



TENDER NO. TCML/MGD/WS/2019/01

**TENDER FOR THE PROPOSED DRILLING OF
MUSIRO COMMUNITY BOREHOLE**

APRIL, 2019

CLIENT:

TATA CHEMICALS MAGADI LIMITED

P.O. BOX 1-00205

THE HEAD OF PROCUREMENT

TATA CHEMICALS MAGADI LTD.

P.O. BOX 1-00205



SCOPE OF WORK

The scope of works shall be as described in the BoQ and tender document.

QUALIFICATION FOR TENDERING

Mandatory Requirements

The following must be submitted together with bid:

- i) **Certified** copy of Certificate of incorporation
- ii) Copy of Registration certificate for National Construction Authority (NCA) in category **NCA 5 and above**
- iii) Copy of Valid Tax Compliance Certificate
- iv) **Certified** copy of **Current** Single business permit
- v) **Certified** copy of CR 12 form

Other Requirements

The Bidder shall submit information which will enable the technical team to evaluate their capability to undertake the works. For the purpose of these works, it is required that the firms should provide the following: -

- i) Proof of similar previous experience (attach evidence)
- ii) Attach Professional and technical staff (attach CV's and Practicing license)
- iii) Attach a detailed work schedule Gantt Chart

All information in the attached forms should be provided in full and failure to do so will constitute grounds for disqualification.

There shall be a mandatory pre-tender site visit as specified in the table below:

Date	25 th April 2019
Time	9.30 a.m
Venue	TCML Magadi Offices

NOTE: Every bidder shall be represented by one person bearing a letter from the company participating in tendering and to come complete with 4x4 vehicles for use to access the borehole site.

BID SUBMISSION

Bidders must submit the technical and The Financial proposals separately.

A TECHNICAL PROPOSAL

Two (2) copies in sealed envelopes clearly marked **"TECHNICAL PROPOSAL FOR TENDER NO: TCML/MGD/WS/2019/01-Tender for THE PROPOSED DRILLING OF MUSIRO COMMUNITY BOREHOLE"** One copy marked as **"ORIGINAL"** and One other copy marked as **"COPY"**. All to be finally put in one sealed envelope. (The bidder will ensure that there is no reference at all on their financial proposal within the technical proposal envelope)

B FINANCIAL PROPOSAL

Two (2) copies in sealed envelopes clearly marked “**FINANCIAL PROPOSAL FOR TENDER NO: TCML/MGD/WS/2019/01-Tender for THE PROPOSED DRILLING OF MUSIRO COMMUNITY BOREHOLE**” One copy marked as “**ORIGINAL**” and One other copy marked as “**COPY**”. All to be finally put in one sealed envelope. (The financial proposal shall include all taxes applicable)

Addressed to:

**The Head of Procurement,
TATA Chemicals Magadi Limited,
P.O. Box 1-00205,
MAGADI.**

The same will be deposited in the tender box situated in Administration Block, Magadi OR Collection Centre, and Enterprise Road – Avon house, Industrial area so as to reach him/her on or before **5.00 p.m. on 30TH April, 2019.**

The Management reserves the right to accept or reject any bids and does not bind itself to any reasons for doing so.

EVALUATION CRITERIA

- The information provided by interested firms will be weighed by the following criteria: -

Points to qualify for financial evaluation

70

No.	Description	Max. Point		
1	TRACK RECORD : 15 Points			
1.1	The following shall be provided; Certified Copy of Certificate of incorporation to show that the applicant is a registered company and legally authorized to do business in Kenya	5		
1.2	Proof of registration with the NCA (NCA-5 and above)	5		
1.3	Copy of valid Tax Compliance certificate (To be checked online through KRA portal) Certified copy of trading licence / single business permit.	5		
2	Staff Qualifications :20 Points			
2.1	Attach CV's of Key staff:	20		
No.	Position		Total Works Experience (Years)	In Similar Works Experience (Years)
1	Project Engineer/Site Agent (Bsc/Btech. in Civil/Water Engineering)		8	5
2	Hydrogeologist (Registered)		8	5
3	Environmentalist (Registered Lead Expert with NEMA)		8	5
4	Foreman (Diploma in Civil/water Engineering)		8	5
4	Driller (must on minimum be holders of civil/water diploma or equivalent)		8	5
7	Welder/Fitter (must on minimum be holder of Diploma or equivalent)		5	3

3	Contractor Equipment: 20																										
3.1	<table><tr><td>No.</td><td>Equipment Type and Characteristics</td><td>Minimum number Required</td></tr><tr><td>1</td><td>Borehole drilling percussion/rotary rigs (to depth >200 m and nominal internal bore diameter of 203 mm)</td><td>1</td></tr><tr><td>2</td><td>Air compressor 1000/300 psi capacity or equivalent</td><td>1</td></tr><tr><td>3</td><td>Generator 15 kVa</td><td>1</td></tr><tr><td>4</td><td>7 Ton Lorries</td><td>1</td></tr><tr><td>5</td><td>0.75 m³ Concrete mixers with vibrators</td><td>1</td></tr><tr><td>6</td><td>0.75 m³ concrete dumpers</td><td>1</td></tr><tr><td>7</td><td>Dewatering pump (with 50 mm inlet)</td><td>1</td></tr></table>	No.	Equipment Type and Characteristics	Minimum number Required	1	Borehole drilling percussion/rotary rigs (to depth >200 m and nominal internal bore diameter of 203 mm)	1	2	Air compressor 1000/300 psi capacity or equivalent	1	3	Generator 15 kVa	1	4	7 Ton Lorries	1	5	0.75 m ³ Concrete mixers with vibrators	1	6	0.75 m ³ concrete dumpers	1	7	Dewatering pump (with 50 mm inlet)	1		20
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4	Experience of the Firm: 30 Points																										
4.1	Attach proof/evidence of three (5) similar works undertaken of the same value for the last 3 years.		30																								
5	Completion Period : 15 Points																										
5.1	Completion Period (The contractor to come up with a detailed Work Schedule/Programme) and Work Methodology		15																								
	GRAND TOTAL		100																								

PART A

TENDER AND CONTRACT

CONDITIONS OF TENDER AND INSTRUCTION TO TENDERS

1 INSTRUCTIONS TO TENDERS

- a) The tender validity period shall be sixty (60) days from the tender opening date with an option of extension by further thirty (30) days from expiry of tender validity period.
- b) The Employer is not bound to accept any tender and can nullify the whole tender and call fresh tenders. Until and unless a written acceptance or a formal agreement is signed, this tender does not form a binding contract between the tenderer and the Employer.
- c) Tenderer shall satisfy himself before submitting his tender as to the nature of the ground, the subsoil, the topography of the site, the means of access to site, the accommodation as to risks, contingencies and other circumstances which may influence or affect the sufficiency of their tenders. Tenderers **MUST** visit the site or cause it to be visited by a competent and reliable representative in order to obtain information that may be necessary for preparing a bid and enter into contract. Whilst satisfying that condition the tenderer shall be responsible for his traveling and accommodation arrangements.
- d) Any failure by the tenderer to obtain all necessary information for the purposes of making his tender or fixing the several rates of prices therein shall not relieve him from any risks or liabilities in connection with or for the fulfillment of the contract.
- e) The Contractor **MUST** understand and shall comply with the Employer's site rules and statutory requirements on Safety, Health and Environmental (SHE). The Employer reserves the right to enforce this requirement.
- f) If it is found on examination of a tender that there is a discrepancy between the tender Sum and the amount arrived at by the valuing the quantities at the rates or prices set against them by the tenderer, then the Tender Sum shall remain unaltered. The necessary corrections to adjust the revised total to correspond with the Tender Sum shall be made by means of a compensating percentage increase or decrease. Any such percentage increase or decrease shall apply to all rates in the Bills of Quantities excluding Contingency, Prime Cost and Provisional Sums. This percentage correction factor will be applied to rates for work measured in Certificate valuations and the measurement of variations when preparing the final account.
- g) Should the tenderer notice any discrepancy or conflict between any of the Tender Documents he must inform the Employer, in writing prior to the date of submission of the tenders. Should any discrepancy or conflict between sections of the Tender Documents continue to exist without notice by either party after signing of the contract, then the Employer will give his ruling in writing indicating the overriding clause or section.
- h) Any recipient of the documents for the proposed Contract for the purpose of submitting a tender (whether he submits a tender or not) shall treat the details of this document as "Private and Confidential".
- i) In no case shall the expenses incurred during the preparation of the tender be reimbursed to the tenderer.
- j) The tenders shall be submitted in plain sealed opaque envelope and shall be endorsed "

THE PROPOSED

**THE HEAD OF PROCUREMENT
TATA CHEMICALS MAGADI LIMITED
P O Box 1 - 00205
MAGADI**

- k) Tenderers will not be permitted to alter their bids after they have been opened and only those clarifications which will not change the substance of the tenders will be permitted.

- l) On receipt of the written notification that his tender has been accepted the successful tenderer shall make all the necessary preparations for commencing work pending execution of the formal agreement.
- m) Any tender may be disqualified if it is not complete and accompanied by all the items required to be submitted with the bid in compliance with these Instructions to Tenders.
- n) The Contractor's terms do not form part of this contract unless expressly agreed and documented in writing beforehand. It is his responsibility to perform the work/services to the highest standard of workmanship. The Contractor's occupancy of the site shall not restrict authorized entry by other parties.
- o) The Contractor must avoid any social conduct that is unacceptable to the community and which could prejudice the interest and reputation of the Employer (This will include misconduct both in public and private places).
- p) The Contractor and his/her employees involved in this contract **MUST** be inducted on safety by the Employer before commencement of the works. **No Contractor must work on the Employer's site without first being inducted and wearing the correct safety equipment.** It is the responsibility of the Contractor to make timely arrangements for safety induction with the Employer.
- q) The Contractor shall equip workers with the appropriate safety gear, tools and equipment unless specified that the Employer shall supply these or some of the items. The safety gear must be approved and the Employer reserves the right to reject substandard safety gear. The Contractor must immediately report to the Employer any accident or incident which may occur during his performance of the contract.
- r) The Contractor shall not burn items or keep explosives/inflammables material on site unless authorized by the Employer in writing. Any such authority shall not relieve the Contractor from any liability or obligation under this Contract and he shall be responsible for all his actions.
- s) The Contractor shall be responsible for disposal of all rubbish and waste from his/her work site. The work site must be kept neat and tidy at all times.
- t) The Contractor must ensure workers are fully fit and are not a health /safety risk to other site workers. No worker is allowed on site under the influence of alcohol or drugs. The Employer reserves the right to ban such workers from working any of the Employer's sites.

FORM OF TENDER

NAME OF CONTRACT: PROPOSED DRILLING OF MUSIRO COMMUNITY BOREHOLE

**To: THE HEAD OF PROCUREMENT,
TATA CHEMICALS MAGADI LTD.,
P. O. BOX 1-00205,
MAGADI**

1. Having examined the Terms and Conditions of Contract, the Specifications and the Bills of Quantities attached for the provision/execution of the above-named service/work, we, the undersigned, offer to enter into a contract to provide and execute fully such Services/work and remedy any defects therein in full conformity with the Conditions of Contract.
2. The Tender sum (in Figures) Kshs.
3. The tender sum (in Words) Kenya Shillings

.....
(or such other sum as may be ascertained in accordance with the said Conditions)

4. We undertake, if our Tender is accepted, to commence the Works within seven (7) days of receipt of the order to commence and to complete and deliver the whole of the works within **Eight (8) Calendar weeks (contract period)**.
5. We agree to abide by this Tender for a period of sixty (60) days from the date set for submission of the Tender and it will remain binding upon us and may be accepted at any time before the expiry of that period.
6. We acknowledge that this document containing 24 numbered pages is complete in every respect for the purposes of setting rates.
7. We undertake to provide within seven (7) days of the acceptance of our tender and before signing of the Contract Agreement a **third party insurance** (See Conditions of Contract Clause 22) covering all the works including the work force and to be approved by the Employer.
8. We further agree that until and unless a formal Contract Agreement is executed, this Tender, together with your Purchase Order (PO) thereof, shall constitute a binding contract between us
9. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this day of

Signature in the capacity of

duly authorized to sign tenders for and on behalf of

.....
(NAME OF BIDDER IN BLOCK LETTERS)

Address

.....

Witness

Signature

Address

.....

APPENDIX TO FORM OF TENDER

	Clause	
Amount of Security (if any)	10.1	Ten (10) percent of the Contract Price
Minimum amount of third party insurance (Insurance per occurrence, with the number of occurrences unlimited)	23.2	0.5% of the total contract sum
Time for issue of notice to commence	41.1	Seven (7) days
Time for Completion	43.1	Five (10) Calendar Weeks
Amount of Liquidated Damages	47.1	Kshs 5,000.00 per day
Defect Liability Period	49.1	Six (6) Months
Percentage of Retention	60.2	Ten percent (10%) of certified amount
Limit of Retention	60.2	Five percent (5%) of Tender Sum
Minimum Amount of Interim payment Certificates	60.2	One Million Shillings (Kshs 500,000.00)
Release of Retention Monies	60.2	On completion of defect liability period
Time within which payment is to be made after receipt of invoices.	60.2	Ninety (90) days
Appointment of Arbitrator	67.1	Chairman of the Engineer's Registration Board
Initials of Signatory of Tender	

(Notes: Missing detail(s) in the list above shall be inserted before issue of Tender documents. Where a number of days are to be inserted, it is desirable, for consistency with the Conditions, that the number should be a multiple of seven.

CONTRACTOR CAPACITY

PLANT AND EQUIPMENT TO BE DEPLOYED TO THE WORKS

Item	Plant/Equipment	Registration No.	Ownership Status (tick)	
			Owned	Hired

TECHNICAL STAFF TO BE DEPLOYED TO THE WORKS

ITEM	NAME	ACADEMIC & TECHNICAL QUALIFICATIONS (Attach documents)

FORM OF AGREEMENT

This Agreement made the _____ day of _____ 2018

Between **TATA CHEMICALS MAGADI LTD**

of **P.O BOX 1 – 00205 MAGADI** (hereinafter called “the Employer”) of the one part and

_____ of _____ (hereinafter called “the Contractor”) of the other part

Whereas the Employer is desirous that certain Works should be executed by the Contractor, viz **THE PROPOSED DRILLING OF MUSIRO COMMUNITY BOREHOLE**, and has accepted a Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

Now this Agreement Witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of the Agreement, viz:
The Letter of Acceptance; The said Tender; The Conditions of Contract (Parts I and II); The Technical Specifications; The Drawings (if any); The Bill of Quantities; and Addendum (if any) issued by the Employer
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying of defects therein the Contract Price or such other sum as may become payable under the provisions of 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 the day and year first before written in accordance with their respective laws.

Signed Sealed and Delivered by the

Signature in the capacity of

duly authorized to sign tenders for and on behalf of **TATA CHEMICALS MAGADI LTD**

In the presence of

Signature

Signed Sealed and Delivered by the

Signature in the capacity of

duly authorized to sign tenders for and on behalf of
(NAME OF CONTRACTOR IN BLOCK LETTERS)

Witness

Signature

Address

.....

PART B

CONDITIONS OF CONTRACT

General Conditions of Contract applicable in this contract shall be “The Conditions of Contract (International) for works of Civil engineering Construction Latest Edition, published by the *Federation International Des Ingenieurs – Conseils* (FIDIC)”.

These conditions shall be read together with the “Conditions of Particular Application” stipulated hereafter

Conditions of Particular Application shall be as defined in this contract and all Purchasing and Procurement conditions of the Client.

Conditions contained in the Conditions of Particular Application shall be deemed to prevail in the event of any contradiction with a condition contained in the General Conditions of Contract.

CONDITIONS OF PARTICULAR APPLICATION OF THE CONTRACT

NOTE: The conditions of Particular Application listed hereinafter shall amend or supplement the appropriate Clauses in the General Conditions of Contract and where reference is made herein to specific Clauses or Sub-Clauses reference must also be made to these Clauses in the General Conditions. Where contradictions exist between these Conditions of Particular Application and the General Conditions of Contract Clauses, these Conditions shall prevail.

CLAUSE 1.1 : DEFINITIONS

- | | | |
|-------|----------------------------|---|
| (i) | Employer: | TATA CHEMICALS MAGADI Ltd
P O Box 1, 00205
Magadi. |
| (ii) | Employer's Representative: | Any technical person appointed by the Employer, and notified to the Contractor. |
| (iii) | Tenderer: | Any individual, joint venture, or legal entity, tendering for the execution of the Works |
| (iv) | Successful Tenderer: | The Tenderer whose Tender has been accepted by the Employer but still has not been assigned the execution of the Works. |
| (iv) | Material: | Shall be all materials to be permanently incorporated into the Contract Works. |

CLAUSE 14 : PROGRAMME TO BE SUBMITTED

(Supplement) Notwithstanding anything contained in this clause the Tenderer shall submit his detail programme within Seven (7) days of the date of acceptance of his tender.

CLAUSE 22 : INSURANCE OF WORKS, ETC

The contractor shall insure in the joint names of the Employer and the Contractor a against all loss or damage from whatever cause arising (other than the excepted risks) for which he is responsible under the terms of contract and in such a manner that the Employer and the Contractor are covered during the period of construction of the works and are also covered during the period of Maintenance for loss or damage arising from a cause occurring prior to the commencement of the Period of Maintenance and for any loss or damage occasioned by the contractor in the course of any operations carried out by him for the purpose of complying with this obligations:-

- a) The works and the Temporary Works to the full value of such works executed from time to time.
- b) The materials, constructional plants and other things brought to the site by the contractor to the full value of such materials and other things.

CLAUSE 42 : POSSESSION OF SITE

Add the following:-

"The Employer shall provide right of access to the Site and the Contractor shall bear all expenses and charges for any additional rights of way required by him. The

Contractor shall also provide at his own cost any additional accommodation required by him for the purposes of the Works”.

CLAUSE 43 : TIME FOR COMPLETION

Add the following:-

The construction and completion of the works will be phased. Liquidated damages as provided for under Clause 48 (1) of the Conditions of Contract will be assessed and charged on the basis of delay caused to each phase.

CLAUSE 48 : CERTIFICATE OF COMPLETION OF WORKS

(Supplement) “Should the Employer wish to take over any portion of the works after completion of such portion and before completion of the whole works the Employer shall have the power to do so provided that the normal progress of the Works is not impeded or otherwise by agreement between the Contractor and the Employer’s Representative.

In addition to the foregoing the Contractor shall comply with the stipulated periods for Sectional Completion of the Works.

CLAUSE 49: PERIOD OF MAINTENANCE

(Supplement) The period of Maintenance as defined shall be six (6) Calendar per months.

- (a) It should be noted that parts of completed Works may be commissioned for use by the public and /or other Contractors and staff on site. Pending the adoption of the work by the Employer the Contractor shall be liable for care and maintenance of works.
- (b) If the permanent reinstatement of such work is to be carried out by the Employer or by some person other than the Contractor or any Sub-Contractor to him the Contractor shall at his own cost and independently of any requirement of or notice from the Employer’s Representative be responsible for the making good of any subsidence or shrinkage or other defect, imperfection or fault in the temporary reinstatement of such Works and for the execution of any necessary repair or amendment thereof from whatever cause the necessity arises until the end of the period of Maintenance in respect of the works beneath such Works until the Employer or other period as aforesaid shall have taken possession of the Site for purpose of carrying out permanent reinstatement whichever is the earlier and shall indemnify, and save harmless the Employer against and from any damage or injury to the Employer to third parties arising out of or in consequences of any neglect or failure of the Contractor to comply with the foregoing obligations or any of them and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. As from the end of such Period of Maintenance or the taking of possession as aforesaid whichever shall first happen, the employer shall indemnify and save harmless the Contractor against and from any damage or injury as aforesaid arising out or in-consequences of or in connection with the said permanent reinstatement or any defect, imperfection or failure of or in such work of permanent reinstatement and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Where Employer or other person as aforesaid shall take possession of the Site as aforesaid in sections or lengths the responsibility of the Contractor under paragraph (a) of this Sub-Clause shall cease in regards to any such section or length at the time possession thereof into taken but shall during the continuance of the said Period of Maintenances continue in regard to any length of which possession has not been so taken

and the indemnities given by the Contractor and the Employer respectively under the said paragraph shall be construed and have effect accordingly.

CLAUSE 60: CERTIFICATES AND PAYMENT

1. PAYMENT

- (a) The Contractor shall submit to the Employer's Representative after the end of assignment or completion of works for checking and certification of statement showing the estimated value of the permanent work executed up to the end of the works (if such value shall justify the issue of a final Certificate) of the Contractor will be paid at the end of the works, on the certificate of the Employer's Representative the amount due to him on account of the estimated value of permanent work executed up together with the cost of materials for permanent work delivered by the Contractor on the Site and approved by the Employer's Representative, and in addition such amount as the Employer's Representative may consider fair and reasonable for temporary works for which separate amounts, if any, are provided in the Bills of Quantities subject to a retention as specified in the Appendix to the Conditions on the full amount of payment.

Provided that no Interim Certificate shall be issued for a less sum than that named in the Tender at any one time.

- (b) The final release of all retention money shall become due and paid to the Contractor thirty (30) days after the completion of the "Maintenance Period" notwithstanding that at such time there may be outstanding claims by the Contractor against the Employer.

If at such time there shall remain to be executed by the Contractor any work ordered during such period pursuant to Clauses 49 or 50 hereof the employer shall be entitled to withhold payment until the completion of such works of so much of the retention money as shall in the opinion of Employer represent the cost of the works remaining to be executed. In the event of different maintenance periods having become applicable to different parts of the works pursuant to Clause 49 hereof the expression "expiration of the period of maintenance" shall for the purpose of this Sub-Clause be deemed to mean the expiration of the latest of such periods, notwithstanding that should the Employer's Representative decide that the Contractor has fulfilled all of his obligations under the part of the Contract which bears the shorter maintenance period then the Employer's Representative may decide to release a proportion of the retention money held upon expiration of this shorter maintenance period in an amount pro data to the cost of these works against the total cost of the works.

CORRECTION AND WITHHOLDING OF CERTIFICATE

- (c) The Employer's Representative may by any certificate make any correction or modification in any previous certificate which shall have been issued by him and shall have power to withhold any certificate if the works or any part thereof is not being carried out to his satisfaction.

TIME OF PAYMENT

- (d) Payment upon each of the Employer's Representative's Certificates shall be made within Ninety (90) days after such Certificates have been signed by the Employer's Representative.

CLAUSE 68 : NOTICES

This clause is replaced by the followings:

- (1) The Contractor shall furnish the Employer with an address in Kenya and any notice to be given to the Contractor shall be served by sending the same to such address or by delivering the same to the Contractor's office or his Site office.
- (2) Any notice to be given to the Employer under the terms of the Contract shall be served by sending the same or leaving the same at the office of the Employer, Tata Chemicals Magadi Limited, or by delivering the same to a place approved by the Employer.

CLAUSE 70 : INCREASE OR DECREASE OF COSTS

- (1) The Contract Sum, and a subsequently added to or deducted from in accordance with provisions of this Contract, shall be deemed to have been calculated to include all duties on materials to be incorporated into the finished works. If at any time during the period of the Contract the duties shall be varied and in the opinion of the Employer's Representative this shall affect the cost to the Contractor of such materials, then the Employer's Representative after due consultation with the Employer, shall ascertain the net difference in cost of such materials. Any amount from time to time so ascertained shall be added to or deducted from the Contract Sum as the case may be. In the purpose of this clause, 'duties' shall include all customs and excise charges, tariffs, taxes and other duties imposed by statutory or other authority in the country where the Works are being carried out.

CLAUSE 72 : TAXES

Notwithstanding any relief from prescribed dues and charges including customs duties which may be allowed on Plant, materials or other things imported for the purpose of the Contract, the Contractor shall pay all prescribed dues and charges including customs duties on all such plant, material or other things which he disposes of in Kenya during the currency of this Contract or after termination thereof.

CLAUSE 73 : LAW

This Contract shall be construed in accordance with and is subjected to the Laws of the Republic of Kenya.

The Contractor shall comply with all Government Laws, Ordinances and Regulations, all Local Authority By-Laws and Regulations and Works. He shall pay all fees and give all notices required by the said Laws, or ordinance.

GIFTS, INDUCEMENTS AND REWARDS

- (a) The Employer shall be entitled to cancel the Contract and to recover from the Contractor the amount of any loss resulting from such cancellation, if the Contractor or any person employed by him or acting on his behalf (with or without the knowledge of the Contractor) shall have offered or given or agreed to give to any person any gift or consideration of any kind as an inducement or reward for doing, forbearing to do, or for having done or forborne to do any action in relation to obtaining or execution of the Contract.

- (b) **ADVERTISING AND NON-DISCLOSURE OF INFORMATION**

The Contractor or his Representative shall not exhibit photographs of the Works or advertise the works without the prior approval of the Employer's Representative. In addition the Contractor or his Representative shall not disclose any information concerning the works to any party or parties not connected with the Contract nor shall he or his Representatives issue press releases relating to the Works to any media.

(c) **RECOVERY OF SUMS DUE FROM CONTRACTOR**

When under the Contract any sum of money shall be recoverable from or payable by the Contractor the same may be deducted from any Sum then due or which any time thereafter may become due to the Contractor under the Contractor.

(d) **LANGUAGE**

The ruling language shall be in English.

PART C

TECHNICAL SPECIFICATIONS

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure a substantially equal or higher quality than the standards and codes specified will be accepted subject to the Client Engineer's prior review and written consent. Differences between the standards specified and the proposed alternative standards shall be fully described in writing by the Contractor and submitted to the Client Engineer at least 28 days prior to the date when the Contractor desires the Client Engineer's consent. In the event the Client Engineer determines that such proposed deviations do not ensure substantially equal or higher quality, the Contractor shall comply with the standards specified in the documents.

Description of the works

The contract works include:

- a) Drilling of the borehole
- b) Testing pumping
- c) Borehole equipping with solar powered pumps
- d) Constructing a 20,000 m³ steel tank
- e) Constructing a cattle water trough
- f) Fencing of the borehole site with a gate.
- g) Constructing a water kiosk

The borehole is to be drilled and developed at a site about 34 kilometres from the Magadi. The property lies along Ngoromara road in Koriamat area within the survey map of Kenya sheet no. 160/2 on 1:50,000 Scale.

Provision of equipments material and labour

The contractor shall provide all equipments, transport consumable materials and labour necessary for the satisfactory completion of the works in compliance with the specifications herein. The Client Engineer reserves the right to inspect plant and materials prior to contractor selection, and may reject plant or material that in his/her opinion is substandard or inappropriate. The contractor shall provide full descriptions of all plants to be deployed for these works. The contractor shall present method statements describing in detail the proposed approach to work.

The contractor shall provide summary detail of the experience of key personnel to be deployed for these works.

Occupation of site

The employer will provide land on which the works shall be constructed. The contractor shall be given possession of such parts of the site that he requires for activities related to construction works including storage of raw materials, equipment and setting up of camp during the period of contract provided his operation does not interfere with the daily activities of the employer.

The Contractor shall not enter upon or occupy with men, tools, equipment and materials any land other than the land or right of way provided by the employer

Diligent performance

The contractor shall at all times perform the Works diligently and in accordance with sound professional practice. He/she shall not proceed from one stage of works to another without the express permission of the Client Engineer

Decisions regarding Temporary halt, discontinuing of any element or part of any element of these works, or abandonment of these works, shall be discussed jointly between the contractor and the Client Engineer before any further actions are authorized by the Engineer. The Client Engineer's decision shall be final.

The Engineer will require a written submission justifying any steps taken by the successful bidder taken without the Client Engineer's approval. An unsatisfactory explanation shall lead to non-payment for works undertaken without prior agreement, and may be included for consideration as liquidated Damages.

Drawings

The project drawings shall comprise

- a) The drawings attached to tender documents
- b) Such other drawings and/or sketches as are issued from time to time by the Client representative to deal with design modifications in response to on-site conditions.

Record drawing

As the work proceeds the Contractor shall mark up 'As Built' details on a set of prints of the contract Drawings modified to portray the works as actually constructed and issue to the Client Engineer for approval within 7 days of completion of the works covered by each drawing.

Level datum

The Client representative will establish on site temporary benchmark and will assign a value to it. The Contractor shall establish and maintain such additional benchmarks as are necessary; the form of such benchmarks shall be approved by the Client Engineer.

Contractor's staff, communication, offices etc

General

The contractor shall advise the Client representative at which of his offices any notices may be served in accordance with the conditions of contract.

Language of correspondence and records

All communication from contractor to the Client and the client representative shall be in English language.

All site books, time sheets, records, notes drawings, documents, specifications etc. shall be in English language

Contractor's duty staff & offices

At least one responsible senior representative of the contractor shall be immediately available at all times and he shall be on site during normal working hours.

To such representative shall be delegated full authority to confer with Client Engineer and to take all steps and to issue all those instructions which may be required in an emergency to ensure the safety of all personnel of the works and of all the Employer's and other property on the site and in the immediate vicinity thereof. The Client Engineer may from time to time at his discretion after taking into consideration all the prevailing conditions allow some relaxation of this clause but such relaxation shall be made only with his written permission and subject to any special conditions which he may then require.

If deemed necessary and upon request by the Client, the contractor shall provide and maintain at the site, offices for the use of representative and to which written instructions by the Client Engineer can be delivered. Any instructions delivered to such offices shall be deemed to have been delivered to the contractor.

Public Relations

The contractor shall designate within his site organization competent staff whose responsibility shall be to ensure good relations.

The location of all yards, stores, workshops, offices, etc. shall be agreed beforehand with the Client Engineer and shall be such as to avoid obstruction and nuisance to public and/or the client.

The contractor shall provide and maintain at or near the site suitable and sufficient shelters, mess rooms, washrooms, latrines etc. as are necessary and customary, to the satisfaction of the Client Engineer Client Engineer and in accordance with the law and regulations of the relevant authorities.

Accommodation for workmen

Where the contractor wishes to construct camp to accommodate his labour, the following requirements shall be adhered to and shall also be subject to the requirement made by the area administration or any local Authority.

Demolition of contractor's temporary structures

The Client Engineer may at any time before the end of the period of maintenance give the contractor notice in writing to demolish and remove those buildings and works which are no longer required, whereupon the title to such buildings and works and materials connected therewith shall revert to the contractor. After the demolition and removal of building and works as required by the Client Engineer and contractor shall level, clear, restore and make good the sites and surrounding ground and fill in and compact all latrines, drains, pits and similar works leaving the satisfaction of the Client Engineer.

First aid outfits

The contractors shall provide and maintain in an easily accessible place at the site of the works adequate first aid outfits for the whole duration of the contract, to the satisfaction of the Client Engineer. The contractor shall have available at all times a suitable vehicle for conveyance of the sick or injured people to hospital.

Protective clothing

The contractor shall provide all protective or any other special clothing or equipment for his employees that may be necessary.

Inspection by Client Engineer during period of defects liability

The Client Engineer will give the contractor due notice of his intention to carry out any inspection during the period of Defects Liability and the contractor shall hereupon arrange for a responsible representative to be present at the times and dates named by the Client Engineer. This representative shall render all necessary assistance and take note all matters and things to which his attention is directed by the Client Engineer.

Advertisement

No advertisements shall be placed on any boarding or scaffolding erected for any purpose connected with the contract without the written permission of the Client Engineer.

Site investigations

- a. Ground levels shown on the drawings are believed to be correct. Should the contractor consider the levels shown to be inaccurate he must draw the attention of the Client Engineer to the discrepancy before interfering with the existing ground.
- b. The Contractor must make such site investigations as he thinks fit and satisfy him/her as to the nature of the ground and availability of materials.

Work Programme

The contractor shall submit a work programme showing the sequence and timing of the various stages in the execution of the works as per the conditions of contract.

Facilities for the Client Engineer

In need be and upon request by the client, the Contractor shall provide for the Client Engineer or his representative:

- a. Such instruments as are necessary to enable the Client Engineer to check the setting out and make such inspections as he may deem necessary.
- b. Such labour and assistance as may be required.
- c. Any facilities necessary to enable the Engineer to take samples
- d. Provide a temporary site office during the contract period.

Testing facilities

- (i) The Contractor shall provide laboratory facilities on site suitable for carrying out tests as shown:-
- (ii) Concrete
 - Slump
 - Crushing strength
- (iii) Aggregates
 - Particle Size
 - Impurities

Should the contractor so wish he may make arrangements for the necessary tests to be carried out by a Laboratory to be approved by the Client Engineer?

Water supply

The contractor will arrange to provide water for use in the camps and on the works. The Contractor must provide any treatment necessary to ensure it is suitable for use as in accordance to health regulations.

Electrical supply

The Contractor must provide his own source of electricity if he so requires.

Security

The Contractor will be responsible for the security of the Works and of site installations during the Contract period. He must provide such fencing, watching & lighting as he deems necessary.

Description of the materials and workmanship

The following apply to all sections hereafter.

a) Materials

Materials, commodities, components and equipment are to be new and unused unless otherwise specified. Handle, store, fix and protect all commodities with care to ensure that they are in perfect condition when incorporated into the work and handed over on completion.

b) Manufacturer's recommendation

Handle, store and fix every commodity strictly in accordance with the printed or written recommendations of the manufacturer and/or supplier. Supply the Client Engineer with copies of the manufacturer's recommendations. Inform the Client Engineer if the manufacturer's recommendations conflict with any other specified requirements, and obtain his instructions before proceeding.

c) Standards

Where commodities or workmanship are specified by reference to Kenya Bureau of Standards (K.S.), or British Standards (B.S.) or Codes of Practice (C.P.) or International (I.S.O.), or other standards, such standards are deemed to be the latest published at the time of tendering. The Contractor will be deemed to have read and understood the standards specified, and no claim for want of knowledge will be allowed. The substitution of commodities or standards of workmanship complying with other standards may be allowed at the discretion of the Client Engineer, but application for permission for such substitution must be made in writing in sufficient time to allow adequate investigation. Obtain Certificates of Compliance with standards and supply to the Client Engineer on request.

d) Local conditions

All materials, commodities, components and equipment must be suitable for use in tropical climates.

Samples

The Contractor shall submit to the Client Engineer samples of materials to be used in the works, the samples must be fairly representative of the bulk to be supplied. Samples should be subject to relevant tests before submission and Test Certificates should accompany the samples.

Clearing site on completion

The site, including borrow pits and spoil dumps shall be carefully tidied up on completion, and shaped to avoid ponding, holes, and dangerous slopes. The borrow pits and spoil dumps must be covered with topsoil neatly trimmed and the whole site left in a tidy and satisfactory condition.

EARTHWORKS

Clearing in general

Clear the area of the permanent works, and borrow pits of all vegetation and destroy by burning or otherwise.

Stripping top soil

N/A

Excavation and classification

Excavation shall be carried out to the lines and levels shown on the drawings or to such other lines and levels as the Engineer may direct.

Excavation in excess of the lines and levels shown on the drawings or without the approval of the Engineer will be rectified by the Contractor at his expense in a manner approved by the Engineer.

Any patches of unsuitable ground in the bottom of the excavations shall be excavated to such additional depth as the Engineer may direct.

Excavation must be kept dry and the sides supported as necessary. Excavation classification shall be as in the Ministry of Works Standard Specification (MOWSS) Section 5.

Class 1 "Rock" or "Hard Material" shall include all materials which in the opinion of the Client Engineer requires blasting or the use of metal wedges or the use of compressed air drilling for its removal or cannot be extracted by ripping with a tractor of less than 180 hp. and rear mounted heavy ripper. Individual boulders greater than 0.2 m³ in volume shall be included in this class when their nature and size are such that they cannot be removed without recourse to one of these methods.

When a portion of excavation contains 75% or more by volume of boulders of this order such portion shall be considered as class 1 material throughout.

Class 2 "Normal" or "Soft Material" shall include all material, which, in the opinion of the Engineer, does not require blasting and metal wedges and sledge hammers, or compressed air drilling or rooting or ripping.

It shall include wearing course gravel stones and boulders less than 0.2 m³ in volume that can be removed without recourse to these methods.

Class 3 "Compacted Gravel" or "Decomposed Rock" shall include all material such as consolidated murrum and decomposed stratified rock, stones or boulders less than 0.2 m³ in volume which are harder than "soft" or "normal" material in that they may be extracted by ripping as defined in Class 1, or in confined spaces by hand excavation using compressor tools, provided all other reasonable steps to the satisfaction of the Client Engineer have been taken to facilitate the removal by other methods.

"Waterlogged Material" material (Class 2 and Class 3) that is excavated in a waterlogged condition and necessitates de-watering and pumping operations, provided all reasonable precautions have been taken by the contractor to dewater the material to the satisfaction of the Client Engineer.

Blasting

The prior approval of the Client Engineer must be obtained and the methods approved if the Contractor wishes to remove rock by Blasting. The handling and use of explosives must comply with the explosives act or the department of mines and geology regulations. All necessary precautions to prevent injury or Damage to person or property must be taken. Generally blasting on the Weir site is to be avoided.

Borrow areas

N/A

Spoil tips

Surplus or unsuitable materials are to be disposed of in spoil tips to be approved by the Client Engineer. Spoil tips must be neatly graded, properly drained, and have stable slopes and a tidy appearance.

Earth fill

The embankment is to be built of selected soil as specified and shown on the drawings. The earthfill shall be of cohesive material of low permeability, with negligible organic matter.

Specially selected material free from stones shall be used in the cut off and central zone; the upstream zone shall also be free of stones, the downstream zone may have small quantities of stone not exceeding 25 mm.

Compaction of earthfill

Earth fill shall be placed and mechanically compacted in layers, approximately horizontal, to give a finished thickness of not more than 150 mm after compaction to 95% of Proctor Maximum Dry Density. Each layer shall be scarified to ensure a satisfactory bond with the next overlying layer, and water shall be added if necessary to ensure uniform moisture content. Subsequent layers will be placed only after the previous layer has been ratified by the Client Engineer.

Heavy rollers of a type and weight to be approved by the Client Engineer shall be used for compaction. In the cut off trench and other confined spaces compaction in area which the rollers cannot serve shall be by means of approved pneumatic tampers.

BOREHOLE DRILLING AND CONSTRUCTION

BOREHOLE DRILLING

GENERAL

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure a substantially equal or higher quality than the standards and codes specified will be accepted subject to the Client Engineer's prior review and written consent.

This contract comprises the drilling, construction, development. Test pumping and water quality analysis.

REGULATIONS AND STANDARDS

The borehole shall be drilled at the site identified by the investigating hydro-geologist and confirmed by Client Engineer. It shall be drilled to a depth specified in the hydro geological survey report. It shall be drilled through all strata encountered.

The Employer will acquire the relevant permits and Government authorizations.

MOBILIZATION, DEMOBILIZATION AND RESTITUTION

(a) The Contractor shall mobilize to the site in accordance with the Agreed Programme. The sum for mobilization/demobilization shall include transportation of machinery, erection, dismantling and preparation of temporary camp as the Contractor deems necessary, provision of drilling and development fluids (bentonite, foam, and water), water for camping, personnel sanitary facilities.

(b) The Contractor shall minimize disturbance to neighbouring plots. This shall particularly include ensuring that bailed fines and pumped test water are discharged in a manner that does not create a nuisance either to the public or private property.

(c) Site re-instatement under the conditions of contract shall include the removal of all hydrocarbons spilled, leaked or otherwise released and associated packaging and cotton waste. Site re-instatement is deemed an integral part of mobilization. This activity shall be costed taking into account the items above and expressed as a lump sum.

DRILLING

(a) Unless otherwise approved by the Client Engineer, drilling shall be by the air hammer method, or by flush rotary drilling method. Drilling shall continue through all strata encountered. Drilling fluids and additives used must be approved by the Client Engineer prior to use. The Contractor shall provide the appropriate tools and equipment and maintain them in good condition capable of operating to the manufacturer's rating to ensure a smooth, straight hole.

(b) Drilling shall continue to the stipulated total depth at a minimum diameter of 205mm

(8 inches) to provide for a finished borehole of a cased internal diameter of 152mm after allowing for 50mm thick gravel pack and temporary casings as found necessary. The Client Engineer reserves the right to stop drilling operation if he considers that further drilling is unlikely to be advantageous. In this event payment shall only be made for the amount of work actually executed.

(c) All materials used in the borehole construction other than temporary works shall comply with the relevant standard specifications. A tolerance in dimensions will be permitted provided that the material quality is not inferior to specification and work is in no way impaired.

(d) The boreholes shall be drilled straight and vertical.

SAMPLE COLLECTION, STORAGE AND RECORD KEEPING

(a) **Samples** of the drill cuttings returned to the surface shall be collected at two (2) metre intervals, dried and bagged. Each bag shall be clearly marked with the sample depth interval and borehole number. The Contractor shall record the depth and any zone of lost circulation for which no sample was taken.

(b) The Contractor shall maintain a log of the penetration rate on a metre by metre basis, in minutes per meter drilled. A stopwatch shall be used for this purpose so that only the net drilling time is recorded, excluding any time taken in drilling disruptions.

(c) The depth of any voids, or of particular rapid penetration, or significant changes in rig noise shall also be noted.

(d) Water level shall be measured and recorded at the start and end of every shift, after significant breaks in activity (such as meal breaks), and during periods of plant downtime (as appropriate). The water levels shall be measured using a sounding and/or lighting dipper approved for use by the Client Engineer.

SUPPLY AND INSTALLATION OF CASINGS AND SCREENS

CASING AND SCREEN SPECIFICATIONS

(a). Casings shall be new, 152mm (6 inches) internal diameter, black pipe class B, with a minimum wall thickness of 4.0mm in 6 meter lengths.

(b). Mill slotted screens shall be constructed from new 152mm internal diameter black pipe class B with a minimum wall thickness of 4.0mm. Slots shall not exceed 1.0 mm in width, and should constitute not less than 6.0% open space area. Gas slotted casing screens are not acceptable.

CASINGS AND SCREEN INSTALLATION

(a). Before installation of the casings and screens, the Contractor shall ensure that the hole is clear to the total depth and shall flush out any backfilled materials present. The

Client Engineer shall provide the design of the casings and screens string prior to installation by the Contractor.

b). Casing jointing shall be by either flush square-section threading or tree pass electric arc welding. Screens may be welded to casing, or screw-jointed by means of flush square-section threads. Externally socket joints may be welded to the casing, or screw-jointed by means of flush square-section threads. Externally socketed joints will not be accepted. Where screwed joints are deemed by the Client Engineer to be below standard, joint shoulders shall be spot welded at 900mm interval around the casing circumference at no extra cost. If screens and casing are to be welded, the appropriate welding electrode must be used.

c). during welding, casing and screen lengths must be held absolutely vertical in order to ensure a plumb installation. All joints to be welded must be levelled at the butt end; three continuous weld passes must be made to ensure a sound joint and the oxide coating be removed before the second and third passes.

d). Burn-through and subsequent deposition of metal on the inside of the casings and screens must be avoided. The base of the casing shall be sealed, unless otherwise directed by the Client Engineer, with a circular plate of black pipe class B of thickness not less than 4.0mm ($\frac{1}{4}$ inch) fixed with a continuous weld to the casing strip. The appropriate welding electrode shall be used. The weld passes will be made, with oxide coating removed prior to the second and third passes. The top of the casing straight shall terminate not less than 600mm above the highest recorded level of ground at the site.

e). The contractor shall be responsible for the provision of temporary casings as necessary, including the insertion and removal. Where the Client Engineer deems it necessary to have temporary casings left in the borehole as a measure of securing the borehole, this will be indicated in the item for other works in the bill of quantity.

ADMISSIBLE RATES

a.) Rates shall be expressed as supply and installation of casing or screen per Unit Linear Metre.

SUPPLY AND INSTALLATION OF GRAVEL PACK

SPECIFICATIONS

a). The Contractor shall supply and install filter pack/formation stabilizer. The material shall be 2-4 mm diameter, clean well rounded riverbed siliceous gravel with no more than 5.0% non-siliceous materials. The pack must be approved by the Client Engineer prior to installation. Granular calcium hypochlorite will be introduced into the annular space along the pack material at a concentration of 500 grammes per cubic metre of pack.

The gravel pack shall be placed in the production boreholes to a thickness of 50mm around the casing up to where all screen zones are covered with the gravel as per the

Client Engineer's satisfaction.

This will initiate the process of sterilizing the wellbore. The Contractor shall provide the Client Engineer with the bulk density of the pack material (Kg/M³).

b). Installation of the filter pack/formation stabiliser may be water wash down or reverse circulation methods. In the latter case a pump set or airlift string shall be installed in the bore so as to encourage material settlement. The filter pack shall terminate not less than 3.0 metres above the uppermost screen when stabilized, or as otherwise directed by the Client Engineer. The Contractor shall provide a means by which this level shall be measured.

ADMISSIBLE RATES

Rates shall be expressed as supply and installation of gravel pack per Unit Cubic Metre.

INSTALLATION OF BACKFILL

SPECIFICATIONS

a). Backfill material shall comprise of fine clayey drill cuttings and shall be installed from the top of the filter pack to 3.0 metres below ground level unless otherwise directed by the Client Engineer. The installation method must ensure that no bridging occurs within the annular space.

b). The Contractor shall measure the depth to the top of the backfill and provide the means by which this level may be measured.

ADMISSIBLE RATES

Rates shall be expressed as installation of backfill per Unit Linear Metre.

DEVELOPMENT

Development shall comprise both Physical and Chemical development, and shall include the following operations:-

BOREHOLE CLEANING

a). The Contractor shall clean the borehole to its "completed depth" using any of the methods listed below or as otherwise authorized by the Client Engineer:-

- By bailer with percussion drilling rig
- By means of airlift, which may use a light or stable foam to assist in the removal of materials from the borehole.
- By means of educator airlift, with or without light or stable foam.

b). Bailers and other down hole plant shall adopt diameter limits of half a normal size or smaller (12.5mm or ½ inch) than the smallest casing or screen diameter.

c). Water levels shall be measured and recorded at the start and end of every shift, at significant breaks in activity (such as meal breaks), and during periods of plant downtime (as appropriate). Water levels be measured using a sounding and/or lighting dipper previously approved by the Client Engineer.

d).The borehole shall be deemed clean when measured drilled depth has been reached and when insignificant or no materials is removed from the base of the borehole. Cleaning costs shall be expressed as a rate Per Hour.

CHEMICAL DEVELOPMENT

a).When the Client Engineer has deemed the borehole clean; he may instruct the Contractor to commence with Chemical development. Chemical development shall comprise of an approved Polyphosphate as a disaggregate that shall break down the silty concentrations, any build up clay or silts, or other fine materials within and adjacent to the borehole. The decision as whether chemical development shall be adopted and what dosage rates shall be made by the Client Engineer.

b). Typical dosage shall comprise of powdered Sodium Hexameta phosphate dissolve in hot water. The polyphosphate shall be dosed at 10 to 15 Kg/m³ of water depending on the concentration of clays in the aquifer matrix. This shall be mixed with calcium hypochlorite at a dose of 200grammes per cubic metre to inhibit bacteria activity. The volume of polyphosphate dosed water shall be one and a half times the Volume of water within the screen section.

c) Both polyphosphate and added water shall be introduced by means of a pipe, the bottom end of that shall be located in the middle of the screen section of the borehole. The Contractor may get the liquids into the screened section using a jetting head if he wishes.

d). after dosing, the borehole shall be left overnight to allow disaggregation to occur. The borehole shall then be subject to physical development.

e). Chemical development costs shall be expressed as an Hour rate, and include all labour and materials (including clean water) required for the operation. Chemical development undertaken by a Contractor familiar with the technique shall take no longer than three (3) hours.

PHYSICAL DEVELOPMENT

(a).Physical development may adopt any of the commonly used methods, including but not necessarily restricted to the following:-

- Surging
- Bailing
- High Velocity Water Jetting
- Airlift raw hiding
- Airlift raw hiding with educator pipe.

b). Development shall be considered complete when the water discharged is clear and contains no more than an estimated 5 parts per million of suspended solids and the borehole has been restored to the cleaned total depth or as otherwise directed by the Client Engineer.

c) The Contractor shall describe the method he proposes to adopt and the plant required for physical development in his method statement. **Over pumping** shall not be considered

a development method. The rate submitted by the Contractor for physical development is deemed to include installation and removal of necessary plant. The quantities given in the bills of quantities only apply to actual development time. Costs for physical development shall be expressed as an Hour Rate.

AQUIFER TESTING

Borehole testing will be conducted according to British Standard BS 6316 (1992) (Code of Practice for Test Pumping of Water Wells). The following elements are required.

- A pre-test
- A step drawdown test
- A constant discharge test
- A recovery test

INSTALLATION, PLANT AND METHODOLOGY

Pumping plant and dipping tube shall be installed in the borehole to be tested. The Contractor shall investigate and agree with the Client Engineer the anticipated discharge and pump intake depth.

PUMPING PLANT

- i) Pumps used for test pumping should be electrical submersible turbine pumps or reciprocating pumps.
- ii) Any pump used in tests must have a fully functioning **non-return valve** either in the pump itself or in the rising main immediately above the top of the pump.
- iii) The Contractor must have pumps covering the anticipated discharge range.
- iv) The water pumped from the borehole shall be discharged to waste at a distance and in such a manner that it does not pond or flow back towards the borehole.
- v) The Contractor must provide a generator or other prime mover for powering the pump, as power is not necessarily available at the sites.

DISCHARGE MEASUREMENT AND CONTROL

Discharge measurements shall be by an approved accurate method, such as an Orifice Plate, calibrated flow meter or a V-notch weir. If volumetric methods are proposed, the Contractor will ensure the container to be used has been calibrated. When time to fill measurements is made, each discharge measurement shall be calculated from the average of three time measurements. Discharge shall vary by no more than 15% across each step of step drawdown test, and across the constant discharge test.

WATER LEVEL MEASUREMENT

Water level measurements shall be by electric sounding and/or lighting dipper, and shall

be made in a dipper tube installed alongside the test pump rising main and tied securely to it. The Client Engineer will check the dipper for stretch and any other inaccuracies prior to accepting its use. Accuracy measurements must not be less than 1.0 cm. Water level measurements using an airline will not be acceptable on the grounds of poor precision.

TIME MEASUREMENT

All times shall be measured by means of a stopwatch. The Contractor shall ensure that spare batteries etc for all equipment are available prior to commencing tests.

PRE-TEST

The pre-test will check all equipment, determine the range of discharge for the step drawdown test and set the globe values for the first step discharge rate. Pre-test shall not exceed three (3).

STEP DRAWDOWN TEST

- The step drawdown test will comprise five (5) steps tests of sixty (60) minutes each, with no recovery phase between successive steps. The step drawdown test shall not start until water level has returned to the true static water level, unless otherwise directed by the Client Engineer.
- Typically, individual step discharges would comprise 25%, 50%, 75%, 100% and 125% of the anticipated production discharge rate.
- Discharge increments shall be effected as nearly instantaneously as possible and once set shall not be changed except by instruction of the Client Engineer.
- Discharge variations and measurement shall be effected by means of the globe valve and manometer gauge as follows;

A globe valve of suitable diameter shall control the discharge and on the upstream side of this, not closer than six (6) pipe diameters from the valve, a manometer tapping and gauge will be installed such that it can be clearly seen by any person using the valve. This will be used during the step drawdown tests for the flow control purposes.

CONSTANT DISCHARGE TEST

Constant discharge test shall typically last not less than twenty four (24) hours, or as otherwise determined by the Client Engineer. A water sample will be procured towards the end of the test for subsequent analysis by a competent laboratory.

RECOVERY TEST AND REMOVAL OF PLANT

Recovery tests shall not continue for more than twenty four (24) hours, or as otherwise directed by the Client Engineer. Only after the completion of recovery data collection may pumping and ancillary plant be removed from the borehole, though above ground components may be dismantled during the recovering phase.

ADMISSIBLE RATES

Rates of pumping and recovery are deemed to include the cost of plant installation and removal. The rates are deemed inclusive of installation, removal, plant use, testing and data collection.

WATER SAMPLING AND ANALYSIS

- In the closing hour of the constant discharge test a water sample shall be collected for chemical and bacteriological analysis by a competent laboratory. The water samples shall be collected in containers supplied by the laboratory, in the manner conventionally used by the laboratory.
- The Contractor's unit rate of sampling and analysis will include the cost of analysis and transportation to and from the laboratory for the sampling exercise.

BOREHOLE DISINFECTION

After removal of test equipment, the borehole shall be disinfected with Chlorine/water solution at a concentration of 50 milligrams per litre or greater of free chlorine. This will be sprayed into the borehole so as to ensure that all exposed borehole wall surfaces are coated. In preparing their Tenders, Contractors should allow for one (1) cubic metre of solution per borehole. This item shall be costed as a unit Lump Sum

BOREHOLE HEAD WORKS

SANITARY SEAL CASING

A sanitary seal shall be constructed at the wellhead. This shall comprise the following elements:

- A 3.2 metre length of internal diameter 205 mm (8 inch) plain black pipe class B sanitary steel casing installed around the permanent casing string.
- A grout seal between the 254mm sanitary seal casing and the 152 mm Permanent casing string.
- A 1.0x1.0x1.0 metre reinforced concrete block (Y8/1:2:4) cast around the Sanitary seal casings.
- A lockable steel cap.

GROUT SEAL

A sanitary ground seal shall be installed between the 152 mm (6 inch) and 205 mm (8 inch) casings and grouted into place. Grout shall be a cement slurry, or cement and fine sand and shall have a density of at least 1175 Kg/lt. This shall be introduced into the annular space from the top of the inert backfill to the ground level, using a method that must be approved by the Client Engineer.

CONCRETE PLINTH

The ground surface at the wellhead shall be excavated to a depth of one (1) metre, and be one metre square, to allow a Concrete Plinth to be cast. The 1.0x1.0x1.0 metre pit will be filled with concrete, to be finished flush with the ground surface. Concrete shall be 1:2:4 OPC: sand: half-inch ballast. This must be cast with two 0.8 metre lengths of 12 mm reinforcing steel bar welded to the 205 mm (8 inch) casing, 0.7 metre below ground level.

TEMPORARY CAP

The top of the borehole shall be sealed with a cap that shall comprise a round plate of mild steel, of thickness not less than 3.0mm. This will be continuously welded in single pass to the mild steel borehole casing or should be lockable.

RECORDS

After completion of all works at the borehole, the Contractor shall submit to the

Client Engineer within four (4) days a complete document with the following additions:-

- Drilling penetration Log
- Geological Log
- WAB 28 Borehole Completion Record (Three Complete Sets of Completion Reports shall be submitted.

TECHNICAL LITERATURE

A Tenderer **must** submit the following information together with the Tender documents to assist in fair evaluation:-

- Technical specifications on drilling rig and other ancillary equipment (make, model, rated capacity etc)
- Particulars and specifications of materials used in the construction of the borehole.
- Any other information the tenderer may deem is important in evaluation as well as BOOSTING his/her chances of winning the tender.

ELECTRO – MECHANICAL WORKS SPECIFICATIONS

ELECTRICAL WORKS

REGULATIONS AND STANDARDS

The complete solar installation shall be carried out by a competent Contractor and in accordance with the specifications and compliance with the following;

- (a). Kenya Bureau of Standards
- (b). Regulations for the Solar/Electrical Equipment of Buildings (Latest Edition) issued by the Institution of Electrical Engineers of Great Britain.
- (c). IEC standards.
- (d). Electric Power Act and the Rules made there under.
- (e). Kenya Power & Lighting Co. Ltd Regulations and Bye-Laws.
- (f). Government Electric Specifications GES 1 and 2 which can be viewed at the office of the Chief Electrical Engineer, Ministry of Roads, Public Works and Housing.

(g). Industrial Safety Regulations currently in force.

SWITCH GEAR PANELS, DISTRIBUTION BOARDS ENCLOSURES, INSTRUMENTATION PANELS, STARTER PANELS, BUS-BAR CHAMBERS, CONSUMER UNITS, JUNCTION BOXES AND OTHER ELECTRICAL ENCLOSURES

Unless otherwise specified, all shall be surface mounting, water tight, corrosion resistant, vermin-proof, termite-proof, dust-proof and resistant to attack by oils and grease. They shall be fabricated from heavy gauge 14swg, folded, spangled, galvanized and rust protected sheet steel of minimum thickness 1.5mm. They shall be finished in a two tone, heat resistant, non-peeling-off stoved gray enamel paint or epoxy powder coating.

ELECTRIC CABLES

Unless otherwise specified, all cables shall be made of copper material and conform to BSS 5004, 500/600 volts grade.

(i). UNARMoured CABLES

They shall be PVC insulated.

(ii). ARMoured CABLES

They shall be PVC SWA PVC copper cables.

(iii). BOREHOLE CABLES

They shall be made from tough flexible rubber material that will not allow water to seep through when submerged in the borehole water.

GS CABLE TRUNKING

The trunking shall be manufactured from heavy duty hot dip galvanized mild steel sheet of minimum thickness 1.15 mm with screw-in and twist-to lock top lid.

PUMP SET STARTER

It shall be 3 phase, 415 V ac, 50/60 Hz Direct-On line.

It shall be in a water tight, front access, hinged door, lockable enclosure, comprising of the following components among others fully wired and labeled.

The starter shall be **Telemecanique, ASEA, MEM, Crabtree, Siemens, Klockner-Moeller or Sprecher-Schuh**. It shall be fully wired and 3 No. sets of schematic and control wiring drawings **MUST** be supplied along with the starter.

- Appropriate rating contactors.
- Appropriate rating thermal overload.

- Start, Stop/Reset push buttons (green marked "START", black marked "STOP/RESET").
- Integral TPN (MCB) type 2.
- 1 No. 50x50mm AC ammeter of appropriate range.
- 1 No. 50x50mm AC voltmeter of range 0-500 vac.c/w protection MCB/ fuse
- Over/Under voltage and phase failure protection relay set at 380 and 440 vac.
- 2 No. Water level control relays.
- Pilot indicator lights (green marked "PUMP RUN", red marked "OVER LOAD TRIPPED", yellow marked 'BOREHOLE LOW', white marked "TANK HIGH" etc.
- Hours run counter range 0-99999 hours.
- Cable terminal blocks of appropriate rating.

BOREHOLE MOTOR

The motor shall be the two pole cased asynchronous, 3 phase, 415vac, squirrel cage, induction type, continuously rated and of minimum CLASS "B" insulation.

The entire body including the shaft shall be made of heavy duty stainless steel material. The motor shall be supplied complete with 3 lead copper tail cable.

BOREHOLE PUMPS

The pumps shall be the high pressure, vertical mounting, multi-stage, centrifugal type running at a full load speed of not less than 2800 rpm.

The entire pump body including the strainer, cable guard, non-return valve, impellers, shaft, locking nuts and washers shall be made of heavy duty stainless steel material.

The bearings shall be the water lubricated type, wear resistant.

The impeller(s) shall be hydraulically and dynamically balanced.

WATER LEVEL CONTROL ELECTRODES

All the electrodes shall be made of stainless steel material **AISI 304 as Omron F03-01, Londex, and Ascoor** similar approved quality made of stainless steel.

BOREHOLE ELECTRODES

They shall be of size 6.0 mm diameter and 120mm length (D6x120mm) and in their tough moulded shrouds.

WATER TANK ELECTRODES

They shall be of size 6.0mm diameter and varying length dependent on the depth of the tank or intended control water levels. They shall be in a circular, water tight, electrically insulated (500 vac) tough moulded enclosures with screw top and knock-outs for 20mm diameter conduit and rubber grommets. The electrodes shall have tough plastic ring separators of size D75x3mm thick fixed at 300mm intervals for the entire length.

BOREHOLE COMBINED PIPE AND CASING CLAMP

The clamp shall be the heavy duty type. It shall comprise of 3 pieces; the bottom half clamps to the borehole casing, while the top portion which rests on the top of the casing clamps to the pipe column and holds it centrally in the casing bore.

The clamp covers the bore and so prevents foreign matter falling into the borehole. The clamps shall be made of steel material of minimum thickness 6mm.

BOREHOLE SUNDRIES

Unless otherwise specified, the words “BOREHOLE SUNDRIES” shall mean the following items to be used in the installation, support and inter-connection of the borehole pump and drop pipes to the rising mains. Unless otherwise specified, the GI fittings shall be of the same diameter as the drop pipes.

- 6 rolls of 6metre water proof adhesive rubber tape.
- 1 No. Tee, 4 No. sockets, 4 No. nipples, 2 No. 90° bends, 1 No. plug.
- 2 No packet of 250mm plastic cable ties
- 4 Litres of Boss black type COLAS RC.

RC CABLE AND PIPE ROUTE MARKERS

They shall be of size 1100mmLx200mmWx80mmT with the words “POWER CABLE” OR “WATER PIPE” in 40mm height letters mould cast in black indelible colour in the concrete. They shall be caste using Y8 RC concrete of mix ratio (mix ratio 1:3:6).

HATARI TILES

The tiles shall be used to cover the underground armoured cables for protection against mechanical damage. They shall be of size 300mmLx150mmWx30mmT with the word “HATARI” in 40mm height letters mould cast in the concrete. They shall be pre-cast using concrete of mix ratio (mix ratio 1:3:6).

LIGHTING FITTINGS AND SOCKET OUTLETS

LIGHTING FITTINGS

Unless otherwise specified, they shall be rated so as to operate on single phase, 220-240vac, 50/60 Hz power supply mains.

INDOOR LIGHTING FOR OFFICES

Unless otherwise specified, they shall be the energy saving type, 1200mm single fluorescent fitting as Thorn, Crab-Tree or Philips, power factor compensated and complete with choke, tube and starter.

NOTE

Pump house lighting shall be water tight and corrosion resistant to water.

EXTERNAL WALL FITTED LIGHTING FITTINGS

Unless otherwise specified, the fittings shall be the tungsten bulkhead type, Thorn, Crab-Tree or Philips IP65, dust-tight and jet-proof and rated 100 watts. The body shall be made of pressure die cast aluminium material and stoved with light gray enamel paint.

The diffuser shall be patterned mould glass bowl with captive vandal-proof nylon retaining screws, gasket seal to glass and heat resistant cable sleeves.

GS BOREHOLE PROTECTION COVER

The cover shall be all weather-proof, rectangular in shape with pitched top (3°). The cover shall be fabricated from hot dip galvanized heavy gauge (16swg) sheet steel plate of minimum thickness 1.75mm. It shall have GS solid handles and pad locking facilities on the opposite sides. The cover shall be in an L-SHAPED steel frame (25x25x2.5mm thick).

WIRING METHODS OF ELECTRICAL INSTALLATIONS AT MEDIUM AND LOW VOLTAGEE

SYSTEM "A"

Plastic insulated cables enclosed in screwed steel conduit or trunking on the surface of walls and ceilings or in the roof space.

SYSTEM “B”

Plastic insulated wires armoured cables laid on the surface of walls, cable trays, in cable trenches or ducts.

SYSTEM “C”

Plastic insulated cables clipped to the roof members and run in metal or plastic conduit drops concealed in walls or ducts formed in the fabric of the building.

PERFORATED CABLE TRAYS

The tray shall be U-shaped, fabricated from hot dip galvanized heavy gauge (16swg) sheet steel plate of minimum thickness 1.5mm.

The tray shall have 2 no. GS brackets firmly welded at the back for wall mounting. The perforations shall be 25mmLx2.5mmW spaced at 15mm interval.

CHEQUERED PLATES

The plate shall be fabricated from hot galvanized heavy gauge (12swg) sheet steel plate of minimum thickness 3.0mm with serrated top side.

SYSTEM BONDING

All non-conducting metallic parts which form part of the electrical system or are within the vicinity/route of the electrical system shall be effectively bonded to the main earthing system.

EARTHING SYSTEM

All the electrical installation earthing conductors shall be connected to the earth electrode through an earth lead. The earth lead shall be firmly connected to the electrode by means of the clamp, after which a thin film of grease or Vaseline shall be applied at the clamp area for protection against corrosion.

SOLAR PANNELS (Photo Voltaic Solar Modules)

The contractor shall supply and install solar panels and all the necessary accessories as manufactured by Solar World or Yingli Solar or equivalent and should comply with the following standards:

- High efficiency multi crystalline solar cells with minimum 15% energy conversion rates to provide maximum power even under weak lights.

- High transmission rate tempered glass with an anti-reflection coating to increase the power output and provide mechanical strength
- Multi-function water proof junction box for easy connection.
- 25 year power output warranty.

ELECTRICAL /SOLAR INSTALLATION TEST RESULTS

The Contractor shall at the end of the electrical installation work carry out electrical tests on the system and ensure that the results are compliant with the I.E.E. Regulations and Kenya Power & Lighting Co. Ltd Regulations and Bye Laws currently in force before the system performance tests are carried out.

Electrical parameters to be tested are;

- Insulation between phases Mega ohms
- Insulation between phases and Earth Mega ohms
- Earth continuity test Ohms
- Earth Electrode test Ohms
- Earth loop impedance test Ohms
- Earth lead test Ohms

AVAILABILITY OF SPARE PARTS

The Contractor shall indicate local registered companies which stock spares and carry out repairs/ maintenance of the equipments installed (solar pannels, motor, pump starter etc).

TECHNICAL LITERATURE

a) The bidder **MUST** submit adequate technical literature to assist in evaluation. The literature information shall **INCLUDE**;

- Performance curves for the pump set (CAPACITY VS HEAD, EFFICIENCY, and POWER CONSUMPTION etc).
- Make, type model and country of origin of the pump, motor, pump starter etc.
- Specifications of materials used in the construction of the components of the pump, motor etc.
- Any other information the bidder may deem is important in evaluation as well as BOOSTING his/her chances of winning the bid.

b) The winner of the bid must submit the following;

- 1 No. set of the User Manual for the pump set.
- Written Warranty document of minimum 12 months for the pump set, starter etc.
- 1No.SET of original film and 3 No. SETS each of as-fitted electrical schematic drawings, control wiring drawings for main switch gear, pump starter, cabling and water pipe lay out between borehole and tank.

TANKS, SUPPORT STRUCTURES AND ANCILLARIES

REGULATIONS AND STANDARDS

The complete work shall be carried out as per the specifications and complying with the following regulations and standards:

- a) World health Organization Safety Regulations and Standards
- b) Kenya Bureau of Standards

Testing of Water-Retaining Structures

Water retaining structures shall be tested for the water tightness at appropriate stages or on completion. They shall be filled with water in stages and held at each water level for such lengths of time as required by the Engineer. Should leakage occur at any stage, the water shall be drawn off and the defects remedied. The procedure shall be continued and finally the structure shall be allowed to remain full for 7 days. At the expiration of this period, the level of the surface of the water shall be recorded and further measurements made at intervals of 24-hours for 7 days. The structure shall be deemed to be watertight if the total drop in surface level does not exceed 10 mm in 7 days. For open structures, additional allowance shall be made for evaporation. If the structure does not satisfy the condition of the test and the daily drop in water level is decreasing, the period of test may be extended for a further 7 days, and if the specified limit is then reached, the structure may be considered as satisfactory.

The Contractor shall provide a hook gauge to measure variations in water level during the tests.

The testing shall be carried out before the excavations are backfilled and embankments placed.

The Contractor shall be solely responsible for the water tightness of the structure and any remedial measures necessary.

Cleaning and Sterilizing of Water-Retaining Structures

The inside of all water-retaining structures and all interior pipework and fittings, shall be thoroughly cleaned and washed to remove all contamination and the water from these operations removed by squeezing and drained away.

The inside of water-retaining structures shall be filled to overflow level with water containing 50 parts per million of chlorine and left for at least 24-hours. They shall then be drained and refilled with clean water from which samples and analyses shall be taken as instructed by the Engineer. If the results of the analyses are unsatisfactory, the sterilizing process and refilling and sampling shall be repeated until the results of the test are satisfactory.

The provision of all necessary water, labour and materials for carrying out the foregoing operations, shall be included in the Contractor's rates and prices. The cost of sampling, testing and the reports on the bacteriological quality of the water will be borne by the Employer, provided the results of the tests are satisfactory, otherwise the cost of such sampling, testing and reporting shall be borne by the Contractor.

Structural Steel

All structural steel work shall be of mild steel conforming to SSRN 905. All sections shall be at least equivalent to those shown in SSRN 913.

Ends of beams and joints, etc. shall be cut to exact lengths true and square and shall be cleaned of burrs or rough edges. Drilled or punched holes shall not be greater than 1/16" more than the bolt diameter and they shall be cleaned of burrs and rough edges. Punching of holes shall be allowed for plates thinner than 8 mm.

Prices for all mild steel shall include for removing all rust and mild scale and applying one coat of red lead or other approved priming paint to all surfaces before vising. Following erection, all structural steel not galvanised shall receive three coats of lead paint and be finished in an approved colour.

Bolts, Nuts and Washers

Bolts, nuts and washers shall conform to SSRN 914 threaded to SSRN 923. Washers shall be to SSRN 925 except that the outside diameter shall be at least 2.5 x the bolt diameter. Tapered washers shall be supplied where required.

Where specifically called for, nuts, bolts and washers shall be electroplated. For below ground environments including chambers, the electroplating shall be to SSRN 922. Elsewhere it shall be to SSRN 921.

Hot Dip Galvanizing

All hot dip galvanizing shall conform to SSRN 903.

Handrail

Hand railing shall be designed and manufactured in accordance with SSRN 848. It shall consist of 38 mm diameter galvanised steel sections of tubing to SSRN 203, screwed at each end. The sections shall be joined by 38 mm diameter galvanised steel equal crosses, equal tees or short radius 900 bends where appropriate, such that the top rail shall be 1 metre and the lower rail 0.5 metre above the concrete slab, and the spacing between standards shall be 2 metres maximum. A 38 mm diameter galvanised steel flange shall be screwed to the base of each standard and drilled for four 20 mm diameter, 100 mm long mild steel rag bolts which shall be welded on platform.

All hand railing components shall be galvanised after cutting, screwing and drilling and shall be supplied complete with all bolts, nuts, washers and other fixings necessary to complete the installation

Chequered plate flooring

Chequered plate flooring shall be of mild steel and manufactured with diamond chequering or other non-slip pattern. The plates shall be of sufficient thickness not to bend or spring in ordinary usage and shall be fitted evenly and truly into steel angle frames or curbing with suitable attachments for building into concrete flooring.

Chemical Waterproofing of Concrete

Should it become necessary or if indicated in the Bills of Quantities or directed by the Engineer, the Contractor shall apply a concrete waterproofing chemical to concrete surfaces. For surfaces in contact with potable water, such a chemical shall have been certified as suitable for use in potable water retaining structures by competent and internationally recognised authorities.

Products acceptable include waterproofing chemicals consisting of rapid hardening Portland cement, oven-dried quartz sand and active inorganic chemicals of a type that upon application to a concrete surface a crystal chain reaction starts as the active chemical ingredients react with the free lime and water in the concrete capillaries resulting in the

formation of insoluble crystals which drive out the surplus capillary water ensuring a permanently water tight concrete but which however at the same time allow the concrete to breath.

New Pressed Steel Reservoirs

Construction and Fittings

Pressed steel reservoirs shall be constructed of pressed galvanised mild steel panels and in accordance with SSRN 909. They shall be externally flanged. The tanks shall be complete with all necessary stays, cleats, bolts, nuts, washers and jointing compound. Pipework and pipe connections shall be provided as shown on the Drawings.

Tanks that have a Central Division wall shall have this of similar construction to the external walls of the tanks and shall effectively divide the tank into two separate reservoirs which can be used independently.

For roof covers, weatherproof covers shall be provided. These shall be complete with all stiffeners, and supports, with pressed steel gable fillers where necessary, and with all necessary stays, cleats, bolts, nuts, washers and jointing compound. The connection between roof and walls shall be weatherproof.

Each tank, (or compartment in the case of tanks with Central Division walls) shall be equipped with an access manhole, 2 fresh air ventilators, internal and external access ladders, peripheral platform, a float indicator, a valve box with access manhole, and a float valve.

Galvanizing

For new panels galvanising shall be carried out at the manufacturer's works and shall be in general conformity with SSRN 903. Re-usable existing panels shall be re-galvanised at an approved nominated subcontractor's works. Periodical inspection by the Engineer will be undertaken to confirm that the procedure followed for re-galvanising and the final quality of re-galvanised panels is satisfactory. Where painting is required, refer to Clause 14.

Fittings

a) Access Manholes

Each tank or compartment shall have one access manhole to permit inspection of the tank internally. In addition, one manhole may be located on top of the valve box in order to permit inspection of the ball valve without entering the reservoir. Manholes shall be of appropriate size and/or the same size as existing ones (for refurbished tanks) and shall be equipped with a hinged lid, which shall be provided with a means of locking into position (with a padlock) on a thick gasket of felt or bitumen.

b) Access Ladders

Internal and external access ladders shall be mild steel galvanised and shall be provided adjacent to access manholes. External ladders shall be fitted with a safety cage and intermediate landing platform.

Ladders shall be designed and manufactured in accordance with SSRN 847. They shall be of mild steel with 25 mm solid rungs at 250 mm centres. The stringers shall be 65 mm x 20 mm, 400 mm apart, turned over at top and bottom and drilled for 12 mm dia rag bolts. Stays shall be 75 mm x 10 mm, length to suit, bent to shape and drilled for 12 mm dia rag bolts, and shall be of such length that will give a minimum clearance of 200 mm behind the

rungs. Finish to ladders and stays shall be galvanised to SSRN 903 unless otherwise directed by the Engineer or shown on the Drawings.

c) Fresh Air Ventilators

Two fresh air ventilators shall be fixed to the roof of each compartment. They shall be cowled to prevent rain from entering and fully mosquito-proofed with fine meshed gauze all fixed to the satisfaction of the Engineer.

d) Float Level Indicator

Float level indicators shall be attached to the side of each compartment with vitreous enamelled scales graduated at intervals of 0.5 metres and clearly marked in indelible paint. Pointer and float shall be connected by a steel cable. Guides for the cable shall be provided to prevent snagging or fouling of cable travel.

e) Valve box

Valve boxes shall be provided to maximise the capacity of the reservoirs where float valves are to be fitted.

Testing, Sterilising and Flushing

a) Testing

After refurbishment and/or erection and before testing the Contractor shall ensure that the tank is cleaned internally and ensure that no foreign matter is present. Where applicable each compartment shall be tested by being filled with clean cold water and left for twenty four hours. Throughout the test period there shall be no visible leakage and no measurable drop in water level in the compartment. In the case of reservoirs with central division walls each compartment shall be tested separately and not concurrently.

b) Sterilising

Tanks shall be sterilised by filling them with potable water containing 50 mg/l of chlorine and permitting them to stand 4 hours when full. Thereafter the residual chlorine shall be measured. If no residual is found the process must be repeated. Chlorine shall be added to the test water in a manner approved by the Engineer.

c) Flushing

None of the water used for testing or sterilizing shall be released for consumption but all shall be discarded via the scour to drain. Tanks and pipes shall be thoroughly flushed with potable water after sterilization.

Supporting Steel Structures

Elevated reservoirs shall be supported on structural steel towers of height as indicated on the relevant drawing or in the Bills of Quantities. These towers shall be designed by the Nominated Sub-contractor and approved by the Engineer prior to fabrication. They shall be designed in accordance with SSRN 863. The design shall cater for all vertical and horizontal loads including those imposed by wind forces and seismic disturbances.

The towers shall be provided with all necessary beams, adequate cross bracing, bolts, cleats, base plates and holding down bolts. The tower shall be provided with an adequate valve operating platform one metre wide. These platforms shall be of open steel flooring with 20 mm diameter tubular handrails and angle iron handrail stands, and shall be provided with toe-boards.

The Nominated Sub-contractor shall provide two sets of properly dimensioned working drawings showing sizes of all principle tower members and maximum and minimum stanchion loads together with two sets of supporting detailed calculations for approval by the Engineer before fabrication. All damage to paintwork during the course of erection shall be repaired. The final painting of the tower etc. shall comprise two coats of suitable primer and two coats of a thixotropic, aluminium pigmented, bitumen based barrier coating paint.

Foundations

Concrete pad foundations for the towers shall be designed by the Nominated Sub-contractor and approved by the Engineer prior to erection. The nominated Sub-contractor shall provide, for approval, two sets of properly detailed calculations supporting the designs. These drawings shall also show details and position of holding down bolts.

Lightning Protection

Where present lightning protection is found inadequate or obsolete, the water tower structures are to be re-earthed so that the maximum resistance to earth is 10 ohms. At a position at the base of the tower a test clamp shall be fitted and from this test clamp a copper strip 25 mm x 3.2 mm shall be installed to the earth rod. The earth rod shall consist of a 12 mm dia. hard drawn copper rod approx. 2.5 metres long. The head of the earth rod shall be located in a concrete inspection pit, complete with cover.

Pipes and Pipework Fittings

Where required by the Engineer or shown on Drawings each tank or each compartment shall be fitted with inlet, outlet, overflow and scour pipework.

All overflow pipes shall be mosquito proofed with fine meshed gauge fitted covering the pipe opening inside the reservoir, fixed with galvanised wire tightly bound or otherwise to the satisfaction of the Engineer.

All pipes and fittings shall be flanged ductile iron or steel and shall comply with the specification for pipes and fittings contained elsewhere in this specification. Suitably designed pipework supports shall be provided in order to minimise pipeline stresses. After erection all pipework shall be painted externally with two coats of a suitable primer and two coats of a thixotropic aluminium based barrier coating paint.

Geomembrane Lining to Water Reservoirs

If indicated in the bills of quantities, any geomembrane lining shall be suitable for potable water, and comprise an ultra - violet light resistant high density polyethylene (HDPE) to SSRN 307, suitable for onsite fusion/extrusion welding. It shall be provided in seam free rolls of at least 7 m width, and of thickness not less than 500 micrometres, and breaking strength not less than 180 N/25 mm. When used to line compacted earth or sand, it shall be underlain by an appropriate geotextile layer. It shall be provided rolled on hollow cores of diameter not less than 150 cm, and each roll shall be provided with slings to assist handling on site. The length of rolls shall be such that only longitudinal welds between rolls are required. In situ jointing shall be undertaken by a person or persons well experienced in the technique and approved by the manufacturer. The Contractor will have specified both the proposed manufacturer, and provided full details of laying and jointing techniques, complete with examples of previous similar usage in a tropical environment. The material manufacturer shall have a locally based agent of technically proven capability.

Floating Covers to Water Reservoirs

Any cover shall be of chlorosulphonated polyethylene, or other similar and approved geomembrane, mechanically fixed at the edges, and provided with floats. It shall be self-draining under gravity and capable of being suspended on pre - positioned stainless steel wire ropes allowing access when empty for inspection, cleaning etc. It shall be provided to site in rolls and appropriately jointed together on site. In situ jointing shall be undertaken by a person or persons well experienced in the technique and approved by the manufacturer. The Contractor will have specified both the proposed manufacturer, and provided full details of the material, its thickness and properties and of the laying and jointing techniques, complete with examples of previous similar usage in a tropical environment. The material manufacturer shall have a locally based agent of technically proven capability.

Painting of Metalwork

All work shall be carried out in accordance with SSRN 900, 908 and 917, as appropriate.

All paints shall be obtained from an approved manufacturer, and applied strictly in accordance with the manufacturer's instructions. The source of supply shall not be altered without the Engineer's approval. The colour of the paints used shall be to the Engineer's approval and where possible alternate coats shall be of different shades.

Where blast cleaning is specified prior to painting, the cleaned surfaces shall conform to First Quality finish to SSRN 933.

All preparation and painting shall be carried out under dry conditions and on completely clean and dry surfaces.

All preparation and painting at manufacturer's works shall be carried out under cover at a controlled ambient temperature in the range 15 to 21 degrees C. Site painting shall not proceed when the ambient temperature falls below 10 degrees C.

Where surfaces are joined during fabrication, they shall be brought together while the final protective coat is still wet.

After welding and fabrication, all weld areas shall be thoroughly cleaned and touched up as specified with the appropriate priming system.

Coatings and paints used for all structures, including tanks, pipes, valves, flow meters, fittings etc., which are in contact with potable water shall be non-toxic, and shall not foster microbiological growth or give rise to taste, odour, turbidity or discoloration of the water with which they are, or could be in contact.

The Engineer reserves the right to inspect all work prior to painting, and reasonable access shall be given for such inspection at any stage of the work.

Site Painting

Equipment or plant that has to be refurbished on site shall be manually cleaned to the in compliance with SSRN 900, 908 and/or 917 as appropriate.

The protective system shall then, where possible conform to the requirements of Section 2.3 hereof. Any deviation shall be indicated in the appropriate schedule of Part 4.

Types Of Paint Protection

TYPE A (Hot Dip Galvanized)

- (a) Blast clean to first quality finish to SSRN 933.

- (b) Hot-dip galvanized to give a minimum coating weight of 610 g/m² in accordance with SSRN 903.

Finish dry film thickness shall both be less than 85 microns for metals in interiors of buildings and normally dry condition, and 140 microns for other conditions.

NOTE:

All fastenings including bolts, for use with materials having a Type a finish shall be sterilized in accordance with SSRN 934.

TYPE B (Zinc Rich 2-Pack Epoxy Primer and Heavy Duty Epoxy Coal Tar)

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Within 2 hours of blast cleaning apply by airless spray one coat of 2-pack zinc rich epoxy primer, to a finished dry film thickness of not less than 50 microns.
- (c) Apply by airless spray one coat of 2-pack zinc epoxy primer as in (b) above to a finished thickness of not less than 100 microns.
- (d) Apply by airless spray two coats of high build epoxy coal tar, to a final finished dry film thickness of not less than 350 microns.

TYPE C

As type B above but with sufficient number of coats in (d) to give a final finished dry film thickness of not less than 450 microns.

TYPE D (2-Pack Zinc Rich Epoxy Paint)

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Within 2 hours of blast cleaning apply by airless spray one coat of 2-pack zinc rich epoxy primer all as in Type B part (b) above.
- (c) Apply two coats of 2-pack zinc rich epoxy high build matt finish dry film thickness of not less than 300 microns.
- (d) Apply final coat of 2-pack epoxy gloss finish of approved shade to produce a total finished minimum dry film thickness of 350 microns.

Application shall be by airless spray and a minimum of 16 hours shall be allowed between coats.

TYPE E (Epoxy Paint)

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Within 2 hours of blast cleaning, apply by airless spray one coat of high build 2-pack cold cure epoxy resin primer to give a finished dry film thickness of 125 microns.
- (c) After a period of not less than 8 hours from the first coat ('b' above), a finish coat of high build pure epoxy shall be applied by airless spray to give a total dry film thickness of not less than 350 microns.

TYPE F (Epoxy Primer and Chlorinated Rubber Paint)

- (a) Blast clean to First Quality finish to SSRN 933.

- (b) Within 2 hours of blast cleaning, apply by airless spray one coat of 2-pack zinc rich epoxy primer to give a finished dry film thickness of 50 microns.
- (c) Apply 2 coats of 2-pack zinc epoxy high build to a matt finished dry film thickness of 300 microns.
- (d) Apply one coat of chlorinated rubber paint of approved shade to a gloss finished dry film total thickness of not less than 350 microns.

TYPE G (Chlorinated Rubber Paint) - Brush Application

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Apply 2 coats of chlorinated rubber paint primer to give a finished dry film thickness of 100 microns.
- (c) Apply 2 coats of chlorinated rubber based high build undercoat to give a finished dry film thickness of 220 microns.
- (d) Apply 2 coats of chlorinated rubber base gloss finish of approved shade to give a total dry film thickness of 280 microns.

TYPE H (Chlorinated Rubber Paint) - Airless Spray Application

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Apply 2 coats of chlorinated rubber based high build primer to give a finished film thickness of 150 microns.
- (c) Apply 2 coats of chlorinated rubber based high build semi-gloss finish of approved shade to give a total dry film thickness of 300 microns.

TYPE J (Lead Primer and Epoxy Paint)

- (a) Blast clean First Quality finish to SSRN 933.
- (b) Within 2 hours of blast cleaning apply one coat of 2-pack epoxy metallic lead primer to give a finished dry film thickness of 50 microns.
- (c) Apply 2 coats of 2-pack epoxy micaceous iron oxide undercoat to give a total dry film thickness of 150 microns.
- (d) Apply one coat of 2-pack epoxy gloss finish of approved shade to give a total dry film thickness of not less than 180 microns.

TYPE K (Lead Primer and Epoxy Paint for Galvanized Metal)

- (a) Thoroughly clean and degrease.
- (b) Apply one coat of 2-pack epoxy metallic lead primer to give a finished dry film thickness of 50 microns.
- (c) Apply one coat of 2-pack epoxy micaceous iron ore undercoat to give a finished dry film thickness of 120 microns.
- (d) Apply one coat of 2-pack epoxy gloss finish of approved shade to give a total dry film thickness of not less than 155 microns.

TYPE L (Bitumen Coating)

- (a) Blast clean to First Quality finish to SSRN 933 or pickle in hot dilute sulphuric acid.
- (b) After thorough washing, phosphate coating by immersion in a bath of hot dilute phosphoric acid.
- (c) Application of one coat of primer to SSRN 908.
- (d) Hot dip bitumen/bitumen coating applied to give a smooth lining having a minimum dry film thickness of not less than 300 microns.

TYPE M (Electro-zinc Plated and Stove Enamelled)

- (a) Blast clean to First Quality finish to SSRN 933 or pickling in hot dilute sulphuric acid.
- (b) After thorough washing, phosphate coating by immersion in a bath of hot dilute phosphoric acid.
- (c) Electro zinc plated.
- (d) Apply stoved zinc based epoxy primer (incorporating suitable pigments to act as acid scavengers and counteract the formation of adhesion destroying compounds).
- (e) Finishing coat(s) of stoved alkyd enamel to give a high standard of gloss finish of approved shade, and of not less than 150 microns dry film thickness.

TYPE N (Clean and Degrease)

Thoroughly clean using hand, and/or power tools where available, to remove all mill scale, rust and grease.

TYPE P (Lead Primer)

- (a) Blast clean to First Quality finish to SSRN 933.
- (b) Within 2 hours of blast cleaning apply by brush two coats of metallic lead primer to a finished thickness of not less than 100 microns.

TYPE Q (Bitumen Enamel or Coal Tar Enamel Wrappings)

Apply bitumen enamel wrapping or coal tar enamel wrapping in accordance with SSRN 214.

TYPE R (Sealed Sprayed Aluminium Coating)

- (a) Blast clean to First Quality finish to SSRN 933.
Surface preparation shall be in accordance with to SSRN 900.
- (b) Apply suitable primer.
- (c) Apply sprayed - aluminium coating to give a finished dry film thickness of not less than 150 microns.
- (d) Apply suitable pre-treatment primer (e.g. Two-pack polyvinyl butyral or Two-pack polyvinyl butyral/phenolic, containing not less than 85% by weight of zinc tetroxochromate pigment).
- (e) Apply suitable sealer e.g. (Blend of vinyl chloride/acetate copolymers, or Two-pack phenolic binder or Two-pack epoxy or Two-pack polyurethane).

TYPE S (Sealed Sprayed Zinc Coating)

- (a) As in (a) type R.
- (b) As in (b) type R.
- (c) As in (c) type R but using sprayed zinc coating to give a finished dry film thickness of not less than 175 microns.
- (d) As in (d) type R.
- (e) Apply suitable sealer e.g. Silicone resin containing not less than 95% by weight of aluminium pigment.

TYPE T (Decorative Painting)

Decorative paint (when specified) shall be compatible with the final finish paint or coating.

The final shade shall be as recommended by the Engineer.

The film thickness of decorative paint shall not be included in the total dry film thickness specified.

Painting Systems for Metalwork

The applications shall be to the approval of the Engineer but generally in accordance with the schedule below.

Item	Application	Type
1.	All steel ladders, staircases, guardrails, guardrail stands, safety cages, open steel flooring, small bore pipework and steel conduit. All small metalwork such as pipe supports, steel flooring supports and safety chains.	A
2.	All steelwork, castings and other metal surfaces which are immersed in water (non-potable water), sewage, and other effluents, or in contact with liquid or subject to splashing, or buried in the ground.	C
3.	All steel, ductile and cast iron pipes, valves, flow meters and fittings 75 mm diameter and larger, used for the conveyance of sewage and other effluents as in 2 above.	B
4.	All steelwork, castings, pipes, valves flow meters and other surfaces which are exposed (exterior) and frequently damp or wet.	B
5.	As 4 above but in interior of building and normally dry.	D or F
6.	All steel pipes laid underground.	Q
7.	All valves, penstocks, flow meters, tanks and fittings which are in contact with potable water.	E, F or H
8.	Potable water pumping plant installed inside pumping station-normally dry condition.	

Item	Application	Type
	(a) <u>Suction and delivery pipes</u> Internal protection External protection	L E,F or H
	(b) <u>Valves</u> Internal protection External protection	E or L E, F or H
	(c) <u>Pumping Casing</u> Internal protection External protection	E or L E,F or H
	(d) <u>Flow meter (body)</u> Internal protection External protection	E,F or L E,F or H E,F or H
	(e) <u>Extension shaft and couplings</u>	E, F or H
	(f) <u>Pump motor casing and support steelwork</u>	E or H
9.	Screw pumps (screws and shafts) used for potable water.	E or H
10.	Filter internals (potable water)	A
11.	Over painting of galvanized items (not in contact with potable water)	J
12.	Switchboard, multi-motor control panels and other similar enclosures.	M
13.	Metal cable trays, conduits and fixings	A
14.	Section of pipe to be built into concrete.	N
15.	All steelwork and castings in contact with potable water	A, D, E, F or H

Repair of Damaged Paintwork Coatings

Any damage to the protective coating shall be made good as soon as possible, and shall not be left until the time of general finish painting. Damaged areas shall be cleaned down to bright metal by power wire brushing or sanding and feathered off to the surrounding area. A new protective system approved by the Engineer shall then be applied generally following the requirements of the system originally applied, modified if necessary to comply with the recommendations of the manufacturer of the protective materials used.

Metalwork Surface Preparation Prior to Painting

Surface preparation shall conform generally to SSRN 900, 903 or 917 as appropriate, together with any additional preparation recommended by the paint manufacturer, and/or approved by the Engineer.

Prior to painting, protective coatings shall be thoroughly cleaned, degreased, and washed with clean water.

Where steelwork has been delivered with zinc rich epoxy primer and has been allowed to weather, the primed surface shall be washed with clean water to remove zinc salts and allowed to dry.

Site Painting During Erection of Metalwork

Site connections shall be given a second coat and be brought together wet. Where the finishing paint has been subject to damage during transit or erection, the areas affected shall be cleaned, repaired, and re-painted generally following the requirements of the system originally applied.

Painting of Steel Tanks and Tower Supports

(a) General

This clause shall be read in conjunction with the following sub-clauses described above, Cl. 14 "Painting of Metalwork", Cl. 617 "Repair of damaged paintwork coatings", Cl. 618 "Metalwork surface preparation prior to painting", Cl. 619 "Site painting during erection of metalwork"

(b) Painting internal tank surfaces with bitumen based paints

Internal surfaces of panel tanks shall be prepared by power brushing to remove all rust, scales and loose paint to the approval of the Engineer. Sand blasting shall not be allowed for tank panel unless if directed otherwise by the Engineer. On the prepared surface 2 coats of a bitumen based paint such as a single component, liquid coating, based on a blend of bitumen and solvents e.g. "Igol A" or a thixotropic high build fast drying bituminous coating e.g. "Intex No. 1", shall be applied in strict accordance with the manufacturer's specifications.

(c) Painting surfaces with epoxy paints

The surfaces shall be prepared as indicated in the Bill of Quantities. For steel hand rails, walkways, stairs and steel sections, this shall involve mechanical brushing. Sand blasting shall not be allowed for tank panels unless if directed otherwise by the Engineer. On the prepared surface 2 coats of an epoxy paint (a 2-component, solvent-free coating material based on epoxy resins) e.g. "Sika guard 63", shall be applied according to the manufacturer's instructions.

(d) Painting of steel tower frames with aluminium paint

Removal of soil deposits at the base of tower shall be done prior to cleaning entire surfaces including corners and edges, ladder, platforms etc. by wire brushing mechanically to the satisfaction of the Engineer. Alternatively surfaces may be prepared by blast cleaning to remove all rust and loose paint. Cleaned surfaces shall be painted with 2 coats of a suitable primer such as red oxide primer followed by 2 coats of an approved bituminous aluminium paint according to the manufacturer's instructions.

(e) Painting surfaces with oil-based gloss paint

Surfaces shall be cleaned by mechanical wire-brushing. Where surfaces are buried the material should be excavated and the surface cleaned using water and brush and after the surface is dry it shall be cleaned of all rust and loose paint by power-brushing. Cleaned surfaces shall then be painted with 2 coats of a suitable primer such as red oxide followed by 2 coats of an approved oil based gloss paint. The final shade shall be as recommended by the Engineer.

Insulation of Dissimilar Metals

Where dissimilar metals are likely to be in contact with each other a suitable insulating barrier shall be incorporated to prevent galvanic action occurring. This shall be to the approval of the Engineer.

Expanding Rawl Bolts

These Bolts shall be expanding type and be made of stainless steel. Drilled or punched holes shall not be greater than 1.5 mm more than the bolt diameter and the depth shall be sized to suit the length of the bolt. The holes shall be cleaned of any loose material and rough edges before the bolts are fitted. Washers shall be at least 2.5 x the bolt diameter. Washers should be fitted under each bolt head.

CONCRETE WORKS

General

(a) **Code of practice**

All workmanship, materials, tests and performances in connection with the reinforced concrete work are to be in conformity with the latest edition of British Standard Code of Practice (B.S. 8110 for "Structural Use of Concrete") where not inconsistent with these specifications.

(b) **Contractor's plant**

Not less than 30 days prior to the installation of the Contractor's plant and equipment for processing, handling, transporting, storing and proportioning ingredients, and for mixing, transporting and placing concrete, the Contractor shall submit drawings for approval by the Client Engineer, showing proposed general plant arrangements, together with a general description of the equipment he proposes to use.

After completion of installation, the operation of the plant and equipment shall be subject to the approval of the Client Engineer.

Materials

Cement

Cement, unless otherwise specified, shall be Portland cement of the Blue Triangle brand, or Bamburi Portland Cement brand, Mombasa cement brand or any other brand which comply with the requirements of B.S.12 and is approved by the Client Engineer. The cement shall not contain reactive volcanic ash (of not more than 10% of total weight) and the quantity of insoluble residue permitted in B.S. 12 may be exceeded. A manufacturer's Certificate of Test in accordance with B.S. shall be supplied for each consignment delivered to site.

Should the Contractor require using cement of the rapid hardening variety, he shall obtain the approval of the Client Engineer and also obtain any instructions regarding the modifications to the preambles caused thereby. Any additional cost that may be caused by the use of the rapid hardening cement shall be at the Contractor's expense.

Cement may be delivered to site either in bags or in bulk. If delivered in bags, each bag shall be properly sealed and marked with the manufacturer's name and on the site is to be stored in a weather-proof shed of adequate dimensions with a raised floor. Each consignment shall be kept separate and marked so that it may be used in the sequence in which it was received. Any bag found to contain cement which has set or partly set shall be completely discarded and not used in the Works. Bags shall not be stored more than 1500 mm in height.

If delivered in bulk the cement shall be stored in a weather-proof silo either provided by the cement supplier or by the Contractor, but in either case the silo shall be to the approval of the Engineer.

Aggregates

The aggregates shall conform to the requirements of B.S. 882 and the sources and all types of all aggregates are to be approved in all respects by the Client Engineer before work commences.

The grading of aggregates shall be one within the limits set out in B.S. 882 and as later specified and the grading, once approved, shall be adhered to throughout the Works and not varied without the approval of the Client Engineer. Fine aggregate shall be clean, coarse, siliceous sand of good, sharp, hard quality and shall be free from lumps of stone, earth, loam, dust, salt, organic matter and any other deleterious substances. It shall be graded within the limits set out in zone 1 or 2 of B.S. 882.

Coarse aggregate shall be good, hard, clean approved black trap or similar stone, free from dust, decomposed stone, clay, earthy matter, foreign substances or friable thin elongated or laminated pieces. It shall be graded within the limits of Table 1 of B.S. 882 for its respective nominal size.

If in the opinion of the Client Engineer the aggregate meets the above requirements, but is dirty or adulterated in any manner it shall be screened and/or washed with clean water if he so directs at the Contractor's expense.

Aggregates shall be delivered to the site in their prescribed sizes or grading and shall be stockpiled on paved areas or boarded platforms in separate units to avoid intermixing.

Fine aggregate

Fine aggregate shall be sand free from impurities and complying with British Standard No. 882. Grading zone 2 of Table 2.

Coarse aggregate

Coarse aggregate shall be hard crushed rock free from impurities and complying with British Standard No. 882 "graded aggregate" 20 mm to 5 mm nominal size as Table 1.

Water

Water for concrete shall be free from impurities, complying with BS 3148

Hardcore

Hardcore for filling under floors shall be good, hard stone ballast or quarry waste, to the approval of the Client Engineer, broken to pass through not greater than a 150 mm ring or to be 75% of the finished thickness of the layers being compacted, whichever is the lesser. Hardcore shall be free from all weeds, roots, vegetable soil, clay, black cotton soil or other unstable materials.

It shall be graded with smaller stones and fine materials to give a dense compact mass after consolidation. Sufficient fine material shall be added to each layer to give gradation of material as necessary to obtain a solid compact mass after rolling. Hardcore filling is to be laid in layers each of a consolidated thickness not exceeding 250 mm. Each layer shall be compacted by at least 8 passes of a 10-tonne smooth-wheeled roller or a 2-tonne vibrating roller until all movement ceases. Sufficient water is to be added to obtain maximum compaction to the Client Engineer's approval. To each layer a 25 mm thick layer of sand complying with the specification of fine aggregate for concrete shall be spread over the surface and forced into the hardcore by the use of a vibrating roller weighing not less than 2 tones. This operation should be carried out when the materials are dry and repeated whilst the sand is well watered. Should all the sand be absorbed the Client Engineer may require a further layer to be applied and the process repeated.

The top surface of the hardcore shall be levelled or graded to fall as required, and shall then be blinded with a layer of similar material broken to 25 mm gauge and finished with a 10-tonne smooth-wheeled roller. The surface so obtained shall be to the Engineer's approval.

Compacted hardcore

The sub-grade shall be compacted by a smooth-wheeled roller of 8 to 10 tonnes weight or the vibrating roller of minimum 1300 Kg., or other approved plant. The number of coverage shall be at least 10 and there shall be a 50% overlap of successive coverage. If so instructed by the Engineer, water shall be added during compaction to obtain optimum water content. Filling shall be compacted as above but in maximum 200 mm deep layers.

Sand

The sand shall be as described for fine aggregate but that for plastering shall be light in colour and well graded to a suitable fineness in accordance with the nature of work in order to obtain the finish directed.

Finishes

General

The Contractor will be required from an early stage in the contract to prepare samples, for the approval of the Client Engineer, of the various concrete finishes specified hereafter. Samples are to be prepared using the same materials and the same methods of construction, compaction, curing, etc. as the Contractor proposes to use for executing the full quantity of the work. A record of the mix, water content, method of compaction, any additives used, etc., is to be kept for each sample prepared. When the Client Engineer has approved a sample it will be kept on site in an approved location. The finishes in construction will be expected to be up to a standard equal to the approved sample. Consistency in cement colour, and the colour, grading and quality of aggregates must be maintained in all finished concrete work.

Mortars

Cement mortar shall consist of one part of Portland cement to three parts sand by volume. The cement/lime mortar shall consist of one part of Portland cement, one part of lime and six parts of sand by volume.

The ingredients of mortar shall be measured in proper gauge boxes on a boarded platform, the ingredients being thoroughly mixed dry, and again whilst adding water. In the case of cement/lime mortar, sand and lime shall be mixed first and then the cement added.

All mortar is to be thoroughly mixed to a uniform consistency with only sufficient water to obtain a plastic condition suitable for towelling. No mortar that has commenced to set is to be used or re-mixed for use.

Tamped finish

Areas so specified shall be finished at the time of casting with a tamped finish to the Engineer's approval produced by an edge board. Board marks are to be made to a true pattern and will generally be at right angles to the traffic flow. Haphazard or diagonal tamping will not be accepted.

Fair face

Fair face surfaces shall be clean, smooth, even, true to form, line and level, and free from all board marks, joint marks, and honey combing, pitting, and other blemishes. Forms are to be provided with a smooth lining of plywood, steel, or other approved material which will achieve the required finish without any general rubbing down. Rubbing down will only be permitted to remove any projecting fins at corners or joints.

Fine face

Fine face surfaces shall be for Fair face above, but to a higher standard obtained from forms provided with an impervious sheet lining of metal or plastics faced plywood in large panels arranged in an approved pattern. Rubbing down shall only be permitted after an inspection by the Client Engineer. The finished surfaces shall be capable of receiving a painted finish.

Chisel-dressed finish

Chisel-dressed finish is to be carried out on any grade of concrete but not until it is at least 30 days old. The surfaces are to be fully chisel-dressed to remove a maximum of 12 mm (average 9 mm) of the surface by shearing and exposing the aggregate without excessive cracking of the surrounding matrix. Arises of columns, beams, etc., are pre-formed fair face with timber fillets set in the formwork and care must be taken in working up to these to preserve a clean line.

For vertical surfaces of walls and columns particular care must be taken to remove all sharp projections. For beam soffits this requirement is not necessary. All surfaces requiring this treatment are to have margins chisel-dressed by hand for a minimum width of 75 mm commencing from the fillet edge. Thereafter, mechanical chisel-dressing may be used, but the Contractor must ensure that a uniform texture and even plane surface is achieved. The use of sharply pointed steel tools for both hand and mechanical chisel-dressing is essential. Upon completion the surfaces are to be thoroughly wire brushed and washed down.

Protection of finishes

Wherever possible, in-situ exposed concrete finishes should be commenced at the highest level and worked progressively down the building. Precaution shall be taken to avoid staining or discoloration of previously finished concrete faces by leakage of grout from newly placed concrete. The Contractor shall, during all stages of construction, adequately protect all concrete finishes from Damage by leaking grout, knocking, paint stains, falling plaster, etc. In cases of balustrade walls to staircases and members where Damage is otherwise likely, concrete finishes shall be protected by cladding with timber, Celotex, or other approved sheeting. All Sub-contractors shall be informed accordingly on the precautions to be taken.

Blinding

All blinding concrete to be 1:3:6, or as otherwise instructed by the Client Engineer in writing.

Formwork

The method and system of formwork which the Contractor proposes to use shall be approved of by the Client Engineer before construction commences. Formwork shall be substantially and rigidly constructed of timber or steel or pre-cast concrete or other approved

material.

All timber for formwork shall be good, sound, clean, sawn, well-seasoned timber, free from warps and loose knots and of scantings sufficiently strong for their purpose.

Construction of formwork

All formwork shall be of sufficient thickness and with joints close enough to prevent undue leakage of liquid from the concrete and fixed to proper alignment, level and plumb and supported on sufficiently strong bearers, shores, braces, plates etc. properly held together by bolts or other fastenings to prevent displacement, vibration or movement by the weight of materials, men and plant on same and so wedged and clamped as to permit easing and removal of the formwork without jarring the concrete. Where formwork is supported on previously constructed portions of the reinforced concrete structural frame, the Contractor shall by consultation with the Client Engineer ensure that the supporting concrete is capable of carrying the load and/or sufficiently propped from lower floors or portions of the frame to permit the load to be temporarily carried during construction.

Soffits shall be erected with an upward camber of 5 mm for each 5 meters of horizontal span or as directed by the Client Engineer.

Great care shall be taken to make and maintain all joints in the formwork as tight as possible, to prevent the leakage of grout during vibration. All faulty joints shall be caulked to the Client Engineer's approval before concreting. The formwork shall be sufficiently rigid to ensure that no distortion or bulging occurs under the effects of vibration. If at any time the formwork is insufficiently rigid or in any way defective the Contractor shall strengthen or improve such formwork as the Client Engineer may direct.

The Contractor's attention is drawn to the various surface textures and applied finishes required and the faces of formwork next to the concrete must be of such material and construction and be sufficiently true to provide a concrete surface which will in each particular case permit the specified surface treatment or applied finish.

All surfaces which will be in contact with concrete shall be oiled or greased to prevent adhesion of mortar. Oil or grease shall be of a non-staining mineral type applied as a thin film before the reinforcement is placed. Surplus moisture shall be removed from the forms prior to placing of the concrete.

Temporary openings shall be provided at the base of columns, wall and beam forms and at any other points where necessary to facilitate cleaning and inspection immediately before the pouring of concrete. Before the concrete is placed the shuttering shall be trued-up and any water accumulated therein shall be removed. All sawdust, nails, chips and other debris shall be washed out or otherwise removed from within the formwork. The reinforcement shall then be inspected for accuracy of fixing. Immediately before placing the concrete the formwork shall be well wetted and inspection openings shall be closed. The erection, easing, striking and removing of all formwork must be done under the personal supervision of a competent foreman, and any Damage occurring through faulty formwork or its incorrect removal shall be made good by the Contractor at his own expense.

After removal of formwork, all projections, fins etc., on the concrete surface shall be chipped

off, and made good to the requirements of the Client Engineer. Any voids or honeycombing shall be treated as described in "Faulty Concrete".

Stripping formwork

All formwork shall be removed without undue vibration or shock and without Damage to the concrete. No formwork shall be removed without the prior consent of the Engineer and the minimum periods that shall elapse between the placing of the concrete and the striking of the formwork will be as follows:

Beam sides, wall and columns	2 days
Slab Soffits (props left under)	3 days
Beam Soffits	7 days
Removal of props (partly subject to 7 days Concrete cube strength being satisfactory) to:	

Slabs	10 days
Beams	14 days
Cantilevered Beams and Slabs	28 days

If the Contractor wishes to take advantage of the shorter stripping times permitted for beams and slab soffits when props are left in place, he must so design his formwork that sufficient props are agreed with the Client Engineer can remain in their original positions without being moved in any way until the expiry of the minimum time for removal of props. Stripping and re-propping will not be permitted.

The above times may be reduced in certain circumstances, at the discretion of the Engineer provided an approved method is adopted at the Contractor's expense to ensure that the required concrete strength is attained before the forms are stripped.

Solid strips in composite slabs shall be considered as beams. The tops of retaining walls shall be adequately supported with stout raking props at intervals required by the Engineer. These props are not to be removed until 7 days after casting of the floor slab is over.

Supporting props to wall and beam soffits

When directed by the Client Engineer, supporting props to wall and beam soffits are to be left in position until the completion of the whole of the reinforced concrete structure. The props are to be to the approval of the Engineer and the Contractor must submit the suggested method of propping to the Engineer prior to removal of formwork to the relevant surfaces.

Concrete mixes

Concrete to be used shall be of the classes specified in "Ministry of Works standard Specification" Section 17.

Class	Nominal mix	Trial Strength in N/mm ²		Where used in this Contract
		7 day	28 day	
15	1:3:6	13	19.5	Surround to pipes
25	1:2:4	25	32.5	Spillway lining, walls

Concrete mixing and placing

The concrete shall be mixed only in approved power-driven mixers of a type and capacity suitable for the work, and in any event not smaller than 0.04/0.28 cubic meter capacity. The mixer shall be equipped with an accurate water measuring device. All materials shall be thoroughly mixed dry before water is added and the mixing of each batch shall continue for a period of not less than two minutes after the water has been added and until there is a uniform distribution of the materials and the mass is uniform in colour.

The entire contents of the mixed drum shall be discharged before recharging. The volume of mixed material shall not exceed the rated capacity of the mixer. Whenever the mixer is started, 10% extra cement shall be added to the first batch and no extra payment will be made on this account.

As a check on concrete consistency slump tests may be carried out and shall be in accordance with B.S. 1881. The Contractor shall provide the necessary apparatus and carry out such tests as are required. The slump of the concrete made with the specified water content, using dry materials, shall be determined and the water to be added under wet conditions shall be so reduced as to give approximately the same slump.

The concrete shall be mixed as near to the place where it is required as is practicable, and only as much as is required for a specified section of the work shall be mixed at one time, such sections being commenced and finished in one operation without delay. All concrete must be efficiently handled and used in the Works within twenty (20) minutes of mixing. It shall be discarded from the mixer direct either into receptacles or barrows and shall be distributed by approved means which do not cause separation or otherwise impair the quality of the concrete. Approved mechanical means of handling will be encouraged, but the use of chutes for placing concrete is subject to prior approval of the Client Engineer.

Concrete shall be placed from a height not exceeding 1,500 mm directly into its permanent position and shall not be worked along the shutters to that position. Unless otherwise approved, concrete shall be placed in a single operation to the full thickness of slabs, beams, and similar members, and shall be placed in horizontal layers not exceeding 1,500 mm deep in the walls and similar members.

Concrete in columns may be placed to a height of 4 meters with careful placing and vibration and satisfactory results. Where the height of the column exceeds 4 meters suitable openings must be left in the shutters so that this maximum lift is not exceeded.

Concrete shall be placed continuously until completion of the part of the work between construction joints as specified hereinafter or of a part of the approved extent. At the completion of a specified or approved part a construction joint of the form and in the

positions hereinafter specified shall be made. If stopping of concrete be unavoidable elsewhere, a construction joint shall be made where the work is stopped. A record of all such joints shall be made by the Contractor and a copy supplied to the Client Engineer.

Any accumulation of set concrete on the reinforcement shall be removed by wire brushing before further concrete is placed. The Contractor shall provide runways for concreting to the satisfaction of the Client Engineer. Under no circumstances will the runways be allowed to rest on the reinforcement. Care shall be taken that the concrete is not disturbed or subjected to vibrations and shocks during the setting period. Mixing machines, platforms and barrows shall be clean before commencing mixing and be cleaned on every cessation of work. Where concrete is laid on hardcore or other absorbent materials, the base shall be suitable and sufficiently wetted before the concrete is deposited.

Works cube tests

Work cubes are to be made at intervals as required by the Client Engineer in accordance with C.P. 114, and the Contractor shall provide a continuous record of the concrete work. The cubes shall be made in approved 150 mm moulds in strict accordance with the Code of Practice. Three cubes shall be made on each occasion. Each cube shall be marked with a distinguishing number (numbers) to run consecutively and the date, and a record shall be kept on site giving the following particulars:-

- a) Cube No.
- b) Date made
- c) Location in work
- d) 7-Day Test, Date, Strength
- e) 28-Day Test, Date, Strength

Cubes shall be forwarded, carriage paid, to an approved Testing Authority, in time to be tested two at 7 days and the remaining one at the discretion of the Client Engineer. No cube shall be dispatched within three days of casting. Copies of all Works Cube Tests shall be forwarded to the Client Engineer and one shall be retained on site. If the strengths required above are not attained and maintained during the carrying out of the contract, the Contractor will be required to increase the proportion of cement and/or substitute better aggregates so as to give concrete which does comply with the requirements of the contract. The Contractor may be required to remove and replace at his own cost any concrete which fails to attain the required strength as ascertained by Works Cube Tests.

Compaction

At all times during which the concrete is being placed, the Contractor shall provide adequate trained and experienced labour to ensure that the concrete is compacted in the forms to the satisfaction of the Client Engineer. Concrete shall not be placed at a rate greater than will permit satisfactory compaction or to a depth greater than 400 mm before it is compacted.

During and immediately after placing, the concrete shall be thoroughly compacted by means of continuous tamping, spading, slicing and vibration. Vibration is required for all concrete of classes 40, 35, 25, and 20. Care shall be taken to fill every part of the forms, to work the

concrete under and around the reinforcement without displacing it to avoid disturbing recently placed concrete which has begun to set. Any water accumulating on the surface of newly placed concrete shall be removed and no further concrete shall be placed thereon until such water is removed.

Internal vibrators shall be of a frequency not less than 7000 cycles per minute and shall have a rotating eccentric weight of at least 0.05 Kg. with an eccentricity of not more than 12 mm. Such vibrators shall visibly affect the concrete within a radius of 250 mm from the vibrator. Internal vibrators shall not be inserted between layers of reinforcement less than one and one half times the diameter of the vibrators apart. Contact between the vibrators and reinforcement, and vibrators and formwork shall be avoided. Internal vibrators shall be inserted vertically into the concrete at not more than 500 mm centres and shall be moved constantly from place to place. No internal vibrator shall be permitted to remain in any one position for more than ten seconds and it shall be withdrawn very slowly from the concrete.

In consolidating each layer of concrete the vibrating head shall be allowed to penetrate and re-vibrate the concrete in the upper portion of the underlying layer. In the area where newly placed concrete in each layer joins previously placed concrete more than usual vibration shall be performed, the vibrator penetrating deeply at close intervals along these contacts. Layers of concrete shall not be placed until layers previously placed have been vibrated thoroughly as specified. Vibrators shall not be used to move concrete from place to place in the formwork.

At least one internal vibrator shall be of the high frequency, low amplitude type applied with the principal direction of vibration in the horizontal plane. They shall be attached directly to the forms at no more than 1200 mm centres. In addition to internal and external vibration the upper surface of suspended floor slabs shall be levelled by tamping or vibrating to receive finishes. Vibrating elements shall be of the low frequency high amplitude type operating at a speed of not less than 3000 r.p.m.

Curing and protection

Care must be taken that no concrete is allowed to become prematurely dry and the fresh concrete must be carefully protected, within two hours of placing, from rain, sun and wind by means of Hessian sacking, polythene sheeting, or other approved means. This protective layer and the concrete itself must be kept continuously wet for at least 7 days after the concrete has been placed. The contractor will be required to provide complete coverage of all fresh concrete for a period of 7 days. Hessian or polythene sheeting shall be in the maximum widths obtainable and shall be secured against wind. The Contractor will not be permitted to use old cement bags, Hessian or other materials in small pieces.

Concrete in foundations and other underground work shall be protected from admixture with falling earth during and after placing. Traffic or loading must not be allowed on the concrete until the concrete is sufficiently matured, and in no case shall traffic or loading be of such magnitude as to cause deflection or other movement in the formwork or Damage to the concrete members. Where directed by the Client Engineer props may be required to be left in position under slabs and other members for greater periods than those specified hereafter.

Faulty concrete

Any concrete which fails to comply with these specifications, or which shows signs of setting before it is placed shall be taken out and removed from site. Where concrete is found to be defective after it has set, the concrete shall be cut out and replaced in accordance with the Client Engineer's instructions. On no account shall any faulty, honeycombed, or otherwise defective concrete be repaired or patched until the Client Engineer has made an inspection and issued instructions for the repair. The whole cost whatsoever, which might be occasioned by the need to remove faulty concrete, shall be borne by the Contractor.

Pre-cast units

Pre-cast reinforced concrete slabs to be made to sizes as shown in the Drawings. Slabs to be cast with Grade 25 concrete in approved formwork, suitably vibrated and cured for 28 days before use.

REINFORCEMENT

Material

Reinforcement shall be as specified by the Client Engineer.

Bending and placing reinforcement

Reinforcement shall be cleaned before placing and secured with space blocks in the correct position. It shall be bound with suitable wire and have such cover as shown on the drawings.

Strength of reinforcement

Characteristic strengths of reinforcement are as given in B.S. 4449, 4461, and 4483. Refer to 503.

Rod reinforcement

The steel reinforcement shall comply with the latest requirements of the following British Standards:-

Hot Rolled bars for the Reinforcement of concrete to B.S. 4449 (metric units)

Cold worked steel for the reinforcement of concrete to B.S. 4461 (metric units)

The Contractor will be required to submit a test certificate of the rolling. Reinforcement shall be stored on racks above ground level. All reinforcement shall be free from loose mill scale or rust, grease, paint or other substances likely to reduce the bond between the steel and the concrete.

BRC

The BRC should be electrically cross-welded steel wire mesh reinforcement to B.S. 4483: 1969, or as directed by the Client Engineer, and of the size and weight specified in the Drawings.

The fabric shall be free from scale, dust, rust, grease or other substance likely to reduce the bond between the steel and the concrete and shall be laid with a minimum 300 mm laps and bound with No. 18 S.W.G. annealed iron wire.

Fixing reinforcement

Reinforcement shall be accurately bent to the shapes and dimensions shown on the Drawings and in accordance with B.S. 4466 (1969). Reinforcement must be cut and bent cold and no welded joints will be permitted, unless so detailed. Reinforcement shall be accurately placed as shown on the Drawings, and before and during concreting, shall be secured against displacement by using No. 18 S.W.G. annealed binding wire or suitable clips at intersections, and shall be supported by concrete or metal supports, spacers or metal hangers to ensure the correct position. No concreting shall be commenced until the Client Engineer has inspected the reinforcement in position and until his approval has been obtained and Contractor has given two clear days' notice of intention to concrete.

The Contractor is responsible for maintaining the reinforcement in its correct position, according to the drawings, before and during concreting. During concreting, a competent steel fixer must be in attendance to adjust and correct the position of any reinforcement which may be displaced. The vibrators are not to come into contact with the reinforcement.

Position and correctness of reinforcement

Irrespective of whether any inspection and/or approval of the fixing of the reinforcement has been carried out as in C above, it shall be the Contractor's sole responsibility to ensure that the reinforcement complies with the details on the Drawings and is fixed exactly in the positions shown therein and in the positions to give the prescribed cover. The Contractor will be held entirely responsible for any failure or defect in any portion of the reinforced concrete structure and including any consequent delay, claims, third party claims. etc., where it is shown that the reinforcement has been incorrectly positioned or is incorrect in size or quantity with respect to the detailed Drawings.

Concrete cover to reinforcement

Unless otherwise directed, the concrete cover to rod reinforcement over main bars in any face shall be:-

Foundations against blinding	50 mm
Strip foundations	40 mm
Columns/Floor slab	40 mm
Beams	25 mm

Projecting reinforcement

Where reinforcement projects from a concreted section of the structure and this reinforcement is expected to remain exposed for some time, it is to be coated with a cement grout to prevent rust staining on the finished concrete. This grout is to be brushed off the reinforcement prior to the continuation of concreting.

Fixtures

No openings, chases, holes or other voids shall be formed in the concrete without the prior approval of the Client Engineer. Details of any fixtures to be permanently built into the concrete including the proposed position of all electrical conduits 25 mm and over in diameter shall be submitted to the Client Engineer for his approval before being placed.

Chases, holes, etc., in concrete

The Contractor shall be responsible for the co-ordination with the Electrical and other Sub-Contractors for incorporating electrical conduits, pipes, fixing blocks, chases and holes in concrete members as required and must ensure that adequate notice is given to such Sub-Contractors informing them when concrete members incorporating the above are to be poured. The Contractor shall submit full details of these items to the Engineer for approval before the work is put in hand. All fixing blocks, chases, holes, etc., to be left in the concrete shall be accurately set out and cast with the concrete. Unless otherwise instructed by the Client Engineer, all electrical conduit to be positioned within the reinforced concrete shall be fixed inside the steel cages of beams and columns and between the top and bottom steel layers in the slabs and similar members.

The proposed position of all electrical conduits 25 mm and over in diameter which are to be enclose in the concrete shall be shown accurately on a plan to be submitted to the Engineer, whose approval shall be obtained before any such conduit is placed.

MISCELLANEOUS

FENCING

The fencing shall be as detailed on the Drawings, and in general shall follow the recommendations set out in BS 1722, unless otherwise indicated.

Straining posts shall be 100 mm x 100 mm x 3 m long of reinforced concrete, and struts shall be 100 mm x 100 mm x 2.6 m long of reinforced concrete.

Straining posts to be provided at all ends, corners and changes of direction or acute changes of level and at intervals not exceeding 60 m in straight lengths, each shall be strutted in each line of fence.

Holes for straining posts shall be 450 mm square in plan and for struts 500 mm x 300 mm. All straining posts shall be set in foundation concrete for the full size of hole in plan and half the depth of the hole.

GATES

The gates shall be as detailed on the Drawings. They shall be complete with a sliding padbolt locking device and gate stops.

The gates shall be primed with calcium plumbate and painted with three coats of approved oil paint.

SPECIAL SPECIFICATIONS

1) Location of Works and Access to Site

The works site is located about 34 kilometers from the Magadi. The property lies along Ngoromara road in Koriamat area within the survey map of Kenya sheet no. 160/2 on 1:50,000 Scale.

Suitable site at an approximate co-ordinate 37M 0195102 and UTM 9819572 at an approximate elevation of 955 meters above mean sea level.

2) Scope and nature of Works

As attached in the BOQ the scope of works include;

1. Conducting a hydrogeological and EIA study and permit application
2. Drilling of borehole approximate depth 200m
3. Equipping of Borehole (pump running on solar)
4. Construction of 20m³ steel storage tank, 8 m high
5. Construction of cattle watering trough and two number stand pipes

3) Work Procedure

- i. The Contractor should submit a detailed program of works to the Engineer before commencement of the works.
- ii. For any shift working the contractor must ensure there is adequate professional supervision that will guarantee quality workmanship and safety of personnel.

4) Price, Measurement

- i. The Contractor rates are assumed to cover all preliminaries anticipated in the works including provision for client's safety requirements, site offices, workmen accommodation & transport and insurance cover. In fixing his rates, the contractor may wish to take note of a 3% withholding tax chargeable on each invoice submitted.
- ii. The rates quoted by the contractor shall be deemed to cover all costs of works as specified and/or as shown on the drawings, including the cost of delivery to site or other agreed place(s) and making good the site after the works.
- iii. Prices shall include for erection, labour, scaffolding and other erection equipment/plant necessary and covering the cost of additional requirements to properly execute the works to the satisfaction of the client.
- iv. Payment for drilling works shall be subject to the bidder having obtained a productive borehole based on his hydro-geological report.

5) Assessment of Contractors Personnel

- i. The Engineer will require the Contractor to submit a list of professional and sub-professional personnel to be employed on the site, stating their qualifications and experience. The Contractor shall notify the Engineer at least 14 days in advance on any key personnel transfer or replacement. No transfer of staff shall be effected unless the Engineer grants permission in writing authorizing such transfers or replacement.
- ii. The Engineer reserves the right to determine suitability of persons employed by the Contractor and may request replacement at any time of any members of Contractor's team if in the opinion of the Engineer; the presence of such a person is detrimental to the execution of the Contract. The Engineer shall give written notice to the Contractor stating his reasons substantiating the request for removal of such persons. The Engineer's decision shall be final and binding.

6) Plant and Equipment

If in the opinion of the Engineer the plant or equipment used by the Contractor for any specific item of work does not fulfill the requirements of the specification, in respect of workmanship, quality and safety of structures, such item of plant shall be replaced with the same or equivalent item to the satisfaction of the Engineer. No extra payment shall be made in respect of such replacement.

7) Notice of Operations

The Contractor shall from time to time supply to the Engineer in writing full information with respect to locations in which any material for the work is being prepared. Such general notices will enable arrangements for checking the works.

8) Working Hours

At the commencement of the Contract, the Contractor shall submit to the Engineer in writing the hours that shall be considered normal working hours. When approved, the working hours shall be maintained throughout the continuance of the Contract. Where the Contractor wishes to work outside these hours, he shall obtain written permission from the Engineer at least 24 hours in advance to enable the Engineer make a provision for proper inspection of the works.

9) Faulty Works

Any work that fails to comply with the specifications shall be rejected and the Contractor will at his expense make good any default as directed by and to the satisfaction of the Engineer.

10) Communication

- i. All instructions and communications relating to this contract shall flow from the Employer or a person to whom the Employer delegates the authority to issue such communication. Instruction given by the Employer shall be in writing, provided that if for any reason the Employer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Employer, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Employer any oral instruction of the Employer and such confirmation is not contradicted in writing within 7 days by the Employer, it shall be deemed to be an instruction of the Employer.
- ii. All communication to the Contractor will be directly to the Contractor or through a nominated contact person(s). The name(s) of the contact person(s) should be advised prior to awarding of the contract.
 - The Contractor's nominated person must be capable of communicating in both English and Kiswahili languages
 - There will be regular meetings between both parties to review the progress of the contract and address all issues outstanding. Each meeting must be properly documented in writing and circulated to both parties.
 - Inspection of the works/services being provided will be undertaken by the Employer in the presence of the Contractor at a time mutually agreed.

11) Payment Terms

- i. The basis for actual payment of any item shall be measured quantity of work actually done multiplied with the rate for the said item. Any variation from the original quantity on which the quotation was made which results in either an increase or decrease in the measured quantity of work as completed shall cause appropriate additions or deductions to the quotation.
- ii. Any written instructions from the Engineer that may result in additional work over and above that for which the Contractor quoted will be considered as extras and shall be paid for on the basis of measured additional quantity based on the prevail contract rate.
- iii. The Contractor shall be paid the agreed sum for services rendered provided the services have been completed to the satisfaction of the Employer. No payment will be made if the work has not been completed to the agreed standards.
- iv. The Contractor must submit his/her invoice against which the Employer shall effect payment. Payment will be made within thirty (30) days from the date of the invoice.

- v. No advance payment will be made and payment will only against an invoice submitted by the contractor on the basis of an agreed and signed payment certificate for work satisfactorily completed.

PART D

BILLS OF QUANTITIES

PREAMBLE TO SCHEDULE OF PRICES

1. General

A

- 1.1 The Schedules of prices are for the purpose of recording the rates and prices upon which the contract price is determined and are not to be taken as descriptive of the extent of Works to be executed or the extent of the Contractor's obligations.
- 1.2 The rates and prices in the schedule of prices shall be the full consideration for the Contractor's obligations under the Conditions of Contract. Specification and Drawings as reasonably could have been anticipated at the time of tender.
- 1.3 The rates and prices shall be deemed to include allowance for all the materials, equipment, labour, superintendence, services and all other things necessary to complete the Works, render them functional as intended, and remedy any defects therein, in accordance with the contract.
- 1.4 The contractor rates are assumed to cover any preliminaries anticipated in the works including provision for client's safety requirements, site offices, workmen accommodation & transport and insurance cover. It fixing his rates, the contractor may wish to take note of a 3% withholding tax chargeable on each invoice submitted.
- 1.5 The rates and prices in the Schedule of Price will be used for valuing the work executed and the Engineer will measure the whole of the Works executed in accordance with the Contract.

2. Completion of Schedule of Prices

- 2.1 The Schedule of prices shall be completed in conformity with Instructions to Tenders and clause 15 of the Preamble to Bills of Quantities above. Tenderers are advised to peruse and carefully consider the requirements of the Instructions to Tenders before making any entries in the Schedule of Prices.
- 2.2 The rates and prices inserted by the tenderer in the Schedule of Prices are to be the full inclusive costs of the Works, compete in place and in accordance with the Specifications and Drawings, including all costs and expenses for the construction of the works described, together with the costs of Contractor's Equipment and of any temporary installations which may be necessary and all general risks, liabilities and obligations set forth or implied in the documents on which the Contract is based.
- 2.3 No alternation shall be made to the Schedule of Prices and no extra item shall be inserted. The tenderer shall satisfy himself that the Tender Price arrived at and the pricing given is sufficient compensation for completing the whole of the works and remedying any defects therein in accordance with the Tender Documents.
- 2.4 The rates and prices entered by the tenderer shall be deemed to include for the cost of any price increases which may affect the works and which may occur during the validity of the Tender and any extended period of validity thereof, and during the execution of the Works.

PREAMBLE TO DAY WORK

The Client may if in his opinion, it is necessary or desirable, issue an instruction that any varied work shall be executed on a day work basis. The Contractor shall then be paid for such varied work under the terms set out in the day work schedule included in the Contract and at the rates and prices affixed thereto by him in the tender.

In respect of such works executed on a day work basis, the Contractor shall, during the continuance of such work, deliver each day to the Client or Client's Representative, an exact list in duplicate of names, occupation and time of all workmen employed on such work and a statement also in duplicate, showing all equipment used. Client or Client's Representative shall, on the copies of each list and statement, record in writing, signed by him, the extent to which he agrees with the accuracy thereof and return one copy to the Contractor.

The Contractor shall deliver to the Client a priced statement of the labour and equipment used and the Contractor shall not be entitled to any payment unless and until such statement has been properly rendered and supported by one copy of each of the signed lists and statements. Provided always that the Client considers that for any reason the sending of such lists or statement by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorize payment for such work as day work on being satisfied as to the time employed and the labour deployed.

In the absence of a Day work Schedule, the Contractor shall be paid the aggregate of the gross remuneration of the workmen and of any foremen for the time they are actually engaged on the work concerned and the net cost of the materials actually used.

PREAMBLE TO BILLS OF QUANTITIES

1. The Contractor is required to check the numbers of the pages and should any be found to be missing or in duplicate or the figures or writing indistinct he must inform the Engineer at once and have the same rectified. Should the Contractor be in doubt about the precise meaning of any item, word or figure, for any reason whatsoever, or observe any apparent omission of words or figures, he must inform the Engineer in order that the correct meaning may be decided upon before the date for the submission of the Tender.
2. No liability whatever will be admitted nor claim allowed in respect of errors in the Contractor's Tender due to mistakes in the Bills of Quantities which should have been rectified in the manner described above.
3. These Bills are to be read and priced in conjunction with the Conditions of Contract, the Specification, the Drawings and Schedules.
4. The quantities set forth in the Bills of Quantities are believed to be approximately correct, and to represent substantially the work to be carried out, and are given for the purpose of enabling the Employer to compare Tenders on an equal basis.
5. The prices and rates inserted in the Bills of Quantities will be used for valuing the work executed, and the Engineer will re-measure the whole of the works executed in accordance with this contract.
6. The prices and rates inserted in the Bills of Quantities are to be the full inclusive values of the work described under the items, including all costs and expenses which may be required in and for the construction of the work described, together with any temporary works and installations which may be necessary, and all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based.
7. The brief description of the items given in the Bills of Quantities is purely for the purpose of identification, and in no way modifies or supersedes the details descriptions given in the Conditions of Contract and Specification. When pricing items, reference is to be made to the Conditions of Contract, and Specifications for the full directions and description of work and materials.
8. A price or rate is to be inserted, in ink, against each item in the Bills of Quantities and Schedule of materials, whether quantities are stated or not, and if the Tender includes the cost of a particular item elsewhere in his rates or prices, he shall insert the word "Nil" against both the rate and extensions of that particular item. Should the Tenderer omit to price an item, then it will be assumed that he has included the cost of the item elsewhere in his rates or prices.
9. No alteration shall be made to the Bills of Quantities or Schedule of materials and no extra item shall be inserted. The Tenderer shall satisfy himself that the Tender sum arrived at by pricing and quantities and items given is sufficient compensation for constructing and maintaining the whole of the works in accordance with these contract documents.
10. The Bills of Quantities have been prepared generally in accordance with the Standard Method and Measurement – Institution of Civil Engineers (U.K) Variations have been made in some cases to suit local practice.
11. All quantities are measured net (unless otherwise stated) in accordance with the Drawings and no allowance has been made for cutting or waste. The Tenderer must allow in his rates accordingly.
12. Where other Contractors engaged by the employer are working in the same area, the Contractor shall give way and clearance as required and shall programme his work to give a minimum of interference to other contractors. Under these conditions the Contractor must ensure that such back-filling and

surplus soil as he is responsible for are kept rigidly separate from that of other Contractors also employed. The prices and rates given must include for compliance with this requirement.

13. The Contractor must note that materials should be ordered for the Contract from the working Drawings, checked where necessary from Site measurements. They may not be ordered from either the Bills of Quantities or the Tender Drawings. The contractor is solely responsible for accurate ordering of materials in accordance with the Drawings and no claim for any loss or expense will be entertained for orders for materials based upon the Bills of Quantities.
14. Metrication – All quantities are given in Metric Dimensions. However, where the changeover of production sizes has not yet taken place the Contractor may use equivalent goods manufactured to Imperial Dimensions at no extra cost to the Employer.
15. The Bills of quantities must be priced in Kenya currency, i.e. Shillings and Cents. All items in the Bills of Quantities **MUST** be priced and entered in “INK” against each item of work given. The word “NIL” is to be entered if no rate is required. Items not priced will be deemed to be included in other rates.
16. Definition of Abbreviation

Abbreviations used in the Bills of Quantities shall be interpreted as follows:-

“BS” Shall mean	the current British Standard Specification published by the British Standards Institution
“No.” shall mean	number
“Ditto” shall mean	the whole of the preceding description except as qualified in the section in which it occurs. Where it occurs in brackets it shall mean the whole of the preceding description which is contained within the appropriate brackets
“mm” shall mean	millimeter
“LM.” shall mean	linear metre
“SM” shall mean	square metre
“CM” shall mean	cubic metre
“n.l.t” shall mean	not less than
“n.e.” shall mean	not exceeding
“Kg” shall mean	kilogramme
“ha” shall mean	hectare
“EO” shall mean	extra over

BILL SUMMARY PAGE[illegible]

BILL 1: PRELIMINARIES AND GENERALS

ITEM No.	DESCRIPTION	UNIT	QUANTITY	RATE (KES.)	AMOUNT (KES.)
A	Allow provision for insurance for Drilling	LS	1		
B	Allow provision for power and water supply	LS	1		
C	Provide sign board for the work as required by law	LS	1		
	TOTAL CARRIED TO BILL SUMMARY				

BILL 2: BOREHOLE HDRO-GEOLOGICAL AND ESIA STUDIES

ITEM No.	DESCRIPTION	UNIT	QUANTITY	RATE (KES.)	AMOUNT (KES.)
A	Conduct a comprehensive hydro geological survey, to include report compiling, permit application, WRMA fees.	LS	1		
B	Conduct comprehensive ESIA, works to include report compilation, License application, NEMA fees and license follow-ups	LS	1		
C	Allow for County Government/water service provider approval fees	LS	1		
	TOTAL CARRIED TO BILL SUMMARY				

BILL 3: DRILLING, TEST PUMPING AND DEVELOPMENT

ITEM No.	DESCRIPTION	UNIT	QUANTITY	RATE (KES.)	AMOUNT (KES.)
	<i>Drilling works shall be subject to the hydro-geological report developed in bill No. 2</i>				
1	Mobilization, setting up, Demobilization and shifting				
1.1	Mobilization of all equipment and personnel to site and later remove & clear the site of all equipment upon completion of the drilling of the	LS	1		
2	Drilling, Installation, Development, Testing of productive borehole				
2.1a	200mm dia from ground level to 100 meters	M	100		
2.1b	As item 2.1a but beyond 100 meters	M	100		
2.1c	As item 2.1 a but beyond 200 meters	M	100		
2.2	Supply & installation of 153 mm dia steel plain casing and capping	M	146		
2.3	Installation of 153mm dia steel machine cut screen casing	M	74		
2.4	Water supply for drilling and domestic purpose at the site	L.S	1		
2.5	Supply & installation of Gravel pack	TON	8		
2.6	Well development-Before Test pumping-Air	HRS	6		
2.7	Well development-Before Test Pumping-Chemical	HRS	2		
2.8	24 hrs Test pumping and measurements	HRS	24		
2.9	Logging	LS	175		
3	Surfacing casing				
3.1	Install & remove surface casing	M	1		
3.2	Install permanent surface casing	M	1		
4	Completion				
4.1	Construct concrete to well head capping and lock	L.S	1		
4.2	Full chemical Analysis (F.C.A) of water sample and borehole report		1		
4.3	Standby time beyond the control of contractor	HRS	1		
	TOTAL CARRIED TO BILL SUMMARY				

BILL 4: BOREHOLE EQUIPPING

ITEM No.	DESCRIPTION	UNIT	QUANTITY	RATE (KES.)	AMOUNT (KES.)
	SUPPLY AND INSTALLATION OF GRUNDFOS PUMP (Assumed head HEAD=300m (PUMP TYPE SP 5A series with DISCHARGE of 5.0M ³ /hr Powered by 3.0KW motor and 51 Solar PANNELS with 200W capacity) as approved by Engineer with standards provided on Technical Specification				
	<i>Material deviation is allowed with the borehole depth</i>				
A	Supply and install Grundfos SP 5A series complete with motor	nr	1		
B	Supply and install poly crystalline Solar panels capacity 200 watts	nr	51		
C	Supply and install solar pump control unit	nr	1		
D	Supply and fix 6mm ² 4 core flat submersible drop cable	M	120		
E	Supply and fix 6mm ² 4 core underground cable	M	15		
F	Supply and Install Well probe sensor system	sum	1		
G	Supply and fit 1.5" adapter set	nr	1		
H	Supply and fit 1.5" borehole rising upvc pipe 3m length (Heavy	m	250		
I	Supply and install 25mm airline pipes	nr	19		
J	Splicing kit	nr	1		
K	Supply and fit cooling sleeve	nr	1		
L	Supply and fix 1.5"x 6" borehole cover complete with sundries	nr	1		
M	15mm ² x 2 core underground cable for float switch	M	20		
N	Supply and install float switch	nr	1		
O	Supply and install earth rod complete with clamp and earth cable	nr	1		
P	Supply and install water meter Dayliff water meter WP DN50	nr	1		
Q	Supply and install peglar 50mm non return valve	nr	1		
R	Supply and install peglar 50 mm Gate valve	nr	1		
S	Supply and install module support structure	Sum	1		
T	Installation accessories	Sum	1		
	TOTAL CARRIED TO BILL SUMMARY				


BILL 5: 20 m³ HIGH LEVEL TANK AND WATER SUPPLY

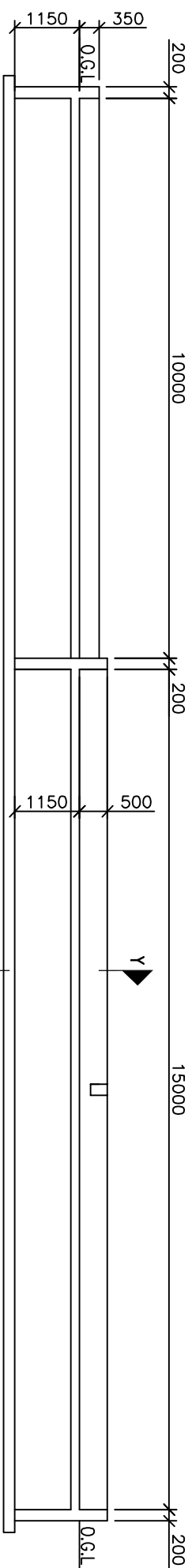
ITEM No.	DESCRIPTION	UNIT	QUANTITY	RATE (KES.)	AMOUNT (KES.)
1	<u>TANK FOUNDATION</u>				
	<u>CLASS E: EARTH WORKS - Excavation for foundation</u>				
1.1	Removal of top soil	m ³	2.25		
1.2	Excavation in overburden material	m ³	9		
1.3	Excavation in in rocks	m ³	4.5		
	<u>Excavated ancillaries</u>				
1.4	Preparation of excavated surfaces to receive blinding	m ²	9		
	<u>Filling</u>				
1.6	Filling to excavated voids around structure	m ³	2		
	<u>CLASS F: IN SITU CONCRETE</u>				
	<u>Provision and placing of design mix</u>				
1.7	Concrete class 15/40 - mass concrete for gravity concrete	m ³	9		
1.8	Concrete class 25/20 - RC for foundation, columns and dwarfs	m ³	6.8		
	<u>CLASS G: CONCRETE ANXILLARIES</u>				
	<u>Form work</u>				
1.11	Rough finish, all planes	m ²	18		
	<u>Reinforcement</u>				
1.22	Deformed high yield steel bars to BS 4449	tons	1.2		
2	<u>TANK SUPPORT STRUCTURE</u>				
	<u>The rate to include fabrication, transport to magadi site and installation, fabrication and installation to BS 449-1969</u>				
2.1	Supply and install 8 m high free standing steel structure tower and follow technical specification and the drawings for material recommended, stand to come complete with beams, adequate cross bracing, bolts, cleats, base plate, holding down bolts, protected walkway platform, ladder to the walkway platform and tank roof, painted with approved one coat of red oxide primer backed up with one coat of aluminium paint	LS	1		
3	<u>PRESSED STEEL TANK</u>				
	<u>The rate to include fabrication, transport to magadi site and installation, metals used to be hot galvanized to BS EN ISO 1461:2009 and tank made to BS 1564 type 2 1975</u>				
3.1	Supply and install 20 m ³ pressed steel tank, with pressed metal panels sizes of 1.22m by 1.22m by 5mm thickness. As detailed in the BS 1564 TYPE 2:1975 and the technical specification, tank to come complete with legible water level indicator in metric, access lockable manhole and vent cowls. To have non-toxic bituminous paint inside, zinc chromated backed up by 2 coats of aluminium paint on the outside.	LS	1		
4	<u>PIPE WORK</u>				
4.1	Supply and install inlet, outlet, overflow and scour pipe as detailed in the drawings, including all pipe fittings and joinery works	LS	1		
5	<u>CATTLE WATERING TROUGHS</u>				
5.1	Provide material and construct a masonry cattle watering trough of 10m long by 1.2m wide by 0.5 m deep. Works to include but not limited to foundation excavation, concreting, walling and water connection as detailed in the drawing.	LS	1		
6	<u>WATER DRAWING POINTS</u>				
6.1	Provide material and construct two number stand pipe watering point	LS	1		
7	<u>FENCING AND GATE</u>				
7.1	Provide material and construct a chainlink fence 2.5 m high, 80 m long, on precast concrete. Works to include installation Razor Wire Concertina, supply and install of a double leaf gate 3m wide as detailed in the drawings and specifications	LS	1		
	TOTAL CARRIED TO GRAND SUMMARY				

PART E

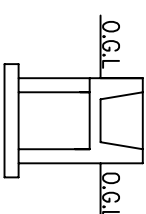
DRAWINGS



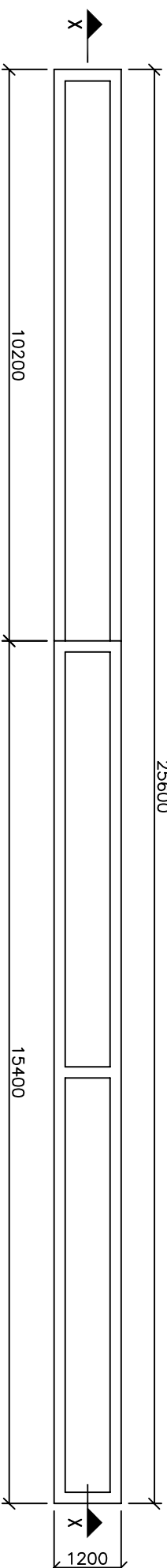
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REV.	BY	DATE	APPR.	ALTERATION					
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				<div style="display: flex; justify-content: space-between;"> <div> <p>DRAWING NUMBER</p> </div> <div> <p>REVISION</p> </div> </div>					
				<div style="display: flex; justify-content: space-between;"> <div> <p>4367</p> </div> <div> <p>4367</p> </div> </div>					



SECTIONAL ELEV. X-X
(SCALE : N.T.S)



SECTIONAL ELEV. Y-Y
(SCALE : N.T.S)



PLAN
(SCALE : N.T.S)

TYPICAL PLAN OF TROUGH

[illegible]

GENERAL NOTE:

1. ALL STEELWORK TO BE M.S. TO B.S. 4360 GRADE 43A.
2. PIPES TO BE 300 MM BELOW G.L
3. ALL DIMENSIONS ARE IN MM.

