# Wastewater Risk Abatement Plan of

# STEVE TSHWETE LOCAL MUNICIPALITY

**This document should be read in conjunction with WRC Report TT 489/11 (Wastewater Risk Abatement Plan – A $W_2$RAP guideline to plan and manage towards safe and complying municipal wastewater collection and treatment in South Africa.**

**WRC Report No. SP 24/11**

June 2011

# STEVE TSHWETE LOCAL MUNICIPALITY

## WASTEWATER RISK ABATEMENT PLAN

**Revision 1**






**NOVEMBER 2010**

# WASTEWATER RISK ABATEMENT PLAN FOR STEVE TSHWETE LOCAL MUNICIPALITY : REV 1

## TABLE OF REVISION

| Rev No. | Date | Nature of Revision |
|---|---|---|
| 0 | November 2010 | Basic risk assessment to review CRR score of first-order assessments |
| 1 | 18 November 2010 | Final Document |
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# 1. EXECUTIVE SUMMARY

Steve Tshwete Local Municipality (STLM) is committed to effective governance to ensure the delivery of all essential services to its residents. STLM management strives to achieve this while employing best practice procedures and compliance to all relevant legislation.

In light of the requirements outlined under the Green Drop certification programme run by Department of Water Affairs (DWA), STLM has dedicated resources to comply with all these requirements. One of the requirements is a Wastewater Risk Abatement Plan ($W_2$RAP) which is a plan of action to outline corrective actions to reduce all identified risks as well as to improve the Cumulative Risk Rating (CRR) of each treatment plant as outlined in the first-order assessments conducted by DWA[1].

The process of development of a $W_2$RAP for STLM has begun in 2010. As per the scope of works described in Table 1 , Step One has been completed and is presented in this document .This section focuses on the review of the Cumulative Risk Rating (CRR) outlined in the first-order assessments resulting in proposal and implementation of a plan of action to reduce these risks.

The $W_2$RAP will be extended to include a detailed risk identification and risk assessment process of all four Wastewater Treatment Works (WWTW) as per Table 1 and this will be completed at the end of January 2011.

The 1st order CRR rating for Boskrans WWTW confirms that the plant is operating on average at 80% of design capacity and this has resulted in non-compliance with four effluent parameters. The current expansion and upgrade of Boskrans should address the issues of non-compliance.

Although the 1st Order CRR rating of Kwaza WWTW outlines several non-compliances to effluent standards, the operational management is excellent as indicated by the Green Drop Technical report. Lack of information on the assessment criteria, like the number of biological samples to be analysed on an annual basis. Appear to be the major contributing factors related to non-compliance. Hydraulic and biological capacity will be assessed to address the need for future upgrading of the plant.

Blinkpan WWTW and Komati WWTW have a reduced CRR rating because of their small hydraulic capacity and hence has a smaller impact on the receiving environment. However, STLM has appointed a task team that is currently assessing the performance of these two plants as they were previously owned and operated by Koornfontein Mines. A number of initiatives have begun such as gathering of technical drawings to show plant configuration, replacement of faulty flow meters, upgrade of chlorination units and appointment of a new supervisor.

STLM has identified a number of risks after review of the CRR scores and proposed implementation of actions to reduce these. A summary of these findings is included below.

[1] An extract of: Municipal Wastewater Treatment Base Information for Targeted Risk-Based Regulation, Steve Tshwete LM (Mpumalanga Province), Status at August 2009. Department of Water Affairs, Pretoria. 2009.

(1) Possible incorrect flow meter readings due to faulty equipment: currently addressed by appointment of service provider to replace meters and calibrate on an annual basis.

(2) Lack of technical information for Komati WWTW and Blinkpan WWTW: have begun process to acquire information from Eskom. Have also set up task team to evaluate performance of these two Wastewater Treatment Works

(3) Non-compliance at Boskrans WWTW with major impact on environment: to be addressed by upgrading of the plant.

(4) Operational and compliance monitoring is inadequate: Both operational and compliance monitoring programmes have been reviewed and new programme implemented in May 2010. Investigate addition of upstream and downstream monitoring points.

(5) Lack of relevant water-use licenses: STLM is in the process of obtaining quotes for license application as detailed water quality report and EIA's are required for Boskrans. The cost must be included in the next financial budget.

(6) Lack of technical skills; this will be evaluated once registration certificates have been issued by DWA.

STLM views the CRR scores as a guide to overall risk management at all WWTW. The detailed risk assessment process that will begin in 2011 will assist STLM in identifying specific actions to be taken to manage risk at all levels namely: Environmental, Financial, Operational, and Institutional. This will be an on-going process that will include an annual review and verification of the process as well as effective communication of the risks and implementation plan.

## 2. BACKGROUND TO RISK-BASED REGULATION AND CRR SCORES

The Green Drop certification programme is part of incentive-based regulation that acknowledges excellence in wastewater management. This programme introduces best practises and excellence to the Water Services Authority (WSA). DWA has also embarked on risk-based regulation that provides for practical/tangible turn-around action plans that reduce identified risks. The risk-based regulation requires that all risks are identified and monitored so that an action plan can be implemented to reduce the high risks. This risk-based regulation was initiated in 2009 resulting in the publication of the 1st order Risk Profile of Cumulative Risk Ratios (CRR) for WWTW in South Africa.

The CRR is based on four criteria which gives an indication of the operational risk that the plant represents to the receiving environment. These four criteria are:

A. The **Design Capacity** of the plant that also represents the hydraulic loading discharged into the environment;

B. The **Average Daily Flow volume exceeding** on or below the hydraulic design capacity;

C. The number of **Non-Compliant Effluent Quality Variables** in terms of final effluent discharged; and

D. The non-compliance in terms of the **Technical Skills** staffing requirements.

**CRR = A*B+C+D**

The weighting factors used for the purpose of establishing the cumulative risk rating per WWTW are outlined under Section 3.1 in Table 2.

The rationale behind the CRR formulae is that all WWTW regardless of size pose a potential risk to the environment. However, a plant with a larger hydraulic capacity that does not comply with effluent standards will have a larger impact than a smaller plant which may be complying with more parameters.

These CRR scores are described as the 1st order risk profile and was based on information obtained from municipalities. From the 1st order CRR scores, municipalities are able to prioritise risks and can begin with intervention strategies based on the operational risk that a plant represents.

The risk status as given by the 1st order CRR scores can be further developed with the inclusion of a general risk assessment of all treatment plants to represent wastewater management.

DWA has undertaken to expand the CRR score to include the impact of the discharged effluent on the receiving environment. The 2nd order Risk Profile or CRRr will include three additional criteria i.e.

F = Present ecological state and condition of the receiving environment

G= Ecological Importance and sensitivity of the receiving environment

I = % of Green Drop Certification Score

The revised 2nd order CRRr will be calculated as:

CRRr = {A*B+C+D] * [F+G] * I

All WSA are urged to review the 1st order CRR scores, undertake a detailed risk assessment and then implement a risk-abatement plan that will lead to an increase in the 2nd Order CRRr scores.

## 3. SCOPE OF WORK FOR WASTEWATER RISK ABATEMENT PLAN ($W_2$RAP)

This risk-based regulation is in line with the concept of a Water Safety Plan developed by the World Health Organisation (WHO)[2] for water supply systems. According to the World Health Organisation, the most effective means of consistently ensuring the safety of a water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in the supply. The Green Drop certification process serves to include this risk-based approach by advocating the implementation of a $W_2$RAP.

The purpose of a $W_2$RAP is to provide a risk-reduction plan with practical time-bound activities that will reduce all risks identified in the supply system as well as the address the criteria outlined in the CRR scores. The methodology of the $W_2$RAP is similar to that of the Water Safety Plan as per WHO guidelines but also incorporates the CRR scores for each WWTW[3]. This ensures that the WSA is able to organise and systematize management practices for wastewater.

Effective risk management will achieve a number of aims including, improved effluent quality, effective asset management, green drop compliance and compliance to relevant legislation.

STLM recognises the advantage of a risk-based management system and is committed to compliance with all the criteria outlined in the Green Drop Certification process. STLM therefore has embarked on development of a $W_2$RAP for all four WWTW in the municipality. The scope of work and timeframe for delivery for this $W_2$RAP is outlined below in Table 1.

[2] Water Safety Plan Manual: step-by-step risk management for drinking-water suppliers. World Health Organization, Geneva, 2009.
[3] Wastewater Risk Abatement Plan. A guide to plan and manage towards safe and compliant wastewater collection and treatment in South Africa. August 2010, Draft 01. Water Research Commission and Department of Water Affairs, Pretoria, South Africa.

**Table 1: Scope of work for development of $W_2$RAP for STLM**

| Description | | Action | Timeframe |
|---|---|---|---|
| 1. | Review CRR scores and calculate new CRR scores if applicable. Propose management plans to reduce CRR scores | • Review each of the four criteria for each WWTW to verify the CRR scores presented in the first-order assessment.<br>• If there are change, provide proof and amend CRR scores accordingly.<br>• Propose a plan of action to reduce the overall CRR score for each WWTW, | November 2010 |
| 2. | Document and describe the system. | Document and describe the collection system, pump stations and treatment plants in STLM | January 2011 |
| 3. | Conduct a hazard assessment and risk assessment of all hazards throughout the system . | • This should include possible risk to: incoming effluent quality from possible contamination, pump stations, sewage collection system , treatment plant, final effluent quality and risk to receiving environment from effluent and sludge.<br>• The risk assessment is conducted using a risk matrix based on consequence and likelihood of occurrence for each identified hazard. | January 2011 |
| 4. | Identify critical control points and define operational limits . | • Identify control points that will influence the final effluent quality.<br>• Define operational limits for all major unit processes in treatment plant as well as for inflow and final effluent(based on license requirements) | January 2011 |
| 5. | Determine control measures, verify effectiveness of control measures, re-assess and prioritise remaining high risks | • Identify all existing control measures in place for each risk.<br>• Verify the efficacy of each control measure at the critical control points by comparing to the operational limits at those points.<br>• Re-assess the risks after verification.<br>• Propose additional control measures if required. | January 2011 |
| 6. | Evaluate and establish monitoring. | • Evaluate the existing operational and compliance monitoring to ensure that all critical control points identified are included in the monitoring programme.<br>• Implement additional monitoring if required | January 2011 |
| 7. | Develop and implement plan to address risks and develop supporting programmes | • Senior management to commit itself to implementation of additional proposed control measures to reduce risks.<br>• Details to include personnel responsible, time-frame for implementation and budget allocation.<br>• CRR risks to be included in this implementation plan focusing on WWTW with a higher target risk. | February 2011 |

| Description | | Action | Timeframe |
|---|---|---|---|
| 9. | Develop management procedures for incident response and corrective actions | Compile a detailed Incident Management Protocol to address the following:<br>• Normal conditions i.e. non-compliance of final effluent),<br>• Incident conditions i.e. alert levels for all compliance parameters, and<br>• Emergency conditions i.e. accidental spillage and/or illegal release of contaminants, pumpstation and/or pipe failures and emergency conditions that can occur at the plant (flood, power failure, strike, sabotage, etc.). | January 2011 |
| 10. | Establish documentation and communication of plan | • STLM to communicate the $W_2$RAP to management and personnel of STLM and facilitate implementation.<br>• Plan to be communicated to DWA. | 2011 |
| 11. | Review plan and also undertake verification of all effluent data.by external parties on an annual basis. | • STLM must undertake on-going verification of effluent quality.<br>• STLM to conduct annual review of plan to identify new risks, review incident protocol and determine progress for implementation of additional corrective actions. | Annually |

## 3.1 Review of CRR ratings

As indicated in Section 2, the CRR rating is based on four criteria i.e.

CRR = A*B+C+D

Where:

**A** = The **Design Capacity** of the plant,

**B** = The **Average Daily Flow volume exceeding** on or below the hydraulic design capacity,

**C** = The number of **Non-Compliant Effluent Quality Variables** in terms of final effluent discharged, and

**D** = The non-compliance in terms of the **Technical Skills** staffing requirements.

For each of the four wastewater treatment works, the existing CRR score was reviewed and where applicable a new score was proposed. The target CRR score was also calculated for each WWTW so that any progress in reducing risk can be evaluated. The weighting factors used for the purpose of establishing the CRR per WWTW is given below in Table 2.

**Table 2: Weighting Factors for CRR ratings**

| Category/Description | Weighting Factor |
|---|---|
| **A = DESIGN CAPACITY (ML/D)** | |
| > 400 | 7 |
| 201 to 400 | 6 |
| 101 to 200 | 5 |
| 51 to 100 | 4 |
| 21 to 50 | 3 |
| 5 to 20 | 2 |
| < 5 | 1 |
| **B = CAPACITY (%) EXCEEDANCE** | |
| > 151% | 5 |
| 101 – 150% | 4 |
| 51 – 100% | 3 |
| 10 – 50% | 2 |
| 0 – 10% | 1 |
| < 0% | 0 |
| **C = NO OF NON-COMPLIANT PARAMETER FAILURES** | |
| 9 | 9 |
| 8 | 8 |
| 7 | 7 |
| 6 | 6 |
| 5 | 5 |
| 4 | 4 |
| 3 | 3 |
| 2 | 2 |
| 1 | 1 |
| 0 | 0 |

| Category/Description | Weighting Factor |
|---|---|
| **D = WEIGHTING FACTOR (WF) FOR TECHNICAL SKILLS** | |
| Superintendent + Process Controllers + Maintenance Team | 1 |
| Superintendent + Maintenance Team but no Process Controllers | 2 |
| Process Controllers + Maintenance Team but no Superintendent | |
| Process Controllers + Superintendent but no Maintenance Team | |
| Superintendent & no Maintenance Team & no Process Controllers | 3 |
| Process Controllers but no Maintenance Team & no Superintendent | |
| Maintenance Team but no Superintendent & no Process Controllers | |
| No Superintendent + no Process Controllers + no Maintenance Team | 4 |

**Table 3: Review of CRR Rating of WWTW in STLM**

| Name of WWTW | CRR Criteria | As per 1st order CRR score | Revised CRR score | Target CRR score | Reason for score |
|---|---|---|---|---|---|
| **Boskrans** | (A) Design Capacity | 3 | 3 | 3 | Capacity is 30 Ml/day, currently being upgraded to 45Ml/day |
| | (B) Flow exceeding capacity | 3 | 3 | 3 | Flow data for 2010 indicate that the average flow is 23M/day = 95% of design capacity. |
| | (C) Effluent Failures | 4 | 4 | 0 | Boskrans WWTW does not comply with 4 parameters. Results are discussed in 3.2.2 |
| | (D) Technical Skills | 1 | 1 | 1 | Technical skills are adequate. Qualified supervisor available on plant. External service provider responsible for maintenance has qualified artisans. List of operators and relevant qualifications discussed under 3.2.3 |
| | Total CRR score | **14** | **14** | **10** | **CRR score remains the same** |
| **Blinkpan** | (A) Design Capacity | 1 | 1 | 1 | Design = 0.54Ml/day |
| | (B) Flow exceeding capacity | 3 | 5 | 3 | Flow date for 2010 indicate that the average flow is 0.9Ml/day = 166% of design capacity.<br>However flow meters at this plant are faulty and this information is not accurate. |
| | (C) Effluent Failures | 3 | 1 | 0 | Blinkpan WWTW does not comply with 1 parameter. Results are discussed in 3.2.2 |
| | (D) Technical Skills | 1 | 2 | 1 | Technical skills are not adequate. Qualified supervisor is available on plant. External service provider responsible for maintenance has qualified artisans. List of operators and relevant qualifications are discussed under 3.2.3 |
| | Total CRR score | **7** | **8** | **4** | **CRR score is increased from 7 to 8** |

| Name of WWTW | CRR Criteria | As per 1st order CRR score | Revised CRR score | Target CRR score | Reason for score |
|---|---|---|---|---|---|
| **Kwazamokhule** | (A) Design Capacity | 1 | 1 | 1 | Design Capacity = 3.8Ml/day |
| | (B) Flow exceeding capacity | 5 | 2 | 3 | Flow data for 2010 indicate that the average flow is 1.5Ml/day = 40% of design capacity. Therefore CRR score is changed |
| | (C) Effluent Failures | 5 | 3 | 0 | Kwaza WWTW does not comply with 3 parameters. Results are discussed in 3.2.2 |
| | (D) Technical Skills | 1 | 1 | 1 | Technical skills are adequate. Qualified supervisor available on plant. External service provider responsible for maintenance has qualified artisans. List of operators and relevant qualifications are discussed under 3.2.3 |
| | Total CRR score | **11** | **6** | **4** | **CRR score is decreased from 11 to 6** |
| **Komati** | (A) Design Capacity | 2 | 2 | 2 | Design = 1.2Ml/day |
| | (B) Flow exceeding capacity | 2 | 3 | 3 | Flow data for 2010 indicate that the average flow is 2.2Ml/day = 32% of design capacity. The positioning of the flow meter is incorrect as it records the return activated sludge stream together with the inflow resulting in flow volume that is double that of the outflow. The flow meter reading is therefore halved with an average flow = 90% of design capacity. Therefore CRR score is changed. |
| | (C) Effluent Failures | 3 | 2 | 0 | Komati WWTW does not comply with 2 parameters. Results are discussed in 3.2.2 |
| | (D) Technical Skills | 1 | 2 | 1 | Technical skills are not adequate. Shortcomings will be addressed in future with specific focus on skills development. Qualified supervisor is available on plant. External service provider responsible for maintenance has qualified artisans. List of operators and relevant qualifications are discussed under 3.2.3 |
| | Total CRR score | **8** | **10** | **7** | **CRR score is increased from 8 to 10** |

## 3.2 Recommendations to Reduce CRR Scores

According to the CRR formulae, that lowest CRR that can be achieved is '1' and the highest CRR possible is '48'. STLM is committed to reduce the CRR score for each of the four plants. A list of recommendations to be implemented is discussed below per criteria.

### 3.2.1 (A) Design Capacity and (B) Flow Exceeding Capacity

| Name of WWTW | (A) | Target Value | (B) | Target Value |
|---|---|---|---|---|
| Boskrans | 3 | 3 | 3 | 3 |
| Blinkpan | 1 | 1 | 5 | 3 |
| Kwazamokhule | 1 | 1 | 2 | 3 |
| Komati | 2 | 2 | 3 | 3 |

Design capacity of a plant is represented here by the hydraulic loading discharged into the receiving environment. The design capacities (hydraulic and organic load) of a WWTW is a significant contributing factor to the non-compliance in terms of operations and maintenance that must be undertaken. Although some WWTW are able to operate successfully under either hydraulic or organic load this will eventually lead to a decrease in final water quality. Any WWTW that is operating above 80% of its capacity would necessitate some short-to-medium term planning for upgrade/expansion of the plant

The risks identified that relate to criteria (A) and (B) as well as the recommendations to address these risks are outlined below in Table 4:

**Table 4: Summary of Risks and Recommendation's for Criteria (A) and (B)**

| Risk Identified | | Recommendations | Timeframe for implementation of recommendations and progress to date. |
|---|---|---|---|
| 1. | Deterioration in final effluent due to Boskrans, Komati and Blinkpan WWTW's operating above 90% of design capacity. | • Boskrans is a largest WWTW in STLM and consequently has a larger impact on the receiving environment. Therefore funds were identified and allocated to the upgrade and expansion of Boskrans WWTW. The upgrade is currently being undertaken to increase capacity to 45Ml/day. | • More than R 105 mil will be spent over the next three years to upgrade the plant and to increase the design capacity to 45 Ml / day. |
| | | • There are no plans for expansion of Blinkpan and Komati at present time. Faulty flow meters have been identified and once this is corrected, the hydraulic capacity of these plants will be evaluated to establish if an expansion is required. | • The faulty flow meters will be repaired before end December 2010. Once accurate daily flow figures are available, only then can the hydraulic capacities be calculated. The final audit report will confirm the design capacities after the installation and calibration of the flow meters |
| 2. | Possible incorrect design capacity of Blinkpan and Komati due to lack to technical drawings | • Blinkpan and Komati WWTW were built and operated by Eskom up to 2005. The detailed drawing of each unit process were not handed to STLM and the design capacity information is therefore only an estimation.<br>STLM has begun communication with ESKOM to obtain all drawing for both of these WWTW. Once this is completed, the correct design capacity of these plants will be calculated. | • The lay out drawings of the units with the design capacity for the Komati plant has been obtained from Eskom.<br>• A detailed assessment of the different unit processes of the Blinkpan WWTW will have to be under taken to determine the capacities of each unit. This will be done during the next financial year, Sept. 2011 |
| 3. | Faulty/No flow meters leading to incorrect flow readings | STLM understand that measurement of final effluent flow rate is a requirement according to the license. | |
| | | • The flow meters at Blinkpan and Komati were not working. A service provider has been appointed to replace these flow meters. | • Provision has been made on the Capital budget to install and calibrate new flow meters for both raw and final effluent. This should be done within the next three months. |
| | | • The inflow meter at Komati is positioned at a point which records both inflow of effluent as well as the Return Activated Sludge that is sent from the clarifier back to the activated sludge process. The inflow meter therefore does not give a true representation of the inflow into the plant. Management is currently investigating an alternative position for the inflow meter in consultation with a service provider. | • The RAS will be pumped through a dedicated pump line directly into the aeration basin where it can mix with the incoming raw sewerage. The sensor of the flow meter will stay where it is but only measure the raw sewerage |

| Risk Identified | | Recommendations | Timeframe for implementation of recommendations and progress to date. |
|---|---|---|---|
| 3. | Faulty/No flow meters leading to incorrect flow readings (continued) | • All flow meters (inflow and outflow) will be added to a yearly calibration schedule to ensure that they are operating correctly. | • Instru-Serv is at this stage the sole service provider to service and calibrate the flow meters. The calibration will be undertaken on an annual basis. |
| | | • Process controllers will be required to record the inflow and outflow during every shift and record them on the log sheet. | • Comprehensive O&M manuals have been completed by the service provider. Supervisors are in the process of reviewing the documents and introducing process controllers to the new procedures and log sheets. |
| 4. | Deterioration of final effluent due to organic overload | The documented design capacity of Boskrans and Kwaza includes details of organic capacity, there is no information for Blinkpan and Komati. There has been no monitoring of COD at inflow to establish the operational organic capacity of each WWTW.<br>• STLM understands that a WWTW must operate within both hydraulic and organic capacity. If the plant operates above capacity, the quality of the final effluent may not comply with limits. STLM has begun monitoring the incoming effluent for COD to determine the operational organic load. | On-going. This was begun in June 2010. A sample of the inflow is collected once a month and analysed for COD. The Chemical analyst receives the COD load and keeps a record of this. Any increase in COD loading is then reported to the Manager Water Quality as this might indicate illegal discharges. These procedures are outlined in the Incident Management Protocol. |

3.2.2 (C) Effluent Failures

| Name of WWTW | (C) | Target Value |
|---|---|---|
| Boskrans | 4 | 0 |
| Blinkpan | 1 | 0 |
| Kwazamokhule | 3 | 0 |
| Komati | 2 | 0 |

As per the 1st order assessments, it was identified that Blinkpan WWTW and Komati WWTW have been operating under a General Authorisation as they discharge less than 2Ml/day. General limits are used to evaluate compliance.

Kwaza WWTW has no authorisation or license and discharges into the Klein Oliphant's River which is a sensitive catchment. In light of the absence of any Authorisation, general limits are currently being used to evaluate the compliance of the effluent.

Boskrans WWTW has been operating as per a general permit that stipulates special limits as it discharges into a sensitive catchment namely, the Oliphant's River. Relaxed standards apply to a certain number of parameters namely Suspended Solids, COD, Nitrates, Ortho-phosphates, pH and Faecal Coliforms. The plant is currently being upgraded to accommodate ADWF of 20Ml/day. The plan is to increase the capacity to 45Ml/day within the next 3 years.

STLM has approached a service provider to assist with license application and understands that licensing is a legislative requirement that forms a crucial aspect in water resource planning and allocation.The application for licensing is estimated to cost Council R1.8 million for the four treatment works.

A summary of the compliance data for all four WWTW is presented below in Table 5..

**Table 5: Summary of Compliance Data for 2009-June 2010**

| Parameter | Relaxed Standards | Boskrans | | General Limits | Blinkpan | | Komati | | Kwaza | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 90th Percentile | Average | | 90th Percentile | Average | 90th Percentile | Average | 90th Percentile | Average |
| Suspended Solids | 15 | 40.8 | 28.2 | 25.0 | 22.0 | 14.2 | 24.4 | 11.6 | 14.9 | 9.3 |
| Conductivity at 25° C In mS/m | 50 | 139.0 | 104.1 | 70.0 | 155.0 | 130.3 | 81.8 | 65.2 | 71.0 | 60.8 |
| Chemical Oxygen Demand (mg/l) | 65 | 284.2 | 172.6 | 75.0 | 46.0 | 32.0 | 52.0 | 33.7 | 67.8 | 51.6 |
| Free and Saline Ammonia $NH_3$ as N | 2 | 50.8 | 29.8 | 6.0 | 5.7 | 3.7 | 16.1 | 8.5 | 17.5 | 11.4 |
| Nitrate - $NH_3$ as N | 1.5 | 4.7 | 2.7 | 15.0 | 6.5 | 3.1 | 3.5 | 1.8 | 16.4 | 10.7 |
| Ortho - Phosphate $PO_4$ as P | 2.2 | 7.0 | 5.2 | 10.0 | 5.0 | 2.0 | 1.9 | 1.8 | 13.8 | 9.9 |
| pH-Value at 25° C | 6.5 to 8.5 | 7.9 | 7.5 | 5.5 to 9.5 | 7.9 | 7.5 | 7.6 | 7.4 | 7.1 | 7.0 |

| Parameter | Relaxed Standards | Boskrans | | General Limits | Blinkpan | | Komati | | Kwaza | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 90th Percentile | Average | | 90th Percentile | Average | 90th Percentile | Average | 90th Percentile | Average |
| Residual Chlorine as $Cl_2$ | 0 | 0.2 | 0.1 | 0.25 | 0.2 | 0.2 | 2.3 | 1.0 | 0.4 | 0.3 |
| Faecal Coliforms/100ml | 1000 | 800 | 333 | 1000 | 709 | 258 | 105 | 38 | 0 | 0 |
| Indicates relaxed standards | | | | | | | | | | |

The information presented above is for the period 2009-June 2010. Compliance monitoring was not taking place every month and the data presented is not based on full data sets. Also monitoring of Faecal Coliforms has only begun in March 2009 and data presented above for this parameter is therefore based on three months of analysis. A comprehensive compliance monitoring programme has begun and all test results will be entered on the Green Drop System.

As indicated in Table 5, Boskrans WWTW exceeds the limits for five parameters: SS, Conductivity, COD and Ammonia indicating inadequate nutrient removal. The Boskrans plant is operating at 95%biological capacity and cannot adequately treat the increased COD load that is entering the plant. The upgrade of the existing plant should address this issue and effluent quality is expected to improve after completion of the upgrade.

Blinkpan WWTW and Komati WWTW face a number of challenges including lack of monitoring equipment, insufficient qualified personnel on site, ageing infrastructure and design flows.

Kwaza WWTW has qualified personnel, sufficient operational monitoring equipment and an excellent maintenance programme which contribute to a well-maintained treatment plant. However the plant was designed to comply with General limits and utilises Biofilters to treat effluent. This type of technology cannot achieve adequate phosphorous and ammonia removal required under legislation.

STLM recognises that non-compliance to effluent limits may be the results of a number of factors namely:

- Works not designed to treat to the applied standards
- Lack of adequate maintenance
- Ageing maintenance and inadequate budget for asset management
- Budget constraints for upgrades and for routine and preventative maintenance
- Problems with procurement process and management issues.
- Impact of load shedding

The detailed risk assessment of each WWTW that will be conducted as part of this $W_2$RAP will highlight specific risks that compromise compliance to effluent standards. The detailed risk assessment will assist STLM to implement specific actions that will result in compliance to effluent standards. The risks identified that relate to criteria (C) as well as the recommendations to address these risks are outlined below in Table 6.

**Table 6: Summary of risks and recommendation's for Criteria (C)**

| Risk Identified | | Recommendations | Timeframe for implementation of recommendations and progress to date. |
|---|---|---|---|
| 1. | Non-compliance with legislation due to inadequate compliance monitoring | • As noted, STLM acknowledges that there was in-adequate compliance monitoring of final effluent. A comprehensive compliance monitoring programme has been set up to monitor the final effluent of all four WWTW on a monthly basis for all 9 parameters outlined in the Section 21(f) and (h) of the National Water Act, 1998.<br>• The monitoring of upstream and downstream points will be included in the latter part of 2011 as this will be included in the next financial budget | The chemical analyst has begun with the new compliance monitoring programme in March 2010. The compliance programme, monitoring sites and all test results are currently being loaded onto the GDS system. |
| 2. | Non-compliance with legislation due to lack of waste discharge license | Management of STLM is in the process of obtaining quotations from service providers to assist with completing the license applications for all four WWTW. However initial quotes obtained were far higher than anticipated and other service providers has been approached for more competitive quotes. | A quote has been received from a service provided to submit applications for water use licences for all the WWTW. No provision has been made in the current year's budget to fund the water use applications. The expected expenses still need to be submitted to Council after which the prescribed procurement process needs to be followed if the funds are secured. The process could be carried over to the next financial year. |
| 3. | Non-compliance with effluent standards | The non-compliance to effluent standards is due to a number of factors and these will be investigated during the risk assessment of each treatment plant. | Comprehensive risk assessment to be undertaken in January so that factors relating directly to non-compliance can be identified. |
| | | • Quarterly Process audits and inspections have been undertaken at all WWTW and the results of these audits will be used by management in 2011 to plan ahead. | • Detailed information regarding all wastewater treatment plants is contained in the "WASTE WATER TREATMENT OPTIMIZATION AUDIT REPORT" compiled by Mpumamanzi. |
| | | • The upgrade of Boskrans will address the non-compliance as the present plant was not designed to handle the increased COD load that is currently entering Boskrans. | |

| Risk Identified | | Recommendations | Timeframe for implementation of recommendations and progress to date. |
|---|---|---|---|
| 3. | Non-compliance with effluent standards (continued) | Kwaza cannot achieve phosphate and ammonia limits as it utilises biofilters. Optimisation of this process must be investigated. The Green Drop Technical report on Kwaza noted that this treatment plant complied with all criteria for the Green Drop indicating a well operated and maintained plant. As Kwaza is a small WWTW, its impact is minimal compared to Boskrans the majority of available funding has been allocated to the upgrade of Boskrans However the upgrade of this plant to include processes that can achieve special limits will be included in the long term plan of STLM as outlined in the IDP. | |
| | | • Blinkpan and Komati have been allocated to a qualified supervisor who is knowledgeable on wastewater processes. A task Team has been set up to improve the operation and maintenance of these two plants. The Task Team is currently reviewing the process audit and have compiled a list of priorities that should be addressed as a matter of urgency | • Provision has been made in the 2011/2012 Capital budget to replace redundant aeration equipment. This will include the replacement and calibration of flow meters. The RAS at the Komati WWTW will be recycled to aeration basin to mix with the raw inflow. The DSM water services will be responsible to co-ordinate the different task. etc. |

3.2.3 (D) Technical Skills

| Name of WWTW | (D) | Target Value |
|---|---|---|
| Boskrans | 1 | 1 |
| Blinkpan | 2 | 1 |
| Kwazamokhule | 1 | 1 |
| Komati | 2 | 1 |

Regulation 2834, in conjunction with Schedule III and IV of the Government Gazette No. 28557, February 2006 outlined the regulations for registration of waterworks and process controllers. The number of process controllers required at a treatment plant is dependent on the classification of the plant.

STLM has applied for registration of all process controllers. DWA has indicated that all necessary qualifications have not been submitted and therefore registrations certificates have not been submitted. STLM is in the process on gathering all relevant qualifications which will then be submitted to DWA for registration purposes.

A summary of all technical staff at the four WWTW is presented below in Table 7 to indicate the level of compliance to Regulation 2834. The risks and recommendations that apply to this criteria (D) is also discussed below in Table 8 .

**Table 7: Summary of Technical Skills at STLM for Wastewater in Accordance with Regulation 2834**

| Name of WWTW | Class | Staff required as per Regulation 2834 | | Existing Staff Capacity based on proposed qualifications | |
|---|---|---|---|---|---|
| | | Supervisor | Process controllers | Supervisor | Process controllers |
| Boskrans | A | V | Class IV | Class V supervisor, have applied for re-registration and awaiting new registration certificate. | 1 X Class V, 2 X Class IV, 1 X Class I : are in the process of re-registering with DWA and awaiting certificates.<br>3 X Process Controllers that have not yet been registered but have relevant qualifications.<br>13 X general workers that have no qualifications |
| Blinkpan | E | V* | Class I | Class V foreman available at Hendrina Office and is in charge of Kwaza, Komati and Blinkpan.<br>2 X 'Senior Operators' responsible for all 3 plants: are in the process of classification and have relevant qualifications to be classified as Class III | 3 X general workers that have not yet been registered and have no qualifications |
| Kwaza | C | V* | Class III | | 7 X process controllers that are awaiting registration certificates.<br>Four of them have relevant qualifications and can be classified. |
| Komati | E | V* | Class I | | 3 X general workers that have not yet been registered and have no qualifications |

*Class V to be available at all times but does not have to be on the plant

**Table 8: Summary of Risk and Recommendations for Criteria (D) Technical Skills**

| Risk Identified | | Recommendations | Timeframe for implementation of recommendations and progress to date. |
|---|---|---|---|
| 1. | In-sufficient information on qualifications of operators that is delaying process of registration of process controllers and leads to non-compliance to Regulation 2834 | STLM has previously submitted registration forms to DWA for all water and wastewater process controllers. However due to an influx of registration forms to the national office of DWA during 2009 all registration certificates could not be processed immediately. As copies of the registration certificates are required for both the Blue and Green drop certification programmes, DWA issued certificates for process controllers registered as Class "O" if information on qualifications was outstanding. STLM has a received a number of "Class O" certificates and is in the process of gathering the necessary information. This information together with the registration forms are loaded on the GDS so that a current and updated certificate can be issued for all process controllers. | The chemical Analyst is responsible for this process. She is currently evaluating all certificates issued, gathering the required outstanding information and submitting the amended registration forms and qualifications to DWA |
| 2. | Non-compliance to final effluent due to lack of technical skills at WWTW | • STLM is confident that all supervisors are knowledgeable on treatment processes and also have access to senior personnel that can assist if required. A number of specialist service providers are also available for consultation if problems cannot be solved internally. | • Further training and education has already been introduced through the skills development plan. Training in WW treatment has been provided by an accredited service provider to more than 30 process workers during November 2010. |
| | | • STLM is committed to on-going training of process controllers. Detailed operations and maintenance manuals have been completed and will be presented to process controllers in the new year so that they are knowledgeable on their daily duties and responsibilities. | • It is believed that the detailed operational manuals will contribute towards the understanding of the different processes and the importance and function of each unit process. |
| | | • STLM has a number of 'general workers' that have no qualifications. This issue is under discussion by senior management. | • New regulations that acknowledge the experience of process controllers who do not have academic qualifications might contribute towards the recognition of experience of process controllers who have years of experience |

# 4. REFERENCES


(a) An extract of : Municipal Wastewater Treatment Base Information for Targeted Risk-Based Regulation, Steve Tshwete LM (Mpumalanga Province), Status at August 2009. Department of Water Affairs, Pretoria. 2009.

(b) Water Safety Plan Manual: step-by-step risk management for drinking-water suppliers. World Health Organization, Geneva, 2009.

(c) Wastewater Risk Abatement Plan. A guide to plan and manage towards safe and compliant wastewater collection and treatment in South Africa. August 2010, Draft 01. Water Research Commission and Department of Water Affairs, Pretoria, South Africa.