Government of Zimbabwe

STANDARD BIDDING DOCUMENT

Kunzvi Phase 1 Irrigation Development Scheme

August 2025

Standard Bidding Document for Kunzvi Phase 1 Irrigation Development Scheme

Procurement Reference No: ZINWA/WOR/2025/23

Procuring Entity: Zimbabwe National Water Authority (ZINWA)

Date of Issue: 01 August 2025

Closing Date: 05 September 2025

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PART 1: BIDDING PROCEDURES

1. References:

References to the Public Procurement and Disposal of Public Assets Act [*Chapter22:23*] and also the Public Procurement and Disposal of Public Assets (General) Regulations (Statutory Instrument No. 5 of 2018), that governs the terms and conditions for submission of Bids.

2. Procurement Reference Number: ZINWA/WOR/2025/23

Preparation of Bids

You are requested to bid for the items specified in the Statement of Requirements below, by completing and returning the following documentation:

1. the Bid Submission Sheet in this Part 1;
2. the Priced Bill of Quantities or Schedule of Activities (in Part 2)
3. a copy of documentation necessary to demonstrate eligibility in terms of section 28 (1) of the Regulations;
4. Supplier Registration number showing that you are registered with the Procurement Regulatory Authority of Zimbabwe;
5. A bid security specified in this Part;
6. The Bidders are advised to carefully read the complete Bidding Document, as well as the General Conditions of Contract which are available on the Authority's website, before preparing your Bid. The standard forms in this document may be retyped for completion but the Bidder is responsible for their accurate reproduction. All pages of the Bid must be clearly marked with the Tender Number above.
7. Proof of registration with CIFOZ/ZIBCA/Ministry of Public Works as a minimum Category D or better for Civil/ Mechanical/ Electrical Works Contractor

You are also required to pay the SPOC administration fee of US$400.00 OR Equivalent payable by bidders for bids subject to prior review by the Special Procurement Oversight Committee in terms of section 54 of the Act and as set out in Part IV of the Fifth Schedule to the Regulations. The administration fees should be paid to Procurement Regulatory Authority of Zimbabwe (PRAZ).

You are advised to carefully read the complete Bidding Document, the General Conditions of Contract **(available on the PRAZ's website),** as well as the Special Conditions of Contract in Part 3: Contract, before preparing your Bid. The standard forms in this document may be retyped for completion but the Bidder is responsible for their accurate reproduction. All pages of the Bid must be clearly marked with the Procurement Reference Number above and the Bidder's name and any reference number.

3. Lots and Packages

The project is not divided into lots.

4. Number of bids allowed

No Bidder may submit more than one bid, either individually or as a joint venture partner in another

Bid, except as a subcontractor. Where the works are divided into lots and packages, only one Bid can be submitted. A conflict of interest will be deemed to arise if Bids are received from more than one Bidder owned, directly or indirectly, by the same person.

5. **Clarification**

Clarification of the bidding document may be requested in writing by any Bidder up to **25 August 2025** and should be sent to: ***https://egp.praz.org.zw***

Att. -: Head Procurement Management Unit (ZINWA)

All queries should be communicated not later than 7 days before the tender closing date and responses should be conveyed not less than five (5) days before tender closing date in writing. Responses to bidders will be conveyed, without disclosing the source of the query, in not less than five (5) days before tender closing date.

6. Pre-bid meeting and Site Visit

There will be a pre-bid meeting and a site visit conducted by the Zimbabwe National Water Authority is set for **DATE 19 August 2025** at Kunzvi Dam,

DIRECTIONS TO THE SITE

Kunzvi Dam site is located about seventeen (17) kilometers south of Juru Growth Point and is on Nyagui River. Access to site is the Harare-Mutoko Road. Fifty (50) kilometers from Harare and just before Juru, a gravel road lead south to St John' Mission. The site is beyond the mission and approximately two (2) km upstream of the confluence the Nora River with the Nyagui River. Bidders will meet at Juru Growth Point on 19 August 2025 at 1000hrs, then proceed to the site.

The bidder is expected to submit his bid together with a signed site visit certificate failure will lead to automatic disqualification.

7. Services to be performed, location(s) and other requirements

The services to be performed under the Contract, the location or locations where these services are to be performed, the times of performance and the manpower, equipment and other resources required and the supervising agent at these locations are stated in the Statement of Requirements in Part 2. Bidders must signify their acceptance of these requirements when submitting their Bid.

The Supervising Agent will have authority on behalf of the Procuring Entity to give directions on the performance of the services and to approve satisfactory completion of these services.

8. Documents establishing conformity of services

To establish the conformity of the Services to the Bidding Document, the Bidder must furnish as part of its Bid a proposed methodology, work plan and schedule to establish that the services will be carried out in accordance with the required technical specifications and quality standards.

9. Validity of Bids

The minimum period that the Bidder's bid must remain valid is **90 days** from the deadline for the submission of bids.

10.0 Submission of Bids

Bids must be submitted on line through the EGP system on https://egp.praz.org.zw, no later than the date and time of the deadline below.

Late bids will be rejected by the EGP System. The Procuring Entity reserves the right to extend the bid submission deadline but will notify all potential bidders who have collected the bidding documents of the amended bid submission deadline.

Date of deadline:	**05 September 2025**	Deadline Time:	**1000hrs**
Submission address:	https://egp.praz.org.zw		

Means of acceptance: https://egp.praz.org.zw on line on the given address.

11.0 Bid opening

Bidders and their representatives may witness the opening of bids, which will take place at the submission address immediately following the deadline.

12.0 Withdrawal, amendment or modification of Bids

A Bidder may withdraw, substitute, or modify its Bid after it has been submitted.

13.0 Bid Prices and Discounts

The bid rates and prices must cover all costs of labour, materials, equipment, overheads, profits and all associated costs for performing the Works and must include all taxes and duties. The whole cost of performing the Works must be included in the items stated, and the cost of any incidental works will be deemed to be included in the prices quoted.

The Bidder must fill in rates and prices for all items of the Works described in the Bill of Quantities or Schedule of Activities. Items against which no rate or price is entered by the Bidder will be deemed to be covered by the rates or prices for other items in the Bill of Quantities or Schedule of Activities.

The price quoted in the Bid Submission Sheet must be the total price of the Bid, excluding discount. The Bidder must quote any discounts and the methodology of its application in the Bid Submission Sheet.

14.0 Currency

Bids should be priced in United States Dollars. The currency of evaluation will be United States Dollars **US$**, but please note that the payment will be done in Zimbabwe Dollars at the prevailing inter-bank rate on the date of payment**.** Bids submitted in ZiG$ will be converted into US$ using the prevailing Reserve Bank of Zimbabwe rate at the closing date

15.0 Bid Security

The Bidder must include either:

<u>Option 1:</u> (Bid bonds/ security from Financial Institutions)

Option 1

The Tender must be accompanied by a Bid Bond or Bid Security of **US$10 000.00 or Equivalent in ZiG** that shall be valid for a period of **90 days** after tender closing date, in line with Section 26 of the Procurement Regulations (S.I. 5 of 2018).

Bidders are free to choose the form Bid Security that they would want to submit from any one of the following options below: -

Option 1…. **A certified bank cheque** in the name of ZINWA that should be valid up to 01 December 2025

Option 2…… **A Bank Guarantee** in the name of ZINWA that should be valid up to 01 December 2025

<u>Please note</u> that the required **Bid Bond** should include the following features in order for it to be **considered valid:** -

a) **Letter head** of a registered Commercial Bank (i.e. the Supplier of the Bid Bond/Surety).

b) The **Header** to clearly state that it is a **Bid Security Bond**.

c) **Purpose** of the **Bid Bond** to be **clearly stated**.

d) The **date** when the **Common Seal** of the said **Surety** was effected to **be stated**.

e) **Conditions** of the said **Obligation to be stated**.

f) **The physical address** of the **Surety to be** stated.

g) **The validity period** of the **Bid Bond** to be **clearly stated**.

h) **Signature of Surety** and the **date** when it was endorsed to be **clearly shown.**

i) It must be an **original** document and **date stamped**.

Option 3…. **A Cash Deposit** to the **Authority PRAZ**

If **Option 3** is chosen bidders must pay **US$10 000.00 or Equivalent in ZiG** for Bid Security that shall be Refundable at the end of the Bidding period plus another **US$750.00 or Equivalent in Zig** that shall be non-refundable for cash bid bond establishment fee in line with Part IV of the Procurement Regulations (S.I. 5 of 2018).

Failure to comply with the <u>above</u> requirements on Bid-security will lead to automatic disqualification.

Any bid not accompanied by a Bid Security in accordance with section 26 (3) of the **Public Procurement and Disposal of Public Assets (General) Regulations, 2018** or Bid Securing Declaration in accordance with section 26 (4) of the said **Regulations,** where this is a requirement of bidding, will be rejected by the Procuring Entity as non-responsive.

The Bid Security or Bid-Securing Declaration of a Joint Venture (JV) must be in the name of the JV that submits the Bid. If the JV has not been legally constituted at the time of bidding, the Bid Security or Bid-Securing Declaration must be in the names of all intended partners.

16.0 Origin of Materials, Equipment and Services:

All materials, equipment and services to be used in the performance of the contract shall have as their country of origin an eligible country, as defined in the Special Conditions of Contract.

17.0 Evaluation of Bids

Bids will be evaluated using the following methodology:

1. Preliminary examination to confirm that all documents required have been provided, to confirm the eligibility of Bidders in terms of section 28(1) of the Regulations and to confirm that the Bid is administratively compliant in terms of section 28(2) of the Regulations.
2. Technical evaluation to determine their substantial responsiveness to the specifications in the Statement of Requirements;
3. Financial evaluation and comparison to determine the evaluated price of Bids and to determine the lowest evaluated Bid (to specification).

Bids failing any stage will be eliminated and not considered in subsequent stages.

18.0 Review by the Special Procurement Oversight Committee

Section 54 of the Act provides for review by the Special Procurement Oversight Committee for certain especially sensitive or especially valuable contracts. The bidders are required to pay a Non-Refundable fee of US**$400.00 Or Equivalent in ZiG** for local bidders subject to review by the above Committee. **Failure to pay will lead to disqualification.**

19.0 Eligibility and Qualification Criteria

Bidders are required to meet the criteria in section 28 of the Act to be eligible to participate in public procurement and to be qualified for the proposed contract. They must therefore provide any available documentation and certify their eligibility in the Bid Submission Sheet. Under this criteria please attach Company Documents i.e.

To be eligible, Bidders must specify the documentation that is required to demonstrate the criteria listed below:

1. Have the legal capacity to enter into a contract, please provide certificate of cooperation and any other documents to prove that they have legal capacity. (CR14, CR6, Certificate of Incorporation)
2. Not be insolvent, in receivership, bankrupt or being wound up, not have had business activities suspended and not be the subject of legal proceedings for any of these circumstances, (Provide declaration that you are not insolvent or bankrupt)
3. Have fulfilled their obligations to pay taxes and social security contributions in Zimbabwe; (provide tax clearance and valid NSSA compliance certificate)
4. Not have a conflict of interest in relation to this procurement requirement (Provide declaration that you do not have a conflict of interest)

5. Not been debarred from participation in public procurement under section 72 (6) of the Act and section 74(1) (c), (d) or (e) of the Regulations or declared ineligible under section 99 of the Act;
6. Have been registered with the Authority as a Supplier under and have paid the applicable Supplier Registration Fee set out in Part III of the Fifth Schedule to the Regulations. Participation in this bidding procedure is open to both Zimbabwean and foreign bidders.

In addition to these eligibility requirements, Bidders must demonstrate that they have the qualifications, resources and experience to perform the contract to satisfactory standards, as indicated in the Statement of Requirements.

Participation in this bidding procedure is open to **Zimbabwean bidders only.**

20.0 Detailed Evaluation

The Bids will be examined to confirm that all terms, conditions and requirements of the bidding document have been compiled with by the Bidder. The assessment of responsiveness shall be determined in accordance with the criteria in section 28 of the Regulations.

Evaluation of Technical Bids will include an assessment of the Bidder's technical capacity to mobilize key equipment and manpower which is substantially responsive to the Procuring Entity's Requirements.

Total scores will be determined using a weighting of **70% for technical submissions** and a weighting of **30% for the priced bill of quantities**. In the evaluation of the priced bill of quantities, percentages of the maximum available (i.e., of the 30 points) will be allocated as follows:

- Lowest price gets 100% (of the available 30 points).
- All other priced bill of quantities will be awarded points in accordance with the formula: ***30 x lowest price of all proposals received / price of proposal being evaluated.***

The bidder's final score will be made up of a summation of the technical and financial scores.

20.1 Preliminary Evaluation

a) A signed **Bid submission sheet** to establish that the Works will be carried out in accordance with the terms and conditions stated in the Bidding Document and to the required technical specifications and quality standards.

b) Memorandum and articles of association or Joint Venture Agreement where applicable.

c) Comprehensive company profile

d) Adequate bid security *or bid bond amounting to US$10 000.00 OR Equivalent in ZIG*

e) Proof of payment for Special Procurement Oversight Committee (SPOC) fee amounting to US$400.00 OR Equivalent in ZIG.

f) CR 14

g) CR 6

h) Valid Certificate of Incorporation

i) Valid tax clearance certificate OR VAT registration,

j) Valid NSSA Compliance Certificate, and

k) Supplier Registration number and documentation showing that you are registered with the Procurement Regulatory Authority of Zimbabwe. Attach PRAZ certificate.

l) Site visit certificate

m) Gantt chart

m) Proof of registration with CIFOZ/ZIBCA/Ministry of Public Works as a minimum Category D or better for Civil/ Mechanical/ Electrical Works Contractor **(Attach on professional registration slot provided on EGP)**

21.0 – Technical Capacity

The following will lead to automatic disqualification;

i) Failure to provide proof of ownership

ii) If you provide proof in the form of lease/Hire agreement, the equipment leased or hired must not be found in any one of the participating bidders Bid Document.

2. Previous experience for the same type of work, stating the specific district/area where the work was done (centre pivots installation, brick house construction, road works). If a subcontractor is being used for certain works, then their relevant experience must be attached. **Attach traceable reference list and reference letters from at least (3) clients where similar jobs have been carried out.**

3. Availability of **key personnel** for the works (Please provide CVs and Certificates - failure to submit will lead to disqualification)
    - Contract/Project Manager
    - Civil/Mechanical/Irrigation Engineer (Site Engineer)
    - Foreman (Civil and earthworks)

4. **Method statement** that clearly shows how the works will be executed including a **programme of works**

		Sub-Points	Total Points
a) Method statement			20
i.	Material procurement plan provided and reasonable	5	
ii.	Programme of Works provided	5	
iii.	Cash flow requirements provided and reasonable	5	
iv.	Labour and Plant requirements on site during the construction period	5	
b) Qualification and Experience of personnel to be engaged on the project.			**25**
i.	Contract/Project Manager		
	Degree in Civil/Mechanical Irrigation Engineering or Quantity Surveying		
	· 5 years' experience	10	
ii.	Site Agent		
	Degree in Civil/Mechanical/Irrigation Engineering or Equivalent		
	· 5 years' experience	10	
iii.	Foreman (Civil and earthworks)		
	National Diploma in Civil Engineering or Construction Technology		
	· 5 years' experience	5	
c) Experience of the company			**35**
	Record of having successfully completed construction/mechanical/installation works of a similar nature. **NB**: If a bidder meets this stated minimum requirement, they shall be awarded full marks (35). **Attach traceable reference list and reference letters from at least (3) clients where similar jobs have been carried out.**	35	

d)	Proof of equipment ownership or lease agreement minimum of 5 items. If the bidder meet all then will be awarded full marks. Failure to meet all zero marks will be awarded	20	20
The minimum technical score required to pass is: **70%**			

Financial Evaluation

Financial evaluation will be carried out on **technically compliant bids only.**

The lowest evaluated bid, that has been deemed responsive through preliminary and technical evaluation will be awarded the contract. A price reasonableness analysis will also be done to ascertain that the price of the recommended bidder is reasonable given the prevailing market conditions.

22.0 Award of Contract

The bid which is substantially responsive to the requirements of this bidding document will be recommended for award of the Contract.

The proposed award of contract will be by issue of a Notification of Contract Award in terms of section 55 of the Act which will be effective on receipt of a Letter of Acceptance in accordance with Part 3: Contract. Unsuccessful Bidders will receive the Notification of Contract Award and if they consider they have suffered prejudice from the process, they may, within 14 days of receiving this Notification, submit to the Procuring Entity a Challenge in terms of section 73 of the Act, subject to payment of the applicable fee set out in section 44 of and the Third Schedule to the Regulations.

NB: i) The contract will only be valid subject to payment of contract administration fees to Procurement Regulatory Authority of Zimbabwe.

ii) The winning bidder shall be required to produce a performance guarantee equivalent to 1% of the contract price from a commercial bank.

23.0 Margin of preference,

Five percent (5%) preference shall be given to women-owned businesses. To qualify for this preference the Bidder shall submit its Memorandum and Articles of Association. The Employer may verify the authenticity of the documents with the Registrar of Companies.

24.0 <u>Right to Reject</u>

The Procuring Entity reserves the right to accept or reject any Bids or to cancel the procurement process and reject all Bids at any time prior to contract award.

25.0 Corrupt Practices

The Government of Zimbabwe requires that Procuring Entities, as well as Bidders and Contractors, observe the highest standard of ethics during the procurement and execution of contracts. In pursuit of this policy:

1. the Procuring Entity will reject a recommendation for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive or coercive practices in competing for the Contract or has been declared ineligible to be awarded a procurement contract under section 99 of the Act;
2. the Authority may under section 72 (6) of the Act impose the debarment sanctions under section 74(1) of the Regulations; and
3. any conflict of interest on the part of the Bidder must be declared.

Bid Submission Sheet

{Note to Bidders: Complete this form with all the requested details and submit it as the first page of your Bid. Attach the completed Statement of Requirements and any other documents requested in Part 1. Ensure that your Bid is authorised in the signature block below. A signature and authorisation on this form will confirm that the terms and conditions of this Bid prevail over any attachments. If your Bid is not authorised, it may be rejected. If the Bidder is a Joint Venture (JV), the Bid must be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

Bidders should mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.}

Procurement Reference Number: Subject of

Procurement:

Name of Bidder

Bidder's Reference Number:

Date of Bid:

We offer to supply the items listed in the attached Statement of Requirements, at the prices indicated on the attached Price Schedule and in accordance with the terms and conditions stated in your Bidding Document referenced above.

We confirm that we meet the eligibility criteria specified in Part 1: Procedures of Bidding.

We declare that we are not debarred from bidding and that the documents we submit are true and correct.

The validity period of our bid is: ……*{days}* from the date of submission.

We confirm that the prices quoted in the attached Price Schedule are fixed and firm for the duration of the validity period and will not be subject to revision, variation or adjustment.

Bid Authorised By:

Signature …….. **Name:** ……

Position: …….. **Date:** ……*(DD/MM/YY)* **Authorised for and on behalf of:**

Company ……

Address: ……

……

PART 2: PROCURING ENTITY'S REQUIREMENTS

Part 2: Statement of Requirements

The following specific requirements for the Non-Consulting Services to be procured complement, supplement, or amend the provisions in the Bidding Procedures. Whenever there is a conflict, the provisions set out below prevail over those in the Bidding Procedures.

SCOPE OF WORKS

The contract is for the expansion of an existing irrigation scheme and the works are itemized below;

Trenching of (1m depth x 1m width) for the 3640m secondary pipelines. And the trenching of (1.5m depth x 1m width) for the 2500m mainline.
Road construction
-Scheme access road (6m wide x 5900m)
-Pump station access road (4m wide x 3100m)
Centre pivot Installation
Infield pipeline installation
Pump house construction
Pumps installation
Suction pipe and pump steel fittings (Gate valves, NRVs, Eccentric & Concentric Reducers), pressure gauge installation.
Electrification (Pump house, Centre Pivots, F14 Houses) Construction of 4 x F14 Houses (Rural).

SPECIFICATIONS

The Works are to be performed in accordance with the following Specifications:

A. GENERAL CLAUSES:

1. EXTENT OF CONTRACT:

The name of the Project is the **KUNZVI IRRIGATION DEVELOPMENT SCHEME.**

2. ENVIRONMENTAL PROTECTION

The Contractor shall take all precautions for safeguarding the environment during the course of the construction of the works. The contractor shall abide by all prevalent laws, rules and regulations governing pollution and environmental protection.

Where trees or shrubs in the vicinity of the construction site should, in the opinion of the

Contractor, be removed or cut back, application shall be made in writing to the Project Manager in respect of each tree, or shrub or group of trees or shrubs. Where the Project Manager agrees that such removal or cutting back is necessary, approval shall be given in writing. Removal or significant damage to any tree or shrub by the Contractor without such approval, whether intentional or accidental, shall attract a penalty charge of $50 for each tree or shrub affected.

Where water from drainage of excavations or pipelines is disposed of, it shall be done in such a way as to avoid erosion and environmental pollution. Where such water contains suspended soil, clay, or other suspended matter, it shall be allowed to settle in suitable temporary ponds or lagoons before discharge.

No filling, drainage, or other permanent change to any wetland shall be carried out without the prior authority of the Project Manager having been obtained in advance.

Temporary tipping of spoil shall be carried out in such a manner as to minimise nuisance and obstruction to pedestrians, cyclists, other traffic and storm water drainage.

The Contractor shall keep the dust generated during construction to the lowest possible levels by periodic watering of haulage and other roads being used during construction

3. SUPPLY OF MATERIALS BY THE CONTRACTOR

The Contractor should supply and install all material required for the Project.

Compliancy standards

South African Bureau of Standards SABS and ISO 4422
SANS 966-1 & 2:2008

Standards Association of Zimbabwe 327 PART 1:2001

Standards Association of Zimbabwe 219:1993

Standards Association of Zimbabwe SAZS 327 PART 2:2002

SABS ISO 9001:2008 Quality Management Systems

ISO 9001:2000 Manufacturing and Testing Standards

Test Requirements

- Acid Resistance
- Water Absorption/Softening
- Physical Dimension
- Heat Reversion/Toxicity
- Impact Performance

Equipment: The contractor shall provide all the necessary equipment for lifting and connecting pipes, equipping boreholes and for all concrete works.

4. CONDITIONS OF CONTRACT

The General and Special Conditions of Contract accompanying this Specification and all clauses therein shall be read together with and included in this Specification. Any clauses in the Specification, which relate to work or materials not required by the Bill of Quantities or subsequently by an Extra Works Order shall be deemed not to apply.

5. STANDARD SPECIFICATIONS

Any Standard Specification quoted or referred to in these Specifications is thereby made part of the Specifications. Where reference is made to a Standard Specification, prepared either by the British Standards Institution, or by the Standards Association of Zimbabwe or the South Africa Bureau of Standards, the reference shall be deemed to apply to the issue of the specification with amendments or addenda, if any, current at the date of invitation to tender for the Works.

All materials, which the Contractor proposes to use in the construction of the Works, shall comply with the appropriate British Standard Specification or by the Standards Association of Zimbabwe or the South Africa Bureau of Standards.

Where items complying with a British Standard Specification, or any other standard specification, are called for, this requirement shall be read as including items complying with a relevant international standard, which provides an equivalent guarantee of safety and suitability.

If no appropriate Standard Specification has been published for an item or material, it shall be to the satisfaction of the Engineer. (See: **Compliance Standards** Clause 2 of the specification)

6. BEACONS AND PEGS

When the Contractor moves onto the site, survey beacons and pegs will have been established defining stand boundaries, road reserves, outer perimeters and all other necessary primary identification of sub-divisional boundaries. The Contractor is to make every effort to avoid damaging or interfering with such beacons and pegs or covering them with spoil.

Any repairs or replacements necessitated by neglect on the part of the Contractor to comply with this Clause will be carried out at the Contractor's expense. The Contractor shall exercise similar care in regard to any pegs established by the Engineer specifically for purposes of the contract until such time as the Engineer may authorize their destruction or removal.

7. SURVEY AND SETTING OUT

The contractor shall provide, and maintain in adjustment, all surveying instruments necessary to fulfill his obligation in setting out this contract. He shall also provide all the labour and assistance which the Engineer may require from time to time to enable him to carry out any necessary checks surveys or measurements concerned with the works.

The Engineer will pinpoint permanent reference pegs and the Contractor shall establish and maintain reference pegs appropriate for setting out and checking the works. Before removal of any

reference pegs the Engineer's, approval must be obtained. Before commencing of any operations, the Contractor will verify the accuracy of setting out these pegs.

8. CONSTRUCTION CAMP

Should the Contractor wish to set up a Construction Camp, he may apply to the Project Manager for allocation of a suitable piece of land.

9. INSPECTION OF SITES

It is the Bidders own responsibility to examine the sites of the Work and their surroundings in order to obtain all information he finds necessary for his fulfillment of the Contract.

10. TELEPHONE

The Contractor shall equip his site manager / foremen with cellular phones. These numbers must be submitted to the Employer by the time of the Contract Award.

11. WATER FOR WORKS

The Contractor shall provide all water required for the construction of the Works, where necessary.

12. SANITARY ACCOMMODATION

The Contractor shall provide and maintain and keep in good sanitary condition sanitary accommodation, to the approval of the Medical Officer of Health, for the use of all persons engaged on the Works, and shall remove, disinfect, and clear away on completion. Buildings and latrines shall be within the areas provided by the Project Manager for the purpose of the Contract unless the Contractor makes his own arrangements for the use of ground and liable for any resulting charges, costs, damages or penalties. If at any time the Contractor fails to observe the aforesaid conditions and after being warned, the Engineer shall have the right immediately to order such material, appoint such workmen and institute such measures, all at the Contractor's expense, as in his opinion may be necessary to maintain clean, sanitary conditions.

13. ORDER OF WORK

The Contractor shall submit to the Engineer a Program of work and details of arrangements for carrying out the work, in accordance with the procedure prescribed in the Conditions of Contract.

14. SAFETY/MAINTAIN ACCESS/NUISANCE ETC.

The Contractor shall so program and execute the work as to ensure the safety of the public, cause the minimum of inconvenience to road users and maintain access to all premises. He shall avoid interference with all over ground and underground services and maintain flow in all existing pipelines and watercourses.

The Contractor shall order the Works so that safe and free access to properties for both pedestrians and vehicles is preserved at all times. To this end he shall provide temporary bridges over the trenches wherever necessary. He shall not deposit plant, materials or spoil in such a manner as to interfere unnecessarily with the convenience of the public.

At night all open trenches shall be surrounded with fencing or tow strands of rope, the top rail or strand being at least 0,8 metres above the ground level, and an ample supply of light shall be provided around all trenches, spoil heaps plant, materials or other obstructions.

When working on roads or footpaths, the Contractor shall provide such barricades, warning signs and automatic or hand operated traffic control signal as may be necessary for the protection and warning of the public or required by the relevant Authority or the Police. No road shall be closed to traffic without the written permission of the relevant Authority and or the police. The Contractor shall save harmless and indemnify the Employer in respect of any claims, demands, proceedings, damages, and cost of expenses whatsoever arising out of any denial of access or obstruction of the Works.

Throughout the period of maintenance the Contractor shall notify the Engineer what work or operation he intends to carry out on the Site and he shall obey any instructions which the Employer/Engineer may give as to times and manner of working so that any inconvenience to the general public is kept to a minimum.

Where required by the Engineer, the Contractor shall provide and maintain to a standard approved by the Engineer adequate detours and deviations to ensure full compliance with this Clause. The cost of detours or deviations as well as their maintenance and any necessary signs in connection therewith shall be deemed to be included in the tendered rates and prices. Similarly the cost of repairs and reinstatement of any road necessitated by the Contractor's activities shall be deemed to be included in his tendered rates and prices.

The Contractor shall comply in all respects with the Safety Legislation and with any Statutory Instruments or Regulations. The Contractor shall ensure that all plant used on the contract is adequate for the duty proposed and does not cause public nuisance due to fumes, noise or leaks. The Contractor should note that excessive noise should not be caused, particularly outside normal working hours.

15. TRAFFIC CONTROL

All work affecting traffic on public roads shall be phased in a manner acceptable to the Local Authority and the Engineer. Before commencing work the Contractor shall produce an agreed phased program for such work.
Where roads are closed to traffic or traffic is otherwise restricted, the Contractor shall supply, erect and maintain, for the duration of the Works, adequate warning and diversion signs and any other signs or control light signals, which may be considered necessary.
Work shall not commence until all traffic safety measures are fully operational and the safety measures are approved in writing by the Engineer.

16. WATCHMEN

The Contractor shall provide competent watchmen at all times, for the protection of equipment at each site until the Employer in writing have accepted the work to be accomplished according to the specifications in this contract. The Contractor must include this cost in the BOQ.

17. PRIVATE AND PUBLICLY OWNED SERVICES

The contractor shall take careful note of the requirements under SAZS 254: D: 1984 Clause 5.1.2 in respect of known services and underground services which are not shown on the drawings but whose presence can be inferred. In this regard the Contractor shall arrange for the exposure and protection of services.

The Contractor shall take all measures required by the Project Manager or his representative to support or protect adjacent services during the course of the work and, in the case of damage; services shall be restored by the Contractor at his own expense without delay.

Trial holes to locate existing underground services shall be dug by the contractor where required by the Engineer. Wherever it is necessary, in the opinion of the Engineer, to relocate any service the Contractor shall carry out the work or such portion of it as the Engineer may direct.

The Contractor shall indemnify the Employer against any claim or damage to services caused by his operations whether in constructing the Works themselves, digging trial holes or protecting or supporting services.

18. TEMPORARY WORKS AND SAFETY PRECAUTIONS

The design, fabrication and installation of all temporary works, necessary for the Works to be constructed including access to the site, shall be the responsibility of the Contractor. He shall submit detailed proposals and drawings of such temporary works for the Engineers approval before commencing work. Approval of such proposals or drawings shall not relieve the Contractor of his total responsibility for the adequacy or safety of such temporary works.

The Contractor shall so carry out all his operations as not to encroach upon, or interfere with, trespass on, or injure adjoining lands, buildings, property, roads, structures, places and things in the vicinity of the Works.

The Contractor shall at his own cost provide whatever temporary works may be required for the purpose of ensuring the safety of adjoining works and property and for the protection of all persons or animals. He shall make full provision to the satisfaction of the Engineer for all barricading, watching and lighting necessary for the protection of persons, animals, vehicles etc; from injury by reason of the Works. He shall provide ample warning signs, guard rails, etc; around open excavations, stacks of materials, debris, or the like. The Contractor must comply in every respect with any requirements of the Police, Local or Traffic Authorities.Particular care should be taken to prevent veld fires and erosion.

The Contractor shall assume full responsibility for any failure on his part to observe these conditions. He shall relieve the Employer of all liability incurred as a result of his failure in this respect and he shall be held liable for all claims made upon himself or upon the Employer by reason of his neglect of any such precautions and provisions. The rates for excavation must allow for all these safety measures.

19. INTERRUPTION OF WATER SUPPLIES.

The Employer is responsible of all handling and operation of valves, and no such operation of valves shall be done without the permission of the Engineer. The Contractor shall notify the Engineer in writing minimum 24 hours before he intends to execute work that necessitate interrupting the water supply.
The Contractor having given notice to the Employer that isolation of the water main is required, the Employer shall be responsible for ensuring continuity of supply to consumers or shall give adequate notice of the interruption to supplies.

20. POWER SUPPLIES

Unless particularly specified the Contractor shall provide all power supplies required for the construction of the works where necessary. He shall make all the necessary arrangements with the relevant authority for the provision of the power supply and shall include for any costs arising there from in his rates for the works.

21. INFORMATION TO NOMINATED SUB-CONTRACTORS

The Contractor shall be responsible for supplying all Nominated Sub-Contractors with sufficient information to enable them to prepare their schemes and working drawings, (if any), and shall also be responsible for ensuring that any work carried out by him in connection with sub-contracted work shall conform with this information including such dimensions as may be agreed with Nominated Sub-Contractors.

22. CLEARANCE OF SITE ON COMPLETION

On the completion of the Works the Contractor shall clear away and remove from the Site of Construction plant, surplus materials, rubbish and temporary works of every kind, and leave the whole of the site and works clean and in workmanlike condition to the satisfaction of the Engineer.

23. NOTIFYING THE PUBLIC

The contractor shall give the necessary notices to the owners and occupiers of land entered upon for any purpose connected with the works and obtain permits from the Engineer for any of the operations contemplated or determined upon in connection with these works. He shall make his own arrangements for laying down his own plant and materials and shall also make arrangements for the disposal of the surplus material, unless other arrangements are intimated to him by the Engineer.

24. INCLEMENT WEATHER

During inclement weather the Contractor shall suspend all operations which may be adversely affected, for such times as the Engineer may direct and effectively cover up and protect from injury by weather the work then in progress.

25. EMERGENCIES

If during the progress of the work, any accident or failure, etc., occurs which requires immediate attention, and if , in the opinion of the Engineer the Contractor is unable to deal with the said accident or failure, etc., the Engineer shall be empowered to employ others to do whatever work he may consider necessary, and the Contractor shall bear the full cost of the work involved.

26. FIRST AID OUTFIT.

The Contractor shall provide on the site of the Works an adequate and easily accessible First Aid Outfit as required in terms of the Workman's Compensation Act of 1941 or any amendment thereto**.**

27. LIABILITY IN RESPECT OF OBSTRUCTION, INTERRUPTION AND DAMAGE

During the period of construction and maintenance of the Works, the Contractor shall take sufficient and adequate measures, to the satisfaction of the Engineer, the Local Authorities and the Proprietors interested, to avoid interrupting the use of roads, footpaths, railways, watercourses, gutters, drains, channels, pipes, telephones, electric wires and cables, premises, places and works, public or private, with which his operations may in any way interfere or alternatively take measures approved by the Engineer for their effective temporary diversion. The Contractor shall also afterwards permanently restore all structures and everything, which may have been temporarily displaced or otherwise, suffered interference and remove all temporary diversion works, all to the Proprietors without extra charge beyond the Contract Price except in instances where specifically allowed for in the contract.

The Contractor must take all responsibility for damage to property or crops and claims resulting from trespass or depredation by his employees. At all times during the execution of the Contract the Contractor shall be responsible for the closing of all gates and for the proper protection of property of every description which may have been entered upon or interfered with any way by him in carrying out the works.

28. CONTRACTOR'S PLANT AND TOOLS

The Contractor's plant and tools shall be in sound working condition and shall be sufficiently ample in capacity or number for carrying out the work in an efficient and expeditious manner. Should the Engineer be of the opinion that the plant used by the Contractor is insufficient or in any way unsuitable for carrying out the Works in a manner or at a rate commensurate with his requirements, he shall have the right to require that the Contractor provide such additional or approved plant and tools as may, in his opinion, be necessary to attain these requirements.

29. SOILS TESTING AND COMPACTION CONTROL

The Project Manager will provide onsite soils testing laboratory when required and the Contractor will not be required to meet the costs of this facility. He may provide at his own cost any similar facilities required for his own purposes. The Contractor shall give the Engineer's Representative at least 24 hours' notice in writing of his requirements for compaction tests to be carried out which tests shall not unreasonably be delayed. Any re-testing that may be required due to the failure of test Sections to meet specified requirements, shall be at the Contractor's expense.

30. RETURNS TO BE SUBMITTED BY CONTRACTOR

The Contractor shall submit weekly returns in duplicate to the Engineer showing the number of artisans and labourers employed upon the Works, listing plant on site and indicating whether each item of plant is owned by the Contractor, hired, or acquired on hire purchase.

31. NOMINATED SUB-CONTRACTORS

Where any work is ordered by the Engineer to be executed by Nominated Sub-Contractors, the Contractor shall enter into Sub-Contracts as described in the conditions of Contract and shall thereafter be responsible for such Sub-Contractors in every respect.

32. ASSIGNMENT AND SUBLETTING

The contractor shall not assign nor sub-let the Contract, nor any part thereof without the written consent of the Engineer.

33. PERMITS AND CUSTOMS CLEARANCE

The Contractor shall be responsible for obtaining any import or export permits which may be required in connection with goods to be supplied by him under this Contract, for obtaining any foreign exchange which may be required and for all customs clearance and expenses connected with such matters.

34. CONTRACTOR'S RISKS/ALLOWANCES IN EXCAVATION

The Contractor shall allow in his rates for excavation, for the following ancillary works: -

a) Any timbering and shoring necessary for the safety of excavations and to comply with the law;

b) All measures necessary to keep the excavations free of surface or subsoil water from whatever source, including the obliteration of all temporary works such as channels or banks when no longer required;
c) All risks of damage or injury from blasting, which shall in all cases comply with any applicable regulations, and shall not unduly interfere with the operations of any other contractor or the convenience of the public;
d) Correction to the satisfaction of the Engineer of any excavation in excess of that required or specified, including the use of concrete.
e) The repair of any damage resulting from slips, falls or cave-ins and the filling of all resultant cavities when the Engineer so instructs;
f) Any measure, not specifically mentioned elsewhere, necessary to maintain excavation in a safe and proper condition to the Engineer's satisfaction both before and after backfilling;
g) The protection and restoration where necessary of any existing services affected by his excavation.

35. COMPLETION DATE AND PROGRAMME OF WORKS

Tenderers are to submit a preliminary programme with their tender detailing the amount of time required for the main stages of the works based on time for completion given in the Tender. The successful Tenderer will be required to submit to the Engineers a fully detailed programme within 14 days of being awarded the contract.

36. VALUE ADDED TAX

Allowance must be made by the Tenderer for the cost of Value Added Tax levied on any article, materials or service that he shall be called upon to supply for the purpose of carrying out the Works, except for the articles or materials for which Prime Costs Sums have been allowed. He must accordingly make allowance for this Value Added Tax.

The Contractor shall provide the Engineer with whatever information the Employer may require for the recovery of Value Added Tax from the authorities in terms of Government Notice No. 438 of 1972 or any other regulations, and if necessary provide original relevant invoice and payment receipts.

37. PERIOD OF MAINTENANCE

The Defects Liability Period is twelve months and includes the rainy season.

B. MATERIALS

1. MATERIALS GENERAL

All goods and materials shall be of the best quality and obtained from an approved maker. The latest relevant Standard Association of Zimbabwe Specification or other approved National or International Standard Specification with current amendments shall apply. Compliance with any such Standards shall include compliance with any amendments thereto current at the date upon

which tenders are first invited, and must hold well when the materials are incorporated into the Works. This is not intended to be restrictive, and materials of equivalent or superior quality will be acceptable. The onus is on the Contractor to satisfy the Engineer that any alternatives offered are equivalent or superior to those specified

Materials are specified in detail under the section for which they are required. The Contractor shall be fully responsible for securing all necessary materials and shall bear all costs for any import of materials from other countries, if necessary, for him to adhere to the Works Programme.

Samples

Fair and representative samples of all materials to be used in the work shall be submitted to the Engineer for his approval, wherever practicable, at least three weeks before it is proposed to use the materials. No materials shall be used until such approval in writing has been obtained. Any material which, in the opinion of the Engineer, does not comply with the standard of the samples submitted and approved, shall be rejected and replaced by the Contractor at his own expense.

Packing

All goods are to be carefully packed to prevent damage during transit and the Contractor is to include in his price for all packing and crating necessary to ensure safe transport. All damage and breakage's are to be made good by the Contractor.

Unloading

The Contractor shall exercise care and be responsible for the loading and unloading of all materials and he shall make his own arrangements at his own expense for the safe storage of all materials on the site for which storage he alone will be responsible. In the transport and off-loading of materials the Contractor shall ensure that no stoppage or disorganization of traffic at any point shall occur by reason of negligence or carelessness on his part. Materials shall not be off loaded in such positions as will cause a nuisance or danger to life or property. The Contractor will be responsible for taking delivery and for protecting and storing all materials, including those to be supplied by nominated sub-contractors (if any), at site, until such time as they are required for erection at the site.

Inspection at the Factory

The right is reserved to appoint an Inspector to inspect the materials at the manufacturer's works, to attend to the official tests specified or otherwise agreed, and to satisfy himself that the material is in accordance with the Specification.

The Inspector shall be given a minimum of three days notice by the Contractor of tests to be carried out and he shall be afforded all reasonable facilities in his visits of inspection to inspect the manufacture and tests at all stages and to satisfy himself that the materials manufactured and test performed comply with the specified conditions.

All expenses in connection with the tests, except the Inspector's fees and traveling expenses, shall be borne by the Contractor. In the event of the Inspector not being present at the tests after the specified notice has been given to him, the Contractor, immediately after carrying out of such tests, submits to the Inspector a signed statement in triplicate that the tests have been carried out, together with the all test sheets and relevant data. Every article passed by the Inspector shall be clearly marked with his stamp or pencil; the Inspector shall also be entitled to demand that all rejected

material is distinctly marked as such. If no Inspector is appointed, the Contractor shall properly carry out the test in the manner specified and shall submit in duplicate to the Engineer signed certificates setting out the details and results of the tests, and in such certificates shall guarantee that no material failing to comply with the Specification will be or has been delivered under the Contract. Such certificate shall be mailed within three days of the carrying out of tests.

1.1 CEMENT

All cement used shall be Portland cement normal setting quality complying with **SAZS A46: 1972**. All cement should be delivered to site in the original sealed bags of the manufacturer and shall be stored not less than 250 mm above the ground level in an approved watertight shed. Cement of different consignments shall be stored separately and shall be used in the order in which they are delivered to site. Cement on site for longer than three months shall be deemed unusable and removed from site.

Manufacturer's test certificates shall be produced to ensure that all cement delivered to site complies with the relevant standards.

1.2 AGGREGATE FOR CEMENT PRODUCTS

Coarse and fine aggregates for concrete and mortar shall comply with **SAZS 233: 1978 AND SAZS 190: 1978**. Aggregates shall consist of river or pit ballast, crushed stone or other hard nonfriable materials of approved quality, grading and shape. It shall be clean hard and durable and free from dust slate, clay, loam, slag, breeze, coal or any other deleterious matter. It shall be screened so that all the materials pass the maximum size required. Flaky material will not be accepted. The grading shall be such as to permit the production of sound dense concrete of the strength specified. Sand shall be clean, sharp, river or pit sand washed free from dust, clay, organic matter or any other impurities and shall be graded from fine to coarse as specified and required.

1.3 WATER

Water used in concrete and mortar shall be clean, free from dirt, vegetable matter, mineral salts or other impurities. The Contractor shall provide a chemical analysis of the water to prove its suitability for use in concrete work.

1.4 BRICKS

Bricks used in the Works shall comply with **SAZS 221**. All bricks must be new, well burnt, of uniform colour, size and shape, with straight sharp arises, rectangular and free from defects in quality, shape or substance.

1.5 CEMENT BRICKS

All cement bricks shall be sound, well cured and conform to **SAZS No. A41**"Cement Bricks". They shall be of 'Common' classification unless otherwise detailed on the drawings.

1.6 PRECAST CONCRETE BLOCKS

Precast concrete blocks shall comply with SAZS 119 for Type A blocks.

1.7 REINFORCING STEEL

Steel used for reinforced concrete shall comply with SAZS 157, B.S. 4449 B.S. 4461, and B.S. 4482 or 4483 as appropriate, and at the time of placement shall be free from oil, paint, and excessive rust and scale or coatings of any character, which might impair the bond between steel and concrete.

1.8 STRUCTURAL STEELWORK

Structural steel framework shall comply with the requirements of the current BS449 and all other relevant British Standards, and Materials and Workmanship shall be in accordance with those Standards unless specifically varied.

2. MATERIALS - WATER RETICULATION

2.1 SERVICE WATER METERS

Shall be semi-positive cyclometer pattern in accordance with S.A.B.S. 798, such as Kent P.S.M bulk water meter or equal approved. The dial should read in cubic metres.

2.2 AIR VALVES

Air valves shall be the double orifice type with bronze stop tap screwed make B.S.P.T. and manufactured in accordance with a Specification approved by the Engineer.

2.3 STOP VALVES

Stop valves, 50mm diameter and under shall be screw-down type manufactured in accordance with B.S. 1010. Ends to be female screwed with hexagonal shoulders. Closing shall be clockwise.

2.4 VALVES

a) **Sluice Valves** to conform to SAZS. 149 Class 10, with following gate, wedge closure and unless otherwise specified, Teflon gland packing and non-rising spindle. Other pressure ratings or accessories may be specified for certain valves bodies, gates and glands shall be gunmetal or stainless steel. All valves shall be clockwise closing.

b) **Valves on Plastic Pipework** are to be approved by the Engineer.

c) **Pressure Relief Valve.** The pressure relief valves shall be able to resist an inlet head of up to 100 m with an adjustable spring set to open the valve from 30 to 50 m head. The valve is to be drop tight when closed.

d) **Test.** Sluice valves shall be tested to twice the rated working pressure on body and one and half times rated working pressure on either side of the gate. Sluice valves designated as 'scour valves' are to be used in a terminal position rigidly held at one end only, are to be subjected to 'open end' tests as described in BS 5163 and are to be drop tight on gate at nominal pressure.

e) **Coating**. All valves are to be coated with approved protective paint or solution in an approved manner except when made from non-corrodible material and are to be adequately protected and packed against damage or injury in transport.

2.5 P.V.C. WATER PIPING

Polythene water piping shall be manufactured by the extrusion method to comply with SAZS.177 for Type II Class 9 pipes, with the added requirements that the material used shall contain not less than 0,02% by mass of anti-oxidant and that every coil of pipe supplied shall have been tested to a pressure of 180 metres head of water before delivery. Each coil shall be clearly stamped and numbered, and the relevant pressure test certificate must accompany delivery. Coils may additionally be subjected to a similar test by the Engineer, and any failure may result in the rejection of the whole consignment.
P.V.C. Pipes shall be manufactured in accordance with I.S.O. 4422.

2.6 STORAGE ACCOMMODATION

The Contractor must allow for the storage, protection and security of all materials brought onto the site for the purposes of the Contract including any supplied by the Employer to the satisfaction of the Engineer at his sole discretion. All materials including cement, sand, stone steel and water shall be stored in such a manner that they are not subject to contamination from any source or to any other deterioration.

For this purpose, the Contractor shall at his own cost provide and maintain, on sites approved by the Engineer, adequate and suitable storage accommodation for the proper housing and storage of all perishable or corrodible materials and fittings. All storage accommodation, particularly cement stores, shall be well ventilated, weather and waterproof, with floors raised off the ground so as to keep the materials perfectly dry and freely aerated and shall be subject to the approval of the Engineer, who shall have free access at all times to the storage sheds and shall be provided, if he so requires, with duplicate keys of doors of the storage shades.

2.7 PIPEWORK

Pipes, fittings and specials are to be as specified in the Contract Documents or approved by the Engineer and, except where otherwise specified, shall conform to the following standards

The piping must satisfactorily withstand British Standard Pipe male taper threading so that when jointed with screwed Galvanised Mild Steel fittings a strong watertight joint is made.

The Engineer will require copies of the test certificate of the material from which the pipes are made to be submitted with these first deliveries. If approved, all subsequent deliveries shall be of a similar mixture and texture.

2.8 GALVANISED MILDSTEEL WATER PIPING

Galvanised Mild Steel water piping and fittings shall comply with B.S. 1387 and shall be medium thickness' class

2.9 FLANGED JOINTS

Flanges shall comply with BS 4504 except that bolts of non-preferred diameter shall be replaced by preferred bolts one size smaller and the flanges drilled to suit. Flanges shall be slip-on plate flanges, machined and spirally grooved; a protective coating shall be applied immediately to prevent rust. The sealing face of a flange welded to a pipe shall not be concave but a convexity not exceeding 15% of the flange or fitting, the distance from the end pipe to the front of the flange or fitting, the distance from the end of the pipe to the front of the flange before welding shall not exceed the thickness of the pipe wall by more than 2mm.

Jointing gaskets shall be from rubber reinforced jointing material conforming to the requirements of Section 3 of BS 5292 with a thickness of 3.2 mm and hardness of 60 IRHD.

Each set of joining material shall be supplied in a separate bag and suitably labelled.

2.10 FLEXIBLE COUPLINGS

Flexible couplings are to be suitable for use with the plain ended pipes and fittings supplied and rated for the factory test pressure applicable to the matching pipework. The barrel of flexible couplings is to be fabricated to facilitate easy and watertight deflection of the pipework; metal barrels shall therefore be concave internally or alternatively cambered.

Flexible couplings for steel pipework shall be of approved pattern without central register and with a robust and continuous upstanding flange capable of withstanding without visible deflection a load in the flange bolts well in excess of that corresponding to the recommended torque. The same principle of robust design shall apply to the whole coupling. Couplings are to be selfcentering on the pipework and afford effective restraint to the rubber sealing rings to prevent these being blown out under pressure or sucked in under vacuum. All those parts of the couplings in contact with the liquid in the pipeline shall be sand or shot-blasted primed and painted with two coats of a white epoxy resin or other approved and taint-free paint. The remaining surfaces of the couplings are to be protected by wire brushing and painted with two coats of approved paint. All sand blasting must produce a finish equivalent to Standard two and half of Swedish Specification SIS 05 5900-1967, which, requires the removal of most traces of mill scale, rust and foreign matter.

Rubber rings for flexible joints shall comply with SAZS 196. Couplings shall be supplied assembled complete with all bolts and nuts and the rubber joint rings supplied in separate bags labelled by joint size.

C. WORKMANSHIP

1. TRIAL HOLES

If at any time during the execution of the works the Engineer may require the Contractor to make trial holes for any purpose; such requirement shall be ordered in writing and shall be deemed to be an addition ordered under the provisions of the General Conditions of Contract unless a provisional sum in respect of such work shall have been included in the Bill of Quantities. Such trial holes shall be made under the conditions prescribed for excavation.

2. EXCAVATION CLASSIFICATION

Excavation shall be in two classes, Class 1 and Class II

Class I : Excavation shall include the excavation of sand, soil decomposed or rotten rock, boulder clay, small loose stones or gravel and other material not covered by the definition for Class II and Class III.

Class II: Excavation shall consist of material termed locally as schistose and shall be stone which, in the opinion of the Engineer, can be removed by the use of picks, bars or compressor tools.

Class III: Excavation shall consist of material which, in the opinion of the Engineer, cannot reasonably be removed without the use of explosives. Boulders over 0.100 cubic meters in volume will be paid for as Class III excavation.

The Engineer's decision as to what shall constitute Class I, Class II and Class III excavation shall be final and binding. The Engineer's attention shall be drawn by the Contractor to any material which he proposes to claim as Class II and Class III, and the measurement thereof shall be checked on the site by the Engineer's and the Contractor's representatives. Claims for Class II and Class III material will not be considered unless this procedure, has been followed.

3. BLASTING

Where the Contractor proposes to excavate by blasting, the authority of the Engineer shall first be obtained. The Contractor will be held responsible for ensuring that the explosive charges used are not excessive, that charged drill holes are properly protected before being fired, that proper precautions are taken for the safety of persons and property and that only licensed persons be engaged to carry out blasting work.

When the excavation of rock is being measured, no allowance will be made for any excess excavation or filling above the net length and width of dimensions specified. Excess may be allowed where it results from the use of minimum charge sizes and cover, laid down by regulations.

4. METHODS OF EXCAVATION AND BACKFILLING

The methods of excavation and backfilling adopted by the Contractor shall be subject to the approval of the Engineer. In general open trench excavation methods will be favoured, but excavation by means of short headings may be approved. The headings are to be broken down when backfilling. Payments for excavation-using headings will be made as though open trench methods have been employed.

Material excavated from trenches is to be placed well clear of the trench sides until it is used for backfilling or spread as directed.

5. TRENCHING AND BACKFILLING

(a) Trench Widths

The base width of the trench dug for any pipeline is to be such as to permit adequate access for all operations necessary to fulfil the requirements of the contract, having regard to the methods used, and shall be subject to the approval of the Engineer. For purposes of measurement and payment the trench will be deemed to be of a uniform width throughout, 500mm in excess of the internal diameter of the pipe, but not less than 550mm for sewer and storm-water pipes. Trench widths for PVC pipes are to be 300 mm in excess of internal diameter of pipe. Contractor has to allow for working room in his rates where this is necessary and required.

(b) Trench Depths

(i) For water pipes, trenches are to be dug so that in general the depth of cover from the top of the bedded pipe to finished ground level is not less than the following: -

Under Roadways	1200mm
Elsewhere	750mm
Service Connections	450mm

If so directed by the Engineer, minor depressions in the surface will be disregarded in determining the general pipe level. Pipe gradients will normally follow the general slope of the ground, ignoring the occurrence of local irregularities as anthills.

Sewer pipes will usually be laid at such depths as to allow water pipes, laid as described above, to pass over them. Water mains of 50mm internal diameter and over will, however, generally pass below storm-water pipes and channels, necessitating water pipe trenching deep enough to afford clearance. Changes of grades and direction accommodated in the

pipe joints or by pipe flexure shall be within the pipe manufacturer's recommended safe limits and trenches are to be dug accordingly.

(ii) For sewer pipes, depths of trench are to be deducted from the drawings, having regard to the type of bedding to be employed, and manhole invert.

(iii) Levels for storm-water pipe depths, will be governed by the considerations outlined in Section III D.

(c) **Hollows and uneven Trench Beds**

All hollow and uneven places caused by inaccurate or unnecessary excavation in the bottom of trenches, shall be completely filled in with cement concrete (Grade 10 MPa) or at the Engineer's discretion, with rammed selected fill material or river sand, all at the Contractor's expense. Hollows left at the bottom of trenches caused by the excavation of boulders shall be filled in with similar cement concrete or sand fill and will be measured and paid for. In pipe trenches excavation shall be to the depth of the underside of the barrel of the pipe .The bottom of all excavations shall be trimmed, dressed and rammed in such a way that the pipe barrels rest on a solid foundation from joint to joint. The tendered price for trench excavation shall include for the excavation of all joint holes in the bottom of the trench. Where the bottom of the trench is composed of rock, the excavation shall be taken out to 75mm below the underside of the barrel of the pipe, and the pipe shall be laid on a firm bed of approved soft material, unless the Engineer shall direct, in special cases, the use of river sand concrete Grade 10 MPa for bedding.

(d) **Trench Lengths**

The permissible length of trench opened up ahead of pipe-laying is to be subject to the approval of the Engineer.

(e) **Backfilling Trenches**

Backfilling of trenches shall be carried out as soon as possible after the pipe has been laid. Where the pipe surround does not extend up to a level of 300mm above the top of the pipe, specially selected material of a maximum particle size 12mm shall be laid and evenly compacted with the addition of water in 150 mm thick (after compaction) layers to that level, each layer being hard compacted to 90% LCE (Lower Compactive Effort). Unless otherwise specified the remainder of the backfill shall be of material excavated from the trench, laid and compacted with the addition of water in layers 300 mm thick (after compaction), each layer being compacted to 90% LCE.

(ii) **Backfill to Trenches across Roads and Hard-standings**

Where trenches cross surfaced or gravelled roads, lanes or paved areas, or across which are eventually to be surfaced or paved, the trenches shall be backfilled as described over under 'General Backfill' except that: -

(1) all backfill material shall be approved by the Engineer before backfilling may commence;

(2) each layer of backfill shall be compacted with the addition of water to 100% L.C.E,

(3) the last 450mm backfill shall be compacted to the density specified by the Engineer which shall not exceed 96% Mod ASSHTO.

(iii) **Field Density Tests**

The Engineer may control compaction in trench fill by taking a minimum of two Field Density Tests at points selected at random in the backfill. These tests will be regarded as being typical of the backfill under examination, and should any of these tests show that the compaction fails to achieve the required densities the contractor shall, at his own expense, take all necessary steps to ensure that the required densities are achieved. The Engineer will make routine and systematic Field Density Tests in all backfill where trenches cross roads and other areas described in paragraph (ii) above. The Contractor is advised that particular importance is attached to these backfill procedures, which must be rigorously adhered to.

(iv) **Maintenance**

At the ground surface the filling shall be banked to about 100mm above the level of the adjacent ground surface and shall be thus maintained until the completion of the period of maintenance and/or until surfacing has been laid, where this period is less than the period of maintenance.

(f) **Measurement and Payment**

Payment for trench excavations and backfilling for water mains, sewers and storm-water will be by length along the pipe centre line, at the various ranges of depth to pipe invert, billed for each diameter of pipe.

The prime rates shall relate to excavation in "Soft material" as defined. The lineal measurement will be continuous through manholes, valve boxes and the like. The additional excavation for such structures shall be covered in the individual rates for such items.

Payment for excavation in "Hard material" or Rock will be by volume as an extra over excavation in soft material. For measurement purposes widths will be taken as stated in Clause 5.6(a) and depths as the actual depth to the underside of the pipe bedding specified.

Rates for excavation are to include for the provision of extra working room required for installing joints, fittings, valves or other appurtenances, for backfilling as specified, for spreading and levelling surplus material within 1000m free haul, for all items listed in Clause 3 .14 and for all other contingent operations described or implied that are not separately billed.

Where excavation is complete but backfilling is not, the Contractor may claim for payment at 60% of the appropriate rate for the complete operation. The balance will be paid only upon satisfactory completion of the backfilling.

(g) **Planking and Strutting**

The Contractor shall allow in his rates for excavation for all necessary planking and strutting to excavations to ensure the safety of the workmen and to prevent any movement, all to the satisfaction of the Engineer and to comply with relevant regulations.

All responsibility for the foregoing shall rest with the Contractor and should any ground fall in due to the omission or insufficiency of the planking and strutting, it will not be paid for as excavation and must be dug out and deposited on site, returned, filled in and rammed or carted away and the depression filled in with concrete as previously described or as directed by the Engineer entirely at the Contractor's expense.

(h) **Keep Excavation Clear**

The Contractor shall allow in his rates for excavation for all necessary baling and pumping by hand or machinery, to keep the excavations free from water. He shall provide all necessary day and night attendance so as to ensure that no water is allowed to accumulate in the excavations and the inverts or bottoms restored to the conditions specified.

(i) **Setting out the Work**

The Contractor will be provided with plans and sufficient reference pegs at the Site of Works to enable him to set out the work. Once datum pegs have been placed by the Engineer, the Contractor shall be responsible for preserving them and for all further setting out and levelling.

(j) **Sight Rails**

Unless the Engineer considers that they are unnecessary, sight rails shall be erected along the line of any pipe trench at convenient intervals not exceeding 500 meters. Sight rails shall be of Substantial construction and painted on both sides in black and white in such a manner as to indicate clearly the lines and levels' suitable boning rods shall be provided for use with them.

Each sight rail shall consists of two posts firmly planted, one on either side of the trench, and horizontal rail 150mm deep with the top edge planed true and smooth, firmly fixed to the posts The centre line of the pipe shall be indicated on each sight rail at both the front and the back.

Sight rails shall be left in position until pipes are laid, and the Contractor will be held solely responsible for errors in the excavation of the Work due to any cause whatsoever, including disturbance of sight rails or faulty setting out there from.

(k) **Protection of Existing Pipes, Cables, Services and Services**

Before commencing any excavation, the Contractor shall obtain full information with regard to the position of any water mains, cables, drains and other services which may be encountered, and he shall notify the proprietors concerned before commencing excavation in the vicinity of any service. He shall at all times exercise the utmost care not to cause any disturbance or damage to services or structures.

Where trenches cross any services or structures the work of excavation shall be carried out wherever possible, by means of headings so as not to disturb them. If electric and telephone cables are exposed in the course of excavation, the Contractor shall immediately notify the proprietors concerned and shall not refill the trench around such cables until the cables have been inspected and passed in writing as intact by their respective owners. See Clause 3.7 and 3.8.

(l) **Timbering and Strutting on Side Sloping**

The contractor's rates for excavation shall allow for any timbering and shoring required and in this connection attention is drawn to the Factories and Works Regulations in regard to the minimum standards for timbering excavations.
The contractor shall assume full responsibility for the safety of excavations, and shall carry out all measures necessary to make the work secure, by timbering and strutting the excavated face or by side sloping where it is not required to act as a mould to concrete work. All timbering and strutting must be of sufficient strength and suitably arranged to permit the placing of concrete and formwork and the laying and jointing of pipes; it must be possible to remove the timber readily as the work proceeds.

If at any time the Engineer considers that an excavation requires additional timbering or support, he may direct the Contractor to provide whatever additional support he considers necessary; the Contractor shall then immediately comply with all these directions without additional charge. Where trenches are timbered and shored, they shall be left thus until after laying and jointing the testing of pipes, and the Contractor's prices must provide for and will be held to be inclusive of the cost of the use of such timbering and shoring for the whole of this period.

Where an order in writing is given by the Engineer for timbering to be left in place, payment will be allowed for it at the rate to be quoted by the Contractor against the provisional item allowed in the Bill of Quantities to cover such a contingency. The methods of timbering most commonly required will be: -

(i) Single walling of 225 x 75 mm timber, strutted at right angles with steel trench struts at centres not exceeding 2 metres.

(ii) double walling, the upper set normally 1 metre below ground level and the other lower but clear of all construction work, both strutted in the same vertical line.

(iii) Poling Boards of 225 x 75 mm timber placed vertically on each side of trench at a spacing not exceeding 1.5 metres and supported by strutted walling. Intermediate poling boards, i.e. those between struts, may be 225 x 50mm and wedged back from the walling, this system shall be used where the ground is soft and there is a danger of slips and the spacing of the poling boards is to depend upon the nature of the ground. In very bad ground these will be placed side by side, so that the sides of the trench will be afforded continuous support.

In areas where shrinkage can occur the method of timbering must allow props to be tightened each day.

(m) **Additional Excavation Below Underside of Pipe in Rock, Hard Material or Clay**

Where rock, hard material, pot clay or other material occurs, of such a nature that a firm and even bed cannot be readily obtained for the proper grading of pipes the Contractor will be required to excavate the trench to a depth of 75mm below the required grade of the underside of the pipe in rock or hard material, or 150mm below in clay or soft material, for the full specified width of the trench and shall refill this space with approved filling property compacted to 95% Lower Compactive Effort, as determined by test described in SAZ 185, Part I, before laying commences.

The items in the Bill of Quantities allow for excavation, trimming, refilling and compaction.

As an alternative, concrete bedding may be specified, and an item is also allowed to cover the additional excavation, trimming, concrete and any shuttering required.

(n) **Backfilling and Construction of Subgrade Adjacent to Precast Arch Culverts**

A separate item had been provided in the Bill for the fill adjacent and to 500mm above the arch culverts.

This fill shall be constructed in horizontal layers of not more than 200mm thickness using approved granular material for the full height of the embankment. Compaction of approved filling shall be controlled and to a density of 93% H.C.E. unless otherwise specified. A separate item has been provided in the Bill for the fill adjacent, and to 500mm above, the arch culverts.

The backfill material is to be brought up equally to both sides of the arch at the same time in order to be brought up equally on both sides of the arch at the same time in order to eliminate the possibility of vertical skewness.

The compaction equipment is to be kept a little away from the concrete arch in order not to damage the thin concrete shell.

6. TRENCH EXCAVATION FOR WATER PIPES

Excavation in all cases shall imply the complete removal of rock or other material according to dimensions shown on the drawings, or otherwise as indicated by the Engineer, and for the temporary disposing of excavated material so as to avoid hindrances to transport and pipe-laying operations.

Trenches shall be bottomed to exact grade and to a level 200mm deeper than the invert of the pipe. The depth of the sewer trenches shall be as shown on the sections, unless otherwise ordered by the Engineer.

Class I excavation in trenches shall be measured in meters of the length excavated. In calculation the quantity of Class II and Class III excavation to be paid for in trenches, the width shall be taken as the outside diameter of the pipes plus 800mm. Class II and Class III excavation shall be measured in cubic meters and will be paid for as an "extra" item.

7. PROTECTION OF EXCAVATIONS

The Contractor is to include in his excavation prices for all timbering necessary for the protection and safety of excavations. Where such protection is found necessary, the protection shall consist of properly supported timber poling boards, wallings and struts adequately braced and stayed. The strength of the timbering shall be appropriate to the position and depth of the several parts of the work and shall be executed in a thoroughly workmanlike manner, square and plumb.

If, in the opinion of the engineer, any excavation not protected requires protection and / or any timbering as defined above is adequately or insecurely fixed, the Contractor shall execute the instructions of the Engineer thereon, to ensure the safety of the work. Any slips or falls of the earth shall be made good at the expense of the Contractor, who shall be entirely responsible the safety of all excavations. The Engineer, if he finds it necessary, may order timbers to be left in the excavation. In this case, the timber left in the excavations shall be paid for in cubic meters.

8. PLACING OF EXCAVATION MATERIAL

Excavated materials or other superimposed loads shall not be placed nearer than 600mm from the sides of any trench or other excavation in soft material, unless strutting has been placed to withstand such loads. Excavated material shall be deposited on one side of the trench only.

9. LADDERS

Strongly constructed ladders shall be provided as access to excavations, the cost of which is to be included in the excavation rates.

10. DE-WATERING EXCAVATIONS

The Contractor shall keep all excavations clear of water in such a manner as not to impede the proper execution of the work, and to the entire satisfaction of the Engineer. Tender price for excavation shall be held to cover any expenses necessitated by this Clause.

11. BACKFILLING OF EXCAVATIONS

The Contractor shall receive the approval of the Engineer before commencing any backfilling, which shall be commenced immediately on receipt of such approval.

The first 300mm of depth of backfilling measured from the crown of the pipe shall be carried out in selected soft material which shall

12. LAYING AND JOINTING OF PIPES

No pipe laying shall take place in any trench unless the excavation shall have been approved by the Engineer. All trenches shall be completely de-watered and laying and jointing shall be carried out only in dry trenches

The Contractor shall employ his drain layers only workmen who are in possession of a drain layer's license, issued or approved by Bulawayo Municipality. Pipe laying is to commence at the lower end of the section, and to proceed uphill. Sockets are to face uphill and the line and level shall be maintained by reference to string line positioned alongside the pipes at half barrel height.

The first pipe at manhole shall be firmly bedded to line and level on small heaps of moderately dry Grade 20 concrete near each end of the pipe. Thereafter concrete shall be placed and rammed under and around the pipe. The second pipe shall then be set to line and level by firmly bedding the socket and on a heap of selected material, sieved through a 25mm screen and pushed well into the first pipe in accordance with the manufacturer's instructions.

Pipe laying shall continue in this manner until the next manhole and the last pipe shall be bedded in concrete in alike manner to the first. Sections between manholes shall be completed in a continuous operation with bedding being carried out immediately behind the pipe laying by filling beneath the barrel and up to a ½ barrel height with selected material thoroughly compacted by well ramming on either side of the pipe.

As soon as possible after laying, jointing and bedding, the section shall be tested and then backfilled to a depth of 300mm above the crown of the pipe with selected material placed in 100mm layers and well and carefully tamped around and over the pipe.

The Contractor shall allow in his rates for pipe laying for supplying selected soft material sieved through a 25mm screen, and for backfilling to a depth of 300mm above the crown of the pipe.

Granular material for bedding where required by Engineer shall be decomposed granite of crushed stone passing a 12mm sieve. A separate item has been provided for supplying and placing this material where required.

13. TESTING OF WATER NETWORK SYSTEM

After pipe laying on each section is completed, the section shall be tested by air. This air test shall be carried out with appropriate apparatus such that there will be an air pressure in the pipes equivalent to 125mm of water as shown on the differential readings on the U-tube gauge. The air pressure shall be maintained without variation for a period of four minutes.

The test shall be repeated after backfilling is completed and in the event of any faulty joints or pipes being revealed, the Contractor shall, at his own expense, remove such pipes and remake the joints as necessary. The Contractor shall provide all necessary labour, materials and apparatus for testing and a separate item has been allowed for this in the Bill of Quantities.

14. CONCRETE MANUFACTURE AND PLACING

14.1 CONCRETE

14.1.1 Concrete Mixes

The Contractor may elect to use either a prescribed or designed mix subject to the prior approval of the Engineer and as stated on the drawing.

14.1.2 Prescribed Mixes

A prescribed mix shall be proportioned as set out in Table A or B to reach the required strengths and durability as stated on the drawings and specification.

14.1.3 Designed Mixes

The proportion of a designed mix shall be calculated by a recognised testing laboratory nominated by the Contractor to reach the required strengths and durability as stated on the drawings, in Tables 1 and 2 and other parts of this Specification.

14.1.4 Trial Mixes

The Contractor shall produce laboratory designed mixes for the various concrete grades. He shall submit results obtained from tests on trial cubes and aggregates, together with the mix proportions, the origins of the aggregate and other recommendations made by the laboratory for the Engineer's approval all before any concrete works commence. The cube results are to comply with Table 2.

14.1.5 Proportion of Mixes

The proportions of aggregates and water to be used with the cement shall be accurately measured by weight or volume and all measuring equipment shall be kept in good working order. Allowance is to be made for the moisture content of the aggregate and for the bulking of the sand.

The minimum amounts of cement in the grades of 'designed' concrete mixes shall be determined by using the following data:-

Structures containing Liquid: - B.S. 8007

Other Structures: - SAZS C.P. 170 Table 48, Moderate degree of exposure.

Ready mixed concrete must be obtained from a plant which holds a current Certificate of Accreditation under the Quality Scheme for Ready Mixed Concrete. Each mix must be obtained from only one source unless otherwise approved. Confirm name and address of depot(s) to so before any concrete is delivered. Retain all delivery notes for inspection.

14.1.6 Method of Mixing

All mixing shall be done by mechanical mixer. The mixers shall be kept in good working order and be thoroughly cleaned at the end of each pour.

When a rotating drum mixer is used it shall be rotated between 30 and 50 revolutions after water is added and where a paddle mixer is used it shall be rotated between 20 and 40 revolutions after water is added. Each batch of concrete shall be completely discharged before the mixer is recharged.

14.1.7 Slump Tests

Slump tests shall be carried out in accordance with B.S. 1881 at regular intervals during mixing and at the request of the Engineer. The results are to comply with Table 1.

14.1.8 Cube Crushing Tests

At least one set of six test cubes shall be made by the Contractor from each 20m3 pour, or part thereof in the presence of the Engineer.

The cubes and their curing shall be in accordance with B.S. 1881.

Two cubes of each set shall be crushed at an age of 7 days and the remaining at an age of 28 days. The crushing tests are to be carried out by an approved laboratory. The results are to comply with Table 2. The average strength of 4 cubes shall constitute one test result.

Concrete for cubes must be taken from the point of discharge from the mixer or delivery vehicle before any vibration has taken place.

NOTE: The number of cubes/set may be reduced to four if in the opinion of the Engineer sufficient consistency of quality in concrete mixing has been obtained by the Contractor.

The result of compressive strength test carried out after 7 days will be recorded on a control chart and the values used:-

a) as an indication of what can be expected from the results of the 28 day tests.

b) to decide whether immediate adjustment should be made to the concrete mix design.

The results of the compressive strength tests carried out after 28 days will be recorded on the control chart and the values will be used to assess whether the concrete from which the test cubes were taken shall be considered to comply with the requirements for compressive strength as indicated in Table 2.

The cost for making and testing of cubes under this clause of the specification shall be borne entirely by the Contractor and should be included in the rates.

Notwithstanding the control excised by the Contractor and tests done by the Contractor as instructed, the Engineer may carry out check test and arrange for 150mm cubes to be taken, stored and tested in accordance with the BS 1881. These check tests shall be taken at the point of deposition of the concrete. The results of these tests will be recorded and will form part of the criteria for assessment of failure.

A provisional sum is included in the Bill of Quantities for check tests done by the Engineer. This sum may be deducted in part or in full from the Contract Price.

The Contractor shall arrange that the results of the tests, in certificate form, endorsed by the laboratory, be forwarded to the Engineer within 24 hours of the test.

14.1.9 Transporting

Runs or gangways for concrete transporters and main runs for foot traffic shall not be supported or allowed to bear on the fixed reinforcement.

14.2 PLACING OF CONCRETE

14.2.1 General

The contractor shall ensure during the tender period that his price is based on the use of the correct placing equipment such as cranes, dumpers, mixing trucks so that there is no double handling of the mixed concrete.

14.2.2 Engineer's Right to Stop Concreting Operations

The Engineer shall be empowered to stop any concreting operations if the method or plant used does not comply with the specification.

14.2.3 Segregation

Concrete shall be placed in such a manner that no segregation takes place, that no ingredients are lost and that the quality of the concrete is not impaired in any way.

The concrete shall be placed so that the mortar is intimately in contact with the coarse aggregate and the reinforcement and other embedded parts, such as pipes and ducts.

Placing methods which allow or cause the concrete to flow in the forms will not be permitted.

Concrete shall not be dropped through reinforcement or embedded pipes and ducts so that segregation can be brought about by impact.

Correcting of segregated concrete by means of remixing will not be permitted.

14.2.4 Time Between Mixing and Placing

Concrete shall be placed in its final position with as little delay as possible. Unless concrete is kept in an agitator, the time between addition of water to the mix and placing shall not exceed thirty minutes.

Concrete which is kept in an agitator which imparts a mild mixing action to it shall be placed in its final position within one hundred and twenty minutes of adding water to the mix.

Check slump tests will be taken and concrete which becomes unworkable will be rejected by the Engineer.

14.2.5 Placing Methods and Compaction

Concrete shall be placed in horizontal layers of 300mm to 500mm deep (or as directed by the Engineer). Each layer shall be soft when a new layer is placed on it. Precautions shall be taken to avoid entrapment of air in partially enclosed spaces to be filled with concrete.

The height through which concrete may be dropped will not be limited and unconfined fall will be permitted, with the proviso in both cases that groups and/or clusters of segregated aggregate are not produced.

Wherever possible the concrete shall be deposited vertically into its final position in the structure, but in any case the lateral movement of concrete shall be restricted to two metres and shall be effected by shovelling only.

Permission to place concrete using a chute must be obtained from the Engineer. The chute slope must be uniform throughout its length and must not be flatter than 1 in 3 or steeper than 1 in 2. The flow of concrete must be maintained at a steady rate and baffles must be provided at the discharge ends.

The transport of Concrete in dumpers must not exceed 300 metres and wheelbarrows may be used provided each wheelbarrow carries a full load and the distance does not exceed 50 metres. It is essential that wheelbarrows are full to minimise segregation. Half loads and less will not be allowed.

Concrete shall be placed and compacted in all corners of the forms and around the reinforcement without segregation and the placing and compaction shall be continued without delay or interruption until a stipulated construction joint or authorised stopping point is reached.

The rate of placing shall be controlled so that the compacting operations for each batch can be completed before the next batch is deposited in the forms or spaces to be filled, and shall not be so rapid as to result in movement or failure of the forms.

The concrete shall be worked by vibration or, if the permission of the Engineer is obtained, by other effective means, to ensure thorough compaction, and to remove all voids.

After vibration, the concrete shall be spaded in the corners, angles and against the forms to release air bubbles with may have been trapped in these positions.

Once concrete has been placed and compacted it shall not be disturbed. In general, adequate measures shall be taken to ensure that the finished hardened concrete is a dense, homogeneous material free from voids, air-holes, and honeycombing, and that the exposed surface is even and uniform.

14.2.6 Re-Tempering of Concrete

Under no circumstances shall concrete be re-tempered by the addition of water or other materials.

The practice of adding water to concrete after it has been discharged from the mixer will not be permitted. If this, in fact, does occur the Engineer will reject the concrete as unacceptable.

Adequate precautions shall be taken to prevent outside water such as rain-water, ground-water, storm-water or waste-water from entering the concrete before it has hardened.

14.2.7 Plums

Displacers or plums may be placed in unreinforced concrete sub-foundations or in other concrete members where agreed to in writing by the Engineer. Where plums are permitted they shall be deposited by hand. In no case will plums be permitted in sections of which the thickness is less than 0.5 metres.

Plums shall not displace more than twenty per cent of volume of the concrete member.

The plums shall generally have a minimum dimension of 150mm and a maximum dimension of 300mm provided this maximum dimension shall not exceed one third of the minimum width of the member in which the plums are being placed.

Each plum shall be surrounded by not less than 150mm of concrete.

The stones used as plums shall have a truly crystalline structure throughout, shall show no signs of fracture, and shall not show any signs of decomposition or weathering on the surface.

14.2.8 Placing in Water

The Contractor shall not be permitted to place concrete in water except by written consent of the Engineer. Permission to place concrete in water will only be given if the Engineer is satisfied that the method to be used and the precautions to be taken will ensure concrete which is free from segregation and of the required strength and quality.

14.2.9 Precaution in Excavation

Particular care shall be taken when pouring concrete against the side of an excavation, to avoid contamination of the concrete by loose material.

14.2.10 Placing on Slope

When it is necessary to place concrete on a slope by hand methods, the consistency shall be such as to exhibit no slump.

Placing, vibration, and strokes of finishing operations shall be performed in an upward direction on the slope.

14.2.11 Vibration of Concrete

a) Plant

The apparatus and method of vibration employed during concrete placing shall be subject to the approval of the Engineer.

Vibrators may be of the external, surface or internal type. The vibrators shall conform to the following requirements:-

Table and /or surface vibrators - Frequency at least 3,000 v.p.m. with variable acceleration of 4 g and upwards.

Form vibrators - Frequency 3,000 to 6,000 v.p.m. at an acceleration of 4g

Internal vibrators - Frequency 6,000 to 7,000 v.p.m. with acceleration 4 g to 10 g.

i. Table vibrators may be used for small precast pre-stressed or precast reinforced concrete work.

ii. Surface vibrators may be used wherever the concrete has a large surface area.

iii. Form vibrators may be used for precast or pre-stressed members and for all structural members where in the opinion of the Engineer heavy reinforcement excludes the use of internal type vibrators.

Where form vibrators are used the forms shall be so constructed as to be sufficiently strong to permit such vibration without deformation of leakage.

iv. Internal vibrators may be used for all types of precast and cast in-situ concrete.

The size and number of vibrators on hand for any concreting operation shall be sufficient to cope with the concrete to be placed. Sufficient stand-by vibrators shall be available for immediate use if required.

b) Use of Vibrators

All concrete shall be compacted by means of vibration, unless permission to use other methods is given by the Engineer.

In general the period of vibration shall be not less than ten seconds or more than twenty seconds per 0.1 m^2 of surface area over which the vibration is visibly effective. The intensity and period of vibration shall be sufficient to ensure complete consolidation of the concrete, as indicated by the cessation of air bubbles which rise to the surface and the appearance of a lime of cement paste at the forms and the attainment of a level top surface with just sufficient mortar for finishing. Care shall be taken to avoid over-vibration and bringing excess mortar to the surface.

Internal vibrators shall be inserted vertically and withdrawn slowly.

Under no circumstances are vibrators to be used to push concrete, or to transport concrete laterally.

The distance between insertions shall not exceed 0.5 m or a distance equal to the radius over which vibration is visibly effective.

Internal vibrators shall not be allowed to touch the formwork, and shall not be allowed to damage or deform the formwork; neither shall the vibrators be deliberately held against the reinforcing steel.

When concrete is placed in layers, the vibrators shall be inserted near the bottom of the layer close to previously placed concrete.

Where surface vibrators in the form of vibrating screeds are used, they are to be moved by positive means such as cranking or by winch and cables. Pulling by hand may be approved by the Engineer when he has determined that the method will produce satisfactory results.

Vibrating screeds shall be moved slowly at a uniform rate along rails or screed guides which have been accurately set and securely supported. A uniform amount of concrete shall be kept in front of the screed at all times for the full width of the screed.

Vibrators may not be attached to the reinforcement.

14.2.12 Protection and Curing of Concrete

14.2.12.1 Protection on Concrete during Placing

Walking on unset concrete during placing operations will not be permitted unless, in the opinion of the Engineer, it is absolutely necessary in order to carry out the placing operations.

Wheelbarrows and other vehicles shall not be permitted on concrete which is still soft. Special movable platforms or bridges shall be provided for the purpose.

14.2.12.2 Protection of Concrete during Setting and Hardening

All newly placed concrete shall be protected against any process which is likely to interfere with the setting and shall be protected from the harmful effects of the sun, wind, cold weather and running or surface water.

While concrete is setting, it shall not be subjected to vibrations of any nature, which in the opinion of the Engineer, are avoidable. Formwork shall not be jarred and no stress shall be placed on the ends of protruding reinforcement.

Unsupported reinforced concrete members shall not be subjected to any superimposed load before the permission of the Engineer is obtained. All other concrete shall be kept free of any load for at least twenty four hours after casting. Notwithstanding the above provisions, no vehicles, pedestrians or loads or any form shall be permitted on any of the concrete work without the permission of the Engineer.

14.2.12.3 Curing of Concrete - Duration

The concrete shall be protected from loss of moisture from any exposed surface for a period after is has been placed. This curing period shall vary as follows:-

Where atmospheric temperatures do not fall below 15^0C the curing period for concrete made with normal Portland cement shall be seven days and the curing period for concrete made with rapid hardening Portland cement shall be three days.

Where at any time during the curing period the atmospheric temperature falls below 15^0C the above curing periods shall be extended to ten days and four days for normal and rapid hardening Portland cement respectively.

Where at any time within the periods specified below the atmospheric temperature falls, or in the opinion of the Engineer is likely to fall below 5^0C effective measures shall be taken to maintain the concrete at a temperature of not less than 10^0C nor more than 25^0C for the remainder of these periods.

a) In the case of concrete made with normal Portland cement, 72 hours from the time of placing.

b) In the case of concrete made with rapid hardening Portland cement, 24 hours from the time of placing.

Curing and protection of unshuttered surfaces shall commence immediately after any portion of the surface has been completed and not at the end of the day's work.

14.2.12.4 Curing of Concrete - Methods

Protection against the loss of moisture shall be brought about by one or more of the following methods.

a) Retaining forms in place, provided the forms are made of material suitable for the purpose, and provided the forms are kept wet.

b) Ponding of water on exposed surfaces.

c) Covering and suitable moisture retaining materials kept continuously wet. Sand, earth, straw, cotton mats and jute mats are considered to be suitable moisture retaining materials.

d) Sprinkling or spraying with water to keep the exposed surfaces continuously wet.

e) Covering with waterproof or other curing paper or other acceptable waterproof membranes held firmly at the edges.

Re-use of curing paper or other membranes will not be permitted without prior approval for every proposed re-use.

f) Application of liquid curing compounds. Where formwork to vertical faces is removed before the specified curing period has elapsed, the application of liquid curing compound shall be carried out immediately.

14.2.12.4 Prevention of Staining when Curing

The Contractor shall ensure that the concrete is not stained, marked, contaminated, or otherwise damaged as a result of the curing operations.

Any staining or other blemish which does occur shall be immediately removed.

14.2.13 Failure of Concrete

14.2.13.1 Definition of Failure

Concrete from which test cubes have been taken shall be considered to have failed to meet the requirements of this specification if:-

1. Any one cube result falls more than 10% below the specified compressive strength for that particular class of concrete.

2. The result of any one test is less than the specified compressive strength for that particular class of concrete.

14.2.13.2 Procedure in the Event of Failure

Should the strength of test specimens fail to meet the requirements of the above Clause the Engineer shall have the right to instruct the Contractor to remove and replace the portion of the structure affected. In this event the Contractor shall carry out the removal and replacement to the satisfaction of the Engineer.

Before taking the action mentioned above, the Engineer, at his discretion, may require the Contractor to adopt any combination of the following courses:-

a. Drill and test cores, from portions of structure represented by the particular test cubes as indicated by the Engineer and according to the manner laid down in B.S. 8110.

The corrected equivalent cube strengths, as laid down, shall be recorded for assessment of the strength of the concrete in question.

b. Conduct full scale load test on the portion of the structure under consideration according to the manner laid down in B.S. 8110.

c. Effect remedial measure to the satisfaction of the Engineer.

In all events the Contract shall effect improvements in the concrete for the remainder of the contract.

14.2.13.3 Costs in the Event of Failure

All costs which may be incurred by reason of failure of the concrete to meet the strength requirements of Table 2 including any costs of testing which may be required, shall be borne by the Contractor and no extra payment on account of such costs shall be made.

14.2.13.4 Quality of Cast Concrete

Treatment of Cast Concrete

Unless the Engineer directs otherwise, no treatment of any kind other than that required for curing, shall be applied to the concrete after removal of the forms until it has been inspected by the Engineer.

The Contractor's methods of making good any defects are to be to the prior approval of the Engineer in each case before work commences.

Protection

Surfaces which will be exposed in the finished works shall be protected from spillage, stains and any other damage.

Quality of Exposed Concrete Surfaces

Any finished work which the Engineer judges to be inferior in any respect to the approved sample or to be unacceptable different in appearance from parts of the works already constructed or which is subsequently stained or damaged, will be classed as defective work.

14.2.14 Concrete in Hot Weather

General

On exposed concrete surfaces in high sun temperatures and/or strong drying wind conditions, the Contractor shall use a curing method which also shades the concrete and this shall be placed in position no later than half an hour after final tamping. If the surface exhibits cracking while the concrete is still plastic then it shall be retamped to close the cracks.

Any formwork made of metal, concrete or other material of high thermal capacity shall be cooled by water before the concrete is placed on it.

14.3 FORMWORK
14.3.1 General

Formwork is to be designed to have adequate strength to support the wet concrete and all joints are to be of adequate tightness to stop undue leakage of concrete fines during vibration. The inside of formwork is to be clean, to the satisfaction of the Engineer. All surfaces shown circular on the drawings are to be true circular shape unless agreed otherwise with the Engineer previously.

Formwork panels shall be stiff enough to prevent damage to the concrete surface during vibration.

14.3.2 Damaged Formwork

Damaged formwork shall not be re-used if in the opinion of the Engineer the making good would impair the surface appearance of the concrete.

14.3.3 System of Formwork

Before construction of formwork begins the Contractor shall notify the Engineer in writing of the system of formwork he proposes to use for all structural members.

No metal part of any device for maintaining formwork in the correct location shall remain permanently within the specified concrete cover to reinforcement.

14.3.4 Propping

Formwork props shall mean props that are part of the formwork and are necessary to support new construction until it is strong enough to carry its own weight.

If formwork props are to be left in place when soffit forms are removed they shall not be disturbed during the removal process except with the approval of the Engineer.

Formwork props shall be positioned between permanent supports so that all members are supported at no more than 3m centers in both directions.

Temporary supports may also be necessary to assist the structure or part of the structure in resisting imposed loads during construction.

14.3.5 Tolerances

General Basis of Measurement

Permissible deviations appropriate to the degree of accuracy required will be applied to linear dimensions, position, verticality level, squareness, and bow. The degree of accuracy may be one of the following:

a) Degree of Accuracy III for use where a high degree of accuracy is unnecessary, e.g. mass foundations.
b) Degree of Accuracy II for what is commonly called "good work".
c) Degree of Accuracy I where the use of special, as opposed to normal, methods of materials (or both) is warranted despite the probability of higher costs than are caused by the use of Degree of Accuracy II. This may apply where, for example, prefabricated units (windows, precast panels) are required to fit in position.

Methods of measurement of deviations

Certain deviations will be measured as set out below:

a) Any deviation from flatness of a plane surface will be measured as the maximum deviation of the surface from any straight line of length 3m joining two points on the surface, determined by means of a straight-edge the ends of which are supported on identical blocks of suitable thickness placed over each of points.

b) Any abrupt change in a continuous surface, including a local depression or peak in a floor or wall and any abrupt change caused by a joint in formwork will be measured as specified in (a) above.

c) Out-of-squareness of a corner or an opening or an element such as a column will be measured by taking the longer of two adjacent sides as the base line, and determining any departure from the perpendicular of the side at either end of the base line.

Permissible Deviations

i) General. The Contractor shall construct each of the various parts of the Works within the limits of the applicable permissible deviations set out in Table below appropriate to the degree of accuracy specified in the project specification or shown on the drawings. If no degree of accuracy is specified, Degree of Accuracy II shall apply.

ii) Concrete surfaces. Any departure from flatness and the height or depth of any irregularity of a finished plane concrete surface shall not exceed the applicable maximum value given in (d) (7) and (8) below. The specified accuracy shall be achieved without any treatment except the rubbing down of hardened surfaces with carborundum blocks.

Specified Permissible Deviations (PD's)

	PERMISSIBLE DEVIATION : DEGREE OF ACCURACY **111 mm** **11 mm** **1 mm**
A) REINFORCEMENT	
1. Spacing between two adjacent bars	+25 +20 +15
2. Longitudinal location of bend and ends of bars	+40 +30 +20
3. Cover to reinforcement	-0+20 -0+20 -0+10
B) FORMWORK	
Form work shall be so constructed as to endure that the position of the finished work will be as specified, subject to the relevant permissible deviation given in (c) or (d) below, as applicable.	
C) FOUNDATIONS : MASS & REINFORCED CONCRETE	
1. Position on plan of any edge or surface measured from	+50 +35 +20
the nearest grid line or agreed centre line	
2. Linear dimension on plan cast against excavation sides	+60 +40 +20
3. Linear dimension on plan cast against formwork	+30 +20 +10

4. Level of underside of concrete	-40+20 -30+15 -20+10
D) <u>ELEMENTS OF COMPONENTS ABOVE FOUNDATION</u> (Including floor slabs)	
1. Position on plan of any edge or surface measured from the nearest grid line or agreed centre line	+25 +15 +5
2. Linear (other than cross-section) dimensions	+30 +20 +10
3. Cross-section dimension	-10+20 -5+15 +5
4. Level (deviation from designed level with reference to the nearest transferred datum (TD) of the upper or lower surface, as may be specified or any slab or other element or component)	-20+20 -15+5 -10+0
5. Vertically, per metre of height	70 50 50
6. Out-of-squareness of a corner or an opening or an element such as a column for short side or length i. Up to and including 0,5m ii. Over and up to and including 2m iii. Over 2m, up to and including 4m	+10 +5 +3 +20 +15 +10 +25 +20 +15

	PERMISSIBLE DEVIATION : DEGREE OF ACCURACY **111 mm** **11 mm** **1 mm**
7. Exposed concrete surface : i. Flatness of plane surface ii. Abrupt changes in a continuous surface	10 5 3 10 5 2
8. Exposed concrete surface to be plastered : i. Flatness of plane surface ii. Abrupt change in a continuous surface	15 10 * 10 5 *
9. Location of holding-down bolts : i. The centre line of a holding-down bolt from its designated location on plan	* +3 * * 3+5 *
ii. The top of the bolt from its designated elevation	

10.Constituents in concrete mix (including water) PD of quantities from approved or designated or prescribed mix : i. For cement, sand and water ii. Course aggregate	% +5 +7	% +5 +7	% +5	 +7

Tolerances not stated and those for bow, camber, and twist, and for slip-form concrete and precast concrete will be stated in the project specification where applicable.

14.3.6 Treatment of Shutter Surfaces

All surfaces in contact with the wet concrete shall be treated with an approved releasing agent which will not stain or damage the concrete finish.

14.3.7 Striking of Formwork
14.3.7.1 General

Before any formwork is removed the Contractor shall ensure that the concrete has attained sufficient strength for striking to proceed.

The structure shall not be distorted, damaged or overloaded in anyway by the removal of the formwork.

The responsibility for the safe removal of any part of the formwork or props rest with the Contractor.

14.3.7.2 Striking Times

a) The minimum periods after casting that the formwork is to be kept in position are shown in Table 4.

The periods may be extended by the Engineer whenever he considers it advisable.

b) The Contractor may determine the striking time, at his own expense, from the strength of the concrete provided that earlier striking will not result in unacceptable deflections due to shrinkage, creep, etc.

The forms and/or formwork props to a structural member may be removed when the strengths of two concrete cubes made from the batch used in the member and cured under the same conditions as the member both exceed 15MPa or twice the stress to which the concrete will be subjected, whichever is the greater.

Permission to carry out this procedure will be withdrawn if the Engineer is not satisfied that the strength of the cubes is representative of the concrete.

Notwithstanding the above, formwork props shall remain in position for at least 3 days.

14.3.8 Cambers

Unless otherwise instructed, all formwork to suspended beams and slabs shall be constructed with the following upward cambers:-

a) Spanning between supports – 0.2% of span at centre

b) Cantilevers – 0.8% of span at free end

14.3.9 Release Agents

The release agent shall be a material marketed as such and shall be of one of the following types:-

1. Cream Emulsion
2. Neat oil with surfactant added
3. Chemical release agent.

Release agents shall be stored and used strictly in accordance with the manufacturer's instructions.

14.3.10 Sealers on Timber Surfaces

Where their use has been specified or approved, sealers shall be applied to surfaces which are dry and free from dirt, grease and other impurities. Before a surface is sealed is shall be sanded to remove any protrusions, or to smooth any rough areas. Any holes or indentations shall be stopped with water-proof filler. The manufacturer's instruction regarding the method of applying the sealer shall be followed exactly and the work shall be borne by a skilled painter.

Whether or not the surface of formwork is in contact with the concrete, all edges to plywood or other timber, including the edges of any holes drilled through it, shall be sealed.

14.4 PLACING AND FIXING REINFORCEMENT, BOLTS, WATER BARS

14.4.1 Cleanliness

All reinforcement and items to be cast in place are to be free of loose rust and scale and free of oil and shutter releasing agents. All metal parts to be built-in and in contact with concrete shall be cleaned and free of paint, protective coatings or any other extraneous material.

14.4.2 Positioning

Unless otherwise specified the concrete cover to reinforcements shall be as recommended in Clause 14.9b

The reinforcement and items to be cast in are to be positioned in accordance with the drawing to within the following tolerances:-

14.4.3 Reinforcement

Cover See Clause 14.9b
Bars may be moved to clear holes etc. in concrete provided approval is given by the Engineer.

14.4.4 Cast in Items

Position and projection see Clause 6.5.5.4.9

14.4.5 Fixing

All reinforcement and cast in items to be held securely in position by spacer blocks, ties, chairs, etc., in such a way that the positions indicated on the drawings are maintained to the above tolerances during the placing of the concrete. Spacer blocks shall match the mix proportions of the surrounding concrete, be comparable in strength, durability and appearance.

14.4.6 Cutting and Bending

All reinforcement shall be bent to the details shown in the schedules, unless otherwise stated, in accordance with B.S. 4466 except the shape coding.

14.4.7 Rust Staining

Concrete surfaces which will be exposed in the finished works shall be protected from staining due to rusting of projecting reinforcement either by coating the reinforcement with cement grout or by another approved method.

14.4.8 Welding

No reinforcement shall be welded without the approval of the Engineer.

14.4.9 Final Preparation and Inspection

The Contractor shall give notice as required by the Engineer before each concrete pour, so that an inspection may be made before the concrete is placed.

14.5 CONSTRUCTION JOINTS

14.5.1 Positions

The spacing of construction joints other than those in watertight construction shall comply with the following requirements:-

Maximum area 100 m^2
Maximum length 13 m

If construction joints are not shown on the drawings the Contractor shall obtain the agreement of the Engineer to their positions before work starts.

14.5.2 Forming Construction Joints

The concrete shall be run up to a stop board and not allowed to run to feather edge. Immediately prior to the casting of the next position the existing concrete must be cleaned of all laitance and roughened to the extent that the largest aggregate is exposed but not disturbed.

When work is to be resumed at a construction joint the contact face shall be clean. The fresh concrete shall be placed directly against it. No grout or mortar shall be used except with the approval of the Engineer.

14.5.3 Forming Moving Joints

Movement joints shall be constructed strictly in accordance with the drawings and in cases where water bars are shown they are to be continuous. All joints shall be to the Engineer's approval.

Concrete shall not be placed on both sides of a movement joint at the same time unless otherwise approved by the engineer.

14.5.4 Watertight Construction

A. General

Methods of fixing formwork which result in holes through the concrete section when the formwork is removed shall not be used. Wall ties shall have water baffles.

Wall kickers shall be cast monolithically with the base slab.

The Contractor will be required to carry out remedial work at his own cost and to the satisfaction of the Engineer in the event of leaks or damp patches occurring.

B. Water Bars

Water bars shall be used in all construction joints in accordance with the manufacturer's written instructions, and the Contractor shall obtain the approval of the Engineer of the methods to be used to maintain them in their correct locations while the concrete is being placed.

14.6 FINISHES

14.6.1 Smooth or Wrot Shuttering (Fair Face)

The minimum standard of finishes for smooth shuttering shall be as follows:-

On removal of the formwork, concrete surfaces will present a uniform, clean and smooth appearance, free from honey-combing and faulty junction with concrete previously pieced and unevenness due to movement and/or warping of timber and/or leaking joints.

The surfaces shall conform in every way to the outline and sections shown on the drawings an all curved, straight, horizontal, vertical or inclined surfaces shall be true to the lines and shapes indicated on the drawings and shall not show distortion or blemish. All surfaces shall be cleaned and rubbed down to the satisfaction of the Engineer and freed from all irregularities. The rates for concrete and shuttering shall be deemed to include for the cost of this work.

All shuttering shall be approved by the Engineer before concrete is poured.

Where badly honey-combed surfaces are evident, the Contractor shall break down and remove the portion of the structure affected, on the instructions of the Engineer.

The Engineer, at his discretion, may allow remedial measures to be carried out.

Remedial measure to make good any defects shall not be commenced until the Engineer has approved the manner of effecting repairs. Repair work shall be made at the expense of the Contractor and no payment additional to the scheduled rates will be allowed.

14.6.2 Rough Shuttering

The general stipulations under Clause 6.5 apply with regard to quality and density, however, where appearance of exposed surfaces is not important, rough shuttering will generally be allowed.

14.6.3 Free Surfaces

The concrete is to be struck off with a template and tamped with a tamping board to bring the mortar to the surface. Either steel or wood float finishes will be measured and specified.

14.7 TESTING OF STRUCTURES

14.7.1 General

All water retaining structures are to be tested for water-tightness to ensure compliance with the relevant design parameters and acceptance of the structure for its intended use.

The method of testing is to be agreed with the engineer to suit site conditions, visibility and position of the elements under consideration.

No backfilling around (or burying of) concrete elements shall be allowed prior to testing and acceptance of the effected structure by the Engineer.

Prior to undertaking any testing the structure should be thoroughly cleaned and all "foreign" matter removed.

In the first instance all inspections, testing and interpretations of results shall comply with B.S. 8807:1987 Section 9 (And other related clauses contained within that document) which may be deemed as supplementary to and forms part of the specification.

14.7.2 Testing of Water Retaining Structures

14.7.2.1 Procedure for testing of structures

The following method shall be adopted for testing purposes:-

- All outlets shall be sealed to prevent loss of water through pipes, overflows and other connections
- The structure is to be filled to its normal maximum operating level at a uniform rate. The maximum acceptable rate of rise in water level is 2.0m in 24 hours or as otherwise directed.
- Upon completion of filling the structure a 7 day stabilization period is to be allowed for complete saturation and absorption of the retained liquid by the concrete. During this 7 day period the structure shall be "topped up" as required.
- The water is to be allowed to stand for a further 7 days during which time the top water level is to be monitored and recorded as indicated in Section 6.9.2.2 below. No additional water may be added at this time.

14.7.2.2 Procedure for measurement

- In the first instance the structure shall be visually inspected to ensure there are no obvious signs of leakage occurring. Following approval by the Engineer the test period may commence.
- During the test period the water level is to be recorded on the first day of the test and subsequently at the same time each day for a total of 7 days.
- The results are to be reviewed by the Engineer at the end of the test period to ensure compliance with Section 6.9.2.3. below. Should the structure fail the test for water tightness, at the discretion of the Engineer, the structure shall be tested for a further 7 days at which time the new results will be reviewed. No structure shall be subject to more than 3 weeks of testing without determination of the source of water egress and the institution of appropriate remedial works.

- The water levels are to be measured by fixing scales to the inner walls at four equally spaced position on open tanks and at all access positions on roofed tanks.

- In the case of open tanks allowance is to be made for rain and evaporation. This shall be measured in evaporation pans of the same design as those used by the Meteorological Department of Government of Zimbabwe. Measurements of these tanks shall take place at the same time as those taken for the open concrete structure.

Any losses or gains shall be included in the calculations for water loss in the open tank.

14.7.2.3 Acceptance of Structures (Limiting Parameters)

- The difference in level of the water over the 7 day test period is used to assess the results of the tests.

- The maximum allowable difference in water level is being the lesser of $1/500^{th}$ of the average of the full water tank or 10mm during the stipulated test period of 7 days.

- At the discretion of the Engineer the above acceptance criteria may be altered to suit the nature of the structure and its requirements in accordance with the design and intended use.

- Notwithstanding the satisfactory completion of the tests, any evidence of seepage of the liquid to the outside faces of the liquid-retaining elements shall be addressed in accordance with Section 6.9.3.2 below.

14.7.2.4 Localised Inspection

The appearance of damp patches on the "dry" faces of any structural element after the element under review has been continuously subjected to water testing for 3 weeks or more shall be deemed as failure. The affected area shall be repaired and waterproofed, at the contractor expense, preferably from the water side, in accordance with the Engineer's instruction.

14.7.2.5 Testing of Roofs

The roofs of liquid retaining structures should be water tight and should be tested in accordance with the following procedure.

Procedure for testing roofs

The following method shall be adopted for testing purposes:-

- Where practicable the roof should be flooded with water to a minimum depth of 25mm for 24 hours (or longer if so specified by the Engineer).

- Where it is impracticable, because of roof falls or otherwise, to contain a 25mm depth of water, the roof should have water applied by a continuous hose or sprinkler system to provide a sheet flow of water over the entire area of the roof for not less 12 hours.

Acceptance of Structures (Limiting Parameters)

The roof shall be considered satisfactory if no leaks or damp patches show on the soffit. Should the roof structure not satisfy either of the above tests, then after completion of the remedial work it should be retested in accordance with Item 9.3.3.9.1 above. The roof covering (with stone or other materials so specified) should be completed as soon after satisfactory testing.

14.7.2.6 Summary

All water retaining structures are to be tested for water-tightness. The method of testing shall be to fill with water at a uniform rate of not more than 2m in 24 hours and allowed to stand for 7 days for absorption. During the 7 day absorption period, the structure shall be 'topped up'. The structure shall then be left a further 7 days, during which time no signs of leakage must take place. In the case of underground or partially underground tanks, backfilling must not be carried out until testing has been completed. The maximum drop in water level allowed is to be 10mm in 7 days, with due allowance made for rain and evaporation in the case of open tanks.

14.7.2.7 Sterilization of Structures

Where structures holding potable water have been tested and before they are handed over to the employer and put into service they shall be sterilized as follows:

1. The Reservoir shall be cleaned and washed down with clean water until all sediment and other foreign matter has been removed.

2. The Reservoir shall then be filled with water containing not less than 150mg/l of calcium hypochlorite. The concentrate solution shall be added slowly into the reservoir until it fills the whole reservoir and shall be left for a maximum of 24 hours.

3. The Reservoir shall be emptied and washed down so that any further sediment is removed and refilled with potable water. Tests shall be taken to ensure the water complies with the local authority or Government Requirements before being discharged into the water reticulation.

14.8 MEASUREMENT AND PAYMENT

14.8.1 Concrete

Shall be measured in m3 from the drawings incorporating any variations authorised by the Engineer. The rate shall include for manufacture of cubes, testing, transporting and placing.

14.8.2 Shuttering and formwork

The cost is to be included in the concrete rates and shall include for all centering, props, etc.

14.8.3 Free Surfaces

The cost of these is to be included in the concrete rates.

14.8.4 Reinforcement

Reinforcement shall be measured in tonnes as calculated from the bar bending schedules incorporating alterations authorised by the Engineer.

The mass of the bars per metre run to be used for these calculations are to be as follows. The rates hall include for supply, cutting, bending and fixing in position, chairs, clips, tying wire etc.

MASS OF BAR PER METRE

SIZE	ROUND MILD STEEL	SQUARE TWISTED
6 mm	0,2485 kg	-
8 mm	0,395 kg	-
10 mm	0,616 kg	0,784 kg
12 mm	0,887 kg	1,129 kg
14 mm	1,207 kg	1,537 kg
16 mm	1,577 kg	2,008 kg
20 mm	2,464 kg	3,137 kg
22 mm	2,981 kg	3,796 kg
25 mm	3,850 kg	4,902 kg
30 mm	5,544 kg	7,059 kg
35 mm	7,546 kg	9,609 kg

Except where specifically provided for otherwise, no payment will be made for stools, chairs, spacers, tying wire etc.

14.8.5 Joints

All construction joints are to be allowed for in the concrete rates. Other joints are to be measured in Lin. m., as indicated on the drawing incorporating any variations authorised by the Engineer. The rate is to include for water bar, filler, sealer, and all contingent work, as detailed on the drawing, except where separate items for these appear in the Schedule of Prices.

14.8.6 Testing

The cost of testing and sterilization of water retaining structures shall be included in the rates. Any re-tests due to faulty workmanship shall be to the Contractor's account. The cost of the supply of water shall be included in the rates.

TABLE A

PRESCRIBED MIXES FOR ORDINARY STRUCTURAL CONCRETE WHERE AGGREGATES ARE BATCHED BY VOLUME

Grade (MPa)	Nominal Size of Stone (mm)	Quantities of Aggregates (liters/sack)				Max. allowed amount of water (liters/Sack)	Min cement content (sacks/cubic metre	Min current margin (MPa)
		Stone (mm)						
		Sand	37.5	19	9.5			
10	37.5 19	160 155	200 -	- 165	- -	34.0 34.5	4.4 4.8	6.5
15	37.5 19	135 130	170 -	- 140	- -	29.5 30.0	5.1 5.6	12.0
20	37.5 19 9.5	115 110 125	155 - -	- 125 -	- - 80	26.5 27.0 26.0	5.7 6.3 7.0	15.0
25	37.5 19 9.5	100 95 105	135 - -	- 110 -	- - 70	23.5 24.0 23.5	6.5 7.1 8.0	15.0
30	37.5 19 9.5	85 80 90	120 - -	- 100 -	- - 65	21.5 21.5 21.0	7.0 8.0 8.9	15.0

TABLE A NOTES

Notes:

1) The sand quantity for volume batching is the bulked volume of damp sand.

Provided the sum total of the quantities of sand and stone for a mix is not altered, the proportions of sand and stone may be revised by +/- 10 litters.

Maximum slump - 60mm

2) The proportions by volume may be calculated using the following densities :-

Coarse Aggregate 1 400 kg/m3
Fine Aggregate 1 550 kg/m3

If the fine aggregate is damp, 15 per cent bulking can be assumed. Where possible, actual figures for bulking and 'as batched' densities should be used to calculated the equivalent volumetric proportions.

3) Concrete for water retaining structure shall be designed mixes in accordance with Clause 6.4.1.3

TABLE B

PRESCRIBED MIXES FOR ORDINARY STRUCTURAL CONCRETE WHERE AGGREGATES ARE BATCHED BY WEIGHT

Grade (MPa)	Nominal Size of Stone (mm)	Quantities of Aggregates (kilograms per sack)				Max allowed amount of water (liters per sack)	Min cement content (sacks per cubic metre	Min current margin (MPa)
		Stone (mm)						
		Sand	37.5	19	9.5			
10	37.5 19	200 190	270 -	- 220	- -	34.0 34.5	4.4 4.8	6.5
15	37.5 19	165 155	235 -	- 190	- -	29.5 30.0	5.1 5.6	12.0
20	37.5 19 9.5	140 135 150	210 - -	- 170 -	- - 110	26.5 27.0 26.0	5.7 6.3 7.0	15.0
25	37.5 19 9.5	120 115 125	185 - -	- 150 -	- - 95	23.5 24.0 23.5	6.5 7.1 8.0	15.0
30	37.5 19 9.5	100 95 110	165 - -	- 135 -	- - 85	21.5 21.5 21.0	7.0 8.0 8.9	15.0

TABLE B: NOTES

Notes:

1. Provided the sum total of the quantities of sand and stone for a mix is not altered, the proportions of sand and stone may be revised by +/- 15 kg.

   Maximum slump - 60 mm.

2. Concrete for water retaining structures shall be designed mixers in accordance with Clause 6.4.1.3

3. For Statistical analysis by batching by volume or weight

   Target strength = specified strength + (K x standard deviation)

Degree of control under which the number of results falling below the specified strength	16%	5%	2%
K Factor from Normal distribution curve	1.0	1.7*	2.0

4. Standard Deviation

Degree of Site Control	Standard Deviation (MPa)
Good	5
Poor	7*
None	8

Absolute Minimal Acceptance

Example: - Target strength = 30 + (1.7 x 7) = 41.9 say 42 MPa

Normal Minimal Acceptance

Example Target Stream = 30 + (1.7 x 8) = 43.6 say 44 MPa.

TABLE 1

TABLE OF CONCRETE MIXES

Grade of Concrete (MPa)	***Maximum Aggregate***	***Slump Limits***	***Type of Cement***	***Indicated Class of Work***
10A *10B*	*20* *40*	*25 - 75* *50 - 100*	*Portland or PC 15* *Portland or PC 15*	*Blinding* *Backfilling*
15A *15B*	*20* *40*	*25 - 75* *50 - 100*	*Portland or PC 15* *Portland or PC 15*	*Blinding* *Backfilling*

20A *20B*	*20* *40*	*25 - 75* *50 -100*	*Portland or PC 15* *Portland or PC 15*	*Structural* *Backfilling*
25A *25B* *25WR*	*20* *40* *20*	*25 -75* *50 - 100* *25 - 50*	*Portland or PC 15* *Portland or PC 15* *Portland or PC 15*	*Structural* *Mass Sections* *Water Retaining Structures*
30A *30B* *30WR*	*10* *40* *20*	*25 -75* *50 - 100* *25 - 50*	*Portland or PC 15* *Portland or PC 15* *Portland or PC 15*	*Structural* *Large Structural Sections]* *Water Retaining Structures*
40A *40B*	*10* *20*	*10 - 25* *25 - 50*	*Portland or PC 15* *Portland or PC 15*	*Special Structural Sections* *Structural*
50A *50B*	*10* *20*	*10 - 25* *25 - 50*	*Portland or PC 15* *Portland or PC 15*	*Special Structural Sections* *Structural*

Concrete Mixes 25 WR and 30 WR

To have a minimum cement content of 360 kg/cubic metre and a maximum of 400 kg/cubic metre.

TABLE 2

COMPRESSIVE STRENGTH AT 28 DAYS EXPRESSED IN MPa

Grade of Concrete (MPa)	Design Strength Used in Structural Calculations	Absolute Minimum Compressive Strength (no more) than 5% may be below design strength	Minimum Average Compressive Strength for two consecutive tests	Minimum Average Compressive Strength for three consecutive tests	Minimum Average Compressive Strength for four consecutive tests
10A 10B	10	9.0	10.0	11.5	13.5
15A 15B	15	13.5	15.5	17.0	20.5
20A 20B	20	18	20.5	24	27.5

25A 25B 25WR	25	22.5	25	28.5	32.5
30A 30B 30WR	30	29.5	32.0	36.	39.0
40A 40B	40	36.5	38.5	43	47.5
50A	50	45.0	47.5	52.5	57.0

TABLE 3: NORMAL CURING PERIODS

Condition under which concrete is maturing	**Minimum periods of protection for different type of cement**		
	Curing Period		
	Portland blast furnace cement	**PC15 Portland cement**	**High early strength Portland cement**
	days	days	days
Damp or indoors	4	3	1
Ambient Temperature greater than 18 deg. C (Normal)	8	6	2
5 deg. C to 18 deg. C (cool)	12	8	3
under 5 deg. C (Cold)	14	10	4

NOTE: During the first 3 to 5 days of the curing period, effective measures should be taken to maintain the concrete at a temperature of between 10 deg. C and 25 deg. C and all surfaces should be protected from frost damage.

TABLE 4: MINIMUM PERIOD BEFORE STRIKING FORMWORK

	TYPE OF CEMENT USED

	Normal Portland Cement and PC 15			***High early strength Portland cement & High early strength PC 15***			***Portland blast furnace cement***		
WEATHER	***Normal***	***Cool***	***Cold****	***Normal***	***Cool***	***Cold****	***Normal***	***Cool***	***Cold****
TYPE OF STRUCT. MEMBER OF FORMWORK		*3 d*	*4 d*				*3 d*	*5 d*	*6 d*
Beam sides: walls & unloaded columns	*36 h*			*24 h*	*30 h*	*36 h*			
Slabs with props left under	*4 d*	*7 d*	*7 d*	*2 d*	*4 d*	*4 d*	*7 d*	*10 d*	*12 d*
Beams soffits with props left under : & ribs on a ribbed-floor construction	*7 d*	*12 d*	*12 d*	*3 d*	*5 d*	*5 d*	*10 d*	*17 d*	*17 d*
Slab props	*10 d*	*17 d*	*17 d*	*5 d*	*9 d*	*9 d*	*14 d*	*17 d*	*21 d*
Beam props	*14 d*	*21 d*	*28 d*	*7 d*	*12 d*	*12 d*	*16 d*	*21 d*	*28 d*

Weather may be regarded as 'normal' when atmospheric temperatures adjacent to the concrete, as measured by a maximum and minimum thermometer, do not fall below 18 deg. C; as 'cool' when the temperature measured similarly is between 5 deg. C and 18 deg. C; as 'cold' when under 5 deg. C.

* Shorter periods may be used for sections of thickness at least 300mm.Y

14.9 REINFORCEMENT

a. General

Bends in bars shall be cold formed on approved machines in which the power is applied smoothly and evenly and at such a speed so as to cause no fracture or damage in the reinforcement, Reinforcement damaged in any way shall be removed from the site. Before being placed in position, the rods shall be thoroughly cleaned of all grease, dirt, bituminous material, scale and loose rust.

Great care must be taken in placing the rods in their correct positions as shown on the drawings and in retaining them during the placing of the concrete.

When the ends of bars are to be formed into a U-hook, they must be bent to a semi-circular hook, the internal diameter of which is to be not less than twice the diameter of the rod, with a straight end beyond the semi-circular portion having a length of not less than four times the diameter of the rod.

Unless otherwise shown on the drawings, all joints in reinforcing rods are to be lapped 24 times the diameter of the rod for compression laps and 30 times the diameter of the rod for tension laps. The lap must be securely tied with 16 or 18 S.W.G. annealed iron wire. Rods crossing one another are to be bound at every intersection, unless otherwise directed with 16 or 18 S.W.G. annealed iron wire.
All stirrups are to be properly fastened to the main reinforcement so as to retain their position during the placing of the concrete.

Welding will not be permitted in any rods.

The Contractor will be provided with bending schedules giving the cut lengths, diameter, bending dimensions and location of each bar in the work. The Contractor should however satisfy himself that no discrepancies exist between reinforcing drawings and schedules.

The Contractor shall notify the Engineer when any section is ready for concreting and no concrete shall be placed in position until the steelwork has been inspected and approved by the Engineer or his representative.

b. Cover

The concrete cover to the main reinforcement shall not be less than the following: -

Slabs	15mm
Ends of beams	50mm) or the diameter
Soffits and sides of beams	25mm) of the rod
Columns	30mm) whichever is
Retaining wall	50 mm)
Columns bases	60mm) the greater

The cover for steel in cast-in situ manholes and water-bearing structures shall be 40mm.

In all other cases the cover to the reinforcement shall be not less than 25mm, unless stated on the drawings.

Cast cement spacers composed of two parts of sand and one part cement, 40 x 40 x 10 thick, or of the requisite size to give the required concrete cover, slightly tapered on side, shall be used for lifting the reinforcement up from the formwork. The concrete spacers must be at least three weeks old before being used. Small pieces of steel rod shall be used for distance pieces for spacing the rods in beams.

15. ANT POISON AND REMOVAL OF ANTHILLS

Ant poison shall contain not less than 0,5% Dieldrex or Aldinal emulsion in water or 5% pentachlorophenol solution in mineral oil.

Anthills which come within the construction area and 3m clear all round shall be entirely removed and the queen eradicated. The cavity formed by the removal of the rest must be filled in with approved materials in layers not 300mm thick compacted to 100% L.C.E.

Volumes of anthills shall be measured under the formula V=CxCxH/25.2 where volume in cubic metres, C is the circumference in metres around the base taken at the point where the steep slope commences, H is the average vertical height in metres measured from points on the circumference C to the top of the main body of the anthill (ignoring any stalagmite tip.)

16. ELECTRICAL & MECHANICAL WORKS

16.1 GENERAL PROJECT SPECIFICATIONS

16.1.1 COORDINATION

The Contractor shall consult with other sub-contractors on site to determine any interference with his work and locate equipment so that there will be no interference found afterwards, where necessary the Contractor shall relocate the equipment without additional cost to the Employer.

16.1.2 FABRICATION DRAWINGS

Drawings and documents shall be submitted as follows:-

Drawings for Approval	3 prints
Final and Certified Drawings	3 prints

16.1.3 CORROSION PROTECTION

All pipework and structural steel surface preparation and corrosion protection shall be in strict accordance with BS 5493 "Protective Coating of Iron and Steel Structures Against Corrosion", Clause 3.10 or as shown on the Drawings.

16.1.4 DRAWINGS FOR CONSTRUCTION

a) <u>Mechanical, Electrical and Instrumentation</u>

Where applicable, three prints will be provided by the Consultant to the Contractor for construction at no cost.

b) <u>Piping</u>

The Contractor will supply detail drawings for the Piping and must note that final dimensions must be verified on site before commencement of Piping fabrication.

c) Any repairs or modifications to any Employer-supplied equipment shall be done only with the written consent of the Engineer.

d) All Employer supplied equipment will require final assembly and installation on site, the extent of which will be shown on the drawings and/or Supplier's Installation Instructions and/or manuals.

e) It shall be the contractors responsibility to familiarise themselves with the status of each piece of equipment and provide all labour, material and services required to assemble, install, connect up, test and commission all Employer supplied equipment.

f) Provision of supplier's field assistance, if required, shall be made by the Contractor through the Engineer at least 14 days ahead of the required date. Cost of the Supplier's field assistance shall be paid for by the Contractor.

g) Fabrication Drawings - Structural Steelwork Only

The Contractor shall be responsible for the preparation of all workshop detail drawings, erection diagrams and material lists. No work shall be commenced until the workshop detail drawings have been approved by the Consultants.

Approval of any drawing shall not absolve the Contractor of any responsibility in terms of this Contract.

Typical detail drawings showing the different types of connections and haunches shall be submitted with Tender Documents.

Drawings for Approval	3 prints
Final and Certified Drawings	3 prints

The Contractor shall supply full workshop detail drawings of all open grid type flooring and stair treads.

16.2 DAY BOOK

The Contractor shall maintain a suitable "Day Book" in his site office in which all circumstances that may affect the progress of the Contract are to re-recorded, e.g. weather conditions, labour difficulties, non-receipt of materials, etc. This book shall be available for daily scrutiny by the Engineer

The cost of complying with the Clause shall be deemed to be included in the Establishment Charge.

16.3 GAS BOTTLES

Gas bottles will be clearly marked as to their contents and their ownership. Any person found removing gas bottles from the site or using bottles belonging to others within the site without permission will be ejected from the site.

16.4 ATTACHMENT TO BUILDINGS

In making the installation, attachment to structural steel, suitable beam clamps, cable clips, brackets and supports shall be used for the equipment.

16.5 CUTTING, DRILLING AND PATCHING

Under no circumstances shall cutting, drilling, removal or burning of structural parts of sections of the building, whether steel, concrete or masonry, be undertaken without written authorization of the Engineer.

16.6 ASSEMBLY OF EQUIPMENT

Some assembly of components shall be carried out in the manufacturers shop. It is the responsibility of the Contractor to establish what remaining assembly operations must be carried out in the field:-

a) Prior to installing the equipment the Contractor shall check the specific technical specifications, drawings and manufacturer`s installation instructions to ensure that the equipment installation procedure is properly understood and followed.

b) The manufacturer's specification must be rigidly followed. The requirements of these contract documents are subsidiary to the manufacturer's specifications.

c) Prior to placement of the equipment on hold-down bolts, the concrete foundations shall be checked for elevation and shall be cleaned by removal of all debris and dirt. The surface of the concrete shall be free of oil, grease, paint or other substances that will affect the bonding of grout.

d) All misfits shall be reported to the Engineer, and any corrective measure employed shall be subject to his approval.

e) The Contractor shall make any minor adjustments or alterations necessary for proper assembly and fit, particularly where there has been no shop assembly. Nevertheless, standard components (motor base plate, etc.) shall not be altered in such a way as to reduce their inter-changeability, or to complicate their replacements. Legs, braces, or other components shall not be altered in any manner which would reduce their strength.

f) The Contractor shall ensure that the manufacturer's guarantee is not invalidated.

16.7 SHIMS

The Contractor shall furnish and install all shims on both sides of hold-down bolts, where required to align and level equipment. Shims shall not protrude beyond edge of equipment unless specified

otherwise. All shims of 16 ga. and heavier shall be made of steel. All shims thinner than 16 ga. shall
be made of brass or bronze. Shims shall have either round holes of C-slots, so that clamping bolts do not induce bending stresses in the equipment concerned.

Where practical, shims shall be the same size as the baseplate to be supported. Where practical, numerous thick shims should be tack-welded together at the ends to prevent separation during subsequent handling.

16.8 SHEAR BLOCKS

Where necessary, the Contractor shall install suitable shear blocks to prevent components moving over the surface to which they are mounted.

16.9 WEDGES, JACKS

Wedges and jacks may be used to move machinery into position, but the Contractor must ensure that such devices do not damage the machine in any way.

Wedges and jacks must be removed prior to tightening of hold-down bolts. After the hold-down bolts have been tightened, the machine must be re-checked for correct location, elevation and alignment before commencing the final grouting.

16.10 FASTENERS

a) Anchor bolts set in concrete shall be supplied by the Contractor.

b) Anchor bolts not set in concrete (such as "Clinch", anchors, "Red Heads", "Rawlplugs", etc.) shall also be supplied by the Contractor.

c) The Contractor shall check all foundation bolts before setting base plants. Bolts shall not be cut from the group because of misalignment. Bolts shall not be bent to suit equipment base plate holes. All cases of misalignment shall be reported to the Engineer and any corrective measures employed shall be subjected to his approval. After the setting of base plates has been completed, the Contractor shall cut off all anchor bolts so they do not project beyond the nut a distance greater than half the bolt diameter. Bolts shall be cut in such a manner as to avoid damage to the threads.

16.11 GROUTING

The grouting shall be done by the Contractor. The grouting shall not be carried out until the equipment has been finally levelled and aligned. Immediately before grouting, the space under the equipment bases or base plates shall be thoroughly cleaned and left free from excessive moisture.

Grouting shall be non-shrink, non-ferrous. The grout shall be placed in accordance with the manufacturer's recommendations and all workmanship shall be subject to the approval of the Engineer.

16.12 LUBRICATION

The Contractor shall be entirely responsible for ensuring that all equipment has been properly lubricated prior to start-up.

Where equipment arrives at the site already filled with a lubricant, the Contractor's responsibility is to ensure that the oil level is correct and that the machine is ready to operate. At the end of the run-in period, the Contractor will drain and refill, using his own labour and lubricants.

Where equipment arrives at the site without lubricants, the Contractor shall supply and immediately fill with a flushing oil or grease approved by the Employer.

The Contractor shall then drain this flushing oil and refill with the correct lubricant. At the end of the run-in period, the Contractor will drain and refill, using his own labour and lubricants.

The Contractor shall take care that lubricants are not spilled onto walkways or other surfaces where the lubricant would cause damage or a safety hazard.

16.13 INSTALLATION OF ROTATING EQUIPMENT

a) Alignment

Each piece of rotating equipment, together with its driver and any intermediate couplings or connections, shall be aligned, levelled and plumbed to the tolerance specified by the manufacturer. Where components are received as an assembled unit, all alignments shall be checked and adjusted as necessary. Permanent alignment shall be ensured by the installation of dowels wherever appropriate. When pumps have been standing on site for a period of six months or more without having been rotated regularly, all bearings are to be replaced at contractor's cost before being installed in situ.

b) Rotation

After setting, prior to connecting the motor, each piece of rotating equipment shall be checked to ensure that rotation is in the proper direction and that the rotating parts are free of interference.

c) End Float

During the installation of motor or other equipment having sleeve bearing shafts, extreme care shall be taken to ensure that the end float of the shaft falls within the limits specified by the manufacturer.

d) Noise and Vibration levels

i) All pumps and pipework shall have adequate acoustic treatment so that airborne noises are limited to noise criteria (NC) of fifty (NC50).

ii) Based on current available vibration criteria the minimum allowable vibration peak to peak displacement of the pumps rotating at 1450RPM shall be 0.05mm taken on the bearing or machine structure if it is sufficiently rigid.

e) Final Connection

Final assembly of motor couplings shall not be completed until the motors have been electrically connected and run under no load conditions, and direction of rotation has been reconfirmed.

After connecting the couplings the equipment shall be turned by hand and finally by power.

16.14 INSPECTION AND TESTING

After erection, interconnection, flushing, lubrication and inspection, the Contractor shall test, to the satisfaction of the Engineer, all equipment and systems installed under this specification.

Before testing, all equipment shall be thoroughly cleaned of all dirt, debris and foreign matter. All pipe joints and supports shall be checked for tightness upon completion, and all obstructions such as temporary blind flanges, shipping flanges, etc. shall be removed. After all tests are completed, temporary strainers shall be removed and replaced by permanent ones as called for on drawings. Alignment of equipment shall be rechecked and corrected where required.

In general, preliminary testing shall consist of operating the equipment under no load conditions, for a period of time under surveillance by the Contractor to assure proper alignment of gears, couplings, etc. and running fits of bearings.

16.15 ADJUSTMENTS

a) It is the Contractor's responsibility to ensure that all moving machinery can travel the full amount that it was designed for.

b) Many of these movements are adjustable for speed, pressure stroke and these adjustments must be made prior to start-up.

16.16 RETURN TO SITE

The Contractor must provide for returning to site to complete calibration and tests for which the Contractor or his sub-contractor are responsible and can be done only during actual operation of the plant.

16.17 PROTECTIVE EQUIPMENT COATING

The Contractor shall remove grease or other protective coatings applied for protection during shipment or storage with suitable solvents and cleaners. He shall ensure that there is no damage to machinery finishes.

16.18 WELDING

The Engineer must approve, in writing, all field welding not specifically called for on the Contract drawings. The Contractor shall make good all paint systems damaged by field

16.19 TAGGING OF EQUIPMENT

All equipment installed by the Contractor shall be tagged by the appropriate trade, following his part of the erection work. Tags shall carry notations as to status of work done by each trade, and completion of lubrication requirements. The Engineer shall approve the equipment installation before testing by the Contractor's comments.

16.20 TUBULAR HANDRAILING

Hand-railing shall be made up of top and knee rails in tubular steel with an outside diameter of 30mm. Stanchions are to have an outside diameter of 40mm and spaced at a maximum distance of 2.0 meters. At the ends of a 450mm diameter closure bend shall join the top and knee rail. Stanchions feet are to have flanges for either top or side mounting and to be fixed to concrete surface with two number 16mm diameter M.S. bolts.

Handrails are to be wire-brushed and primed with one coat Zinc Chromate primer followed by an undercoat and two coats of high gloss alkyd enamel paint. The total dry film thickness shall not be less than 100 micrometers. In very corrosive environments the Engineer will specify paint application type D, Clause SP2.6.0.

16.21 OPEN GRID FLOORING

Open grid flooring shall be of an approved design of which a sample shall be submitted to the Engineer for approval. In the Schedule of Prices and drawings the trade name "wecroloc" has been used but alternatives will be considered. The open grid flooring shall be cut to the correct size and shape and shall be finished with a 25mm by 5 mm framing bar.

The open grid flooring shall be placed in a 30mm x 30mm x 5mm angle frame to which bifurcated 10mm dia. round bars are welded in sufficient numbers to hold the frame in position without movement in the concrete.
The open grid and framing shall be protected by pickling and hot dip galvanising at a minimum of 610/m2. Alternatively, the flooring shall be had cleaned to St. 2 and hot bitumen to a minimum of 3mm thickness.

CONTENTS

Bill of Quantities

PREAMBLE TO THE BILL OF QUANTITIES

GENERAL

1.1 This preamble to the Schedule of Quantities provides the tender with guidelines and requirements with regards to the completion of the Schedule of Quantities. The Schedule has to be completed in black ink and the tenderer is referred to the Notes to Tenderers in regard to the correction of errors.

1.2 The Schedule of Quantities shall be read with all the documents which form part of this Contract.

1.3 The following words shall have the meanings hereby assigned to them:

1.1.1	Unit:	The unit of measurement for each item of work in terms of the General and Special conditions of Contract, the Specifications and the Project Specifications.
1.1.2	Quantity:	The number of units of work for each item.
1.1.3	Rate:	The payment of quantity and the rate tendered for an item.
1.1.4	Amount:	The product of the quantity and the rate tendered for an item.
1.1.5	Lump Sum:	An amount tendered for in item, the extend of which is described in the Schedule of Quantities, the Specifications and the Project Specifications, but the quantity of work of which is not measured in any units.

PAY ITEMS

2.1 The abbreviated descriptions of the payment items given the Schedule of Quantities are only for the purpose of identifying the items and providing specific details. Reference shall be made, inter alia, to the Drawings, Specifications, Project Specifications, General Conditions of Contract and Special Conditions of Contract for the more detailed information regarding the extend of the work entailed under each item.

2.2 The item numbers appearing in the Schedule of Quantities refer to the corresponding item numbers in the specifications and in the Project Specifications.

2.3 The units of measurement indicated in the Schedule of Quantities are metric units.

RATES

3.1 The tenderer must fill in a rate for each item in the Schedule of Quantities, even where no quantities are given. Items against which no rate is entered or where a word or phrase such "included" or "provided elsewhere" has been entered, will be accepted as a rate of nil having been entered against such item.

3.2 Any work executed to which such a pay item applies, shall be measured under the appropriate items in the Schedule of Quantities and valued at a rate of nil. The rate of nil shall be valid irrespective of any change in the quantities during the execution of the contract.

3.3 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.

3.4 The tenderer shall not group together a number of items and tender one rate for such group of items.

3.5 All rates and sums of money quoted in the Schedule of Quantities shall be in US$

GENERAL NOTES

4.1 These bills of quantities form part of and must be read in conjunction with the Specifications, which contain the full descriptions of the work to be done and material and equipment to be used. Unless otherwise described in these bills of quantities, reference should be made to the Specifications for the full meaning of descriptions of work to be done and materials and equipment to be used in this service.

4.2 These bills of quantities contain pages numbered as indexed.

4.3 The bills priced in detail shall be submitted with the tender. The bills shall have all items properly priced and extended. If any items in the bills are not priced it shall be deemed that either no costs are involved, or the costs are covered elsewhere.

4.4 The total tender price in the Tender Form shall constitute the contract price of the successful tenderer. Tenderers are advised to check their item extensions and total additions, as no claim for arithmetical errors will be considered.

4.5 No alteration, erasure or addition in the text of the bills of quantities will be recognised and as such the original wording of these bills of quantities will be adhered to.

CORRECTION OF ENTRIES MADE BY TENDERER

Any entry by Tenderer in the Schedule of Quantities, forms, etc, which the Tenderer desires to change, shall not be erased or painted out. A line shall be drawn through the incorrect entry and the correct entry shall be written above in black ink and the full signature of the Tenderer shall be placed next to the correction.

Currency of Bid: US$

Item	Description	UOM	Quantity	Unit Cost	Total Cost
A	**PRELIMINARY AND GENERAL (CHEMHONDORO AND CHASI IRRIGATION SCHEME)**				
1	Deliver to site all plant and equipment	lump	1		
2	Establish a containerised site office with air condition for Engineers and ablution facilities. Include office chairs and desks and all the necessary security required	unit	2		
3	Establish facilities on site for the Contractor including storage, workshop and ablution facilities.	unit	2		
4	Provide and construct signboard of height 2500 mm x 2000 mm length	unit	10		
5	Site Running Cost	unit	1		
6	Remove all plant equipment and temporary buildings and clear site on completion of the works	lump	1		
7	Provide for maintenance of the work for twelve calendar months after Engineer's certified date of completion	lump	1		
8	Allow provision for test ordered by the Engineer	lump	1		

9	Allow for procurement of an RTK Drone	lump	2		
10	Allow for Services to the Engineer (2%)	unit	1		
Sub-Total excl. VAT					

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
1.00	**PUMPING UNIT (CHEMHONDORO IRRIGATION SCHEME)**					
	Mechanicals					
1.11	Floating Barge c/w 15.0m Walkway (to accommodate 132kWx3 pumping units)	unit	standard	1		
1.12	End Suction Centrifugal Pump (250m^3/hr; 100.0m)	unit	standard	3		
1.13	2P Electric Motor	unit	132kW	3		
1.14	Pump and Motor Coupling Unit (to suit pump and motor sizes)	lump	standard	3		
1.15	Suction Pipe (Flanged Steel pipe)	length	250mmx6.0m	3		
1.16	JIS Bend	unit	250mmx90deg.	3		
1.17	Unifit VJ Coupling	unit	250mm	3		
1.18	Aluminium foot valve	unit	250mm	3		
1.19	Eccentric Tapper (Flanged Both Ends)	unit	to suit pump inlet	3		
1.20	Concentric Tapper (Flanged Both Ends)	unit	to suit pump outlet	3		
1.21	Gear Operated Butterfly Valve	unit	200mm	3		
1.22	JIS Bend	unit	200mmx45deg.	9		
1.23	Discharge Manifold mounted on Pontoon Base	length	350mmx200mmx200mmx200mm	1		
1.24	Belo Flange	unit	200mm	3		
1.25	Cast iron Gate Valve	unit	350mm	1		
1.26	Discharge End Hydrant	unit	350mmTDx350mmTD	1		
1.27	Steel NB Pipe	length	350mmx4.5mm	1		
1.28	Steel NB Pipe	length	250mmx4.5mm	1		
1.29	Steel NB Pipe	length	200mmx4.5mm	1		
1.30	Table D Flange	unit	350mmx25mm	4		
1.31	Table D Flange	unit	250mmx20mm	4		
1.32	Table D Flange	unit	200mmx20mm	4		
1.33	Non-Return Valve (Waffer Type)	unit	350mm	1		
1.34	Bulk Water Meter	unit	350mm	1		
	Electricals					
1.35	High Tension Line	m	11kV	5000		

1.36	Transformer Substation (11kV/0.4kV)	unit	315kVA	1		
1.37	Variable Speed Drive c/w Enclosure	unit	132kW	3		
1.38	4C SWA Cable	m	185mm^2	20		
1.39	4C SWA Cable	m	95mm^2	80		
1.40	All Weather Distribution Box	unit	12Way	1		
1.41	T/P MCB	unit	250A	2		
1.42	T/P MCB	unit	500A	1		
1.43	Solar Flood Lights (Mounted on a Steel Pole)	unit	300W	4		
	Civils					
1.45	Pontoon Anchor Blocks	unit	standard	1		
1.46	**Consumable and Ancillaries**	lump	standard	1		
1.47	**Labour** (Pumping Unit)	lump	standard	1		
1.48	**Transport** (Pumping Unit)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
2.00	**PIVOT MECHANICALS AND ELECTRICALS (CHEMHONDORO IRRIGATION SCHEME)**					
	Pivots (12mm Sprinkler Package)					
2.11	Fixed Centre Pivot c/w end hydrant	unit	50Ha	4		
2.12	Fertigation Unit	unit	standard	4		
2.13	Pivot Concrete Centre Pad	cubic meter	M30	4		
	Electricals					
2.14	Transformer Substation (11kV/0.4kV)	m	50kVA	2		
2.15	LT line	m	50mm	500		
2.16	All Weather Distribution Box (Mounted on a LT Pole)	unit	6Way	2		
2.17	T/P MCB	unit	80A	1		
2.18	T/P MCB	unit	20A	6		
2.19	4C SWA Cable	m	10mm^2	1700		
2.20	**Consumables and Ancillaries**	lump	standard	1		
2.21	**Labour** (Pivots and Electricals)	lump	standard	1		
2.22	**Transport** (Pivots and Electricals)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
3.00	**PROPOSED MAINLINE AND SUB-MAINS (CHEMHONDORO IRRIGATION SCHEME)**					
	Pipes					
3.11	mPVC Pipe class 12	m	355mm	900		
3.12	mPVC Pipe class 9	m	355mm	700		
3.13	mPVC Pipe class 6	m	250mm	2510		
3.14	Steel NB Pipe Flanged	length	350mmx4.5mmx6.0m	4		
3.15	Steel NB Pipe Flanged	length	250mmx4.5mmx6.0m	4		
	Steel Fittings					
3.16	Steel Clamp Saddle (refer to drg)		350mmx50mm PN16	3		
3.17	Unifit VJ Flange Adaptor	unit	350mm	9		
3.18	Unifit VJ Flange Adaptor	unit	250mm	10		
3.19	NRV	unit	350mm	3		
3.20	Heavy Duty Steel Air Release Valve	unit	50mmPN16	3		
3.21	Flanged Steel Tee (refer to drg)	unit	350mmTDx350mmTDx250mmTD	3		
3.22	Scour Tee	unit	350mmTDx350mmTDx150mmTD	1		
3.23	Cast Iron Gate Valve	unit	350mm	1		
3.24	Cast Iron Gate Valve	unit	250mm	3		
3.25	Cast Iron Gate Valve	unit	150mm	1		
3.26	Table D Flange	unit	350mmx25mm	10		
3.27	Table D Flange	unit	250mmx20mm	10		
	Excavations					
3.28	Trenching (Class 1 Excavation)	m	1.0mx1.2m	3660		
3.29	Backfilling	m	1.0mx1.2m	3660		
3.30	Class II Excavation (provision)	m	1.0mx1.2m	-		
3.31	Class III Excavation (provision)	m	1.0mx1.2m	-		
3.32	River Crossing Supports (provision)	unit	standard	-		
	Civils					
3.33	Thrust Block	lump	M20	1		
3.34	Valve Box (Masonry)	unit	standard	5		
3.35	**Consumables and Ancillaries**	lump	standard	1		
3.36	**Labour** (Proposed Mainline and Sub-mainline)	lump	standard	1		

3.37	**Transpor**t (Proposed Mainline and Sub-mainline)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
4.00	**FENCING (CHEMHONDORO IRRIGATION SCHEME)**					
4.10	Perimeter fencing standard mesh wire with 30cm vertical overhang with 3 strands of barbed wire	m	1.8m	8000		
4.20	Double leaf gate complete with lockset and heavy-duty lock	set	4.5m	2		
4.30	Pedestrian gate complete with lock set and heavy-duty lock	set	0.8m	4		
4.40	Concrete	cubic meter	M20	24		
4.50	**Consumables and Ancillaries**	lump	standard	1		
4.60	**Labour** (Fencing)	lump	standard	1		
4.70	**Transport** (Fencing)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
1.00	**PUMPING UNIT (CHASI IRRIGATION SCHEME)**					
	Mechanicals					
1.11	Floating Barge c/w 15.0m Walkway (to accommodate 132kWx3 pumping units)	unit	standard	1		
1.12	End Suction Centrifugal Pump (250m^3/hr; 110.0m)	unit	standard	3		
1.13	2P Electric Motor	unit	132kW	3		
1.14	Pump and Motor Coupling Unit (to suit pump and motor sizes)	lump	standard	3		
1.15	Suction Pipe (Flanged Steel pipe)	length	250mmx6.0m	3		
1.16	JIS Bend	unit	250mmx90deg.	3		
1.17	Unifit VJ Coupling	unit	250mm	3		
1.18	Aluminum foot valve	unit	250mm	3		
1.19	Eccentric Tapper (Flanged Both Ends)	unit	to suit pump inlet	3		
1.20	Concentric Tapper (Flanged Both Ends)	unit	to suit pump outlet	3		
1.21	Gear Operated Butterfly Valve	unit	200mm	3		
1.22	JIS Bend	unit	200mmx45deg.	9		
1.23	Discharge Manifold mounted on Pontoon Base	length	350mmx200mmx200 mmx200mm	1		
1.24	Belo Flange	unit	200mm	3		
1.25	Cast iron Gate Valve	unit	350mm	1		

1.26	Discharge End Hydrant	unit	350mmTDx350mmTD	1		
1.27	Steel NB Pipe	length	350mmx4.5mm	1		
1.28	Steel NB Pipe	length	250mmx4.5mm	1		
1.29	Steel NB Pipe	length	200mmx4.5mm	1		
1.30	Table D Flange	unit	350mmx25mm	4		
1.31	Table D Flange	unit	250mmx20mm	4		
1.32	Table D Flange	unit	200mmx20mm	4		
1.33	Non-Return Valve (Wafer Type)	unit	350mm	1		
1.34	Bulk Water Meter	unit	350mm	1		
	Electricals					
1.35	High Tension Line	m	11kV	5000		
1.36	Transformer Substation (11kV/0.4kV)	unit	315kVA	1		
1.37	Variable Speed Drive c/w Enclosure	unit	132kW	3		
1.38	4C SWA Cable	m	185mm^2	20		
1.39	4C SWA Cable	m	95mm^2	80		
1.40	All Weather Distribution Box	unit	12Way	1		
1.41	T/P MCB	unit	250A	2		
1.42	T/P MCB	unit	500A	1		
1.43	Solar Flood Lights (Mounted on a Steel Pole)	unit	300W	4		
	Civils					
1.45	Pontoon Anchor Blocks	unit	standard	1		
1.46	**Consumable and Ancillaries**	lump	standard	1		
1.47	**Labour** (Pumping Unit)	lump	standard	1		
1.48	**Transport** (Pumping Unit)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
2.00	**PIVOT MECHANICALS AND ELECTRICALS (CHASI IRRIGATION SCHEME)**					
	Pivots (12mm Sprinkler Package)					
2.11	Fixed Centre Pivot c/w end hydrant	unit	50Ha	4		
2.12	Fertigation Unit	unit	standard	4		
2.13	Pivot Concrete Centre Pad	cubic meter	M30	4		
	Electricals					

2.14	Transformer Substation	m	100kVA	1		
2.15	LT line	m	50mm	610		
2.16	All Weather Distribution Box (Mounted on a LT Pole)	unit	6Way	2		
2.17	T/P MCB	unit	80A	1		
2.18	T/P MCB	unit	20A	6		
2.19	4C SWA Cable	m	10mm^2	1700		

2.20	**Consumables and Ancillaries**	lump	standard	1		
2.21	**Labour** (Pivots and Electricals)	lump	standard	1		
2.22	**Transport** (Pivots and Electricals)	lump	standard	1		
Sub-Total						**USD -**

Item	Description	UOM	Size	Qnty	Unit Cost (	Total Cost
3.00	**PROPOSED MAINLINE AND SUB-MAINS (CHASI IRRIGATION SCHEME)**					
	Pipes					
3.11	mPVC Pipe class 12	m	355mm	500		
3.12	mPVC Pipe class 9	m	355mm	1010		
3.13	mPVC Pipe class 6	m	355mm	520		
3.14	mPVC Pipe class 6	m	250mm	1852		
3.15	Steel NB Pipe Flanged	length	350mmx4.5mmx6.0m	4		
3.16	Steel NB Pipe Flanged	length	250mmx4.5mmx6.0m	4		
	Steel Fittings					
3.17	Steel Clamp Saddle (refer to drg)		350mmx50mmPN16	3		
3.18	Unifit VJ Flange Adaptor	unit	350mm	9		
3.19	Unifit VJ Flange Adaptor	unit	250mm	10		
3.20	NRV	unit	350mm	3		
3.21	Heavy Duty Steel Air Release Valve	unit	50mmPN16	3		
3.22	Flanged Steel Tee (refer to drg)	unit	350mmTDx350mmTDx 250mmTD	3		
3.23	Scour Tee	unit	350mmTDx350mmTDx 150mmTD	1		
3.24	Cast Iron Gate Valve	unit	350mm	1		
3.25	Cast Iron Gate Valve	unit	250mm	3		
3.26	Cast Iron Gate Valve	unit	150mm	1		
3.27	Table D Flange	unit	350mmx25mm	10		
3.28	Table D Flange	unit	250mmx20mm	10		
	Excavations					

3.29	Trenching (Class 1 Excavation)	m	1.0mx1.2m	3632		
3.30	Backfilling	m	1.0mx1.2m	3632		
3.31	Class II Excavation (provision)	m	1.0mx1.2m	-		
3.32	Class III Excavation (provision)	m	1.0mx1.2m	-		
3.33	River Crossing Supports (provision)	unit	standard	-		
	Civils					
3.34	Thrust Block	lump	M20	1		
3.35	Valve Box (Masonry)	unit	standard	5		
3.36	**Consumables and Ancillaries**	lump	standard	1		
3.37	**Labour** (Proposed Mainline and Sub-mainline)	lump	standard	1		
3.38	**Transpor**t (Proposed Mainline and Sub-mainline)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Qnty	Unit Cost	Total Cost
4.00	**FENCING (CHASI IRRIGATION SCHEME)**					
4.10	Perimeter fencing standard mesh wire with 30cm vertical overhang with 3 strands of barbed wire	m	1.8m	7000		
4.20	Double leaf gate complete with lockset and heavy-duty lock	set	4.5m	2		
4.30	Pedestrian gate complete with lock set and heavy-duty lock	set	0.8m	4		
4.40	Concrete	cubic meter	M20	24		
4.50	**Consumables and Ancillaries**	lump	standard	1		
4.60	**Labour** (Fencing)	lump	standard	1		
4.70	**Transport** (Fencing)	lump	standard	1		
Sub-Total						

Item	Description	UOM	Size	Quantity	Unit Cost	Total Cost
5.00	**Project Management Cost (3%)- Chemhondoro and Chasi Irrigation Scheme**	-	standard	1		
Sub-Total						

Cost Summary for Chemhondoro and Chasi Irrigation Scheme

Item	DESCRIPTION	AMOUNT
A	PRELIMINARY AND GENERALS	
1	PUMPING UNIT	
2	PIVOT MECHANICALS AND ELECTRICALS	
3	PROPOSED MAINLINE AND SUB-MAINS	
4	FENCING	
5	PROJECT MANAGEMENT FEE (3%)	
SUB-TOTAL		
	CONTINGENCY 10%	
	VAT 15%	
TOTAL		

DRAWINGS

Figure1: Chemhondoro Irrigation Scheme

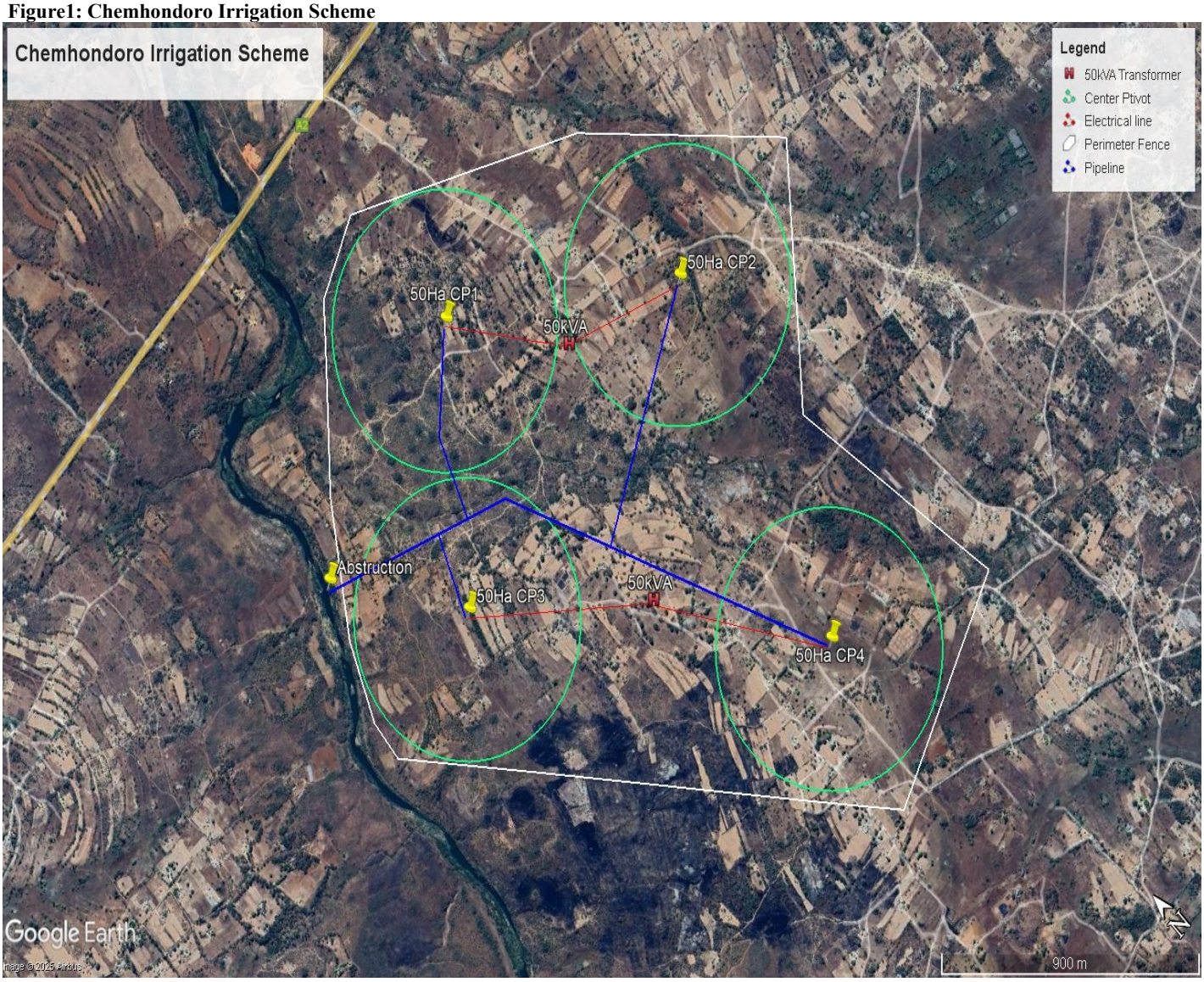
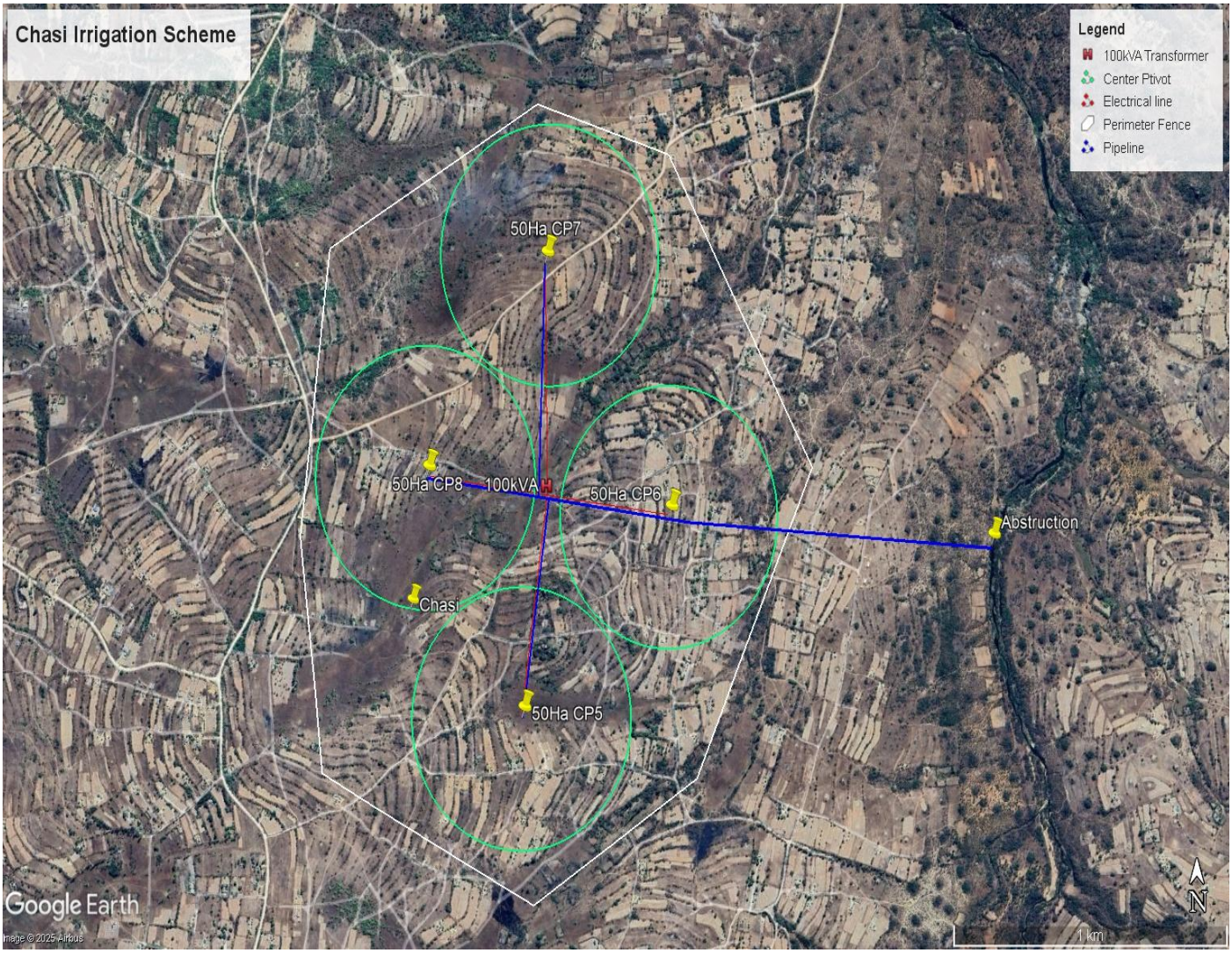


Figure 2: Chasi Irrigation Scheme Layout



BIDDING DOCUMENT FOR KUNZVI PHASE 1 IRRIGATION SCHEME

PART 3 CONTRACT

General Conditions of Contract

Any resulting contract is subject to the Zimbabwe General Conditions of Contract (GCC) for the Procurement of Non-Complex Works (copy available on request) except where modified by the Special Conditions below.

Special Conditions of Contract

Procurement Reference Number: **ZINWA/2022/31**

The clause numbers given in the first column correspond with the relevant clause number of the General Conditions of Contract.

GCC reference	Special Conditions
1.1(g)	**The Contractor is:**
1.1(q)	**The Intended Completion Date for the Whole Works is:** 6 months
1.1(t)	**The Procuring Entity is:** Zimbabwe National Water Authority Stand No 19820 Block 4 East Celestial Office Park Borrowdale HARARE
1.1(v)	**The Project Manager is:** Director of Irrigation and Commercial Services
1.1(w)	**The Sites are located at Chasi and Chemhondoro Villages, Mashonaland East Province**
1.1(z)	**The Start Date shall be:**

PART III CONTRACT

1.1(cc)	**The Works consist of:** Trenching of (1m depth x 1m width) sub-main pipelines. And the trenching of (1.5m depth x 1m width) mainline. Centre pivot Installation Infield pipeline installation Construction of Floating Pumping Units Electrification (Pump house and Centre Pivots) Land Clearing Perimeter fence
2.2	**The documents that form part of the Contract shall be following:** a. the Contract Agreement,

GCC reference	Special Conditions
	b. the Letter of Acceptance, c. the Contractor's Bid Submission Sheet, d. the Special Conditions of Contract, e. the General Conditions of Contract, f. the Procuring Entity's Requirements, g. the Contractor's Bill of Quantities or Schedule of Activities (as applicable), and h. any other documents submitted by the Contractor forming part of the Contract. The priority of the documents shall be in the aforementioned order. If there is any discrepancy or inconsistency, the Project Manager shall issue any necessary clarification.
2.3	**The Contract is a:** admeasurement contract
3.1	**The Language of the Contract is English.** The Law governing the Contract is that of the Republic of Zimbabwe.
7	**7.1 The limit of subcontract is:** 50% If subcontracting is allowed, this shall not diminish or affect the contractor's responsibility for fulfilling its obligations under a Contract.
16.1	**The Site Possession Date shall be**:

19.1	The Contractor shall submit a Program for the Works within 14 days after the date of the Letter of Acceptance.
26.1	**The Defects Liability Period is**: 12 months.
32.1	**Payments** shall be made after issue of a Payment Certificate, but in no case later than two months after submission of an invoice or request for payment by the Contractor, and after ZINWA Entity has accepted it. Quantities for the payment certificate will be closed on the 25th of every month.
34.2	**Adjustment of the Contract Price**: There shall be no price adjustment for this contract. Project Manager shall not adjust the Contract Price if taxes, duties, and other levies are changed during the period from Start date to the date the Completion certificate. In the event a price escalation, the formula below will be used.

GCC reference	Special Conditions
35.1	The retention shall be 5%
36.1	The Liquidated Damages shall be 1% of the contract amount per day of delay or the contract amount divided by the time for completion, whichever is higher. The total liquidated damages (LD) shall not exceed 10% of the Contract Amount.
38.1	The Client **may** assist the Contractor with an advance payment up to a maximum **20%**. However, this does not take away the Contractor's obligation to source for funds to mobilise and establish on site
39.1	The Performance Security shall be in the form of a Bank Guarantee and in the amount of 10% of the Contract Amount.
42.1	The Contract Administration Fee set out in Part V of the Fifth Schedule of the Regulations is due upon the signing of the Contract and the applicable Fee is ZWL$ 16,000.00

PART III	CONTRACT
46	**46.1** The date to supply "as-built drawings and/or operating manuals shall be within 14 days following issue of Completion Certificate. **46.2** The amount to be withheld shall be 0.01% of the Contract amount per day of delay.

Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, should only be completed by the successful Bidder after contract award.

Table of Forms

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LETTER OF ACCEPTANCE

To:

Subject: Letter of Acceptance

This is to notify you that your Bid dated……. for the execution of the . . . ……. . . . . for the Accepted Contract Amount of the equivalent of . ……. . . . . ., as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by the Procuring Entity.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose the of the Performance Security Form included in Section 3 (Contract Forms) of the Bidding Document.

Signed:	……..…*[insert signature of authorised person]*
Name:	……[*insert complete name of person signing]*
In the capacity of:	……..……..…....[*insert legal capacity of person signing]*
Duly authorized to sign the letter of acceptance for and on behalf of	……..……...[*insert complete name of Procuring Entity]*
Date:	…….. day of ……..…….. ……*{DD/MM/YY}*

Attachment: Contract Agreement

CONTRACT AGREEMENT

Procurement Reference: ZINWA/2022/31

THIS CONTRACT AGREEMENT is made the…… day of ……, 2025.

BETWEEN

(1) **Zimbabwe National Water Authority** (Ministry of Land, Agriculture, Fisheries, Water and Rural Development) and having its principal place of business at Block 4 East Celestial Park, Borrowdale Road, P.O Box CY617 Causeway, Harare, Zimbabwe, (hereinafter called "the Procuring Entity"), and

(2) ……, a corporation incorporated under the laws of Zimbabwe and having its principal place of business at …….. (hereinafter called "the Contractor").

WHEREAS the Procuring Entity desires that the Works known as **Kunzvi Phase 1 Irrigation Development** should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and for the remedying of any defects in them,

THE PROCURING ENTITY AND THE CONTRACTOR AGREE AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are assigned to them in the General and Special Conditions of Contract referred to below.

2. The following documents shall constitute the Contract between the Procuring Entity and the Contractor, and each shall be read and construed as an integral part of the Contract:

   (a) This Contract Agreement;

   (b) The Letter of Acceptance;

   (c) The Contractor's Bid;

   (d) The Special Conditions of Contract;

   (e) The General Conditions of Contract;

   (f) The Procuring Entity's requirements (Specifications and Drawings);

   (g) The completed Bill of Quantities

3. This Contract Agreement shall prevail over all other Contract Documents. In the event of any discrepancy or inconsistency within the Contract Documents, then the documents shall prevail in the order listed above.

4. In consideration for the payments to be made by the Procuring Entity to the Contractor as mentioned below, the Contractor hereby agrees with the Procuring Entity to execute the Works and to remedy any defects in them in conformity with the Contract.

5. The Procuring Entity hereby agrees to pay the Contractor, in consideration for the execution and completion of the Works and the remedying of any defects in them, the Contract Price or such

other sum as may become payable under the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed in accordance with the laws of Zimbabwe on the day, month and year indicated above.

For and on behalf of the Procuring Entity

Signed: ……..

Name:

In the capacity of: *[Title or other appropriate designation]*

For and on behalf of the Contractor

Signed: ……..

Name: ……..

In the capacity of: ……*[Title or other appropriate designation]*

For and on behalf of each member of the Joint Venture

Signed: ……..

Name of member: ……

In the capacity of: *[Title or other appropriate designation]*

Signed: ……..……..

Name of member: …….

In the capacity of: *[Title or other appropriate designation]*

BANK GUARANTEE FOR PERFORMANCE SECURITY

Date: ……..

Title of the procurement: ……

Procurement Reference No:

Bank's Branch or Office:……

Beneficiary: Zimbabwe National Water Authority

Performance Guarantee No: …….

We have been informed that …….., (hereinafter called "the Contractor") has entered into Contract No. . dated ……, with you, for the execution of
…….. (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we ……. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of ……..…… such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the . . . . . day of . . . . . , ... [2], and any demand for payment under it must be received by us at this office on or before that date. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed ……months, in response to the Procuring Entity's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 758, except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.

. . . . . .

[Seal of Bank and Signature(s)]

ADVANCE PAYMENT SECURITY

[Delete page if no Advance Payment is required in the SCC]
[The bank, as requested by the successful Tenderer, shall fill in this form in accordance with the instructions indicated.]

Date: *[insert date (as day, month, and year)]*
Procurement Reference No: *[insert reference]*

[Issuing bank's letterhead]

Beneficiary: *[insert legal name and address of Procuring Entity]*

PART III CONTRACT

ADVANCE PAYMENT GUARANTEE No.: *[insert Advance Payment Guarantee no.]*

We have been informed that ……. *[name of the Contractor]* (hereinafter called "the Contractor") has entered into Contract No……. *[procurement reference number of the Contract],* dated *[insert day and month], [insert year]* with you, for the execution of …….. *[name of contract and brief description of Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum …….. *[name of the currency and amount in figures]* [1] (….. *[amount in words]*) is to be made against an advance payment guarantee.

At the request of the Contractor, we …….. *[name of the Bank].* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of …….. *[name of the currency and amount in figures]** (……. *[amount in words]*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number …….*[Contractor's account number].* at …….. *[name and address of the Contractor's Bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the ….. day of …….. [2], whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months][one year]*, in response to the Procuring Entity's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 758.

……..

[Seal of Bank and Signature(s)] ……..

Note –

All italicized text is for guidance in preparing this demand guarantee and shall be deleted from the final document.

1 The Guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Procuring Entity.

2 Insert the expected expiration date of the Time for Completion. The Procuring Entity should note that in the event of an extension of the time for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.