BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

TENDER SUBMITTED BY:

Registered Name of Company :_____

Address :_____

_____

Telephone No :_____

E-mail :_____

CONTACT:

Tender Administrative Queries can be directed to:	**Tender Technical Queries can be directed to:**
Supply Chain Management Mr Thato Khaeane Tel: 051 4030 800 Fax: 051 – 422 5333 Email:thatoks@vcwater.co.za	Mr. L Biggs Bigen Africa Services (Pty) Ltd 2 Chris Botha Street, Westdene Tel: +27(0) 51 430 1423 Email: Llewellyn.biggs@bigengroup.com

ISSUE DATE: 08 SEPTEMBER 2026

COMPULSORY CLARIFICATION MEETING DATE: TUESDAY, 22 SEPTEMBER 2026 @ 11:00

CLOSING DATE: TUESDAY, 06 OCTOBER 2026 @ 12:00

Vaal Central Water

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(See Drawing Register bound into Volume 2)

END OF SECTION

TENDER SUMMARY PAGE

TENDERER	**(Name of Tenderer)**
CIDB GRADING	**7CE or Higher**
TOTAL PRICE (Incl. VAT)	**(in words)** **(in words)** **(in figures)**
COMPLETION PERIOD	**(weeks)**
PREFERENCES CLAIMED FOR:	

LOCAL ENTERPRISE:	**YES**		**NO**	

<u>Note: This page is used for tender opening purposes only. Where there is a discrepancy between this page and the Form of Offer and Acceptance, then the latter will be taken as the valid offer.</u>

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

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TENDERING PROCEDURES

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	(Index contained in Part T1, Section T1.3)	

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

TENDER NOTICE AND INVITATION TO TENDER

1. Tenders are invited for the construction of a steel by-pass pipeline and break pressure tank at Brandkop reservoir including reservoir joint sealing and concrete repairs.

2. It is estimated that tenderers should have a CIDB contractor grading in the appropriate Civil Engineering (CE) class, at a minimum grading of **CIDB 7CE**, or higher.

   For the specialist water proofing and joint sealing portion of the Works it is estimated that tenderer or his Sub-Contractor should have a CIDB contractor grading in the appropriate Water Supply and Drainage (SN) Classification of Work at a minimum grading of **CIDB 3SN**, or higher.

3. Tender documents will be available on 08 September 2026 at 22:00 on VCW Website.

4. Tenders close on 06 October 20026 at 12:00. Particulars regarding the submission of tenders appear in Part T1.2 of Volume 1 of the tender documents.

5. An official site visit and clarification meeting will be held on 22 September 2026 at 11:00. Tenderers are requested to meet the Engineer at Brandkop Reservoir as shown on the Locality Plan at the front of the tender document.
   Address: 02 Mzuzu Street Pellissier Bloemfontein 9301 The office coordinates are - 29°08'42.2"S 26°09'23.5"E

6. Enquiries relating to this tender should be addressed to Llewellyn Biggs at the Bloemfontein Office of BIGEN AFRICA Services (Pty) Ltd.

END OF SECTION

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in Annex C of the Construction Industry Development Board's Board Notice 423 of 2019 (contained in Government Gazette No. 42622 of 08 August 2019), bound into section T1.3.

The Standard Conditions of Tender makes several references to the Tender Data. The Tender Data also contains project specific amendments to the Standard Conditions of Tender applicable to this document. The Tender Data shall have precedence in the interpretation of any ambiquity or inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross–referenced to the clause in the Standard Conditions of Tender to which it mainly applies.

Clause	Addition or Variation to Standard Conditions of Tender
1.1	The Employer is Vaal Central Water.
1.2	The tender documents issued by the Employer comprise two volumes. Volume 1: Contract Document contains the parts and sections (contained in each part) as listed in the Contents List of Volume 1 bound in the front of this document. Volume 2: Book of Drawings contains the drawings listed in the Drawing Register bound in the front of that volume.
1.3.2	Replace this sub-clause with the following: These Conditions of Tender, the Tender Data, List of Returnable Documents and Returnable Schedules which are required for tender evaluation purposes, shall form part of the Contract arising from the invitation to tender.

Clause	Addition or Variation to Standard Conditions of Tender
1.4	The Employer's Agent is (also known as the Engineer): Bigen Africa Services (Pty) Ltd 2 Chris Botha Street BLOEMFONTEIN 9301 Tel: (051) 430 1423 e-mail: llewellyn.biggs@bigengroup.com Attention: Llewellyn Biggs
2.1	Only those tenderers who are registered with the CIDB, or are capable of being registered prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a **CIDB 7CE** class of construction work **and** who is registered for a **CIDB 3SN** class of construction work **or** identified a sub-contractor registered for a **CIDB 3SN** class of construction work , are eligible to have their tenders evaluated. Joint ventures are eligible to submit tenders provided that: 1. every member of the joint venture is registered with the CIDB; 2. the lead partner has a contractor grading designation in the CE class of construction work; not lower than one level below the required grading designation in the class of works construction works under consideration and possess the required recognition status; and 3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a CIDB 8CE class of construction work, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.
C.2 **C.2.1** New item	**Tenderer's obligations** **Eligibility** Add the following New sub-clause: Only those tenderers who satisfy the following criteria are eligible to submit tenders: The bidder's primary business is to provide supplies or services as per the bid invitation

Clause	Addition or Variation to Standard Conditions of Tender
C.2.1.3	Accept that all returnable documents and schedules which are required to be certified are done so by a registered Commissioner of Oaths of the Republic of South Africa. a) The Employer will only enter into a formal contract with a tenderer who is registered on the National Treasury Central Supplier Database. In the case of Joint Venture partnerships this requirement will apply individually to each party of the Joint Venture. b) CIDB Registration and Grading i) Only those tenderers who are registered with the CIDB, or are capable of being registered prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a **CIDB 7CE** class of construction work and who is registered for a **CIDB 3SN** class of construction work or identified a sub-contractor registered for a CIDB 3SN class of construction work , are eligible to have their tenders evaluated. ii) Joint ventures are eligible to submit tenders provided that: a) every member of the joint venture is registered with the CIDB, b) the lead partner has a contractor grading designation in the CE class of construction work; not lower than one level below the required grading designation in the class of works construction works under consideration and possess the required recognition status; and c) the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a CIDB 8CE class of construction work, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations The Employer may, in its discretion, subject to the provision of Section 4(1)(d) of the State Tender Board Act (Act 86 of 1968), condone any failure to comply with the foregoing condition. c) The tender has not failed to perform on any previous contracts and has been given a written notice to this effect. d) The Tenderer or any of its directors is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of

Clause	Addition or Variation to Standard Conditions of Tender
	2004 as a person prohibited from doing business with the public sector. e) Only authorised signatories may sign the original and all copies of the tender offer where required. f) Tenderers shall be registered and in good standing with the South African Revenue Services (SARS) and should be able to submit a valid tax compliance pin issued by SARS. Each party to a Consortium/Joint Venture should be able to submit a separate valid Tax Clearance Certificate and attach it to the schedule. g) Standard Bidding Documents (SBD) The following standard SBD's should be completed (if applicable) legibly and in full in terms of the requirements of the Department of National Treasury of the Republic of South Africa: • SBD1: Invitation to bid and company information • SBD4: Disclosure Forms • SBD6.1 : Preferential Procurement h) The tenderer should be able to submit the following Certificate: • Certified copy of certificate of Incorporation if tenderer is a company or; • Certified copy of founding statement if tenderer is a closed corporation or; • Certified copy of Partnership agreement if tenderer is a partnership or; • Certified copy of Identity document if tenderer is a one-man concern or; i) Original (or certified copy) of municipal rates clearance certificate or a certified copy of the lease agreement with the lessor's municipal rates certificate - Not older than 3 months (Vaal Central Water reserves the right to conduct physical verification of premises). j) The tenderer should be able to attach certified proof of registration and in Good Standing with the Compensation Commissioner or with a licensed compensation insurer. k) The Bidder should be able to provide a Financial References. l) Certificate copy of latest Unemployment Insurance Fund (UIF) return (if not stated on the valid tax compliance pin).
2.7	An official clarification meeting and site visit will be held as follows: Location : 2 Mzuzu Street, Pellissier Date : Tuesday, 22 September 2026

Clause	Addition or Variation to Standard Conditions of Tender
	Time : 11:00 Confirmation of attendance will be recorded, on site, in the Site Inspection Certificate included in Section T2.2 of the Document. Tender documents will not be made available at the site visit or clarification meeting. Detail relating to the collection of tender documents is indicated in the Tender Notice and Invitation to Tender (Section T1.1 of the document)
2.10	Add the following sub-clause 2.10.5: A digital copy of the Bill of Quantities can be obtained from the office of the Engineer upon sufficient notice.
2.11	Replace the last sentence of the clause with the following: To correct errors made, draw a line through the incorrect entry and write the correct entry above in black ink and place the full signatures of the authorised signatories next to the correct entry.
2.12.1	Add the following to the clause: All alternative tender offers shall be referred to in Section T2.2.1 – Alterations to Tender.
2.12.2	Add the following to the clause: Should the Tenderer wish to offer alternative designs and/or construction materials, he shall include with this Tender full details thereof, including a complete bill of quantities, formal design calculations, and full details of all alternative components proposed to be included in the Works. Refer also to the Contract Data in this regard. Failure to properly comply with this clause, thereby preventing the Employer and/or the Engineer to properly assess the full implications of the alternative tender, is likely to disqualify the alternative offered from further consideration. No submission by the Contractor after award for additional payment or time for completion of Works relating to the alternative offer will be considered, the tendered rates submitted shall be considered to reflect the full and final cost implications of the alternative offer.
2.12.3	Delete this clause.
2.13.2	Replace the contents of the clause with the following: Return all volumes of the tender document to the Employer after completion of the relevant

Clause	Addition or Variation to Standard Conditions of Tender
	sections of each volume in their entirety, either electronically (if they were issued in electronic format) or by writing in black ink. All volumes are to be left intact in its original format and no pages shall be removed or re-arranged.
2.13.3	Only one (1) original bid offer is required. It is recommended that all pages be numbered. One (1) scanned copy of the document is also required on a memory stick.
2.13.4	Add the following to the clause: Only authorised signatories may sign the original and all copies of the tender offer where required in terms of 2.13.3.
2.13.5	The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are: Tender box location : Vaal Central Water Head Office Physical address : 2 Mzuzu Street, Pellissier, Bloemfontein Identification details : BID NUMBER VCW440/STEELBPTB/26 – Construction of a Steel By-pass Pipeline and Break Pressure Tank at Brandkop Reservoir including Reservoit joint Sealing and Concrete Repairs The name and address of the tender shall be entered on the back of the envelope.
2.13.6	A two-envelope procedure will not be followed.
2.13.10	Add the following new sub- clause 2.13.10: Accept that all conditions, which are printed or written upon any stationary used by the Tenderer for the purpose of or in connection with the submission of a tender offer for this Contract, which are in conflict with the conditions laid down in this document shall be waived, renounced and abandoned.
2.14	Add the following to the clause: The Tenderer is required to enter information in the following sections of the document: Section T2.2 : Returnable Schedules Section C1.1 : Form of Offer and Acceptance

Clause	Addition or Variation to Standard Conditions of Tender
	Section C1.2 : Contract Data (Part 2) Section C2.2 : Bill of Quantities The above sections shall be signed by the Tenderer (and witnesses where required). Individual pages should only be initialled by the successful Tenderer and by the witnesses after acceptance by the Employer of the Tender Offer. The Tenderer shall complete and sign the Form of Offer prior to the submission of a Tender Offer. The Schedule of Deviations (if applicable) shall be signed by the successful Tenderer after acceptance by the Employer of the Tender Offer. Accept that failure on the part of the Tenderer to submit any one of the Returnable Documents listed in clause 2.23 within the period stipulated, shall be just cause for the Employer to consider the tender offer as being regarded as non-responsive. Accept that the Employer shall in the evaluation of tender offers take due account of the Tenderer's past performance in the execution of similar engineering works of comparable magnitude, and the degree to which he possesses the necessary technical, financial and other resources to enable him to complete the Works successfully within the contract period. Satisfy the Employer and the Engineer as to his ability to perform and complete the Works timeously, safely and with satisfactory quality, and furnish details in section T2.2.2 of contracts of a similar nature and magnitude which they have successfully executed in the past. Accept that the Employer is restricted in accordance with clause 5 (1) of the Construction Regulations, 2014, to only appoint a contractor whom he is satisfied has the necessary competencies and resources to carry out the work safely. Accept that submitting inferior and inadequate information relating to health and safety (as required in clause 2.23) shall be regarded as justifiable and compelling reasons not to accept the Tender Offer of the Tenderer scoring the highest number of tender evaluation points.
2.15.1	The closing time and location for the submission of tender offers are: Time : 12:00 on Tuesday, 22 September 2026 Location : Vaal Central Water Head Office, 2 Mzuzu Street, Pellissier, Bloemfontein
2.16.1	The tender offer validity period is 90 days.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Clause	Addition or Variation to Standard Conditions of Tender
2.16.1	Add the following to the clause: If the tender validity expires on a Saturday, Sunday or public holiday, the tender shall remain valid and open for acceptance until the closure of business on the following working day.
2.16.5	Add the following new clause: Accept that should the Tenderer unilaterally withdraw his tender during the tender validity period, the Employer shall, without prejudice to any other rights he may have, be entitled to accept any less favourable tender for the Works from those received, or to call for fresh tenders, or to otherwise arrange for execution of the Works, and the Tenderer shall pay on demand any additional expense incurred by the Employer on account of the adoption of the said courses, as well as either the difference in cost between the tender withdrawn (as corrected in terms of clause 3.9 of the Conditions of Tender) and any less favourable tender accepted by the Employer, or the difference between the tender withdrawn (as corrected) and the cost of execution of the Works by the Employer as well as any other amounts the Employer may have to pay to have the Works completed.
2.18.1	Add the following to the clause: Accept that if requested, the Tenderer shall within 7 days of the date upon which he is requested to do so, submit a full report from his banker as to his financial standing. The Employer may, in its discretion, and subject to the provisions of Section 4(1)(d) of the State Tender Board Act 86 of 1968, condone any failure to comply with the foregoing condition. Accept that the Employer or his agent, reserves the right to approach the Tenderer's banker or guarantor(s) as indicated in the tender document, or the bankers of each of the individual members of any joint venture that is constituted for purposes of this Contract, with a view to ascertaining whether the required guarantee will be furnished, and for purposes of ascertaining the financial strength of the Tenderer or of the individual member of such venture.
2.22	Replace the contents of the clause with the following: Return all retained tender documents prior to the closing time for the submission of Tender Offers.
2.23	The following certificates / information are to be provided with the tender offer or within seven days of receipt of the Employer's or his Agent's written request to submit same:

Clause	Addition or Variation to Standard Conditions of Tender
	a) CIDB registration certificate in the grading designation stipulated in clause 2.1 above, b) Original valid Tax Clearance Certificate, or a unique security personal identification number (PIN) issued by the SA Revenue Services (in terms of the Preferential Procurement Regulations, 2001 published in Government Gazette No. 22549 dated 10 August 2001), c) Certified copy of VAT Registration Certificate (if VAT number is not included in tax clearance certificate), d) Certified copy of Letter of Good Standing issued by the Department of Labour in terms of Act 130 of 1993, e) Certified copy of Unemployment Insurance Fund Certificate of Compliance in terms of Act 4 of 2002, f) Certified copy of Certificate of Incorporation (if tenderer is a Company), g) Certified copy of Founding Statement (if tenderer is a Closed Corporation), h) Certified copy of Partnership Agreement (if tenderer is a Partnership), i) Certified copy of Identity Document (if tenderer is a One-man concern), j) Joint Venture Agreement (if tenderer is a Joint Venture), k) Curriculum vitae of the person who prepares the Contractor's Health and Safety Plan, and l) Curriculum vitae of the Health and Safety Officer the successful tenderer intends appointing in accordance with the Occupational Health and Safety Act (Act 85 of 1993). m) Curriculum Vitae of all supervisory staff n) Appointment letter and Completion certificates and signed reference letters by the client/engineer to prove successful completion of projects relating to the construction of civil projects [see functionality table under CL3.11].
3.1.1	Replace the contents of the clause with the following: Respond to a request for clarification received up to ten (10) working days before the Tender closing time stated in the Tender Data and notify all Tenderers who collected

Clause	Addition or Variation to Standard Conditions of Tender
	procurement documents within five (5) working days of the same date.
3.4	Tenders will be opened immediately after the closing time of submission of tenders at the venue indicated in Clause 2.13.5 of the Tender Data.
3.5	A two-envelope procedure will not be followed.
3.8.1	Add the following to the clause: Failure on the part of the Tenderer to submit a tender offer as stipulated in clause 2.13 prior to the closing time as stipulated in clause 2.15 shall be just cause for the Employer to consider the tender offer as being non-responsive Failure on the part of the Tenderer to submit any one of the returnable documents or certificates listed in clause 2.23 within the period stipulated shall be just cause for the Employer to consider the tender offer as being non-responsive. A. Bidders who do not adhere to the criteria listed below as PRE-QUALIFIER, will be disqualified immediately.

Responsiveness Criteria		Prequalifying Criteria	Applicable to this Tender (Y/N)
1	Fully completed and signed Standard Bidding Documents · SBD Form 1 · SBD Form 4 · SBD Form 6.1	Pre-Qualifier	Y
2	Attendance at the Compulsory Clarification Session attended by the Bidder	Pre-Qualifier	Y
3	CIDB registration and Grading The following tenderers who are registered with the CIDB, or are capable of being so registered prior to the evaluation of submissions, are eligible to have their	Pre-Qualifier	Y

Clause	Addition or Variation to Standard Conditions of Tender				
		tenders evaluated: 1- Contractors who have a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) of 25 (7A) of the Construction Industry Development Regulations, for a level **7CE or HIGHER** are eligible to submit Tenders for this contract. Main Contractor and/or Sub-contractors selected for reservoir joint sealing and repair to be also registered for Water Supply and Drainage (SN) Classification of Work at a minimum grading of **CIDB 3SN or Higher.** 2- Contractors registered as potentially emerging enterprises with the CIDB who are registered in one contractor grading designation lower than that required in terms of (a) above and who satisfy the following criteria: • the Employer is satisfied that such a contractor has the potential to develop and qualify to be registered in that higher grade as determined in accordance with the provisions of the CIDB Specification for Social and Economic Deliverables in Construction Works Contracts; and			

Clause	Addition or Variation to Standard Conditions of Tender				
		• the Employer agrees to provide the financial, management or other support that is considered appropriate to enable the contractor to successfully execute that contract. 3- Joint ventures are eligible to submit Tenders provided that: 1. every member of the joint venture is registered with the CIDB within 10 days from the closing date of tenders; 2. the lead partner has a contractor grading designation in the **7 CE OR HIGHER** class of construction work; and 3. The combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a **7 CE or HIGHER** class of construction work The Employer may, in its discretion, subject to the provision of Section 4(1)(d) of the State Tender Board Act (Act 86 of 1968), condone any failure to comply with the foregoing condition.			
	4	The Bidder should be able to submit the	Pre-Qualifier	Y	

Clause	Addition or Variation to Standard Conditions of Tender

	following: • Certified copy of certificate of Incorporation if Bidder is a company or; • Certified copy of founding statement if Bidder is a closed corporation or; • Certified copy of Partnership agreement if Bidder is a partnership or; • Certified copy of Identity document if Bidder is a one-man concern.			

B. Bidders who do not adhere to the indicated response time for clarifications requested by the Employer will be deemed to be non-responsive and their submissions will not be evaluated further.

Responsiveness Criteria		Clarification Time	Applicable to this Tender (Y/N)
1	The Respondent submits a valid Tax Compliance Status PIN letter issued by the South African Revenue Services or has made arrangements to meet outstanding tax obligations. Respondents shall be registered and in good standing with the South African Revenue Services (SARS) and should be able to submit a valid tax compliance pin issued by SARS. Each party to a Consortium/Joint Venture should	7 days	Y

Clause	Addition or Variation to Standard Conditions of Tender			
		be able to submit a separate valid Tax Compliance Status PIN letter and attach it to the schedule.		
	2	Respondents that provide a copy of latest Unemployment Insurance Fund (UIF) return (if not stated on the valid tax compliance pin)	7 days	Y
	3	The Respondent has not abused the Employer's Supply Chain Management System or failed to perform on any previous contract and has been given written notice to this effect.	7 days	Y
	4	The Respondent or any of its Directors/Shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector.	7 days	Y
	5	The Employer will only enter into a formal contract with a respondent who is registered on the National Treasury Central Supplier Database (CSD). The submission of a full CSD report (not summary) is compulsory for any Respondent to be eligible to submit.	7 days	Y
	6	The Respondent has completed the Declaration of Interest and there are no conflicts of interest which may impact on the Respondent's ability to perform the contract in the best interests of the Employer or potentially compromise the submission process and persons in the employ of the state are permitted to submit bids or participate in the contract.	7 days	Y

Clause	Addition or Variation to Standard Conditions of Tender			
	7	The Respondent submits a valid B-BBEE Compliance Certificate issued by an Accredited Service Provider or Certified Sworn Affidavit.	7 days	Y
	8	The Respondent submits and original (or certified copy) of Municipal rates clearance certificate or a certified copy of the lease agreement - Not older than 3 months (Vaal Central Water reserves the right to conduct physical verification of premises).	7 days	Y
	9	Only those Respondents that can provide Financial references, audited financial statements as required and with a bank rating of not less than a "C" can be considered for evaluation.	7 days	Y
	10	Annexure 1: Acceptance of Bid conditions – to be duly completed and	7 days	Y
	11	Annexure 2: Supply Chain Management Questionnaire – to be duly completed.	7 days	Y

3.9

Replace the contents of the clause with the following:

Check responsive tender offers for arithmetical errors, correcting them in the following manner:

a) Where there is a discrepancy between the amounts in figures and in words, the amount in words shall govern.
b) If a bill of quantities (or schedule of quantities or schedule of rates) applies and there is an error in the line-item total resulting from the product of the unit rate and the quantity, the unit rate shall govern, and the line-item total shall be corrected.
c) Where there is an error in the total of the prices, either as a result of other corrections required by this checking process or in the Bidder's addition of prices, the total of the prices shall govern.
d) Where there is a discrepancy between the amount indicated in the Bidder's bid offer and the corrected amount obtained after completing the above steps, the bid offer amount shall govern.

Notify a Bidder upon written request received after the closing date of bids of all arithmetical errors made by that particular bidder.
Consider the rejection of a bid offer if the Bidder does accept the correction of the

Clause	Addition or Variation to Standard Conditions of Tender
	arithmetical errors in the manner described above.
3.11.1	Add the following: The evaluation of all responsive tender offers will be carried out in accordance with the following method: **Functionality, Price and Preference** Functionality shall be evaluated first and only those tenderers who achieve the minimum qualifying score for functionality shall be considered for further evaluation in respect of price and preference. **Minimum Requirements** ***<u>Tender will not be evaluated further if these requirements are not met. All necessary documentation should be attached to the document, or the tenderer will be deemed to not have adhered to the minimum requirements.</u>***

Minimum Requirements			
Description	**Minimum Requirements**	**Proof to be submitted**	**Outcome**
Key Personnel: **Contracts Manager**	Minimum qualification of contracts manager - **NQF level 6** in Civil Engineering, Professional Registration with ECSA. Foreign qualifications should be SAQA rated and accredited. (Attach certified copy of accreditation)	Attach certified copies of certificates of qualification in Civil Engineering. Certified copy of professional registration.	Failure to submit will result in disqualification
Key Personnel: **Site Agent**	Minimum qualification of site agent - **NQF level 4** Foreign qualifications should be SAQA rated and accredited. (Attach certified copy of accreditation)	Attach certified copies of certificates of qualification.	Failure to submit will result in disqualification

Clause	Addition or Variation to Standard Conditions of Tender

CIDB Grading	Tenderers shall be registered with the CIDB in the appropriate Civil Engineering (CE) class, at a minimum grading of **CIDB 7 CE**. Contractor/sub-contractor shall be registered for Water Supply and Drainage (SN**)** Classification of Work at a minimum grading of **CIDB 3SN**.	CIDB Registration Number to be provided.	Failure to meet minimum CIDB requirements will result in disqualification
Methodology and technical approach	Tenderers shall submit a detailed Methodology and technical approach. Methodology to clearly define how the contractor intends to execute the following works: Pipeline works, steel pipeline works, repairs to water-retaining structures, concrete joint sealing, concrete spall repairs, quality control, sequencing, and protection of existing infrastructure	Tenderers shall submit a detailed Methodology and technical approach with an indicative programme.	Failure to submit will result in disqualification

Functionality shall be evaluated in terms of the following Functionality Criteria and weightings:

	Criteria	Weight
1	Company Experience - Reservoir sealing & concrete repairs	30
1.1	*Joint Sealing Product*	*20*
1.2	*Company Experience*	*10*
2	Company Experience - Civil works: Large bore steel pipelines	30
3	Key Personnel Experience	20
3.1	*Key Personnel Experience – Contracts Manager*	*10*
3.2	*Key Personnel Experience – Site Agent*	*5*
3.3	*Key Personnel Experience - Health and Safety Officer*	*5*
4	Methodology and technical approach	10
5	Locality	10
	Maximum possible score for functionality (M_s)	**100**

The functionality criteria shall be scored as follows:

Clause	Addition or Variation to Standard Conditions of Tender			
	Criteria No.	**Criteria**	**Evaluation Indicators**	Maximum score
	1.1	Employer preferred product	Evaluation will be based on the bidder's confirmation for supply and installing Employer's product of choice: *Note: Failure to mark applicable box will result in no points allocated for this section.* Scoring (Mark applicable box): – Criteria (minimum product specification and bidders must submit product to be utilized meets the specifications together with relevant warranties'/ certificates to be submitted - 20 point ☐ - Does not meet min. specifications and not certificates / warranties submitted - 0 points ☐	20
	1.2	Company Experience - Reservoir sealing & concrete repairs	Evaluation will be based on the number of successfully completed projects involving reservoir rehabilitation, joint sealing, concrete repairs or similar water-retaining structure works. Tenderers shall submit a list of completed projects. Proof of experience must be provided in the form of certified copy/s of the following documents per project completed: • Appointment Letter/s • Completion Certificate/s OR Signed reference letter by the current or previous Institution/Employer where the project was completed. Note: Failure to attach all mandatory documents per project will result in no points allocated for the project. Only projects involving potable water infrastructure or water-retaining structures will	10

Clause	Addition or Variation to Standard Conditions of Tender			
			be considered. Scoring (based on number of completed similar projects): – 3 or more similar projects: 10 points – 2 similar projects: 8 points – 1 similar projects: 2 points – No relevant experience: 0 points	
	2	Company Experience - **Civil works**	Tenderers shall demonstrate experience in projects of a similar nature and complexity. Only projects involving potable water infrastructure, reservoir construction or rehabilitation, water-retaining structures or pipeline works will be considered. Tenderers shall submit a list of completed projects. Proof of experience must be provided in the form of certified copy/s of the following documents per project completed: • Appointment Letter/s • Completion Certificate/s OR Signed reference letter by the current or previous Institution/Employer where the project was completed. *Note: Failure to attach all mandatory documents per project will result in no points allocated for the project.* Scoring (based on number of completed similar projects): – 5 or more similar projects: 30 points – 4 similar projects: 24 points – 3 similar projects: 18 points – 2 similar projects: 12 points – 1 similar projects: 6 points – No relevant experience: 0 points	30
	3.1	Key Personnel Experience – **Contracts Manager**	Evaluation will be based on the experience and qualifications of the proposed Contracts Manager. **Minimum Requirements:** - Minimum qualification: NQF Level 6 in Civil Engineering - Professional Registration: Must be	10

Clause	Addition or Variation to Standard Conditions of Tender			
			registered with the Engineering Council of South Africa (ECSA) as a Professional Engineer (Pr Eng) or Professional Engineering Technologist (Pr Tech Eng), in good standing. - Minimum years of experience: 10 years *Note: Failure to meet the minimum requirements will result in a score of zero for this criterion.* Tenderers shall submit certified copy of registrations and a detailed CV of the proposed Contracts Manager, clearly indicating qualifications, years of experience, and involvement in similar projects, including project descriptions and roles. **Scoring (based on number of similar projects listed):** – 5 or more similar projects: 10 points – 4 similar projects: 8 points – 3 similar projects: 6 points – 2 similar projects: 4 points – 1 similar projects: 2 points – No relevant experience: 0 points	
	3.2	Key Personnel Experience – **Site Agent**	Evaluation will be based on the experience and qualifications of the proposed Site Agent. **Minimum Requirements:** - Minimum qualification: NQF Level 4 in Civil Engineering - Minimum years of experience: 5 years *Note: Failure to meet the minimum requirements will result in a score of zero for this criterion.* Tenderers shall submit a detailed CV of the proposed Site Agent, clearly indicating qualifications, years of experience, and involvement in similar projects, including project descriptions and roles. **Scoring (based on number of similar projects listed):** – 5 or more similar projects: 5 points	5

Clause	Addition or Variation to Standard Conditions of Tender			
			– 4 similar projects: 4 points – 3 similar projects: 3 points – 2 similar projects: 2 points – 1 similar projects: 1 points – No relevant experience: 0 points	
	3.3	Key Personnel Experience – **Health and Safety Officer**	Evaluation will be based on the experience and qualifications of the proposed Health and Safety Officer. **Minimum Requirements:** - Relevant Health and Safety qualification (minimum NQF Level 5 or equivalent) - Registration with SACPCMP as a Construction Health and Safety Officer (attach certified certificate) - Minimum years of experience: 5 years *Note: Failure to meet the minimum requirements will result in a score of zero for this criterion.* Tenderers shall submit a detailed CV of the proposed Health and Safety Officer, clearly indicating qualifications, years of experience, and involvement in similar projects, including project descriptions and roles. Similar projects shall include construction works involving potable water infrastructure, pipelines, reservoirs, confined space work or similar high-risk environments. **Scoring (based on number of similar projects listed):** – 5 or more similar projects: 5 points – 4 similar projects: 4 points – 3 similar projects: 3 points – 2 similar projects: 2 points – 1 similar projects: 1 points – No relevant experience: 0 points	5
	4	Methodology and technical approach	Evaluation will be based on the quality, completeness and relevance of the tenderer's methodology in relation to the scope of works.	10

Clause	Addition or Variation to Standard Conditions of Tender			
			Tenderers shall submit a methodology covering, as a minimum, the following elements: 1. Pipeline and steel pipeline construction 2. Repairs to water-retaining structures 3. Concrete joint sealing 4. Concrete spall repairs 5. Quality control procedures 6. Sequencing of works 7. Protection of existing infrastructure Quality and relevance of the tenderer's methodology for pipeline works, steel pipeline works, repairs to water-retaining structures, concrete joint sealing, concrete spall repairs, quality control, sequencing, and protection of existing infrastructure. Scoring: - Detailed, project-specific and technically sound methodology covering all scope elements: 10 points - Good methodology covering most scope elements: 7 points - Basic but acceptable methodology: 5 points - Generic / weak methodology: 2 points - No methodology: 0 points	
	5	Locality	Evaluation will be based on the physical business location of the tenderer. Tenderers shall demonstrate a permanent business address by submitting a valid municipal rates and taxes account, municipal clearance certificate (not older than 90 days), or a valid lease agreement in the name of the company **Scoring:** - Business located within Mangaung Metropolitan Municipality: 10 points - Business located within Free State Province (outside Mangaung Metropolitan Municipality): 5 points	10

Clause	Addition or Variation to Standard Conditions of Tender

		- Business located outside Free State Province (within South Africa): 2 points - No valid proof of business address submitted: 0 points	
Maximum possible score for functionality (Ms)			**100**

NOTE:

The minimum qualifying score for functionality is 70 points out of 100.

Tenderers who fail to achieve the minimum qualifying score shall be regarded as non-responsive and shall not be evaluated further.

Subject to paragraph 3.13 the contract must be awarded to the tender who scores the highest total number of points.

The points scoring for price and B-BBEE contribution will be a function of the financial value in accordance with:

a) Clause 3.11.2 where the financial value inclusive of VAT of one or more responsive tender offers equals or is less than R50 000 000; or
b) Clause 3.11.3 where the financial value inclusive of VAT of all responsive tenders received have a value in excess of R50 000 000.

Clause	Addition or Variation to Standard Conditions of Tender
3.11.2	Add the following sub-clause: **The 80/20 preference point system for acquisition of services, works or goods up to Rand value of R50 million will apply.** a) The following formula must be used to calculate the points for price in respect of tenders (including price quotation) with a rand value equal to, or above R 30 000 and up to Rand value of R50 000 000 (all applicable taxes included): $$Ps = 80 \times \left[1 - \frac{Pt - Pmin}{Pmin}\right]$$ *Where:* *Ps = Points scored for comparative price of tender or offer under consideration;* *Pt = Comparative price of tender or offer under consideration; and* *P_{min} = Comparative price of lowest acceptable tender or offer.* b) An employer of state may apply the formula in paragraph (a) for price quotations with a value less than R30 000, if and when appropriate c) Subject to subparagraph (d), points must be awarded to a tender for attaining Specific Goals verified on their B-BBEE certificate of contributor in accordance with the table below:

Specific Goal	Number of points
Black-owned enterprises	10
Women-owned enterprises	4
Youth-owned enterprises	2
Local suppliers within operating regions	4
Total	20

d) A maximum of 20 points may be allocated in accordance with subparagraph (c).

Clause	Addition or Variation to Standard Conditions of Tender
3.11.3	Add the following sub-clause: **The 90/10 preference points system for acquisition of services, works or goods with a Rand value above R 50 million.** a) The following formula must be used to calculate the points for price in respect of tenders (including price quotation) with a rand value above R50 000 000 (all applicable taxes included): $Ps = 90 \times \left[1 - \frac{Pt - Pmin}{Pmin}\right]$ *Where:* *Ps = Points scored for comparative price of tender or offer under consideration;* *Pt = Comparative price of tender or offer under consideration; and* *P_{min} = Comparative price of lowest acceptable tender or offer.* b) An employer of state may apply the formula in paragraph (a) for price quotations with a value less than R30 000, if and when appropriate c) Subject to subparagraph (d), points must be awarded to a tender for attaining Specific Goals verified on their B-BBEE certificate of contributor in accordance with the table below: **Specific Goal** / **Number of points** Black-owned enterprises: 5 Women-owned enterprises: 2 Youth-owned enterprises: 1 Local suppliers within operating regions: 2 Total: 10 A maximum of 10 points may be allocated in accordance with subparagraph (c).
3.16	Add the following to the clause: Notice of non-acceptance of tender will not be sent to individual unsuccessful tenderers. Particulars of the accepted tender can be obtained from the Employer' Agent.

Clause	Addition or Variation to Standard Conditions of Tender
3.17	The successful tenderer shall receive one copy of the signed contract.

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

STANDARD CONDITIONS OF TENDER

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These standard conditions of tender are identical to those published in Annex C of the Department of Public Works Notice 423 of 2019. (Government Gazette No 42622, 8 August 2019)

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

STANDARD CONDITIONS OF TENDER

GENERAL

Actions

1.1.1 The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in clauses 2 and 3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

1.1.2 The employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

Note: 1) *A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.*

2) *Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken*.

1.1.3 The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract

Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

Interpretation

1.3.1 The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

1.3.3 For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation in which:

i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfill his or her duties impartially;

ii) an individual or organisation is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or

iii) incompatibility or contradictory interests exist between an employee and the organisation which employs that employee.

b) **comparative offer** means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;

c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process;

d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels;

Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

Cancellation and Re-Invitation of Tenders

1.5.1 An employer may, prior to the award of the tender, cancel a tender if-

(a) due to changed circumstances, there is no longer a need for the engineering and construction works specified in the invitation; or

(b) funds are no longer available to cover the total envisaged expenditure; or

(c) no acceptable tenders are received; or

(d) there is a material irregularity in the tender process.

1.5.2 The decision to cancel a tender must be published in the same manner in which the original tender invitation was advertised.

1.5.3 An employer may only with the prior approval of the relevant treasury cancel a tender invitation for the second time.

Procurement procedures

General

Unless otherwise stated in the tender data, a contract will, subject to 3.13, be concluded with the tenderer who in terms of 3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

Competitive negotiation procedure

1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of 3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of 3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

1.6.2.2 All responsive tenderers, or at least a minimum of not less than three responsive tenderers that are highest ranked in terms of the evaluation criteria stated in the tender data, shall be invited to enter into competitive negotiations, based on the principle of equal treatment, keeping confidential the proposed solutions and associated information.

Notwithstanding the provisions of 2.17, the employer may request that tenders be clarified, specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to revise their tender offer, based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

1.6.2.4 The contract shall be awarded in accordance with the provisions of 3.11 and 3.13 after tenderers have been requested to submit their best and final offer.

Proposal procedure using the two stage-system

Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

Option 2

1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

TENDERER'S OBLIGATIONS

Eligibility

2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with employer.

2.1.2 Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

Cost of tendering

2.2.1 Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

2.2.2 The cost of the tender documents charged by the employer shall be limited to the actual cost incurred by the employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

Check documents

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting (s) are stated in the tender data.

Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five (5) working days before the closing time stated in the tender data.

Insurance

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

Pricing the tender offer

2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes (except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable fourteen (14) days before the closing time stated in the tender data.

2.10.2 Show VAT payable by the employer separately as an addition to the tendered total of the prices.

2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

Alternative tender offers

2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

2.12.2 Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

2.12.3 An alternative tender offer must only be considered if the main tender offer is the winning tender.

Submitting a tender offer

2.13.1 Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

2.13.2 Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer.

Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked "financial proposal" and place the remaining returnable documents in an envelope marked "technical proposal". Each envelope shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

2.13.8 Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

2.13.9 Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

Closing time

2.15.1 Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

2.15.2 Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

Tender offer validity

2.16.1 Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

2.16.2 If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

2.16.3 Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted. If the validity period stated in

2.16 lapses before the employer evaluating tender, the contractor reserves the right to review the price based on the Consumer Price Index (CPI).

2.16.4 Where a tender submission is to be substituted, a tenderer must submit a substitute tender in accordance with the requirements of 2.13 with the packages clearly marked as "SUBSTITUTE"

Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

Note: *Sub-clause 2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.*

Provide other material

Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment.

Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive.

Dispose of samples of materials provided for evaluation by the employer, where required.

Inspections, tests and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

Submit securities, bonds and policies

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

Check final draft

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

Return of other tender documents

If so instructed by the employer, return all retained tender documents within twenty-eight (28) days after the expiry of the validity period stated in the tender data.

Certificates

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

THE EMPLOYER'S UNDERTAKINGS

Respond to requests from the tenderer

3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up to five (5) working days before the tender closing time stated in the Tender Data and notify all tenderers who collected procurement documents.

3.1.2 Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;

b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or

c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

Issue Addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three (3) days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who collected tender documents.

Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

Opening of tender submissions

3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

3.4.3 Make available the record outlined in 3.4.2 to all interested persons upon request

Two-envelope system

Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

Evaluate functionality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the functionality evaluation more than the minimum number of points for functionality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any points claimed on BBBEE status level. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality.

Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that

he engaged in corrupt or fraudulent practices.

Test for responsiveness

Determine, after opening and before detailed evaluation, whether each tender offer properly received:

a) complies with the requirements of these Conditions of Tender,
b) has been properly and fully completed and signed, and
c) is responsive to the other requirements of the tender documents.

A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer's opinion, would:

a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,
b) significantly change the Employer's or the tenderer's risks and responsibilities under the contract, or
c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non- conforming deviation or reservation.

Arithmetical errors, omissions and discrepancies

Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amount in words, the amount in words shall govern.

3.9.2 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with 3.11 for:

a) the gross misplacement of the decimal point in any unit rate;
b) omissions made in completing the pricing schedule or bills of quantities; or
c) arithmetic errors in:
   i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or
   ii) the summation of the prices.

3.9.3 Notify the tenderer of all errors or omissions that are identified in the tender offer and either confirm the tender as tendered or accept the corrected total of prices.

3.9.4 Where the tenderer elects to confirm the tender offer as tendered, correct the errors as

follows.

a) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.

b) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

Evaluation of tender offers

The Standard Conditions of Tender standardize the procurement processes, methods and procedures from the time that tenders are invited to the time that a contract is awarded. They are generic in nature and are made project specific through choices that are made in developing the Tender Data associated with a specific project. Conditions of tender are by definition the document that establishes a tenderer's obligations in submitting a tender and the employer's undertakings in soliciting and evaluating tender offers. Such conditions establish the rules from the time a tender is advertised to the time that a contract is awarded and require employers to conduct the process of offer and acceptance in terms of a set of standard procedures.

The CIDB Standard Conditions of Tender are based on a procurement system that satisfies the following system requirements:	
Requirement	**Qualitative interpretation of goal**
Fair	The process of offer and acceptance is conducted impartially without bias, providing simultaneous and timely access to participating parties to the same information.
Equitable	Terms and conditions for performing the work do not unfairly prejudice the interests of the parties.
Transparent	The only grounds for not awarding a contract to a tenderer who satisfies all requirements are restrictions from doing business with the employer, lack of capability or capacity, legal impediments and conflicts of interest.
Competitive	The system provides for appropriate levels of competition to ensure cost effective and best value outcomes.
Cost effective	The processes, procedures and methods are standardized with sufficient flexibility to attain best value outcomes in respect of quality, timing and price, and least resources to effectively manage and control procurement processes.

The activities associated with evaluating tender offers are as follows:

a) Open and record tender offers received
b) Determine whether or not tender offers are complete

c) Determine whether or not tender offers are responsive
d) Evaluate tender offers
e) Determine if there are any grounds for disqualification
f) Determine acceptability of preferred tenderer
g) Prepare a tender evaluation report
h) Confirm the recommendation contained in the tender evaluation report

General

The employer must appoint an evaluation panel of not less than three persons conversant with the proposed scope of works to evaluate each responsive tender offer using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer's information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

Acceptance of tender offer

Accept the tender offer, if in the opinion of the employer, it does not present any risk and only if the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,
b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,
c) has the legal capacity to enter into the contract,
d) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his/her affairs administered by a court or a judicial officer, has suspended his/her business activities, or is subject to legal proceedings in respect of any of the foregoing,
e) complies with the legal requirements, if any, stated in the tender data, and
f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

Prepare contract documents

3.14.1 If necessary, revise documents that shall form part of the contract and that were issued by the employer as part of the tender documents to take account of:

a) addenda issued during the tender period,

b) inclusion of some of the returnable documents, and

c) other revisions agreed between the employer and the successful tenderer.

3.14.2 Complete the schedule of deviations attached to the form of offer and acceptance, if any.

Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

Registration of the award

An employer must within twenty-one (21) days from the date on which a contractor's offer to perform a construction works contract is accepted in writing by the employer, register and publish the award on the CIDB Register of Projects.

Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the Tender Data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

Provide written reasons for actions taken

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

RETURNABLE DOCUMENTS

CONTENTS LIST

Section **Description ..... Page No**

T2.1 **LIST OF RETURNABLE DOCUMENTS T2.1-1**

T2.2 **RETURNABLE SCHEDULES T2.2-1**

(Index contained in Part T2, Section T2.2)

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

LIST OF RETURNABLE DOCUMENTS

1. Tenderers are required to submit the following with their tenders or within three days of receipt of the Employer's or his Agent's written request for same:

   (a) Copy of Certificate of Contractor Registration with the CIDB,

   (b) Original valid Tax Clearance Certificate, or a unique security personal identification number (PIN) issued by the SA Revenue Services (in terms of the Preferential Procurement Regulations, 2001 published in Government Gazette No. 22549 dated 10 August 2001),

   (c) Certified copy of VAT Registration Certificate (if VAT number is not included in tax clearance certificate),

   (d) Certified copy of Letter of Good Standing issued by the Department of Labour in terms of Act 130 of 1993,

   (e) Certified copy of Unemployment Insurance Fund Certificate of Compliance in terms of Act 4 of 2002,

   (f) Certified copy of Certificate of Incorporation (if tenderer is a Company),

   (g) Certified copy of Founding Statement (if tenderer is a Closed Corporation),

   (h) Certified copy of Partnership Agreement (if tenderer is a Partnership),

   (i) Certified copy of Identity Document (if tenderer is a One-man concern),

   (j) Joint Venture Agreement (if tenderer is a Joint Venture),

(k) Curriculum vitae of the person who prepares the Contractor's Health and Safety Plan, and

(l) Curriculum vitae of the Health and Safety Officer the successful tenderer intends appointing in accordance with the Occupational Health and Safety Act (Act 85 of 1993).

(m) Curriculum Vitae of all supervisory staff

(n) Appointment letter and Completion certificates and signed reference letters by the client/engineer to prove successful completion of projects relating to the construction of civil projects [see functionality table under CL3.11].

2. The returnable schedules included in Section T2.2 will be used to evaluate tenders received. These schedules will also form part of the Contract.

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

RETURNABLE SCHEDULES

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END OF SECTION

ALTERATIONS BY TENDERER

Should the Tenderer desire to make any departures from or modifications to the General Conditions of Contract, Contract Data, Scope of Work, Pricing Data or the Drawings, or to qualify his tender in any way, he shall set out his proposals clearly hereunder or alternatively state them in a covering letter attached to his tender and referred to hereunder, failing which the tender will be deemed to be unqualified.

Page	Clause or Item

Signature of Tenderer : _____ Date : _____

WORKS PREVIOUSLY EXECUTED

The following is a statement of major works successfully executed by myself/ourselves in recent years:

Employer	Consulting Engineers (incl. contact person and contact details)	Nature of Works	Value of Works	Duration and Completion Date

Failure to detail the required information, shall signify that the tender is submitted by an inexperienced tenderer.

Signature of Tenderer : _____ Date : _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

PRESENT COMMITMENTS

Employer	Consulting Engineers (incl. contact person and contact details)	Nature of Works	Value of Works	Duration and Completion Date

Signature of Tenderer : _____ Date : _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

SUPERVISORY AND SAFETY PERSONNEL

PREVIOUS EXPERIENCE ON WORKS OF A SIMILAR NATURE DURING THE LAST FIVE YEARS

Name	% Time on Site	Position (Current)	Service (Years)	Name of Project And year executed	Value of Works	Position Occupied
Contracts Manager						
Contractor's Site Agent						
Contractor's Foremen						
Construction Health and Safety Officer						

Tenderers shall indicate the percentage of working time these persons will be engaged on site. Tenderers are required to provide copies of curriculum vitas of all supervisory and safety personnel.

Signature of Tenderer : _____ Date : _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

LABOUR UTILISATION

Labour Categories - Definitions

NOTE: These definitions serve as a guideline to complete the following table and will in no respect alter the Scope of Work.

1. General Foreman / Foreman

An employee who gives out work to and directly co-ordinates and supervises employees. His duties encompass any one or more of the following activities :

a) Supervision;

b) maintaining discipline;

c) ensuring safety on the workplace;

d) being responsible to the Contractor for efficiency and production for his portion of the works; and

e) performing skilled work, whether in an instructional capacity or otherwise.

2. Charge hand

An employee engaged in any one or more of the following activities :

a) Being primarily employed in a supervisory capacity, but who may also be doing the work of an artisan;

b) giving out work to other employees under his control and supervision;

c) ensuring safety on the workplace;

d) maintaining discipline; and

e) being directly responsible to a general foreman or foreman or the Contractor or the Contractor's representative for efficiency and production for his portion of the works.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

3. Artisan

An employee who has successfully completed all prescribed courses at a practical institutional training centre for a particular trade and who has successfully completed the on-site period of training as prescribed and who has successfully passed the prescribed trade tests.

4. Team Leader

An employee engaged in any one or more of the following activities :

a) Being employed in a supervisory capacity, but who may also be doing the work of a skilled person;

b) giving out work to other employees under his control and supervision;

c) maintaining discipline;

d) being directly responsible to a Charge hand or a foreman or a general foreman or the employer's authorised representative for efficiency and production for his portion of the works.

5. Skilled Employee

An employee engaged in an ancillary trade or an assistant artisan.

6. Semi-Skilled Employee

An employee with any specified skills, an apprentice or a trainee-artisan.

7. Unskilled Employee

An employee engaged on any task or operation not specified above.

8. Imported Employee

Personnel permanently employed by Contractor.

9. Local Employee

Temporary workforce employed through Labour Desk.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

MAN DAYS

Categories	No. of Man Days	
	Imported	**Local**
1. Contracts Manager		
2. Site Agent		
3. Foreman/Supervisors (specify type)		
3.1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _		
3.2 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _		
3.3 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _		
4. Safety Inspectors (specify type)		
4.1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _		
4.2 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _		
5. Charge hands		
6. Artisans		
7. Operators/Drivers		
8. Clerks/Storeman		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Categories	**No. of Man Days**	
	Imported	**Local**
9. Team Leader		
10. Skilled Labour		
11. Semi-skilled Labour		
12. Unskilled Labour		

Signature of Tenderer

Date

COMPLIANCE WITH OHSA (ACT 85 OF 1993)

Tenderers are required to satisfy the Employer and the Engineer as to their ability and available resources to comply with the above by answering the following questions and providing the relevant information required below.

1. Is the Contractor familiar with the OHSA (ACT 85 OF 1993) and its Regulations? **YES / NO**
2. Who will prepare the Contractor's Health and Safety Plan? (Provide a copy of the person/s curriculum vitae/s or company profile).

   _____

3. Does the Contractor have a health and safety policy? (If yes, provide a copy). How is this policy communicated to all employees? **YES / NO**

   _____

4. Does the Contractor keep records of safety aspects of each construction site? If yes, what records are kept? **YES / NO**

   _____

5. Does the Contractor conduct monthly safety meetings? If yes, who is the chairperson of the meeting, and who attends these meetings? **YES / NO**

   _____

6. Does the Contractor have a safety officer in his employment, responsible for the overall safety of his company? **YES / NO**
   If yes, please explain his duties and provide a copy of his CV.

   _____

   _____

7. Does the Contractor have trained first aid employees? If yes, indicate who. **YES / NO**

   _____

8. Does the Contractor have a safety induction training programme in place? (If yes, provide a copy). **YES / NO**

_____ _____
Signature of Tenderer Date

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

PLANT AND EQUIPMENT

1. Major Plant and Equipment available for this Contract:

Quantity	Size, Description, Capacity, etc.

2. Major Plant and Equipment that will be acquired for this contract if my/our tender is accepted:

Quantity	Size, Description, Capacity, etc.

_____ _____
Signature of Tenderer Date

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

PROPOSED SUB-CONTRACTORS

The tenderer shall list below any subcontractors he intends to employ to carry out part(s) of the Works.

The acceptance of this tender shall not be construed as being approval of all or any of the listed subcontractors. Should any or all of the subcontractors be not approved subsequent to the acceptance of the tender, it shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding in the event of a subcontractor not listed below being approved by the Employer.

Company	Portion of Contract	Approx. Value

Signature of Tenderer _____ Date _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

SITE INSPECTION CERTIFICATE

As required by Clause 2.7 of the Tender Data, I/we certify that I/we have visited the site of the Works and attended the site visit and clarification meeting on the date certified below.

I/we further certify that I am / we are satisfied with the description of the Work and the explanations given by the Engineer at the site visit and clarification meeting.

_____ _____
Signature of Tenderer Date

Site Visit

This will certify that _____

representing _____

attended a Site Inspection for this Contract on _____ 20_____

_____(signed)
For the Engineer

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

AUTHORITY OF SIGNATORY

With reference to Clause 2.13.4 of the Tender Data, I/we herewith certify that this tender is submitted by : *(Mark applicable block)*

a company, and attach hereto a certified copy of the required resolution of the Board of Directors	☐
a partnership, and attach hereto a certified copy of the required resolution by all partners	☐
a close corporation, and attach hereto a certified copy of the required resolution of the Board of Officials	☐
a one-man business, and attach hereto certified proof that I am the sole owner of the business submitting this tender	☐
a joint venture, and attach hereto	☐

- an notarially certified copy of the original document under which the joint venture was constituted; and
- certified authorisation by the participating members of the undersigned to submit tenders and conclude contracts on behalf of the joint venture

Signature of Tenderer _____ Date _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

RECORD OF ADDENDA TO TENDER DOCUMENTS

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

	Date	**Title or Details**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Attach additional pages if more space is required.

Signature of Tenderer _____ Date _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

COMPULSORY ENTERPRISE QUESTIONNAIRE

The following particulars must be furnished. In the case of a joint venture, separate enterprise questionnaires in respect of each partner must be completed and submitted.

Section 1: Name of enterprise

Section 2: VAT registration number, if any

Section 3 CIDB registration number, if any

Section 4: Particulars of sole proprietors and partners in partnerships

Name	Identity Number	Personal Income tax number*

***Complete only if sole proprietor or partnership and attach separate page if more than 3 partners.**

Section 5: Particulars of companies and close corporations

Company registration number : .....

Close corporation number : .....

Tax reference number : .....

Section 6: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999, (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

If any of the above boxes are marked, disclose the following:

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Name and sole proprietor, partner, director, manager, principal shareholder or stakeholder	Name and institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*Insert separate page if necessary

Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999, (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Name of spouse, child or parent	Name and institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*Insert separate page if necessary

The undersigned, who warrants that he/she us duly authorised to do so on behalf of the enterprise:

i) Authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my/our tax matters are in order;

ii) Confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;

iii) Confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud and corruption;

iv) Confirms that I/we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

v) Confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief bot true and correct.

Signature of Tenderer : _____ Date : _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

SBD1

PART A

INVITATION TO BID

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE (*NAME OF DEPARTMENT/ PUBLIC ENTITY*)					
BID NUMBER:	VCW440/STEELBPTB/26	CLOSING DATE:	06 October 2026	CLOSING TIME:	12:00
DESCRIPTION	Construction of a Steel By-pass Pipeline and Break Pressure Tank at Brandkop Reservoir including Reservoir joint Sealing and Concrete Repairs				
THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM (SBD7).					

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT *(STREET ADDRESS)*

02 Mzuzu Street
Pellissier
Bloemfontein
9301

SUPPLIER INFORMATION					
NAME OF BIDDER					
POSTAL ADDRESS					
STREET ADDRESS					
TELEPHONE NUMBER	CODE		NUMBER		
CELLPHONE NUMBER					
FACSIMILE NUMBER	CODE		NUMBER		
E-MAIL ADDRESS					
VAT REGISTRATION NUMBER					
	TCS PIN:		**OR**	CSD No:	
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX]	Yes No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT		Yes No

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

IF YES, WHO WAS THE CERTIFICATE ISSUED BY?			
	AN ACCOUNTING OFFICER AS CONTEMPLATED IN THE CLOSE CORPORATION ACT (CCA) AND NAME THE APPLICABLE IN THE TICK BOX		AN ACCOUNTING OFFICER AS CONTEMPLATED IN THE CLOSE CORPORATION ACT (CCA)
			A VERIFICATION AGENCY ACCREDITED BY THE SOUTH AFRICAN ACCREDITATION SYSTEM (SANAS)
			A REGISTERED AUDITOR
			NAME:
[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/SWORN AFFIDAVIT (FOR EMEs& QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]			
ARE YOU THE ACCREDITED REPRESENTATIVE **IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?**	Yes No [IF YES ENCLOSE PROOF]	ARE YOU A FOREIGN BASED SUPPLIER FOR **THE GOODS /SERVICES /WORKS OFFERED?**	Yes No [IF YES ANSWER PART B:3 BELOW]
SIGNATURE OF BIDDER	……	**DATE**	
CAPACITY UNDER WHICH THIS BID IS SIGNED (Attach proof of authority to sign this bid; e.g. resolution of directors, etc.)			
TOTAL NUMBER OF ITEMS OFFERED		**TOTAL BID PRICE (ALL INCLUSIVE)**	
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		**TECHNICAL INFORMATION MAY BE DIRECTED TO:**	

DEPARTMENT/ PUBLIC ENTITY		CONTACT PERSON	
CONTACT PERSON		TELEPHONE	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

		NUMBER	
TELEPHONE NUMBER		FACSIMILE NUMBER	
FACSIMILE NUMBER		E-MAIL ADDRESS	
E-MAIL ADDRESS			

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

PART B
TERMS AND CONDITIONS FOR BIDDING

1. **BID SUBMISSION:**
1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION. 2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE** 3. **BIDDERS MUST REGISTER ON THE CENTRAL SUPPLIER DATABASE (CSD) TO UPLOAD MANDATORY INFORMATION NAMELY: (BUSINESS REGISTRATION/ DIRECTORSHIP/ MEMBERSHIP/IDENTITY NUMBERS; TAX COMPLIANCE STATUS; AND BANKING INFORMATION FOR VERIFICATION PURPOSES). B-BBEE CERTIFICATE OR SWORN AFFIDAVIT FOR B-BBEE MUST BE SUBMITTED TO BIDDING INSTITUTION.** 4. **WHERE A BIDDER IS NOT REGISTERED ON THE CSD, MANDATORY INFORMATION NAMELY: (BUSINESS REGISTRATION/ DIRECTORSHIP/ MEMBERSHIP/IDENTITY NUMBERS; TAX COMPLIANCE STATUS MAY NOT BE SUBMITTED WITH THE BID DOCUMENTATION. B-BBEE CERTIFICATE OR SWORN AFFIDAVIT FOR B-BBEE MUST BE SUBMITTED TO BIDDING INSTITUTION.** 5. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT 2000 AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER LEGISLATION OR SPECIAL CONDITIONS OF CONTRACT.
2. **TAX COMPLIANCE REQUIREMENTS**
1. BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS. 2. BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS. 3. APPLICATION FOR TAX COMPLIANCE STATUS (TCS) OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA. 4. BIDDERS MAY ALSO SUBMIT A PRINTED TCS TOGETHER WITH THE BID. 5. IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE PROOF OF TCS / PIN / CSD NUMBER. 6. WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

3.	**QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS**
1.	IS THE BIDDER A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)? YES NO
2.	DOES THE BIDDER HAVE A BRANCH IN THE RSA? YES NO
3.	DOES THE BIDDER HAVE A PERMANENT ESTABLISHMENT IN THE RSA? YES NO
4.	DOES THE BIDDER HAVE ANY SOURCE OF INCOME IN THE RSA? YES NO

IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN, IT IS NOT A REQUIREMENT TO OBTAIN A TAX COMPLIANCE STATUS / TAX COMPLIANCE SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.

NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

SBD 4

BIDDER'S DISCLOSURE

1. **PURPOSE OF THE FORM**

Any person (natural or juristic) may make an offer or offers in terms of this invitation to bid. In line with the principles of transparency, accountability, impartiality, and ethics as enshrined in the Constitution of the Republic of South Africa and further expressed in various pieces of legislation, it is required for the bidder to make this declaration in respect of the details required hereunder.

Where a person/s are listed in the Register for Tender Defaulters and / or the List of Restricted Suppliers, that person will automatically be disqualified from the bid process.

2. **Bidder's declaration**

2.1 Is the bidder, or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest1 in the enterprise, employed by the state? **YES/NO**

2.1.1 If so, furnish particulars of the names, individual identity numbers, and, if applicable, state employee numbers of sole proprietor/ directors / trustees / shareholders / members/ partners or any person having a controlling interest in the enterprise, in table below.

Full Name	**Identity Number**	**Name of State institution**

2.2 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution? **YES/NO**

2.2.1 If so, furnish particulars:

……

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

……

2.3 Does the bidder or any of its directors / trustees / shareholders / members / partners or any person having a controlling interest in the enterprise have any interest in any other related enterprise whether or not they are bidding for this contract?

YES/NO

2.3.1 If so, furnish particulars:

…….

…….

3. **DECLARATION**

I, the undersigned, (name)……. in submitting the accompanying bid, do hereby make the following statements that I certify to be true and complete in every respect:

3.1 I have read, and I understand the contents of this disclosure;

3.2 I understand that the accompanying bid will be disqualified if this disclosure is found not to be true and complete in every respect;

3.3 The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium2 will not be construed as collusive bidding.

3.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications, prices, including methods, factors or formulas used to calculate prices, market allocation, the intention or decision to submit or not to submit the bid, bidding with the intention not to win the bid and conditions or delivery particulars of the products or services to which this bid invitation relates.

3.4 The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

3.5 There have been no consultations, communications, agreements or arrangements made by the bidder with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification on the bid submitted where so required by the institution; and the bidder was not involved in the drafting of the specifications or terms of reference for this bid.

3.6 I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

I CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 1, 2 and 3 ABOVE IS CORRECT.
I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME IN TERMS OF PARAGRAPH 6 OF PFMA SCM INSTRUCTION 03 OF 2021/22 ON PREVENTING AND COMBATING ABUSE IN THE SUPPLY CHAIN MANAGEMENT SYSTEM SHOULD THIS DECLARATION PROVE TO BE FALSE.

…… ……
Signature Date

…… ……
Position Name of bidder

MBD 6.1

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022

---

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

a) The applicable preference point system for this tender is the 90/10 preference point system.

b) The 90/10 preference point system will be applicable in this tender. The lowest/ highest acceptable tender will be used to determine the accurate system once tenders are received.

1.2 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:

1.3

(a) Price; and

(b) Specific Goals.

The maximum points for this tender are allocated as follows:

	POINTS
PRICE	90
SPECIFIC GOALS	10
TOTAL POINTS FOR PRICE AND SPECIFIC GOALS	**100**

1.4 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

points for specific goals are not claimed.

1.5 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

(a) **"tender"** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation;

(b) **"price"** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;

(c) **"rand value"** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

(d) **"tender for income-generating contracts"** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and

(e) **"the Act"** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

3.1.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$\boldsymbol{Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right)} \quad \text{or} \quad \boldsymbol{Ps = 90\left(1 - \frac{Pt - P\,min}{P\,min}\right)}$$

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

3.2. **FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT**

3.2.1. **POINTS AWARDED FOR PRICE**

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$\boldsymbol{Ps = 80\left(1 + \frac{Pt - P\,max}{P\,max}\right)} \quad \text{or} \quad \boldsymbol{Ps = 90\left(1 + \frac{Pt - P\,max}{Pmax}\right)}$$

Where

Ps	=	Points scored for price of tender under consideration
Pt	=	Price of tender under consideration
Pmax	=	Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

4.1. In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:

4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—

(a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or

(b) any other invitation for tender, that either the 80/20 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,

then the organ of state must indicate the points allocated for specific goals for both the 80/20 preference point system.

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 preference point system is applicable, corresponding points must also be indicated as such.

Note to tenderers: The tenderer must indicate how they claim points for each preference point system.

Specific Goals claimed shall be verified against Central Suppliers Database by National Treasury and through sworn affidavit.

To claim points for disability sworn affidavit with supporting medical certificate must be attached)

Specific Goal	**Points**
Black-owned enterprises	5
Women-owned enterprises	2
Youth-owned enterprises	1
Local suppliers within operating regions	2
Total	**10**

DECLARATION WITH REGARD TO COMPANY/FIRM

4.3. Name of company/firm…….

4.4. Company registration number: ……..

4.5. TYPE OF COMPANY/ FIRM

- o Partnership/Joint Venture / Consortium
- o One-person business/sole propriety
- o Close corporation
- o Public Company
- o Personal Liability Company
- o (Pty) Limited
- o Non-Profit Company
- o State Owned Company

[TICK APPLICABLE BOX]

4.6. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

i) The information furnished is true and correct;

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;

iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –

(a) disqualify the person from the tendering process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution, if deemed necessary.

……
SIGNATURE(S) OF TENDERER(S)

SURNAME AND NAME: ……

DATE: ……

ADDRESS: ……
……
……
……

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

AGREEMENTS AND CONTRACT DATA

CONTENTS LIST

Section	Description	Page No
C1.1	**FORM OF OFFER AND ACCEPTANCE**	**C1.1-1**
C1.2	**CONTRACT DATA**	**C1.2-1**
	Annexure A: Form of Guarantee	C1.2-16
C1.3	**Occupational Health and Safety Specifications**	**C1.2-1**

END OF SECTION

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

FORM OF OFFER AND ACCEPTANCE

OFFER

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

.....

The Tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS

.....

..... Rand (in words); R.....(in figures)

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

For the Tenderer:

Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

Name and address of organisation:

_____
_____
_____
_____
_____

Signature and names of witnesses:

Signatures _____ _____

Names _____ _____

Date: _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the Tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the Conditions of Contract identified in the Contract Data. Acceptance of the Tenderer's Offer shall form an agreement, between the Employer and the Tenderer upon the terms and conditions contained in this Agreement and in the Contract that is the subject of this Agreement.

The terms of the contract, are contained in

Part C1	Agreements and Contract Data, (which includes this agreement)
Part C2	Pricing Data
Part C3	Scope of Work
Part C4	Site Information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C4 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of Offer and Acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representative(s) of both parties.

The Tenderer shall within two weeks after receiving a completed copy of this Agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after the date this Agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now Contractor) within five days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

For the Employer:

Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

Name and address of organisation:

_____
_____
_____
_____
_____

Signature and Names of witnesses:

Signatures _____ _____

Names _____ _____

Date: _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

SCHEDULE OF DEVIATIONS

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
2. A Tenderer's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid become the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here.
3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here.
4. Any change or addition to the tender documents arising from the above agreements and recorded here, shall also be incorporated into the final draft of the Contract.

1. Subject .....

Details.....

2. Subject .....

Details.....

3. Subject .....

Details.....

4. Subject .....

Details.....

By the duly authorised representatives signing this Schedule of Deviations, the Employer and the Tenderer agree to and accept the foregoing Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the Tenderer:

Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

Name and address of organisation:

_____
_____
_____
_____
_____
_____

Signature and Names of witnesses:

Signatures _____ _____

Names _____ _____

Date: _____

For the Employer:

Signature(s) _____ _____

Name(s) _____ _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Capacity _____ _____

Name and address of organisation:

_____
_____
_____
_____
_____
_____

Signature and Names of witnesses:

Signatures _____ _____

Names _____ _____

Date: _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

CONFIRMATION OF RECIEPT

The Tenderer, (now Contractor), identified in the Offer part of this Agreement hereby confirms receipt from the Employer, identified in the Acceptance part of this Agreement, of one fully completed original copy of this agreement, including the Schedule of Deviations (if any) today:

the …….. (day)

of …… (month)

20 ….. (year)

at …….(place)

For the Contractor:

Signature(s) _____

Name(s) _____

Capacity _____

Signature and Names of witnesses:

Signatures _____

Names _____

END OF SECTION

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

CONTRACT DATA

CONDITIONS OF CONTRACT

The General Conditions of Contract for Construction Works, Fourth Edition (2025), published by the South African Institution of Civil Engineering, Private Bag X200, Halfway House, 1685, is applicable to this Contract and is available from www.saice.org.za.

AMENDMENTS

The following amendments to the General Conditions of Contract for Construction Works, Fourth Edition (2025), shall be applicable to this Contract:

1. Minor changes or corrections as published by the South African Institution of Civil Engineering on their website www.saice.org.za.
2. The following contract specific amendments are applicable to this Contract.

Clause	Contract Data
1.2.1	Add the following paragraph after Sub-clause 1.2.1.3: **Electronic Communications** The Parties agree that any notice, consent, approval, certificate, or instruction required or permitted in terms of the Contract may be given by means of electronic communication, including email or any other electronic platform agreed in writing by the Parties. For the purposes of the Contract, such electronic communications shall constitute written notice or written instruction and shall satisfy any requirement that a

Clause	Contract Data
	communication be in writing. Any instruction issued electronically shall be valid and binding provided that: a. it is transmitted by an authorised representative designated in writing by the issuing Party; b. the content of the instruction is in a form that is clear and capable of being retained and reproduced; and c. receipt thereof is confirmed, either expressly or by conduct. Communications transmitted via instant messaging platforms (including WhatsApp or similar applications) shall not constitute valid contractual notices or instructions unless subsequently confirmed by electronic mail sent by an authorised representative. Electronic communications, including emails and attached documents (whether signed electronically or scanned), shall have the same legal force and effect as written and signed hard copy documents. The risk of non-receipt or delayed receipt of electronic communications shall remain with the sender unless receipt is confirmed. The Parties may agree in writing on specific electronic platforms or systems for the issuing and management of communications, and communications via such platforms shall be deemed valid for all purposes under the Contract.
2.6.3	Add a new Sub-clause 2.6.3: The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, and without limiting the Employer's Agent's powers under Clause 2.6.1, any ambiguity or discrepancy shall be resolved by applying the following order of priority, listed from highest to lowest: 1. Form of Offer and Acceptance 2. Contract Data (where stated to supersede other provisions) 3. General Conditions of Contract 4. Drawings 5. Variations and Additional Clauses to Particular Specifications and Standard Specifications

Clause	Contract Data
	6. Particular Specifications 7. Standard Specifications 8. Bill of Quantities 9. any other documents forming part of the Contract
2.6.4	Add a new Sub-clause 2.6.3 The resolution of any ambiguity or discrepancy by application of the priority order set out in Clause 2.6.3 shall not in itself constitute a Variation, unless the clarification or instruction results in a change to the scope, quality, or extent of the Works. Where such clarification or instruction results in additional cost and/or delay to Practical Completion, the Contractor's entitlement shall be assessed strictly in accordance with Clause 2.6.2.
4.1.2	Add the following to the clause: The Contractor shall provide the following to the Employer's Agent for retention in respect of all works designed by the Contractor: 4.1.2.1 A Certificate of Stability of the Works signed by a registered Professional Engineer confirming that all such works have been designed in accordance with the applicable legislation, standards, and the appropriate codes of practice. 4.1.2.2 Proof of current registration with the relevant statutory professional body and proof of adequate and current professional indemnity insurance cover held by the designer(s) of the works. 4.1.2.3 Design calculations and supporting information, should the Employer's Agent request a copy thereof. 4.1.2.4 Engineering drawings and workshop details (both signed by the relevant professional engineer), to enable the Employer's Agent to compare the design with the specified requirements and to record any comments he may have with respect thereof. 4.1.2.5 "As-Built" drawings in DXF electronic file format, to be submitted, after completion of the Works. The submission of any document, certification, calculation, or drawing under Sub-Clause 4.1.2, and any review, acceptance, or comment

Clause	Contract Data
	thereon by the Employer's Agent, shall not relieve the Contractor of responsibility or liability for the design of the Works.
4.3.3	Add the following new Sub-Clause 4.3.3: **Health and Safety Plan** The Contractor shall comply with the Occupational Health and Safety Specification prepared by the Employer in terms of the Construction Regulations, 2014 promulgated in terms of Section 43 of the Occupational Health and Safety Act (Act No. 85 of 1993). Without limiting the Contractor's obligations in terms of the Contract or any applicable law, the Contractor shall prior to commencement of the Works or any part thereof, be in the possession of an approved Health and Safety Plan.
4.3.4	Add the following new clause: **Contractor's liability as mandatory** Notwithstanding any actions which the Employer may take, the Contractor accepts sole liability for due compliance with the relevant duties, obligations, prohibitions, arrangements and procedures imposed by the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and all its regulations, including the Construction Regulations, 2014, for which he is liable as mandatory. By entering this Contract, it shall be deemed that the parties have agreed in writing to the above provisions in terms of Section 37 (2) of the Act.
4.3.5	Add the following new clause: **Contractor to notify the Employer** The Employer retains an interest in all inquiries conducted under this Contract in terms of Section 31 and/or 32 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and its Regulations following any incident involving the Contractor and/or Sub-Contractor and/or their employees. The Contractor shall notify the Employer in writing of all investigations, complaints or criminal charges which may arise pursuant to work performed under this Contract in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Regulations.

Clause	Contract Data
4.3.6	Add the following new clause: **Contractor's Designer** The Contractor and his designer shall accept full responsibility and liability to comply with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Construction Regulations, 2014 for the design of the Temporary Works and those part of the Permanent Works which the Contractor is responsible to design in terms of the Contract.
4.10.1	Add the following to the clause: The Contractor shall meet the minimum Construction Skills Development Goal (CSDG) percentage as defined and recorded under C2.3 Summary of Bills, which shall be an integral part of the Contract upon acceptance by the Employer. Failure to meet the tendered [and minimum] CSDG percentage shall entitle the Employer to deduct local content damages to the value of the CSDG amount not achieved in Rand, multiplied by a factor of 0.7. The factored amount in Rand shall be deducted from the Contractor's final certificate.
5.3.3	Replace both periods of "7 days" with "14 days".
5.3.4	Add the following new clause: Construction Works Permit Notwithstanding anything to the contrary contained in these Conditions of Contract, the Contractor shall not be entitled to any claim for additional cost, nor to any extension of time for Practical Completion, arising from any delay in obtaining a Construction Works Permit, provided that the Contractor has submitted all information and documentation required of him in terms of Clause 5.3.1, and where the application for the Construction Works Permit is submitted by the Employer or the Employer's appointed Occupational Health and Safety Agent, the Contractor shall bear the risk of any delay in the issuing of such permit for a period of up to forty five (45) consecutive days. The Contractor shall only be entitled to claim an extension of time where the delay in the issuing of the Construction Works Permit by the relevant authority exceeds forty five (45) consecutive days, calculated from the date on which the Employer or the Employer's Occupational Health and Safety Agent submitted the final

Clause	Contract Data
	document required for such application, provided that the delay is not attributable to any act or omission of the Contractor.
5.12.5	Add the following new clause: **Abnormal Rainfall** Extension of time for Due Practical Completion in the event of abnormal rainfall shall only be allowed in accordance with the following formula. No additional extension of Time for Practical Completion caused by abnormal climatic conditions will be allowed, irrespective of the cause thereof or the effect it may have on the execution of the Works: $V = (N_w - N_n) + (R_w - R_n)/20$ *Where:* **V = Extension of time in calendar days for the calendar month under consideration** Nw = Actual number of days during the calendar month under consideration on which a rainfall of 10mm and more is recorded R_w = Actual total rainfall in mm recorded during the calendar month under consideration Nn = Average number of days, derived from rainfall records, on which a rainfall of 10mm and more was recorded during the relevant calendar month as per the data tabulated hereinafter Rn = Average total rainfall in mm for the relevant calendar month, derived from rainfall records, as tabulated hereinafter Where the extension of time due to abnormal rainfall must be calculated for portion of a calendar month, pro rata values shall be used. Should V be negative for any month, and should its absolute value exceed the corresponding value of N_n, then V shall be taken as being equal to minus N_n. The total extension of time to be granted shall be the algebraic sum of all the monthly extensions, provided that if this total is negative then the time for completion shall not be reduced due to subnormal rainfall. Rainfall records for the period of construction shall be taken on Site. The Contractor shall provide and install all the necessary equipment for accurately measuring the rainfall. The Contractor shall also provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his

Clause	Contract Data
	own cost. The Employer's Agent or his Representative shall take and record the daily rainfall readings. The Contractor shall be permitted to attend these readings, in the company of the Employer's Agent's Representative. Access to the measuring gauge(s) shall at all times be under the Employer's Agent's control. The rainfall records applicable to this Contract are those recorded at Weather Station [Bloemfontein Airport]. The following values of N_n and R_n shall apply: -

Month	R_n (mm)	N_n (days)
January	83	4.5
February	111	5.5
March	72	4.5
April	56	3.1
May	17	1.1
June	12	0.9
July	8	0.5
August	15	0.7
September	24	1.2
October	43	2.6
November	58	3.6
December	60	3.8
Total	559	32

6.2.2	Delete the contents of the clause and replace with the following: If the Contractor fails to select the security to be provided, or if the Contractor fails to provide the selected security within the time period stated in Clause 5.3.2, or if the performance guarantee shall differ from the pro forma, it shall be accepted that the Contractor has selected a security of a Cash Deposit of 10% of the Contract Sum, including VAT. This does not waive the Employer's right to terminate the Contract in terms of Clause 9.2.
6.2.3	Delete the contents of the clause and replace with the following:

Clause	Contract Data
	If the Contractor has selected a performance guarantee as security, the Contractor shall ensure that it remains valid and enforceable until the Certificate of Completion is issued. A fixed expiry date shall not be accepted, and the performance guarantee shall be valid until such time that the Certificate of Completion has been delivered. The performance guarantee shall be provided by a financial service provider approved by the Employer. Guarantees submitted must be issued by either an insurance company duly registered in terms of the Short-Term Insurance Act, 1998 (Act 35 of 1998) or by a bank duly registered in terms of the Banks Act, 1990 (Act 94 of 1990). The financial institution shall be an authorised financial service provider as contemplated in the Financial Advisory and Intermediary Services Act, 2002 (Act No 37 of 2002) (FAIS Act). In addition, the financial institution shall also be a licensed authorised financial services provider with the Financial Sector Conduct Authority of South Africa (FSCA). The financial institution/financial services provider shall have the following credit rating from one of the registered credit rating agencies mentioned: • Insurance companies: A claim paying ability rating of A- or above (Fitch, Global Credit Rating or Standard & Poor) or A3 or above for Moody's Investor's Service. • Banks: A short-term rating of F1 or above for Fitch Ratings, A1 or above for Global Credit Rating, A-1 or above for Standard & Poor or P-1 or above for Moody's Investor's Service. Guarantees must be issued on the pro-forma attached as Annexure A to the Contract Data. No alterations or amendments of the wording of the pro forma will be accepted.

CONTRACT SPECIFIC DATA

The following contract-specific data, referring to the General Conditions of Contract for Construction Works, Fourth Edition (2025), are applicable to this Contract. The Contract Data consists of two parts. Part 1 contains information provided by the Employer, while Part 2 contains information to be provided by the Contractor.

Part 1: Data Provided by the Employer

Clause	Contract Data
1.1.1.13	The Defects Liability Period for the Works shall be 365 calendar days.
1.1.1.14 / 5.5.1	The time for achieving Due Practical Completion of the whole of the works is: 365 days or less, including all public holidays, non-working days and builder's break. The times for achieving Due Practical Completion for the portions as set out in the Scope of Work are: 1. Portion/Phase 1 By-Pass Pipeline: 180 days. 2. Portion/Phase 2 Joint Sealing and Repair: 180 days.
1.1.1.15	The Employer is Vaal Central Water
1.1.1.16	The Employer's Agent is Bigen Africa Services (Pty) Ltd.
1.1.1.27	The pricing strategy is Re-measurement Contract.
1.2.1.2	The address and contact number of the Employer is: Vaal Central Water 2 Mzuzu Street, Pellissier, Bloemfontein e-mail: loyisom@vcwater.co.za Tel: +27 51 403 0800 The Employer's representative is Loyiso Mdolo The address and contact number of the Employer's Agent is: Bigen Africa Services (Pty) Ltd 2 Chris Botha Street Westdene Bloemfontein 9301

Clause	Contract Data
	Tel: (051) 430 1423 e-mail: llewellyn.biggs@bigengroup.com Employer Representative: Llewellyn Biggs
1.3.3	The language of the Contract and for written communications is English.
3.2.3	The Employer's Agent shall obtain the specific approval of the Employer before carrying out any of these functions or duties in accordance with the following Clauses of the General Conditions of Contract: 3.2.3.1 Clause 5.11 - The issuing of an order to suspend the progress of the Works, the extra cost resulting from which order is to be borne by the Employer or the effect of which is liable to give rise to a claim by the Contractor for an extension of time under Clause 5.12 of these conditions, 3.2.3.2 Clause 6.3 - The issuing of an instruction, the estimated effect of which will increase the Contract Price by an amount exceeding R100 000 excl. VAT, 3.2.3.3 Clause 6.4 - The valuation of all variation orders.
3.3.1	The Employer's Agent's Representative shall be on Site full time.
4.1.2	The Contractor shall be responsible for the design of all Temporary Works.
4.4.2	The Employer's Agent's prior written consent for subcontracting shall not be required, provided that: • the extent of the works sub-contracted does not change the contractual obligations of the Contractor, contractual relationship between the parties and risk to the Employer. • the sub-contractor is in good standing in terms of Clause 4.3. • the sub-contractor is suitably experienced, qualified and registered to complete the work intended.
5.3.1	The documentation required before commencing with the Works are: • Approved Health and Safety Plan (Refer to Clause 4.3.3)

Clause	Contract Data
	• Initial programme (Refer to Clause 5.6) • A detailed cashflow forecast (Refer to Clause 5.6.2.6) • Security (Refer to Clause 6.2) • Insurance (Refer to Clause 8.6) • Valid Letter of Good Standing from the Compensation Commissioner • Project Management Plan (Refer to Clause 3.5.1.3 in Section C3.5 of this document) • *Other*
5.3.2	The time to submit the documentation required before commencement of the Works is 14 days.
5.4.2	Access and possession of Site shall not be exclusive to the Contractor but shall be as set out in the Scope of Works and Site Information.
5.6.3	The time for the Employer's Agent to accept the Contractor's programme is within 14 days of receipt of the programme.
5.8.1 / 5.1.1.	Non-working days are: • Sundays Special non-working days are: • Any statutory public holiday in terms of the Public Holidays Act, and, where such statutory public holiday falls on a Sunday, and the next Monday subsequently becomes a statutory (observed) public holiday in terms of the Public Holidays Act, then both the relevant Sunday and the relevant Monday shall be special non-working days under the contract; • Any proclaimed statutory day of mourning, any proclaimed statutory election day which is proclaimed as a statutory public holiday; • The annual year-end break, commencing on 16th December 2026 and ending on 10th January 2027, as published by the Bargaining Council of the Civil Engineering Industry (BCCEI). Contact details (011) 450 4966/63 or info@bccei.co.za.

Clause	Contract Data
5.13.	The penalty for failing to complete Portion 1, as set out in the Scope of Work, is [R10 000] per day excluding VAT. The penalty for failing to complete Portion 2, as set out in the Scope of Work, is [R10 000] per day excluding VAT.
5.14.1	The requirements for achieving Practical Completion are: • Completion of the works as specified in the Contract, • All health and safety requirements have been met, • All environmental requirements have been met, • All quality assurance has been me and approved, and • All as-built information has been verified, submitted and approved.
5.14.6	The work and/or rectification of certain defects and/or the clearing of the Site that may be completed by a later date than the date of the Certificate of Completion shall be the following: 1. Removal of construction board 2. Establishment of vegetation or landscaping 3. Removal of Contractor's Site Camp.
5.16.3	The latent defect period is 10 years.
6.2.1	The Contractor shall select one security in PART 2 of which the percentages shall be as follows: • Fixed Performance Guarantee being 10 % of the Contract Sum, or • Cash Deposit being 10 % of the Contract Sum.
6.8.2	The application of a Contract Price Adjustment factor will apply to this Contract. Refer to Contract Price Adjustment Schedule for details.
6.8.3	Price Adjustments for variations in the cost of special materials will be allowed. The Contractor will be required to provide full details in PART 2 of the Contract Data].
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80%.

Clause	Contract Data
	The percentage advance on Plant not yet supplied to Site is *"Not required"*
	The value of the security bond for Plant and materials not yet supplied to Site or not yet built into the permanent Works is: "*Not Required"*
6.10.3	The percentage of retention being 10 % of the value of works completed.
	The limit of retention money being 5% of the Contract Price.
8.6.1.1.2	The value of Plant and materials supplied by the Employer to be included in the insurance sum: "*Not Required*
8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum: "*Not Required*
8.6.1.3	The limit of indemnity for liability insurance is R10 million per event, the number of events being unlimited.
10.5.3	The number of Adjudication Board Members to be appointed is One.
10.7.1	The determination of disputes shall be by arbitration.

CONTRACT PRICE ADJUSTMENT SCHEDULE	
Clause	**Contract Data**
1	The application of a Contract Price Adjustment factor will apply to this Contract. The price adjustment formula provided in the General Conditions of Contract will apply, together with the following coefficients and the definition of the relevant indices indicated below: X=0,15 a=0,25 b=0,15 c=0,55 d=0,05 The following definitions of the relevant indices shall apply to this Contract: “L” is the “Labour Index” and shall be the Consumer Price Index CPI for the province of Free State, as published by Statistics South Africa in the Statistical Release, P0141, Table A - Consumer Price Index: Main indices; Geographic indices. "E" is the "Contractor’s Equipment Index" and shall be the “Plant and Equipment” indices, as published by Statistics South Africa in the Statistical Release, P0151.1 Table 4 - Mining and construction plant and equipment price index. “M” is the “Materials Index” and shall be the “Civil engineering material- total” as published by Statistics South Africa in the Statistical Release, P0151.1 Table 6 - Civil engineering material price indices. “F” is the “Fuel Index” and shall be the “Diesel” indices as published by Statistics South Africa in the Statistical Release, P0142.1, Table 1 - PPI for final manufactured goods; Coke, petroleum, chemical, rubber and plastic products. The **base month** shall be the month before the offer was made.

Part 2: Data provided by the Contractor

Clause	Contract Data
1.1.1.9	The name of the Contractor is: ....
1.2.1.2	The address of the Contractor is: Physical address: .... Postal address: .... Email: .... Contractor's Representative: ..... Contact numbers: Office: ..... Mobile: .....
6.5.1.1.3	The percentage allowance on the net cost of materials actually used in the completed work is _____%. The percentage allowance on the gross remuneration of the workmen and foremen actually engaged is _____%.
	The variation in cost of special materials is based on the following:

	Special Material	Unit	Rate/Price for Base Month
6.8.3			

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

(To be supplied on the official letterhead of "The *Bank/Company*")

PRO FORMA

PERFORMANCE GUARANTEE

GUARANTOR DETAILS AND DEFINITIONS

"Guarantor" means: ……..……..

Physical address: ……..

"Employer" means: ……..

"Contractor" means: ……..

"Employer's Agent" means: ……

"Works" means: ……..

"Site" means: ……

"Contract" means: The Agreement made in terms of the Form of Offer and Acceptance and such amendments or additions to the Contract as may be agreed in writing between the parties.

"Contract Sum" means: The accepted amount inclusive of tax of R……

Amount in words: ……..

"Guaranteed Sum" means: The maximum aggregate amount of R ……..

Amount in words: ……..

Type of Performance Guarantee: Fixed

"Expiry Date" means: Date on which the Certificate of Completion of the Works has been issued.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

1. VARIABLE PREFORMANCE GUARANTEE

1.1. Where a Variable Performance Guarantee has been selected, the Guarantor's liability shall be limited during the following periods as follows:

1.1.1. To the Guaranteed Sum from the period from and including the date of issue of the Performance Guarantee up to and including the date of issue of the interim payment certificate, certifying for the first time, more than 50% of the Contract Sum.

1.1.2. The Reduced Amount set out below for the period from the day following the date of issue of the said interim payment certificate up to and including the date of issue by the Employer's Agent of the Certificate of Completion of the Works, or the date of payment in full of the Guaranteed Sum, or the Expiry Date, whichever occurs first,:

1.2. The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the interim payment certificate, certifying for the first time, more than 50% of the Contract Sum, has been issued and the date on which the Certificate of Completion of the Works has been issued.

2. FIXED PERFORMANCE GUARANTEE

2.1. Where a Fixed Performance Guarantee has been selected, the Guarantor's liability shall be limited to the amount of the Guaranteed Sum.

2.2. The Guarantor's period of liability shall be from and including the date of issue of the Performance Guarantee, up to the date of issue by the Employer's Agent of the Certificate of Completion of the Works, or the date of payment in full of the Guaranteed Sum, or the Expiry Date, whichever occurs first.

3. CONDITIONS APPLICABLE TO VARIABLE AND FIXED PERFORMANCE GUARANTEES

3.1. The Guarantor hereby acknowledges that:

3.1.1. Any reference in this Performance Guarantee to the Contract is made for the purpose of convenience and shall not be construed as any intention whatsoever to create an accessory obligation or any intention whatsoever to create a suretyship.

3.1.2. Its obligation under this Performance Guarantee is restricted to the payment of money.

3.2. Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 3.2.1 to 3.2.3:

3.2.1. A copy of a first written demand issued by the Employer to the Contractor stating that payment of a sum certified by the Employer's Agent in an Interim or Final Payment Certificate has not been made in terms of the Contract and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 3.2.2;

3.2.2. A first written demand issued by the Employer to the Guarantor at the Guarantor's physical address with a copy to the Contractor stating that a period of seven (7) days has elapsed since the first written demand in terms of 3.2.1 and the sum certified has still not been paid;

3.2.3. A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 3.2.

3.3. Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, the Guarantor undertakes to pay to the Employer the Guaranteed Sum or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor at the Guarantor's physical address calling up this Performance Guarantee, such demand stating that:

3.3.1. the Contract has been terminated due to the Contractor‘s default and that this Performance Guarantee is called up in terms of 3.3; or

3.3.2. a provisional or final sequestration or liquidation court order has been granted against the Contractor and that the Performance Guarantee is called up in terms of 3.3; or

3.3.3. a voluntary winding up resolution has been filled by the Contractor and that the Performance Guarantee is called up in terms of 3.3; or

3.3.4. a resolution to commence business rescue proceedings has been filled by the Contractor and that the Performance Guarantee is called up in terms of 3.3; or

3.3.5. a court order has been granted placing the Contractor under supervision and the commencement of business rescue proceedings and that the Performance Guarantee is called up in terms of 3.3.

3.3.6. The written demand to be accompanied by a copy of:

3.3.6.1. the notice of termination or

3.3.6.2. the relevant court order or

3.3.6.3. the relevant notice issued by the Companies and Intellectual Properties Commission or

3.3.6.4. the relevant notification by the applicable governmental authority.

3.4. Where the Employer is not in the possession or unable to submit the documents in terms of 3.3.6 above, the Employer shall be allowed a 60-calender day period to submit the documents subject to the following:

3.4.1. The demand in terms of 3.3 must be received by the Guarantor before the Expiry Date.

3.4.2. The effective date as evidenced in the documents in terms of 3.3.6 is prior to the Expiry Date.

3.4.3. Payment by the Guarantor shall be made within 7 calendar days after receipt of the documents.

3.4.4. Failure to submit the documents within the 60-calendar day period will result in the demand being null and void.

3.5. It is recorded that the aggregate amount of payments required to be made by the Guarantor in terms of 3.2 and 3.3 shall not exceed the Guarantor's maximum liability in terms of 1.1 or 2.1.

3.6. Where the Guarantor has made payment in terms of 3.3, the Employer shall upon the date of issue of the Final Payment Certificate submit an expense account to the Guarantor showing how all monies received in terms of this Performance Guarantee have been expended and shall refund to the Guarantor any resulting surplus. All monies refunded to the Guarantor in terms of the Performance Guarantee shall bear interest at the prime overdraft rate of the Employer's bank compounded monthly and calculated from the date payment was made by the Guarantor to the Employer until the date of refund.

3.7. Payment by the Guarantor in terms of 3.2 or 3.3 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.

3.8. Payment by the Guarantor in terms of 3.3 will only be made against the return of the original Performance Guarantee by the Employer.

3.9. The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may consider fit and the Guarantor shall not have the right to claim his release from this Performance Guarantee on account of any conduct alleged to be prejudicial to the Guarantor.

3.10. The Guarantor chooses the physical address as stated above for the service of all notice for all purposes in connection herewith.

3.11. This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 1.1.2 or 2.2, where after no claims will be considered by the Guarantor. The original of this Guarantee shall be returned to the Guarantor after it has expired.

3.12. This Performance Guarantee, with the required demand notices in terms of 3.2 or 3.3, shall be regarded as a liquid document for the purposes of obtaining a court order.

3.13. Where this Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrate's Courts Act No 32 of 1944, as amended, to the jurisdiction of the Magistrate's Court of any district having jurisdiction in terms of Section 28 of the said Act, notwithstanding that the amount of the claim may exceed the jurisdiction of the Magistrate's Court.

Signed at ……..
Date ……..

Guarantor's signatory (1)
……
Capacity
……

Guarantor's signatory (2)
……
Capacity
……

Witness signatory (1) ……

Witness signatory (2) ……

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

OCCUPATIONAL HEALTH AND SAFETY SPECIFICATION BASELINE RISK ASSESSMENT

VAAL CENTRAL WATER

CONTRACT NO:

BRANDKOP DAM SAFETY ASSESSMENT AND JOINT SEALING IN THE CRR

HEALTH AND SAFETY SPECIFICATION

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1. RELATED REGULATIONS

This document is to be read and understood with the following inter-alia: -

- Occupational Health and Safety Act, Act 85 of 1993 (the Act)
- All regulations published under the Act.
- Construction Regulations 2014
- SABS Codes of Practice (with specific reference to SANS 10085:2025)
- Contract Documents
- National Environmental Management Act, Act 46 of 2003
- Compensation for Occupational Injuries and Diseases Act, Act 61 of 1997
- Basic Conditions of Employment Act, Act 75 of 1997
- Applicable Provincial/Municipal by-laws

2. ABBREVIATIONS

OHS	Occupational Health and Safety
CEO	Chief Executive Officer
CR	Construction Regulations
CWP	Construction Work Permit
CIDB	Construction Industry Development Board
DSTI	Daily Safety Task Instruction
PAR	Physical Agents Regulations
EMR	Electrical Machinery Regulations
ERC	Emergency Response Coordinator
ECA	Electrical Contracting Association
FR	Facilities Regulations
GAR	General Administrative Regulations
GMR	General Machinery Regulations
GSR	General Safety Regulations
HCA	Hazardous Chemical Agents
SDS	Safety Data Sheet
PC	Principal Contractor
PPE	Personal Protective Equipment
DEL	Department of Employment and Labour
CHSO	Construction Health and Safety Officer
CHSM	Construction Health and Safety Manager
CI	Chief Inspector
SWP	Safe Work procedures
SABS	South African Bureau of Standards
SAQA	South African Qualification Authority
US ID	Unit Standard Identification
NQF	National Qualification Framework
MS	Method Statement
ECSA	Engineering Council of South Africa
SACPCMP	South African Council for Project and Construction Management Professions

3. DEFINITIONS

Agent:	Means a competent person who acts as a representation of the client on a construction project.
Competent Person:	(a) Means any person having the knowledge, training, experience and qualifications specific to the work or task being performed. Provided that where appropriate qualifications and training are registered in terms of the provisions of South African Qualifications Authority Act (Act 58 of 1995), these qualifications and trainings shall be deemed to be the required qualifications and training. (b) is familiar with the Act and with the applicable regulations made under the Act;
Construction Work:	a) the construction, erection, alteration, renovation, repair, demolition or dismantling or addition to a building or any similar structure; b) construction, erection maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or similar civil engineering structure; or the moving of earth, clearing of land, making of an excavation, piling or any similar civil engineering structure or type of work.
Contractor:	Means an employer who performs construction work.
Chief Executive Officer:	In relation to a body corporate or enterprise conducted by the state, means a person who is responsible for the overall management and control of the business of such body corporate or enterprise.
Danger:	Means anything that may cause injury or damage to anyone's property.
Employee:	means any person who is employed by or works for any employer who receives and entitles to receive any remuneration or who works under the direction or supervision of an employer or any other person.
Employer:	Means any person who employs or provides work for any person or remunerates such person or express or tacitly undertakes to remunerate him but excludes the Labour Broker as defined in section 1(1) of the Labour Relations Act, 1953 (Act 28 of 1953)

Hazard Identification:	Means identification and documenting of existing or expected hazards to the health and safety of persons, which are normally associated with the type of construction work being executed or to be executed.
OHS file:	Means a file or other records containing information required in these regulations.
Health and Safety Plan:	Means a project specific documented plan in accordance with client health and safety specifications.
OHS Specifications:	Means a project specific document prepared by the client pertaining to all health and safety requirements related to construction work.
Healthy:	Means free form illness or injury attributable to occupational causes.
Machinery:	Means any articles or combination or articles assembled, arranged or connected and which is used or intended to be used for converting any form of energy to performing work, or which is used or intended to be used, whether incidental thereto or not, for developing, receiving, storing, containing, confining, transforming, transmitting, transferring or controlling any form of energy.
Medical Surveillance:	Means a planned programme of periodic examination (which may include clinical examination, biological monitoring or medical tests) of employees by occupational health and safety practitioner or in prescribed cases, occupational medicine practitioner.
Method Statement:	Means a document detailing key activities to be performed to reduce as far as reasonably practicable the hazards identified in any risk assessment.
Plant:	Includes fixtures, fitting, implements, equipment, tools and appliances, and anything, which is used for any purpose in connection with that plant.
Principal Contractor:	Means an employer appointed by the client to perform construction work.
Risk Assessment:	Means a program to determine any risk associated with any hazards or aspect at a construction site to determine the steps to be taken to remove, reduce or control such hazards.

User:	In relation to plant and machinery, means a person who uses plant or machinery for his own benefit or who has a right of control over the use of plant or machinery, but does not include a lessor of, or any other person employed in connection with plant or machinery.
Reasonably Practicable:	Means practicable having regard to a) the severity and scope of the hazard or risk concerned, b) the state of knowledge reasonably available concerning that hazard or risk or any means to mitigate that hazard or risk, c) the availability and suitability of means to mitigate or remove that hazard or risk, d) the cost of removing that hazard or risk in relation to be benefits derived there from.
Risk:	Means the probability that an injury or damage may occur.
Safe:	Means free form any hazards.
Standard:	Means any provision occurring: a) in a specification, compulsory specification, code of practice or standard method as defined in section 1 of the Standards Act, 1993 (Act 29 of 1993); or: b) any specification, code or any other directive having standardization as its aim and issued by an institution inside or outside the republic of South Africa, which, whether generally or with respect to any particular article or matter and whether internationally or in any particular country or territory, seek to promote standardization.

4. THE CLIENT

The client for this project is VAAL CENTRAL WATER ("the Client")

5. OBJECTIVES OF THE PROJECT

The primary objective of the project is the

BRANDKOP DAM SAFETY ASSESSMENT AND JOINT SEALING IN THE CALEDON RIVER REGION

6. LOCATION OF THE WORKS

BRANDKOP RESERVOIR, BLOEMFONTEIN

7. SCOPE OF WORKS

- Draining, cleaning and surface preparation of CRR (No Design Required),
- Crack, joint and concrete repairs (No Design Required),

- Application of a potable-water-approved sealing or lining system as per tender specifications (No Design Required),
- Testing, disinfection, refilling and return to service (No Design Required),
- Construction of a steel bypass pipeline to maintain water supply during reservoir decommissioning,
- Construction of a reinforced concrete break pressure tank, including associated pipework, valves and fittings.
- Site access and logistics;
- Excavation and lateral support requirements;
- Structural stability during construction;
- Temporary support and erection sequencing;
- Work at height
- Lifting, cranage, and handling requirements;
- Interfaces with existing services and adjacent structures;
- Safe access for operation and maintenance;
- Confined spaces, restricted access, or hazardous environments;
- Demolition, alteration, and future extension considerations;
- Public safety and third-party impacts.
- Simplification of construction activities;
- Reduction of manual handling and work at height;
- Provision for safe access to inspect, clean, maintain, and repair;
- Consideration of safe construction sequencing;
- Specification of suitable materials and systems;
- Identification of critical installation and stability requirements;
- Coordination with other disciplines to reduce interface risks;
- Communication of residual hazards on design documentation

8. HEALTH AND SAFETY OBJECTIVES

- To ensure that construction work is performed in such a way that harm to employees, members of the public and our natural environment is minimised.
- To clearly state the PC obligations to develop an OHSmanagement system as directed by the provisions of the CR 7 and to ensure that its elements are implemented completely on site for the scope of contract.
- Where the PC employs the services of subcontractors, all obligations imposed to the PC by these OHS Specifications shall also apply to the subcontractor so appointed.

9. SUPPLEMENTARY DOCUMENTS

These OHS Specifications may be amended or supplemented by any standard or recommendation that in the view of appointed OHS Agent advances the interest of health and safety on site.

The PC or subcontractors are not relieved from their inherent obligations of having to comply with all the provisions of the Occupational Health and Safety Act and all other

incorporated regulations. In cases of contradiction that may be established, the OHS Act, shall be the point of reference.

10. APPLICABILITY

These OHS Specifications are applicable to the PC and all other subcontractors undertaking work on the aforesaid project.

11. AUTHORITY TO STOP WORK

The OHS Consultant is empowered through CR 5(1)(q) to stop work, which in their own opinion is dangerous, and/or not in compliance to the Health and Safety Plan as agreed.

Any instruction to stop construction activities shall be in writing and shall clearly state what needs to be done to attain the required level of compliance. Only when the conditions that gave rise to the issuing of the prohibition are fulfilled will an instruction be revoked, or work be allowed to continue.

12. OHS FILE

The PC shall provide and maintain a OHS file containing all relevant documents as prescribed in the OHS Act and Regulations and all records referred to in the OHS Plan. The OHS file shall be kept on the construction site and made available for perusal by any interested relevant party. The OHS file becomes the property of the client after the completion of the project.

The OH&S file / files opened in terms of Construction Regulation 5(1)(s) and CR 7(1)(b) shall be always kept on site. This shall be a file or permanent record containing information on aspects of the contract regarding OHS of any person who may be affected by the construction work.
The principal contractor shall appoint a suitably qualified person to prepare the file / files and to keep it up to date for the duration of the contract. The file shall include the following information but not limited to:

- Appointment – Principal contractor
- 37(2) Mandatory agreement between client and principal contractor
- Appointment – OHS Agent
- Client OHS specifications.
- Client Baseline Risk assessment
- Principal contractor OHS plan and approval.
- Construction Work Permit
- Letter of Good Standing
- Public liability insurance
- Copy of the Occupational Health and Safety Act
- Copy of Construction Regulations
- Copy of the COID Act
- Legal Register
- OHS Policy
- Organogram & Appointments & Competencies of appointed persons
- Employee management: Personal profiles / ID's / Medicals with annexure 3 attached.

- Risk Management: Risk assessment review register / method statements / risk assessments / safe operating procedures / planned task observations / daily safety task instructions.
- Training and communication. (Induction / toolbox talks)
- Minutes of meetings
- Monthly reports
- Inspections
- Incident management: Incident registers / Incident investigations forms & templates
- Emergency Management
- PPE management
- Management of Contractors
- Fall protection.
- HCS
- Construction vehicles and mobile plant
- Lifting machines
- Traffic management
- Waste management
- COC's (Certificate of compliance)
- Confined spaces
- Excavation inspections

13. PRINCIPAL CONTRACTOR HEALTH AND SAFETY PLAN

The principal contractor shall prepare the OHS plan as specified in Construction Regulation 7(1)(a) and the Vaal Central Water occupational health and safety specifications. The principal contractor shall demonstrate that he /she has a suitable sufficiently documented OHS plan as well as the necessary competencies, experience, and resources to perform the construction work safely. No site establishment or construction work shall commence before receipt by the principal contractor of approval of the OHS plan.

The OHS plan shall be submitted to the Client/Client's agent who is appointed as the OHS agent, ***7 days*** prior to submitting the application for a construction work permit to the Department of Employment and Labour.

Upon the health and safety agents' approval and receipt of the construction work permit the principal contractor shall immediately implement the OHS plan and any amendments and keep it in operation for the full duration of the contract. The OHS plan shall be reviewed as a minimum once a year or if there is:

- Changes in legislation
- Changes in design
- After an incident
- After a serous nonconformance was identified.

The contractor shall indicate on the OHS plan:

- Revision
- Date revised.

- Sections revised /amended/changed.
- Full description of revision/amendment / changes

Once the OHS plan is revised, the contractor shall not remove the previous revision. The previous revision will be superseded and kept in the file as record. The new revision shall be signed by CR 8(1), 8(5) and must be approved by CR 5(5).

Preparation of the OHS Plan

The OHS plan shall be a fully detailed plan, specifying the framework for the OHS plan. The principal contractor must demonstrate that it has developed a suitable and sufficiently documented OHS plan for the **Brandkop Dam Safety Assessment And Joint Sealing In The Caledon River Region.**

Based on the scope of work. The contractor must also prove that he/she has the necessary competencies, experience, and resources to perform the construction work safely.
The principal contractor shall compile an OHS File as specified under 5.4 of these specifications that should be submitted for approval prior to site establishment or any construction work.

Contents of the OHS plan.

The OHS plan shall include but not limited to the following:

- Principal contractor OHS Policy
- **Legal and other requirements:** Principal contractor must specify what legal and other requirements will be applicable to the construction process:
- **Hazard Identification and Risk Assessment:** The principal contractor must in detail demonstrate how, when, where and what type of risk assessments and by whom risk assessments will be conducted.
- **Objectives and targets:** Objectives and targets must be set and detailed description to be given how objectives and targets will be reached.
- **Resources, Roles, and responsibilities:** Appointments, who will be appointed for what.
- **Competency training and awareness.** Detailed description of what training will take place, including induction, job specific training and external training.
- **Communication:** Types of communication that will take place. Meetings and frequency of meetings (OHS committee meetings / site meetings. Monthly reports).
- **Performance monitoring:** What types of monitoring would be done: Inspections/ PTO's etc.
- **Inspections:** Inspections, frequency of inspections the people responsible for inspections.
- **Incident Management and Investigation:** Who, when, why, where, and how **incidents** will be managed.
- **Audits:** Types of audits and frequency of audits
- **Signage:** Signage that will be used
- **Access control / Security**
- **Public Health and Safety**
- **Traffic Management and accommodation**
- **PPE Management**
- **First Aid arrangements**
- **Emergencies**
- **Management of subcontractors.**

- **Control of Documents**
- **Occupational Health and Safety budget**
- **Operational control:** This refers to the material, equipment and activities that will take place on site based on the scope of work and will be as follows:
  - Signage
  - Equipment transport to site. Delivery and offloading.
  - Construction employee facilities
  - Stacking and Storage
  - Housekeeping
  - Waste management
  - Construction vehicles and mobile plant
  - Hand tools
  - Temporary electrical installations
  - Electrical work
  - Use of portable electrical tools
  - Ladders
  - Clearing and grubbing. Vegetation clearance
  - Excavations
  - Bedding and Backfilling
  - Lifting machines and lifting equipment
  - Lifting operations
  - Welding and flame cutting activities.
  - Grinding / Using circular saws.
  - Tie into existing services
  - Confined spaces
  - Adverse weather conditions
  - Use and storage of flammable liquids.
  - Hazardous chemical substances
  - Dangerous animals.
  - Working close to water environments
  - Lighting
  - Ventilation
  - Noise
  - Working in or with sewage / effluent
  - Excavations at night

14. SITE ACCESS AND SECURITY

The construction site camp shall be provided with perimeter fencing and access points.

"No Unauthorized Entry" signage shall be posted at the entrance of the site camp and along perimeter fencing.

A security guardhouse must be provided at the entrance of the site camp. Security personnel must be inducted, medically screened, provided with PPE and site access control book.

No one should be allowed on site unless such person is fully authorized or and is allowed by law to have access to site. No one shall be allowed to access site if such person is intoxicated from drugs, alcohol or other prohibited substances.

The site shall be secured day and night by a security service provider who is registered and in good standing with PSIRA.

The PC must further erect a construction board that indicates the mandatory PPE that must be worn when coming onto site. There must also be signs that instruct every on "what do to, where to report" with directional arrows.

15. INDUCTION TRAINING

The Principal Contractor shall ensure that all employees and visitors are inducted on the hazards prevalent to site at the time of entry and proof of such induction shall be kept in the OHS file. No person shall be allowed on site unless such person has been fully inducted. The induction training must appreciate the ever-changing environment of a construction site and be reviewed and communicated as and when necessary.

16. INTOXICATION

No intoxicating substance of any form shall be allowed on site. Any person suspected of being intoxicated shall not be allowed on the site. Any person required to take medication shall notify the relevant responsible person thereof, as well as of the potential side effects of the medication.

17. MEDICAL SURVEILLANCE

All employees shall be subjected to entry and exit medicals examinations.
The medical examinations shall be done in accordance with Annexures 3 of the CR.

A registered occupational health practitioner shall carry out medical examinations on employees and manage results as confidential.
The records of such shall only be made available as and when requested by authorized interested parties and only for the benefit of advancing the course of health and safety.

The PC shall ensure that employees are correctly placed as guided by the results of their medical examination and risk assessment of that task, job or responsibility. Medical certificates are only valid for a period of 12 months and when expired must be redone.

18. PERSONAL PROTECTIVE EQUIPMENTS

The Principal Contractor shall ensure that: -

- A PPE matrix is developed to indicate what trades is allocated what PPE.
- PPE is issued free of charge and a PPE issue register is be kept and maintained.
- The PC shall instruct all employees on the proper use, maintenance, limitations and safe disposal of PPE issued to them. Such training shall be done in a form of a toolbox talk and the records thereof shall be kept in the OHS file.

19. DUTIES OF EMPLOYEES AT WORK

The Principal Contractor shall ensure that duties in relation to their employees at work are realized, by encouraging them to: -

- Take reasonable care for their own health and safety.
- Take reasonable care for the health and safety of others who may be affected by their acts or omissions.
- Cooperate with anything that the employer does to comply with OHS requirements.
- Not intentionally or recklessly interfere or misuse anything provided in the workplace for the course of OHS.

20. DESIGNER DUTIES

Designers must: -

- Ensure that they carry out their responsibilities in line with provisions of CR 6 of the Construction Regulation 2014.
- Carry out designs in the manner that appreciate the aspects of constructability, operability and maintainability of structures to minimize the risks of construction, operation and maintenance.

21. PROJECT RISK PROFILE

Hazard Identification and Risk Assessment

Baseline risk assessment

Baseline risk assessment was drafted by a Client OHS Agent as prescribed by Construction Regulation 5(1) and will be issued to the principal contractor. The Baseline risk assessment shall be reviewed as required and re-issued to the principal contractor.

The following risk assessment methodology was used to evaluate the risks and hazards:

Risk Assessment Methodoligy	
Likelihood	**Weight Number**
Might well be expected or inherently dangerous	10
Quite possible	6
Unusual but possible	3
Only remotely possible	1
Exposure	
Continuosly or inherentily dangerous	10
Daily (few times per day)	6
Weekly (few times per week	3
Monthly (few times per month)	2
Annualy or less often	1
Severity	
Irreversible effect	5
Severly harmful	4
Harmful	3
Slightly Harmful	2
Minimal effect	1

Risk Classification	
Very High Risk	200 - 500
High Risk	100 - 200
Medium Risk	50 - 90
Low Risk	0 - 50

The following significant risks have been identified.

Hazard / Risks	Risk Rating	Significance
Community stealing barricading netting and signage	500	Very High Risk
Working in Confined Spaces	500	Very High Risk
Working in excavations	500	Very High Risk
Managing public safety around excavations	500	Very High Risk
Water accumulation in all excavation including trenches and ponds.	500	Very High Risk
Bedding and Backfilling	500	Very High Risk
Principal contractor procurement and services *(Inadequate resources, not provided for cost of H&S measures)*	300	Very High Risk
Incompetent contractor	300	Very High Risk
Cost for H&S requirements (*No funds for: formal and informal training, PPE, stationary, printing, notice boards, signage, first aid equipment, firefighting equipment, facilities, lifting tackle*	300	Very High Risk

certification, medical surveillance, load testing, COC temporary electricity)		
Legal Framework for Project *(Not complying with legislation, regulations and standards)*	300	Very High Risk
Compulsory community labour use *(Disputes, rioting, picketing, arson, vandalism)*	240	Very High Risk
Stacking and Storage inside community. *(Members of the public removing barricading netting and signage. Children playing in stacking areas)*	240	Very High Risk
Construction Vehicles & Mobile plant. *(Interaction between construction vehicles / Mobile plant and the members of the public.)*	240	Very High Risk
Clearing and grubbing, vegetation clearance *(Moving machinery, interaction between driven machinery and members of the public. Dangerous snakes)*	240	Very High Risk
Unskilled / Incompetent employees / lack of experience	180	High Risk
Lifting operations (*Manual and Mechanical)*	180	High Risk
Crossing of other existing services	144	High Risk

Risk assessment process

The overall all risk management process shall include but not limited to:

- Risk assessment review register
- Method statements for all tasks
- Issue based (task specific risk assessments)
- Safe operating procedures / Safe working procedures
- Daily safety task instructions
- Planned task observations.

Risk assessment review register

The principal contractor and all contractors shall ensure that a risk assessment review register is implemented and maintained. The risk assessment review register shall include the following:

- Risk assessment number
- Risk assessment name
- Date: (*When risk assessment was developed)*
- Revision number
- Description of revision

Method statements

The principal contractor shall ensure that during any construction work or work associated with the aforesaid construction work, ensure that a task specific method statement is

undertaken by a competent person. Preferably the appointed 16(1), CR 8(1), CR 8(2), or the CR 8(7). Method statements shall be communicated to all employees involved in the task before commencement of the task.

All method statements shall indicate:

- Name of Method statement
- Project name
- Date
- Revision
- Revision date
- Must be signed off by the CR 8(1), CR 8(7), and CR 8(5)

Issue Bases (Task Specific) Risk Assessments

The principal contractor shall ensure that during any construction work or work associated with the aforesaid construction work, ensure that a task Specific risk assessment is undertaken by a competent appointed person. These risk assessments shall be communicated to all employees involved in the task before commencement of the task.

All issue-based risk assessments (task specific risk assessments) must indicate:

- Name of Risk Assessment
- Project name
- Date of risk assessment
- Revision
- Revision date
- Must be signed off by the CR 8(1), CR 8(7), and CR 9(1)

The issue-based risk assessments (task specific risk assessments) should clearly stipulate the:

- Hazards identified.
- Analyzed Risks
- Evaluation of risks – Risk assessment matrix should clearly indicate how risks are assessed.
- Controls
- Once the risks have been evaluated and the significance of the risks has been identified it is important that controls are implemented based on the hierarchy of controls:
- Eliminate
- Substitute
- Engineering controls
- Administrative controls
- PPE

Safe operating procedures (SOP's) / safe working procedures (SWP'S) shall be generated based on the task specific risk assessments and communicated to all employees. Planned task observations (PTO's) shall be generated based on the SOP's /SWP's. PTO's must be conducted weekly by supervisors; safety officers and OHS reps.

Continuous Risk Assessments

The principal contractor and all contractors shall provide and maintain a working environment that is safe and without risk to the health of all employees. The general awareness of hazards needs to be identified and controlled continuously to create a working environment that is as reasonably practicable, safe and without risk. This is achieved by continuous (ongoing) risk assessments.

DSTI's shall be conducted daily by the principal contractor and all other contractors on site. All DSTI's shall be signed off by the CR 8(1), CR 8(5), CR 8(7). An attendance register shall be completed and signed by all employees after the DSTI was communicated to them.

Risk Assessment Review

Method statements, risk Assessment and safe working procedures shall be reviewed after incidents or accidents or when:

- Designs are amended.
- New machines are introduced.
- Systems of work change or operations alter.
- Technological developments invalidate prior risk assessments.

All Risk Assessments must be indicated on a risk assessment review register and reviews to be indicated with dates and personnel responsible for reviews.

All documents used in the risk assessment process shall be marked with an approved or superseded stamp. If documents are live and in use it shall be marked as approved. If the document has been revised and the revision is no longer in use, it will be marked as superseded.

No superseded documents may be removed from the health and safety files or from site. Superseded documents shall be kept on record and be filed behind approved documents. It is imperative that all revisions are available and that previous revisions are superseded, and the latest revisions are signed by all responsible persons and approved.

22. OBJECTIVES AND TARGETS

Despite general objectives set by the principal contractor, objectives shall be developed to mitigate the top 10 significant risks identified during the risk assessment process.

The principal contractor shall strive to:

- Maintain a Los Time Injury Frequency Rate (LTIFR) of 0.
- Zero fatalities
- Limit / avoid lost time injuries and occupational diseases.
- Create a safe working environment that is as far as reasonably safe and without risk to employees.
- Ensure that employees are fully aware of hazards and risks and controls to protect themselves.
- That loss due to incidents are limited.

23. ADMINISTRATIVE REQUIREMENTS

23.1. CONSTRUCTION WORK PERMIT

The Client has the responsibility to apply to the DEL for a construction work permit for the intended construction 30 days before commencement of construction activities. The application shall be done on Annexure 1 to the CR and a copy of the CWP shall be kept in the OHS file as well as be clearly displayed at the entrance to the site.

23.2. OHS POLICY

The PC shall compile and communicate to the workforce a health and safety policy of the company. The OHS policy shall bear signature of the CEO or his appointee.

The health and safety policy shall be posted up in a conspicuous place in the workplace to everyone's view.

23.3. SITE RULES

The Principal Contractor shall ensure that: -

- Non-negotiable site rules are developed and posted up in a conspicuous place around the site camp. These site rules must be communicated to all employees. Proof of such communication shall be kept in the OHS file.
- Any employee who transgresses the rules as established must be subjected to the company's disciplinary processes.

23.4. LETTER OF GOOD STANDING

The PC shall: -

- Keep an up-to-date letter of good standing in the OHS file for perusal by an inspector, OHS Consultant, Client or PA.
- Ensure that the contractors that they appoint are registered and in good standing with the Compensation Commissioner or registered compensation insurer.

23.5. OHS BUDGET

The principal contractor shall provide the client with a sufficient OHS budget that shall include a complete breakdown of all OHS costs. See under Annexure B a breakdown of the proposed budget that must be completed and submitted.

Health and safety expenditure percentage vs progress percentage to be included in the monthly statistical return that must be submitted to the OHS agent on the 25th of each month.

All contractors appointed by the principal contractor shall complete sections of the OHS budget applicable to the construction activities to ensure that they have made sufficient provision for the management of OHS.

23.6. SUBCONTRACTOR MANAGEMENT

The PC may sign a Mandatary Agreement in terms of Sec 37(2) with any subcontractor whom he wishes to employ. If this contract is not signed, the subcontractors' employees are legally deemed to be the PC's employees and therefore the PC will be liable for any of their acts or omissions on the project.

All labour-only subcontractors must only be employed on the basis that the PC will register them as part of his own staff compliment to be able to comply with Compensation Commissioner registration requirements.

The following are very important in as far as the employment of subcontractors are concerned: -

- All subcontractors must be appointed in writing as per CR 7 (1)(c)(iv).
- All subcontractors must be in possession of a valid letter of good standing issued by the Compensation Commission or FEM.
- The PC must provide all subcontractors with relevant sections of these OHS Specifications.
- They must submit their health and safety files and plans for approval by the PC appointed Health and Safety Officer. The approval of subcontractor health and safety plans shall be in writing. The subcontractor health and safety plans must be based on sections of these OHS Specifications as it related to them.
- All subcontractors' employees must be thoroughly inducted, and records thereof must be kept in the OHS file.
- All subcontractor employees must undergo entry medical surveillance, and the records thereof shall be kept in the OHS file.
- It shall remain the responsibility of the PC to audit the OHS files of the subcontractor monthly.
- Any deviations identified from any appointed subcontractor by the PC will be viewed as deviation of the PC so appointed.

23.7. LEGAL APPOINTMENTS

The employer is obligated to make appointments in writing. Appointments shall be accompanied by proof of competency of the person being appointed where applicable. The following appointments, which are not exhaustive, are anticipated to be applicable for the project: -

Item	Legal Appointment	Regulation
1.	Construction Manager	CR 8(1)
2.	Assistant Construction Manager	CR 8(2)
3.	Construction Supervisor	CR 8(7)
4.	Assistant Construction Supervisor	CR 8(8)
5.	Sec 16.2 Appointee	OHSA Sec 16.2
6.	Health and Safety Officer	CR 8(5)
7.	Health and Safety Representatives	Sec 17(1)
8.	Health and Safety Committee Members	Sec 19(3)
9.	First Aid Attendant	GSR 3(4)
10.	Fire Fighters	ER 9/ CR 29
11.	Risk Assessor	CR 9
12.	Incident Investigator	GAR 9(2)
13.	Emergency Coordinator	GSR 3
14.	Temporary Electrical Installation Controller	CR 24(d)
15.	Temporary Electrical Installation Inspector	CR 24(c)
16.	Construction Vehicle Operator	CR 23(1)(d)(i)
17.	Construction vehicle Inspector	CR 23(1)(k)

18.	Stacking and Storage Supervisor	GSR 8
19.	Portable Electrical Tools Inspector	CR 24(d)
20.	Excavation Supervisor	CR 13(1)
21.	Fire Equipment Inspector	CR 29(h)
22.	Confined Space Supervisor	GSR 5(1)
23.	Lifting and Rigging	DMR

23.7.1. Construction Manager

The PC shall appoint a competent person to act in the capacity of a Construction Manager (Site Agent) in terms of CR 8.(1) of the Construction Regulation. The PC may appoint Assistant Construction Managers (Engineers, Technicians etc.) to assist him in the execution of duties. the person so appointed as Construction Manager must be competent and preferably be registered with the appropriate Council.

23.7.2. Assistant Construction Manager

The appointment of the Assistant Construction Manager is not a must but rather a preference if it will assist in getting better health and safety management on site. If appointed, the Assistant Construction Manager will execute similar role as the Construction Manager. The appointment of assistants does not relieve the Construction Manager of his duties in terms of the provisions of the Act.

23.7.3. Construction Supervisor

The PC shall appoint a competent person to act in the capacity of a Construction Supervisor (Foreman) in terms of CR 8(7) of the Construction Regulation. The PC may appoint Assistant Construction Supervisors (Assistant Foreman, Charge Hand etc.) to assist him in the execution of duties.

23.7.4. Assistant Construction Supervisor

The appointment of the Assistant Construction Supervisor is not a must but rather a preference if it will assist in getting better health and safety management on site.
If appointed, the Assistant Construction Supervisor will execute similar role as the Construction Supervisor. The appointment of assistants does not relieve the Construction Supervisor of his duties in terms of the provisions of the Act.

23.7.5. Section 16.2 Appointee

The CEO of the company may designate a 16.2 person in writing who will take full responsibilities of all health and safety related obligations on behalf of his company from a management level. The appointment of this person does not in any way relieve the CEO of his inherent responsibilities in terms of Sec 16(1) of the Act.

The duties of the appointed person shall be clearly highlighted in the letter of appointment as well as the duration and location of appointment.

23.7.6. Health And Safety Officer

The Principal Contractor shall employ and appoint a fulltime competent person in writing to act as a Construction Health Safety Officer with the duties of assisting the Construction

Manager with the day-to-day administration and coordination of health and safety related matters on site.The person so appointment shall have resources (office, computer, printer etc.) to perform their functions and shall possess either one of the following credentials: -

- National Diploma in Safety Management and at least 1 year of construction health and safety experience.
- Or short health and safety management course on NQF5 level such as SAMTRAC, SHEMTRAC, Modern SHEQ Risk Management etc. and at least 2 years of construction health and safety experience.
- The person so appointed shall further be registered with South African Council for Project and Construction Management Professions (SACPCMP) as CHSO.

23.7.7. Health And Safety Representatives

The PC shall appoint individuals as health and safety representatives for the project in terms of Sec. 17 of the OHSA.
The health and safety representatives shall have the power and the authority to inspect any item, to question any employee and to recommend measures that must be taken to obviate hazards that may be discovered from time to time.

The health and safety representatives shall be part of any incident investigation process that will be conducted by the CHSO.

The health and safety representatives shall be trained in terms of the aapropriately registered skills programmes of the QCTO. .

23.7.8. Health And Safety Committee Members

All members of the health and safety committee other than health and safety representatives appointed shall be appointed in writing. The health and safety representatives appointed shall automatically be members of the health and safety committee. The number of employer's representatives in the health and safety committee shall not be more than that of the employee representatives. All subcontractors employed by the PC shall nominate members to serve on the PC health and safety committee.

23.7.9. First Aid Attendant

The PC shall appoint First Aid Attendants. The South African Red Cross Society, or the St John's Ambulance, or the South African First Aid League or any other organization approved by the Chief Inspector (with CI Number) for that purpose should be utilized to train these individuals on First Aid at an intermediate Level.

The PC shall allow the subcontractor with less than 5 employees in their employ to use their first aid box if they are unable to provide their own. The PC shall provide first aid box for the treatment of occupational related injuries. The said first aid box shall be stocked with minimum contents instructed in the GSR. The First Aid Attendant assisted by the Construction Safety Officer shall keep a record or all incidents in which first aid treatment was administered together with any other incident described under section 24 of the Act.

23.7.10. Fire Fighters

The PC shall train enough employees in the use of firefighting equipment's. The Principal Contractor must do fire drills at intervals determined by him to ascertain the effectiveness of fire prevention systems in place.

23.7.11. Risk Assessor

The PC shall further appoint the Construction Safety Officer as a Risk Assessor. The person so appointed shall carry out baseline, continuous and issue based risk assessments and ensure that they are communicated to the workforce and that a record thereof is kept in the OHS file. The appointed person shall further ensure that the attached baseline risk assessment is considered in his/her risk assessments and are also communicated to the workforce and that the records thereof are kept in the OHS file.

All risk assessments shall be done in writing and approved by the Construction Manager by way of signature prior to be implemented on site.

Risk assessment shall be reviewed in case of accidents, near misses or incidents that had the potential to cause damage, fatal injury or severe environmental harm.

23.7.12. Incident Investigator

The person appointed as a Construction Safety Officer shall further be appointed as an incident investigator. The incident Investigator shall investigate and keep records of incidents and/or accidents arising in connection with activities of persons at work.

All section 24 accidents shall be reported to the Workman's Compensation Commissioner and the local DEL inspector within 7 days of them occurring. Such reporting shall be done in the prescribed WCL1 or WCL2 forms obtainable from http://www.labour.gov.za.

All section 24 incidents shall be investigated and recorded in a form similar to Annexure 1 of the General Administrative Regulations. This form shall after investigation, within 7 days be forwarded to the Provincial Director of the DEL in the jurisdiction where the incident occurred. Proof of submission to DEL shall be kept in the OHS file.

All accidents and incidents must be discussed at the health and safety committee meetings and solutions must be implemented to prevent their recurrence.

23.7.13. Emergency Coordinator

The PC shall appoint in writing a competent person in writing to act as an emergency response coordinator responsible for the coordination of all emergency operations on site. The person appointed should keep up to date emergency contact details of all authorities that might need to be contacted in case of emergency.

Emergency contact details shall be posted in a conspicuous place in the workplace to everyone's view.

The person so appointed together with CHSO must ensure that emergency evacuation drills are conducted at intervals determined by them.

23.7.14. Temporary Electrical Installation Controller/Inspector

The PC shall, in addition to compliance with Electrical Installations Regulations 2009 and Electrical Machinery Regulations (EMR), 1988, ensure that control of all temporary electrical installation on site is designated to a competent person appointed in writing.

The person so appointed shall be registered and possess credentials with ECA and DEL as an electrician.

23.7.15. Portable Electrical Tool Inspector

The PC shall appoint in writing a person in writing to act as portable electrical tool inspector.

The person so appointed shall ensure that each operator of a portable electrical tool inspect their tool prior to use and record all deviation in an inspection register. It shall remain the responsibility of this person together with the CHSO to ensure that deviations are rectified as soon as discovered.

23.7.16. Construction Vehicle Operator/Inspector

The PC shall appoint a person in writing with the duty of inspecting and operating a mobile equipment and/or construction vehicle. All operators shall be licensed/certificated and authorized to operate the type of construction vehicle or mobile plant.

No operator shall operate a construction vehicle or mobile plant other than the one they are trained and authorized on. It is a disciplinable offence to for operator to allow anyone to operate their construction vehicle without permission.

Passengers are not allowed on construction vehicle and mobile plant during construction operations.
All operators shall be medically examined and certified eligible to operate construction vehicle and mobile plant prior to operating such construction vehicle or mobile plant.

All operators shall conduct pre-start inspections of their construction vehicle or mobile plant prior to operating such equipment every day and records any findings in an inspection register.

23.7.17. Stacking And Storage Supervisor

The PC must ensure that in addition to compliance with provisions of the stacking of articles in General Safety Regulations, 2003, a competent person is appointed in writing with a duty of supervising stacking and storage on site.

23.7.18. Excavation Supervisor

The PC shall ensure that all excavation work is carried out under supervision of a competent person appointed in writing for that purpose. The PC shall ensure that every

excavation is inspected daily prior to the commencement of each shift, after every blasting operation, after an unexpected fall of ground, after damage to supports, after rain. The PC shall further ensure that all deviation in relation to the excavation are recorded in a register that must be kept in the OHS file.

23.7.19. Fire Equipment Inspector

The PC shall appoint a person in writing with the duty of inspecting all firefighting equipment on site. The person so appointed shall possess training in the use of firefighting equipment and keep up to date a register for inspection of all firefighting equipment.

23.7.20. Fall Protection Planner

The PC shall appoint a competent individual to prepare a fall protection plan. This person shall be trained in the appropriate QCTO qualification and be registered with the Institute for Work at Height as such.

In preparing the fall protection plan, the competent person shall ensure that the plan includes all elements as instructed in CR 10(2).

23.7.21. Confined Space Supervisor

The contractor shall appoint a competent full-time confined space supervisor to test and evaluate the safety of confined spaces and certify in writing that the confined space is safe and will remain safe.

23.6.22. Other Appointments

The principal contractor shall ensure that during any construction work or work associated with the aforesaid construction work to appoint competent employees as required by all legal and other requirements.

24. LEGAL TRAINING

Job specific training will include but not limited to as applicable:

1. Health and safety representative training
2. First Aid training
3. Firefighting training
4. Emergency evacuation controller training
5. Handling of dangerous snakes
6. Operate construction vehicles and mobile plants.
7. Hand tool training
8. Training in the use of PPE and its limitations
9. Fall prevention and protection training.
10. All other training was determined during the HIRAC process.
11. Scaffolding training
12. Temporary works training
13. Working in confined spaces training
14. Excavation inspection training
15. Training to use soil moisture and density gauges.
16. Using grinders
17. Using of Portable Electrical equipment
18. Use of welding and flame cutting equipment

19. Stacking and storage supervision training
20. Housekeeping training
21. Use of air monitoring equipment operation procedure

25. PERFORMANCE MONITORING AND MEASUREMENT

Planned Task Observations
The monitoring of the effectiveness of the risk assessments, safe work procedures and remedial and corrective actions measures taken after an accident or incident will be done by means of planned task observations. One PTO must be conducted weekly by Construction Manager, supervisors, safety officer and OHS reps.

General inspections
Pre-used, monthly, daily, quarter, bi-annual and annual inspections shall be conducted by the principal contractor and contractors as required as well as by legal and other requirements.All registers must be properly completed and signed by responsible personnel. Deviations identified shall be documented, reported, and actioned.

Audits

External audits and inspections
The Client/Client's safety agent shall in a month conduct one site verification inspection and one compliance audit. Detailed reports with pictures shall be generated and submitted to the contractor within seven days of the audit or the inspection. Two days after the audit or inspection the contractor shall issue the Client/Client's safety agent with a detailed action plan.

The action plan shall include but not limited to:

- Deviations identified.
- Corrective actions
- Preventative actions
- Responsible persons
- Due date

All action plans shall be signed by the appointed Construction manager and safety officer.

Internal audits
The principal contractor shall conduct monthly self-audits to identify gaps, shortcomings and to ensure continual improvement. The principal contractor shall conduct a monthly audit on all contractors. Action plans will be drawn up, discussed with subcontractors. Audit reports compiled during external audits, self-audits and audits on contractors shall be minted and discussed during the OHS committee meeting.

26. RISK ASSESSMENTS

Baseline and issue based risk assessments must be included in the OHS file and be communicated to all employees concerned. Risk assessments of all risk bearing activities identified in the scope of work shall form an integral part of the OHS file. All risk assessment shall be conducted in terms of an acceptable and documented methodology, prior to the commencement of work and in accordance with the provisions of the CR.
Precautionary measures must be communicated to all employees concerned and proof of such must be included in the OHS file. Risk assessments (baseline, continuous/ issue based) must be reviewed at regular intervals to grow with the experience of the project.

The PC must further develop Risk Assessment Monitoring and Review plan and ensure that the administration of all risk assessments on site are done in line with the expectations of these plans.

27. METHOD STATEMENTS AND SAFE WORK PROCEDURES

The PC shall ensure that the MS and SWP are developed and communicated for every key activity highlighted in the scope of work outlined under section 7 of this document.

28. REGISTERS, CHECKLIST AND FORMS

The following registers, checklist and forms must be maintained by the PC during the execution of works: -

Item	Legal Appointment	Regulation
1.	First Aid Dressing Register	GSR 3(6)
2.	First Aid Contents Checklist	GSR 3(2)
3.	Fire Equipment Checklist	CR 29(h)
4.	Portable Electrical Tools Checklist	CR 24(d)
5.	Construction Vehicle Checklist	CR 23(1)(k)
6.	Excavation Register	CR 12(2)(h)
7.	Stacking and Storage Register	CR 28(d)
8.	PPE Issue Register	GSR 2(2)
9.	PPE check register	GSR 2
9.	Annexure 1 Forms	GAR 9(1)
10.	WCL1/WCL2 Forms	GAR 8(1)(a)

Other checklists and registered as dictated by operations and health and safety imperatives.

FIRST AID DRESSING REGISTER
This register shall be completed whenever the first aid box is used and shall be maintained by the first aider. This register shall bear record of every accident (first aid case, near misses or section 24 accident) as the case may be.

FIRST AID CONTENTS CHECKLIST

This register shall be filled by the First Aiders as a way of monitoring the contents of the first aid box and of ensuring that it is up to date. The First Aid Attendant shall ensure that the first aid box is stocked in accordance to the Annexure of the GSR.

FIRE EQUIPMENT CHECKLIST

This register shall be filled monthly and maintained by the fire extinguisher inspector. The records thereof shall be kept in the OHS file.

PORTABLE ELECTRICAL TOOLS CHECKLIST

A register shall be kept for all portable electrical tools or tools prior to be handed to the workforce for usage. All defective tools shall be repaired or taken off site immediately.

CONSTRUCTION VEHICLE AND MOBILE PRE-START CHECKLIST

This register shall be filled daily and maintained by a construction vehicle or mobile plant operator. The records thereof shall be kept in the OHS file. All deviations identified must be dealt with as soon as discovered.

EXCAVATION REGISTER

The PC shall ensure that excavation records are kept and are up to date.
Method statement and safe work procedures shall be developed for all excavations that involve the use of explosives.

All excavation shall be barricaded, provided with signage and provided with a safe means of access within 6m of any worker.

STACKING AND STORAGE REGISTER

The PC must ensure that stacking and storage register is kept and always maintained. Materials must not be stacked in such a manner that vehicles moving nearby may compromise it. All deviations must be recorded in an inspection register, which must be kept in OHS file.

PERSONAL PROTECTIVE EQUIPMENT

The principal contractor and all contractors on site shall comply with OHS ACT requirements to provide PPE.

PPE Requirements

The principal contractor shall conduct a PPE survey and based on the risks identified and MSDS requirements provide employees with the correct PPE. The following PPE shall be mandatory on site.

- Overall, with company logo and reflectors
- Employees not wearing overalls – reflector vests.
- Safety shoes
- Hard hat

- Ear protection
- Safety goggles
- Dust Masks

A PPE issue register shall be completed for all employees. Employees must sign PPE issue registers as proof that PPE was received. PPE shall be issued as follows:

- Employees to receive training on the correct use, maintenance, and storage of PPE. Attendance registers to be completed as proof that training was received.
- PPE shall be checked monthly and recorded in the appropriate register.
- Procedure to be compiled and implemented to manage redundant PPE.
- Proper storage facilities shall be provided for the safekeeping of PPE.

SIGNAGE

Signage that will be considered and posted are as follows but not limited to:

Entrance

- Construction signs indicate construction is in progress, access is prohibited, and the required PPE is needed to access the site. Visitors to report to the site office.

Site office

Name, Surname, picture, and cellphone number of the following shall be displayed:

- First Aider
- SHE reps
- Emergency coordinator
- Fire fighters
- Safety officer

At the site office, the following information signs shall also be posted but not limited to:

- Location of the first aid box and the first aiders
- Location of fire extinguishers
- Location of emergency alarms.
- Toilets
- Eating areas
- Drinking water
- Walkways
- Assembly points
- Any other information signs required.

Stacking areas

Stacking areas shall be clear, visible, and barricaded with orange netting. No danger tape shall be used. Information signs, warning signs and prohibition signs shall be displayed at all stacking areas.

Construction areas

Based on the site conditions and risks identified the contractor shall ensure that all:

- Walkways and driveways are clearly visible.
- Emergency evacuation routes and assembly points
- Required warnings signs.
- Required mandatory signs.
- Required prohibition signs.
- All signage shall be inspected monthly.

Storing of HCS & flammable liquids

- Required warnings signs.
- Required information signs.
- Required mandatory signs.
- Required prohibition signs.
- All signage shall be inspected monthly.

ANNEXURE 1 FORMS

The PC shall when a section 24 accident happens cause such accident to be investigated by the person appointed as an incident investigator and cause the findings to be recorded in a form like Annexure 1 of the General Administrative Regulations.

All section 24 incident should be reported to client to the Client and the appointed OHS Agent within 7 days of them happening.

WCL1/WCL2 FORMS

The PC shall upon the happening of a reportable accident also complete both the WCL1 or WCL2 forms as a way of notifying Compensation Commissioner and the DEL. The employer shall keep all records of incidents in the OHS file for future scrutiny by relevant parties.

29. SITE ACTIVITIES

29.1 EXCAVATIONS

- Prior to excavation work commencing contractor will plan the works by investigation and Develop a method statement, risk assessment, safe working procedure and emergency evacuation plan in case of a collapse and communicate with employees.
- Competent excavation supervisor to be appointed in writing. Duties to be clearly specified.
- The designer must provide any known or anticipated danger or hazards relating to the construction work and make available all relevant information required for the safe execution of the work upon being designed or when the design is subsequently altered. The designers must refrain from including anything in the design of the structure necessitating the use of dangerous procedures to the health and safety of persons, which

can be avoided by modifying the design as specified in Construction Regulations 6(1)(d) and 6(1)(e)

- All excavations are to be inspected and declared safe daily, after adverse weather conditions or any conditions that might affect the excavation stability by a competent person. An excavation checklist to be specific to each excavation.
- DSTI to be completed and communicated with employees.
- Ladders used for access to be used not exceeding 6 meters from area where employees are working. Ladder to protrude at least one meter above landing.
- No plant, equipment, or material to move or to be stored/stacked in the zone of influence of the excavation. ***(Example if the excavation is two meters deep the zone of influence will be at least two meters)***
- Fencing to be consistent with the risk of the excavation, 1.6-meter fence,
- Fence to be designed to with stand possible wind loads at installation location.
- Installed fencing to be sited in a manner that mitigates the risk and restricts movement of public and vehicles for a prolonged period.
- Water is to be extracted, no water should be allowed to accumulate at any time.
- Due to the nature of these projects, there is a significant risk that fencing/ poles and signage will be stolen daily. This can expose the public to various hazards and risks. The contractor shall develop daily reports including pictures (indicating the date and time) before and by the end of each day.
- Contractor to maintain a schedule of all excavations and the activities to be signed off by the Construction Manager and the Resident Engineer.
- Excavation work is to be planned and backfilled within reasonable time, any excavation that will remain open for a period longer than 5 days should be communicated to the client and client's agents. Communication should include the following:
  - Reason for the delay in completing the work.
  - Controls that will be implemented to manage safety of public.
  - Any reason why the excavation cannot be backfilled and opened when work can be completed.

A contractor shall:

- Ensure that all excavations work is carried out under the supervision of a competent person who has been appointed in-writing for that purpose: and
- Evaluate, as far as it is reasonably practicable, the stability of the ground before excavation work begins.

A contractor who performs excavation work-

- Shall take reasonable and sufficient steps in order to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation.
- May not require or permit any person to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where-
  - The sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or

- Permission has been given in writing by the appointed competent person contemplated above upon evaluation by him/her of the site conditions; and
- Where any uncertainty pertaining to the stability of the soil still exists, the decision from a professional engineer or a professional technologist competent in excavation is decisive and such a decision shall be noted in writing and signed by both the competent person and the professional engineer or technologist.

- Shall take steps to ensure that the shoring or bracing contemplated above is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question.
- Shall ensure that no load, material, plant, or equipment is placed or moved near the edge of any excavation where it may collapse and consequently endanger the safety of any person, unless precautions such as provision of sufficient and suitable shoring or bracing are taken to prevent the sides.
- Shall ensure that where stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons:
- Shall cause convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six meters from the point where any worker within the excavation is working.
- Shall ascertain, as far as is reasonably practicable, the location and nature of electricity, water, gas, or other similar services which may in any way be affected by the worked to be performed, and must before commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all bracing and shoring, is inspected:
- Shall ensure that every excavation, including all bracing and shoring, is inspected.
  - Daily, prior to commencement of each shift.
  - After an unexpected fall of ground
  - After damaged to supports.
  - After rain; and
  - When there is a leak or the excavation is filled with water.
  - By the competent person, in order to ensure the safety of the excavation and of persons, and those results shall be recorded in a register kept on site and made available on request to an Inspector, Client, the Client's Safety Agent, any other contractor or any employee.
- Shall cause every excavation which is accessible to the public or adjacent to the roads or thoroughfares, or whereby the safety of persons may be endangered, to be
  - Adequately protected by fence or steel corrugation of at least 1.6 meter in height and as close to the excavation as is practicable; and
  - Provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor, or have resort to any other suitable and sufficient precautionary measure where this is not practicable:
  - Regularly pump out the water filling the excavation as practicable as possible.
  - Provide security after hours and 24/7 over the weekends and holidays.
- Shall ensure that all precautionary measures stipulated for confined spaces as determined in General Safety Regulations, 2003 are complied with by any person entering any excavation;

- Where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and shall ensure that a method statement is developed by that person in accordance with the applicable explosive's legislation; and
- Shall cause warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections

Bedding and backfilling

- Method statement, risk assessment and SWP to developed and communicated with employees.
- Competent excavation supervisor to be appointed in writing. Duties to be clearly specified.
- The designer must provide any known or anticipated danger or hazards relating to the construction work and make available all relevant information required for the safe execution of the work upon being designed or when the design is subsequently altered. The designers must refrain from including anything in the design of the structure necessitating the use of dangerous procedures to the health and safety of persons, which can be avoided by modifying the design as specified in Construction Regulations 6(1)(d) and 6(1)(e)
- All excavations are to be inspected and declared safe daily, after adverse weather conditions or any conditions that might affect the excavation stability by a competent person. An excavation checklist to be specific to each excavation.
- DSTI to be completed and communicated with employees.
- Ladders used for access to be used not exceeding 6 meters from area where employees are working. Ladder to protrude at least one meter above landing.
- No plant, equipment, or material to move or to be stored/stacked in the zone of influence of the excavation. (Example if the excavation is two meters deep the zone of influence will be at least two meters)
- Employees to use the correct PPE.
- Regular checklists to be completed for compactors and hand tools.

29.2 CONTRUCTION VEHICLES AND MOBILE PLANT

The PC shall ensure the following in relation to excavation: -

- That all Construction Vehicle and Mobile Plant operators are certificated, appointed in writing, medically screened and authorized.
- That daily pre-start inspections are done and recorded.
- That all construction vehicles and mobile plant are equipped with a reverse acoustic warning device and orange lights.
- That "Construction Vehicle" signage is affixed on every construction vehicle and mobile plant.

29.3 LIFTING MACHINES AND LIFTING EQUIPMENT

Lifting Machines

- All lifting machines are to be constructed in accordance with acceptable technical standards.
- Ensure safe workloads are conspicuously displayed, identification plates are displayed.
- Ensure that it has at least three full turns of rope on the drum.

- Obtain load test certificates not exceeding 12 months and ensure that it is up to date and still valid.
- Full-service history records to be obtained.
- Crane operators and riggers to be appointed in writing.
- Competency certificates and medical certificates of fitness to be verified.
- Operators must be specifically trained to operate a particular lifting machine.
- Operators must be in possession of a certificate of training issued by a training provider accredited at the Transport Seta.
- Generate inspection registers for all lifting machines. All lifting machines to be inspected before use. Inspection checklist to be completed and signed by the operator and supervisor.
- Deviations or defects to be reported immediately and rectified. If that is not possible lifting machines have to be removed from site until fully compliant.
- *Lifting Machinery to comply with all SANS standards.*

Lifting Equipment

- All chains and ropes that form part of the load path of the lifting machine have a factor of safety provided to the standard to which the machine was manufactured.
- Hooks or any other load attaching devices shall be designed or proportioned so that accidental disconnection cannot take place.
- Verify that ropes, chains, hooks, other attaching devices, sheaves, brakes, and safety devices went through a thorough examination by a competent person not exceeding six months.
- Generate registers for all lifting equipment.
- Place all lifting equipment on registers with serial numbers and test certificates.
- All lifting equipment to be inspected before use.
- Inspection checklist to be completed and signed by the operator and supervisor.
- Damaged lifting equipment to be removed from site immediately.

Lifting operations

- Method statement, risk assessment and SWP to be developed and communicated with employees.
- Crane operators and Competent riggers to be appointed in writing.
- Crane radius and slew path correctly designed and restricted where required.
- Depending on if excavations is battered or shored the contractor must indicate a safe working distance to prevent any load, material, plant, or equipment is moved or placed on the edges of the excavation. Generating inspection registers for lifting machines and equipment.
- DSTI to be conducted and communicated with employees.
- All lifting activities to be controlled by competent riggers.
- Areas where lifting activities are taking place are to be barricaded. Access to be restricted.
- No employees to work/walk under suspended loads.
- Crane operator and rigger to use two-way radio for communication. Two assistants used on both sides of the 12-meter pipes with guide ropes to prevent swinging of pipes.

- Mobile cranes or hi-ab trucks shall be operated by persons who are certificated, appointed in writing and authorized.
- Mobile crane operator shall have a valid medical certificate of fitness.
- Load test certificates of the mobile crane must be made available.
- Chain slings and lifting tackles used in the lifting operation must have valid certificates and be inspected 3 monthly.
- No one should be allowed to stand under suspended loads.
- No one should be allowed to work near lifting operation without wearing PPE necessary for the work being undertaken.

29.4 MANUAL HANDLING

The following shall be observed in relation to manual handling: -

- Employees shall not be permitted to lift items that are too heavy or 50kg and above in weight. Two or more employees must lift heavier objects.
- When lifting items employees shall be encouraged to bend their knees ensuring that back muscles are relaxed.

29.5 PORTABLE ELECTRICAL TOOLS

The following shall be observed in relation to portable electrical tools: -

- Employees shall not be permitted to use portable electrical tools unless such employees have received either formal or informal training with respect to such tools.
- No portable electrical tools should be used before being inspected and deviations recorded in an inspection register.

29.6 HAND TOOLS

The following shall be observed in relation to hand tools: -

- Employees shall not be permitted to use hand tools unless such employees have received either formal or informal training with respect to such tools.
- No portable hand tools should be used before being inspected and deviations recorded in an inspection register.

29.7 SCAFFOLDING

All scaffold erected on site must be in full compliance to SANS 10085:2025 No scaffold should be used unless such scaffold has attained full compliance with the said standard after erection. All scaffolds must be tagged and inspected daily by scaffold inspectors prior to use. All employees who are tasked with the erection of scaffold should be trained and appointed in writing.

29.8 LADDER USE

No defective ladders must be used on site. All defective ladders must be taken off site immediately. No ladder must be used without first being inspected for suitability of use. All deviation of the ladder must be recorded in an inspection register.

29.9 NUISANCE

The PC shall ensure that no hindrance, hazard, annoyance or inconvenience is inflicted on anyone. Where such situations are unavoidable, the PC shall give prior notice to the Client.

29.10 HOUSEKEEPING, STACKING AND STORAGE

The following shall be observed in relation to housekeeping, stacking and storage: -

- Proper storage of material must be provided,
- Scrap and waste must be removed off site at regular intervals. Unwanted materials must not be allowed to accumulate on site.
- Storage areas must be demarcated.
- Stacks must not be in any danger of collapsing.

29.11 CONFINED SPACE

- Specific method statement, risk assessment and SOP to be generated and communicated with employees.
- A competent person to be appointed to evaluate the air in a confined space.
- The air monitor to be used should be able to detect all gasses likely to be present inside the confined space.
- Air monitor should be operated by a trained person using calibrated monitor recording the findings and following the works procedure outline in the contractors confined space procedure.
- Confined space ventilation by means of dilution/ extraction ventilation.
- All employees working in confined spaces are to be trained in confined spaces.
- A permit to access confined spaces must be obtained from the PC before commencing any work inside a confined space.
- A detailed emergency evacuation plan to be developed in case of an emergency inside a confined space.
- Before entering a confined space all rescue equipment to be present (Confined space harness, trypot and pully and communications).
- The Contractor to comply with all the requirements as specified in the GSR 5.
- No employee from the client, contract managers, engineering consultants or OHS consultants or any other employees shall enter confined spaces before the air was tested and was declared safe by the confined space supervisor.
- The confined space supervisor to supervise work at point of entry.

30. EMERGENCY PLANNING AND RESPONSE

Pre-Emergency Planning

The PC shall appoint ERC together with the appointed OHS Officer shall perform the applicable pre-emergency planning tasks before starting construction activities and coordinate emergency response with onsite parties, the facility, the local emergency service providers as appropriate. Pre-Emergency Planning activities performed by the ERC shall include: -

- Review the emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (two-way radio, cell phones, air horn)
- Determine what offsite communication equipment is needed (nearest telephone, cell phone)
- Confirm and post the “Emergency Contact Numbers “page on the notice boards, communicate the information to onsite personnel and keep it updated.

- Post “Exit” signs above exit doors, and post “Fire Extinguisher signs above locations of extinguishers. Keep area near exist and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated type of site emergencies.
- Inventory and check site emergency equipment, supplies and portable water.
- Communicate emergency procedure for personal injury, exposures, fires, explosions, and releases.
- Rehearse emergency response plan before site activities begin. This may include actual drill depending on the nature and complexity of the project.
- Brief the new employees on the emergency action plan.
- The ERC shall evaluate emergency response actions and initiate appropriate follow up actions.

Incident Response

In fires, explosions and chemical releases, actions to be followed shall include the following: -

- Notify appropriate response teams.
- Shut down the operations and evaluate the immediate work area.
- Account for personnel at the designated “Assembly Point”
- Assess the need for site evacuation.
- Conduct incident notification, reporting and investigation as instructed by legislation.
- Notify and submit reports to clients as required by the contract.
- Small fires and spills posing minimal safety or health hazards may be controlled with onsite spill kit or fire extinguishers without evacuating site.

Emergency Medical Treatment

Emergency medical treatment is needed when there is life-threatening injury (such as severe bleeding, loss of consciousness, breathing of heart has stopped). In case of medical emergency, the ERC assisted by the appointed OHS Officer shall: -

- Notify 112 or other appropriate emergency response authorities as listed in the Emergency Contacts” page located in this section.
- The ERC shall assume charge during medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Make certain that the injured person is accompanied to the emergency room.
- Notify and submit reports to your employer as required in the contract.

Emergency Evacuation

The following procedure shall apply as far as evacuation is concerned; -

- Evacuation routes, assembly points, and severe weather shelters are to be specified in the site map.

- Evacuation routes and assembly points shall be will be designated by the ERC before work begins.
- Personnel shall assemble at the assembly point upon hearing the emergency signal for evacuation.
- The ERC and a OHS Officer shall remain on site after the site has been evacuated (if safe) to assist the local responders and advise them of the nature and the location of the incident.
- The ERC will account for all personnel in the assembly point.
- The ERC will follow the incident reporting procedures as per contract with client and legislation.

Incident/Accident Management

The following shall be noted in relation to incident management: -

- All first aid cases must be reported and recorded in a first aid dressing register. Similar first aid cases that happen three times shall be fully investigated. Causes of such cases must be established and an incident recall should be applied.
- All near miss cases shall be reported and recorded.
- All section 24 incidents or accidents shall be investigated by the appointed Incident Investigator and records thereof shall be entered in an Annexure 1 of the GAR.
- The DEL should further be notified in writing of any Section 24 accident.
- The OHS Agent shall be immediately notified and be provided with a preliminary report of any section 24 incidents.
- In any incident the Incident investigator shall establish a); the cause of the accident; b) determine measures that must be taken to prevent recurrence of similar accidents; c) inform employees on measures undertaken to prevent similar accidents from happening again through an incident recall exercise.
- The Compensation Commissioner and DEL should further be notified in a form of WCL1 or WCL2 of such accident within 7 days of the happening of the accident.

Record keeping

The following records but not limited to should be kept up to date and available for inspections and audits.

- Up to date incident register
- Up to date dressing record
- WCL 1 & 2 forms
- Incident investigation forms with supporting documents: supporting documents shall include but not limited to:
  - Method statement
  - Risk assessment
  - Safe working procedures
  - Any plans, policies, procedures, monitoring plans about the involved activity.
- Incident recall schedule / incident recall
- Annexure 1, incident investigation forms and all supporting documents shall be kept for at least 3 years.
- Incident statistics / trends: trends to form part of the OHS committee meeting minutes and displayed on notices boards.
- Incidents recorded and statistics should also form part of the monthly report.

Control of documents

The principal contractor shall establish a process for the compilation, distribution, control, and disposition of all documents, which are part of the company's Health and Safety Management System. The principal contractor shall also establish a process for the identification, filing, indexing, storage, safeguarding, retention, and disposal of H&S MS records.

- All non-operational documents must be kept in the file and marked with a stamp as superseded.
- All operational documents must be kept in the file and marked with a stamp as approved.

Documents that have been revised may not be removed from safety files. Revised documents to be maintained in order according to the revision numbers

31. TOOLBOX TALKS AND DSTI

DSTI shall be administered every morning before the commencement of construction activities. Toolbox talks shall be conducted once a week based on topical health and safety issues on site. The Toolbox Talks and DSTI shall be documented and proof of communication with employees shall be kept in the OHS file.

32. TRAFFIC MANAGEMENT

The risks of all traffic arrangements included in the scope of work shall be assessed and a traffic management plan shall be developed. Where the need for traffic deviation is identified in the risk assessment, the PC shall perform an issue-based risk assessment and document a SWP compliant with the relevant traffic ordinances and traffic control standards. The method statement shall include the competency of traffic officers, flagmen and operators of traffic control equipment. Appropriate traffic management signage and infrastructure must be installed where required.

Traffic Accommodation

The principal contractor shall be responsible for the safe control of traffic on construction sites and public roads. The requirements of the South African Road Traffic Act (Act 93 of 1996) and the National Road Traffic Regulations (2000) as well as the requirements of the relevant authorities shall be always complied with particular attention to signage and flagmen.

A traffic management plan shall be developed, implemented, and reviewed as the project progresses. The plan shall include but not limited to:

- Introduction
- Licensing / Roads / Maintenance
- Routing of traffic / speed limits and signs
- Pedestrians and passenger safety
- Transport of equipment and materials
- Emergency response and identifying significant hazards.
- Review of the plan.

- Traffic control plan

The principal contractor shall ensure that:

- Driveways are properly demarcated.
- Signage to be used – Inspections on signs to be conducted weekly.
- Speed limits should clearly be indicated and displayed.
- Employees shall be trained in the traffic management plan and traffic management risk assessment.
- Traffic adheres to speed reductions and warning signs.
- Flagmen / Women to be appointed and to receive appropriate training.
- Flagmen / Women to reduce speed of vehicles. Visibility is essential!

Due to the nature of these projects the contractor shall manage the interaction between construction sites.

33. HEALTH AND SAFETY REPRESENTATIVES

The PC must appoint one health and safety representatives for every 50 employees employed. When the number of employees exceeds 100, another health and safety representative must be appointed.

The core duties of health and safety representatives shall be as follows: -

- To review the effectiveness of health and safety measures.
- To identify major hazards and major incidents.
- To investigate health and safety related complaints.
- To advise the health and safety committee and the PC.
- To take part in the investigation of incidents.
- To conduct monthly health and safety inspections and report to the health and safety committee platform for actions.

The PC shall further ensure that the appointed health and safety representatives are resourced to enable them to perform their function as effectively as possible.

34. HEALTH AND SAFETY COMMITTEE

Where more than one health and safety representative have been appointed the PC shall further ensure that health and safety committee meetings are established. All health and safety representatives are automatic members of the health and safety committee. Other members of the health and safety committee shall be appointed in writing as such.

The OHS Officer shall chair the health and safety committee.

Coherent health and safety committee minutes shall be produced and signed off by the Construction Manager.

The health and safety committee meeting shall meet on the monthly basis and deliberate on health and safety issues prevalent to site at the time including the closure of audit findings by the OHS Agent.

The health and safety committee shall be proactive and be the driving force behind the closure of deviations as identified on site from time to time. It shall be the core function of the health and safety committee to understand the cause of incidents at the workplace and apply whatever necessary measures to curb incidents and accidents.

All resolutions and decisions of the health and safety committee must be implemented without fail.

35. FACILITIES

35.1 PUBLIC HEALTH AND SAFETY

In the interest of public safety, the PC shall ensure that all persons who may be affected by construction activities are informed and kept aware of all dangers that could emanate from the works. This awareness shall be in the form of posters, warning signs and inductions. Members of the public shall not be allowed on site unless managed as an official visitor to site.

35.2 SANITARY FACILITIES

A sufficient number of male and female sanitary facilities shall be made available on the site. SABS approved signs must be posted at the entrance of sanitary facilities to indicate the gender of a person for whom the facility is intended. All sanitary facilities must be kept clean and hygienic.

Toilet paper, a cleansing agent and paper towel must be provided near the sanitary facility. Clean water for washing hands must be provided as well.

35.3 CLEAN DRINKING WATER

Clean drinking water must be provided on site. SABS approved signage must be posted up near the installation to indicate the location of clean drinking water.

35.4 EATING PLACE

The PC must erect a structure to be used as eating-place to be utilized by all employees on site. The eating-place shall be kept as clean as possible to allow for an environment that is conducive to human occupation. Eating/resting facilities shall be weather proof and provide suitable shade.

35.5 FACILITIES FOR SAFEKEEPING OF PERSONAL GOODS

The PC shall provide all employees with personal lockable facilities for safekeeping of personal goods. It shall remain the responsibility of the PC to ensure that these facilities are in a good state of repair.

35.6 EQUIPMENT TRANSPORT TO SITE: DELIVERY AND OFFLOADING

- Dedicated designated off-loading areas to be established and demarcated. Signs to be displayed to indicate offloading areas.

- Vehicle roadworthiness tested. Insurance for damage/ loss of loads to be in place. Required PDP and licenses obtained for all delivery vehicles. Competent driver to be assigned. Competencies to be verified.
- Loads to be always secured.
- Vehicles to be serviced/ maintained. Copies of maintenance records to be kept on site.
- No Overloading to be allowed on site.
- Loads to be always balanced.
- Traffic Management Plan to be implemented. Speed limit to be obeyed.
- Equipment to be offloaded by competent, assigned staff.
- Lifting Equipment use, as per legal requirements.

36. ENVIRONMENTAL CONSIDERATIONS

36.1 POLLUTION

The following must be observed in as far as pollution is concerned: -

- Any negative impact to the environment by any action undertaken during construction works must be eliminated or minimized.
- Waterways shall not be contaminated.
- Oil must not be spilled on the ground.
- HCA must be disposed off in accordance to acceptable disposal norms.
- Unnecessary noise pollution must be avoided.
- Natural resources must be used efficiently, and biodiversity must be conserved throughout the life of this project.

36.2 RESOURCE USE

Consideration must be given to the following: -

- Waste minimization
- Energy and water efficiency
- Prevention of water and soil contamination
- Management of air emissions.

37. HAZARDOUS CHEMICAL AGENTS

The PC must ensure that all chemicals are handled in a manner that will not pose danger to employees, members of the public or our natural environment.

SDS must be in place for all chemicals used on site. List of all chemicals in use must be posted up or included in the OHS file.

The transportation of HCA shall comply to SABS 072 or SABS 228 code of practice. All flammable chemicals shall be stored in a dedicated flammable liquid store that must be constructed with a bund capable to hold 110% of the anticipated of quantities to be stored.

The flammable liquid store must be provided with the following signage: -

- “No Cellphone Use”

- “No Naked Flames”
- “No Smoking”
- Quantity of liquid that may be stored

38. CIVIL CLAIMS

Nothing contained in or omitted in this Health and Safety Spec shall relieve the PC of any liabilities or obligations. The client shall not be liable for any civil claim because of anything contained in or omitted from this document.

BASELINE RISK ASSESSMENTS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
CONSTRUCTION														
PROCESS														
1.	**Sequencing of construction process**	The sequencing of the construction process. Safest possible way of construction, allowing enough space, in	Too many people on site, too much activity leading to congestion and incidents. Lack of co-ordination. Collision Property damage	**SHE**	**4**	**3**	**12**	Designer and PC to ensure construction scheduling considers limited space on site, Project team and PC to manage subcontractor engagement	**4**	**1**	**4**	Designer PM, CHSA, PC 16(2), CR 8(1)		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		"live/ active" plant												
2.	**Principal contractor procurement services and vetting**	Incompetent, no letter of good standing, no adequate resources, not provided for cost of H&S measures, no safety plan, no safety file,	Construction work of inferior quality (even collapse thereof). Injured workers not receiving proper medical care. Construction project not completed. Incidents accidents and property damage due to lack of funds or equipment. Breach of laws/ regulations, no H&S	**SHE**	**2**	**3**	**6**	Provide contractors with relevant section of H&S specification, ensure contractor safety files are legally compliant, stop unsafe work executed	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		safety plan not approved,	commitment, no safety system to eliminate/ mitigate unsafe acts or conditions.					by contractors, provide induction training for all on site, secure access to site, ensure contractors are in good standing with the compensation commissioner, keep safety records updated. EHS Vendor requirements to adhere to.						

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
3.	**Competency of site management**	Unskilled management	Non- Compliance to Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed.	**SHE**	**2**	**3**	**6**	Legal Liability training and awareness program implemented. Implement Safety and Health Management Plan. Risk Communication and Awareness strategy implemented.	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
4.	**Legal Authority, Roles and Responsibilities and Accountability**	Major non-conformance to Legal Requirements	Non- Compliance to Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed.	**SHE**	**2**	**3**	**6**	Manage and supervise tasks and operations. Discipline where required. Manage H&S systems and records.	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		
PEOPLE														
5.	**Incapability**	Not medically fit as per Legal Requirements	Incapability. Not fit for work (medical and Psychological)	**SH**	**3**	**3**	**9**	Implement Medical Surveillance Program. Annexure 3 medical certificates by	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Registered OMP obtained and kept on file.						
6.	**Using unskilled workers**	Incompetency	Non- Compliance with Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed. Sub-standard work	**SH**	**3**	**3**	**9**	Manage and supervise tasks and operations. Do in-house training with new employees where required. Manage H&S systems and records. Discipline	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								where required.						
7.	**Compulsory community labour use**	Disputes, riot, picketing, arson, vandalism.	Non- Compliance with Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed.	**S**	**4**	**3**	**12**	Dispute resolution, training, awareness, supervision and security.	**4**	**2**	**8**	PM, CHSA, PC 16(2), CR 8(1)		
8.	**Employee Transport**	Accident to/ from site	Personal injury, damage to vehicles, public liability insurance. Under influence of intoxicating substances.	**S**	**4**	**3**	**12**	Comply to NRTA. People not transported together with equipment. Random substance abuse checks.	**4**	**1**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Vehicle condition checks. Regular maintenance on vehicles						
9.	**Employee Access**	No/Inadequate access control Intoxicated	Personal injury	**SH**	**4**	**3**	**12**	Testing, inspection for drugs, alcohol, substance abuse. Disciplinary procedure.	**4**	**2**	**8**	PC		
10.	**Ergonomics-Physical**	Repetitive motion, body positioning, physical stresses	Cumulative trauma disorders such as: carpal tunnel syndrome, Tendonitis, Tenosynovitis, tennis	**HS**	**3**	**4**	**12**	Ergonomic risk assessment, training, environmental monitoring,	**2**	**3**	**6**	PM, CHSO, workers,		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		(ventilation, vibration, temperature extremes, noise, illumination, radiation), heavy lifting	elbow, trigger finger, lower back pain. Fatigue, overexertion, respiratory diseases					medical surveillance, effective PPE incl. impact absorbing gloves, jackets, efficient hearing protection, work places properly illuminated.				CHSA, OHSA 16(2), CR 8(1)		
11.	**Ergonomics - Organisational**	Psychosocial factors (long hours due to excessive travelling	Unhealthy coping behaviour (drinking, smoking, other drug use, deteriorating family relationships) unhealthy work morale, negative	**H**	**3**	**3**	**9**	Ergonomic risk assessment to address these elements, ensure travelling time	**2**	**2**	**4**	Sec 16(2), CR 8(1), PM,		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		time, stress due to threats to work security, management style) Cognitive factors (not understanding the work and relationships, not properly trained, new equipment and procedures) Organisational factors (not	culture, insubordination, no time for relaxation leading to excessive behaviour, exhaustion, alcohol abuse, sabotage					is reasonable, establish clear communication and reporting channel, maintain stable organisational structure as far as possible, ensure open communication channels, ensure workers are competent and properly orientated to				CHSO, CHSA		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		clear line of communication/ command, contradictory commands, unstable organisational structure, job security)						their scope of work						
EQUIPMENT														
12.	**Equipment Transport to site. Delivery and Off-loading.**	Road accidents, off-loading accidents	Loss of material/ equipment. Personal injury, damage to vehicles, public Liability insurance. Under influence of intoxicating substances	**S**	**3**	**3**	**9**	Load secured. Vehicles serviced/ maintained. No Overloading. Loads balanced.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Traffic Management Plan to be implemented. Speed limit obeyed. Equipment to be off loaded by competent, assigned staff. Lifting Equipment use; as per legal requirements. Supervision.						

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
13.	**Stacking and Storage**	Un-levelled laydown areas, unsafe height/ width ratio, laydown/ rubble areas not demarcated, unsafe stacking/ tools at work area, tripping hazard, unsafe Hazchem storage, unsafe storage of	Damage to equipment/ material/ property. Personal injury to workers/public, fire	**S**	**3**	**3**	**9**	Stack material properly. No stacking allowed outside the planned laydown area. Control delivery and off-loading. Follow manual handling safety rules.	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		flammable material												
14.	**Construction Vehicles and Plant**	Unauthorised operators, operators not trained, vehicles not suitable for the job, vehicles not road worthy, vehicles on site not accompanied by flagmen, vehicles	Vehicle accidents, Vehicles colliding into structures, vehicles hitting pedestrians on site, noise, pollution	**SE**	**4**	**3**	**12**	Flagman to control traffic to and from site entering public roads. Required PPE including high visibility vests to be used. Regular maintenance on mobile plant. Use drip trays to prevent	**4**	**1**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		operating in public areas						pollution. Practice dust allaying where relevant. Demarcate roadways and separate walkways. Control vehicle speed. Traffic management plan to be implemented.						
15.	**Use and operate Portable Electrical Equipment**	Hand-arm vibration. Noise. Equipment failure. Electrical	Electrical shocks, Severe injuries, noise induced hearing loss, respiratory problems (Silicosis in lungs). Ergonomic injury. Environmental pollution	**S**	**4**	**3**	**12**	Checklist and/or registers to be completed regularly by competent	**4**	**1**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		shock. Cracked housing. Unsafe cables. Unsafe operating practice.	Cuts, bruises, Amputations of limbs/ body parts					staff. All Portable Electrical Power Tools to be maintained and/or repaired by a competent person. Required PPE to be used. Comply with relevant regulation requirements. Noise and Dust be controlled at source to						

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								mitigate risk exposure to surrounding and plant areas						
16.	**Use and operate Hand Tools**	Hand-arm vibration. Noise. Cuts bruise, Amputations of limbs/ body parts. Equipment failure. Cracked and chipped (mushroomed) tools,	Injuries, noise induced hearing loss, respiratory problems (Silicosis in lungs). Ergonomic injury.	**S**	**3**	**3**	**9**	Checklist and/or registers to be completed regularly by competent staff. Required PPE to be used. Comply with relevant regulation requirements.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		Unsafe operating practice. Wrong/incorrect tools for task used.						**NO Stanley (Utility) knives allowed.** Chisels shall not be used when "mushroom headed" and removed off site. No "home-made" tools allowed.						
17.	**Use and operate Explosive fastening**	Incompetent operator. Hand-arm vibration/	Severe injuries, noise induced hearing loss, respiratory problems (Silicosis in lungs).	**S**	**3**	**3**	**9**	Operators must be competent to use the	**3**	**1**	**3**	PM, CHSA, PC		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
	devices/ Power Tools	shock. Noise. Equipment failure. Unsafe operating practice. Wrong, Incorrect tools for task used. Uncontrolled cartridges.	Ergonomic injury. Explosion/ fire. Cuts bruises, Amputations of limbs/ body parts.					equipment and be formally trained to use the explosive fastening device. All equipment must be inspected daily and results recorded. Explosive cartridges for the explosive device must be controlled and locked in a safe. Unsafe equipment				16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								must be withdrawn from service. Required SANS/ UN or EN standard PPE to be used. Noise and Dust be controlled at source to mitigate risk exposure to surrounding and plant areas						

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
18.	**Temporary Electrical Installations**	Electricity	Electrical shocks, Severe injuries (burns). Fires	**S**	**3**	**3**	**9**	Lock-out procedure complied with when installing temporary BD. When fully installed make BD live taking precautionary measures so as not to electrocute anybody. Certificates of Compliance completed for DB's. Weekly inspections. Install flash	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								plates. Installation checked by Competent Person.						
19.	**Compressed Air (Pneumatic Equipment) Tools (Pressurised Equipment)**	Excessive noise, compressed air injury (pepper wounds). Dust and Air pollution. Flushing using hoses. Hose bursts (snaking).	Personal Injuries, eye injuries, noise induced hearing loss.	**SH**	**3**	**3**	**9**	No compressed air to be directed to person. Equipment registers to be maintained. Equipment / hose links (Chicago couplings)	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								secured with safety slings. Noise and Dust be controlled at source to mitigate risk exposure to surrounding and plant areas Minimise dust liberation when using compressed air. Use required PPE when working with						

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								compressed air.						
STRUCTURES														
20.	**Excavations**	Unstable soil condition. Placing load on excavation edge, mobile plant movement, not inspecting excavation condition, not barricading edges.	Collapse of excavation, inundation of persons, mobile plant falling into excavation. Property damage. Fatal injury to person/s. persons falling into excavation causing injury	**S**	**3**	**3**	**9**	Shore and brace or batter excavation, use retaining wall or equivalent for permanent safety. Barricade edges of excavation. Provide quick	**3**	**1**	**3**	PM		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								egress out of excavation. Backfill excavations without undue delay. Complete the excavation register daily and after rain or other flooding of excavations. Competent person to declare it safe for usage.						

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
21.	**Columns**	Unsafe installation. Unsafe Access scaffold. Incompetent installers and inspectors. Unsafe design. Unsafe behaviour. Failure of equipment and material. Not using PPE (Safety harness).	Falling to lower elevation, temporary structure collapsing/falling over, falling onto. Falling down.	**S**	**4**	**3**	**12**	Comply to SANS 10085. Implement the fall protection plan. Work from "safe" scaffold only. Use required PPE. Where possible use lifting equipment to lift formwork in place and hold it until installed/ dismantled for removal.	**4**	**1**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
22.	**Temporary works**	Not using fall protection equipment, unstable structure, objects at height, no safe access, unsafe design, and failure of equipment / material.	Falling to lower elevation, temporary structure collapsing/falling over, falling onto. Falling through. Falling down.	**S**	**5**	**3**	**15**	Installation to be done under the supervision of a competent person. Erectors to be competent. Material and equipment (scaffold/ formwork comply SANS 10085. PC Safety and health Plan implementation.	**5**	**1**	**5**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
23.	**Concrete placement**	Wet concrete, repetitive movements, cement dust, hazardous chemical, polluting environment. Heavy lifting, lifting to higher level. Struck by uncontrolled power float	Concrete (chemical burns). Inhalation of cement, silicosis, dermatitis. Muscle strain. Environmental pollution.	**S**	**3**	**3**	**9**	Correct PPE worn. Rest periods/ person rotation. Trained persons to use power floats. Inspect and complete the checklist.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
24.	**Steel Beams, rafters**	Unsafe installation. Incompetent installers and inspectors. Unsafe design. Unsafe behaviour. Failure of equipment and material. Not using PPE (Safety harness).	Falling to lower elevation, temporary structure collapsing/falling over, falling onto. Falling down.	**S**	**5**	**3**	**15**	Implement the fall protection plan. Work from scaffold only. Use PPE and lifeline where required. Where possible use lifting equipment to lift steelwork in place.	**5**	**2**	**10**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
25.	**Roofing; Trusses and roof sheeting**	Unsafe installation. Incompetent installers and inspectors. Unsafe design. Unsafe behaviour. Failure of equipment and material. Not using PPE (Safety harness). No lifeline.	Falling to lower elevation, temporary structure collapsing/falling over, falling onto. Falling through. Falling down.	**S**	**5**	**3**	**15**	Roof work inspected daily and after inclement weather. Implement fall protection plan. Work from already placed sheeting as a platform. Have equipment for fall rescue plan available for use. Under Supervision. No "beam crawling".	**5**	**2**	**10**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Secure Full body safety harness. Life line where working on roof installing sheeting as per Best Practice for lifelines.						
26.	**Wet trades**	Wet concrete, epoxy. Repetitive movements, dust, hazardous chemical, polluting environment.	Inhalation of cement, silicosis, dermatitis. Muscle strain. Environmental pollution. Cuts, bruises.	**SE**	**3**	**3**	**9**	Correct PPE worn. Rest periods/ person rotation. Trained persons to use power floats. Inspect and	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		Heavy lifting, lifting to higher level.						complete the checklist.						
27.	**Tie-in plumbing, storm water, electrical services**	Tie-in done by incompetent person/s. Damage to existing services. Damage done to council installations	Injury to person/s. Extensive damage to equipment and property	**S**	**4**	**3**	**12**	Ensure lockout, where applicable is done. Ensure, where applicable lockout is functional. Competent person/s supervise tie-in. Do tests to	**4**	**1**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								ensure tie-in is correctly completed. Remove lockout.						
28.	**Working at Fall Risk Positions**	Unsafe installation. Incompetent installers, inspectors. Unsafe design. Incompetent users. Unsafe behaviour. Failure of equipment,	Falling to lower elevation, temporary structure collapsing/falling over, falling onto. Falling through. Falling down.	**S**	**5**	**3**	**15**	Registers to be completed at regular intervals. Ladder to be held by co-worker when used by worker. Ladders to be fastened if required for	**5**	**1**	**5**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		and material. Not using PPE (Safety harness). Construction equipment failure, i.e. scaffold material, formwork, construction vehicles, mobile elevating work platforms, etc.						work purposes. Ladders to be on solid ground. Fall protection plan to be implemented. Fall risk work to be done under supervision. Horizontal life lines installed for roof sheeting						
29.	**Cranes and Lifting**	Base unstable,	Crane collapse. Crane boom fall. Crane boom	**S**	**5**	**3**	**15**	Only competent	**5**	**1**	**5**	PM, CHSA,		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		unsafe erecting/ set-up, unsafe operation, crane boom radius not known, operator incompetent, falling from height, working under suspended load, unsafe rigging practices, damaged slings	damaging property. Falling loads. Operator fear of height or not resting when climbing to crane top. Workers on site not moving out of slew path. Load falling due to poor rigging. Sling breaking under load causing load falling and injuring persons.					persons erecting the crane and base. Operator to be trained for the type of crane. Regular inspections done and result recorded. Operator to take rest breaks when climbing to control cabin. Workers to be trained to obey				PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								banksman warnings. Rigging to be done by competent person and rigging study done where required. Lifting tackle i.e. Slings inspected regularly (LMI) and damaged ones rejected.						
MATERIAL														

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
30.	**Reinforcing Steel**	Sharp edges, sharp points, off cuts, wire cuts. Poor stacking and storage. Poor housekeeping. Sharp ends and binding wires.	Injuries, cuts and bruises, eye injuries, pollution	**S**	**2**	**3**	**6**	Tie reinforcing steel according to drawings. Use correct PPE when tying steel. Clean steel tying area at least daily and place off-cuts in provided skip.	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		
31.	**Bricks**	Rough brick surfaces, unnatural postures, repetitive movements, poor stacking.	Twisting and straining of back muscles. Hand injuries. Stack collapse on top of worker.	**S**	**3**	**3**	**9**	Use required PPE when working with bricks. Keep bricks properly stacked. Use forklifts where	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								possible to transport and lift bricks.						
32.	**Finishes**	Hand tools used incorrectly. Exposure to hazardous materials, dust and toxic vapours. Slip, trip and fall hazards. Not using correct PPE.	Hand injuries. Injuries to persons. Occupational disease,	**SH**	**2**	**3**	**6**	Ensure hand tools are in good condition and used correctly by supervisor. Correct PPE used. Handle and install hazardous materials according to manufacturer's instructions. Use	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Hazardous chemicals according to SDS. Remove slip, trip hazards from work area.						
33.	**Doors, Windows**	Manual handling- injury to hands and back strain. Hand tools used incorrectly. Slip, trip and fall hazards. Not using correct PPE	Injury to persons/ hand/ back.	**S**	**2**	**3**	**6**	Follow manual handling SWP when moving and handling doors, window material. Use correct lifting technique. Use the correct tools for the task. Remove all slip and trip	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								hazards from the work area.						
34.	**Ceilings**	Working at fall risk position. Twisting and turning. Hand tools used incorrectly. Not using PPE correctly	Falling from height, ergonomic disease, hand and other injuries to persons.	**S**	**3**	**3**	**9**	Implement the Fall Protection Plan. Use the correct PPE. Ensure scaffolds and ladders get checked before use. Have periodic rest or rotate teams to prevent ergonomic stress. Use the	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								correct tools for the task.						
35.	**Flooring and Carpeting**	Hand tools used incorrectly. Exposure to hazardous materials, dust and toxic vapours (VOC[1]). Slip, trip and fall	Hand injuries. Injuries to persons. Occupational disease,	**SH**	**2**	**3**	**6**	Supervisor to ensure the correct tools are used for the task. Use hazardous chemicals according the SDS. Keep work area	**2**	**2**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

[1] VOC - volatile organic compound are organic chemicals that have a high vapor pressure at ordinary room temperature.

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		hazards. Not using correct PPE.						ventilated and clear of slip and trip hazards.						
36.	**Plumbing**	Core drilling through slabs / rebar. Flooding of services / electrical installations. Collapsing of subsoil drainage. Pipes not stacked and	Wet/ slippery slab. Water in contact with electricity. Excavation collapse. Trip and fall on pipes. Burns. Fire.	**S**	**3**	**3**	**9**	Core drilling to be done under supervision of a competent person. See control Portable Electrical Power tools). Dry any wet areas immediately	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		stored correctly. Hot work where brazing is done.						after completion of core drilling. Plan and implement the plan to prevent flooding electrical installations and equipment. When working in excavations comply with the relevant SWP. Where hot work is done ensure fire-fighting						

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								equipment is in close vicinity.						
37.	**Electrical**	Electricity	Electrical shocks, Severe injuries (burns).	**S**	**4**	**3**	**12**	Installation work done on non-live circuits as far as possible. Use lockout procedure where live work must be done. Competent person/s to	**4**	**2**	**8**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								Provide COC for new circuits after testing thereof. Comply with the Electrical Installation regulations.						
38.	**HVAC**[2]	Working at fall risk position. Twisting and turning. Hand tools used incorrectly. Not using PPE correctly.	Falling from height, ergonomic disease, hand and other injuries to persons. Damage to property.	**S**	**4**	**3**	**12**	Use correct PPE. Comply with the fall protection plan when working in a fall risk position. Take rest breaks or	**4**	**2**	**8**	PM, PC 16(2), CR 8(1)		

[2] HVAC - Heating, ventilation, and air conditioning is the technology of indoor environmental comfort, goal to provide thermal comfort and acceptable indoor air quality.

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		Heavy material and equipment handling.						rotate teams to prevent ergonomic stress. Supervisor to check the condition of tools and ensure the correct use thereof. Heavy equipment to be moved and lifted into position using lifting equipment.						
39.	**Parking and roads**	Mobile plant movement not	Mobile plant moving at excessive speed.	**S**	**3**	**3**	**9**	Mobile plant operators to	**3**	**1**	**3**	PM,		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		controlled. Flagmen not appointed. Persons not involved in injured by plant, vehicles and/ when access public roads (Crossing).	Collision with other mobile plant or property. Plant colliding with persons.					look out for pedestrians. Minimise the number of persons allowed on the crossing. Mobile plant not to operate at excessive speed. Flagmen to control truck movement at junctions with public roads.				PC 16(2), CR 8(1)		
40.	**Signage**	Emergency, strategy failure, fire	Chaotic conditions existing in emergency situations. Poor, incorrect	**S**	**2**	**2**	**4**	Identify and display signage in	**2**	**1**	**2**	PM, CHSA, PC		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		equipment position signage not displayed. Obstructed and or closed escape ways. Inadequate, incorrect signage confusion. Damaged signage.	demarcations. Personal injury Security risk					positions where required. Maintain signage in good condition. Remove/ replace signage when no longer required/ damaged.				16(2), CR 8(1)		
41.	**Water proofing**	Waterproofing not done by competent employees. Unsafe equipment	Injuries to persons. Burns. Fire. Property damage. Unable to extinguish fire.	**S**	**3**	**3**	**9**	Supervisor the check condition of tools and equipment. Take rest	**3**	**1**	**3**	PM, PC 16(2), CR 8(1)		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		used to apply waterproofing products. No fire fighting equipment available. Not using correct PPE.						periods or rotate teams to prevent ergonomic stress. Keep work areas free from slip and trip hazards. Use the required PPE. Ensure firefighting equipment is in close vicinity in case of a fire.						
ENVIRONMETAL CONDITIONS AND HYGIENE														

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
42.	**Site Facilities**	Sleeping on site, Ablution, sanitation, Changing and washing facilities inadequate. Eating and Resting areas. Inadequate potable water (fatigue, heat stress etc.)	Non-Conformance to Legal Requirements as per Construction and Facilities Regulations. Eating on-site (diseases site contamination/ pollution).	**HE**	**3**	**2**	**6**	Maintain Toilets, ablutions, changing and washing facilities at site establishment/ laydown. NO Sleeping on-site. Establish designated Eating/ resting areas with waste management. Establish potable water.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		
43.	**Occupational Hygiene**	Occupational Hygiene	Occupational Hygiene Diseases, Toxicology/	**H**	**3**	**3**	**9**	Medical Surveillance	**3**	**1**	**3**	PM,		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		stressors, Loss of production, Diseases, contamination,	Hazardous Chemicals, Biological Stress, Noise Induced Hearing Loss, Radiation.					Systems, AIA Assessments and Control measures, Hazardous Chemical, ergonomics - stacking, storage and monitoring, Noise Induced Hearing Loss control measures, Soil Compacting Testing equipment controls (i.e. troxlers). Hand				PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								washing facilities maintained.						
44.	**Hazardous Chemicals**	Flammable, Pollution, Explosion, Toxic,	Fire, Explosion, Toxic, Diseases, Environmental Pollution,	**SE**	**4**	**3**	**12**	Hazardous Chemical Controls (Engineering and Admin.), Waste Management, Flammable / Hazardous Chemical store be bunded with 110% of Max. stored capacity.	**4**	**2**	**8**	PM, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
45.	**Environmental impacts of building process**	Environmental stressors; dust, project noise, waste water from construction activity, ground pollution due to oil and fuels	Unhappy neighbours due to dust pollution, noise pollution, storm water contaminated during construction.	**HE**	**4**	**4**	**16**	Dust control measures, scheduling of work during work hours, restriction of concrete mixing on site, use of drip trays, proper waste removal process. Noise pollution not allowed. Waste water not discharged to storm water system	**4**	**2**	**8**	PM, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
46.	**Climate**	Adverse/ Abnormal rainfall, Heat stress, Cold stress,	Flooding, Heat stress, Cold Stress, Loss of production,	**SH**	**3**	**3**	**9**	**Construction**: No work allowed during inclement weather (specific scaffolds and excavation). Sufficient, suitable Personal Protective Equipment (clothing). Safe to use potable /drinking water available.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
47.	**House-keeping, stacking, storage**	Un-levelled laydown areas, unsafe height/width ratio, laydown/rubble areas not demarcated, unsafe stacking/tools at work area, tripping hazard, unsafe Hazchem storage, unsafe	Damage to equipment/material/property, personal injury too workers/public, fire	**S**	**3**	**3**	**9**	Stacking and storage regulations to be implemented & monitored. Rubble removal to be done regularly, removal to a registered dump site (Env. Man. Plan) Maintain waste skips. (EIA, RoD[3]). Chemical /	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

[3] RoD - Record of Decision by Dept of Environmental Affairs (DEA)

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		storage of flammable material						facilities / store areas to be separated and in one area (as far as reasonably practicable). Inspect works area before works commence, DSTI'S and/or PTO to be completed.						
48.	**Access and Egress Routes to/ from site**	Inadequate, Unidentified. Public. Pedestrians.	Collisions. Loss of production. Pollution. Public Liability (claims).	**S**	**3**	**3**	**9**	Traffic management plan. Accommodation. Temporary	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								signage. Public Awareness. (Comment: Limit long vehicles for delivery to site).						
49.	**Perimeter fencing and hoarding.**	Theft, vandalism, loss of production, Unauthorised persons enter site.	Theft, Loss of Production, damage, arson, Injury to public,	**S**	**3**	**2**	**6**	Erect sound fencing/ hoarding and manage access control / security. Maintain. Security controls during night and long	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								periods of absence (week-ends, holidays etc.).						
50.	**Emergency and Evacuation**	No plan, no alarm, escape way not demarcated, no assembly point, no first aid equipment, no firefighting equipment, no trained fire fighters.	Injury, burns, persons unable to escape, persons not knowing where to assemble (chaos), injured not treated, fire not extinguished (in case the emergency is a fire), nobody able to extinguish a fire.	**S**	**3**	**3**	**9**	Provide an alarm on site. Demarcate the escape route. Demarcate the assembly point position. Provide first aid and firefighting equipment on site. Do evacuation drills.	**3**	**2**	**6**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
FINANCIAL / COMMERCIAL														
51.	**Cost for H&S requirements**	No funds for: formal and informal training, PPE, stationary, printing, notice boards, signage, first aid equipment, firefighting equipment, facilities, lifting tackle certification, medical surveillance, load testing,	Lack of the following on the project: formal and informal training, PPE, stationary, printing, notice boards, signage, first aid equipment, firefighting equipment, facilities, lifting tackle certification, medical surveillance, load testing, COC temporary electricity.	**SHE**	**1**	**2**	**2**	Provide funding for: formal and informal training, PPE, stationary, printing, notice boards, signage, first aid equipment, firefighting equipment, facilities, lifting tackle certification, medical surveillance, load testing,	**1**	**1**	**1**	PM, CHSA, PC 16(2), CR 8(1)		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		COC temporary electricity.						COC temporary electricity.						
LEGAL														
52.	**Legal Framework for Project**	Not complying with legislation, regulations and standards	Court cases against project, fines, imprisonment	**SHE**	**3**	**2**	**6**	Apply the legal framework of all Acts, regulations and standards that have effect on the project to the work and administration of the project.	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
POST CONSTRUCTION														
OPERATIONS														
1.	**Maintenance.**	No safe and easy access for maintenance on: • Lighting • Electricity • Plumbing • Gas • ICT[4] Working at fall risk position. Twisting and turning. Hand tools used incorrectly. Not	Loss of material/ equipment. Personal injury, damage to vehicles. Falling from height, ergonomic disease, hand and other injuries to persons	**S**	**3**	**3**	**9**	Implement the Fall Protection Plan. Use the correct PPE. Ensure scaffolds and ladders get checked before use. Have periodic rest or rotate teams to prevent ergonomic	**3**	**2**	**6**	Matla, CHSA, PC 16(2), CR 8(1)		

[4] ICT - Information and Communication Technologies

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		using PPE correctly						stress. Use the correct tools for the task.						
2.	**Stacking and Storage**	Un-levelled laydown areas, unsafe height/ width ratio, laydown/ rubble areas not demarcated, unsafe stacking/ tools at work area, tripping hazard, unsafe Hazchem	Damage to equipment/ material/ property. Personal injury to workers/public, fire	**S**	**3**	**3**	**9**	Stack material properly. No stacking allowed outside the planned laydown area. Control delivery and off-loading. Follow manual handling safety rules.	**3**	**2**	**6**	Matla, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		storage, unsafe storage of flammable material												
3.	**Deliveries**	Unsuitable material delivered, vehicle movement not controlled	Failures due to substandard material, vehicle accidents on site, vehicles hitting pedestrians	**S**	3	2	6	Access control Personal Protective Equipment	3	1	3	Matla, CHSA, PC 16(2), CR 8(1)		
4.	**Security**	Does the new design take into account all security requirements as stipulated by the client?	Theft, security breaches, dissatisfied workers/sympathetic strikers gaining access to site.	**S**	**4**	**3**	**12**	Assign Security	**4**	**1**	**4**	Matla, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
PEOPLE														
5.	**Legal Authority, Roles and Responsibilities and Accountabilities**	Major non-conformance to Legal Requirements	Non- Compliance to Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed.	**SHE**	**1**	**2**	**2**	Cancel appointments.	**1**	**1**	**1**	PM, Matla,		
6.	**Incapability**	Not medical fit as per Legal Requirements	Incapability. Not fit for work (medical and Psychological)	**SH**	**1**	**2**	**2**	Have exit medical examinations completed.	**1**	**1**	**1**	PM, Matla		
7.	**Unskilled**	Incompetent	Non- Compliance with Legal Requirements. Personal Injury. Public Liability. Unskilled/ untrained. Not informed.	**S**	**1**	**2**	**2**	Cancel appointments. Terminate employment contracts	**1**	**1**	**1**	PM, Matla		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								where relevant. Maintain Skills levels as per Skills Training Matrix						
8.	**Compulsory community labour use**	Disputes, rioting, picketing, arson, vandalism.	Non- Compliance with Legal Requirements. Personal Injury. Public Liability. Not informed.	**S**	**1**	**3**	**3**	Close-out meeting with community leaders. Termination of contracts.	**1**	**1**	**1**	PM, CHSA, PC 16(2), CR 8(1)		
9.	**Employee Transport**	Accident to/ from site	Personal injury, damage to vehicles, public liability insurance. Under influence of intoxicating substances.	**S**	**1**	**2**	**2**	Cancel rental contracts where relevant. Checklists added to	**1**	**1**	**1**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								consolidated client H&S file.						
EQUIPMENT														
10.	**Stacking and Storage**	Un-levelled stacking areas, unsafe height/ width ratio, laydown/ rubble areas not demarcated, unsafe stacking/ tools at work area, tripping hazard, unsafe	Damage to equipment/ material/ property. Personal injury to workers/public, fire	**S**	**2**	**3**	**6**	Remove all unused materials from site. Clean laydown area. Remove barricading.	**2**	**2**	**4**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		Hazchem storage, unsafe storage of flammable material												
11.	**Construction Vehicles and Plant**	Unauthorised operators, operators not trained, vehicles not suitable for the job, vehicles not road worthy, vehicles on site not accompanied by flagmen,	Vehicle accidents, Vehicles colliding into structures, vehicles hitting pedestrians on site, noise, pollution	**S**	**2**	**3**	**6**	Clean roads, remove vehicle signage, include checklists in consolidated file.	**2**	**1**	**2**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		vehicles operating in public areas												
12.	**Temporary Electrical Installations**	Electricity	Electrical shocks, Severe injuries (burns), fires	**S**	**3**	**3**	**9**	Lockout DB at main breaker. Remove DB from circuit. Remove DB off site	**3**	**2**	**6**	PM		
PROCESS														
13.	**Electrical**	Electricity connections failure.	Electrical shocks, Severe injuries (burns). Loss of production	**S**	**3**	**2**	**6**	Inspect and sign off correct installation and place drawings and schedules on consolidated file. Obtain	**3**	**1**	**3**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
								COCs for new installations.						
14.	**HVAC**	Working at fall risk position. Twisting and turning. Hand tools used incorrectly. Not using PPE correctly. Heavy material and equipment handling.	Falling from height, ergonomic disease, hand and other injuries to persons. Damage to property.	**S**	**1**	**2**	**2**	Inspect and sign off correct installation and place drawings and schedules on consolidated file. Obtain COCs for new installations.	**1**	**1**	**1**	PM, CHSA, PC 16(2), CR 8(1)		
15.	**Signage**	Emergency, directive, fire equipment position	Chaotic conditions existing in emergency situations	**S**	**1**	**2**	**2**	Remove temporary construction signage.	**1**	**1**	**1**	PM, CHSA, PC		

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date
		signage not displayed										16(2), CR 8(1)		
LEGAL														
16.	**Legal Framework for Project**	Not complying with legislation, regulations and standards	Court cases against project, fines, imprisonment	**SHE**	**1**	**2**	**2**	Close out all legal aspect for the project and comply with legislation that specifically obligated actions to be taken with regard to the closure of the project.	**1**	**1**	**1**	PM, CHSA, PC 16(2), CR 8(1)		

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Item	Task/Activity	Energy/Hazard/ Risk (Potential danger)	Possible Consequence likely to happen	Consequence Type (SHE)	Initial Risk Score			Existing and Proposed Control measures	Revised Risk Score			Action assigned to	Acceptance of Responsibility	
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating		By	Date

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Risk Matrix								
RISK MATRIX				PROBABILITY				
				Practically impossible	Conceivable but unlikely to occur	Is known to occur "it has happened"	Quite possible- happens regularly	Might well be expected- Happens often
				1	2	3	4	5
SEVERITY \ EXPOSURE	No injury / illnesses / damage	Virtually no damage / disruption to operation	1	1	2	3	4	5
	Minor injury – first aid case	Minor damage / brief disruption to operation	2	2	4	6	8	10
	More severe injury – require medical assistance	Partial shutdown / med damage	3	3	6	9	12	15
	Serious injuries – lost workday	Serious damage / disruption of operation	4	4	8	12	16	20
	Loss of life / multiple serious injury	Substantial damage / total loss of operation	5	5	10	15	20	25

Risk Result

01-06 = Possible Risk – Attention needed. Risk perhaps tolerable

07-14 = Medium Risk – Immediate correction required

15-25 = High Risk – Management intervention required

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

vaal central water naturally

CONSTRUCTION REGULATIONS AUDIT CHECKLIST

Y=Yes **N**=No **N/A**=Not Applicable

VCW SHEQ Officer	**LABIUS MMUSI**	
Name of Company		**Principal Contractor Sub-Contractor:**
Project Name		
Project Amount		
Duration		
Manager		
Cell #		
Email		
Date		

1.	Act	Principal Contractor & Sub-Contractor	Y	N	N/A	Remarks
		Contractor's Organogram				
	Sec 7	Contractor's OHS Policy				
	CR 3	Application for construction work permit				
	CR 4	Notification of construction work to DOL				
	CR 5 1(g)	Sufficient OHS budget in the BOQ (Budget Breakdown)				
	CR 5(1)(j)	Letter of Good Standing (Workman's Compensation)				
	*	**Certificate Number**				
		Registration Number				
		Expiry Date				
		Public Liability insurance				
		Insured Amount				
	CR 5(a)	Baseline Risk Assessment				
	CR 5(b)	Health and Safety Specification				
	CR 6	Designer's Report				
	CR 7	Health and Safety Plan				

	Sec 37(1& 2)	Mandatory Agreement				
2.	**Act**	**Appointments (Competent Person)**	**Y**	**N**	**N/A**	**Remarks**
	Sec 16(2)	Designated Employer				
		Competency				
		Institution				
		Competency				
		Institution				
		Professional Registration				
	Sec 17(1)	SHE REP (More than 20 employees)				
		Competency				
		Institution				
	Sec 19(1)	Chairperson (SHE Committee)				
	GAR 8/9 Sec 24	Competent Person to do Investigations kept on SHE file				
		Competency				
		Institution				
	GMR 2(1)	Competent Person (Machinery)				
	CR 8(1)	Construction Manager				
		Competency				
		Institution				
		Competency				
		Institution				
		Professional Registration				
	CR 8(7)	Construction Supervisor				
		Competency				
		Institution				
		Professional Registration				
	CR 8(8)	Assistant Construction Supervisor				
		Competency				
		Institution				

	GSR 3(4)	First Aider				
		Competency				
		Institution				
	CR 8(5)	Construction Safety Officer				
		Competency				
		Institution				
		Competency				
		Institution				
		Professional Registration (SACPCMP)				
	*	Full Time				
	*	Part Time				
	*	If part time what is the frequency of visits to site				
	CR 9(1)	Competent Person to do Risk Assessment				
		Competency				
		Institution				
	*	Monitoring Plan				
	*	Review Plan				
	CR 10(1)(a)	Competent Person (Fall Protection Plan)				
		Competency				
		Institution				
	CR 10(a)	Competent Person (Form Work & Support Work)				
		Competency				
		Institution				
	CR 13(1&2)	Competent Person (Excavation Work)				
		Competency				
		Institution				
	CR 14(1)	Competent Person (Demolition Work)				
		Competency				
		Institution				

	CR 16(1)	Competent Person (Scaffolding)				
		Competency				
		Institution				
	CR 19	Competent Person (Material Hoist Operator)				
	CR 19(8)(a)	Competent Person (Material Hoist Inspector)				
		Competency				
		Institution				
	CR 18(1)	Competent Person (Batch Plant Operation)				
		Competency				
		Institution				
	CR 19(2)(b)	Competent Person (Inspection of explosive powered tools)				
	CR 19(2)(g)	Competent Person (Issuing & collection of cartridges & nails)				
		Competency				
		Institution				
	CR 22(e)	Competent Person (Crane and Certified)				
		Competency				
		Institution				
	CR 23(1)(j)	Construction Vehicle & Mobile Plants Inspector				
	CR 24 (c & d)	Temporary Electrical Installation Inspector				
		Competency				
		Institution				
	CR 28(a)	Competent Person (Stacking and Storage)				
		Competency				
		Institution				
	CR 29 (h)	Competent Person (Fire Equipment Inspector)				
		Competency				
		Institution				
3.	**Act CR 9(1)**	**Risk Assessment shall include:**	**Y**	**N**	**N/A**	**Remarks**
	CR 9(1)(a)	Risk Identification				

	CR 9(1)(b)	Risk Analysis				
	CR 9(1)(c)	Risk Controls				
		Matrix and Rating				
	CR 9(1)(d)	Monitoring Plan				
	CR 9(1)(e)	Review Plan				
		Training Attendance Register				
4.	**Act CR 7(7)**	**Induction Training**	**Y**	**N**	**N/A**	**Remarks**
	CR 7(4)	Company Training Syllabus				
	CR 7(9)(a)	**Training Attendance Register**				
	CR 7(9)(b)	Proof of Induction on Person				
	*****	Was induction done by Client				
	*****	Was Induction done Company				
5.	**Act CR 8(1)(a)**	**Fall Protection Plan**				
	CR 8(2)(A)	A Risk Assessment				
		Where people are working on elevated position				
	CR (2)(c)	Training Program				
		Training Attendance Register				
	CR 8(2)(d)	Planned Inspections (Fall Protection Equipment)				
	CR 8(3)	Is the Supervisor in possession of Fall Protection Plan)				
6.		**Certificate of Medical Fitness**				
		Evaluation of physical fitness of persons by a registered Medical Practitioner **(ORIGINALS)**				
7.	**Various**	**Planned Maintenance Inspection. Registered Records (Checklists and Signature)**				
	Sec 44	**Scaffolds**				
	CR 8(2)(d)	Inspection, testing and maintenance of fall protection equipment (Checklists and signature)				
	DMR 18(5)	Lifting machines and lifting tackle				
	GSR 3(3) **GSR 3(4)**	First aid box Valid Certificate in First Aid				
	EMR 9	Portable Electric Equipment				
	EMR 10	Portable Electric Lights				

	GSR 2	Personal Protective Equipment				
	*	PPE/Risk Analysis				
	*	Do you have Checklists				
	*	Are all equipment permanently and clearly numbered				
8.		**Records to be kept**				
	CR 4(1)	Notification to the Regional Director				
	CR 5(6)	Copy of every contractor available on site.				
	CR 5(7)	Contractor's SHE File including all required documentation available on site				
	CR 5(8)	Consolidated SHE File to be handed to Bloem Water after completion of work.				
	CR 5(9)	Comprehensive and updated list of all contractors, agreements, the work being done included in SHE File available onsite.				
	CR 7(2)	Risk Assessments Available onsite				
		Risk Assessments addressing all the hazards on site, dated and signed by the Risk Assessor.				
		All hazards identified communicated to the employees. **(Provide proof).**				
	CR 7(9)	Proof of induction training available on site.				
	CR 8(3)	Construction Supervisor has latest available version of Fall Protection Plan.				
	CR 9(2)(b)	Designer's information in writing to contractor of dangers and hazards relating to construction work.				
	CR 11(1)(c)	Drawings pertaining to the design of/support work structure kept on site and available.				
	CR 11(3)(h)	Record of excavation inspections on site and available				
	CR 12(2)	Method statement for demolition a structure				
	CR 12(11)	Method statement for demolishing a structure				
	CR 15(2)(b)	Certificates of system design for suspended platform				
	CR 15(2)(c)	Operational Compliance Plan				
	CR 15(10)	Competence of Erectors, Operators and Inspectors				
	Permit System	**Daily Inspection Record**				
	CR 15(11)	Suspended platform design drawings, inspections and performance test records on site and available				

	CR 15(12)(c)	Training Records Signature				
	CR 17(8)(c)	Materials Hoist Inspection records on site and available				
	CR 18(9)	Maintenance and Repair Records on site and available				
	CR 19(2)(9)	Register of nails and studs (explosive powered tool)				
	CR 21(1)(j)	Construction Vehicle and mobile plant inspection register				
	CR 22(d)	Temporary Electrical Installation Inspection Register				
	Permit System	**Workers Register Daily**				
	HCS.REGS	Chemical substances and Data Sheets				
		Toolbox Talks Daily				
	GSR 2	Issuing of PPE and Facilities (Proof and Signed)				
		Treatment Register (First Aid Box)				
	GAR 9	Reportable Incidents				
	File	Accident and Incident reports (firs aid-medical cases-lost time cases)				

REMARKS:

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Construction Safety Officer	LABIUS MMUSI	Contractor	
Signature		Signature	

Manager SHEQ		Approved	YES	NO
Signature		Please Tick		

Date	

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OHS FILE REQUIREMENTS and FILE INDEX

#	Requirement	Yes	No	NA
1	Company Health, Safety and Environmental Policy **Relevant and signed by s16.1**			
2	Company HIV and Aids Policy **Relevant and signed by s16.1**			
3	Company Letterhead with Contact Details			
4	Company Profile			
5	Proof of Company Registration			
6	Proof of SARS Registration **(COIDA)**			
7	Public Liability Insurance			
8	OHS Bill of Quantities			
9	Company Organogram (showing company reporting structure)			
10	Site Team Organogram with names and Cell Numbers **Certified copies of id's/passport/work permit not older than 3 months**			
11	List of Employees working on this project (with their id copies and positions listed) **Certified copies of id's/passport/work permit not older than 3 months**			
12	Scope of Work			
13	List of tools and equipment to be used on this project			
14	Sub-contractors internal Employee Induction (focusing on specialist work, specific tasks, risk assessment related to these tasks, method statements and general site safety.			
15	Clients' Letter of Appointment			
16	Principal Contractors' Letter of Appointment **(sub-contractor)**			
17	Agreement with Mandatory signed by Contractor and Client			
18	Agreement with Mandatory signed by Contractor and Client			
19	Agreement with Mandatory signed by Principal Contractor and Sub-contractors			
20	Statutory Legal Appointments (application to all contractors)			
	CE's Delegation of Duties **(attach ID, CV and competences as per the OHS 16.1 and 16.2**			
	Supervisor of Construction Work **(attach ID, CV and competences as per the CR 8.1 of 2014)**			
	Assistant Supervisor of Construction Work **(attach ID, CV and competences as per the CR 8.2 of 2014)**			
	Fall Protection Plan Developer **attach ID, CV and competences as per the CR 10 (1) (a) of 2014)**			

#	Requirement	Yes	No	NA
	Risk Assessor **(attach ID, CV and competences as per the CR 9 (1) of 2014)**			
	Portable Electrical Tools Inspector **(attach ID, CV and competences)**			
	Accident/Incident Investigator **(attach ID, CV and competences)**			
	Health and Safety Committee Member **(attach ID, CV and competences)**			
	Stacking and Storage Inspector **(attach ID, CV and competences)**			
	Hand Tools Inspector **(attach ID, CV and competences)**			
21	Other Appointments			
	Health and Safety Officer **(attach ID, CV and competences as per the CR 8 (5) of 2014)**			
	First Aider **(attach ID, CV and competences)**			
	SHE Representative **(certified and certificate attached)**			
	Emergency Evacuation Planner **(certified and certificate attached)**			
22	Site Specific **(related to the scope of work)** Company's Health and Safety Plan signed by the CE			
23	Site Specific **(related to the scope of work)** Environmental Management Plan signed by the CE			
24	Method Statement **(how you are going to do your work)**			
25	Hazard Identification and Risk Assessments **(based on the method statement)**			
26	Register and Checklists-general (if required as per scope of work)			
	Material Safety Data Sheets register and supporting documentation if hazardous substances will be used.			
27	Accident/Incident Standard Operating Procedure			
	Appointment of Accident/Incident Investigator **(attach ID, CV and competences)**			
	Accident/Incident Register			
	All Compensation Commissioner Forms (Wcl1 &2 etc.			
28	First Aider **(attach ID, CV and competences)**			
29	Medical Certificates including Id's and immunisation			
	Drivers and operators			
	Vehicle Maintenance Records			

#	Requirement	Yes	No	NA
	Appointments			
30	DSTI's			
32	Equipment Training Records			
33	Emergency Standard Operating Procedure			

**** Please ensure that your OHS Safety File is created in this order**

**** All information in this file must be specific to the site/project**

**** You are responsible to provide the necessary PPE for your employees.**

SUMMARY:		
SECTION	**DESCRIPTION**	**AMOUNT**
1	Occupational Health and Safety Management	
2	Competency, Training and Compliance	
3	Medical Examination	
4	Incident Management	
5	Security Measures	
6	Traffic Management	
7	Personal Protective Equipment (PPE)	
8	Construction Signs	
9	Emergency Evacuation Measures	
10	Stacking, Storage and Housekeeping	
11	Temporary Electrical Installations	
12	Safe Excavation	
13	Lifting Tackle (Cranes)	
14	Construction Site Facilities	
15	Hazardour Chemical Substance (HCS)	
16	Waste Management	
17	Confined Space	
18	Dangerous Species	
19	Working with sewer/effluent	
20	Asbestos Abatement Management	
	SUBTOTAL	
	10% CONTINGENCIES	
	SUBTOTAL	
	15% VAT	
	TOTAL	

BOQ: OHS BUDGET BREAKDOWN FOR CONTRACTORS					
ITEM NO.	**SHORT DESCRIPTION**	**UNIT**	**QUANTITY**	**RATE**	**AMOUNT**
	Contract Details				
	Site description:				
1	**SECTION 1: OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT**				
1.1	SACPCMP Registered Health and Safety Manager/Safety Officer				
1.2	Site establishment				
1.3	Health and Safety Management System (Health & Safety File)				
1.4	Laptop				
1.5	Printer				
1.6	Office				
1.7	Laminator				
1.8	SMI Board				
1.9	Laminating pouches				
1.10	Printing Paper				
1.11	Printing Catridges/Tonners				
1.12	Dividers				
1.13	Files				
1.14	Document Control: Approved Stamp and Superseded Stamp				
1.15	**Additional Items:**				
		Amount			
2	**SECTION 2: COMPETENCIES, TRAINING AND COMPLIANCE**				
2.1	Safety for Supervisors Training				
2.2	Legal Liability Training				
2.3	Hazard identification and Risk Assessment (HIRA) Training				
2.4	Incident Investigation Training: Level 3				
2.5	First Aid Level 1 & 2				
2.6	Firefighting Training				
2.7	Emergency Co-ordinator Training				
2.8	Safety Representative training				
2.9	Basic Working at Heights Training				
2.10	Scaffold Erector				
2.11	Scaffold Inspector Training				
2.12	Scaffold Supervisor Training				
2.13	Excavation supervisor training				
2.14	Fall Protection Plan Developer Training				
2.15	Confined Space Training				
2.16	Use of Electrical Tools and Portable Electrical Equipment.				
2.17	Snake Handling Training				
2.18	Crane Operator				

2.19	Rigging Training				
2.20	Stacking and Storage training				
2.21	Construction Vehicles and Mobile Plant Training				
	Additional Items:				
		Amount			
3	**SECTION 3: MEDICAL EXAMINATION**				
3.1	Pre employment	Sum			
3.2	Annual Medical	Sum			
3.3	Exit Medical	Sum			
	Additional Items:				
		Amount			
4	**SECTION 4: INCIDENT MANAGEMENT**				
4.1	First Aid Box				
4.2	Refill kits				
4.3	Spine Board				
4.4	Immobilisation Package				
4.5	Emergency Chair/Bed				
	Additional Items:	**Amount**			
5	**SECTION 5: SECURITY MEASURES**				
5.1	Access cards for employees, visitors				
5.2	Office cubicle for security				
5.3	Office furniture				
5.4	Locker				
5.5	Stationary				
5.6	Visitor register				
5.7	Breathelizers				
5.8	Training				
	Additional Items:				
		Amount			
6	**SECTION 6: TRAFFIC MANAGEMENT (If Applicable)**				
6.1	Training				
6.2	Traffic Equipment				
6.3	Traffic Control Signage and delineators				
6.4	Traffic Accomodation				
	Additional Items:				
		Amount			
7	**SECTION 7: PERSONAL PROTECTIVE EQUIPMENT (PPE)**				
7.1	Overall, with company logo and reflectors				
7.2	Employees not wearing overalls – reflector vests				
7.3	Safety shoes				
7.4	Hard hat				
7.5	Ear protection				
7.6	Safety goggles				
7.7	Dust Masks				
7.8	Gloves				
7.9	Respirators				
7.10	Sun Hats				
7.11	Gumboots				
7.12	**Additional Items:**				

		Amount			
8	**SECTION 8: CONSTRUCTION SIGNS**				
8.1	Warning signs				
8.2	Information signs				
8.3	prohibition signs				
8.4	Mandatory signs				
8.5	**Additional Items:**				
		Amount			
9	**SECTION 9: EMERGENCY EVACUATION MEASURES**				
9.1	Emergency Evacuation Alarms				
9.2	Emergency Signs				
9.3	Fire Extinguishers				
9.4	Emergency Equipment				
		Amount			
10	**SECTION 10: STACKING, STORAGE & HOUSEKEEPING**				
10.1	Orange safety netting				
10.2	Warning signs				
10.3	Information signs				
10.4	Prohibition signs				
10.5	Mandatory signs				
10.6	Colour Coded dust bins				
10.7	**Additional Items:**				
		Amount			
11	**SECTION 11: TEMPORARY ELECTRICAL INSTALLATIONS**				
11.1	Temporary electrical installation controller.				
11.2	Monthly earth leakage tests				
11.3	COC				
11.4	**Additional Items:**				
		Amount			
12	**SECTION 12: SAFE EXCAVATIONS**				
12.1	Ladders for Safe access				
12.2	Orange safety netting				
12.3	Signage				
12.4	Step, batter, or shore of excavations				
12.5	Material to shore and brace excavations				
12.6	Appointment of temporary works designer				
12.7	Temporary works design				
12.8	Training to erect and install temporary works according to designs.				
12.9	Provision for temporary works designer to inspect temporary designs.				
		Amount			
13	**SECTION 13: LIFTING TACKLE (CRANE)**				
13.1	Load test / hook test				
13.2	Rigging ropes/slings inspections				
13.3	Radios for communication				
13.4	Rigging ropes/slings				
13.5	Crane operators				
13.6	Riggers				
13.7	Nylon & polyester web slings				
	Additional Items:				

		Amount			
14	**SECTION 14: CONSTRUCTION SITE FACILITIES**				
14.1	Toilets				
14.2	Maintenance of toilets				
14.3	Changing facilities for each sex				
14.4	Sheltered eating areas				
14.5	Sufficient cleaning implements (brooms etc.)				
14.6	Waste bins				
14.7	Soap				
14.8	Toilet paper				
14.9	Lockers				
	Additional Items:				
		Amount			
15	**SECTION 15: HAZARDOUS CHEMICAL SUBSTANCE (HCS)**				
15.1	HCS / Flammable Liquid Storage				
15.2	HCS Controller Training				
15.3	Fire Fighting Equipment				
15.4	Spillage Kits				
	Dip Trays				
	Additional Items:				
		Amount			
16	**SECTION 16: WASTE MANAGEMENT**				
16.1	Colour Coded dust bins				
16.2	Refuse removal service provider				
	Additional Items:				
		Amount			
17	**SECTION 17: CONFINED SPACE**				
17.1	Air monitor to be used should be able to detect all gasses likely to be present inside the confined space.				
17.2	Calibration of air monitor				
17.3	Training: use of air monitor				
17.4	Emergency equipment				
17.5	Extractor fans				
17.6	Force fans				
17.7	Safety Harnesses				
17.8	Trypot and pully				
17.9	Lifelines				
	Additional Items:				
		Amount			
18	**SECTION 18: DANGEROUS SPECIES**				
18.1	Snake handling training				
18.2	Snake handling equipment				
18.3	Snake Repellant				
18.4	Anti Vernom				
		Amount			
19	**SECTION 19: WORKING WITH SEWER/EFFLUENT**				
19.1	Hepatitis A & B injections.				
		Amount			
20	**SECTION 20: ASBESTOS ABATEMENT MANAGEMENT**				
20.1	AIA to be appointed (survey to be conducted)				
20.2	Air monitoring				

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS
PRICING DATA

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Section	Description	Page No
PART C2.1	**PRICING INSTRUCITONS**	
1.	General	C2.1-1
2.	Pay Items	C2.1-1
3.	Quantities	C2.1-2
4.	Rates	C2.1-3
PART C2.2	**BILL OF QUANTITIES**	
PART C2.3	**SUMMARY OF BILL OF QUANTITIES**	

END OF SECTION

20.3	Asbestos training				
20.4	Special PPE				
20.5	Asbestos Contractor				
20.6	Removing, stacking, and storing of asbestos material				
20.7	Transport and disposal of asbestos material				
	Additional Items:				
		Amount			
21	**SECTION 21: OTHER**				
		Amount			
	SUB TOTAL				
	10 % CONTINGENCIES				
	SUB TOTAL				
	15% VAT				
	TOTAL				

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

BILL OF QUANTITIES

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PRICING INSTRUCTIONS

1. GENERAL

These pricing instructions provide the Tenderer with guidelines and requirements with regard to the completion of the bill of quantities. These pricing instructions also describe the criteria and assumptions which will be assumed in the Contract to have been taken into account by the Tenderer when developing his prices.

The bill of quantities shall be read with all the documents which form part of this Contract.

The following words have the meaning hereby assigned to them:

Unit	:	The unit of measurement for each item of work in terms of the Scope of Work.
Quantity	:	The number of units for each item.
Rate	:	The payment per unit of work at which the tenderer tenders to do the work.
Amount	:	The product of the quantity and the rate tendered for an item.
Lump sum (L.Sum)	:	An amount tendered for an item, the extend of which is described in the Pricing Instructions, Bill of Quantities or the Scope of Work but the quantity of work of which is not measured in any units.

2. PAY ITEMS

The method of measurement published by the South African Bureau of Standards in Clause 8 of the Standardised Specifications for Civil Engineering Construction (SABS 1200) is applicable, subject to the variations and amendments contained in section C3.4.2.

Descriptions in the Bill of Quantities are abbreviated and comply generally with those in the Standard Specifications. The measurement and payment clause of each Standard Specification, read together with the relevant clauses of the Scope of Work, set out what ancillary or associated activities are included in the rates for the operations specified. Should any requirements of the measurement and payment clause of the applicable Standard Specification, or the Scope of Work, conflict with the terms of the Bill of Quantities, the requirements of the Standard Specification or Scope of Work, as applicable, shall prevail.

The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in the Bill of Quantities are as follows:

mm	=	millimetre	h	=	hour
m	=	metre	kg	=	kilogram
km	=	kilometre	t	=	ton (1000kg)
m^2	=	square metre	No.	=	number
m^2.pass	=	square metre pass	sum	=	lump sum
ha	=	hectare	MN	=	meganewton
m^3	=	cubic metre	MN.m	=	meganewton-metre
m^3.km	=	cubic metre-kilometre	PC sum	=	Prime Cost Sum
l	=	litre	Prov sum	=	Provisional sum
kl	=	kilolitre	%	=	per cent
MPa	=	megapascal	kW	=	kilowatt
kPa	=	kilopascal	wt	=	wall thickness
			dia	=	diameter

3. QUANTITIES

3.1 Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.

3.2 The quantities set out in the Bill of Quantities are the estimated quantities of the Works, and do not necessarily represent the actual amount of work to be done. The quantities certified for payment, and not the quantities given in the Bill of Quantities, shall be used for determining payments to the Contractor. The Contract Price for the completed contract shall be computed from the actual quantities of work done, valued at the relevant unit rates and prices.

4. RATES

4.1 The prices and rates to be inserted in the Bill of Quantities are to be full inclusive prices for the work described under the several items. Such prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. Reasonable prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out.

4.2 A price or rate is to be entered against each item in the Bill of Quantities, whether the quantities are stated or not. An item against which no price is entered or where a word or phrase such as “included” or “provided elsewhere” will be accepted as a rate of nil (R0,00) having been entered against such items and covered by the other prices or rates in the schedule.

Any work executed to which such a pay item applies, shall be measured under the appropriate items in the Bill of Quantities and valued at a rate of nil (R0,00). The rate of nil shall be valid irrespective of any change in the quantities during the execution of the Contract.

4.3 The Tenderer shall fill in a rate against all items where the words “rate only” appears in the amount column. The intention is that, although no work is foreseen under such item and no quantities are consequently given in the quantity column, the tendered rate shall apply should work under this item be actually required.

4.4 Except where rates only are required, the Tenderer shall insert all amounts to be included in his total tendered price in the “Amount” column and show the corresponding total tendered price.

4.5 The Tenderer shall not group together a number of items and tender one rate for such group of items.

4.6 All rates and sums of money quoted in the Bill of Quantities shall be in rands and whole cents. Fractions of a cent shall be discarded.

4.7 All prices and rates entered in the Bill of Quantities must be **excluding Value Added Tax (VAT)**. VAT will be added last on the summary page of the Bill of Quantities.

4.8 Should excessively high unit prices be tendered, such prices may be of sufficient importance to warrant rejection of a tender by the Employer.

4.9 Where the Contractor is required to furnish detailed drawings and designs or other information in terms of the Contract Documents, all costs thereof shall be deemed to have been provided for and included in the unit rates and sum amounts tendered for the items scheduled in the Bill of Quantities, and separate additional payments will not be made.

END OF SECTION

Item	Ref	Description	Unit	Qty	Rate	Amount
	SANS 1200 A PSA	**Schedule 1** **Preliminary and General**				
		FIXED-CHARGE ITEMS				
1.1	8.3.1	.1 Contractual Requirements	sum	1		
		Establishment of Facilities on Site				
	PSAB 8.3.2	.2 Facilities for the Engineer				
1.2		(a) Furnished Offices, Latrines and Carports	sum	1		
1.3		(b) Telephone	sum	1		
1.4		(c) Nameboards	No	1		
1.5		(d) Survey Assistant	sum	1		
1.6		(e) Survey Equipment	sum	1		
	8.3.2	.3 Facilities for the Contractor				
1.7		(a) Offices and storage sheds	sum	1		
1.8		(b) Workshops	sum	1		
1.9		(c) Laboratories	sum	1		
1.10		(d) Living accommodation	sum	1		
1.11		(e) Ablution and latrine facilities	sum	1		
1.12		(f) Tools and equipment	sum	1		
1.13		(g) Water supplies, power and communication	sum	1		
1.14		(h) Dealing with water (Sub-clause 5.5)	sum	1		
1.15		(i) Access (Sub-clause 5.8)	sum	1		
1.16		(j) Construction Equipment	sum	1		
1.17	8.3.3	.4 Other fixed-charge Obligations	sum	1		
1.18	8.3.4	.5 Removal of Contractors and Engineers site on completion	sum	1		
		Occupational Health and Safety				
1.19	8.3.5	.6 Compliance with Occupational Health and Safety Act (Act 85 of 1993) and its regulations and with the Employers Health and Safety Specification	sum	1		
		Environmental Management				
1.20	8.3.6	.7 Compliance with Environmental Management plan	sum	1.0		R/O
		TIME-RELATED ITEMS				
1.21	8.4.1	.1 Contractual requirements	month	12		
		Operation and maintenance of facilities on the Site for the duration of construction				
	8.4.2	.2 Facilities for the Engineer				
1.22		(a) Furnished Offices, Latrines and Carports	month	12		
1.23		(b) Telephone	month	12		
1.24		(c) Nameboards	month	12		
1.25		(d) Survey Assistant	month	12		
1.26		(e) Survey Equipment	month	12		
	8.4.2	.3 Facilities for the Contractor				
1.27		(a) Offices and storage sheds	month	12.00		
1.28		(b) Workshops	month	12.00		
1.29		(c) Laboratories	month	12.00		
1.30		(d) Living accommodation	month	12.00		
1.31		(e) Ablution and latrine facilities	month	12.00		
					Carried forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought forward	
1.32		(f) Tools and equipment	month	12.00		
1.33		(g) Water supplies, power and communication	month	12.00		
1.34		(h) Dealing with water (Sub-clause 5.5)	month	12.00		
1.35		(i) Access (Sub-clause 5.8)	month	12.00		
1.36		(j) Construction Equipment	month	12.00		
1.37	8.4.3	.4 Supervision for duration of construction	month	12.00		
1.38	8.4.4	.5 Company and Head Office Overheads	month	12.00		
1.39	8.4.5	.6 Other time-related Obligations	month	12.00		
		Occupational Health and Safety				
1.40	8.4.6	.7 Compliance with Occupational Health and Safety Act (Act 85 of 1993) and its regulations and with the Employers Health and Safety Specification	month	12.00		
		Environmental Management				
1.41	8.4.7	.8 Compliance with Environmental Management plan	month	12.00		R/O
		Schedule 1 **Preliminary and General**				
					Carried forward to summary of schedules	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
	SANS 1200 A	**Schedule No.: 2** **Provisional Sums and Prime Cost Items**				
		PROVISIONAL SUMS				
		SUMS STATED PROVISIONALLY BY THE ENGINEER				
		Bypass Pipeline and Associated Works				
		Eployer Requirements				
	8.5	.1 Requirements				
2.1		(a) Remuneration i) CLO/LDO remuneration	Prov. Sum	1	120 000.00	120 000.00
2.2		(b) Overheads, Charges & Profit on Above	%			
2.3		(c) Artisans and Skills Training	Prov. Sum	1	100 000.00	100 000.00
2.4		(d) Overheads, Charges & Profit on Above	%			
2.5		(e) Maintenance Spares	Prov. Sum	1	100 000.00	100 000.00
2.6		(f) Overheads, Charges & Profit on Above	%			
		Engineers Requirements				
	8.5	.2 ; Requirements				
2.7		(a) Cellular phone costs	Prov. Sum	1	12 000.00	12 000.00
2.8		(b) Overheads, Charges & Profit on Above	%			
2.9		(c) Acceptance control testing	Prov. Sum	1	250 000.00	250 000.00
2.10		(d) Overheads, Charges & Profit on Above	%			
2.11		(e) Site Office Consumables & PPE	Prov. Sum	1	32 000.00	32 000.00
2.12		(f) Overheads, Charges & Profit on Above	%			
2.13		(g) Electronic Office Equipment	Prov. Sum	1	15 000.00	15 000.00
2.14		(h) Overheads, Charges & Profit on Above	%			
		Work to Existing Services				
		.3 Existing Services				
2.15		(a) Locating Existing Services	Prov. Sum	1	15 000.00	15 000.00
2.16		(b) Overheads, Charges & Profit on Above	%			
2.17		(c) Relocating Existing Services	Prov. Sum	1	50 000.00	50 000.00
2.18		(d) Overheads, Charges & Profit on Above	%			
		Professional or Specialist Services				
		.4 Specialist Services				
2.19		(a) Specialist surge analysis, testing and commissioning of altitude valves and pressure relief system	Prov. Sum	1	50 000.00	50 000.00
2.20		(b) Overheads, Charges & Profit on Above	%			
2.21		(c) SCADA integration, calibration and commissioning	Prov. Sum	1	150 000.00	150 000.00
2.22		(d) Overheads, Charges & Profit on Above	%			
					Carried forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought forward	
		PRIME COST ITEMS				
	8.6	**Prime Cost Items**				
		Prime Cost Items				
2.23		.1 (a) Materials Used in the Execution of Dayworks	Prov. Sum	1	50 000.00	50 000.00
2.24		(b) Overheads, Charges & Profit on (a) above	%			
2.25		.2 (a) Materials Used in the Altitude Valves	Prov. Sum	1	2 000 000.00	2 000 000.00
2.26		(b) Overheads, Charges & Profit on (a) above	%			
2.27		(c) Transport and labour to handle and install (a) above	Sum	1		
		OTHER GENERAL CHARGES				
2.28	PPG 8.3.2	.1 Provision of as-built drawings and details	Sum	1		
2.29	PPG 8.3.3	.2 Provide Operation and Maintenance Manuals	Sum	1		
2.30	PPG 8.3.4	.3 Training	Sum	1		
		Schedule No.: 2 **Provisional Sums and Prime Cost Items**				
					Carried forward to summary of schedules	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
	SANS	**Schedule No.: 3** **DAYWORKS**				
	8.7	**LABOUR**				
3.1		a) Qualified Artisan	hr	1		
3.2		b) Skilled	hr	1		
3.3		c) Semi-skilled	hr	1		
3.4		d) Unskilled	hr	1		
3.5		e) Welder	hr	1		
		PLANT HIRE: WORK RATES ON SITE				
		Tipper truck (specify capacity)				
3.6		a) .....m³ (small)	hr	1		
3.7		b) .....m³ (large)	hr	1		
		Tractor Loader Backhoe (TLB)				
3.8		a) .....m³ bucket	hr	1		
3.9		Specify type	hr	1		
		Compactor				
		Plate compactor (Specify model)				
		Model type				
3.10		a) .....(3000 kg applied force)	hr	1		
		Concrete mixer (Specify capacity)				
3.11		a) .....(small towable)	hr	1		
		Miscellaneous				
3.12		a) Compressor with capacity of 10m³/min	hr	1		
3.13		b) Water pump with 25 l/s capacity	hr	1		
3.14		c) Welding unit (300 Amp)	hr	1		
3.15		d) 4 kVA Diesel driven generating set	hr	1		
3.16		e) Other (Specify)	hr	1		
		PLANT HIRE: TRANSPORT COST TO AND FROM SITE				
		(Distance shall be measured one way only. Tendered rates shall include for transport both to and from site)				
3.17		Low bed (suitable for the largest piece of equipment above)	km	50		
		Tipper truck				
3.18		a) Small	km	20		
3.19		b) Large	km	20		
		Water Tanker				
3.20		a) Small (towable)	km	20		
3.21		b) Large	km	20		
		Concrete mixer				
3.22		a) Small	km	20		
3.23		b) Large	km	20		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		LABOUR BASED EQUIPMENT				
3.24		a) Pick	day	1		
3.25		b) "Gwalas"	day	1		
3.26		c) Shovel	day	1		
3.27		d) Wheelbarrow	day	1		
3.28		e) Bucket (20l)	day	1		
		Schedule No.: 3 **DAYWORKS**				
					Total Carried forward to Summary of Schedules	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
		Schedule I 4 **NEW BREAK PRESSURE TANK (BPT) AND ADJOINING VALVE**				
	SANS 1200 C	**BREAK PRESSURE TANK (BPT)**				
	PSC	**SITE CLEARANCE**				
		CLEAR SITE				
		CLEAR AND GRUB SITE				
	8.2.1	.1 Clear and grub area for				
4.1		(a) Platforms	m²	94		
		REMOVE LARGE TREES AND STUMPS				
	8.2.2	.2 Remove and grub large trees and tree stumps of girth				
4.2		(a) Exceeding 1m and up to and including 2m	no	1		
	SANS 1200 DM	**TOPSOIL AND LANDSCAPING**				
		REMOVE TOPSOIL				
	8.3.2	.1 Remove topsoil to a depth of 150mm and				
4.3		(a) Stockpile on site and maintain	m³	14		
		FINISHING, TOPSOILING AND GRASSING				
	8.3.10	.2 Topsoiling with material from stockpiles on site				
4.4		(a) Spread over site	m³	14		
	SANS 1200 D	**EARTHWORKS**				
		BULK EXCAVATION				
	8.3.2	.1 Bulk excavation in all materials and place material on site				
4.5			m³			R/O
	8.3.2	.2 Extra over reference 8.3.2 (a) for				
4.6		(a) Hard rock excavation	m³			R/O
4.7		(b) Boulder excavation, Class A	m³			R/O
4.8		(c) Boulder excavation, Class B	m³			R/O
		RESTRICTED EARTHWORKS				
	8.3.3	.1 Restricted excavation in all materials and place material on site				
4.9		(a) Excavation for break pressure tank and adjoining valve chamber	m³	842		
		RESTRICTED EXCAVATION				
	8.3.3	.1 Extra over reference 8.3.3 (a) for				
4.10		(a) Hard rock excavation (No high velocity explosives allowed)	m³	85		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		IMPORTING OF MATERIALS				
		NOTE: The rates for imported materials shall also cater for the same volume of spoiling of unsuitable material.				
		COMMERCIAL MATERIAL PROVIDED BY THE CONTRACTOR				
	8.3.4	.1 Extra over reference 8.3.2 (a) .3 & .4 for importation of materials				
		NOTE: Rate to include for bulking factor to accommodate for a minimum of 95% mod AASHTO density. Addditional volume will not be paid for shortfall of material due to bulking.				
4.11		(a) G5 material - Mass fill material for platform	m³	30		
	SANS 1200 DB	**SHORING OF EXCAVATIONS**				
		Temporary support to sides of excavations				
	8.3.4	.1 Shore sides of excavation for structures				
4.12		(a) Support to sides of BPT and adjoining valve chamber excavation	m²	197		
		NOTE: Measurement for support to sides of excavations for structures shall be based on the exposed area of excavation faces requiring support.				
		The Contractor shall be deemed to have allowed for all necessary temporary works and shoring required to ensure excavation stability, including in embankment conditions.				
		Shoring is measured only to excavation faces requiring support, as per SANS 1200 DB 8.3.4, and excludes sides open to atmosphere or constructed above ground.				
		BACKFILLING RESTRICTED EXCAVATIONS				
		Extra over reference 8.3.2 (a) and 8.3.3 (a) for backfill or for fill material against structures				
	8.3.9	.1 Selected material compacted to 93% mod AASHTO density				
4.13		(a) Alongside outer reservoir walls, sloping of platform embankment & filling chambers in foundations	m³	629.00		
4.14		(b) Permanent protective soil cover to pipelines supported on pedestals adjacent to reservoir embankment, placed to exclude soil ingress and protect pipework. No structural function intended.	m³	15		
		CONCRETE (STRUCTURAL)				
	SANS 1200 G	**ROUGH FORMWORK**				
	8.2.5	.1 Rough formwork to narrow widths				
4.15		(a) Edges, risers, etc not exceeding 300mm wide	m	150		
		SMOOTH FORMWORK				
		SMOOTH FORMWORK				
	8.2.2	.1 Plane horizontal				
4.16		(a) Soffit of Roof Slab	m²	69		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	8.2.2	.2 Plane vertical				
4.17		(a) Sides of BPT and adjoining chamber walls (internal & external)	m²	415		
	8.2.5	.3 Smooth formwork to narrow widths				
4.18		(a) Edges, risers, etc.	m	150		
	8.1.1.2	.4 Smooth formwork to chamfers, grooves, rebates, etc. exceeding 20x20mm in size				
4.19		(a) Drip groove 25mm halfround	m	5.7		
		REINFORCEMENT				
	8.3.1	Steel bars				
		.1 Mild steel				
4.20		(a) All sizes	ton			R/O
		.2 High tensile steel				
4.21		(a) All sizes	ton	32.0		
		CONCRETE				
		STRENGTH CONCRETE				
	8.4.2	.1 Strength concrete 15Mpa/20mm				
4.22		(a) Blinding layer 50mm thick	m³	2.00		
4.23		(b) Blinding layer 100mm thick	m³	6.00		
4.24		(c) Mass concrete thrust blocks	m³	3		
	8.4.3	.2 Strength concrete 30Mpa/20mm				
4.25		(a) BPT and adjoining valve chamber base slab	m³			R/O
4.26		(b) BPT and adjoining valve chamber walls	m³			R/O
4.27		(c) BPT and adjoining valve chamber roof slab	m³			R/O
	8.4.3	.3 Strength concrete 30Mpa/20mm with "Penetron add mix" to engineers specification				
4.28		(a) BPT and adjoining valve chamber Floor slab	m³	47.30		
4.29		(b) BPT and adjoining valve chamber Walls	m³	145.09		
4.30		(c) BPT and adjoining valve chamber Roof Slab	m³	20.53		
	8.4.3	.4 Strength concrete 40Mpa/20mm with "Penetron add mix" to engineers specification				
4.31		(a) BPT and adjoining valve chamber Walls	m³			R/O
	8.4.3	.5 Strength concrete 10Mpa				
4.32		(a) Leveling screed 10mm thick to top of no fines concrete (wastage shall be included in the rate) including steel float finish	m²	48.00		
		SURFACE FINISHING				
		Unformed surface finishes				
	8.2.6	.1 Wood floated finish				
4.33		(a) Internal floor surfaces	m²	48.00		
		.2 Steel floated finish				
4.34		(a) Top of walls, plinths, slabs (where exposed)	m²	47.00		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	8.2.6	.3 Power floated finish				
4.35		(a) Internal floor slab	m²	47.30		
		EXPANSION JOINTS				
		CONSTRUCTION JOINTS *DWG 3890.00.00.SQA.14.D001*				
4.36	8.5	.1 Construction joint at floor slab	m	30		
4.37	8.5	.2 Construction joint at walls	m	60		
4.38	8.5	.3 Construction joint at roof slab	m	30		
	8.2.8	.4 Joint sealer				
4.39		(a) Remove tear off strip, prime with an approved primer and fill joint with 50 x 25mm thick ultra low modulus silicone/ hybrid sealant (including backing cord), after waterproof testing has been successfully completed	m	120		
	8.5	.5 Waterstops				
4.40		(a) "Sika" waterbar (AR-20) or similar approved	m	120		
4.41		(b) "Sika" waterbar (AR-25) or similar approved	m			R/O
4.42		(c) "Sikaswell P-2005M" or similar approved	m			R/O
		MEMBRANES AND BANDAGES				
		SLIP MEMBRANES				
	8.5	.1 2 layers x 250 micron PVC sheeting				
4.43		(a) Slip membrane under blinding / base slab	m²	47.30		
		TRIANGULAR FILLETS				
		.2 "Sondor SPX 120" or similar approved triangular corner fillets				
4.44		(a) 100 x 100 mm triangular fillets at floor–wall junctions	m	50		
		BANDAGES				
		.3 "Sikadur-combiflex SG-20M" or similar product approved) sealing strip bonded 75mm on each side onto concrete with 40 x 2.5mm bond breaker PVC backing strip over joint, fixing to manufacturers instructions				
4.45		(a) 200mm wide sealing strip to floor construction joint	m	80		
		.4 "Sikadur-combiflex SG-20M" or similar approved sealing strip bonded 50mm on each side onto concrete with 100mm centre portion left unbonded, fixing to manufacturers instructions				
4.46		(a) 200mm wide sealing strip to floor & wall corner joint	m	3		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		SUNDRIES				
		VENTILATION				
		.1 Supply, deliver and fix vermin-proof cover to side ventilation opening of Break Pressure Tank, manufactured from stainless steel or hot-dip galvanised steel mesh, securely fixed to concrete, including all frames, fixings and making good, complete.				
		Note: Vent cover to prevent ingress of vermin, insects and debris while allowing free airflow.				
4.47		(a) 120 x 1200 mm Air Vent	No	1		
		TESTING				
4.48		.1 Testing the Break Pressure Tank (BPT) for water tightness, including filling, monitoring, inspection, rectification of leaks and emptying on completion.	Sum	1		
		STERILIZATION				
4.49		.1 Sterilization and disinfection of the Break Pressure Tank (BPT) in accordance with the project specifications and applicable water authority requirements.	Sum	1		
		STRUCTURAL STEELWORK				
	SANS 1200 H	**SUPPLY, FABRICATE AND ERECT STEELWORK - ALL INCLUSIVE**				
		HANDRAILS				
		Supply, fabricate and install continuous handrail system to perimeter of Break Pressure Tank (BPT) roof slab, minimum 1 000 mm high, including posts, top rail, intermediate rail(s) and toe board where required, manufactured from hot-dip galvanised mild steel, fixed to concrete, installed complete in accordance with applicable SANS standards and occupational health and safety requirements.				
	8.3.7	.1 "Mentis" or similar approved standard galvanised handrail system, installed complete including posts, rails, fixings and anchorage to concrete, as detailed on the drawings and to the Engineer's approval. ***DWG 3890.00.00.SQA.14.D001***				
4.50		(a) Continuous handrail system to BPT roof perimeter	m	30.6		
		LADDERS *Including all necessary design, detailing, fabrication, corrosion protection, transport and installation complete*				
	8.3.8	.2 Hot dip galvanised mild steel vertical access ladders installed complete, including fixing bolts, etc. as per ***DWG 3890.00.00.SQA.14.D001***				
4.51		(a) External access ladder with safety cage and bolted to reservoir walls with M16 "Hilti HVU M16 x 125" adhesive anchors and "HAS-E-R M16 x 125/20" rods, installed complete	No	1		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	8.3.8	.3 Stainless steel internal vertical access ladder (cat ladder) inside Break Pressure Tank (BPT), manufactured from Grade 304 (minimum) stainless steel, including brackets and fixings, installed complete as per ***DWG 3890.00.00.SQA.14.D001***				
4.52		(a) Camber 1, 2 and 3 Internal access ladder with safety cage and bolted to reservoir walls with M16 "Hilti HVU M16 x 125" adhesive anchors and "HAS-E-R M16 x 125/20" rods, installed complete	No	3		
4.53		(b) Valve Chamber internal access ladder with safety cage and bolted to reservoir walls with M16 "Hilti HVU M16 x 125" adhesive anchors and "HAS-E-R M16 x 125/20" rods, installed complete	No	1		
4.54		(c) Extra over item above for external access ladder locking device installed complete as per ***DWG 3890.00.00.SQA.14.D001***	No	1		
		ACCESS COVERS				
		.4 Stainless steel access cover, support frame and locking device, hinges, etc. installed complete as per ***DWG 3890.00.00.SQA.14.D001***				
4.55		(a) 1200 x 2400mm Roof manhole cover, support frame, locking device, hinges, etc. installed complete	No	2		
4.56		(b) 900mm x 600mm STANDARD SMARTLOCK NON-METALLIC ACCESS LID	No	4		
	SANS 1200 L	**VALVES AND APPURTENANCES (BPT)**				
		Supply, install and commission gate valve complete with all flanges, bolts, nuts, gaskets, fixings and extended spindle and penstock				
4.57		.1 NB300 gate valve (Class 10) located in 3rd compartment of Break Pressure Tank for drainage to overflow system	no	1		
		NOTE: Valve shall be installed within BPT chamber and include all necessary supports, connections to pipework and sealing arrangements.				
		Schedule No: **NEW BREAK PRESSURE TANK (BPT) AND ADJOINING VALVE CHAMBER**				
		Carried forward to Summary of Bills			**Total**	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
		Schedule 5 **VALVE / PIPE CHAMBERS**				
		Cross-Connection Chamber (US) and Hydropower Connection				
	SANS 1200 D	**EARTHWORKS**				
		RESTRICTED EARTHWORKS				
	8.3.3	.1 Restricted excavation in all materials and place material on site				
5.1		(a) Excavation for cross-connection valve chamber	m³	88		
5.2		(b) Excavation for valve chamber downstream of hydropower connection	m³	33		
		WORKING SPACE				
	8.3.5	.1 Extra excavation and backfilling in all materials to provide working space around structures				
5.3		(a) Excavate for working space (previously excavated face +- 300mm away from perimeter of structure) for the placing and removal of external formwork to foundation footings & walls. Average depth of excavation 3m deep, including backfilling and compaction to 90% mod AASHTO density	m²	9		
	SANS 1200 DB	**SHORING OF EXCAVATIONS**				
		Temporary support to sides of excavations				
		.1 Shore sides of excavation for structures				
5.4		(a) Cross-connection valve chamber excavation	m²	14		
		NOTE: Measurement for support to sides of excavations for structures shall be based on the exposed area of excavation faces requiring support.				
		The Contractor shall be deemed to have allowed for all necessary temporary works and shoring required to ensure excavation stability, including in embankment conditions.				
		BACKFILLING RESTRICTED EXCAVATIONS				
	8.3.9	Extra over reference 8.3.2 (a) and 8.3.3 (a) for backfill or for fill material against structures				
		.1 Selected material compacted to 93% mod AASHTO density				
5.5		(a) Alongside outer valve chamber walls in foundations	m³	27		
	SANS 1200 G	**CONCRETE (STRUCTURAL)**				
		ROUGH FORMWORK				
	8.2.5	.1 Rough formwork to narrow widths not exceeding 300mm wide				
5.6		(a) Edges, risers, etc.	m	52.0		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		SMOOTH FORMWORK				
		(To include for drip grooves and chamfers on all exposed edges as shown)				
	8.2.2	.1 Plane vertical				
5.7		(a) Chamber walls - Internal & External	m²	210.0		
5.8		(b) Thrust blocks/plinths inside chamber	m²	1.0		
	8.2.5	.2 Smooth formwork to narrow widths not exceeding 300mm wide				
5.9		(a) Edges, risers, etc.	m	50		
		BOXING IN FOR HOLES AND VOIDS				
	8.2.6	.1 Large, circular, of a diameter over 0.35m and up to and including 0,7m				
5.10		(a) up to 0,5m	no	9		
		REINFORCEMENT				
		Steel bars				
	8.3.1	.1 Mild steel				
5.11		(a) All sizes	ton	1		R/O
	8.3.1	.2 High tensile steel				
5.12		(a) All sizes	ton	11.00		
		CONCRETE				
	8.4.2	.1 Strength concrete 15Mpa/19mm				
5.13		(a) Blinding layer 50mm thick	m³	6.00		
	8.4.3	.2 Strength concrete 25Mpa/19mm				
5.14		(a) Mass filling as pipe/valve support	m³	0.10		
	8.4.3	.3 Strength concrete 40Mpa/19mm				
5.15		(a) Floor slabs	m³	17.00		
5.16		(b) Walls	m³	37.00		
	8.4.3	.4 Strength concrete 25Mpa/13mm				
5.17		(a) Benching to floors including steel floated surface finish	m³			R/O
		SURFACE FINISHES				
		Unformed surface finishes				
	8.4.4	.1 Wood floated finish				
5.18		(a) Floor	m²	56.0		
	8.4.4	.2 Steel floated finish				
5.19		(a) Top of walls, beams, plinths, etc	m²	23.0		
		JOINTS				
	8.5	.1 Cold placed bitumen or mastic sealant to all joints between each **precast** roof slab panel and the chamber walls				
5.20			m	47.5		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Pay Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		PRECAST CONCRETE				
		REMOVABLE COVER SLAB PANELS				
	8.6	.1 250mm thick concrete (35/19 strength) cover panels. Complete with reinforcing, lifting hooks, openings, etc.				
5.21		**Refer Dwg 3890.00.00.GZA.05.D004**	no	6		
5.22		.2 Extra over for casting in lifting hooks (Hooks included)	no	24		
	SANS 1200 G	**SUNDRIES**				
		ACCESS LIDS AND COVERS				
		.1 Supply, deliver to site and casting of Non-metallic, polymer Clear opening access cover and frame.				
5.23		(a) SmartLock MHL-001 Type (700mm Lid)	no	3		
	8.3.8	**HOT DIP GALVANISED MILD STEEL LADDERS**				
5.24		.1 Ladder **2200mm** long, including grab bar, supply and install	no	1		
5.25		.2 Ladder **1000mm** long, including grab bar, supply and install	no	2		
		VENTILATORS				
	8.3.12	Galvanised mild steel ventilator installed complete **Refer Dwg 3890.00.00.GZA.05.D004**				
5.26		.1 100mmx75mm ventilator complete with vermin proof	no	3		
		Schedule 5 **VALVE / PIPE CHAMBERS**				
		Carried forward to Summary of Bills			**Total**	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
		Schedule 6				
		BUFFER TANK				
	SANS 1200 C	***500kl pressed steel buffer tank with isolation***				
		SITE CLEARANCE				
		CLEAR SITE				
		CLEAR AND GRUB SITE				
	8.2.1	.1 Clear and grub area for				
6.1		(a) Platforms	m²	144		
		REMOVE LARGE TREES AND STUMPS				
	8.2.2	.2 Remove and grub large trees and tree stumps of girth				
6.2		(a) Exceeding 1m and up to and including 2m	no	5		
	SANS 1200 DM	**TOPSOIL AND LANDSCAPING**				
		REMOVE TOPSOIL				
	8.3.2	.1 Remove topsoil to a depth of 150mm and				
6.3		(a) Stockpile on site and maintain	m³	22		
		FINISHING, TOPSOILING AND GRASSING				
	8.3.10	.2 Topsoiling with material from stockpiles on site				
6.4		(a) Spread over site	m³	22		
		EARTHWORKS				
	SANS 1200 D	**BULK EXCAVATION**				
	8.3.2	.1 Bulk excavation in all materials and place material on site				
6.5			m³	43		R/O
	8.3.2	.2 Extra over reference 8.3.2 (a) for				
6.6		(a) Hard rock excavation	m³			R/O
6.7		(b) Boulder excavation, Class A	m³			R/O
6.8		(c) Boulder excavation, Class B	m³	30		
		RESTRICTED EARTHWORKS				
	8.3.3	.1 Restricted excavation in all materials and place material on site				
6.9		(a) Excavation for buffer tank footings	m³	259		
		RESTRICTED EXCAVATION				
	8.3.3	.1 Extra over reference 8.3.3 (a) for				
6.10		(a) Hard rock excavation (No high velocity explosives allowed)	m³	26		
		BACKFILLING RESTRICTED EXCAVATIONS				
	8.3.9	Extra over reference 8.3.2 (a) and 8.3.3 (a) for backfill or for fill material against structures				
		.1 Selected material compacted to 93% mod AASHTO density				
6.11		(a) Alongside support walls below tank in all foundations\	m³	259		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		CONCRETE (STRUCTURAL)				
	SANS 1200 G	**ROUGH FORMWORK**				
	8.2.5	.1 Rough formwork to narrow widths not exceeding 300mm wide				
6.12		(a) Edges, risers, etc.	m	240.0		
		SMOOTH FORMWORK				
		(To include for drip grooves and chamfers on all exposed edges as shown)				
	8.2.2	.1 Plane vertical				
6.13		(a) Tank supports including corners and edges	m²	148.0		
	8.2.5	.2 Smooth formwork to narrow widths not exceeding 300mm wide				
6.14		(a) Edges, risers, etc.	m			R/O
		BOXING IN FOR HOLES AND VOIDS				
	8.2.6	.1 Large, circular, of a diameter over 0.35m and up to and including 0,7m				
6.15		(a) up to 0,5m	no			R/O
		REINFORCEMENT				
		Steel bars				
	8.3.1	.1 Mild steel				
6.16		(a) All sizes	ton	1		R/O
	8.3.1	.2 High tensile steel				
6.17		(a) All sizes	ton	3.30		
		CONCRETE				
	8.4.2	.1 Strength concrete 15Mpa/19mm				
6.18		(a) Blinding layer 50mm thick	m³			R/O
	8.4.3	.2 Strength concrete 25Mpa/19mm				
6.19		(a) Tank supports including corners and edges	m³	22.00		
		SURFACE FINISHES				
		Unformed surface finishes				
	8.4.4	.1 Wood floated finish				
6.20		(a) Floor	m²	72.0		
	8.4.4	.2 Steel floated finish				
6.21		(a) Top of walls, beams, plinths, etc	m²	36.0		
	SANS 1200 G	**SUNDRIES**				
	8.3.8	**HOT DIP GALVANISED MILD STEEL PANEL TANK INCLUDING**				
6.22		.1 Supply, deliver and errect 500kl pressed steel tank with roof rectangular, complete with all fasteners, ladders, latches, etc.	no	1		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	SANS 1200 DB	**MEDIUM PRESSURE PIPELINES**				
		EARTHWORKS (PIPE TRENCHES)				
		CLEAR AND GRUB SITE				
	8.3.1	.1 Clear and grub strips for (where not cleared within other clear and grub areas)				
6.23		(a) Pipeline 3m wide	m	20		
		EXCAVATION AND BACKFILLING				
		Excavate in all materials, backfill and compact to 90% mod AASHTO density, and dispose of surplus and unsuitable materials within the freehaul distance for trenches				
	8.3.2	.1 Up to 1m wide				
6.24		(a) Over 1m and up to 2m deep	m³			R/O
6.25		(b) Over 2m and up to 3m deep	m³	60.0		
	8.3.2	.2 Extra over items 8.3.2 (a) for				
6.26		(a) Hard rock excavation	m³	30		
6.27		(b) Hand excavation to expose existing services	m³	3		
	8.3.2	.3 Excavate unsuitable material from trench bottom, dispose within the freehaul distance, and re-fill with suitable imported material compacted to				
6.28		90% mod AASHTO density	m³			
	8.3.3.1	Make up deficiancy in backfill material (Provisional)				
	8.3.2	.4 Excavate from stockpile material on site and place over pipeline to form berm, including placement, compacting				
6.29		and shaping of embankments to 90% mod AASHTO density	m³			R/O
	SANS 1200 DB	**EXISTING SERVICES**				
		EXISTING SERVICES				
		Existing services that intersect or adjoin pipe trench excavations				
	8.3.5	.1 Services that intersect a trench				
6.30		(a) Electric cable	no	1		R/O
6.31		(b) Water main exceeding 300mm diabut not 1000mm	no	1		R/O
	8.3.5	.2 Services that adjoin a trench				
6.32		(a) Electric cable	m	1		R/O
6.33		(b) Water main not exceeding 300mm dia	m	1		R/O
	SANS 1200 LB	**BEDDING (PIPES)**				
		BEDDING FROM TRENCH EXCAVATIONS				
	8.2.1	.1 Provision of bedding material from trench excavations				
6.34		(a) Selected granular material	m³	1		R/O
6.35		(b) Selected fill material (sieved)	m³	1		R/O
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		BEDDING BY IMPORTATION				
	8.2.2	.2 Provision of bedding material by importation from other necessary excavations within the freehaul distance				
6.36		(a) Selected granular material	m³	22		
6.37		(b) Selected fill material	m³	8		
	SANS 1200 L	**MEDIUM PRESSURE PIPELINES**				
		STEEL PIPES				
	8.2.1	Supply, lay, joint, (bevel ended for fieldwelding) and bed and test steel water pipes				
		STRAIGHT STEEL PIPES				
		Supply and deliver flanged steel water pipes complete with solvent-free epoxy internal lining and 3-layer polyethylene (3LPE) external coating.				
		All pipes shall be suitable for a PN25 pressure rating and shall be supplied with EN 1092-1 PN25 weld-neck flanges factory-welded to the pipe ends.				
		Note: Cutting and welding of pipe mitres up to 3° are included in the price for pipe installation below (only mitres exceeding 3° are measured elsewhere).				
		.1 Grade X42 steel pipe (8mm)				
6.38		(a) ND600 steel pipeline	m	2.5		
		DISINFECT PIPES				
	8.2.1	.2 Disinfect pipes				
6.39		(a) 600mm Diameter	m	2.5		
		PIPE FITTINGS				
		PIPE FITTINGS Extra over items 8.2.1(a) for supply, install, bed and test the following Grade X42 steel fittings, including cutting of pipes, couplings or welding, etc (linging and coating included)				
		.1 Spool Pieces				
6.40		(a) SS puddle pipe ND600 (one end plain) (PS5)	no	1		
		VALVES AND APPURTENANCES				
		New valves (AVK or similar approved by Engineer), including supply, installation and tetsing				
6.41		.1 NB600 RSV Gate valve (Class 10)	no	1		
		Schedule 6 **BUFFER TANK**				
		Carried forward to Summary of Bills			**Total**	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
	SANS 1200 DB	**Schedule 7** **MEDIUM PRESSURE PIPELINES**				
		EARTHWORKS (PIPE TRENCHES)				
		CLEAR AND GRUB SITE				
	8.3.1	.1 Clear and grub strips for (where not cleared within other clear and grub areas)				
7.1		(a) Pipeline 3m wide	m	204		
		EXCAVATION AND BACKFILLING				
		Excavate in all materials, backfill and compact to 90% mod AASHTO density, and dispose of surplus and unsuitable materials within the freehaul distance for trenches				
	8.3.2	.1 Up to 1m wide				
7.2		(a) Over 1m and up to 2m deep	m³	160.0		
7.3		(b) Over 2m and up to 3m deep	m³	58.0		
	8.3.2	.2 Over 1m and up to 2m wide				
7.4		(a) Over 1m and up to 2m deep	m³	1		R/O
7.5		(b) Over 2m and up to 3m deep	m³	1		R/O
	8.3.2	.3 Over 2m and up to 3m wide				
7.6		(a) Over 1m and up to 2m deep	m³	1		R/O
7.7		(b) Over 2m and up to 3m deep	m³	1		R/O
7.8		(c) Over 3m and up to 4m deep	m³	1		R/O
	8.3.2	.4 Extra over items 8.3.2 (a) for				
7.9		(a) Hard rock excavation	m³	63		
7.10		(b) Hand excavation to expose existing services	m³	16		
	8.3.2	.5 Excavate unsuitable material from trench bottom, dispose within the freehaul distance, and re-fill with suitable imported material compacted to				
7.11		90% mod AASHTO density	m³	16		
	8.3.3.1 8.3.2	Make up deficiancy in backfill material (Provisional) .6 Excavate from stockpile material on site and place over pipeline to form berm, including placement, compacting				
7.12		and shaping of embankments to 90% mod AASHTO density	m³	500		
	SANS 1200 DB	**SHORING OF EXCAVATIONS**				
		Temporary support to sides of excavations				
	8.3.4	.1 Shore trench opposite structure or service				
7.13		(a) Pipeline excavations (both sides)	m	203.717		
		NOTE: The Contractor shall be deemed to have allowed for all necessary temporary works and shoring required to ensure excavation stability, including in embankment conditions.				
		ADDITIONAL COMPACTION				
	8.3.3	.1 Additional compaction in road reserves				
7.14		(a) Additional compaction (90% compaction included elsewhere) to obtain 93% mod AASHTO density	m³	8		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	SANS 1200 L	**WORK TO EXISTING SERVICES**				
		WORK TO EXISTING PIPELINES				
	8.2.8	.1 Cutting into existing pipelines				
7.15		(a) Existing ND700 steel pipeline (P1) – cut-in / connection	no	2		
7.16		(b) Existing ND1200 steel pipeline (P2) – cut-in / connection	no	1		
		.2 Preparation and repairs				
7.17		(a) Surface preparation, coating repair and wrapping to existing pip	m²			R/O
7.18		(b) Repair of internal cement mortar lining at cuts and joints	m			R/O
		.3 General connection item				
7.19		(a) Cutting into and connection to existing pipelines, including welding, coating, testing and reinstatement	no	1		R/O
	SANS 1200 DB	**EXISTING SERVICES**				
		Existing services that intersect or adjoin pipe trench excavations				
	8.3.5	.1 Services that intersect a trench				
7.20		(a) Electric cable	no	1		R/O
7.21		(b) Water main exceeding 300mm diabut not 1000mm	no	1		R/O
	8.3.5	.2 Services that adjoin a trench				
7.22		(a) Electric cable	m	1		R/O
7.23		(b) Water main not exceeding 300mm dia	m	1		R/O
	SANS 1200 LB	**BEDDING (PIPES)**				
		BEDDING FROM TRENCH EXCAVATIONS				
	8.2.1	.1 Provision of bedding material from trench excavations				
7.24		(a) Selected granular material	m³	21		R/O
7.25		(b) Selected fill material (sieved)	m³	62		R/O
		BEDDING BY IMPORTATION				
	8.2.2	.1 Provision of bedding material by importation from other necessary excavations within the freehaul distance				
7.26		(a) Selected granular material	m³	21		
7.27		(b) Selected fill material	m³	62		
	SANS 1200 L	**MEDIUM PRESSURE PIPELINES**				
		STEEL PIPES				
	8.2.1	Supply, lay, joint, (bevel ended for fieldwelding) and bed and test steel water pipes				
		STRAIGHT STEEL PIPES				
		Supply and deliver steel pipe with butt welded joints with solvent free epoxy internal lining and 3LPE external coating				
		Note: Cutting and welding of pipe mitres up to 3° are included in the price for pipe installation below (only mitres exceeding 3° are measured elsewhere).				
		.1 Grade X52 steel pipe (t=8mm)				
7.28		(a) ND700 steel pipeline (cross-connection)	m	18		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
7.29		(b) ND750 steel pipeline (cross-connection)	m	12		
7.30		(c) ND1016 mm steel pipeline (bypass pipeline)	m	129		
7.31		(d) ND1200 steel pipeline (downstream of BPT)	m	20		
		Use from site, lay, joint, bed and test steel pipe with butt welded joints with solvent free epoxy internal lining and 3LPE external coating as specified in the project specification including repair of internal linning and external coating after welding				
		.1 Grade X52 steel pipe (t=8mm)				
7.32		(a) ND700 steel pipeline (cross-connection)	m	18		
7.33		(b) ND750 steel pipeline (cross-connection)	m	12		
7.34		(c) ND1016 mm steel pipeline (bypass pipeline)	m	129		
7.35		(d) ND1200 steel pipeline (downstream of BPT)	m	20		
		Extra-over item 7.28 to7.31 for cutting of the pipe and the supplying and fixing of rated flanges including installation and making good for the protection against corrosion				
		.2 For all grades of steel pipes				
7.36		(a) ND700 steel pipeline (cross-connection)	no	3		
7.37		(b) ND750 steel pipeline (cross-connection)	no	2		
7.38		(c) ND1016 mm steel pipeline (bypass pipeline)	no	2		
7.39		(d) ND1200 steel pipeline (downstream of BPT)	no	2		
		PIPE BENDS AND SPECIALS				
		All pipe specials to be lined and coated with solvent free epoxy and taped wrapped as per as per Particular Specification PLQ.				
		Pipe Mitres				
		Extra over reference 8.2.1(a) for supply, install, bed and test the following fittings, including cutting of pipes, couplings, etc.				
		.1 Mitre Cut and Welded Joints				
7.40		(a) ND700mm Diameter (>3°- 12°)	no	1		R/O
7.41		(b) ND750mm Diameter (>3°- 12°)	no	2		
7.42		(c) ND1016mm Diameter (>3°- 12°)	no	1		R/O
7.43		(d) ND1200mm Diameter (>3°- 12°)	no	1		R/O
		Purpose Made Bends				
		Extra over reference 8.2.1(a) for supply, install, bed and test the following fittings, including cutting of pipes, couplings, etc.				
		.2 Purpose made steel bends				
7.44		(a) ND700mm Diameter (13°- 45°)	no	2		
7.45		(b) ND750mm Diameter (13°- 45°)	no	2		R/O
7.46		(c) ND1016mm Diameter (13°- 45°)	no	2		R/O
7.47		(d) ND1200mm Diameter (13°- 45°)	no	2		R/O
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		DISINFECT PIPES				
	8.2.1	.1 Disinfect pipes				
7.48		(a) 700mm Diameter	m	18		
7.49		(b) 750mm Diameter	m	12		
7.50		(c) 1000mm Diameter	m	129		
7.51		(d) 1200mm Diameter	m	20		
		.2 Hydraulic pressure test pipes				
7.52		(a) 700mm Diameter	m	18		
7.53		(b) 750mm Diameter	m	12		
7.54		(c) 1000mm Diameter	m	129		
7.55		(d) 1200mm Diameter	m	20		
		PIPE FITTINGS				
		PIPE FITTINGS Extra over items 8.2.1(a) for supply, install, bed and test the following Grade X42 steel fittings, including cutting of pipes, couplings or welding, etc (linging and coating included)				
		.1 Reducers				
7.56		(a) Flanged reducer ND900–ND750 (R1)	no	1		
7.57		(b) Flanged reducer ND750–ND1000 (R2)	no	1		
7.58		(c) Flanged reducer ND750–ND1000 (R3)	no	1		
7.59		(d) Flanged reducer ND750–ND500 (R4)	no	1		
		.2 Tees (All Tees to be gussated)				
7.60		(a) Unequal flanged tee ND900 × ND450 (T1)	no	1		
7.61		(b) Unequal flanged tee ND900 × ND750 (T1)	no	1		
		.3 Cross-connection fittings (ND700 PN25)				
7.62		(a) Loose PN25 flange welded onto existing ND711 pipe	no	1		
7.63		(b) Equal gusseted flanged tee ND700 PN25	no	1		
7.64		(c) Unequal gusseted flanged tee ND700 PN25	no	1		
7.65		(d) ND700 PN25 dismantling joint (Viking Johnson)	no	1		
7.66		(e) Puddle flange PN25 welded in halves onto existing pipe	no	1		
7.67		(f) Pipe special with puddle flange (flanged/plain ends)	no	1		
7.68		(g) 13° bend ND700 PN25	no	1		
7.69		(h) 15° bend ND700 PN25	no	1		
		.4 Pipe specials / spools				
7.70		(a) Flanged ND750 main branch with ND450 branches (PS1)	no	1		
7.71		(b) Flanged 90° bend ND450 (PS2)	no	1		
7.72		(c) Flanged ND500 pipe piece (PS3)	no	1		
7.73		(d) SS puddle pipe ND450 (one end plain) (PS4)	no	1		
7.74		(e) SS puddle pipe ND500 (one end plain) (PS5)	no	1		
7.75		(f) SS puddle pipe ND1200 (one end plain) (PS6)	no	1		
7.76		(g) Flanged ND1200 pipe piece (PS7)	no	1		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		.5 Flanges				
7.77		(a) Blank flange PN25 (B1)	no	1		
		VALVES AND APPURTENANCES				
		VALVES AND APPURTENANCES				
		.1 Existing valve				
7.78		(a) Existing ND700 butterfly valve PN25 (remove, refurbish, and reinstall)	no	1		
		.2 New valves (AVK or similar approved by Engineer)				
7.79		(a) NB750 eccentric flanged butterfly valve (Class 25)	no	1		
7.80		(b) NB900 eccentric flanged butterfly valve (Class 25)	no	1		
7.81		(c) NB1200 eccentric flanged butterfly valve (Class 10)	no	1		
		.3 Flow meter				
7.82		(a) Clamp-on ultrasonic flow meter on ND1016 pipeline (M1), including installation, calibration and commissioning	no	1		
	SANS 1200 LE	**STORMWATER DRAINAGE**				
		BPT OVERFLOW OUTLET PIPELINE AND MANHOLE				
	8.2.1	Supply, lay, bed (class B bedding) and test concrete pipe culverts to SABS 677. Excavation measured elsewhere.				
	8.2.1	.1 Interlocking Joint Pipes Class 50D				
7.83		(a) 1200mm Diameter	m	25		
		NEW MANHOLE AT STORMWATER CONNECTION				
		Reinforced Concrete Base				
		New stormwater outlet concrete base in strength concrete 25Mpa/19mm, including all formwork, , reinforcement, benching to invert level and making good, complete				
	8.2.11	.1 Measured per m³				
7.84		(a) Manhole Base Footings (Incl. reinforcing)	m³	3		
		Supply, deliver to site and installation of new concrete ring manholes (1800mmND) complete with custom SmartLock, no-metallic lid and frame cast into cover slab, cover slab and step irons, vents, etc. Concrete footing measured elsewhere. Refer Dwg 3338.00.00.GZA.05.D004 & D005				
		.1 For total chamber depths of:				
7.85		(a) 0 to 2m	no			R/O
7.86		(b) 2 to 2.5m	no	1		
7.87		(a) 2.5 to 3.5m	no			R/O
		CONNECTION TO EXISTING STORMWATER PIPELINE				
	8.2.1	Breaking into existing stormwater manhole or pipeline and making good, including all cutting of existing pipe or structure, preparation of surfaces, installation of connector or saddle fitting, sealing of joint, and making good all disturbed surfaces, complete				
7.88	8.2.1	(a) Connection of 600mm diameter BPT overflow outlet pipe to existing stormwater infrastructure	no	1		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	SABS 1200L	**CONCRETE ENCASEMENT AND THRUST BLOCKS**				
		CONCRETE ENCASEMENT AND THRUST BLOCKS				
		Anchor/thrust blocks and pedestals in strength concrete 25Mpa/19mm, including all formwork, reinforcement, etc				
	8.2.11	.1 Measured per m³				
7.89		(a) Thrust blocks	m³	2		
7.90		(b) Bypass pipeline pedestals (no reinforcement), 6m intervals (Ap	no	24		
	8.2.12	Encasement of pipes in strength concrete 25Mpa/19mm including all formwork, reinforcement, etc				
7.91		.2 Casing around pipes	m³			R/O
		SOILCRETE				
		.1 Soilcrete (5% OPC)				
7.92		(a) Backfilling around pipes	m³	8		
		Schedule 7 **MEDIUM PRESSURE PIPELINES**				
		Carried forward to Summary of Bills			**Total**	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
		Schedule 8 **EARTHWORKS (ACCESS ROADS & DIVERSION)**				
	SANS 1200 C	**ACCESS ROAD, TEMPORARY DIVERSION AND CROSSING**				
		.1 Clear and grub				
8.1	8.2.1	(a) Clear and grub areas for temporary access tracks and deviations	m²	900		
	8.2.2	.2 Remove and grub trees and tree stumps				
8.2		(a) Exceeding 300 mm girth up to 1 m girth	no	15		
8.3		(b) Exceeding 1 m girth and up to 2 m girth	no	10		
		NOTE: Rates for tree removal shall include cutting, grubbing of roots, backfilling, compaction and disposal of material off site.				
		.3 Disposal of vegetation				
8.4		(a) Disposal of cleared vegetation, trees and stumps off site or at an approved area	sum	1		
	SANS 1200 DM	**EARTHWORKS (ACCESS ROADS/TRACKS)**				
		.1 Formation of tracks				
8.5	8.3.3	(a) Shape and prepare formation for access tracks including trimming and compaction	m²	600		
	8.3.4	.2 Localised cut to fill to form access tracks				
8.6		(a) Compacted to 90% mod AASHTO density	m³	150		
		.3 Removal of unsafe material				
8.7	8.3.7	(a) Excavate and dispose unsuitable material	m³	100		
		.4 Selected gravel				
8.8	8.3.4	(a) Provide selected gravel material for access tracks from on-site or imported sources	m³	150		
		TEMPORARY ACCESS MANAGEMENT				
		.1 Management of tracks				
8.9		(a) Maintain access tracks including grading and repair for the duration of construction	month	12		
		.2 Relocation of tracks				
8.10		(a) Allow for relocation and regrading of access tracks as construction progresses (by instruction of Engineer only)	sum	1		
		PIPELINE ROAD CROSSING				
	SANS 1200 DB	**EXCAVATION**				
8.11	8.3.2	.1 Excavate trench for pipeline crossing under access track	m³	4		
	SANS 1200 LB	**BEDDING**				
8.12	8.2.1	.1 Provide selected granular bedding material to pipeline	m³	1.2		
	SANS 1200 G	**CONCRETE ENCASEMENT**				
8.13		.1 Concrete encasement to pipeline from CH 7.374 to CH 13.374 of bypass pipeline complete	m³	6		
		TEMPORARY ACCESS DURING CROSSING				
8.14		.1 Provide temporary deviation during crossing construction	SUM	1		
					Carried Forward	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref.	Description	Unit	Qty	Rate	Amount
					Brought Forward	
	SANS 1200 DM	**REINSTATEMENT**				
		.1 Remove temporary tracks				
8.15		(a) Scarify and remove temporary access tracks	m²	600		
		.2 Reinstate original condition				
8.16		(a) Reinstate ground and access tracks to original condition	m²	600		
		Schedule 8 **ACCESS ROAD, TEMPORARY DIVERSION AND CROSSING WORKS**				
		Carried forward to Summary of Bills			**Total**	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
	PSJS	**Schedule 9** **JOINT SEALING**				
		EXPANSION JOINTS				
	4.2	.1 Cleaning of surfaces				
9.1	5.1.1 a)	(a) Concrete surfaces on floor	m^2	500		
9.2	5.1.1 a)	(b) Concrete surfaces on walls	m^2	35		
9.3	5.1.1 b)	(c) Steel surfaces on any plane and angle	m^2	10		
	4.3	.2 Joint Sealing (Sika range or similar approved)				
9.4	5.2.1 a)	(a) Sikadur - Combiflex® SG System complete (250mm wide, 2mm thick) (on floor)	m	1375		
9.5	5.2.1 a)	(b) Sikadur - Combiflex® SG System complete (250mm wide, 2mm thick) (on walls)	m	100		
9.6	5.2.1 a)	(c) Sikadur - Combiflex® SG System complete (250mm wide, 2mm thick) (on wall/floor joints)	m			R/O
9.7	5.2.1 b)	(d) Thermal joint welding	No	59		
	3.3	.3 Waterstopping through cracks and joints (Sika range or similar approved)				
9.8	5.3.1 a)	(a) Temporary waterstopping with injected Sika® Injection - 101 RC	m	10		
9.9	5.3.1 b)	(b) Perminant waterstopping with injected Sika® Injection - 203	m	10		
	PSG	**REFILL AND TESTING PHASE**				
	8.12	Facilitate & monitor refilling of reservoir (Water supplied free) .1 For each reservoir compartment:				
9.10		(a) 65 Mℓ reservoir compartment 1	sum	1		
9.11		(b) 65 Mℓ reservoir compartment 2	sum	1		
		Test water quality post-filling of the reservoir .2 For each reservoir:				
9.12		(a) 65 Mℓ reservoir compartment 1	sum	1		
9.13		(b) 65 Mℓ reservoir compartment 2	sum	1		
		Facilitate and monitor water level drop test .3 For each reservoir:				
9.14		(a) 65 Mℓ reservoir compartment 1	sum	1		
9.15		(b) 65 Mℓ reservoir compartment 2	sum	1		
		SUNDRIES				
		Access Ladders				
		.1 Stainless steel internal vertical access ladder (cat ladder) inside Reservoir manufactured from Grade 304 (minimum) stainless steel, including brackets and fixings, installed complete				
9.16		(a) 9400 mm Height	no	4		
		ALTERNATIVE				
		.2 Aluminium internal vertical access ladder inside Reservoir with safety cage including brackets and fixings, installed complete				
9.17		(a) 9400 mm Height	no	4		R/O
		Schedule 9 **JOINT SEALING**				
		Carried forward to Summary of Bills			**Total**	

Contractor | Witness 1 | Witness 2 | Employer | Witness 1 | Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
	PSG	**Schedule 10** **CONCRETE SPOIL REPAIR**				
		.1 Pressure wash all concrete surfaces to remove loose material and leave an open pore structure, including removal of waste from reservoir				
10.1		(a) Floor and inclined surfaces less than 45 degrees	m^2	24500		
10.2		(b) Walls/Inclined surfaces from 45 degrees and greater	m^2	6600		
10.3		(c) Roof Soffit	m^2	25000		
10.4		(d) Columns and column heads	m^2	10200		
		Minor concrete spalls				
10.5		Cut max 20mm deep with a grinder around the area to be removed. Cut at a slight angle to create a dovetail/mechanical key for repair. Break out concrete to depth of spalled reinforcement. Remove any corroded material from rebar by mechanical means. Ensure concrete is acceptably clean with an open pore structure and meets the product supplier's requirements.	m^2	90		
		.2 Apply Penecrete mortar in layers all strictly in accordance with the manufacturer's specifications:				
10.6		(a) floor and inclined surface less than 45 degrees	litre	50		
10.7		(b) walls and inclined surfaces 45 degrees and greater	litre	50		
10.8		(c) columns and column heads	litre	1040		
10.9		(d) roof soffit	litre	1560		
		.3 Severe concrete spalls but where reinforcing loss due to corrosion is limited (to be evaluated on site)				
10.10		a) Cut max 20mm deep with a grinder around the area to be removed. Break out concrete to approximately 50mm deep beyond spalled reinforcement. Remove any corroded material from rebar by mechanical means. Ensure concrete is acceptably clean with an open pore structure and meets the product supplier's requirements.	m^2	105		
		b) Apply Penecrete mortar in layers all strictly in accordance with the manufacturer's specifications:				
10.11		(a) floor and inclined surface less than 45 degrees	litre	60		
10.12		(b) walls and inclined surfaces 45 degrees and greater	litre	240		
10.13		(c) columns and column heads	litre	3400		
10.14		(d) roof soffit	litre	3600		
		.4 Severe concrete spalls where reinforcing corrosion is significant, requiring reinforcing steel replacement (to be evaluated on site)				
10.15		a) Cut max 20mm deep with a grinder around the area to be removed. Break out concrete to approximately 50mm deep beyond spalled reinforcement and 50 x bar diameter beyond the area where reinforcing must be replaced. Cut out compromised reinforcing section. Remove any corroded material from remaining rebar by mechanical means. Ensure concrete is accepably clean with an open pore structure and meets the product supplier's requirements.	m^2	130		
					Carried Forward	

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Item	Ref	Description	Unit	Qty	Rate	Amount
					Brought Forward	
		.5 Bend existing reinforcing inwards where required to ensure a minimum cover of 20mm (roof soffit) or 40mm (walls). Bend replacement reinforcement to suit where required and splice onto existing exposed reinforcement, securing with tie wire while maintaining minimum cover requirements.				
10.16		(a) Y8 reinforcing bars	kg	104		
10.17		(b) Y12 reinforcing bars	kg	1920		
10.18		(c) Y16 reinforcing bars	kg	160		
		.6 Apply Penecrete mortar in layers all strictly in accordance with the manufacturer's specifications:				
10.19		(a) floor and inclined surface less than 45 degrees	litre	100		
10.20		(b) walls and inclined surfaces 45 degrees and greater	litre	100		
10.21		(c) columns and column heads	litre	1800		
10.22		(d) roof soffit	litre	16200		
		.7 Apply Penetron Slurry on prepared surfaces, all in accordance with manufacturer's specifications				
10.23		(a) Floor and inclined surfaces less than 45 degrees	m^2	24500		
10.24		(b) Walls/Inclined surfaces from 45 degrees and greater	m^2	6600		
10.25		(c) Roof Soffit	m^2	25000		
10.26		(d) Columns and column heads	m^2	10200		
		.8 Inlet pipes				
10.27		(a) 4 Inlet pipes: mechanically brush/clean inside of **400mm** Diameter pipes to remove corroded material; prepare internal surface as required and apply internal lining with a trenchless system e.g. AMT trenchless, or similar approved. Work complete including establishment, access, installation, etc.	P sum	1		
		.9 Roof expansion joints				
10.28		(a) Rake away 100mm stone covering on roof for sufficient working space requirements at joints; reinstate upon completion	m	1380		
10.29		(b) Remove existing sealant material and part of filler board where required to suit new installation. Prepare internal surfaces in accordance with new joint seal manufacturer's specifications	m	1380		
10.30		(c) Install primer, backing cord and self-levelling ultra-low modulus silicone/hybrid sealant to manufacturer's specification, joints 20 to 25mm wide	m	1380		
		.10 Swellable waterstop				
10.31		(a) Install Penebar SW55 swellable waterstop strictly in accordance with the manufacturer's specifications	m	10		
		Schedule 10 **CONCRETE SPOIL REPAIR**				
		Carried forward to Summary of Bills			**Total**	

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

SUMMARY OF BILL OF QUANTITIES

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

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Summary of Bills

Bill No.	Description	Amount (R)
	PORTION 1 - GENERAL	
1	PRELIMINARY AND GENERAL	
2	PROVISIONAL SUMS AND PRIME COST ITEMS	
3	DAYWORKS AND TEMPORARY WORKS	
	PORTION 2 - BY-PASS	
4	NEW BREAK PRESSURE TANK (BPT) AND ADJOINING VALVE CHAMBER	
5	VALVE / PIPE CHAMBERS	
6	BUFFER TANK	
7	MEDIUM PRESSURE PIPELINES	
8	ACCESS ROAD, TEMPORARY DIVERSION AND CROSSING WORKS	
	PORTION 3 - JOINT SEAL AND CONRETE REPAIR	
9	JOINT REPAIR	
10	SPOIL REPAIR	
	SUB-TOTAL:	

Provisional sum: Allowance for Contingencies (10% of Sub-Total)	
SUB-TOTAL:	
Provisional sum: Allowance for CPA (3.5% of Sub-Total)	
SUB-TOTAL:	
Provisional sum: Allowance for Construction Skills Development Goal (CSDG)(0,25% of Sub-Total)	
TOTAL CONSTRUCTION COST (EXCL VAT):	
Value Added Tax at 15%	
TOTAL CONSTRUCTION COST (INCL VAT):	

Bankers Details :

Contractor's Name: _____

Name reflected on bank statement: _____

Bank: _____

Branch: _____

Account Number: _____

Cheque Account ☐ or ☐ Savings Account

Signature :

By Tenderer : _____

Company Name : _____

Date : _____

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

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SCOPE OF WORKS

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Section C3.5 Management.....C3.5

END OF SECTION

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SCOPE OF WORKS

C3.1 DESCRIPTION OF THE WORKS

C3.1.1 Employers Objectives

The Employer's objectives are to implement dam safety and rehabilitation works at the Brandkop Clear Water Reservoir in order to restore structural integrity, prevent leakage, and ensure the continued safe and reliable operation of this critical bulk water supply asset.

The objectives of this Contract are to:

- Reinstate the watertightness and durability of the existing reservoir through joint sealing and concrete repair works;
- Maintain continuity of potable water supply during construction through the provision of a bypass system;
- Improve system functionality and hydraulic control through the construction of a break pressure tank;
- Ensure compliance with applicable legislation, including the National Water Act, Dam Safety Regulations, and potable water standards;
- Deliver a fit-for-purpose and durable solution with acceptable lifecycle performance;
- Execute the Works within the operational constraints of a live bulk water system.

The works form part of regulated bulk water infrastructure with direct implications for service delivery, water quality and statutory compliance.

C3.1.2 Overview of the Works

The Works comprise the rehabilitation of the existing Brandkop Clear Water Reservoir and

the construction of associated infrastructure required to maintain operation during the execution of the rehabilitation works.

In broad terms, the Works include:

- Joint sealing and concrete repairs to the existing reservoir structure;
- Construction and commissioning of a steel bypass pipeline;
- Construction of a reinforced concrete break pressure tank with associated pipework and valves;
- Integration with the existing bulk water system;
- Testing, disinfection, commissioning, and return to service.

The Works shall be executed in accordance with the Drawings, Specifications, and the requirements of this Contract.

The Contractor shall programme and sequence the Works such that the bypass system is fully constructed, tested, commissioned and operational prior to any shutdown or decommissioning of the reservoir required for rehabilitation works.

All materials and workmanship shall comply with the applicable SANS standards relevant to civil engineering, structural works and potable water infrastructure.

C3.1.3 Scope of the Works

The Contractor shall provide all labour, materials, plant, supervision, and temporary works necessary for the execution and completion of the Works in accordance with the Contract.

Without limiting the generality of the Contract, the Scope of Works includes the following:

a) Preliminary and General
    - Establishment, operation and removal of the Site establishment;
    - Provision of offices, services, security and access;
    - Compliance with occupational health and safety requirements;
    - Implementation of environmental management measures;
    - Surveying and setting out of the Works;
    - Identification, protection and management of existing services;
    - Coordination with the Employer in respect of operational constraints and access to live infrastructure.

b) Reservoir Rehabilitation Works

The rehabilitation works shall be executed in such a manner as to restore watertightness, maintain water quality and extend the service life of the structure:

- Draining and cleaning of the reservoir;
- Surface preparation including removal of unsound material, laitance, coatings and contaminants;
- Preparation and repair of construction and movement joints;
- Sealing of joints using approved potable-water-compliant systems;
- Repair of cracks, leakage paths and defects;
- Structural concrete repairs to slabs, walls, columns and soffits;
- Application of approved repair and sealing systems;
- Inspection, testing and quality control in accordance with the Specifications.

c) Bypass Pipeline Works

The bypass system shall be fully commissioned and operational prior to reservoir shutdown and shall remain functional for the duration of the rehabilitation works:

- Supply, installation and commissioning of a steel bypass pipeline;
- Excavation, trenching, bedding, pipe laying, jointing, backfilling and reinstatement;
- Installation of valves, fittings, supports and associated appurtenances;
- Construction of tie-ins to existing infrastructure;
- Pressure testing, leak testing and commissioning.

d) Break Pressure Tank

- Construction of a reinforced concrete break pressure tank;
- Supply and installation of associated inlet and outlet pipework;
- Installation of valves, fittings and control elements;
- Structural, civil and mechanical works required for full functionality;
- Integration into the bypass and existing systems.

e) Testing and Commissioning

- Pressure testing and leak testing of pipelines;
- Inspection and verification of joint sealing and repair works;
- Cleaning and disinfection of the reservoir in accordance with potable water requirements;
- Refilling and water-tightness verification;

- Functional testing of the system including bypass and pressure control infrastructure.

f) Completion and Handover
- Submission of as-built drawings and records;
- Submission of operation and maintenance documentation;
- Provision of guarantees and warranties;
- Completion of defects and outstanding work;
- Assistance during commissioning, handover and return to operation.

C3.1.4 Location of the Works

The Site of the Works is located at the Brandkop Reservoir within the jurisdiction of Vaal Central Water in Bloemfontein, Free State.

The reservoir forms part of an operational bulk water supply system serving the Mangaung Metropolitan Municipality and constitutes critical water storage infrastructure.

The Contractor shall be deemed to have satisfied themselves as to the Site location and conditions, including:
- Access to and within the Site;
- The nature and condition of existing infrastructure;
- Operational constraints associated with a live water supply system;
- Restricted working conditions within the reservoir;
- Requirements for working in a potable water environment.

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C3.2 ENGINEERING

C3.2.1 Employer's Design

The permanent works included in this contract has been designed by the Employer. The detail of the works is indicated on the drawings and in the specifications. The Tenderer may submit alternative offers for designs prepared by himself subject to the conditions specified in the Contract Data.

C3.2.2 Drawings

Tender drawings are bound in Volume 2 – Book of Drawing. A drawing list is included in Volume 2.

Construction drawings will be issued in electronic format (PDF format). Only digitally signed drawings of which the signature is certified by SigniFlow will be accepted as official construction drawings. Construction drawings will be issued by means of an electronic issue list which will record the latest version of the drawing issued and the issue date. The Contractor shall sign the issue list and return the signed issue list to the Engineer to confirm that the drawings have been received. The latest version of the drawing issued shall be applicable from the date of issue.

One A3 set of paper prints of the construction drawings will be made available to the Contractor on or before the handing over of Site for information purposes only. No further paper copies will be issued to the Contractor. The onus will be on the Contractor to ensure that paper copies of the latest issued electronic format construction drawings are available

on Site for construction purposes.

The Employers Agent will maintain a set of paper copies of all issued drawings on Site for the recording of As Built information.

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C3.3 PROCUREMENT

C3.3.1 Procurement Principles

The Employer decided to adopt the Standard of Uniformity in Construction Procurement published by the Construction Industry Development Board (CIDB) for his procurement process.

The Standard for Uniformity in Construction Procurement establishes minimum requirements that:

- promote cost efficiencies through the adoption of a uniform structure for procurement documents, standard component documents and generic solicitation procedures;
- provide transparent, fair and equitable procurement methods and procedures in critical areas in the solicitation process;
- ensure that the forms of contract that are used are fair and equitable for all the parties to a contract; and
- enable risk, responsibilities and obligations to be clearly identified.

C3.3.2 Contractors Personnel

The Contractor shall limit the utilisation of his permanently employed personnel to that of key personnel only on the Works, as defined below, and shall execute and complete the Works utilising a temporary workforce employed directly by the Contractor and/or by his sub-contractors, using the assistance of the Labour Desk(s), from the various communities that are established in proximity to the Works or which will be consumers from the Scheme.

Without derogating from the Contractor's obligations to complete the Works within the specified time for completion in terms of the General Conditions of Contract, the numbers in each category of the Contractor's key personnel, as stated by the Contractor in the Returnable Schedules, will be strictly controlled during the contract period and any increase in numbers will be subject to the prior approval of the Employer.

Key personnel means all contracts managers, site agents, site clerks, materials and survey technicians, quantity surveyors, trainers, supervisors, foremen, skilled plant operators, brick layers, welders, shutter hands and the like, and all other personnel in the permanent employ of the Contractor or his sub-contractors who possess special skills, and/or who play key roles within the Contractor's or his subcontractor's operations.

The Engineer may at his discretion, upon receipt of a written and fully motivated application from the Contractor, and where he deems the circumstances so warrant, authorise in writing that the Contractor may utilise in the execution of the Works, workers not being his key personnel but who are in his permanent employ. Without limiting the generality of application of this sub-clause, circumstances which may be considered by the Engineer to warrant authorization of the use of the Contractor's permanent employees other than key personnel, include:

a) The unavailability from local sources of sufficient numbers of temporary workers and/or sub-contractors to execute the Works, provided always that the Contractor has satisfied the Engineer that he has exercised his best endeavours and taken all reasonable actions to recruit sufficient temporary workers and sub-contractors from local sources.

b) The unavailability within the temporary worker pool and/or from subcontractor sources available to the Contractor in terms of the Contract, of sufficient skills necessary to execute the Works or specific portions thereof, in situations where the completion period allowed in the Contract is insufficient to facilitate the creation of the necessary skills through the provision of suitable training as contemplated in the Contract;

c) Any other circumstances which the Engineer may deem as constituting a warrant.

C3.3.3 Temporary Workforce

The Contractor shall employ labour from the local communities through the Labour Desk(s). Accordingly, the workforce that is employed on Site shall consist of local residents, except for

approved key staff in the permanent employ of the Contractor, to the maximum extent that is compatible with the requirements of Clause C3.3.2.

The Labour Desk(s) shall assist in identifying available local labour and, where available, semi-skilled labour as well as local sub-contractors. The Labour Desks shall also assist and advise regarding conditions of employment, minimum wages, disputes and disciplinary procedures. The function of the Labour Desk(s) shall however in no way diminish the responsibilities of the Contractor in terms of the Conditions of Contract.

Although the Contractor shall adhere to the statutory minimum wage rates, he is however at liberty to negotiate additional incentive payments based on performance.

A contract of employment or subcontract should be signed between the Contractor and each of his employees or sub-contractors, as the case may be. Likewise contracts of employment must be entered into between each such sub-contractor, and each of the specific subcontractor's employees. Employment and subcontract agreements shall make clear reference to at least the following conditions:

- The minimum agreed wage rate per hour in respect of labourers;
- The agreed pay rate per unit of production where applicable;
- UIF and WCA payments;
- Minimum working hours per day;
- Start and end times of a daily shift;
- Lunch break times;
- Company Policy regarding :
    - Rain time
    - Sickness and absenteeism
    - Disciplinary matters
    - Grievances
- Method and frequency of payment;
- Work clothes and safety equipment to be issued.

C3.3.4 Subcontracting

The Contractor shall appoint such authorities and/or specialist subcontractors and suppliers as may be designated or nominated by the Employer or the Engineer for those portions of the Works specified in the Scope of Works.

As required by the Conditions of Contract, the Contractor shall be responsible for all work carried out by sub-contractors (whether nominated by the Employer or selected by the Contractor) on his behalf. The Engineer will not liaise directly with any such sub-contractor, nor will he become involved in any problems and/or disputes related to payments, programming, workmanship, etc, unless provided for in the Conditions of Contract. Such problems and/or disputes shall remain the sole concern of the Contractor and his sub-contractors.

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C3.4 CONSTRUCTION

C3.4.1 Standard Specifications

The Standard Specifications on which this contract is based are the South African Bureau of Standard's Standardized Specifications for Civil Engineering Construction (SABS 1200). (Note: "SABS has been changed to "SANS").

Although not bound in nor issued with this Document, the relevant sections of the standard specifications shall form part of this Contract. These documents are available at the Contractor's expense from the SA Bureau of Standards, Private Bag X191, PRETORIA, 0001.

The applicable SABS 1200 Standardised Specification for this Contract shall be the following:

A	-	General
AB	-	Engineers office
C	-	Site clearance
D	-	Earthworks

DB	-	Earthworks (Pipe Trenches)
G	-	Concrete (structural)
GA	-	Concrete (small works)
L	-	Medium pressure pipelines
LB	-	Bedding (pipes)

The various documents listed in section C3.4.1 shall be treated as mutually explanatory. However, should any requirement of section C3.4.2 conflict with any requirement of the Standardised Specifications or with any requirement of the Particular Specifications, then the requirement of section C3.4.2 shall prevail.

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C3.4.2 VARIATIONS AND ADDITIONAL CLAUSES TO THE STANDARD AND PARTICULAR SPECIFICATIONS

The following variations and additions to the Standard and Particular Specifications will be applicable to this Contract:

PSA	-	General
PSAB	-	Engineers office
PSC	-	Site clearance
PSD	-	Earthworks
PSDB	-	Earthworks (Pipe Trenches)
PSG	-	Concrete (structural)
PSGA	-	Concrete (small works)
PSL	-	Medium pressure pipelines
PSLB	-	Bedding (pipes)

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PSA GENERAL

1. PSA1 QUALITY (Clause 3.1)

All material used in the Works shall, where such mark has been awarded for a specific type of material, bear the SABS mark. Alternatively, the Contractor shall furnish the Engineer with certificates of compliance of materials, which bear the official mark of the appropriate standard.

2. PSA2 PLANT (Clause 4.3)

Except where the use of plant is essential in order to meet the specified requirements by the Due Completion Date, the Contractor shall use only hand tools and equipment in the construction of those portion(s) of the Works that are required in terms of the Scope of Works to be constructed using labour intensive construction methods.

3. PSA3 SITE FACILITIES

PSA3.1 SITE FACILITIES AVAILABLE

PSA3.1.1 Contractor's Camp

A Site will be made available by the Employer for the Contractor's camp and depot.

PSA3.1.2 Source of Water Supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all water that he may require for purposes of constructing the Works. Accordingly, the Contractor shall receive as free-issue all water for testing and commissioning that remains withing the distribution system. For his site camp, the Contractor shall pay all connection fees and consumption charges, and at his cost provide all connections, consumption meters, pipework, storage tanks, transport and other items associated with the supply of water for the Works.

Water can be provided by Vaal Central Water. The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making water available for purposes of constructing the Works.

Water for filling, testing and disinfecting the pipelines and structures will be made available by the Employer at no cost to the Contractor. However, should the pipelines and/or structures have to be drained and refilled due to defective materials or workmanship by the Contractor or by his subcontractors, then the water required for refilling shall be made available at the cost of the Contractor.

PSA3.1.3 Source of Power Supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all electricity that he may require for purposes of constructing the Works. Accordingly, the Contractor shall pay all connection and consumption charges, and at his cost provide all connections, transformers, consumption meters, cables, distribution boards and other items that are associated with the supply of electricity for construction of the Works.

Centlec is the power supply authority in the area. The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making electricity available for purposes of constructing the Works. The distribution of electricity shall be in accordance with the applicable bylaws and regulations of the supply authority.

PSA3.1.4 Housing

The Contractor shall not be permitted to house any Personnel within his camp site(s). Only security personnel will be allowed to occupy, as part of their duties, office and storage areas after working hours.

PSA3.2 SITE FACILITIES REQUIRED

PSA3.2.1 For the Contractor

Whatever may be required for the satisfactory execution of the Contract.

PSA3.2.2 For the Engineer

As specified under Section PSAB.

PSA3.2.3 Sanitary facilities

Water borne sewerage is available at the Engineer's camp site. Flush toilets/Chemical toilets shall be provided by the Contractor and maintained for the use of the Contractor's personnel at all camp sites that the Contractor may establish for construction of the Works. In addition, the Contractor shall at all times during construction of the Works provide adequate sanitary facilities on site so that all employees are at all times within easy reach of sanitary facilities.

4. PSA4 ADJUSTMENT OF PRELIMINARY AND GENERAL TIME-RELATED ITEMS (Clause 8.2.2)

PSA4.1 Replace the note on the end of the clause with the following:

Note: An approved extension of time will qualify the Contractor to receive additional payment for each relevant time related item at the original tendered unit rate for such item. The additional payment will be calculated pro rata to the extension of time in relation to the time for achieving Practical Completion for the Works at the date when the agreement came into effect.

PSA4.2 Should the Time for Completion be automatically extended due to abnormal weather conditions occurring during execution of the Contract as provided for in the Conditions of

Contract, adjustment to the total for time-related preliminary and general items will be applicable as specified in Clause PSA4.1.

5. PSA5 HEALTH AND SAFETY

The maintenance of safe work practice at all times and in all sections of the execution of the works is embedded in the day to day site activities of all the Contractor's management, staff and workforce on the contract.

However, the introduction of the Construction Regulations in 2014 requires from the Employer to ensure that the Contractor has made adequate provision for the execution of the works within the specifications of said regulations. The Contractor are referred to the Occupational Health and Safety Specifications bind into the Contract for a detailed list of items to be provided as a minimum requirement.

It must be noted that this lists below are not exhaustive and that many items have been traditionally priced by the Contractor as an integral part of his Preliminary and General items or as part of the overhead costs of other items. The tender document, although not detailed with regards the Construction Regulations, requires that the Contractor ensures adherence to the Occupational Health and Safety Act (Act 85 of 1993) the Construction Regulations, 2014.

PSA5.1 Fixed-charge Items

Add the following new Clause (Clause 8.3.5):

	Unit
Compliance with the Occupational Health and Safety Act (Act 85 of 1993) and its regulations and with the Employer's Health and Safety Specification.	Sum

The fixed charge item shall include but shall not be limited to the following:

- Preparation of Health and Safety Plan,
- Establishment of Health and Safety File,
- Health and Safety Training
- Personal Protective Clothing and Equipment
- Fences, Signs and Barricades

- Establishment of Safety Administration
- Other Health and Safety Fixed-charge Obligations

PSA5.2 Time-related Items

Add the following new Clause (Clause 8.4.6):

	Unit
Compliance with the Occupational Health and Safety Act. (Act 85 of 1993) and its regulations and with the Employer's Health and Safety Specification.	Sum

The time related item shall include but shall not be limited to the following:

- The employment cost of all health and safety personnel including consultants, health and safety officers, inspectors, supervisors and issuers required in terms of the Contractor's Health and Safety Plan,
- Updating the Health and Safety Plan as needed,
- Carrying out of periodic own audits and follow-up audits,
- Compiling ongoing risk assessments and risk assessment reports as required by the Works,
- Convening of regular safety meetings with the Safety Representatives,
- Accompanying and supporting the Employer or his Safety Agent during ad hoc audits,
- Compilation of monthly safety reports and statistics for the Employer or his Safety Agent,
- Implementation and maintenance of Training
- Maintenance of personal protective clothing and equipment
- Maintenance of fences, signs and barricades
- Implementation and maintenance of safety administration
- Other Health and Safety Time-related Obligations

6. PSA6 ENVIRONMENTAL MANAGEMENT PLAN

The Contractor shall comply with all the conditions of the Record of Decision and the Environmental Management Plan bound into Annexure B (Section C3.5.3).

PSA6.1 Fixed-Charge Items

Add the following Clause (Clause 8.3.6):

	Unit
Compliance with Environmental Management Plan and Record of Decision	Sum

The sum tendered shall cover all costs, overheads, profits and charges incurred in complying with all the conditions of the Environmental Management Plan and Record of Decision bound into Section C3.5.3.

PSA6.2 Time-related Items

Add the following Clause (Clause 8.4.7):

	Unit
Compliance with Environmental Management Plan and Record of Decision	Sum

The sum tendered shall cover all costs, overheads, profits and charges incurred in complying with all the conditions of the Environmental Management Plan and Record of Decision bound into Section C3.5.3.

7. PSA7 SUMS STATED PROVISIONALLY (Clause 8.5)

PSA7.1 Contingencies

A Provisional Sum shall be included in the Summary of Schedules for contingencies. No percentage mark up will be applicable to any payments made using contingency money other than the mark up included in prices for variations determined in terms of the Conditions of Contract.

PSA7.2 Contract Price Adjustment

A Provisional Sum shall be included for Contract Price Adjustment in the Summary of Schedules to make provision for contract price adjustment in terms of the Conditions of Contract. The value of the Provisional Sum shall be based on the percentage of the subtotal value as specified in the Summary of Schedules. No percentage mark up will be applicable to any payments made in this regard.

PSA7.3 Salary for Labour Desk Officer and Community Liaison Officer

A Provisional Sum has been included in Schedule 2 for a salary to be paid to the Labour Desk Officer and Community Liaison Officer.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.4 Artisans and Skills Training

A Provisional Sum has been included in Schedule 2 for payments to be made to specialists for the training of unskilled or semi-skilled persons in industry accredited management and generic skills. Payment to the Contractor will be based on invoices certified by the Engineer and issued by training specialists to the Contractor for work undertaken in terms of this item.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.5 Telephone Calls and Rental

A Provisional Sum has been included in Schedule 2 for telephone calls and facsimile transmissions for the Engineer's Representative. The Engineer's representative will provide his own cellular telephone for the contract. Payment will be based on call and rental costs, but excluding any deposits and installation costs which shall be priced under the preliminary and general items.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.6 Acceptance Control Testing

A Provisional Sum has been included in Schedule 2 for acceptance control testing ordered by the Engineer to be undertaken by a commercial laboratory. Payment will be based on the actual invoicing by the laboratory to the Contractor.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.7 Office Consumables for Engineer's Site Facility

A Provisional Sum has been included in Schedule 2 for the appointment and payment of office consumables for Engineer's site facility.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.8 Electronic equipment for Engineer's office

A Provisional Sum has been included in Schedule 2 for the appointment and payment of a specialist sub-contractor for electronic equipment for Engineer's site office.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.9 Relocation of Existing Services

A Provisional Sum has been included in Schedule 2 for the relocation of existing services by specialists if and when required and ordered by the Engineer.

The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract

PSA7.10 Specialized Services

A Provisional Sum has been included in Schedule 2 for the appointment and payment for specialized services if and when required. These may include all work required by the following specialists:

- Landscaping and hydroseeding;

- CCTV;
- Geotechnical surveys and inspections;
- Surge Analysis;
- Land Surveyor; and
- Acceptance control testing of pipework, coatings and linings.

In addition to the abovementioned amounts, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.11 Cathodic Protection

A Provisional Sum has been included in Schedule 2 of the Principal Contract for work to be undertaken by the sub-contractor in protecting the pipeline against cathodic corrosion and aggressive soil conditions. The Engineer undertakes to issue details and instructions during the currency of the Principal Contract describing the exact nature of the work that is required, as well as the specialists that should be employed by the Principal Contractor to undertake the work.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.12 SCADA / Telecommunication

A Provisional Sum has been included in Schedule 2 of the Principal Contract for work to be undertaken by the sub-contractor in providing level transducers and communication on the existing communication network. The Engineer undertakes to issue details and instructions during the currency of the Principal Contract describing the exact nature of the work that is required, as well as the specialists that should be employed by the Principal Contractor to undertake the work.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA7.13 Engineer's PPE

A Provisional Sum has been included in Schedule 2 of the Principal Contract for providing protective clothes and equipment to the Engineer's personal for the duration of the Contract. The Engineer undertakes to issue details and instructions during the currency of the Principal Contract describing the exact nature of the work that is required, as well as the specialists that should be employed by the Principal Contractor to undertake the work.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

8. PSA8 PRIME COST ITEMS (Clause 8.6)

PSA8.1 Materials for Dayworks

A Provisional Sum has been included in Schedule 2 for materials to be used during the execution of dayworks. In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the materials used during the execution of the dayworks by the Contractor. Payment made shall be regarded as full compensation for overheads, charges and profit on the materials that are used when executing dayworks.

PSA8.2 Materials for Altitude Valves

A Provisional Sum has been included in Schedule 2 for Client preferred brand of altitude valves to be used in the permanent works. In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the materials provided. Payment made shall be regarded as full compensation for overheads, charges and profit on the materials that are used when executing dayworks.

PSAB ENGINEER'S OFFICE

PSAB1 NAME BOARDS (Clause 3.1)

One name board conforming to the standard requirements of the South African Association of Consulting Engineers and as shown on drawing 3890.00.00.AAA.01.A011 must be provided and erected at points to be designated by the Engineer.

PSAB2 OFFICE BUILDING (Clause 3.2)

One office facility shall be provided and furnished for the Engineer's Representative and maintained for the duration of the contract. The office facility shall be furnished as per Drawing No. 3890.00.00GZA.01.A002. All finishings shall be in accordance with the above drawing and all furniture shall comply with specifications in Drawing No. 3890.00.00GZA.01.A004.

Upon completion of the Works, ownership of all buildings, furnishings and equipment specified herein shall revert to the Contractor who shall remove same from Site.

PSAB3 TELEPHONE (Clause 5.4)

A prime cost item has been allowed in Schedule 2 to cover all call and rental costs that are associated with the provision of this facility for the Engineer's Representative. The contractor shall include the invoice as provided by the Engineer in the monthly payment claim.

PSAB4 TESTING

PSAB4.1 General

No laboratory building or fittings are required by the Engineer. The Engineer will arrange separately with a commercial laboratory of designate specialists to carry out all acceptance control testing, excepting for density control test and moisture content determinations. The Contractor shall remain responsible to carry out the process control testing required by the Standardised, Particular and Project Specifications.

PSAB4.2 Laboratory Equipment

The Contractor shall supply the following equipment for the duration of the Contract.

(a) Six concrete cube moulds, 150mm nominal size, as well as a suitable concrete cube curing basin to keep all concrete cubes submerged in water for at least 28 days.
(b) Pinless Moisture Meter

PSAB5 SURVEY ASSISTANTS (Clause 5.5)

One suitably educated Survey Assistant shall be made available for the sole use of the Engineer's Representative for the duration of the Contract. The assistant may also be required to fulfil the function of Community Liaison Officer during the Contract should the Engineer consider this arrangement to be in the interests of the Employer. The Survey Assistants may therefore have to be appointed from the local communities. Transport shall be supplied for the Survey Assistant/Community Liaison Officer by the Contractor for the duration of the Contract should he be requested to do so. In such event payment will be made at scheduled dayworks rates.

PSAB6 SURVEY EQUIPMENT

The survey equipment listed below shall be made available and be maintained in good condition for the exclusive use of the Engineer or his Representative for the duration of the Contract. Payment will be made as provided for in the Time Related Items included in Schedule 1.

(a)	Automatic surveyor's level complete with tripod and leather carry case such as Zeiss N1-2 or equivalent	1 No
(b)	20-second tachometer with optical plumbob complete with tripod and leather carry case such as Sokkisha TM20C or equivalent.	1 No.
(c)	Nylon-coated steel surveyor's tape 100m long and 10mm wide	1 No.
(d)	5m long steel tape	1 No.
(e)	5m long three-piece telescopic survey staves (metric double-face)	

	complete with angle bracket level	2 No
(f)	Survey books: Level	3 No.
(g)	2kg hammer with rubber handle	1 No.
(h)	Steel pegs, 300mm long and 12mm dia	120 No.
(i)	Aluminium tags, 100mm long, 15mm wide and 2mm thick	120 No.
(j)	Reverse polar notation pocket calculator (Hp32SII or similar)	1 No
(k)	Change point	2 No
(l)	Measuring wheel	1 No
(m)	Tripod holders for ranging rods (heavy duty)	2 No.
(n)	Optical square (Sokkisha or Wild), complete with telescopic aluminium rod and bubble	1 No.
(o)	“Rabone” steel tape 10 meters long and 13mm wide	1 No.
(p)	Triangular change plate with chain	2 No.
(q)	100m long 50 kg strength fish line	1 No.
(r)	One metre long spirit level	1 No.
(s)	Three metre aluminium straight edge	1 No.

PSAB7 CARPORTS

The Contractor shall provide and maintain carports as indicated on the detailed on the drawing mentioned in PSAB2 for the duration of the Contract. The floor shall consist of crushed aggregate to alleviate dusty and muddy conditions.

PSC SITE CLEARANCE

PSC1 DISPOSAL OF MATERIAL (Sub-clauses 3.1 and 8.2.1)

Materials arising form clearing and grubbing shall be disposed of at a suitable spoil site. The Contractor shall be responsible to make his own arrangements for a suitable spoil site. Trees and stumps necessarily removed shall not be burnt unless authorised by the Engineer but shall be cut and stacked at areas designated by the Engineer.

PSC2 AREAS TO BE CLEARED AND GRUBBED (Clause 5.1)

The areas to be cleared and grubbed will be indicated by the Engineer. Should a portion or the whole of the site have been cleared and grubbed by others prior to the start of construction then no clearing and grubbing will be ordered or payment made with respect to the applicable portion of the site.

PSC3 PRESERVATION OF TREES (Sub-clause 5.2.3)

The penalty in respect of every individual tree, designated as a tree to be preserved, that is damaged or removed unnecessarily by the Contractor, shall be R500. Trees that fall within areas upon which the Works are to be constructed or within areas that the Contractor must occupy for the proper construction of the Works will not be designated for preservation.

PSC4 FREEHAUL AND OVERHAUL

Refer to clause PSD7 in this regard.

PSD EARTHWORKS

PSD1 CLASSIFICATION FOR EXCAVATION PURPOSES (Clause 3.1.2)

Delete clause 3.1.2 (a) and clause 3.1.2 (b) and replace with the following:

<u>3.1.2 (a) Soft excavation:</u>

"All material that is not classified as hard rock excavation in terms of clause 3.1.2 (c), boulder excavation class A in terms of clause 3.1.2 (d) or boulder excavation class B in terms of clause 3.1.2 (e) shall be classified as soft excavation"

In clause 3.1.2 (c) (1), replace the words "equivalent to that specified in (b) (1) above" with the words "of mass approximately 35 t, fitted with a single-tine ripper suitable for heavy ripping and of fly wheel power approximately 220 kW."

In the last sentence of clause 3.1.2 (d), replace the words "intermediate excavation" with the words "soft excavation."

In the last sentence of clause 3.1.2 (e), replace the words "or intermediate excavation, according to the nature of the material" with the word "excavation."

PSD2 SAFEGUARDING OF EXCAVATIONS (Sub-Clause 5.1.1.2)

Any cost the Contractor may undergo in ensuring the safety of excavations or any additional excavation and backfilling he may have to undertake due to the unstable sides of excavations and trenches shall be held to his account and the various rates for excavation and trenching included in the Schedule of Quantities shall include full compensation therefore.

PSD3 EXPLOSIVES (Sub-Clause 5.1.1.3)

Only soft explosives will be permitted for this project.

Add the following to the sub-clause:

Use of Soft Explosives

For the purposes of this project, **"soft explosives"** shall mean low-velocity, controlled-energy blasting agents designed to minimize vibration, shock waves, and structural risk to the pipeline and surrounding works.

- **Permitted materials:** low-velocity explosives such as ANFO (ammonium nitrate/fuel oil) blends or other controlled blasting agents approved by the Engineer.
- **Prohibited materials:** high-velocity explosives (e.g., dynamite, gelignite, emulsions intended for hard-rock mining) are not allowed under any circumstances.
- **Performance requirement:** charges must be designed to fracture or loosen material without generating excessive ground vibration or risk of damage to the pipeline.
- **Documentation:** the Contractor shall record charge type, spacing, and loading for each blast, and submit this information to the Engineer for review.

Compliance with this requirement will not relieve the Contractor of any responsibility as provided for in this sub-clause".

PSD4 DISPOSAL OF SURPLUS MATERIAL (Sub-Clause 5.1.4.3 and 5.2.2.3)

Add the following to the sub-clause:

"All surplus or unsuitable materials arising from trench excavations shall be spoiled and neatly spread and levelled along the route of the pipeline so as not to interfere with future works nor to disrupt the natural overland flow of storm runoff. Rocks, trees, debris and other unsightly material from trench excavations shall be disposed of at a suitable spoil site. Where the pipeline is laid within a road reserve the route of the pipeline shall be finished neatly to be flush with the natural ground level or finished sidewalk level as may be applicable.

The Contractor shall be responsible to make his own arrangements for a suitable spoil site".

PSD5 ACCOMMODATION OF TRAFFIC (Sub-Clause 5.1.6)

The Contractor shall tender a lump sum in Schedule 3 for accommodating traffic during the duration of the Contract, which sum shall cover all his obligations in this regard, including but not limited to temporary barricades; the erection and re-erection of existing and/or temporary traffic signs; lights and flagmen for the guarding and protection of the Works; and

for making all necessary arrangements with the applicable traffic authorities. Payment shall be made monthly pro-rata to the overall progress of the Works.

PSD6 BORROW PITS (Sub-Clause 5.2.2.2)

The Contractor shall be responsible for making his own arrangement regarding the provision of pipe bedding material, if required, from commercial borrow pits. The Contractor shall provide in his tender prices for all royalties payable and for the transport of the material to site.

PSD7 HAUL AND SPOIL ROADS (Sub-Clause 5.2.2.2)

The Contractor shall be responsible for the opening up and closing down of designated borrow pits. The Engineer will obtain the necessary permissions and authority to utilise such borrow pits. The Contractor in turn shall in all respect comply with the various requirements of SABS 1200D and of the Minerals Act (No 50 of 1991 in relation to the opening up, closing down and utilisation of borrow pits. Except for the crushing or screening of materials in accordance with the written instructions of the Engineer, and for royalties should such become payable, no additional payment will be made for excavating or processing material from designated borrow pits, regardless of the hardness or other properties of the material.

PSD8 FREEHAUL (Sub-Clause 5.2.5.1)

Add the following to the sub-clause:

“The freehaul distance shall be 0,5 km”.

PSD9 OVERHAUL (Sub-Clause 5.2.5.2)

Delete the second sentence of the paragraph and replace with the following:

“All overhaul beyond the freehaul distance will be measured as long overhaul and no limited overhaul will be measured”

PSDB EARTHWORKS (PIPE TRENCHES)

PSDB1 ACCOMMODATION OF TRAFFIC (Sub-Clause 5.1.3)

See Clause PSD3.

PSDB2 EXISTING SERVICES (Sub-Clauses 5.1.4)

Where any existing service occurs within the specified trench excavation, and the presence of such service is known before being uncovered, then the protection of the service will be scheduled and measured as provided for in Clause 8.3.5 of 1200DB. Only known services (as defined in Clause 5.4 of 1200A) shall be measured for payment.

Where an unknown existing service is damaged during construction, and the Engineer orders that the Contractor should undertake the repair of such service, then such repair will either be measured and paid as dayworks or alternatively as a contractual variation in terms of Clause 40 of the General Conditions of Contract.

No construction activity which may affect the integrity of telephone or electrical poles or stays may be carried out without the prior written approval of the Engineer, which approval shall only be given subject to the acceptance of a modus operandi that will ensure the integrity of such structures during construction.

PSDB3 TRENCH WIDTHS (Sub-Clauses 4.1 and 5.2)

Trenches in general shall not exceed the widths laid down in Sub-Clause 8.2.3. If trenches exceed the specified width the Contractor shall be liable for the cost of any thicker pipes or more expensive bedding which may be required as a result of the additional trench width.

PSDB4 TRENCH BOTTOMS (Sub-Clause 5.5)

Replace the first paragraph of this sub-clause "Material that ..... compacted as directed" with the following :-

Where a firm foundation cannot be obtained at the grade indicated due to soft or unsuitable material, the Engineer may instruct the Contractor to remove such unsuitable material and to backfill the excess depth with approved selected material or concrete, as directed by the

Engineer in each particular case, at the cost of the Employer. Backfill other than concrete, shall be placed in layers of 100mm uncompacted thickness, each layer thoroughly compacted to the entire satisfaction of the Engineer, to provide adequate support for the pipe bedding to be placed on top of it.

Should the Contractor remove more ground than is required to secure the proper grade of the pipeline, the Contractor must, at his own cost, backfill the excess excavation with approved selected material or concrete, as directed by the Engineer in each particular case.

PSDB5 DISPOSAL OF EXCAVATED MATERIAL (Sub-Clauses 5.6.3 and 5.6.4)

All surplus or unsuitable materials arising from excavation shall be spoiled and spread within or adjacent to the Site of the Works or when ordered by the Engineer be spoilt at a spoil site established by Contractor.

PSDB6 FREEHAUL AND OVERHAUL (Sub-Clause 5.6.8)

No overhaul will be payable on earthworks for pipe trenches.

PSDB7 AREAS SUBJECTED TO TRAFFIC LOADS (Clause 5.7.2)

The requirements of Clause 5.7.2 shall apply only to pipes and sleeves crossing streets or paved areas and pipes running parallel to the road as described below.

All service trenches running parallel to the road of which the roadside edge of the trench is located less than 1,4m away from the edge of the travelled way, will be subject to the requirements for the above mentioned clause.

The measurement and payment will apply to the full trench width. Pipes and sleeves crossing streets or paved areas will be measured and paid for to a length equal to the width of road or length of pavement crossed plus 1,4 m either side of the travelled edges.

Compaction of other pipe trenches running parallel to the roadway shall be considered areas subject to traffic loads only where instructed by the Engineer in writing. The volume will be computed from the minimum base width determined in accordance with Sub-Clause 5.2 and the depth from the top of the back fill to the top of the bedding as specified in Sub-Clause 8.3.3.1.

PSDB8 REINSTATEMENT OF EXISTING BITUMEN SURFACED ROADS (Clause 3.6 and 5.9.4)

Pipe trenches through the existing bitumen surfaced roads shall be reinstated with a 150mm upper selected subgrade layer compacted to 93 % mod AASHTO density, followed by a 150mm subbase layer compacted to 95 % mod AASHTO density and a 150mm graded crushed stone base compacted to 98 % of mod AASHTO density. The road shall be provided with a 25mm thick asphalt seal.

The upper selected subgrade layer shall have a CBR of at least 15, a grading modulus of at least 0,75 and a maximum PI of 12. The subbase shall conform to SABS 1200 ME and the base to SABS 1200 MF.

PSDB9 MEASUREMENT AND PAYMENT (Clause 8.3.2)

PSDB9.1 Basic Principles (Clause 8.1)

Add the following to the sub-clause 8.1.2(a):

Payment for the excavation and backfilling of trenches shall be made at the tendered rates and at the following stages of the construction:

i) upon completion and approval of the trench bottom, prior to bedding : 40 %
i) upon completion and approval of top of selected backfill: 70% (cumulative)
ii) upon completion and approval of the mainfill: remaining 30 %.

PSG CONCRETE (STRUCTURAL)

PSG-2 INTERPRETATIONS

PSG-2.3 DEFINITIONS

(a) General

Add the following definition:

"Water-retaining structures: All structures designed for containment of aqueous liquids (e.g. reservoirs) or retention of aqueous liquids (e.g. valve chambers, manholes, wet and dry wells of underground pump stations, etc.).

Durability concrete: Concrete that is able to resist weathering action, chemical attack, abrasion and any other processes of deterioration. This implies concrete with a very low permeability and a high resistance to especially, but not limited to, carbonation and chloride attack. The prefix "W" shall precede the specified 28 day characteristic compressive strength of the concrete where the concrete strength is specified.

Important factors that will contribute to achieving durability concrete, other than the cementitious content and water:cement ratio, is as follows and shall receive special attention by the Contractor and the specialist concrete mix designer:

- The mix shall be designed so as to ensure cohesion and prevent segregation and bleeding, resulting in a final product of very low permeability.
- Compaction shall receive special attention to ensure a well-compacted and dense concrete, free of voids and entrapped air. Care shall at the same time be taken to prevent overcompaction.
- Curing of concrete is considered to be of extreme importance and shall be implemented meticulously.
- Concrete cover shall be meticulously checked prior to casting and controlled during concrete casting.
- Shrinkage cracks of any kind are deemed to be a gross compromise of concrete with a low permeability and any part of a structure with such cracks outside the specified limits shall not be deemed acceptable. The location, extent and severity of such cracks shall be objectively considered by the Engineer prior to instructing relevant repairs or demolition of said structure, or portion thereof."

PSG-2.4.1 EXPLANATION OF TERMS

For the purpose of this Specification, exposure conditions for all concrete shall be deemed as *severe* as set out in clause 2.4.1.3 of SABS 1200 G. This corresponds with exposure conditions as defined in the current version of SANS 10100-2.

PSG-3 MATERIALS

PSG-3.1 Approval of material and procedures

Change the title of this clause to the above-mentioned, and add the following to this clause:

"The Contractor shall submit a method statement to the Engineer for his approval containing procedures, construction methods and quality assurance procedures for the practical implementation of the project specifications."

PSG-3.2 CEMENT

PSG-3.2.1 Applicable Specifications

Replace this clause with the following:

"Subject to the provisions of Clause 3.2.2, cement and blends of Portland cement with extenders, shall

comply with the following specifications:

SANS 50197-1	:	Cement Part 1: Composition, specifications and conformity criteria for common cements
SANS 50197-2	:	Cement Part 2: Conformity evaluation
SANS 1491-1	:	Portland Cement Extenders Part 1: Ground granulated blast-furnace slag
SANS 1491-2	:	Portland Cement Extenders Part 2: Fly ash
SANS 1491-3	:	Portland Cement Extenders Part 3: Silica fume
SANS 50413	:	Masonry cement"

PSG-3.2.2 Alternative Types of Cement

Add the following sub clauses:

"PSG-3.2.2.1 Cementitious material for water-retaining structures

Structural (reservoirs, wet and dry wells, chambers, manholes, drop-structures, etc.) and non-structural concrete (screeds, benching, blinding, etc) shall consist of a blend of CEM I 52.5N (Ordinary Portland Cement) or CEM II 52.5N/42.5N and Fly Ash (FA), lime (optional) and Silica Fume (SF) that will satisfy the durability requirements.

This specification shall not be rigidly prescriptive in the exact composition of the concrete mix and the percentages of the supplementary cementitious materials (SCM's) to be used, but in all instances the clinker content shall be in the range of 50% to 70% of the total cementitious content.

The following SCM's shall be allowed and may be considered in varying combination by the mix designer (maximum allowed quantities given in brackets):
- Pulverised Fly Ash (siliceous only) (proposed 30%, maximum 35%)
- Silica Fume (proposed 3%, maximum 5%)
- Lime (optional, maximum 10%)

Should pre-blended cements be proposed, CEM II 42.5N shall be allowed with the provision that the exact % content of the clinker and SCM's making up the cementitious content shall be submitted by the supplier in writing. No mix design containing CEM II shall be considered without said written submission.

The contractor shall employ the services of an accredited concrete specialist and/or laboratory to determine mix designs compatible with the specification. Should the approved specialist consider other SCMs to be appropriate, he may, in addition to designs conforming to the above, submit to the Engineer alternative design mixes with a detailed motivation for the use of alternative SCMs or increased quantities of approved SCMs. Alternatives that are well presented and motivated shall be considered. Consideration shall not be deemed as a sign of acceptance until acceptance of said alternative mix design is given in writing by the Engineer.

Over and above the proportions of the mix, the following information shall also be provided in the mix design report:

- the type, description and source of fine aggregate (e.g. washed quarzitic river sand from ABC) and course aggregate (e.g. pink quartzite from XYZ crusher);
- grading analysis and grading graphs of fine and coarse aggregates;
- water demand of fine aggregate determined in accordance with Colto Clause 8105 (e);
- water absorption values of fine and coarse aggregates;
- average crushing values and flakiness index of coarse aggregate;
- petrographic analysis of fine aggregate (see PSG-3.4.1);
- exact composition of the cementitious material in case of a pre-blended cement;
- exact brand name, manufacturer and dosage in ml/100kg cementitious material of admixture, accompanied by a data sheet from the manufacturer.
- workability retention tests (see PSG-3.4.1) if applicable;
- at least the 7 day cube test results for all structural concrete mixes.

If aggregates to be used in this Contract are alkali-reactive, the cement used on this Contract shall not have an alkali content (Na_2O + 0,658 K_2O) which exceeds 0,6 % by mass of the cement. The total alkali content of the concrete shall not exceed 2,1 kg/m^3 for aggregates falling in the rapidly expanding group (e.g. Malmesbury Group Meta sediments) or 2,8 kg/m^3 for Cape Granite. The Contractor shall submit the necessary test results to prove the above.

PSG-3.2.2.2 Pulverised Fly Ash (PFA)

If PFA is blended with OPC on site, the following additional requirements shall apply:

(a) PFA shall be obtained from only one power station, of which the PFA has to be approved for use in concrete. Should the Contractor wish to change the source of PFA during the Contract, he shall inform the Engineer accordingly in advance, carry out tests on the PFA, produce trial mixes in accordance with the Specifications and obtain the Engineer's approval in writing. After receiving the approval, the Contractor shall inform the Engineer in writing as to the date when the PFA from the new source is to be used.

(b) All PFA shall comply with the requirements of BS 3892 Part 1 1982.

(c) The Contractor shall obtain the producer's test certificates for each consignment of PFA, which shall be retained as record documents.

(d) Each consignment shall be tested for loss of ignition (which shall not exceed 7%), and the percentage mass retained on a 45 micron sieve by wet screening (which shall not exceed 12,5 %). Testing shall be carried out in accordance with the procedures specified in BS 3892 Part 1 1982.

(e) The chloride content and sulphate (SO_3) content of the PFA shall be tested every three months for each power station source.

PFA shall be stored separately from cement and shall have separate delivery facilities. It shall be stored in the same manner as specified for cement. When handled in bulk and stored in silos, PFA will require a greater silo capacity and more efficient filters than Portland cement, and furthermore, provision must be made for aeration in the storage silo."

PSG-3.2.3 Storage of Cement

Add the following after the words "...may promote deterioration." In the second paragraph:

"It is of prime importance that cements to be used in concrete for water-retaining structures shall always be stored in a cool environment, and it is strongly advised that cement silos be painted white to reduce any temperature rise in the stored cement."

PSG-3.3 WATER

Add the following to this clause:

"To limit heat gain in concrete for water-retaining structures, the temperature of mixing water must be below 20°C when added to the concrete mix.
If the concrete temperature remains above the maximum allowable as specified in PSG-5.5.9.2 despite measures pertaining to cement silo's and shading of aggregate as specified, the Contractor shall employ measures to chill mixing water."

PSG-3.4 AGGREGATES

PSG-3.4.1 Applicable Specification

Add the following:

"The aggregates shall be uncontaminated dolomitic aggregates and free from organic material and hard burnt lime, and comply with the requirements of SANS 1083. The maximum water absorption of the coarse aggregate shall not exceed 1 % and the flakiness index shall not exceed 25 %. The maximum water demand of the fine aggregate shall be 190 liter/m^3.

In addition to SANS 1083-2006, the grading of fine aggregate shall preferably comply with the requirements in Table 1 below. If the Contractor proposes to use sand which complies with the prescribed grading of Table 1 of SANS 1083, he shall proof to the satisfaction of the Engineer that the concrete produced will comply with the specifications. In addition, workability retention tests on the proposed mix design(s) shall be conducted by an accredited laboratory by measuring the slump of the mix at 15 minute intervals starting immediately after mixing over a period of 1½ h after mixing.

Table 1: Grading requirements for fine aggregate

Sieve size (mm)	Cumulative % passing	
4.75	90 – 100	
2.36	75 – 100	
1.18	60 – 90	
0.60	40 – 60	
0.30	20 – 40	
0.15	10 – 20	
0.075	Natural sand	Crusher sand
	5 – 10	5 – 20

Petrographic analysis shall be conducted on natural sands to determine the presence of minerals (such as smectite) which may have a negative impact on workability of the fresh concrete or may be detrimental to the hardened concrete.

Aggregates to be used in this contract shall be tested in accordance with SANS 1083. Further tests not covered by this standard shall be the test for alkali-silica reactivity as mentioned in SANS 1083 Annex C.2.2. If aggregates are alkali-silica reactive, it shall either be replaced with aggregates that are non-reactive if found to be rapidly expanding, or the requirements of Clause PSG-3.2.2.1 in respect of alkali-silica reactiveness shall apply if found to be slowly expanding.

Results of all tests shall be submitted to the Engineer for consideration as part of the concrete mix design report.

Course aggregate shall be 20 mm stone. Fine aggregate may be obtained from local sources subject to testing as mentioned above.

The fineness modulus (FM) of the fine aggregate (sand) as determined with SANS 3001-AG1 shall be between 1.7 and 3.0 and if necessary shall be achieved by the blending of at most two types of sand. After acceptance of the mix design with stated FM for the sand, the actual value of the FM shall not differ from the accepted value by more than 0.2.

At tender stage the Contractor shall assure himself by means of tests and test mixes by an accredited laboratory that the fine and coarse aggregates that he intends to use comply with the specification. <u>The tendered rates shall therefore be deemed to allow for the importation of aggregates, if necessary, that do comply with the Specification.</u>

The Contractor shall be responsible for locating the sources of all aggregates."

PSG-3.4.3 Storage of Aggregates

Add the following additional sub clauses:

"c) The aggregate to be used for water-retaining structures shall at all times be stored in a cool environment and, if at time of mixing, the ambient temperature exceeds 30°C, only the coarse aggregate shall be sprayed with water to assist cooling. It is advisable that all aggregate stockpiles be shaded from the sun by means of 80 % shade netting.

d) The Contractor shall ensure adequate drainage of the coarse aggregate stockpile."

PSG-3.5 ADMIXTURES

PSG-3.5.1 Approval of Admixtures Required

Add the following:

"In order to achieve a durability concrete specifically to water retaining structures, a crystalline admixture with tracing agent (e.g. Penetron) shall be added to the concrete at a dosage rate by weight of the total cementitious content (this includes all cementitious extenders) as specified by the supplier.

Other concrete elements not considered to be water retaining structures, will not be subject to the addition of a crystalline admixture as mentioned in this clause. Other water-reducing admixtures may still be used in accordance with the supplier's specifications.

The Contractor shall, by way of the information required in sub clause 3.5.1, prove to the satisfaction of the Engineer that the proposed admixtures are non-toxic and beneficial and not detrimental to the durability of the concrete.

The use of plasticisers with air-entraining properties will not be allowed."

PSG-3.5.2 Air-Entraining Agents

Replace the contents of the clause with the following:

"Air-entraining agents shall not be used."

PSG-4 PLANT

PSG-4.2 BATCHING PLANT

Add the following:

"All concrete shall be weigh-batched."

PSG-4.4 VIBRATORS

Add the following:

"All concrete shall be compacted by vibrators."

PSG-4.5 FORMWORK

PSG-4.5.1 Design

Add the following:

"Only steel formwork shall be used for concrete structures. Small approved laminated wooden board inserts to steel framed panels may only be used in confined places and the use thereof will be subject to approval by the Engineer. The panels shall be free from rust, ridges, fins, bulges, imperfections, irregularities, chips, scratches and holes. The finished concrete surface shall be smooth and free from irregularities, bulges, ridges, imperfections, air bubbles, honeycombing or surface discolourations.

Suitable temporary openings shall be allowed for in the formwork design to allow for the removal of sawdust, shavings, nails, wires, debris, etc.

A sample of all shutter types and joints shall be submitted to the Engineer for approval. This rule shall be waived for foundation pad footings and/or pile caps."

PSG-4.5.3 Delete subclause 4.5.3 and replace with the following:

"Form accessories

All form accessories such as ties, spacers and hangers shall be of a commercially manufactured type. Non-fabricated wire shall not be used. Form ties and spacers left in-situ shall not impair the desired appearance or durability of the structure, for example by causing spalling or rust staining or by allowing moisture to pass.

After the ends or end fasteners of form ties have been removed, any embedded portion of the tie shall terminate at a distance of not less than the specified minimum cover from the formed surface of the concrete.

Runways for moving equipment during concreting shall be provided with struts and legs and shall be supported directly on the formwork or structural member, and shall not rest on the reinforcing steel."

PSG-5 CONSTRUCTION

PSG-5.1 REINFORCEMENT

PSG-5.1.3 Cover

In Sub clause 5.1.3(a) amend the words " ... or stirrup" to read: "bar, secondary reinforcement, tie stirrup, tying-wire knots or wire ends."

Add to Sub clause 5.1.3: "Tying wire shall not encroach on the specified minimum cover by more than a single strand thickness."

Add the following:

"The minimum concrete cover to reinforcement shall be as stated on the drawings, but in the absence of anything specified, it shall at a minimum be as follows:

members cast against soil	:	75 mm
members cast against shutters but in contact with soil	:	50 mm
members exposed to the atmosphere	:	50 mm
members (semi-) permanently submerged under water	:	40 mm
members above retained water (e.g. reservoir roof)	:	40 mm

Cover blocks shall preferably be of a commercially manufactured type.

Concrete cover blocks are to be used. It shall be manufactured from concrete of grade, durability, density and permeability at least equal to that specified for the respective elements except that uncontaminated 12 mm stone (similar to that used in the concrete mix design) from organic material and hard burnt lime, instead of 19 mm stone shall be used. The size of the cover blocks shall be 50 mm x 50 mm, with a thickness equal to the specified cover.

Wires shall be cast into the blocks to enable them to be fixed to the reinforcement. The wires shall be fully galvanised Class A as per SANS 675. The wires shall be carefully held in position while the concrete is setting to ensure that all the wires are inserted to a uniform and consistent depth of 50 % of the thickness of the cover block for all the cover blocks.

The concrete shall be thoroughly compacted by means of a vibrator or vibratory table and the blocks shall be protected against early drying and shrinkage due to sun and wind, by being kept continually wet while still in the mould. After the blocks have been removed from the mould they shall be kept in water continuously until being used, and this period shall not be less than 14 days.

A proper mix design for concrete cover blocks shall be submitted to the Engineer for approval."

PSG-5.1.4 Splicing

Add the following:

"Splice lengths for reinforcement shall be as detailed on the bending schedules but shall not be less than 50 diameters. Where possible, splices shall be staggered so that they are evenly spread throughout the structure."

PSG-5.2 FORMWORK

PSG-5.2.1 Classification of Finishes

Delete subclause 5.2.1 and replace with the following:

"Formwork will be classified in accordance with the surface condition required on the finished concrete. These requirements shall be indicated on the drawings that forms part of this contract. Where no indication is given, the requirement shall be requested from the Engineer. Failing his response, Smooth finish shall be assumed.

The surface conditions mentioned above are classified as follows and will be so scheduled:

a) "***Rough***: after repair work has been done to surface defects as specified in PSG-5.5.14.2, no further treatment of the as-stripped finish will be required. Regular pattern alignment of shutters is not a priority.
b) ***Smooth***: This finish shall be equivalent to that obtained from the use of good condition resin-lined or steel shutters arranged in a regular pattern. Special attention shall be paid to shutter joints to ensure conformance with the tolerances specified in PSG-6.2.3(d)7)ii). The finish is intended to be left as struck but surface defects shall be remedied as specified in PSG-5.5.14.2. Although minor surface blemishes and slight discolourations will be permitted, large blemishes and larger or severe stains and discolouration shall be repaired where so directed by the Engineer.
c) ***Special***: This finish shall be obtained by first producing a surface better than or at least equivalent to a *Smooth* finish. Only steel shutters with no joints or form ties (within reason) shall be allowed where *Special* surface finishes are specified. Major surface defects shall not be allowed or accepted. All remaining projections shall then be removed, irregularities repaired and the surface rubbed or treated to form a smooth finish of uniform texture, appearance and colour.

All concrete surfaces, formed or unformed, shall be finished to a Degree of Accuracy II according to SANS 1200 G Clause 6.2 and PSG-6.2, except ***special* finishes** as defined above, which shall be finished to a **Degree of Accuracy I**."

PSG-5.2.2 Preparation of Formwork

Delete this clause and replace with the following:

"Forms shall be installed with joints between shutter panels being sealed tightly to prevent local honeycombing or leaching of concrete. Joints between panels shall form straight horizontal and vertical lines which shall be spaced evenly on the formed concrete surface, and shall be even and smooth and require minimal or no finishing. The layout of all formwork panels and construction joints shall be discussed with the Engineer before implementation, who reserves the right to instruct the Contractor to adjust his panel layout to suit the appearance of the structure.

Chamfers shall be provided at all exposed/visible corners, typically 25x25 mm unless noted otherwise.

All matter that could contaminate the concrete, including but not limited to rubble and dust, shall be removed from the interior of the forms before the concrete is placed. Surfaces that are to be in contact with fresh/wet concrete shall be clean and covered with an acceptable coating of material that will effectively prevent absorption of moisture, will prevent bond with the concrete and will not stain the concrete surfaces. A mineral oil or other similar approved material may be used.

On days that the ambient temperature is above 30 degrees Celsius, the steel shutters shall be cooled down by spraying with cold water."

PSG-5.2.3 Re-use of Formwork

Add the following:

"Reconditioned formwork shall be suitable to ensure the specified surface finish. All reconditioned formwork shall be presented to the Engineer for approval to confirm that the specified surface finish can be attained. The Engineer reserves the right to instruct demolition of elements cast with unapproved reconditioned shutters, at the Contractor's expense. "

PSG-5.2.5 Removal of Formwork

Delete sub clause 5.2.5.2 and Table 2 and replace with the following:

"For this purpose, shoring and/or formwork shall remain in place until the concrete is strong enough to prevent plucking of the surface during the removal of formwork. Unless qualitative data can be presented to the Engineer who will approve it in writing, the periods before striking formwork shall not be less than those given in Table 2 below.

Table 2: Removal of Formwork

Formwork to structural member	Strength Class of cement								
	CEM I 42.5R or higher			CEM I and CEM II A-S, D, P, Q, V, A, W, T, L, LL, M and blends of CEM I with 20% or less GGBS or fly ash			CEM II B-S, P, Q, V, W, T, L, LL, M; CEM III, CEM IV and CEM V and blends of CEM I with more than 20% GGBS or fly ash		
	Minimum time before removal of formwork (days)								
	Weather								
	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold
Beam sides, walls and unloaded columns	0.5	0.75	1	0.75	1.25	1.5	2	3	4
Slabs with props left underneath	2	3	4	4	5.5	7	6	8	10
Beam soffits with props left underneath and ribs in a ribbed floor construction	3	4	5	7	9.5	12	10	13.5	17

Slab props including cantilevers	5	7	9	10	13.5	17	10	13.5	17
Beam props including cantilevers (span<6m)	7	9.5	12	14	17.5	21	14	17.5	21
Beam/Deck props (6m<span<12m)	10	14	18	21	25	28	21	25	28
Beam/Deck props (span>12m)	14	18	21	28	32	36	28	32	36
NOTE: In varying cool weather stripping times may be determined by interpolation between periods specified for normal and col weather									
A day is taken as 24 hours									

Formwork remaining in place shall be considered as part of the curing process.

During summer months, formwork shall be struck early in the morning to allow the curing application to start before loss of moisture from the concrete can occur as the ambient temperature rises. During winter months when minimum ambient temperatures (including the wind chill factor) are below 5°C, formwork shall be struck towards midday to prevent freezing of curing water in the concrete.

PSG-5.5 CONCRETE

PSG-5.5.1 Quality

PSG-5.5.1.3 Consistency

Add the following:

"The target slump for reinforced concrete shall be less than or equal to 100 mm and for pump mixes for reinforced concrete less than or equal to 120 mm. Increased slump shall be accomplished by the use of plasticizers or super-plasticizers, and not by changing the water-cement ratio nor by adding air-entraining agents.

Slump tests will be performed on site before concrete is being placed. Where slumps are found to vary by more than 25 mm from the approved design slump, the test shall be repeated. If it fails again, the concrete shall be rejected and returned."

PSG-5.5.1.5 Durability

Add the following:

"Refer to Clause PSG-2.3 for the definition of durability concrete.

The maximum ratio of water to cementitious material shall be as follows:

a) 0.70 for 15 MPa blinding as mass concrete
b) 0.60 for 25 MPa concrete screeds and benching
c) 0.60 for 30 MPa concrete in encasements and strip foundations
d) 0,50 for structural concrete of 35 MPa, 40 MPa and 45 MPa strength
e) 0.45 for precast prestressed concrete from 50 MPa and higher strength

The maximum water allowance shall be 190 liter/m^3 of concrete."

PSG-5.5.1.7 Strength concrete

Delete this clause and replace with the following:

"Strength concrete shall be applicable to this contract and it shall be in accordance with the durability requirements and the guidelines set out in this specification. The Contractor shall be responsible for the design of the concrete mixes required under this contract, and the submission of test cubes to an approved laboratory, and for the measurement of the constituent materials to produce concrete that complies with the requirements specified by the Engineer.

In addition to the requirement that the Contractor design the mixes to the specified strengths, the cementitious material content shall be sufficient to contribute to durability but at the same time be limited to prevent any potential alkali-aggregate reaction or to prevent overly strong and expensive mixes prone to excessive shrinkage cracking. To this end, cementitious material content shall be within the following limits:

a)	For 15 MPa mass concrete and blinding	:	250 – 290 kg/m^3
b)	For 25 MPa screeds and benching	:	280 – 310 kg/m^3
c)	For 30 MPa concrete	:	300 – 320 kg/m^3
d)	For 35 MPa concrete	:	320 – 340 kg/m^3
e)	For 40 MPa or higher reinforced concrete	:	340 – 380 kg/m^3
f)	For 50 MPa or higher pre-stressed concrete	:	360 – 420 kg/m^3

It is of the utmost importance that good strength concrete with consistent quality and composition is used throughout. All possible measures to limit shrinkage shall be applied.

All concrete shall be based on designed mixes. Trial mixes shall be made by an approved laboratory with suitable experience in the design of concrete mixes and mix designs and cube results submitted timeously to the Engineer for approval.

Add a new clause:

"PSG-5.5.1.8 No-fines concrete

The Contractor shall be responsible for the design of the no-fines concrete mix on the basis and within the limitations and parameters specified hereafter:

a) Classes of no-fines concrete

No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used e.g. class NF-20 means a no-fines concrete with a 20 mm nominal size aggregate. For this contract class NF-20 shall be used.

The volume of aggregate per 50 kg of cement for each class of no-fines concrete shall be as follows:

Class	Aggregate per 50 kg cement
NF-28	0,32 m^3
NF-20	0,30 m^3

b) Aggregates

Aggregate shall be a single-graded aggregate in accordance with SANS 1083, provided that the particle size shall be less than 38 mm and greater than 14 mm. Aggregate shall be thoroughly washed and not contain any dust. Aggregate not complying with these requirements will be summarily rejected.

c) Cementitious materials

Ordinary Portland cement as specified in Clause PSG-3.2 shall be used in no-fines concrete. The addition of pozzolans other than PFA and SF, in whatever form, will not be permitted.

d) Cement Paste

The consistency of cement paste shall be such that all aggregate particle surfaces receive a uniform coating. Paste consistency shall be sufficiently viscous as to prevent the flow of paste through the placed concrete.

e) Strength

Concrete cube strengths at 4 and 28 days shall be 3,0 and 4,0 MPa respectively.

f) Permeability

Notwithstanding the preceding specifications, it is the Contractor's responsibility to ensure the permeability of the no-fines concrete. The Contractor shall be required to demonstrate the permeability of cast no-fines concrete on request of the Engineer. Any portion of the said no-fines concrete, deemed by the Engineer to be of insufficient permeability, shall be broken out and replaced at the Contractor's expense.

g) Batching and mixing

Cement shall be measured by mass or full bags of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The quantity of water added shall be just sufficient to form a smooth paste that will adhere to and completely coat each and every particle of aggregate and that is just wet enough to ensure that at points of contact of the aggregate the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water per 50 kg of cement.

Mixing shall be carried out in an approved batch-type mechanical mixer.

h) Placing

No-fines concrete shall be placed in accordance with the procedure agreed to by the Engineer. It shall be placed in a single operation in its final position within 30 minutes of mixing.

The concrete shall be worked sufficiently to ensure that it completely fills the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming must be avoided and under no circumstances shall the concrete be vibrated.

i) Protection

All no-fines concrete shall be protected from the elements and from loss of moisture. Protection against loss of moisture shall be accomplished in one or more of the following ways:

- Retaining formwork in place.
- Covering exposed surfaces with sacking or other approved material kept wet continuously.
- Covering exposed surfaces with plastic sheeting complying with the requirements of Clause PSG-5.5.8.

No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days."

PSG-5.5.3 Mixing

PSG-5.5.3.2 Ready-mixed concrete

Add the following:

"The use of ready-mixed concrete for this contract shall be permitted provided that it complies with the requirements of this specification. Test results obtained by such a production facility shall not be regarded as part of the quality control system, and the Contractor shall take his own samples of concrete on site and have them tested in accordance with Clause 7 of SANS 1200 G and Clause PSG-7.1.2.

Ready-mixed concrete shall only be acceptable for incorporation into the works if supplied from commercial sources complying with the following criteria:

The batching plant supplying the ready-mix concrete for the contract shall be either:

a) a SARMA member in good standing, which has been evaluated by means of

   i) a SARMA S.H.R.E.Q. Audit and attained a minimum compliance score of 80% or

b) ISO 9002 – Standardization; ISO 14001 – Environmental; ISO 39001 – Road Transport Safety Management System; OHSAS 18001 – Legal and SANS 878:2004 – Quality compliant.

Where a commercial ready-mix supplier is commissioned to supply concrete, the contractor shall submit documented proof, to the satisfaction of the Engineer, to prove compliance with the above requirements."

PSG-5.5.5 Placing

PSG-5.5.5.1 Add the following to sub clause 5.5.5.1:

"The casting procedure shall be approved by the Engineer prior to casting. The Contractor shall give the Engineer at least 48 hours' notice of his intention to cast concrete."

PSG-5.5.5.3 Add the following to sub clause 5.5.5.3:

"Fresh concrete shall not be placed against concrete which has been in position for **more than 30 minutes** unless a construction joint has been formed or unless a retarding additive has been used in the concrete.

Care shall be taken when elements of substantial thickness to avoid layering of the concrete, i.e. the 450 mm thick layer guideline in the standard clause 5.5.5.3 is waived such elements (consult the Engineer if required). The entire thickness shall be placed in one pass."

PSG-5.5.5.5 Add the following to sub clause 5.5.5.5:

"Concrete in water-retaining structures shall not be allowed to fall freely through a height of more than 2,7 m. This implies that walls in these structures may not be cast in heights exceeding 2,7 m in height unless a chute or tremie pipe is used."

PSG-5.5.5.9 Add the following to sub clause 5.5.5.9:

"When concrete is pumped the slush used to prime the pump shall be wasted before commencing placing of the concrete."

Add the following new sub clauses:

"PSG-5.5.5.10 No kickers in walls or columns will be allowed.

PSG-5.5.5.11 During summer months, when maximum ambient temperatures is forecast to exceed 30℃, concreting shall start as early as possible in the mornings, but not later than 7:00.

During winter months, when minimum ambient temperatures are below 5℃, concreting shall start towards

mid-morning. In any event, the ambient temperature shall have risen to at least 7℃ before concrete placement commences."

PSG-5.5.7 Construction Joints

PSG-5.5.7.1 Add the following to sub clause 5.5.7.1:

"Construction joints shall only be permitted as shown on construction drawings. Otherwise, before construction work commences the Contractor shall indicate on the drawings his proposal for positioning construction joints and submit these to the Engineer for his comment and approval."

PSG-5.5.7.3 The following additional requirements shall be applicable to water retaining structures:

The Engineer may allow the Contractor to cut an additional straight construction joint if it is possible without prejudicing the water tightness of the structure. The additional construction joint shall be sealed with the same seal that is specified for planned construction joints at the expense of the Contractor.

Construction joints in reinforced concrete walls, embankments, etc. shall consist only of horizontal joints unless noted otherwise. No vertical joints other than those indicated on the drawings may be constructed without the written approval of the Engineer.

Horizontal joints shall be formed by casting against a timber or metal former. Recesses shall be formed as detailed on the drawings.

The application of compounds to the surfaces of stop ends at vertical joints to retard the setting of a film of concrete in contact with the stop end will be permitted subject to the Engineer's approval of the compound to be utilized and the Contractor's methods for the application and removal of the compound.

The exact position of construction joints shall be marked on the formwork in order to obtain truly horizontal joints.

Preparation of Surface

Prior to placing any further concrete the joint must be clean, damp and free of laitance. During the period when the concrete is still green, all loose material shall be removed, without disturbing the aggregates, by light brushing. Where this is not possible, or if the concrete has already set, the surface film shall be removed by mechanical means appropriate to the degree of hardness of concrete so as to expose the aggregate over the entire surface and leave a sound, irregular surface.

Before Placing Concrete

Where the concrete of the previous lift is more than three days old, it shall be kept wet to create a concrete surface that is saturated but surface-dry and the swellable bar shall be installed in accordance with the supplier's specification prior to proceeding with placement of the fresh concrete.

PSG-5.5.8 Curing and Protection

Replace this clause with the following:

"PSG-5.5.8.1 Early age protection

The use of high pressure fog sprayers (such as electric Kärcher fog sprayers or equivalent to be approved by the Engineer) shall be employed to maintain a state of high humidity immediately above the surface of the concrete in horizontal elements such as floor slabs, roof slabs and wall footings without resulting in pools of water, in order to prevent plastic shrinkage cracking. This procedure shall be employed from the time that

placing of concrete starts until after initial and final finishing, at which time curing of the concrete as specified below, can start. The sprayers shall be positioned at strategic positions before placement of the concrete starts.

The number of fog sprayers shall be such as to maintain the high humidity over the complete surface of the particular element being cast, but not be less than two shall be used.

Any pooled or standing bleed water on the surface of the concrete shall be removed before any final finishing operations may commence. Where no bleed water is present, final finishing shall proceed at the earliest possible time, without delay, especially considering the quick-setting nature of the cement specified in PSG-3.2.2.1.

Immediately after final finishing, all exposed surfaces shall be covered and secured with approved plastic sheets complying with the requirements below.

PSG-5.5.8.2 Curing

a) Floor and roof slabs and wall footings

The first morning following completion of final surface finishing, the plastic sheets shall be removed. Slabs shall then be cured as follows:

- During summer months (generally September to March): The slab shall be flooded with water to a minimum depth of 25 mm for the full prescribed curing period. On suspended slabs, the water depth shall not exceed 75 mm.

- During winter months (generally April to August): The slab shall be covered with geotextile sheets complying with the requirements below, which shall be thoroughly soaked with water. Immediately thereafter, geotextile sheets shall be covered with plastic sheets in compliance with the requirements below. Plastic sheets shall be removed each morning during the prescribed curing period, where after geotextile sheets shall be thoroughly soaked with water, followed by replacement of plastic sheets.

b) Column footings and wall footings

The first morning following completion of final surface finishing, the plastic sheets shall be removed, and above-mentioned structural elements shall be covered with geotextile sheets complying with the requirements below, which shall be thoroughly soaked with water. Immediately thereafter, geotextile sheets shall be covered with plastic sheets in compliance with the requirements below. Plastic sheets shall be removed each morning during the prescribed curing period, whereafter geotextile sheets shall be thoroughly soaked with water, followed by replacement of plastic sheets.

c) Columns

Columns shall be thoroughly sprayed with water immediately after the removal of formwork, and removal of formwork shall strictly conform to the times as stated in Table 2 in PSG 5.2.5. Thereafter columns shall be wrapped with minimum 15 micron thickness plastic wrapping (i.e.17 micron pallet wrapping rolls), which shall overlap by 50 mm, to be approved by the Engineer.

d) Walls

Walls shall be thoroughly sprayed with water immediately after the removal of formwork, and removal of formwork shall strictly conform to the times as stated in Table 2 in PSG 5.2.5. Thereafter walls shall be covered with geotextile sheets which shall be maintained in contact with the concrete surface by fastenings spaced at no more than 2 m centers. These sheets shall be kept in a continuous state of saturation.

During summer months, formwork shall be struck early in the morning to allow curing to start before loss of moisture from the concrete can occur as the ambient temperature rises. During winter months

when minimum ambient temperatures (including the wind chill factor) are below 5°C, formwork shall be struck towards midday.

Special care shall be taken to ensure that the top surfaces of walls are kept wet continuously to prevent rapid drying. The top of the wall shall be covered with a sausage of geotextile, which shall be kept wet continuously.

f) Determination of intervals and duration of application of water

The duration of water application and the intervals of application will be determined on site by the Engineer, and shall be such as to prevent the concrete from drying out. The duration and intervals shall be adjusted to allow for adverse conditions such as high temperatures and/or dry, windy conditions.

g) Plastic sheets and geotextiles

Plastic sheets used for curing shall be new, waterproof and may not be torn or be otherwise discontinuous. Plastic sheets shall be at least 250 micron thick. Joints in plastic sheets shall be taped to prevent loss of moisture from the concrete (overlapping only would not be sufficient). Sheets shall overlap by at least 500 mm, shall extend at least 500 mm past the area to be cured, and shall be draped and secured around the edges and ends of elements to prevent any loss of moisture from the concrete.

Geotextile sheets shall be new, of the Kaymat A4 type (or equivalent to be approved by the Engineer) and may not be torn or discontinuous.

Plastic and geotextile sheets may be re-used for curing of further elements, but shall be replaced with new sheets when torn or damaged

Plastic and geotextile sheets shall be held down or fixed securely to the elements being cured.

h) Duration of curing

The curing period shall be at least 10 days from date of concrete casting in summer and at least 14 days in winter.

The Contractor shall ensure that curing will be continuous over weekends, public holidays and builders' holidays, and therefore shall have responsible employees on site on such days to ensure compliance with this requirement.

i) General

The use of curing compounds for curing is not allowed under this contract.

Before casting of concrete may commence, the Contractor shall prove to the satisfaction of the Engineer that all measures to comply with the requirements of curing and protection of concrete, have been put in place.

Notwithstanding the preceding specifications, the Contractor shall also ensure that the concrete shall not be exposed to thermal shocks during the first 28 days after casting and he shall take the necessary, additional precautionary measures to shield the concrete during extreme warm, cold, dry or windy weather conditions. Curing shall be done in such a manner as not to cause staining, contamination or marring of the surface of the concrete.

Only potable water shall be used for the curing process, unless expressly otherwise instructed by the Engineer in writing.

The Contractor shall take the necessary precautions to prevent water used for curing from penetrating the soil underneath or adjacent to the structures. The water shall be drained away effectively as soon as possible to prevent any ponding.

Non-compliance with the above-mentioned protection and curing requirements shall be considered as sufficient grounds by the Engineer to order demolition and replacement of affected structural elements."

PSG-5.5.9 Adverse Weather Conditions

PSG-5.5.9.1 Add the following:

"No concrete shall be placed when the ground or air temperature is below 7°C on a rising thermometer, or if it is likely to fall below 2°C within six hours of placing the concrete."

PSG-5.5.9.2 Replace the first sentence with the following:

"The Contractor shall ensure that the temperature of fresh concrete at time of casting does not exceed the ambient temperature by 5°C. In any event, the temperature of the concrete when cast shall not be allowed to exceed 30°C."

PSG-5.5.10 Concrete Surfaces

PSG-5.5.10.1 Delete sub clause 5.5.10.1 and replace with the following:

"Striking off: after placement and compaction of concrete as specified, the top surface shall be struck off with a template to the required cross section and tamped with a tamping board to compact the surface thoroughly and to bring mortar to the surface, so as to leave the surface slightly rough but at the required level/elevation to within the dimensional tolerances specified in PSG-6.2.3.

This finish is considered to be included in the concrete rate.

PSG-5.5.10.2 Add the following to sub clause 5.5.10.2:

"a) Wood-floated Finish

The surface shall first be treated as specified in sub clause 5.5.10.1, and after the concrete has hardened sufficiently, it shall be floated to a uniform surface free from trowel marks with a wood float. The levelled surface shall be wood-floated either by hand or by machine.

b) Broomed Finish

The surface shall first be given a wood-float finish (as defined in PSG-5.5.10.2(a)). Then the broom finish will be applied. The corrugations produced by the hard-bristled broom shall be approximately 1 mm deep, uniform of appearance and width and shall be perpendicular to the direction of movement along the surface.

c) Steel-floated Finish

The surface shall first be treated as specified in sub clause 5.5.10.1, and after the bleed water has disappeared and the concrete has hardened sufficiently to prevent the migration of concrete foam to the surface, the levelled surface shall be floated with a steel trowel on which a firm uniform pressure shall be applied to provide a dense, smooth, uniform surface free from trowel marks.

d) Power-floated Finish

When a power-floated finish is specified, the surface shall be treated as specified for a wood-floated finish above, except that the levelled concrete surface shall be power-floated to provide a dense, smooth, uniform surface of high quality free from trowel marks."

For wood and steel-float finishes, rubbing the surface with a carborundum stone after the concrete has hardened to achieve the required finish and dimensional tolerances shall be allowed within reason, but under no circumstances shall plastering/building up of the surface be permitted.

PSG-5.5.11 Watertight Concrete

Add the following to this clause:

"All water retaining structural elements (refer PSG-2.3) shall be required to be watertight. They shall be watertight without the addition of supplementary cement plaster, coatings or membranes. Ensuring water tightness is the exclusive responsibility of the Contractor and he shall take all the measures necessary to achieve this.

The structural elements not forming part of the water containment reservoir shall be deemed watertight in terms of this contract if no visible leakage or obvious damp spots are apparent on any visible surface of the structure. Failure to comply shall be deemed to be a result of insufficient curing, notwithstanding any proof to the contrary, and shall be subject to repairs (refer PSG 5.5.14.2) at the expense of the Contractor.

Should any form of cracking be present and be so prolific and of such widths that is be deemed unacceptable, the Engineer reserves the right to order demolition and reconstruction of the affected structure/structural element at the expense of the Contractor (refer PSG-5.5.8.2 h))."

Ferrules

The holes left on the waterside face shall be repaired as follows:

Prepare the ferrule hole with a Penetron slurry coat and pack the hole with a Penecrete/Penetron Slurry combination, all in accordance with the manufacturer's specification. The surface finish of the repaired area shall match that of the surrounding concrete and curing compound shall be applied over the area.

The holes left on the exterior face shall be repaired by first soaking the surface as for construction joints, whereafter the hole shall be packed with a 1:3 sand-cement mortar thoroughly panned/rammed in. The surface finish of the repaired area shall match that of the surrounding concrete and curing compound shall be applied over the area.

NOTE: Specialist products such as those from Sika and Penetron shall be applied/installed by an applicator approved by the product supplier in order for the product warranties to be valid.

PSG-5.5.14 Defects

PSG-5.5.14.2 Add the following to sub clause 5.5.14.2:

"a) Where repair of surface defects are ordered, the Contractor shall consult specialist suppliers of concrete repair products, obtain from them a proposal(s) for a suitable repair product(s) along with a detailed method statement from such specialists and submit it to the Engineer for approval. All products shall be applied strictly in accordance with the manufacturer's specification.

The repaired area shall match the surrounding concrete as closely as possible in both colour and texture. All repair materials shall be equivalent to concrete in respect of thermal properties and structural elasticity.

b) If the finish of exposed formed surfaces does not comply with the requirements for accuracy, smoothness at shutter joints or uniformity of texture, appearance and colour, the Contractor shall upon instruction by the Engineer, rub down the exposed surfaces of the entire structure or any part of it as specified below:

The surface shall be saturated with water for at least one hour. Initial rubbing shall be done with a medium-coarse carborundum stone, where a small amount of mortar (having a sand : cement ratio equal to that of the concrete being repaired) is used on the surface. Rubbing shall be continued until all form marks, projections and irregularities have been removed and a uniform surface has been obtained. The paste produced by the rubbing shall be left in place. The final rubbing shall be carried out with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth, even texture and is uniform in colour. The surface shall then be washed with a brush to remove surplus paste and powder.

Add the following new clause:

"PSG-5.5.15 Replace the first sentence and clause a) with the following:

"The Contractor shall monitor and record the following on a form (to be drafted by the Contractor and approved by the Engineer), to ensure compliance with the specifications:

a)- date and time of casting and the time taken to place the concrete;
- structural element and description of pour;
- daily maximum and minimum temperatures;
- ambient temperature at time of casting (start and finish);
- temperature of mixing water (to be obtained from supplier in case of the use of readymix;
- temperature of concrete on arrival at the point of casting.

Add at the end:

To this effect, the Contractor shall install a mini weather station (to be approved by the Engineer) to record meteorological data such as humidity, wind speed, precipitation and ambient temperature continuously. A digital pen type thermometer shall be used to record mixing water and concrete temperatures."

Add the following clauses:

"PSG-5.6 Items built into water-retaining structures

The building in of items, such as puddle pipes etc. into water-retaining structures shall be executed as follows:

a) the items shall be positioned prior to construction of the relevant part of the water-retaining structure, a swellable bar secured onto the pipe near or at the centre of the wall and subsequently cast in simultaneously with the concreting of the specific element of the water-retaining structure. (Also refer to PSG-5.5.11d))

The Contractor's attention is drawn to the following:

- Water-retaining structures shall be fully watertight, especially around cast in items, and no leaks or damp areas will be allowed. Where cast in items don't have puddle flanges, a swellable bar to be provided around the full perimeter of the item and positioned between the reinforcing steel layers.
- The concrete of the water-retaining structure around the built-in item shall be free of any honeycombing, shall have an acceptable smooth finish and the colour of the whole relevant part shall be uniform.
- Pipes passing through water-retaining structures shall be properly aligned as specified and as detailed on the drawings, and valve stems intended to be vertical shall, for example, be 100 % vertical in both planes.

Building in of items will not be measured separately as it is included in the supply and installation of the pipes and specials measured in SANS 1200 L.

PSG-5.7 Items built into existing structures

Where pipes or other items have to be built into existing water-retaining structures, the existing concrete shall be cut out carefully to obtain sufficient space to install the items.

The building in of the items shall then be executed as follows:

a) recesses or holes to be subsequently grouted or concreted in: The procedure entails sandblasting and water jetting the recess surfaces followed by installing a swellable bar and the application of an approved acrylic polymer bonding agent. The pocket shall be filled with the same type and strength of concrete as the original and properly cured after removal of the formwork.

Building in of the items will not be measured separately as it is included in the supply and installation of the pipes and pipe specials as measured in SANS 1200 L. The cost of breaking into existing concrete and making good after installation will however be measured separately."

PSG-5.8 Rehabilitation of deteriorated concrete in existing structures

Concrete identified for rehabilitation will be prepared and treated in four headline steps:
- Surface preparation
- Remove compromised concrete and reinforcing (where applicable)
- Concrete repair build-up
- Surface seal/revitalisation

The steps will be detailed in the sections below.

PSG-5.8.1 Surface Preparation

All concrete that has been identified and confirmed by the Engineer, will be pressure washed with a minimum pressure of 120 bar. While higher pressures can be used, wash technique may have to be adjusted by maintaining a greater gap between nozzle and concrete. The purpose of the washing step is to remove all laitance, dirt, grime, compromised material and provide a sound surface with an open pore structure and rough surface profile that will ensure the repair products to mechanically bond with the concrete. It is not intended for concrete demolition that will significantly reduce the concrete cover to the reinforcement.

All loose material will be removed from the reservoir in a suitable way. It may not be flushed through the outlet pipe system, unless agreed to in writing by the reservoir operator with the express understanding that such waste can be scoured from the system in a safe manner in a suitable location on site.

PSG-5.8.2 Remove compromised concrete and reinforcing

The concrete cover to the rebar is limited and is expected to vary to some extent. Any cutting into the concrete as part of preparatory work must be done conservatively. A maximum depth of cut of 20mm is recommended but proceed only after initial checks to confirm typical concrete cover in the area where the work will be executed and confirm that the chosen depth will not compromise the existing reinforcement in any way.

Areas where concrete has spalled, must be cut with neat and straight edges. Cutting will be done with suitable grinders or diamond blade saw-cutting. Cutting will be done at a slight angle from vertical to the concrete face in such a way that a "dovetail", or mechanical key, is created within the concrete structure.

After cutting, concrete will be broken out by suitable mechanical means to an even depth over the affected area. Depth of break-out will be dependent on the severity of corrosion of the reinforcing bar within the spalled area.:

- For small spalls with rebar not exposed yet or barely exposed and with limited surface corrosion, concrete will be broken out up to the surface of the reinforcing bar

- For larger spalls with reinforcing bars more significantly exposed and corroded away (bar area visibly reduced), but where steel loss is estimated to be up to 1mm on smaller bars (<=12mm) and up to 2mm on larger bars (>=16mm), concrete will be broken out to approximately 30mm beyond the affected reinforcing bar
- For larger spalls with reinforcing bars exposed and significantly corroded away (bars visibly reduced, in excess of the limit on the category above), concrete will be broken out approximately 30mm beyond the affected reinforcing bar. The compromised bar shall receive a splice bar of similar size with a minimum splice of 40x diameter on either side of the area of highest steel loss. Splice length shall be increased as steel loss increases, to the point where a bar that is totally corroded away, will have a splice length of 50x diameter.

Exposed bars with signs of corrosion will be vigorously cleaned by mechanical means to remove all rust from all surfaces. The final call on whether a splice bar is required and what the minimum length of such bar must be, shall be determined only after mechanical cleaning to confirm the actual steel loss.

The reinforcing bars shall be gently knocked “inwards” (into the existing concrete structure) where required to ensure that a minimum cover of 20mm will be achieved after the repair build-up.

The described preparation work of the spalled area shall be followed by a second round of pressure washing locally within the prepared areas to ensure acceptably clean surfaces. No additonal payment will be made for the second round of washing; it will be deemed to be included in the rate of the initial pressure wash and concrete breakout.

PSG-5.8.3 Concrete repair build-up

The prepared areas shall first be coated by Penetron slurry as primer and a corrosion inhibitor on the rebar, followed by Penecrete mortar that shall be built up in discreet layers in accordance with Penetron’s recommendations where the total build depth exceeds the maximum applied thickness of the product. The build will be complete once finished flush with the surrounding existing concrete surfaces. Curing/waiting periods in between subsequent build layers will be in accordance with the Penetron’s guidance.

PSG-5.8.4 Surface seal / revitalisation

Once the repairs have been completed, a Penetron slurry coat will be applied over the full surface area that will provide a uniform surface finish as well as provide the chemical load that will migrate into the concrete and revitalise it by the crystalline growth in the concrete pore structure, also restoring the alkalinity of the old concrete.

PSG-5.8.5 Structural safety and protection during work

In areas where invasive work into columns, column heads and the roof slab soffit is done (areas of all spall repairs except the minor repairs), props must be provided to the surrounding area to support the roof structure. The minimum prop requirement shall be:
- a maximum spacing of 2.5m x 2.5m
- A prop allowance of 0.5kN/m^2 of roof slab where significant repairs are being done.
- Example: using the maximum allowed prop spacing of 2.5m x 2.5m, the typical prop will have an effective capacity of 3.1kN.
- Prop capacity will be calculated based on the effective length of the props and does not refer to the nominal or maximum prop capacity
- Prop requirements will be calculated by the Contractor’s appointed competent person who will carry the responsibility of this and all other temporary works designs

The existing roof slab has an estimated maximum design imposed load of 2 kPa, or 200 kg/m^2 in addition to the 100mm thick stone layer on the roof. The Contractor will ensure that his applied construction loads on the roof will never exceed this unless suitable props are provided inside the reservoir to protect the roof from damage. Note that if stone is moved around or heaped locally for joint repair access on the top, this affects the remaining capacity of the roof slab. To this end, stone will not be stockpiled higher than 350mm overall over areas larger than 1m^2 to prevent local overloading, or higher than 220mm overall over areas larger than 1m^2.

Any construction loading applied to the roof will be sufficiently spread to protect the integrity of the roof structure while limiting the maximum loading over any given area. These considerations and determinations will form part of the duties of the Contractor's competent person.

PSG-5.8.6 Roof joints

The existing (failed) sealant in the expansion joints on the roof shall be fully stripped out and the bonding surfaces cleaned and prepared in accordance with the sealant manufacturer's specifications. The us of a primer is optional but recommended and the cost of a primer is deemed to be included in the tendered rate. Filler board in the joint shall also be removed to a suitable depth to facilitate the installation of a backing cord. The backing cord will be mandatory to ensure the correct form and seal geometry. Pourable or self-levelling ultra-low modulus silicone or hybrid sealant shall be used.

PSG-6 TOLERANCES

PSG-6.2 PERMISSIBLE DEVIATIONS (PDs)

PSG-6.2.1 General

Degree of Accuracy II shall apply in general, except for ***special* finishes** where **Degree of Accuracy I** shall apply (Refer PSG-5.2.1).

PSG-6.2.3 Specified PDs

Amend this clause to read as follows:

"(a)1): Spacing between adjacent bars: -10 +10 mm, irrespective of the Degree of Accuracy (additional bars have to be added at the Contractor's expense if the number of detailed bars are insufficient due to creep in position of bars due to incorrect bar placement by the Contractor);
(a)2): Cover to reinforcement: –0 +5 mm irrespective of the Degree of Accuracy;
(d)7)ii): Abrupt changes in a continuous surface: ± 1.0 mm irrespective of the Degree of Accuracy."

PSG-7 TESTS

PSG-7.1 FACILITIES AND FREQUENCY OF SAMPLING

PSG-7.1.2 Frequency of Sampling

PSG-7.1.2.1 Replace this clause with the following:

"Subject to the requirements of sub clause 7.1.2.4, while concrete of a particular grade and in sufficient quantity is being placed under the same conditions, sets of samples (each sample, as defined in clause 2.3(b), being sufficient for six cubes) shall be taken until a maximum of 30 valid test results (5 sets of samples) have been obtained.

The sets of samples shall be taken in accordance with SANS 5861-2 from different batches of concrete, chosen on a random basis. At least one sample shall be taken from each day's placing and from at least every 50 m^3 of concrete of each grade. The frequency of sampling shall be determined by the importance of the work, i.e. a critical structural element may require that additional samples be taken (e.g. one sample every 10 m^3 of concrete, as directed by the Engineer)."

PSG-7.2 TESTING

PSG-7.2.1 General

Add the following:

"Concrete materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Engineer to final acceptance.

The Contractor shall allow in his tendered rates for all the costs for quality or process control testing."

PSG-7.2.4 Early-Strength Testing

Add the following to this clause:

"Of each sample of six cubes, three cubes shall be tested at 7 days and the remaining three cubes at 28 days."

Add new sub clauses:

"PSG-7.2.5 Sterilization of Reservoirs

Before a reservoir is sterilized, the roof shall have been tested for water tightness as set out in Clause 7.2.6 below, and the pipelines serving the reservoir shall have been sterilized. The reservoir shall then be thoroughly cleaned out and washed down with clean water.

The roof, beams, columns and walls shall thereafter be thoroughly sprayed down with water containing 0,30g per litre of calcium hypochloride with 65% available chlorine. All surfaces shall remain wet with the solution for a minimum of two hours.

On completion of the sterilisation, the sterilising solution shall be run to waste before the reservoir is filled for testing its water tightness.

Should additional work be required to be done inside the reservoir after the water tightness test has been completed, the reservoir shall be re-sterilised at the Contractor's expense.

PSG-7.2.6 Tests for Water Tightness

Roofs

Roofs shall be tested prior to the containment structure. The cost of water required for the testing of the roofs shall be included for in the tendered rates.

The roof slabs that are required to be water-excluding shall be ponded with water to a maximum depth of 80 mm and a minimum depth of 20 mm for a period of at least two days (48 hours). The ponding shall be carried out in an approved systematic manner over the entire top surface area of the slab. The roof slab shall be deemed watertight if there is no visible leakage or damp spots on the soffit of the slab."

Domed roofs or sloped roofs of reservoirs shall first be visually inspected from below. Access for visual inspections of the roof soffit shall be arranged while scaffolding that supported the roof shutters are still in place. Sufficient and safe access walkways shall be provided to enable the Engineer to complete a full visual survey of the roof soffit. Should the Engineer not be afforded an opportunity to access the roof soffit up close, whether for the initial inspection or any inspections thereafter that may be required after any repair works have been completed, the Contractor shall arrange for a suitable means of access and/or recording of the entire dome roof soffit surface (technology possibly affords, amongst others, the use of high definition footage from drones and/or ultra-high definition cameras with software to stitch all the images into a single image).

The Contractor shall provide sufficient lighting to the roof soffit to the satisfaction of the Engineer during all inspections that may be required up until final acceptance of the reservoir roof structure.

The water tightness of a domed/sloped reservoir roof shall be tested by water being continuously sprayed over the roof in an approved manner so that a film of water is maintained on the dome surface. The roof shall be considered watertight if no damp patches are visible on the roof soffit after two days (48 hours) of continuous spraying.

Reservoirs

All water levels shall be carefully noted and recorded by the Engineer. The Contractor is free to attend the taking of all measurements by the Engineer.

Water-containment structures (reservoirs) shall be subjected to watertight testing. Prior to filling, a thorough **inspection** shall be done to ensure that all joints are properly sealed and that all inlet and outlet pipes are closed.

The structure shall then be **filled** with water to its maximum operating level at a rate not exceeding 2,0 m depth in 24 hours.

If there are no visible leakages, the **saturation period** will be three weeks during which water will be checked daily and topped up as required to maintain the top water level. Concrete is afforded time to become fully saturated and self-heal any minor cracks that may be present. If water level proves to be constant or stabilises quickly, the saturation period my be reduced to as little as 7 days.

If any leakages are visible, the water test shall be aborted, depending on the seriousness of the leakages (minor leaks may self heal). Repairs will be done by the Contractor at his own cost, in accordance with an approved method and product(s) before another water test shall be done.

In structures where the water surface is exposed to the atmosphere a small cylindrical watertight container (like a 20 litre tin) floating in the water should be filled with water to approximately 80% of its capacity. This can be monitored and any fluctuations herein due to evaporation or precipitation may be used for corrections to determine the true reservoir water level.

The **test period** will follow after the reservoir level has finally been topped up to its maximum operating level (and the water level in the container to the original level, where applicable). The water levels in the structure and the underfloor drainage pipes shall then be monitored daily for a period of 7 days (with corrections applied based on readings from the containing, where applicable).

Watertight criteria: the structure shall be deemed watertight if:

(a) no visible leakage or obvious damp spots are apparent on the outside of the structure or in the underfloor drainage system; and

(b) the drop in water level after being corrected for evaporation and precipitation where applicable during the 7 day test period does not exceed the lesser of 0.2% of the water depth or 10mm.

If the structure fails the water tightness test the Contractor shall determine the cause of the leakage. The Contractor shall repair at his own cost the leakage on the inside of the structure after the water has been drained, in accordance with an approved method and product(s). Thereafter the structure shall again be subjected to a complete water test as described above. Full payment under Item 8.4.3 will only be made once the water tightness test has been passed (refer to Clause PSG-8.1.3 hereafter).

Water will be supplied free of charge by the Employer for the initial filling and testing of the reservoir only. Should the failure of the reservoir to pass the first or any subsequent test for water tightness necessitate the drainage of the structure, the Employer reserves the right to utilise the water discharging it into its water-reticulation network, in which case the Contractor –

c) shall not have to pay for the subsequent refilling of the reservoir:

c) shall, if applicable, reimburse the Employer for any additional costs incurred to make the water fit for consumption, and

c) shall not be entitled for extra time whilst waiting for the water to be discharged into the network.

The time and cost of re-testing the reservoir for water tightness shall be borne by the Contractor."

PSG-8 MEASUREMENT AND PAYMENT

PSG-8.1 MEASUREMENT AND RATES

PSG-8.1.1 Formwork

PSG- 8.1.1.2 **Delete** "and fillets or splays over 20 mm x 20 mm"
Add "Splays up to and including 25 mm x 25 mm will not be measured separately and will be deemed to be included in the formwork costs."

Add the following clause:

"PSG-8.1.1.7 No formwork will be measured to edges of blinding layers under structures. The cost for such formwork (if needed) will be deemed to be included in the rates tendered for the concrete in blinding layers.

PSG- 8.1.1.8 Back-shuttering or formwork to top revealed surfaces of sloping or conical formwork will only be measured to surfaces at angles of over 40° and up to 85° to the horizontal.

PSG- 8.1.1.9 Formwork to horizontal surfaces in pump stations, valve chambers, manholes, sumps, etc can either be designed to be removed through the manhole cover opening or the Contractor may use permanent formwork at his own cost as no claims in this regard will be considered."

PSG-8.1.2 Reinforcement

PSG- 8.1.2.2 Replace subparagraph (a) with the following:

"The mass of steel bars will be measured as the total mass of the steel, irrespective of diameters."

PSG-8.1.2.3 Amend the clause as follows:

"Delete the words "nominal size 25 mm" in the first line of subparagraph (a).

Delete subparagraph (b)."

Add the following clause:

"PSG-8.1.4 Casting in of pipes and specials

No separate items will be scheduled for building in items supplied under this Contract except for those

specially measured in the Bills of Quantities. The relevant rates for supply and installation shall cover the cost for casting in the items supplied under this Contract whether the items are positioned prior to construction or subsequently placed in blocked-out holes."

PSG-8.2.1 Rough

Refer to clause PSG-5.2.1a) above.

PSG-8.2.2 Smooth

Refer to clause PSG-5.2.1b) above.

PSG-8.2.3 Special Smooth, Repaired and Rubbed

Refer to clause PSG-5.2.1c) above.

PSG-8.4 SCHEDULED CONCRETE ITEMS

PSG-8.4.3 Strength Concrete, Grade

Add the following to the payment paragraph:

"The tendered rate for concrete to be used shall also include:
- all measures necessary to store cement, water and aggregates in a cool environment to ensure that the ingredients of the concrete are cool at the time of mixing in order that the allowable concrete temperature at time of placement is not exceeded.
- the cost of any all water-reducing as well a durability admixtures (refer PSG-3.5.1 and PSG-5.5.1.5)
- striking off of concrete
- all construction joints
- curing of concrete as described in this specification"

PSG-8.4.4 (a) Wood-float finish
Refer to clause PSG-5.5.10.2(a) above.

PSG-8.4.4 (b) Steel-float finish
Refer to clause PSG-5.5.10.2(c) above.

PSG-8.4.4 (d) Broom finish
Refer to clause PSG-5.5.10.2(b) above.

Add the following items:

"PSG-8.4.7 No-fines Concrete (*describe class and position***) Unit: m^3**

The relevant measurement and payment clauses for strength concrete (clause 8.4.3) shall apply.

PSG-8.4.8 Concrete screed

Description of application and thickness **……Unit: m^2**

The rate shall include all costs associated with the installation of a screed and the average thickness and proportions of the screed stated, enhanced with Sikafume (or equivalent to be approved by the Engineer) to the manufacturer's specifications. (Also refer PSG-5.5.1.7.)"

PSG-8.4.9 Screeds

Description of application and thickness **……Unit: m²**

Floor screeds (1:3) with falls including V-joints to form panels and a steel trowelled finish to the top surface.

The tendered rate shall include full compensation for constructing the screeds as specified including supplying of all materials, preparing the concrete surface to receive the screeds and for all else that may be necessary to complete the work."

PSG-8.5 **JOINTS ……Unit: m or m²**

The tendered rate shall cover the cost of all materials and labour for the construction of each type of wall/floor joint as specified in Clause PSG-5.5.7 and PSG-5.5.11 and shown on the drawings, including the cost of formwork, testing and making good."

Add the following items:

"PSG-8.9 **Installation of pipes and pipe specials in existing concrete structures (***describe items and locality***)** ..... **Unit: Sum**

The tendered sum for each item shall cover the cost of breaking out existing concrete sufficient to allow the installation of the item in its correct position, additional cost for installation not measured elsewhere, and making good of the concrete after completion of the installation of the item. The sum tendered shall be regarded as an extra over the cost for supply and installation of the item which has been measured elsewhere under SANS 1200 L.

PSG-8.10 **Miscellaneous work other than metalwork**..... **..Unit: as scheduled**

Separate items will be scheduled for each type of miscellaneous work.

The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed.

PSG-8.11 **Sterilization of reservoir**.....**..Unit: Sum**

Separate items will be scheduled for each type of structure to be sterilized in accordance with PSG-7.2.5.

PSG-8.12 **Testing for water tightness** ..... **Unit: Sum**

Separate items will be scheduled for each type of structure to be tested in accordance with PSG-7.2.6.

PSGA CONCRETE (SMALL WORKS)

PSGA1 CEMENT (Sub-Clause 3.2.1)

Only the use of Ordinary Portland Cement to SABS 471 will be permitted.

PSGA2 CONCRETE FINISHES (Sub-Clauses 4.4.2)

Concrete against which earth will be backfilled shall be classified as rough. All exposed concrete surfaces shall be classified as smooth. Degree of accuracy II shall prevail.

PSGA3 STRENGTH CONCRETE (Sub-Clause 5.4.1.5)

The grade of concrete and nominal size of aggregate shall be as specified on the Drawings. The successful tenderer will be required to submit samples of the coarse and fine aggregate which he proposes using, to the Engineer's Representative(s) for tests regarding the suitability of such aggregates. The Contractor shall prepare trial mixes of the grades of concrete required for the Contract to establish acceptable design mixes. These mixes shall be designed for vibration. All data and reports prepared by the Contractor shall be submitted to the Engineer for information and approval prior to the commencement of concreting operations.

PSGA4 ANCHOR AND THRUST BLOCKS

At tees, bends, terminal valves, end caps, and where otherwise directed, anchor/thrust blocks shall be constructed to dimensions ordered, shown on the Drawings or agreed to by the Engineer. Unless otherwise specified, anchor/thrust blocks and pedestals shall be constructed of prescribed mix 20MPa/19mm concrete.

The concrete shall be well punned round the pipe and, if in trenches, against the undisturbed faces and bottom of the trench. Backfilling behind or under thrust faces will not be permitted. Excess excavation shall be replaced with the prescribed mix concrete given above for anchor/thrust blocks at the Contractor’s expense, unless an item is scheduled to cover payment for overbreak. Care shall be taken to leave the joints accessible. No anchor/thrust blocks and pedestals shall be concreted until the approval of the Engineer has been obtained.

Anchor and thrust blocks will be measured by volume of concrete; the rate tendered shall include for any formwork required to construct the block.

Should the Contractor offer an alternative method of coupling involving flexible joints, he shall design suitable thrust and anchor blocks in order to prevent movement of the pipeline under operating and test conditions. The working and test pressure to be used by the Contractor for the calculation of anchor and thrust blocks shall be in accordance with the design information that is issued together with the tender. The earth bearing pressure to be used for the calculation of anchor and thrust blocks shall be based on the geotechnical reports which are bound into Part C4: Site Information. The factor of safety to be used in calculating the above shall be 2,5.

PSGA5 MEASUREMENT AND PAYMENT (Anchor and thrust blocks)

Anchor and thrust blocks are measured by volume of concrete; the rate tendered shall include for formwork and reinforcing.

PSL MEDIUM PRESSURE PIPELINES

PSL1 MATERIALS - WATER SUPPLY MAINS (Clauses 3.1 to 3.7)

(a) Reticulation mains shall be uPVC pressure water pipes with shouldered-end couplings to Johannesburg Water's approval with sizes and classes as specified on the drawings.

(b) Steel fittings and specials shall be manufactured in accordance with the requirement of BS 534 but to the dimensions shown on the detailed layouts. Steel pipe sections shall be 6mm thick grade A complying with the requirements of SABS 719.

(c) Cast iron fittings and specials shall be, manufactured in accordance with the requirements of 1200L, clause 3.3.

(d) Flexible slip-on type Viking Johnson couplings shall be complete with removable centre registers (locating lugs). The area surrounding the locating lug shall be built up to prevent damage to the female thread on the Viking Johnson coupling.

(e) HDPE pipes shall confirm to SABS 533.

PSL2 CORROSION PROTECTION (Clause 3.9)

Protective coatings described in this sub-section shall not be measured for payment but shall be included in the rates tendered for piping, fittings, couplings and specials.

a) All cast iron valves, cast iron or steel fittings and cast iron or steel specials shall receive a two component solvent borne epoxy pipe coating and lining such as Copon KSIR 88 from Plascon or similar approved equivalent.

Surface preparation, application, testing and performance shall comply with the requirements of SABS 1217 type 1A, except that the minimum total dry film thickness shall be 300 micron.

Materials shall be applied in accordance with SABS 1217 and in accordance with the manufacturer's data sheet. Attention is drawn to the need for strict observance of the manufacturer's minimum and maximum coating thickness and time interval between

coats relative to ambient and steel temperatures.
The coating shall be applied in either two or three coats with either one or two coats being applied in the workshop. After installation any scratch or chip marks shall be touched up and the whole item covered with a further coat (or two coats) of copon to give a total thickness of not less than 250 micron.

b) All bolts, nuts and washers used for flanges and couplings shall be heavy duty galvanised (clause 3.9.5 of 1200L)

c) All steel fittings and specials indicated for encasing in concrete shall be wire brushed externally and left uncoated for encasing in concrete. Lining shall be as described in (a) above.

d) Steel fittings that are partly enclosed in concrete shall be coated internally as well as the exposed external part of the fitting up to 100 mm into the concrete encasement as described in (a) above.

PSL3 VALVES (Clause 3.10)

(a) Gate valves shall be cast iron flanged waterworks pattern resilient seal valves of the class shown on the drawings and manufactured in accordance with the requirements of SABS 664. Valves shall have non-rising spindles, cap-top and be anti-clockwise closing. Valves shall be provided with a spur gear if specified on the detailed fittings lists and with a mechanism to indicate the percentage closure of the valve. An arrow on the valve shall indicate the direction of flow.

(b) Valves 150mm and smaller shall be provided with a plain thrust collar. All of the valves shall be provided with ball thrust collars.

PSL4 MANHOLES, DRAW BOXES AND SURFACE BOXES (Clause 3.11)

Valve boxes shall confirm to the details as indicated on 2330.20.ZA.05.D002.

PSL5 HANDLING AND RIGGING (Clause 4.1)

PSL5.1 Transportation

Fittings, specials and valves shall be protected during transportation and handling against damage caused by impact, dropping, etc.

PSL5.2 Off-loading and storage

Pipes, fittings and specials shall at no time be laid, stacked or rolled directly onto the ground but shall be supported on suitable padded cradles or other approved material near each end of the pipe, fitting or special. Particular care shall be taken where pipes with fitted couplings are handled or stacked to prevent any pressure on the couplings.

PSL5.3 Inspection on delivery

The Engineer's Representative will thoroughly inspect all pipes, fittings and specials delivered to the site but his acceptance of same as being in good condition shall not relieve the Contractor of any of his obligations or responsibilities under this contract.

Materials rejected by the Engineer shall be removed from the site within 30 days and shall be replaced by other approved materials by the Contractor at his own expense.

PSL6 STANDARD HYDRAULIC PIPE TEST (Clause 7.3)

Field test pressures shall be 1,5 times the recommended maximum working pressure for the class of pipe and/or valves, specials and fittings being tested.

PSL7 MEASUREMENT AND PAYMENT (Clause 8)

PSL7.1 Protective coatings and linings described in this sub-section shall not be measured for payment separately but shall be included in the rates tendered for piping, fittings and specials.

PSLB BEDDING (PIPES)

PSLB1 BEDDING (Sub-Clause 3.3)

PSLB1.2 Rigid Pipes

All clay and concrete pipes shall be laid on a class C bedding as shown on Drawing LB-1 of SABS 1200LB.

PSLB1.3 Flexible pipes

All steel, uPVC, PVC-O and polyethylene pipes will be regarded as being flexible and shall be bedded as per Drawing LB-2 of SABS 1200 LB.

PSLB2 MATERIAL NOT AVAILABLE FROM TRENCH EXCAVATION (Clause 3.4.2)

Material for the bedding shall be obtained from a commercial source designated by the Contractor.

PSLB3 CLASS A BEDDING (Sub-Clause 5.2.1)

Concrete to be used in class A bedding to pipes shall be of grade 20/19.

PSLB4 CONCRETE CASING TO PIPES (Sub-Clause 5.4)

Concrete to be used in the casing of pipes shall be of grade 20/19.

PSLB5 TOLERANCE ON COMPACTION OF BEDDING MATERIAL

Degree of accuracy II shall prevail.

PSLB6 VOLUME OF BEDDING MATERIAL (SUB-CLAUSE 8.1.3)

The cross sectional area of the pipe shall be deducted from the area of the bedding calculated in terms of Drawing LB-4.

PSLB7 STONE BEDDING (Sub-Clause 8.2.6)

Add the following new sub-clause:

Stone bedding will be measured per cubic metre under the appropriate item in SABS 1200LB. Type A bedding (crushed stone wrapped in a geotextile blanket) shall be measured per linear metre along the centreline of the trench. The provision, operation and removal of (a) de-watering pump where authorised by the Engineer will be measured as dayworks under the appropriate item in Schedule 2.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

C3.4.3 PARTICULAR SPECIFICATIONS

The following additional specifications for work not covered by the SABS 1200 Standardised Specifications are required for the Contract and are bound in hereafter:

PJS	-	Joint Sealing (Concrete Reservoirs)
PLK	-	Manufacturing and Supply of Valves
PLN	-	Manufacture Supply and Testing of Steel Pipes
PLQ	`-	Corrosion Protection of Steel Pipes and Pipework Specials
PLT	-	On-Line Flow Meters (General)
PTV	-	Corrosion Protection
OHS	-	Occupational Health and Safety Specifications

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PSJS: JOINT SEALING (CONCRETE RESERVOIRS)

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PSJS JOINT SEALING (CONCRETE RESERVOIRS)

PSJS1 SCOPE

This specification covers the requirements for post construction and maintaining of joint sealants for water retaining structures.

PSJS2 INTERPRETATIONS

The relevant SANS 1200 Standardised Specifications such as Concrete (Structural) and Concrete (Small Works) shall also apply to the work under this section.

PSJS2.1 Definition

For the purpose of this Specification, Water retaining structures shall be deemed to be classified under clause 2.4.1.3 (severe conditions) as specified in SABS 1200 G unless specified otherwise in the project specification.

PSJS3 MATERIAL

Different systems of waterproofing (or construction of systems) exists and the appropriate system (or combination) will be applied as specified on the drawings and approved by the Engineer.

Systems or materials applicable under this specification is:

JOINT BANDAGE:

a) Sikadur Combiflex SG 20 – Polyolefin Bandage for joint sealing
b) Sikadur 31DW – Potable water certified epoxy for adhesion of Sikadur Combiflex SG20
c) Sika Primer 3N – Primer for joint sealant inside joint, prior to application of Sikadur Combiflex system

OR

d) Schomburg ASO®-TAPE – Polyolefin Bandage for joint sealing
e) Schomburg ASODUR K4031 – Potable water certified epoxy resin for adhesion of ASO-TAPE.

JOINT FILLERS:

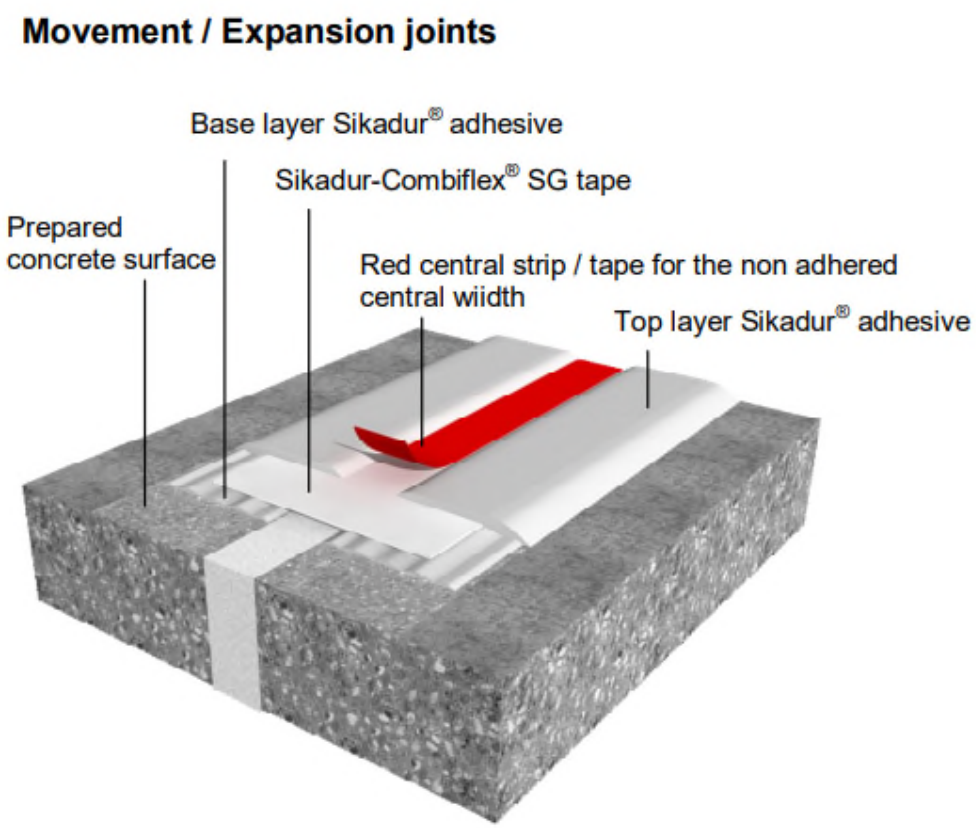
f) Sika Injection 101 RC and 203 (For seepage stopping through cracks and joints prior to final sealing, if required).

OR

g) SPETEC® SEAL GT350 (Hydrophilic injection resin for seepage stopping through cracks and joints prior to final sealing, if required).

PSJS3.1 Waterproofing with Sikadur – Combiflex® SG system

The joint sealing system by Sikadur-Combiflex® SG System.



The Sikadur-Combiflex® SG system consist of a modified flexible Polyolefin (FPO)

waterproofing tape, with advanced adhesion properties and a range of different special Sikadur® epoxy adhesives for use in different types of applications and conditions.

The joint shall consist of 2 mm thick Combiflex SG-20 (M/P) Polyolefin waterproofing tape, 200mm and/or 250mm wide, as shown on the drawings. The Polyolefin sheeting shall have a tensile strength of 6N/mm² and an elongation at failure of not less than 400%.

The Sikadur-Combiflex® SG-20 (M/P) shall be bonded to the concrete with Sikadur® 31 DW two component, solvent free, moisture intensive, high viscosity, epoxy paste adhesive. Prior to applying the Sikadur-Combiflex® SG system, insides of joints shall be primed with Sika Primer 3N.

The minimum bond strength for the Sikadur-Combiflex® SG System (Sikadur-Combiflex® SG Tape glued with Sikadur® 31DW adhesive) shall be 2N/mm^2.

PSJS3.2 Waterproofing with ASO® -Tape system

The joint sealing system by ASO®-Tape System.

The ASO®-Tape system consist of a thermoplastic waterproofing tape, with advanced adhesion properties combined with the universal resin adhesive ASODUR-K4031.

The joint shall consist of 2 mm thick ASO®-Tape Polyolefin waterproofing tape, 250mm and/or 300mm wide, as shown on the drawings. The Thermoplastic tape shall have a tensile strength of 14N/mm² and an elongation at failure of not less than 1000N/mm².

The ASO®-Tape shall be bonded to the concrete with ASODUR-K4031, solvent free, universal epoxy resin adhesive.

The minimum bond strength for the ASO®-Tape system (ASO®-Tape glued with ASODUR-K4031 adhesive) shall be 2N/mm^2.

PSJS3.3 Waterstopping through cracks and joints

Joints or other areas with active water flow need to be sealed with the Sika® Injection system prior to applying the Sikadur-Combiflex® SG System or SPECTEC® SEAL GT350.

a) Temporary Waterstopping

For a temporary waterstopping in high water intrusions inject Sika® Injection – 101 RC.

b) Permanent Seal

For a permanent watertight crack sealing inject with Sika® Injection – 203 after temporary waterstopping,

or

Inject with SPECTEC® SEAL GT350 a low viscosity, flexible, hydrophilic injection resin.

A single part application high pressure pump to be used for injection of the sealant.

PSJS4 INSTALLATION

Applications may only be done by experienced professionals. Strict adherence to product specifications and requirements must be complied with. Where conditions or application differ from that stated or from what the experienced professional are familiar with, product specialists needs to be consulted.

PSJS4.1 Further Information

a) Sika Method Statement: Sikadur – Combiflex® SG System
b) Relevant Product Data Sheets

PSJS4.2 Concrete Surface Preparation

Substrate to be clean, sound and homogeneous. The following steps must be taken as required:

a) Grinding or wire brushing
- Typically done with an angle grinder
- For removing cement laitance or significant foreign material on either side of the joint/crack.
- Surface cleaning 50mm wider either side of the joint/crack than the width of tape to be applied.
- Protruding residual sealant to the scrapped of with a scraping tool to a level flush or lower than the floor soffit.
- To avoid grinding of residual sealant as it will burn from friction and form a non-adhering carbon layer.

b) High pressure cleaning with water
- After grinding or wire brushing, high pressure water jetting to be used to remove resulting residue and foreign material.
- Sweep any standing water from the surface.
- Dry surface with high pressure air free from oil and water.

ALTERNATIVELY

c) High pressure cleaning with Dry Ice (CO_2)
- Using high pressure Dry Ice jet blasting to remove resulting residue and foreign material.
- Dry surface with high pressure air free from oil and water

d) Metal Surfaces

- Steel surfaces must be treated to white metal (SA2$^1/_2$)

PSJS4.3 Installation of Joint Bandage System

Applications may only be done by experienced professionals. Product specifications and requirements must be complied with. Refer to applicable method statements.

a) Substrate moisture content.
- Surface to be dry or matt damp (No standing water)

b) Substrate Temperature
- Maximum: +30°C
- Min: +10°C

c) Application - Adhesive.
- Adhesive to be applied with a gauging trowel, smooth or notched and evenly spread over the substrate.
- Masking tape to be used to mark out application area and provide smooth, clean edge once removed.
- Minimum adhesive bed thickness is 2,0mm.
- Mortar systems to be protected for 4-6 hours from dampness after application.
- Minimum time for full cure (@23°C) – 16 hours.
- Top layer to be applied only after the first layer stiffened and began to harden.
- Top layer to be applied to a minimum thickness of 1,0mm.
- Top layer to be smoothed off with round and clean edges in straight lines.

d) Application - Tape.
- Tape to be applied within the open time for adhesive.
- Press tape firmly, without entrapping air, into the adhesive with a suitable roller. Adhesive to be squeezed out on both sides of the tape by ~5mm.

e) Tape Connections.
- Tape end connections to be conducted through hot air thermal welding.
- Welding area to be prepared by abrading and roughening the surface.
- Tape overlap to be between 40~50mm.

PSJS5 MEASUREMENT AND PAYMENT

PSJS5.1 Measurement and Rates

PSJS5.1.1 <u>Surface Preparation</u>

a) Cleaning concrete surfaces (by any means) Unit: m²

b) Cleaning steel surfaces (by any means) Unit: m²

Separate items will be scheduled for each type of surface.

"The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed".

PSJS5.2.1 <u>Joint sealing</u>

a) Joint tape bandage system with approved adhesive and bonding Unit: m

b) Tape connections with hot air thermal welding Unit: No

Separate items will be scheduled for each type of bandage system.

"The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed".

PSJS5.3.1 <u>Water Stopping</u>

a) Temporary water stopping through injection Unit: m

b) Permanent water stopping through injection Unit: m

Separate items will be scheduled for each type of water stop injection system.

"The tendered rates shall include full compensation for providing all labour, materials and equipment required to carry out the work, for all preparatory work, for constructing the work scheduled in a workmanlike manner and for finishing off and cleaning up when the work has been completed".

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PLK : MANUFACTURE AND SUPPLY OF VALVES

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PLK 1 SCOPE

This section of the Specification includes the manufacture, testing and supply of valves for the conveyance of raw or potable water at ambient temperatures in pipes under pressure.

PLK 2 STANDARDS

The most recent issues of the following standard specifications will apply for the purposes of this Specification.

SANS 144	:	Cast-iron single door non-return valves
SANS 191	:	Cast steel gate valves
SANS 192	:	Cast steel single door non-return valves
SANS 664	:	Cast iron gate valves for waterworks
SANS 665	:	Cast iron gate valves for general purposes
BS 5155	:	Cast iron and carbon steel Butterfly valves
ISO 2441	:	Pipeline flanges for general use - shapes and dimensions of pressure tight surfaces
SANS 1123	:	Steel pipe flanges
SIS 05 5900	:	Pictorial surface preparation standard for painting steel surfaces

PLK 3 MATERIALS

PLK 3.1 Sluice Valves

PLK 3.1.1 The valve body, bonnet, thrust dome, gate and glands shall be of cast iron or cast steel as specified and depending on the required test pressures.

PLK 3.1.2 The stuffing box shall be of ample depth to afford sufficient space for long period packing and the design shall be such as to allow the gland to be easily and conveniently repacked under pressure.

PLK 3.1.3 Body and gate sealing rings shall be of bronze, gunmetal or stainless steel. RSV gate shall be nitrile rubber covered and fully encapsulated. The rubber shall not be removed from the

guides of the gate.

PLK 3.1.3 Spindles shall be of high grade stainless steel.

PLK 3.1.4 An isolating valve must be able to check the specified water pressure from both sides.

PLK 3.2 Butterfly Valves

PLK 3.2.1 Valve bodies and discs shall be of high-grade cast-iron or cast steel as specified and depending on the required test pressures.

PLK 3.2.2 The disc shaft or stub-shafts shall be of stainless steel located in self-lubricating bearings.

PLK 3.2.3 Sealing rings, seal retaining rings, body seatrings and associated screws shall be of stainless steel.

PLK 3.2.4 A butterfly valve must be able to check the specified water pressure from both sides.

PLK 3.3 Reflux Valves

PLK 3.3.1 Valve bodies shall be of cast iron or cast steel depending on the specification or test pressures.

PLK 3.3.2 Valve doors shall be of cast iron or cast steel.

PLK 3.3.3 The valve body and doors or disc shall be fitted with replaceable stainless steel body and door seat rings.

PLK 3.4 Air Valves

PLK 3.4.1 Function

Air valves are required to perform any combination of the following functions:

- Uninterrupted high volume air discharge through a large orifice during pipe filling.
- Uninterrupted high volume air intake through a large orifice during pipe emptying.
- Discharge of pressurised air through a small orifice during normal operation.

- Surge alleviation mechanism during rapid air discharge or rejoining of separated water columns.

PLK 3.4.2 Closing mechanism, construction and design

PLK 3.4.2.1 The air release and vacuum break valve shall be of a compact single chamber design with solid cylindrical High Density Polyethylene control floats. Floats of spherical design shall not be accepted. Any hollow float design will not be acceptable due to implosion and distortion making sealing difficult or impossible.

PLK 3.4.2.2 The ends of the cylinder shall be of fusion bonded epoxy powder coated mild steel, secured by means of stainless steel tie rods.

PLK 3.4.2.3 Floats shall be housed in a tubular stainless steel or corrosion protected body, secured by means of stainless steel fasteners.

PLK 3.4.2.4 The seats, spindles, guides, etc shall be of a suitable non-corroding metal with sufficient clearance and shall be designed to prevent abrasion of the ball or float when subjected to frequent operation.

PLK 3.4.2.5 The seats of the orifices shall not have sharp edges and shall be designed so as not to damage the ball or float when subjected to pressure.

PLK 3.4.2.6 The valve shall have an integral surge alleviation mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of separated water columns.

The limitation of pressure rise must be achieved by deceleration of approaching water prior to valve closure.

Relief mechanisms that act subsequent to valve closure cannot react in the low millisecond time span required and are therefore unacceptable.

The performance capability of an integral surge alleviation mechanism shall be substantiated through third party testing, conducted by a recognized authority.

PLK 3.4.2.7 Large orifice sealing shall be effected by the flat force of the control float seating against a nitrile rubber ‘O’ Ring housed in a dovetail groove circumferentially surrounding the large orifice.

Sealing in any other form shall not be accepted due to the vulcanizing of the float or the wedging of the float in the large orifice.

PLK 3.4.2.8 Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice on a natural rubber seal affixed to the control float.

Valves with slotted air release apertures shall not be considered.

PLK 3.4.2.9 The intake/discharge orifice area shall be equal to the nominal size of the valve i.e. a 200 mm valve shall have a 200 mm intake/discharge orifice.

Valves up to and including 200mm NB shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. This feature shall consist of easily replaceable components such as gaskets, seals or the like.

PLK 3.4.2.10 The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to 2 times the designed working pressure.

PLK 3.4.3 Testing

PLK 3.4.3.1 Manufacturers' published performance data must be substantiated by third party testing from a recognized test authority.

PLK 3.4.3.2 A high pressure strength and leak test whereby the valve is filled with water and pressurized to 2 times the rated working pressure which shall be held for a period of 2 minutes. Any leaking, weeping and sweating shall be a reason for rejection. These tests must be on total, completed units including floats.

PLK 3.4.3.3 Any imported valves shall be retested locally in all areas of specification.

PLK 3.4.4 Isolating valves for air valves

PLK 3.4.4.1 Each air valve shall be provided with a suitable double flanged resilient seal gate valve to isolate the air valve from the main.

PLK 3.4.4.2 The isolating valves shall be capable of operating in a horizontal position and shall be

provided with a handwheel for operation and gearing is not required.

PLK 3.4.4.3 Each isolating valve shall be provided with a handwheel fitted to the spindle in an approved manner and shall have directional indication so cast into a recess on the upper surface of the rim that the top of the letter, arrows and rim are at the same level.

PLK 3.4.5 Drains

PLK 3.4.5.1 All air valves be provided with drain cocks so that the body of the valve can be drained when isolated from the pipeline. Cast steel gate valves shall be provided for this purpose.

PLK 3.4.6 Pressure gauge fitting

PLK 3.4.6.1 A ½" nipple and a ball or cock valve shall be fitted to the spool piece between the isolating valve and the air valve flanges for attaching a pressure gauge.

PLK 3.5 Ring needle valves

PLK 3.5.1 The valve body shall be of spheroidal graphite iron or cast-steel with supporting feet. The body seat shall be of stainless steel and shall be replaceable or may be deposit welded on a removable body section.

PLK 3.5.2 For ring needle valves the piston (plunger) shall be of cast stainless steel with replaceable resilient seal to obtain drop tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws.

PLK 3.5.3 For spherical ball valves, the eccentrically supported ball plug shall be of cast stainless steel or spheroidal graphite iron with replaceable resilient seal to obtain drop-tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws. The valve body shall include an access door to permit adjustment or replacement of the valve seal without dismantling the valve.

PLK 3.6 Manufacture

PLK 3.6.1 General

PLK 3.6.1.1 The design pressure of the valves shall not be less than the pressure specified subject to a minimum of 1 000 kPa.

PLK 3.6.1.2 All valves shall be double-flanged with bolt holes drilled off-centre all in accordance with the requirements of SANS 1123 or as otherwise specified.

PLK 3.6.1.3 The Tenderer shall give as a function of the downstream pressure the maximum acceptable discharge of water through the valves without risks of vibration and cavitation. The Tenderer shall also submit the head-loss characteristics of the valves.

PLK 3.6.1.4 The design pressure will be hand stamped on the top edge of the flanges or cast into the body of valves in kPa .

PLK 3.6.1.5 If specified, valves shall be supplied with by-passes to be bolted on to the body of the valve and not to the adjoining pipework.

PLK 3.6.1.6 Valves shall be fitted with position indicators if specified. Fully closed, fully open and intermediate positions shall be indicated in corrosive proof and robust design indicators.

PLK 3.6.1.7 Arrows shall be cast on all handwheels together with the wording "OPEN" or "CLOSE". The closing direction shall be clockwise unless otherwise specified.

In the case of cap top valves, an aluminium disc of at least 100 mm diameter and with the same wording and arrows shall be slipped over the spindle and retained by the cap.

PLK 3.6.1.8 All valves shall be supplied complete including bolts, nuts, washers and gaskets in accordance with the class of valve. Bolts shall be of sufficient length to allow not more than three screw threads to protrude outside units after complete tightening of the assembly. Gaskets for flanged joints shall be of compressed asbestos fibre to BS 2815 Grade A and full faced with a minimum thickness of 3 mm for pressures up to and including 1 600 kPa cloth-inserted rubber may be used.

PLK 3.6.1.9 Where isolating valves are required to be equipped with extended off-set spindles, the spindles shall be equipped with sufficient universal joints to ensure satisfactory valve operation. All spindle extensions shall be secured to permanent structures with

galvanised clamps to the Engineer's approval. The rate for such valve items shall include for any required clamps, extensions joint, etc.

Handwheels on such extended spindles shall be mounted on plain-ended spindle or handwheel pedestal as specified or indicated on the construction drawings.

Isolating valve operation:

Cap top	CT
Handwheel	HW
Electric actuator	EA
Pneumatic actuator	PA
Handwheel spindle extension	HSE
Plain ended spindle extension	PESE
Platform-mounted handwheel pedestal	PMP
Handwheel pedestal on wall support bracket	HPWB
Stub handwheel pedestal on wall support bracket	SHWB
Grid-mounted handwheel pedestal	GMP

PLK 3.6.1.10 The following information shall accompany the tender:

- Description
- Flange Drilling
- Maximum working pressure
- Maximum unbalanced pressure
- Test pressure
- Manufacturers number
- Material of components
- Gearing
- Accessories

PLK 3.6.2 Sluice Valves

PLK 3.6.2.1 Double-flanged, wedge-gate, internal (non-rising) spindle sluice valves of the waterworks pattern are required to comply fully with SANS 191 or SANS 664 where applicable.

PLK 3.6.2.2 Only full-way valves will be accepted (i.e. the gate must be clear of the waterway in the

fully open position).

PLK 3.6.2.3 The maximum force required to turn the handwheel at the maximum torque shall not be greater than 100 N per hand at the handwheel run (Total effort = 200 N) when operating at an unbalanced pressure equal to the rated working pressure of the valve. This may be achieved with the aid of gearing of a suitable ratio.

Where gears are used replaceable shear pins shall be provided to prevent damage to the valve if excessive pressure is used.

PLK 3.6.3 Butterfly Valves

PLK 3.6.3.1 Horizontal spindle type butterfly valves complete with gearing, handwheels and flanged at both ends with separate bolting for joining to the adjacent pipework is required.

PLK 3.6.3.2 All butterfly valves shall be double eccentric / offset type.

PLK 3.6.3.3 Wafer valves or valves fitted with studs for attachment to the adjacent flanges are not permitted.

PLK 3.6.3.4 Valves shall be drop-tight when closed and metal to metal sealing is not acceptable.

PLK 3.6.3.5 All resilient seals shall be removable and readily replaceable on Site with the valve in position.

PLK 3.6.3.6 Resilient seals shall be retained by corrosion resistant securing elements to prevent corroding in position (e.g. bolts, set screws, etc.)

PLK 3.6.3.7 The valve-water seal shall be of the following types:

- a resilient seal fixed to the edge of the disc by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the body.
- a resilient seal fixed to the body of the valve by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the edge of the discs.

PLK 3.6.4 Reflux Valves

PLK 3.6.4.1 Reflux valves shall be double-flanged, SANS 1551.

PLK 3.6.4.2 Valve bodies and seals shall be free of pockets that will allow dirt accumulation and prevent the doors from closing fully.

PLK 3.6.4.3 Stops or an approved resilient material shall be fitted into the body to prevent the doors from fluttering under full flow conditions.

PLK 3.6.4.4 Valves shall be designed to allow for rapid but non-slamming closing characteristics.

PLK 3.6.5 Air Valves

PLK 3.6.5.1 Air valves shall be supplied with double-flanged, wedgegate internal (non-rising) spindle sluice valves for isolation, which unless otherwise specified shall conform in all respects to this specification.

PLK 3.6.6 Ring needle valves

PLK 3.6.6.1 Ring needle valves used as auto closing valves shall fulfil the following functions:

- Electrical operation (isolating and control) suitable for opening and closing against the specified pressure and for continuous operation in any intermediate position.
- Automatic as well as manual mode control.
- Automatic reflux action for quick closure by means of drop-weight and hydraulic dash pot in case of power failure or motor protective tripping.
- Adjustable closing time and adjustable closing characteristic.

PLK 3.6.6.2 The totally enclosed flanged-on gearbox shall include the following:

- Either an electo-mechanical unit comprising:
  - a totally enclosed brushless electromagnetic gear clutch for quick closing;
  - a totally enclosed directly mounted electric valve actuator with integral electric controls and auxiliary handwheel for manual operation;

- or an electro-hydraulic unit comprising:
  - an oil hydraulic lift cylinder for opening the valve;
  - a totally enclosed directly mounted electronic driven oil pump and oil reservoir. The oil pump and reservoir may be individually mounted on each valve or a

centralised system may be employed to feed more than one valve and/or pumpline;

- a solenoid operated hydraulic control valve which shall be de-energised to initiate closure of the valve.

PLK 3.6.6.3 Either of the above actuators shall also be provided with:

- limit switches for signalling the “open”, “closed” and intermediate “10%” positions and further control functions as required;
- a directly mounted oil hydraulic dashpot with the necessary control valves for adjusting closing time and operating characteristic;
- means to operate the valve manually;
- valve shaft (stub shafts) of high tensile stainless steel located in bushes of zinc-free bronze;
- a drop weight lever arm of steel with adjustable cast iron drop weight. The lever arm shall be keyed or splined to the shaft.

PLK 3.6.6.4 The overhang shaft carrying the drop weight lever arm shall be supported at its bearing housing from the foundation block.

PLK 3.6.6.5 Travel of the drop weight shall be restrained for reasons of safety at either end of the lever arm.

PLK 3.6.6.6 The control valves shall be arranged for selection of either manual-electric or automatic-electric operation controlled from the pump control console. Push buttons “open”, “close” and “stop” for piloting ghese valves, when throttling is required, shall be incorporated in each pump control console, as well as indicator lamps showing “closed” (green) “intermediate” (amber) “open” (red) positions. In addition, a selector switch “manual/automatic” shall be incorporated, the automatic position being in conjunction with pump starting. A further “test” selector switch shall bew mounted inside the panel to permit manual-electric testing of the equipment without running the pumpset.

PLK 3.6.6.7 In the “automatic” mode the valve shall open automatically from the fully closed to fully open position when the pumpset is started, likewise closing automatically, when the pumpset is to be shut down. In die “manual” mode the valve shall open automatically to at least the “10% open” intermediate position, whereafter manual selection of the valve position shall be enabled.

- Each valve shall be interlocked with the pump starter. When the pump is to be stopped, the valve shall close slowly to prevent water hammer either by means of the electric actuator or by releasing hydraulic pressure in the lift cylinder by means of control valves before the pumpset ios tripped and stopped by interlocked relays.
- Similarly, the valve shall be arranged so that the pump can be started only when the valve is fully closed. The valve shall open only when the starting operation is completed and the motor is up to speed.

PLK 3.6.6.8 The control valves shall have automatic reflux action features to close by drop-weight, controlled by an oil hydraulic dashpot, in the event of power failure or motor protective tripping. The drop-weight shall be released by a solenoid operated clutch or a valve which is constantly energised during pumping operations. Closing time and characteristics shall be adjustable to minimise water hammer.

PLK 3.6.6.9 It shall be possible to energise the “manual” mode only when:

- the associated pump is running.
- the valve is at least 10% open as indicated by the “intermediate” lamp.
- the valve is in the “test” mode

Selection of the “manual” mode shall not affect the automatic reflux action.

When the opening of the valve has been set manually, the valve shall maintain this position in the absence of any further action.

PLK 3.6.6.10 “Test” mode: With both isolating valves closed and electrically interlocked, a test facility shall be provided to enable the maintenance personnel to manually operate the valve without the pumpset running by selection from inside the pump control console.

PLK 3.6.6.11 Valves shall be designed to operate free of cavitation in intermediate positions.

PLK 3.6.7 Electric Actuators

PLK 3.6.7.1 When specified, in the Project Specification the valves shall be fitted with electric, motor-driven flood-proof IP 68 actuators of robust design, capable of closing the valves under all unbalanced pressures.

PLK 3.6.7.2 The Tenderer shall state the maximum torque required to operate the valve in his Tender. In determining this maximum torque an allowance shall be made for any deterioration that could be expected to occur in the bearings during the life of the valve. The actuator shall be capable of transmitting twice this maximum torque without any of its components suffering permanent damage. This shall be proven to the Engineer's satisfaction by workshop tests.

PLK 3.6.7.3 The actuators shall be capable of restraining the valve in any position under all possible conditions of operation, and shall not, in any circumstances, be capable of becoming self-motorised as a result of the dynamic torque loading on the disc or plunger.

PLK 3.6.7.4 All gearing shall be manufactured in accordance with BS 436 Class C and shall be machine cut. All components requiring lubrication shall be adequately lubricated and totally enclosed flood-proof casing fabricated in cast iron and/or die cast aluminium to suit the service weather proof casing whether the valve is to be installed in the open or under cover. Actuators shall also be fitted with mechanical stops to prevent excessive turning and shall be provided with replaceable shear pins.

PLK 3.6.7.5 Handwheels shall be fitted to all actuators. The direction of rotation to close the valve shall be clockwise when viewed from above the end of the input shaft and from the position of operation. In addition, they shall be clearly and indelibly marked with an arrow showing the direction of closing and the words "Close" and "Toe".

PLK 3.6.7.6 Whether the valve is actuator driven or manually operated, the maximum force required to turn the handwheel at the maximum torque defined above shall not be greater than 100 N per hand at the handwheel rim. (Total effort = 200 N.) For large valves the minimum of complete revolutions of the handwheel to move the valve gate from fully open to fully closed shall not be less than 100.

PLK 3.6.7.7 All electric actuators shall be provided with reversing contactors: local and remote control shall be provided; a device making the local control non-operative shall also be provided on the relevant remote control panel.

PLK 3.6.7.8 After factory tests, the actuators shall be removed from the valve and delivered to Site in separate boxes to safeguard against damage.

PLK 3.6.8 Protection

All materials and workmanship to comply with relevant SANS Specifications.

PLK 3.6.8.1 Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a Sa 2½ of SIS 05 50 00 finish. Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP 2300 or similar) shall then be applied to give a final dry film thickness of 250 µm. Drying times between successive layers shall be strictly in accordance with the requirements of the paint manufacturer.

As an alternative to the protection as specified above, the Contractor may be required to use either a solventless epoxy paint system or a fusion bonded epoxy powder coating as specified in the Project Specification.

PLK 3.6.8.2 External Protection

External surfaces of valve bodies shall be wire brushed to a A 3 of SIS 05 59 00 standard and painted with one layer zinc chromate primer (dried film thickness 50 µm). This will be followed by two alkyd-based undercoats (each coat 25 µm thick) and one alkyd-based enamel finishing coat (dried film thickness 25 µm). Final colour will be as specified by the Engineer.

Machined flanges will be painted with a protective coating of shellac or similar.

PLK 3.7 Tolerances

Tolerances as specified in the appropriate SANS or BS standards shall apply to this Contract.

PLK 4 TESTING AND INSPECTION

PLK 4.1 Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials conform to the requirements of the relevant SABS or BS Specification. These tests will not necessarily

be attended by the Engineer but records must be kept and all test results shall be made available to the Engineer.

PLK 4.2 Testing by Independent Body

The Engineer may appoint an independent recognised body to conduct control tests. Samples required for such tests will be provided by the Manufacturer free of charge and sampling will be done by this body in accordance with the relevant SANS or BS Specification.

The cost of such control tests will be borne by the Employer.

PLK 4.3 Inspection

PLK 4.3.1 Visual, operational and dimensional inspection of valves as well as inspection of protective coatings will be carried out by the Engineer and/or the Manufacturer in the Manufacturers workshops prior to the despatch of valves to site.

PLK 4.3.2 Inspection by the Engineer shall in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the Specification.

PLK 4.4 Hydrostatic Testing

PLK 4.4.1 All hydrostatic tests will be witnessed by the Engineer and the Manufacturer will give at least one week prior notification to the Engineer of the proposed dates for such tests.

PLK 4.4.2 Valve bodies will be close end tested to at least 1,5 times the working pressure. Test pressures will be maintained for at least 5 minutes and valve bodies will be water tight in all respects at the test pressure.

PLK 4.4.3 Assembled valves will be open-end tested to 1,5 x working pressure for materials strength and soundness. Valves will be drop tight from both directions over the complete range of pressures from 0 to 1,5 x working pressure.

PLK 4.4.4 Each valve will be supplied with a test certificate certifying that it complies in all respects

with the requirements of this Specification.

PLK 5 MEASUREMENT AND PAYMENT

PLK 5.1 General

Tendered prices shall include for the following unless otherwise specified in the Project Specification.

- Protective coatings as specified.
- Couplings and/or jointing material for each type of valve.
- Packing and temporary protection against damage during transport and delivery.
- Temporary storage and maintenance if required.
- Delivery and storage of material on site or in a store as specified.
- Testing and inspections at Manufacturer's works.

PLK 5.2 Valves will be measured per unit of each type

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PLN: MANUFACTURE, SUPPLY AND TESTING OF STEEL PIPES

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PLN 1 SCOPE

This specification covers the manufacture and supply of bare, electric welded low carbon steel pipes and steel pipe special items for the conveyance of water at ambient temperatures and at medium pressures.

PLN 2 STANDARDS

Pipes and specials shall be manufactured, tested and inspected in accordance with the latest issues of the following standard specifications unless amended in subsequent clauses in this specification.

a) Welded pipes larger than 150mm:

SANS 719: Steel Grades A, B and C
SABS 1431: Steel Grades 300 WA, 350 WA
API 5L: Steel Grades, X42, X46, X52, X56 and X60
EN 10025-2: Steel Grade S355JR + AR (where specified for specials)

b) Welded specials and fittings smaller than or equal to 150mm:

SANS 62 (Heavy Class) up to 50 bar design pressure

c) Seamless Pipes:

ASTM A106 – Schedule 40(40 bar) or 80(80 bar) as determined by the design pressure.

d) Seamless specials and fittings:

ANSI B16.5 & B16.9 – Schedule as determined by the design pressure

e) Qualifications of Welders

All manual or semi-automatic welds and repair welds shall only be undertaken by

welders qualified under the tests laid down in accordance with API 1104.

f) Non-destructive Tests and Adjudication

- Radiographic inspection: API 1104
- Ultrasonic inspection: API 5L

g) In this Specification reference is made to the latest issues of the following specifications:

SANS	719
API	5L
API	1104
ASME	Section V
BS	2971
BS	2633

PLN 3 PROCESS OF MANUFACTURE FOR PIPES

PLN 3.1 Welding process

Pipes shall be manufactured by an approved semi-automatic submerged-arc welding process or shall be electric resistance welded. Where semi-automatic submerged-arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside. The number of longitudinal weld seams shall not exceed:

a) one seam for pipes up to 1 000mm nominal diameter
b) two seams for pipes larger than 1 000mm and up to 2 000mm nominal diameter

Circumferential welds by semi-automatic submerged-arch welding method for factory double jointed pipes shall have at least one pass on the inside and at least one pass on the outside.

PLN 3.2 Welds

SANS 719, BS 2971 and BS 2633 shall generally apply.

For fusion welded pipes and specials, the internal weld bead shall not protrude more than 1,0 mm into the bore of the pipe or special.

For electric resistance welded pipes, the height of upset metal and flash on the inner surface shall not exceed 2,0mm.

For pipes to be joined by butt welding, the internal weld bead shall be ground flush with the pipe body for a length of 200mm from ends to be jointed.

For pipes to be coupled by flexible couplings, external weld reinforcement or upset metal and flash shall be ground flush with the pipe body for a length of 200mm from the end to be coupled.

PLN 4 DIMENSIONAL REQUIREMENTS

PLN 4.1 Pipes

All dimensions shall be in accordance with SANS 719 clause 5.1 (or other relevant clause numbers in later versions) except for the following amendment to clause 5.1.3:

The wall thickness of pipe shall, subject to a tolerance of +10% or -0%, be one of the relevant values given in columns 3 to 6 of table 2, unless otherwise specified by the purchaser.

PLN 4.2 Specials

The tolerances on specials will be in accordance with BS 534, Section 4.

Unless shown otherwise, branch and manifold sections of Tees to have a common centre line and of scour tees to have a common invert line.

All dimensions on layout drawings or item details are outer face to outer face, i.e. overall.

Position dimensions for puddle flanges and restraining flange refers to centre of flanges.

PLN 5 TESTING AND INSPECTION AT MANUFACTURER'S WORKS AND AT SITE

PLN 5.1 General

Factory and site testing and inspections (quality assurance), supervision of tests and reviewing of test records shall be carried out by the Contractor.

Unless otherwise specified in the contract documents, the Contractor shall appoint an independent inspectorate ("Inspectorate") and shall be responsible for the Inspectorate's and all associated costs. The name of the Inspectorate to be submitted for the Employer /Engineer's approval. The Inspectorate will be responsible for the monitoring, witnessing and reviewing of the quality assurance plans, testing, inspections and records on behalf of the Employer / Engineer. The service provided by the Inspectorate shall not replace the duties and responsibilities of the Contractor in terms of the Contract.

All tests and inspections at the factory and on site shall be at the expense of the Contractor who shall provide all necessary testing facilities, labour, instruments, equipment and samples that will be required by the Contractor and the Inspectorate, to verify that the material complies with the Specifications. The testing facilities, instruments and equipment shall comply with the requirements of the Inspectorate.
The Inspectorate shall be afforded every facility and opportunity during the manufacturing and testing to enable the inspection to be carried out effectively.

All test samples shall be selected by the appointed Inspectorate and all instruments used for testing purposes shall be approved by the Inspectorate and if in the opinion of the Inspectorate any instrument should require calibration, such instruments shall be calibrated at the expense of the Contractor by the SABS or such other body as may be approved by the Inspectorate.

No mechanical working or straining of pipes and specials shall be allowed after testing and inspection.

PLN 5.2 Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L Section 10.2.7. In addition, welds on specials shall be inspected by the application of a penetrant-dye on the inside of the welds and no trace of the dye should appear on the outside of the pipe after completion of the test.

PLN 5.3 Non-destructive Inspection

PLN 5.3.1 Ultrasonic Inspection

The Engineers approval of a detailed method statement is required for the use of this test method prior to the start of production. When this method is used 100% of all longitudinal or spiral welds on straight pipes shall be checked with an approved ultrasonic method capable of continuous and uninterrupted inspection of the weld seam in accordance with API 5L, Annexure E5. The equipment shall be checked with an applicable reference standard at least twice every production shift.

PLN 5.3.2 Radiographic Inspection to API 1104

Radiographic testing of welds are regarded as industry norm and shall be used unless approved otherwise by the Engineer. Test records are required to be saved in digital format. It is a requirement that 100% of longitudinal, circumferential, spiral welds and scalp welds shall be subject to radiographic inspection in accordance with API 1104, Section 9.3.

Radiographic inspection of pipes shall be as follows:

a) Longitudinal Welded Pipe

Submerged-arc fusion welded pipe, if inspected full length by ultrasonic methods, shall also be inspected by radiographic methods for a distance of 200 mm from each end of each length of pipe. Electric resistance welded pipes shall, however, only be inspected full length by ultra-sonic methods.

b) Spiral Welded Pipe

Submerged-arc fusion welded pipe, if also inspected full length by ultrasonic methods, shall also be inspected by radiographic methods for a distance of 100 mm from each end of each length of pipe and of the complete "H" at all skelp end welds including 150 mm of the spiral welds in both directions away from the intersection points with the skelp end welds.

c) Circumferential Butt Welds

100 percent of the length of circumferential butt welds shall be examined radiographic methods unless consistently acceptable results are obtained. Then the number of welds to be tested may be reduced by the Engineer.

d) Specials

100 percent of the length of all manual or semi-automatic welds in specials shall be examined radiographically (where possible) and all other welds by liquid penetrant testing unless consistently acceptable results are obtained. Then the number of welds to be tested may be reduced by the Engineer.

Where specials cannot be hydrostatically tested, all welds shall be liquid penetrate tested as per ASME Section V.

e) Repairs

For straight pipes 100 percent of the total length of all repairs shall be examined radiographically unless repairs are done prior to ultrasonic inspection and such repairs pass ultrasonic inspection. Then no radiographic inspection of same is required.

For pipe specials, 100% of all repairs shall be examined radiographically (where possible) and all other weld by liquid penetrant testing.

f) Pipes for rail, road and river crossings shall be examined radiographically 100 percent of the total length of all welds.

PLN 5.3.3 Liquid Penetrant Testing

All fillet welds and other welds where requested by the Engineer, shall be liquid penetrant tested in accordance with sub-clause 7.2.1 of SANS 1200 L, clause 9.5 API 1104, ISO 10893-4 and ASTM E165.

PLN 5.3.4 Magnetic Particle Testing

Where requested by the Engineer, magnetic particle testing shall be done in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

PLN 5.4 Hydrostatic Testing

Each individual straight pipe shall be subjected to a hydrostatic test in accordance with the methods described in API 5L. Test pressures shall be such as to produce tensile fibre stresses in the pipe wall of 90% of the minimum specified yield strength of the steel or shall be 9 MPa whichever is the lesser. Leaks or sweats shall be considered injurious defects.

Should it not be possible to hydrostatically test straight piping and/or specials, the liquid penetrant test as per ASME Section V shall be done on all welds over and above the non-destructive tests specified above. This shall only be applicable with the prior written approval of the Engineer.

PLN 5.5 Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or determined by any other means to exceed the limitations in API 5L Section 10, shall be repaired in accordance with API 5L Annexure D but subject always to the requirements of this specification.

PLN 5.6 Destructive Testing

PLN 5.6.1 Type of tests

The following destructive tests shall be performed in accordance with SANS 719 clause 6.2 on the first pipe and thereafter on one pipe of every 500 subsequent pipes.

a) Transverse Tensile Test
b) Root Bent Test (Electric Fusion Welds)
c) Flattening Test (Electric Resistance Welds)

PLN 5.6.2 Sampling for Destructive Tests

The following samples shall be selected for destructive testing:

a) **First Sample**

A section long enough to provide all the test specimens and material shall be cut from the selected pipe.

b) **Second Sample**

If the test specimens and material from the first selected pipe fail to pass any of the tests, a section long enough to provide the appropriate specimens for the tests failed by the first sample shall be cut from two further pipes.

c) **Third Sample**

If the test specimen from the second sample fails to pass the test(s) a similar section shall be cut from each of a further ten pipes.

d) **Compliance**

The piping shall be considered as complying with the specification if after testing of the first or the second or the third sample no defect is found.

PLN 6 FLANGES

a) Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the drawings. Flanges not covered by BS EN 1092 shall be manufactured according to NWS 1676 Revision

0 dated May 1981. Unless otherwise indicated on the drawings or specified in the Bill of Quantities, flanges shall be of forged Grade 300WA steel or ASTM A105.

b) Sealing faces shall be machined flat to a tool-mark of 0.8 mm to 1.25 mm pitch spiral or concentric serrations and back of flanges to be either machined or spot-faced around holes with sufficient clearance to ensure proper seating of bolt heads and nuts. All bolt holes shall be drilled perpendicular to the flange face. Bolt holes shall be positioned off-centre and symmetrically off-set from the vertical centre lines of the flange and flanges shall be installed truly square to the axis of the pipe. The Contractor shall check the compatibility of drilling of all flanges to be connected together.

c) Flange thicknesses and bolt sizes shall conform to the appropriate table of BS EN 1092 or NWS 1676 Revision 0 dated May 1981 for flanges not covered by BS EN 1092. The Contractor shall satisfy himself that the flanges in his supply shall match the flanges supplied by others or at interfaces between Subcontractors, if any.

d) The Contractor shall ensure that the drilling patterns of pipe specials to be installed on both sides of valves and flow meters will match that of the appropriate supplied valve and flow meter.

e) All flanges designed for pressure ratings up to and including 1600 kPa, shall be flat faced with full face gaskets. Flanges designed for pressure rating exceeding 1600 kPa shall be raised face flanges supplied with ring (IBC) gaskets. Flanges with pressure ratings of 6400 kPa and higher and flange sizes of 2500 mm diameter and larger, irrespective of pressure rating, shall incorporate an “O” ring groove. Details of the “O” ring groove shall be furnished by the Contractor for consideration by the Engineer.

f) Gaskets shall have suitable temperature and pressure resistance in line with the design conditions, chemical resistance to the sealed media and any flushing or purging media and shall have ASME design factors, equal to or less than Y = 12MPa. The material shall be tanged graphite full face for flat joint faces and aramid and glass fibre with nitrile rubber binder to BS 7531 ring face for raised faces, or equal material approved by the Engineer. Gaskets shall be suitable for the specified pressures with a minimum thickness of 3 mm and purpose made to the dimensions of the matching flanges. Joints in gaskets shall be kept to the minimum. Where not avoidable, joints shall be a tight fitting dovetail design.

g) Corrosion protection for the area not clamped shall be similar in all respects to that applied externally to the pipework/valve/pump.

h) All mill scale on flanges shall be removed by abrasive blasting before flanges are fitted and welded to pipes and fittings.

i) All flanges shall be supplied complete with bolts, nuts, washers and gaskets. Rubber joint rings shall comply with SANS 4633.

j) Puddle flanges shall not be drilled.

k) Some flexible couplings to be restrained by means of a restraining flange. Unless specified on the Drawings, the diameter, number and length of the long restraining bolts as well as any possible pipe wall thickening shall be designed by the Contractor with the assistance with the manufacturer. The effect of cyclic loading and fatigue must also be taken into consideration. The seal retaining flange on the flexible coupling may be factory machine scalloped to accommodate the long bolts. All the necessary nuts, washers, etc. for the restraining bolts must be provided by the Contractor.

   Restraining flanges need not have all the bolt holes specified in the applicable flange drilling table. Only those required for the long restraining bolts need to be provided. These holes must comply with the applicable flange drilling table and be spaced equally on the flange PCD and symmetrically around the flange centre lines.

   Restraining bolts to be positioned so as to not interfere with any stubs specified for an item.

l) Blank (Blind) flanges for pipes equal to or greater than 400 dia to be provided with two suitable lifting handles with coating similar to the blank flange.

PLN 7 FLEXIBLE COUPLINGS AND FLANGE ADAPTORS

Flexible couplings and flange adaptors shall be the Viking Johnson, Klamflex or Klinger type or equal approved by the Engineer. Straub, Arpol or similar clamp on couplings are not acceptable. For traceability, the product name, code, kPa rating and date of manufacture shall be provided to the Engineer.

Manufacturer of straight and stepped couplings (SR-C & ST-C) as well as flange adaptors (FA) to be approved by the Engineer. Couplings must be able to withstand hydrostatic test pressures of 1.5 times the specified design pressures and coupling flanges must be designed to withstand all stresses due to tightening of the bolts.

Rubber rings shall generally comply with SABS 974 Class F.

Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

Coupling and flange adaptor installation setting gaps to comply with supplier's specification.

Applicable to all coupling and step couplings:

- Circumferential weld beads are not be allowed on long barrel couplings. Two coupling sleeves may not be welded together; and
- Step couplings shall exhibit a smooth, tapered transition where possible to reduce pipeline turbulence. Profile plates shall not be used.

PLN 8 BOLTS, THREADED RODS, STUDS, NUTS AND WASHERS

The following specification is applicable:

(a) The threads of all bolts, nuts and studs shall be in accordance with SANS 1700-7-3, 1700-7-5, 1700-14-3, 1700-14-4 (in part);

(b) No brass bolt or stud shall have a diameter of less than 6mm;

(c) Two through hardened washers shall be installed underneath each bolt and nut;

(d) Each bolt shall protrude by at least three threads but not more than five threads through the nut with all washers in position and all bolts at a flange must be of equal length;

(e) Bolt load and the appropriate torque values have to be requested from the gasket manufacturer.

(f) The Contractor shall supply to the Employer any special tool required for any nut, bolt, screw or other fastener used in a position which is not accessible using conventional

tools. This also applies where the size or shape of the fastener is not conventional.

(g) Bolts, threaded rods, studs, nuts and washers shall be hot dipped galvanised to SANS 763 or ISO 1461 and shall be coated with molybdenum disulphide lubricant after installation.

(h) Bolts, shall comply with SANS 1700 Grade 8.8.

(i) Stainless steel threads shall be treated with nickel base anti-seize corrosion protection compound.

PLN 9 THERMIT WELDING PADS

Where pipes and specials are to be jointed by means of flexible couplings and will be subjected to cathodic protection, the manufacturer shall weld steel plates not less than 50 x 75 x 10 mm thick 250 mm from each end of all pipes during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for thermit welding pad bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

PLN 10 MARKING OF PIPES

All pipes and specials shall be clearly hand stamped alongside a longitudinal or spiral weld on one end of the pipe with the following.

a) Grade and thickness of steel
b) Serial number of the pipe or specials
c) Outside diameter
d) Factory hydraulic test pressure in kPa

PLN 11 UV PROTECTION OF COATINGS

All pipes with MDPE, 3LPE or Bituguard coatings shall be painted with a white polypropylene overcoat [to be approved by the Engineer] for protection against UV. The

overcoat to be maintained by applying additional layers until the pipe is backfilled.

PLN 12 HANDLING, DELIVERY AND STORING OF PIPES AND SPECIALS

The contractor shall ensure that pipes and specials including coating and lining are not damaged.

Coated pipes and fittings shall be handled with the use of padded slings of width sufficient to prevent damage to the coating. Chain slings, hooks, wire ropes, rope slings without canvas covers, composition belt slings with protruding rivets and any other equipment with a possibility to damage the coating shall not be used. Slings shall be suitably rated for the loads to be handled and in good condition. Deteriorated slings shall not be used.

All pipes are to be handled with the aid of a “spreader” lifting beam. The dragging or skidding of pipes and specials in contact with the ground shall not be permitted.

Pipes shall be stacked with a minimum clearance of 100 mm between adjacent pipe walls and a minimum of 200mm clear of the ground. Pipes shall be stored on sand bags with sufficient supports to prevent permanent longitudinal deflections. Sandbags are required at least at one third of a single pipe length from each pipe end. The sand bags shall be at least 500 mm wide for pipes with Bituguard coating.

Pipes shall also be stacked in a manner that limits loading on lower layers of pipes. Any pipe showing permanent ovality as a result of surcharge loading will be rejected.

All pipe deliveries shall be accompanied by delivery notes which will be checked by the Engineer on-site. The Engineer reserves the right to not accept and reject pipe deliveries where there are discrepancies.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PLQ: CORROSION PROTECTION OF STEEL PIPES AND PIPEWORK SPECIALS

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PLQ 1 SCOPE

This specification covers various corrosion protection systems for cast iron, steel and stainless steel pipes and fittings for the conveyance of water at ambient temperatures.

PLQ 2 CORROSION PROTECTION SYSTEMS

PLQ 2.1 Standards and codes

The following standards and codes form part of this specification. Unless otherwise specified herein, the latest edition shall apply.

ASTM–American Society for Testing and Materials

ASTM D2240	Standard test method for rubber property (Durometer Hardness)
ASTM D4541	Standard test method for pull-off strength of coatings using portable adhesion testers
ASTM G14	Standard test method for impact resistance of pipeline coatings (falling weight test)
ASTM D4285	Standard test method for indicating oil or water in compressed air
ASTM G62	Standard test methods for holiday detection in pipeline coatings

BS EN–British Standard European Norm

BS EN 10289	Steel tubes and fittings for onshore and offshore pipelines. External liquid applied epoxy and epoxy-modified coatings
BS EN 10290	Steel tubes and fittings for onshore and offshore pipelines - External liquid applied polyurethane and polyurethane-modified coatings
BS EN 12068	Cathodic protection - External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection - Tapes and shrinkable materials
BS EN 13000	Steel tubes and fittings for onshore and offshore pipelines. Bitumen hot applied materials for external coating

ISO–International Organization for Standardization

ISO 1514	Paints and varnishes – Standard panels for testing
ISO 2808	Paints and varnishes – Determination of film thickness
ISO 4624	Paints and varnishes – Pull off test for adhesion
ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-Cleaned steel substrates Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces. Part 2: Method of grading of surface profile of abrasive blast-cleaned steel-comparator procedure. Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - stylus instrument procedure. Part 5: Replica tape method for the determination of surface profile.
ISO 8504-2	Preparation of steel substrates before application of paints and related products - Surface preparation methods - part 2: Abrasive blast cleaning
ISO 11124-1	Preparation of steel substrates before application of paints and related products - Specifications for metallic blast cleaning abrasives - Part 1: General introduction and classification

	Part 2: Chilled iron grit Part 3: High-carbon cast-steel shot and grit Part 4: Low-carbon cast-steel shot
ISO 12944-4: 2017	Paints and varnishes — Corrosion protection of steel structures by protective paint systems - part 4: Types of surface and surface preparation
ISO 12944-5: 2018	Paints and varnishes — Corrosion protection of steel structures by protective paint systems - part 5: Protective paint systems

NACE - National Association of Corrosion Engineers

NACE RP0274	High-Voltage electrical inspection of pipeline coatings prior to installation
NACE RP0287	Field measurement of surface profile of abrasive blast cleaned steel surfaces using a replica tape
NACE SP0394	Application, performance, and quality control of. plant-applied, fusion-bonded epoxy external pipe

SSPC–Steel Structures Painting Council

SSPC PA 2	Measurement of dry coating thickness with magnetic gauges (Steel Structures Painting Manual, Ch 5 - Paint Application Specs.)
SSPC SP1	Solvent cleaning
SSPC SP11	Power tool cleaning to bare metal
SSPC SP 15	Commercial Power Tool Cleaning.
SSPC SP 16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

South African Bureau of Standards

SANS 241	Specifications for drinking water
SANS 1160:2011	Drinking water system components - Health effects
SANS 1217	Internal and external organic coating protection for buried steel pipelines

PLQ 2.2 Standard corrosion protection systems

The following corrosion protection systems shall apply unless otherwise specified in the project specific specifications/employer's requirements or in the bill of quantities or on the drawings.

Pipework includes pipe specials, fittings, couplings, flange adaptors and flanges.

PLQ 2.2.1 Buried steel pipework

Buried pipework shall be lined and coated with epoxy paint plus a tape wrapping system in accordance with ISO 21809-3:2016/A1:2020 on top of the epoxy paint. The following alternative wrapping systems are applicable:

a) Specials and fittings

- Type 10 – hot applied bituminous tapes, minimum 5mm thickness (e.g. Densotherm HD).
- Type 11A – Petrolatum tapes, with profiling mastic filler and external bondbreaker (e.g. Denso Petrolatum).
- Type 12A – Polymeric tapes, with pressure sensitive adhesive, minimum thickness 300µm (e.g. Denso MDP 032).
- Type 12A – Polymeric tapes, with polymer modified bitumen mastic adhesive, minimum thickness 1000µm (e.g. Denso Ultraflex or CPT).
- Type 13A – Pure polyisobutylene visco-elastic wrapping as the inner corrosion protection coating layer, with polyethylene (PE) or PVC outer wrap with minimum thickness of 300 µm with synthetic butyl rubber adhesive as the outer mechanical protection layer.

The type, combination and application of the tape wrapping system shall be as detailed in the project specific specifications/employer's requirements or in the bill of quantities or on the drawings.

b) Couplings, flange adaptors and flanges
Type 11A

c) Standard pipe lengths

Standard pipe lengths shall be lined with epoxy paint and coated with fusion bonded medium density polyethylene (FBMDPE), Polymer Modified Bitumen, 3LPE, Rigid Polyurethane or Visco-Elastic Pure Polyisobutylene Wrapping as specified below in this specification, unless otherwise specified in the scope of work/project specific specifications/employer's requirements or in the bill of quantities or on the drawings.

Where the application of epoxy lining and the testing thereof is not feasible for a specific pipe or special or fitting of small diameter, the Contractor shall notify the Engineer and request the approval of the Engineer for hot-dipped galvanized lining and coating of the particular pipe or special or fitting as specified below in this specification.

PLQ 2.2.2 Pipework inside chambers

a) New pipework:

Fittings, specials and couplings shall be coated and lined with epoxy paint.

Where the application of epoxy lining and the testing thereof is not feasible for a specific pipe or special or fitting of small diameter, the Contractor shall notify the Engineer and request the approval of the Engineer for hot-dipped galvanized lining and coating of the particular pipe or special or fitting as specified below in this specification.

The outside end of the fitting cast into the wall as well as flanges and couplings outside the chamber shall be protected with a Denso Petrolatum Tape protection system.

After installation and where specified in project specific specifications/employer's requirements or in the bill of quantities or on the drawings, the pipe shall be painted with re-coatable polyurethane to the Employer's colour coding specification. All systems to comply with ISO 12944-4 and 12944-5 (Table C.4 System C4.07).

b) Deteriorated aged external coatings shall be repaired as follows:

i) *<u>General</u>*

The area to be repaired shall be demarcated to the extremity of sound coating which shall retain a firm edge during surface preparation. If the apparently sound coating does not display a firm edge during surface preparation, the repair shall be extended until a firm edge is obtained.

The sound coating adjacent to the repair area shall be feathered and roughened using abrasive paper only for a distance of 50mm from the edge of the exposed steel.

Surface preparation shall be undertaken by means of one of the following techniques:

- Abrasive blast cleaning of steel surface to Sa 2½ of ISO 8501-1 using portable vacuum recovery blasting equipment.
- Mechanical cleaning of steel surface using Bristle Blaster™, abrasive flapper disc or power sander to SSPC SP15. Grinding discs may not be used.

The prepared steel surface shall be free of moisture, dust & debris prior to application of the repair coating.

Dust and debris shall not exceed 0,2% when tested in accordance with SANS 8502-3:2008.

Total soluble salts shall be in accordance with the requirements of the specific coating supplier when tested in accordance with SANS 8502-6 (Bresle Patch).

The feathered edge of the sound epoxy shall be activated using MEK or the solvent compatible with the repair coating.

ii) *<u>Aged epoxy coated pipework</u>*

The repair material shall be aluminium flake pigmented surface tolerant epoxy mastic (e.g. Carbomastic 15) or similar approved by the Engineer plus re-coatable polyurethane to the Employer's colour coding specification.

The repair coating shall be applied in multiple coats to match the dry film thickness of the original coating. (minimum 300 micron).

The painted area shall be tested for pinholes and thickness.

iii) *Aged bitumen coated pipework*

The repair material shall be Polymer Modified Bitumen heat applied wrapping (Densotherm HD) or similar approved by the Engineer.

PLQ 2.2.3 Pipework exposed to sunlight

a) Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.
Pipe surface shall be prepared for coating application as per ISO 12944-4.

Atmospheric exposure (Inland) ISO 12944-5: 2018 Table D.1 System G3.02:
Galvanised pipes shall be coated in the factory with epoxy primer (80 micron).

Erection damage must be repaired with "single pack zinc rich epoxy primer" followed by a full coat of silver polyurethane acrylic (50 micron)

Atmospheric Exposure (Coastal) ISO 12944-5:2018 Table D.1 System G5.05:
Galvanised pipes shall be coated in the factory with epoxy primer (80 micron) plus epoxy intermediate (125 micron per coat).

Erection damage must be repaired with "single pack zinc rich epoxy primer" and epoxy intermediate, followed by a full coat of silver polyurethane acrylic (50 micron)

After installation the pipe shall be painted with re-coatable silver polyurethane acrylic (50 micron) as per ISO 12944-5.

b) Pipe diameter larger than 150mm

Pipework shall be lined with epoxy paint.

Atmospheric exposure (Inland) ISO 12944-5: 2018 Table C.3 System C3.06:
Pipes shall be coated in the factory with two component inorganic zinc silicate primer (75 micron) plus one coat of silver polyurethane acrylic (50 micron).

A second coat of silver polyurethane acrylic (50 micron) must be applied on site. The inorganic zinc silicate must be repaired with “single pack zinc rich epoxy primer”.

Atmospheric Exposure (Coastal) ISO 12944-5:2018 Table C.5 System C5.08:
Pipes shall be coated in the factory with two component inorganic zinc silicate primer (75 micron) plus two coats of epoxy intermediate (125 micron per coat).

Erection damage must be repaired with “single pack zinc rich epoxy primer” and epoxy intermediate, followed by a full coat of silver polyurethane acrylic (50 micron).

c) General

All products to be industrial type complying with ISO 12944-5:2018 supplied by a manufacturer approved by the Engineer.

At the interface between atmospheric exposure, Type 13A coating as per PLQ 2.2.1 shall be applied to the pipe section underground and overlapping the coating of the pipe exposed to atmospheric up to 500 mm vertically above the final ground level.

PLQ 2.2.4 Exposed pipework inside buildings

a) Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

Pipe surface shall be prepared for re-coatable polyurethane site application.

After installation the pipe shall be painted with re-coatable polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and

12944-5:2018 (Table D.1 System G2.01)

b) Pipe with diameter larger than 150mm

Pipes, fittings and couplings shall be lined and coated with epoxy paints.

After installation the pipework external shall be painted with re-coatable polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and 12944-5:2018 (Table C.2 System C2.05).

PLQ 2.2.5 Pipework inside water retaining structures

All pipework (including stainless steel) inside water retaining structures and cast into the walls or floor of water retaining structures shall be lined and coated with epoxy paint.

All stainless steel shall be grade 316L.

PLQ 3 SURFACE PREPARATION

Contractors must submit information on the cleaning methods to be used to comply with the specified requirements.

PLQ 3.1 Surface preparation of steel surfaces

All projections, sharp edges, layers that have formed and tool marks must be removed from the surface so that the surface is smooth, and it must be abrasive blast cleaned in accordance with section 5.3 of SANS 10064:2011 so that it meets the following requirements, unless specified differently for a particular coating system in other clauses below.

(a) A grade of cleanliness of Sa 3 of ISO 8501-1 for immersion/buried conditions or Sa 2 ½ of ISO 8501-1 for atmospheric exposure.
(b) A surface profile between 60 micron and 85 micron when tested in accordance with SANS 5772.

(c) Dust and debris shall not exceed 0,2% when tested in accordance with SANS 8502-3:2008.

(d) The profile produced shall be angular and shall be in accordance with the requirements of the material product data sheet when tested in accordance with SANS 5772 (profile gauge) or SANS 8503-5 (replica tape)

(e) Water soluble salts shall not exceed 100mg/m^2 when tested in accordance with the Weber Reilly Method or conductivity measurement. Lower values may be required for immersion applications.

(f) Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the requirements above.

PLQ 3.2 Surface preparation of galvanized surfaces

Surfaces to be coated shall not be passivated.

Galvanized steel surfaces shall be degreased prior to coating, using either a water soluble solvent degreaser in accordance with SANS 1344 and the manufacturer's instructions, or a mild acid-detergent degreasing solution to be approved by the Engineer.

Large areas shall be prepared by sweep-blasting with non-metallic abrasive in accordance with SSPC SP16. Cracking, flaking or any form of de-lamination of the zinc coating due to excessive blast-cleaning shall not be permitted. Removal of zinc by blast-cleaning shall not exceed 10 µm.

Surfaces that cannot be sweep-blasted shall be abraded manually or mechanically with abrasive paper grade 220 or by using non-metallic abrasive pads.

Finally, all dust and debris shall be removed by vacuum-cleaning.

Epoxy primer for galvanised surfaces shall be applied immediately after surface preparation to a minimum dry thickness of 50 µm.

PLQ 3.3 Surface preparation of stainless steel surfaces

Oil and grease contamination shall be removed by:

- Steam-cleaning
- An emulsifiable or aqueous detergent, or
- An alkaline cleaning solution.

Stainless steel surfaces shall be blast-cleaned with stainless steel grit or non-metallic abrasive. The use of steel shot and steel or cast iron grit is strictly prohibited.

The grade of cleanliness shall be in accordance with SSPC SP16.

Surface profile shall be in the range of 30 to 50 µm.

Where blasting is impractical, the surface shall be roughened manually with abrasive paper grade 220, disc grinders or flapper wheel abrasive pads. In all instances, clean, uncontaminated equipment must be used.

Dust and debris shall be removed by vacuum-cleaning.

PLQ 4 HOT-DIP GALVANIZING

The following specification is applicable:

(a) Where galvanising is specified or a requirement of the design, such galvanising shall be performed by the hot-dip process to SANS EN 10240 in part and SANS ISO 1461;
(b) For all parts, other than wires, the equivalent zinc coating thickness shall not be less than 455 g of zinc per square metre of surface;
(c) The galvanising must be clean, smooth, of uniform thickness, unblemished and free from defects;
(d) All drilling, welding, cutting, sawing, punching, filing and bending shall be complete and the metal shall be cleaned of any machining blemishes, millscale, rust and lubricants, before galvanising;
(e) Galvanised areas must be kept free of lubricants. Surfaces which are in contact with oil shall not be galvanised or cadmium plated;
(f) Electrolytic deposition of zinc is not acceptable.

(g) Unless otherwise specified, steel pipes up to 150 mm dia shall be hot-dipped galvanized. Hot-dip galvanizing to be in accordance with SANS 121 ISO 1461 except that minimum thickness shall be 55 micron. Cut ends and small damaged areas shall be repaired by the application of a zinc-rich epoxy (single pack) to SANS 121 ISO 1461 (ZINC GALV 1 – Dulux or POLY GALV – Plascon).

(h) Only heavy duty galvanising shall be accepted and all items to be provided with a SANS approval certificate.

PLQ 5 EPOXY PAINTS

PLQ 5.1 General

Epoxy paint shall comply with SANS 1217 or ISO 12944-4 and ISO 12944-5. Surface preparation shall be abrasive blast cleaning to Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals for internal linings/immersion conditions, or Sa 2½ . of ISO 8501-1 or SSPC SP16 for non-ferrous metals for atmospheric exposure.

The following will be applicable where epoxy paint is specified:

- Lining of pipes with nominal diameter equal or larger than 600 mm and standard pipe lengths of 9,144 m, 12,192 m, 18,3 m and 19.2 m:

  Solvent free epoxy SANS 241 certified (Pipecoat SFX or similar product approved by Engineer), with a minimum dry film thickness of 500 micron and a maximum dry film thickness of 800 micron. (Equivalent to ISO 12944-5:2018, Table C.6 System I.06)

- Lining and coating of all other pipes, specials and fittings, except where multi-purpose epoxy coating is specified:

  Solvent borne epoxy (Carboguard 891 or similar product approved by Engineer) with a minimum dry film thickness of 500 micron and a maximum dry film thickness of 800 micron. (Equivalent to ISO 12944-5:2018, Table C.6 System I.06)

Epoxy paint and the repair kit for the repair of epoxy shall be from the same manufacturer.

Edges with epoxy paint shall have a radius of 3 mm or 50 % of the pipe wall thickness (smaller of two).

Where another type of coating is specified, epoxy paint lining shall continue around pipe edge for each of the following:

- *Flanged end*

  Onto both flange faces, extending for 50 mm (min) onto pipe outer wall beyond flange.

  Epoxy on flange faces with a grooved (gramophone) finish shall be hand sprayed to a thickness of 80 micron.

- *Ends suitable for straight or stepped couplings or flange adapters*

  Onto pipe outer wall for 250 mm (min) from pipe end.

- *Ends suitable for flange adapters, incorporating a restraining flange*

  Onto pipe outer wall from pipe end, up to and including both faces of the restraining flange as well as 50 mm (min) beyond the restraining flange.

The following specification shall be applicable to pipes, specials and fittings to be welded on site:

- In the factory:

  Abrasive blast cleaning of complete steel surface to Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals. Apply epoxy paint to 100mm from pipe end.

- On site:

  Abrasive blast cleaning of steel surface to Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals and 50 mm of painted surface to a surface profile of 60 – 85 microns.

Apply epoxy repair kit from the same manufacturer as the factory applied epoxy to a minimum dry film thickness of 500 micron. The type of epoxy repair kit shall be subject to the approval of the Engineer.

At completion of the laying of pipes, after the epoxy lining of welded joints, repair of lining defects and cleaning of pipes and before filling of the pipe with water, the Contractor shall be responsible for the holiday (pinhole) testing of the epoxy lining of the complete pipeline. The Contractor shall implement measures to prevent entrance by persons, animals, water or any other foreign matter into the sections where holiday testing was successfully completed.

Holiday testing shall be undertaken in accordance with ASTM D5162 Test method B: High Voltage Spark Testing.

PLQ 5.2 Repair/rehabilitation of aged internal epoxy linings on site

The following deviations from paragraph PLQ 5.1 shall be applicable to the repair/rehabilitation of aged internal epoxy linings of steel pipes, specials and fittings on site:

The repair material shall be a surface tolerant reinforced epoxy with minimum 90% volume solids. A certain level of solvent is preferred in order to enhance the wettability, flow and adhesion characteristics of the material. The following materials are approved for this application:

- Carboguard 891GF Glass Flake System from Stoncor
- Ceramic Epoxy from Spec Coats
- Zip E from Corrocoat

Glass flake pigmented epoxy coatings from other manufacturers may be considered subject to approval by the Engineer.

Alternative products (e.g. Pipecoat SFX or Carboguard 550) may be considered for special cases of large scale repair work under controlled climatic conditions and with special measures for quality assurance in place and subject to approval by the Engineer. These

alternative products shall be subjected to site application trials.

The area to be repaired shall be demarcated to the extremity of the sound epoxy coating which shall retain a firm edge during surface preparation. If the apparently sound epoxy does not display a firm edge during surface preparation, the repair shall be extended until a firm edge is obtained.

The sound epoxy adjacent to the repair area shall be feathered and roughened using abrasive paper only for a distance of 50mm from the edge of the exposed steel.

Surface preparation shall be undertaken by means of one of the following techniques:

- Abrasive blast cleaning of steel surface to Sa 2½ of ISO 8501-1 using portable vacuum recovery blasting equipment.
- Mechanical cleaning of steel surface using Bristle Blaster™, abrasive flapper disc or power sander to SSPC SP15. Grinding discs shall **not** be used.

The prepared steel surface shall be free of moisture, dust & debris prior to application of the repair coating.

Dust and debris shall not exceed 0,2% when tested in accordance with SANS 8502-3:2008.

Total soluble salts shall be in accordance with the requirements of the specific coating supplier when tested in accordance with SANS 8502-6 (Bresle Patch).

The feathered edge of the sound epoxy shall be activated using MEK (Carboline Surface Prep 1 or similar approved by the Engineer) or the solvent compatible with the repair coating.

The epoxy repair coating shall be applied by brush ensuring the paint is worked into the surface of both the exposed steel and the feathered edge of the sound epoxy, overlapping 50mm onto the sound coating.

The repair coating shall be applied in a single coat to a minimum dry film thickness of 600 micron.

The painted area shall be tested for pinholes and thickness.

PLQ 6 UV-RESISTANT MULTI-PURPOSE EPOXY PAINT

Multi-purpose Epoxy shall be surface tolerant, self-priming aluminium pigmented epoxy mastic.

PLQ 7 RE-COATABLE POLYURETHANE

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The surface shall be vacuum-cleaned to remove dust and debris.

Over-coat with a 40 µm minimum layer of re-coatable polyurethane in accordance with the Employer's colour code.

PLQ 8 FUSION BONDED, MEDIUM DENSITY, POLYETHYLENE COATINGS (FBMDPE)

A uniform FBMDPE coating must be obtained by dipping the already prepared and heated pipe into a fluidified bed of FBMDPE powder which then fuses directly on to the heated surface.

The pipe coating shall be Xtalene complying with all aspects of AS 1193, AS 4131 and AS 4321 of the latest revisions.

All coating materials shall be supplied complete with an original ISO 17050-1 Certificates of Conformity (COC) for the materials, clearly indicating compliance with all mechanical, physical and chemical properties of the coating, as defined in AS 4321, AS 1193 and AS 4131.

The supplier shall ensure that testing takes place as per AS 4321 Appendix A, as defined in Table A1 for the pipeline coating at the mill. In addition to this, a detailed third party report indicating compliance as per the 5 Yearly Type Testing and the annual testing as per Table A1 shall be submitted to the Engineer before production commences.

The minimum Dry Film Thickness (DFT) shall be 2.3mm minimum or as per Table 1 of AS 4321 for the different pipeline diameters as agreed by the Engineer.

The pipeline frequency of testing during production shall be as per AS 4321 Table 2.

The surface profile shall be angular and at least 60µ-75µ and the dust and debris level shall never exceed Class 2 ISO 8502-3 during production, the latter shall be confirmed during production on every 5th pipe and records shall form part of the hand-over pack issued to the Engineer. The cutback distance of the coating shall be 75mm from the pipe end.

PLQ 9 POLYMER MODIFIED BITUMEN (BITUGUARD)

This specification relates to factory applied pipe coating operations based on hot applied polymer modified bitumen. It is also applicable to modification, refurbishment and repairs on pipes coated with standard (oxidised or blown) bitumen fiberglass coatings.

PLQ 9.1 Applicable Standards

This part of the Specification makes reference to the standards listed below. Unless otherwise specified the latest editions of these documents, including all addenda and revisions, shall apply.

British Standards

BS 410	Specification for test sieves.
BS 1796	Methods using test sieves of woven wire cloth and perforated metal plate.
BS 2000	Methods of test for petroleum and its products.
BS 3900	Methods of test for paints:
	Part A 6 (replaced by EN 535) – Determination of flow time of

	paints. Part B 2 (replaced by ISO/DR 1515) – Determination of volatile matter and non-volatile matter.
BS 4147	Bitumen-based hot-applied coating materials for protecting iron and steel, including suitable primers where required.
BS 7079	(Replaced by ISO 8501-8504) – Preparation of steel substrates before application of paints and related products.
BS EN 10300	Steel tubes and fittings for onshore and offshore pipelines – Bituminous hot applied materials for external coating.

Swedish Standard

SIS OS 5900	Pictorial surface preparation standards for painting steel surfaces.

American Standard

ASTM D 113-86	Ductility of bituminous materials.
ANSII AWWA C203-91	Coal-tar Protective Coatings and linings for steel water pipelines – enamel and tape-hot applied.

PLQ 9.2 Materials

PLQ 9.2.1 Primer

The primer shall be of synthetic composition, designed to be used with a specific polymer modified bitumen. The drying rate of the primer shall be suited to the application conditions. The primer shall be supplied in new sealed steel drums.

The primer shall have the characteristics shown in the table below. In addition, when stored in original sealed containers at ambient temperature, the primer shall retain the properties as set out in the table for not less than 6 months from the date of delivery.

CHARACTERISTICS OF PRIMER

CHARACTERISTIC	REQUIREMENTS	METHOD OF TEST
Viscosity at 23°C	35-60 seconds	Flow cup No 4 BS3900: Part A6 = EN 535

Volatile matter (max. % loss by mass)	75	BS3900: Part B2 = ISO/DR 1515 (105^{0}C for 3 hours)

PLQ 9.2.2 Polymer Modified Bitumen

a) Composition

The polymer modified bitumen shall consist of a uniform mixture of the following:

- A formulated blend of polymer modified bitumen, as specified in (c) and (d) below.
- A proportion of approved filler (limestone or asbestos shall not be used).
- Characteristics of the filler shall be as specified in (b) below.

b) Filler Grading

Method of test to BS 1796 modified to use the metric sieves specified in BS 410.

Passing 90 microns – not less than 93%.

Passing 250 microns – not less than 99%.

c) Characteristics of the Polymer Modified Bitumen

The material shall conform to the requirements given in the table below when tested in accordance with the methods specified.

d) Performance Tests of the Polymer Modified Bitumen System

The polymer modified bitumen shall be of thermoplastic rubber/bitumen modification.

The polymer modified bitumen containing mineral filler shall pass the performance test specified in the following table:

CHARACTERISTICS AND PERFORMANCE TEST: PMB

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Softening Point	ASTM D36	^{o}C	115-130
Penetration @ 25°C	ASTM D5	1/10 mm	15-30
Density @ 25°C	BS 4147	g/cm^3	1.1-1.4
Viscosity @ 170°C	Brookfield	Cp	7000-12000
Viscosity @ 190°C	Brookfield	Cp	3000-6000
Filler Content	BS 4147	%	20-30

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Impact @ -10ºC	BS 4147	mm^2	Max. 6500
Peel Initial / Delayed	BS 4147	mm	Max:
Sag @ 25ºC	BS 4147	mm	3,0/3,0
Sag @ 40ºC	BS 4147	mm	3,0/3,0
Sag @ 50ºC	BS 4147	mm	3,0/3,0
Sag @ 60ºC	BS 4147	mm	3,0/3,0
Sag @ 80ºC	BS 4147	mm	Max. 1.5
Aging Test @ 190ºC	Phoenix	hours	Min. 72
Bend	BS 4147	mm	Min. 15

Notes:
The test plates shall be cleaned by abrasive blasting to grade Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals and with a profile of 50 – 75 microns (SANS Method 772). They shall be coated with primer at a rate of 100g per m^2.

- For the impact test a plate 12.7 mm thick shall be used and a single impact made in each quarter of the plate. The average of the four areas disbanded shall not exceed the permitted value shown in the table.
- The peel test at 25ºC is equivalent to / replaces the preliminary adhesion test in the original Specification.

PLQ 9.2.3 Outerwrap

a) The outerwrap consists of a combination of polyester and glass fibres to ensure the required strength and elasticity. This is combined with a glass fabric of uniform quality and amount to control the best application and the required amount of bleed through, in order for the outerwrap to provide maximum protection.
b) The outerwrap shall be impregnated with the polymer modified bitumen compatible material to fulfil the characteristics shown in the table below.
c) The characteristics of the outerwrap shall comply with the requirements of the table below and shall be determined in accordance with the test procedure.

CHARACTERISTICS OF OUTERWRAP SATURANT

CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
Softening Point	Min 100ºC	BS 2000
Penetration @ 25ºC	60-85 1/10 mm	BS 2000
Saturant	Polymer Modified Bitumen	

PHYSICAL CHARACTERISTICS OF OUTERWRAP

CHARACTERISTIC	TYPE A	TYPE B	METHOD OF TEST
Minimum Thickness (mm)	0.6	0.6	AWWA C203-91
Weight (g) per m^2	500 – 700	500 – 700	AWWA C203-91
Tensile strength (N/50 mm)			
Longitudinal	> 800	> 400	AWWA C203-91
Transverse	> 800	> 200	AWWA C203-91

PLQ 9.3 Application

PLQ 9.3.1 Care of Wrapping Materials

All wrapping materials consigned to the coating yard or factory shall be properly stored to prevent damage or deterioration.

PLQ 9.3.2 Care of Pipe

Throughout the wrapping process pipe and coating materials shall be kept clean and away from all foreign matter.

PLQ 9.3.3 Marking

Any pipe manufacturer's identifying marks shall be removed before the start of the wrapping

process and shall be permanently marked on the side of each pipe at both ends with a weatherproof paint. Metallic dye stamping shall only be permitted using approved stamps and only on the pipe bevel.

PLQ 9.3.4 Blast Cleaning

In preparation for the application of primer all grease or heavy soil shall be removed without spreading over the surface with a volatile solvent, e.g. xylene (or approved equivalent) and thereafter the external surface of the pipes shall be cleaned by abrasive blasting to Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals and surface profile amplitude 75 µm. Refer to 37.15 for detailed description of surface preparation process.

PLQ 9.3.5 Priming

a) Following blast cleaning and within 2 hours, the pipe exterior shall be coated with the primer applied at a controlled rate to the manufacturer's recommendations. Pipes shall be coated within 24 hours of being primed.
b) The primer shall be applied to a dry, clean and dust free pipe and thereafter the primed pipe shall be kept free from moisture, dust or any other contaminant. The primed pipe shall be uniform and free from runs, drips, flooded or bare areas. Particular care shall be taken to ensure complete coverage of weld areas.
c) The primer should be applied at a pipe temperature of 10°C (or above) or 3°C above the dew point. If the pipe temperature is lower than this level or if moisture is present on the pipe, heating of the pipe may be required.
d) Deteriorated or contaminated primer shall not be applied to the pipe. Primer that has deteriorated or become contaminated after its application shall be removed to the satisfaction of the Employer or his representative, at the Contractor's expense. The cleaned area shall then be re-primed.

PLQ 9.3.6 External Coating and Wrapping Application

a) The pipe, after priming and when the primer is no longer tacky, shall be passed through coating facilities of a type approved by the Engineer. The machine shall coat the pipe weld (longitudinal or spiral) with a 50 mm wide strip of extruded polymer

modified bitumen and thereafter the entire pipe with an extruded coating of polymer modified bitumen and shall simultaneously apply the outerwrap.

b) All primed surfaces shall be clean and dust free immediately prior to coating.

c) The coating (including the outerwrap) shall have a minimum average thickness as specified in SANS ISO 2808 (5.5 mm minimum average and 5 mm minimum at any point) The coating shall be reinforced by a spirally-wound layer of outerwrap pulled into the polymer modified bitumen with an overlap of 20 mm, such that the outerwrap is wetted by the polymer modified bitumen. Particular attention shall be paid to the location of the reinforcement and thickness of the wrapping over the weld. The average thickness shall be determined in the following manner: At least four thickness measurements at approximately the pipe quarter points per lineal metre of pipe length shall be taken. At least 25% of the measurements shall be taken at the weld bead. The average thickness shall be the arithmetic average of all measurements.

d) The completed coating shall be well bonded to the pipe metal; uniform, smooth and free from Holidays, laminations, voids or other defects.

e) The wrapping shall be carefully trimmed off 100 mm from the ends of each pipe and bevelled throughout its thickness over a minimum length of ±5 mm, unless otherwise specified by the Employer or his representative.

f) Solar protection paint shall be applied to the coated pipe while the coating is still warm. It shall be white in colour, water resistant, continuous and shall cover the wrapping sufficiently to form an effective barrier to solar radiation. The solar protection shall be terminated approximately 100 mm from each end of the wrapping (i.e. 200 mm from each end of the pipe).

PLQ 9.4 Inspection and Testing

The Contractor shall be responsible for, and shall bear the cost of a system of inspection and repair of the wrapped pipe approved by the Engineer. The system shall meet all relevant requirements in this Section and in addition the following requirements:

a) Monitoring of grit size and the finish of blast cleaned pipe.

b) Viscosity measurement and control of film thickness of external primer at least once for every batch of primer, in addition to visual checks of the applied prime coating.

c) Adequate temperature control of the polymer modified bitumen at the application head. In order to ensure that the polymer modified bitumen applied to the pipe has

the characteristics specified, samples of the polymer modified bitumen shall then be taken from the application head and subjected to the following test and frequency of testing shown in the table below.

d) Visual checks on the outer wrap and the appearance of the final wrap.

e) Holiday detection of 100% of the surface area of every wrapped pipe with approved equipment operating at a minimum 15 kV, maximum 25 kV with regular calibration of the equipment to the satisfaction of Quality Assurance.

f) Test of bond strength and thickness of the wrapping including removal of samples of the wrapping for inspection.

g) Adequate and proper repair of any defects to ensure compliance with this Section. A need to repair more than 1 defect per m^2 of pipe coating shall be sufficient grounds to reject the pipe and cause the Contractor to adjust his process to reduce the number of defects to an acceptable level.

Any necessary repairs of tested pipes shall be carried out by the Contractor at no additional cost to the Employer.

One pipe from every day's production shall be held back for examination on the following day. This examination shall include bond testing, thickness testing and examination for laminations, voids or any other defects.

If, in the opinion of the Engineer, there are a signification number of defects on the test pipe, then a back check procedure will be invoked. This will involve checking the ten pipes immediately preceding and the ten pipes immediately following the faulty test pipe (the pipe numbers shall be available from the final inspection). These twenty pipes shall be subjected to an examination similar to that carried out on the test pipe. Should the number of defects detected be, in the opinion of the Engineer, significant, then the entire production for that week shall be quarantined and jointly investigated by the Contractor and the Engineer.

Should tests in any production batch show a defect rate of more than 10%, the Engineer may reject the whole batch. In such cases the Contractor shall conduct an investigation to establish the cause of the defects.

'IN PLANT TESTING'

TEST	FREQUENCY OF TESTING

1.	Softening Point	Twice per working shift
2.	Penetration at 25°C	Twice per working shift
3.	Bond test for coated pipes	One pipe per working shift

These tests should be conducted at the coating Plant by the Contractor and monitored by the Authority (AIA), who would be trained in the procedures by the coating material supplier.

At least once during the Contract or when the method of surface preparation is changed, a sample wrapped pipe shall be tested for resistance to cathodic disbonding.

When tested, the wrapping shall not be disbonded from the pre-damaged area by more than a 5 mm radius after exposure for 28 days at the specified potential, i.e. -1500 mV (BS 3900:F1 1).

The inspection activities shall be coordinated with the Contractor's operations so as to delay or interfere with the operations as little as possible. The Contractor's methods shall, nevertheless, always permit inspection to be made and allow adequate repair of imperfections.

Prior to dispatch from his Plant, the Contractor shall ensure that the wrapped pipe is correctly marked on the internal painted surface of the pipe at each end with approved paint, with sufficient information to enable subsequent identification of the pipe to be made. Documentation shall be supplied to the Engineer to enable the history of the processing of each pipe to be traced.

PLQ 9.5 Methods of Testing

PLQ 9.5.1 Testing of Wrap Characteristics

a) General

The procedures given below are reference methods of test, which shall be used to establish conformity to the Specification in cases of dispute. Other similar methods, however, may be used by manufacturers for routine quality control purposes with the approval of the Engineer.

b) Thickness

The thickness shall be determined by means of a suitable instrument fitted with a micrometre dial gauge, a cylindrical brass block 57 mm in diameter and giving a nominal loading of 3.45kN/m^2 and a surface plate.

The thickness shall be measured by interposing the outer wrap between the cylinder and the surface plate. Measurements shall be made by marking 75 mm square across the effective width of the mat and making a measurement within each square. No single reading across the width of the mat shall be less than the specified minimum thickness.

c) Weight per m^2

The weight per square metre shall be determined by cutting representative samples from the effective width of the outer wrap. The samples shall be of such a size, that the weight per square metre may be determined to an accuracy of ±2%.

d) Tensile Strength

The tensile strength shall be measured with approved equipment. The size of the samples cut from the roll shall be 520 mm long and shall have the required width.

When mounted in the equipment, the distance between the jaws shall be 320 mm. The constant rate of separation of the jaws shall be in the range of 100 mm to 610 mm/minute and the tensile strength at breaking point shall be determined. For reference purposes the rate of separation of the jaws shall be 200 mm/minute. At least four samples shall be tested and an average figure obtained. The test may be carried out on narrower samples if required, provided that at least two of the reinforcing strands are included in the specimen. Sealing of the ends is recommended.

The value for tensile strength obtained from a narrower sample shall be extrapolated to 150 mm width.

PLQ 9.5.2 Bond Test for Coated Pipes

a) Measure the temperature of the coating with a surface thermometer.
b) If the temperature of the coating is not between 10°C and 25°C, cool or warm the pipe in the test area to bring the temperature within this range.
c) Using a knife, heated if necessary, make two parallel cuts, through the coating down to the pipe surface. The cuts shall be 100 mm long and 30 mm apart.
d) With a stiff flat blade, loosen the coating the full width between the two cuts and lift the wrap upward in a direction at right angles to the pipe surface.
e) The bond shall be considered satisfactory if the coating does not peel cleanly from the primer or the pipe surface but is removed with difficulty.
f) This bond test should be carried out at the start of each shift or change in production and thereafter at a frequency approved by the Engineer.

PLQ 9.6 Handling

At all times the pipe, unwrapped as well as wrapped, shall be handled with the aid of slings, lifting yokes and protected hooks to the approval of the Engineer.

At all times the coated pipe shall be handled and stacked in such a manner as to prevent damage to the coating. Particular care shall be taken immediately after coating to avoid damage while the enamel is above ambient temperature. No stacking or loading shall be undertaken until the coating has cooled sufficiently to avoid marking.

The coated pipe shall be stored at all times clear of the ground and in such a way that either water or mud cannot accumulate on the inside or outside of the pipe. Storage shall be effected by the use of wooden bearers, suitably covered, or mounds of gravel-free sand, covered with polyethylene sheets.

The pipe shall only be stacked to a height such that no flattening of the wrapping occurs.

The pipes shall be separated from each other with approved polyethylene covered pads.

PLQ 9.7 Repairs

Although the polymer modified bitumen has excellent self-healing properties, damage caused by transportation or laying of the coated pipe may occur. This shall be quickly

repaired using torch-on membrane.

Damage shall be repaired by removing the existing coating to at least 10 mm beyond the area of damage. The repair area shall then be cleaned of all deleterious matter to 100 mm beyond the proposed repair area. Exposed metal shall be re-primed in accordance with this Section. The repair patch, which shall lap at least 50 mm onto sound coating, shall be applied by gently heating with a gas torch and applying it to the pipe in a manner, which prevents the entrapment of air bubbles. All air bubbles shall be removed using a wooden roller or by other means and the perimeter of the repair patch shall be neatly finished off. The patched area shall then be Holiday tested in accordance with the Specification.

PLQ 10 THREE LAYER POLYETHYLENE COATING (3LPE)

The 3LPE coating shall comply with ISO 21809-1. The Canadian Specification CSA Z245.20/Z245.21 is not applicable.

The materials supplied as part of the 3LPE coating, including the Fusion Bonded Epoxy (FBE), Copolymer adhesive and Polyethylene (PE) outer coating shall be supplied with ISO 10474 or EN 10204 Inspection Certificates 2.1 and 2.2, giving the results of the testing of coated pipes, as supplied on the contract/purchase order and signed by an authorised representative of the Engineer.

An Inspection and Testing Plan (ITP) providing an overview of the sequence of inspections and tests, including appropriate resources and procedures and a Quality Control Procedure (QCP) shall be submitted for the approval of the Engineer's representative prior to coating production commencing.

Subsequent to the approval of the documentation detailed above, a Procedure Qualification Trial (PQT) shall take place and shall be witnessed by the Engineer's representative as well as subsequent inspection/testing of its properties, to confirm that the Application Procedure Specification (APS) is adequate to produce a coating with the specified properties. All to be carried out prior to the start of production.

The 3LPE shall be Type B coating, as per ISO 21809-1 Table 1.

The minimum thickness of the 3LPE coating shall be as follows:

FBE	0.30 mm
Adhesive	0.20 mm
HDPE	2.00 mm for nominal pipe diameter up to and including 250 mm
	2.50 mm for nominal pipe diameter larger than 250 mm but less than 600 mm
	3.0 mm for nominal pipe diameter 600 mm and larger

The 3LPE shall have minimum total thickness as above, and on heavier wall pipes it shall comply with class B3, as per ISO 21809-1 Table 2.

Polyethylene layer cut back shall be provided at pipe ends as follows:

Pipe ends shall be supplied as bare steel, free of all coating, for a distance of 100 mm (+25mm/-0mm tolerance) from the pipe end. In addition, each pipe end shall be left without polyethylene / adhesive coating so that a 20 mm (+10mm/-0mm tolerance) FBE toe protrudes on the steel beyond the cutback polyethylene coating layer.

The ends of the coating shall be bevelled at 30º to 45º.

The applicator shall use epoxy material that is in accordance with Table 3, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall use adhesive material that is in accordance with Table 4, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall use PE/PP material that is in accordance with Table 5, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall provide batch certificates supplied by the manufacturer of each material

and shall contain the information given in Table 6 ISO 21809-1. The batch certificate shall state test methods and acceptance criteria. The applicator shall identify the materials and shall confirm that the certificates comply and relate to the specified materials, as well as the requirements stipulated in Clauses 8.3.2 and 8.3.3 ISO 21809-1.

Prior to the start of coating production and any specified PQT, the applicator shall prepare an APS as per Clause 9.2 ISO 21809-1.

The APS, including any Engineer approved written revisions, shall be approved by the Engineer prior to the start of production and any specified PQT and there shall comply with the requirements of Table 7, Class B coating system.

The APS shall be verified by a PQT in accordance with ISO 21809-1 Annexure L. The applicator shall prepare an ITP and a daily log to record quality control data in accordance with Annexure L of ISO 21809-1.

Prior to the commencement of the surface preparation for the coating operations, a visual inspection shall be performed on the bare steel pipes in order to verify that there are no steel or weld defects (welding slag, spatter or raised/sharp edges) or contamination with oil, grease, soil, dirt and similar contaminants.

In the event that steel defects are detected they shall be rectified using a file, light grinding or any other suitable tool as stipulated in API 1104 Clause 13.10. This intervention shall not reduce the pipe wall thickness below the tolerances specified in the relevant Specifications. In case the steel defect is of the nature that simple correction of this defect cannot be performed, the pipe affected by this defect shall be quarantined until the appropriate measures are taken.

In case oil, grease, or any other residues (e.g. adhesive materials or similar contaminants) are present, then they shall be removed using a high pressure water based detergent cleaner, and/or a suitable “solvent” as per the requirements of SSPC-SP-1 Specification. In the event of other “adherent” contaminant being present, then power tool brushes or any other appropriate method may be utilised in order to remove the contaminant from the pipe surface prior to grit blasting.

The blast cleaning abrasives shall be, at all times, kept dry, clean and free from contamination. The blast cleaning shall be performed when the following conditions are satisfied:

- The steel surface temperature is at least 3ºC above the ambient dew point, which shall be checked using a calibrated hygrometer or other method approved by the Engineer.
- The steel surface shall have no traces of moisture;
- The steel surface is protected from bad weather conditions such as rain or strong winds which can bring contaminants such as soil, sand, dirt, salt or any other such similar contaminant.

In the case that the steel surface temperature is less than 3ºC above the ambient dew point or traces of moisture are detected on the steel surface, the steel surface shall be heated using induction heating until the steel surface temperature is within the range of 50ºC to 60ºC. This temperature shall be maintained until all of the moisture has been removed from the steel surface.

Abrasive blast cleaning shall be in strict compliance with ISO 21809-1 Clause 10.1.2 with the exception that the profile shall be measured using ISO 8503-4 (Stylus method), replica tape is not permitted.

As per ISO 8502-3, the cleanliness of the steel surface shall be measured using the ISO Form: “Preparation of Steel Substrates before Application of Paint and Related Products – Test for the Assessment of Surface Cleanliness – Part 3: Pressure Sensitive Tape Method.” As prescribed, a strip of clear tension tape shall be placed, tacky side down, onto the blasted steel surface of the pipe after cleaning. The tape shall then be removed from the surface and placed on a piece of white glossy paper where it will be compared to the cleanliness levels provided in the ISO 8502-3 specification procedure. This shall not exceed a “Debris” and “Dust” level of Class/Level 2 at any given time and shall be recorded during pipe production on at least every 5th pipe to confirm compliance and records shall be kept for the client, which may be inspected at any given time.

The salt level on the bare steel pipe surface shall be measured according to ISO 8502-2 and shall be a maximum of 20 mg NaCl/m². The basic procedure of the test shall be to

dampen circular piece of test paper of known area with a specified volume of laboratory water containing less than 0.1µg/cm² of salt. The test paper shall then be applied to the pipe for a period of 2 minutes, after which the test paper will be removed from the pipe and its resistivity measured. The salt content on the pipe will then be determined through the calibrated Salt Contamination Meter which uses the negative correlation between resistivity and salt content, along with empirically measured historical data to provide a reading.

If excessive salt contamination is established (≥20 mg NaCl/m²) during production testing, then the applicator shall ensure that a "Pre-Wash" system shall be employed prior to coating in order to remove the salt without causing "flash rusting" or any other "surface contamination". The "pre-wash" shall be performed and shall form an integral part of the production Pre-Qualification Testing (PQT) before acceptance of the "Pre-Wash" procedure.

The maximum time elapsed after completion of the abrasive blasting operation, pre-wash (if applicable) and the application of the P primer shall be 120 minutes if RH < 85% and 60 minutes if RH > 85%. At no time shall the steel surface temperature be allowed to drop below the dew point before application of the P Primer. Should either of these conditions apply, the surface preparation shall be re-inspected and/or the surface preparation repeated as required.

The application of the 3LPE coating shall be in accordance with the approved APS in accordance with Clauses 10.2.2.3 and 4 of ISO 21809-1.

Inspection and testing shall be carried out in accordance with the approved APS and ITP and shall meet the minimum requirements as stipulated in ISO 21809-1 Tables 8 and 9.

Coating repairs shall be addressed in accordance with an Engineer's approved APS and PQT as per Clause 12 ISO 21809-1.

Pipeline marking shall be as per the Employer's requirements, but shall as a minimum include all aspects detailed in Clause 13 of ISO 21809-1.

PLQ 11 RIGID POLYURETHANE COATING (RPU)

PLQ 11.1 Introduction

This part of the Specification defines the minimum technical requirements for liquid applied coating for factory coated pipe and specials. The coating system shall comprise a homogenic layer of 100% solids rigid polyurethane mechanically bonded to the metal substrate.

Where specified it shall be used for the external coating of pipes. The pipeline will be buried and will be protected against external corrosion by the external coating and cathodic protection systems. The external coating (primary corrosion protection system) shall be suitable for the operating conditions applying to the specific pipeline.

PLQ 11.2 Standards

Unless otherwise specified herein, the latest edition of the following Standards should be read in conjunction with this Specification:

American Society for Testing and Materials

ASTM D16	Standard Test Method for Paint, related coatings, materials and applications.
ASTM D 543	Standard Test Method for Evaluating the resistance of plastics to chemical reagents.
ASTM D 570	Standard Test Method for Water absorption of plastics.
ASTM D 2240	Standard Test Method for Rubber Property (Durometer Hardness)
ASTM D 4060	Standard Test Method for Abrasion resistance of organic coatings by the Taber abraser.
ASTM D 4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM G14	Standard test method for impact resistance of pipeline coatings (Falling Weight Test)
ASTM D 4285	Method for indicating Oil or Water in Compressed Air

British Standard and European Norm

BS EN 10290	Steel tubes and fittings for onshore and offshore pipelines - External liquid applied polyurethane and polyurethane-modified coatings.

ISO – International Organisation for Standardization

ISO 1514	Paints and varnishes - Standard panels for testing
ISO 2808	Paints and varnishes - Determination of film thickness
ISO 4624	Paints and varnishes - Pull off test for adhesion
ISO 8501-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates and of Steel Substrates after Overall Removal of Previous Coatings
ISO 8502	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8503	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces. Part 2: Method of grading of surface profile of abrasive blast-cleaned steel comparator procedure. Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - Stylus instrument procedure. Part 5: Replica tape method for the determination of surface profile.
ISO 8504-2	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Preparation Methods - Part 2: Abrasive Blast Cleaning
ISO 11124-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Specifications for Metallic Blast Cleaning Abrasives - Part 1: General introduction and classification Part 2: Chilled iron grit

Part 3: High-carbon cast-steel shot and grit
Part 4: Low-carbon cast-steel shot

NACE – International

NACE RP0274	High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
NACE RP0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
NACE RP0394	Application, Performance, and Quality Control of Plant-applied, Fusion- Bonded Epoxy External Pipe Coating

SSPC – Society for Protective Coatings

SSPC SP11	Power Tool Cleaning to Bare Metal
SSPC PA 2	Measurement of Dry Coating Thickness with Magnetic Gauges (Steel Structures Painting Manual, Ch 5 - Paint Application Specs.)
SSPC SP 10	Near-White Metal Blast Cleaning NACE No.2-2000 (Steel Structures Painting Manual, Ch 2 - Surface Preparation Specs.)

PLQ 11.3 Materials

The required coating shall be a two-component liquid applied rigid polyurethane subject to the approval of the Engineer.

The two components shall have different colours allowing the verification of the correct mixing, and checking of the uniformity of the colour of the mixed product.

The coating is considered cured when it has attained the hardness recommended by the product manufacturer.

PLQ 11.3.1 Handling of Materials

Materials shall be handled and stored in accordance with the material manufacturer's recommendations, which shall be available for review by the Engineer at the Contractor's premises. Materials shall be stored in an air-conditioned, temperature controlled environment until required for use.

Coating materials shall be segregated by type and batch during storage and handling. Materials from damaged containers shall be rejected, unless otherwise agreed with the Engineers representative in the factory or on Site.

Materials shall be used in the order in which they are delivered and before their expiry date for use.

PLQ 11.3.2 Documentation from the Materials Manufacturer

The commercial rigid polyurethane coating system offered shall be qualified by the Contractor and will be subject to the Engineer's approval prior to application. Testing should be conducted on each applicable coating and shall meet the acceptance criteria of the table below. The qualification shall be based on tests carried out by an independent recognized certifying body and the relevant documents shall be submitted to the Engineer.

Full traceability of each batch of coating material shall be maintained. As a minimum, the following data shall be compiled and shall be available for immediate review by all parties:

- Name of manufacturer;
- Complete material identification: Trade name, chemical name and type of product details;
- Batch number;
- Date of manufacture;
- Place of manufacture;
- Shelf life / expiry date (if appropriate);
- Health and safety, and environmental instructions;
- Hazard warnings;
- Storage instructions;
- Quantity; and
- Manufacturing standard.

Any material not labelled with the above information shall not be used.

PLQ 11.3.3 Rigid Polyurethane Properties

The coating material properties and characteristics with respect to the 100% solids rigid polyurethane coating shall comply with the requirements of a Type V coating type in terms of the ASTM D16 Standard. The coating material shall be a homogenic solvent free layer with a chemical three-dimensional covalent cross-linked structure. The layer shall be made up from a liquid two pack coating system with Part A being poly-isocyanate rich and Part B consisting of polyols or amines that ensures relatively short curing times. Aliphatic polyurethanes shall be used above ground and aromatic polyurethanes shall be used below ground.

The performance properties of the coating shall comply with the requirements stated in the following table. The Contractor shall submit a full and comprehensive product datasheet to confirm material compliance with the Specification.

COATING MATERIAL PERFORMANCE PROPERTIES

PROPERTIES	TEST REFERENCE	ACCEPTANCE CRITERIA
Minimum application thickness	BS EN 10290 (Annexure A)	1800 µm (Dry Film Thickness)
Adhesion to steel	ASTM D 4541 Method E	> 15 MPa
Adhesion to factory coating	ASTM D 4541 Method	> 10 MPa
Hardness	ASTM D 2240 (Shore D)	As specified by coating manufacturer
Flexibility	BS EN 10290 (Annexure K)	Pass
Tensile strength	ASTM D 638	>15 MPa at 3mm thickness
Resistance to cathodic disbondment	BS EN 10290 (Annexure E)	r < 8mm (28 days)
Dielectric strength	ASTM D 149	Minimum 15 V/µm
Specific Electrical Insulation Resistance	BS EN 10290 (Annexure F)	10^6 ohm.m^2
Impact resistance	BS EN 10290	> 5J/mm at 23°C >3J/mm at 5°C

PROPERTIES	TEST REFERENCE	ACCEPTANCE CRITERIA
Indentation resistance	BS EN 10290 (Annexure H)	<0.2mm at 23ºC

PLQ 11.4 Application

PLQ 11.4.1 Surface Preparation

Refer to Clause PLQ 3 for the general steel surface preparation requirements. The steel surface shall be grit blasted to Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals with an anchor profile of minimum 75 µm. The hardness of the abrasive material must be Rockwell C 54 or greater. The abrasive material shall be dry, clean, and free from contamination. Salt contamination tests shall be regularly performed on abrasive to verify that total salt level in the soluble contaminants is less than 25ppm. Extensive grinding shall not be performed without Engineer approval. The anchor pattern shall be restored on all ground surfaces.

The quality control plan (QCP) hold point at the completion of the surface preparation shall be subject to the signing off by the Approved Inspection Authority (AIA) prior to the application of the coating material for all pipes, specials and joint repairs.

PLQ 11.4.2 Coating Application

The application of the coating shall only proceed once the cleanliness of the steel substrate has been approved and the substrate temperature is more than 3ºC above the dew point temperature. The work area shall be kept dry as the material reacts with humidity and moisture.

When required the surface shall be heated using an induction heating coil, radiant heaters or hot air to a temperature as recommended by the coating material manufacturer and in accordance with this Specification. The temperature shall not exceed 85°C and the use of propane torches or gas burners for pre-heating and post-heating is expressly prohibited. Infrared heaters may be used for post-heating. The temperature of the bare steel shall be monitored using temperature-indicating crayons. The amount of crayon used shall be the minimum amount required for accurate measurement. Crayon markings shall be removed with a wire brush.

The individual liquid components of the rigid polyurethane coating shall be agitated thoroughly before use to disperse pigments and assure homogeneity. No thinning shall be done and the components shall not be mixed together.

The material shall be applied using a plural component, adjusted to the specified mix ratio on a heated airless spray unit with metering pumps. The width of the spray jet, the set up distance from the substrate surface and the overlap, the pipe rotation speed and the rate of application shall be predetermined for the final required dry film thickness applied in the workshop.

The wet film thickness shall be measured in accordance with ISO 2808. Particular attention shall be paid to the recommended dry film thickness which shall be measured in accordance with SSPC PA 2. No spot measurement may be less than 85% of the specified average thickness. Tools and equipment shall be cleaned using only such solvents as are recommended by the product manufacturer. Particular care shall be taken in the handling of the coated items before the coating has reached the minimum value of hardness recommended by the manufacturer. All pipes and other components shall be high spark holiday tested in accordance with NACE RP0274 at the test voltage recommended by the coating manufacturer.

For factory-coated pipe, bends and specials the cut back shall be 150 ± 20 mm. The edge of the cut-back shall be feathered at 30 – 45°.

PLQ 11.5 Inspection and Testing

The Contractor shall demonstrate that the proposed coating material and procedures will meet the requirements of this Specification when applied to pipes and pipe specials. The Contractor shall provide the documentation proof that the final selected coating material complies with the requirements listed in Table 37/15.

The Contractor shall test the finished coating during production to demonstrate continued compliance with this Specification. Details of all inspections and testing shall be fully documented in accordance with the approved quality control plan mentioned in Clause

37.4.2.

All stages of the surface preparation, coating and testing shall be subject to 100% inspection by the Contractor. The Engineer shall be informed at least two weeks prior to the start of surface preparation to allow scheduling of inspection personnel in the factory as well as on Site.

PLQ 11.6 Testing of Production Pipes

The Contractor shall execute the following tests and provide written documentation proof of the test results within the agreed time frames:

PLQ 11.6.1 Visual Inspection (every pipe)

The coating shall be smooth, glossy, and free from pin holes, excessive orange peel effect, bubbling or excessive runs or sags.

PLQ 11.6.2 Dry Film Thickness (every pipe)

DFT shall be inspected in accordance with SANS ISO 2808, with a minimum average thickness of 1.8mm and a minimum of 1.6mm at any point.

PLQ 11.6.3 Electrical Insulation Defects (Holiday) Inspection (every pipe)

The coating shall be free from electrical insulation defects when tested with a high voltage holiday detector set at 15 kV.

PLQ 11.6.4 Hardness Shore 'D' (every pipe)

The Shore 'D' hardness shall comply with the minimum set by the manufacturer in pre-qualification.

PLQ 11.6.5Adhesion (1 test per shift)

The pull-off adhesion at 23ºC shall be greater than 15 MPa.

PLQ 11.6.6 Cathodic Disbondment (1 test per 50 pipes and commencement of new batch or new production run))

The disbondment shall be less than 8mm radius. BS EN 10290 Annexure E 48hr.

PLQ 11.6.7 Composition (1 test per 50 pipes or new batch or new production run)

The Thermo Gravimetric Analysis (TGA) scan shall be checked against the manufacturer's qualification scan.

PLQ 11.7 Coating Repairs

Since polyurethane systems are chemically cured, very thorough abrasion of damaged or defective coating is required to ensure an adequate physical bond.

PLQ 11.7.1 Repairs before Full Cure in the Factory [Within Sixteen (16) Hours at 23°C of Application of Last Coat]

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The abraded surface shall be vacuum-cleaned or be blown clean with uncontaminated dry compressed air to remove dust and debris.

Brush grade polyurethane shall be applied in as many coats as are required to achieve the specified thickness free of electrical insulation defects.

PLQ 11.7.2 Repairs after Full Cure [After Sixteen (16) Hours at 23°C of Application of Last Coat]

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The abraded surface shall be vacuum-cleaned or be blown clean with uncontaminated dry compressed air to remove dust and debris.

The coating manufacturer's adhesive primer or activating solvent shall be applied only to the abraded surface.

After the designated curing time, brush grade polyurethane shall be applied in as many coats as are required to achieve the specified thickness free of electrical insulation defects.

Repairs shall be carried out with repair grade materials from the supplier of the factory applied coating, unless otherwise approved by the Engineer.

The repair material shall be as recommended by the supplier of the factory applied coating. The supplier shall confirm material compatibility and surface preparation requirements. Prior to any repair work, the supplier shall demonstrate the use of the material to the Contractor and Engineer on site.

The repaired area shall comply with the quality control requirements as set out in paragraph PLQ 11.6.

Based on the above the Contractor shall prepare a detailed method statement on the repair of the coating for the approval of the Engineer.

Repair of coating defects with 1.5 mm thick pure polyisobutylene visco-elastic (refer to PLQ 13) will be considered by the Engineer, based on a method statement submitted by the Contractor and approved by the supplier of the specific product, also indicating required repair patch sizes (overlapping minimum 50 mm onto the sound coating with minimum size of 100x100 mm), or circumferential wraps at extensive defects.

PLQ 12 PETROLATUM TAPE WRAPPING SYSTEM

PLQ 12.1 General

An EN 12068 Class A Petrolatum System shall be used for the wrapping of buried flanges, couplings (including flange adaptors) and where specified in the Specifications, Bill of Quantities or Drawings. The Denso Petrolatum Tape protection system as specified below

or similar products approved by the Engineer will also be acceptable.

PLQ 12.2 Surface Preparation

Bare pipes and fitting to be prepared to a minimum standard of St2 as specified by the Swedish Standard SIS 05590:

St2: Hand Tool Cleaning
Removal of all rust scale, mill scale, loose rust and loose paint to the degree specified by hand wire brushing, hand sanding, hand scraping, hand chipping or other hand impact tools or by a combination of these methods. The substrate should have a faint metallic sheen and also be free of oil, grease, dust, soil, salts and other contaminants.

Chamfer any raised edges or steps in the existing coating.

PLQ 12.3 Primer Application

Surface to be primed with Priming Solution (e.g. Denso S105 Paste)

Primer is applied to the steel surface with a brush or paint roller. The primer to be thoroughly mixed prior to application.

The primer to cover the entire steel surface, including the nuts and bolts and overlap onto the mill applied primary coating system by a minimum of 200mm.

The primer must not be diluted. Primer cans should remain covered when not in use to avoid solvent evaporation and contamination.

PLQ 12.4 Profiling Mastic Application

Apply Profiling Mastic to both sides of the fitting to form a generous fillet from the coupling or flange onto the pipe barrel. The Profiling Mastic is also used to cover the bolt heads and nuts to form a regular profile onto which the Petrolatum Tape can be applied.

PLQ 12.5 Petrolatum Tape Application

Apply one layer of the Petrolatum Tape to the body of the pipe or fitting, ensuring that there is no air entrapped beneath the tape. The Petrolatum Tape must be applied spirally, with a 55% overlap and at least 100 mm onto the factory coating and the barrel of the pipe.

PLQ 12.6 Petrolatum Tape Outerwrap Tape Application

Spirally apply Petrolatum PVC Heavy Duty Self Adhesive Outerwrap Tape with a minimum thickness of 500 micron to cover the entire Petrolatum Tape system. Start at one end, wrapping with a 55% overlap, proceed to the other end and ensure the Petrolatum Outerwrap Tape extends 100mm beyond each end of the repair.

PLQ 13 VISCO-ELASTIC PURE POLYISOBUTYLENE COATING SYSTEM

PLQ 13.1 Materials

PLQ 13.1.1 Visco-Elastic Inner Wrap

For factory coating together with the glass reinforced epoxy outer wrap, the inner wrap shall be a fabric backed polyisobutylene tape 1 – 1.2 mm thick.

For hand application, the inner wrap shall be a high temperature pipeline grade 1.5 mm thick fabric backed polyisobutylene tape of appropriate width for field joints, bend, and specials.

PLQ 13.1.2 Factory Applied Glass Reinforced Epoxy Outer Wrap

The glass woven roving for factory applied outer wrap shall be 600 gsm.

The epoxy for saturating the glass shall be a bespoke solvent free 2–component resin designed for pipeline encapsulation. An additional accelerant or retardant may be required based on seasonal application temperatures.

The outer veil for factory application shall be a non-woven 30 gsm glass tissue which prevents the glass strands of the outer wrap from protruding outside the epoxy coating thus creating a smooth and uniform finish.

PLQ 13.1.3 Adhesive PE/PVC Outer Wrap for Field Joints

Either polyethylene (PE) or PVC outer wrap shall be 300 µm tape with synthetic butyl rubber adhesive.

PLQ 13.2 Surface Preparation

All rust, mill scale, weld primer, paint, contamination and debris shall be removed by grit blasting of the steel surface in accordance with the code of practice SANS 10064 to achieve a cleanliness of Sa2. (SANS 8501-1).

PLQ 13.3 Application

PLQ 13.3.1 Factory Applied Coating (Machine Wrapping)

Apply a single circumferential fabric backed polyisobutylene 1 – 1.2 mm thick wrap at each end of the pipe to define the 100mm cut-back for welding.

Apply the inner fabric backed polyisobutylene 1 – 1.2 mm thick tape in a spiral with a minimum 10 mm overlap, starting and finishing on the circumferential wrap each end of the pipe.

Ensure that the inner wrap is free of folds, bubbles, and fish-mouths.

Holiday test the inner wrap at 10 kV and repair any insulation defects.

Prepare the epoxy for the outer wrap by mixing the components in accordance with the required pump mix ratios, as per the manufacturer's data sheets.

Saturate the start of the glass fibre outer wrap and draw it through the epoxy, ensuring that the glass fibre fabric is fully coated.

Apply the saturated outer wrap in a spiral at 50% overlap ensuring that there are no wrinkles or entrapped air bubbles.

Whilst the epoxy is still wet, apply the synthetic veil tissue in a spiral to cover the woven roving edges, side by side with no overlap onto itself.

Allow the outer wrap to cure prior to handling. Pipes must be stored on custom racks which contact the pipe only on the cut-back ends. Until the coating is cured, the use of slings is prohibited.

Where armoured coating is specified, apply an additional layer of glass reinforced epoxy outer wrap in the factory, or apply a layer of moisture cured urethane impregnated glass tape at 55% overlap in the field.

No coating is to be applied to the pipe ends as they are required to be left bare for welding or couplings.

PLQ 13.3.2 Hand Applied Coating of Specials

Visco-Elastic Polyisobutylene systems can be used in conjunction with any pipeline coating.

The 1.5 mm thick fabric backed polyisobutylene tape inner wrap may be applied spirally, or cigarette wrap as appropriate with 10 mm adjacent and 100 mm circumferential overlap.

As the hand applied inner wrap tape is thicker than the factory applied tape, the inner wrap shall be holiday tested at 15kV prior to application of the outer wrap.

Adhesive PVC/PE outer wrap shall be applied spirally with 55% overlap.

PLQ 13.3.3 Field Joints

Visco Elastic Polyisobutylene systems can be used in conjunction with any pipeline

coating.

Field joints shall be free of all contamination, weld spatter and flux.

The previously grit-blasted surface shall be prepared to grade St2 of SANS 8501-1.

Chamfer any raised edges or steps in the existing coating.

Prior to application of the field joint coating, the surfaces of the field joint and the adjacent factory coating shall be wiped down with isopropanol.

Apply the 1.5 mm thick fabric backed polyisobutylene inner wrap to the field joint with 50 mm overlap onto the factory applied coating and 100 mm overlap onto itself.

Ensure the circumferential overlap is correctly weatherboarded.

Apply the adhesive PVC/PE outer wrap with minimum thickness of 0.55 mm with 55% overlap and 100 mm overlap onto the factory applied coating.

PLQ 13.4 Inspection and Testing

The completed pipe shall be visually inspected for mechanical damage prior to transport, on receipt at site and prior to backfilling. Any visual damage shall be assessed and repaired as specified.

Holiday testing shall be conducted on completion of application of the inner wrap, whether applied to pipes, specials, or field joints.

In addition, the completed pipeline shall be tested at 25kV after laying and prior to backfilling.

PLQ 13.5 Coating Repairs

PLQ 13.5.1 Damage to Substrate

Areas dis-bonded or damaged through to the substrate shall be repaired as follows:

- Remove any loose or dis-bonded coating and chamfer the edges of the sound coating.
- Clean the exposed steel surface and wipe the steel and surrounding coating with isopropanol.
- Apply a patch of 1.5 mm pipeline grade inner wrap overlapping 50 mm onto the sound coating with minimum size of 100 x 100 mm.
- For tape wrapped surfaces, apply a full circumferential wrap of adhesive PE/PVC with 55% overlap and 100 mm overlap onto the sound coating.
- For glass reinforced epoxy coated surfaces, abrade the edges of the damaged area, apply a patch of the woven roving and saturate the fabric with a repair kit of 2 part epoxy of the same kind as is used in the factory application.

PLQ 13.5.2 Partially damage

Areas where the outer wrap is damaged without exposing the substrate shall be verified by means of holiday detection and repaired with a full circumferential wrap of adhesive PE/PVC with 55% overlap extending 100 mm beyond the damaged area or abrade the edges of the damaged area, apply a patch of the woven roving and saturate the fabric with a repair kit of 2 part epoxy of the same kind as is used in the factory application, as appropriate.

PLQ 14 JOINT COATING SYSTEMS

PLQ 14.1 FBMDPE, three layer polyethylene (3LPE) and Rigid Polyurethane (RPU) coating (Option 1 – Epoxy and tape wrapping)

The unprotected area at welded joints shall be protected against corrosion as follows:

- The cutback of the coating shall be 100mm from the pipe ends.
- Chamfer any raised edges or steps in the existing coating.
- The factory applied polyethylene pipe surface to which the cold tape wrapping is to be applied shall be abraded with 40 grit abrasive paper or sweep blasted for a

minimum of 50 mm onto the mainline coating to obtain a surface profile with an R_z value between 40 and 70 µm

- Abrasive blast clean the steel surface Sa 3 of ISO 8501-1 or SSPC SP16 for non-ferrous metals. The surface profile shall be checked in accordance with ISO 8503-1, ISO 8503-4 and ISO 8503-5 with an average R_z larger than 75 µm. All types of abrasive that are used in the preparation of the field joints and small repairs shall comply with ISO 11124-2 to 4.
- The surface to be coated shall at the time of application be dry and free of dust and any contamination detrimental to the adhesion of the coating to the steel substrate. The Contractor shall prepare a detailed method statement on how the field joint area will be kept dry and clean during the application operation. It shall also include the trench space requirements for the application equipment.
- All dust, detritus and salts shall be removed from the metal substrate. The level of salts shall be measured in accordance with the requirements of ISO 8502-9 and shall be ≤ 30 mg/m^2
- The application of the coating shall only proceed once the cleanliness of the steel substrate has been approved and the substrate temperature is more than 3ºC above the dew point temperature.
- The temperature of the substrate shall be within the application temperature range specified by the coating manufacturer. When required the surface shall be heated using an induction heating coil, radiant heaters or hot air to a temperature as recommended by the coating material manufacturer and in accordance with this Specification. The temperature shall not exceed 85°C and the use of propane torches or gas burners for pre-heating and post-heating is expressly prohibited. Infrared heaters may be used for post-heating. The temperature of the bare steel shall be monitored using temperature-indicating crayons. The amount of crayon used shall be the minimum amount required for accurate measurement. Crayon markings shall be removed with a wire brush.
- **Applicable to 3 LPE only:** Apply Denso Protal 7200 liquid epoxy to the blast cleaned surface and adjacent prepared factory FBE coating to a minimum dry film thickness of 400 micron.
- The entire joint surface to be wrapped shall be primed with Denso Butyl Primer P16HT.

  Allow approximately 30 minutes drying time or until the primer is tacky to the touch.

- Apply 100mm or 150mm wide 3 ply PE/Butyl rubber self-amalgamating inner-wrap compliant with DVGW EN12068 Class C 50°C (DENSO S43HT on similar product approved by the Engineer).

  The tape shall be applied to ensure that a minimum 55% overlap.

- Apply 100mm or 150mm wide 2 ply PE/Butyl rubber outer-wrap compliant with DVGW EN 12068 Class C 50°C (DENSO R23 on similar product approved by the Engineer).

  The tape shall be applied to ensure that a minimum 55% overlap shall be achieved.

  The tape shall be applied to a minimum width of 50mm beyond the applied inner tape-wrapped area onto the primed shop applied coating.

  Ensure that the tape is in full contact with the underlying surface with no wrinkles, fish-mouths or bubbles.

- Holiday detection shall be carried out in accordance with NACE RP0188.

The quality control plan (QCP) hold point at the completion of the surface preparation shall be subject to the signing off by the Approved Inspection Authority (AIA) prior to the application of the coating material for joint repairs

Damaged areas on coatings shall be repaired in accordance with the specifications and guidelines of the coating manufacturer. Hand or power cleaning can be used for small repair areas such as pinholes and areas inaccessible for blast cleaning. 80 Grit or coarser sandpaper can be used to suitably roughen and abrade the area to be prepared. The area shall be sanded to the substrate taking care not to polish the substrate.

Only Engineer approved DVGW Certified and or other Engineer approved certification materials may be used. All materials shall comply with the requirements of EN 12068 Class C HT50°C UV for either tapes and heat shrinkable sleeves (HSS), unless otherwise approved by the Engineer.

An ISO 17050-1 Certificate of Conformity from the supplier (point of origin) stipulating compliance with all chemical, physical and mechanical properties of the applied product, as per ISO 10474 or EN 10204 Inspection Certificates 3.1.B and 3.1 shall be submitted to the Engineer i.e. the DVGW Type Test Report and in-house batch testing for the batch(s) to be supplied.

Pipeline field joint repairs (FJR) may not commence without an Engineer approved Inspection and Testing Plan (ITP) document providing an overview of the sequence of inspections and tests, including appropriate resources and procedures and Quality Control Procedure (QCP).

Subsequent to the approval of the documentation detailed above, a Procedure Qualification Trial (PQT) shall be carried out, to be witnessed by the Engineer's representative. The PQT shall include the application of the FJR and subsequent inspection/testing of its properties, to confirm that the Application Procedure Specification (APS) is adequate to produce a FJR system with the specified properties and shall be carried out prior to the start of production.

Alternatively for RPU mainline coatings, the same RPU material can be applied, once the Engineer has approved the APS, QCP and ITP. An ISO 17050-1 Certificate of Conformity from the RPU supplier (point of origin) stipulating compliance with all chemical, physical and mechanical properties of the applied product, as per ISO 10474 or EN 10204 Inspection Certificates 2.1 and 2.2 shall be submitted to the Engineer i.e. the EN 10290 Type Test Report and in-house batch testing for the batch(s) to be supplied as per EN 10290.

PLQ 14.2 FBMDPE, 3LPE and RPU coating (Option 2 - Pure Polyisobutylene Visco-Elastic Wrapping)

As an alternative to PLQ 14.1, the unprotected area at welded joints shall be protected against corrosion with the Visco-Elastic Pure Polyisobutylene coating system as specified above.

Unless otherwise specified in the BoQ, Scope of Work or on the Drawings, Option 2 shall apply for joint coating of FBMDPE, 3LPE and RPU coated pipes.

PLQ 14.3 Polymer Modified Bitumen (Bituguard) Coating

The unprotected area at welded joints shall be protected against corrosion as follows:

- Where applicable, remove the whitewash for a distance of 150mm from the edge of the factory applied coating. Ensure the end of the factory coating is firmly adhered. Cut back any areas of loose or damaged coating to 10mm beyond the area of damage. Ensure the edge of the factory applied coating is bevelled at 30°or less.
- Chamfer any raised edges or steps in the factory coating.
- Surface preparation shall be abrasive blast cleaning to Sa 2,5 of ISO 8501-1. The white wash on the factory coating to be removed for a distance of 100 mm from the end of the coating.
- The steel surface and 100 mm of the factory coating on both sides of the joint to be coated with Bitumen Primer (Denso Primer D or similar product approved by the Engineer).
- Using hot air or gas torches, apply custom sized Hot Applied EN 10268 Class B HT50°C Bitumen rolls of membrane to achieve the same minimum thickness as the factory applied coating with a minimum thickness of 5 mm. Densotherm HD heat applied bitumen wrapping is also acceptable. The applied membrane shall overlap onto itself or the factory coating by a minimum of 50 or 100mm respectively.
- Ensure a liquid bead of coating is maintained in contact with the steel at all times to prevent air entrapment. The perimeter of the field joint shall be neatly finished off and blended into the factory coating.
- The finished joint shall be free of air bubbles, and shall exhibit the same bond to steel as the factory coated pipe.

Joint preparation shall be subject to witness and hold inspection by the Engineer prior to application of the primer and coating. The finished joint shall be holiday tested at 15kV and any holidays repaired.

PLQ 15 CUT BACK AT PIPE ENDS

Only if it is expected that the pipes will be exposed to corrosive conditions for long periods before it is installed, the unprotected grit blasted bare steel surface at the ends of pipes,

specials and fittings to be welded on site shall be painted with a temporary paint product in the factory, to prevent corrosion of the pipe end before the permanent joint corrosion protection is applied on Site. Alternatively the uncoated steel surface could be temporarily protected by a pressure sensitive tape. The temporary paint and remains of the tape (after being removed by hand) shall be completely removed by abrasive blast cleaning as part of the surface preparation process. For each project the Contractor shall consult with the Engineer whether the temporary paint on the pipe ends is required.

PLQ 16 UV PROTECTION

All pipes with FBMDPE, 3LPE or Bituguard coatings shall be painted with a white PVA or acrylic (to be approved by the Engineer) for protection against UV. The overcoat to be maintained by applying additional layers until the pipe is backfilled.

PLQ 17 ADDITIONAL EXTERNAL PROTECTION FOR PIPES CAST INTO CHAMBER WALLS

After the concrete has cured for 7 days, wire brush or scabble the exterior and interior surfaces of the wall to remove laitance. Dry brush to remove all loose powder.

Mix ABE Super Laykold and water (1:1 ratio) and apply as a primer to the concrete and the pipe surfaces. After 1 hour apply a thick coat of ABE Super Laykold to the concrete and the pipe and immediately embed 250mm wide ABE non-woven polyester membrane “SBP” into the Super Laykold. After 3 hours apply another coat of Super Laykold.

Similar products approved by the Engineer can also be used.
This additional protection is required on the inside and outside of chamber walls.

There must be no contact between the steel pipe and the chamber reinforcement.

PLQ 18 JOINT BETWEEN EPOXY LINING AND CEMENT MORTAR LINING

The joint between epoxy lining and cement mortar lining shall be protected as follows:

- Unprotected steel surface to be abrasive blast cleaned to Sa3.
- Epoxy lining to be light abrasive blast cleaned to a surface profile of 60 – 85 micron over a distance of 50 mm minimum.
- Pro-Struct 617NS mortar filler to be applied into the joint between the epoxy and the cement mortar and finished to a smooth surface at a 45-degree angle to the pipe surface.
- Epoxy paint (approved by the Engineer) to be applied on the blast cleaned steel surface, the Pro-Struct 617NS mortar filler and on the cement mortar lining for a minimum distance of 50mm, with a minimum dry film thickness of 500 micron.

PLQ 19 MEASUREMENT AND PAYMENT

If corrosion protection and painting is not measured separately in the Bill of Quantities, the price for corrosion protection and painting shall be deemed to be included in the price for the pipes, fittings and specials.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PLT: FLOW METERS (GENERAL)

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PLT 1 SCOPE

This section of the Specification deals with the supply, delivery, installation and commissioning of:

h) in line ultrasonic flow meters;
i) clamp on ultrasonic flow meters
j) flanged mechanical turbine meters
k) electromagnetic flow meters.

PLT 2 IN-LINE ULTRASONIC FLOW METERS

PLT 2.1 General Requirements

An in-line ultrasonic flow meter will consist of:

l) Two machined, stainless steel, weld-on sockets with inserted perspex windows, which are held by two plastic flanges secured with stainless steel bolts and spring washers.

The tenderer shall be responsible for the welding of the sockets on to the pipeline, as well as making good all corrosion protection according to applicable specifications.

m) Two 1 MHz sensing units, connected via co-axial cables of 50 ohms, with a minimum length of 12 m, to the transmitter.

The sensing units are to be removable under full pressure, while the pipeline is operating.

Both sensing units shall be electrically isolated from the pipeline.

n) A transmitter that shall have two output circuits:

i. One circuit for the 4-20 mA output signal to drive an indicator, and if later required a recorder, with maximum load capacity of 1 000 ohm.

ii. The second circuit to drive a 24 V integrator, with a 2% zero flow cut off.

All power requirements other than 230 V will have to be provided for by the successful Tenderer.

The transmitter shall have facilities to adjust for the various pipe diameter and flow rates.

PLT 3 CLAMP-ON ULTRASONIC FLOW METERS

PLT 3.1 General Requirements

Single channel flow meters operated in transit time or time-of-flight mode shall be provided unless otherwise specified. The flow meter provided shall be capable of measuring the instantaneous flow in a pipeline and give the accumulated flow. The installation shall comprise at least two (2) sensing units (transducers) that are connected via co-axial cables and connected to a signal conversion unit. The signal unit shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall further more have a LCD display for instantaneous flow and totalize flow and shall have a 4-20 mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle, which will be supplied and installed under the electrical portion of the Contract.

Welding of transducers onto the pipe will not be allowed.

The IP rating for the housing of the transducers shall be *submersible.*

The mountings on the transducers shall be manufactured by stainless steel.

The location of the flow meter installation shall be indicated on the relevant drawings, together with the following general information:

- Pipe outer diameter
- Pipe material
- Pipe wall thickness

- Internal lining
- Average thickness of internal lining
- Fluid to to be measured
- Distance between transducers and signal converter
- The operating temperature for all equipment shall be minimum -10°C and maximum 55°C.

PLT 3.2 Flow Accuracy

The flow accuracy (velocity) shall be ± 1% of reading for pipe diameter greater than 150mm and flow velocities greater than 0.3 m/s. For pipe diameters smaller than 150mm, the flow accuracy shall be ± 3%.

The overall rangeability or turn-down ration shall be at least 400:1.

The repeatability for clamp-on transducers shall be 0.2 to 0.5% of full scale reading.

PLT 3.3 Calibration

The Contractor shall allow for the calibration of the flow meter one month after installation by Technology Services International of Eskom enterprises. A certificate of calibration shall be submitted to the Engineer, acceptance of wich signifies final completion of the installation.

PLT 3.4 Guarantee Period

The ultrasonic flow meter shall be guaranteed for a period of at least **24 Months** from date of **successful commissioning.**

PLT 4 FLANGED MECHANICAL TURBINE METERS

PLT 4.1 Equipment Preferred

All mechanical turbine meters shall shall be type Sensus or similar and approved.

PLT 4.2 Accuracy

All mechanical meters supplied in terms of this Contract shall perform to an accuracy of better than ± 2% error over the meters operating range i.e. between Q_t (transitional flow) and Q_n (continuous flow). The performance characteristics of the meters offered shall be equal to or better than the values tabled below:

Size (DN) (mm)	Q_{min} (m^3/h)	Q_t (m^3/h)	Q_n (m^3/h)	Q_{max} (m^3/h)
40	0.3	0.8	40	60
50	0.3	0.8	50	90
80	0.5	0.8	120	200
100	0.8	1.8	230	300
150	1.8	4	450	600
200	4	6	800	1200
250	6	11	1250	1600
300	12	15	1400	2000
400	25	50	2000	3000
500	45	60	3000	4500
600	100	180	3300	6500
800	210	320	6000	12000

PLT 4.3 General Requirements

Meters must be fitted with dry dial registers, which comprise 6 digit cyclometer-type totalizers, registering in kiloliters (kl) or m^3. These registers must be sealed to prevent ingress of dirt or moisture. The registers, which are to be fitted as standard, must be able to provide one high frequency opto-type pulse output function and two low frequency reed-type pulse output functions. All flow meters shall be provided complete with frequency converter unit and opto coupler. The frequency converter unit will be mounted in an outdoor type cubicle, which will be supplied and installed under the electrical portion of the Contract.

No consideration will be given to meter types, which necessitate the use of special tools or

fitment of any form of gland in the process of connecting pulser units, or, meters which require a register-change to switch from one volume unit per pulse to another. Dismantling of registers for this purpose will not be acceptable. Tenderers are to provide full details of these aspects with their tenders.

Cover bolts must be of stainless steel material to facilitate easy removal of mechanisms. Meter bodies must be coated with a high quality sintered epoxy powder coating, both internally and externally, to provide maximum protection against corrosion.

Although most of the meters will be installed horizontally, it must be possible to install the meters vertically (with flow in the upward direction) or in an inclined position (with flow in the upward direction), should site conditions make this necessary.

Tenderers must provide full details of the minimum lengths of straight pipe required upstream and downstream for each size of meter offered, to ensure that the accuracy of the meters remain within the stated limits, under normal operating conditions. Preference will be given to meter types requiring a minimum of straight pipe upstream and downstream, as installation space and lay lengths are at a premium.

The performance of the meters offered shall not be affected by outside magnetic influences.

Details of head loss across the meters offered shall be provided by the Tenderer.

PLT 5 ELECTROMAGNETIC FLOW METERS

PLT 5.1 General Requirements

All electromagnetic flow meters supplied under this contract shall be for high measuring accuracy i.e. ± 0.5% of reading plus 0.05% of full scale. The repeatability or reproducibility of measurement shall be ± 0.1% of full scale. The meter shall have a long term zero stabiity of ± 0.2% and linear variation shall be less than 0.2%.
Electrodes shall be manufactured from a high quality metal and shall be removable for cleaning purposes. Removal of electrodes with the line under pressure is preferred.

The minimum downstream and upstream unrestricted straight pipe run required for the specified measurement accuracy shall be stated by the Tenderer.
Although most of the meters will be installed horizontally, it must be possible to install the meters vertically (with flow in the upward direction) or in an inclined position (with flow in the upward direction), should site conditions make this necessary.

The flow meter shall be eqipped with a separate mountable signal converter unit complete with sufficient length of signal cable. The signal converter shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall further more have a LCD display for instantantaneous flow and totalized flow and shall have a 4-20 mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cublicle supplied under the electrical scope of the Contract.

Electromagnetic meters and converters shall be suitable for outdoor installation and shall be adequately protection against lightning.

PLT 6 DIGITAL INDICATOR/INTEGRATOR

The display shall be a 6-digit, 0.56” (14.2mm) High Red L E D, giving a maximum display of 999999. The decimal point shall be selectable.

A flashing display shall be given during totaliser overflow.

The indicator/integrator shall be powered by 230 V AC at 50 Hz.

The indicator/integrator shall be constructed in such a way that it can be calibrated to the required flow and also by means of a selector button, display the accumulated quantity of water released.

The front bezel shall meet NEMA 4/IP65 requirements

The manufacturer of the indicator/integrator shall comply with ISO 9001 and proof of this to be submitted with the tender documents.

The indicator/integrator shall have a lock-out facility to limit operator entry to the programmable settings and totaliser.

The totaliser shall have a programmable time base with a scale factor of 0.001 to 100.0 and a low-end cut-out.

The remote indicator/integrator if required is to be fitted into an IP 66 enclosure in such a way that the flow reading is clearly visible with space available for the labelling and surge protection as specified.

PLT 7 INSTRUMENT PANELS

All panels will comply with the minimum requirements for an IP 65 rating.

All cable entries will be fitted with the appropriate cable gland. All cable glands will comply with IP 68.

Each enclosure is to be fitted with an M10 brass bolt and two nuts that will act as an earth bar. All surge protection in the enclosure to be grounded onto this bolt.

a) Local indicator/integrator

An instrument panel is required to house the flow meter power supply unit if required, indicator/integrator and surge protection and shall comply with the following:

1. At least 500 mm high, 400 mm wide and 200 mm deep.
2. Constructed from polycarbonate.
3. The door shall be removable and have concealed hinges and captive, stainless steel hinge pins.
4. Be fitted with a plain painted metal chassis of at least 2.5 mm thick.
5. Be fitted with a polyester internal door for mounting of the totaliser.
6. The external door shall be fitted with a window that allows sight of the totaliser.
7. The external door shall have an extruded polyurethane seal fitted to a groove.
8. Only two closure points that are situated outside the sealed area. At least one of the closure points shall be lockable with a cylindrical barrel type lock and two keys shall be supplied for this lock.
9. Shall be wall mountable with 4 stainless steel brackets giving a space of at least 10 mm between the enclosure and the wall.

b) Remote indicator/integrator (if required)

An instrument panel is required to house the remote indicator/integrator and surge protection and shall comply with the following:

1. Constructed from polycarbonate.
2. The door shall be removable and have concealed hinges and captive, stainless steel hinge pins.
3. Fitted with a polyester internal door or stand-offs for mounting of the totaliser.
4. The external door shall be fitted with a window that allows sight of the totaliser.
5. The external door shall have an extruded polyurethane seal fitted to a groove.
6. Only two closure points which are situated outside the sealed area. At least one of the closure points shall be lockable with a cylindrical barrel type lock and two keys shall be supplied for this lock.
7. Shall be wall mountable with 4 stainless steel brackets giving a space of at least 10 mm between the enclosure and the wall.

PLT 8 SURGE PROTECTION

Single phase 230 V AC medium protection units that are certified to withstand surges of up to 75kA.

Two wire, 230 V AC fine protection units that are certified to withstand surges of up to 40kA.

Two wire, 24 V AC fine protection units that are certified to withstand surges of up to 40kA.

Two explosion proof, pipeline spark gaps rated to withstand surges of up to 100kA, complete with pipeline mounting brackets and a fly lead of at least 300mm.
All surge protection units must be grounded to a common earth point in the panel that houses the ultra sonic flow meter. If a nut and bolt arrangement is used it shall be at least an M10 and shall be made of brass. Care has to be taken to ensure that the nut and bolt do not negate the IP 65 rating of the enclosure.

PLT 9 SIGNAL CABLE

All signal cable to be 1,5 mm², 4 core, twisted pair, braided screened cable.

PLT 10 EARTHING

The successful Tenderer is to supply 70 mm^2, stranded copper cable as well as lugs that will fit the cable and an M10 bolt to connect between the equipotential bar and earth mat.

The successful Tenderer is to supply 16 mm^2, green PVC insulated, stranded copper cable to connect between the common earth at the instrument panel and the equipotential bar.

PLT 11 EQUIPOTENTIAL BAR

An equipotential bar with cover must be suitably mounted within each flow meter chamber. Modular terminals should be provided to accommodate 3 connections of up to 16 mm², 3 connections of 16 - 95 mm² and 3 for flat connections up to 30 mm wide.

PLT 12 LABELS

Two types of labels are required. One for the site and installation name, the other giving details of the flow meter characteristics.

Labels to be manufactured from plastic engraved stock with white lettering on a black base. Lettering to be 10 or 6 mm high x 5 and 3 mm wide and labels to be at least 105 mm X 30 mm.

All labels to be fitted with at least two strips of 12 mm wide double sided tape that run for the total length of the label.

PLT 13 GENERAL REQUIREMENTS

All screws, brackets, cable saddles, nuts, bolts, washers etc. used in the installation of the equipment shall be from stainless steel.

Before delivery to site all equipment and all parts supplied under this contract will be checked and certified at the supplier's workshop to ensure that they are in working condition by a delegated representative of the client.

PLT 14 COMMISSIONING

The equipment as supplied under this Contract shall be commissioned after **one fault free month** of operation.

If during this month the equipment or any part thereof should fail the successful Tenderer shall repair the equipment at his own expense and once again leave the equipment to operate for one fault free month before commissioning. All costs incurred shall be for the successful Tenderer's account. This cycle to continue until one fault free month has been attained.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

PTV : CORROSION PROTECTION

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PTV CORROSION PROTECTION

PTV 1 SCOPE

This section includes the corrosion protection and materials required for this Contract.

PTV 2 GENERAL

PTV 2.1 The Contractor shall ensure that he has available the latest editions of all the relevant National Specifications and Codes of Practice and the manufacturer's data sheets for materials to be used.

PTV 2.2 All paints in a paint system shall be purchased from the same manufacturer.

PTV 2.3 The Contractor shall submit in the Appendices to the document, details of the paints he intends using and shall only proceed with purchase of the paints upon receipt of written approval from the Engineer. Manufacturer's data sheets or legible copies thereof for each product shall be attached to the Appendices.

PTV 2.4 Materials and procedures shall comply with the appropriate SABS Specifications and Codes of Practice when relevant.

PTV 2.5 Strict attention shall be paid to fettling of surfaces by the Fabricator (see Clause PTV 4) prior to coating. Surface preparation requirements, the need for strict cleanliness and adherence to specification requirements especially with regard to overcoating times are emphasised.

PTV 2.6 Areas which are inaccessible after assembly shall be prepared and fully coated with the specified system and to the specified requirements before assembly. The coating shall be fully hard dry before assembly.

PTV 2.7 Mating surfaces shall be coated with primer or first coat only. The coating shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joint shall be fully coated.

PTV 2.8 The painting sub-contractor shall provide evidence of his competence to apply the specified materials in the specified manner and to apply the necessary Quality Control procedures. The Engineer, at his discretion, may demand a Quality Audit of the

Contractor's facilities by a technically competent and independent organisation (See Clause PTV 10).

PTV 2.9 The Contractor shall provide a Quality Plan to show the stages at which Quality Control will be carried out. Further details are given in Clause PTV 10. The Quality Plan is subject to approval by the Engineer, who may require it to be revised if considered inadequate.

PTV 2.10 The Engineer will require a Program of Work so that Quality Surveillance inspection can be planned and executed at the appropriate time according to the Contractor's program (see Clause PTV 10).

PTV 2.11 The Contractor shall provide to material suppliers the specified descriptions of materials to be used and shall receive from them a written assurance that the materials to be supplied comply with the requirements specified.

PTV 3 DESIGN

PTV 3.1 General

All items shall be designed to minimise corrosion in exposed environments, under immersion conditions and in interior corrosive situations such as in chlorination rooms. The following notes may be used as guidelines.

PTV 3.2 Water Retention Areas

Avoid water retention areas wherever possible. For example, angle or U section steel should be used with the toes pointing downwards. The concrete base of steel columns should be sloped away from the steel and the sloping edge should be painted to avoid water ingress at the steel/concrete interface.

PTV 3.3 Crevices

Crevices give rise to accelerated corrosion by forming an oxygen concentration cell. Crevices may be avoided by using

(i) continuous welding, not space welding
(ii) mastics or sealants to seal unavoidable crevices such as bolted connections

(iii) insertion rubber or suitable plastic between mating surfaces (See also Clause PTV 2.7).

PTV 3.4 Bimetallic Couples

Electrical contact between dissimilar metals gives rise to a corrosion cell when an electrolyte such as water is present. Junctions between dissimilar metals shall be insulated.

PTV 3.5 Accessibility

Whenever possible, the surfaces of corrodible materials such as mild steel shall be accessible for maintenance. The use of back to back angles, partially open box sections or inaccessible stiffeners shall be avoided.

PTV 3.6 Differential Aeration

Posts buried in soil are subject to accelerated corrosion due to differential aeration. Additional protection shall be given to that part which is buried and up to at least 100 mm above ground.

PTV 3.7 Sharp Edges, Weld Spatter and Weld Slag

The designer shall specify that all sharp edges shall be ground to a radius not less than 2 mm and that all weld spatter and weld slag shall be removed by the Fabricator (see Clause PTV 5).

PTV 3.8 Hot Dip Galvanising

The design of articles to be galvanised shall be referred to the galvaniser (see Clause PTV 8).

PTV 4 COATING MATERIALS

PTV 4.1 No variation in materials tendered and approved by the Engineer shall be permitted without the approval of the Engineer in writing.

PTV 4.2 Correct material selection shall be confirmed by the material supplier (see Clause PTV 12.1).

PTV 4.3 All coating materials shall be delivered in the manufacturer's original sealed containers, clearly marked with the following:

(i) Manufacturer's name.

(ii) Product Brand and Reference Number.

(iii) Batch Number which may incorporate the date of manufacture.

(iv) Date of manufacture, unless already incorporated in the batch number.

(v) Abbreviated instructions for storage and use of the material, which shall include mixing ratios of components of multi-component materials, minimum temperature of application and method of application.

(vi) The SABS mark where applicable.

PTV 4.4 All coating materials shall be kept in an approved store, which shall be dry, enclosed and where the temperature is unlikely to exceed 40°C or drop below 0°C.

PTV 4.5 Usage of materials shall be on a first in, first out basis and no materials may be used which have exceeded the shelf life recommended by the manufacturer.

PTV 5 FETTLING OR DRESSING BY THE FABRICATOR

Before any surface preparation or painting is commenced, dressing shall be carried out to avoid projections, sharp edges, weld slag and spatter that will interfere with the corrosion protection. This included the following:

PTV 5.1 Remove all weld flux and weld spatter. Flux is best removed by washing with clean water whilst weld spatter is normally removed by grinding to a smooth surface.

PTV 5.2 Sharp edges shall be ground to a radius not less than 2 mm.

PTV 5.3 Welds shall be continuous and shall have a smooth contour. Rough welds shall be

ground where necessary to achieve the required smooth profile. Discontinuous welds shall not be permitted except by written approval of the Engineer. Undercuts are not permitted and shall be rewelded and ground where necessary.

PTV 5.4 Articles for hot dip galvanising shall not contain overlap joints. Closed sections shall be suitably vented. See Clause PTV 8 (Hot Dip Galvanising).

PTV 6 SURFACE PREPARATION FOR PAINTING

PTV 6.1 Mild Steel

Oil and grease contamination, when present, shall be removed by degreasing before blast cleaning.

Mild steel shall be blast cleaned in accordance with Section 4.3 of SABS 064 Code of Practice for "The preparation of steel surfaces for coating".

An additional requirement is that water soluble salts present in the steel after blast cleaning shall not exceed the values given in Table 1. Should these values be exceeded, the steel shall be cleaned by washing with clean potable water or by water shrouded or water injected blast cleaning until the soluble salts are within the limits specified in Table 1. The steel shall then be allowed to dry, after which it shall be flash blast cleaned to achieve the required degree of cleanliness.

PTV 6.2 Cast Iron and Cast Alloys

All cast surfaces shall be blast cleaned with new iron slag, copper slag, or platinum slag abrasives designed for blast cleaning. The abrasive shall not be recycled or re-used. Cast iron shall be blast cleaned until all sand particles, residual burst on sand and casting skin have been completely removed. This blast cleaning shall be carried out by the Foundry prior to despatch to the galvaniser or painting contractor, when relevant. Conventional cleaning of castings is inadequate for galvanising.

PTV 6.3 Galvanised Steel Surfaces

Galvanised steel surfaces shall be thoroughly degreased prior to painting, using either a water risible solvent degreaser used in accordance with the manufacturer's instructions, or a mild acid-detergent degreasing solution. In both cases care shall be taken to avoid entrapment of cleaning agent in recesses or other retention areas and in

both cases the surfaces shall be thoroughly washed until a "water break fee" surface is achieved. If necessary, the process shall be repeated until a "water break free" surface is obtained.

A water break free surface is one which, when wetted all over with potable water, maintains a continuously wet surface and the water does not break up into islands of unwetted surface.

TABLE 1 - STANDARDS FOR BLAST CLEANING REQUIRED

Property	Above Water	Immersed Surface	Tape Wrapping
Cleanliness to SIS 06 5900 (min)	Sa2½	Sa3	Sa2
Residual dust and debris	0,5%	0,3%	1%
Oil grease and perspiration	Nil	Nil	Nil
Surface Profile min (micrometers)	25 50	50 10	50 100
Water soluble iron salts - maximum At any point	500 mg/m^2	100 mg/m^2	500 mg/m^2
Average of any 250 cm	100 mg/m^2	100 mg/m^2	100 mg/m^2

After degreasing, the surface shall be lightly abraded by one of the following methods:

(i) On small areas by the use of abrasive paper not coarser than 120 grade, or by using non-metallic abrasive pads.

(ii) On large areas by "sweep blast cleaning", using a nozzle pressure not greater than 300 kPa and a very fine abrasive. Cracking, flaking, or any form of delamination of the zinc coating due to excessive blast cleaning shall not be permitted. Removal of zinc by blast cleaning shall not exceed 10 micrometers.

Finally, all dust and debris shall be removed by vacuum cleaning, or by washing, and the surface shall be allowed to dry before coating.

PTV 6.4 Aluminium

Generally, aluminium surfaces will be anodised or powder coated and will require no further treatment. Where painting is required, the aluminium surface shall be thoroughly

degreased, then rinsed with clean potable water. If the surface is not "water break free", repeat the degreasing process until a water break free surface is obtained. Allow to dry completely, then apply a thin coat (8 to 13 micrometers dry film thickness) of wash primer complying with SABS 723, mixed and applied in accordance with the manufacturer's instructions.

NOTE: Wash primer is an adhesion promoter and does not replace the primer specified in the paint system.

PTV 6.5 Stainless Steel

Components fabricated from stainless steel shall not be contaminated with iron or mild steel. Sheared edges, welds or surfaces subjected to any form of heat treatment shall be pickled and passivated. Stainless steel surfaces shall not be scratched or stressed.

When it is required to paint stainless steel, the surface shall be blast cleaned with non-metallic abrasive such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast iron grit is strictly prohibited. Any contamination with iron or mild steel is prohibited.

Where blasting is impractical, the surface shall be cleaned with detergent solution and roughened manually by using non metallic abrasive pads, followed by washing with clean potable water to a "water break free" surface. If a "water break free" surface is not obtained, detergent cleaning shall be repeated until the surface is "water break free". Allow the surface to dry before coating.

PTV 6.6 Painted Surfaces

(i) Fully painted surfaces to be repaired

Bare areas shall be cleaned with abrasive paper not coarser than 220 mesh to bright metal surface. The surrounding paint, which must be intact, shall be feathered for a distance of 20 mm beyond the damaged areas. Dust and debris shall be removed by the use of a clean rag dampened with water or clean solvent that will not attack the coating. The damaged area shall be allowed to dry, after which spot repair shall be carried out with all the coats previously applied and shall overlap the undamaged area by 20 mm.

The requirements of the spot repair shall be not less than that specified for the undamaged coating.

When additional coats are required over the whole surface, the whole surface shall be abraded to a uniform matt finish, dust and debris removed, and the surface allowed to dry. All further coats shall then be applied as specified to give a uniform finish. Note that abrasion of the coating is not required for vinyl systems.

(ii) Fully painted surfaces to be overcoated

Where additional coats are required over the whole surface, the surface shall be degreased and abraded to a uniform matt finish. The surface shall be washed to remove all contamination and then allowed to dry. Further coats shall then be applied as specified to give the required coating thickness and specified finish.

(iii) Primed surfaces

Shop applied primers shall be thoroughly sanded with fine abrasive paper to achieve a uniform matt surface, then scrubbed with a solution of suitable water based detergent-degreaser using a bristle brush, followed by clean water rinses to remove all grease and water soluble matter. The surface shall be allowed to dry completely before application of the specified coating system over the whole surface.

PTV 6.7 Plastic Surfaces such as uPVC and Polyester GRP

Sand the surface thoroughly with fine abrasive paper to achieve a uniform matt finish. Remove all debris, oil and grease by scrubbing with a solution of a suitable water based detergent such as Shell Teepol Lensex. Allow to react for 15 to 30 minutes, then rinse off very thoroughly with clean potable water to remove all residues. Allow to dry completely before painting.

PTV 7 APPLICATION OF PAINTS

PTV 7.1 Environmental Conditions

Paint shall not be applied in dusty conditions, nor when the steel surface temperature is

less than 3°C above dew point, or higher than that advised by the paint manufacturer, nor when humidity is greater than 85%, nor when the ambient temperature is less than the minimum or greater than the maximum specified by the manufacturer of the coating material.

PTV 7.2 Mixing

All coating materials shall be very thoroughly mixed until completely homogeneous. In the case of two-pack materials, each component containing pigments shall be thoroughly mixed. The two components shall then be mixed together in the proportions supplied by the manufacturer until the mixture is completely homogeneous. In the case of solvent based epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period of 20 to 30 minutes before use.

For two pack materials, the use of part of the contents (split packs) is strictly forbidden.

PTV 7.3 Method of Application

Application shall be by brush, roller, spray, airless spray, or other suitable equipment as appropriate for the surface to be coated and in accordance with the recommendations of the manufacturer. Application equipment shall be maintained in clean condition and in good working order. The use of equipment not maintained in good condition may lead to rejection of the coating.

NOTE: Zinc silicate primers shall be applied by conventional spray, using a continuously agitated pressure pot, unless otherwise recommended in writing by the manufacturer.

PTV 7.4 Overcoating

Overcoating times shall be not less than the minimum nor greater than the maximum specified by the manufacturer relevant to the ambient temperature. Strict adherence to overcoating times is particularly important for coatings which are subsequently immersed.

The Contractor shall be held responsible for blistering of paint coatings on immersion, when shown to be caused by solvent retention.

All coats shall be clean and free from dust, oil, moisture, perspiration before overcoating. Operators handling blast cleaned or partially painted surfaces shall wear clean gloves to avoid contamination of the surface.

PTV 7.5 Manufacturer's Instructions

Recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead, shall be followed. Verbal information by the manufacturer's representative will not be accepted unless confirmed in writing by the company.

PTV 7.6 Handling

Coated components shall not be handled earlier than the hard dry time recommended by the manufacturer, relevant to the ambient temperature. Coated components shall be handled with broad band slings and suitable packing to minimise damage to the coating. All damage caused in handling, transportation, and erection, shall be repaired to the satisfaction of the Engineer at no extra cost.

METAL COATINGS AND CORROSION RESISTANT METALS

PTV 8 HOT DIP GALVANIZING

PTV 8.1 Design and Fabrication

Components for hot dip galvanising shall be designed and fabricated in accordance with the recommendations of SABS Code of Practice Project No. 341/50490 (not published at the time of preparation of this specification), except that the use of lead plugs is not permitted.

It is recommended that the manufacturer consults the galvaniser before design and fabrication to ensure that the fabrication will be suitable for galvanising.

The main requirements are as follows:

(i) Overlap joints shall be avoided wherever possible. If essential, such overlap joints shall be thoroughly degreased before assembly and shall be vented by drilling holes through one or both overlapping materials.

(ii) Closed sections shall be suitably vented. If the inside of a closed section is not to be galvanised, a snorkel vent tube of suitable length and bore shall be attached.

(iii) Gussets and internal baffles in tanks shall be cropped to allow free flow of zinc and air.

(iv) Joints shall be continuously welded, using balanced welding techniques to avoid stresses. Welds shall be free from cavities, undercutting, weld slag and spatter.

(v) Symmetrical design shall be used whenever possible and the use of thin gauge steel adjacent to heavy sections shall be avoided.

(vi) Openings and flanges of manholes and bosses shall finish flush on the inside to ensure complete drainage.

(vii) Castings shall be designed to be of as uniform section as possible and shall be blast cleaned in accordance with Clause PTV 6.2 before despatch to the galvaniser.

PTV 8.2 The Hot Dip Galvanising Process

(i) Hot dip galvanising shall comply with SABS 763 for fabricated articles, SABS 934 for pregalvanised sheet, or SABS 935 for wire.

(ii) Mating surface on fabricated or cast iron components shall be wiped or centrifuged on removal from the galvanising bath to remove blobs, runs or excess metal that may impair the air/gas/water tightness of the joint.

(iii) Bolts, nuts and washers used for fixing shall be hot dip galvanised to SABS 763. Electroplated fasteners will not be accepted unless otherwise agreed by the Engineer in writing.

PTV 8.3 Repair Of Galvanised Articles

Welding, flame cutting, or other heat processes shall not be carried out on galvanised articles unless permission is granted by the Engineer in writing.

If such permission is given, or if mechanical damage has occurred, repairs shall be carried out as follows:

(i) All scale, spatter and flux shall be removed by grinding and washing with clean water. Edges shall be ground to a radius not less than 2 mm.

(ii) The preferred repair process is to blast clean the bare steel and apply zinc by the thermal spray process in accordance with SABS 1391 Part 1, Grade Zn 150. On completion of metal spraying, burnish the surface by means of a mechanical wire brush to give a uniform appearance. Such burnishing shall remove not more than 10 micrometers of zinc.

(iii) Where small areas are to be repaired, clean the surface thoroughly with fine abrasive paper, remove all debris with a damp cloth and allow to dry. Apply an approved one pack epoxy ester based zinc rich primer containing not less than 90% by mass of zinc in the dry film. A sufficient number of coats (usually 3 or 4) shall be applied such that the repair coating thickness is not less than the average zinc thickness specified in SABS 763, 934 or 935, as appropriate. The repair shall extend not less than 5 mm beyond the damaged area.

On completion of the repair and when the zinc primer is completely dry, one coat of alkyd resin based aluminium paint may be applied to obtain a uniform appearance.

NOTE: Repair of galvanised surfaces by application of aluminium paint alone IS NOT PERMITTED.

PTV 8.4 Storage of Galvanised Components

Galvanised components shall be stored to avoid the formation of "white rust" or other forms of storage staining.

Components shall be separated and supported on wooden battens to ensure adequate ventilation of all surfaces and in such a manner to avoid "ponding" by rainwater.

If storage staining does occur, remove the stains by scrubbing with detergent solution and bristle brush or nylon pad. The use of steel wool or other metallic abrasive is not

permitted. Rinse thoroughly and allow to dry. If the residual zinc thickness complies with the requirements of the appropriate grade in the relevant specification, no further action is required unless instructed by the Engineer.

If the zinc thickness is below specification, the article shall be regalvanised or repaired in accordance with Clause PTV 8.3 as instructed by the Engineer.

PTV 9 STAINLESS STEEL FABRICATIONS

PTV 9.1 Grade and Welding Techniques

The grade of stainless steel to be used shall be as specified in the appropriate section of the mechanical specification or drawings. Where welding is necessary, the appropriate "L" grade (low carbon content) shall be used. Plate shall be supplied as No 1 Finish in accordance with BS 1449 Part 4.

Welding procedures shall be only those recommended by the stainless steel manufacturer or by the South African Stainless Steel Development Association. Only welders coded to BS 4870 Part 1 or to ASME IX, 1983 shall be employed.

Welds shall be smooth and free from blowholes, undercuts, sharp projections and similar visual defects.

Fabrication of stainless steel components shall be carried out in clean work places where there is no contamination by mild steel. Grinding and polishing equipment shall be dedicated and shall not be contaminated with iron or mild steel.

Stainless steel shall be suitably handled to avoid scratching the surface.

PTV 9.2 Pickling and Passivation

Cut edges, welds and heat treated surfaces shall be pickled and passivated to remove all discolouration. Proprietary pickling and passivating pastes (as supplied by Duva Chemicals (Pty) Ltd., or other approved supplier) shall be used in accordance with the manufacturer's recommendations. Care shall be taken not to exceed the maximum contact time recommended.

The safety precautions given in PTV 10.2 shall be strictly observed.

After passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. The surface shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer or the South African Stainless Steel Development Association.

SAFETY PRECAUTIONS as specified in Clause PTV 10.1(ii) shall be strictly observed.

PTV 10 CORROSION RESISTANT STEEL 3CR12

PTV 10.1 Welding Techniques

(i) Welds shall be full penetration welds, using 309 austenitic electrodes or filler wire, or as recommended by the manufacturers (Middelburg Steel & Alloys (Pty) Ltd).

(ii) Welders shall be suitably coded for welding similar thickness of austenitic stainless steel, in accordance with BS 4870 Part 1 or ASME IX, 1983.

(iii) Welding procedures shall comply with the recommendations of the manufacturers of 3CR12 (Middelburg Steel & Alloys (Pty) Ltd).

(iv) Welds shall be smooth and free from blow holes, undercuts, sharp projections and similar visual defects.

PTV 10.2 Pickling and Passivation

(i) After completion of welding, both weld and heat affected zones shall be cleaned, pickled and passivated. Any heat scale on the steel shall be pickled and passivated.

(ii) The procedure shall be as follows:

(a) Not to painted surfaces.

Grind or wire brush, using dedicated grinders or stainless steel wire brushes to achieve the required smooth profile or remove scale.

(b) Pickle with a thixotropic paste containing 15-20% nitric acid and 1-2% hydrofluoric acid, with a contact time of 15 to 10 minutes.

(c) Rinse thoroughly with clean water until the pH of the washings is the same as that of the wash water.

(d) Repeat the above process, if necessary to remove all discolouration.

(e) Passivate with 10% nitric acid solution, or a proprietary passivating paste, for a contact time of 10-15 minutes, keeping the surface wet during this period.

(f) Rinse thoroughly with clean potable water until washings are the same pH as the wash water.

(g) Operatives shall wear protective aprons, gloves and safety glasses during pickling and passivating operations.

(h) Splashes on the skin shall be thoroughly washed with clean water immediately after contract. A weak solution of sodium bicarbonate shall be kept available for neutralisation. Seek medical attention if in doubt.

(i) Disposal of effluent shall be in accordance with the requirements of the local authority in whose area the work is being carried out. Generally, the effluent is stored in drums containing an excess of lime (calcium carbonate).

PTV 11 ALUMINIUM

PTV 11.1 Anodising

Aluminium components where specified as anodised shall be natural anodised and sealed in accordance with SABS 999 Grade 25. The corrosion resistance of the coating shall be not less than 8 when tested in accordance with 3.6 of specification SABS 999. Anodising shall be carried out after completion of all welding.

PTV 11.2 Powder Coating

When specified by the Engineer, aluminium handrails may be coated with polyurethane

powder. Such coating shall only be carried out by Contractors with the necessary plant, equipment and experience to pretreat and powder coat aluminium effectively. The coating shall comply with BS6496, 1984.

PTV 11.3 Fixing

Whenever aluminium components, such as stop log frames, come into contact with concrete or grout, the surface of the aluminium in contact with the concrete shall be coated with two coats of an approved epoxy tar composition.

PTV 12 QUALITY ASSURANCE REQUIREMENTS

PTV 12.1 Contractor Qualification

The Tenderer shall state in the Appendix to this document the name of the painting sub-contractor that he proposes to use to carry out the painting or coating. The Engineer may, at his discretion, require a Quality Audit of the painting sub-contractor to ensure that he has the management, facilities, skilled staff, and quality control facilities and staff to carry out quality control during application of coatings to ensure compliance with the specification.

The contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Engineer or his representative.

The contractor shall obtain confirmation from the material supplier that materials to be used comply with the specification and are suitable for the intended purpose by having the appropriate Appendix completed by the material supplier.

PTV 12.2 Quality Control

The contractor shall have the necessary equipment and staff knowledgeable in test procedures to carry out all the quality control required to ensure compliance with the specification. The contractor will be required to produce a quality plan and a program for carrying out the work. The contractor shall maintain quality control records of all stages of the work, batch numbers of materials used, environmental conditions, all as required by the specification. Quality control shall be inclusive in the contractor's tender price.

PTV 12.3 Quality Surveillance

Independent surveillance - The Engineer may employ an independent service provider to perform the quality surveillance on his behalf.

Program - The Contractor shall advise the Engineer timeously, in writing, when and where the following processes will be carried out:

(i) Completion of fettling or dressing prior to leaving the fabricator's works.

(ii) Blast cleaning and application of the first or primer coat.

(iii) After completion of all coats to be applied at the contractor's works.

(iv) At the commencement of repairs to be carried out on site.

Failure of the Contractor to advise the Engineer of his program may result in rejection of the work.

PTV 12.4 Access for Surveillance

For the purpose of carrying out quality surveillance, the Engineer or his representative shall be granted access to any part of the Contractor's premises relevant to the work being carried out, at any reasonable time. The Contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

PTV 12.5 Samples

The Engineer or his representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the sample will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material.

PTV 12.6 Destructive Testing

The Engineer or his representative may carry out reasonable destructive tests to ascertain compliance with the specification. Areas thus damaged shall be repaired by the contractor to the satisfaction of the Engineer at no additional cost.

PTV 12.7 Cost of Quality Surveillance

Cost of Quality Surveillance shall be borne by the Employer, except when surveillance results in rejection of the lot or when notice by the Contractor results in a fruitless strip, in which cases the cost shall be debited against the contractor's account.

PTV 12.8 Quality Control Records

Proper and adequate quality control records shall be maintained by the Contractor for all stages of the work. These records shall be available for inspection by the Engineer or his representative at the time of Quality Surveillance. Incomplete, inaccurate or inadequate records shall be regarded as non-compliance with the specification, and the cost of surveillance will be back charged to the contractor.

PTV 12.9 Data Sheets, Specifications, and Codes of Practice

The Contractor shall have available the latest issues of manufacturer's data sheets materials to be used, National specifications and Codes of Practice relevant to the work to be carried out, as well as a copy of this specification, all of which shall be available to the Contractors Quality Control Manager.

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

C3.5 MANAGEMENT

C3.5.1 Management of the Works

C3.5.1.1 Applicable Specifications

The Standard Specifications for Civil Engineering Construction SANS 1200 published by the South African Bureau of Standards and referred to as the "Standard Specifications", including the variations and additions specified in Section C3.4.2, shall be applicable to this project.

C3.5.1.2 Concurrent Construction Contracts

The Contractor's attention is drawn to the fact that other contiguous works will be executed concurrently by independent Contractor's under separate contracts in the vicinity of the Site.

The Contractor shall ensure that neither his operations nor those of his subcontractors nor the activities of his employees shall interfere with or hinder the operations of the Employer or of other Contractors and he shall indemnify the Employer against all claims arising through default of this requirement.

The Contractor shall hand over portions of the Site of the Works (whether completed or not), or completed portions of the Works, to these Contractors when required by the Employer or detailed elsewhere in this document. The Contractor

shall cause no interference with or delays in the execution of these contiguous contracts.

No discount or commission for the Contractor is allowed on these contracts, and it will be assumed that he has fully allowed in the Contract Price for the presence of these Contractors on Site. Any service rendered or assistance given by the Contractor to these Contractors, save as are provided for in the Project Specifications, shall be for their accounts only since the Employer shall in no way be responsible to the Contractor for any payments in this respect.

The Contractor shall protect all known existing services as well as all work being carried out and structures being erected on the Site by other Contractors. Any damage caused to these services or structures, or any obstructions or hindrance caused to other contractors by the Contractor, and all claims arising there from, will be the sole responsibility of the Contractor.

All repair work shall be carried out at the Contractor's expense to the entire satisfaction of the Engineer.

The same obligations shall be imposed on the Employer and on other Contractors in respect of the Works being executed under this Contract.

C3.5.1.3 Contractor's Project Management Plan

The Contractor is required to prepare and submit a project management plan for the construction. The particular contents that should be included in the Contractor's Project Management Plan are listed below:

- Project structures and agreements

  The Contractor shall indicate how responsibility for the various work packages will be divided between joint venture partners (where applicable) and sub-contractors. A contract organogram shall be provided showing work apportionment and project management responsibilities. The particular division of work shall match the established capabilities and capacities of each particular partner or subcontractor.

- Plant, materials and equipment

The Contractor shall prepare a Plant and Materials procurement plan, indicating the source of key Plant and Materials designated for inclusion in the Works, and demonstrating that such Plant and Materials have a proven track record of successful maintenance support in South Africa.

The Contractor shall also prepare a plan of Contractor's Equipment, indicating the source and details of construction equipment planned for use on the Contract and based on the Contractor's particular approach.

- Staffing plan

  The Contractor shall prepare a detailed staffing plan showing in an organogram all key members of the Contractor's Personnel, providing a detailed CV for each such key position. The Contractor shall also show the numbers and source of all non key staff and indicating the particular local content offering of the Contractor.

- Method statements

  The Contractor shall clearly describe the overall methodology proposed for construction of the Works and include particular method statements for each work discipline included in the Works.

C3.5.1.4 Construction Programme

The Contractor shall submit within the period stated in the Contract Data a suitable and realistic construction programme for the consideration of the Engineer.

The programme shall be in the form of a Gantt chart and shall include the following details:

- A work breakdown structure, identifying the major activity groups.
- For each activity group further details shall be provided with regard to the scheduled start and end dates of individual activities.
- The linkages between activities shall be clearly indicated and the logical network upon which the programme is based shall be separately submitted to the engineer if requested. Any constraints shall be classified as being time-related or resource-

related.

- The critical path(s) shall be clearly indicated and floats on non-critical activities shall be shown.

- The Contractor shall indicate the working hours per day, night, week and month allowed for in the programme.

- Where relevant the Contractor shall state the production rates for key activities, e.g. earthworks, etc.

Together with the programme as detailed above the contractor shall submit to the engineer a cash flow projection, indicating projected monthly invoice amounts. The cash flow projection shall be updated at monthly intervals to reflect actual payments to date and anticipated further payments.

The programme will be reviewed at the monthly site meetings at which the Contractor shall provide sufficient detail that will allow the comparison of completed work per activity that has fallen behind. The updated programme shall be submitted to the Engineer at least two days prior to the monthly meetings.

If the programme has to be revised by reason of the Contractor falling behind his programme, he shall produce a revised programme showing how he intends to regain lost time in order to ensure completion of the Works within the time for completion or any granted extension of time. Any proposal to increase the tempo of work must be accompanied by positive steps to increase production by providing more labour and plant on site, or by using the available labour and plant in a more efficient manner.

Failure on the part of the Contractor to submit the programme or to work according to the programme or revised programmes shall be sufficient reason for the Engineer to take steps as provided in the General Conditions of Contract.

The approval by the Engineer of any programme shall have no contractual significance other than that the Engineer will be satisfied that the work is carried out according to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. It shall not limit the right of the Engineer to instruct the Contractor to vary the programme if required by circumstances.

C3.5.1.5 Quality Assurance

The Contractor shall institute a quality assurance system and provide experienced personnel as well as all the necessary transport, instruments and equipment, to ensure adequate supervision and positive control of the works at all times in order to comply with the requirements. The Contractor shall deliver to the Engineer, for his consideration, quality assurance programmes prior to the Contractor's appointment of any suppliers or commencement of the Works. Failure to comply with these requirements shall be just cause for the Engineer to order supervision of the Works without additional remuneration or for him to recommend termination to the Employer in terms of the Conditions of Contract.

The Contractor shall do at least the quality control tests at the frequencies specified in the Scope of Works. If the scale of the works, construction methods or any other circumstances dictates, the Contractor shall do more tests when required for quality assurance purposes.

The Contractor shall keep systematic records of the test results and all worksheets relating thereto. All test results obtained by the Contractor in the course of his process control of the Works shall be submitted to the Engineer or his Representative prior to requesting inspection of the relevant portions of the Works. Any request for inspection shall be submitted on the prescribed forms.

The employer is at liberty to carry out such tests as he deems necessary to determine compliance with the contract requirements and will make available the results of all tests to the contractor.

Acceptance control, record keeping and payment certificates shall be done in accordance with the Engineer's standard system except if the Engineer approves that the Contractor's standard system may be used. An index to the Engineer's standard site administration forms is appended as Annexure A to section C3.5.1.

C3.5.1.6 Site Administration

- Daily Site Diary

The daily site diary in accordance with the pro forma appended in Annexure A to

section C3.5.1 shall be kept up to date by the Contractor's Site Agent and will be signed on a daily basis by the Engineer's Representative.

- Information in Respect of Plant

  Information relating to plant on Site shall be recorded in the daily site diary. In addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of construction plant kept on the Site, full particulars given for each day of the month. Distinction shall be made between plant in working order and plant out-of-order. Such inventory shall be submitted by the first day of the month following the month to be reported.

- Information in Respect of Employees

  Information relating to labour and management on Site shall be recorded in the daily site diary. In addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of supervisory staff, labour employed (own and local labour) by category, and sub-contractors (both local and imported) for each day of the month. Such return shall be submitted by the first day of the month following the month to be reported.

- Rainfall Records

  Rainfall records for the period of construction shall be taken on Site and recorded in the daily site diary. The Contractor shall provide and install all the necessary equipment for accurately measuring the rainfall. The Contractor shall also provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his own cost. The Engineer or his Representative shall take and record the daily rainfall readings. The Contractor shall be permitted to attend these readings, in the company of the Engineer's Representative. Access to the measuring gauge(s) shall at all times be under the Engineer's control.

C3.5.1.7 Site Instructions

Site instructions by the Engineer, addressed to the Contractor at his office on the Site, will be numbered consecutively and will be deemed to have been received by the Contractor's Representative unless a break in the sequence of numbers is brought to the notice of the

Engineer in writing immediately.

C3.5.1.8 Site Meetings

The Contractor and his authorised representative shall attend all meetings held on the Site with the Employer and the professional team at dates and times to be determined by the Engineer. Such meetings will be held to evaluate the progress of the Contract, and to discuss matters pertaining to the Contract which any of the parties represented may wish to raise. It is not the intention to discuss day-to-day technical matters at such meetings.

C3.5.1.9 Payment Certificates

Monthly Progress Payment Certificates shall be submitted to the Engineer's Representative on Site not later than the 20th of each month (or on the last working day prior to this date) in order to allow for checking and reconciliation of all quantities, rates, extensions and additions in the certificate. Each progress payment certificate shall include work executed or reasonably expected to be executed up to the 30th day of the specific month. The Engineer's Representative shall have a period of five (5) calendar days to review the draft certificate in collaboration with the Contractor. All quantity calculations and certificates submitted by the Contractor for checking shall be in accordance with the Engineer's standard site administration forms and formats as referred to in C3.5.1.5.

Upon agreement by the Engineer's Representative by not later than the 25th of each month, the certificate shall be submitted by the Contractor in a neat typed form in accordance with the prescribed format, and with the correct spelling, to the Engineer by not later than the 28th of each month (or on the first working day thereafter), together with four additional copies, for certification.

Where dayworks have been instructed by the Engineer, the Contractor shall submit the returns to the Engineer for signature and approval within twenty-four (24) hours of the end of the working day on which the work was executed. Daywork returns shall be submitted on forms according to the Engineer's standard format as referred to in Section C3.5.1.5. Failure to comply with the terms of this clause ill result in non-payment for such dayworks.

The tax invoice submitted with the certificate shall be dated the 1st of the month following the period certified. All costs for the preparation and submission of progress certificates shall be borne by the Contractor.

C3.5.1.10 Drawings, Operation and Maintenance Manuals

All information in the possession of the Contractor that is required by the Engineer's Representative in order to complete the As-Built drawings and to prepare a completion report for the Employer must be submitted to the Engineer's Representative before a Certificate of Practical Completion will be issued for the Works. Similarly, the Contractor will be required to submit full details of all pipes, valves, meters and specials in a suitable loose bound format, including any special operational and maintenance procedures related thereto, for incorporation in the overall operation and maintenance manual for the Scheme prior to the issue of a Certificate of Completion for the Works.

Only figured dimensions on the Drawings may be used in the interpretation thereof, and the Drawings shall not be scaled unless the Contractor is so instructed by the Engineer in writing. The Contractor shall notify the Engineer in writing of any lack of information or conflict in the information on the Drawings. The Engineer will upon written request provide any dimensions that may have been omitted from the Drawings.

Vaal Central Water

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SITE INFORMATION

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PORTION 2: **CONTRACT**

PART C4 **SITE INFORMATION.....C4.1-1**

END OF SECTION

Vaal Central Water

BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

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SITE INFORMATION

C4.1 Site Information

C4.1.1 Geological and Geotechnical Aspects

BIGEN AFRICA SERVICES (PTY) LTD
(Bloemfontein / Pretoria)

GEOTECHNICAL (SOILS) INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR, BLOEMFONTEIN, FREE STATE

SOILS INVESTIGATION

REFERENCE: ML / 318 **Document No.: 2026/633/Doc. (BB0080)** **APRIL 2026**

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES

sanas Testing Laboratory T0455

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Enquiries	:	BLOEMFONTEIN
File Reference	:	ML / 318
Your Reference	:	GEOTECHNICAL (SOILS) INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR, BLOEMFONTEIN, FREE STATE
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SOILS INVESTIGATION

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REPORT

1. INTRODUCTION

1.1 Terms of reference

BIGEN AFRICA SERVICES (PTY) LTD (Bloemfontein / Pretoria) appointed Simlab (Pty) Limited - Geotechnical Services (Bloemfontein) to conduct a Soils Investigation and compile a report for the Proposed Bypass Pipeline and Associated Break Pressure Chamber at the Vaal Central Water Brandkop Reservoir, Bloemfontein, Free State. The scope of the investigation was to investigate the proposed route by excavating a total of five (5) test pits covering the route of the proposed pipe-line.

The purpose of the investigation was to determine the sub-soil conditions that are likely to be encountered during the project along the investigated route.

- Determine the geological and geotechnical characteristics of the *in situ* soils / materials underlying the site.
- Determine the excavatability of the *in situ* soils / materials on site.
- Determine the characteristics of the *in situ* soils / materials for the use of bedding, back filling materials.

This report contains the results and findings of the pipe-line investigation conducted by Simlab (Pty) Limited - Geotechnical Services (Bloemfontein). The investigation includes five (5) test pits and laboratory testing of the *in situ* soils / materials.

Recommendations are made with regard to bedding, back filling of materials, excavatability and for the proposed establishment pipes. Recommendations are based on the information gathered at the time of the investigation.

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1.2 Location

The proposed route for the pipe-line is along the southern edge of the existing Vaal Central Water Brandkop Reservoir, Pellissier, Bloemfontein. The reservoir is located approximately 9.7 km from the Bloemfontein city centre in a western direction.

See Figure 1, Location Plan and Layout Plan in Appendices A & B for more detail.

Figure 1 –Site Location. (Google Earth)

1.3 Route

The approximate total length of the investigated pipe-line route is: ±140m.

1.4 Available Information

At the time of the investigation the following were available:

- 1 : 50 000 Topocadastral map (2926 Bloemfontein)
- 1 : 250 000 Geological map (2926 Bloemfontein)
- Google Photo of the area / site

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2. INFORMATION USED IN THIS STUDY

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- South African Bureau of Standards, Standardized Specifications for Civil Engineering Construction – SABS 1200 LB.

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3. PROJECT DETAIL

3.1 Client

BIGEN AFRICA SERVICES (PTY) LTD (Bloemfontein / Pretoria)

3.2 Client Representative

Mr. Llewellyn Biggs / Me. Marizel Pienaar

3.3 Client Contact Details

Table 1: Client Contact Details

Street Address
Allan Cormack Street The Innovation Hub **PRETORIA** 0087
Tel no: 076 421 3137
llewellyn.biggs@bigengroup.com / marizel.pienaar@bigengroup.com

3.4 Project Name

Geotechnical (Soils) Investigation for the Proposed Bypass Pipeline and Associated Break Pressure Chamber at the Vaal Central Water Brandkop Reservoir, Pellissier, Bloemfontein, Free State.

3.5 Testing Laboratory

Simlab (Pty) Limited – Geotechnical Services (Bloemfontein).

3.6 Laboratory Contact Details

Table 2: Laboratory Contact Details

Postal Address	Street Address
PO Box 6249 **BLOEMFONTEIN** 9300	Cnr. Lunn Road & Grey Street Hilton **BLOEMFONTEIN** 9301
Tel : 051 – 447 0224 / 5	
www.simlab.co.za ; simbfn@simlab.co.za	

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3.7 Sample Details

Sampled by: Mr. PW van Heerden (Technologist)
Date Sampled: 17th of March 2026
Date Tested: 18th of March 2026 to the 8th of April 2026
Report Date: 15th of April 2026

3.8 Sampling and Testing

Sampling was conducted according to TMH5: 1981, Method MA2 and the specifications of the client. Test pits were excavated by means of a TLB (JCB 3CX). Samples were tested according to the SANS 3001 as well as TMH1: 1986, specifications. The test methods used include SANAS accredited methods:

- SANS 3001 – GR1: 2013 – Wet preparation and particle size analysis.
- SANS 3001 – GR10: 2013 – Determination of the one-point liquid limit, plastic limit, plasticity index and linear shrinkage.
- SANS 3001 – GR20: 2010 – Determination of the moisture content by oven-drying.
- SANS 3001 – GR30: 2015 – Determination of the maximum dry density and optimum moisture content.
- SANS 3001 – GR40: 2013 – Determination of the California Bearing Ratio.
- SANS 3001 – PR5: 2011 – Computation of soil-mortar percentages and grading modulus.
- * SABS 0120: Part 3 – The extent to which a particular material will compact.
- * TMH1: 1986, A6 – The determination of the grain size distribution in soils by means of a hydrometer. (Particle Size Distribution of Samples)
- * TMH1: 1986, A20 – The electrometric determination of the pH-value of a soil suspension.
- * TMH1: 1986, A21T – Tentative method for the determination of the conductivity of a saturated soil paste and water.
- * TMH6: 1984, ST6 - Dynamic Cone Penetrometer (DCP) Test
- * COTO Classification of Materials properties.
- * Potential Expansiveness of the Materials – Van Der Merwe's Method (1964).
- * Estimated Bearing Ratio of the Materials – Dr. B van Wyk's method.

Tests marked "*" In this report are not in the SANAS Schedule of Accreditation for this laboratory and is not SANAS accredited. Opinions and interpretations expressed in the report are outside the scope of SANAS Accreditation of Simlab (Pty) Limited – Geotechnical Services

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3.9 Positions Sampled

Simlab (Pty) Limited – Geotechnical Services (Bloemfontein) sampled and tested at the positions specified by the Client: BIGEN AFRICA SERVICES (PTY) LTD (Bloemfontein / Pretoria) and is indicated on the Layout Plan (Appendix B).

3.10 Evaluation

The results of the tests are evaluated in reference to COTO (2020) and the SABS 1200 LB.

Table 3: Material Symbols and Abbreviated Specifications used in COTO (2020) and SABS 1200 LB

COTO Class	Material	Abbreviated Specification
G5B	Natural gravel	Minimum CBR ≥ 45% at 95% MDD; Maximum size 63 mm or 2/3 of layer thickness; GM: 1.5 – 2.5; LL ≤ 30; PI ≤ 10; LS ≤ 5%; Swell ≤ 0.5% at 100% MDD
G6	Natural gravel	Minimum CBR ≥ 25% at 95% MDD; Maximum size 63 mm or 2/3 of layer thickness; GM: 1.5 – 2.5; LL ≤ 30; PI ≤ 2GM +10; LS ≤ 7%; Swell ≤ 0.5% at 100% MDD
G7	Gravel / Soil	Minimum CBR ≥ 15% at 93% MDD; Maximum size 2/3 of layer thickness; GM: 0.75 – 2.7; PI ≤ 3GM +10; Swell ≤ 1.5% at 100% MDD
G8	Gravel / Soil	Minimum CBR ≥ 10% at 93% MDD; Maximum size 2/3 of layer thickness; GM: 0.75 – 2.7; PI ≤ 3GM +10; Swell ≤ 1.5% at 100% MDD
G9	Gravel / Soil	Minimum CBR ≥ 7% at 93% MDD; Maximum size 2/3 of layer thickness; GM: 0.75 – 2.7; PI ≤ 3GM +10; Swell ≤ 1.5% at 100% MDD
Materials – SABS 1200 LB		
Class B and Class C Bedding		Selected granular materials
Blanket		Selected fill materials
Selected Granular Materials		Singularly graded between 0.6mm and 19mm; Compactability not exceeding 0.4
Selected Fill Materials		PI not exceeding 6; No lumps and stones exceeding diameter of 30mm.

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4. GEOLOGY AND TOPOGRAPHY

4.1 Geology

The geology of the Bloemfontein area is underlain by the Lower Stage of the Beaufort Group which is part of the Karoo Super Group. The sedimentary rocks that are present in this group consist of fine-grained grey Sandstone and coarse Arkose alternating with green and maroon-coloured Mudstone beds. The typical materials / rock type found in the area of Bloemfontein are Dolerite, (K_3l) Sandstone / Shale / Mudstone and (K_2u) Mudstone / Shale. Table 4 summarise the Geology found in the area of Bloemfontein.

Table 4: Geology Formation

Symbol	Typical Materials / Rock Type	Super Group	Group	Sub - Group	Formation
	Dolerite	Intrusive Rock			
K_3l	Sandstone / Shale / Mudstone	KAROO	BEAUFORT	Lower	-
K_2u	Mudstone / Shale	KAROO	ECCA	Upper	-

Figure 2 is an extract of the 2926, Bloemfontein Geology map indicating the estimated position of the site.

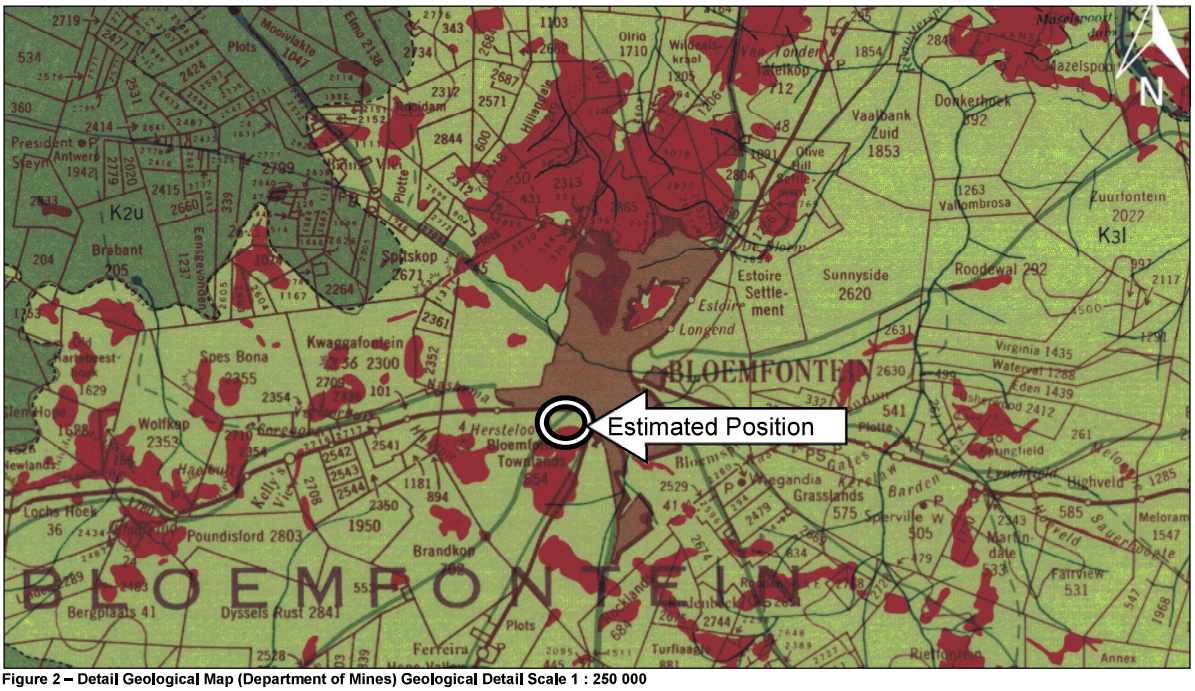

Figure 2 – Detail Geological Map (Department of Mines) Geological Detail Scale 1 : 250 000

4.2 Topography

The proposed pipe-line runs along the existing Brandkop reservoir which is located atop Brandkop, Pellissier, Bloemfontein. The site adjacent to the reservoir is covered in excavated boulders and rubble. Large trees cover the northern section of the proposed pipeline. In-between the rubble and reservoir, a dirt road runs along the length of the reservoir with a downward slope from south towards the north.

5. PIPE-LINE INVESTIGATION

The Investigation was conducted along the proposed route at the Vaal Central Water Brandkop Reservoir, Pellissier, Bloemfontein, Free State.

Test pit positions were indicated by the client. A total of five (5) test pits were excavated up to an average depth of 1.060m ranging from 0.500m to 1.600m. Site photos are presented in Appendix F. The in-situ test pit profiles and test pit with materials photos can be found in Appendix C.

Random layers of each test pit were sampled and profiled as per the client's request. The materials of each test pit were tested to determine the in-situ characteristics and evaluated according to COTO (2020) and SABS 1200 LB. These test results can be found in Appendix D.

5.1 Materials Discussion

Table 5 below discusses the different materials and the soil properties of each section respectively.

Table 5: Pipe-line Materials Discussion

Test Pit No. & Layer	Description (USC)	Classification Details (min. – max.)	Classification and recommended usage
TP 1: 0 – 200 TP 2: 700 – 1000 TP 3: 0 – 1100 TP 4: 1400 – 1600	Clayey SAND with gravel (SC)	MDD: 2108 – 2190 OMC: 7.6 – 9.5 CBR Swell %: 0.4 – 2.5 CBR @ 100%: 20 – 76 CBR @ 95%: 9 – 29 CBR @ 93%: 6 – 20 Compactability: 0.32 – 0.36 LL: 25 – 37 PI: 8 – 17 LS: 4.0 – 8.0 GM: 2.04 – 2.16 Clay: 2 – 8 Silt: 9 – 13 Sand: 23 – 38 Gravel: 47 – 60 Expansiveness: Low	Unified Soil Classification: SC COTO Classification: G7: TP2 & TP3: Material is suitable for Selected and Subgrade layers. No Classification: TP4: Material is not suitable for any layer works. Suitability SABS 1200 LB: Not Suitable for Bedding and Blanket materials.

Test Pit No. & Layer	Description (USC)	Classification Details (min. – max.)	Classification and recommended usage
TP1: 200 – 500	Well graded SAND with clay and gravel (SW-SC)	MDD: 2291 OMC: 5.5 CBR Swell %: 0.1 CBR @ 100%: 115 CBR @ 95%: 54 CBR @ 93%: 40 Compactability: 0.34 LL: 21 PI: 4 LS: 2.0 GM: 2.20 Clay: 1 Silt: 10 Sand: 33 Gravel: 56 Expansiveness: Low	Unified Soil Classification: SW-SC COTO Classification: G5B: TP1: Material is suitable for Subbase, Selected and Subgrade layers. Suitability SABS 1200 LB: Not Suitable for Bedding and Blanket materials.
TP 2: 0 – 700	Sandy lean CLAY (CL)	LL: 28 PI: 10 LS: 5.0 GM: 0.85 Clay: 11 Silt: 40 Sand: 35 Gravel: 14 Expansiveness: Low	Unified Soil Classification: CL COTO Classification: No Classification: TP2: Material is not suitable for any layer works. Suitability SABS 1200 LB: Not Suitable for Bedding and Blanket materials.

Note: TP - Test Pit

6. EXCAVATIBILITY

The average depth of the excavations is 1.060m ranging from 0.500m to 1.600m. Excavation in the area of the proposed site should generally be feasible with large (Excavator) equipment, with Firm and Dense to Very Ddense materials occurring on site. The restricted excavation class for the investigated area, to an average depth of 1.060, is Soft Excavation, according to the SANS 634:2012 Edition 1.

The materials found at the bottom of the test pits are typically classified as Hard Excavation. Hard Excavation Materials cannot be removed without blasting or wedging and splitting according to SANS 634:2012 Edition 1 which is summarised in Table 6.

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Table 6: Classification of Materials for Machine Excavation (SANS 634:2012 Edition 1)

Excavation	Classification	Description
Restricted	Soft	Materials can be efficiently removed by back-acting excavator (TLB) with flywheel power >0.10 kW for every tined bucket width
	Intermediate	Materials can be removed by excavator with flywheel power >0.10 kW for every tined bucket width or with the use of pneumatic tools
	Hard Rock	Materials that cannot be removed without blasting or wedging and splitting

Table 7: Test Pit Excavation Depth

Test Pit No.	Depth of Test Pit (m)	Materials Description at Bottom of Test Pit	Excavation Class at Bottom of Test Pit
Test Pit 1	0.500	Hard Dolerite	Hard Rock
Test Pit 2	1.000	Hard Weathered Dolerite	Hard Rock
Test Pit 3	1.100	Large Dolerite Boulders	Hard Rock
Test Pit 4	1.600	Hard Dolerite	Hard Rock
Test Pit 5	1.100	Hard Dolerite	Hard Rock

7. GROUND WATER CONDITIONS

Ground-water seepage was not encountered at the time of the investigation in any of the test pits. A shallow water-table can be expected from time to time during the rainy season. Considering the natural environment and climate, one can expect that the ground-water seepage may theoretically occur above the investigated average test pit depth of 1.060m.

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8. SUMMARY & RECOMMENDATIONS

Material Quality

- In terms of Selected Granular Materials, all materials tested are not suitable for Selected Granular Materials. Therefore, alternative sources of materials are recommended to be used.
- In terms of Selected Fill, all materials tested are not suitable for Selected Fill. Therefore, alternative sources of materials are recommended to be used.
- Materials are not suitable for Bedding And Blanket materials according to SABS 1200 LB.

Excavatability

- Test Pit 1 to Test Pit 5 is Hard Rock below the average depth of 1.060m according to SANS 634:2012.
- The materials found at the bottom of the test pits are typically classified as Hard Excavation. Hard Excavation Materials cannot be removed without blasting or wedging and splitting according to SANS 634:2012 Edition 1.

Trenching

- It is recommended to excavate trenches in 20m to 30m sections to lessen the chances of unstable trench walls.
- The risk of unstable trench walls is low due to the average excavation depth of 1.060m.
- Potentially unstable trench walls must be supported and inspected daily. This includes areas where high moisture content of the soil is located.

Groundwater

- Areas with shallow to moderately deep bedrock may display a perched water table, especially during the rainy seasons.
- It is recommended to provide for dewatering excavations in the areas that will be prone to water seepage.
- Water seepage may cause instability in the excavated trench walls. It is therefore recommended to inspect the excavations daily for signs of instability.

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We trust this report meets your requirements.

PW VAN HEERDEN (Technologist)
(N Dip Eng.: Civil (General), B Tech Eng.: Transportation)
(ECSA Registration Number.: 2019401970)

BJ VAN VUUREN (Technologist / CEO)
(N Dip Eng.: Civil (General), B Tech Eng.: Geotechnical, BSc (Hons) Eng.: Transportation Planning)
(ECSA Registration Number.: 200380075)
(Technical Signatory)

For: **SIMLAB (PTY) LIMITED – GEOTECHNICAL SERVICES (BLOEMFONTEIN)**

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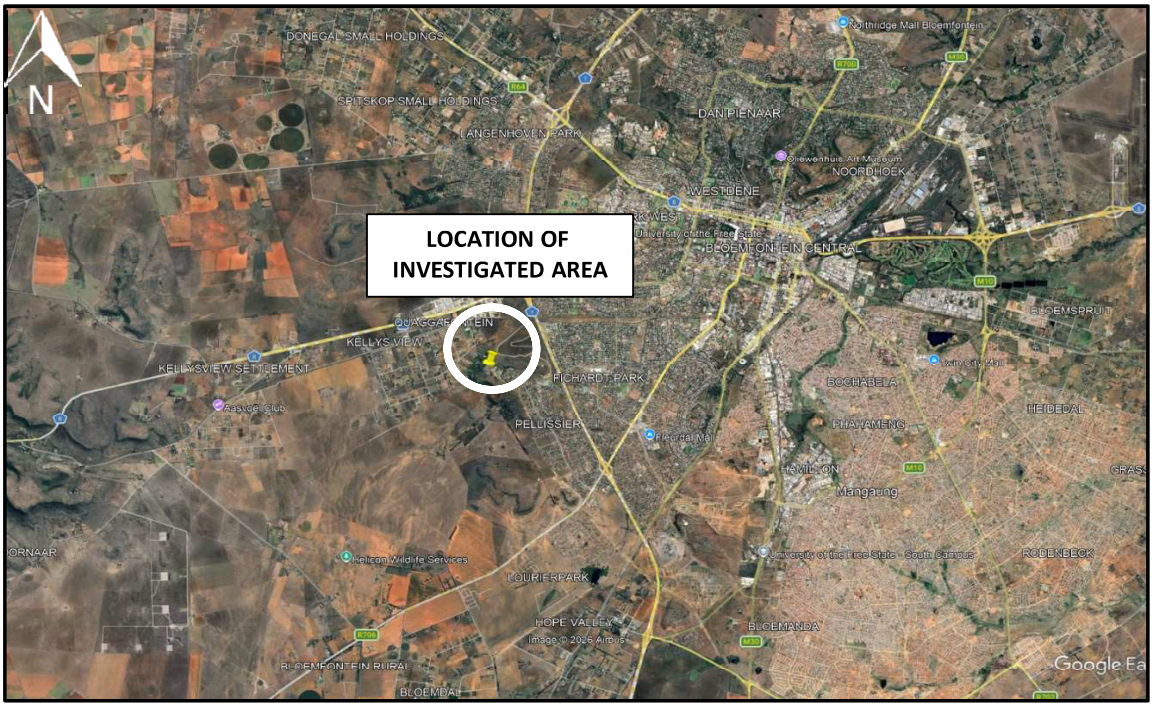
APPENDIX A

LOCALITY PLAN

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
+27 (0) 51 447 0224/5, simbfn@simlab.co.za

sanas Testing Laboratory T0455

LOCALITY PLAN



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APPENDIX B

LAYOUT PLAN

6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
+27 (0) 51 447 0224/5, simbfn@simlab.co.za

LAYOUT PLAN

COORDINATES

Test Pit 1 / DCP 1 : 27 Y0082233 X3225625
Test Pit 2 / DCP 2 : 27 Y0082286 X3225596
Test Pit 3 / DCP 3 : 27 Y0082351 X3225547
Test Pit 4 / DCP 4 : 27 Y0082314 X3225572
Test Pit 5 / DCP 5 : 27 Y0082269 X3225617
DCP 6 : 27 Y0082252 X3225623
DCP 7 : 27 Y0082278 X3225607
DCP 8 : 27 Y0082300 X3225584
DCP 9 : 27 Y0082334 X3225559

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APPENDIX C

*IN SITU MATERIAL PROFILES

(Test Pits with Materials Photos)

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

HOLE No: Test Pit 1
Sheet 1 of 1

JOB NUMBER: 2026/633/Doc.

Scale			
BB1	1:10	0.00	Dry red brown medium dense clayey SAND with weathered dolerite gravel; Transported.
		0.20	Slightly moist light brown dense well graded SAND with clay and weathered dolerite gravel; Residual.
BB2		0.50	0.500+ Refusal - Hard dolererite.

NOTES

1) Disturbed sample BB1 taken at 0.100m.
2) Disturbed sample BB2 taken at 0.350m.
3) No groundwater seepage was encountered in the test pit.
4) SOUTH AFRICAN - WGS84 CO-ORDINATE SYSTEM USED.

CONTRACTOR : SIMLAB (PTY) LIMITED
MACHINE : TLB (JCB 3CX)
DRILLED BY : Mr. PW van Heerden
PROFILED BY : SIMLAB (PTY) LIMITED

INCLINATION : VERTICAL
DIAM : 600mm
DATE : 17/03/2026
DATE : 13/04/2026

ELEVATION : -
X-COORD : X3225625
Y-COORD : 27 Y0082233

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

DATE : 13/04/2026 17:24
TEXT : ..SituProfile(DotPlot).txt

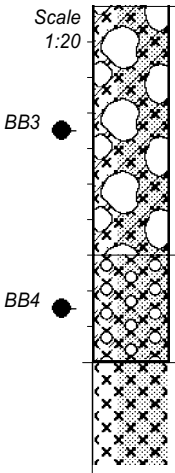
HOLE No: Test Pit 1

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

HOLE No: Test Pit 2
Sheet 1 of 1

JOB NUMBER: 2026/633/Doc.

Scale 1:20



0.00 Slightly moist red brown firm shattered sandy lean CLAY with dolerite boulders; Transported.

0.70 Slightly moist light grey brown very dense clayey SAND with weathered dolerite gravel; Residual.

1.00 1.000+ Refusal - Hard weathered dolerite.

NOTES

1) Disturbed sample BB3 taken at 0.350m.
2) Disturbed sample BB4 taken at 0.850m.
3) No groundwater seepage was encountered in the test pit.
4) SOUTH AFRICAN - WGS84 CO-ORDINATE SYSTEM USED.

CONTRACTOR : SIMLAB (PTY) LIMITED
MACHINE : TLB (JCB 3CX)
DRILLED BY : Mr. PW van Heerden
PROFILED BY : SIMLAB (PTY) LIMITED

INCLINATION : VERTICAL
DIAM : 600mm
DATE : 17/03/2026
DATE : 13/04/2026

ELEVATION : -
X-COORD : X3225596
Y-COORD : 27 Y0082286

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

DATE : 13/04/2026 17:24
TEXT : ..SituProfile(DotPlot).txt

HOLE No: Test Pit 2

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

HOLE No: **Test Pit 3**
Sheet 1 of 1

JOB NUMBER: **2026/633/Doc.**

Scale 1:20

BB5

0.00

Slightly moist red brown loose clayey SAND with weathered dolerite gravel and dolerite boulders. Residual.

1.10

1.100+ Refusal - Large dolerite boulders.

NOTES

1) Disturbed sample BB5 taken at 0.550m.
2) No groundwater seepage was encountered in the test pit.
3) SOUTH AFRICAN - WGS84 CO-ORDINATE SYSTEM USED.

CONTRACTOR : SIMLAB (PTY) LIMITED
MACHINE : TLB (JCB 3CX)
DRILLED BY : Mr. PW van Heerden
PROFILED BY : SIMLAB (PTY) LIMITED

INCLINATION : VERTICAL
DIAM : 600mm
DATE : 17/03/2026
DATE : 13/04/2026

ELEVATION : -
X-COORD : X3225547
Y-COORD : 27 Y0082351

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

DATE : 13/04/2026 17:24
TEXT : ..SituProfile(DotPlot).txt

HOLE No: **Test Pit 3**

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

HOLE No: Test Pit 4
Sheet 1 of 1

JOB NUMBER: 2026/633/Doc.

Scale 1:20

0.00		Slightly moist red brown medium dense clayey SAND with dolerite boulders. Residual.
1.40	BB6	Slightly moist dark brown dense clayey SAND with weathered dolerite gravel and dolerite boulders; Residual.
1.60		1.600+ Refusal - Hard dolererite.

NOTES

1) Disturbed sample BB6 taken at 1.500m.
2) No groundwater seepage was encountered in the test pit.
3) SOUTH AFRICAN - WGS84 CO-ORDINATE SYSTEM USED.

CONTRACTOR : SIMLAB (PTY) LIMITED
MACHINE : TLB (JCB 3CX)
DRILLED BY : Mr. PW van Heerden
PROFILED BY : SIMLAB (PTY) LIMITED

INCLINATION : VERTICAL
DIAM : 600mm
DATE : 17/03/2026
DATE : 13/04/2026

ELEVATION : -
X-COORD : X3225572
Y-COORD : 27 Y0082314

HOLE No: Test Pit 4

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

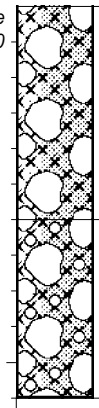
DATE : 13/04/2026 17:24
TEXT : ..SituProfile(DotPlot).txt

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

HOLE No: Test Pit 5
Sheet 1 of 1

JOB NUMBER: 2026/633/Doc.

Scale 1:20



0.00	Slightly moist red brown medium dense clayey SAND with dolerite boulders. Residual.
0.60	Slightly moist dark brown dense clayey SAND with weathered dolerite gravel and dolerite boulders; Residual.
1.10	1.100+ Refusal - Hard dolererite.

NOTES

1) No groundwater seepage was encountered in the test pit.
2) SOUTH AFRICAN - WGS84 CO-ORDINATE SYSTEM USED.

CONTRACTOR : SIMLAB (PTY) LIMITED
MACHINE : TLB (JCB 3CX)
DRILLED BY : Mr. PW van Heerden
PROFILED BY : SIMLAB (PTY) LIMITED

INCLINATION : VERTICAL
DIAM : 600mm
DATE : 17/03/2026
DATE : 13/04/2026

ELEVATION : -
X-COORD : X3225617
Y-COORD : 27 Y0082269

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

DATE : 13/04/2026 17:24
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HOLE No: Test Pit 5

BIGEN AFRICA SERVICES (PTY) LTD
SOILS INVESTIGATION FOR THE PROPOSED BYPASS PIPELINE AND ASSOCIATED BREAK PRESSURE CHAMBER AT THE VAAL CENTRAL WATER BRANDKOP RESERVOIR
BLOEMFONTEIN, FREE STATE

LEGEND
Sheet 1 of 1

JOB NUMBER: 2026/633/Doc.

	BOULDERS	{SA01}
	GRAVEL	{SA02}
	SAND	{SA04}
	SANDY	{SA05}
	CLAY	{SA08}
	CLAYEY	{SA09}
	DOLERITE	{SA18}{SA42}
Name ●	DISTURBED SAMPLE	{SA38}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : Mr. PW van Heerden
SETUP FILE : STANDARD.SET

DATE : 13/04/2026 17:24
TEXT : ..SituProfile(DotPlot).txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX D

LABORATORY TEST RESULTS

(Particle Size Distribution) (Material Classification)

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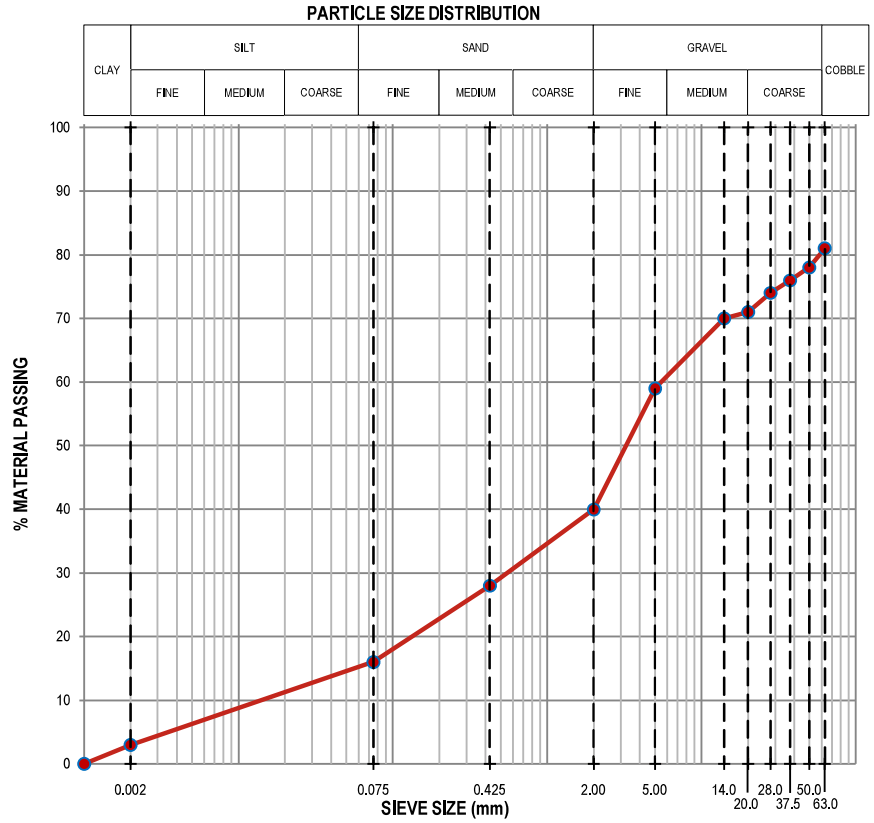
Simlab (EDMS) BEPERK (PTY) LIMITED GEOTEGNIESE DIENSTE GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
+27 (0) 51 447 0224/5, +27 (0) 51 448 8329, simbfn@simlab.co.za

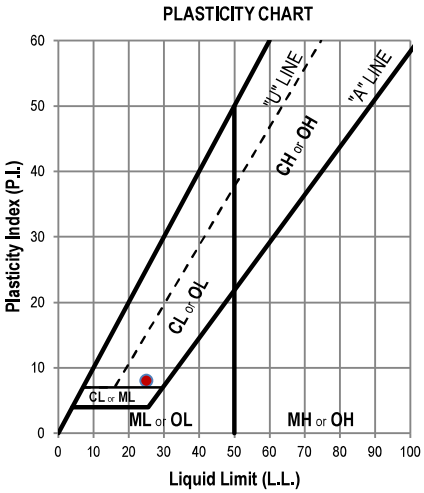
sanas Testing Laboratory T0455

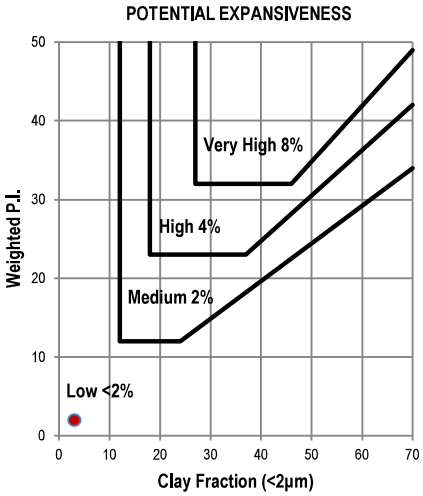
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 1	MATERIAL DEPTH (mm) :	0 - 200	SAMPLE No / LABORATORY No.:	BB1
MATERIAL DESCRIPTION :	Dry red brown medium dense clayey SAND with weathered dolerite gravel; Transported.				

IN SITU MOISTURE CONTENT (GR20) (%)		4.3
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	81
	50.0 mm	78
	37.5 mm	76
	28.0 mm	74
	20.0 mm	71
	14.0 mm	70
	5.00 mm	59
	2.00 mm	40
	0.425 mm	28
	0.075 mm	16
*TMH1: METHOD A6	0.002 mm	3
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.16
SOIL MORTAR	COARSE SAND	30
	FINE SAND (Course)	8
	FINE SAND (Medium)	8
	FINE SAND (Fine)	15
	SILT AND CLAY (<0.075mm)	39
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	25
	P.I. (%)	8
	L.S. (%)	4.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	415.6
	C_C (ASTM D2487)	3.7
	% Clay (>0.002mm)	3
	% Silt (0.075 - 0.002mm)	13
	% Sand (0.075 - 2.0mm)	24
	% Gravel (>2.0mm)	60
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	
	OPTIMUM MOISTURE (%)	
	SWELL (%)	
	CBR @ 100%	
	CBR @ 98%	
	CBR @ 95%	
	CBR @ 93%	
	CBR @ 90%	
PROCTOR MAX. DRY DENSITY (kg/m³)		
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.1611
*pH VALUE (TMH1: Method A21)		7.67
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-2-4 (0)
*UNIFIED SOIL CLASSIFICATION		SC
*COLTO CLASSIFICATION		







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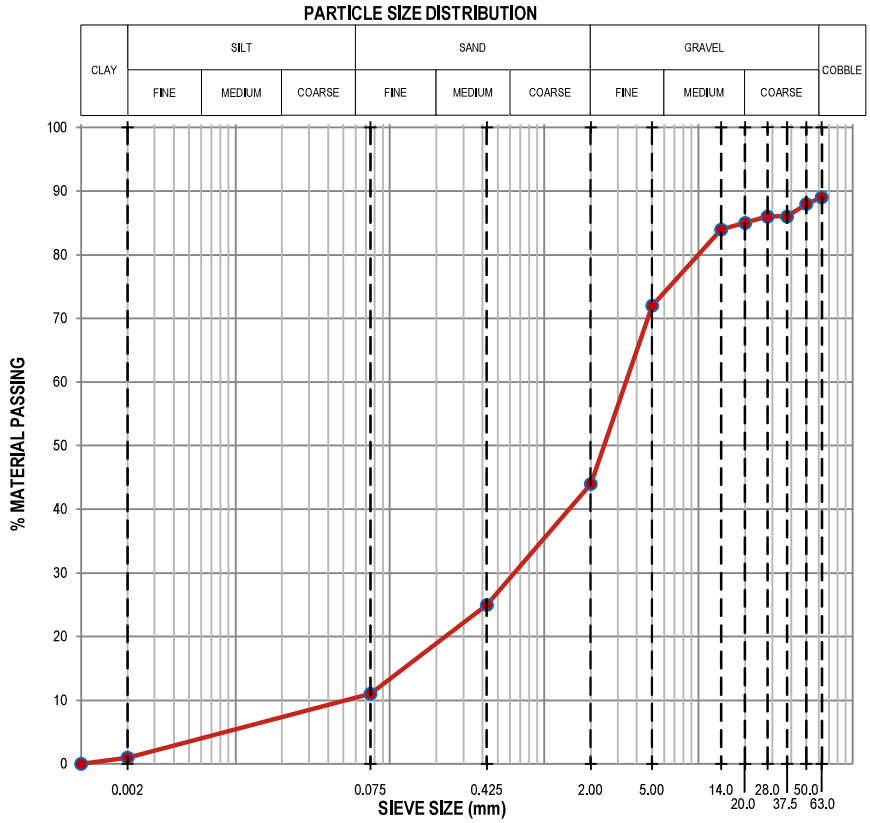
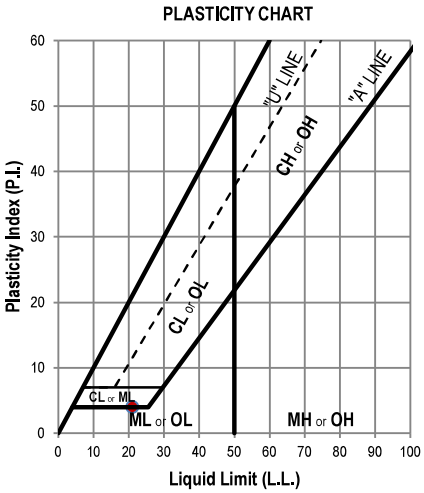
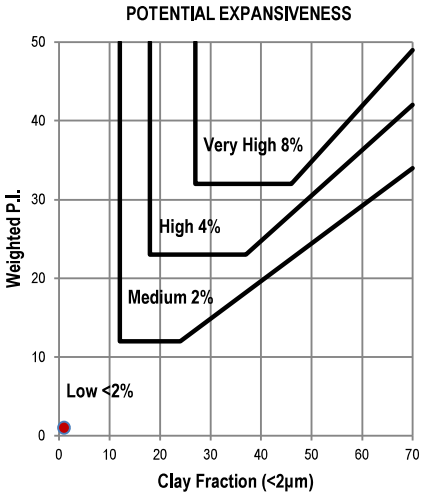
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 1	MATERIAL DEPTH (mm) :	200 - 500	SAMPLE No / LABORATORY No.:	0
MATERIAL DESCRIPTION :	Slightly moist light brown dense well graded SAND with clay and weathered dolerite gravel; Residual.				

IN SITU MOISTURE CONTENT (GR20) (%)		6.0
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	89
	50.0 mm	88
	37.5 mm	86
	28.0 mm	86
	20.0 mm	85
	14.0 mm	84
	5.00 mm	72
	2.00 mm	44
	0.425 mm	25
	0.075 mm	11
*TMH1: METHOD A6	0.002 mm	1
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.20
SOIL MORTAR	COARSE SAND	44
	FINE SAND (Course)	12
	FINE SAND (Medium)	8
	FINE SAND (Fine)	12
	SILT AND CLAY (<0.075mm)	25
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	21
	P.I. (%)	4
	L.S. (%)	2.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	71.4
	C_C (ASTM D2487)	2.1
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	10
	% Sand (0.075 - 2.0mm)	33
	% Gravel (>2.0mm)	56
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	2291
	OPTIMUM MOISTURE (%)	5.5
	SWELL (%)	0.1
	CBR @ 100%	115
	CBR @ 98%	85
	CBR @ 95%	54
	CBR @ 93%	40
	CBR @ 90%	26
PROCTOR MAX. DRY DENSITY (kg/m³)		2062
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		0.34
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
*pH VALUE (TMH1: Method A21)		
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-1-a (0)
*UNIFIED SOIL CLASSIFICATION		SW-SC
*COLTO CLASSIFICATION		G5B







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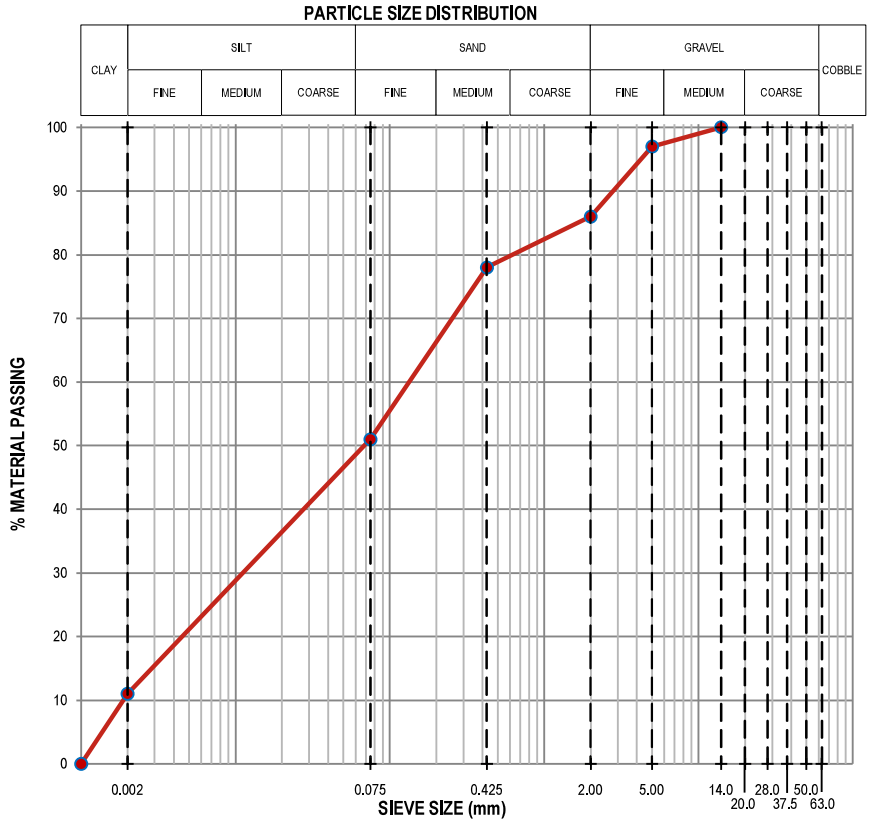
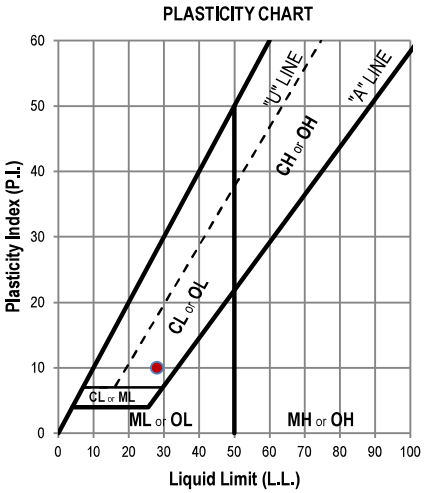
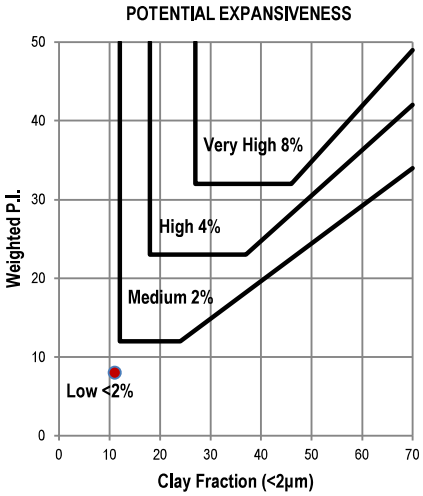
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 2	MATERIAL DEPTH (mm) :	0 - 700	SAMPLE No / LABORATORY No.:	BB3
MATERIAL DESCRIPTION :	Slightly moist red brown firm shattered sandy lean CLAY with dolerite boulders; Transported.				

IN SITU MOISTURE CONTENT (GR20) (%)		9.2
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	
	50.0 mm	
	37.5 mm	
	28.0 mm	
	20.0 mm	
	14.0 mm	100
	5.00 mm	97
	2.00 mm	86
	0.425 mm	78
	0.075 mm	51
*TMH1: METHOD A6	0.002 mm	11
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	0.85
SOIL MORTAR	COARSE SAND	9
	FINE SAND (Course)	4
	FINE SAND (Medium)	9
	FINE SAND (Fine)	19
	SILT AND CLAY (<0.075mm)	59
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	28
	P.I. (%)	10
	L.S. (%)	5.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	96.0
	C_C (ASTM D2487)	0.3
	% Clay (>0.002mm)	11
	% Silt (0.075 - 0.002mm)	40
	% Sand (0.075 - 2.0mm)	35
	% Gravel (>2.0mm)	14
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	
	OPTIMUM MOISTURE (%)	
	SWELL (%)	
	CBR @ 100%	
	CBR @ 98%	
	CBR @ 95%	
	CBR @ 93%	
	CBR @ 90%	
PROCTOR MAX. DRY DENSITY (kg/m³)		
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.1134
*pH VALUE (TMH1: Method A21)		5.46
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-4a (2)
*UNIFIED SOIL CLASSIFICATION		CL
*COLTO CLASSIFICATION		







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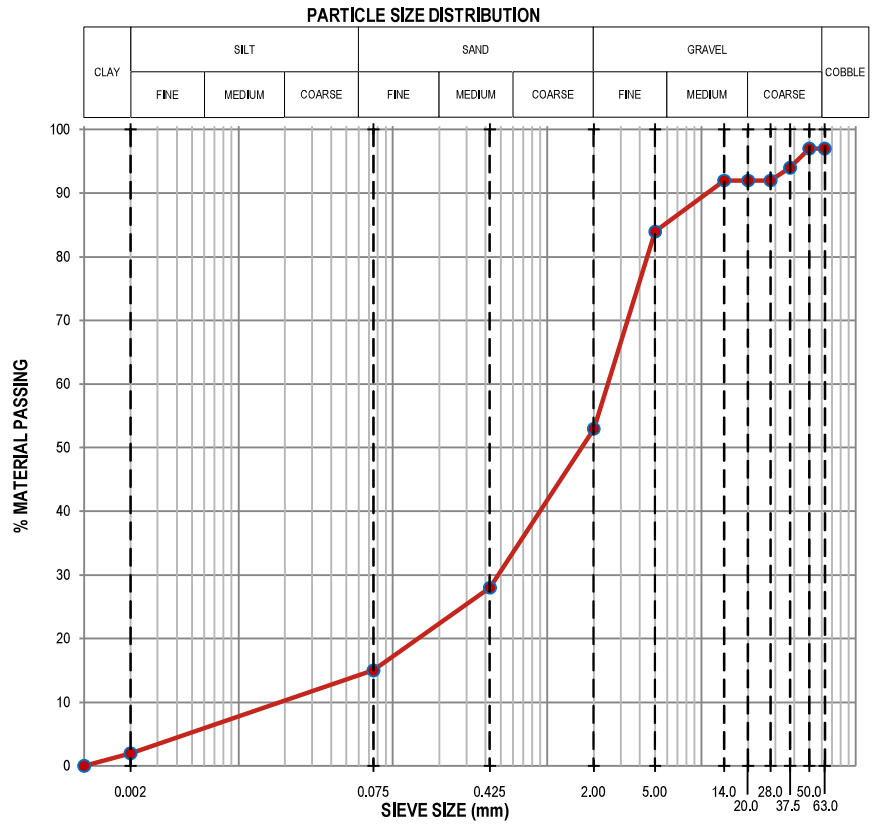
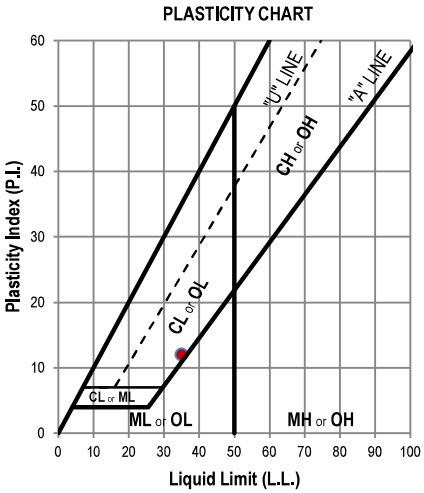
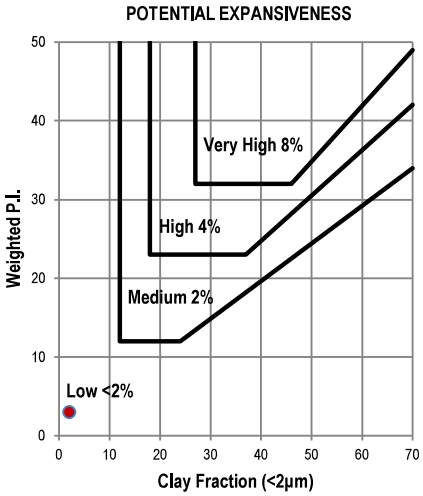
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 2	MATERIAL DEPTH (mm) :	700 - 1000	SAMPLE No / LABORATORY No.:	BB4
MATERIAL DESCRIPTION :	Slightly moist light grey brown very dense clayey SAND with weathered dolerite gravel; Residual.				

IN SITU MOISTURE CONTENT (GR20) (%)		4.6
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	97
	50.0 mm	97
	37.5 mm	94
	28.0 mm	92
	20.0 mm	92
	14.0 mm	92
	5.00 mm	84
	2.00 mm	53
	0.425 mm	28
	0.075 mm	15
*TMH1: METHOD A6	0.002 mm	2
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.04
SOIL MORTAR	COARSE SAND	46
	FINE SAND (Course)	10
	FINE SAND (Medium)	7
	FINE SAND (Fine)	8
	SILT AND CLAY (<0.075mm)	29
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	35
	P.I. (%)	12
	L.S. (%)	6.5
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	140.9
	C_C (ASTM D2487)	4.5
	% Clay (>0.002mm)	2
	% Silt (0.075 - 0.002mm)	13
	% Sand (0.075 - 2.0mm)	38
	% Gravel (>2.0mm)	47
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	2190
	OPTIMUM MOISTURE (%)	7.6
	SWELL (%)	0.6
	CBR @ 100%	76
	CBR @ 98%	52
	CBR @ 95%	29
	CBR @ 93%	20
	CBR @ 90%	11
PROCTOR MAX. DRY DENSITY (kg/m³)		1971
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		0.36
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.0603
*pH VALUE (TMH1: Method A21)		6.77
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-2-6 (0)
*UNIFIED SOIL CLASSIFICATION		SC
*COLTO CLASSIFICATION		G7







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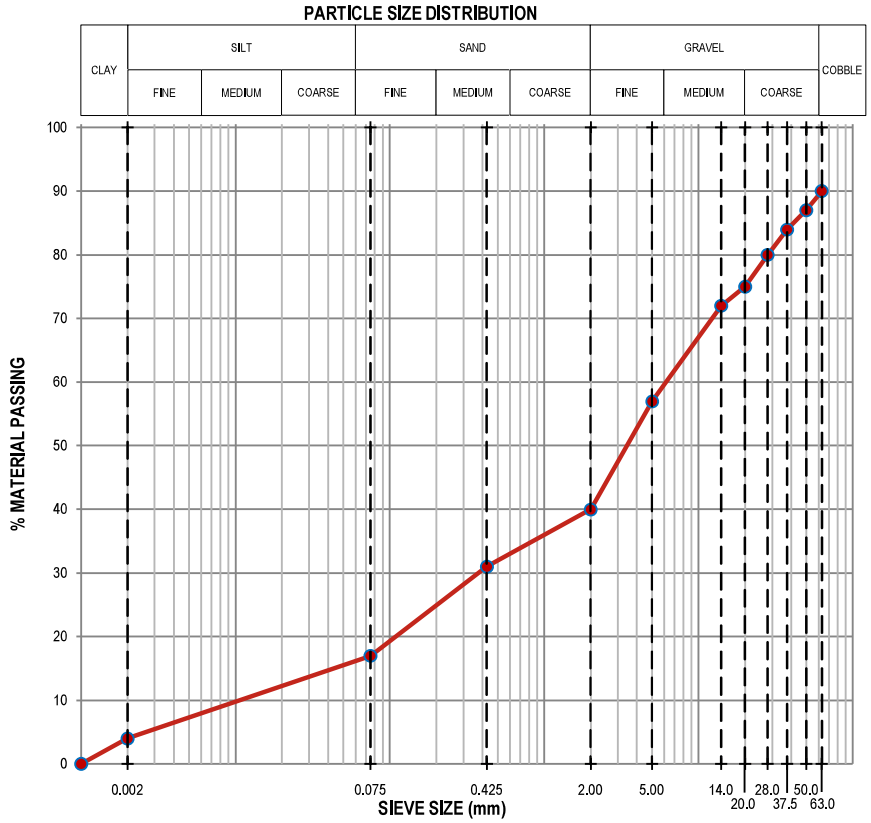
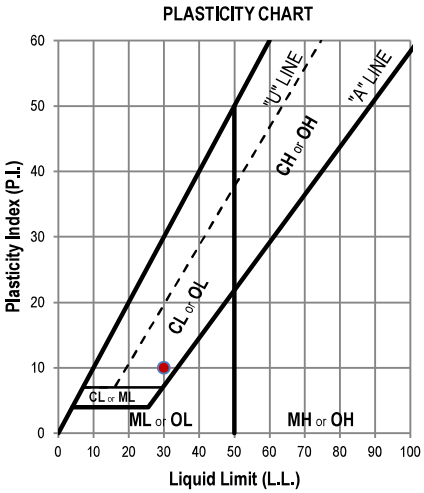
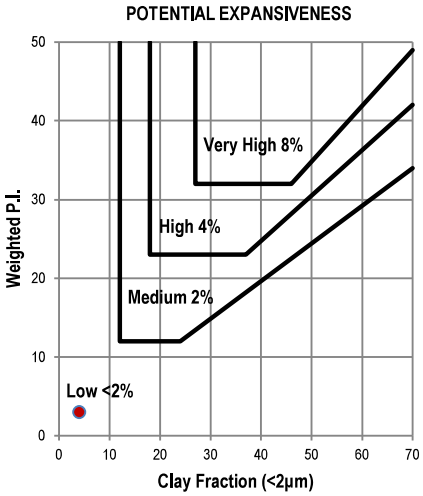
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 3	MATERIAL DEPTH (mm) :	0 - 1100	SAMPLE No / LABORATORY No.:	BB5
MATERIAL DESCRIPTION :	Slightly moist red brown loose clayey SAND with weathered dolerite gravel and dolerite boulders. Residual.				

IN SITU MOISTURE CONTENT (GR20) (%)		9.1
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	90
	50.0 mm	87
	37.5 mm	84
	28.0 mm	80
	20.0 mm	75
	14.0 mm	72
	5.00 mm	57
	2.00 mm	40
	0.425 mm	31
	0.075 mm	17
*TMH1: METHOD A6	0.002 mm	4
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.12
SOIL MORTAR	COARSE SAND	21
	FINE SAND (Course)	5
	FINE SAND (Medium)	9
	FINE SAND (Fine)	22
	SILT AND CLAY (<0.075mm)	43
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	30
	P.I. (%)	10
	L.S. (%)	5.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	618.2
	C_C (ASTM D2487)	1.9
	% Clay (>0.002mm)	4
	% Silt (0.075 - 0.002mm)	13
	% Sand (0.075 - 2.0mm)	23
	% Gravel (>2.0mm)	60
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	2157
	OPTIMUM MOISTURE (%)	9.5
	SWELL (%)	0.4
	CBR @ 100%	33
	CBR @ 98%	27
	CBR @ 95%	20
	CBR @ 93%	16
	CBR @ 90%	12
PROCTOR MAX. DRY DENSITY (kg/m³)		1941
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		0.36
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.1074
*pH VALUE (TMH1: Method A21)		6.75
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-2-4 (0)
*UNIFIED SOIL CLASSIFICATION		SC
*COLTO CLASSIFICATION		G7







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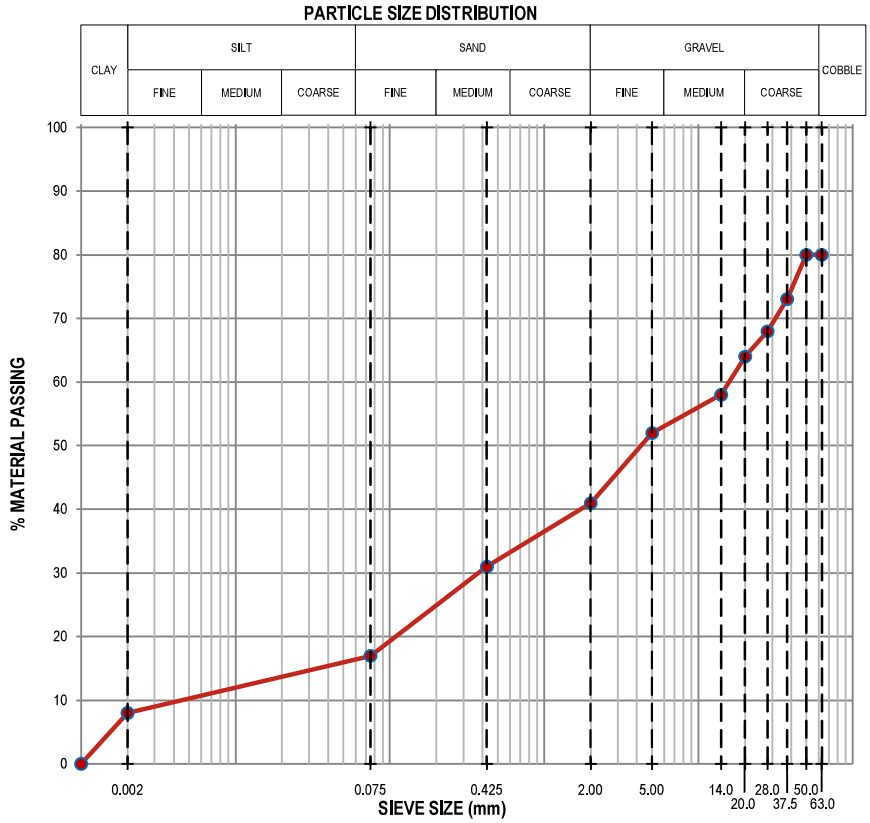
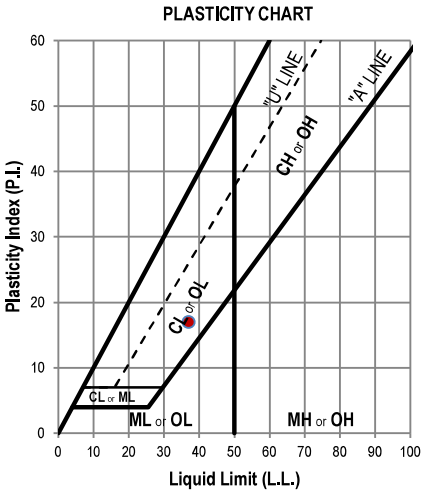
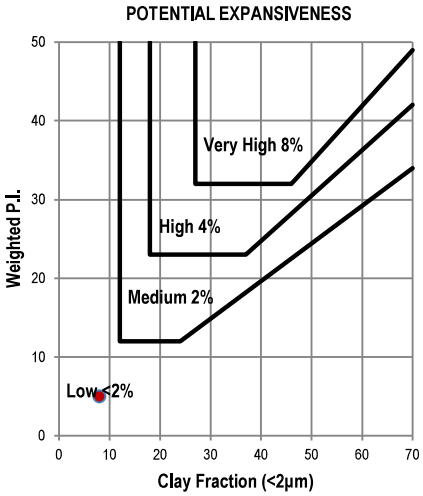
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Test Pit 4	MATERIAL DEPTH (mm) :	1400 - 1600	SAMPLE No / LABORATORY No.:	BB6
MATERIAL DESCRIPTION :	Slightly moist dark brown dense clayey SAND with weathered dolerite gravel and dolerite boulders; Residual.				

IN SITU MOISTURE CONTENT (GR20) (%)		8.9
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	80
	50.0 mm	80
	37.5 mm	73
	28.0 mm	68
	20.0 mm	64
	14.0 mm	58
	5.00 mm	52
	2.00 mm	41
	0.425 mm	31
	0.075 mm	17
*TMH1: METHOD A6	0.002 mm	8
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.11
SOIL MORTAR	COARSE SAND	25
	FINE SAND (Course)	3
	FINE SAND (Medium)	9
	FINE SAND (Fine)	23
	SILT AND CLAY (<0.075mm)	40
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	37
	P.I. (%)	17
	L.S. (%)	8.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	4000.0
	C_C (ASTM D2487)	2.2
	% Clay (>0.002mm)	8
	% Silt (0.075 - 0.002mm)	9
	% Sand (0.075 - 2.0mm)	24
	% Gravel (>2.0mm)	59
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	2108
	OPTIMUM MOISTURE (%)	9.4
	SWELL (%)	2.5
	CBR @ 100%	20
	CBR @ 98%	14
	CBR @ 95%	9
	CBR @ 93%	6
	CBR @ 90%	4
PROCTOR MAX. DRY DENSITY (kg/m³)		1897
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		0.32
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
*pH VALUE (TMH1: Method A21)		
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-2-6 (0)
*UNIFIED SOIL CLASSIFICATION		SC
*COLTO CLASSIFICATION		No Classification







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APPENDIX E

*DYNAMIC CONE PENETROMETER (DCP'S) TESTS

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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 1 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	102	0	-	-	-	-	-
5	158	56	56	11.2	Dense	95	20
10	183	81	25	5.0	Very Dense	174	57
15	199	97	16	3.2	Very Dense	> 200	103
20	214	112	15	3.0	Very Dense	> 200	> 110
25	226	124	12	2.4	Very Dense	> 200	> 110
30	237	135	11	2.2	Very Dense	> 200	> 110
35	248	146	11	2.2	Very Dense	> 200	> 110
40	257	155	9	1.8	Very Dense	> 200	> 110
45	266	164	9	1.8	Very Dense	> 200	> 110
50	276	174	10	2.0	Very Dense	> 200	> 110
55	281	179	5	1.0	Very Dense	> 200	> 110
60	287	185	6	1.2	Very Dense	> 200	> 110
65	289	187	2	0.4	Very Dense	> 200	> 110
70	299	197	10	2.0	Very Dense	> 200	> 110
75	299	197	0	0.0	Very Dense	> 200	> 110
80	299	197	0	0.0	Very Dense	> 200	> 110
85	Refusal						

** According to Dr B van Wyk's Method

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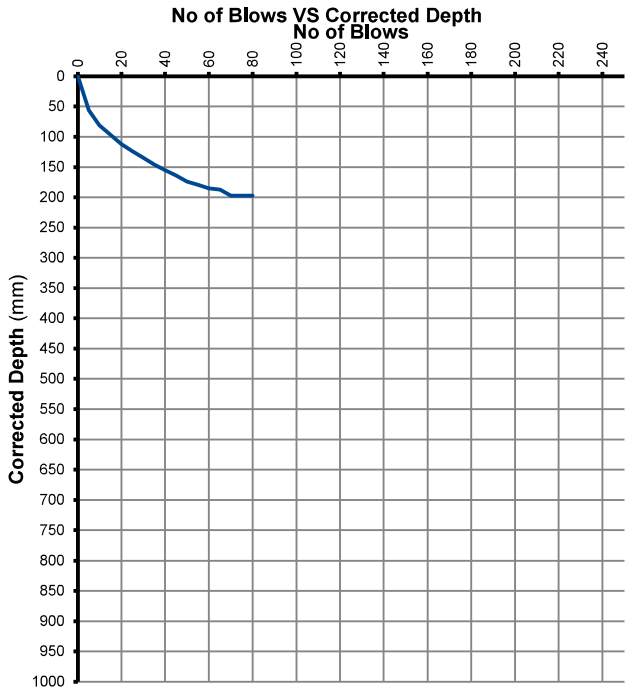
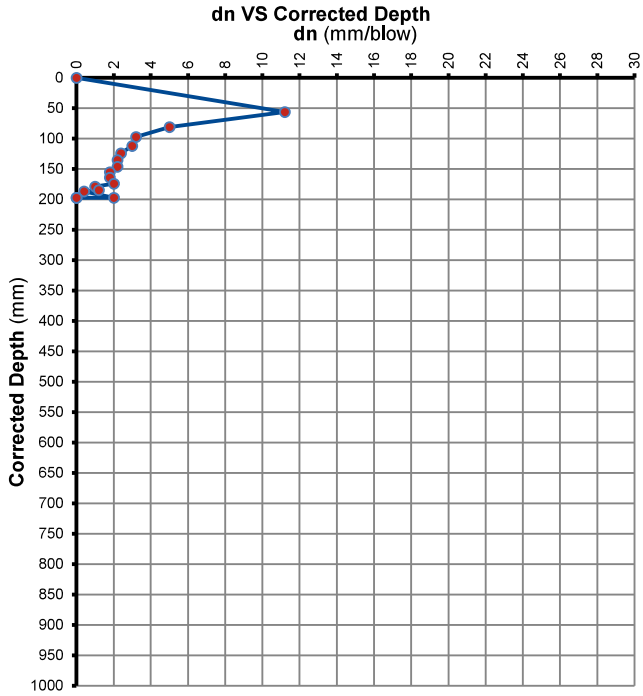
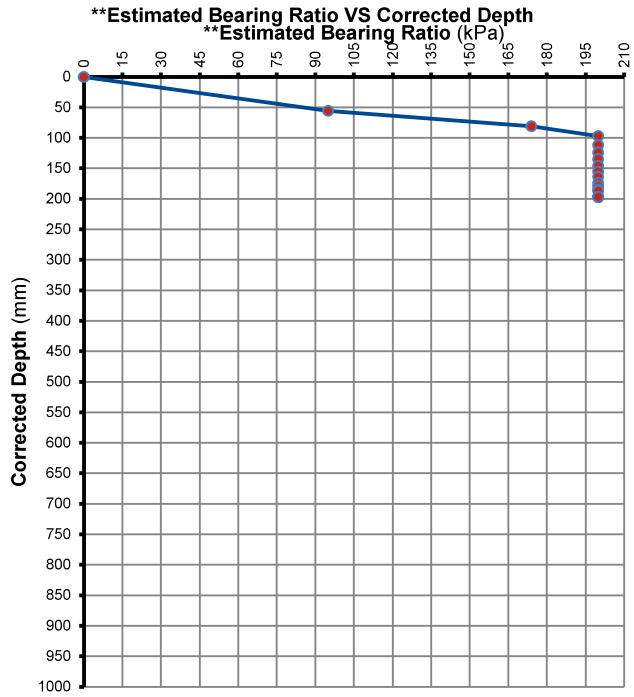
*DYNAMIC CONE PENETROMETER (DCP) TEST

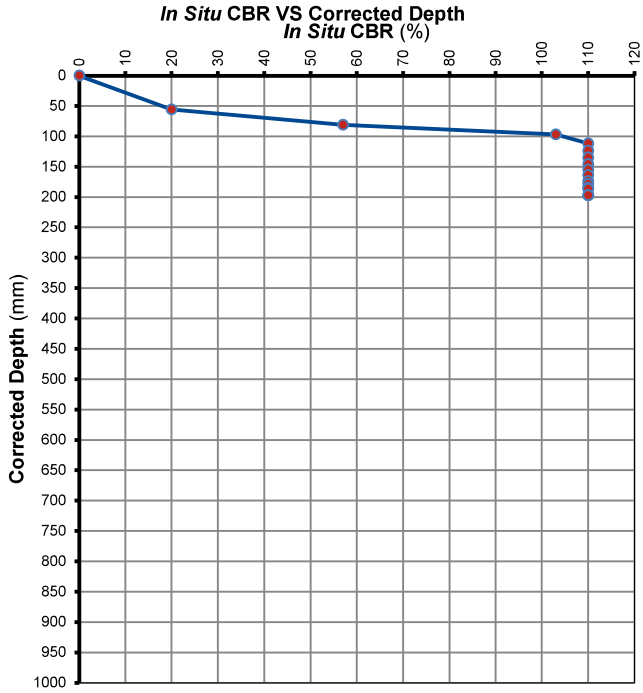
POSITION: DCP 1 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 2 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	97	0	-	-	-	-	-
5	142	45	45	9.0	Dense	113	26
10	172	75	30	6.0	Dense	154	45
15	198	101	26	5.2	Dense	169	54
20	223	126	25	5.0	Very Dense	174	57
25	245	148	22	4.4	Very Dense	188	68
30	279	182	34	6.8	Dense	140	38
35	327	230	48	9.6	Dense	107	24
40	390	293	63	12.6	Medium Dense	88	17
45	451	354	61	12.2	Dense	90	17
50	518	421	67	13.4	Medium Dense	84	15
55	553	456	35	7.0	Dense	137	36
60	574	477	21	4.2	Very Dense	193	72
65	586	489	12	2.4	Very Dense	> 200	> 110
70	592	495	6	1.2	Very Dense	> 200	> 110
75	592	495	0	0.0	Very Dense	> 200	> 110
80	592	495	0	0.0	Very Dense	> 200	> 110
85	Refusal						

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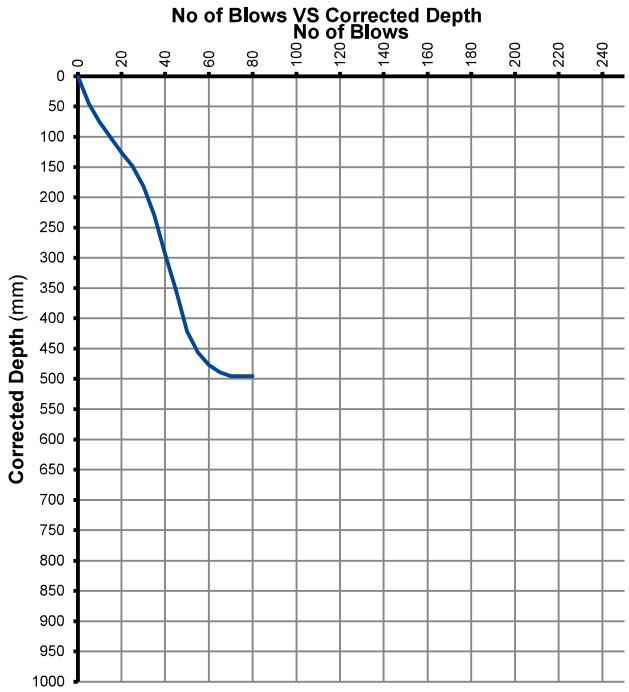
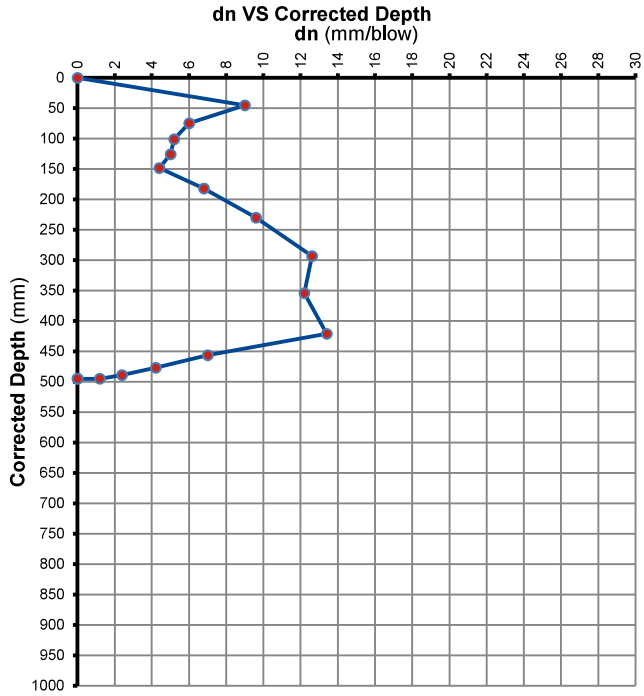
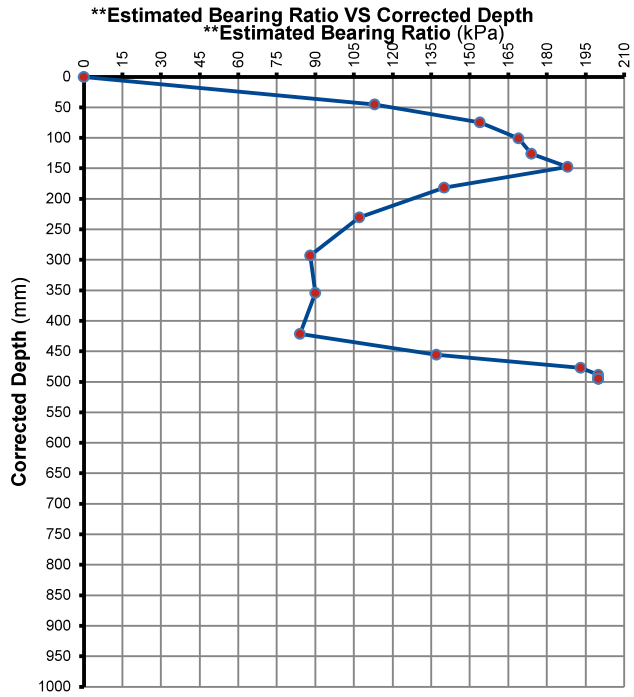
*DYNAMIC CONE PENETROMETER (DCP) TEST

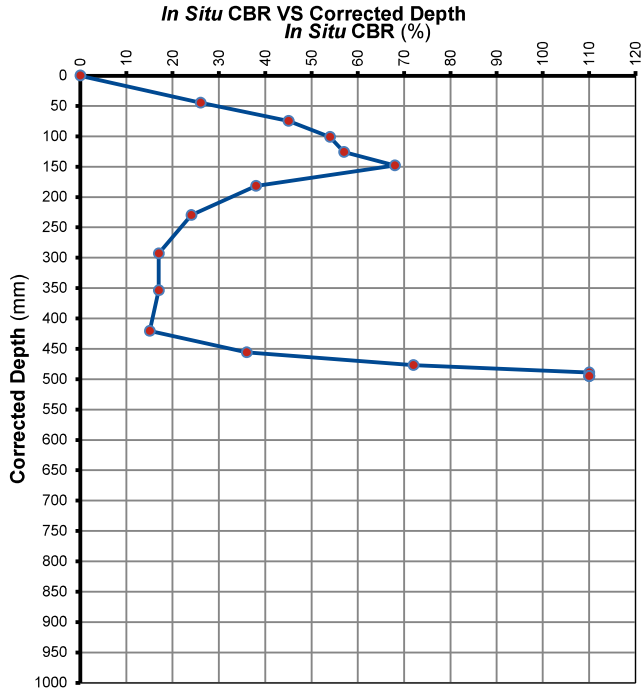
POSITION: DCP 2 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 3 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	112	0	-	-	-	-	-
5	151	39	39	7.8	Dense	126	32
10	182	70	31	6.2	Dense	150	43
15	208	96	26	5.2	Dense	169	54
20	234	122	26	5.2	Dense	169	54
25	261	149	27	5.4	Dense	165	52
30	285	173	24	4.8	Very Dense	178	60
35	304	192	19	3.8	Very Dense	> 200	82
40	316	204	12	2.4	Very Dense	> 200	> 110
45	324	212	8	1.6	Very Dense	> 200	> 110
50	336	224	12	2.4	Very Dense	> 200	> 110
55	345	233	9	1.8	Very Dense	> 200	> 110
60	364	252	19	3.8	Very Dense	> 200	82
65	387	275	23	4.6	Very Dense	183	64
70	411	299	24	4.8	Very Dense	178	60
75	432	320	21	4.2	Very Dense	193	72
80	463	351	31	6.2	Dense	150	43
85	494	382	31	6.2	Dense	150	43
90	524	412	30	6.0	Dense	154	45
95	552	440	28	5.6	Dense	161	49
100	587	475	35	7.0	Dense	137	36
105	623	511	36	7.2	Dense	134	35
110	662	550	39	7.8	Dense	126	32
115	695	583	33	6.6	Dense	144	39
120	721	609	26	5.2	Dense	169	54
125	733	621	12	2.4	Very Dense	> 200	> 110
130	733	621	0	0.0	Very Dense	> 200	> 110
135	733	621	0	0.0	Very Dense	> 200	> 110
140	Refusal						

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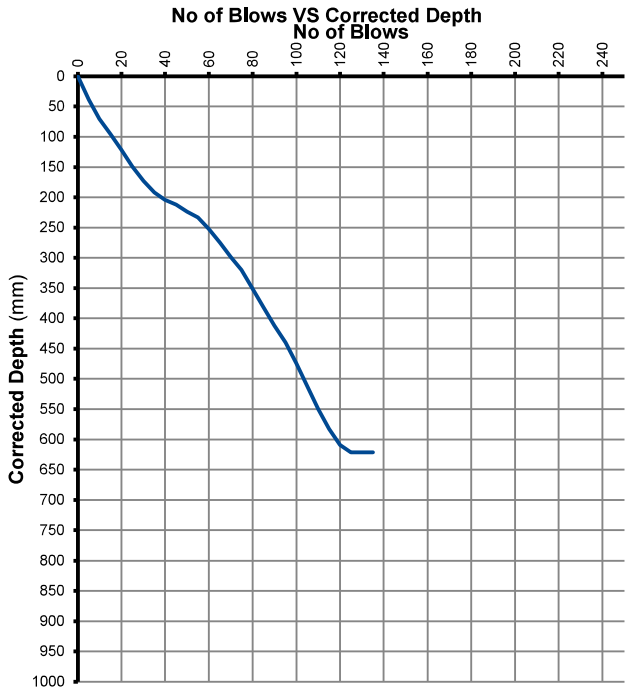
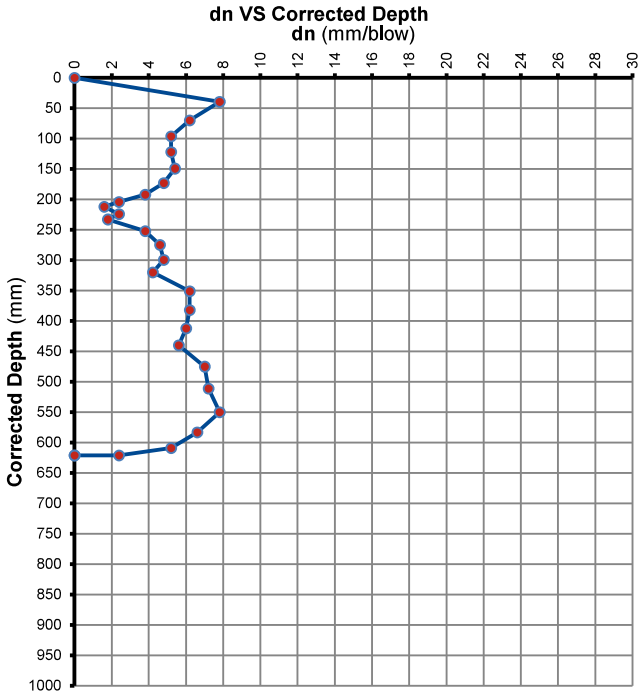
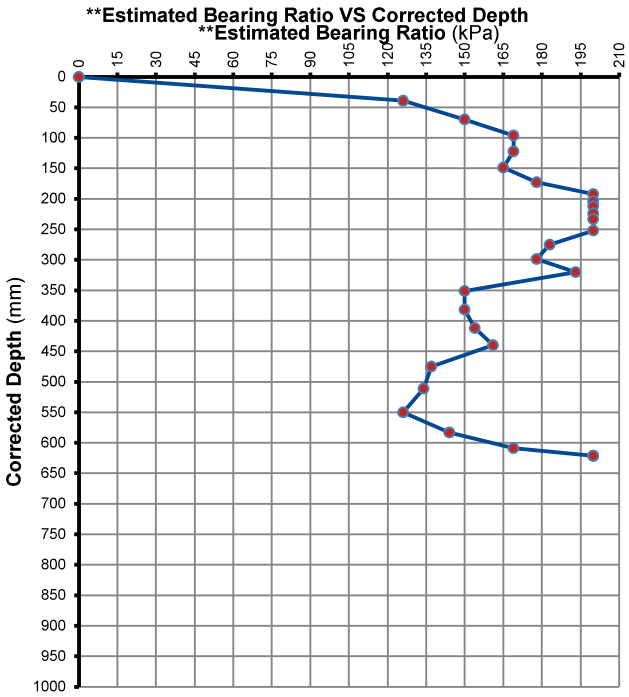
*DYNAMIC CONE PENETROMETER (DCP) TEST

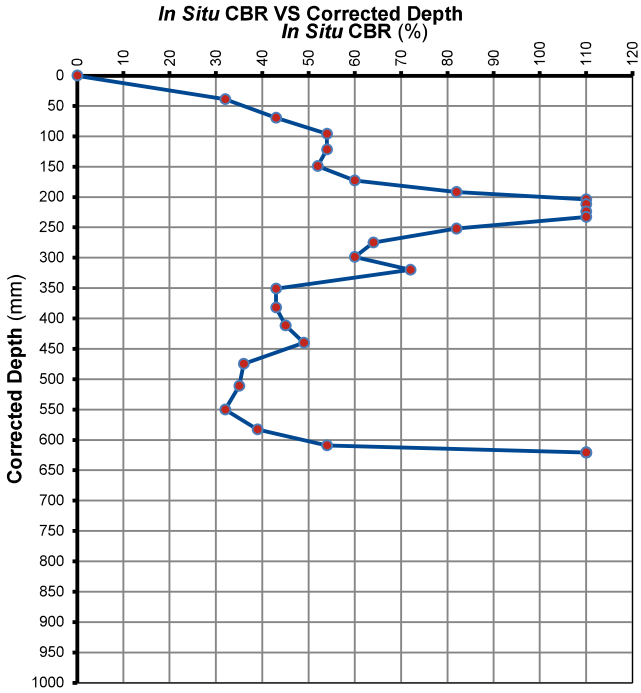
POSITION: DCP 3 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 4 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	116	0	-	-	-	-	-
5	179	63	63	12.6	Medium Dense	88	17
10	208	92	29	5.8	Dense	157	47
15	236	120	28	5.6	Dense	161	49
20	261	145	25	5.0	Very Dense	174	57
25	290	174	29	5.8	Dense	157	47
30	312	196	22	4.4	Very Dense	188	68
35	349	233	37	7.4	Dense	132	34
40	407	291	58	11.6	Dense	93	19
45	458	342	51	10.2	Dense	102	22
50	504	388	46	9.2	Dense	111	25
55	519	403	15	3.0	Very Dense	> 200	> 110
60	531	415	12	2.4	Very Dense	> 200	> 110
65	544	428	13	2.6	Very Dense	> 200	> 110
70	563	447	19	3.8	Very Dense	> 200	82
75	584	468	21	4.2	Very Dense	193	72
80	621	505	37	7.4	Dense	132	34
85	653	537	32	6.4	Dense	147	41
90	689	573	36	7.2	Dense	134	35
95	722	606	33	6.6	Dense	144	39
100	758	642	36	7.2	Dense	134	35
105	791	675	33	6.6	Dense	144	39
110	803	687	12	2.4	Very Dense	> 200	> 110
115	806	690	3	0.6	Very Dense	> 200	> 110
120	806	690	0	0.0	Very Dense	> 200	> 110
125	806	690	0	0.0	Very Dense	> 200	> 110
130	Refusal						

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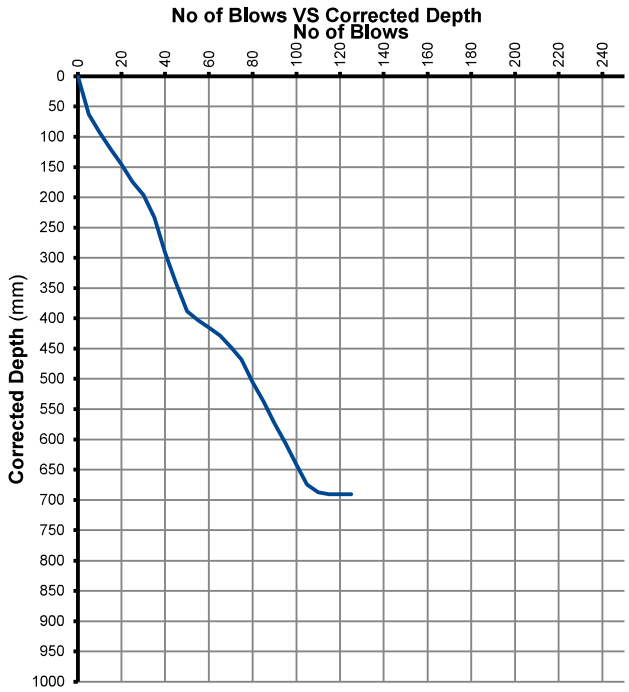
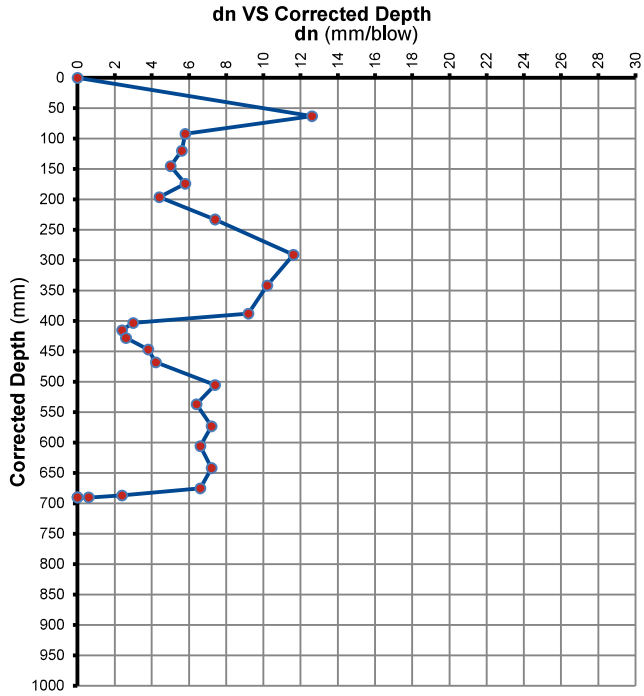
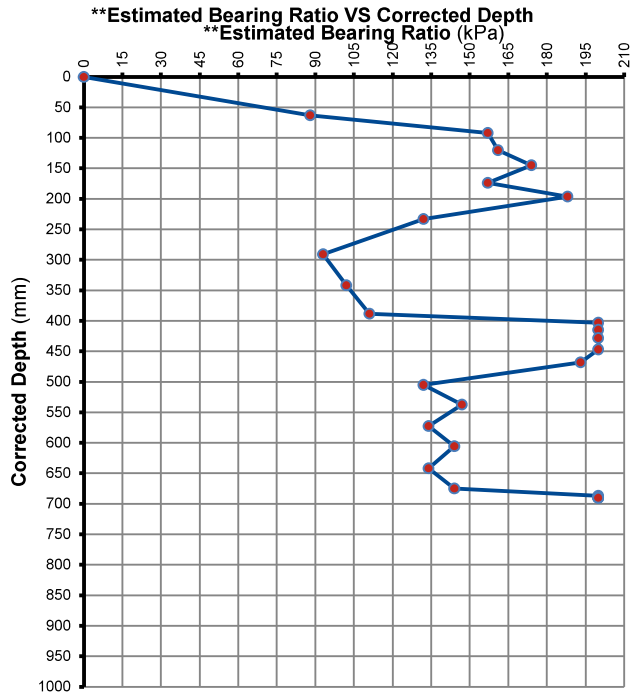
*DYNAMIC CONE PENETROMETER (DCP) TEST

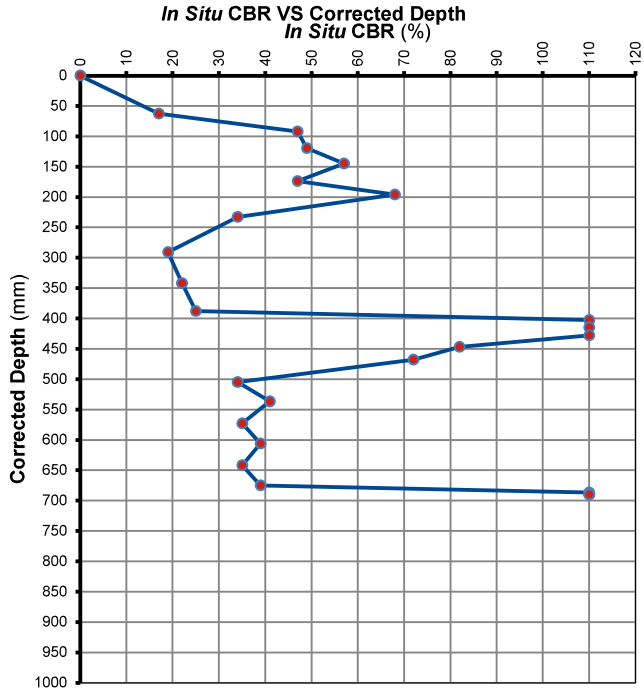
POSITION: DCP 4 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 5 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	126	0	-	-	-	-	-
5	239	113	113	22.6	Medium Dense	58	8
10	312	186	73	14.6	Medium Dense	79	14
15	339	213	27	5.4	Dense	165	52
20	357	231	18	3.6	Very Dense	> 200	88
25	374	248	17	3.4	Very Dense	> 200	95
30	393	267	19	3.8	Very Dense	> 200	82
35	413	287	20	4.0	Very Dense	200	77
40	429	303	16	3.2	Very Dense	> 200	103
45	442	316	13	2.6	Very Dense	> 200	> 110
50	453	327	11	2.2	Very Dense	> 200	> 110
55	453	327	0	0.0	Very Dense	> 200	> 110
60	453	327	0	0.0	Very Dense	> 200	> 110
65	Refusal						

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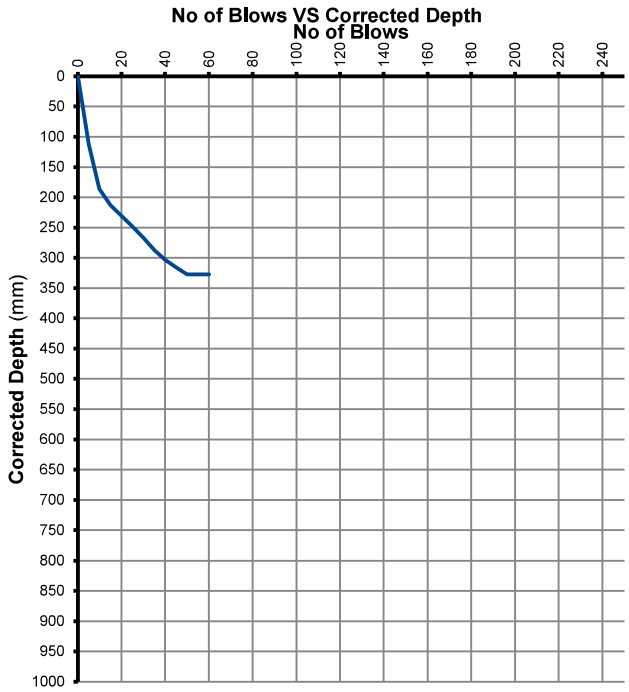
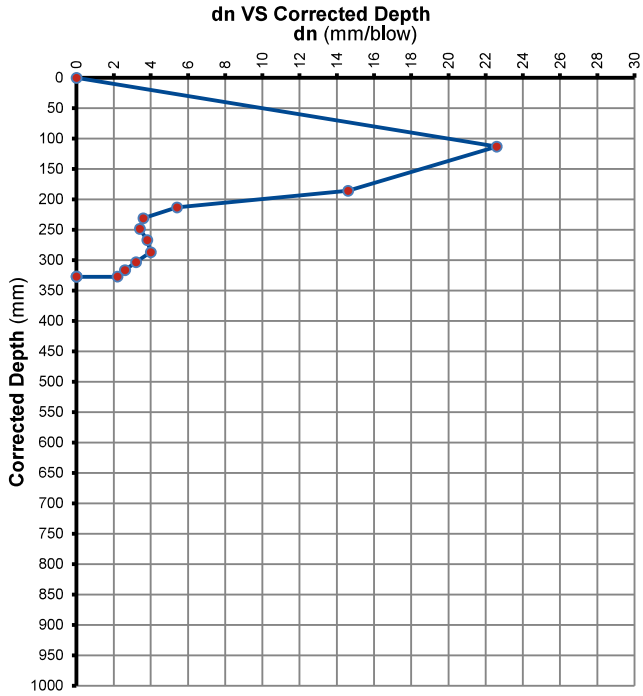
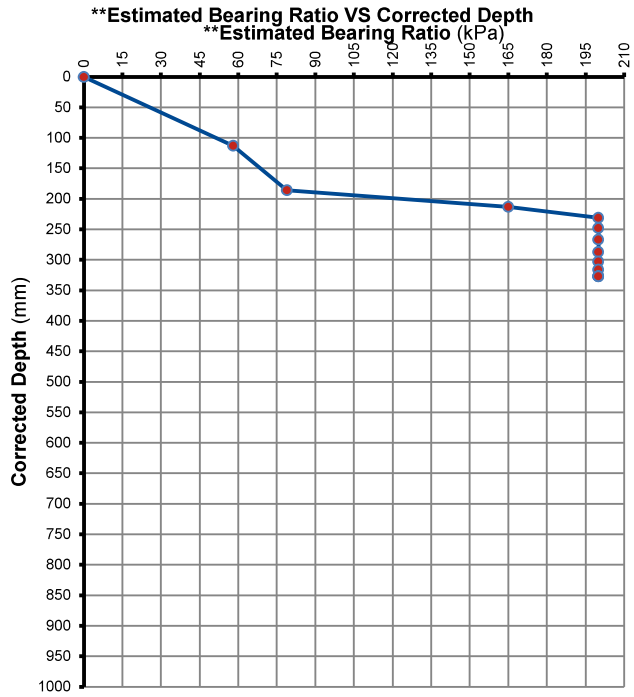
*DYNAMIC CONE PENETROMETER (DCP) TEST

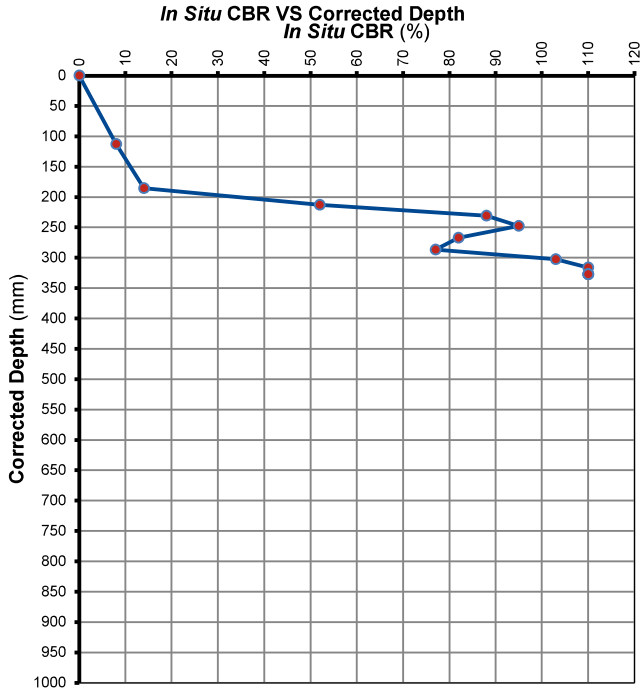
POSITION: DCP 5 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 6 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	103	0	-	-	-	-	-
5	148	45	45	9.0	Dense	113	26
10	197	94	49	9.8	Dense	106	23
15	219	116	22	4.4	Very Dense	188	68
20	235	132	16	3.2	Very Dense	> 200	103
25	249	146	14	2.8	Very Dense	> 200	> 110
30	264	161	15	3.0	Very Dense	> 200	> 110
35	280	177	16	3.2	Very Dense	> 200	103
40	293	190	13	2.6	Very Dense	> 200	> 110
45	304	201	11	2.2	Very Dense	> 200	> 110
50	314	211	10	2.0	Very Dense	> 200	> 110
55	319	216	5	1.0	Very Dense	> 200	> 110
60	325	222	6	1.2	Very Dense	> 200	> 110
65	325	222	0	0.0	Very Dense	> 200	> 110
70	325	222	0	0.0	Very Dense	> 200	> 110
75	Refusal						

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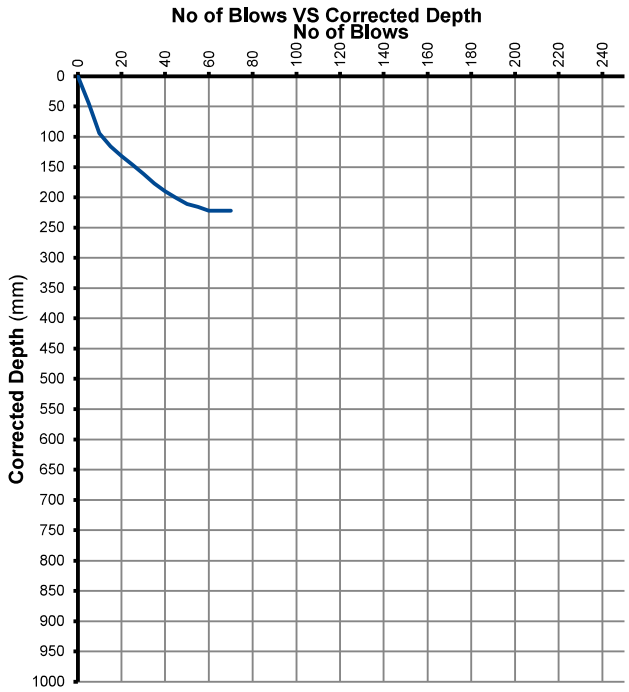
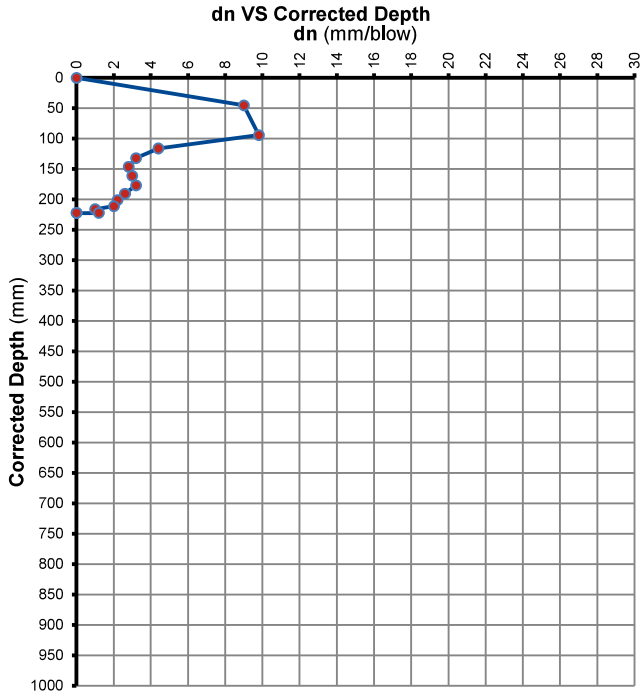
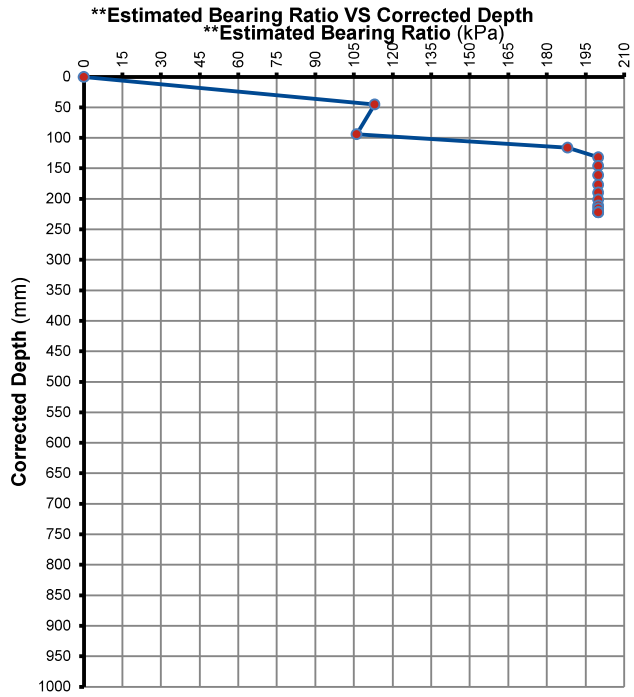
*DYNAMIC CONE PENETROMETER (DCP) TEST

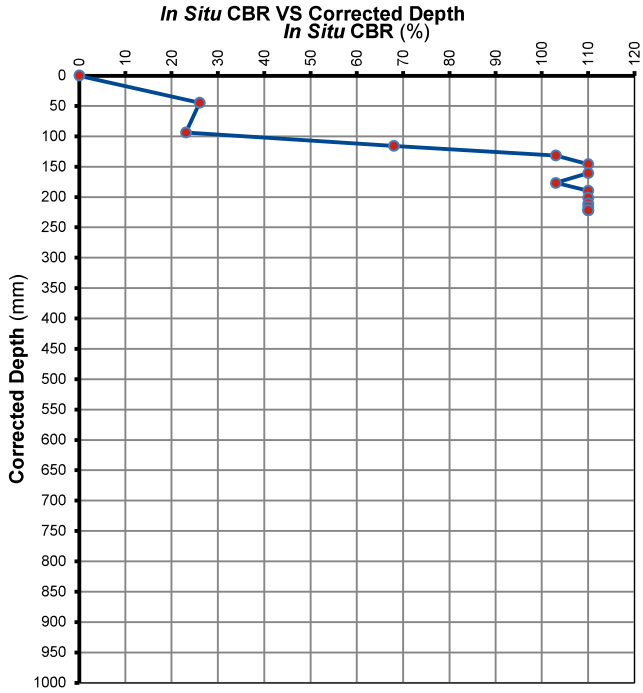
POSITION: DCP 6 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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+27 (0) 51 447 0224/5, simbfn@simlab.co.za

sanas Testing Laboratory T0455

*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 6 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	114	0	-	-	-	-	-
5	183	69	69	13.8	Medium Dense	82	15
10	235	121	52	10.4	Dense	101	22
15	262	148	27	5.4	Dense	165	52
20	284	170	22	4.4	Very Dense	188	68
25	303	189	19	3.8	Very Dense	> 200	82
30	330	216	27	5.4	Dense	165	52
35	360	246	30	6.0	Dense	154	45
40	401	287	41	8.2	Dense	122	30
45	438	324	37	7.4	Dense	132	34
50	477	363	39	7.8	Dense	126	32
55	512	398	35	7.0	Dense	137	36
60	533	419	21	4.2	Very Dense	193	72
65	545	431	12	2.4	Very Dense	> 200	> 110
70	551	437	6	1.2	Very Dense	> 200	> 110
75	554	440	3	0.6	Very Dense	> 200	> 110
80	557	443	3	0.6	Very Dense	> 200	> 110
85	557	443	0	0.0	Very Dense	> 200	> 110
90	557	443	0	0.0	Very Dense	> 200	> 110
95	Refusal						

** According to Dr B van Wyk's Method

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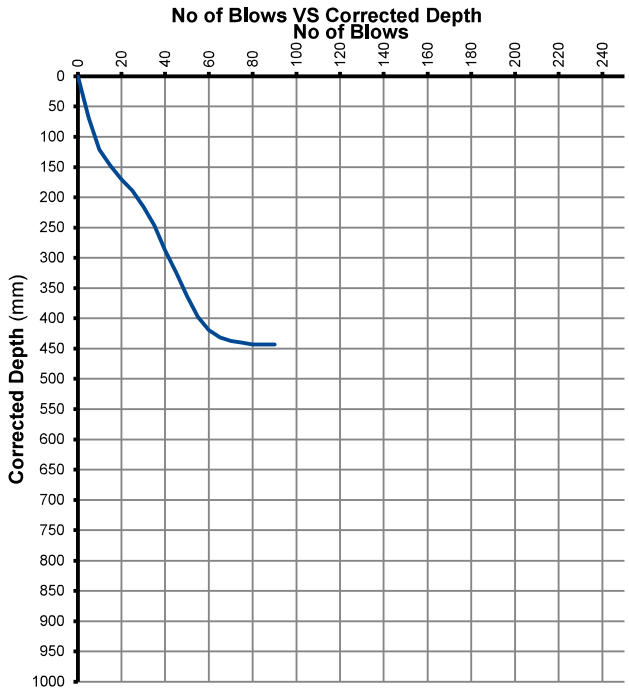
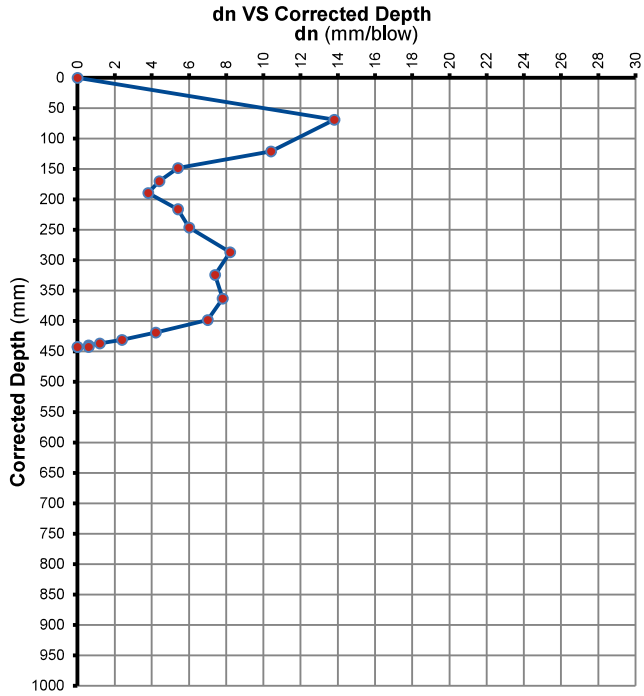
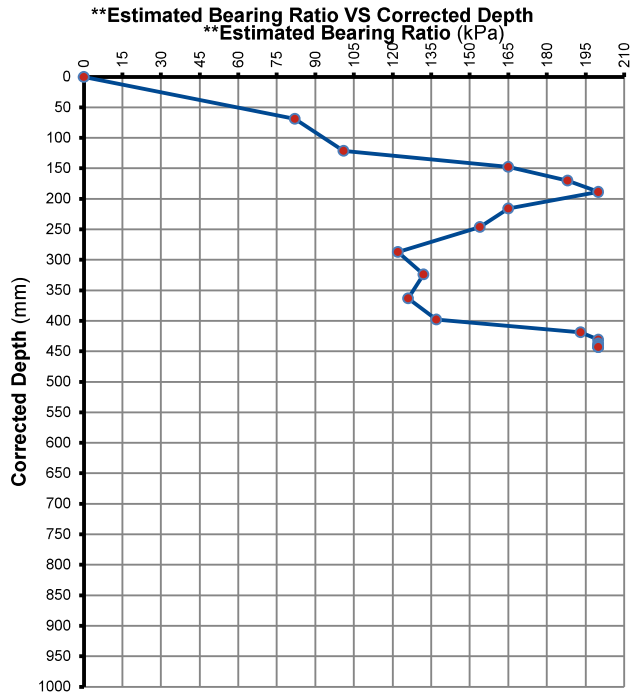
*DYNAMIC CONE PENETROMETER (DCP) TEST

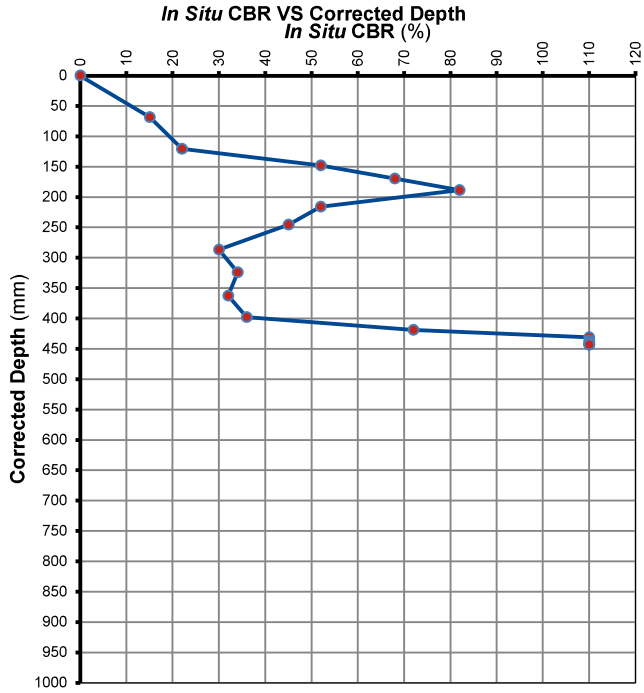
POSITION: DCP 6 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









** According to Dr B van Wyk's Method

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sanas Testing Laboratory T0455

*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 8 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	82	0	-	-	-	-	-
5	136	54	54	10.8	Dense	98	20
10	166	84	30	6.0	Dense	154	45
15	193	111	27	5.4	Dense	165	52
20	218	136	25	5.0	Very Dense	174	57
25	244	162	26	5.2	Dense	169	54
30	272	190	28	5.6	Dense	161	49
35	315	233	43	8.6	Dense	117	28
40	366	284	51	10.2	Dense	102	22
45	422	340	56	11.2	Dense	95	20
50	479	397	57	11.4	Dense	94	19
55	504	422	25	5.0	Very Dense	174	57
60	521	439	17	3.4	Very Dense	> 200	95
65	534	452	13	2.6	Very Dense	> 200	> 110
70	546	464	12	2.4	Very Dense	> 200	> 110
75	550	468	4	0.8	Very Dense	> 200	> 110
80	554	472	4	0.8	Very Dense	> 200	> 110
85	561	479	7	1.4	Very Dense	> 200	> 110
90	567	485	6	1.2	Very Dense	> 200	> 110
95	570	488	3	0.6	Very Dense	> 200	> 110
100	572	490	2	0.4	Very Dense	> 200	> 110
105	572	490	0	0.0	Very Dense	> 200	> 110
110	572	490	0	0.0	Very Dense	> 200	> 110
115	Refusal						

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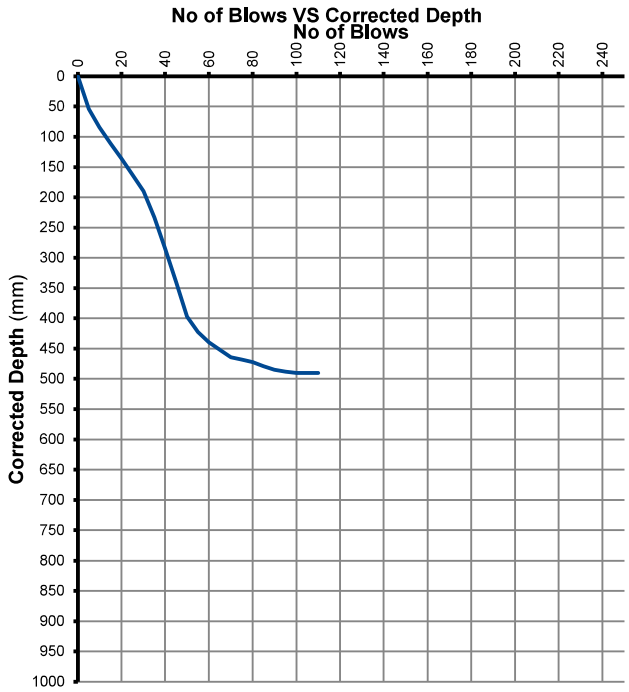
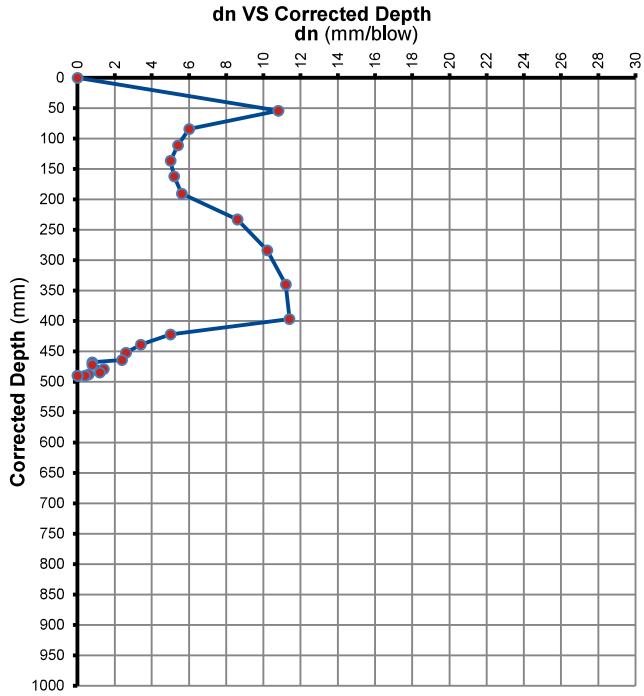
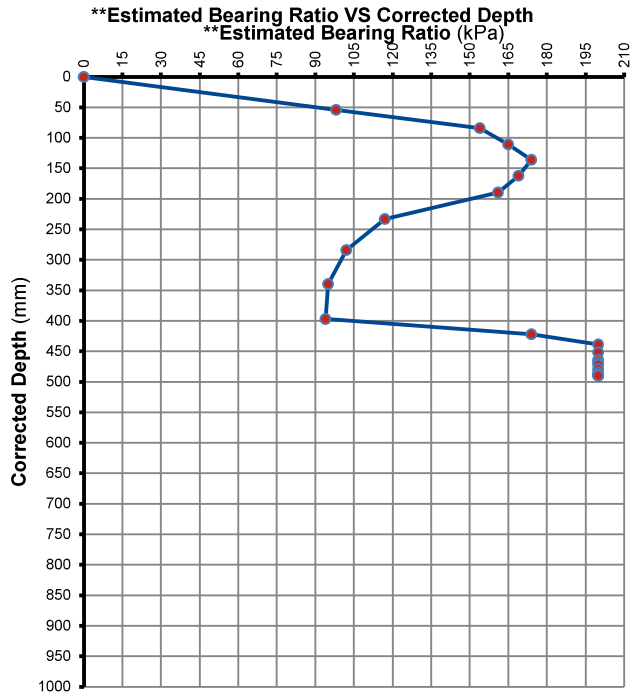
*DYNAMIC CONE PENETROMETER (DCP) TEST

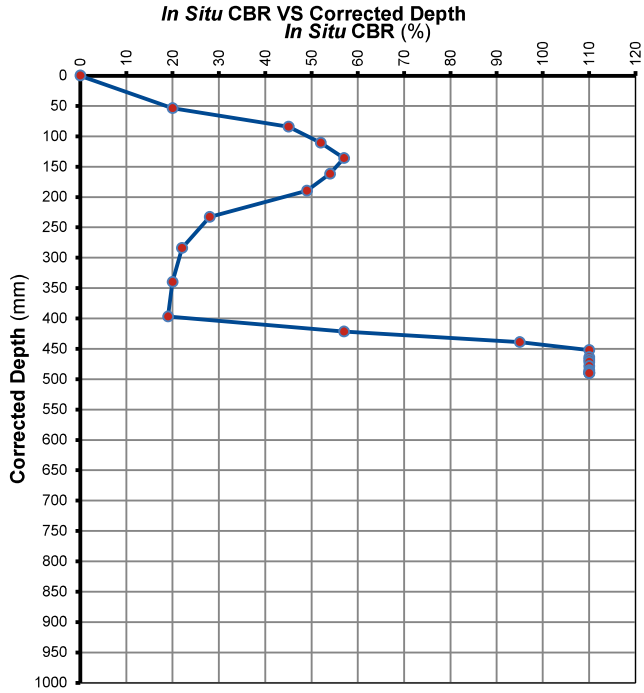
POSITION: DCP 8 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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*DYNAMIC CONE PENETROMETER (DCP) TEST

POSITION: DCP 9 **DEPTH BELOW NGL:** 0.000m

***DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)**

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	107	0	-	-	-	-	-
5	148	41	41	8.2	Dense	122	30
10	179	72	31	6.2	Dense	150	43
15	207	100	28	5.6	Dense	161	49
20	233	126	26	5.2	Dense	169	54
25	261	154	28	5.6	Dense	161	49
30	284	177	23	4.6	Very Dense	183	64
35	312	205	28	5.6	Dense	161	49
40	347	240	35	7.0	Dense	137	36
45	377	270	30	6.0	Dense	154	45
50	406	299	29	5.8	Dense	157	47
55	423	316	17	3.4	Very Dense	> 200	95
60	439	332	16	3.2	Very Dense	> 200	103
65	457	350	18	3.6	Very Dense	> 200	88
70	479	372	22	4.4	Very Dense	188	68
75	500	393	21	4.2	Very Dense	193	72
80	534	427	34	6.8	Dense	140	38
85	566	459	32	6.4	Dense	147	41
90	599	492	33	6.6	Dense	144	39
95	630	523	31	6.2	Dense	150	43
100	656	549	26	5.2	Dense	169	54
105	680	573	24	4.8	Very Dense	178	60
110	693	586	13	2.6	Very Dense	> 200	> 110
115	698	591	5	1.0	Very Dense	> 200	> 110
120	702	595	4	0.8	Very Dense	> 200	> 110
125	702	595	0	0.0	Very Dense	> 200	> 110
130	702	595	0	0.0	Very Dense	> 200	> 110
135	Refusal						

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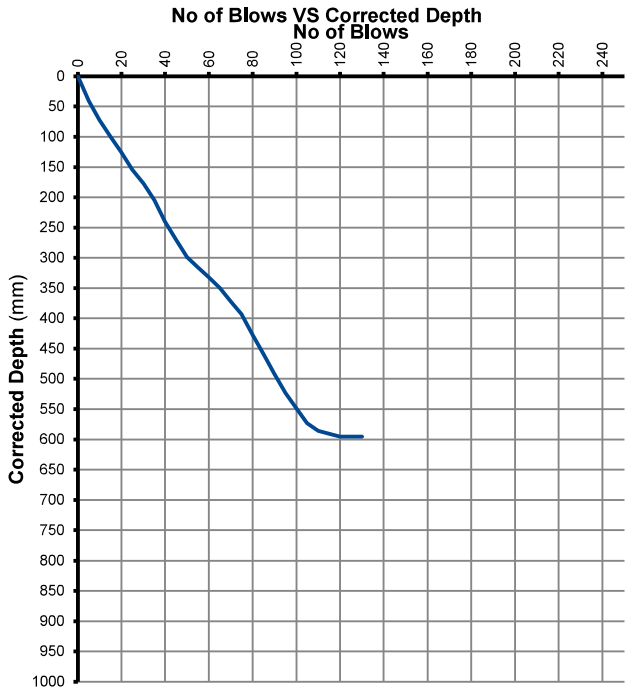
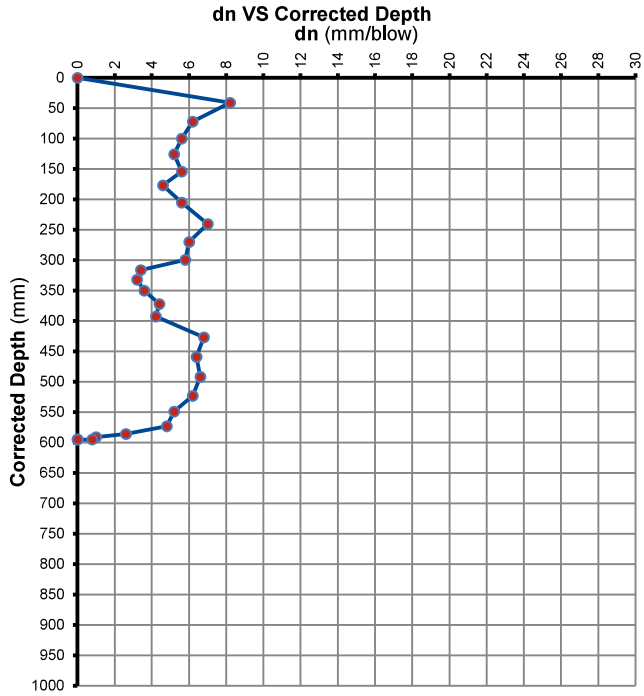
sanas Testing Laboratory T0455

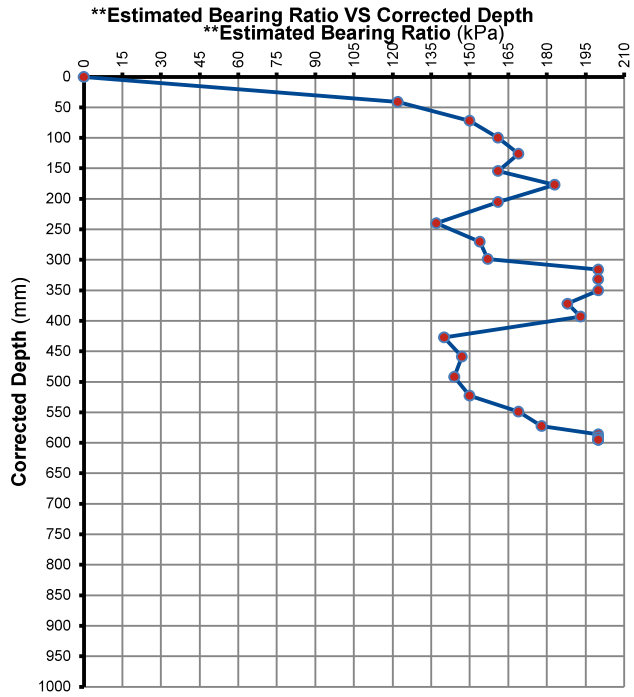
*DYNAMIC CONE PENETROMETER (DCP) TEST

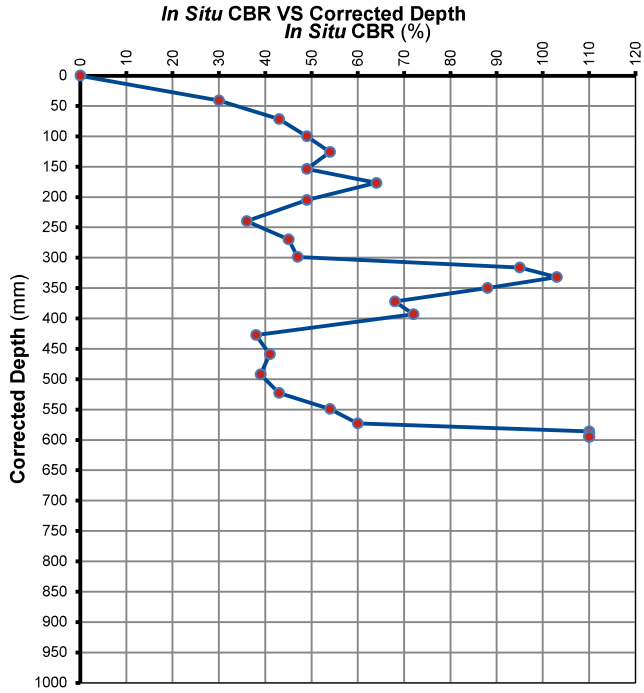
POSITION: DCP 9 **DEPTH BELOW NGL:** 0.000m

*DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)









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APPENDIX F
SITE PHOTOS

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SITE PHOTOS

Test Pit 1

Test Pit 2

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SITE PHOTOS

Test Pit 3

Test Pit 4

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SITE PHOTOS

Test Pit 5

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APPENDIX G

GEOLOGICAL PLAN

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GEOLOGICAL PLAN

Scale of Detail - 1 : 250 000

Jd - Dolerite

K2u - Mudstone and Shale

K_3l - Sandstone / Shale / Mudstone

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Vaal Central Water

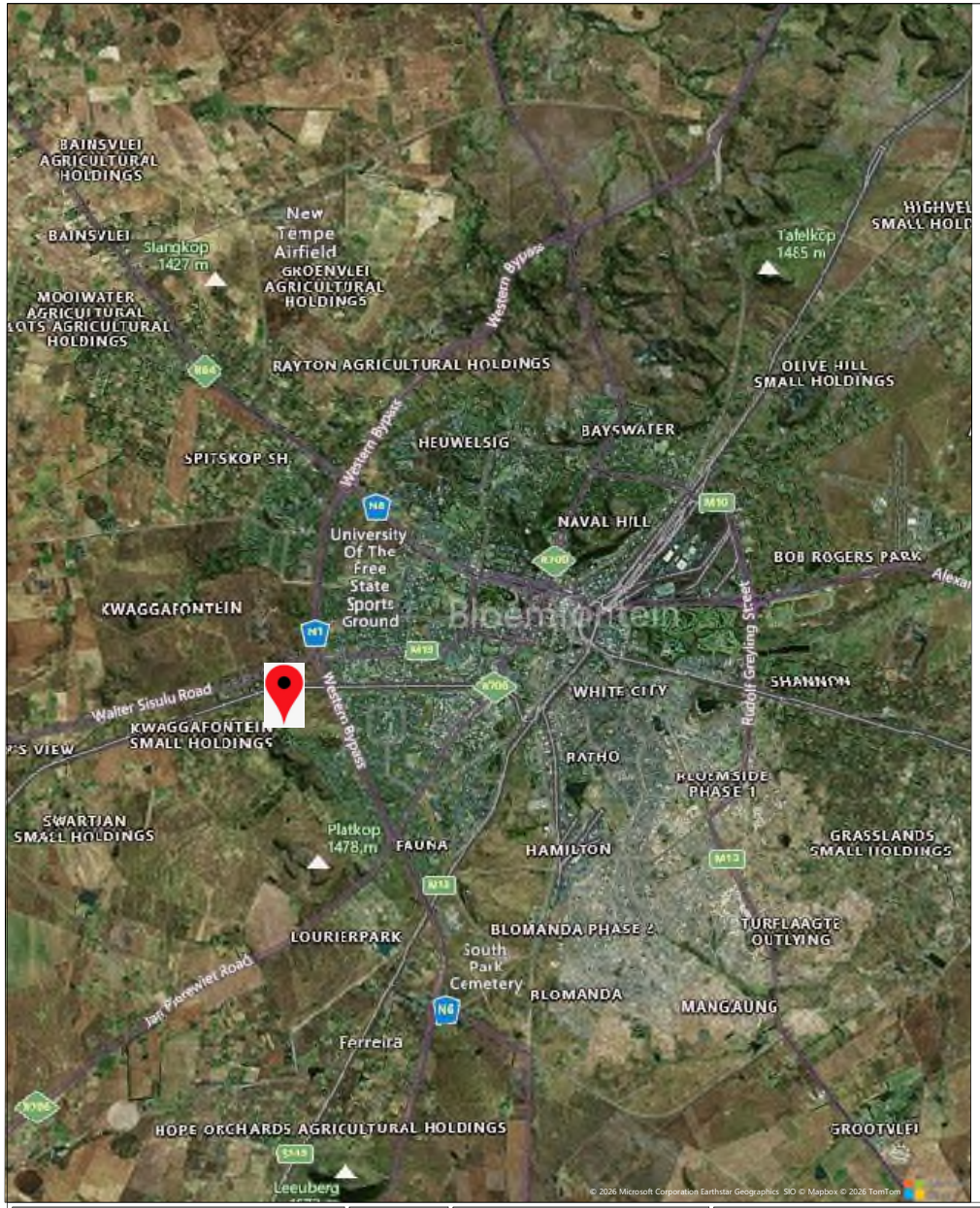
BRANDKOP DAM JOINT SEALING IN THE CRR AND BY-PASS PIPELINE

BID NUMBER: VCW440/STEELBPTB/26

CONSTRUCTION OF A STEEL BY-PASS PIPELINE AND BREAK PRESSURE TANK AT BRANDKOP RESERVOIR INCLUDING RESERVOIR JOINT SEALING AND CONCRETE REPAIRS

BOOK OF DRAWINGS

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2



DRAWING LIST

3890.00.00.AAA.01.A011	PROJECT NAME BOARD
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3890.00.00.GZA.01.A004	SITE OFFICE FURNITURE
3890.00.00.GZA.01.A005	LOCALITY MAP
3890.00.00.GZA.05.U002	SITE LAYOUT
3890.00.00.GZA.05.U004	BRANDKOP PROPOSAL 711DIA BYPASS
3890.00.00.GZA.05.L003	BRANDKOP PROPOSAL LONGITUDINAL SECTION BYPASS ISOLATION
3890.00.00.GZA.05.L004	BRANDKOP PROPOSAL LONGITUDINAL SECTION 711DIA CROSS CONNECTION
3890.00.00.GZA.05.F001	RUSTFONTEIN - WELBEDACHT CROSS CONNECTION ITEM LIST 711 DIA PIPE
3890.00.00.GZA.05.F002	BY-PASS PIPELINE ISOLATION AND CONNECTION ITEM LIST - MAIN ISOLATION
3890.00.00.GZA.05.D004	RUSTFONTEIN - WELBEDACHT CROSS CONNECTION DETAILS AND SECTION 711 DIA CROSS CONNETION PIPE
3890.00.00.GZA.05.D005	BY-PASS PIPELINE ISOLATION AND CONNECTION DETAILS AND SECTION OF MAIN ISOLATION CHAMBER
3890.00.00.GZA.05.D006	BY-PASS PIPELINE ISOLATION AND CONNECTION DETAILS AND SECTION OF FLOW METER CHAMBER
3890.00.00.SQA.14.A001	BY-PASS AND BREAK PRESSURE TANK 3D VIEWS
3890.00.00.SQA.14.D001	BY-PASS AND BREAK PRESSURE TANK LAYOUT AND SECTIONS
3890.00.00.SQA.14.D002	BY-PASS AND BREAK PRESSURE TANK CAT LADDER DETAILS

VERSION

No.	DATE	DESCRIPTION	AUTH. BY

SURVEY DATUM:

www.bigengroup.com
2 Chris Botha Street
Westdene
Bloemfontein
Phone:+ 27 (0) 51 430 1423
bloemfontein@bigengroup.com

bigen
Doing good while doing business

PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
LOCALITY MAP

vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

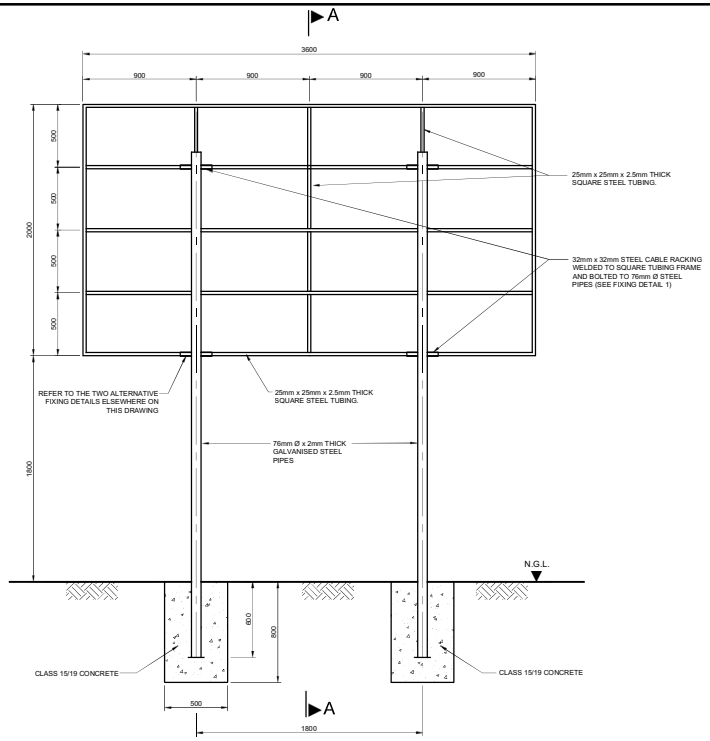
ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1		
SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:
CLIENT DRAWING No.: CLIENT REF No.:

APPROVED ON BEHALF OF BIGEN:
PROJECT MANAGER: Llewellyn Biggs
REVIEWER:

DRAWING No.: **3890.00.00.GZA.01.A005**
VERSION: **A**

3890.00.00.GZA.01.A005

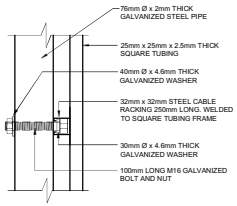


BACK ELEVATION

SCALE 1:20

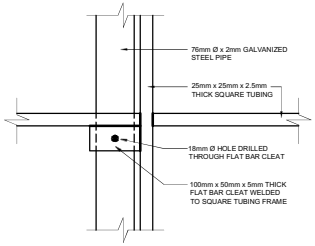
FRONT ELEVATION

SCALE 1:10



FIXING DETAIL 1

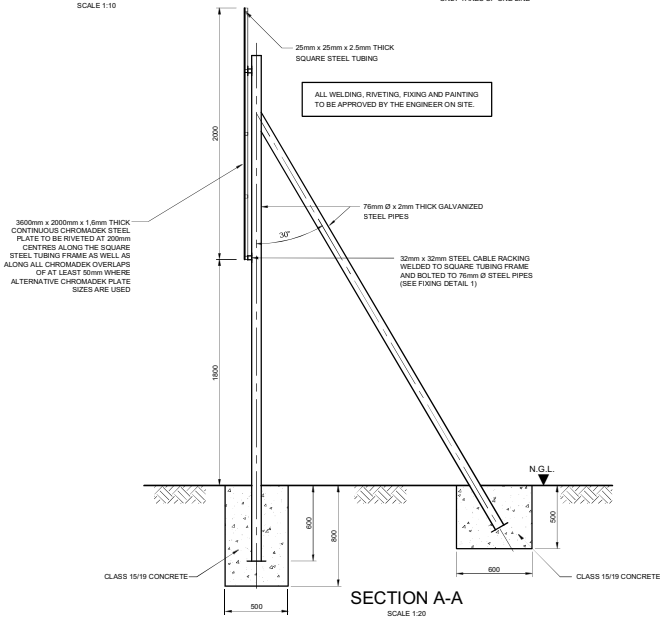
SCALE 1:5



FIXING DETAIL 2

SCALE 1:5

ALTERNATIVE FIXING DETAILS



SECTION A-A

SCALE 1:20

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
SURVEY DATUM:			

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2 Chris Botha Street
Westdene
Bloemfontein

Phone:+ 27 (0) 51 430 1423

bloemfontein@bigengroup.com

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PROJECT TITLE:

PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:

PROJECT NAME BOARD

vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:

NAME:

DATE:

CLIENT DRAWING No.: | CLIENT REF No.:

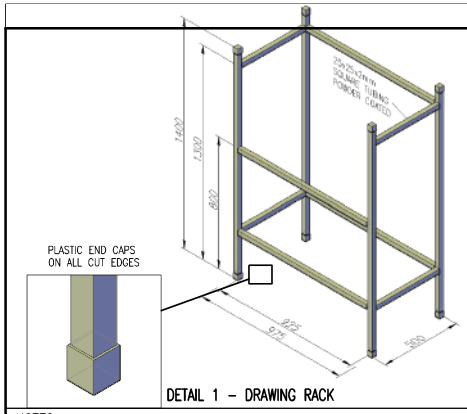
SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:

Llewellyn Biggs

DRAWING No.: **3890.00.00.AAA.01.A011** | VERSION: **A**

3890.00.00.AAA.01.A011



DETAIL 1 – DRAWING RACK

NOTES:

(FOR PHOTOS REFER TO DRAWING NO 01D025–1)

CAMP

- CLEAR, GRUB AND GRADE SITE TO BE SELF DRAINING
- 75mm THICK 19mm STONE GRAVELING THROUGHOUT
- MAST LIGHT TO BE PROVIDED 5m HIGH WOODEN MAST, 500 WATT GLOBE & DAY/NIGHT SWITCH
- FENCING TO BE 2.1m HIGH RAZOR MESH WIRE INCL. RAZOR FLAT WRAP ON TOP (SEE PHOTO 1).
- FULL TIME GATE GUARD TO BE PROVIDED WITH GUARD HOUSE (GH). GUARD HOUSE TO BE A 2.1m x 2.1m MODEL FROM RENT A SHED (WWW.RENTASHED.CO.ZA) OR SIMILAR APPROVED INCL CHAIR
- STEPS TO BE PROVIDED AT ALL OFFICE ENTRIES
- 1x FULL TIME CAMP ASSISTANT TO BE PROVIDED FOR CLEANING AND CAR WASH
- 3x CHEMICAL TOILETS TO BE PROVIDED (FLUSHABLE) (T)
- 80% SHADE CLOTH TO BE FIXED ON INSIDE OF FENCING IF SPECIFIED
- GALVANISED ROOF SHEETING (0.6mm THICK) CARPORT TO DRAIN TOWARDS THE BACK OF THE STRUCTURE (OPPOSITE ACCESS POINT). SIDES AND BACK OF CARPORT TO BE CLOSED WITH SHADE NETTING. THE STRUCTURE OF THE CARPORT STRUCTURE TO BE APPROVED BY A REGISTERED STRUCTURAL ENGINEER.
- 20m GARDEN HOSE TO BE PROVIDED
- CLO AND/OR LDO OFFICES NEED TO BE LOCATED OUTSIDE OF THE ENGINEER'S CAMP

OFFICE (SEE PHOTO 8)

- OFFICE A1 TO BE KWIKSPACE MODULAR BUILDINGS LTD (WWW.KWIKSPACE.CO.ZA) SINGLE WIDE 3m x 3m OFFICE OR SIMILAR APPROVED
- 12000 BTU SPLIT AIRCON UNIT (LG) TO BE PROVIDED IN OFFICE A1.
- KWIKSPACE BLINDS AND BURGLAR PROOFING TO BE INSTALLED
- OFFICE TO BE CLEANED ON A DAILY BASIS

OFFICE FURNITURE (ALL FURNITURE TO BE NEW)

1. 1500x750mm MELAMINE DESK (SEE PHOTO 2) INCLUDING DRAWERS
2. DRAWING RACK – SEE DETAIL 1
3. HALF FILING CABINET (SEE PHOTO 3)
4. ROTATING HIGH BACK CHAIR (SEE PHOTO 4)
5. 4x RICKSTACKER CHAIRS (SEE PHOTO 5)
6. PLASTIC ROUND WASTE BIN
7. 2mx1.2m MAGNETIC WHITE BOARD
8. FULL STATIONERY CUPBOARD (SEE PHOTO 6)
9. DRAWING REFERENCE TABLE

STATIONERY PACKAGE (TOTAL # OF SETS SPECIFIED IN TENDER DOCUMENT)

- 3x PENS (2x BLACK, 1x RED)
- 1x PENCIL & LEAD
- 1x ERASER
- 1x CORRECTION FLUID
- 1x PRESTIK
- 1x PRITT
- 1x SCISSOR
- 4x MAGNETS
- 1x STAPLER & BOX OF STAPLES
- 1x PUNCH
- 1x BOX RUBBER BANDS
- 1x BOX A4 PAPER

RESIDENT ENGINEER COMMUNICATION PACKAGE(S) (TOTAL NO. SETS SPECIFIED IN TENDER DOCUMENT)

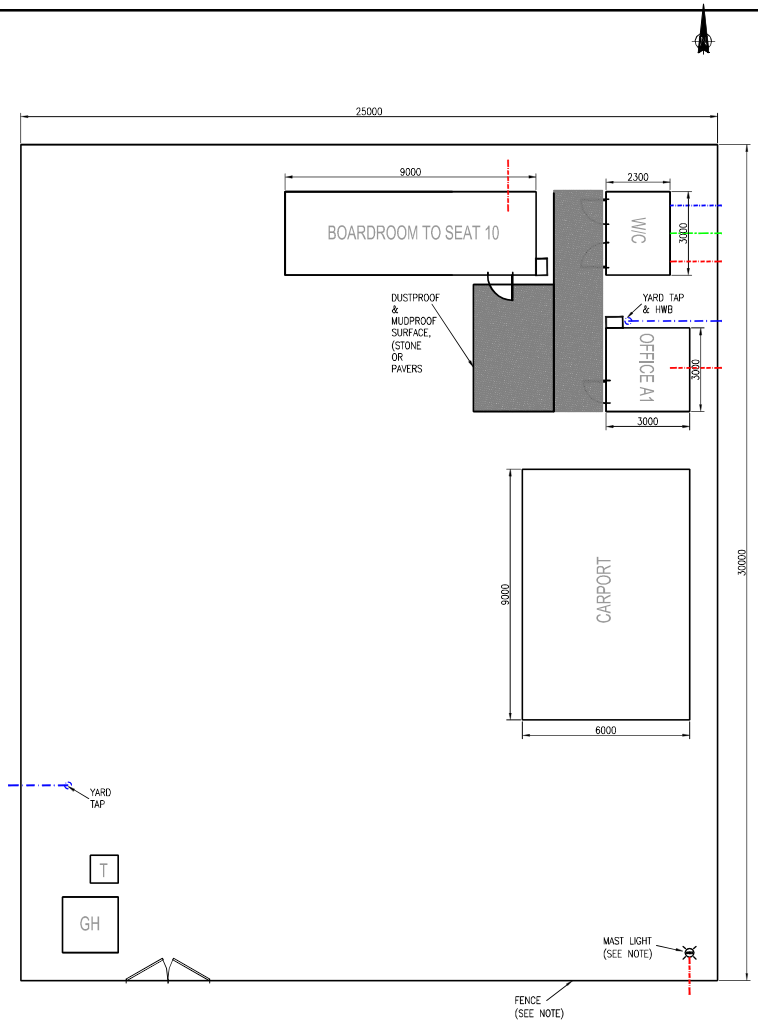
- LAPTOP
- DATACARD
- PRINTER, FAX, COPIER
- 2x3m EXTENSION CORDS } SPECIFICATION ATTACHED TO THIS DRAWING
- CAMERA
- TELEPHONE

KITCHEN (NEW)

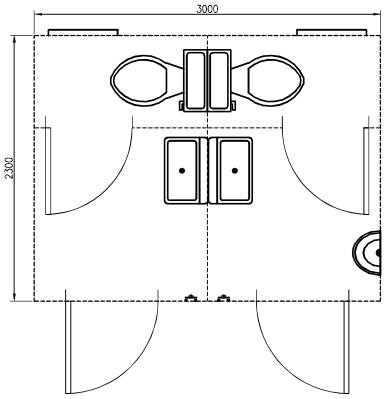
- 1x 220l FREEZER REFRIGERATOR COMBO
- 1x 20l MANUAL MICROWAVE OVEN (800W)
- 1x 1.7L KETTLE
- 1x DOUBLE HOT PLATE (SOLID PLATE)
- 6x MUGS, PLATES, UTENSILS (KNIVES, FORKS, TEASPOONS)
- DISPOSABLE CUPS, KNIVES, FORKS, TEASPOONS (PROVIDED AND MAINTAINED ON A MONTHLY BASIS)
- COFFEE, TEA BOTTLED WATER & MILK (PROVIDED AND MAINTAINED ON A MONTHLY BASIS)
- PAPER TOWEL, CLEANING MATERIALS (DISHWASHING LIQUID, HANDY ANDY, FURNITURE POLISH, CLOTHS, SPONGES), HAND SOAP AND TOILET PAPER (PROVIDED AND MAINTAINED ON A MONTHLY BASIS)

LEGEND

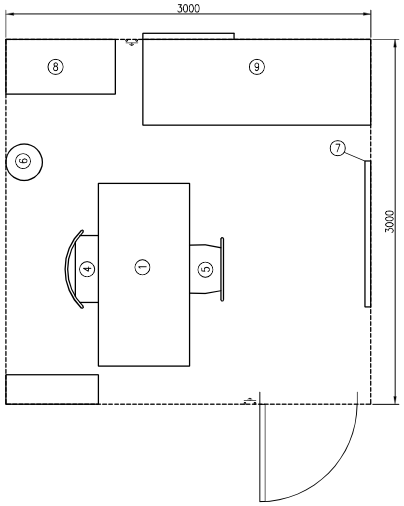
WATER
SEWER
ELECTRICAL



ENGINEER'S CAMP
SITE LAYOUT–TYPE A
SCALE 1:1000



W/C
SCALE 1:25



OFFICE B2
(SEE NOTES FOR FURNITURE)
SCALE 1:25

VERSION

No.	DATE	DESCRIPTION	AUTH. BY

SURVEY DATUM:

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bloemfontein@bigengroup.com

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
ENGINEER'S SITE OFFICE TYPE A

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1		
SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH	CHECKED	L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:

APPROVED ON BEHALF OF BIGEN:
PRACTITIONER(S): Llewellyn Biggs

CLIENT DRAWING No.:
CLIENT REF No.:
DRAWING No.: **3890.00.00.GZA.01.A002**
VERSION: **A**

3890.00.00.GZA.01.A002

PHOTO 1 FENCING

PHOTO 2 DESK

PHOTO 3 FILING CABINET

PHOTO 4 ROTATING HIGH BACK CHAIR

PHOTO 8 C1 PARK HOME

PHOTO 7 BOARDROOM TABLE

PHOTO 6 STATIONARY CUPBOARD

PHOTO 5 RICKSTACKER CHAIR

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
SITE OFFICE FURNITURE

vaal central water. naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:		ORIGINAL DRAWING SHEET SIZE:	A1

APPROVED ON BEHALF OF CLIENT:

NAME:

DATE:

CLIENT DRAWING No.: CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH	CHECKED	L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:

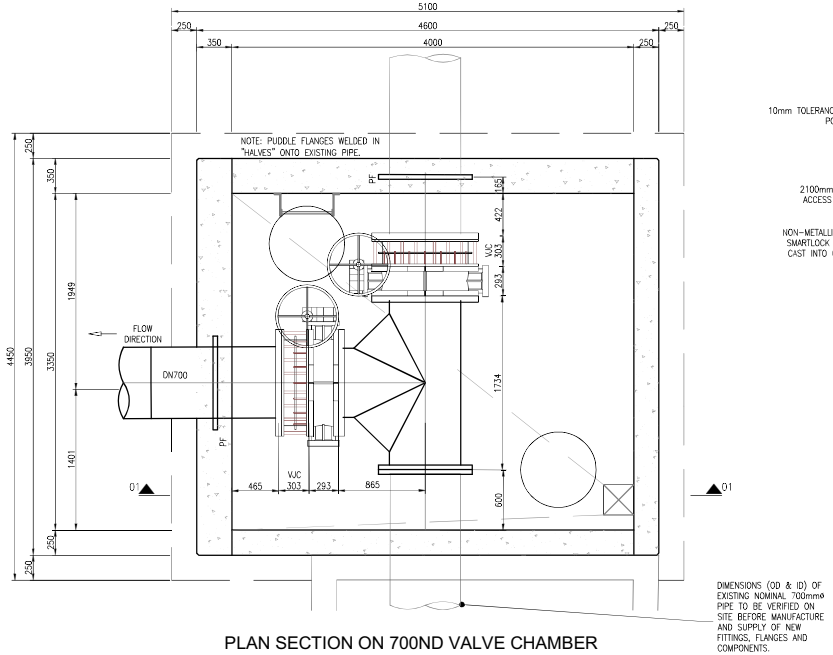
PRACTITIONER: Marcus Pienaar

REVIEWER: Llewellyn Biggs

DRAWING No.: 3890.00.00.GZA.01.A004

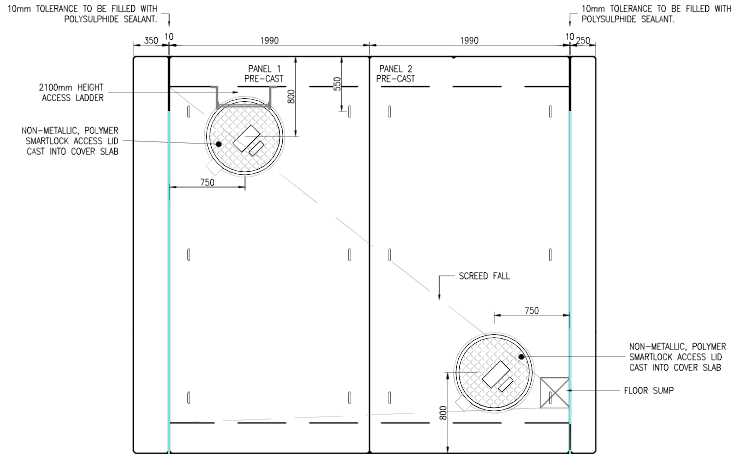
VERSION: A

3890.00.00.GZA.01.A004



PLAN SECTION ON 700ND VALVE CHAMBER

SCALE 1:25

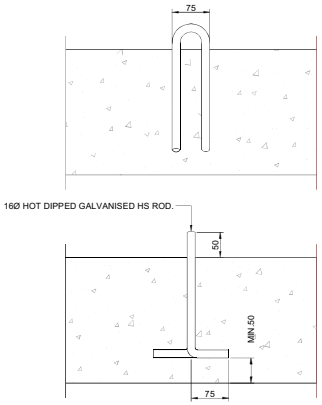


ROOF PLAN ON 700ND CHAMBER

SCALE 1:25

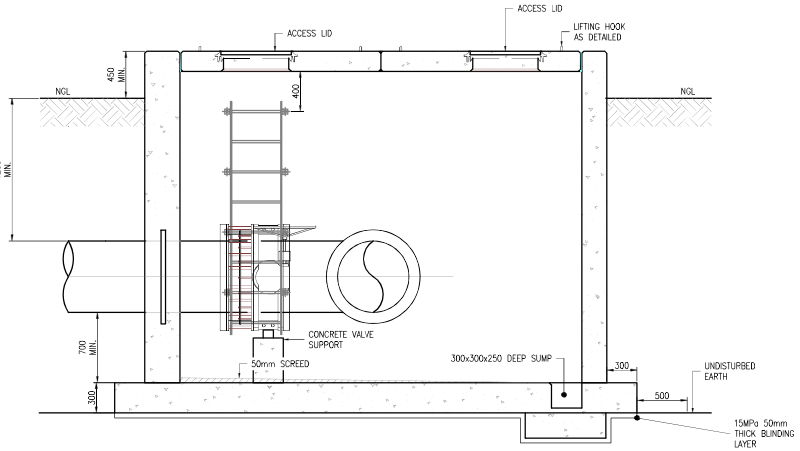
NOTES:

1. ALL EXISTING DETAIL AND DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURE AND SUPPLY.
2. FINAL POSITION OF CHAMBERS TO BE CONFIRMED BY ENGINEER ON SITE.
3. FINAL LEVEL OF EXISTING PIPES TO BE CONFIRMED BY CONTRACTOR ON SITE FOR ENGINEERS APPROVAL.
4. CONCRETE FINISHES SHALL BE AS FOLLOWS, EXCEPT WHERE OTHERWISE SPECIFIED: SMOOTH SPECIALLY FOR SURFACES EXPOSED TO VIEW. ROUGH TO SURFACES AGAINST WHICH BACKFILL OR FURTHER CONCRETE WILL BE PLACED. FLOOR FINISHES INSIDE CHAMBERS TO BE WOOD FLOATED.
5. ALL EXPOSED EDGES TO HAVE 20x20 CHAMFERS.
6. ALL JOINTS AT ROOF PANELS TO BE SEALED WITH POLYURETHANE SEALANT.
7. PIPE SUPPORTS TO BE PROVIDED UNDERNEATH ALL VALVES AS INSTRUCTED BY THE ENGINEER ON SITE.



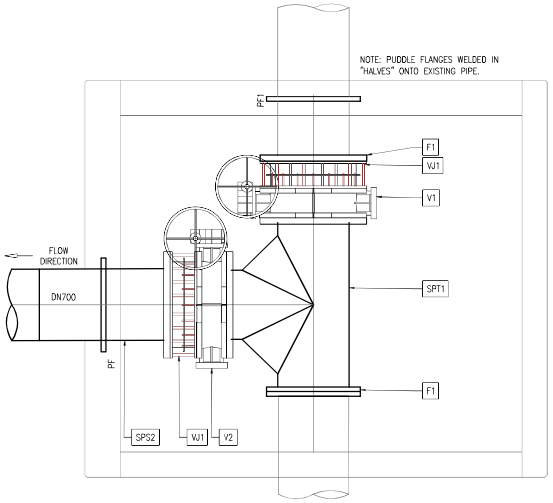
DETAIL OF LIFTING HOOK

SCALE 1:5



SECTION (01-01)

SCALE 1:25

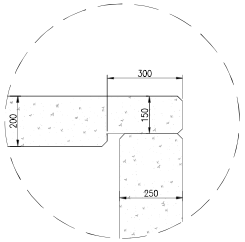


REFER FITTING SCHEDULE FOR COMPONENT DETAIL

NB NOTE: ALL FILLED WELDS ON EXISTING PIPE TO BE REPAIRED BEFORE NEW PIPE PIECES ARE INSTALLED.

PLAN ON MS-900 CHAMBER FITTINGS

SCALE 1:25



DETAIL A - "ANTI-SLIDE" COVER SLAB DEATIL

SCALE 1:10

Llewellyn Biggs

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
SURVEY DATUM:			

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PROJECT TITLE:

PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:

RUSTFONTEIN - WELBEDACHT CROSS CONNECTION DETAILS AND SECTION 711Ø CROSS-CONNECTION PIPE

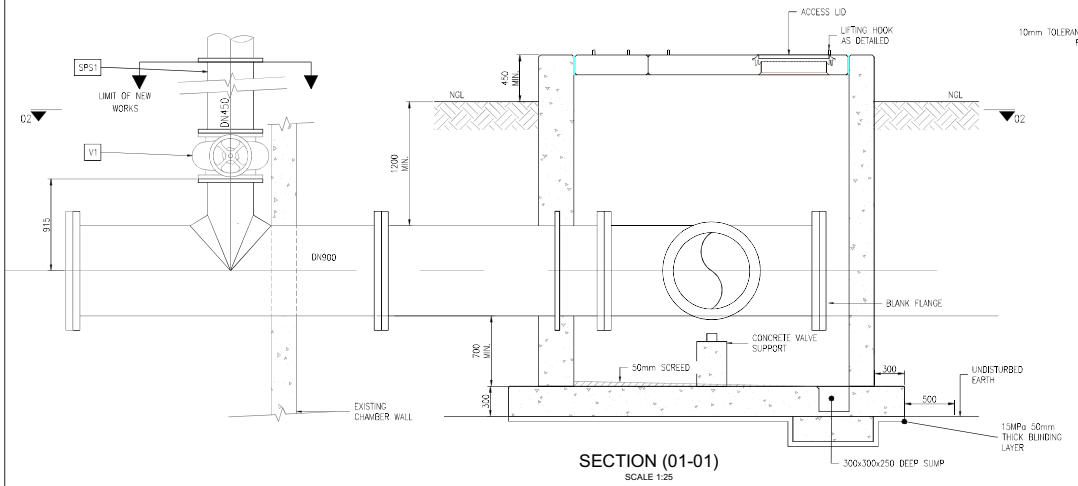
vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

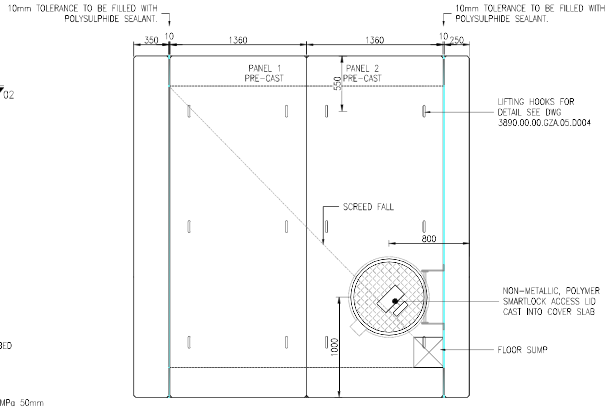
ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1		
APPROVED ON BEHALF OF CLIENT: NAME: DATE:		APPROVED ON BEHALF OF BIGEN:	
CLIENT DRAWING No.:	CLIENT REF No.:	DRAWING No.: 3890.00.00.GZA.05.D004	VERSION: A

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

3890.00.00.GZA.05.D004



SECTION (01-01)
SCALE 1:25



ROOF PLAN TURBO CHAMBER
SCALE 1:25

NOTES:

1. ALL EXISTING DETAIL AND DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURE AND SUPPLY.
2. FINAL POSITION OF CHAMBERS TO BE CONFIRMED BY ENGINEER ON SITE.
3. FINAL LEVEL OF EXISTING PIPES TO BE CONFIRMED BY CONTRACTOR ON SITE FOR ENGINEERS APPROVAL.
4. CONCRETE FINISHES SHALL BE AS FOLLOWS, EXCEPT WHERE OTHERWISE SPECIFIED: SMOOTH SPECIALLY FOR SURFACES EXPOSED TO VIEW. ROUGH TO SURFACES AGAINST WHICH BACKFILL OR FURTHER CONCRETE WILL BE PLACED. FLOOR FINISHES INSIDE CHAMBERS TO BE WOOD FLOATED.
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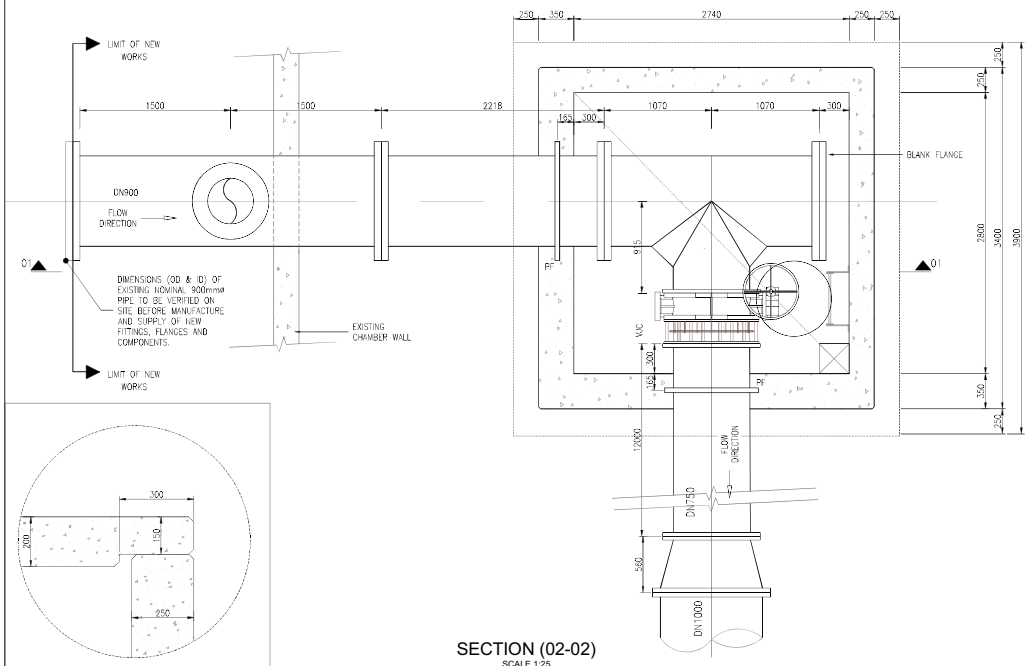
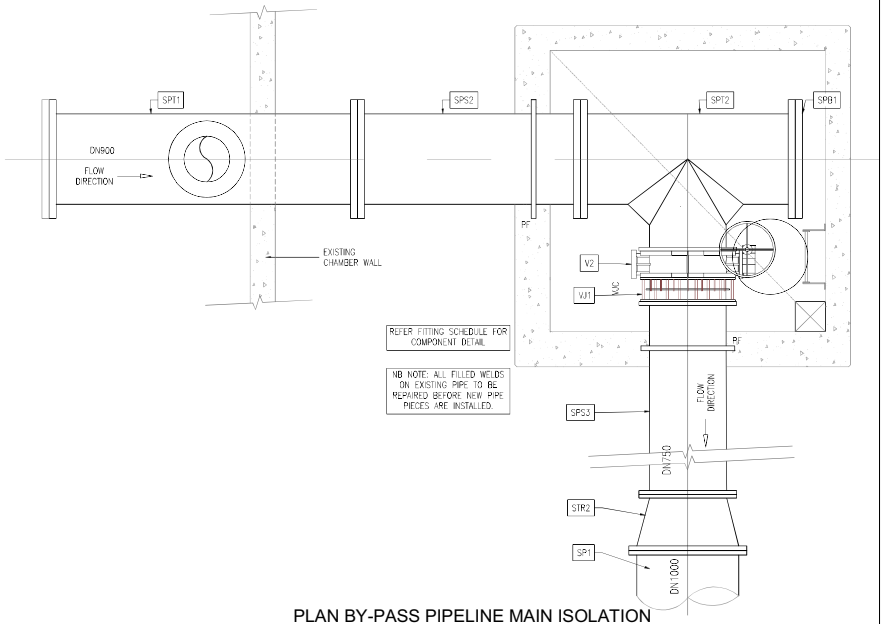
7. PIPE SUPPORTS TO BE PROVIDED UNDERNEATH ALL VALVES AS INSTRUCTED BY THE ENGINEER ON SITE.



SECTION (02-02)
SCALE 1:25

DETAIL A - "ANTI-SLIDE" COVER SLAB DEATIL
SCALE 1:10



PLAN BY-PASS PIPELINE MAIN ISOLATION VALVE CHAMBER FITTINGS
SCALE 1:25

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
BY-PASS PIPELINE ISOLATION AND CONNECTION DETAILS AND SECTION OF MAIN ISOLATION CHAMBER

vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

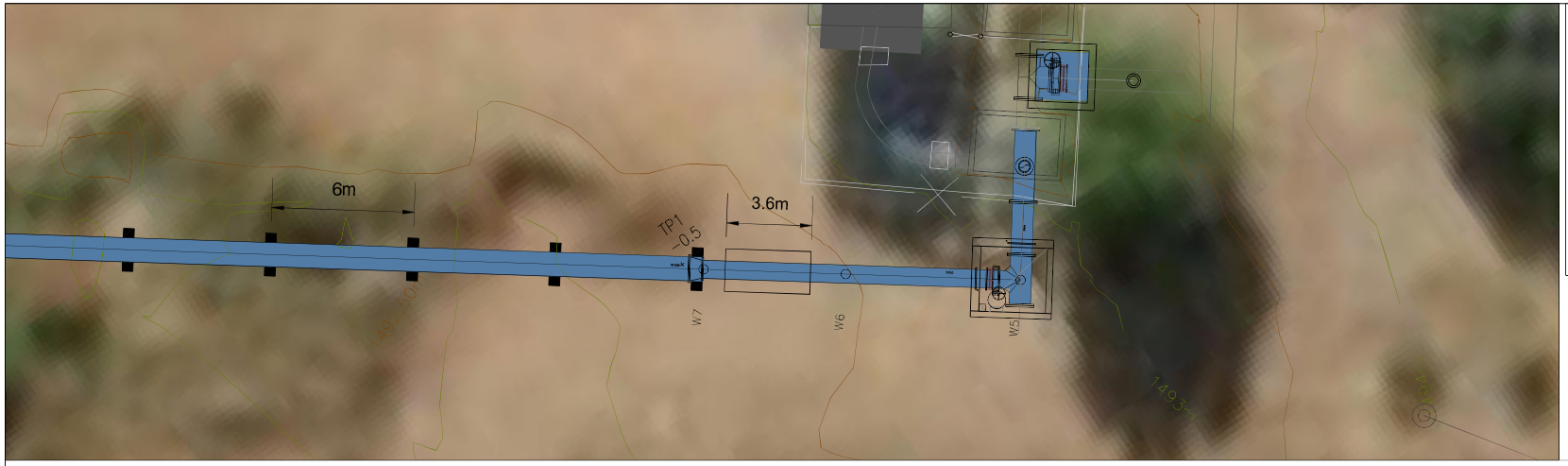
APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:
CLIENT DRAWING No.: CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:
DIRECTOR/CHAIR: Signed by: Hendrik Pienaar
DIRECTOR/CHAIR: Signed by: Llewellyn Biggs

DRAWING No.: **3890.00.00.GZA.05.D005**
VERSION: **A**

3890.00.00.GZA.05.D005



NOTES:

1. ALL EXISTING DETAIL AND DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURE AND SUPPLY.
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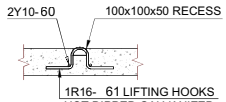
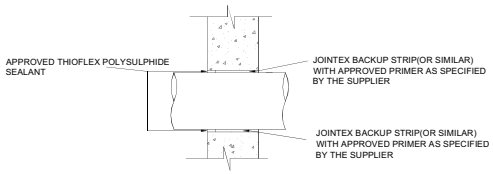
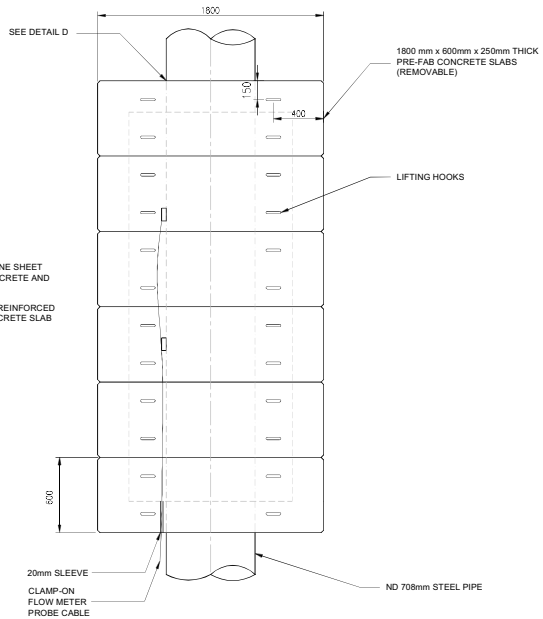


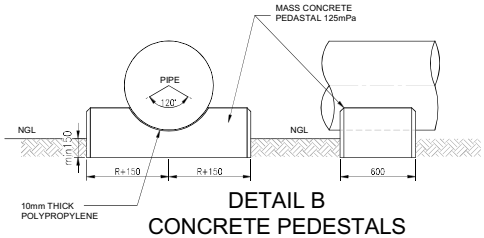
LIFTING HOOK DETAIL
SCALE 1:25



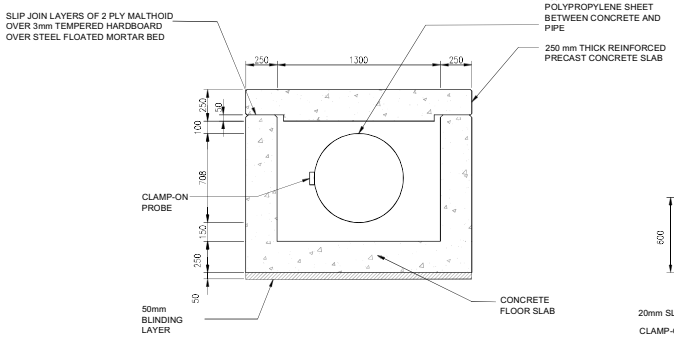
DETAIL D
N.T.S.

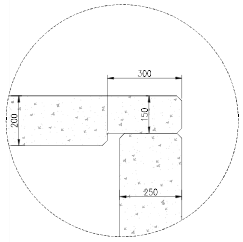


PIPE CROSSING AND FLOW METER CHAMBER
SCALE 1 :20

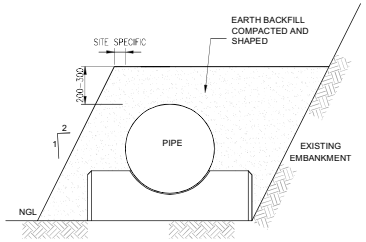


DETAIL B
CONCRETE PEDESTALS
SCALE :1:25





DETAIL A - "ANTI-SLIDE" COVER SLAB DEATIL
SCALE 1:10



DETAIL C
EARTH FILL AROUND PIPE
SCALE :1:25

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
BY-PASS PIPELINE ISOLATION AND CONNECTION DETAILS AND SECTION OF FLOW METER CHAMBER

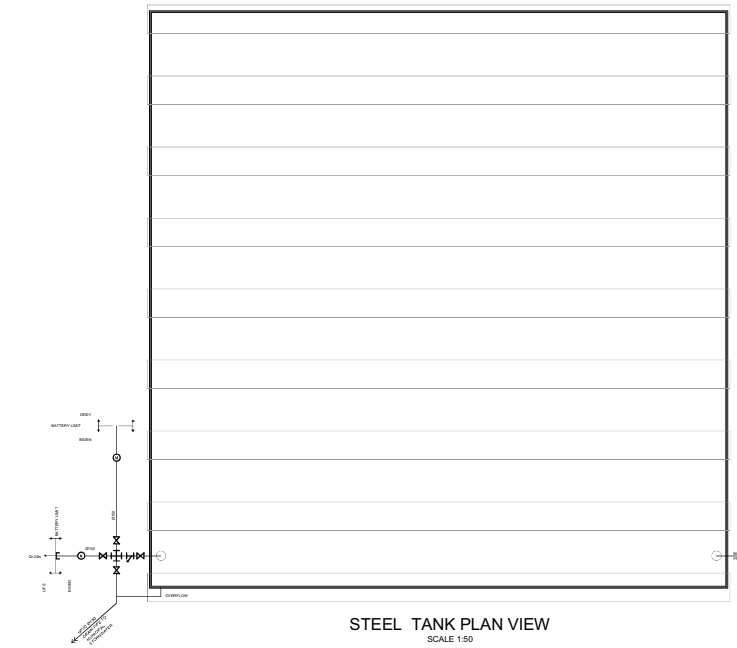
vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

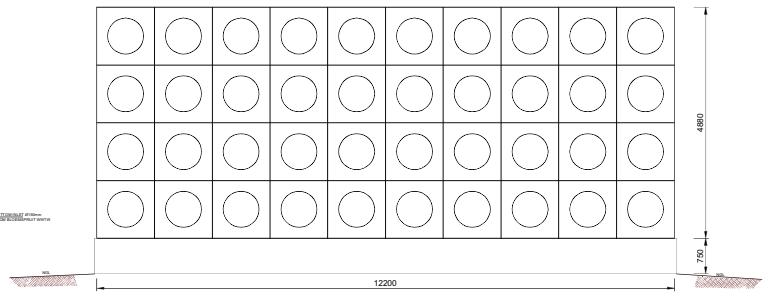
ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1		
APPROVED ON BEHALF OF CLIENT:		APPROVED ON BEHALF OF BIGEN:	
NAME:		ARCHITECT/ENGINEER: Signed by: Mangethwane Email: mangethwane@bigen.co.za Date: 2026-04-14 10:08:07+02:00	REVIEWER: Signed by: Llewellyn Biggs Email: llewellyn.biggs@bigen.co.za Date: 2026-04-14 10:07:12+02:00
DATE:			
CLIENT DRAWING No.:	CLIENT REF No.:	DRAWING No.: 3890.00.00.GZA.05.D006	VERSION: A

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

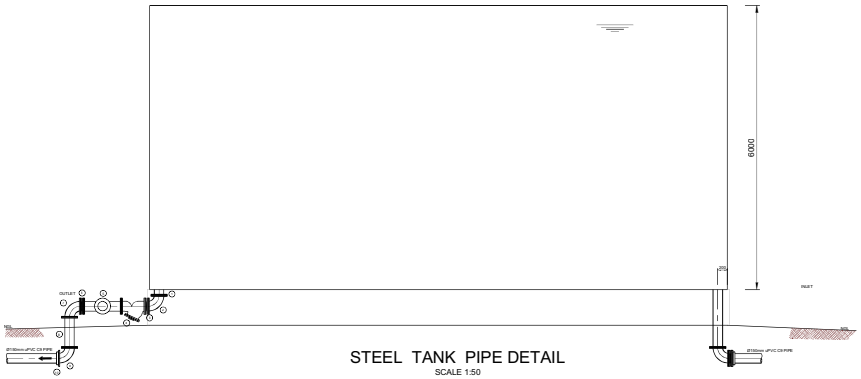
3890.00.00.GZA.05.D006



STEEL TANK PLAN VIEW
SCALE 1:50



TYPICAL SIDE VIEW STEEL TANK
SCALE 1:50



STEEL TANK PIPE DETAIL
SCALE 1:50

PIPE NOTES:

1. Ø150mm FLANGED OUTLET
2. Ø150mm SHORT RADIUS FLANGED BEND
3. Ø150mm WAVER TYPE BUTTERFLY VALVE
4. Ø150mm STRAINER
5. Ø150mm - 150mm FOURWAY FLANGED CROSS
6. Ø150mm WAVER TYPE BUTTERFLY VALVE
7. Ø150mm SHORT RADIUS FLANGED BEND
8. Ø150mm FLANGED PIPE SECTION (F/F 640mm)
9. Ø150mm SHORT RADIUS FLANGED BEND
10. Ø150mm FLANGED ADAPTOR (STEEL TO PVC)
11. Ø150mm WAVER TYPE BUTTERFLY VALVE
12. Ø150mm-200mm EQUAL FLANGED TEE
13. Ø150mm SHORT RADIUS FLANGED BEND
14. Ø150mm FLANGED PIPE SECTION (F/F 640mm)
15. Ø150mm SHORT RADIUS FLANGED BEND WITH FLANGED ADAPTOR (STEEL TO PVC)
16. Ø150mm WAVER TYPE BUTTERFLY VALVE
17. Ø150mm FLANGED PIPE SECTION (F/F 1500mm)
18. Ø150 MECHANICAL FLOW METER
19. Ø150 FLANGED PIPE SECTION INCLUDING BLANK FLANGE (F/F 750mm)

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
SURVEY DATUM:			

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Westdene
Bloemfontein

Phone:+ 27 (0) 51 430 1423

bloemfontein@bigengroup.com

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
STEEL TANK DETAILS

vaal central water .naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:

CLIENT DRAWING No.: | CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH	CHECKED	L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:
Manual Pienaar
Engineering Manager/Reviewer
Cell No: 083 455 3 Email: manuel.bloemfontein@bigengroup.com
Lawrence Biggs
Llewellyn Biggs
Registered Professional Engineer
Registered Professional Engineer
Cell No: 083 455 3 Email: llewellyn.bloemfontein@bigengroup.com

DRAWING No.: **3890.00.00.GZA.05.D007**
VERSION: **A**

3890.00.00.GZA.05.D007

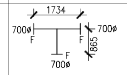
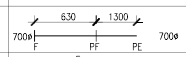
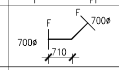
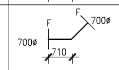
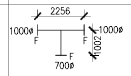
NOTES

1. PIPE ITEM DIMENSIONS – ON LAYOUT DWGS AS REFERRED TO.
   NB – DIMENSIONS MUST BE VERIFIED BY CONTRACTOR ON SITE PRIOR TO ORDERING OF SUCH ITEMS ESPECIALLY WITH REGARD TO NEW AND EXISTING PIPEWORK CONNECTIONS AS WELL AS NEW PIPEWORK IN EXISTING STRUCTURES.
2. DIMENSIONS FOR EQUIPMENT – VALVES, FLOW METERS, PRELIMINARY SELECTED PUMPS, ETC. WERE OBTAINED FROM CATALOGUES FOR PIPEWORK LAYOUT DESIGNS.
   SUCH DIMENSIONS MAY BE INCORRECT ONCE MECHANICAL EQUIPMENT SUBMITTED BY CONTRACTOR HAS BEEN APPROVED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CHECK ALL AFFECTED PIPE ITEM DIMENSIONS PRIOR TO ORDERING ANY ITEMS.
3. DIMENSIONS SHOWN REFER TO:
   – PIPE CENTRE LINES UNLESS OTHERWISE SHOWN
   – OUTSIDE FACE OF FLANGE ON PIPE END
   – CENTRE OF RESTRAINING FLANGES (RF) AND PUDDLE FLANGES (PF)
4. DRILLING OF EXISTING FLANGES MUST BE VERIFIED BY CONTRACTOR ON SITE BEFORE ORDERING.
5. ABBREVIATIONS

CORROSION PROTECTION

CML	CEMENT MORTAR
DP	DENSO PETROLATUM TAPE (ONLY UNDERGROUND SECTIONS)
DT	DENSOTHERM HD SYSTEM (ONLY UNDERGROUND SECTIONS)
DU	DENSO ULTRAFLEX 1250/300 (ONLY UNDERGROUND SECTIONS)
EP	EPOXY PAINT
FBE	FUSION BONDED EPOXY
FMDPE	FUSION BONDED MEDIUM DENSITY POLYETHYLENE (SINTAKOTE)
FRB	FIBRE REINFORCED BITUMEN
G	HOT–DIP GALVANISING
IZS	INORGANIC ZINC SILICATE
MPEP	MULTI–PURPOSE EPOXY PAINT – UV–RESISTANT
PUA	POLYURETHANE ACRYLIC (SILVER)
RPU	RE–COATABLE POLYURETHANE TO CLIENT'S COLOUR CODING SPECIFICATION

CL	CLASS
CP	CROTCH PLATE
CTO	CAP TOP – OPERATED
CTS	PIPE LENGTH CUT TO SUIT ON SITE
DWG	DRAWING
EA	ELECTRIC ACTUATOR
F	FLANGED
F/F	FACE TO FACE DIMENSION
FA	FLANGE ADAPTOR
FDT	FLANGE DRILLING TABLE
GE	GROOVED END
GR	GRADE OF STEEL
GS	GALVANISED STEEL
HD	HEAVY DUTY – GALVANISED STEEL PIPEWORK
HPWB	HANDWHEEL PEDESTAL ON WALL SUPPORT BRACKET
HW	HANDWHEEL
HWO	HANDWHEEL–OPERATED
IF	INSULATED FLANGE
LF	LOOSE FLANGE – WELDED ONTO PIPE END AFTER CUTTING PIPE LENGTH TO SUIT ON SITE – NB: INSTALLATION POSITION AS INDICATED ON LAYOUT DRAWING TO REMAIN UNCHANGED
LH	LEFT HAND SIDE
LR	LONG RADIUS
MD	MEDIUM DUTY – GALVANISED STEEL PIPEWORK
MR	MEDIUM RADIUS
MWP	MAXIMUM WORKING PRESSURE
OD	OUTSIDE DIAMETER
PCD	PITCH CIRCLE DIAMETER FOR FLANGES
PE	PLAIN PIPE END
PF	PUDDLE FLANGE
PMP	PLATFORM–MOUNTED HANDWHEEL PEDESTAL
R	RADIUS
RB	RESTRAINING BOLT
RF	RESTRAINING FLANGE
RH	RIGHT HAND SIDE
RSV	RESILIENT SEAL GATE VALVE
SB	SOLID BODY
SCREW	SCREW TREAD
SE	SPINDLE EXTENSION
SH	STUB HANDWHEEL PEDESTAL ON WALL SUPPORT BRACKET
SP	STRAIGHT PIPE
SR–C	STRAIGHT COUPLING
SS/3,4	STAINLESS STEEL ITEM TO SPECIFICATION WITH 3,4mm WALL THICKNESS
ST/4,5	STEEL ITEM TO SPECIFICATION WITH 4,5 mm WALL THICKNESS
ST–C	STEPPED COUPLING
SW	CERTAIN ITEMS WELDED TOGETHER ON SITE (SITE WELDING). PREPARATION OF ENDS FOR WELDING HAVE TO COMPLY WITH THE SPECIFICATION – NB – CORROSION PROTECTION TO BE REPAIRED TO ENGINEER'S APPROVAL
t	PLATE THICKNESS
WT	PIPE WALL THICKNESS
SO	20mm DIA STAINLESS STEEL SOCKET WELDED ON PIPE ITEM, WITH STAINLESS STEEL NIPPLE AND 20mm DIA 25 BAR FEMALE SCREWED FULL BORE CHROME PLATED BRASS BALL VALVE GATE VALVE, WELDED ON TOP OF PIPE IN A POSITION WHERE IT CANNOT OBSTRUCT INSTALLATION AND REMOVAL OF BOLTS, ALL ITEMS TO BE SUITABLE FOR 2500 kpa WORKING PRESSURE

ITEM NO		TOTAL	REFER DWG	DIA LEFT	DIA RIGHT	DIA BRANCH 1	DIA BRANCH 2	END LEFT	END RIGHT	END BRANCH 1	END BRANCH 2	BEND ANGLE (DEGREE)	BEND RADIUS	MATERIAL/ CLASS	FLANGE SPEC/DRILLING SABS 1123 (1977)	CORROSION PROTECTION FACTORY INTERNAL LINING	CORROSION PROTECTION FACTORY COATING	CORROSION PROTECTION SITE APPLICATION	DESCRIPTION
CROSS CONNECTION (PIPE DIAMETER 700mm)																			
F1		1	3890.00.00.GZA.05.D004	700				F	F						2500/3	EP	EP		ND700 LOOSE PN25 FLANGE WELDED ONTO EXITING ND711 MS PIPE
SPT1		1	3890.00.00.GZA.05.D004	700	700	700		F	F	F				ST/8	2500/3	EP	EP		EQUAL GUSSETED FLANGED TEE PN25 ND700mm
V1		1	3890.00.00.GZA.05.D004	700				F	F						2500/3	FBE	FBE		EXISTING ND 700 BUTTERFLY VALVE PN25 TO BE REPURPOSED
VJ1		2	3890.00.00.GZA.05.D004	700	700			F	F						2500/3	FBE	FBE		ND 700 PN 25 VIKING JOHNSON DISMANTLING JOINT
PF1		1	3890.00.00.GZA.05.D004	700				F							2500/3	EP	EP		PUDDLE FLANGE PN25. PUDDLE FLANGES WELDED IN "HALVES" ONTO EXISTING PIPE
V2		2	3890.00.00.GZA.05.D004	700				F	F						2500/3	FBE	FBE		ND700 PN 25 DOUBLE ECCENTRIC BUTTERFLY VALVE WITH HANDWHEEL
SPS2		1	3890.00.00.GZA.05.D004	700	700			F	PE					ST/8	2500/3	EP	EP+DP		MS PIPE SPECIAL ONE END FLANGED OTHER END PLAIN WELDED ONTO PIPE WITH PUDDLE FLANGE PN25
W2		1	3890.00.00.GZA.05.D004	700	700			F	F					ST/8	2500/3	EP	EP		15° BEND
W3		1	3890.00.00.GZA.05.D004	700	700			F	F					ST/8	2500/3	EP	EP		13° BEND
W4		1	3890.00.00.GZA.05.D004	1000	1000	700		F	F	F				ST/8	2500/3	EP	EP		UNEQUAL GUSSETED FLANGED TEE PN25

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
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bloemfontein@bigengroup.com

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
RUSTFONTEIN - WELBEDACHT CROSS CONNECTION ITEM LIST 711Ø CROSS-CONNECTION PIPE

vaal central water. naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:		ORIGINAL DRAWING SHEET SIZE:	A1
APPROVED ON BEHALF OF CLIENT:		APPROVED ON BEHALF OF BIGEN:	
NAME:		PRACTITIONER:	REVIEWER: Llewellyn Biggs
DATE:			
CLIENT DRAWING No.:	CLIENT REF No.:	DRAWING No.: 3890.00.00.GZA.05.F001	VERSION: A

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

3890.00.00.GZA.05.F001

NOTES

1. PIPE ITEM DIMENSIONS – ON LAYOUT DWGS AS REFERRED TO.
   NB – DIMENSIONS MUST BE VERIFIED BY CONTRACTOR ON SITE PRIOR TO ORDERING OF SUCH ITEMS ESPECIALLY WITH REGARD TO NEW AND EXISTING PIPEWORK CONNECTIONS AS WELL AS NEW PIPEWORK IN EXISTING STRUCTURES.
2. DIMENSIONS FOR EQUIPMENT – VALVES, FLOW METERS, PRELIMINARY SELECTED PUMPS, ETC. WERE OBTAINED FROM CATALOGUES FOR PIPEWORK LAYOUT DESIGNS.
   SUCH DIMENSIONS MAY BE INCORRECT ONCE MECHANICAL EQUIPMENT SUBMITTED BY CONTRACTOR HAS BEEN APPROVED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CHECK ALL AFFECTED PIPE ITEM DIMENSIONS PRIOR TO ORDERING ANY ITEMS.
3. DIMENSIONS SHOWN REFER TO:
   – PIPE CENTRE LINES UNLESS OTHERWISE SHOWN
   – OUTSIDE FACE OF FLANGE ON PIPE END
   – CENTRE OF RESTRAINING FLANGES (RF) AND PUDDLE FLANGES (PF)
4. DRILLING OF EXISTING FLANGES MUST BE VERIFIED BY CONTRACTOR ON SITE BEFORE ORDERING.
5. ABBREVIATIONS

CORROSION PROTECTION

CML	CEMENT MORTAR
DP	DENSO PETROLATUM TAPE (ONLY UNDERGROUND SECTIONS)
DT	DENSOTHERM HD SYSTEM (ONLY UNDERGROUND SECTIONS)
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EP	EPOXY PAINT
FBE	FUSION BONDED EPOXY
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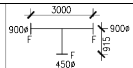
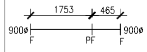
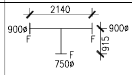
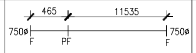
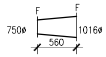
FRB	FIBRE REINFORCED BITUMEN
G	HOT-DIP GALVANISING
IZS	INORGANIC ZINC SILICATE
MPEP	MULTI-PURPOSE EPOXY PAINT – UV-RESISTANT
PUA	POLYURETHANE ACRYLIC (SILVER)
RPU	RE-COATABLE POLYURETHANE TO CLIENT'S COLOUR CODING SPECIFICATION

CL	CLASS
CP	CROTCH PLATE
CTO	CAP TOP – OPERATED
CTS	PIPE LENGTH CUT TO SUIT ON SITE
DWG	DRAWING
EA	ELECTRIC ACTUATOR
F	FLANGED
F/F	FACE TO FACE DIMENSION
FA	FLANGE ADAPTOR
FDT	FLANGE DRILLING TABLE
GE	GROOVED END
GR	GRADE OF STEEL
GS	GALVANISED STEEL
HD	HEAVY DUTY – GALVANISED STEEL PIPEWORK
HPWB	HANDWHEEL PEDESTAL ON WALL SUPPORT BRACKET
HW	HANDWHEEL
HWO	HANDWHEEL-OPERATED
IF	INSULATED FLANGE
LF	LOOSE FLANGE – WELDED ONTO PIPE END AFTER CUTTING PIPE LENGTH TO SUIT ON SITE – NB: INSTALLATION POSITION AS INDICATED ON LAYOUT DRAWING TO REMAIN UNCHANGED
LH	LEFT HAND SIDE
LR	LONG RADIUS
MD	MEDIUM DUTY – GALVANISED STEEL PIPEWORK
MR	MEDIUM RADIUS
MWP	MAXIMUM WORKING PRESSURE
OD	OUTSIDE DIAMETER
PCD	PITCH CIRCLE DIAMETER FOR FLANGES
PE	PLAIN PIPE END
PF	PUDDLE FLANGE
PMP	PLATFORM-MOUNTED HANDWHEEL PEDESTAL
R	RADIUS
RB	RESTRAINING BOLT
RF	RESTRAINING FLANGE
RH	RIGHT HAND SIDE
RSV	RESILIENT SEAL GATE VALVE
SB	SOLID BODY
SCREW	SCREW TREAD
SE	SPINDLE EXTENSION
SH	STUB HANDWHEEL PEDESTAL ON WALL SUPPORT BRACKET
SP	STRAIGHT PIPE
SR-C	STRAIGHT COUPLING
SS/3,4	STAINLESS STEEL ITEM TO SPECIFICATION WITH 3,4mm WALL THICKNESS
ST/4,5	STEEL ITEM TO SPECIFICATION WITH 4,5 mm WALL THICKNESS
ST-C	STEPPED COUPLING
SW	CERTAIN ITEMS WELDED TOGETHER ON SITE (SITE WELDING). PREPARATION OF ENDS FOR WELDING HAVE TO COMPLY WITH THE SPECIFICATION – NB – CORROSION PROTECTION TO BE REPAIRED TO ENGINEER'S APPROVAL
t	PLATE THICKNESS
WT	PIPE WALL THICKNESS
SO	20mm DIA STAINLESS STEEL SOCKET WELDED ON PIPE ITEM, WITH STAINLESS STEEL NIPPLE AND 20mm DIA 25 BAR FEMALE SCREWED FULL BORE CHROME PLATED BRASS BALL VALVE GATE VALVE, WELDED ON TOP OF PIPE IN A POSITION WHERE IT CANNOT OBSTRUCT INSTALLATION AND REMOVAL OF BOLTS, ALL ITEMS TO BE SUITABLE FOR 2500 kpa WORKING PRESSURE

ITEM NO		TOTAL	REFER DWG	DIA LEFT	DIA RIGHT	DIA BRANCH 1	DIA BRANCH 2	END LEFT	END RIGHT	END BRANCH 1	END BRANCH 2	BEND ANGLE (DEGREE)	BEND RADIUS	MATERIAL/ CLASS	FLANGE SPEC/DRILLING SABS 1123 (1977)	CORROSION PROTECTION FACTORY INTERNAL LINING	CORROSION PROTECTION FACTORY COATING	CORROSION PROTECTION SITE APPLICATION	DESCRIPTION
BY-PASS PIPELINE ISOLATION																			
SPT1		1	3890.00.00.GZA.05.D004	900	900	450		F	F	F				ST/8	2500/3 1600/3	EP	EP		UNEQUAL GUSSETED FLANGED TEE PN25 ND900mm MAIN ND450 BRANCH = LENGTH CUSTOM
V1		1	3890.00.00.GZA.05.D005	450				F	F						1600/3	FBE	FBE		EXISTING ND 450 RSV VALVE PN16 TO BE REPURPOSED
SPS1		1	3890.00.00.GZA.05.D005	450				F	F						1600/3	EP	EP		FLANGED STEEL PIPE SPECIAL EXISTING TO BE REPURPOSED AND SHORTERED ON SITE
SPS2		1	3890.00.00.GZA.05.D005	900				F	F						2500/3	EP	EP		FLANGED PIPE SPECIAL WITH RESTRAINER FLANGE LENGTH 2218mm
SPT2		1	3890.00.00.GZA.05.D004	900	900	750		F	F	F				ST/8	2500/3	EP	EP		UNEQUAL GUSSETED FLANGED TEE PN25 ND900mm MAIN ND750 BRANCH
V2		1	3890.00.00.GZA.05.D005	750				F	F						2500/3	FBE	FBE		ND750 PN 25 DOUBLE ECCENTRIC BUTTERFLY VALVE WITH HANDWHEEL
VJ1		1	3890.00.00.GZA.05.D005	750	750			F	F						2500/3	FBE	FBE		ND 750 PN 25 VIKING JOHNSON DISMANTLING JOINT
SPS3		1	3890.00.00.GZA.05.D005	750				F	F						2500/3	EP	EP		FLANGED PIPE SPECIAL WITH RESTRAINER FLANGE LENGTH 12m
STR2		1	3890.00.00.GZA.05.D005	750	1016			F	F						2500/3	EP	EP		FLANGED STEEL PIPE REDUCER ND750 – ND 1016
SPB1		1	3890.00.00.GZA.05.D005	900				F	F						2500/3	EP	EP		BLANK FLANGE – ND 900

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY
SURVEY DATUM:			

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bloemfontein@bigengroup.com

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
BY-PASS PIPELINE ISOLATION AND CONNECTION ITEM LIST - MAIN ISOLATION

vaal central water. naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1
APPROVED ON BEHALF OF CLIENT: NAME: DATE:	
CLIENT DRAWING No.:	CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:
PRACTITIONER: Signed by: Marnel Pienaar, Professional Engineer, Pr.Eng. No. 20100278 (E-E-K-S-M-S)
REVIEWER: Signature of Reviewer: Llewellyn Biggs, Signed by: Llewellyn Biggs, Professional Engineer, Pr.Eng. No. 20100278 (E-E-K-S-M-S)

DRAWING No.: **3890.00.00.GZA.05.F002**
VERSION: **A**

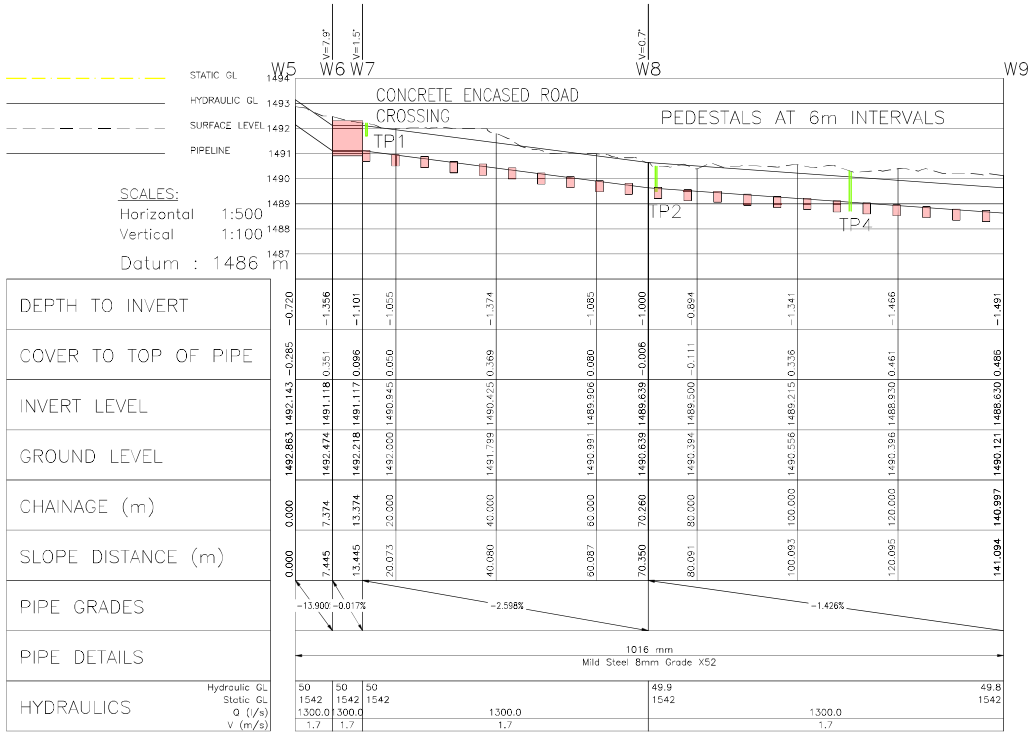
3890.00.00.GZA.05.F002

NOTES:

1. ALL EXISTING DETAIL AND DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURE AND SUPPLY.
2. FINAL POSITION OF CHAMBERS TO BE CONFIRMED BY ENGINEER ON SITE.
3. FINAL LEVEL OF EXISTING PIPES TO BE CONFIRMED BY CONTRACTOR ON SITE FOR ENGINEERS APPROVAL.
4. CONCRETE FINISHES SHALL BE AS FOLLOWS, EXCEPT WHERE OTHERWISE SPECIFIED: SMOOTH SPECIALLY FOR SURFACES EXPOSED TO VIEW. ROUGH TO SURFACES AGAINST WHICH BACKFILL OR FURTHER CONCRETE WILL BE PLACED. FLOOR FINISHES INSIDE CHAMBERS TO BE WOOD FLOATED.
5. ALL EXPOSED EDGES TO HAVE 20x20 CHAMFERS.
6. ALL JOINTS AT ROOF PANELS TO BE SEALED WITH POLYURETHANE SEALANT.
7. PIPE SUPPORTS TO BE PROVIDED UNDERNEATH ALL VALVES AS INSTRUCTED BY THE ENGINEER ON SITE.

LEGEND:

- CADASTER
- EXISTING INFASTUCTURE
- NEW BYPASS 700ND PROPOSAL



Coordinate List		
Lo 27		
hydro		
Node	YLo	XLo
Const:		
W5	82 221.545	3 225 633.533
W6	82 227.511	3 225 629.199
W7	82 232.366	3 225 625.673
W8	82 278.392	3 225 592.243
W9	82 335.615	3 225 550.659

Pipe Data List					
Node	–	Node	Length	Dia.	MATERIAL	GRADE
hydro			(m)	(mm)		
W5	–	W6	7.37	1016	Mild Steel	25
W6	–	W7	6.00	1016	Mild Steel	25
W7	–	W8	56.89	1016	Mild Steel	25
W8	–	W9	70.74	1016	Mild Steel	25

PIPE MATERIAL LIST		
Diameter (mm)	Grade	Length (m)
Mild Steel 1016	25	141.00
Total length :		141.00

Pipe Bends Schedule (>3.0 Deg)			
CH	Diameter1 (mm)	Diameter2 (mm)	Angle (Deg)
7.374	1011	1011	7.9

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No.	DATE	DESCRIPTION	AUTH. BY

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
BRANDKOP PROPOSAL LONGITUDINAL SECTION BYPASS ISOLATION

vaal central water. naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:

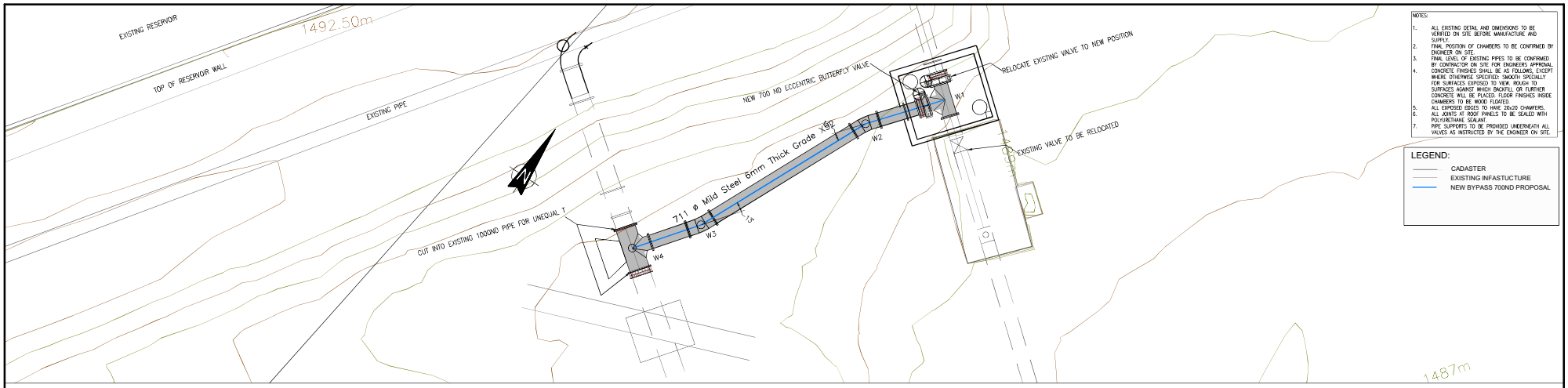
CLIENT DRAWING No.: CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:
PREPARED BY: Pieter Van Niekerk
REVIEWED BY: Llewellyn Biggs

DRAWING No.: 3890.00.00.GZA.05.L003
VERSION: A

3890.00.00.GZA.05.L003



NOTES:

1. ALL EXISTING DETAIL AND DIMENSIONS TO BE VERIFIED ON SITE BEFORE MANUFACTURE AND SUPPLY.
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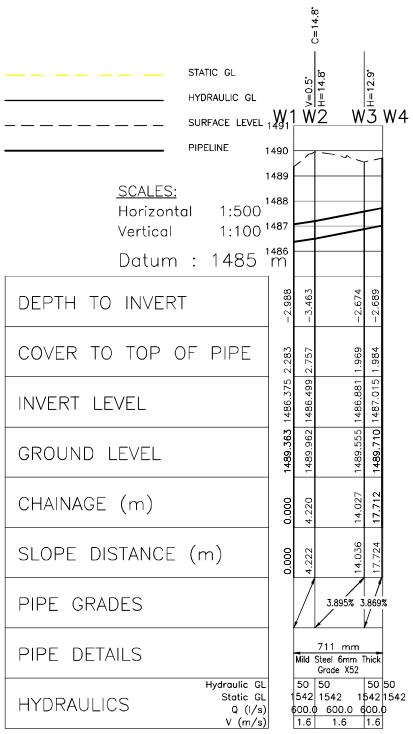
4. CONCRETE FINISHES SHALL BE AS FOLLOWS, EXCEPT WHERE OTHERWISE SPECIFIED: SMOOTH SPECIALLY FOR SURFACES EXPOSED TO VIEW. ROUGH TO SURFACES AGAINST WHICH BACKFILL OR FURTHER CONCRETE WILL BE PLACED. FLOOR FINISHES INSIDE CHAMBERS TO BE WOOD FLOATED.
5. ALL EXPOSED EDGES TO HAVE 20x20 CHAMFERS.
6. ALL JOINTS AT ROOF PANELS TO BE SEALED WITH POLYURETHANE SEALANT.
7. PIPE SUPPORTS TO BE PROVIDED UNDERNEATH ALL VALVES AS INSTRUCTED BY THE ENGINEER ON SITE.

LEGEND:

- CADASTER
- EXISTING INFASTUCTURE
- NEW BYPASS 700ND PROPOSAL



Coordinate List		
Lo 27		
GRP		
Node	YLo	XLo
Const:		
W1	82 154.793	3 225 557.585
W2	82 157.488	3 225 560.833
W3	82 161.612	3 225 569.730
W4	82 163.870	3 225 572.642

Pipe Data List					
Node	–	Node	Length (m)	Dia. (mm)	MATERIAL	GRADE
GRP						
W1	–	W2	4.22	711	Mild Steel	X52
W2	–	W3	9.81	711	Mild Steel	X52
W3	–	W4	3.68	711	Mild Steel	X52

PIPE MATERIAL LIST		
Diameter (mm)	Grade	Length (m)
Mild Steel 711	X52	17.71
Total length :		17.71

Pipe Bends Schedule (>3.0 Deg)			
CH	Diameter1 (mm)	Diameter2 (mm)	Angle (Deg)
5.220	711	711	14.8

VERSION			
No.	DATE	DESCRIPTION	AUTH. BY

SURVEY DATUM:

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Westdene
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Phone:+ 27 (0) 51 430 1423
bloemfontein@bigengroup.com

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
BRANDKOP PROPOSAL LONGITUDINAL SECTION 711Ø CROSS CONNECTION

vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:
CLIENT DRAWING No.: CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

APPROVED ON BEHALF OF BIGEN:
PRACTITIONER: Marnari Pienaar
REVIEWER: Llewellyn Biggs

DRAWING No.: 3890.00.00.GZA.05.L004
VERSION: A

3890.00.00.GZA.05.L004

LEGEND:

- EXISTING ABOVE-GROUND PIPELINES
- EXISTING BELOW-GROUND PIPELINES
- PROPOSED NEW ABOVE-GROUND PIPELINES
- PROPOSED NEW BELOW-GROUND PIPELINES
- EXISTING CHAMBERS
- PROPOSED NEW BREAK PRESSURE TANK

NOTES:

PROPOSED BYPASS PIPELINE:
THE PROPOSED BYPASS PIPELINE COMPRISES A DN 1100 ABOVE-GROUND STEEL PIPELINE, SUPPORTED ON PEDESTALS. CONNECTIONS TO THE EXISTING INFRASTRUCTURE WILL BE BELOW GROUND.

BREAK PRESSURE TANK:
REFER TO THE SEPARATE BREAK PRESSURE TANK (BPT) DRAWINGS FOR BPT CONFIGURATION AND LAYOUT.

THE FINAL BPT LOCATION AND DIMENSIONS ARE SUBJECT TO THE OUTCOMES OF THE GEOTECHNICAL INVESTIGATION.

INFRASTRUCTURE POSITIONING:
THE EXACT POSITIONING OF EXISTING AND PROPOSED INFRASTRUCTURE WILL BE REFINED ONCE THE TOPOGRAPHICAL SURVEY INFORMATION HAS BEEN RECEIVED.

VERSION

No.	DATE	DESCRIPTION	AUTH. BY

SURVEY DATUM:

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PROJECT TITLE:
PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:
SITE LAYOUT

vaal central water naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:

CLIENT DRAWING No.: | CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

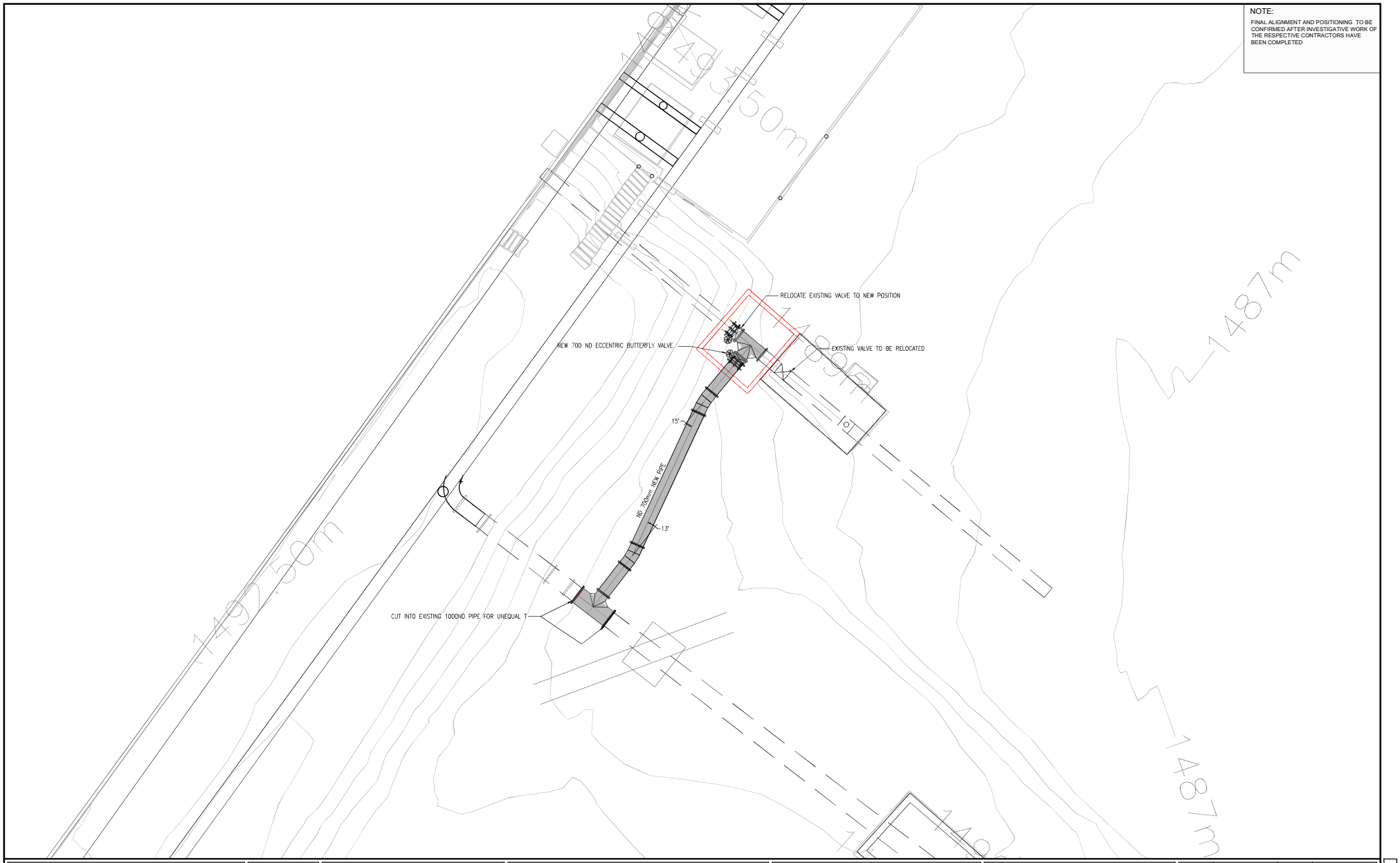
APPROVED ON BEHALF OF BIGEN:
Manager Planner
Manager Engineer
DIRECTOR/OWNER: Signed by: Manager/Director Date: 2026/04/30 08:15:23 (UTC+02:00)
APPROVED BY: Signed by: Consultant Engineer Date: 2026/04/30 10:08:33 (UTC+02:00)

DRAWING No.: **3890.00.00.GZA.05.U002**
VERSION: **A**

3890.00.00.GZA.05.U002

NOTE:

FINAL ALIGNMENT AND POSITIONING TO BE CONFIRMED AFTER INVESTIGATIVE WORK OF THE RESPECTIVE CONTRACTORS HAVE BEEN COMPLETED



VERSION			
No.	DATE	DESCRIPTION	AUTH. BY

SURVEY DATUM:

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PROJECT TITLE:

PROPOSED BYPASS PIPELINE AT VAAL CENTRAL WATER BRANDKOP RESERVOIR

DRAWING TITLE:

BRANDKOP PROPOSAL 711Ø BYPASS

vaal central water. naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	ORIGINAL DRAWING SHEET SIZE: A1

APPROVED ON BEHALF OF CLIENT:

NAME:

DATE:

CLIENT DRAWING No.: CLIENT REF No.:

SURVEYED	-	DESIGNED	M PIENAAR
DRAWN	KL SMITH		L BIGGS
COORD SYSTEM		DATE	APR 2026

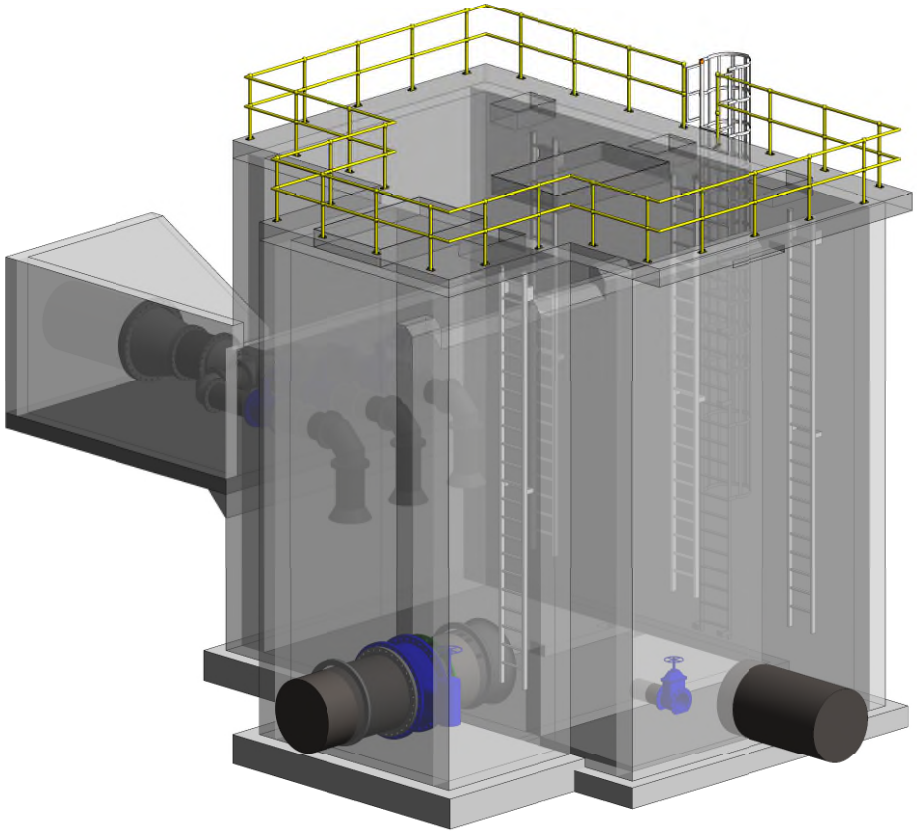
APPROVED ON BEHALF OF BIGEN:

CHECKED BY: Llewellyn Biggs

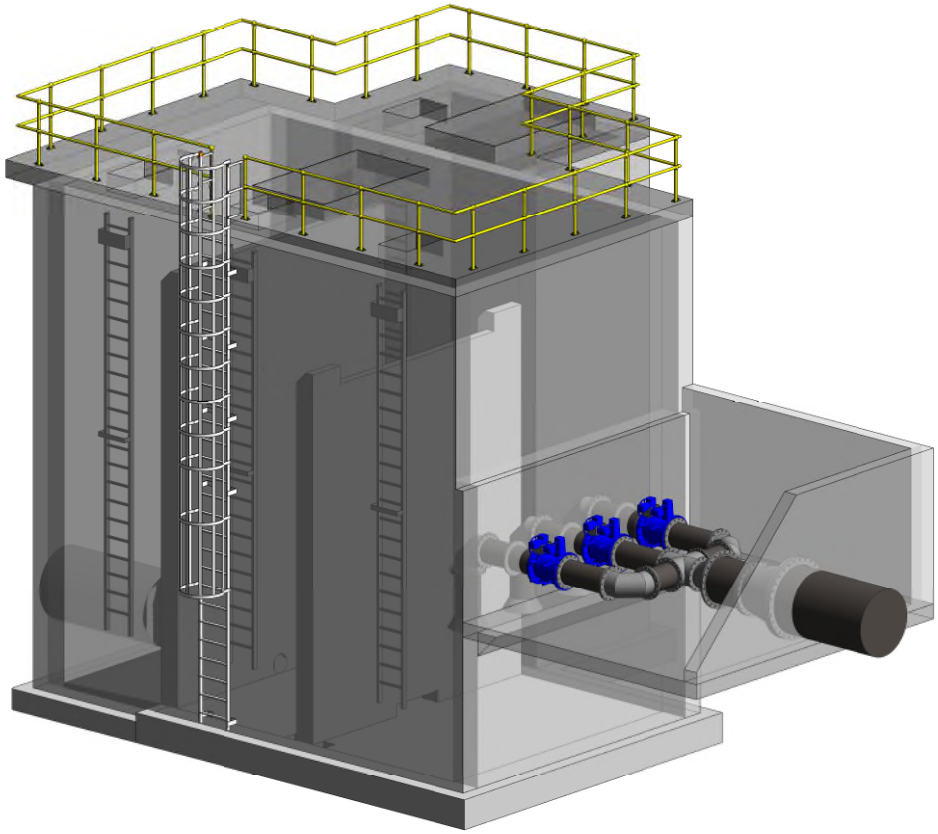
DRAWING No.: **3890.00.00.GZA.05.U004**

VERSION: **A**

3890.00.00.GZA.05.U004



3D VIEW FROM OUTLET



3D VIEW FROM INLET

Revision Schedule			
No.	DESCRIPTION	DATE	AUTH. BY

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PROJECT TITLE:

BRANDKOP RESERVOIR JOINT SEALING AND REPAIR

DRAWING TITLE:

BYPASS AND BREAK PRESSURE TANK 3D VIEWS

vaal central water

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:		ORIGINAL DRAWING SHEET SIZE:	A1

APPROVED ON BEHALF OF CLIENT:

NAME:

DATE:

CLIENT DRAWING No.:

CLIENT REF No.:

SURVEYED		DESIGNED	M PIENAAR
DRAWN	V MABONA	CHECKED	
COORD. SYSTEM		DATE	APRIL 2026

APPROVED ON BEHALF OF BIGEN:

Llewellyn Biggs

DRAWING No.: **3890.00.00.SQA.14.A001**

VERSION: **0**

3890.00.00.SQA.14.A001

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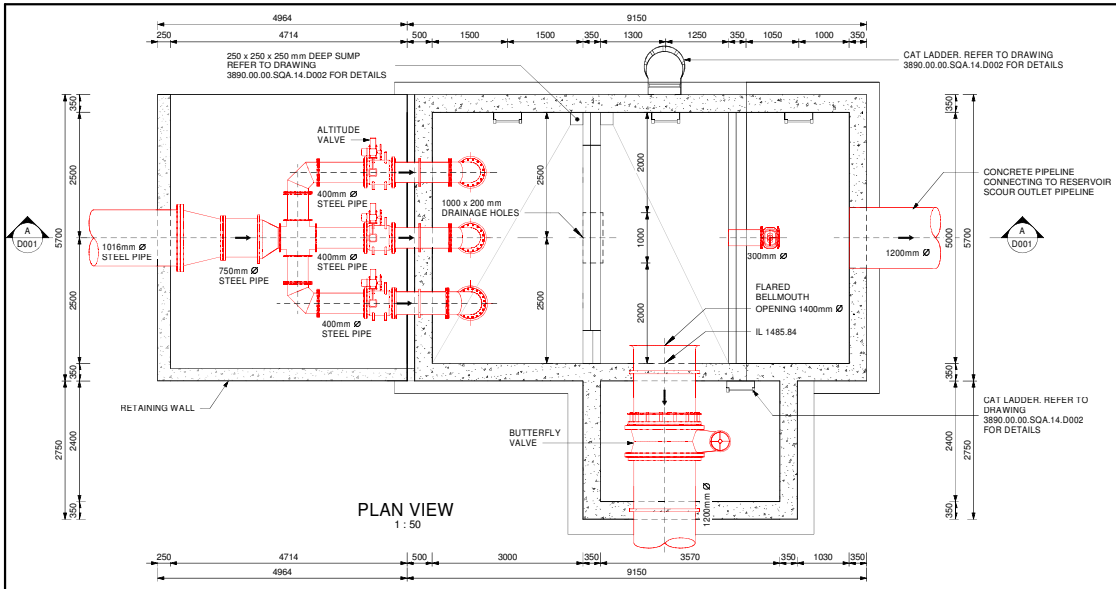
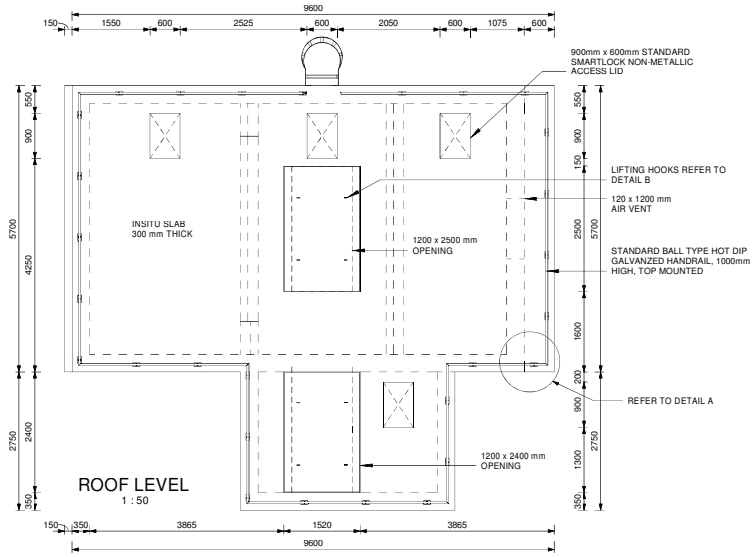
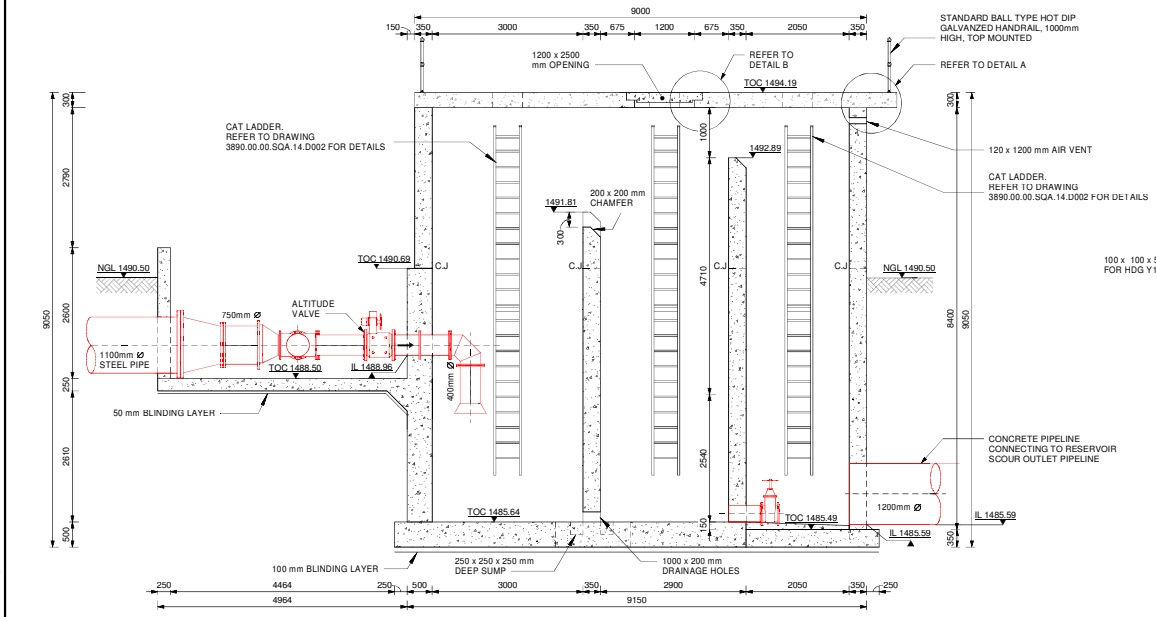


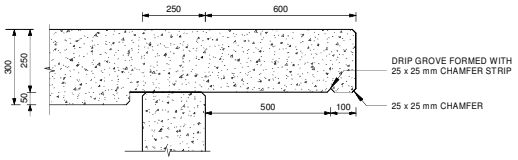
PLAN VIEW
1 : 50



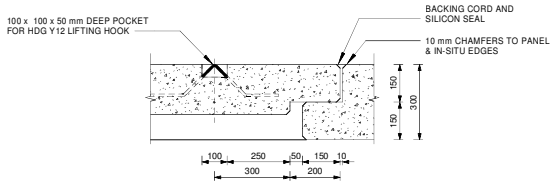
ROOF LEVEL
1 : 50



SECTION A - A
1 : 50



DETAIL A
1 : 10



DETAIL B
1 : 10

NOTES:

1. ALL PIPEWORK IS INDICATIVE AND SHALL NOT BE MANUFACTURED FROM THIS DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE PIPEWORK, VALVES AND SPECIALS. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DESIGN ENGINEER FOR APPROVAL BEFORE MANUFACTURING OR FABRICATION COMMENCES. THE DESIGN MUST BE IN ACCORDANCE WITH THE MECHANICAL SPECIFICATION.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. ALL MATERIAL AND WORKMANSHIP MUST COMPLY THE REQUIREMENTS OF THE LATEST RELEVENT SABS REQUIREMENTS.
4. REFER TO PARTICULAR SPECIFICATION FOR CORROSION PROTECTION. UNLESS OTHERWISE SPECIFIED ALL PIPE SPOOLS WILL BE MILD STEEL PIPES.
5. CONCRETE FINISHES SHALL BE AS FOLLOWS, EXCEPT WHERE OTHERWISE SHOWN:
   a. SMOOTH SPECIALLY FOR SURFACES EXPOSED TO VIEW.
   b. ROUGH TO SURFACES AGAINST WHICH BACKFILL OR FURTHER CONCRETE WILL BE PLACED.
   c. FLOOR FINISHES INSIDE CHAMBERS TO BE WOOD FLOATED.
6. ALL EXPOSED EDGES TO HAVE 20x20 CHAMFERS.
7. ALL JOINTS AT ROOF PANELS TO BE SEALED WITH POLYURETHANE SEALANT.
8. ANY DISCREPANCIES BETWEEN THE DRAWINGS, SPECIFICATIONS AND DATA SHEETS MUST BE REPORTED IMMEDIATELY.

Revision Schedule

No.	DESCRIPTION	DATE	AUTH. BY

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PROJECT TITLE:
BRANDKOP RESERVOIR JOINT SEALING AND REPAIR

DRAWING TITLE:
BYPASS AND BREAK PRESSURE TANK LAYOUT AND SECTION

vaal central water
ORIGINAL DRAWING SCALE: As indicated
ORIGINAL DRAWING SHEET SIZE: A1

SURVEYED		DESIGNED	M PIENAAR
DRAWN	V MABONA	CHECKED	
COORD. SYSTEM		DATE	APRIL 2026

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:
CLIENT DRAWING No.:
CLIENT REF No.:

APPROVED ON BEHALF OF BIGEN:
Llewellyn Biggs

DRAWING No.: 3890.00.00.SQA.14.D001
VERSION: 0

3890.00.00.SQA.14.D001

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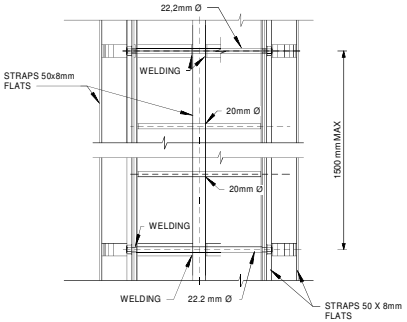
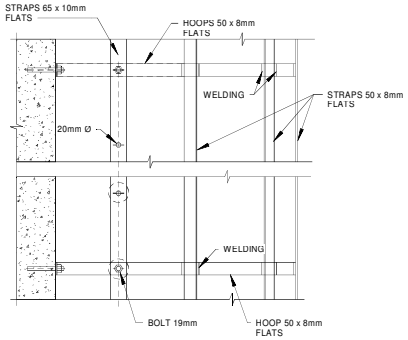
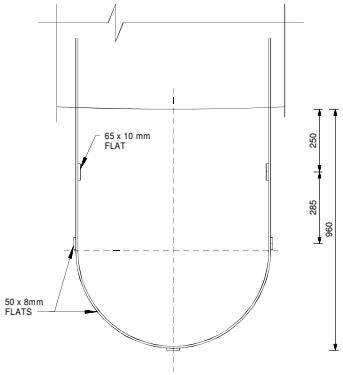


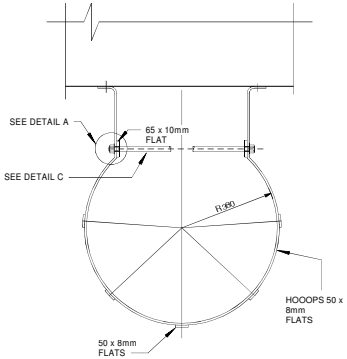
FRONT VIEW
SCALE 1:10



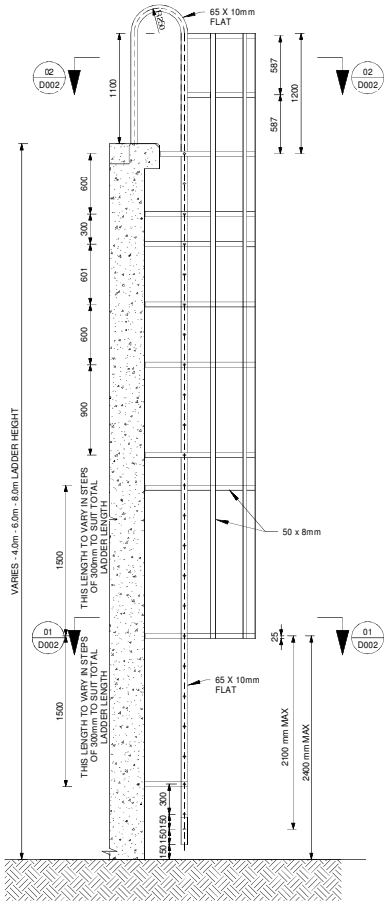
SIDE VIEW
SCALE 1:10



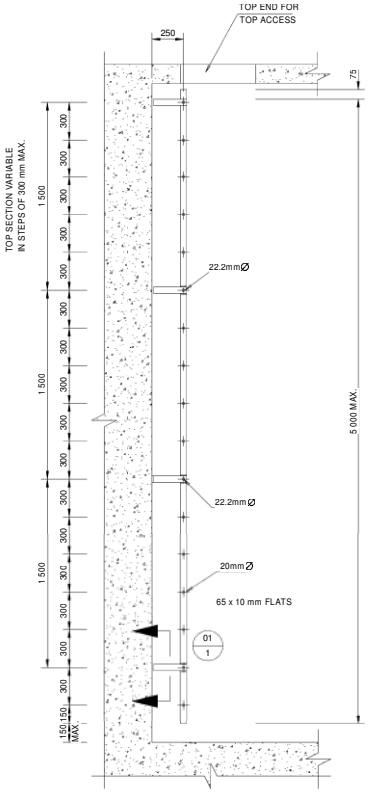
SECTION 02-02
SCALE 1:10



SECTION 01-01
SCALE 1:10



ELEVATION OF CAT LADDER
SCALE 1:25



LADDER WITHOUT SAFETY HOOP
SCALE 1:20

Revision Schedule			
No.	DESCRIPTION	DATE	AUTH. BY

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PROJECT TITLE:
BRANDKOP RESERVOIR JOINT SEALING AND REPAIR

DRAWING TITLE:
BYPASS AND BREAK PRESSURE TANK CAT LADDER DETAILS

vaal central water
naturally

0 50 100
100mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SCALE:	As indicated	ORIGINAL DRAWING SHEET SIZE:	A1

SURVEYED		DESIGNED	M PIENAAR
DRAWN	V MABONA	CHECKED	
COORD. SYSTEM		DATE	APRIL 2026

APPROVED ON BEHALF OF CLIENT:
NAME:
DATE:
CLIENT DRAWING No.:
CLIENT REF No.:

APPROVED ON BEHALF OF BIGEN:
Llewellyn Biggs

DRAWING No.: **3890.00.00.SQA.14.D002**
VERSION: **0**

3890.00.00.SQA.14.D002

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