

CITIZEN SCIENCE CATCHMENT TOOLKIT

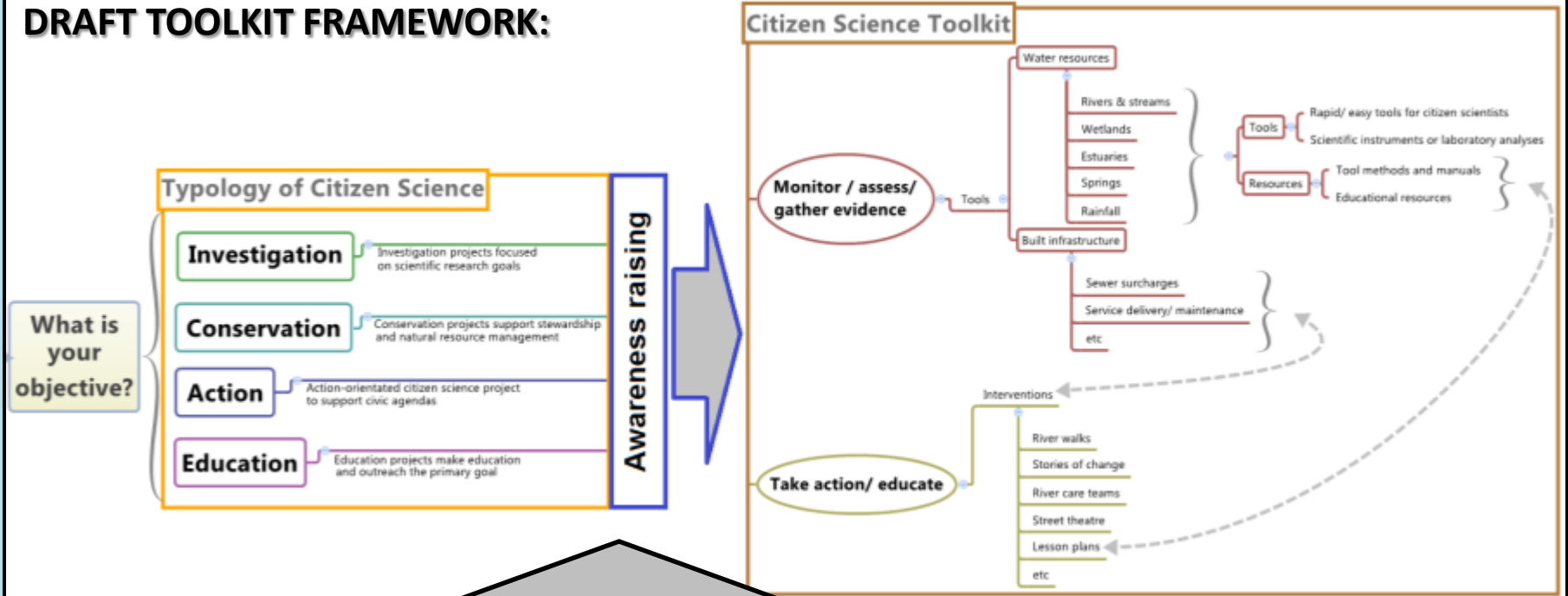
WRC K5 2350:

“Development and Innovative Use of Community-Based Water Resource Monitoring Tools to Research and Mainstream Citizen Science and Improve Trans-Boundary Catchment Management.”

Learning Exchange Matatiele: 24th August 2015



DRAFT TOOLKIT FRAMEWORK:



International	South Africa			
Global Action Programme (GAP) Education for Sustainable Development (ESD)	National Water Resources Strategy 2 <i>"Civil society will be encouraged to play a watchdog role in supporting compliance by water users with water regulations at all levels".</i>	National Development Plan 2030 Government must 'actively support and incentivise citizen engagement'. Citizens must actively seek opportunities for advancement, learning, development, resolve problems and raise the concerns of the voiceless, while holding government, business and leaders in society accountable for their actions.	Operational-Isolation/ Strategy	
Sustainable Development Goals (SDGs)	National Water Act Provisions for the protection and management of water resources, <i>inter alia</i> to meet basic human needs of the present and future generations.	Water Services Act Various provisions including rights of access to basic water supply and basic sanitation.	National Environmental Management Act Various provisions for the management, sustainable use, regulation and protection of ecosystems, biodiversity etc, including provisions relating to cooperative nvrnance and public participation therent.	Legal framework
Millennium Development Goals (MDGs)	Constitution <i>'Everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources'.</i>		Constitutional framework	

Citizen science rain gauge tool

Develop a rain gauge tool that can be used by a wide range of users that is:

- Low cost
- User friendly
- Robust
- Accurate

NB - Linking up with ARC and their cheap weather stations

Tool Development

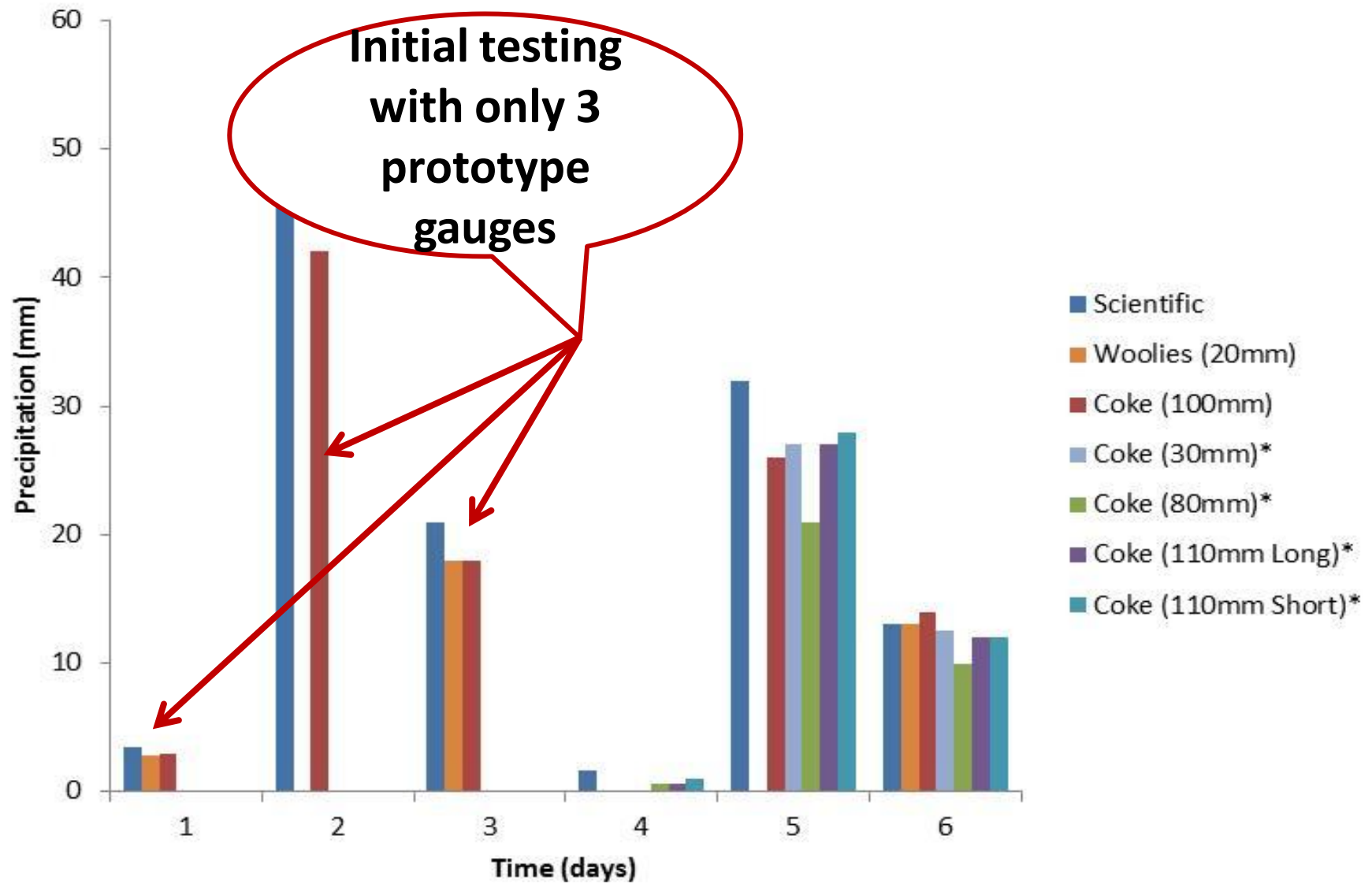
Homemade rain gauges using recycled materials - *Woolworths* 500ml sparkling water and 2L *Coca-Cola* bottles - **calibrated**



In-field testing



Preliminary results



Rainfall (mm) measured by a standard scientific and homemade rain gauges with filled* and unfilled caps.

Spring Health Index Tool

Tools or method to assess, monitor, manage and protect South African springs

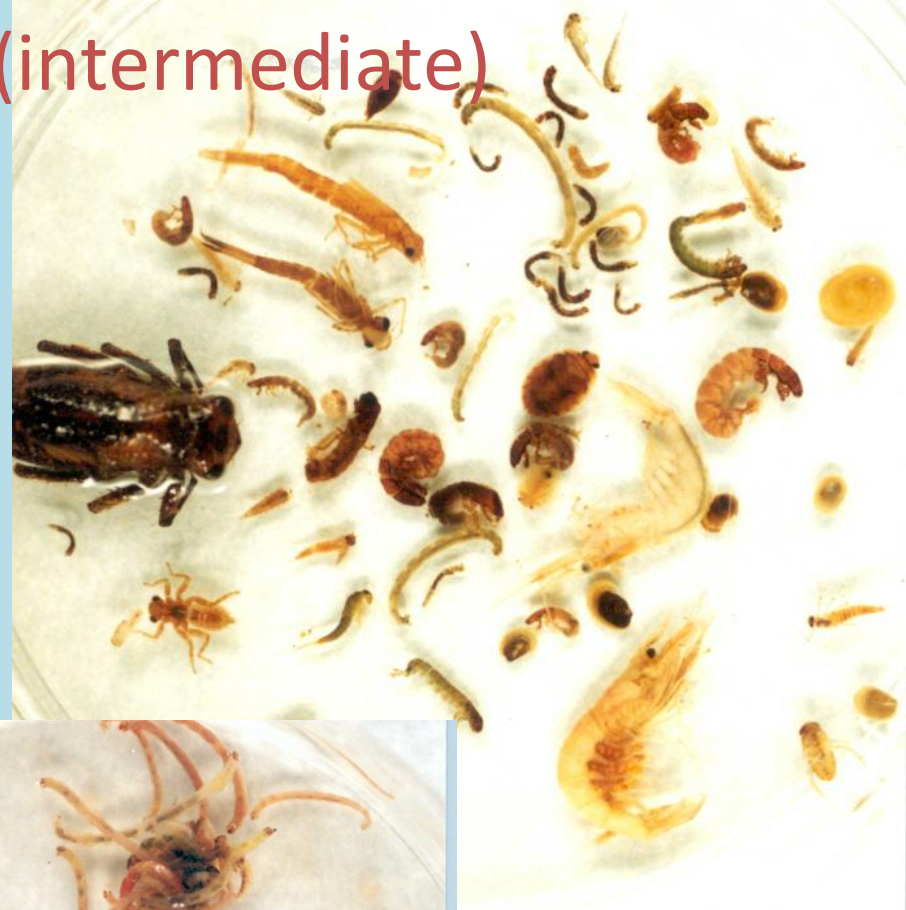


miniSASS Background



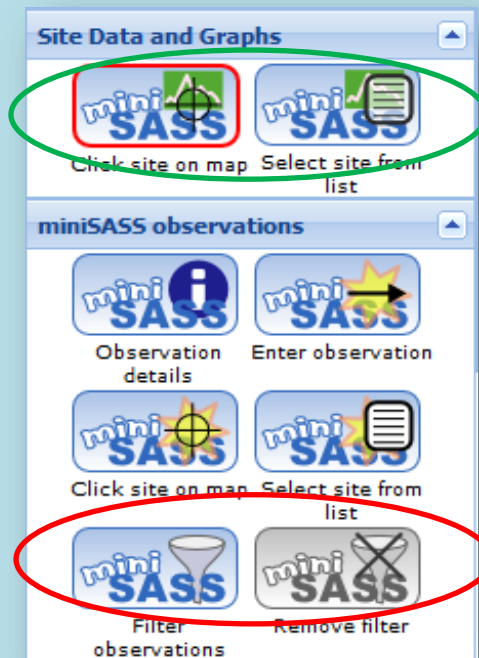
Fair (intermediate)

Good (sensitive taxa)



Poor (tolerant taxa)

Enhancements to the website



Filter observations

The 'Filter Observations' dialog box allows users to filter observations based on various criteria. It includes fields for River name, Site name, River category, User name, Organisation, Health class, Start date, End date, and Status. There is also a list of biological indicators with checkboxes: Flat worms, Worms, Leeches, Crabs/Shimps, Stoneflies, Minnow mayflies, Other mayflies, Damselflies, Dragonflies, Bugs/beetles, Caddisflies, True flies, and Snails.



The "View on Map" tool

Additional measured parameters:

Measured Parameters

Water clarity: cm
 Water temperature: °C
 pH: pH units
 Dissolved oxygen:
 Electrical conductivity:

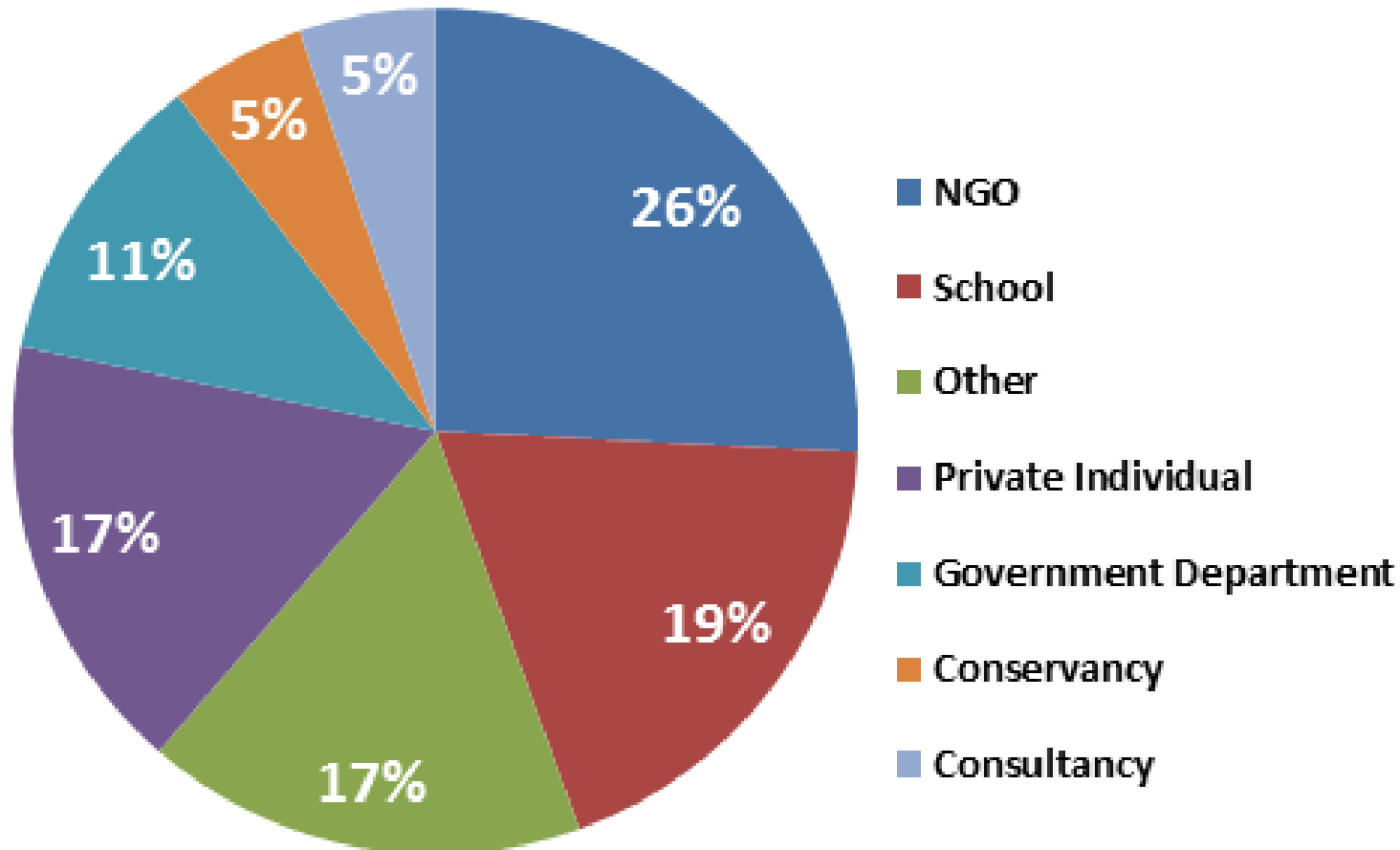
The 'miniSASS Data Input' form contains the following information:

- Site Details:** River name: Upton, Site name: D/S Hagle Dam, Site description: 500m downstream of Hagle Dam, Latitude: 26.999442, Longitude: 30.433048, Where there rocks where you sampled?: Rocky
- Measured Parameters:** Water clarity: 24 cm, Water temperature: 18 °C, pH: 4, Dissolved oxygen: 5.3 mg/L, Electrical conductivity: 241 µS/cm
- Observation Details:** Date: 2014-08-17, Collector's name: Areille Gilbrigo, Comments/notes: Rain two days ago, Solid waste present
- Biological Indicators (Sensitivity Score):** Flat worms: 1, Worms: 2, Leeches: 1, Crabs or Shimps: 1, Stoneflies: 1, Minnow mayflies: 5, Other mayflies: 1, Damselflies: 1, Dragonflies: 6, Bugs or beetles: 5, Caddisflies: 9, True flies: 1, Snails: 1
- Summary:** Total score: 27, Number of groups: 5, Average score: 5.4 (Poor)

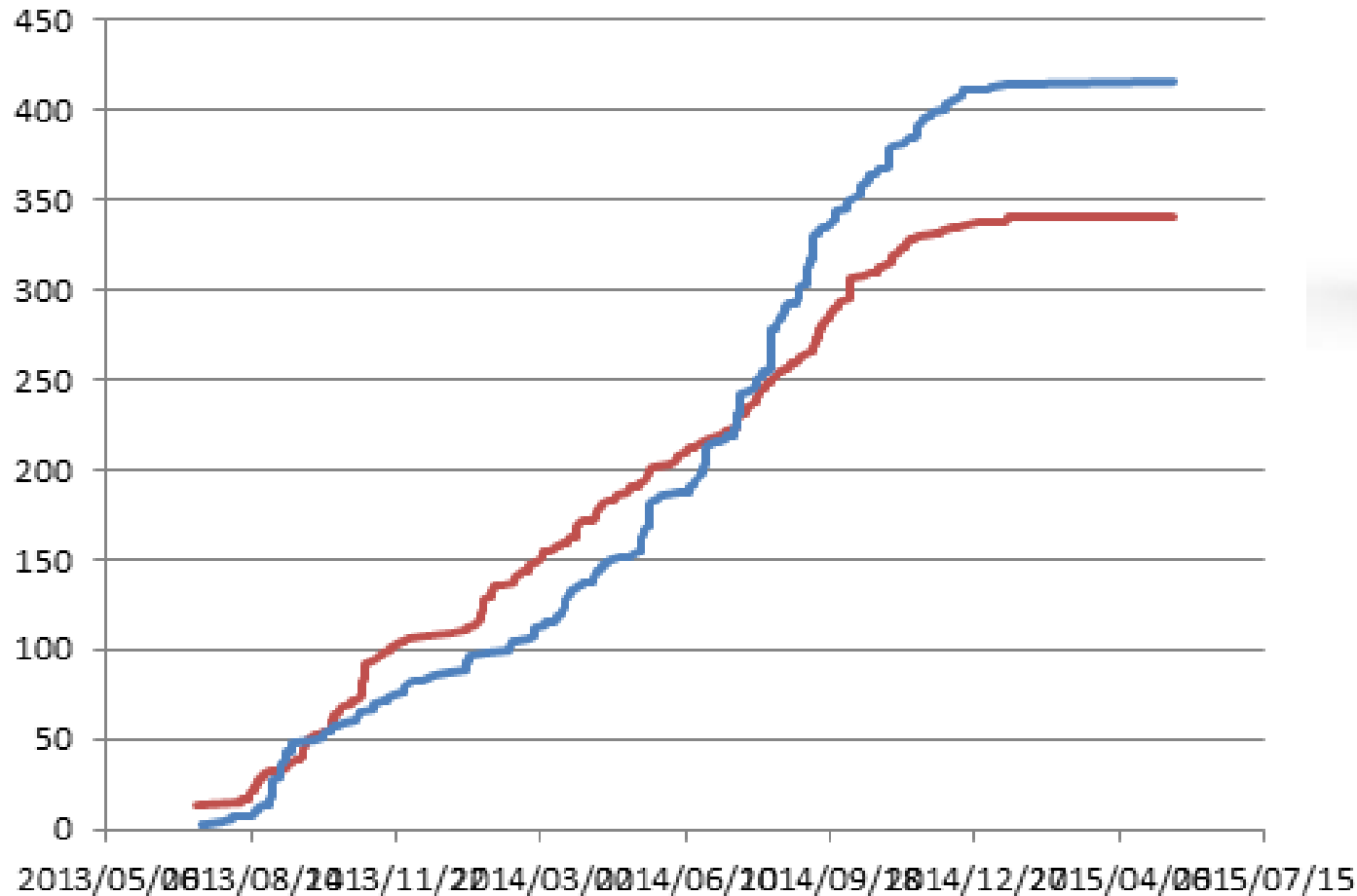
The map on the right shows a river flowing through a landscape, with a red circle indicating the sampling location.

miniSASS website statistics

Registrations on the miniSASS database by organisation type



miniSASS website statistics



— Users
— Observations

Riparian Health Audit Tool

AIM: Develop an easy-to-use citizen science tool for determining the ecological health of Riparian Ecosystems.



Which system is healthier?



Riparian Health Audit - Method

8 principle impacts identified to form the basis of the RHA:



1. Alien Invasive Plants



2. Rubbish dumping



3. Bank erosion



4. Inundation



5. Flow modification



6. Physico-chemical modification



7. Vegetation removal



8. Channel modification

Riparian Health Audit - Outputs

- ❑ Field data entered into a model & the EC (Ecological Condition) is generated as an output.
- ❑ The EC is based on the percentage change in the riparian system from natural and/or pre-anthropogenic conditions.

Score	Percentage Change	Ecological Condition
0-4.5	0-10	Natural
5-11.5	11-29	Good
12-19.5	30-49	Fair
20-27.5	50-69	Poor
28-35.5	70-89	Very Poor
36-40	90-100	Critical

Water Clarity Tube

□ Monitoring rivers, streams and WWTW:

1. Stream/river, wetland and dam water clarity
2. Monitoring performance (discharge WQ) of WWTW to GLVs and SLVs



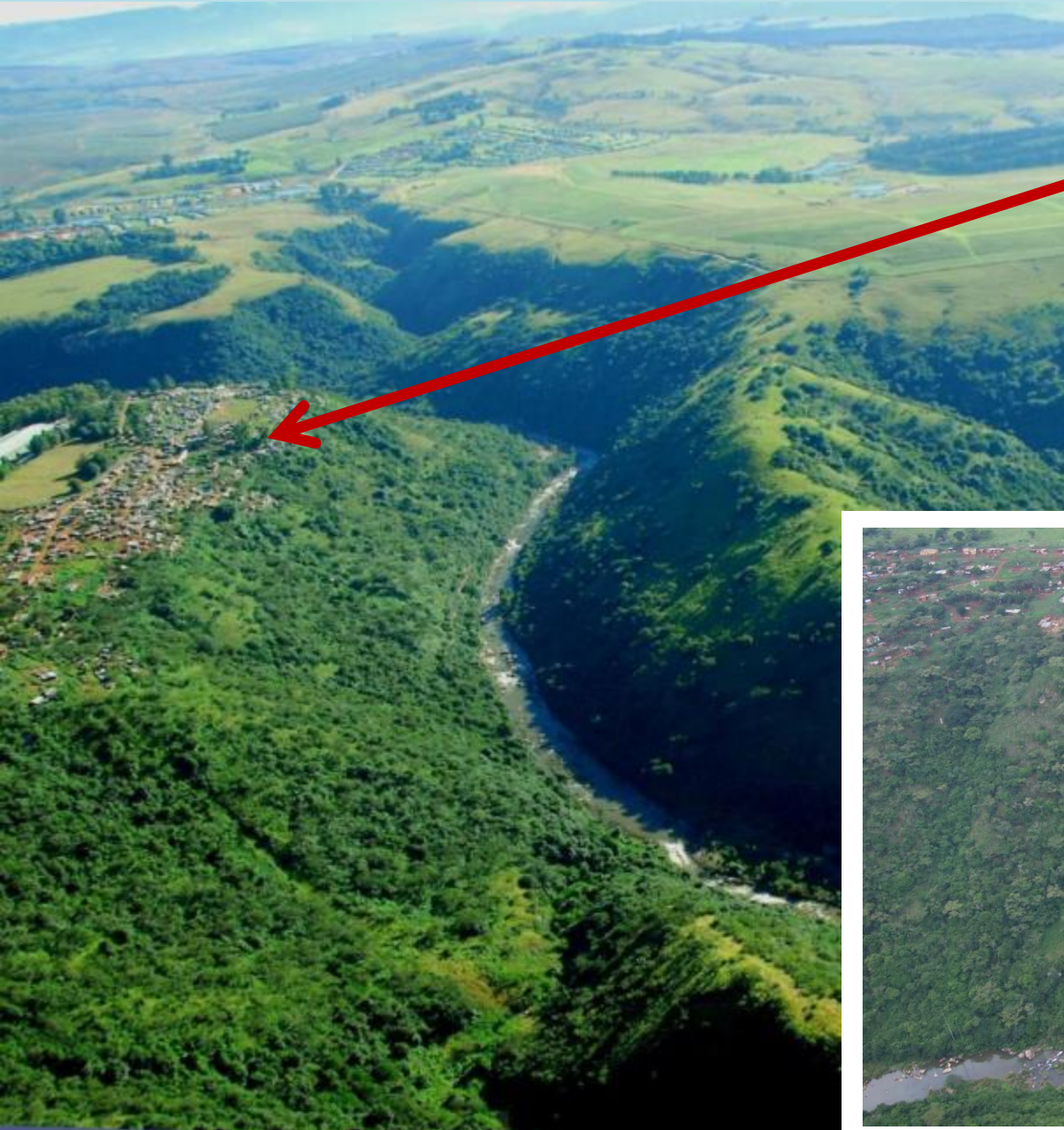
The Water Clarity Tube Tool

- ❑ Clarity Tube: 1 m long, 50 mm external diameter tube constructed of 3 mm thick clear Perspex.
- ❑ Measures visibility of water column in aquatic ecosystems (cm).

Magnet →
Matt Black Disk →
cm Markings →
Viewing Window →



Wastewater Monitoring: A Case Study



**Shiyabazali & Howick
WWTW final effluent**



Wastewater Monitoring: A Case Study

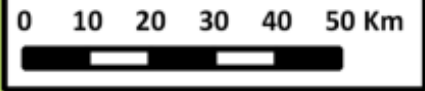


Eutrophication!



Possible TSS bonded nutrients accumulate at Albert Falls Dam

**Howick Wastewater Treatment Works
(final effluent often non-compliant with TSS discharge limits and associated nutrients TN, TP, etc.)**



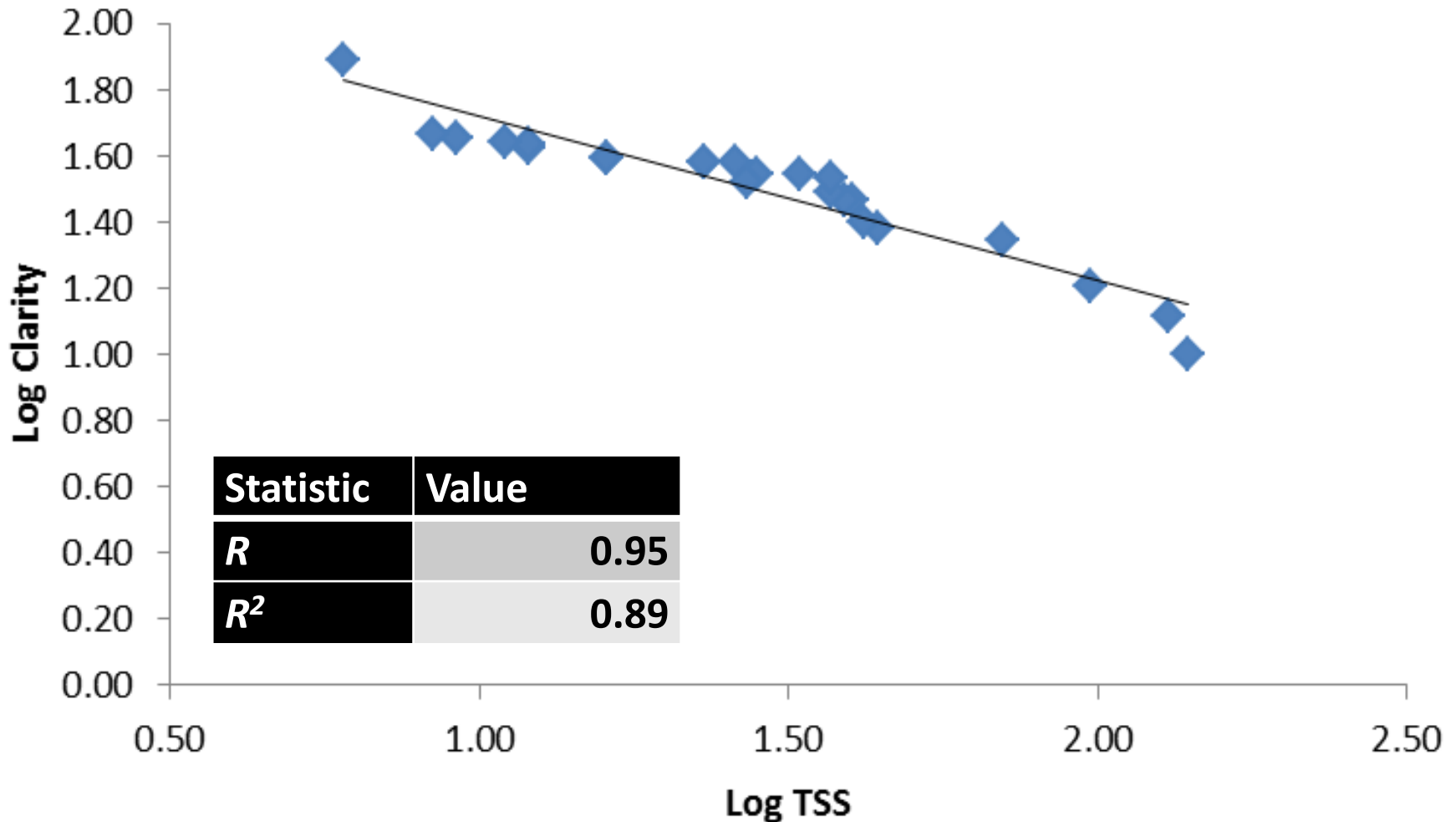
Wastewater Monitoring: A Case Study



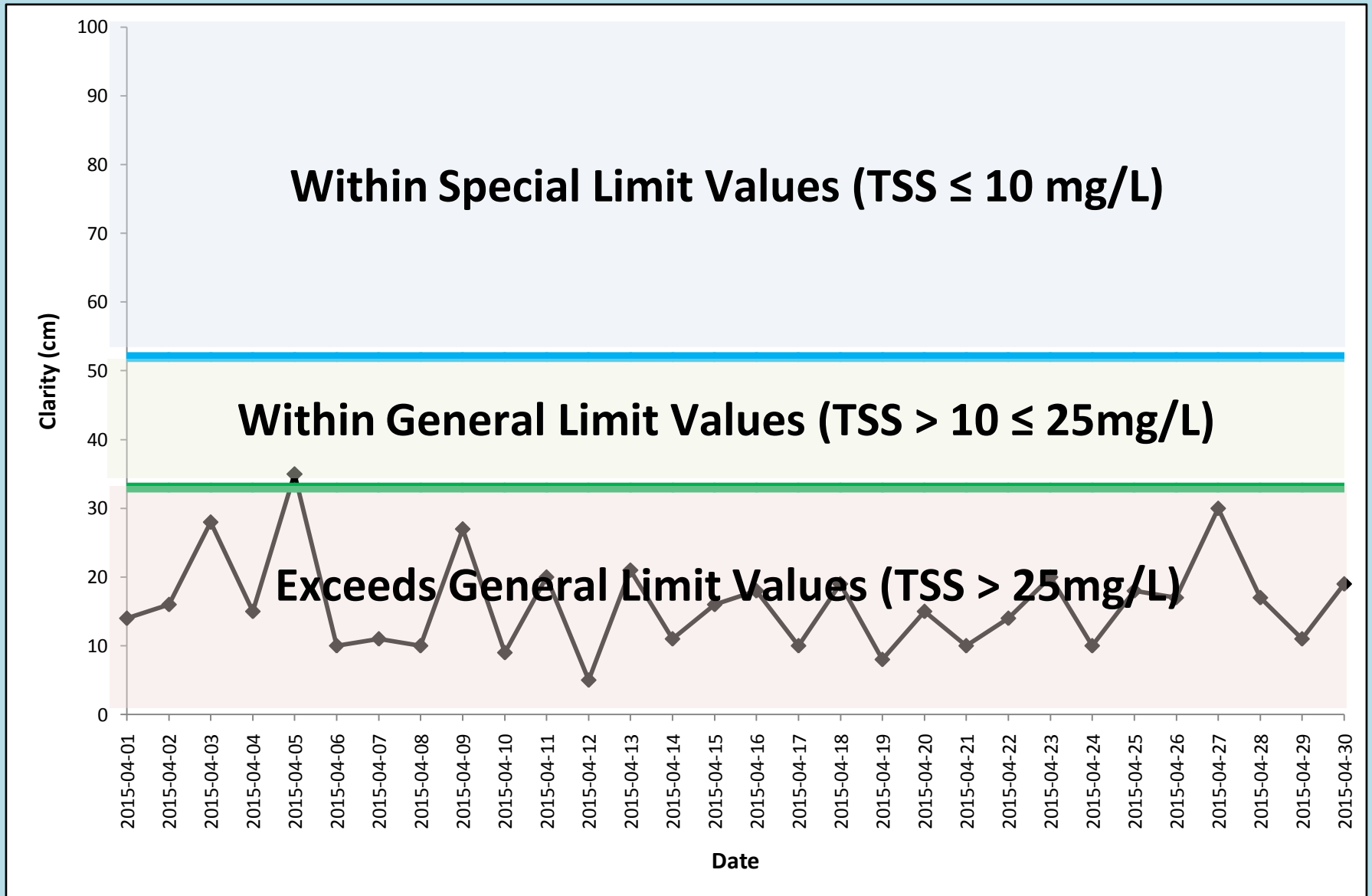
- Zongile Ngubane monitors the Howick WWTW final effluent 3Xdaily
- Consistent monitoring determines quality of the final effluent-
quality is based on DWS discharge limits.
- However: no limits established for water clarity!

Wastewater Monitoring: A Case Study

- ❑ How do we determine if Howick WWTW is really compliant?
- ❑ Linear regression between TSS and Clarity.



Wastewater Monitoring: A Case Study



Citizen Science: Sediment Sampling & Profiling

- How may citizen scientists assist with understanding more about the sediment dynamics of our rivers ?

IFR 5 (Summer)

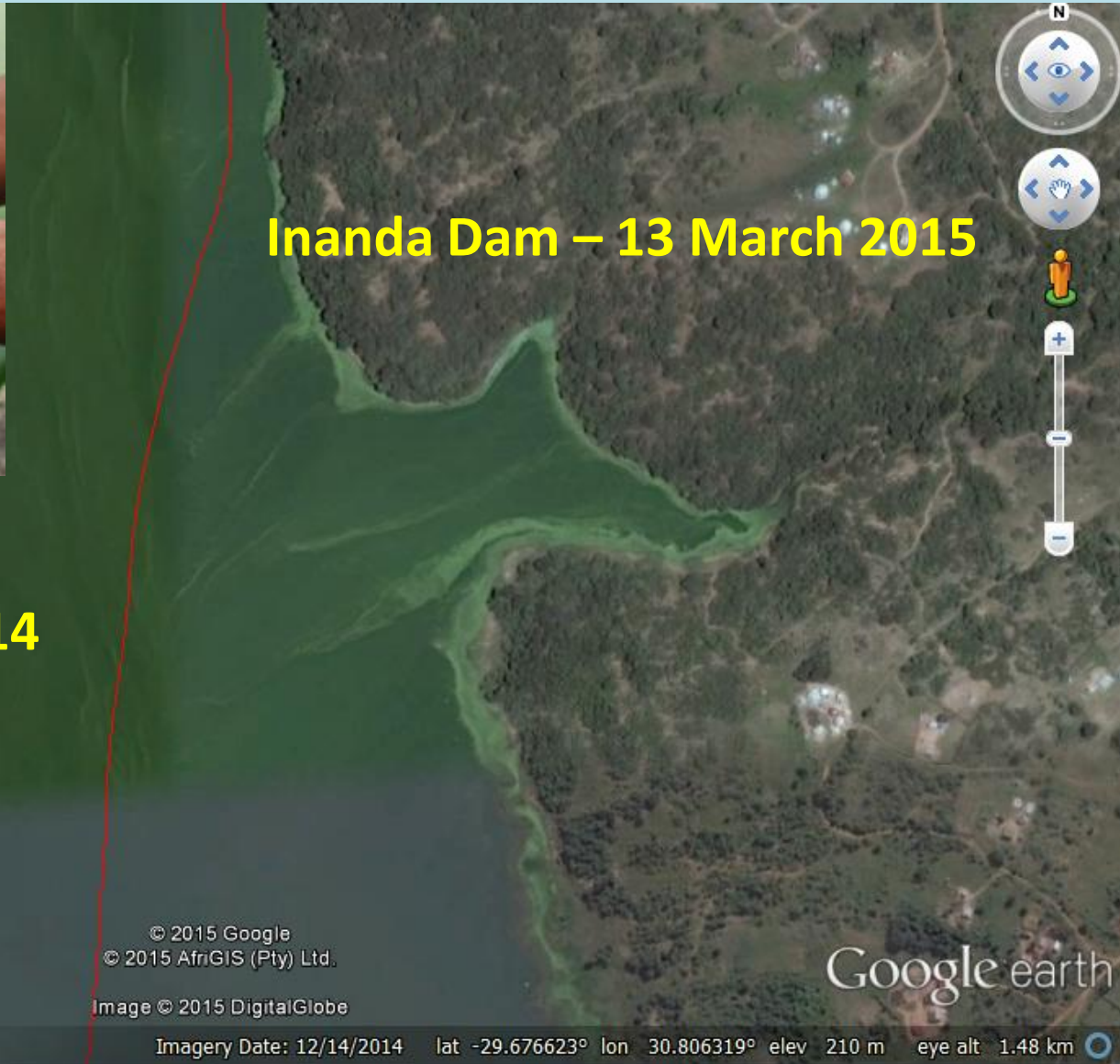


IFR 5 (Winter)



Nutrient Enrichment : Eutrophication

Streams/rivers, wetlands & dams

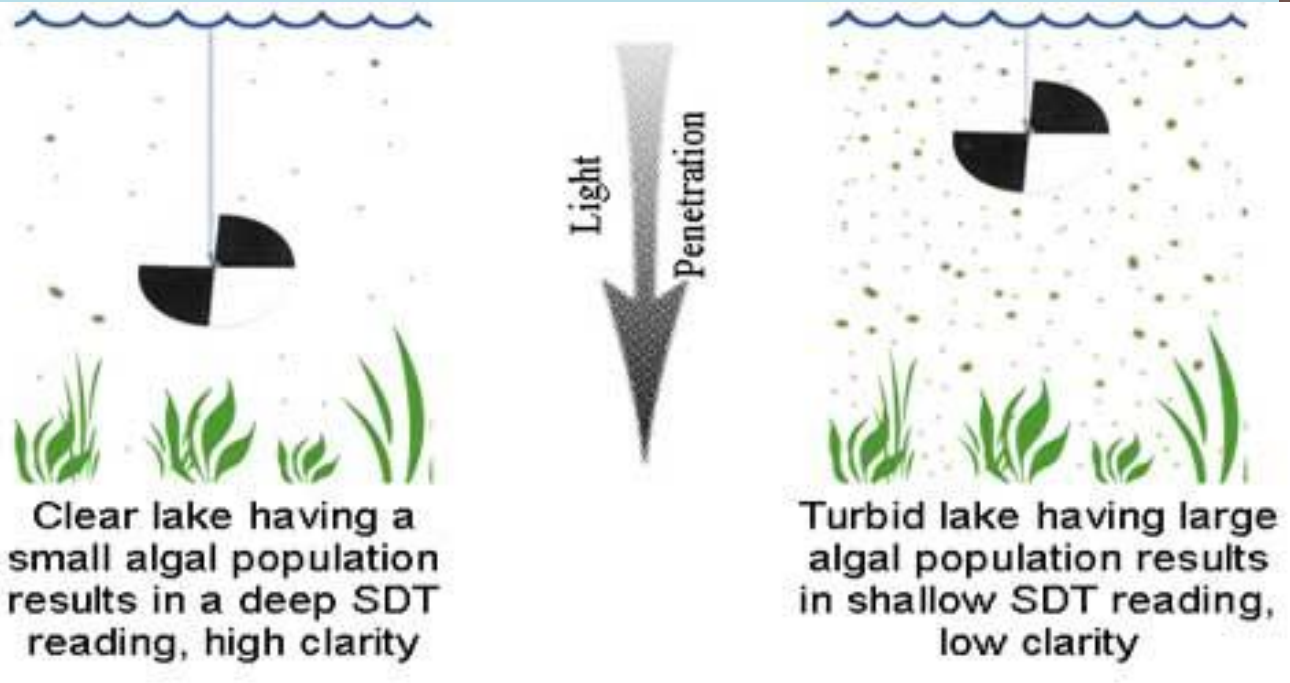


Nutrient Enrichment : Eutrophication

Streams/rivers, wetlands & dams

Nonkululeko Mokoena (DWS – M.Tech - TUT)

Streams, dams, wetlands

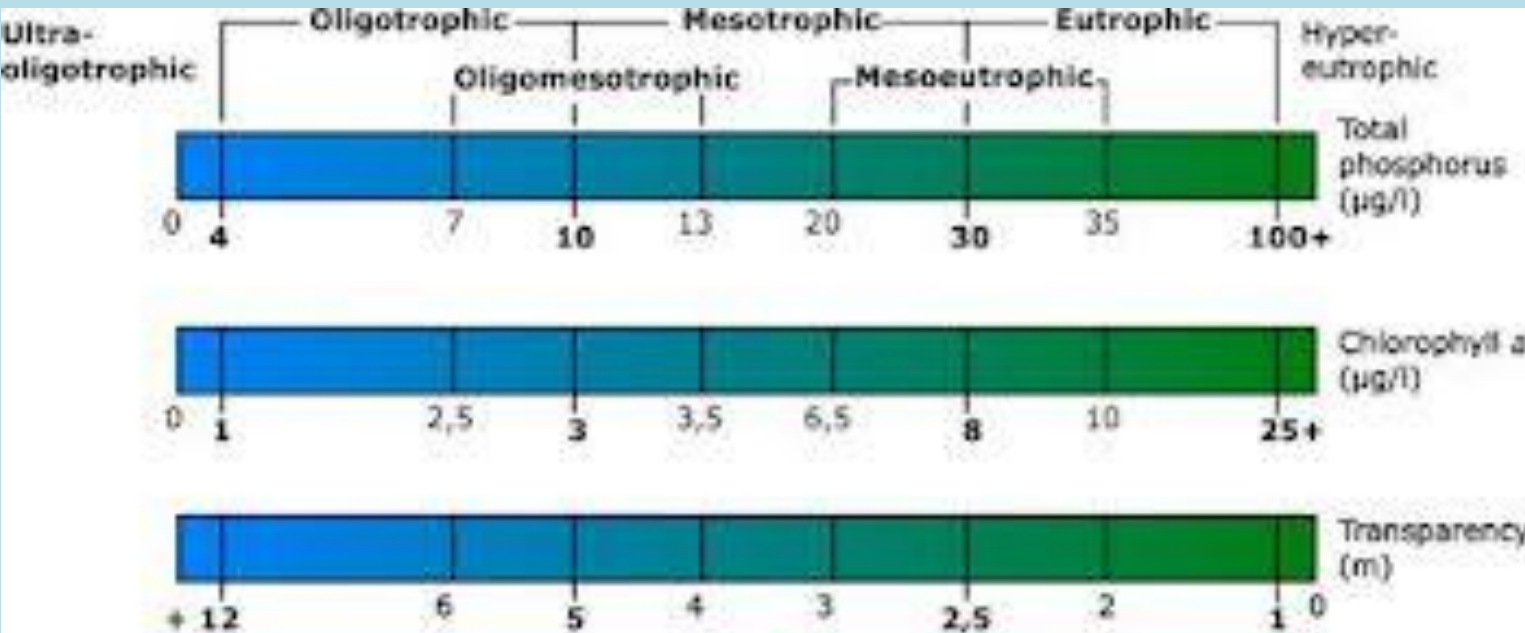


Nutrient Enrichment : Eutrophication Streams/rivers, wetlands & dams

Nonkululeko Mokoena (DWS) M.Tech (TUT) studies

Direct measures of algal concentrations – correlated to Chlorophyll “a”

Indirect measures of nutrient concentrations *in situ*



Transparent Velocity Head Rod (TVHR)

A tool for measuring water velocity and stream/river discharge:

Equation: $Q = A * V$ (m³.s)

So you need:

A: Area

Make a cross section of the river, then calculate the area measuring the depth along the stream

V: Velocity

For each interval, you need to measure the velocity and then take an average.



Transparent Velocity Head Rod (TVHR)



INTERVENTIONS



Working with local NGOs (DUCT and WESSA), a number of intervention initiatives are being developed:

- Ecological Infrastructure & Leadership Seminars
- Street Theatre
- EnviroChamps
- River Walks
- River Care Teams
- Accredited Training (level 2 & 5)
- Non-accredited Training (1 day)
- EnviroPicture Building

El & Leadership Seminars

amaKhosi, iziNduna, Municipal planners & authorities, etc.



Street Theatre

Communicating current environmental crises & bridging the gap between science and society.



EnviroChamps

Develop a community monitoring model to

- record
- report on and
- respond to environmental problems.



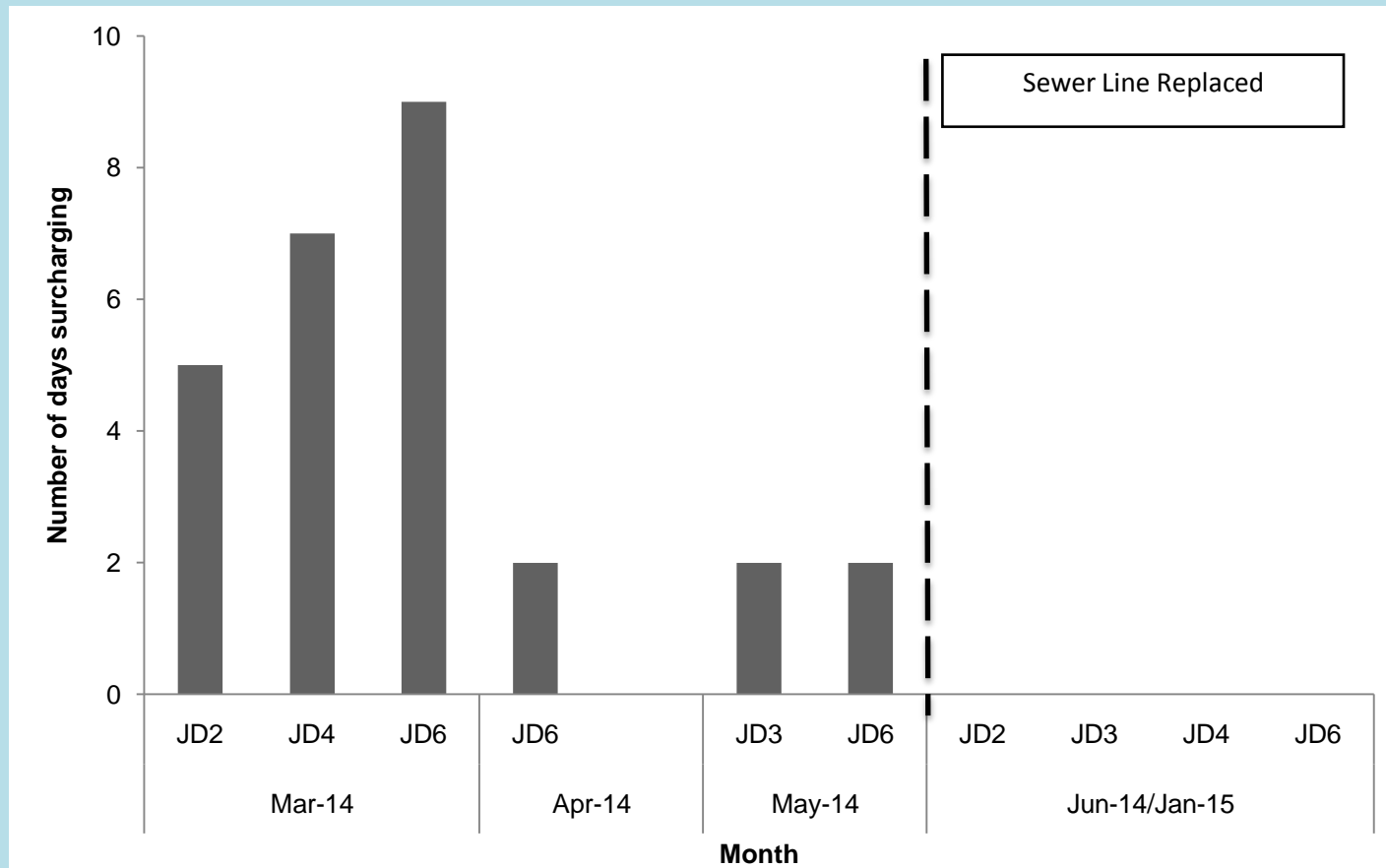
Wastewater Monitoring: A Case Study



- ❑ Zongile Ngubane monitors the Howick WWTW final effluent 3 X daily.

Interventions – success story

- ❑ EnviroChamp Jabulani Dladla repeatedly reported surcharging manholes within his area.
- ❑ Municipality replaced the sewer line in June 2014.
- ❑ Constantly surcharging manholes improved – significant reduction in water pollution from this area.



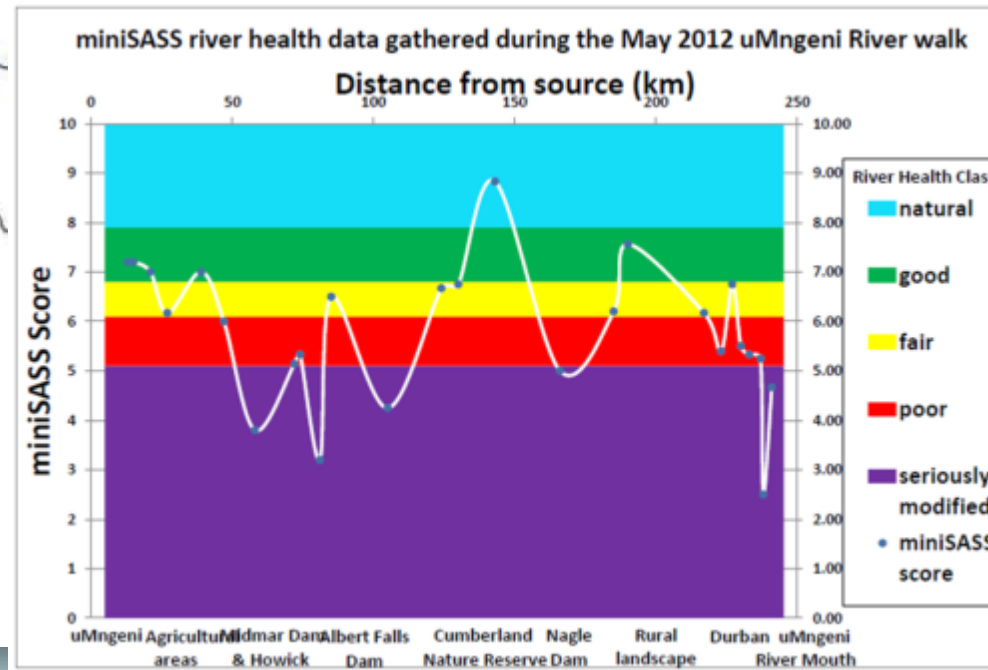
River Walks



Legend

Minisass

- Natural >7.9
- Good 6.8-7.9
- Fair 6.1-6.8
- Poor 5.1-6.1
- Very Poor <5.1



Where Tools & Interventions come together

River walks hosted by Ayanda Lipheyana – DUCT EnviroChamp in Mpophomeni:

Date	River Walk	Materials used	No. of participants
10/10/2014	UMthunzima stream	none	unknown
15/12/2014	UMthunzima River walk	miniSASS kit and Turbidity tube	20 school learners
20/12/2014	Nguga River Walk	miniSASS kit and Turbidity tube	12 school learners & 1 adult
15/01/2015	UMthunzima River walk	miniSASS kit	22 school learners & 4 adults
17/01/2015	UMthunzima River walk	miniSASS tool kit, Share net picture building & turbidity tube	38 school learners & 4 adult
08/04/2015	Nguga River Walk	miniSASS kit	26 school learners & 2 adults
11/04/2015	UMthunzima River walk	miniSASS kit	24 school learners
18/04/2015	Nguga River Walk	miniSASS kit	21 Participants
25/04/2015	UMthunzima River walk	miniSASS kit	7 school learners



Non-accredited training



Accredited training

NQF Levels 2 & 5

Learner Manual

Module 2: Understanding and Using Environmental Management Tools

Unit Standard 119554: Apply Environmental Management Tools to Assess Impacts (5 credits)

Revised
Edition
2014



Environmental
Practices Skills
Programme
NQF Level 2

Workbook

Module 2: Understanding and Using Environmental Management Tools

Unit Standard 119554: Apply Environmental Management Tools to Assess Impacts (5 credits)



Name:

Student Number:



Environmental
Practices Skills
Programme
NQF Level 2

School Lesson Plans

The *Fundisa For Change* Toolkit initiative:

Established to update and add to fieldwork lesson plans for:

- Senior Primary phase – Grade 5-7 (Natural Science)
- Further Education and Training phase - Grade 10 (Geography)

Developing a mobile phone app for miniSASS

The screenshot displays the miniSASS web application interface. At the top left is the logo for miniSASS (Stream Assessment Scoring System) with the URL www.minisass.org and the text 'RIVER HEALTH'. Navigation buttons include 'Explore the map', 'How to do miniSASS', and 'Submit results'. A user login area on the top right says 'Welcome back, SimonAdmin' with links for 'Logout' and 'Change Password'. A secondary navigation bar contains 'Home', 'How To', 'Map', 'Downloads', 'Partners', and 'Contact Us'. The main content area features a map of the Mago River region with colored markers representing different observation conditions. A legend on the left lists these conditions: Unmodified (NATURAL condition), Largely natural/few modifications (GOOD condition), Moderately modified (FAIR condition), Largely modified (POOR condition), Seriously/critically modified (VERY POOR condition), and Unverified data. Below the legend are sections for 'Schools' (Primary, Intermediate, Combined, Secondary) and 'Layers'. At the bottom of the interface are logos for 'water affairs' (Department of Water Affairs, Republic of South Africa), 'GroundTruth' (Water, Wetlands and Environmental Engineering), and 'WESSA' (Water Research Commission, People Caring for the Earth).



**Working with
MLab and DST**

Information & knowledge dissemination

miniSASS poster

miniSASS field pamphlet

miniSASS field and identification sheets (English, Afrikaans and isiZulu versions)

miniSASS Nunu book (draft)

Student capacity development & involvement

Student involvement:

- bursary funded students with a research topic contributing directly to the project; or
- non-bursary funded students whose research topic aligns with the project, receiving necessary mentorship;
- students seeking interesting research topics using other/own funding;
- vac students contributing to the testing of various citizen science tools;
- foreign students on study or internship programmes; and
- student research support group meetings.

Summary: Projected number of students

1 PhD student	<ul style="list-style-type: none">▪ Mr Tichaona Pesanayi	
5 Masters students	<ul style="list-style-type: none">▪ Ms Louine Boothway▪ Ms Marilyn Govender▪ Ms Pamella Magida	<ul style="list-style-type: none">▪ Ms Abulele Qulu▪ Mr Denis Radebe
0 Honours students		

Actual: Number of students supported

3 PhD students	<ul style="list-style-type: none">▪ Mr Tichaona Pesanayi▪ Ms Morakane Madiba	<ul style="list-style-type: none">▪ Mr Thobani Khomo
9 Masters students	<ul style="list-style-type: none">▪ Ms Louine Boothway▪ Mr Luvuyo Dlamini▪ Mr Richard Ndou▪ Ms Nondumiso Dumakude	<ul style="list-style-type: none">▪ Ms Xolile Nkomo▪ Ms Hlengiwe Cele (thesis)▪ Ms Andrea Kolbe (thesis)▪ Mr Andreas Johnsson and Ms Karolina Klasander (thesis)
4 Honours students	<ul style="list-style-type: none">▪ Ms Samiksha Singh (thesis)▪ Mr Bryan Paul	<ul style="list-style-type: none">▪ Ms Sarah-Lynn Williams▪ Ms Nokwanda Ndebele
5 students providing research support	<ul style="list-style-type: none">▪ Mr Baptiste Lelong▪ Ms Melissa Aurelle	<ul style="list-style-type: none">▪ Mr Rudzani Tshiswise▪ Mr Roger van Tonder▪ Ms Adwoa Awuha

Palmiet River Watch

30th August 2013



Activity:

- miniSASS presentation and practical
- Introduction to the clarity tube



Included:

- Local residents along the Palmiet River
- GroundTruth
- 17 attendees

miniSASS day with Pelham Prep School

10th October 2013



Activity:

- miniSASS presentation and practical

Included:

- 23 school children from Pelham School- PMB (grade 7)



Groen Sebenza Provincial River Health Day

7th March 2014



Activity:

- Discussions surrounding water resources
- Intro to citizen science tools- miniSASS and clarity tube

Included:

- Groen Sebenza pioneers
- WESSA
- UKZN students
- GroundTruth
- 49 attendees



International Day of Action for Rivers

14th March 2014

Activity:

miniSASS training



Included:

- Alexander High School EnviroClub
- DUCT EcoClub
- Teachers
- 30 attendees

National Water Week

17th – 20th March 2014

South Africa's National Water Week



Activity:

miniSASS day with the the Deputy Minister, Miss Rejoice Mabudafhasi

Included:

- Department of Water & Sanitation
- Water Research Commission
- GroundTruth
- Department of Science & Technology
- WESSA's Eco-schools



WRC Youth Summit

29th June – 4th July 2014

Activity:

- Included workshops & training sessions in citizen science tools - such as miniSASS, clarity tube and EnviroPicture building
- Deputy Minister Pam Tshwete conducting a miniSASS assessment



Included:

- Students and teachers from across the country
- Delegates from DWS
- WRC
- GroundTruth

Student Water Symposium

30th July 2014



Included:

- GroundTruth
- WESSA
- DUCT
- Students & lecturers from UKZN
- 26 attendees

Activity:

Students presented on research topics associated with water resources

Youth Water Workshop

Mphophomeni Sanitation Education Project (MSEP)

6th Sept 2014

Activity:

- miniSASS training
- Teaching about water resources



Included:

- DUCT EcoClub
- EnviroChampions
- 45 attendees

SADC Citizen Science Network Training Symposium

30th Sept – 2nd Oct 2014



Activity:

- miniSASS training
- Clarity tube
- EnviroPicture Building etc.

Included:

- Delegates representing different SADC countries
- GroundTruth & WESSA
- 55 attendees

Cata Cultural Village Community Workshop

4th October 2014

Activity:

- miniSASS training
- Introduction to Stream Ecology



Included:

- Local community members of the Cata Cultural Village, Eastern Cape
- GroundTruth & WESSA
- 10 attendees

Centre for Environmental Rights (CER) Workshop

20-21th October 2014

Activity:

miniSASS training
Sannieshof
community

Included:

- CER staff
- GroundTruth
- 30 attendees



Ecological Infrastructure Workshop

28th October 2014

Included:

- Traditional Leaders from the uMgungundlovu district municipality
- WESSA
- GroundTruth
- 34 attendees

Activity:

Introduction and training with citizen science tools- miniSASS, clarity tube and EnviroPicture Building etc.



New Generations Plantations Study & Tour

October 2014

Activity:

- miniSASS training

Included:

- International foresters; WWF – local & international; Mondi; local farmers, GroundTruth



St Anne's school biodiversity study & frogging evening

November 2014



Activity:

Assessing the various plants and animals present within the local wetland

Included:

- St Anne's EnviroClub
- Teachers
- GroundTruth
- 25 attendees



TriWaters Tour

January - March 2015



Included:

Triwaters adventurers Franz Fuls and Brett Merchant



The team paddled for about 2,500 kilometers, from the source of the Vaal River to the mouth of the Orange River in Alexander Bay – March to May 2015.



Activity:

River Talks

These informed local residents and schools surrounding the Vaal and Orange River on how to use miniSASS.



Ecological Infrastructure Workshop

5th February 2015

Included:

- Local Msunduzi Municipality officials
- GroundTruth
- WESSA
- 15 attendees

Activity:

Introduction and training with citizen science tools- miniSASS, clarity tube and EnviroPicture Building



World Water Forum (Korea)

April 2015

Activity:

Simon Bruton (GroundTruth) facilitated two miniSASS field assessments and training in Korea. Presented on miniSASS at the conference



Included:

- International delegates
- Youth
- Citizens
- media
- 35 attendees attended two training sessions



“WWF Journey of Water”

13th May 2015

Included:

- Rapper “ProVerb” and other celebrities
- Miss Earth of 2015, Ilze Saunders
- Dusi King, Andrew Birkett



Activity:

- miniSASS practical
- Clarity Tube demo