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REPUBLIC OF SOUTH AFRICA

Version 1.3
Last Updated: October 2021

ENGINEERING SERVICES INVESTIGATION REPORT

INTERNAL MEMORANDUM

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ENGNEERING DISCIPLINE	**Tick (x)**
ARCHITECTURAL ENGINEERING SERVICES	**X**
ELECTRICAL ENGINEERING SERVICES	**X**
MECHANICAL ENGINEERING SERVICES	**X**
CIVIL ENGINEERING SERVICES	**X**
STRUCTURAL ENGINEERING SERVICES	**X**

STATUS	**INVESTIGATION REPORT**
SUBJECT:	**DWS: Boskop Area Offices Multidisciplinary condition assessment**

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	Version	Designation	Name	Signature	Date
Author	1.0	Technical Lead/ Chief Mechanical Engineer	Kabelo Chabalala		24/ 02/ 2023

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1. INTRODUCTION

The Department of Water and Sanitation (DWS) requested Department of Public Works and Infrastructure (DPWI) to assist in conducting condition assessment for the office buildings of DWS at Boskop Dam area in order to compile findings as recommendations and scope of works that needs to address challenges on-site.

In response to the request, a multidisciplinary team in DPWI through Engineering Services (ES) comprised of Technical Lead (TL), Architect, Quantity Surveyor (QS), Mechanical Engineer (ME), Electrical Engineer (EE), Civil Engineer (CE) and Structural Engineer (SE) was therefore tasked to conduct visual condition assessment on 17 November 2022, subsequently the team was expected to produce reports with findings, recommended scope of works and high level cost estimates.

The purpose of this report is therefore to summarise the findings, recommended scope of works and cost estimates from different disciplines which are annexed in this report for more detailed information.

2. LOCATION

DWS Boskop Dam offices are located in the North West Province, Dr. Kenneth Kaunda District Municipality, between Carletonville and Potchefstroom along R501 road. GPS coordinates of the site as well as aerial view are indicated below:

Building name	Latitude	Longitude	Location
DWS Boskop Hydrometry	26°34'21''S	27°07'10''E	Noordbrug, Potchefstroom

3. BACKGROUND

The Department of Water and Sanitation Boskop Offices consist of an office block (with guard house), carports, technical stores, firefighting garage, gas store, backup generator room and single quarters. The Offices are currently in a dilapidated condition, which poses a health and safety risk to the staff members. The assessment will assist UDM to register a project which will address all the identified technical issues. Highlighted below are the areas inspected:

Blocks A to F denote the following:

- Block A and B denote the main office blocks and consist of single-storey buildings
- Block C denotes the office storage
- Block D denotes the single living quarters which are single-storey buildings
- Block E denotes elevated plastic water tanks supported by a steel frame
- Block F denotes the single-storey pump house

4. FINDINGS AND SCOPE OF WORKS

4.1. Architectural

4.1.1. Findings

- Manned and access controlled with gravel routes leading to different parts of the property.
- Openable windows provide natural lighting and ventilation.
- Fire escape maps require updating, assembly points and fire drills non-existent. Signage not SABS approved.
- Waterproofing required.
- Roof sheeting corroded.
- Paint and coatings delaminating, peeling and discoloration.
- Security panic latches and fire rated doors recommended to comply with OHSA.
- Joinery and Sanitary fittings must be thoroughly checked, repaired and replaced were necessary including provision for disabled toilets.

4.1.2. Scope of works

- Repairs and renovation of DWS buildings with utilization of general specification and tenant installation requirements.
- Alteration of existing buildings in order to comply to required standards, that is, installation of new paraplegic toilets, provision of fire escape doors and assembly points to name but a few.
- Demolitions where required.
- Refer to Annexure A: Architectural Photo report
- Costs to be covered in QS report.

4.2. Electrical

4.2.1. Findings

- Transformer is pole mounted and main supply metering kiosk located below transformer which feeds single and married quarters.
- 75kVA stand-by generator which supplies emergency power to the main office building. Generator currently not operational.
- Most DBs are non-compliant to SANS 10142.
- Most interior lights are not working. Refer to electrical report for more information.
- Some exterior lights are not operational, some cabling damaged.
- Socket outlets wall mounted, not chased into the walls, hence does not comply to SANS 164.
- Socket outlets are insufficient in some areas, others damaged.
- CCTV and motion detectors installed but not operational and in a poor condition.
- PA system installed in the boardroom not operational.
- Fire alarm siren installed which is outdated technology.
- There is no automatic fire detection system.

4.2.2. Scope of works

- Refurbishment of all distribution boards.
- Retrofit all existing light fittings with LED light fittings.
- Refurbish small power.
- Tracing and re-wiring of all faulty cables.
- Repair existing standby generator.
- Repair existing CCTV system.
- Repair existing telecommunication system.
- Install lightning protection system.
- Provision of electrical works on water supply equipment.

4.3. Mechanical

4.3.1. Findings

- Site consists of split ACs, most of which are not operational and in poor condition.
- Fire extinguishers were up to date at the time of inspection, water-based fire protection equipment could not be found during site inspection.
- Wet services i.e. water distribution pipes are poorly installed and pose health and safety hazard.
- Most water supply and drain pipes are in a poor condition.
- There is no fire protection in the archive room.
- Water supply installation in the single/married quarters ablution facility are in a very poor condition and not operational.

4.3.2. Scope of works

- Repair and replace air conditioners and ventilation system.
- Service/ repair/ replace fire protection installations where necessary.
- Repair, renovate and rehabilitate all wet services installations for internal reticulation.

4.4. Civil

4.4.1. Findings

- There are 2x existing boreholes feeding groundwater into storage tanks connected to pumps which could not be accessed at the time of inspection.
- Other boreholes identified on site were not operational due to power failure.
- There are 3x 2.5kL elevated storage tanks at a height of 7m which are fed with borehole water. There is no water softening mechanism to treat water before distribution to site for consumption.
- The water storage tanks are overflowing as a result of lack of water level regulating valve. The overflowing water is ponding at the bottom of the elevated tanks without any form of drainage.
- Storm water management in a poor condition due to aging and dilapidated infrastructure.
- Water supply is available to sanitary fittings, however some fittings do not have running water.
- The facility uses septic tank and French drain for sewer and is in a good and functional condition. There could be a possible leak to the septic tank due to sprouting vegetation along the edges.

4.4.2. Scope of works

- Construction of 20kL steel water tank for admin buildings and single quarters.
- Booster pumps fitted with dual function of solar and electrical power.
- Borehole investigation.
- Drilling of boreholes and pumps.
- Water pipeline reticulation.
- Decommissioning of existing water tanks, boreholes and pump facility.
- Desludging and locate conservancy tanks.
- Water purifier system for admin buildings.
- Maintenance of roads.
- Landscaping.

4.5. Structural

4.5.1. Findings

- Cracked walls throughout the facility buildings and the ground.
- Surface bed around steel shipping containers have grass between joints and worn out sealant.
- Visible voids due to missing mortar.
- Paintwork on the timber trusses is exposed, worn out and peeling off. Some timber trusses were showing signs of damage and rot
- Fire storage constructed from corrugated sheeting, which shows signs of decay on purlins.
- Members of steel structure supporting elevated water tanks were corroded.

4.5.2. Scope of works

- Conduct geotechnical investigation.
- Detailed investigation of roof trusses to assess water damage and replace damaged roof truss members and roof sheeting.
- Identify and seal roof leaks.
- Identify and repair all wall cracks.
- Remove grass/vegetation on surface bed underneath shipping containers and repair joints.
- Demolish and reconstruct surface bed around corrugated houses to comply to SANS.
- Decommission corrugated houses and fire storage and construct new houses that are SANS compliant.
- Construct new foundations and structural steel support for water tanks.
- Decommission (if applicable) and repair/refurbish steel shipping containers.

5. COST ESTIMATES

The table below shows high level cost estimates. Estimate for Architectural works will be provided in a separate QS report.

Discipline	Cost estimate
Architect	**In QS report to be submitted**
Electrical	**2 265 500.00**
Mechanical	**1 250 000.00**
Civil	**1 678 022.06**
Structural	**4 330 536.55**
Total (Incl. VAT)	**R9 524 058.61**

6. RECOMMENDATION

DWS Boskop facilities are in a deteriorating condition hence it is recommended that the scope of work detailed in discipline specific condition assessment report be implemented in order to make the facility safe for occupation and habitable.

4.1. Proposed Procurement Instruction

Total multidisciplinary repair, renovation and rehabilitation of DWS Boskop Dam office buildings, single quarters, and associated buildings comprised of all works pertaining to architectural, electrical, mechanical, civil and structural installations.

7. CONCLUSION

The nature of deterioration at the facility requires attention to ensure the site is safe for occupation and conducive to execute work related duties. This report must be read in conjunction with the annexed reports for more and complete status quo of the facility.

Annexure A: Architectural Investigation photo report

Annexure B: Electrical Investigation Report

Annexure C: Mechanical Investigation Report

Annexure D: Civil Investigation Report

Annexure E: Structural Investigation Report

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ANNEXURE A: ARCHITECTURAL PHOTO REPORT

ANNEXURE C: VISUAL INSPECTION

SITE	
KEY PLAN	**IMAGE**
	
Position: Entrance area	**Category:** Accessibility
A1.1	Internal ☐ External ☑
	Description: Building access as seen from the main gate. Gate house requires overhead shelter in the driveway in order to combat challenges during rainy weather.

SITE	
KEY PLAN	**IMAGE**
	
Position: Surroundings	**Category:** General
A1.2	Internal ☐ External ☑
	Description: Technical stores. Do not form part of the scope of works.

SITE	DWS BOSKOP OFFICE
KEY PLAN	**IMAGE**
	
Position: Block 1 & 2	**Category:** General
A1.3	Internal ☐ External ☑
	Description: Evidence of dilapidating roof. Facias and downpipes need replacement.

SITE	DWS BOSKOP OFFICE
KEY PLAN	**IMAGE**
	
Position: Block 1 & 2	**Category:** General
A1.4	Internal ☐ External ☑
	Description: All doors are normal. Fire escape door and panic latch to be considered. Burglar gates to be removed where fire door is installed.

SITE	
KEY PLAN	**IMAGE**
	
Position: Gate house	**Category:** General
A1.5	Internal ☐ External ☑
	Description: Presence of weeds on apron surrounds indicate lack of building maintenance.

SITE	
KEY PLAN	**IMAGE**
	
Position: General	**Category:** Drainage
A1.6	Internal ☐ External ☑
	Description: Drainage layout to be updated in order to manage future maintenance works and quality measures.

A2.1	Block 1 – Admin block	A2.2	Block 1 – Admin block
IMAGE		IMAGE	
			
Position: Main Building	**Category:** Walls/masonry	**Position:** Main Building	**Category:** Walls/masonry
Description: Repair of vertical crack as per Structural Engineer. (To advise regarding structural integrity in affected areas).	Int ☑ Ext ☐	**Description:** Plinth to be sealed and refurbished.	Int ☑ Ext ☐

Risk assessment

Impact	Insignificant	Minor	Significant	Major ☑	Severe
Rating	**High Risk**				
Consequence	Rare	Unlikely ☑	Possible	Likely	Almost certain
Remarks	Walls have major cracks. Serious preparation and sealing and new paintwork are required to put the walls to acceptable standards.				

A2.3	Block 1 – Admin block	A2.4	Block 1 – Admin block
IMAGE		IMAGE	
			
Position: Offices	**Category:** Walls & Alterations	**Position:** Digitizing room	**Category:** New walls
Description: Cubicles to be demolished. Alterations as per design drawings	Int ☑ Ext ☐	**Description:** Area at which subdivision will be done.	Int ☑ Ext ☐

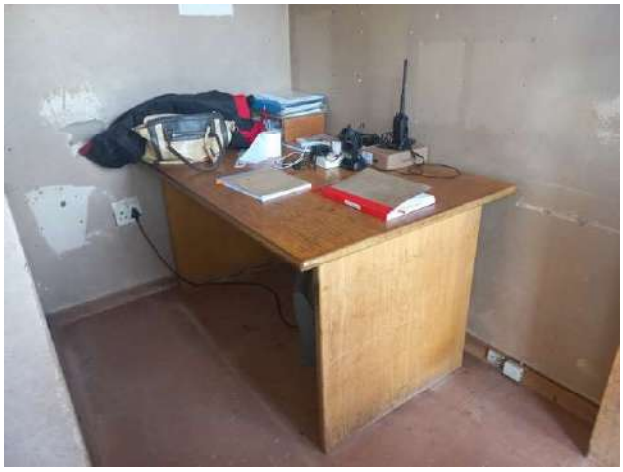
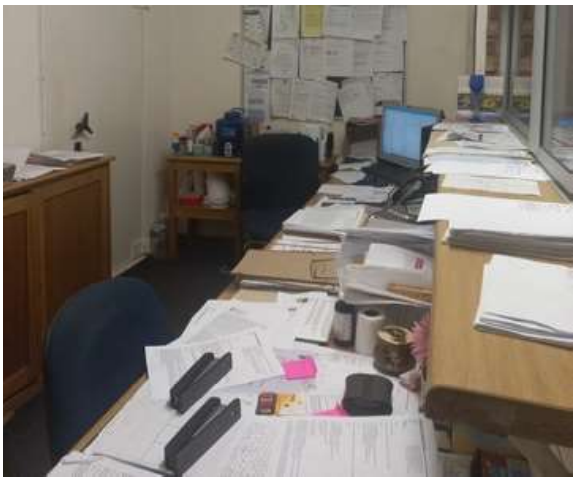
Risk assessment

Impact	Insignificant ☑	Minor	Significant	Major	Severe
Rating	**Eliminated**				
Consequence	Rare ☑	Unlikely	Possible	Likely	Almost certain
Remarks	New design drawings will be required for detailed estimates on the next stage (DDR).				

A3.1	Block 2	A3.2	Block 2
IMAGE		IMAGE	
			
Position: Storage area	**Category:** Roof covering	**Position:** All blocks	**Category:** Roof covering
Description: Roof required attention. Leaks to be checked prior to repair and coating works	Int ☐ Ext ☑	**Description:** Damaged facia and gutters to be replaced.	Int ☐ Ext ☑

Risk assessment

Impact	Insignificant	Minor	Significant ☑	Major	Severe
Rating	**High Risk**				
Consequence	Rare	Unlikely	Possible ☑	Likely	Almost certain
Remarks	Trapped water in concealed gutters and downpipes overflows into office spaces and cause substantial damage to ceilings and building contents.				

A4.1	Block 5 – Guard House	A4.2	Block 1 – Admin
IMAGE		IMAGE	
			
Position: Guard house	**Category:** Joinery and fittings	**Position:** Reception	**Category:** Joinery and fittings
Description: A new fixed counter for guard house is proposed.	Int ☑ Ext ☐	**Description:** New fixed counter and glazed screen is proposed for the reception area.	Int ☑ Ext ☐

Risk assessment

Impact	Insignificant ☑	Minor	Significant	Major	Severe
Rating	**Eliminated**				
Consequence	Rare ☑	Unlikely	Possible	Likely	Almost certain
Remarks	New design drawings will be required for detailed estimates on the next stage (DDR).				

A5.1	Block 2 – Storage area	A5.2	Block 1 – Administrative area
IMAGE		**IMAGE**	
			
Position: Roof space	**Category:** ceilings	**Position:** Offices	**Category:** Ceilings
Description: Damaged plumbing causes leakages and damage in other offices. To be repaired before replacement of ceiling. Roof sisalation is necessary to keep dust and pest away.	Int ☑ Ext ☐	**Description:** Blemishes in ceiling to be fixed before painting is done	Int ☑ Ext ☐

Risk assessment					
Impact	Insignificant	Minor	Significant ☑	Major	Severe
Rating	**High Risk**				
Consequence	Rare	Unlikely	Possible ☑	Likely	Almost certain
Remarks					

A5.3	Block 3 – Storage and consultation	A5.4	Block 3 – Storage and consultation
IMAGE		**IMAGE**	
			
Position: Guard House	**Category:** Floors	**Position:** Block 1 & 2	**Category:** Floors
Description: Vinyl tiles to be replaces in the Guard House.	Int ☑ Ext ☐	**Description:** Carpet tiles to be replaced in offices.	Int ☑ Ext ☐

Risk assessment					
Impact	Insignificant	Minor	Significant ☑	Major	Severe
Rating	**High Risk**				
Consequence	Rare	Unlikely	Possible ☑	Likely	Almost certain
Remarks					

A7.1	Block 1	A7.2	Block 3 – Storage
IMAGE		IMAGE	
			
Position: General	**Category:** Doors & IM	**Position:** Escape routes	**Category:** Doors & ironmongery
Description: Damaged locksets to be replaced.	Int ☑ Ext ☐	**Description:** Fire doors to be provides. Burglar gates to be removed where applicable.	Int ☐ Ext ☑

Risk assessment					
Impact	Insignificant	Minor	Significant	Major ☑	Severe
Rating	Critical Risk				
Consequence	Rare	Unlikely	Possible	Likely	Almost certain ☑
Remarks	Safety risk, evacuation risk				

A8.1	Block 2 – Storage area	A8.2	Block 1 & 2
IMAGE		IMAGE	
			
Position: Storage	**Category:** Metalwork	**Position:** Exterior	**Category:** Metalwork
Description: Repair burglar gates and repaint.	Int ☑ Ext ☐	**Description:** Repair burglar gates and repaint.	Int ☐ Ext ☑

Risk assessment					
Impact	Insignificant	Minor ☑	Significant	Major	Severe
Rating	Moderate risk				
Consequence	Rare	Unlikely ☑	Possible	Likely	Almost certain
Remarks					

A9.1	Block 5 – Guard House	A9.2	Block 5 – Guard House
IMAGE		IMAGE	
			
Position: External	**Category:** Plumbing & drainage	**Position:** Toilet	**Category:** Plumbing & drainage
Description: Plumbing system to be repaired.	Int ☐ Ext ☑	**Description:** Damaged sanitary fixtures to be replaced. Water supply to be repaired.	Int ☑ Ext ☐

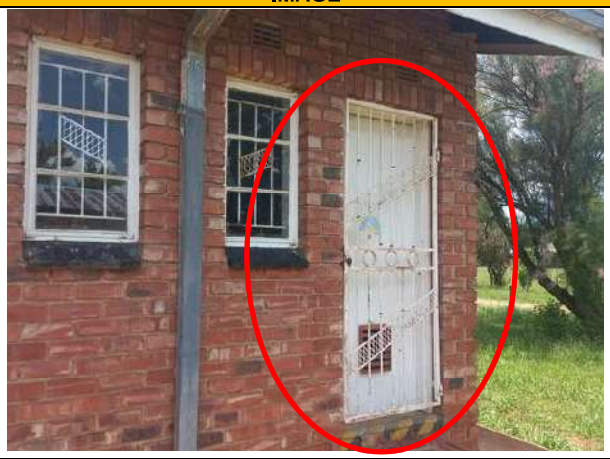
Risk assessment

Impact	Insignificant	Minor	Significant ☑	Major	Severe
Rating	**High risk**				
Consequence	Rare	Unlikely	Possible ☑	Likely	Almost certain
Remarks	Lack of maintenance result in system collapse.				

A10.1	Block 1 & 2	A10.2	Block 1 & 2
IMAGE		IMAGE	
			
Position: Windows	**Category:** Glazing/windows	**Position:** Windows	**Category:** Glazing/windows
Description: Replace broken glass.	Int ☐ Ext ☑	**Description:** Remove damaged putty and replace with new. Painting to be done after drying of putty.	Int ☐ Ext ☑

Risk assessment

Impact	Insignificant	Minor	Significant	Major ☑	Severe
Rating	**Critical risk**				
Consequence	Rare	Unlikely	Possible	Likely	Almost certain ☑
Remarks	Broken glass to be replaced with safety glass. Staff member be cut by glass during opening or closing.				

A11.1	Block 1	A11.2	Block 1
IMAGE		IMAGE	
			
Position: Roof	**Category:** Doors	**Position:** Entrance	**Category:** Doors
Description: Replace damaged internal and external wooden doors.	Int ☑ Ext ☑	**Description:** Replace damaged steel doors.	Int ☐ Ext ☑

Risk assessment

Impact	Insignificant	Minor ☑	Significant	Major	Severe
Rating	**Moderate Risk**				
Consequence	Rare	Unlikely	Possible ☑	Likely	Almost certain
Remarks	Doors must be varnished/painted regularly to prolong the service period and strength.				

A12.1	Block 1 & 2	A12.2	Block 1 & 2
IMAGE		IMAGE	
			
Position: Roof	**Category:** Windows	**Position:** Entrance	**Category:** Windows
Description: Prep wall and repaint.	Int ☑ Ext ☐	**Description:** Putty to be replaced and windows re-painted.	Int ☑ Ext ☐

Risk assessment

Impact	Insignificant	Minor ☑	Significant	Major	Severe
Rating	**Minor Risk**				
Consequence	Rare ☑	Unlikely	Possible	Likely	Almost certain
Remarks	Paint peeling may cause discomfort and sometimes health hazard.				

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ANNEXURE B: ELECTRICAL INVESTIGATION REPORT

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Version 1.5
Last Updated: October 2022

ENGINEERING SERVICES INVESTIGATION REPORT

INTERNAL MEMORANDUM

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ENGNEERING DISCIPLINE	**Tick (x)**
ARCHITECTURAL ENGINEERING SERVICES	
ELECTRICAL ENGINEERING SERVICES	**X**
MECHANICAL ENGINEERING SERVICES	
CIVIL ENGINEERING SERVICES	
STRUCTURAL ENGINEERING SERVICES	

STATUS	**TECHANICAL INVESTIGATION REPORT**
SUBJECT:	**Department of Water and Sanitation (DWS): Boskop Area Offices Electrical Infrastructure Condition Assessment**

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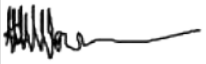
Author	Project Engineer	Khanimamba Ndlovu		30-01-2023
Supervisor	Chief Electrical Engineer	Shane Palackal		31-01-2023

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1. INTRODUCTION

The Directorate: Electrical Engineering Services, received a request from KAM in Head Office to provide professional engineering services. These services include condition assessment of electrical engineering works associated with repairs and renovations at the Department of Water and Sanitation: Hydrometry Boskop Area Offices.

Subsequent to the above request, the Directorate: Engineering services assigned an in-house electrical team to the project, which will be working with other professionals. i.e. Architects, Quantity Surveyors, Civil and Structural Engineers and Mechanical Engineers.

Herewith, this report aims to assist in developing a Procurement Instruction by providing a summary of the current state of the electrical infrastructure, the scope of electrical engineering works together with corresponding high level cost estimates.

2. LOCATION

Building Name	Latitude	Longitude	Location
Department of Water and Sanitation: Hydrometry Office Boskop Dam	**26º34′16.86″**	**27º07′11.18″**	Boskop Dam Area, R501, between Potchefstroom and Carletonville

Picture 1: DWS Boskop Hydrometry Aerial View

3. BACKGROUND

The facility was inspected by Head Office Engineering Services team on 17 November 2022. The site is located in the Boskop Dam area on the R501, between Potchefstroom and Carletonville, 16 kilometres from Potchefstroom, North West Province. The electrical engineering team ascertained the condition of the existing electrical installations and their compliance with the most recent national building standards. The Offices are currently in a dilapidated condition, which poses a health and safety risk to the staff members. The assessment will assist UDM to register a project which will address all the identified technical issues.

4. FINDINGS

4.1.1. Photographic Evidence

Item	Good	Fair	Poor	Comment
1	X			 *Picture 2: Pole-mounted Transformer* The Pole-mounted transformer is located outside the site boundary and supplies the facility via the generator changeover panel. It is in good condition.

2		X		 *Picture 3: Pole-mounted Main Supply Metering Kiosk* The Main supply metering kiosk is located below the transformer and feeds the facility through the generator changeover panel. It is in fair condition with minor dirt ingress and rust. The Main breaker fed from the transformer and feeding the meter has a current rating of 160A, 3ph.
3	X			 *Picture 4: Main supply Kiosk no. 4.*

				"Kiosk no. 4" supplies the single and married quarters buildings. There is a warning sign in place and it is properly enclosed. It could not be opened, however it appears to be in good condition.
4			X	 *Picture 5: Standby Generator located in the Generator Room* The generator has a power rating of 75kVA, 3 ph @ 0.8 power factor. It is currently non-operational and has accumulated dust. It only supplies the main office building.
5	X			 *Picture 6: Generator Changeover Panel* The generator changeover panel has a power rating of 50kVA. Both the transformer and generator feed into this panel. It is properly labelled and still in good condition.

6		X		 *Picture 7: Main Office DB (DB-001)* The main office DB is located in the main office building near the reception. It has a main breaker rating of 60A, 3ph, with a fault level current of 5kA. It is non-compliant to SANS10142 due to some of the spare ways not properly blanked, not properly labelled and missing a legend card. It has emergency provision from the standby generator.
7	X			 *Picture 8: D/B 1* The DB is located in the generator room and has a main breaker rating of 63A, 3ph, with a fault level current of 6kA. It is in good condition as it is properly labelled, warning sign in place and spare ways properly blanked.

8		X		 *Picture 9: DB-002* The DB is located in Room 23. It has a main breaker rating of 60A, 3ph, with a fault level current of 5kA. It is non-compliant to SANS 10142 since it is not completely labelled.
9		X		 *Figure 10: DB-Sub Next to Supply Chain offices* The DB Sub is located next to Supply Chain Offices. It has a main breaker rating of 80A, 3ph, with a fault level current of 5kA. It is non-compliant to SANS 10142 since it is not completely labelled.

10		X		 *Picture 11: Sub Distribution Board in the Water Monsters Offices (DB 003)* The DB is located in the Water Monster's Offices. It has a main breaker rating of 32A, single phase. The DB is in fair condition, however, surge arresters need to be replaced and re-labelled.
11		X		 *Picture 12: Sub DB for Parking bays lights* The Sub-DB is located in the Parking bays. It is in fair condition since it is non-compliant to SANS10142.i.e. Breakers not labelled, no warning signs and no legend card.

12		X		 *Picture 13: Sub DB for Guard House* The sub DB is located in the security guard house. It is in fair condition since it is non-compliant to SANS10142.i.e. Breakers not completely labelled, no warning signs and no legend card. It needs to be cleaned.
13		X		 *Picture 14: Main DB for Single and Married Quarters* The Main DB is located outside the ablution building near the single and married quarters. It is fed from “kiosk No. 4” and has a main breaker rating of 100A, 3 ph, with a fault level current of 10kA. It is in fair condition and complaint to SANS10142. i.e Properly labelled, warning sign in place and spare ways are blanked with blanking plates. It only needs to be cleaned.

14		X		 *Picture 15: Air conditioners (Indoor unit) in the board room* Air conditioners are located in the board room and some other offices in the main building. They both do not have indoor isolators. They currently only have outdoor isolators.
15			X	  *Picture 16: Fluorescent Lights Tubes* The fluorescent light tubes comprises of T8 open channel 1200mm and T8 open channel 2000m. Some of these lights are not working, missing light tubes and have damaged light fittings. Some of the light fittings appear to have reached their end of life. Majority are in poor condition.
16			X	 

				Picture 17: CFL light fittings Some Compact Fluorescent Light fittings are not working, especially in the toilets. Some of the light fittings are worn out and appear to have reached their end of life. Majority are in poor condition.
17			X	  *Picture 18: Floodlights for exterior* Exterior floodlights for the security guard house and general lighting are not operational and worn out. They appear to have reached their end of life.
18			X	

				  *Picture 19: Power Socket* Majority of the sockets are not in good physical condition and not complaint to SANS164. Power cables are not chased into wall in some offices.
19	X			 *Picture 20: Light Switches* All light switches are in good working condition. Few switches need to be cleaned.

20			X	 *Picture 21: Power cables for lights* Power cables for some of the single quarters lights are in poor condition. i.e. exposed and not properly trunked nor channelled in conduit.
21		X		 *Picture 22: Damaged power skirting* Power skirting are damaged in some of the offices and show signs of rust. This exposes the power cables and violates SANS164 standards.
22		X		 *Picture 23: Fire alarm Siren*

				Fire alarm siren is in fair condition and operational. The switch is obsolete and the siren is old technology.
23			X	 *Picture 24: Public Address Speaker* The public address speaker is only installed in the boardroom and is not working
24				 *Picture 25: Data Outlets* Majority of the data outlets are damaged and not operational. They are all surface-mounted and not flush-mounted, which makes them prone to damages.

25			X	 *Picture 26: Motion Detectors* All the motion detectors are currently not working and are in poor condition.

4.1.2. MAIN OBSERVATIONS

a) MV Reticulation System

- The Transformer is pole-mounted and located outside the site boundary. The main supply metering kiosk is located below the transformer. It feeds the single and married quarters via “kiosk No. 4” and the hydrometry offices via the generator changeover panel.

b) Emergency Power

- There is a 75kVA standby generator which only supplies emergency power to the main office building. The generator is currently not operational.

c) Distribution Boards

- Majority of the distribution boards are not compliant to SANS10142.i.e. dirty, not properly labelled, no legend card and no warning labels.

d) Interior Lights

- One T8 Open Channel double tubes 2000m fluorescent light fitting in the board room was replaced with CFL light fitting. This reduces the illuminance required for a board room as per SANS10114 .
- CFL light bulbs are not working in the board room ablutions.
- Two 1,2m fluorescent lights are not operational in the Archive room.
- There is a leaking water pipe on the ceiling close to a light fitting near the supply chain offices. This is a health and safety hazard as it can spark a fire hazard.
- Toilets lights are not working near supply chain offices.
- One Fluorescent light fitting not working in Room 039 (Storeroom).
- Four fluorescent light fittings are not working in the Conference Room.
- Guard house toilet CFL light not working.
- Female toilet lights are not functional in the main office building.
- Fluorescent light fitting damaged in the reception.
- Light tube loose and previously fell on an employee in Room 05.
- 2m fluorescent light not operational in Room 04.
- Two fluorescent light fittings have been replace with CFL light fittings which are missing bulbs in the single and married quarters ablutions.
- Lights need to be installed in the boat storeroom and workshop.

e) Exterior Lights

- Exterior light cable is cut and exposed outside the board room.
- Two pole-mounted floodlights for general lighting are not working.
- Guard house exterior floodlights are warned out and not functional.
- Single and married Quarters exterior light fittings have severely deteriorated and not operational. Seven of the lights are missing light tubes.
- Three post mounted perimeter CFL lights are not operational near the single and married quarters.

f) Small Power

- Most socket outlet power cables in the supply chain offices are running on wall surfaces and not chased into walls. This is a non-compliance to SANS164.
- One power socket outlet is missing a protective cover plate and is exposed in the supply chain offices. This is a health and safety risk as it can electrocute the staff.

- The conference room only has one double socket 3 pin outlet. These are insufficient and more sockets need to be installed.
- There are two double sockets outside supply chain building. These sockets are wearing out since there are not suitable for outdoor use. These need to be replaced with outdoor double socket with appropriate UV and waterproof resistance.
- The Water Monsters Office (Room 16) has no socket outlets along the skirting. There are three 3 pin sockets on the Sub DB. This increases the use of extension cords. More sockets need to be installed along the skirting.
- Socket outlet power cable not chased into wall in Room 23.
- A few power sockets are damaged in some offices in the main office building.
- Power sockets need to be installed in boat storeroom and workshop.

g) Telecommunication system

- Data outlets are all surface-mounted and are easily damaged. Majority of the data outlets are in poor condition and not working. One data outlet burnt in the supply chain office.

h) CCTV and Access Control

- The CCTV system is installed but currently not operational.
- There is no Access Control system installed. No turnstile and boom gates installed in the entrances.
- All the motion detectors are not working and in poor condition.

i) Fire Detection/Alarm System and Intercom system.

- The fire alarm system only comprises of a fire alarm siren, which is old technology and non-operational. There is no automatic fire detection system. i.e. no fire detectors, no fire control panel and no call points.
- Public address speaker is only installed in the boardroom and is currently not working.

j) Lightning Protection

- The existing buildings do not have lightning protection system installed.

5. RECOMMENDATION

From the conducted condition assessment, the following scope of electrical works are recommended:

- Revamping/refurbishing all the DBs in accordance to SANS10142-1. i.e. Installing legend cards, proper labels, blanking spare ways, warning signs, general cleaning and re-painting.

- Retrofitting all faulty and functional (exterior and interior) light fittings with more energy efficient and reliable LED light fittings, in accordance to SANS 10114 and SANS 10389. A light switch in the conference room needs to be installed. Install light fittings and sockets in the boat storeroom and workshop.

- Chasing into wall, all the socket outlet power cables, fixing and replacing all faulty socket outlets and installing more socket outlets in offices where there is a deficiency, in accordance to SANS 164-1 latest recommendations and regulations.

- Reviving the standby generator, CCTV system and telecommunication system.

- As per health and safety regulations, buildings which are at risk of lightning strikes must have lightning protection installed. Provision for installation of a lightning protection system is included in the cost estimations. This may form part of the scope of works as determined by the lightning risk assessment outcome in the design stage.

It is highly recommended that a capital project to address the afore-mentioned technical issues be initiated. The scope of electrical works recommended for the facility is mainly repairs and renovations.

5.1. Cost Estimations

High level cost estimates per scope of works are presented in the table below:

Scope of Works	Cost Estimations
1. Refurbishment of all Distribution Boards in accordance to SANS10142-1	R100 000
2. Retrofitting all existing light fittings with LED light fittings.	R500 000
3. Refurbishment of small power in accordance to SANS 164-1.	R300 000
4. Tracing and re-wiring of all faulty cables	R50 000
5. Repair existing standby generator	R160 000
6. Repair existing CCTV system	R170 000
7. Repair existing Telecommunication system	R150 000
8. Installation of lightning protection system.	R180 000
9. Electrical works on the water supply system project	R360 000
Total Cost (Excl. VAT)	**R1 970 000**
Total Cost (Incl. VAT)	**R2 265 500**

5.2. Proposed Procurement Instruction

The proposed PI project subject is **Repairs and Renovations of electrical installations at Boskop Dam Department of Water and Sanitation Offices**. The high level cost estimations of the required repairs and renovations of electrical works is approximately **R2 265 500**. The cost is for electrical works at the office buildings, single and married quarters and water projects as it will be liaise with other disciplines.

6. CONCLUSION

The inspection indicated that the facility's electrical installations are in poor condition and are non-compliant to local regulations and standards. Major issues were observed with the lighting system and small power. The required work will also include reviving the standby generator and security systems. The project shall be a repairs and renovations type and also covers electrical works required under the water project (s).

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ANNEXURE C: MECHANICAL INVESTIGATION REPORT

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Version 1.5
Last Updated: October 2022

ENGINEERING SERVICES INVESTIGATION REPORT

INTERNAL MEMORANDUM

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ENGNEERING DISCIPLINE	**Tick (x)**
ARCHITECTURAL ENGINEERING SERVICES	
ELECTRICAL ENGINEERING SERVICES	
MECHANICAL ENGINEERING SERVICES	**X**
CIVIL ENGINEERING SERVICES	
STRUCTURAL ENGINEERING SERVICES	

MEMO STATUS	**TECHNICAL INVESTIGATION REPORT**
SUBJECT	REQUEST FOR INVESTIGATION OF EXISTING MECHANICAL EQUIPMENT AND NEW ONES WHERE NEEDED AT BOSKOP HYDROMETRY: MECHANICAL SERVICES (DWS)

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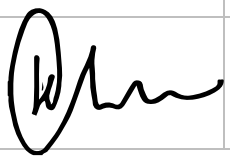
REPUBLIC OF SOUTH AFRICA

APPROVALS

	Designation	Full Name	Signature	Date
Author	Mechanical Engineer	Ngoako Lehong		31/01/2023
Supervisor	Chief Mechanical Engineer	Kabelo Chabalala (Pr Eng)		24/ 01/ 2023

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1. INTRODUCTION

The purpose of this report is to present the findings discovered at Boskop hydrometry pertaining to mechanical installations. Boskop hydrometry is located in the North West Province in Boskop. The facility is made up of the administration buildings, workshops, conference rooms and staff residences.

A site visit was conducted on the 17th of November 2022 by the Department of public works and infrastructure (DPWI)'s technical team which comprises the Mechanical, Civil, Structural, Electrical Engineers and Quantity Surveyor to ascertain the scope of work and to also inspect the condition of the facility pertaining to the respective disciplines.

2. LOCATION

Building Name	Latitude	Longitude	Location
Boskop Hydrometry	-26.57	27.12	Farm Naauwpoort 385

Figure 1. Boskop Hydrometry

3. BACKGROUND

The DPWI Engineering services was requested to carry out an inspection at Boskop Hydrometry in order to identify scope of works that will aid with the registration of a new project that will address the challenges that are prevailing at the facility. This necessitated the need to conduct a site inspection, where the conditions of the current installations were assessed and the findings were analysed to come up with recommendations to address the challenges.

4. FINDINGS

Air Conditioning, Ventilation and Refrigeration

The air conditioning in the facility consists of only split units which comprises mid-walls and under ceiling units. Majority of the units in the facility are not operational and this is due to poor maintenance and some units exceeding their design lifespans. The insulation on majority of the refrigerant pipes has worn off, thus making the units energy inefficient due to significant heat transfer between the surrounding and pipes.

Fire Protection

The fire protection in the facility consists of only fire extinguishers which have all been serviced to comply with statutory regulations. All the fire extinguishers have been recharged and thus medium has been adequately pressurised as observed on the pressure gauges. Fire signage which has been posted in the facility in the vicinity of fire protection equipment is mostly in fair condition.

Wet Services

The wet services installations in the facility are in fair to poor condition with some toilets and wash hand basins not having running water. Some water pipes run through the ceiling where there is electrical wiring for lights, plugs and other electrical appliances. The pipes are, however leaking significantly and thus the personnel at the facility have switched off the valves to such parts of the facility to stop the leakage. The guardhouse and other parts of the facility to do not have running water in their toilets and wash hand basins. The wet services installations for the married quarters are in very poor condition with minimal to no water supply in the ablution facilities.

Table 1. Air Conditioning Findings Table

Item	Good	Fair	Poor	Comment
A			X	 *Figure 2 Indoor midwall unit in poor condition* Some of the midwall units are in poor condition and not operational. These units need to be replaced to ensure the officials have comfortable working spaces.
B		X		 *Figure 3. Under ceiling ac unit in fair condition* The under ceiling in the open plan office is not operational. The unit is mounted in an area where there's a proposal to divide the space and thus different units may need to be installed.

C		X		 *Figure 4. AC condenser unit*  *Figure 5. Condenser refrigerant pipes* The condenser units are mostly in fair condition with apparent signs of wear and tear on the refrigerant pipes. The pipes need to be re-insulated to ensure that minimal heat transfer occurs between the pipes and environment.
D			X	 TRANE CE Model Number: MWW524KB0RAB Rated Voltage 230V Rated Frequency 50Hz Cooling Capacity 6000W Heating Capacity 7000W Fan Motor Power 20W Fan Motor RLA 0.25A Max. Discharge Pressure 2.7MPa Max. Suction Pressure 0.6MPa Insulation Class I Water Proof Class IP20 Refrigerant R22 Trane Export, LLC, USA 63222405 *Figure 6. AC nameplate*

				Most of the air conditioners in the facility are operating using R22 refirgerant which has been phased out due to its high glabal warming potential and thus challenges may be experienced when the need to refill the refrigerant arises.
E			X	 *Figure 7. Toilet hand dryer* The hand dryer in the toilet is in poor non-operational condition. The hand should be replaced with papers towels as hand dyers spread germs and bacteria more rapidly than paper.

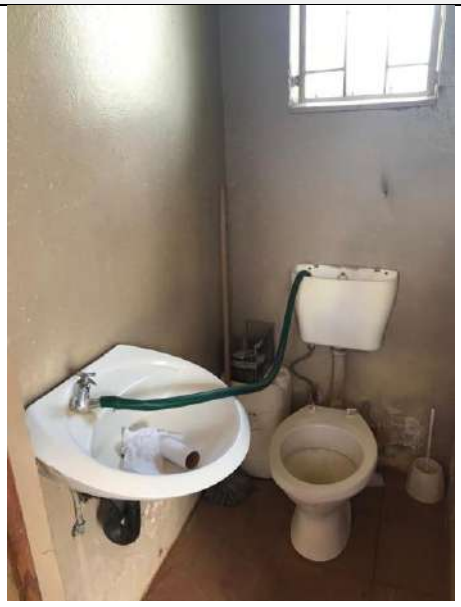
Table 2. Fire protection findings table.

Item	Good	Fair	Poor	Comment
A		X		  *Figure 8. Fire extinguisher* The fire extinguishers are in fair to poor condition with signs of wear. The equipment has been serviced to comply with statutory regulations. The

				extinguishers should be pressure tested to assess the integrity of the vessels.
B	X			 *Figure 9. Extinguisher pressure gauge* The fire extinguishers have adequate pressure.
C	X			 *Figure 10. Direction signage* The fire signage is mostly in good condition and does not need to be replaced.

D			X	 *Figure 11. No fire protection in the archive room* There is no fire protection and/or detection installation in the archive room and thus records are not protected from possible eruption of fire.

Table 3. Wet Services findings

Item	Good	Fair	Poor	Comment
A			X	 *Figure 12. Toilet with no direct water supply*

				Water pipes supplying the toilet do not have water and therefore a hose pipe has been connected from the basin to supply the toilet due to damage to some pipe fittings. The fittings need to be replaced.
B			X	 *Figure 13. Drain pipes for the gulley* Drains pipes are in poor condition and should be replaced.
C			X	 *Figure 14. Urinal in poor condition* The urinals are in poor condition with no running water. Running water should be supplied to the urinals.

D			X	 *Figure 15. Laundry basin* The laundry basin in the staff residence is in poor condition with extensive signs of deterioration.
E			X	 *Figure 16. Married basins for the communal ablution facility* The wash hand basins are in poor condition and do not have running water. The poor water supply pipes should be replaced and flexible pipes, coupled with isolating valves should be connected to the copper pipes connected to the fixtures.

F			X	 *Figure 17. Shower in poor condition* The shower in the conference area is in poor condition. There is no running water and the drainage is also clogged with debris. Therefore, this should be reconstructed or converted into an additional toilet.
G			X	 *Figure 18. Pipe insulation in poor condition* The pipe insulation has worn out, thus leaving the water pipe exposed to the environment, The pipes should be replaced since they have severe leakages and insulated to avoid reduce heat transfer.

5. RECOMMENDATION

The recommendations are as follows:

- Fire protection such as installation of fire extinguishers should be installed in the conference room, record rooms and all the other spaces which do not have adequate or no fire protection as all.
- Flexible pipes should be installed on all water pipes that supply water to the sanitary fixtures.
- Mechanical ventilation should be provided in the spaces where it is not adequate, such as the store room where it is proposed to be converted into a conference room. This could be achieved by installation of fresh air supply fans and installation of an extraction fan to achieve the minimum fresh air requirements as stipulated in SANS 10400 Part O.
- New fire extinguisher installations should be fitted with pressure gauges so that the medium pressure can be regularly monitored.
- Hydrostatic pressure tests should be carried out on all the existing fire extinguishers to test their integrity and their ability to store the medium at the required pressure. The tests should be carried out by certified fire contractor.
- The water supply pipes which are in the ceiling should be replaced and sealed properly to avoid leakages which may affect the electrical reticulation and also damage the ceiling.
- Air conditioners which are in poor condition should be replaced.
- Isolating valves should be installed on the water pipes leading to the wet services fixtures to ensure that maintenance can be completed as and when required without having to shut off supply for the main pipeline.
- The wet services installations for the married quarters have deteriorated greatly and thus major repairs are required to restore the facility to a good working condition. Therefore, all the plumbing fittings and pipes should be replaced and installed in accordance to the SANS 10252, SANS 10400: P and technical specifications.

4.1. Proposed Procurement Instruction

Proposed PI title: Repair, Renovate and rehabilitate all mechanical installations i.e. fire protection, HVAC and wet service at Boskop hydrometry.

Description	Rate	Qty	Amount
Repair and replacement of air conditioners and new installation of ventilation system	R700 000.00	1	R700 000.00
Replacement of fire protection equipment	R150 000.00	1	R150 000.00
Repair and renovations of wet services installations	R400 000.00	1	R400 000.00
Total estimate			**R1 250 000.00**

6. CONCLUSION

The findings indicate that the building has challenges pertaining to wet services and air conditioning. A major concern pertaining to wet services installations in the facility is the married quarter's ablution facility which have water supply shortage and dilapidated plumbing fixtures and fittings. Furthermore, some water pipes which run in the ceiling are leaking severely and thus damage to the ceiling. The air conditioning units are in fair to poor conditioning, with some of the units being non-operational. The fire protection in the facility was serviced to comply with the statutory regulations, however some areas need fire protection installation. Therefore, all recommendations should be implemented using the best available technology to ensure that the energy efficiency standards and regulations are adhered to.

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ANNEXURE D: CIVIL INVESTIGATION REPORT

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ENGINEERING SERVICES INVESTIGATION REPORT

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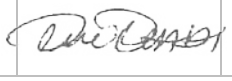
ENGNEERING DISCIPLINE	Tick (x)
ARCHITECTURAL ENGINEERING SERVICES	
ELECTRICAL ENGINEERING SERVICES	
MECHANICAL ENGINEERING SERVICES	
CIVIL ENGINEERING SERVICES	**x**
STRUCTURAL ENGINEERING SERVICES	

PROJECT DETAILS	
CLIENT DEPARTMENT	Department of Water and sanitation
PROJECT NUMBER:	N/A
REPORT TITLE	Refurbishment of DWS Boskop Dam Area Offices : Civil Engineering Services

REPORT STATUS				
	Investigation Report	Status Quo Report	Preliminary Design Report	Detail Design Report
	IR	SQR	PDR	DDR
Tick [x]	X			

APPROVALS

	Version	Designation	Name	Signature	Date
Author	1.0	Production Engineer	Mosianedi Ngakane		18/01/2023
Checked	1.0	Production Engineer	Mosianedi Ngakane		18/01/2023
Approved	1.0	Chief Engineer	Timothy Tladi		18/01/2023

Administrative Approval

	Report Version	Designation	Name	Signature	Date
Supported	1.0	Director of Projects			
Accepted	1.0	Client Representative			

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1. INTRODUCTION

The Department of Water and Sanitation (DWS) sent a request to the Department of Public Works and Infrastructure (DPWI) through the Engineering Services Directorate to assist in performing a condition assessment for the office buildings of the Department of Water and Sanitation (DWS) Boskop Dam Area. The facility has requested maintenance for the existing administration building, dwelling units, bulk water facilities and sewer facilities.

The site inspection for the condition assessment was carried out by an in-house engineering team which consists of structural engineers, civil engineers, mechanical engineers, electrical engineers, quantity surveyor and an architect. The inspection was executed on the 17th of November 2022. This report provides findings and recommendations to be performed at the facility to the client's request.

2. LOCATION

The DWS Boskop Dam offices are located in the North West Province, in between Carletonville and Potchefstroom. It falls under the JB Marks Local Municipality in the Dr Kenneth Kaunda District Municipality. The site is located in farm lands which are in the south west of Johannesburg about 120km away. There is a school, a dam and a nature reserve close to the site. The GPS coordinates of the site are shown in Table 2-1. The Aerial view of the location from google earth is shown in Figure 2-1.

Table 2-1: GPS coordinates

Building Name	Latitude	Longitude	Location
Department of Water and Sanitation Hydrometry Boskop	26°34'21''S	27°07'10''E	Noordbrug, Potchefstroom

Figure 2-1: Locality map of DWS Boskop offices

3. BACKROUND

The Department of Water and Sanitation Boskop Offices consist of an office block (with guard house), carports, technical stores, firefighting garage, gas store, and backup generator room which are shown in Figure 3-1. The site has an area of approximately 27 000m^2. The bulk water supply for the site consists of boreholes located north of the offices and water storage tanks that are located north east of the office. There is a single quarters dwelling unit that is located north east of the offices. Figure 3-2 shows the location of the existing boreholes, water storage tanks and single quarter dwelling units.

Figure 3-1 : Aerial site map

Figure 3-2: Location of the existing boreholes, water tanks and single quarters

Visual assessments were performed on the office buildings, single quarters dwelling, sewer facilities and the bulk water services that have deteriorated over the years. This report aims to discuss the conditions of the facilities through an investigation of the existing civil engineering services.

4. FINDINGS

The purpose of the site inspection was to carry out a visual condition assessment of the civil services Infrastructure from the existing facilities. A population of the site was obtained from the client representative which is shown is Table 4-1.

Table 4-1: Site population

Population type	Number of people
Administration Staff	27
Guards/shift	2
Single quarter dwelling units	20
Total population	**49**

4.1. Dilapidated bulk water infrastructure

4.1.1. Boreholes and Pump houses

There are two existing boreholes within the facility which function to pump groundwater to the water storage tanks. During the site inspection, one of the borehole pumps was not accessed hence there are no findings on the borehole. The other boreholes functions well however due to electrical power cuts, pumps cannot function and water cannot be supplied to the DWS facilities. Boreholes are equipped with submersible pumps.

4.1.2. Storage tanks

The storage tank is located approximately about 600m away from the boreholes with the pipeline length extending further as the exact pipeline layout is unknown. The storage tank is elevated to a height of 7m above the ground with three tanks present, each with a storage capacity of 2,5KL. There is no water treatment or filter method present before the water is stored or distributed to the facilities on the site. There is only one tank fitted with the inlet pipe (from boreholes). The inlet pipe does not have a valve to regulate the water supplied in the tank, causing an overflow of water that occurs as the borehole continuously pumps water into the tank. This has resulted in the overflow water ponding at the bottom of the elevated tank, without any drainage occurring.

4.2. Dilapidated buildings

4.2.1. Stormwater management

The existing gutters and downpipe need urgent repairs. There is evidence of gradual deterioration of the gutters, with visible rusting, chipping of paint and detachment from the roof fascia. The rainwater is discharged onto the building aprons from the downpipe. The building aprons are in good condition.

4.2.2. Water supply and fire protection

The building has good water supply, however pressure readings need to be taken to confirm if there is sufficient pressure for water supply and fire protection in the building. The guardhouse has an inlet pipe to the flush master toilet that does not function while the basin inlet pipe in functional.

4.2.3. Sewer

The facilities use a septic tank and a French drain to drain the sewer waste from the buildings which are in good condition and functional. From the client representative it was stated that, there has not been any desludging of the septic tanks since they were constructed. Sewer ponding or an unpleasant smell near the sewer Infrastructure were not detected. However there could be a possible leak in the septic tank as there is sprouting vegetation along the edges.

4.3. Photographic report

The photographic report is shown below.

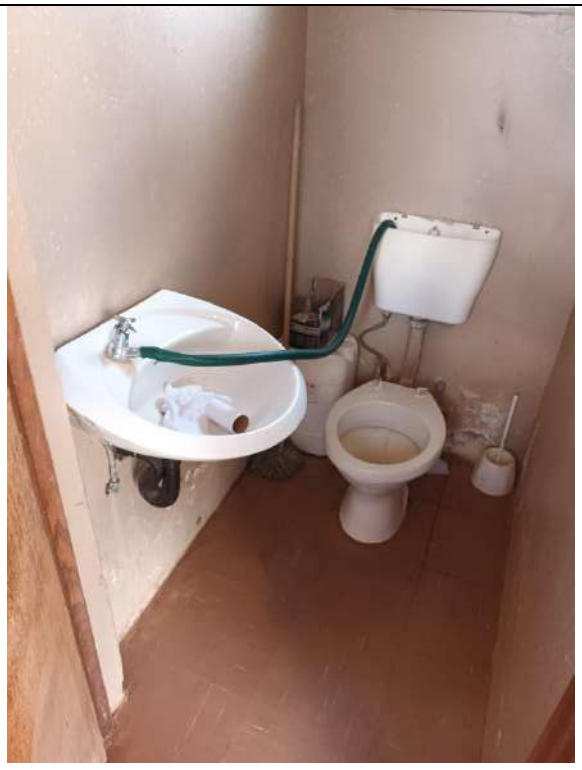
Item	Good	Fair	Bad	
1.			**x**	 **Garden tap**: located outside the office building, it does not have sufficient pressure.
2.		**x**		 Gutter at the office building is rusting with the paint chipping off. The down pipe is disconnected to the gutter.

3.			**x**	 **Outlet sewer pipe**: pipe shows evidence of leaking from the pipe connection.
4.		**x**		 The gutter paint chipped off.

5.			**x**	 The gutter is rusting and detaching from the roof fascia with the paint already chipped off.
6.		**x**		 **Septic tank:** slab cover is a cracked. The size and capacity of the septic tank is unknown.

7.			**x**	 **Drain**: technical stores drain is without a cover. The drain is clogged hence the visible water retention.
8.			**x**	 **Exposed HDPE pipe and Valve**: the chamber cover is removed and is no longer stable with deposists of tree material. The gate valve is damaged.

9.		**x**		 **Chamber cover and Valve**: the valve chamber cover has rusted and the gate valve is damaged.
10.			**x**	 **Water ponding**: valve chamber collapsed causing posible water leakage that has resulted in water ponding with algae.

11.		**x**		 Paint chipped of at the backup generator.
12.			**x**	 **Guardhouse toilet**: The flush master toilet (withou water supply) at the guard house connects to the basin (has water supply) for a water supply connection, to supply water into the toilet.

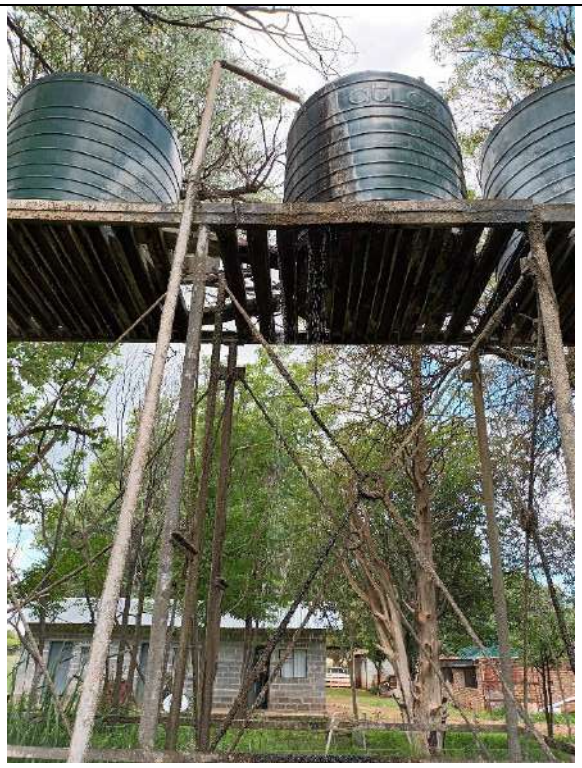
13.		**x**		 **Guardhouse septic tank**: there might be a possible leakage of the septic tank, which sproutes vegetation.
14.	**x**			 **Sewer drainage pipe and the inlet water supply pipe**: the sewer-drainage pipe for the guard house is in good functioning condition however there is no water supply for the inlet water supply pipe for the toilet.

15.			**x**	 **Entrance pathway**: the pathway does not have pavament and a stormwater drainage system. There is possible water ponding next to the guard house.
16.		**x**		 **Guardhouse**: Front view of the Guard House

17.			**x**	 **Road signs**: the road signs are worn out and rusting.
18.			**x**	 The chamber cover is removed, exposing the ball valve that is damaged.

19.		**x**		 **Borehole house**: The DWS officer informed the team, the boreholes system uses a submersible pump. Currently no backup power for the pump system.
20.			**x**	 Downpipe disconnecting form the gutter at the single quarters.

21.			**x**	 **Single quarters bathroom**: the toilets, basins and showers are dilapitated at the single quarters dwelling units.
22.			**x**	 Above ground steel pipe has rust. No visible marking for above ground pipeline.

23.			**x**	 **Storage tanks**: There are three storage tanks. Only one is fitted with an inlet pipe. There is a overflow of water from the tank which occurs continuously as borehole inlet pipe is not fitted with a float valve.
24.			**x**	 **Elevated water tank base**: ponding of water at the base of the elevated water storage tanks because there is no drainage point for the water.

25.		**x**		 **Access road**: Crack sealing and maintenance is required

5. COST ESTIMATES

At this stage of the project only a high level cost estimate of the investigations has been executed. Further consultations should be performed with the Quantity Surveyor. The quantities are inclusive of all the repairs, decommissioning and installations. It is assumed the preliminaries and general of the project will be included in the master cost estimates.

DWS Boskop Dam Office: Civil Engineering Cost Estimates					
	Description	Unit	Quantity	Rate	Total
1	Construction of a 20KL steel water tank for Admin Buildings and Single Quarters: Supply, install, disinfect, watertightness, pipe fittings, float valve	Sum	1	350958	R350 958,01
2	Booster pumps fitted with a dual function of solar and electrical power	No	2	15000	R30 000,00
3	Borehole investigation (Borehole siting, yielding and water quality testing) by a Professional Geo-hydrologist	Prov sum	1	65000	R65 000,00
4	Drilling of boreholes(2) and pumps(2)	Prov sum	1	25000	R25 000,00
5	Water pipeline reticulation (uPVC pipes): supply, laying and bedding	m	1300	200	R260 000,00
6	Decommissioning of existing water tanks, boreholes and pump facility	Prov sum	1	25000	R25 000,00
7	Desludging and locate the conservancy tanks(5 tanks)	Prov sum	1	10000	R10 000,00
8	Water purifier system (osmosis system) for Admin Buildings	Prov sum	1	25000	R25 000,00
9	Gutter and downpipes replacement	m	820	250	R205 000,00
10	Maintenance of roads (crack sealing, vegetation cleaning)	m	800	200	R160 000,00
11	Landscaping	m^2	1000	60	R60 000,00
				SUBTOTAL	R1 215 958,01
				CONTINGENCY 20%	R243 191,60
				VAT	R218 872,44
				GRANDTOTAL	R1 678 022,06

6. RECOMMENDATION

The following recommendations are made for the repairs of the DWS Boskop Area Offices.

a) Roof drainage: Replace the damaged gutters and downpipes. Additionally paint all gutters and downpipes rusted with chipped paint.

b) Sewer: Assess if there are septic tank leaks around the site, repair leaking sewer pipes and desludge the septic tanks.

c) Internal Roads: Perform maintenance and crack sealing of the internal roads.

d) Water supply: Perform water demand calculations for the water inlet pipes to analyse if the required demand is supplied and perform water quality tests. A water treatment system could be required depending on the recommendations of the Geo-hydrologist.

   Install a new borehole with a backup power supply which is preferably solar, such that it function to supply water during electricity power cuts. Additionally provide a valve monitoring system which ensures that the borehole stops pumping water when the storage tank is full to avoid overflow.

   Design and construct the bulk water facilities (borehole, storage tanks and water treatment plant) in close proximity to each other to avoid uneconomical construction costs and frictional losses along the pipelines. Replace the storage tanks with a tank that meets the Annual Average Daily Demand (AADD) of the facility.

   The existing bulk water supply infrastructure (borehole, water storage tanks and pipeline) should be decommissioned and a new bulk water supply infrastructure be installed.

7. CONCLUSION

The Department of Water and Sanitation at the Boskop Offices require refurbishments of the civil engineering services. The sewer outlets, septic tank, borehole, storage water tanks, stormwater management of buildings, landscaping, geo-hydrologist investigations and internal roads are required to be included in the scope of works for this project.

The following project description is applicable for the Civil Engineering works:

Design phase: Provision of Civil Engineering services at the DWS facilities at Boskop Dam: Design of an Elevated Water Tank, water reticulation pipes, borehole drilling services, pumps installations, desludging of septic tanks, maintenance of the internal roads and road signs.

In case the civil engineering works are included as part of a multi-disciplinary project, the following project description is applicable to the project**:**

Design phase: Refurbishment of the DWS facilities at Boskop Dam:

Civil Engineering service includes design of an Elevated Water Tank, water reticulation pipes, borehole drilling services, pumps installations, maintenance of gutters and downpipes, desludging of septic tanks, maintenance of the internal roads and road signs.

The contents of this investigation report serve as motivation that a procurement instruction needs to be developed and the project registration process needs to follow suit with KAM/UDM.

public works
& infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

ANNEXURE E: STRUCTURAL INVESTIGATION REPORT

ENGINEERING SERVICES CHIEF DIRECTORATE

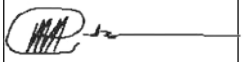
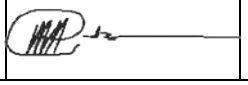
INTERNAL MEMORANDUM

RECIPIENTS AND AUTHOR			
TO :	Makgomo Mabaso Project Manager Head Office	**Email**	Makgomo.Mabaso@dpw.gov.za
CC :	Mokgobi Ramushu Director HO: C&S Engineering Services	**Email**	Mokgobi.Ramushu@dpw.gov.za
	Horisani Madzivane Chief Engineer HO: C&S Engineering Services	**Email**	Horisani.Madzivane@dpw.gov.za
	Shirley Bosie Project Administrator HO: C&S Engineering Services	**Email**	Shirley.Bosie@dpw.gov.za
FROM:	Sabelo Rana Control Engineering Technologist HO: C&S Engineering Services	**Email**	Sabelo.Rana@dpw.gov.za

DISCIPLINE	**Tick (x)**
ARCHITECTURAL SERVICES (AR)	
LANDSCAPE ARCHITECTURAL SERVICES (LA)	
ELECTRICAL ENGINEERING SERVICES (EE)	
MECHANICAL ENGINEERING SERVICES (ME)	
CIVIL ENGINEERING SERVICES (CE)	
STRUCTURAL ENGINEERING SERVICES (SE)	**X**
QUANTITY SURVEYING SERVICES (QS)	

MEMO STATUS	**INVESTIGATION REPORT**
SUBJECT:	**CONDITION ASSESSMENT OF THE BOSKOP AREA OFFICES DEPARTMENT OF WATER AND SANITATION**

APPROVALS

	Designation	Name	Signature	Date
By Author	Control Technologist	Sabelo Rana (Pr Tech Eng)		09/02/2023
Reviewed	Chief Engineer	Horisani Madzivane (Pr Eng)		09/02/2023
Checked	Chief Engineer	Horisani Madzivane (Pr Eng)		09/02/2023

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1. INTRODUCTION

The Chief Directorate: Engineering Services (CD: ES), received a request on the 24th of October 2022 from Key Accounts Management (KAM) Directorate to conduct a condition assessment of the Department of Water and Sanitation (DWS) Boskop area offices, hereinafter referred to as the site.

In response to the request, a multi-disciplinary team was assigned to conduct a visual condition assessment of the site on the 17th of November 2022. This investigation report (IR) aims to outline the findings made during the site visual inspection from a structural engineering perspective.

2. LOCATION

The DWS Boskop area offices are located along the R501 between Potchefstroom and Carltonville, and fall within the Dr Kenneth Kaunda District Municipality in the North West province. ***Table 1*** and ***Figure 1*** below show the GPS coordinates and aerial view of the site respectively.

Table 1: Site location

Building name	Latitude	Longitude	Location
Boskop Area Offices - DWS	26° 34' 17"	27° 07' 09"	Boskop, North

Figure 1: Aerial view of Boskop area offices DWS

Refer to the background section of the report for interpretations of the block numbers as shown in ***Figure 1***.

3. BACKGROUND

The Department of Water and Sanitations' offices in Boskop are currently in a dilapidated state and require maintenance. This IR will only focus on the structural condition assessment for blocks A to F, refer to ***Figure 1*** for the site layout. Blocks A to F denote the following:

- Block A and B denote the main office blocks and consist of single-storey masonry buildings with smooth plastered internal walls and duo pitched corrugated iron roof sheeting. Refer to ***Annexure A and B*** for the schematic plan layout of the main office blocks A and B respectively,
- Block C denotes the office storage which consists of corrugated houses,
- Block D denotes the single living quarters which are single-storey masonry buildings with duo pitched corrugated iron roofs,
- Block E denotes elevated plastic water tanks supported by a steel frame on concrete footings, and
- Block F denotes the single-storey pumphouse made up of masonry brick walls and a corrugated iron roof.

After the condition of all the structural elements on the blocks above have been assessed, recommendations and a high-level cost estimate for the repair and refurbishment of the site will be provided.

4. ASSESSMENT METHODOLOGY

A walkabout site inspection was conducted to visually inspect the various structural elements to identify and assess any structural distress, defects and/or deformations. The inspection was solely based on visual inspection, therefore, no tests requiring specialised equipment were conducted. The assessment methodology consisted of, but was not limited to:

- Identifying the type of structural defect, and
- Taking photographic evidence that is outlined in ***Table 2*** in the next section of this IR.

5. FINDINGS

This section of the report serves to provide an outline of the observations made during the site inspection. The photographs taken during the site inspection will be used to document the findings and the rationale leading to the recommendations made. The following remarks will be discussed under each figure in ***Table 2*** below:

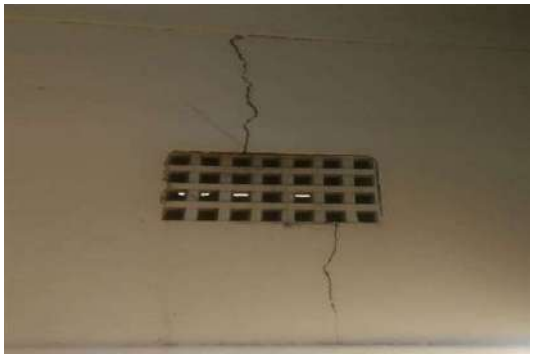
- **Finding:** The structural defects that were identified during the inspection
- **Impact/Risk:** The probable consequence(s) emanating from the identified defect(s),
- **Recommendation:** Proposed remedial action(s)

Refer to ***Annexure A and B*** for a schematic plan layouts of the Main office blocks A and B respectively.

Table 2: Photographic evidence – Main office block A

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 2: Horizontal crack on wall - Snoepie room*  *Figure 3: Vertical crack under the window sill – Snoepie room*  *Figure 4: Vertical cracks along the vents above the doorway – Snoepie room*			X	**Findings:** The following defects were observed in the Snoepie room: • A horizontal crack on a wall. Refer to ***Figure 2.*** • A vertical crack going from the window sill to the surface bed level. Refer to ***Figure 3.*** • Vertical cracks around the air brick. Refer to ***Figure 4.*** The cracks observed in the Snoepie room were all < 5mm in width. **Impact/Risk:** • The cracks leave the masonry wall vulnerable to external effects (i.e. moisture ingress) which will reduce the mechanical resistance of the masonry wall. **Recommendation:** • Conduct a geotechnical investigation to determine if underlying soil and foundation conditions are not the cause of the cracks. • From the results of the investigation, determine the actual cause of the crack and the most effective remedial actions

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 5: Crack on apron slab – Snoepie room*		X		**Findings:** • The apron slab outside the Snoepie room had transverse cracks < 5mm. Refer to ***Figure 5.*** **Impact/Risk:** • The cracks serve as openings which may lead to moisture ingress into underlying soil and foundation. **Recommendation:** • Clean the surface of the crack, apply epoxy coating to fill the crack as specified by a Structural Engineer.
 *Figure 6: Dilapidated shipping containers*		X		**Findings:** • A set of dilapidated shipping containers were observed behind office block A. Refer to ***Figure 6.*** • The surface bed had grass in between its joints and worn out joint sealant. Refer to ***Figure 6.*** **Impact/Risk:** • Worn out joint sealant will allow moisture seepage into the surface bed and underlying material. **Recommendation:** • Decommission (if applicable) or Refurbish dilapidated shipping containers. • Remove the grass on the joints and repair the joints.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 7: Vertical crack on vent - Archive*  *Figure 8: Crack at the corner - Archive*			X	**Findings:** The following defects were observed in the Archive: • A vertical crack going through the air brick. Refer to ***Figure 7.*** • A vertical and horizontal crack on the wall. Refer to ***Figure 8.*** The cracks observed in the archive room were < 5 mm in width. **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the recommendation made for ***Figures 2, 3, and 4***.
 *Figure 9: Voids in the mortar along the window opening - Archive*		X		**Findings:** • The window opening of the Archive office had visible voids from the missing mortar. Refer to ***Figure 9.*** **Impact/Risk:** • Moisture ingress into the masonry wall and the building. **Recommendation:** • Chip out all loose material and fill voids with mortar.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 10: Map cracks on ramp - Workshop*		X		**Findings:** • The ramp leading to the workshop had map cracks < 5mm. Refer to ***Figure 10.*** **Impact/Risk:** • Refer to the impacts/risks associated with ***Figure 5***. **Recommendation:** Refer to the recommendations made for ***Figure 5.***
 *Figure 11: Leaking ceiling - Hallway*			X	**Findings:** • Signs of water leakages were observed on the hallway ceiling. Refer to ***Figure 11.*** **Impact/Risk:** • The water may cause rotting of the timber trusses above the ceiling. **Recommendation:** • Further assess the timber trusses to determine the extent of damage (if any). Repair and/or replace the timber trusses if needed. • Determine the source(s) of the water leaks and seal them off.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 12: Vertical crack through the air brick - Boardroom*  *Figure 13: Vertical crack under the window sill - Boardroom*  *Figure 14: Cracks on walls - Boardroom*		**X**		**Findings:** The following defects were observed in the boardroom: • A vertical crack < 5mm going through the air brick above the entrance. Refer to ***Figure 12.*** • A vertical crack < 5mm going from the window sill to the surface bed level. Refer to ***Figure 13.*** • A horizontal and vertical crack on a section of the wall. Refer to ***Figure 14.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** • For the defects associated with ***Figure 12***, perform detailed analyses and investigations to determine if the beam is properly supported and the most effective remedial action. • For ***Figures 13 and 14*** refer to the recommendations made for ***Figures 2, 3, and 4.***

 *Figure 15: Vertical crack through the air brick - Stinah*  *Figure 16: Vertical along the door frame - Stinah*  *Figure 17: Vertical crack below the window sill - Stinah*  *Figure 18: Horizontal crack at window edges - Stinah*			**X**	**Findings:** The following defects were observed in the Stinah office: • A vertical and diagonal crack < 5mm going through the air brick above the entrance. The crack was visible on both sides of the wall. Refer to ***Figure 15.*** • A vertical crack along the doorframe. Refer to ***Figure 16.*** • A vertical crack < 5mm going from the window sill to the surface bed level. Refer to ***Figure 17.*** • A horizontal crack originating from the edge of the window opening. Refer to ***Figure 18.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** • Refer to the recommendations made for ***Figures 2, 3 and 4.***

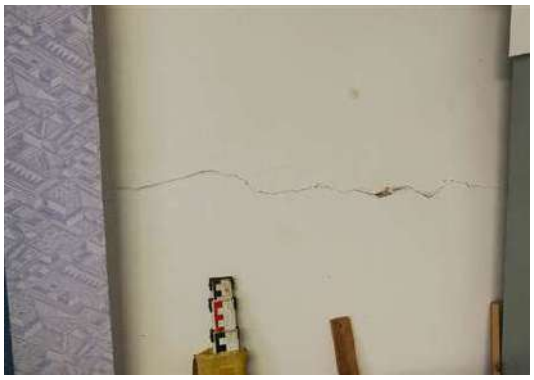
Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 19: Vertical crack at the corner (1 of 2) - Toilet*  *Figure 20: Vertical crack at corner (2 of 2) - Toilet*		X		**Findings:** The following defects were observed in the toilet: • Pieces of plaster were breaking off towards the ceiling level. Refer to ***Figure 19.*** • A vertical crack < 5mm going from the roof level to the surface bed level. Refer to ***Figure 20.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the second recommendation made for ***Figures 2, 3, and 4.***

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 21: Vertical crack on storeroom wall – Store 1*  *Figure 22: Vertical cracks at storeroom 039 – Store 1*			X	**Findings:** The following defects were observed in Store 1: • A vertical crack < 5mm spanning from the roof level to the surface bed level with pieces of the plaster falling off. Refer to ***Figure 21.*** • Vertical hairline cracks above the entrance. Refer to ***Figure 22.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** • Refer to the recommendations made for ***Figures 2, 3 and 4.***

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 23: Vertical crack at old store corner – Store 2*  *Figure 24: Separations at old store corner – Store 2*  *Figure 25: Vertical cracks at the air brick above the entrance – Store 2*  *Figure 26: Transverse crack on old store slab – Store 2*			X	**Findings:** The following defects were observed in Store 2: • A vertical crack < 5mm at one of the corners with a void formed by missing plaster. Refer to ***Figure 23***. • A slab that was detached from two of the walls connected to it. Refer to ***Figure 24***. • A vertical crack going around the air brick above the entrance. Refer to ***Figure 25***. • Hairline cracks on the surface bed slab. Refer to ***Figure 26.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** • For the crack repairs, refer to the recommendation made for ***Figures 2, 3, and 4***. • Conduct geotechnical investigation on the material under the surface bed to determine the cause of the detachment in ***Figure 24***. After the cause has been determined, the appointed Structural Engineer will determine the most effective repair method.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 27: Transverse crack on septic tank slab*			X	**Findings:** • The septic tank next to office block A had a crack spanning across its surface ranging from approximately 3mm to 10mm. Refer to ***Figure 27.*** **Impact/Risk:** • The crack exposes the slab to external elements (i.e. moisture), resulting in loss of mechanical strength. • The crack poses an Occupational Health and Safety risk. **Recommendation:** • Demolish and recast the concrete slab.
 *Figure 28: Damaged timber truss – Office block B*			X	**Findings:** • The paint of the timber trusses exposed at the entrance is worn-out and is peeling off. Refer to ***Figure 28.*** • Some of the nails on the timber truss members had loosened. Refer to ***Figure 28.*** **Impact/Risk:** • Worn-out truss coating exposes the truss elements to external elements such as moisture and mites.

Photograph	Condition			Comment
	Good	Fair	Poor	
				• Loosened nails may fall off completely leading to unrestrained truss members. **Recommendation:** • Replace the damaged trusses and roof sheeting.
 *Figure 29: Vertical crack under the window sill – Data room*			X	**Findings:** • The Data room (room 16) had a vertical crack < 5mm going from the window sill to the surface bed level. Refer to ***Figure 29.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the recommendation made for ***Figures 2, 3, and 4***.
 *Figure 30: Vertical cracks above entrance - Deon*			X	**Findings:** The following defects were observed in Deon office: • Vertical cracks < 5mm above the doorway that are visible on both sides of the wall. Refer to ***Figure 30***. • Map cracks surrounding the air brick. Refer to ***Figure 31***.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 31: Map cracks around the air brick - Deon*  *Figure 32: Horizontal crack next to window - Deon*				• A horizontal crack < 5mm going from the edge of the window opening to the corner of the room. Refer to ***Figure 32***. **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** • Refer to the recommendation made for ***Figures 2, 3, and 4***.
 *Figure 33: Plaster cracks at entrance - Safe*		**X**		**Findings:** • The Safe had numerous plaster cracks above its entrance. Refer to ***Figure 33.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the recommendation made for ***Figures 2, 3, and 4***.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 34: Discoloured ceiling – Fax and copy room*		**X**		**Findings:** • The fax and copy room had a patch of discoloured ceiling indicating a leaking roof. Refer to ***Figure 34.*** **Impact/Risk:** • Continuous contact with water will damage the timber truss supporting the roof. **Recommendation:** Refer to the recommendation made for ***Figure 11.***
 *Figure 35: Vertical crack above entrance – Digitizing room*  *Figure 36: Vertical crack under AC unit – Digitizing room*			**X**	**Findings:** • The entrances to the digitizing room and the safe had vertical cracks above them. Refer to ***Figure 35***. • A vertical hairline crack was observed under the AC unit in the digitizing room. Refer to ***Figure 36***. **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the recommendation made for ***Figures 2, 3, and 4***.

Table 3: Photographic evidence – Corrugated store house block C

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 37: External concrete surface bed*  *Figure 38: Exterior view – Corrugated houses*			X	**Findings:** • The concrete surface bed outside the store houses had grass between its joints and cracks ranging from 3mm to 10mm. Refer to ***Figure 37.*** • A set of corrugated houses were observed to be in a fair structural condition from the outside. Refer to ***Figure 38.*** **Impact/Risk:** • For the surface bed cracks Refer to Impact/risk associated with ***Figure 5.*** • For the corrugated iron store houses, no structural impact/risk was observed from the outside. **Recommendation:** • Demolish and reconstruct a new concrete surface bed. • Decommission corrugated houses (if applicable) and construct new masonry structures.

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 39: Decaying timber purlins – Fire storage*		X		**Findings:** • The fire storage was observed to be constructed from corrugated iron sheeting. Refer to ***Figure 39.*** • The timber purlins supporting the roof sheeting on the fire storage had signs of decay. Refer to ***Figure 39.*** **Impact/Risk:** • Further decay of the timber purlins will weaken the roof. **Recommendation:** • Decommission (if applicable) and reconstruct fire storage building.

Table 4: Photographic evidence – Single living quarters block D

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 40: Rotting roof truss members (1 of 2) – Single living quarters*  *Figure 41: Rotting roof truss members (2 of 2) - Single living quarters*			X	**Findings:** • The exposed roof truss elements at the single quarters were damaged and rotting. Refer to ***Figures 40 and 41.*** • The front walls of the single quarters were covered in map cracks. Refer to ***Figures 40 and 41.*** **Impact/Risk:** • Rotting of the timber truss members weakens the roof truss. **Recommendations:** • Replace damaged timber members and roof sheeting. • For the cracks, refer to the recommendation made for ***Figures 2, 3, and 4***.

Table 5: Photographic evidence – Water tanks block E

Photographic	Condition			Comment
	Good	Fair	Poor	
 *Figure 42: Corroded steel support structure - Water tanks*  *Figure 43: Corroded steel support - Water tanks*  *Figure 44: Corroded steel support structure - Water tanks*			X	**Findings:** • Members of the steel structure supporting the water tanks were corroded. Refer to ***Figures 42, 43 and 44.*** • The concrete footings supporting the steel frame were observed to be damp mouldy and dilapidated. Refer to ***Figure 43***. **Impact/Risk:** • The continued corrosion on the steel elements will weaken the steel structure supporting the water tanks. • Excess mould leaves the concrete susceptible to chemical attacks. **Recommendations:** • Replace the steel structure supporting the water tanks. • Replace concrete footings supporting the steel structure.

Table 6: Photographic evidence - Pump house block F

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 45: Diagonal crack above entrance – Pump house*		**X**		**Findings:** • The pump house housing pump no.1 had a diagonal crack < 5mm going from the air brick to the roof level. Refer to ***Figure 45.*** **Impact/Risk:** • Refer to the impact/Risk associated with ***Figures 2, 3, and 4***. **Recommendation:** Refer to the recommendation made for ***Figures 2, 3, and 4***.

Table 7: Photographic evidence – Guardhouse block G

Photograph	Condition			Comment
	Good	Fair	Poor	
 *Figure 46: Voids in mortar on masonry brick wall - Guardhouse*  *Figure 47: Bulging around the air bricks – Guardhouse*		X		**Findings:** • The mortar of the masonry brick wall of the guardhouse had voids. Refer to ***Figure 46***. • The wall around the air bricks was uneven as seen in ***Figure 47***. **Impact/Risk:** • The openings make the wall vulnerable to external effects like moisture, dust and air. **Recommendation:** • Fill voids in mortar with cementious grout. • Conduct geotechnical investigation to determine if ground conditions are the cause of the bulging around the air bricks and to assist determining the most effective remedial actions.

6. ANTICIPATED SCOPE OF WORKS

From the structural defects identified from ***Table 2 to Table 7*** above, the following scope of works is anticipated for the site:

- Conduct geotechnical investigation around office blocks A and B,
- Detailed investigation on the roof trusses to assess if there is any water damage on all buildings,
- Replace damaged roof truss members and roof sheeting,
- Identify and seal-off the source of the identified roof leakages,
- Once all root causes for the cracks have been identified, repair all identified cracks as follows, unless otherwise specified by the Structural Engineer:
  - Mapping cracks are to be repaired as per Architect's specifications,
  - Hairline and plaster cracks < 5mm in width are to be repaired by crack filling,

- All cracks > 6mm and those visible on both sides of the walls to be repaired using tie rods and crack filler,
- Remove grass/vegetation on the surface bed joints under the shipping containers and repair the joints,
- Demolish the cracked surface bed around the corrugated houses and reconstruct it to be compliant with the South African National Standards (SANS).
- Decommission corrugated houses and fire storage and construct new houses that are compliant with the SANS.
- Construct new foundations and structural steel support for the water tanks, and
- Decommission (if applicable) and repair/refurbishment of steel shipping containers.

7. COST ESTIMATE

Based on the anticipated scope of works, the cost of works for the structural repair, renovation and upgrade of the Boskop area offices is estimated to be **R4 330 536.55** including 15% value-added tax (VAT) and 10% contingencies.

8. RECOMMENDATIONS

The following is recommended for the site:

- Conduct a comprehensive geotechnical investigation to determine the condition of the underlying soil and foundation. This will assist in determining the most effective crack repair methods,
- The damaged roof timber trusses and corrugated iron sheeting should be immediately replaced to avoid further damage,
- Decommission the shipping containers, corrugated houses, and fire storage,
- The repair, renovation, and upgrade of the dilapidated DWS Boskop area offices be implemented based on:
  - The anticipated scope of works in ***section 6*** of the report, and
  - The high-level cost estimate in ***section 7*** of the report.

9. CONCLUSION

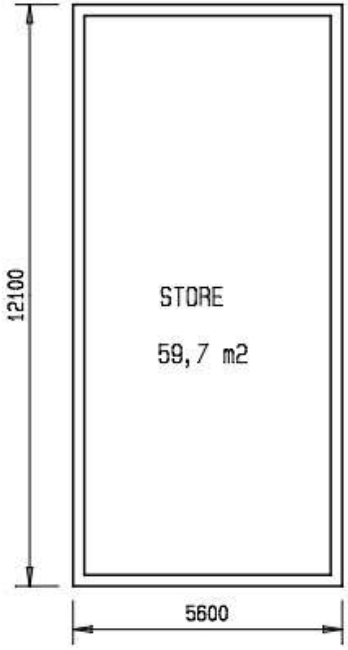
From the visual inspection conducted on the Boskop area offices, the facility has undergone significant dilapidation. The structural integrity of the buildings on site was observed to be in a fair functional state with exception of the structures that need to be decommissioned. The repair, renovations, and upgrade with additional works of capital nature is necessary to prevent further deterioration of the facility.

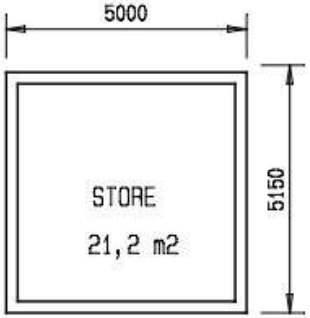
ANNEXURE A: MAIN OFFICE BLOCK A PLAN LAYOUT

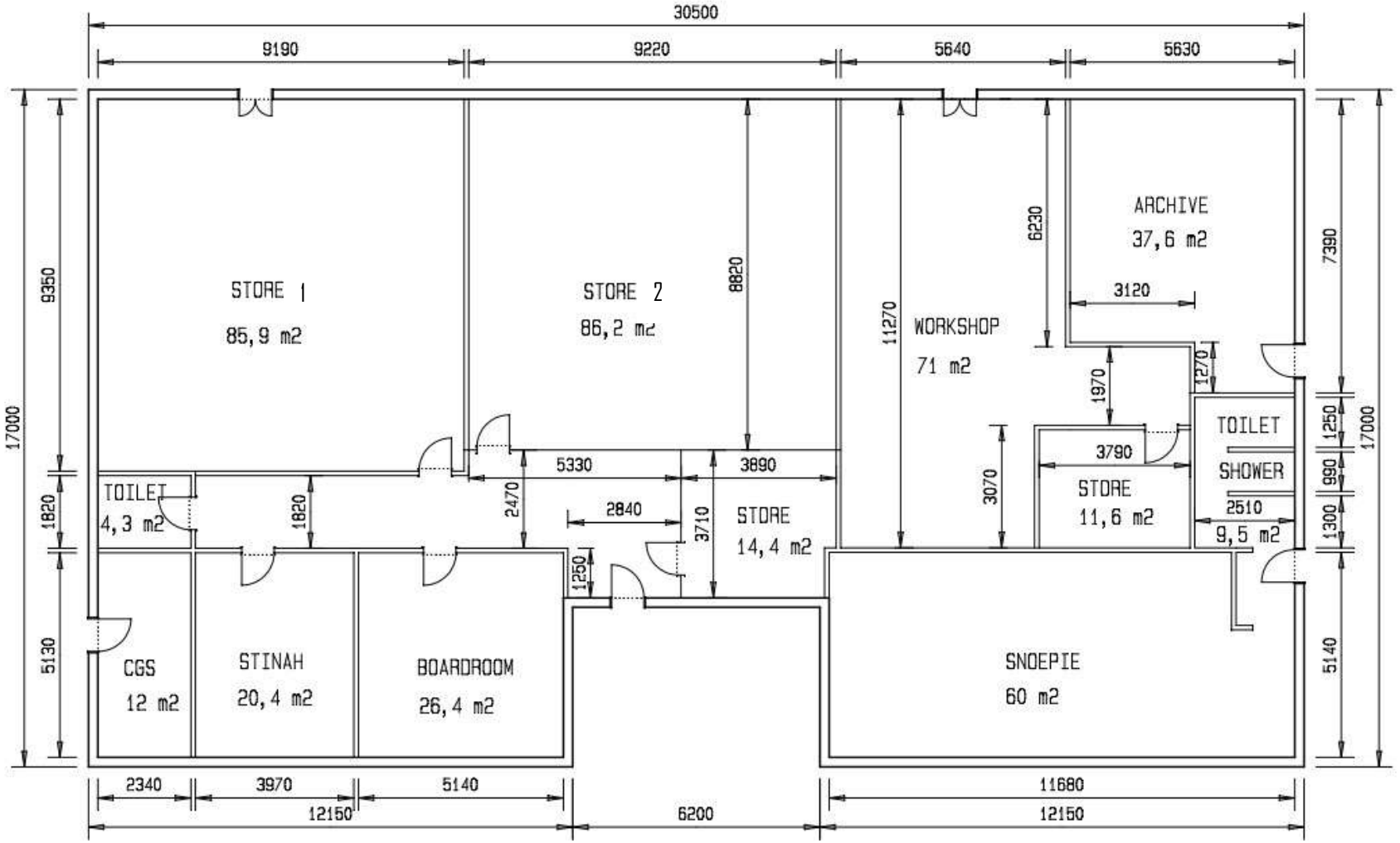
BOSKOP OFFICE

DIMENSIONS

PLAN VIEW
SCALE: 1:150







ANNEXURE B: MAIN OFFICE BLOCK B PLAN LAYOUT

BOSKOP OFFICE

DIMENSIONS

PLAN VIEW
SCALE:1:150