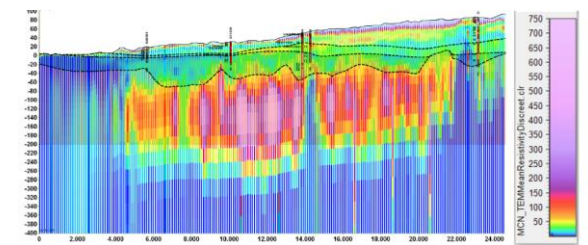
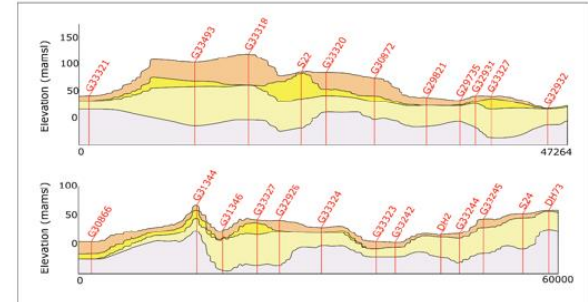
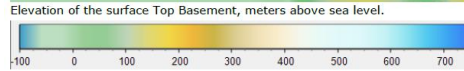
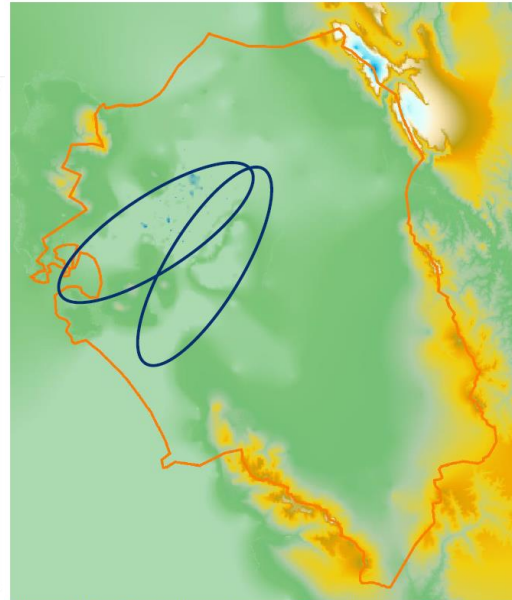
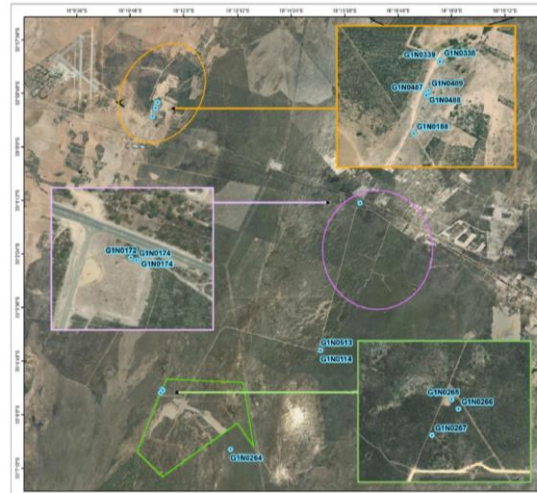
Atlantis and Langebaan Road **STUDY AREAS**



Atlantis



Langebaan Road



AIMS AND OBJECTIVES



Research Questions

- Will the establishment of reactive barriers with, e.g. organic compost at MAR facilities cause more pollutants to be degraded?
- Can aerobic degradation processes be secured by injection of oxidising agents to anaerobic aquifers and what are the adverse effects, e.g. precipitation of metals and clogging?
- What is the salinity limit for waters to be used for MAR?
- What types of pretreatment methods could be introduced to make degradation of certain compounds even more efficient?
- What is the long-term sustainability of MAR under different geological and chemical regimes?
- What are the impacts of increased use of MAR in South Africa in terms of drinking-water availability and ecological and socio-economic benefits for water supply?

Aim

- Develop MAR technologies that allow for a broader span of water resources to be used for MAR, including storm water, river water, saline water, and even reclaimed water (treated wastewater).

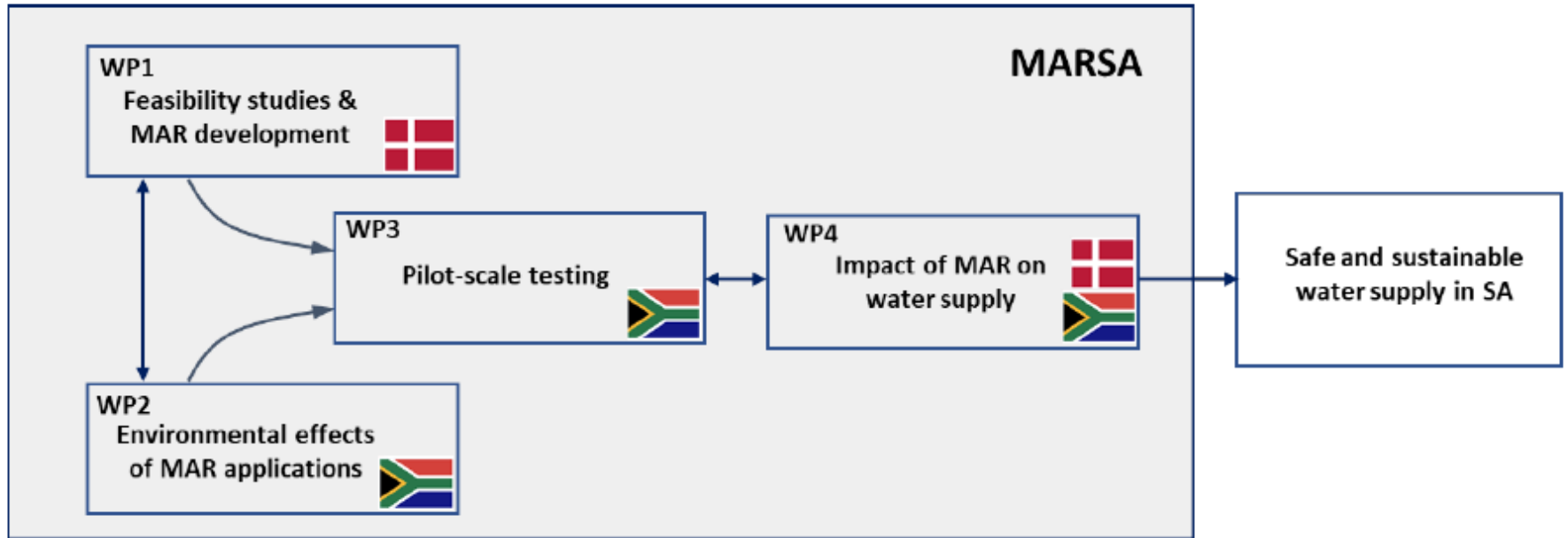
Objectives

- Provide new water recycling tools (MAR) to be used by water managers in South Africa and globally to combat water scarcity.
- Introducing barriers at MAR facilities as well as oxidising agents to stimulate aerobic degradation processes, thereby increasing the range of water qualities that can be used for MAR.
- Allow for a larger amount of water to be reused and less discharge to aquatic ecosystems.
- The potentials of relevant pretreatment technologies and the determination of salinities limiting water recycling via MAR will further increase safe use of lower water qualities for MAR.



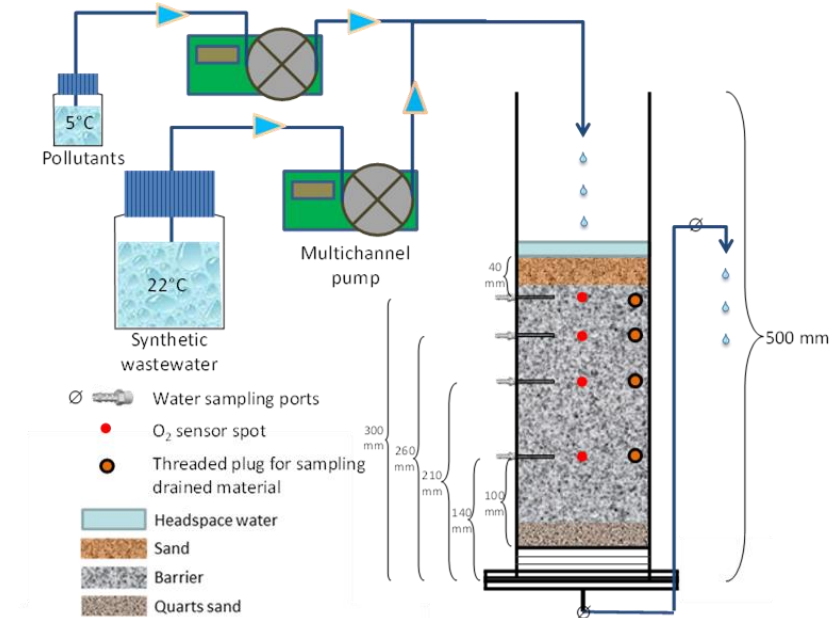
WORK PACKAGES

Research Outline



WP1: Feasibility studies

- design and operation of a model filtration reactor system that simulates MAR
- development of protocols for the analysis of organic pollutants, pathogenic indicators, and ARGs
- feasibility studies and writing of joint scientific publication



WP1



- Columns
- Flow
- Batch experiments

Synthetic wastewater

Pathogens + organic pollutants

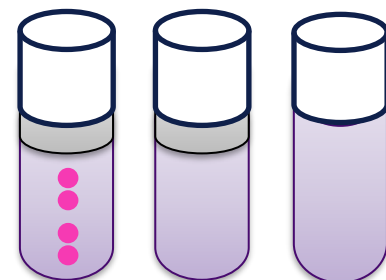


Hydrochar
treatment

600 C biochar
treatment

No biochar
treatment

1% bio or hydrochar



Hydrochar
treatment

600 C biochar
treatment

No biochar
treatment



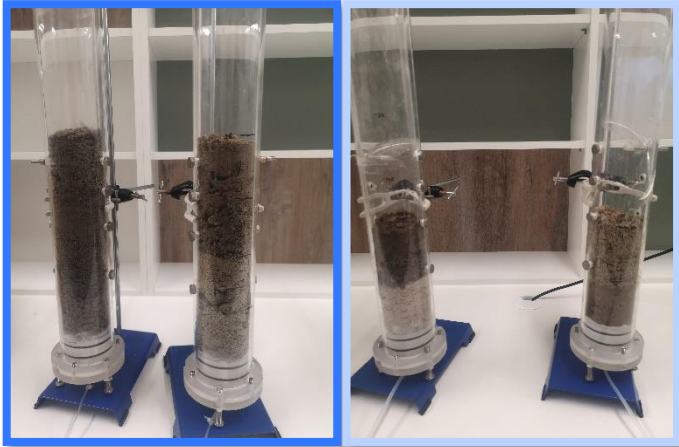
WP2: Effects of MAR on groundwater geochemistry and pretreatment requirements

- columns setup in a South African laboratory, later at Atlantis WWTP or the Langebaan Road field site (output 2.1).
- model system used to study the effects of adding oxidising agents, fluctuating groundwater tables, and salinities on attenuation of organic pollutants, pathogens, and ARGs, metal release and precipitation (e.g. As, Ni, Fe, and Mn), and clogging (output 2.2)



WP2

- Columns set up and first flow experiments conducted



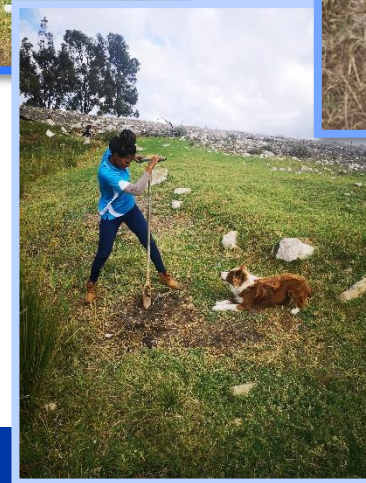
WP3: Field-scale studies

- Characterisation of the geology, geohydrology, and infiltration capacity
- Monitoring of groundwater system and potential source water qualities
- The potential impacts of MAR on associated wetlands, pans, and springs
- Establishment of water infiltration sites and barriers



WP3

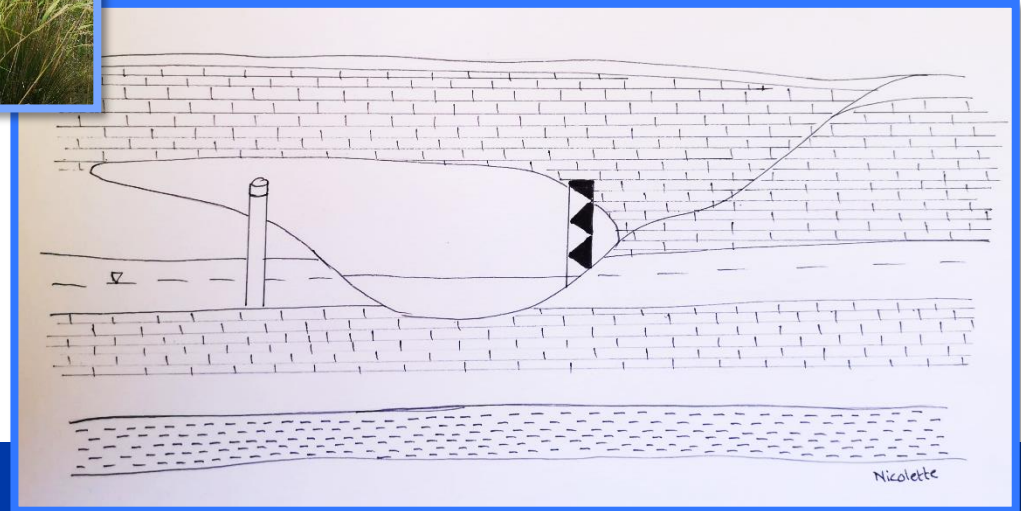
- Wetland monitoring
- Groundwater monitoring
- Collection of soil and water samples



Monitoring and collection of samples



Monitoring and collection of samples



Collection and analysis of data

Collection of existing data

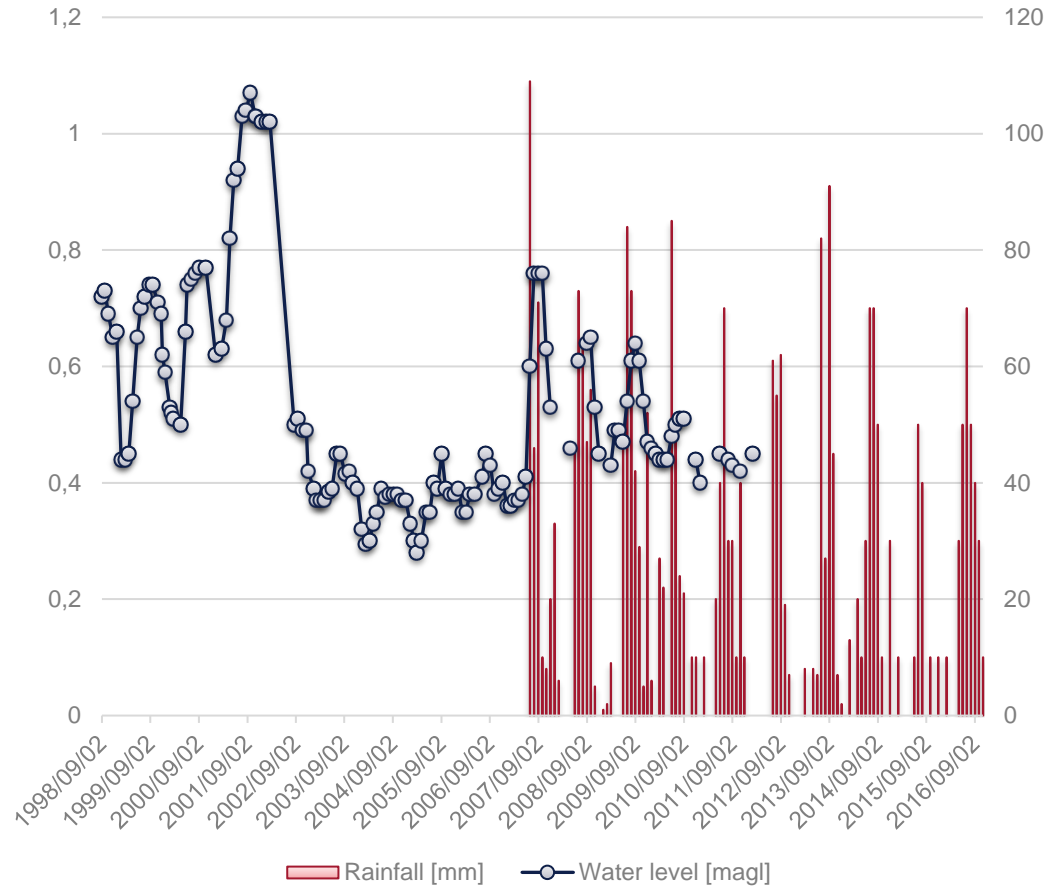
DWS (request & received some of the data; not incorporated yet)

DEA&DP (received; not incorporated yet)

Results of own monitoring/ Lab analysis

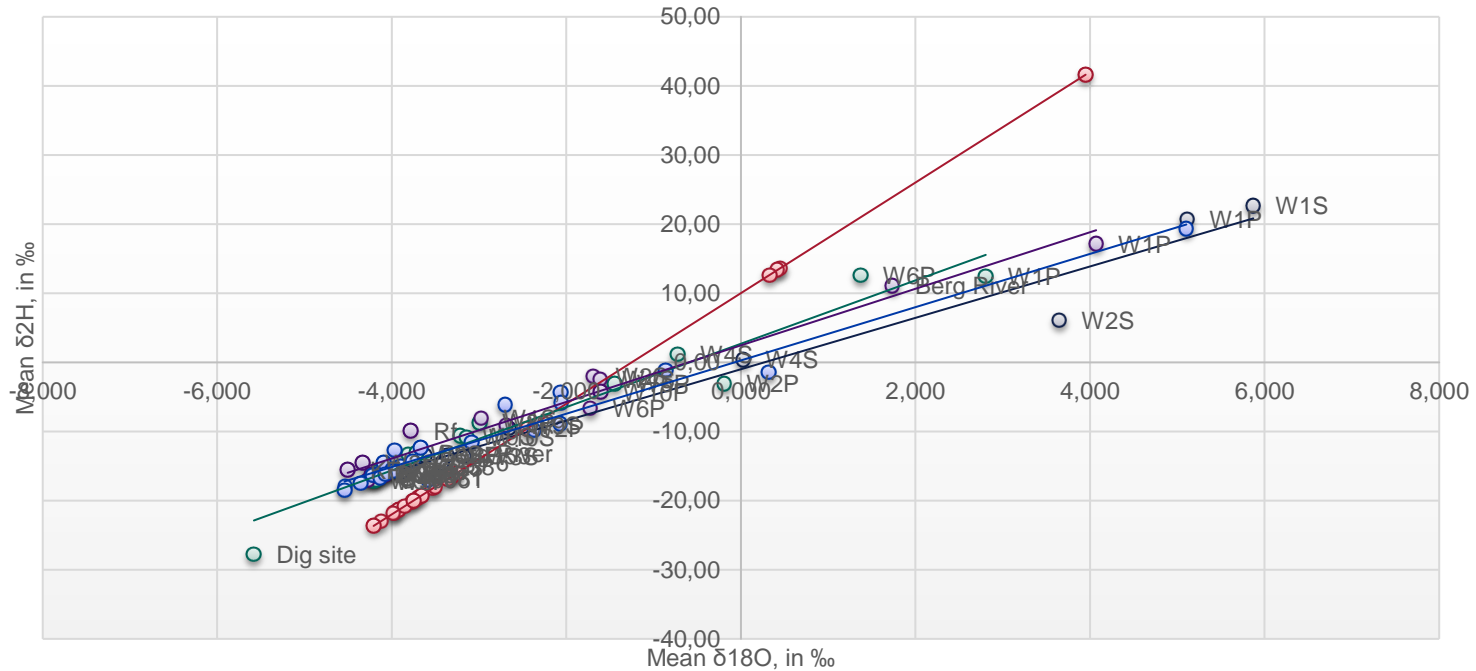
Analysis of data

Gap analysis



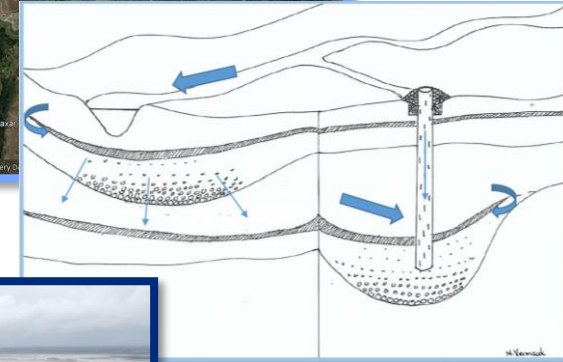
176/1F (W8)

Isotopes



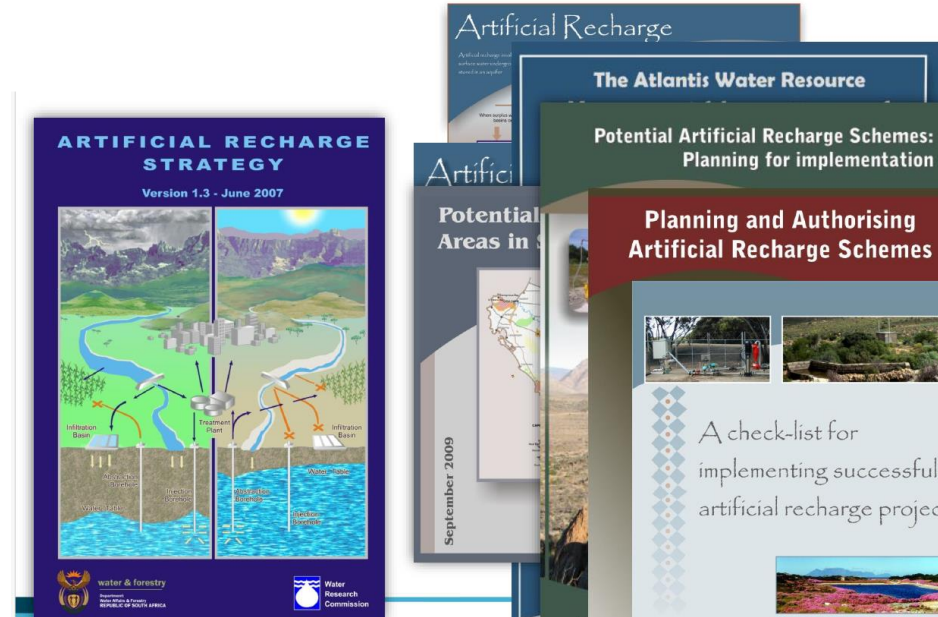
On-site setup recommendations

- Discussion about potential setup and site selection
 - **Infiltration basins/infiltration boreholes/injection**
 - Conceptual setup:
 - Infiltration basins on the Berg River Floodplain (Kersefontein/ Langrietvlei) – need to remove at least the top 15cm; need to have a relatively deep setup for periodic augmentation
 - Hopefield wellfield 2/Langebaan Rd wellfield – sand layers may be too thick for infiltration basins to be effective;; injection boreholes part of wellfield set-up
 - Wetlands as infiltration basins (e.g., W4 and W8) – flow through sediments from W4 fairly good, enough head for storage; W8 may need to be modified.
 - Still need to make sure about the capacity of the sediments to purify water/ determine whether additional layers may be needed.
 - Source water – treated effluent/surface water?



WP4: Groundwater resource development by implementation of MAR in South Africa

- Modelling the potential for MAR in the West Coast District Municipality
- Socio-economic preconditions
- Expanding existing guidelines on MAR to South African conditions



WP4

- Collect information on feasibility of MAR
 - Water availability
 - Water use
- Questionnaire shared with a number of municipalities;
 - Received responses from some
 - Awaiting responses from others
- Updating of guidelines based on results and findings above

Visit to Denmark, Articles & reports, Financial reporting

LAST ACTIVITIES

Last activities

- Visit to DK
- Writing up
 - Articles
 - Reports
- Financial reporting

Follow-up projects, Your contribution, ISMAR12 & Webinar series

WAY FORWARD

Follow-up Projects

- MAR investigations in other areas
- Wetlands and gw-sw interaction
- Calcrete
- Groundwater mapping and modelling



Your contribution

- Unlocking funding
(Candice)
- CEM 30-year birthday
- ISMAR12



**12th International Symposium
on Managed Aquifer Recharge** **STELLENBOSCH
SOUTH AFRICA
28 APRIL-2 MAY 2025**

International Symposium on Managed Aquifer Recharge

Theme

From Theory to Implementation and Operation



28 April – 2 May 2025
Stellenbosch | South Africa

For more information please visit <https://ismar12.org.za/>



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The Protea Hotel Stellenbosch and Conference Centre is ideally located on the outskirts of the lovely old town of Stellenbosch, nestled in the heart of the Winelands. A short distance from Stellenbosch Town Centre, the hotel provides convenient access to local attractions. With state-of-the-art conference facilities, well-appointed rooms, dining options, a spacious pool, and breathtaking views of mountains and vineyards.

18°0'0"E

18°15'0"E

18°30'0"E

18°45'0"E



ISMAR12

32°0'0"S

33°0'0"S

34°0'0"S

32°0'0"S

33°0'0"S

34°0'0"S

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EXCURSIONS

Mid-Symposium excursions



MAR suitability

WCDM well field

Berg River

Soetebos River

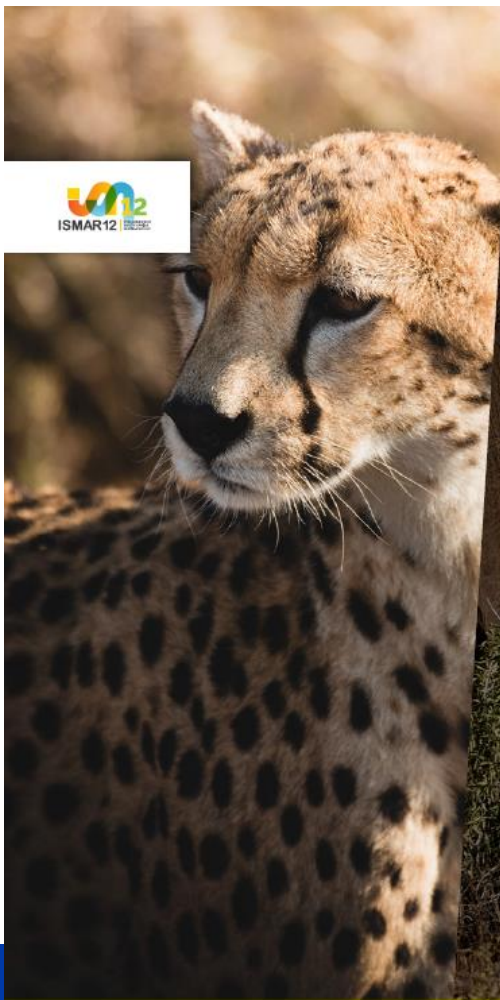
Hopefield

Green River

1. **Cape Flats MAR Scheme** - City of Cape Town water augmentation scheme – drought resilience. MAR within a highly urbanised setting on the outskirts of Cape Town.
2. **Atlantis MAR Scheme** – the town of Atlantis (just north of Cape Town) and receives the bulk of its water from groundwater. MAR is a crucial management intervention to prevent sea water intrusion into the aquifer.
3. **Langebaan and Elandsfontein MAR Schemes** –
 - a. **The Langebaan Rd Aquifer** is a crucial aquifer which is ready as a standby source of water in times of drought for this important West Coast town. All production boreholes are fully geared for abstraction as well injection and is completely monitored and managed remotely by a world class cloud based IT solution.
 - b. **The Elandsfontein Aquifer** is an important aquifer also on the West Coast. It plays a critical role in ecosystem functioning and its characteristics cannot be impacted. A phosphate mine, which has to access the ore below the water table, has a comprehensive abstraction and injection system, balancing mining and environmental requirements.



ISMAR12



TOURS

*Post
Conference
Tours*



ISMAR12



12th International Symposium
on Managed Aquifer Recharge

STELLENBOSCH
SOUTH AFRICA
18-22 FEBRUARY 2025

International Symposium on Managed Aquifer Recharge

28 April – 2 May 2025
Stellenbosch | South Africa

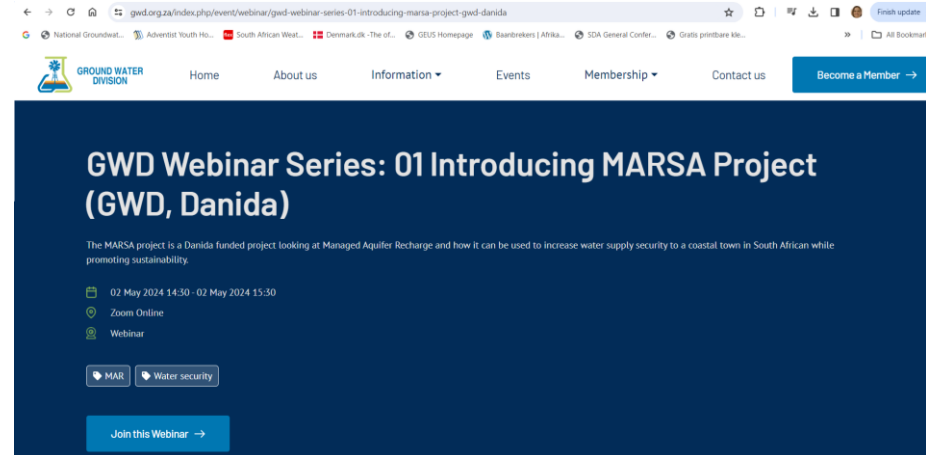


For updates | <https://ismar12.org.za/>

For more information email the organizers: deidre@iafrica.com

Webinar series

- Project importance and what it hopes to achieve
- Study area and its water supply history
- Research overview in the study area



The screenshot shows a web browser displaying the GWD Webinar Series page. The URL is gwd.org.za/index.php/event/webinar/gwd-webinar-series-01-introducing-marsa-project-gwd-danida. The page features the GWD logo and navigation links: Home, About us, Information, Events, Membership, and Contact us. A prominent blue button labeled "Become a Member" is visible. The main content area has a dark blue background with the title "GWD Webinar Series: 01 Introducing MARS Project (GWD, Danida)". Below the title, a short description states: "The MARS project is a Danida funded project looking at Managed Aquifer Recharge and how it can be used to increase water supply security to a coastal town in South African while promoting sustainability." The event details are listed as "02 May 2024 14:30 - 02 May 2024 15:30", "Zoom Online", and "Webinar". There are two tags: "MAR" and "Water security". A blue button at the bottom says "Join this Webinar" with a right-pointing arrow.

Thanks.



Questions?



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