



WISA 2014

Development of WRC Web-enabled (and Supportive Spreadsheet-based) Wastewater Risk Abatement Planning Tools

P.F. de Souza, M. van der Merwe-Botha, V. Naidoo and U. Jack

Presentation Roadmap

1. Background
2. Aims & Methodology
3. Site visits and piloting
4. Web- and spreadsheet tools
5. Discussion and Way Forward



Background

- DWA Green Drop Certification requirements → risk-assessment based regulatory approach
- W₂RAP → primary tool to assess and monitor the performance of wastewater services
- WRC → developed a W₂RAP guideline
- Previous WRC project created web- and spreadsheet-based water safety plan tools → opportunity to create WRC web- and spreadsheet-based W₂RAP tools
- Web-based reporting systems and automatically generated risk assessment reports offer cost saving, time saving, reliability advantages and the potential for enhanced management oversight

Methodology

1. Project initiation
2. Develop spreadsheet based W₂RAP tool and W₂RAP Checklist tool
3. Pilot draft spreadsheet tools
4. Develop web-enabled W₂RAP tool and W₂RAP Checklist tool
5. Pilot draft web-based tools
6. Workshops
7. Final tools refinement, on-going review and promotion
8. Draft and Final Guideline Document



Pilot Sites

- Site selection considered:
 - Different types of WW systems
 - Who needs W₂RAPs?
 - Who is keen to participate/champion?
- Spreadsheet version
 - Hantam Municipality (NC)
 - Hessequa Municipality (WC)
 - Amajuba District Municipality (KZN)
- Web version
 - As above, and including Sol Plaatje (NC)



W₂RAP Tools

1. Wastewater Risk Abatement Plan Tool

- Web-based and supportive spreadsheet-based
- Allows development and tracking of a W₂RAPs

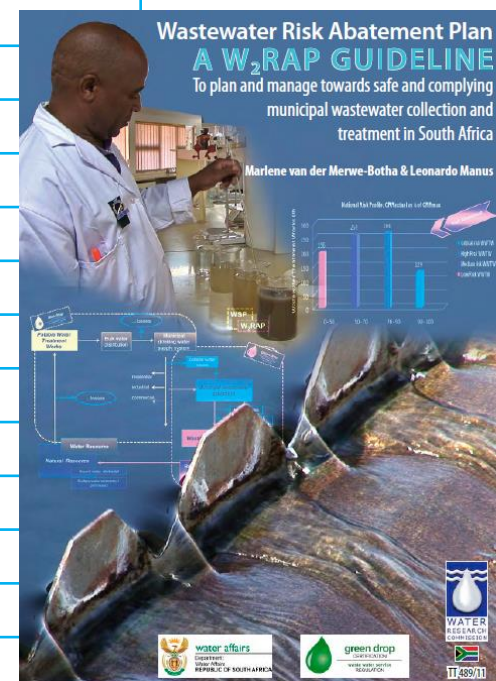
2. Wastewater Risk Abatement Planning Status Checklist Tool

- Web-based and supportive spreadsheet-based
- Allows the user to determine status of W₂RAP processes - i.e. Where are we? What have we completed? What must we still do?



W₂RAP: Workflow

Component	
1	Record of Completion
2	Assemble the W ₂ RAP Team
3a	Document and Describe the Wastewater System
3b	Develop a Basic Flow Diagram of the Wastewater System
4	Sewer Collection System Evaluation
5	Assessment of Collection System Risk
6	Wastewater Treatment Evaluation
7	Assessment of Wastewater Treatment Risk
8	Sludge Management Evaluation
9	Assessment of Sludge Management and Disposal Risk
10	Non-Reticulated Systems Evaluation
11	Assessment of Non-Reticulated Systems Risk
12	Receiving Environment and End Users Evaluation
13	Assessment of Receiving Environment and End Users Risk
14	Management and Administration Evaluation
15	Assessment of Management and Administration Risk
16	Control Measures and Corrective Actions
17a	Summary - Risk Assessment
17b	Summary - Frequency Analysis
17c	Summary - Graphs
18	Management Commitment and Sign-off



Hazardous Events

	Component	Number of Hazardous Events
1.	Collection System	81
2.	Treatment	399
3.	Sludge Management and Disposal	144
4.	Non-Reticulated Systems	23
5.	Receiving Environment and End Users	82
6.	Management and Administration	101
	TOTAL	830



Risk Matrix

RISK RATING = LIKELIHOOD X CONSEQUENCE

Likelihood	Definition	Likelihood Rating	Consequence/ Impact	Definition	Consequence/ Impact Rating
Almost certain	Once per day or permanent feature	5	Catastrophic	Death expected from exposure	25
Likely	Once per week	4	Major	Population exposed to significant illness	20
Moderately likely	Once per month	3	Moderate	Moderate impact to large population	15
Unlikely	Once per year	2	Minor	Minor impact to large population	10
Rare	Once every 5 years	1	Insignificant	No impact or not detectable	5

W₂RAP (Excel): Evaluation

Wastewater Risk Abatement Planning Tool

Step 4 of 17

Collection System Evaluation

This step is:

Complete

Evaluation of Collection System

Aspect	1	Comments
Date of Assessment		
1 Percentage of area unsewered		
2 Manner of service	Pit latrines	
3 Percentage of area sewered or to be sewered		
4 Type of network in place or to be installed	Standard systems	
5 Location of sewers	Midblock	
6 Protection (e.g. covers, enclosures, access)	No	
7 Is any pre-treatment performed at sewage pump stations (e.g. screens installed)?	Yes No	
8 Nature of sewerage		
9 Domestic component		
- Existing volume (daily)		
- Projected volume (daily)		
10 Industrial component	Yes	
- Existing volume (daily)	Yes	
- Projected volume (daily)	No	
11 Type of industrial waste		
- List potential problematic constituent/s received from industries		
12 Stormwater ingress or influx	Yes	
13 Groundwater ingress or influx	Yes	
14 Potable water ingress or influx	Yes	
15 Seasonal variations	Yes	



W₂RAP (Excel): Risk Assessment

Wastewater Risk Abatement Planning Tool

Step 5 of 17

Assessment of Collection System Risk

This step is:

Incomplete

Risk Profile

Risk Profile

No The hazard is not applicable in this instance.

Low These are systems that operate with minor deficiencies. Usually the systems meet the wastewater quality parameters specified by licences/authorisations.

Moderate These are systems with deficiencies which individually or combined pose a high risk to wastewater quality and human health. These systems would not generally require immediate action but the deficiencies could be more easily corrected to avoid future problems.

High These are systems with major deficiencies which individually combined pose a high risk to wastewater quality and may lead to potential health and safety or environmental concerns. Once systems are classified under this category, immediate corrective action is required to minimize or eliminate deficiencies.



Collection System									
Potential Hazards or Hazardous Events	Valid Hazard	Root Cause / Risk Category	Likelihood	Rating	Consequence	Rating	Risk Rating	Risk Profile	Comment
Pump Stations									
1 Pump failure (e.g. pump malfunction, power failure, incorrect settings) may result in low flow/no water supply.	Yes	Operation (incl. safety)	Likely	4	Major	4	16	Moderate Risk	
2 Natural disasters (e.g. storm, earthquake, flood) may damage or destroy pump station resulting in contaminated/no water supply.	Yes	Operation (incl. safety)	Almost certain Likely Moderately likely Unlikely Rare Not applicable	5	Catastrophic	5	25	High Risk	
3 Man made incidents (e.g. truck accident) may damage or									

W₂RAP (Excel): Summary

	A	B	C	D	E	F	G	H	
1	Wastewater Risk Abatement Planning Tool								
2	Step 17 of 17								
3	Summary - Risk Assessment								
4	NOTE: The results presented below are automatically populated from previous inputs - DO NOT MODIFY HERE								
5	<i>To prioritise residual risks (considering control measures), users need to click on "Residual Risk Rating" (column I), then select "Data", "Sort by", "Residual Risk Rating", "Descending" from the top menu.</i>								
6	<i>If additional corrective actions have been completed, users can "Sort by", "Residual Risk Rating", "Descending" and then by, "Corrective Action Completed?", "Ascending". Actions not yet completed (i.e.</i>								
7	Summary Status and Ranking								
8	Component	Sub-Component	Potential Hazards or Hazardous Events	Valid Hazard / Hazardous Event	Root Cause / Risk Category	Risk Rating	Risk Profile	Control Measure in Place (if any)	Validation of Co
9	Collection	Pump Stations	Mechanical pump failure (e.g. pump malfunction) may result in overflow/spillage resulting in contaminated environment/impact on human health.	No	Scientific	60	Moderate Risk	0	0
10	Collection	Pump Stations	Electrical pump failure (e.g. power failure) may result in overflow/spillage resulting in contaminated environment/impact on human health.	Yes	Planning/Design	30	Low Risk	0	0
11	Collection	Pump Stations	Natural disasters (e.g. storm, earthquake, flood) may damage or destroy pump station resulting in contaminated environment/impact on human health.	Yes	Operation	45	Moderate Risk	0	0
12	Collection	Pump Stations	Man-made incidents (e.g. truck accident) may damage or destroy pump station resulting in resulting in contaminated environment/impact on human health.	Yes	Maintenance	60	Moderate Risk	0	0
13	Collection	Pump Stations	Vandalism or sabotage may damage equipment and infrastructure resulting in contaminated environment/impact on human health.	Yes	Management	75	Moderate Risk	0	0
14	Collection	Pump Stations	Poor hygiene during pump maintenance or repair can result in impact on human health.	Yes	Human Resources	125	High Risk	0	0
15	Collection	Pump Stations	Poor pump monitoring/checks can lead to contaminated environment/impact on human health.	Yes	Management	80	High Risk	0	0
16	Collection	Pump Stations	Accidental sudden pump shutdowns or valve closures can lead to pressure transients or water hammer, which can lead to pipe bursts.	Yes	Budget	50	Moderate Risk	0	0
17	Collection	Pump Stations	Flooding leading to contaminated water entry through above-ground hydrants or air valves.	Yes	Procurement	100	High Risk	0	0
18	Collection	Pump Stations	Infrastructure (e.g. pumps) is old and more prone to breakdown or need repair.	Yes	Procurement	100	High Risk	0	0
19	Collection	Pump Stations	Pump stations do not have screen cages for screenings.	Yes	Budget	125	High Risk	0	0
20	Collection	Pump Stations	Screens are not regularly maintained to avoid/minimize blockages.	Yes	Scientific	60	Moderate Risk	0	0
21	Collection	Pump Stations	Structural integrity – civil structure failure may lead to failure to provide services.	Yes	Maintenance	75	Moderate Risk	0	0
22	Collection	Pump Stations	Failure of alarms and monitoring equipment may result in unsecure structures.	Yes	Scientific	50	Moderate Risk	0	0
23	Collection	Pump Stations	Uncontrolled discharge from tankers along the reticulation system may result in nuisance conditions and possible pollution.	No	Not applicable	0	No Risk	0	0
			Design deficiencies may result in ineffective system						

W₂RAP (Web)



RiskQ

TRANSFORM RISKS INTO OPPORTUNITIES



Log in

Take a Tour



What is RiskQ?

RiskQ has been developed with the purpose of providing assistance with:

Tool Features

W₂RAP (Web)

→ SECTION: 1 of 15 – Record of Completion

RiskQ

HANTAM MUNICIPALITY



Name of system:

Save

Cancel



Not applicable

1. Name

2. Title/Job Description

3. Water Services Authority

4. Wastewater System Name

5. Address

6. Province



7. Postal Code

8. Telephone

W₂RAP (Web)



SECTION: 5 of 15 - Collection Risk Assessment

5.1 Pump Stations

Not applicable

	Valid Hazard	Risk Category	Root Cause	Likelihood	Consequence
Mechanical pump failure (e.g. pump malfunction) may result in overflow/spillage resulting in contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	<div> Not applicable Almost certain (once a day) Likely (once a week) Moderately likely (once a month) Unlikely (once a year) Rare (once in 5 years) </div>	Not applicable <input checked="" type="checkbox"/>
Electrical pump failure (e.g. power failure) may result in overflow/spillage resulting in contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>		Not applicable <input checked="" type="checkbox"/>
Natural disasters (e.g. storm, earthquake, flood) may damage or destroy pump station resulting in contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>
Man-made incidents (e.g. truck accident) may damage or destroy pump station resulting in resulting in contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Likely (once a week) <input checked="" type="checkbox"/>	Minor (small aesthetic impact) <input checked="" type="checkbox"/>
Vandalism or sabotage may damage equipment and infrastructure resulting in contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>
Poor hygiene during pump maintenance or repair can result in impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>
Poor pump monitoring/checks can lead to contaminated environment/impact on human health.	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>
Accidental sudden pump shutdowns or valve closures can lead to pressure transients or water hammer, which can lead to pipe bursts	Yes <input checked="" type="checkbox"/>	Safety <input checked="" type="checkbox"/>	Planning / Design <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>	Not applicable <input checked="" type="checkbox"/>

W₂RAP (Web): Summary

No risk The hazard is not applicable in this instance.

Low risk These are systems that operate with minor deficiencies. Usually the systems meet requirements specified by the appropriate guidelines/standards.

Medium risk These are systems with deficiencies which individually or combined pose a high risk. These systems would not generally require immediate action but the deficiencies could be more easily corrected to avoid future problems.

High risk These are systems with major deficiencies which individually combined pose a high risk and may lead to potential health/safety/environmental/etc concerns. Once systems are classified under this category, immediate corrective action is required to minimize or eliminate deficiencies.

Component	Hazard	Valid Hazard	Category	Risk Rating	Risk Profile	Residual Risk Rating	Residual Risk Profile	Control measures	Completed?
7.1 General - Wastewater Treatment	Complaints of wastewater leaks (by community or surrounding residents)	Yes		80	High Risk	16	Medium Risk	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7.1 General - Wastewater Treatment	Natural disasters (e.g. storms, earthquake) can damage treatment unit operations.	Yes		80	High Risk	80	High Risk	<input type="checkbox"/>	<input type="checkbox"/>
7.7 Primary Treatment: Oxidation Pond Systems	The banks of the oxidation pond systems have weeds and are not protected from erosion.	Yes		20	Medium Risk	20	Medium Risk	<input type="checkbox"/>	<input type="checkbox"/>
5.1 Pump Stations	Mechanical pump failure (e.g. pump malfunction) may result in overflow/spillage resulting in contaminated environment/impact on human health.	Yes		12	Medium Risk	9	Low Risk	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

W₂RAP Checklist

SECTION 3

2. W₂RAP CHECKLIST

	YES	NO
1. Has a multi-disciplinary team of experts been assembled to carry out the W ₂ RAP development?	<input type="checkbox"/>	<input type="checkbox"/>
2. Has the team been informed of their duties and commitment?	<input type="checkbox"/>	<input type="checkbox"/>
3. Has the wastewater treatment system been described? (i.e. has each step in the system been considered for range and magnitude of hazards that may be present, and the ability of existing processes and infrastructure to manage actual or potential risk)	<input type="checkbox"/>	<input type="checkbox"/>
4. Following the description of the system above, has all the information been documented on three levels: catchment, collection and treatment?	<input type="checkbox"/>	<input type="checkbox"/>
5. Has the system been assessed and a flow diagram constructed?	<input type="checkbox"/>	<input type="checkbox"/>
6. Has the flow diagram been further developed to allow for flow and quality in-, during-, and out of the plant?	<input type="checkbox"/>	<input type="checkbox"/>
7. Have these hazards been identified and prioritised using the hazard assessment matrix provided?	<input type="checkbox"/>	<input type="checkbox"/>
8. Are there critical control points and control measures in place to reduce the identified hazards?	<input type="checkbox"/>	<input type="checkbox"/>
9. Is there a system in place to monitor the control measures?	<input type="checkbox"/>	<input type="checkbox"/>
10. Have corrective actions been identified for each control measure, especially if	<input type="checkbox"/>	<input type="checkbox"/>

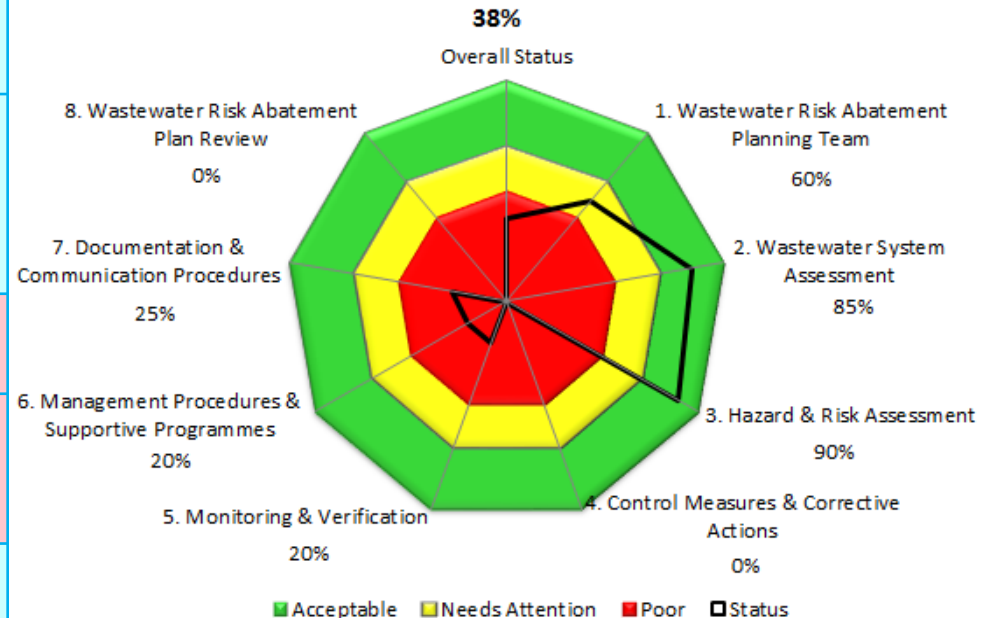


W₂RAP Status Checklist Tool: Excel

7. Documentation & Communication Procedures

7.1	All relevant W2RAP information is documented (e.g. monitoring plans, management procedures) and aligned to other relevant plans (e.g. GDIP, WSDP, IDP)	3
7.2	Communication strategies, procedures and protocols have been developed and implemented (i.e. how/what/when to communicate via media, internet, reports)	2
7.3	A customer complaints register/system is functional and complaints are tracked/resolved	1
7.4	Customer service systems are in place to immediately inform customers of service interruption, contamination of rivers, etc.	1
7.5	Regular awareness campaigns are conducted to inform customers of wastewater system activities, resource protection, reporting incidents, etc.	3

Wastewater Risk Abatement Planning (W₂RAP) Status - Calvinia



W₂RAP Status Checklist Tool: Web

SECTION: 2. Wastewater Risk Abatement Planning Team

TO SAVE, click on the "Next" or "Continue Later" button.

Not applicable

1. A multi-disciplinary team of experts has been assembled to carry out the W2RAP

Neutral (partially complete/in progress) ▼

2. The W2RAP team has been informed of their duties and is committed to the process

Neutral (partially complete/in progress) ▼

3. A W2RAP methodology (e.g. steps 1 - 10) has been defined and agreed by the W2RAP team

Strongly agree (fully complete) ▼

4. The W2RAP team regularly meets to discuss issues, review progress, etc

Disagree (just started) ▼

5. W2RAP development and implementation is funded and supported by top management

Strongly disagree or don't know ▼

Back

Next

Continue later



W₂RAP Status Checklist Tool: Web

RiskQ

HANTAM MUNICIPALITY

cheslynbs

Toolbox

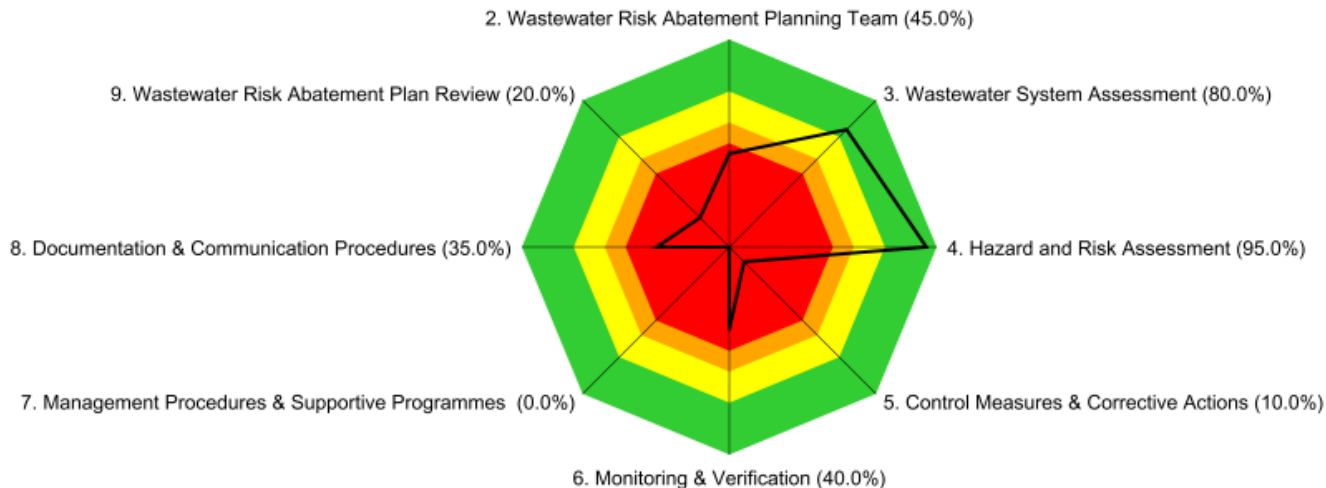
Name Calvinia Wastewater Pond System

Submitted By Cheslyn Barnes-September

Date 18 February 2014

WRC W2RAP (Wastewater Risk Abatement Plan) Status Checklist Tool

■ 0 - 50% (Very High Vulnerability) ■ 50 - 60% (High Vulnerability) ■ 60 - 75% (Moderate Vulnerability) ■ 75 - 100% (Low Vulnerability)



[Return to questionnaires](#)

W₂RAP Draft Tools: User Feedback

- The tool helps us to develop our own W₂RAPs
- Although it takes some time, the tool is easy to complete
- Provides a summary of high priority risks → can rank risks and link to specific root causes
- Ability to calculate residual risk and provision of examples of corrective actions is useful
- Gives us clear guidance on the W₂RAP process (but probably need further training for some staff to understand W₂RAPs)
- Can easily produce a report for feedback to council/stakeholders and/or upload (e.g. GDS)

→ **Recommendations used to refine/improve tools**

Insights Gained from Piloting

- Implementation of W₂RAPs is a challenge as many municipalities do not have enough sufficiently skilled operational and maintenance staff
- Early W₂RAPs only focussed on risks identified at the wastewater treatment works (and did not consider other components e.g. collection system)
- The pilot municipalities acknowledged the value of managing wastewater services using the W₂RAP principles and gained an improved understanding of their challenges
- Need for on-going guidance to understand W₂RAP, more easily complete a W₂RAP and flagging high risk issues

W₂RAP: User Considerations

- Ownership by municipalities
 - Tools help identify & understand issues
 - **SO WHAT?? Plan means little without ACTION!**
- Need to create a prioritized plan of items that will be addressed
 - Consider risk ranking and risk reduction ratio
- Tool outputs can be easily copied/pasted into a W₂RAP Report
- W₂RAP must be implemented; effectiveness of actions implemented/budget spent must be reviewed



Way Forward

- Continue to refine spreadsheet/web-based tools
- Workshops
 - **WISA 2014 (Wed, 28th May 13:20)**
 - **Impala Room Workshop 22**
 - 2 other workshops (NC & KZN)
- Guideline document



Acknowledgements

- WRC
- Input and feedback by municipalities, DWA, Reference Group and other sector role players



Thank you!