

SCOPE OF WORK

Title: **Repair of Water Treatment
Plants at Various Power
Station**

Unique Identifier:

Alternative Reference Number: **N/A**

Area of Applicability: **Engineering**

Documentation Type: **Specification**

Revision: **0**

Total Pages: **15**

Next Review Date: **N/A**

Disclosure Classification: **CONTROLLED
DISCLOSURE**

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1.0 INTRODUCTION

Water treatment plant (WTP) is designed to produce demineralised (demin) water from raw water. The raw water is full of ions which need to be removed to produce demin water. This process involves the ion exchange process wherein the ionised raw water passes through ion exchange vessels which contain ion absorbing resin. The raw water passes over resin which removes the ions from the water and stores it on the resin surface.

The resin has an exchange capacity (which is an inherent property of the resin) and once this capacity has been fully utilised the resin must be regenerated so that it can be re-used to produce demin water again. The process of regeneration involves passing acid/caustic over the respective ion exchange resins to remove the absorbed ions on the resin surface. In this process the acid/caustic passes over the resin to remove the ions and then is collected in the laterals which take the acid/caustic to the outlet pipes. From the outlet pipes the acid/caustic is collected in the effluent launders (channels) to the effluent sump. The effluent is then pumped to the ash water return high level dam (HLD).

Some sections of the effluent launders and effluent sump will seep, causing formation of cavities around the foundation of the WTP structure. The effluent water has PH that varies between 1 to 2 which indicates that it's acidic and very corrosive to concrete structure. This document outlines the repair scope of work to all affected structural components at the WTP due to the seepage of effluent water.

2.0 SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

The purpose of this document is to outline the scope of work required for repair and reline the batch tank area, effluent launder and effluent sump to prevent current seepage to the foundation of WTP structure to ensure structural stability

2.1.2 Objective

The objective of this project is to establish a cost-effective engineering solution to all water treatment plants that are deteriorating due to influence of acidic water.

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The contractor provides plant and materials, machinery, tools, labour, transportation, construction fuels, chemicals, construction utilities, administration and other services and items required to complete the scope of works.

2.1.3 Applicability

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

2.2 NORMATIVE/INFORMATIVE REFERENCES

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

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] Construction Regulations, 2014
- [3] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy
- [4] Occupational Health and Safety Act No. 85 of 1993,
- [5] QM58 - Suppliers contract quality requirements specification
- [6] SANS 1200 - Standardized specification for civil engineering construction
- [7] 240-101712128 - Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings

These documents are indispensable for the application of this document, i.e. documents to be used together with this document.

2.2.2 Informative

Document and Records Management

2.3 DEFINITIONS

Description	Definition
Appointed Contractor	Means a contractor appointed by the principal contractor.

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Baseline Risk Assessment	(32-520) baseline operational risks refer to the health and safety risks associated with all standard processes and routine activities in the business
Cleaning Activity	Means the safe cleaning of transfer chutes from the outside by the disabling of mechanisms to inhibit starting of the plant during the cleaning process, which is done in accordance with formulated safe procedures.
Contractor (includes appointed contractor)	means an employer as defined in section 1 of the Act who performs contract work and includes principal contractors
Competent Person	(OHS Act) means any person having knowledge, training, experience, and qualifications, specific to work or task being performed, provided that, where appropriate, qualifications and training are registered in terms of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995).
Danger/Dangerous	Means a condition/substance that constitutes a risk of personal injury, impairment of health, or death
Employee	(OHS Act) means, subject to the provisions of subsection (2), any person who is employed by or works for an employer and who receives remuneration or who works under the direction or supervision of an employer or any other person.
Employer	(OHS Act) means, subject to the provisions of subsection (2), any person who employs or provides work for any person and remunerates that person or expressly or tacitly undertakes to remunerate him/her, but excludes TES (ex. labour broker) as defined in section 1(1) of the Labour Relations Act.
Field Operator	Employee designated to conduct routine Plant inspections, Preventative Maintenance (PM) and (report) defect any breakdowns or abnormal Plant conditions
Lifesaving Rules	(240-62196227) a rule that, if not adhered to, has the potential to cause serious harm to people.
Permit To Work	Means the printed form containing sections entitled application, permits to work, suspension, suspension revocation, clearance and revocation, and used for the authorisation of all work to be carried out on the plant in terms of these regulations.
Plant	Means structure, machinery, low voltage electrical equipment or equipment which does not fall within the scope of the Operating Regulations for High-voltage Systems, and excludes, mobile, portable lifting equipment, domestic circuits, appliances and tools.

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Responsible Person	Means a person who has been authorised in terms of these regulations to be responsible for ensuring that the work on the plant covered by a permit to work can be carried out and executed taking health and safety precautions into account and within the terms of 36-681_Generation Plant Safety Regulation
Safe/Safely/Safety	Means a condition not posing any danger, an activity that can be carried out without danger, or protection against danger.
Shall and Should	The word "shall" is to be understood as mandatory and "should" as recommended.
Skilled Person	Means a person who has been trained, has adequate knowledge for the task at hand and declared competent in writing.
Supervision/Supervise	Means to oversee the actions of a person(s) to such an extent as to prevent any dangerous act, as far as reasonably practicable. Such a supervisor must be trained in risk assessment techniques and be able to understand the dangers / hazards associated with the task and who has the authority to ensure that precautionary measures taken are implemented.
Visitor	Any person visiting a workplace with the knowledge of, or under the supervision of, an employer.

2.3.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

The following abbreviations are used in this Works Information:

Abbreviation Meaning given to the abbreviation

ECC:	The Engineering and Construction Contract (part of the New Engineering Contract series), Institution of Civil Engineers
NEC:	The New Engineering Contract, Institution of Civil Engineers
SANS:	South African National Standards
FA:	Fly ash
GGBS:	Ground granulated blast furnace slag
OPC:	Ordinary Portland cement

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±:	plus/minus
c / c:	centre to centre
e.g.:	for example
i.e.:	that is
n/a:	not applicable
No.:	number
tba:	to be advised by the <i>Supervisor</i>
1 st :	first
2 nd :	second
3 rd :	third
4 th :	fourth
mm:	millimetre/s
QCP	Quality Control Plan

2.5 ROLES AND RESPONSIBILITIES

Project Manager/Site Manager

- Ensure that all employees comply to safety and environmental standards
- Ensure that this SOW is implemented on site.
- Ensure that this SOW is communicated and understood by all employees on site and all communication records must be filed.
- Ensure that this SOW is recomunicated with employees on a yearly basis. This will encourage employees as it depicts a picture of clear management visibility and leadership
- Ensure that traffic and fatigue management plans are in place

Supervisor

- Ensure for the supply of the correct safety equipment and the correct use at all times.
- Ensure that a risk assessment that covers all known risks was discussed and accepted by all involved parties.
- Ensure that the pre-start check list is a true reflection of the condition of the machine and to report any unsafe or defective parts to the site manager.
- Ensure that the machines are filled with diesel before work commences and before new shifts starts.

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- Ensure that the machines are greased at least ones per shift.
- Is responsible for clear instructions as to where the machine should work and what the task will be for that shift, he must ensure that the operator fully understands the instructions.
- Is responsible to keep detailed records of daily tasks, e.g. risk assessments, machine hours, man hours, weather conditions and diesel consumption.
- Is responsible to monitor the operation during the shift and to address and resolve the any unsafe acts or condition that might occur.
- Ensure that proper dust suppression is done.

Plant Operators

- Is responsible for his own safety, in that he/she must ensure that he/she has all the necessary safety equipment to perform his/her duties and to report any worn out or damaged safety equipment immediately.
- To complete the pre-start inspection on mobile plant and to report all unsafe or defective parts to the Supervisor.
- Is responsible to make sure the mobile plant is filled with diesel before the shift.
- Is responsible to ensure that before any work is done a risk assessment has been filled and discussed with relevant parties, the operator is the responsible person when coming to the operating of his/her machine and must refuse to do any work without a proper risk assessment.
- Ensure that he/she fully understands the task at hand and if not to seek guidance from the Supervisor on site before commencement of work.
- Is responsible to ensure that no high wall areas are left on the area that he dozed before his shift is over, he/she must also ensure to inform the Supervisor of any high wall areas that could not be eliminated before end of shift so that it can be barricaded and communicated to the next Supervisor.
- Ensure that a safe working distance of 10m is kept between his/her machine and other equipment in the area.
- Ensure to keep his/her machine clean.

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SHE Officer:

- Ensure that equipment / vehicles Spot checks are carried out by the supervisors as required and that equipment /vehicles are safe to use.
- Ensure that site records are adequate to demonstrate compliance to the requirements of this method statement and quality work.
- Ensuring that site records are properly stored and are easily retrievable at all times.
- Conduct site induction and communicate all site procedures.
- Ensure that the personal protective equipment (PPE) required for performing the task described in this work instruction is issued to the relevant employees. (contractors to issue their operators with their own company PPE)
- Ensure that a task specific risk assessment and toolbox talk are conducted with all employees involved prior to work commencing and revised whenever the scope changes.
- Conduct site inspections and plant walks.
- Monitor traffic through job observations and SMAT techniques

2.6 REQUIRED CRITERIA FOR CONTRACTOR

- The contractor must provide the CV's of the technical staff and proof certificates.
- The contractor is to provide a Site Manager or Project Manager to supervise, monitor, control and co-ordinate all activities during execution of the project
- The contractor must provide a company profile showing previous work done.
- The contractor will be required to comply with Eskom Rotek Industries SHEQ requirements. This is mandatory as one of Eskom values is Zero harm.

2.7 RELATED/SUPPORTING DOCUMENTS

The following document will be supplied to the contractor before execution of work.

- ERI SHEQ requirements
- QM58- Eskom Generation Standard Quality Requirements
- Safety files assessment form (Check list to be used during file assessment).

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3.0 SCOPE OF WORKS

3.1 DESCRIPTION OF THE WORKS

The scope of work will detail the required repairs at the WTP.

3.1.1 Batch tank area

The batch tanks are tanks that stores sulphuric acid & caustic which are used for the regeneration process as discussed above. The area underneath the tanks is lined with acid resistant tiles however most of the tiles get damaged and these tiles span an area of approximately 100m². The plant arrangement in this area has a lot of restrictions due to all the pipe work and tanks positioned close to each other and as a result access for personnel to do repair work is limited. The following scope must be executed to repair the plant area:

- Remove all tiles in the acid batch tank area
- Repair damaged area on the concrete slab using 30MPa concrete grout for a proper smooth surface.
- Supply and apply a new Corrosion Resistant liner as per specification provide on section 3.2.1.1. (supplier to provide specification from the manufacture to be approved by the engineer before any work commence)

3.1.2 Effluent launder

The effluent launders are concrete channels inside the WTP which collect all acid and caustic effluent during the regeneration process for demin water treatment. The effluent water has a pH of 1 when acid regenerations are taking place and a pH of 11 when caustic regenerations are taking place and maximum temperature of 50 degrees Celsius. The channels are lined with acid resistant tiles, PVC liner and epoxy liner. The plant layout is such that the small channel collects water from vessels and discharges into the main channels that go to the effluent sump. The main channel is 100m long, with a cross sectional area of 0.5m x 2m deep. The main channel is currently lined with two different types of acid liners (one section is PVC and other section is epoxy).

There has been numerous repair work done on the channel where epoxy products were applied as an acid liner but due to the lack of total isolation of water during repair work the surface area preparation was not done properly, the area does not properly dry up and the epoxy material didn't cure leading to liner peeling off.

The station is continuously generating water and to get total shutdown where a launder will be isolated for a longer duration for proper repair is a challenge, the longest time that can be granted is 24 hours at a time.

The supplier will not get total isolation of the plant for the entire execution of the work, there will be minor water still flowing in the channel and not just any epoxy product will be accepted

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in this area. The total area to be repaired is 400m². Due to the previous challenges as explained above the supplier will only work when a total plant shutdown of 24hour is granted and the work will be done in sections until the entire area is completed. The project manager will be the one responsible to liaison with WTP and production department for plant shutdown opportunities, the supplier must always be ready to execute whenever the opportunity is granted.

The repair scope is as follows:

- Remove all damaged epoxy liner on the main launder
- Clean and clear all loose material, loose concrete and any corroded concrete section
- Supply and apply 30Mpa acid resistance grouting on all damaged section of the launder for a proper smooth surface.
- Supplier will be required to submit the proposal for the product that can work in the Duvha plant condition as described above.
 - The material testing and data sheet approval will be required during tender stage as a package to the proposal.
 - The supplier will also be require to provide guarantee of the product proposed of not less than 10years
 - Referral of previous plants will be required and plant visit will be done to verify that the product works as proposed
- The supplier supply and apply the approved product

3.1.3 Off-loading drain pipe

The off-loading pipe is a 200 diameter PVC pipe that collects all spillage from the offloading area outside the WTP and drains it to the main effluent launder which is inside the WTP. The pipe is only accessible in the section for the offloading area next to the manhole just before it runs under the bulk tank area. The section to be replaced is the accessible area. The following must be done

- Remove all paving blocks where the pipe is running as indicated by the engineer
- Excavate all material to a depth of the 200mm PVC pipe which is 0.5m deep and remove the damaged pipe for a distance of 30m and stock pipe the material at an area allocated by the project manager. Note that the excavation can only be done up to the acid bulks tank bund wall. (This pipe discharges to the effluent launder).
- Supply bedding from commercial sources and lay as per SANS 1200

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- Supply and 200mm diameter PVC pipe class 12 on class B bedding (pipe material must be as per SANS 966 Part 1)
- Backfill material using stockpiled material , compact to 95% Mod AASTHO at 2% moisture content to complete terrace
- Reinstate road surfaces complete with all courses, Paving blocks/bricks (using the existing 80 mm interlocking bricks)

3.1.4 Offloading area

The offloading area is the area where the acid and caustic truck offloads acid or caustic into the bulk tank. The area was previously lined with acid resistance bricks, however over time the brick lining has deteriorated and requires to be replaced. The following is required

- Remove all damaged acid Resistant Brick Linings
- Supply and line the area with new acid Resistant Brick Linings as per specification (supplier to provide specification from the manufacture to be approved by the engineer)
- Remove the damaged plaster on the part of the offloading area bund and re-plaster
- Remove all corroded grating and supply and install new galvanized grating in the two catch pits of 300 x 300 mm. (supplier must measure the exact size of the catch pits opening in order to manufacture the correct grating size)
- Supply and install new acid Resistance Brick Linings on the new plinth in the bund

3.1.5 Effluent sump

Effluent collects all acidic and alkaline water from the effluents launders inside the WTP. The sump has 3 compartments, each compartment has an effluent pump assigned to pump water to the HLD and all the compartments are interlinked. Compartment 1 and compartment 3 are of same size while compartment 2 is much smaller. All compartments were previously lined with acid brick lining, however compartment 1 and 3 are currently lined with acid resistant

epoxy liner, only compartment 2 is still lined with brick lined. All compartment were recently inspected, compartment 1 and 3 just have minor corrosion in the area next to the isolation valve while compartment 2 is totally corroded. This section of scope describes the repair work required for compartment 2 and 3 corroded area together with required repairs for compartment 2

3.1.5.1 Compartment 2 and 3 repairs

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The supplier and Eskom engineer will do inspection to identify corroded area and mark the exact area to be repair , after the assessment the following must be done

- Remove all damaged liner on all identified and marked area as per the inspection
- Repair the sump wall and make it smooth using any acid resistance grout of strength not less than 30 Mpa
- Do surface preparation as per the liner specified requirement
- Supply and line the section using acid resistance liner that meets the specification in section 3.2 (epoxy products is recommended because the current liner in these sump is epoxy material)

3.1.5.2 Compartment 2

This compartment is 1.5 m x 1.5m x 6m deep. The sump has limited space to execute any repair work. The supplier must take into consideration this during pricing. The following is required

- Remove all brick liner on all wall sump
- Repair the sump wall in the area where it is corroded or where there are visible holes, acid resistance grout of strength not less than 30Mpa to be used and the area must be repaired to smooth surface
- Do surface preparation as per the liner specified requirements
- Supply and line the entire compartment using acid resistant liner that meets the specification on section 3.2 (epoxy products is recommended because of the limited working space)

3.1.6 WTP floor slab

The WTP floor slab is corroded in certain sections due to all spillage of effluent water when there are defects in the plant. A new concrete screed of estimated average thickness of 50mm must be constructed on those sections. The total area of 400m² will require repair work. After the repairs are done WTP floor area of 2500m² must be painted. The following must be done on this area

- The supplier and Eskom engineer will do inspection to identify corroded area and mark the exact area to be repair

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- Saw cut and removed damage section of the concrete on all identified surface area of the floor slab inside WTP
- Clean the area and remove all loose material on area to receive new screed
- Supply and apply wet to dry epoxy on all area to receive new concrete screed
- Repair all area using a 30 MPa quick dry grouting from any commercial source which meets the specification on section 3.2. (The specification of the grouting material to be approved by the engineer before work commences)
- Supply and repaint the WTP floor of total area of 2500m² to match existing floor paint colours.

3.2 Employer's Design Requirements

3.2.1 Functional Requirements

3.2.1.1 Corrosion Resistant epoxy for batch tank area

The product must be able to handle the following

- Applied to a thickness of at least 5mm
- Should handle Sulphuric acid & caustic
- Should handle effluent with pH of 1 up to 11
- Should be flexible to allow concrete movement without breaking or cracking
- Should be able to handle mechanical stresses, thermal shocks and abrasion.
- Should also be non-slip, non-corrosive, free-thaw resistance, antistatic, antibacterial, aesthetic and should have hygienic advantages
- Should have a life span of not less than 10 years guarantee

3.2.1.2 Corrosion resistant liner for effluent launders

Supplier will be required to submit the proposal for the product that can work in the plant following condition mentioned of section 3.1.2. (The material testing and data sheet approval will be required during tender stage as a package to the proposal). The product:

- Should handle effluent with pH of 1 with of Sulphuric acid & pH of 11 for caustic
- Should handle maximum temperature of 50 degree Celsius
- Should work on areas which are semi dry as mentioned on section 3.1.2 of this cope of work

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- Should be flexible to allow concrete movement without breaking or cracking
- The supplier will be give 24hour at a time and within that time the supplier must do surface preparation, apply the product and the product should able to set and cure within that allowed duration before plant return to service

3.2.1.3 Acid resistance grout should

- Be of a strength of 30Mpa or more
- Handle Sulphuric acid & caustic

3.2.1.4 Corrosion Resistant liner for Effluent sump

The product must be able to handle the following

- Applied to a thickness of at least 5mm
- Should handle Sulphuric acid & caustic
- Should handle effluent with pH of 1 up to 11
- Should be flexible to allow concrete movement without breaking or cracking
- Should be able to handle mechanical stresses, thermal shocks and abrasion.
- Should also be non-slip, non-corrosive, free-thaw resistance, antistatic, antibacterial, aesthetic and should have hygienic advantages
- Should have a life span of not less than 10 years guarantee

3.2.1.5 Concrete works (WTP floor repairs)

The grouting must have the following:

- Compressive Strength of not less than 30Mpa
- Flexural Strength of not less than 6.0 N/mm²
- Tensile Strength of not less than 2.6 N/mm²
- Easy mixing and placing
- Rapid strength development
- Fatigue tested
- Good flow properties

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- Free from chlorides and metallic particles
- Expansive properties
- Very high mechanical strengths.
- Not corrosive or toxic

3.2.1.6 Corrosion resistant brick lining (offloading area)

The Acid resistance brick must conform to the following specification:

Cold crushing strength	> 700 kg/cm ²
Flexural strength	> 100 kg/cm ²
Water absorption	< 2 %
Bulk density	2. 250 kg/cm ³
Sizes	Length:229 x Width:114 x Thickness : 65 / 75 mm
Chemical resistance	Sulphuric & caustic acid

The bricks should also handle mechanical stresses, thermal shocks and abrasion. It should also be non-slip, non-corrosive, free-thaw resistance, antistatic, antibacterial, aesthetic and should have hygienic advantages.

3.2.1.7 Mortar

The mortar should meet the following:

- Application of Impervious mastic membrane as a Primer; to be apply between the surface & brick Lining
- Potassium Silicate Base Cement which resists against wide variety of acids & entire range of temperature up to 8000°C
- Sodium Silicate Base Cement which resists temperature up to 6500°C can be use as bedding materials of acid resistance Brick Lining
- Joining will be done with Silicate – Furan Base Cement; from the Top

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compressive strength minimum kg/cm ² (after 7 days)	450
flexural strength minimum kg/cm ² (after 7 days)	150-200
Bond strength minimum kg/cm ²	6-7
absorption of toluene max % by weight	15%
Chemical resistance	Sulphuric & caustic acid

3.2.1.8 Paving works (Reinstating after repairing the offloading drainage acid pipe)

General:

The area shall be constructed of interlocking paving bricks. Paving blocks which fail to meet these requirements must immediately be removed from the site and replaced at the Contractor's expense to the satisfaction of Eskom.

Materials:

Materials for interlocking paving bricks shall conform to SANS Specification 1058 to the following requirements:

Type S-A

Class 35

Sand for jointing shall pass a 1.18mm sieve and shall contain 10-50% of material that passes a 0,075mm sieve.

Spaces constituting less than 25% of a full block unit and of 25mm minimum dimension at perimeter edges of pavings against kerbs, buildings, inspection chambers, etc. are to be filled with Class B concrete trowelled to a smooth even surface to match paving blocks.

Installation:

Paving blocks are to be laid to approved patterns as specified and in accordance with the relevant clauses (excluding Clause 8) of SANS Specification 1200 MJ on and including a sand bed of the compacted thickness specified. After laying, the paving blocks are to be compacted by means of a vibrating plate compactor with the joints filled in, after compaction, by sweeping in jointing sand.

Laying of Interlocking bricks:

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- After the base course has been approved and the curbing completed the prepared base must be treated with a weed killer similar or equal to HYVAR X at a rate of 4g/m².
- Spread a plus minus 45mm thick loose layer of bedding sand (to compact to 25mm). The sand shall be sharp and well graded, silt and clay content of not more than 3%, with 85% or more passing thru a 2,36 mm sieve.
- The sand must be levelled with a straight edge or other suitable means. The sand surface must not be disturbed or walked upon before placing the blocks.
- Approved 80mm thick interlocking , 30 MPa concrete roadstones with chamfered top edges are to be laid in Herringbone pattern and compacted with a plate vibrator until the desired line and level is received where after the sweeping of sand into the joints and the additional passes of the vibrator are made until the joints are completely filled. The filling sand shall be finer than that used for the bedding and shall completely passed thru a 1,18mm sieve, 90% or more retained on a 0,075mm sieve.

Quality standard

- The repaired area shall be rectangular in shape.
- The edges of the completed surfacing shall not be more than 3 mm higher than the existing surface.
- The cross-fall of the completed area shall be equal to that of the adjacent surface to within a tolerance of $\pm 0,5$ % cross-fall towards the storm water drains.

3.3 PRE-WORK CONSIDERATIONS

3.3.1 General safety requirements

3.3.1.1 Baseline Risk Assessment

Risk Assessment details to be determined by the work team together with the project manager.

The team to consider the following during risk assessment

- The present of acid in the effluent water
- That effluent sump is a confined space and necessary ventilation must be provided
- Limited access in most area to be repair
- Working under the acid tanks and around acid pipe work

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-
- Working inside the trench which are more than 2m deep

3.3.1.2 Excavation Work

The project manager must ensure that for all excavation work to do carried must be accompanied by a signed excavation permit (3T70921_SAS0012-9 Rev 0 -Excavations Permit), signed by all stakeholder.

The area where excavation will be done don't have known services that might be of obstruction for the excavation to take place, however the trench to be excated is small therefore hands excavation is recommended..

No work shall resume without a signed excavation permit

3.3.2 Foreign Material Exclusion (FME)

N/A

3.3.3 Environmental requirements

Environmental requirements to be determined by allocated environmental officer in this project during tender stage.

4.0 CONTRACTOR'S DESIGN

The supplier will be required to provide the following

- The Proposal of the product that can be suitable for the WTP effluent launder taking into account the plant condition and plant availability as mentioned above.

5.0 AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Nhleko T	HOD Civils
Murawo R	Project Manager

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Revisions

Date	Rev.	Compiler	Remarks
December 2020	1	Murawo R	Draft Document

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