Web Enablement of a Water Safety Plan via the Municipal-based Electronic Water Quality Management System (eWQMS)

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Abstract
Despite a good legislative framework, South Africa faces significant challenges in the sustainable provision of adequate and safe water services. To improve the situation, South Africa's Department of Water Affairs (DWA) and other water sector partners undertook initiatives to assist municipalities with operation and management of water services. By way of example, in 2006, the municipal engineering oriented electronic Water Quality Management System (eWQMS) was implemented, providing municipalities with a platform for loading drinking water quality data and tracking performance of key water services management functions. Following this in 2008, DWA introduced an incentive-based regulatory programme, Blue Drop Certification (BDC), and the associated regulatory drinking water quality information system, the Blue Drop System (BDS) which is, for example, populated with data loaded by municipalities onto eWQMS. An integral part of BDC is the development of Water Safety Plans (WSPs). Due to the challenges faced by municipalities in developing WSPs, the Water Research Commission (WRC) saw a need to assist municipalities, and subsequently a generic Water Safety Plan for Small Community Water Supplies was developed. The WRC also saw the need to develop an easy-to-use WSP tool for municipalities. The eWQMS was selected as the platform for making the tool available. This paper will present the development of a web-enabled WSP tool on the eWQMS which ultimately will provide the information to the BDS.

Keywords
BDS; Blue Drop System, electronic Water Quality Management System; eWQMS; water safety plan

BACKGROUND

Water Services in South Africa

The provision of safe drinking-water and effective sanitation are considered the most important determinants of public health. Despite a good legislative framework, South Africa, like many developing countries, faces significant challenges in the sustainable provision of adequate and safe water services. Accountability for water services in South Africa has been delegated to municipalities. Although there has been considerable success in addressing water services backlogs, many municipalities continue to have inadequate drinking water and effluent treatment processes. Associated water quality management practices still needs improvement including sufficient water quality monitoring, structured maintenance, improved awareness and staff capacity to effectively perform functions. These shortcomings sometimes result in drinking water and effluent quality not meeting legislative standards, a lack of monitoring data and information to guide improved service delivery as well as interventions in areas where water quality threats exits to health.

To improve the situation, South Africa's Department of Water Affairs (DWA) (water services sector leader and national regulator) and other water sector partners (Institute of Municipal Engineering of Southern Africa (IMESA), Water Research Commission (WRC), South African Local Government Association (SALGA)) undertook various initiatives to assist municipalities with water services operation and management. In particular, a need existed for a water quality data capture and information dissemination tool, which would both assist municipalities to meet their

responsibilities, and meet DWA's needs to monitor and regulate municipalities. Consequently, a comprehensive municipal engineering oriented electronic Water Quality Management System (eWQMS) was implemented at all 166 municipalities in South Africa in 2006. Following this in 2008, DWA introduced an incentive-based regulatory programme, Blue Drop Certification which included the development of DWA's regulatory drinking water quality information system, the Blue Drop System (BDS). An integral part of Blue Drop Certification is the development of Water Safety Plans (WSPs). Due to the challenges faced by municipalities to develop WSPs, the WRC saw the need to provide municipalities with a WSP orientated tool. Consequently a generic Water Safety Plan for Small Community Water Supplies (Thompson and Majam, 2009) was developed as a guideline for municipalities. The obvious need to further assist municipalities in developing WSPs led to a project to expand the current risk assessment based tools already available on the existing municipal management system (eWQMS) via web-enablement of a WSP. This would potentially not only reduce the costs to municipalities for preparing WSPs, but WSP information captured onto the municipal eWQMS could also be passed onto the BDS for regulatory purposes.

The Electronic Water Quality Management System (eWQMS)

The eWQMS is a novel Open Source Software based system which is able to guide (i) regulatory compliance by municipalities, (ii) the timely supportive intervention in water quality failures, (iii) infrastructure improvement, and (iv) capacity development of municipal staff. The eWQMS is accessible via the internet (http://www.wqms.co.za), and allows a range of participating parties to guide the tracking, reviewing and improving of water quality. Importantly, the eWQMS is a management system for municipalities that has been developed in a "bottom up" approach with inputs by municipalities, IMESA, the DWA and the WRC. The eWQMS has won national and international awards, including the International Water Association's Project Innovation European and Global Awards for 2008 (Category: Operations and Management). Features include: (i) Management Dashboard (sample sites satisfying and/or failing water quality requirements), (ii) Compliance Overview (summary of legislative compliance), (iii) Data Analysis (dynamically generated tables and graphs), (iv) Reports (archive of water quality management reports), (v) Monthly Summary Reports (automatically generated reports), (vi) Information (drinking-water related information and references), (vii) Infrastructure (capture details of water system infrastructure – basic asset register), (viii) Administration (configure and manage system set-up) and (ix) Risk Toolbox (municipalities can perform a self-assessment/health check of infrastructure, etc). To assist municipalities, new tools are continuously added to the eWQMS.

Water Safety Plans

A Water Safety Plan (WSP) is a risk management tool which encompasses the water management chain from catchment to consumer, seeking to identify hazards that the water resource and supply system are exposed to and the level of risk associated with each. In so doing the process allows for better understanding of water supply systems. Once the level of risk has been identified, control measures can be put into place to mitigate these risks. The plan also needs to identify systems by which these measures are implemented and monitored. Management plans describing actions taken during normal operation or incident conditions and documenting the system assessment (including upgrade and improvement), monitoring and communication plans and supporting programmes are included.

Within South Africa there has been an exponential growth of small treatment plants, many of which are situated in rural areas with limited technical support. At present there are no comprehensive national guidelines to manage the supply system from source to consumer and the WSP seeks to address this need. In South Africa, most municipalities became aware of WSPs as part of the introduction of DWA's Blue Drop Certification programme (late 2008). Furthermore, the DWA

supports international best practices and consequently indicated that it expects municipalities to manage their water supply systems against WSPs. Water safety plans have therefore been adopted as a tool to fulfil the objective of ensuring safe drinking water supply through the use of a comprehensive risk assessment and risk management approach. Through these processes, the WRC saw a need to assist municipalities in developing WSPs (which lead to the development of a generic WSP for Small Community Water Supplies (Thompson and Majam, 2009)) and then to develop an easy-to-use tool for municipalities to complete a WSP. The eWQMS, the municipal water quality management tool and already accessible to all municipalities in South Africa, was selected as the ideal platform for such a tool.

DWA's Blue Drop Certification Process

On 11 September 2008, the DWA in South Africa was first to introduce an incentive-based regulatory programme, termed Blue Drop Certification. The programme publicly reports on the Drinking Water Quality Management Performance of municipalities (which include the actual DWQ against the country's standard) while excellent performance is recognised with acknowledgement of Blue Drop Status. The 1st Blue Drop assessments occurred late 2008/early 2009 with 66% of municipalities participating, the 2nd round of assessments occurred late 2009/early 2010 with 94% municipalities participating. Information required for Blue Drop assessments (and other regulatory requirements) needs to be available on the DWA internet based drinking water quality regulation system, known as the Blue Drop System (BDS) (http://www.dwa.gov.za/bluedrop). Blue drop evaluations occur against 9 criteria with an incremental implementation over three years of the contributing individual criterion weightings. Scoring for the 2nd assessments comprised the below criteria, noting that scoring for implementation of water safety plans will increase significantly during future assessments:

1. Water safety plan (5%)
2. Process control, maintenance and management skill (10%)
3. Drinking water quality monitoring programme (15%)
4. Drinking water sample analysis (credibility) (5%)
5. Submission of drinking water quality results (5%)
6. Drinking water quality compliance (30%)
7. Drinking water quality failure response management (15%)
8. Publication of drinking water quality management performance (5%)
9. Drinking water asset management (10%)

Several improvements were noted during and following the second round of Blue Drop assessments including a better understanding by municipalities of the assessment criteria and improvements to the assessment process. The final Blue Drop performance score allocated to municipalities was furthermore calculated against evaluation of all 9 criteria (and not only 6 that constituted the score during the 1st assessment). Water Safety Plans, Asset Management and DWQ Performance Publication although evaluated during the 1st assessment, weighted zero while it accumulatively accounted for 25% of the weighting during the 2nd assessment. The 2nd round of assessments saw almost double the 1st round assessment of water supply systems (from 440 assessments in 2009 to 787 in 2010). The number of water supply systems receiving Blue Drop Certification increased from the first to the second round (23 to 38 systems) (DWA, 2010).

AIMS AND METHODOLOGY

The main aim of the project was to web-enable a WSP tool via the eWQMS. To achieve this, the following project methodology was utilised:

- Carry out technical discussions with key stakeholders and a technical workshop with selected municipalities to present and review any current WSP related risk assessment tools.

- Collate feedback from the discussions/workshop and develop an appropriate WSP tool for South Africa.
- Web-enable the WSP tool via the eWQMS (accessible to all South African municipalities).
- Select a number of municipalities and test the WSP tool via site visits/assessments.
- Develop step-by-step guidelines for users of the WSP tool.
- Carry out an information transfer workshop and train selected municipalities.

This paper will specifically highlight the process followed to develop and refine the web-based WSP tool, and its use to date.

RESULTS AND DISCUSSION

Key Observations from Initial Development and Use of Water Safety Plans in South Africa

Considering the DWA's requirement for municipalities to develop a WSP, it is important to note that DWA do not specify the format of the WSP, and only requires municipalities to use international and national best practices and guidelines (e.g. WHO, WRC, etc.) to ensure development and implementation of an acceptable WSP. In order to obtain the relevant Blue Drop score for the WSP criterion, municipalities were required to provide proof that (i) a WSP inclusive of risk assessments from catchment to consumer has been developed, (ii) the WSP included defined roles and responsibilities, (iii) the WSP specified deadlines for management actions/commitment to fund implementation, and (iv) risk assessment findings had been implemented.

One interesting observation from the 2nd round of Blue Drop Certification assessments was that only 154 of the systems assessed (~20%), had a WSP in place, and that some of the WSPs only had the risk assessment section completed (i.e. WSP not fully implemented). A clear need therefore existed to assist municipalities with both compiling and implementing a WSP. In particular, experience from the KwaZulu Natal province showed that:

- Implementation of plans is seen as a challenge since many municipalities do not have enough sufficiently skilled operational and maintenance staff.
- Many of the WSPs focussed on risks identified at the water treatment plants only, the entire water supply chain was not considered.
- It must, however, be noted that some municipalities submitted comprehensive WSPs which addressed risks from catchment to consumer. Some of these municipalities used available tools such as the draft WSP spreadsheet tool (described later and shown in Figure 1).
- Most municipalities acknowledged the value of managing drinking water using the WSP principles and gained an improved understanding of their challenges.
- Guidance to more easily complete a WSP and flag high risk issues was expressed by municipalities. In particular, software to assist the process was requested.

Additional to the above, comments/challenges highlighted following development of a WSP within the Stellenbosch Municipality (Western Cape) include:

- Considering what the municipality experienced as limited time available to compile a WSP, and being unsure of the process or what development of a WSP entailed, a consultant was appointed to facilitate the process and develop the WSP on behalf of the municipality.
- Development of the WSP took approximately two months. The process was regarded time consuming as Stellenbosch Municipality has a relatively complex system, with a mix of municipal supplied communities and external service provider supplied communities.
- Although Stellenbosch Municipality had most of the required policies, protocols and procedures, these were not always up to-date (i.e. required revision) and not centrally located.
- Stellenbosch Municipality, acknowledging the value of the WSP, compiled a comprehensive WSP and included site visits to all water sources and water treatment facilities (a desktop

assessment of the network was conducted).

- Although the WSP has not yet been implemented, the municipality anticipates that as the Blue Drop Certification programme is currently a high profile indicator of municipal performance, this will be a priority item and that funding for addressing high risk issues will be forthcoming.
- A need to easily complete a WSP and assistance with tracking implementation corrective actions to resolve high risk issues was identified.

Consideration of the above observations was crucial to developing an appropriate WSP tool.

Development of Spreadsheet Based Water Safety Plan Tool

Utilizing project team experience and available literature sources, an initial database of hazards/risks was initially created. However, prior to developing a web-enabled WSP tool, a spreadsheet based WSP tool was first developed for stakeholder/user comment and feedback. In this way, it was possible to quickly develop the tool, obtain stakeholder/user feedback (e.g. addition of new hazards, usability improvements), modify the tool, and use this to develop an appropriate and sector accepted user specification (before any costly IT development commenced). This would ensure that upfront both the required functionality was clearly understood by the development team and that the stakeholders/users were aware what the outcomes of IT development would be (assisting with tool acceptance and subsequent improved use thereof). The spreadsheet tool contains a number of "evaluation" and "risk assessment" worksheets and considers the following water system components: (i) source, (ii) water treatment, and (iii) network. Most worksheets are completed by making appropriate selections from simple drop-down menus. Following completion, users could then add corrective actions and rank risks (see Figure 1).

	A	B	C	D	E	F	G	H	I	J
9										
10	**Distribution Network**									
11		Potential Hazards or Hazardous Events	Valid Hazard	Category	Likelihood	Rating	Consequence	Rating	Risk Rating	Risk Profile
12		**Protected Service Reservoir (Covered Storage Tank)**								
13	1	Animals/birds can enter through faults and contaminate the water with their droppings. If animals drown, there will be a higher level of harmful micro-organisms present.	Yes	Design	Almost certain	1	Catastrophic	100	100	High Risk
14	2	Animal/bird droppings may be washed into storages in rainwater entering through faults in the storage roof or from internally draining roofs.	Yes	Operation	Likely	0.8	Major	70	56	Medium Risk
15	3	Unauthorized human access, such as swimming in the storage tanks can cause microbial contamination.	Yes	Maintenance	Moderately likely	0.5	Moderate	20	10	Low Risk
16	4	High chlorine levels may enter the distribution system if there is poor mixing after disinfection of storages.	Yes	Design	Moderately likely	0.5	Major	70	35	Medium Risk
17	5	Resuspension of sediments containing slimes and odour producing micro-organisms may occur.	Yes	Operation	Rare	0.1	Catastrophic Major Moderate Minor Insignificant Not applicable	1	0.1	Low Risk
18	6	Vandalism or sabotage may pollute the water with chemicals or microbes or damage equipment and infrastructure.	No	Maintenance	Not applicable	0		0	0	No Risk
19		**Unprotected Service Reservoir (Uncovered Storage Tank)**								
20	1	Animals/birds can enter through faults and contaminate the water with their droppings. If animals drown, there will be a higher level of harmful micro-organisms present.	Yes	Maintenance	Almost certain	1	Catastrophic	100	100	High Risk
21	2	Animal/bird droppings may be washed into storages in rainwater entering through faults in the storage roof or from internally draining roofs.	Yes	Design	Likely	0.8	Major	70	56	Medium Risk
22	3	Growth of cyanobacteria (blue-green algae) and other algae can be a problem where storage tanks are open to sunlight.	Yes	Operation	Moderately likely	0.5	Moderate	20	10	Low Risk

Figure 1: *Example of a completed worksheet from the spreadsheet based Water Safety Plan tool*

As can be seen from the above figure, and as part of the water safety planning process, an evaluation of the various water supply system elements is conducted to determine if any hazards exist, or if any hazardous events are likely to occur, and what the risk associated with such hazards are. The following risk assessment matrix was utilised in the tool (Thompson and Majam, 2009):

Table 1: *Risk Assessment Matrix*

Likelihood	Rating	Consequence	Rating
Almost certain (once a day or permanent feature)	1	Catastrophic (Death expected from exposure)	100
Likely (once per week)	0.8	Major (Population exposed to significant illness)	70
Moderately likely (once per month)	0.5	Moderate (Large aesthetic impact)	20
Unlikely (once per year)	0.2	Minor (Small aesthetic impact)	2
Rare (1 in 5 years)	0.1	Insignificant (No impact)	1
RISK RATING = LIKELIHOOD x CONSEQUENCE			

A higher score implies that a bigger risk of a hazardous event occurring exists and should therefore be prioritised. The risk profile utilised is given below:

- Low: 0 – 10
- Medium: 11 – 56
- High: 57 – 100

Development of the Web-Enabled Water Safety Plan Tool

Using the learnings from the above development process, and to ensure that user needs are met, a technical workshop was held with selected municipalities at which the following key requirements for the web-enabled tool were articulated:

- Easy completion (similar to current risk assessment methodology on the eWQMS or not differ much from the spreadsheet based WSP tool). (It was also noted that as there are internet access limitations at some municipalities, a spreadsheet version of the tool is very useful.)
- It should provide a summary of high priority risks and allow the user to rank the risks.
- Should have the ability to include comments (e.g. able to explain or justify a decision).
- The ability to easily produce a report for upload to the BDS.
- The value and importance of the inclusion of a similar tool for wastewater aspects was highlighted (i.e. integrated water management approach, water and wastewater departments within the municipality can co-operate, good preparation for DWA's Green Drop Certification and development of Wastewater Risk Abatement Plans).
- The ability to add site specific hazards/hazardous events to the tool (i.e. flexible, can be customised per supply system).
- Acknowledgement, tracking or sign-off by appropriate manager of completed WSP requirements (e.g. manager ticks a check box to state that a system diagram has been generated).

In addition, key feedback from DWA and the WRC included the following:

- The use of the tool should ensure a cost efficient way to develop a WSP by municipalities (***NOTE:*** In South Africa, a shortage of skills at municipalities often exists, resulting in consultants being appointed to assist/complete key tasks for municipalities. By empowering municipalities with an appropriate WSP tool, municipalities can complete/develop WSPs by themselves, take ownership of the product and from a cost saving perspective, not be reliant on consultants).
- The approach should be based on available national and international best practice and guidelines; the WSP format should follow best practice/guideline requirements (i.e. utilise existing and approved methods for efficiency of effort – e.g. WRC developed risk matrix).
- The tool should not provide a user with a superficial desktop study which is then regarded as a satisfactory, comprehensive WSP (i.e. should emphasise the importance of conducting site visits/assessments; the tool is a starting point to understand what needs to be consider/address.)

- The tool should provide necessary guidance and be easy to use.

Following an extended time period for stakeholder comments and feedback, the web-enablement development component was initiated. Since complex, distributed systems (such as the eWQMS) require more coordination and formality, and as the eWQMS Team needs to maintain, use, and control the knowledge base provided by such an approach, the eWQMS systems engineering function is of a more formalised nature (i.e. not in 'agile programming' terms that are less formal) (MBV Equsys, 2009). This does not, however, mean that the systems engineering function is over-elaborate or cumbersome. The main objective is to achieve an acceptable level of maturity (good governance, best practice development) using minimum or adequate formality. The development of information systems (including eWQMS) typically includes several steps. The following process was used when developing the web-enabled WSP (de Souza et al., 2009):

1. Define user requirements and develop User Requirements Specification (URS).
2. Define high-level architectural and detailed design and system requirements and develop System Requirements Specification (SRS).
3. Develop test procedures to prove compliance with user requirements and system specifications (i.e. Unit Tests and User Acceptance Tests (UAT)).
4. Develop required functionality and perform internal tests (unit tests) against requirements.
5. Software and systems integration and acceptance testing with factory acceptance, site acceptance and system tests performed against the systems requirements specification.
6. User or site acceptance tests which are formally tested against user requirements.
7. Release of new functionality (implementation).

The web-enabled WSP tool was released at the end of January 2011.

Use of the Web-Enabled Water Safety Plan Tool

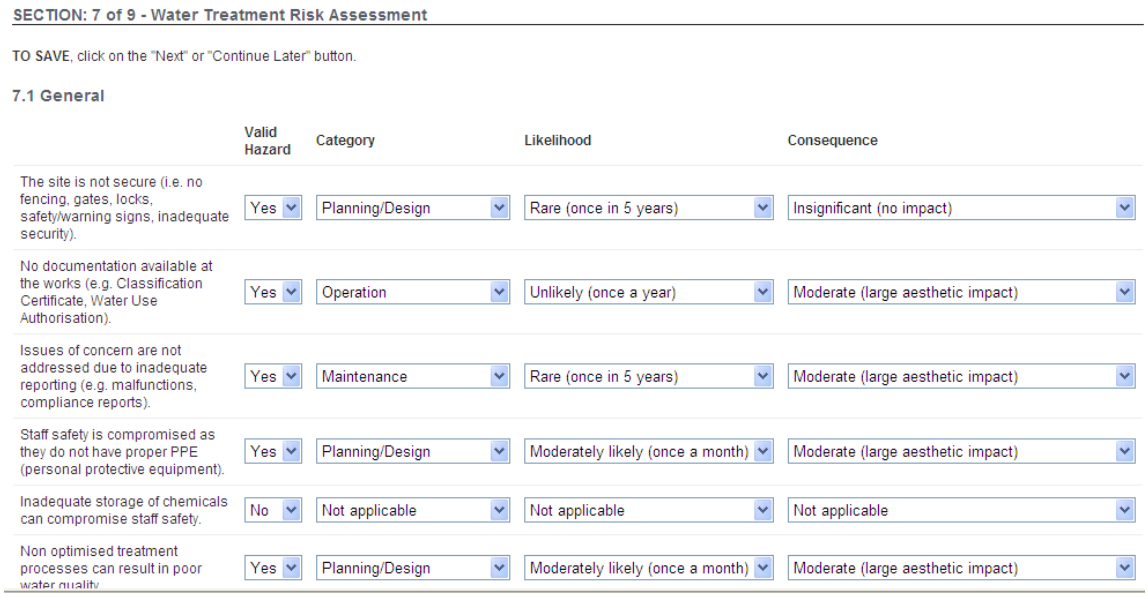
A key requirement of water safety planning is the need to conduct site visits/assessments to identify and understand the current supply system weaknesses and needs. The tool developed not only assists with ensuring that all components of the water supply system are considered, but also prompts the water safety plan team to consider the applicability of possible hazards from an exhaustive database. Typical hazards identified through the WSP process are shown below (see Figure 2).

(a) (b) (c)

Figure 2: *Examples of hazards identified from site visits: (a) site access (e.g. children swimming); (b) contamination threat (e.g. broken reservoir roof); (c) site access (e.g. reservoir fence damaged to use as a walkway)*

Following identification of hazards, photographic evidence can be used to debate and agree on an associated risk. This is easily achieved by stepwise completion of the various WSP worksheets (see Figure 3). Once the WSP has been completed, the tool ranks risks (from highest to lowest) and

allows for capturing of associated corrective actions to reduce identified risks (see Figure 4). Following this, the municipality needs to implement the identified corrective actions and track progress and associated improvements.



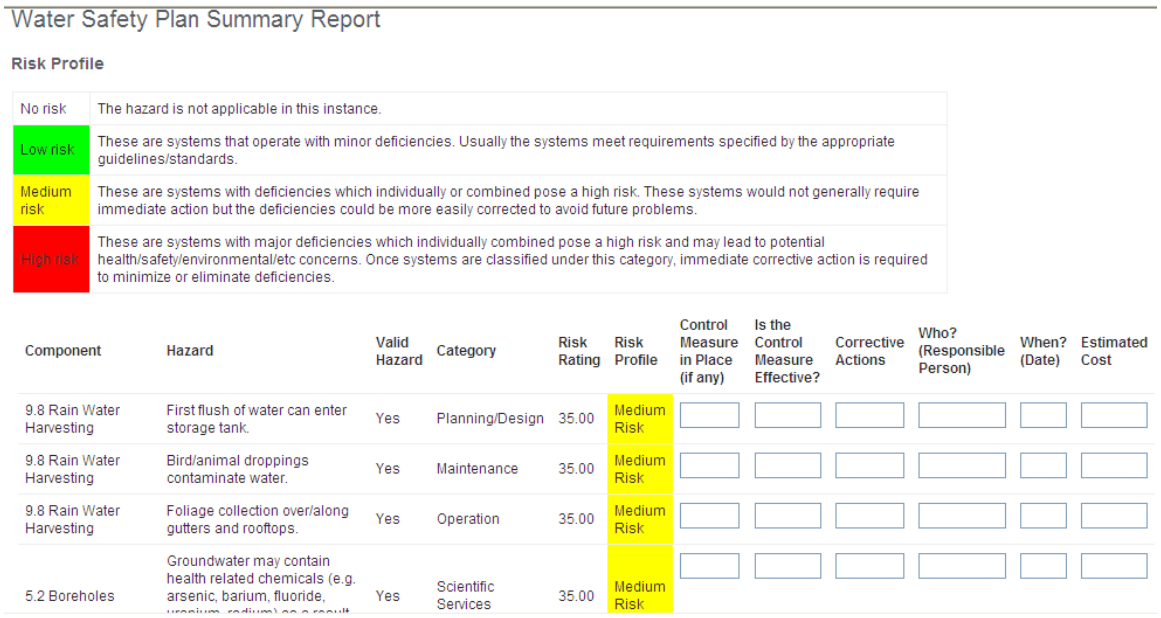
SECTION: 7 of 9 - Water Treatment Risk Assessment

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

7.1 General

	Valid Hazard	Category	Likelihood	Consequence
The site is not secure (i.e. no fencing, gates, locks, safety/warning signs, inadequate security).	Yes	Planning/Design	Rare (once in 5 years)	Insignificant (no impact)
No documentation available at the works (e.g. Classification Certificate, Water Use Authorisation).	Yes	Operation	Unlikely (once a year)	Moderate (large aesthetic impact)
Issues of concern are not addressed due to inadequate reporting (e.g. malfunctions, compliance reports).	Yes	Maintenance	Rare (once in 5 years)	Moderate (large aesthetic impact)
Staff safety is compromised as they do not have proper PPE (personal protective equipment).	Yes	Planning/Design	Moderately likely (once a month)	Moderate (large aesthetic impact)
Inadequate storage of chemicals can compromise staff safety.	No	Not applicable	Not applicable	Not applicable
Non optimised treatment processes can result in poor water quality	Yes	Planning/Design	Moderately likely (once a month)	Moderate (large aesthetic impact)

Figure 3: *Extract from water treatment risk assessment section from the Water Safety Plan tool*



Water Safety Plan Summary Report

Risk Profile

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	Control Measure in Place (if any)	Is the Control Measure Effective?	Corrective Actions	Who? (Responsible Person)	When? (Date)	Estimated Cost
9.8 Rain Water Harvesting	First flush of water can enter storage tank.	Yes	Planning/Design	35.00	Medium Risk						
9.8 Rain Water Harvesting	Bird/animal droppings contaminate water.	Yes	Maintenance	35.00	Medium Risk						
9.8 Rain Water Harvesting	Foliage collection over/along gutters and rooftops.	Yes	Operation	35.00	Medium Risk						
5.2 Boreholes	Groundwater may contain health related chemicals (e.g. arsenic, barium, fluoride,	Yes	Scientific Services	35.00	Medium Risk						

Figure 4: *Extract of ranked risks from the Water Safety Plan tool (and also highlighting how corrective actions can be captured)*

Initial key advantages identified from using the web-based Water Safety Plan tool include:

- Enhanced sharing (parties can access/edit a database at the same time)
- Enhanced security (sensitive information can be easily protected and users can be protected from making mistakes - e.g. deleting information, loading incorrect information)
- Efficiency and cost effectiveness (minimize duplication – standard format in use which is continuously enhanced), economies of scale – enhancements rapidly available to all)
- Enhanced reporting (format the same data many ways in various reports – create more interactive features/outputs)
- Ease of maintenance and lowered downtime (less likely to “break” than spreadsheet)

- Repository of information (hold much greater numbers of records than spreadsheets)
- Ability to conduct strategic analysis if sufficiently adopted (e.g. identify key threats/hazards/risks on a national basis)
- Less duplication (duplication of existing information in a new spreadsheet or creation of "copies" of existing spreadsheets – which is the latest/correct version?)

A key need identified through use of the above WSP tool was a tool to assist municipalities with identifying their current progress in the WSP process, and where attention is still required. This resulted in the development of the web-enabled Water Safety Plan Status Checklist tool.

Water Safety Plan Status Checklist Tool

Initially, many municipalities were under the impression that completion of the hazard and risk assessment component of the WSP was where the process ended. A key initial weakness in many of the Water Safety Planning processes in South Africa was therefore the implementation of the plan. In order to assist municipalities in understanding both the "full" WSP process, and rapidly assess progress in this process (i.e. "where are we and what do we still need to do"), a simple checklist tool was developed. This tool considers the typical WSP steps and asks 5 key questions per step. Municipal officials answer that they: (i) strongly agree, (ii) agree, (iii) neutral, (iv) disagree or (v) strongly disagree (see Figure 5).

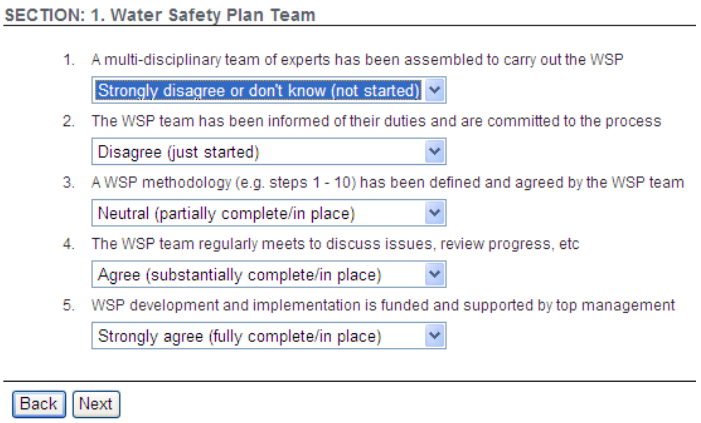


Figure 5: *Completion of the Water Safety Plan Status Checklist tool*

Based on the answers provided, a score is calculated and a colour-coded "spider-diagram" output is provided of the status (see Figure 6).

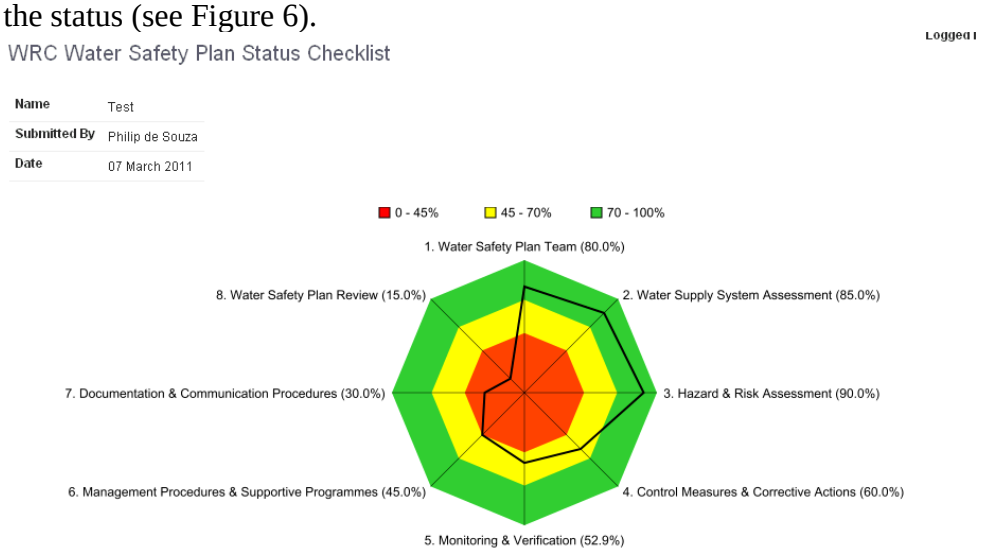


Figure 6: *Example of a completed Water Safety Plan Status Checklist highlighting a weakness in implementation of the Water Safety Plan*

By using the above tool, municipal technical staff can both check their progress, and easily communicate such progress and any associated gaps to municipal management (e.g. Councillors).

CONCLUSIONS

The need for municipalities to complete WSPs has recently been introduced in South Africa. Considering both municipal interactions and feedback from assessments of WSPs, it is clear that municipalities require assistance with development and implementation of WSPs.

Although feedback from some municipalities was that "we do all this, we just don't call it a Water Safety Plan", smaller, rural municipalities are often intimidated by the term "water safety plan" and immediately disregard development of a WSP as an impossible task. Through this project and other associated WSP experiences, municipalities have been encouraged to start small (e.g. What are your Top 5 issues?) and implement quick-wins (e.g. What can we do to fix these Top 5 issues? What other "low hanging fruit" with minimal budget implications can we tackle?). Through such a process, municipalities build confidence in their water safety planning abilities and will gradually develop more substantial WSPs. A further point of importance is that although WSPs are primarily focused on water quality issues, WSP use in South Africa has shown that ideally the scope of the WSP should be expanded to include, for example, infrastructure asset management (e.g. water losses = lost revenue), personnel health and safety and other "softer" issues (e.g. availability of staff mentoring) as these issues often cripple effective service delivery in South Africa.

To date, the use of both the spreadsheet based and web-enabled WSPs have already been shown to greatly assist municipalities with developing a WSP. However, an important message conveyed to South African municipalities is that although WSP tools have been made available to assist them, the developed plan is virtually worthless if it is not an up-to-date living document with corrective actions implemented to address identified issues of concern (i.e. need to include timeframe, responsibilities, top management sign-off of commitment, provision of budget to implement corrective actions, etc). In particular, it is advantageous if the municipality "owns" the plan (i.e. it is not the consultant's plan) and that regular meetings are held to discuss progress (Where are we? What have we done? What must we still do?).

WSPs provide water services professionals a structured and globally accepted methodology. Not only does this allow sharing of experiences and ideas, but this could also enable benchmarking and associated performance improvements. It is anticipated that on-going sector feedback will lead to continuous enhancement of the tools to the benefit of all municipalities. Both the Water Safety Plan tool and the Water Safety Plan Status Checklist tool have been made freely available for use by all municipalities in South Africa

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