URBWAT
ACCESSIBLE GREYWATER SOLUTIONS FOR URBAN INFORMAL TOWNSHIPS IN SOUTH AFRICA

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Water JPI
Water challenges for a changing world

Bundesministerium für Bildung und Forschung

FORMAS

WATER RESEARCH COMMISSION

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Context

- South Africa
  - Johannesburg
  - Franschoek
- Elements of URBWAT

Johannesburg

Franschhoek, Western Cape

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Municipal problems

- Like elsewhere in the world, critical scarce skills shortage
- Green drop report – details how poorly wastewater treatment plants function.
  - 248/824 were listed as critical in 2013
  - Important to note that there are some that are still highly functional – especially in major metropolitan areas (JHB, DBN, CPT)
  - Even in urban metropolitan areas, ageing infrastructure leads to multiple uncontrolled releases of sewage

Municipal problems

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Municipal Problems

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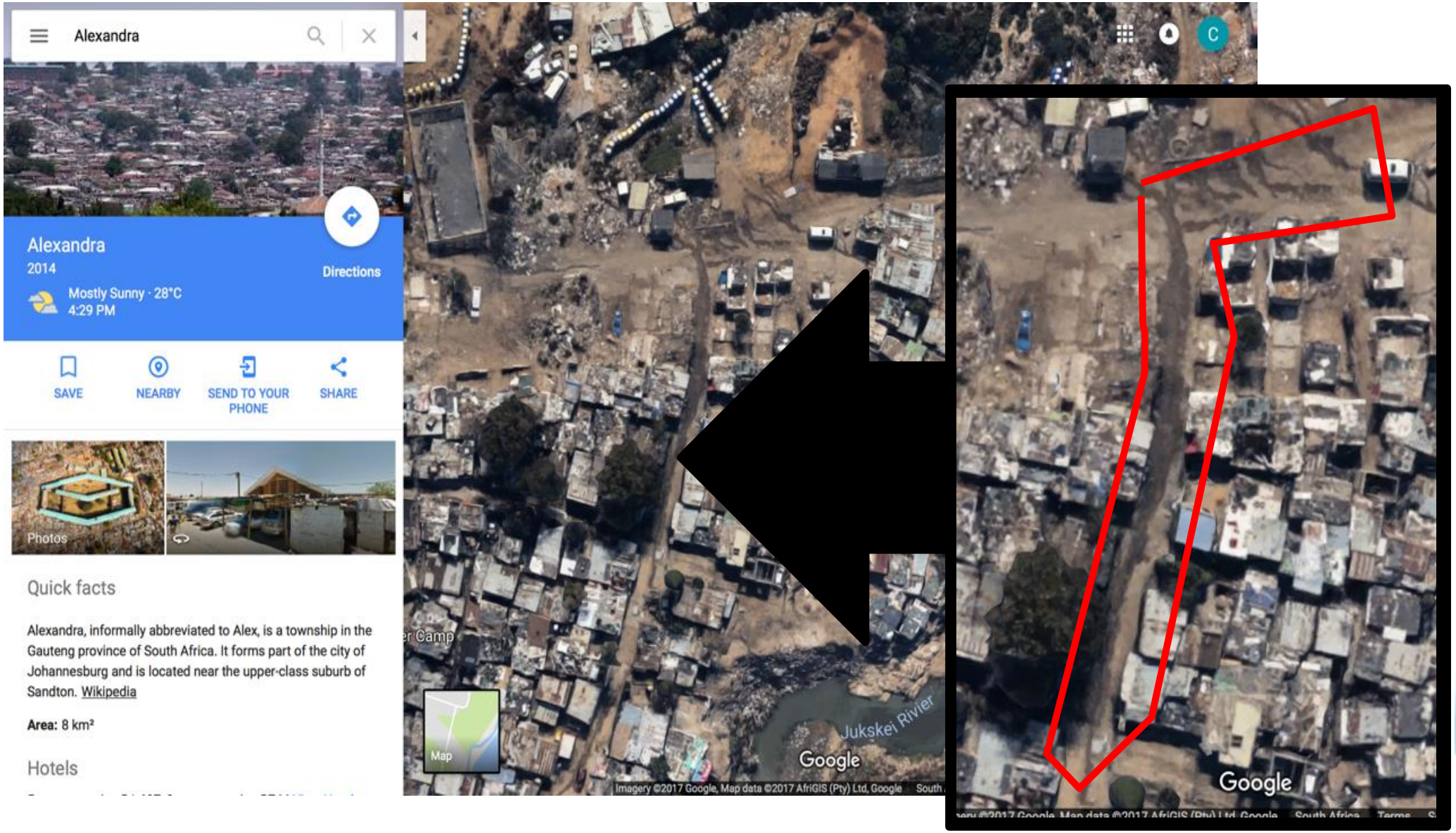
Municipal Problems



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Objectives

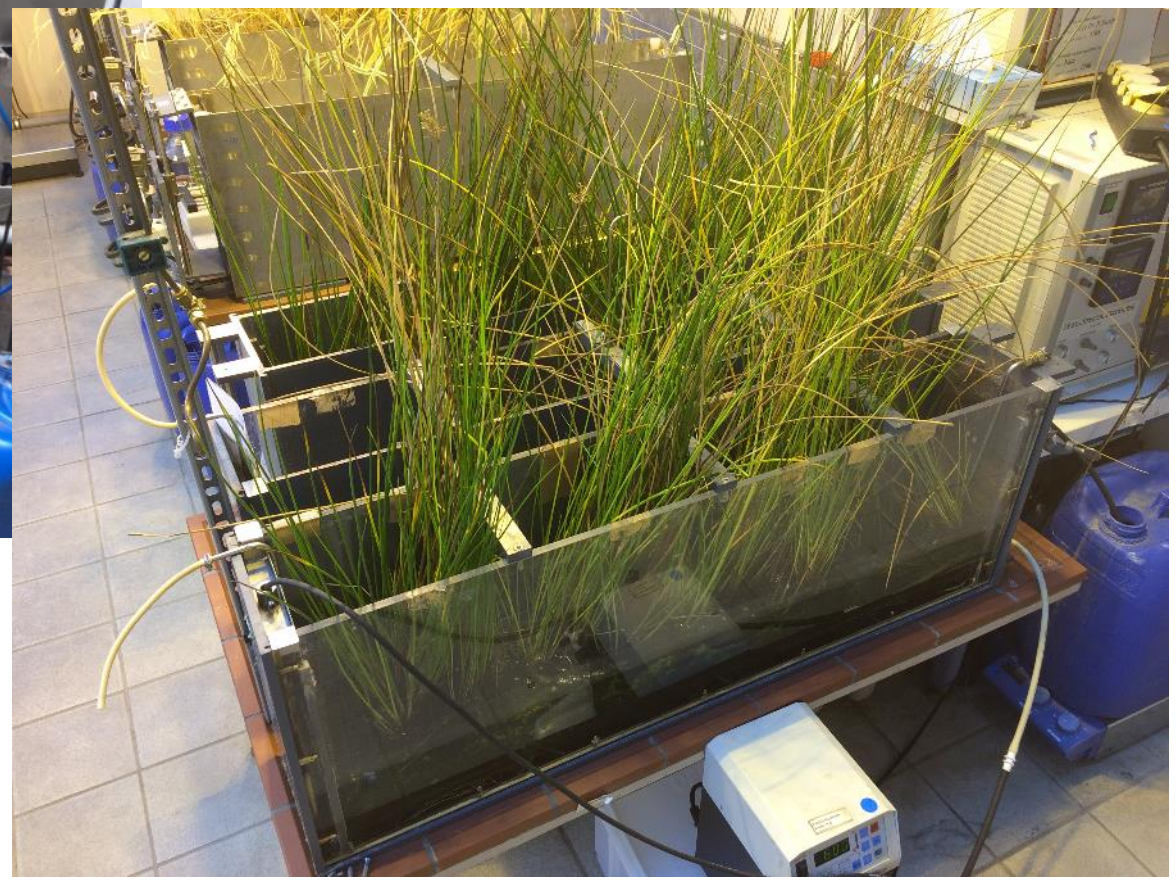
1. To conduct baseline studies at the Langrug site to assess system treatment efficacy and community use and perceptions (whilst Objective 2 is being constructed in Johannesburg)
2. To design, construct and monitor a constructed wetland network within an urban shanty environment (such as Alexandra) treating run-off mixed with variable loads of greywater, sewage and night soil.
3. To measure pathogen and chemical removal and the interplay between hydraulic processes and removal rates.
4. To test various CW matrix media (waste/by-products such as crushed brick, metallurgical slags) to assess and quantify the potential improvement in performance, with specific focus on hydraulic properties and pathogen removal.
5. To install a demonstration site of using for greywater disposal and treatment in informal settlements, and assess how communities perceive system performance and operational challenges.

Work Packages

- WP1. Installation, operation and monitoring of small-scale treatment wetlands in an informal settlement. Lead: Wits
- WP2. Socio-economic – study acceptance and user experiences with wetland based greywater management system.
  - Community experiences with the existing system in Langrug are documented using focus group meetings and short questionnaires distributed during the meetings.
  - Once the site has been identified (WP1), the community interaction will be continuously documented for a comprehensive understanding of stakeholder expectations and challenges they identify, iii) in the last year, a follow-up study on the user perspective will be done using focus group meetings and in-depth interviews with key informants. Lead: LiU
- WP3. Studying the hydraulic properties and system stability towards load fluctuations.
  - Pilot-scale (1 m) greenhouse CWs (in UFZ) will be used to study the system response to fluctuations in greywater load and composition, simulating expected variations as determined from the field monitoring of the Cape Town system.
  - In pilot scale 1m greenhouse CW the effect on treatment efficiency of selected indigenous ornamental plants will be compared with Juncus effuses or Phalaris arundinacea as commonly used plants iii) Different types of filter material (e.g. slag from steel industry, crushed cement) will be studied in column experiments (LiU and Wits) with respect to hydraulic properties, clogging and treatment effects (particularly the bacteria removal) for later use in the constructed wetlands and e.g. before greywater is reused. Samples from the pilot scale wetlands and the column experiments will be taken for analyses in WP4. Lead: LiU/UFZ

Work Packages

- WP4. Description of microbiome and response to inflow variation incl. stress and shock loading
  - A metagenomic analysis of the microbial community of different sample points in the pilot scale (1 m) greenhouse CWs will be conducted.
  - The microbial community structure response to changing inflow conditions will be evaluated with phylogenetic analyses.
  - To link the chemical transformation data to the active microbial community, metatranscriptome analysis will be used. iv) The response of inflow fluctuations will be further investigated by quantitate transcriptome analysis for selected genes (RT-qPCR). v) The analysis of microbial community phylogeny generated from pilot scale greenhouse CWs will be compared with phylogenetic data generated from selected small-scale treatment wetlands in the field. Lead: UFZ
- WP5. Communication and dissemination. i) A visualisation model will be developed to assist in communicating the spatial differences in water quality, and for the results obtained in WP4, showing the microbial community differences in three dimensions in the CW material. ii) a video film will be used to demonstrate the system installed in Alexandra for the communities targeted in WP1. At the end of the project, another video will be produced to disseminate the results from the current project. Films will be freely available on e.g. YouTube. iii) the construction phase (WP1) will be recorded repeatedly and presented as a “diary” on the project homepage. Project results will also be communicated in community gatherings, and via e.g. radio. Results will be presented in scientific conferences during yr 2 and 3, and published as peer reviewed open-access journal papers. Lead:Wits
- WP6. Project management. This package aims at ensuring an efficient scientific coordination and the scientific and technical quality of project outputs, as well as effective and efficient internal communication and working relationships between the partners and the subcontractor to ensure efficient reporting. Administratively, the aim is to handle contractual links between partners and ensure an efficient administration to achieve the project objectives according to timetable and agreed budgets, including the financial reporting. Lead: Wits



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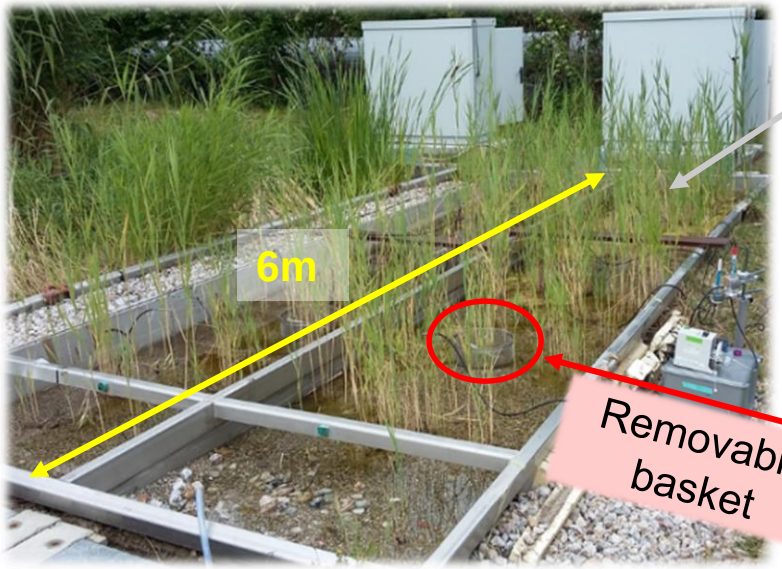
Pilot-scale CWs

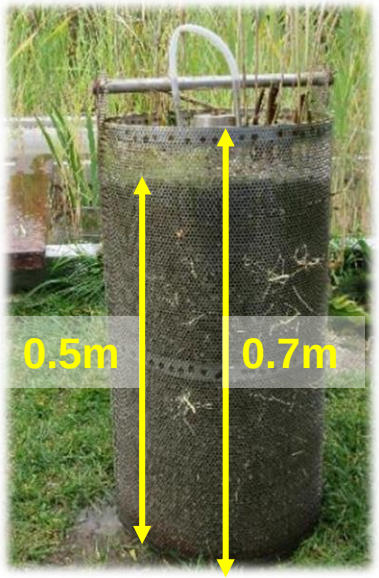
Helmholtz Zentrum für Umweltforschung (UFZ), Leipzig, DE



Photograph of the pilot-scale CWs at the UFZ whose construction was completed in October 2013

Phragmites australis

Mean gravel particle size:
4mm – 8mm



Basket with already well-developed root system

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Genius of Space - Langrug

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Risks and Resources

- Bureaucratic
  - EIA
  - WUL
  - 4 bureaucracies…
- Social
  - Community acceptance
  - Langrug availability
- HR: ZA: postdoc appointed, PhD in Industrial Psychology Interviewed
  DE: TBC
  SE: TBC

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Thank you

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