Wastewater Risk Abatement Plan
(W_2RAP) Template




WATER RESEARCH COMMISSION

TT 624/14

MUNICIPALITY NAME:

SYSTEM NAME:

WASTEWATER RISK ABATEMENT PLAN (W_2RAP) TEMPLATE

DATE OF COMPLETION:

January 2015

Obtainable from:

Water Research Commission
Private Bag X03
Gezina, 0031
orders@wrc.org.za or download from www.wrc.org.za

The publication of this report emanates from a project entitled: Development of Web-enabled (and Supportive Spreadsheet-based) Wastewater Risk Abatement Planning Tools (WRC Project No. K5/2217/3). The aim of this W_2RAP template is to assist those who: (1) Do not understand the W_2RAP process, and/or (2) Do not have computers/access to the electronic tools such that they can still participate in and complete a W_2RAP.

In addition to the above W_2RAP template, the following four tools were developed through this project:

1. Web-based W_2RAP Tool
2. Web-based W_2RAP Status Checklist tool
3. Spreadsheet-based W_2RAP Tool
4. Spreadsheet-based W_2RAP Status Checklist tool

The web-based versions of the W_2RAP Tools can be accessed directly via RiskQ (www.riskq.co.za), while the spreadsheet-based versions can be downloaded via RiskQ. If you do not yet have access to RiskQ, you are welcome to test the tools using the following login details:

- www.riskq.co.za
- Username: test1
- Password: 123

If you would like your own personal access details, please contact RiskQ at Tel: 021 880 2932 or e-mail: info@riskq.co.za.

ISBN 978-1-4312-0628-5

Printed in the Republic of South Africa

Table of Contents

ABBREVIATIONS

CCT	Critical Control Points
COGTA	Department of Cooperative Government and Traditional Affairs
DWS	Department of Water and Sanitation
EHPs	Environmental health Practitioners
GDC	Green Drop Certification
GDS	Green Drop System
PFD	Process Flow Diagram
RiskQ	Web-based Risk Management Association
SALGA	South African Local Government Association
W_2RAP	Wastewater Risk Abatement Plan
WRC	Water Research Commission
WSAs	Water Service Authorities
WSIs	Water Service Institutions
WWTP	Wastewater Treatment Plant

GLOSSARY OF TERMS/DEFINITIONS

Hazard – biological, chemical, physical or radiological agent that has the potential to cause harm.

Hazardous event – an incident or situation that can lead to the presence of a hazard (what can happen and how).

R**isk** – the likelihood of identified hazards causing harm in exposed populations in a specified time frame, including the magnitude of that harm and/or the consequences.

Risk assessment – process of identifying and documenting all potential hazards and risks within the wastewater system.

Wastewater Risk Abatement Planning – systematic process that aims to consistently ensure acceptable wastewater quality that does not exceed the stipulated numerical limits in licences/permits by implementing an integrated water quality management plan, which includes a risk assessment and risk management approach from wastewater collection, through treatment and discharge to the catchment.

Water Services Authority (WSA) – any municipality that has executive authority to provide water services within its area of jurisdiction in terms of the relevant national legislation or the ministerial authorizations made in terms of the relevant national legislation.

Water Services Institution (WSI) – WSA or WSP or both.

Water Services Provider (WSP) – an entity that has a contract with a WSA or another water services provider to provide water services to that authority or provider OR a WSA that provides either both of the services described above itself OR any person who has a contract with WSA to assume operational responsibility for providing water services to one or more consumers (end-users) within a specific geographic area.

Wastewater Treatment System/Works/Plant – process or combination of processes undertaken to render wastewater/sewerage acceptable for discharge to the environment or reuse.

1 INTRODUCTION

This is a Wastewater Risk Abatement Planning (W_2RAP) Template, developed from the web-based and supportive spreadsheet-based W_2RAP tools and may be used by persons who do not have access to computers/internet and those who wish to understand the W_2RAP process.

2 PURPOSE OF THIS TEMPLATE

The purpose of this template is to:

- Briefly introduce Wastewater Risk Abatement Planning
- Highlight key steps to be considered when developing a W_2RAP
- Provide step-by-step guidance as to how to use this document
- Assist in developing and implementing W_2RAP

3 WHO SHOULD USE THE TEMPLATE?

This template is intended for use by:

- Managers of wastewater services within a Water Service Institutions (WSI)
- Water quality managers
- Environmental health practitioners
- Department of Water and Sanitation officials
- Other water sector stakeholders including South African Local Government Association (SALGA) and Department of Cooperative Governance and Traditional Affairs (COGTA)
- Water resources managers
- Any person responsible for wastewater services

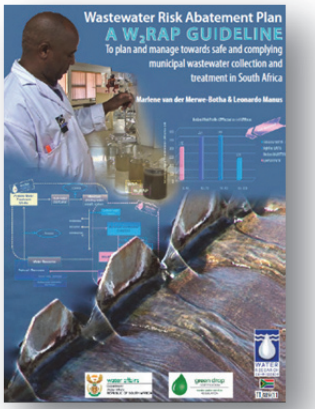
4 WHAT IS WASTEWATER RISK ABATEMENT PLANNING?

Wastewater Risk Abatement Planning is a systematic process that aims to consistently ensure acceptable wastewater quality that does not exceed the numerical limits in wastewater treatment works licences/permits by implementing an integrated risk management plan from wastewater collection through wastewater treatment and including final effluent discharge into the environment. In so doing the process allows for better understanding of wastewater systems.

Once the risk has been identified, control measures and corrective actions can be put into place to mitigate these risks. The process 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, should be included. Key components of a Wastewater Risk Abatement Planning include:

- **System assessment** – determine whether the wastewater system can deliver effluent of a quality that meets health-based and environmental targets. This should be undertaken for both current and planned new systems.
- **Identifying control measures** – conduct a risk assessment to collectively control identified risks and hazardous events and ensure that health-based and environmental targets are met. For each control measure identified, an appropriate means of operational monitoring should be defined that will ensure that any deviation from required performance is rapidly detected in a timely manner.
- **Management plans and risk management** – to develop plans describing actions to be taken during normal operation or incident conditions and documenting the system assessment (including upgrade and improvement), monitoring and communication plans and supporting programmes (Van der Merwe-Botha and Manus, 2011).

Wastewater Risk Abatement Plan (W_2RAP) includes sections such as (1) Formulate the W_2RAP team, (2) Describe the system (collection, treatment, fate of effluent and sludge), (3) Assess/evaluate the wastewater system, (4) Hazard/risk assessment, (5) Identify control measures and associated corrective actions, responsibilities, timeframes, and costs (for subsequent W_2RAP implementation), (6) Operational monitoring and maintaining control, (7) Verification that the W_2RAP is effective and meet health-based and environmental targets, (8) Management procedures for wastewater systems (9) Document and communication, and (10) Review of W_2RAP, etc.



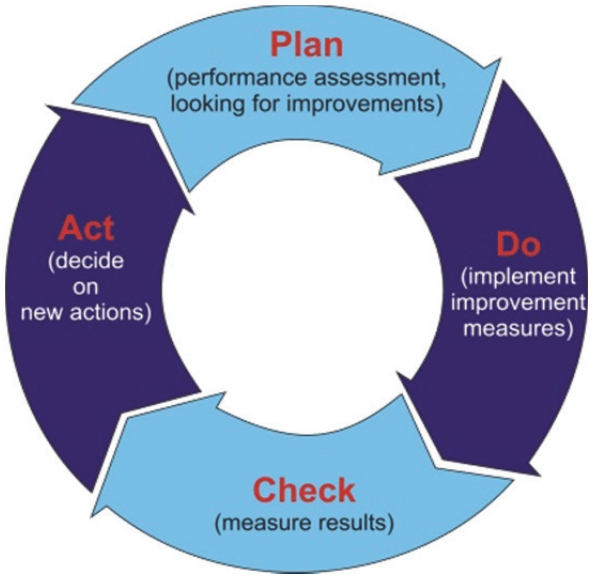
A detailed description of each of the above steps is presented in the WRC W_2RAP Guideline document (WRC TT 489/11) which was used as the basis for development of the W_2RAP web-based and supportive spreadsheet-based tools.

A W_2RAP cannot be completed as a desktop-based exercise. It must involve site visits to confirm the knowledge, information and schematics available to the Water Service Institutions (WSIs). Site visits need to include inputs from those who work at the sites and/or within catchment (from the wastewater influent till the disposal of the sludge) and have detailed local knowledge. The WSIs should take the lead in the Wastewater Risk Abatement Planning development but it is advised not to do this in isolation.

When using this tool, and in particular when conducting risk assessments, it is important that the same risk rating methodology be used throughout the WSI (i.e. all systems within that WSI are assessed using the same tool/risk rating methodology).

This tool contains the following:

- Evaluation tables where you will be required to fill in/circle "Yes/No" or "Not Applicable (N/A)" and make a comment (where possible).
- Risk Assessment tables where you will be required to first identify your Top 15 hazards/hazardous events.
- (Analysis) Summary report of your Top 15 identified risks.
- Control measures for Top 15 identified risks.
- Residual risk profile Top 15 identified risks.
- Implementation plan, including short and medium- to long-term planning.
- Management commitment and sign-off.



The tools assist in developing and monitoring implementation of a Wastewater Risk Abatement Plan. Physical implementation thereof (e.g. taking required actions, implementing corrective actions, developing and implementing management and communication procedures) of the W_2RAP depends on the Water Services Institution (WSI).

5 HAZARD ASSESSMENT AND RISK CHARACTERISATION METHODOLOGY

These tables will guide you in completing the W_2RAP steps:

- Identify hazards/hazardous events from your system by referring to the system documents and conducting site visits. It is suggested to focus on your top 15, however you may have less than that.
- For your Top 15 (or selected/identified) hazards/hazardous events, select the number representing a risk category the hazard/risk is related to (e.g. 1 for Safety or 8 for Security) (see Table 1).
- For your Top 15 (or selected/identified) hazards/hazardous events select the number representing a root cause the hazard may be as a result of (e.g. 1 for Planning & Design or 2 for Operation) (Table 2).
- Use the risk matrix (Table 3) and calculate the risk by multiplying the likelihood of a hazardous event occurring by the consequence of that hazardous event occurring, e.g. 5 (almost certain) for likelihood X 25 (catastrophic) for consequence = 125 (very high risk). (See Table 4 to rate and colour code your risk profile)
- Tables to complete the above mentioned examples can be found on page 5.

Inclusion of a photo diary (as evidence of site visits and issues identified on site) is advantageous and should be considered.

Table 1: W_2RAP Tool risk category

	Risk Category
1	Safety
2	Effluent Quality – Aesthetic
3	Effluent Quality – Environmental Health
4	Effluent Quality – Human Health
5	Infrastructure – Compromised
6	Infrastructure – Failure
7	Infrastructure – Sabotage/Vandalism
8	Security

Table 2: W_2RAP Tool root causes

	Root Causes
1	Planning/Design
2	Operation
3	Maintenance
4	Scientific
5	Human Resources
6	Management
7	Budget
8	Procurement
9	Public Awareness
10	Natural/Act of God

For each assessed hazard, the risk category and associated root cause can be selected; options currently available via the W_2RAP Tool are noted on the above table.

Table 3: W_2RAP Tool risk matrix

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 expected to significant illness	20
Moderate-ly 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

Determine the risk associated with the hazardous event identified by considering the likelihood (probability) (e.g. has it happened in the past, is it likely to happen) and consequence (impact should it happen) of a potential hazardous event. The developed W_2RAP Tools utilises a 5 X 5 matrix (as indicated in the above table).

Table 4: W_2RAP Tool risk matrix profile

	Catastrophic	Major	Moderate	Minor	Insignificant
Almost certain	**125**	**100**	**75**	**50**	**25**
Likely	**100**	**80**	**60**	**40**	**20**
Moderately Likely	**75**	**60**	**45**	**30**	**15**
Unlikely	**50**	**40**	**30**	**20**	**10**
Rare	**25**	**20**	**15**	**10**	**5**
Score	**Risk Profile**				
LOW 0-30	These are systems that operate with minor deficiency and usually meet the effluent quality specifications set by the Department of Water and Sanitation. It is unlikely that this level of risk is harmful to the health of people and the environment. Aesthetical and/or physical non- compliance can be expected for short periods.				
MODERATE 31-60	These are systems with deficiencies which individually or combined pose a high risk to the quality of the receiving environment and health. These systems would not generally require immediate action but the deficiencies should be rectified to avoid future problems and associated cost to rectify once in HIGH risk. Aesthetically and/or physically non-compliance can be expected over a medium term. Medium term impact on infrastructure and partial failure of the wastewater treatment plant and disinfection process is likely.				
HIGH 61-90	These are systems with deficiencies which individually or combined pose a high risk to the quality of receiving environment and health and may lead to potential health, safety and environmental concerns. Once systems (or part of a system) are classified under this category, rapidy corrective action is required to arrest or eliminate the deficiency. High impact on the health of people and the environment and/or significant damage to infrastructure can be expected. Failure of the collector, treatment and disinfection facility is likely.				
VERY HIGH 91-125	These are systems with significant deficiencies which individually or combined pose a very high risk to the quality of the receiving environment and health and may lead to serious health, safety and environmental concerns. Once systems (or part of a system) are classified under this category, urgent and immediate corrective action is required to arrest or eliminate the deficiency. Very high impact on the health of people and the environment and/or significant damage to infrastructure can be expected. Total failure of the collector, treatment and disinfection facility is likely.				

6 W_2RAP STEPS

Step	Component	Complete? (tick if the step is complete)
1	Record of Completion	
2	Assemble the W_2RAP Team	
3	Document and Describe the Wastewater System	
4	Collection System Evaluation	
5	Collection Risk Assessment	
6	Wastewater Treatment Evaluation	
7	Wastewater Treatment Risk Assessment	
8	Sludge Management and Disposal Evaluation	
9	Sludge Management and Disposal Risk Assessment	
10	Non-Reticulated Systems Evaluation	
11	Non-Reticulated Systems Risk Assessment	
12	Receiving Environment and End-Users Evaluation	
13	Receiving Environment and End-Users Risk Assessment	
14	Management and Administration Evaluation	
15	Management and Administration Risk Assessment	
16	Summary Report of all the Highest Risk identified	
17	Control Measure	
18	Residual Risk Profile	
19	Implementation Plan	
20	Management Commitment Sign-off	

Step 1: Record of Completion

W_2RAP Team Leader to fill in the details below:

W_2RAP	
1. Name	
2. Title/Job Description	
3. Water Service Authority	
4. Wastewater System Name	
5. Address	
6. Province	
7. Postal Code	
8. Telephone number	
9. Fax number	
10. Mobile number	
11. E-mail address	

Step 2: Assemble the W_2RAP Team

In the table below, fill in the details of the W_2RAP Team.

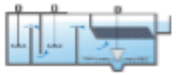
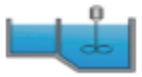
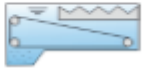
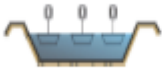
It is recommended that, if possible, the W_2RAP team consists of the following persons: (1) Water service managers, engineers and technicians; (2) Operational staff of treatment plants (if applicable); (3) Water quality managers/specialists; (4) Catchment managers; (5) Water service providers; (6) Environmental, public health or hygienist professionals, and (7) Consumer representatives.

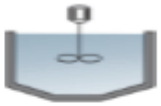
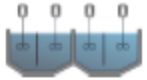
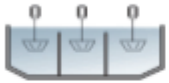
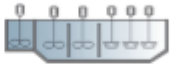
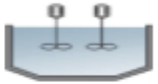
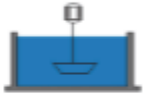
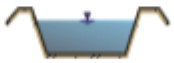
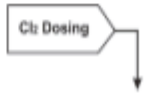
Assemble the W_2RAP Team							
Name	**Organisation**	**Title/Job Description**	**Role in the W_2RAP Team**	**Telephone**	**Fax**	**Mobile**	**E-mail**
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

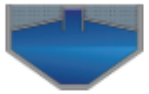
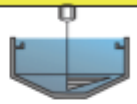
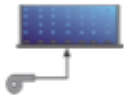
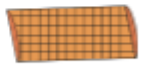
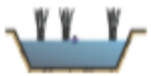
Step 3: Document and Describe the Wastewater System

The icons/images on the table below will assist you in drawing your own systems diagram by identifying and using each icon that represents the components in your system.

Golder Associates is acknowledged for design of the process unit symbols

Symbol chart for drawing process flow diagrams of wastewater treatment systems							
1	Wastewater Collection						
Conveyance / Pipe network		Pumpstations					
2	Preliminary treatment						
Coarse screen		Screenings removal		Screenings Removal		Flow Measurement	
Mechanical screen			Grit Removal		Grit channels		
Vortex degritter		Screw lift pump		Screw pump		Mix tank	
3	Primary Treatment						
Flow Equalisation / Balancing		Primary settling / clarification					
Ponds (primary ponds)			Anaerobic tank		Blending tank		

4	Secondary treatment						
Biofilters(aka Trickling Filters)		Humus Settling / Clarification		Pre-anoxic reactor		Activated sludge reactor	
Activated sludge - extended aeration			Activated Sludge with Biological Nutrient removal		Anaerobic reactor		
Aerobic pond		Integrated Pond systems (Aka lagoons)		Secondary Settling / Clarification		Flocculation basin	
5	**Tertiary treatment**						
Chlorination contact channels			Maturation Ponds				
Ultravoilet		Ozone contactor		Ozone			
Media filter		Sand filter		Chlorine dosing			

6	**Advanced Treatment**						
Membranes		Ultrafiltration		Nanofiltration			
7	**Sludge treatment (Thickening)**						
Gravity Thickener		Air Flotation Thickening					
8	**Sludge Treatment (Stabilisation)**						
Chemical Stabilisation		Aerobic Digestion		Aerobic Digestion Biogas			
9	**Sludge Treatment (Dewatering)**						
Belt Press		Solar Drying Beds					
Centrifuge		Filter Presses		Thermal Drying			
10	**Sludge Treatment (Beneficiation)**						
Composting		Thermo - chemical treatment		Pelletisation			
11	**Treated Effluent and/or Sludge Treatment (Disposal)**						
Land Application (agriculture)		Marine outfall			Polishing wetlands		

T

11	Treated Effluent and/or Sludge Treatment (Disposal)						
Reedbed		Incineration		Lagoons			
River/stream			Surface water				
Ground water		Irrigation		Stockpile			
12	**Equipment and Miscellaneous**						
Pumps		Valves		Sump			
Pipes		Flowmeters		Syphon			
Office, Laboratory		Compressor					

13	Simplified symbols						
Flocculation		Sedimentation		Filtration			
pH adjustment		Disinfection		Preliminary treatment (e.g. screens, degrit, etc)			
Primary treatment (e.g. settlers, ponds, etc)		Secondary treatment (e.g., trickling filters, activated sludge, etc)		Tertiary treatment (e.g. disinfection, maturations ponds, etc)			
Sludge treatment (e.g. dewatering, thickening)		Booster stations		Mixer			

Golder Associates

Sewage Flows / Return Flow	
	Raw sewage
	Effluent recycle
12	Sampling points
	Final effluent
	Chlorine dosing
	Effluent to irrigation
	Sludge filtrate
	Waste activated sludge (WAS)
	Return activated sludge (RAS)
	Air supply
	Primary sludge
	Supernatant liquor

Tips

1. System components to consider
   a. Catchment/drainage area
   b. Collection and reticulation
   c. Treatment facility
   d. Influent quality and quantity
   e. Receiving environment and user
- If you do not know find out (and improve record keeping)!
- If you still do not know conduct sites visits!

On the next page is an example of what your process flow diagram could look like once completed.

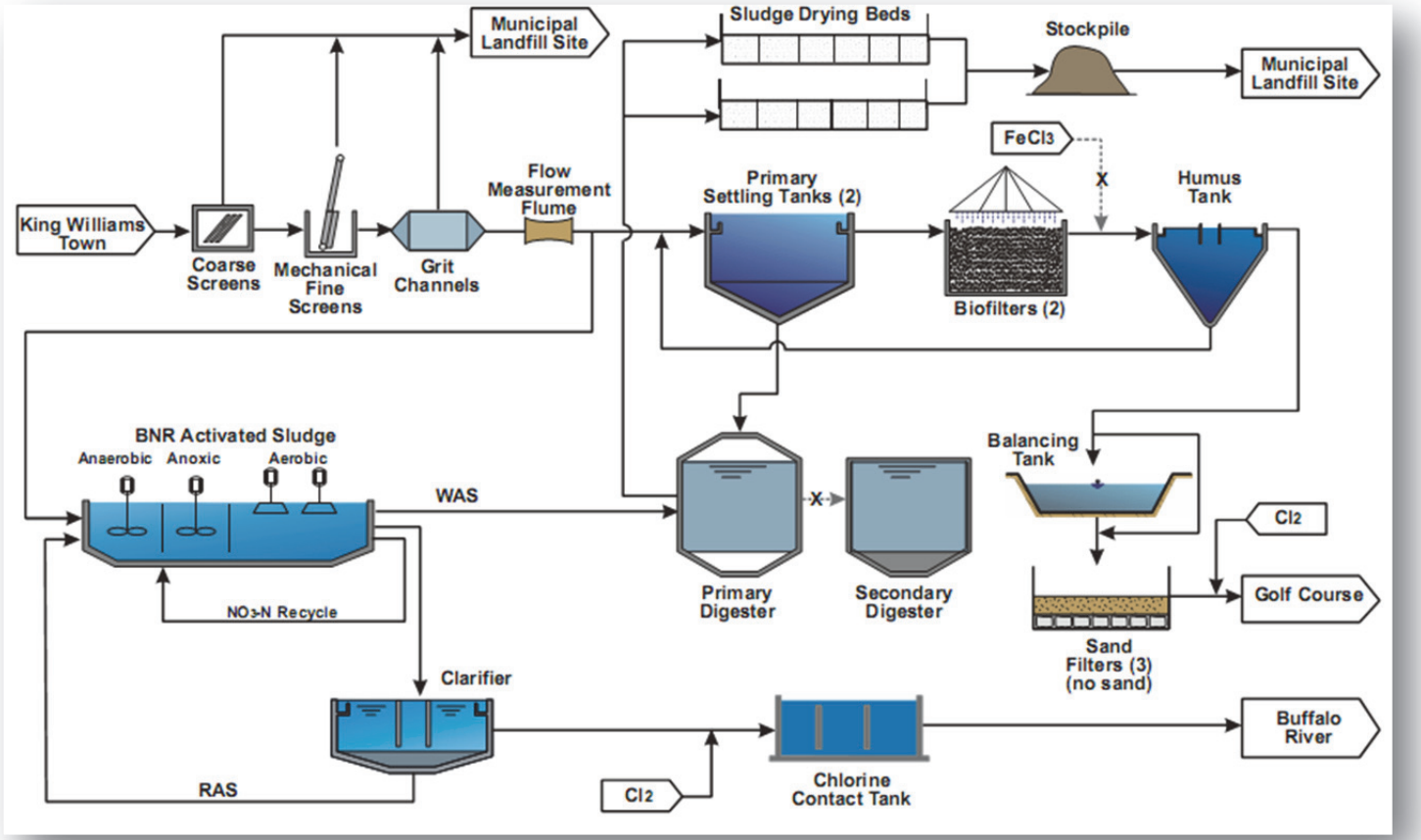
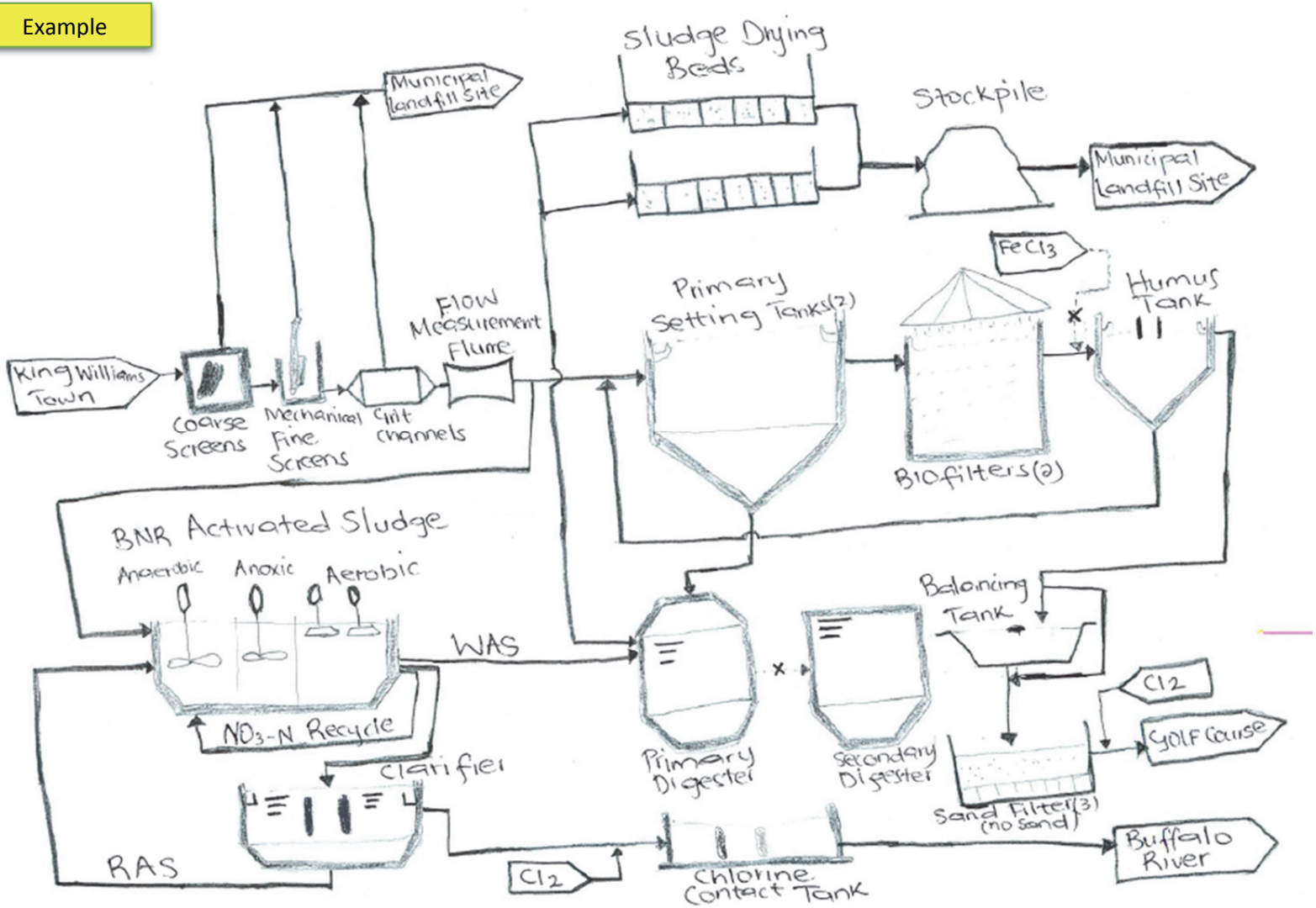


Figure 1: Combined trickling filter and activated sludge process with sludge drying beds and stockpiling for sludge management, example of a system flow diagram completed from selecting the icons on the previous pages.

Below is an example of what your system diagram could look like after you have drawn it by hand

Example



Please draw your systems process flow (PFD) diagram below.

Step 4: Collection System Evaluation

- Please circle **Yes** or **No** and fill in required information. This will help you get an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment.
- If a question/component is not applicable to your system, please circle the **N/A**.

Collection System Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
1. Percentage of areas unsewered	N/A			
2. Manner of service (Pit latrines, Bucket System, Conservancy tanks, French drains etc.)	N/A			
3. Percentage of area sewered or to be sewered	N/A			
4. Type of network in place or to be installed	N/A			
5. Location of sewers	N/A			
6. Protection (e.g. covers, enclosures, access)	N/A	Yes	No	
7. Is any pre-treatment performed at sewage pump station (e.g. screens installed)?	N/A	Yes	No	
8. Nature of sewage	N/A			
9. Domestic component Existing volume (daily)	N/A			
10. Domestic component Projected volume (daily)				
11. Industrial component Existing volume (daily)	N/A			

Collection System Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
12. Industrial component Project volume (daily)				
13. Type of industrial waste (Mainly organic/inorganic, Heavy metals or mixture)	N/A			
14. List potential problematic constituent/s received from industries	N/A			
15. Stormwater ingress or influx	N/A	Yes	No	
16. Groundwater ingress or influx	N/A	Yes	No	
17. Potable water ingress or influx	N/A	Yes	No	
18. Seasonal variation	N/A	Yes	No	
19. Peak dry weather flow factor	N/A			
20. Peak wet weather flow factor	N/A			
21. Safety policies & procedures are in place and adhered to (as per Occupation Health & Safety Act requirements)	N/A	Yes	No	
22. Appropriate safe work procedures, permit to work systems and lock-out procedures are available and implemented	N/A	Yes	Yes	

Step 5: Collection Risk Assessment

- Fill in your identified hazards/hazardous events for the collection system
- Fill in the risk category and root cause for each hazard (see table alongside to assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified Risk

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awereness				
		10.	Natural/Act of God				

Example

Collection Risk Assessment Identify TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
5.1 People digging in the way of wastewater pipes	7	9	5	(4)	3	2	1	X	25	(20)	15	10	5	=	100	VERY HIGH
5.2 Pump failure	6	2	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
5.3 Children Swimming in Wastewater ponds	1	6	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
5.4			5	4	3	2	1	X	25	20	15	10	5	=		

Collection Risk Assessment Identify TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
5.1			5	4	3	2	1	X	25	20	15	10	5	=		
5.2			5	4	3	2	1	X	25	20	15	10	5	=		
5.3			5	4	3	2	1	X	25	20	15	10	5	=		
5.4			5	4	3	2	1	X	25	20	15	10	5	=		
5.5			5	4	3	2	1	X	25	20	15	10	5	=		
5.6			5	4	3	2	1	X	25	20	15	10	5	=		
5.7			5	4	3	2	1	X	25	20	15	10	5	=		
5.8			5	4	3	2	1	X	25	20	15	10	5	=		
5.9			5	4	3	2	1	X	25	20	15	10	5	=		
5.10			5	4	3	2	1	X	25	20	15	10	5	=		
5.11			5	4	3	2	1	X	25	20	15	10	5	=		
5.12			5	4	3	2	1	X	25	20	15	10	5	=		
5.13			5	4	3	2	1	X	25	20	15	10	5	=		
5.14			5	4	3	2	1	X	25	20	15	10	5	=		
5.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 6: Wastewater Treatment Evaluation

- Please circle **Yes** or **No** and fill in the required information. This will help you obtain an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment.
- If a question/component is not applicable to your system, please circle the **N/A**.

Wastewater Treatment Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment	
1. Name of works		
2. Ownership (e.g. Municipality)		
3. Locality (Urban or Rural)		
4. Location of works Latitude (N-S)		
5. Location of works Longitude (E-W)		
6. Province		
7. Year of construction		
8.1. Name of the person responsible for the works		
8.2. Telephone/Cell phone Number		
8.3. E-mail address		
8.4. Address		
9. What is the Cumulative Risk Ratio (CRR) of the WWTW and CRR % / CRR max? (Refer on the reference page)	N/A	

Wastewater Treatment Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
10.1. Classification of works (e.g. A, B, C, D, E.)	N/A			
10.2. Required class of process controller/operator (per shift) (Class iv for A&B plant, class (iii) for plant C, class (ii) for D plant and class (i) for plant E)	N/A			
11. Required class of Supervisor (Not to be available at all times) (e.g. Class V on site if classification is A & B, Class V available if classification is C, Class V available if classification is D, class V available if classification is E)	N/A			
12.1. Numbers of Process controllers per shift /Operators	N/A			
12.2. Names (working full time or part time)	N/A			
12.3. Level of training (NQF2: Grade 10, NQF4: Grade 12, NQF5: Grade 12 + 2, others)	N/A			
13.1. Numbers of Supervisors	N/A			
13.2. Names (working full time or part time)	N/A			
13.3. Level of training (NQF2: Grade 10, NQF4: Grade 12, NQF5: Grade 12 + 2, others)	N/A			
14. How often do you have meetings to discuss items needing attention? (e.g. at least quarterly)	N/A			
15.1. Are there any flow meters installed at the works?	N/A	Yes	No	
15.2. Average volume of wastewater treated daily?	N/A			
15.3. When was the last flow meter calibration?	N/A			

Wastewater Treatment Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
16. Does the plant have infrastructure development for short- and long-term?	N/A	Yes	No	
17. Type of wastewater entering the works? (e.g. domestic, industrial, mining, commercial)	N/A			
18. Type of Preliminary treatment used? (e.g. manual screen/s, mechanical or hand cleaned grit removal channels)	N/A			
19. Type of Primary treatment used? (e.g. primary settler/s, oxidation pond/s or others)	N/A			
20. Type of Secondary treatment used? (e.g. trickling filters, rotating biological contactors, activated sludge tanks, humus tanks, etc.)	N/A			
21. Type of Tertiary treatment used? (e.g. chemical disinfection, constructed wetlands, maturation ponds or others)	N/A			
22. Chemical used for pH adjustment? (e.g. lime or soda ash)	N/A			
23. Type of Disinfection method used? (e.g. chlorine gas, ozone, HTH)	N/A			
24. Does the treated effluent meet the current standards (DWS General Authorisation/Licence/Permit) for wastewater quality?	N/A			
25. How is final treatment effluent disposed of? (e.g. discharged to the ocean, river/stream or re-used)	N/A			
26. With regards to sludge management, what treatment method is used? (e.g. dewatering via filter/belt press, drying bed and others)	N/A			
27. Safety policies and procedures are in place and adhered to (as per Occupational Health and Safety Act requirements)	N/A	Yes	No	
28. Appropriate safe work procedures, permit to work systems and lock-out procedures are available and implemented	N/A	Yes	No	

Step 7: Wastewater Treatment Risk Assessment

- Fill in your identified hazard/s for Wastewater Treatment Risk Assessment
- Fill in the risk category and root cause for each hazard (see table alongside to assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified Risk

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awareness				
		10.	Natural/Act of God				

Example

Wastewater Treatment Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
7.1 Community complaining about Odour	4	3	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
7.2 Broken fence leading to people vandalising the wastewater site	7	7	5	(4)	3	2	1	X	(25)	20	15	10	5	=	100	VERY HIGH
7.3 Staff do not have proper personal protective equipment (PPE)	4	7	(5)	4	3	2	1	X	(25)	20	15	10	5	=	100	VERY HIGH
7.4			5	4	3	2	1	X	25	20	15	10	5	=		

Wastewater Treatment Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
7.1			5	4	3	2	1	X	25	20	15	10	5	=		
7.2			5	4	3	2	1	X	25	20	15	10	5	=		
7.3			5	4	3	2	1	X	25	20	15	10	5	=		
7.4			5	4	3	2	1	X	25	20	15	10	5	=		
7.5			5	4	3	2	1	X	25	20	15	10	5	=		
7.6			5	4	3	2	1	X	25	20	15	10	5	=		
7.7			5	4	3	2	1	X	25	20	15	10	5	=		
7.8			5	4	3	2	1	X	25	20	15	10	5	=		
7.9			5	4	3	2	1	X	25	20	15	10	5	=		
7.10			5	4	3	2	1	X	25	20	15	10	5	=		
7.11			5	4	3	2	1	X	25	20	15	10	5	=		
7.12			5	4	3	2	1	X	25	20	15	10	5	=		
7.13			5	4	3	2	1	X	25	20	15	10	5	=		
7.14			5	4	3	2	1	X	25	20	15	10	5	=		
7.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 8: Sludge Management and Disposal Evaluation

- Please circle **Yes** or **No** and fill in the required information. This will help you obtain an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment.
- If a question/component is not applicable to your system, please circle the **N/A**.

Sludge Management and Disposal Evaluation	**Fill in the appropriate answer by circling N/A, Yes or No and making a comment**			
1. Name of person responsible for sludge management				
2. Telephone/ Cell phone				
3. E-mail address				
	N/A	Yes	No	Comment
4. Have appropriate physical and stability indicators been analysed for the sludge (e.g. pH, TS, VS, VFA)?	N/A	Yes	No	
5. Have appropriate chemical characteristics been analysed for the sludge (e.g. nutrients metals, organic pollutants)?	N/A	Yes	No	
6. Have appropriate microbiological parameters been analysed (e.g. Faecal coliforms, Helminthic ova)?	N/A	Yes	No	
7. Have appropriate microbiological parameters been analysed for the sludge (e.g. faecal coliforms)?	N/A	Yes	No	
8. What is the sludge microbiological class (e.g. A, B, C, Don't know or not applicable)?	N/A			
9. What is the sludge stability class?	N/A			
10. What is the sludge pollution class?	N/A			
11. What is the sludge included? (e.g. raw or primary sludge, oxidation pond sludge, etc.)	N/A			
12. Sludge Treatment-Thickening (e.g. gravity thickener, dDissolved air flotation)	N/A			
13. Sludge Treatment-stabilization (anaerobic/aerobic digestion)	N/A			

Sludge Management and Disposal Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
14. Sludge Treatment – Dewatering (filter/belt press, drying beds, thermal drying, etc.)	N/A			
15. Sludge Treatment – Disposal (e.g. lagoons, marine outlet, land application, agriculture or incineration)	N/A			
16. What is the frequency of sludge treatment operational monitoring for MLSS (of the thickened sludge)?	N/A			
17. What is the frequency of sludge treatment operational monitoring for ortho-phosphate (as P) (of the clear water of the thickening process)?	N/A			
18. How frequently is the sludge re-analysed/re-charged?	N/A			
19. Is the surrounding groundwater monitored?	N/A			
20. What is the average volume of sludge treated daily (m^3/day)?	N/A			
21. What is the average mass of sludge treated daily (kg/day)?	N/A			
22. How often do you conduct upgrades of the sludge treatment plant? (e.g. each-, every 5- or 10 years)	N/A			
23. Is the plant having infrastructure development for short and long term?	N/A	Yes	No	
24. Is there a routine inspection of maintenance of the system/equipment?	N/A	Yes	No	
25. Are there records of maintenance performed on the system?	N/A	Yes	No	
26. Are there any site-specific Operational and Maintenance Manuals for each unit process of the system?	N/A	Yes	No	
27. Are the process controllers regularly assessed in using the Operational and Maintenance Manual? Is the Operational manual being actively used?	N/A	Yes	No	
28. Does the system have an emergency response plan?	N/A	Yes	No	
29. Is the process controller/operator consistent in record keeping and providing the appropriate reports throughout the year?	N/A	Yes	No	

Step 9: Sludge Management and Disposal Risk Assessment

- Fill in your identified hazard/s for Sludge Management and Disposal Risk Assessment
- Fill in the risk category and root cause for each hazard (see table alongside assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awereness				
		10.	Natural/Act of God				

Example

Risk

Sludge Management & Disposal Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
9.1 Inappropriate sludge management may result in ground water contamination	3	1	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
9.2 Onsite sludge piling may cause nuisance conditions	3	2	5	(4)	3	2	1	X	25	20	15	10	5	=	100	VERY HIGH
9.3 Ground water contamination by sludge piled on site or at an unlicensed area	3	1	5	(4)	3	2	1	X	25	20	15	10	5	=	100	VERY HIGH
9.4			5	4	3	2	1	X	25	20	15	10	5	=		

Sludge Management & Disposal Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
9.1			5	4	3	2	1	X	25	20	15	10	5	=		
9.2			5	4	3	2	1	X	25	20	15	10	5	=		
9.3			5	4	3	2	1	X	25	20	15	10	5	=		
9.4			5	4	3	2	1	X	25	20	15	10	5	=		
9.5			5	4	3	2	1	X	25	20	15	10	5	=		
9.6			5	4	3	2	1	X	25	20	15	10	5	=		
9.7			5	4	3	2	1	X	25	20	15	10	5	=		
9.8			5	4	3	2	1	X	25	20	15	10	5	=		
9.9			5	4	3	2	1	X	25	20	15	10	5	=		
9.10			5	4	3	2	1	X	25	20	15	10	5	=		
9.11			5	4	3	2	1	X	25	20	15	10	5	=		
9.12			5	4	3	2	1	X	25	20	15	10	5	=		
9.13			5	4	3	2	1	X	25	20	15	10	5	=		
9.14			5	4	3	2	1	X	25	20	15	10	5	=		
9.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 10: Non-Reticulated Systems Evaluation

- Please circle **Yes** or **No** and fill in the required information. This will help you obtain an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment.
- If a question/component is not applicable to your system, please circle the **N/A**.

Non-Reticulated Systems Evaluation	Fill in the appropriate answer or circle Yes or No					
Date of Assessment						
Safety policies and procedures are in place and adhered to (as per Occupational Health and Safety Act requirements) distribution network						
	VIP Toilets		Septic Tanks		Conservancy Tanks	
	Yes	No	Yes	No	Yes	No
1. Is the system well designed and properly installed?	Yes	No	Yes	No	Yes	No
2. Is the system secure (i.e. appropriate access control?	Yes	No	Yes	No	Yes	No
3. Is the system structurally sound (i.e. built to recognized standards/building codes, no visible cracks?	Yes	No	Yes	No	Yes	No
4. Is the system adequately sized for the load received?	Yes	No	Yes	No	Yes	No
5. Is the system monitored for performance on a regular basis?	Yes	No	Yes	No	Yes	No
6. Is the system proactively maintained (i.e. regular emptying of pits, no blockages/overflowing)?	Yes	No	Yes	No	Yes	No
7. Is there any visible leakage of sewage to the open environment?	Yes	No	Yes	No	Yes	No
8. Is there any visible evidence of nuisance conditions (e.g. attracting flies, odour problems)?	Yes	No	Yes	No	Yes	No
9. Is the system located close to groundwater supplies?	Yes	No	Yes	No	Yes	No
10. Is the system located on areas with unsuitable soil conditions?	Yes	No	Yes	No	Yes	No
11. When emptying, is the disposal of waste controlled?	Yes	No	Yes	No	Yes	No

Step 11: Non-Reticulated Systems Risk Assessment

- Fill in your identified hazard Non-Reticulated System Risk Assessment
- Fill in the risk category and root cause for each hazard (see table alongside to assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified Risk

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awereness				
		10.	Natural/Act of God				

Example

Non-Reticulated Systems Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
11.1 Spillage or discharge to water body may result in contamination of the water body	3	1	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
11.2 Leaking wastewater pipes close to water body may contaminate groundwater.	4	3	5	(4)	3	2	1	X	(25)	20	15	10	5	=	100	VERY HIGH
11.3 wastewater reclamation and reuse is not properly monitored, it is posing health threats.	4	2	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
11.4																

Non-Reticulated Systems Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
11.1			5	4	3	2	1	X	25	20	15	10	5	=		
11.2			5	4	3	2	1	X	25	20	15	10	5	=		
11.3			5	4	3	2	1	X	25	20	15	10	5	=		
11.4			5	4	3	2	1	X	25	20	15	10	5	=		
11.5			5	4	3	2	1	X	25	20	15	10	5	=		
11.6			5	4	3	2	1	X	25	20	15	10	5	=		
11.7			5	4	3	2	1	X	25	20	15	10	5	=		
11.8			5	4	3	2	1	X	25	20	15	10	5	=		
11.9			5	4	3	2	1	X	25	20	15	10	5	=		
11.10			5	4	3	2	1	X	25	20	15	10	5	=		
11.11			5	4	3	2	1	X	25	20	15	10	5	=		
11.12			5	4	3	2	1	X	25	20	15	10	5	=		
11.13			5	4	3	2	1	X	25	20	15	10	5	=		
11.14			5	4	3	2	1	X	25	20	15	10	5	=		
11.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 12: Receiving Environment and End-Users Evaluation

- Please circle **Yes** or **No** and fill in the required information. This will help you obtain an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment
- If a question/component is not applicable to your system, please circle the **N/A**

Receiving Environment and End-Users Evaluation	**Fill in the appropriate answer by circling N/A, Yes or No and making a comment**			
1. Name of catchment				
	N/A	**Yes**	**No**	**Comment**
2. Is the water source vulnerable to contamination from upstream industries?	N/A	Yes	No	
3. Is the water source vulnerable to contamination from agriculture/livestock farms?	N/A	Yes	No	
4. Is the water source vulnerable to contamination from sewer networks and pump stations?	N/A	Yes	No	
5. Is the water source vulnerable to contamination from non-reticulated sewer systems such as leaking septic tanks, etc.?	N/A	Yes	No	
6. Is the water source vulnerable to contamination from other sources? If yes please specify.	N/A	Yes	No	
7. Is the water source vulnerable to contamination from recreational use by the community?	N/A	Yes	No	
8. Is the water source vulnerable to contamination from other sources? If yes please specify.	N/A	Yes	No	
9. Indicate which of the source water protection plans exist? (Zoning, Secure fencing, Locked gates, Limits on agriculture (e.g. phosphorous, pesticides), Waste Discharge System implemented)	N/A			

Receiving Environment and End-Users Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
10. If other sources water protection plans exist, please specify?	N/A			
11. Is regular river/stream monitoring conducted for upstream of WWTWs	N/A	Yes	No	
12. Is regular river/stream monitoring conducted for downstream of WWTWs?	N/A	Yes	No	
13. What is the frequency of upstream monitoring for microbiological determinants? (*E. coli*, faecal coliform, etc.)	N/A			
14. What is the frequency of upstream monitoring for residual chlorine?	N/A			
15. What is the frequency of upstream monitoring for chemical oxygen demand (COD)?	N/A			
16. What is the frequency of upstream monitoring for pH?	N/A			
17. What is frequency of upstream monitoring for conductivity? (e.g. Not done, once weekly, once monthly, once quarterly, annually)	N/A			
18. What is frequency of upstream monitoring for suspended solids (SS)? (e.g. Not done, once weekly, once monthly, once quarterly, annually)	N/A			
19. What is the frequency of upstream monitoring for ammonia? (e.g. Not done, once weekly, once monthly, once quarterly, annually)	N/A			
20. What is the frequency of upstream monitoring for nitrates/nitrites? (e.g. Not done, once weekly, once monthly, once quarterly, annually)	N/A			

Step 13: Receiving Environment and End-Users Risk Assessment

- Fill in your identified hazard/s Receiving Environment and End-Users Risk Assessment
- Fill in the risk category and root cause for each hazard (see table alongside to assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified Risk

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awereness				
		10.	Natural/Act of God				

Example

Receiving Environment and End User Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
13.1 Spillage of wastewater may contaminate water bodies	3	1	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
13.2 Wastewater leaking pipes can contaminate groundwater	4	3	5	(4)	3	2	1	X	(25)	20	15	10	5	=	100	VERY HIGH
13.3 Inappropriate monitoring of wastewater effluent causes health threats	4	2	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
13.4			5	4	3	2	1	X	25	20	15	10	5	=		

Receiving Environment and End-User Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
13.1			5	4	3	2	1	X	25	20	15	10	5	=		
13.2			5	4	3	2	1	X	25	20	15	10	5	=		
13.3			5	4	3	2	1	X	25	20	15	10	5	=		
13.4			5	4	3	2	1	X	25	20	15	10	5	=		
13.5			5	4	3	2	1	X	25	20	15	10	5	=		
13.6			5	4	3	2	1	X	25	20	15	10	5	=		
13.7			5	4	3	2	1	X	25	20	15	10	5	=		
13.8			5	4	3	2	1	X	25	20	15	10	5	=		
13.9			5	4	3	2	1	X	25	20	15	10	5	=		
13.10			5	4	3	2	1	X	25	20	15	10	5	=		
13.11			5	4	3	2	1	X	25	20	15	10	5	=		
13.12			5	4	3	2	1	X	25	20	15	10	5	=		
13.13			5	4	3	2	1	X	25	20	15	10	5	=		
13.14			5	4	3	2	1	X	25	20	15	10	5	=		
13.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 14: Management and Administration Evaluation

- Please circle **Yes** or **No** and fill in the required information. This will help you obtain an idea of the typical challenges/risks faced and assist with completing the subsequent risk assessment
- If a question/component is not applicable to your system, please circle the **N/A**

Management and Administration Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
1. Are all positions within the organisational organogram filled?	N/A	Yes	No	
2. Does the municipality have cost-effective tariffs?	N/A	Yes	No	
3. Is there a formal quotation system?	N/A	Yes	No	
4. Is budget available and ring-fenced for operations and maintenance of the wastewater system under investigation?	N/A	Yes	No	
5. What is the average time taken to obtain an order number from Supply Chain Management (SCM) (days)?	N/A	Yes	No	
6. What is the average time taken for suppliers to deliver goods/services (days)?	N/A	Yes	No	
7. Is Council stable with functional committees?	N/A	Yes	No	
8. Are scientific and analytical services available/can be easily accessed?	N/A	Yes	No	
9. Is a workshop with associated spare parts available/can be easily accessed?	N/A	Yes	No	

Management and Administration Evaluation	Fill in the appropriate answer by circling N/A, Yes or No and making a comment			
10. Is effective administration support available to technical staff to assist with processing work orders? Providing order numbers, handling correspondence, etc.?	N/A	Yes	No	
11. Are appropriate plans, policies and procedures to address Disaster Management/Emergencies and other issues (Safety, public participation, communication, etc.) developed and implemented?	N/A	Yes	No	
12. Is an organisational performance management system developed and implemented (i.e. effectively measure, monitor and track sanitation services performance indicators)?	N/A	Yes	No	
13. Is a functional customer service system in place to immediately inform customers of issues of concern?	N/A	Yes	No	
14. Is a customer services representative and associated complaints register in place and linked to the Technical Department to investigate and resolve?	N/A	Yes	No	
15. Are adequate computers and networks available for sanitation staff to perform their tasks and record their activities?	N/A	Yes	No	
16. Are IT systems policies and procedures in place and adhered to? (e.g. users are registered, access is controlled. Does IT systems have firewalls, activate protection from viruses, etc.).	N/A	Yes	No	
17. Are critical business databases (e.g. personnel details) and documents (e.g. As-built drawings, records, manuals, agreements, etc.) maintained and stored in secure location (both paper & electronic)?	N/A	Yes	No	
18. Are safety policies and procedures in place and adhered to (as per Occupational Health and Safety Act Regulation)?	N/A	Yes	No	
19. Are appropriate safe work procedures, permit to work systems and lock-out procedures available and implemented?	N/A	Yes	No	

Step 15: Management and Administration Risk Assessment

- Fill in your identified hazard/s Management and Administration Risk Assessment
- Fill in the risk category and root cause for each hazard (see table alongside to assist you)
- Determine the likelihood and circle the relevant answer
- Determine the consequence and circle the relevant answer
- Multiply and calculate the risk rating
- Determine the risk profile (e.g. (4) Almost Certain X (25) Catastrophic = (100) (Risk rating) – this shows that the Risk profile is Very High (See table alongside to assist you)
- Below is an example of how you can complete the table for your identified Risk

Hazard Assessment and Risk Characterisation Methodology

Select the number representing risk category associated with hazardous event that will occur (e.g. Safety will be 1)		Select the number representing root cause associated with hazardous event will occur (e.g. Planning/Design will be 1)		Select the number representing likelihood that the hazardous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazardous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Risk Category		**Root Causes**		**Likelihood**	**Consequence/Impact**	**Risk Matrix Profile**	
1.	Safety	1.	Planning/Design	Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
2.	Effluent Quality-Aesthetic	2.	Operation	Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
3.	Effluent Quality-Environmental Health	3.	Maintenance	Moderately likely **3**	Moderate **15**		
4.	Effluent Quality-Human Health	4.	Scientific	Unlikely **2**	Minor **10**		
5.	Infrastructure-Compromised	5.	Human Resources	Rare **1**	Insignificant **5**		
6.	Infrastructure-Failure	6.	Management				
7.	Infrastructure-Sabotage/Vandalism	7.	Budget				
8.	Security	8.	Procurement				
		9.	Public Awereness				
		10.	Natural/Act of God				

Example

Management and Administration Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
15.1 Lack of skills training programmes	6	7	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
15.2 Insufficient documentation for the site leading to improper management	6	7	(5)	4	3	2	1	X	(25)	20	15	10	5	=	125	VERY HIGH
15.3 By-laws Implemantation and monitoring is not carried out	1	6	5	(4)	3	2	1	X	(25)	20	15	10	5	=	100	VERY HIGH
15.4			5	4	3	2	1	X	25	20	15	10	5	=		

Management and Administration Risk Assessment Identify systems TOP 15 Hazards	Risk Category (Fill in)	Root Cause (Fill in)	Likelihood Rating (Circle)					X	Consequence Rating (Circle)					=	Risk Rating (Fill in)	Risk Profile (Fill in)
15.1			5	4	3	2	1	X	25	20	15	10	5	=		
15.2			5	4	3	2	1	X	25	20	15	10	5	=		
15.3			5	4	3	2	1	X	25	20	15	10	5	=		
15.4			5	4	3	2	1	X	25	20	15	10	5	=		
15.5			5	4	3	2	1	X	25	20	15	10	5	=		
15.6			5	4	3	2	1	X	25	20	15	10	5	=		
15.7			5	4	3	2	1	X	25	20	15	10	5	=		
15.8			5	4	3	2	1	X	25	20	15	10	5	=		
15.9			5	4	3	2	1	X	25	20	15	10	5	=		
15.10			5	4	3	2	1	X	25	20	15	10	5	=		
15.11			5	4	3	2	1	X	25	20	15	10	5	=		
15.12			5	4	3	2	1	X	25	20	15	10	5	=		
15.13			5	4	3	2	1	X	25	20	15	10	5	=		
15.14			5	4	3	2	1	X	25	20	15	10	5	=		
15.15			5	4	3	2	1	X	25	20	15	10	5	=		

Step 16: Summary Report of all the Identified Risk

- To complete the Inherent Risk Profile below refer to: Steps 5, 7, 9, 11, 13 and 15 (i.e. Risk Assessment of the various wastewater system components)
- Identify and write down the reference of the TOP 15 hazards/hazardous events (i.e. these hazards with the highest risk rating across all of the risk assessments) together with their Risk Rating and Risk Profile. See the table below as an example

INHERENT RISK PROFILE

Component Reference	Risk Rating	Risk Profile
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

Example

Component Reference	Risk Rating	Risk Profile
1. 5.2	125	VERY HIGH
2. 5.3	125	VERY HIGH
3. 7.1	125	VERY HIGH
4. 9.1	125	VERY HIGH
5.		

Low 0-30	Moderate 31-60
High 61-90	Very High 91-100

Step 17: Control Measures

- Control measures are put in place to minimise the likelihood of hazard occurring. Fill in the current control measures for your identified TOP 15 hazards/hazardous events. If you have an existing control measure in place write it down, if not, complete as "none".
- Validation of a control measure is put in place to measure the effectiveness of a control measure. In the validation of control measure column capture the equipment used to measure the effectiveness of the control measure (e.g. perimeter/access control checks).
- Corrective actions are put in place in the case where the control measure does not exist or is not effective in eliminating the likelihood of a hazard occurring. Identify what corrective actions are required (e.g. if no control measures are currently in place or where current control measures are not effective).
- Fill in the name of the person responsible for ensuring that the corrective action is being implemented.
- Fill in the targeted date for implementing the corrective action.
- Fill in the cost related to implementing the corrective action. If there is no cost implication, indicate "none".
- See the table below as an example.

Example

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
1. 5.2	Pump station has a telemetry connected to the area managers cellphone	Intergrity (output less Incidents noted)	No Corrective action	P. de Souza	June 2016	R 10.000
2. 5.3	Repair fence and gates so that children willnot swim in the wastewater ponds	Conduct daily checks of fence	Replace fence with cement slabs	U. Jack	April 2016	R15. 000
3. 7.1	Repair wastewater pipes to minimise the leaks	Daily monitoring of pipes	Install new pipes/ pipeline System	T. Manxodidi	July 2017	R30. 000

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
1.						
2.						
3.						
4.						

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
5.						
6.						
7.						
8.						

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
9.						
10.						
11.						
12.						

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
13.						
14.						
15.						
16.						

Reference (Fill in)	Control Measures in Place (if any) (Fill in)	Validation of Control Measure (Fill in)	Corrective Actions (Fill in)	Who? (Responsible Personnel) (Fill in)	When? (Date) (Fill in)	Estimated cost? (Budget) (Fill in)
17.						
18.						
19.						
20.						

Step 18: Residual Risk Profile

NOTE: Control measures/corrective actions minimise the likelihood of a hazardous event occurring. The Residual Risk Profile is generated from consideration of the likelihood of the hazard/hazardous event occurring after the implementation of control measure/corrective action. The consequence, however, remains the same (before or after implementation of the control measure/corrective action).

For your TOP 15 identified hazards/hazardous events, now complete a Residual Risk Profile in the table below:

- Go to step 16, and use the captured information. Copy the reference for the component, the risk rating and the risk profile into the first 3 columns of the table below.
- Go to the risk assessment tables (i.e. steps 5, 7, 9, 11, 13, and 15) and copy the consequence for the given reference.
- Re-assess the likelihood with consideration of your implemented control measure/corrective action.
- Multiply the consequence by the likelihood to obtain the residual risk rating (e.g. catastrophic (25) X almost certain (2) = 50 = residual risk rating).
- A lower residual risk profile is due to the effectiveness of the control measure (i.e. the likelihood of the hazard re-occurring has decreased).
- Once you have implemented your corrective actions (as captured in step 17), you can tick that the corrective action is complete.

Select the number representing likelihood that the hazadous event will occur, (e.g. Almost Certain will be 5)	Select the number representing consequence should the hazadous event occur, (e.g. Catastrophic will be 25)	Select the matrix profile	
Likelihood	**Consequence/Impact**	**Risk Matrix Profile**	
Almost certain **5**	Catastrophic **25**	**Low 0-30**	**Moderate 31-60**
Likely **4**	Major **20**	**High 61-90**	**Very High 91-100**
Moderately likely **3**	Moderate **15**		
Unlikely **2**	Minor **10**		
Rare **1**	Insignificant **5**		

Example

Reference for the component (Fill in)	Risk Rating (Fill in)	Risk Profile (Fill in)	Consequence Rating (Circle)					Likelihood Re-Assessment Rating (Circle)					Residual Risk Rating (Fill in)	Residual Risk Profile (Fill in & colour)	Corrective Action Completed? (✓)
1. 5.2	125	VERY HIGH	(25)	20	15	10	5	5	4	3	(2)	1	50	MODERATE	✓
2. 5.3	125	VERY HIGH	(25)	20	15	10	5	5	4	(3)	2	1	75	HIGH	✓
3. 7.1	100	VERY HIGH	(25)	20	15	10	5	5	4	3	(2)	1	50	MODERATE	✓
4.			25	20	15	10	5	5	4	3	2	1			

Reference for the component (Fill in)	Risk Rating (Fill in)	Risk Profile (Fill in)	Consequence Rating (Circle)					Likelihood Re-Assessment Rating (Circle)					Residual Risk Rating (Fill in)	Residual Risk Profile	Corrective Action Completed? (✓)
1.			25	20	15	10	5	5	4	3	2	1			
2.			25	20	15	10	5	5	4	3	2	1			
3.			25	20	15	10	5	5	4	3	2	1			
4.			25	20	15	10	5	5	4	3	2	1			
5.			25	20	15	10	5	5	4	3	2	1			
6.			25	20	15	10	5	5	4	3	2	1			
7.			25	20	15	10	5	5	4	3	2	1			
8.			25	20	15	10	5	5	4	3	2	1			
9.			25	20	15	10	5	5	4	3	2	1			
10.			25	20	15	10	5	5	4	3	2	1			
11.			25	20	15	10	5	5	4	3	2	1			
12.			25	20	15	10	5	5	4	3	2	1			
13.			25	20	15	10	5	5	4	3	2	1			
14.			25	20	15	10	5	5	4	3	2	1			
15.			25	20	15	10	5	5	4	3	2	1			

Step 19: Implementation Plan

Please fill in the table below:

- Look at the corrective actions you have identified for your system and turn them into short-term actions (e.g. 12 months) and medium- to long-term actions (years 2-4).
- Assign a responsible person and the required budget (see step 17).
- Circle the date of completion (e.g. M1 in the example below is Month 1 or January) for the implementation of the corrective action (see step 17).
- The image below is an illustration of how you can complete your W_2RAP implementation plan.

Example

WR$_2$RAP Implementation Plan

From: (Month) January (Year) 2015 **To:** (Month) December (Year) 2018

Year 1: (Month) January (Year) 2014 **To:** (Month) December (Year) 2015

Short-term actions	Who? (Responsible)	Budget (R)	J	F	M	A	M	J	J	A	S	O	N	D	Complete? (Yes/No)
1. Put on new fence	P. deSouza	R10.000	(M1)	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	(M12)	Yes
2. Repair the pump station	U. Jack	R15.000	M1	(M2)	M3	M4	M5	M6	M7	M8	M9	M10	M11	(M12)	Yes
3.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
4.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
5.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
6.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
7.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
8.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
9.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
10.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	

Year 2-4: (Month) March (Year) 2016 **To:** (Month) December (Year) 2018

Medium-to Long-term actions	Who (Responsible)	Budget (R)	M	J	S	D	M	J	S	D	M	J	S	D	Complete? (Yes/No)
1 Put on new wastewater pipes	T. Manxodidi	R 30.000	(M15)	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	(M48)	Yes
2.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
3.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
4.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
5.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	

W_2RAP Implementation Plan

From: (Month)..... (Year) .....**To:** (Month)..... (Year).....

Year 1: (Month)..... (Year) .....**To:** (Month)..... (Year).....

Short-term actions	Who? (Responsible)	Budget (R)													Complete? (Yes/No)
1.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
2.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
3.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
4.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
5.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
6.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
7.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
8.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
9.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	
10.			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	

Year 2-4: (Month)..... (Year) .....**To:** (Month)..... (Year).....

Medium-to Long-term actions	Who? (Responsible)	Budget (R)													Complete? (Yes/No)
1.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
2.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
3.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
4.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	
5.			M15	M18	M21	M24	M27	M30	M33	M36	M39	M42	M45	M48	

Step 20: Management Commitment and Sign-off

Municipal Manager, Chief Financial Officer, and Technical Director to sign in the table below

MANAGEMENT COMMITMENT TO IMPLEMENT THE W_2RAP

Municipality Name:

System Name:

We recognise the value of a risk abatement process as a viable mechanism to continue to improve wastewater services performance within our municipality.

We undertake to support and mobilise the necessary resources to implement W_2RAP in a phased approach, giving attention to the critical and high risk areas in the short term and working towards abating the medium to lower risk areas in the longer term.

We further commit to monitor and track progress on a regular basis and assign clear responsibility to the person/s responsible for the implementation of the W_2RAP.

The W_2RAP presents valuable Key Performance Areas to ensure that the WSA functionality aligns and share common objectives, as outlined in the Vision Statement.

Name	Designation	Signature	Date
1.			
2.			
3.			

6 REFERENCES

1. Department of Water Affairs (DWA) Green Drop Report, chapter 1. (Introduction to the Green Drop Report card for 2010/2011) page 1 to 2.
2. RiskQ (www.riskq.co.za)
3. Van der Merwe-Botha, M. and Manus, L. Wastewater Risk Abatement Plan: A W_2RAP Guideline to plan and manage towards safe and complying municipal wastewater collection and treatment in South Africa. Water Research Commission, TT 489/11.

Now that you have successfully completed your W_2RAP using this template, why not try and use the web or spreadsheet-based W_2RAP Tools available at **Risk Q.**

(www.riskq.co.za)