 Eskom	Specification	Kusile Power Station
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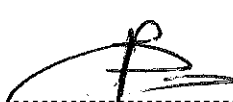
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1. Introduction

Kusile Power Station obtained the Water Use License (WUL) for stream diversion, water abstraction and water pipeline crossing as well as for "disposing of waste in a manner which may detrimentally impact the water resource". The conditions of the license require Kusile Power Station to conduct surface, groundwater and aquatic monitoring at specified monitoring points to determine the impact of the facility and other activities on water quality and aquatic ecosystem.

The monitoring will benefit Kusile Power Station to:

- a) Comply with the water use licence requirements.
- b) Early detection of non-compliance to legislative requirements;
- c) Decrease risk of penalties from Department of Water & Sanitation.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

The purpose of this document is to define the scope of work for surface, groundwater and aquatic monitoring at Kusile Power Station.

2.1.2 Applicability

This document is applicable to Kusile Power Station

2.1.3 Effective date

The scope of work shall be effective immediately after signature.

2.2 Normative/Informative References

2.2.1 Informative

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

1. 32-727 Safety, Health, Environmental and Quality (SHEQ) Policy
2. 32-288 Policy Procurement and Supply Chain Management Standard
3. 32-599 Standard Procurement and Supply Chain Management Standard
4. Kusile Power Station Environmental Management Plan for Operation and Maintenance

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5. Groundwater Governance Guideline 240-8569743

2.2.2 Normative

- [1] ISO 9001 Quality Management System
- [2] ISO 14001 Environmental Management System
- [3] National Water Act 36 of 1998
- [4] National Environmental Management Act No 107 of 1998
- [5] Kusile Power Station Water Use Licenses

2.3 Definitions

2.3.1 Approved

Acknowledged and authorized in accordance with authoritative governing body/ies i.e. SANS

2.3.2 Contractor

Selected service provider employed to provide a specific service to Eskom, Kusile Power Station.

2.4 Abbreviations

Abbreviation	Explanation
ADDD	Ash Dump Dirty Dam
DWS	Department of Water & Sanitation
EMC	Environmental Monitoring Committee
HRD	Holding Recycling Dam
SANS	South African National Standards
SDD	Station Dirty Dam
SHEQ	Safety, Health, Environment and Quality
WUL	Water Use Licence

2.5 Roles and Responsibilities

The Employer

The responsibilities of the Employer include the following:

- a) Informing and issuing the Contractor with the scope of work and relevant documentations
- c) Measure performance against those areas which contribute to the Employer's business.

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Contractor

- a) The contractor will be responsible for routine monitoring of surface, groundwater and aquatic environmental at Kusile Power Station as per the scope of work.
- b) Analyse results and look at possible environmental impacts from Kusile Power Station construction and operations activities
- c) Prepare weekly, monthly, quarterly, annual report and submit to the employer.
- d) Attend and present at EMC meeting
- e) In cases where abnormalities are found from the monitoring reports, the contractor is expected to undertake full investigation on root cause and provide recommendations in a form of a report.

2.6 Process for Monitoring

This specification will be reviewed after every 36 months after the initial authorisation or when necessary

2.7 Scope of work Monitoring Requirements

Routine monitoring of surface, groundwater and aquatic environment

- a) Carry out specific surface and groundwater samples analysis in accordance with monitoring plan requirements. This monitoring should be undertaken weekly, monthly, quarterly and annually at specified points as stipulated in point 9.
- b) Collect and record specific groundwater information in accordance with the monitoring plan requirements showing dates, location and time of monitoring as stipulated in point 9.
- c) Biannual sampling of hydrocarbons in all monitoring points.
- d) Quarterly bio-monitoring analysis must be carried out on 10 monitoring points located upstream and downstream of the Kusile Power Station in order to monitor the effect on the aquatic ecosystem.
- e) Quarterly toxicity testing must be conducted on the three monitoring points boreholes and surface sites associated with waste water streams from the Ash Dump, Coal Stockyard and Pollution Control Dam.
- f) Inspect the functioning of stormwater infrastructure and turbidity level once every year.
- g) Soil sampling twice a year or as and when required upstream and downstream of Kusile Power Station footprint (12 Monitoring points)
- h) Geochemical modelling every 2 years
- i) Geohydrological model based on latest disposal and stockpiling

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- j) Purging of boreholes using potable pumps once a year.
- k) The contractor must use SANS accredited laboratories for analyses.

3.2 Data Capturing

- a) Keep and update the electronic surface and groundwater database after every monitoring run.
- b) Provide data interpretation and trend analyses.
- c) Contamination levels are to be measured and flagged against site specific water quality standards and DWS targets ranges.

1.3 Reporting

The reports must include:

- a) Weekly reports which include compliance status of water quality, water quality maps and identify appropriate mitigation measures should the aquifer be found vulnerable to pollution. The weekly report must be submitted a week after sampling was done.
- b) Monthly reports which include compliance status of water quality, water quality maps and identify appropriate mitigation measures should the aquifer be found vulnerable to pollution. The monthly report must be submitted a month after sampling was done.
- c) Quarterly reports which show trends and recommended action plans, integrated aquatic monitoring findings, reviewed constituents and standards and recommended mitigation measures.
- d) Annual reports which include time dependant analysis of water quality trends, water quality status and recommended mitigation measures and give solutions should water quality be impacted by Kusile Power Station.
- e) Any other reports as per the requirements e.g. Geochemical modelling, Geohydrological model etc.
- f) Two hard copies, and one soft copy should be submitted to the client.

3.4 Adhoc services

The adhoc services will include but not limited to:

- a) Review of existing monitoring methodology and amendment if necessary. The contractor shall drill boreholes when required by the employer.

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- b) Stakeholder notification in cases where water quality objectives/targets are exceeded.
- c) Undertaking water monitoring immediately after rainfall and/or on an "as and when required" basis.
- d) Maintenance of monitoring network which includes replacing of destroyed and lost monitoring points.
- e) Adhoc Environmental Monitoring Committee meeting attendance (4 times per annum).
- f) Conduct risk analysis and pollution source investigations should the need arises, this is related to upstream mining activities, agricultural impacts on water resources around and within the Kusile Complex.
- g) Meetings with the client to provide progress and presentation to management where necessary.
- h) Prepare presentation on surface, ground and aquatic water quality and present it to the EMC quarterly meetings.
- i) In cases where abnormalities are found from the monitoring reports, the contractor is expected to undertake full investigation on root cause and provide a way forward.
- j) Recommend and motivate for follow-up monitoring where necessary.
- k) Advice or make recommendations on future monitoring requirements.
- l) Training to be done on an "as and when required" basis to Kusile Power Station personnel for a better understanding of the total monitoring system ensuring capacity to proactively minimise any environmental issues that could arise from any of the Kusile Power Station activities.

3. Groundwater monitoring specification

a) Review of a site specific sampling and monitoring procedure:

The contractor shall evaluate and review the above mentioned regulatory and other Eskom requirements and develop or amend the existing Kusile Power Station site specific groundwater monitoring and sampling procedure considering the requirements of the Eskom GGG, Groundwater Monitoring (GWG05a) and Groundwater Sampling (GWG05b) Guidelines as the basis for the development of the site specific monitoring and sampling procedure.

The contractor shall update the site specific monitoring procedure if and when the need arises (e.g. amendment of WUL, waste licence, EIA and EMP approvals, changes in risk e.g. sensitive

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receptors etc). This shall be done within a reasonable timeframe from changes incurred ensuring that regulatory compliance to the frequency, sampling points, elements to be analyzed for and reporting timeframes are met at all times.

b) Geophysical surveys. Refer to Eskom, 2014 Geophysical Survey Guideline (GWG02):

The contractor shall undertake a geophysical survey and ensure that all legal requirements regarding the survey on the property are reviewed and complied with. This shall include both surface rights, e.g. as defined by local by-laws and the property title deed, and subsurface rights, e.g. such as relate to the intended exploitation of the groundwater resource in terms of the requirements of the National Water Act, 1998 (Act 36 of 1998).

c) Test pumping, Refer to Eskom, 2014 Test-pumping Guideline (GWG04):

The contractor shall conduct Aquifer test pumping of a borehole in order to obtain information about aquifer parameters and its possible flow rates as per GWG04 but the most appropriate procedure shall be identified by the Contractor pertaining to:

- I. Slug Test;
- II. Tracer Test;
- III. Packer Test; and
- IV. Pump Test

d) Hydrocensus, Refer to Eskom, 2014 Hydrocensus Guideline (GWG07):

A hydrocensus is essentially a site familiarisation involving the collection of important groundwater data from the study area and surrounding environments to an Eskom facility such as a power station. It comprises a census of key boreholes, springs and any other groundwater-related information. The objective is to identify the potential (pollution) risk and depletion risk to receptors – particularly groundwater users such as communities and farmers.

The contractor shall conduct a hydrocensus as per GWG07 and the boundaries should be far enough to include sensitive environments/users relevant to Eskom, potential Eskom groundwater impacts as well as impacts from neighbouring landowners such as mining and industrial activities.

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A hydrocensus should be done for all operations that have waste or products stored on a temporary or permanent basis that could have potential impact on surface or groundwater quality and quantity, by leaching into or coming in contact with water or any large scale dewater activities.

e) Design, drilling and construction of boreholes. Refer to Eskom, 2014 Borehole Drilling Construction and Design Guideline (GWG03):

The contractor shall drill boreholes when required by the employer as per GWG03.

f) Sampling and monitoring: large phase with complete chemical data evaluation/small phase with limited chemical data evaluation, Refer Eskom 2014 Groundwater Monitoring Guideline (GWG05a) Eskom, 2014, Groundwater Sampling Guideline (GWG05b)

A comprehensive overview is provided in GWG05a and GWG05b on groundwater monitoring and sampling principles.

The contractor shall evaluate all relevant regulatory and other requirements (e.g. WUL, EIA, EMP, Waste License Conditions, Closure and Land Use Objectives, IWWMP, Directives etc.) and develop a Kusile Power Station Project site specific monitoring and sampling procedure considering the requirements of the Eskom Groundwater Governance Framework and Guidelines (GGF&G) Groundwater Monitoring (GWG05a) and Groundwater Sampling (GWG05b) Guidelines as the basis for the development of the site specific monitoring and sampling procedure.

g) Risk Assessment Eskom, Refer Eskom 2014 Risk Assessment Guideline (GWG10)

The contractor shall conduct a complete groundwater risk assessment; should assess the three components, which are the source, the pathway and the receptor as per GWG10. The contractor will allow for the numerical ground water modelling to be done and update it annually.

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**h) Groundwater remediation Eskom, Refer Eskom 2014, Groundwater Remediation
Guideline (GWG12)**

The contractor shall propose remediation plans. The remediation objectives or the ultimate goals of any remediation should be defined by the consequence to the critical receptor based on the toxicology and likely dependence/intake as per GWG12.

4. Surface water monitoring

- a) Surface water flow rates must be determined monthly at every sample point (inflow and the exit of each of the sub-catchments) at the same time as the collection of the samples.
- b) Surface water quality impacts must be determined by comparing up and downstream samples locations and by comparing the quality returned with the RWQO for the quaternary catchment.
- c) Contaminant loading concentrations must be calculated and reported on each report to assist with determining the contribution by the Kusile Power Station operation to the water quality of the catchment it impacts.
- d) Inflow and outflow turbidity levels must be measured to identify the Kusile Power Station's specific contribution of turbidity levels to its downstream users taking into consideration the background levels.

5. Comparison of analysis and results

All surface and groundwater samples must be submitted to SANAS **accredited laboratories** for analyses. The water quality results from both surface and groundwater sampling sites shall be compared to the values given in the *South African Water Quality Guidelines, Volume 1: Domestic Use, Volume 4: Agricultural Use-Irrigation, Volume 5: Agricultural Use-Livestock Watering* (DWAf, 1996) and Kusile Water Use Licences. When reporting the findings from this screening exercise, attention must be given to:

- The constituents that exceed any of these Guidelines, and
- Water quality trends that are showing a decline in water quality.

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6. General information regarding health and safety

- a) Kusile Power Station is fully committed to protecting the health and safety of employees, consultants, visitors and members of the public. Occupational health and safety is a core value in Eskom and the belief is that all unsafe acts and incidents are preventable and this belief guides our approach to safety across our business activities.
- b) The Eskom Safety, Health, Environment and Quality policy is available from the Kusile Safety Department.

7. ESKOM SHEQ Policy and Life Saving Rules

- a) There are 5 lifesaving rules that have been identified by Eskom. Failure to adhere to these rules by any Eskom employee or employee of any Principal Consultant or Consultant will be considered a serious transgression. These rules are being implemented to prevent serious injury or death of any employee, labour broker or consultant working in any area within Eskom.
- b) Kusile Management team will take a stance of zero tolerance on these rules.
- c) The Consultant shall at all times comply with the health and safety requirements prescribed by law as they may apply to the services.
- d) This is to ensure that every person who works on or visits Kusile Power Station returns home safely to his or her family.
- e) The Consultant shall at all times comply with the health and safety requirements prescribed by law as they may apply to the services.

8. Monitoring points, parameters analysed and frequency

Number	Identity	X Co-ordinates	Y Co-ordinates	Parameters to be Analysed	Frequency
10490-08	Borehole	28.91759	-25.90990	Parameters: pH, Dissolved oxygen Total dissolved solids, Temperature, Alkalinity, Total Suspended Solids, Total hardness as calcium carbonate,	Monthly
10490-09	Borehole	28.916 64	-25.92740		
10490-10	Borehole	28.89600	-25.92740		
10490-17	Borehole	28.90533	-25.93989		
10490-21	Borehole	28.92259	-25.94277		
10490-25	Borehole	28.88393	-25.92330		
10490-27	Borehole	28.93232	-25.91280		

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Number	Identity	X Co-ordinates	Y Co-ordinates	Parameters to be Analysed	Frequency
BH 02	Borehole	28.90675	-25.90260	Electrical conductivity, Nitrate/nitrite, Ammonia (NH ₃), Phosphate, Fluoride, Sulphate Chloride, Aluminium (total), Sodium Magnesium, Manganese (total), Calcium, Potassium, Iron(total), Turbidity E. Coli, Total Coliform, Faecal Coliform and Chemical Oxygen Demand	
BH 03	Borehole	28.90014	-25.91234		
BH 11	Borehole	28.93147	-25.95020		
BH 24	Borehole	28.899 45	-25.90000		
BH 25	Borehole	28.89334	-25.90450		
BH 27(LGW-B4)	Borehole	28.95413	-25.91610		
BH 30(LGW-B11)	Borehole	28.954 13	-25.91610		
DWBH-06	Borehole	28.92613	-25.92171		
DWBH-07	Borehole	28.93006	-25.92496		
DWBH-36	Borehole	28.91236	-25.91445		
GDF-6D	Borehole	28.92886	-25.90808		
KP05	Borehole	28.93214	-25.91958		
10490-14	Borehole	28.93476	-25.91506		
10490-18	Borehole	28.989815	-25.93727		
MP14-001	Borehole	28.89699	-25.9298		
MP14-002	Borehole	28.89642	-25.91896		
MP14-003	Borehole	28.92724	-25.92724		
Spring 1	Borehole	28.93680	-25.90230		
Spring 2	Borehole	28.93372	-25.88930		
Spring 3	Borehole	28.90632	-25.90632		
Spring 4	Borehole	28.88893	-25.94449		
Spring 6	Borehole	28.92797	-25.94760		
Spring 10	Borehole	28.95462	-25.95428		
Spring 11	Borehole	28.93460	-25.93110		
Spring 12	Borehole	28.91466	-25.94236		
SW 1	Surface	28.88306	-25. 92000		
SW 2	Surface	28.868 47	-25 .8533		
SW 3	Surface	28.889 15	-25. 888 10		
SW 4	Surface	28.89269	-25. 89090		
SW5	Surface	28.90239	-25. 94310		
SW 6	Surface	28.88723	-25.88723		
SW 7	Surface	-25.92578	28.89394		
SW 8	Surface	-25.89460	28.90094		
SW 9	Surface	-25.90245	28.91739		
SW 10	Surface	-25.87853	28.86982		

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Number	Identity	X Co-ordinates	Y Co-ordinates	Parameters to be Analysed	Frequency
SW11	Surface	-25.88439	28.86170		
SW 16	Surface	28.85141	-25.90218		
SW 17	Surface	28.86313	-25.87476		
SW 18	Surface	28.91201	-25.94699		
NCSW01	Surface	28.92214	-25.90743		
NCSW03	Surface	28.90512	-25.92340		
NCSW08	Surface	28.92297	-25.92858		
NCSW09	Surface	28.91531	-25.92697		
CSW08	Surface	28.865289	-25.871985		
Zustertroom	Surface	No coordinates available as yet			
Ezemvelo confluence of the Wilge and Elands River	Surface	No coordinates available as yet			
Before and after the confluence of the Wilge and Bronkhortspruit	Surface	Same as above			
The Wilge Dam (old Premier mine dam)	Surface	Same as above			
After the confluence of the Saalboomspruit with the Wilge River	Surface	Same as above			
One Kilometre upstream from the Kusile perimeter	Surface	Same as above			
ADDD, SDD and HRD				As per above	As per above
All Monitoring points mentioned above (inclusive of the ADDD, SDD and HRD)	All Monitoring points mentioned above			ICP-MS Scan on comprehensive list of Trace Elements: Aluminium (Al), Iron (Fe), Manganese (Mn), Cadmium (Cd), Total Chromium (Cr), Copper (Cu), Nickel (Ni), Lead (Pb), Selenium (Se), Boron (B),	Monthly

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Number	Identity	X Co-ordinates	Y Co-ordinates	Parameters to be Analysed	Frequency
				Vanadium (V), Zinc (Zn), Barium (Ba), Cobalt (Co), Arsenic (As), Mercury (Hg), Silver (Ag), Strontium (Sr), Thallium (Tl), Beryllium (Be), Molybdenum (Mo), Uranium (U), Titanium (Ti), Antimony (Sb), Lithium (Li), Tungsten (W), Tin (Sn), Lanthanum (La), Caesium (Ce), Tellurium (Te), Bromide (Br)	
All groundwater monitoring points mentioned above	All groundwater monitoring points mentioned above			Groundwater Level Measurements	Bi-annually
All Monitoring Points mentioned above	All Monitoring Points mentioned above			Total Hydrocarbons	Bi-annually
Three monitoring boreholes and three surface sites	Three monitoring boreholes and three surface sites associated with waste water streams from the Ash Dump and Coal Stock Yard Pollution Control Dam			Toxicity	Quarterly
10 monitoring points	10 monitoring points			Aquatic monitoring (recommended ecological classes, characteristics of aquatic environment, stressor indicators, habitat indicators, response indicators, wetland assessment, ecotoxicology, sediment sampling – biannually,)	Quarterly
Stream Identity	X Co-ordinates	Y Co-ordinates	Parameters to be Analysed	Frequency	
Spruit upstream of as facility	25.94775	28.92798	Parameters: Flow, Temperature, pH, EC Suspended Solids, Dissolved Oxygen, Chemical Oxygen Demand, Turbidity,	Weekly	
Spruit upstream of ash facility tributary (south)	2595677	2890786			
Spruit North of ash facility	2592636	2889425			

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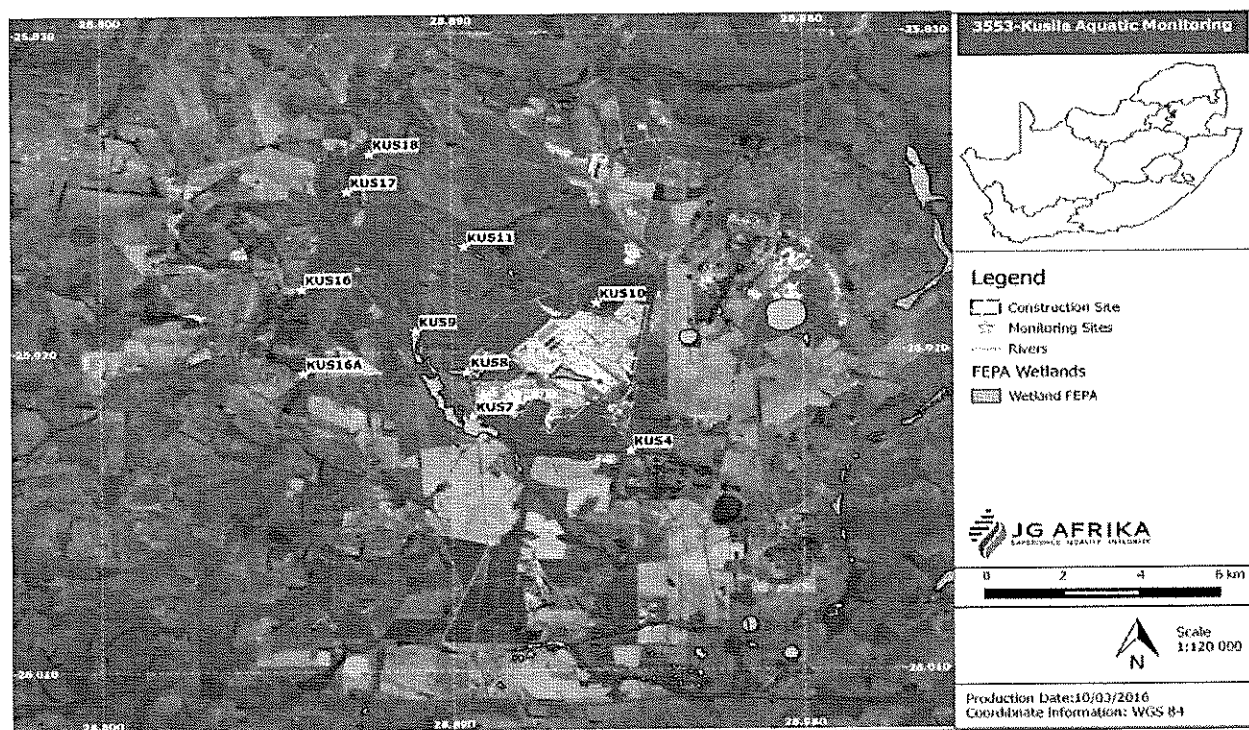
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Spruit downstream of ash facility (South)	2592799	2888535	Sechi disk depth, Alkalinity (mg CaCO_3/l), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Sulphate (SO_4), Fluoride (F) (Si), Ammonia (NH_3), PO_4 , Nitrite, Nitrate, Hydrocarbon (including naphthalene) and Faecal coliforms
Pan	2593620	2891044	
Offset wetland downstream	25.88819	28.88941	
Wilge river B	25.87875	28.86381	
Before wilge river confluence	25.88438	28.86176	
Wilge river A	25.87340	28.86615	
Offset wetland upstream	25.87686	28.92111	

9. Monitoring points

Aquatic Monitoring Points



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10. Acceptance

This document has been seen and accepted by:

Name	Designation
Sipho Shabangu	Risk Management Manager
Lesiba Kgobe	Environmental Management Manager
Charlotte Tsumaki	Chemical Services Manager
Sinothi Buthelezi	Aux Manager

11. Revisions

Date	Rev.	Compiler	Remarks
June 2017	1	C. Malebana	First issue.
Dec 2019	2	C. Malebana	New template

12. Development Team

The following people were involved in the development of this document:

- Lesiba Kgobe
- Cylia Malebana

13. Acknowledgements

None

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