EviBAN

Evidence based assessment of NWRM for sustainable water management

Overview of EviBAN project

Marlene de Witt

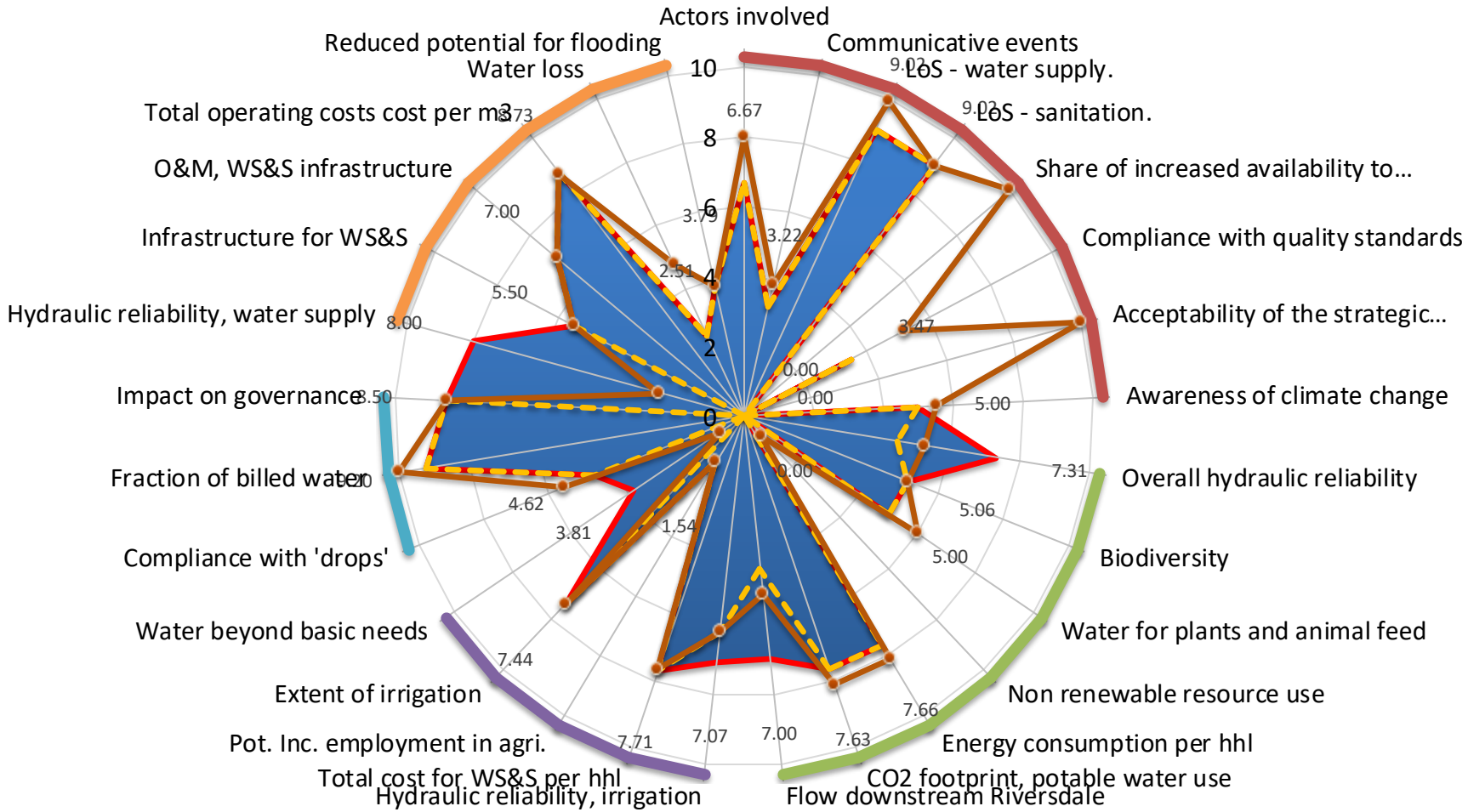
2nd Stakeholder workshop, Riversdale

14 April 2021

Introduction

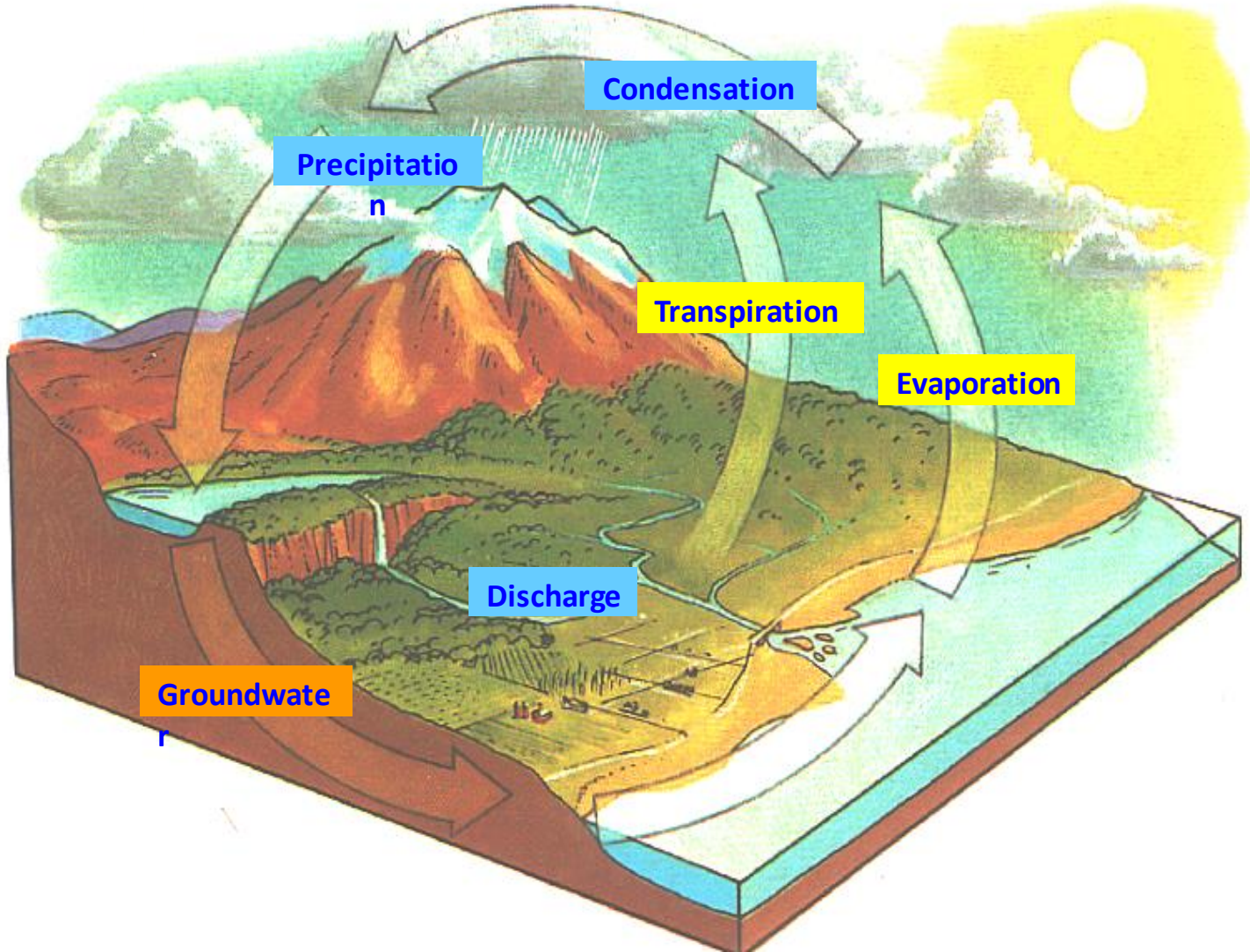
- Local Team
  - Willem de Clercq
  - Marlene de Witt (project manager)
- Norway
  - Herman Helness
  - Sigrid Daman
- WRC
  - Yazeed van Wyk
- UWC
  - Jaco Nel
- Sanbi
  - Nancy Job
- Biodiversity Group
  - Steve du Toit
- Municipality
  - Manager and engineering
- DWS
  - Fanus Fourie
- Stakeholder group

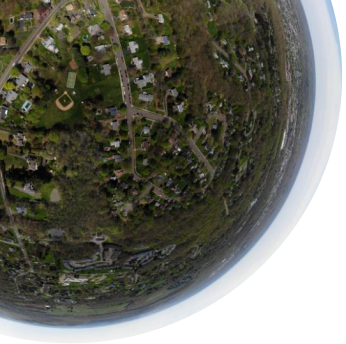
SUWAM sustainability framework – comparing alternatives



The problem

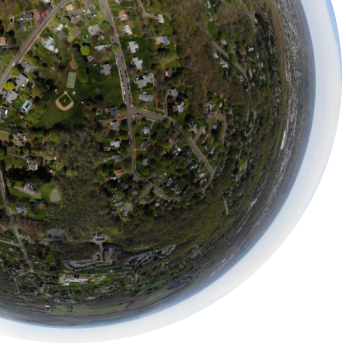
Holistic approach towards internal and external transport dynamics





International project consortium

- EU Water JPI project
  - Promotes international collaboration
  - Each country funds itself
  - SA funding: Water Research Commission – R750 000
- EviBAN consortium
  - Norway: SINTEF (project lead)
  - France: BRGM, Antea Group & ImaGeau
  - Finland: Aalto University & VTT
  - South Africa: Stellenbosch University Water Institute

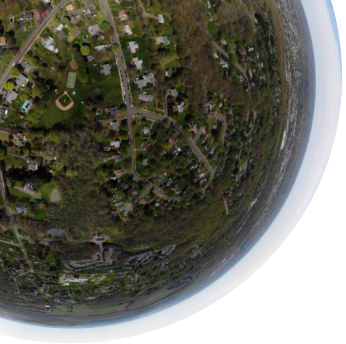


International project

- Nature-based solutions (NBS):

  "Actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits"

- Use in combination with, or instead of engineering/infrastructure solutions



International project

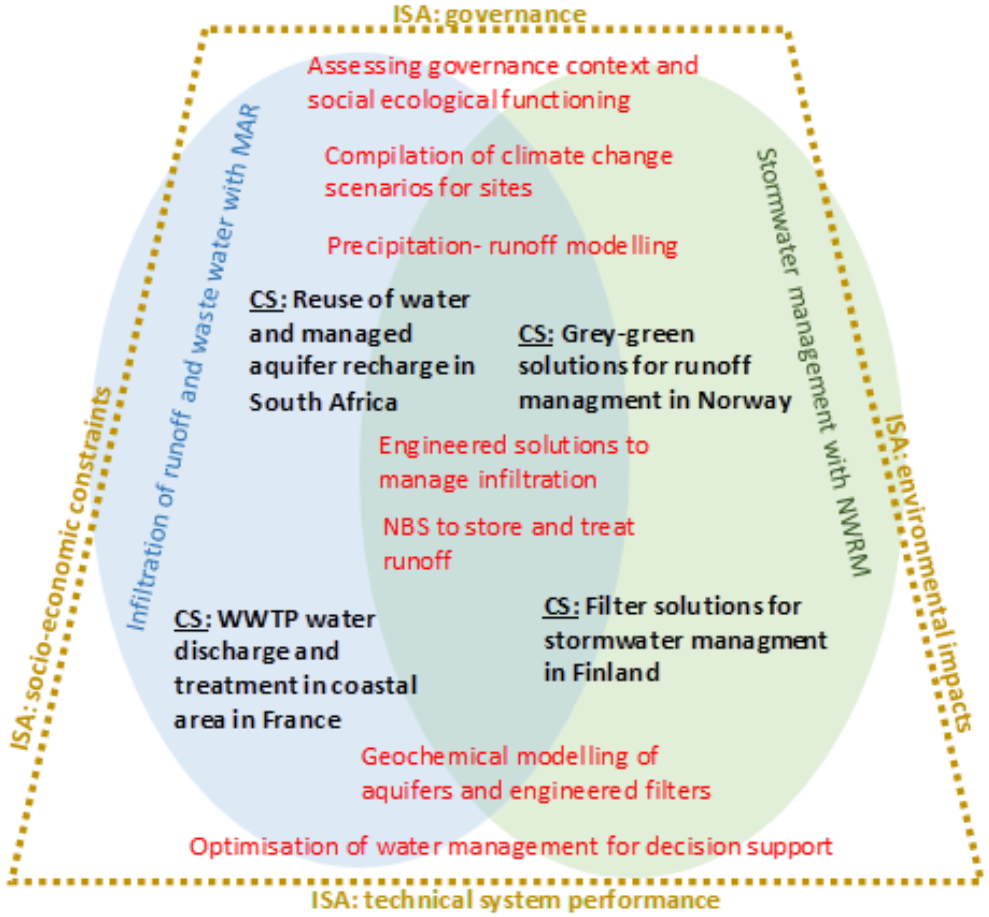
- Aim:

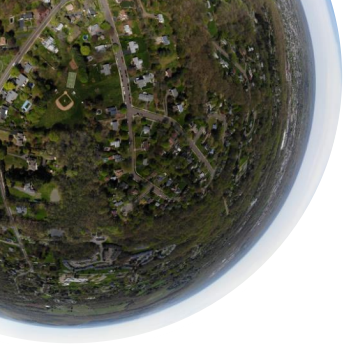
  Increase knowledge on how nature-based solutions (NBS) can be used for management of water resources to counter negative impacts of climate change, anthropogenic activities and societal change, and how NBS should be optimally used under different conditions to contribute to progress towards SDGs.

- Focus on stormwater management and managed aquifer recharge (MAR) as NBS for natural water retention

International project

- 4 case studies
- *Finland, Norway*: Stormwater management with NWRM
- *South Africa, France*: Infiltration of runoff and wastewater with MAR
- Common external pressures, shared tools among case studies

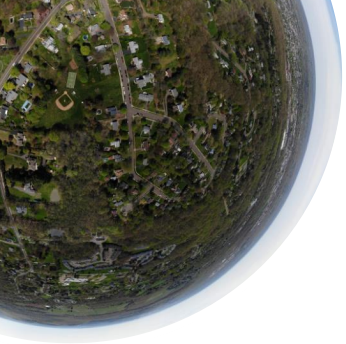




International project

Products to be developed:

- Stormwater tool (Finland & Norway)
- MAR tools (France and SA)
- Governance assessment
- Integrated sustainability assessment
- Optimisation tool



International progress

- (Herman)

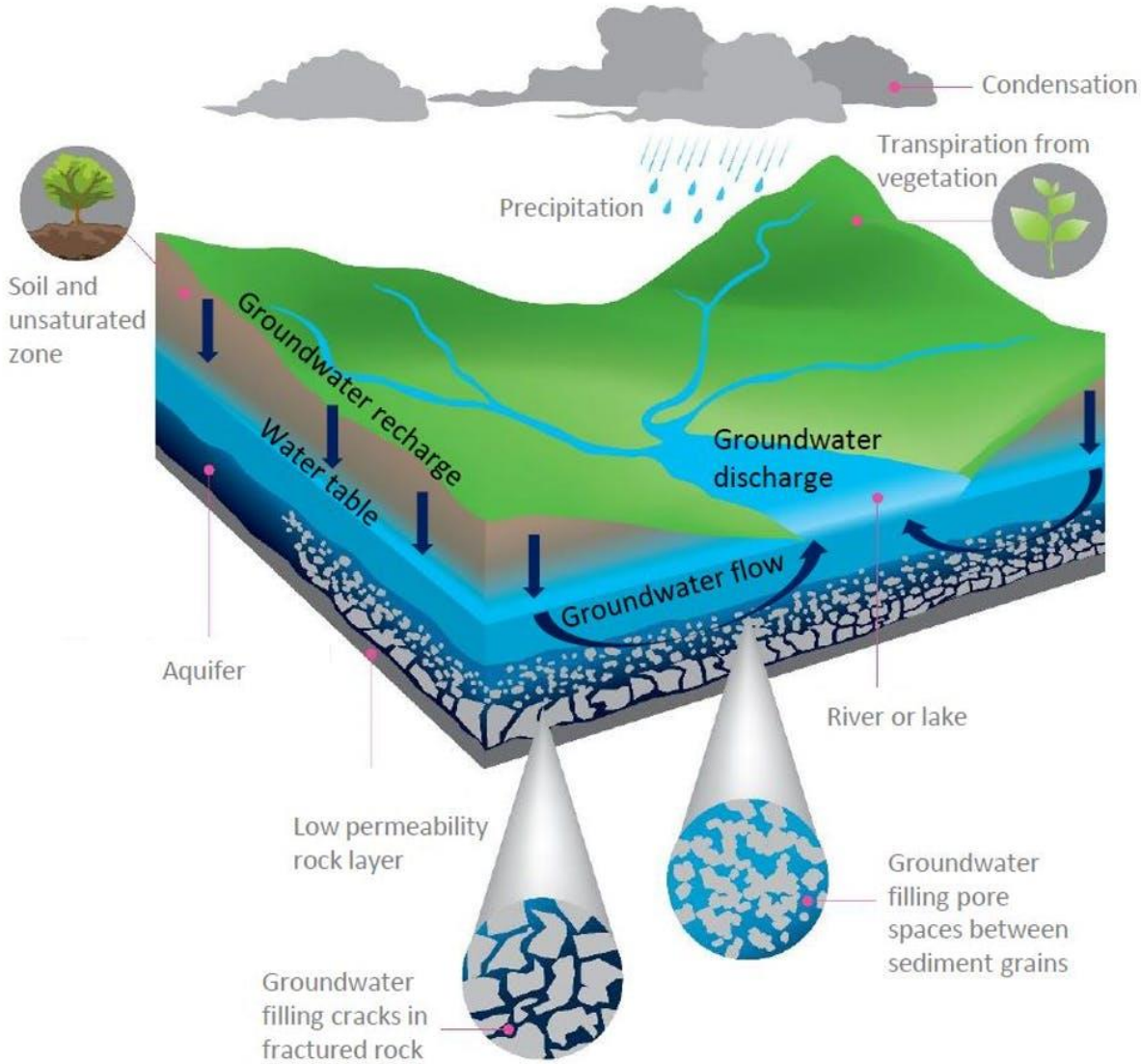
South African case study

Exploring managed aquifer recharge as a nature-based solution to water diversification in the Goukou catchment

- Riversdale & Stilbaai water challenges:
  - Water availability for towns and agriculture
  - Disaster risk (e.g. floods, fire)
  - Environmental degradation
- Earlier studies: another dam won't help
- Groundwater resources?

Managed aquifer recharge

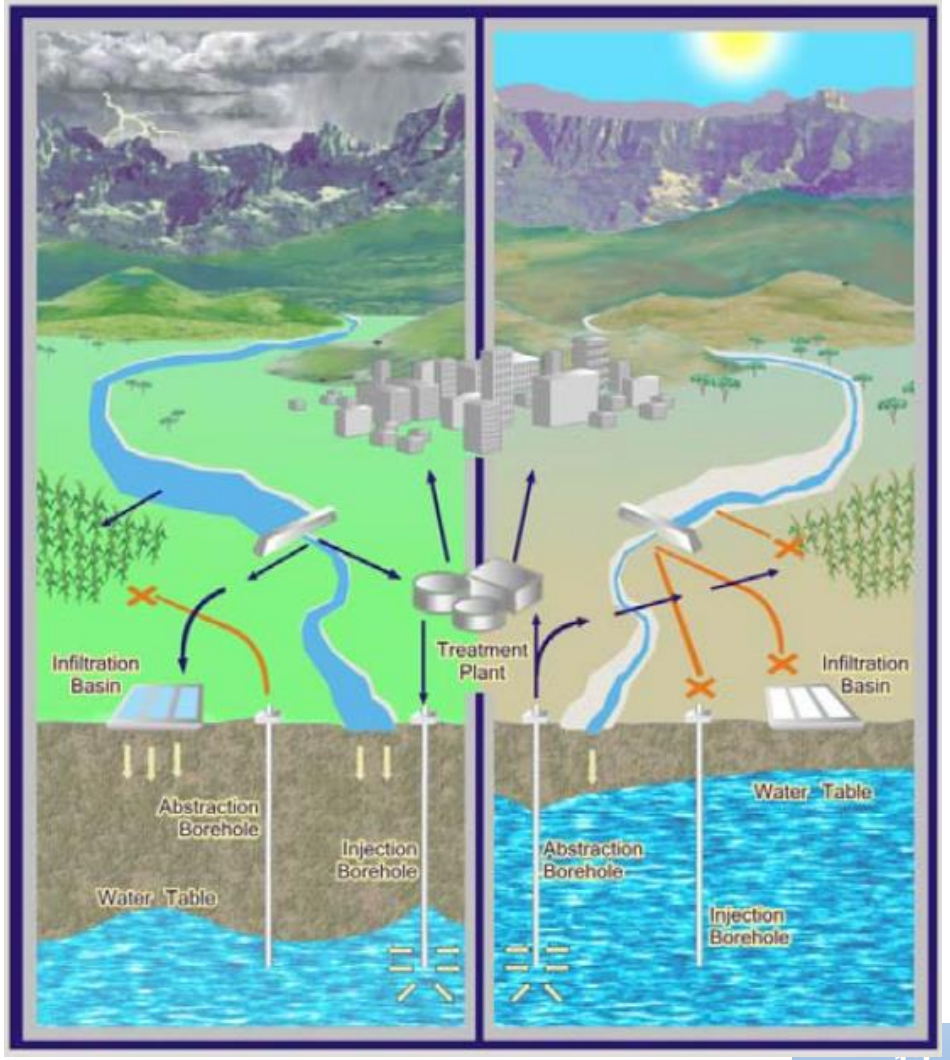
- Sustainable groundwater use
- Store surplus surface water underground when available, use during drought
- Same purpose as surface water dam, but
  - No evaporation
  - Large amounts
  - Less impact on river flow
  - Natural filtration (cleaning)



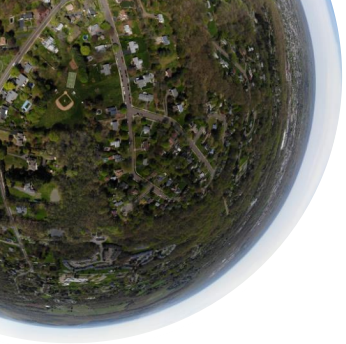
South African case study

- Which elements of MAR will we focus on?
  - Is there a suitable source of water for MAR
  - Which aquifer/s to recharge
  - Public perception & understanding
  - Management and sustainability

- Won't focus on:
  - Engineering aspects, recharge method, quality, treatment, distribution, cost…



SA artificial recharge strategy 2007

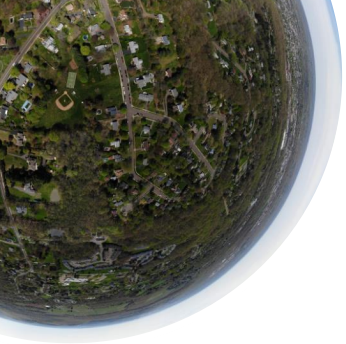


South African case study

1. Context and governance: interviews/surveys
   - Perceptions around groundwater use and sustainability
   - Land-use change over time

2. Understanding the Goukou catchment: hydrological modelling
   - SWAT: basic catchment hydrology
   - Pitman, SPATSIM (widely used in SA): Impact of removing flood water for MAR
   - JAMS: more detailed modelling

3. Water budget
   - How much water is being used (surveys, interviews) vs how much available (modelling results)
   - Is there any water to spare for MAR



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Current

3. Water budget
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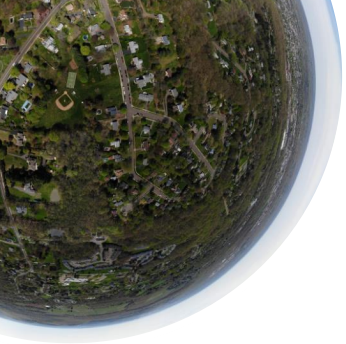
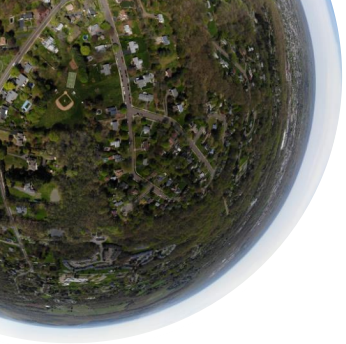


Workshop 1: Results

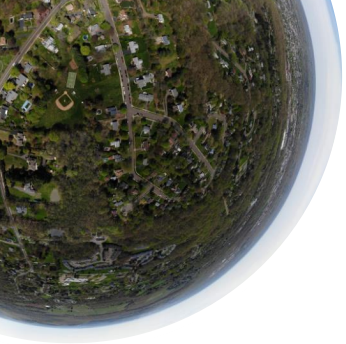
What are some of the main changes you have observed around the flow and quality of the Goukou River over the years, and what do you think have the impacts of these changes been?

- River flows weaker
- Sandbank problems in estuary
- Invasive plants
- Poor farming practices (pig farm in particular)
- Rising salinity in estuary and springs



Workshop 1: Results

- How important do you think are floods for the estuary? Have you observed changes in the estuary particularly related to flood events?
  - Floods and rainfall events changed: “this is the first time in history that we’ve had less than 700mm for four years in a row”.
  - Floods are important to cleanse the system
  - Floods could play an important role in sediment build-up.

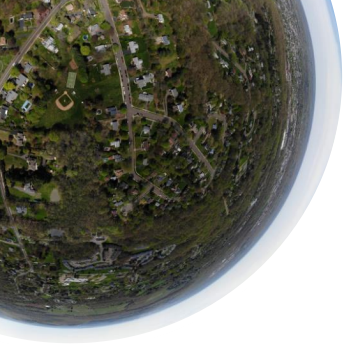


Workshop 1: Results

How important do you think are groundwater and springs to maintain the river's flow? Any observed changes and related impacts?

- Groundwater deemed highly
- Fountains important for river flow
- Non-measurement and policing of boreholes a problem
- Fountains are getting more saline

General comment: Lack of measuring and data collection, especially climate data



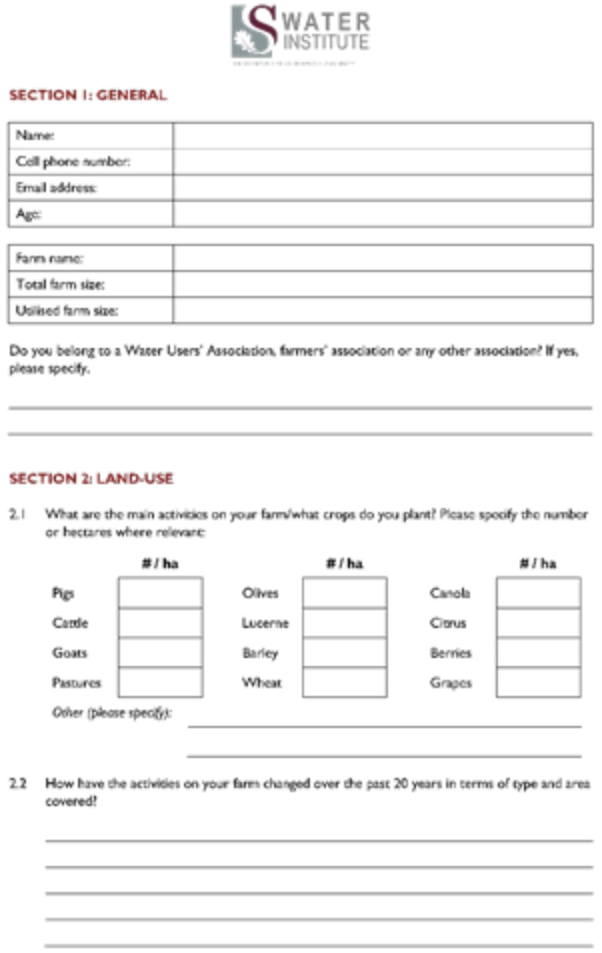
Workshop 1: Actions

Included these issues as questions in questionnaires to obtain more details from residents & farmers

- Floods, rainfall, invasives, land-use changes
- Investigate springs through interviews with farmers, do measurements
- Installed three weather stations for additional climate monitoring

Progress: Context and governance – questionnaires

- NB to better understand problems (actual & perceived)
- Delay due to Covid – no contact research allowed
- Sections:
  - Land-use
  - Water management
  - Groundwater
  - Springs
  - Environment & wetlands



WATER INSTITUTE

SECTION 1: GENERAL

Name:	
Cell phone number:	
Email address:	
Age:	

Farm name:	
Total farm size:	
Utilised farm size:	

Do you belong to a Water Users' Association, farmers' association or any other association? If yes, please specify.

SECTION 2: LAND-USE

2.1 What are the main activities on your farm/what crops do you plant? Please specify the number or hectares where relevant:

	# / ha		# / ha		# / ha
Pigs		Olives		Canola	
Cattle		Lucerne		Citrus	
Goats		Barley		Berries	
Pastures		Wheat		Grapes	

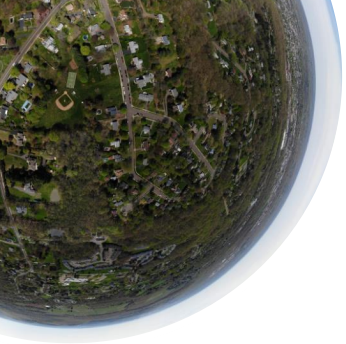
Other (please specify):

2.2 How have the activities on your farm changed over the past 20 years in terms of type and area covered?

Progress: Context and governance – questionnaires

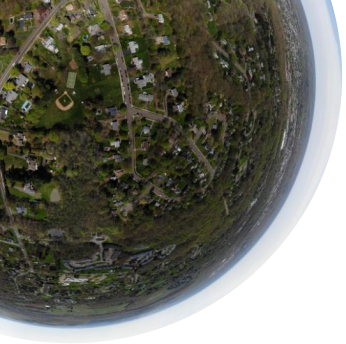
- https://sunsurveys.sun.ac.za/surveys/Goukou-water-management

- Online
- Hard copies at municipal offices



Progress: Context and governance – interviews

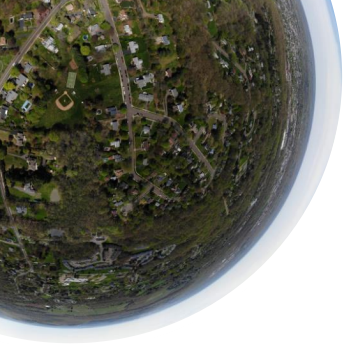
- Interviews with farmers
  - Same as town residents questionnaires
  - Additional information on land-use, water use, irrigation, springs (for modelling and GCBR)
  - Measure spring flow and quality on a few farms (input data for modelling)



Progress: Hydrological modelling

Hydrological modelling data gathering

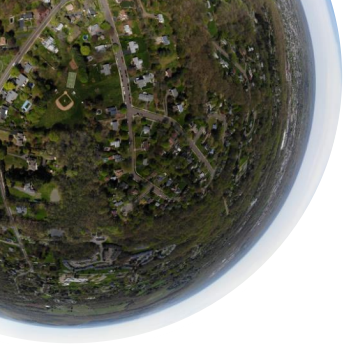
- Climate data
- Streamflow
- Geology
- Land-use
- Soils
- Groundwater



Progress: Hydrological modelling

Hydrological modelling data gathering

- Climate data ✓
- Streamflow ✓
- Geology ✓
- Land-use ✓
- Soils ✓
- Groundwater ✓



- (BREAK)

Hydrological modelling

- Simplification/ conceptualisation of water cycle
- To predict what will happen if you make changes in the system
- Allow for informed planning – combine data into something meaningful

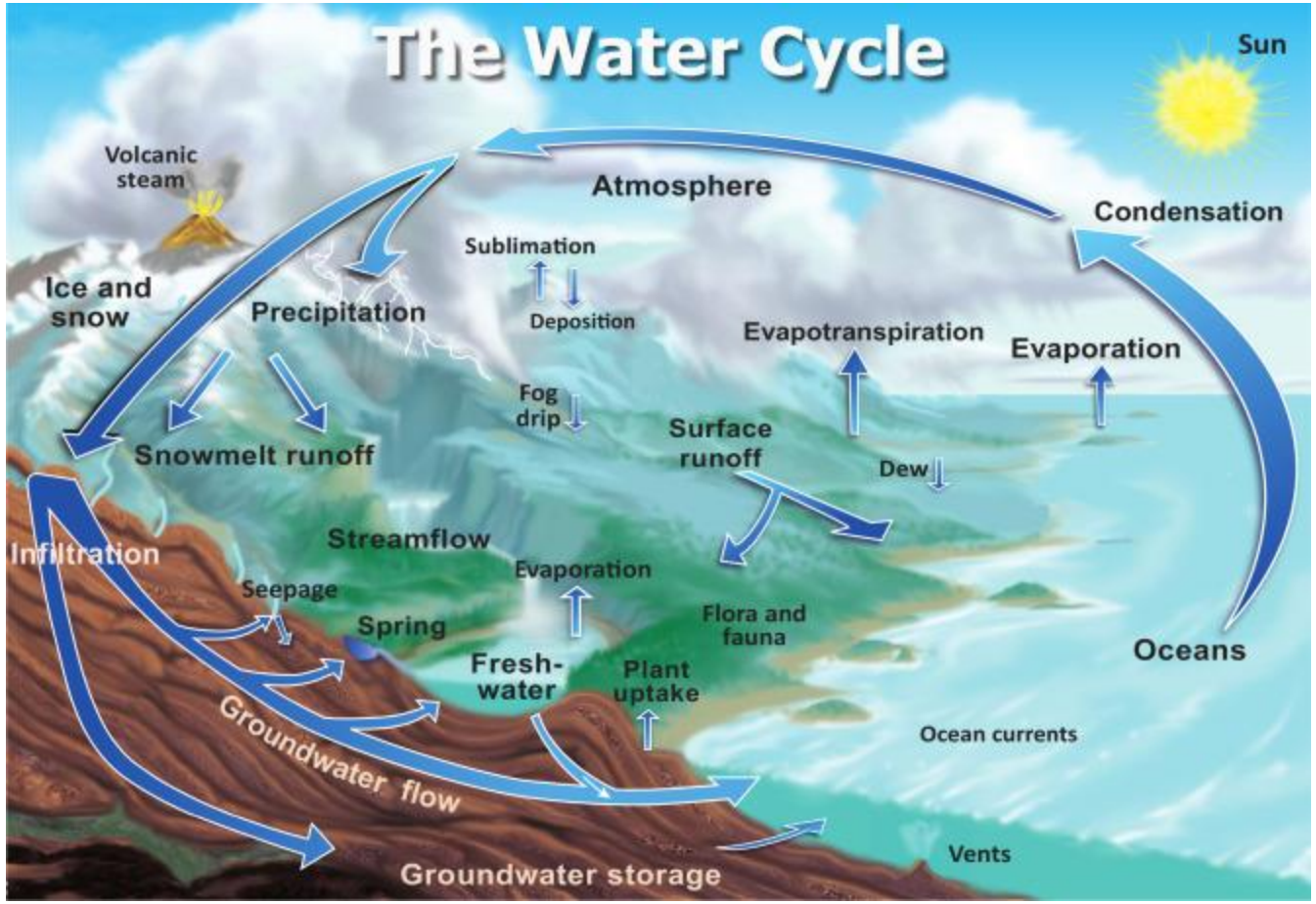
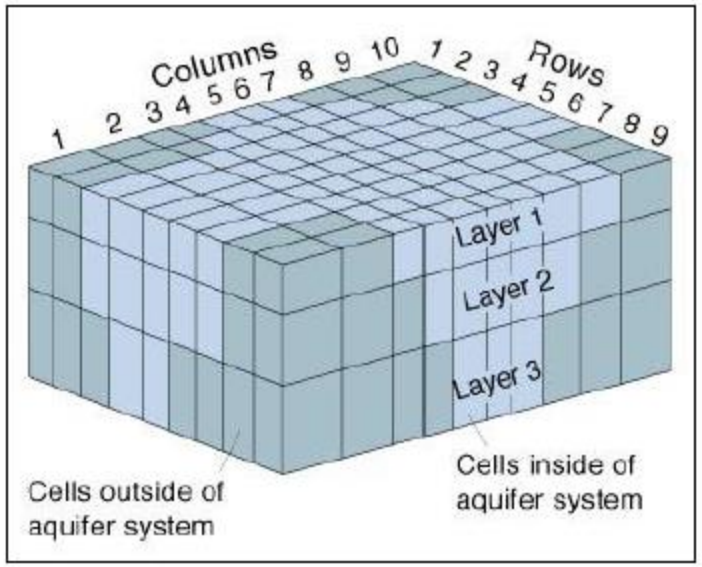
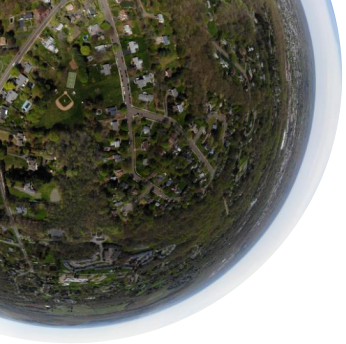


Image taken from Sciencedirect.com

Hydrological modelling

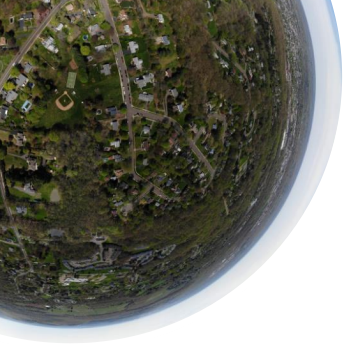
- Complex mathematical modelling with real data from environment
- Better, more & recent data = more realistic results
- Will never be reality
- Need actual flow data to calibrate model





1. WRSM/Pitman model

- Locally developed for Water Affairs in 1969, updated many times
- Used by DWS for:
  - Regional assessment of water resources
  - Check the effect of man-made land-uses
  - Estimate flows in ungauged catchments
  - Simple reservoir (dam) yield analysis
  - Input to water quality studies
  - Input to Ecological Water Requirement models
- Supplement field-measured data to create bigger & more complete picture



Progress: Hydrological modelling

Hydrological modelling data gathering

- Climate data ✓
- Streamflow ✓
- Geology ✓
- Land-use ✓
- Soils ✓
- Groundwater ✓

WR2012

- Data gathered for hydrological modelling since 1952 – Surface Water Resources of South Africa studies
- Latest update done in 2012

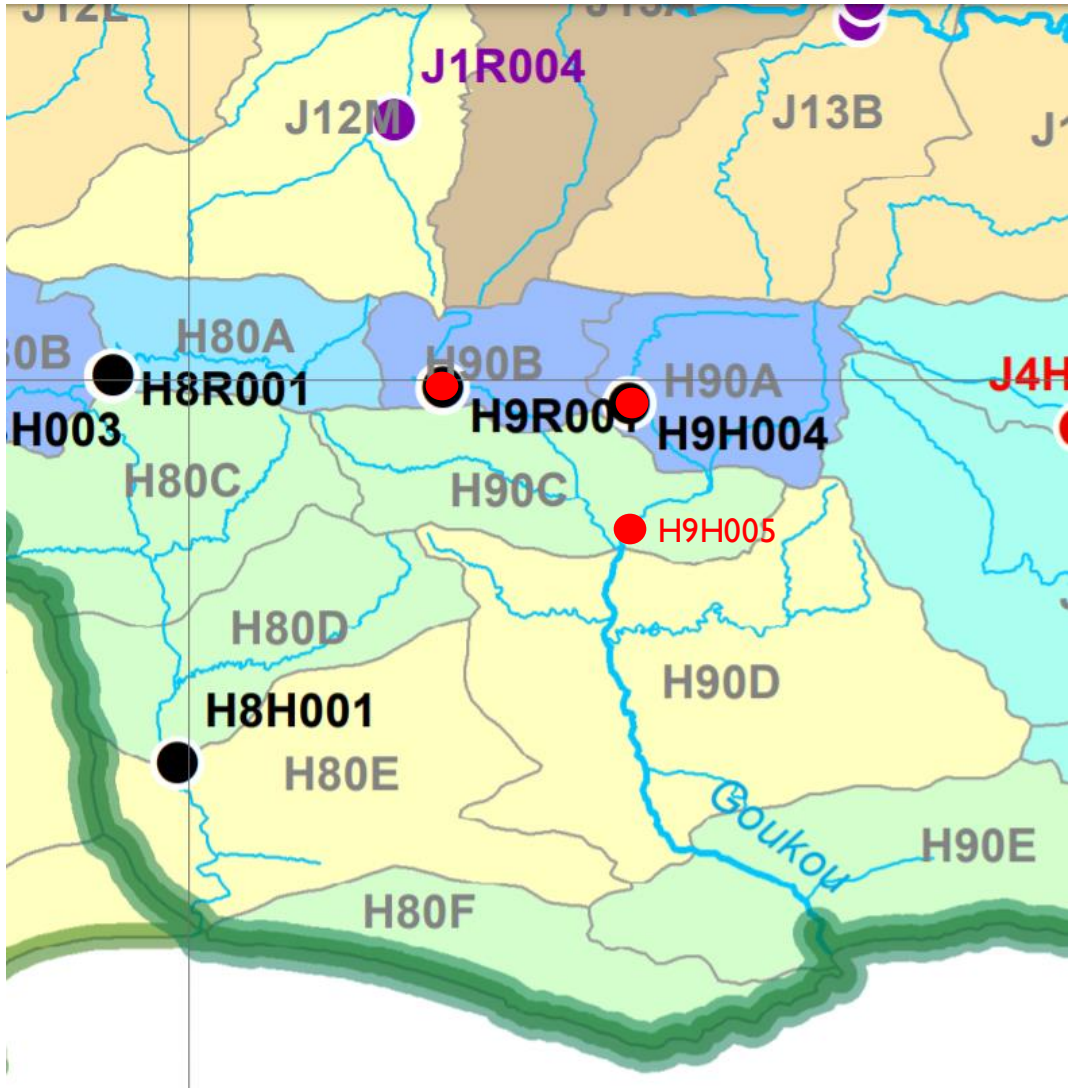
Progress: Hydrological modelling

Input data for hydrological modelling work

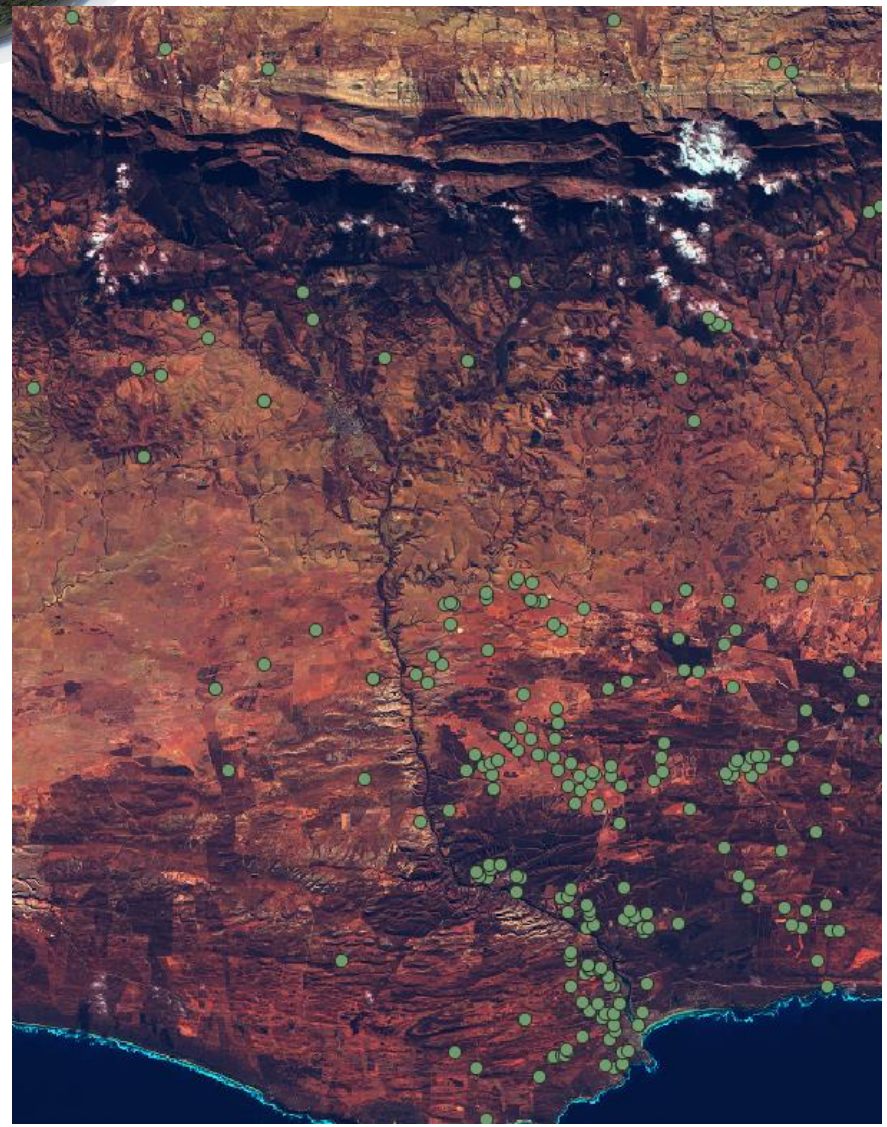
- Climate data
  - Weather stations
  - SAWS
  - ARC

Progress: Hydrological modelling

- Hydrological flow information
  - Weir data from DWS database – 3 weirs

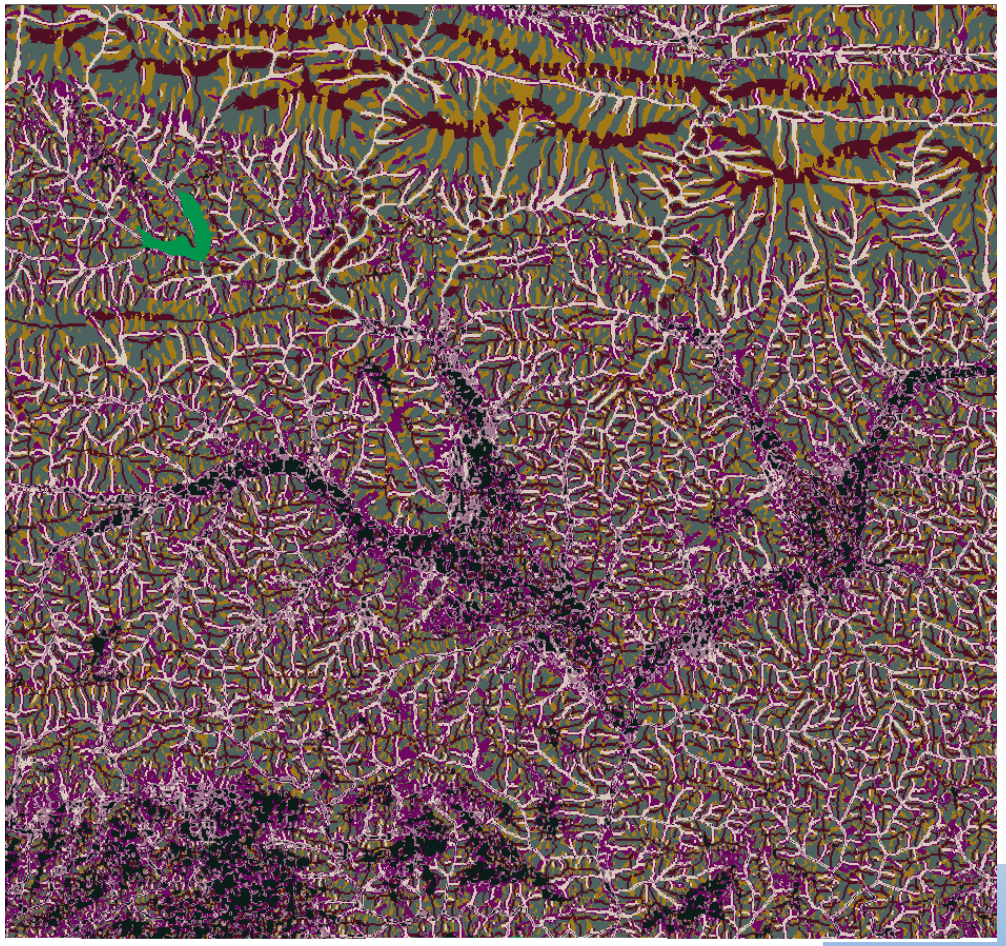


Progress: Hydrological modelling



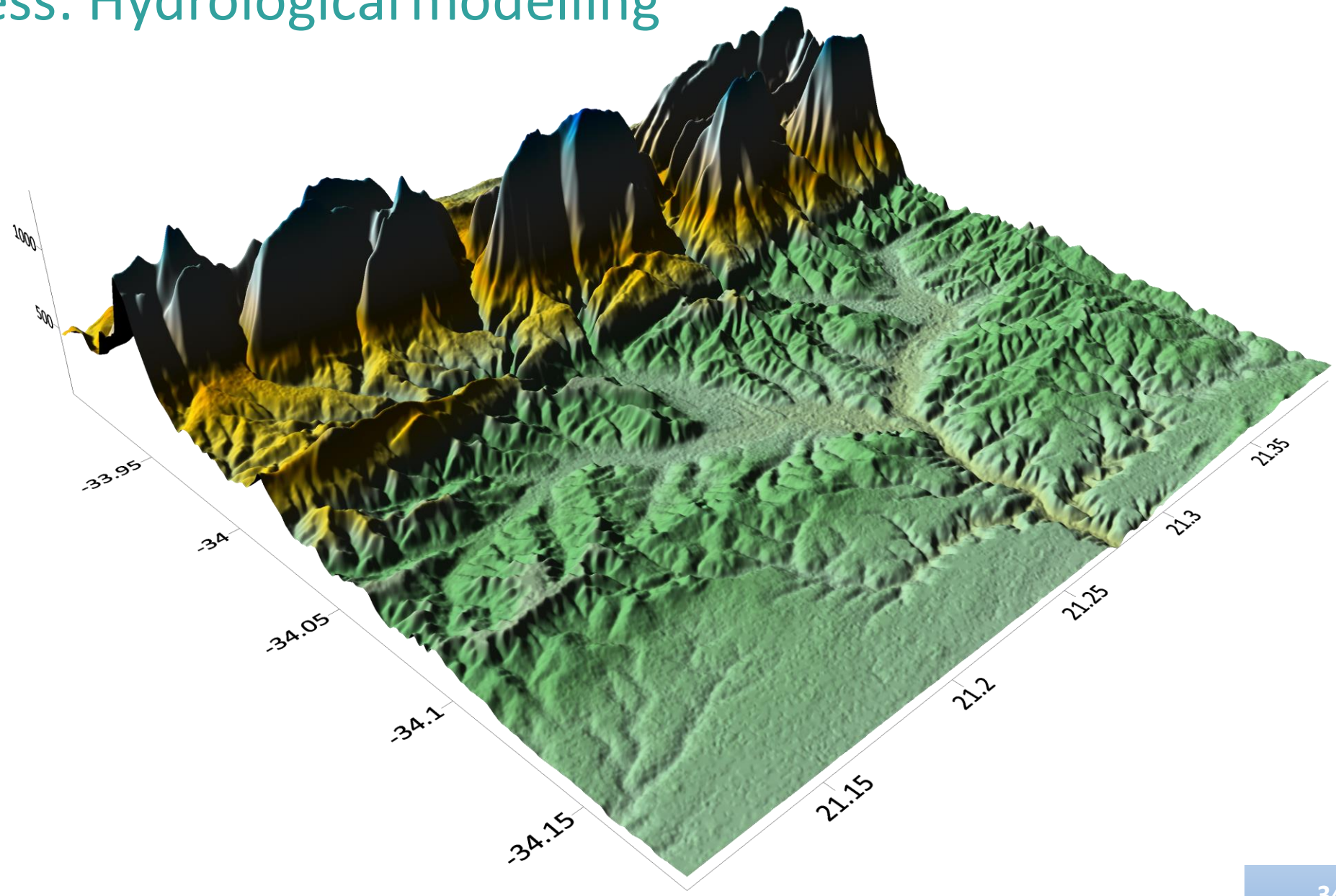
Boreholes

Soils



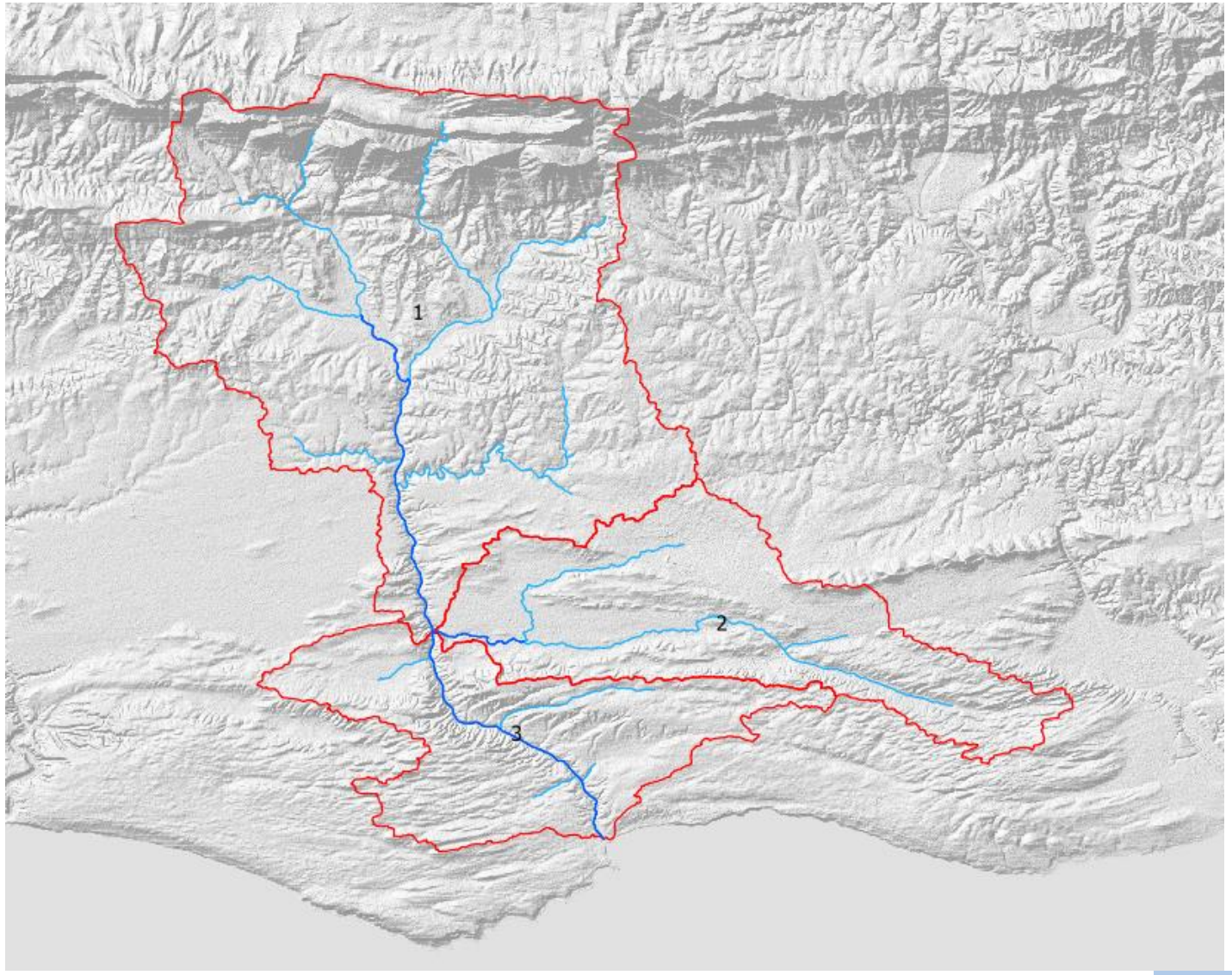
Progress: Hydrological modelling

Terrain map



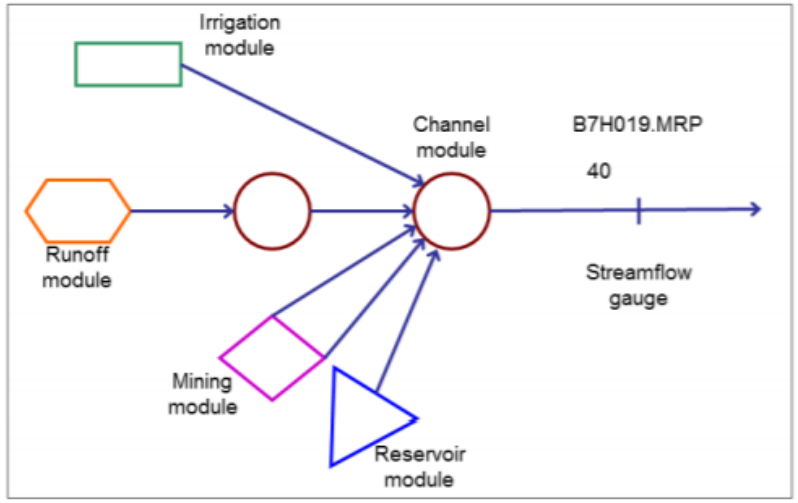
What do we know about Goukou?

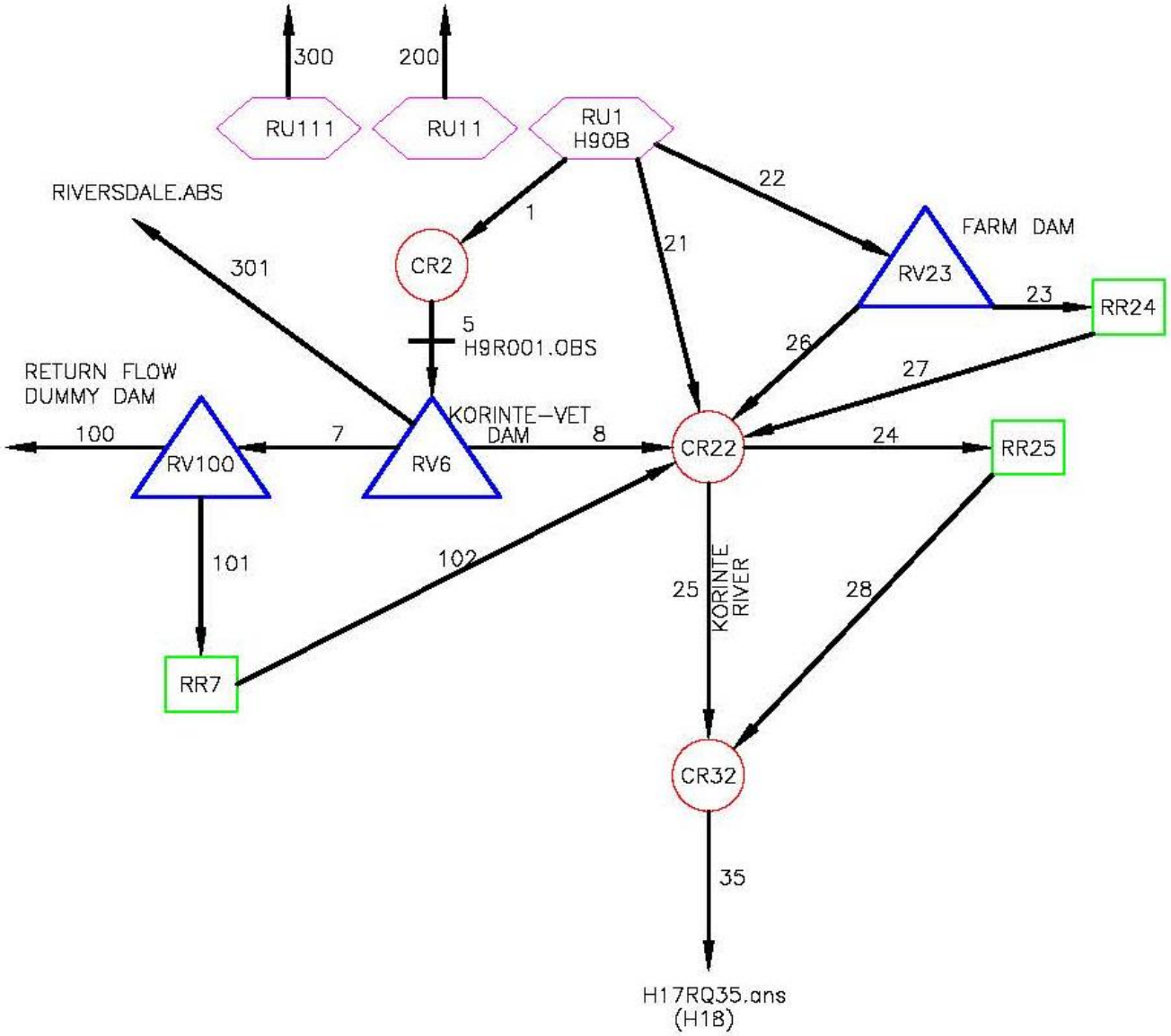
- Not just one large catchment



WRSM/Pitman: Goukou catchment

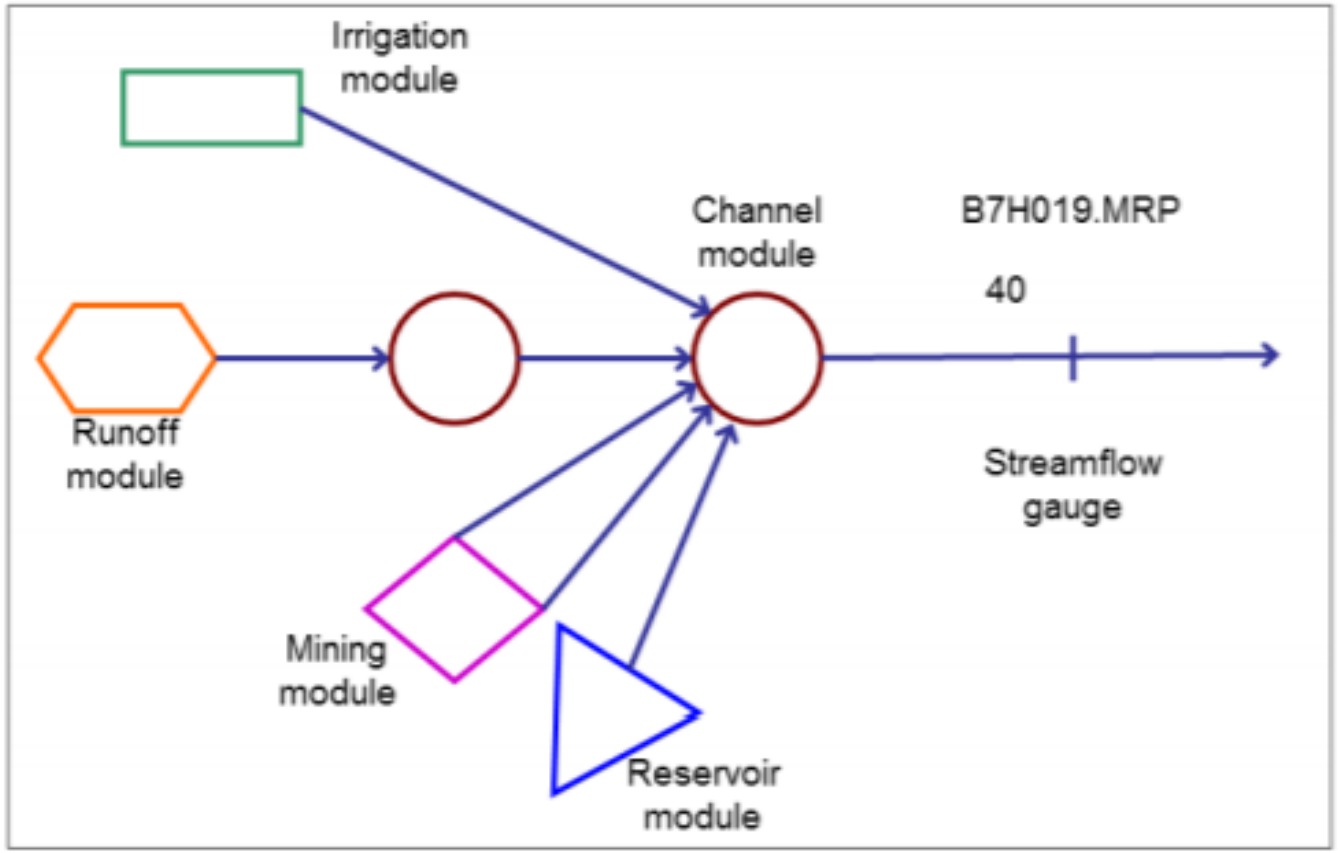
- Network diagrams

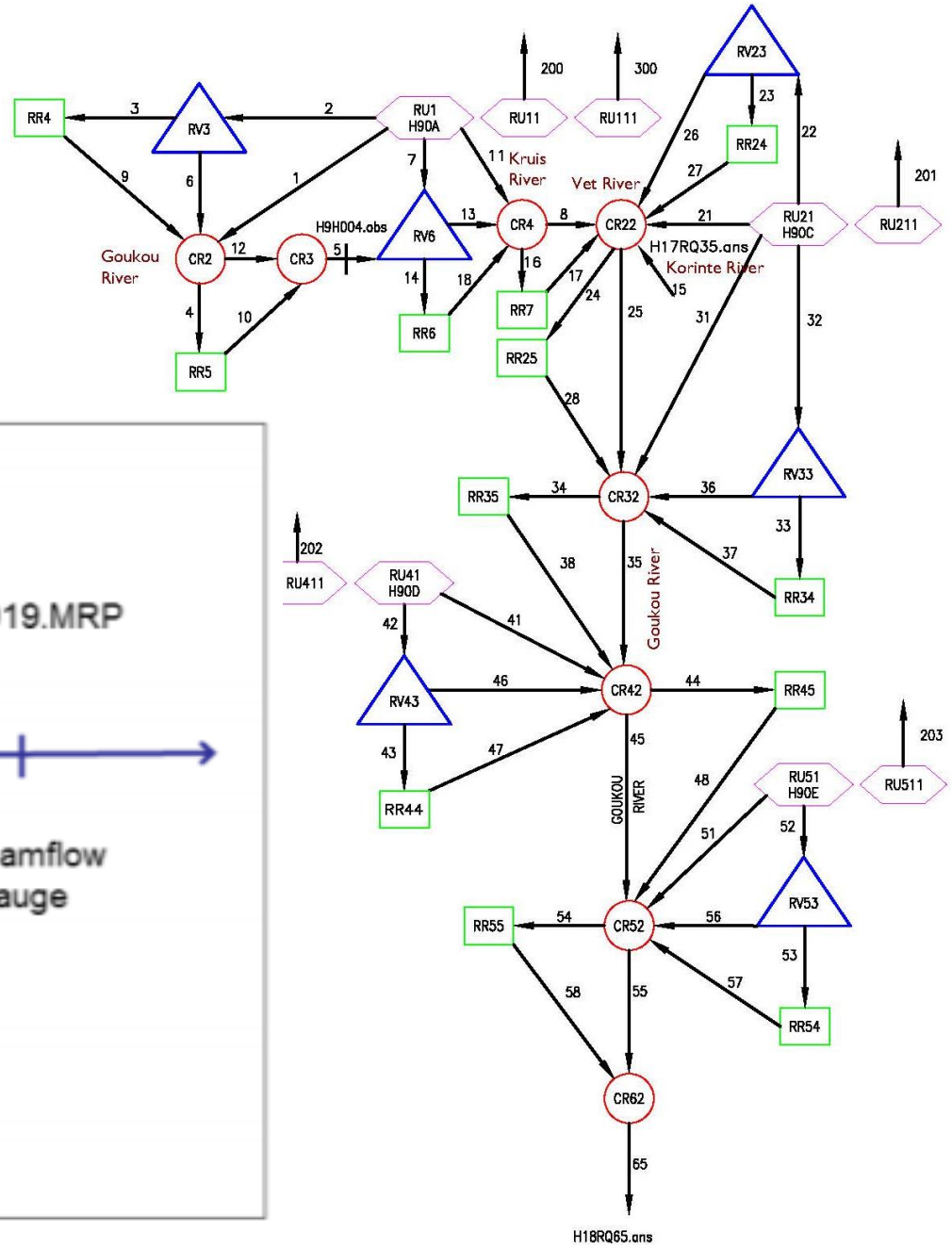




Goukou catchment

- Network diagrams

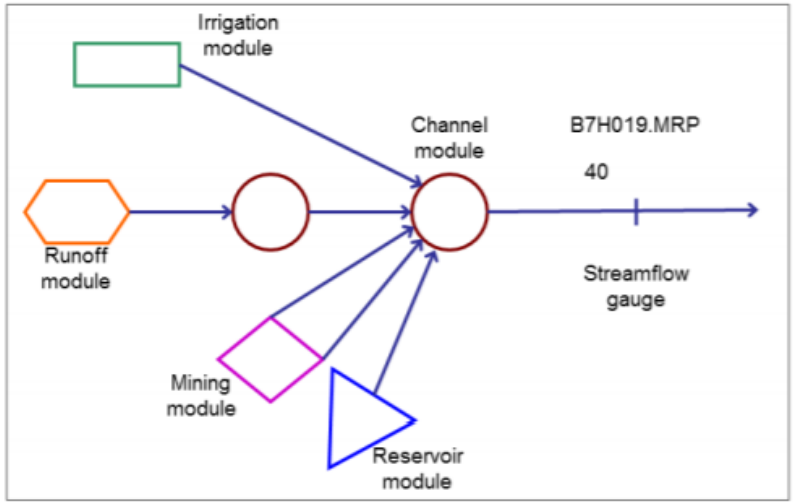


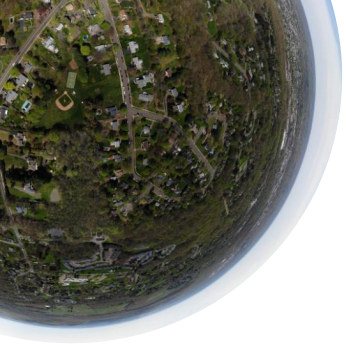


Goukou catchment

- What can we adapt?
  - Additional flow data (refine accuracy)
  - Newer invasive alien coverage
  - Forestry coverage
  - Newer rainfall data
  - Newer wetland data
  - Check irrigation
  - Check farm dams

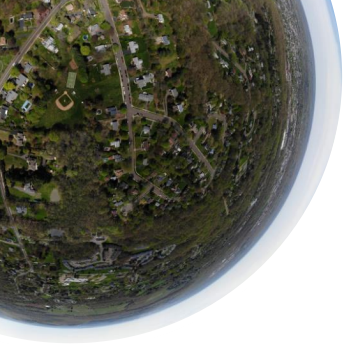
Interview process currently ongoing





WRSM/Pitman model

- (Show Pitman model)
- Check how adaptations change run-off
- Once refined, check how run-off will change with taking water out of system for MAR (can we maintain ecological reserve?)



JAMS

- Jena Adaptable Modelling System (JAMS)
- Daily rainfall data (vs monthly in Pitman, Spatsim)
- Splits catchment into small response units & accounts for spatial variability (vs one unit in Pitman)
- Better surface-groundwater interaction

Thank you for your attention

Marlene de Witt
Project Manager

Stellenbosch University Water Institute
Victoria Street
Stellenbosch – South Africa
Phone: +2782 867 3656
marlenedw@sun.ac.za

Aalto University School of Engineering
anteagroup
Geoscience for a sustainable Earth brgm
imaGeau
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