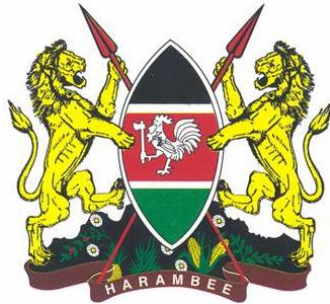


NAME OF TENDER: KANINI IRRIGATION PROJECT

MINISTRY OF WATER, SANITATION & IRRIGATION



TENDER DOCUMENTS

CONSTRUCTION OF KANINI IRRIGATION PROJECT

THARAKA NITHI COUNTY

CONTRACT No. MWSI/ONT/003/2020-2021

DATE: OCTOBER, 2020

SECTION I: INVITATION TO TENDERS

The **Ministry of Water, Sanitation and Irrigation** now invites sealed Tenders from eligible contractors who should meet the following minimum conditions.

- i. Registered with NCA 6 Water Works and above
- ii. Evidence of past experience in similar works of same nature and complexity
- iii. Proof of legal existence
- iv. Copies of valid tax compliance, VAT and PIN certificates
- v. Adequate plant and equipment, professional and technical staff.

Scope of the Works

KANINI IRRIGATION PROJECT will comprise of the following:

- A. Construction of Headworks.
- B. Construction of sedimentation basin.
- C. Conveyance
- D. Construction of main pipeline
- E. Construction of Distribution lines
- F. Construction of infield system.

Interested eligible Contractors may obtain further information and inspect the tender documents at Ministry of Water and Irrigation offices located at Maji House, Ngong Road, at the procurement department 3rd floor room 322 during normal working hours.

A complete set of tender documents can be downloaded from the Ministry's website www.water.go.ke or www.supplier.treasury.go.ke

The completed tender document in plain sealed envelope clearly marked "Tender No.MWSI/ONT/003/2020-2021. Construction of Kanini Project" should be addressed;

Principal Secretary
Ministry of Water, Sanitation and Irrigation
Maji House, Ngong Road.
P.O. Box 49720-00100,
Nairobi, Kenya.

And be deposited in Tender Box on Ground Floor at Ministry of Water, Sanitation and Irrigation Offices so as to be received on or before **17th November, 2020 at 10.00 a.m.** Prices quoted should be inclusive of taxes and shall remain valid for 120 days from closing date of the tender.

The tender will be opened immediately thereafter in Board room 6th floor of Maji House in presence of bidders or their representatives who may wish to attend.

Selection of Bidders will be in accordance with the Public Procurement and Asset Disposal Act, 2015

SECTION II: INSTRUCTIONS TO TENDERERS

A. GENERAL

1. Definitions

- a) "Tenderer" means any persons, partnership firm or company submitting a sum or sums in the Bills of Quantities in accordance with the Instructions to Tenderers, Conditions of Contract Parts I and II, Specifications, Drawings and Bills of Quantities for the work contemplated, acting directly or through a legally appointed representative.
- b) "Approved tenderer" means the tenderer who is approved by the Employer.
- c) Any noun or adjective derived from the word "tender" shall be read and construed to mean the corresponding form of the noun or adjective "bid". Any conjugation of the verb "tender" shall be read and construed to mean the corresponding form of the verb "bid".
- d) "Employer" means a Central Government Ministry, Local Authority, State Corporation or any other Public Institution.

2. Eligibility and Qualification Requirements

2.1 Eligibility requirements

This invitation to tender is open to all tenderers who are qualified as stated in the appendix.

2.2 Qualifications Requirements

To be qualified for award of Contract, the tenderer shall provide evidence satisfactory to the Employer of their eligibility under Sub clause 2.1 above and of their capability and adequacy of resources to effectively carry out the subject Contract. To this end, the tenderer shall be required to update the following information already submitted during prequalification: -

- a) Details of experience and past performance of the tenderer on the works of a similar nature and details of current work on hand and other contractual commitments.
- b) The qualifications and experience of key personnel proposed for administration and execution of the contract, both on and off site.
- c) Major items of construction plant and equipment proposed for use in carrying out the Contract. Only reliable plant in good working order and suitable for the work required of it shall be shown on this schedule. The tenderer will also indicate on this schedule when each item will be available on the works. Included also should be a schedule of plant, equipment and materials to be imported for the purpose of the Contract, giving details of make, type, origin and CIF value as appropriate.

Tender Document for Kanini Irrigation Project

- d) Details of sub-contractors to whom it is proposed to sublet any portion of the Contract and for whom authority will be requested for such subletting in accordance with clause 4 of the Condition of Contract.
- e) A draft Program of Works in the form of a bar chart Schedule of Payment which shall form part of the Contract if the tender is accepted. Any change in the Program or Schedule shall be subjected to the approval of the Engineer.
- f) Details of any current litigation or arbitration proceedings in which the tenderer is involved as one of the parties.

2.1.2 Documents Confidential

All recipients of the documents for the proposed contract for the purpose of submitting a Tender (whether they submit a Tender or not) shall treat the details of the documents as "Private and Confidential".

2.1.3. Cost of Tendering

The Tenderer shall bear all costs associated with the preparation and submission of his bids. The **MINISTRY OF WATER, SANITATION AND IRRIGATION** will not be responsible for, or pay for any expenses or loss which may be incurred by the Tenderer during the preparation of his Tender.

2.1.4 Site Visits

There will be NO FORMAL Site Visit to the Project Area and bidders may make their own arrangement to visit the sites. The Employer will not be liable for any expenses incurred by Tenderers in the execution of this site visit.

2.2 TENDER DOCUMENTS

2.2.1. Tender Documents

The documents issued for the purpose of tendering herein after referred to as Tender are as follows:

- a. Form of Invitation to tender
- b. Instructions to tenderers
- c. Form of Tender
- d. Appendix to Tender
- e. Form of Tender surety
- f. Statement of Foreign Currency Requirements
- g. Contract Form
- h. Details of sub-contractors
- i. Tender Surety
- j. Schedule of particulars
- k. Confidential Business Questionnaire

Tender Document for Kanini Irrigation Project

- l. Bill of Quantities
- m. Schedule of Day works
- n. Schedule of Basic Prices
- o. General conditions of Contract- Section III
- p. Drawings
- q. Technical Specifications -Section v

The Tender documents shall be downloaded from the Ministry website or any other referenced website/portal.

The tender shall be signed on the Form of Tender annexed here to with all blanks in the Appendix filled in. The Form of Tender shall be accompanied by the Bill of Quantities referred to herein. The Bill of Quantities shall be fully priced out to show the amount of the Tender, and the Tender Summary thereof shall be signed. The blanks in the Appendices and schedules, if any, shall be filled in and signed where indicated.

2.2.2. Clarification of Tender Documents

Should there be any doubt or obscurity as to meaning of the Tender documents or as to anything to be done or not to be done by the Constructor or as to these instructions or as to any other matters affecting this Tender, the Tenderer must set forth such doubt or Obscurity in writing to the engineer. Such request shall reach the engineer not less than fourteen days (14) prior to the date fixed for the opening of tenders. Any such explanation will be made by the issue of a circular letter by the Engineer not less than seven (7) days prior to the date fixed for the opening of the tenders and copies of this circular letter will be posted to all parties who have taken out sets of the documents. All communications from the employer to the tenderers shall be through the advert portal as long as the tender is on and tenderers are requested to continue visiting the portal for any amendments/adjustments or addenda. Should any misunderstanding arise afterwards as to their meaning the decision of the engineer as to the true intent and meaning of any clause, dimensions works shall be conclusive and binding to the tenderer.

2.2.3 Amendment to Tender Documents

At any time prior to the original or extended date for submission of Tenders the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Tenderer modify the Tender documents by the issue of any addendum.

The addendum will be in writing and will be sent by the Employer to all prospective Tenderers who purchase the Tender Documents to arrive at least 7 days prior to the original or extended Tender submission date. The prospective Tenderers will be required to acknowledge the receipt of the addendum and the contents of the addendum will become part of the Tender Document and will be binding on the Tenderers. Nevertheless, all amendments /addenda and communications regarding this tender shall be communicated through the advert portal.

In order to afford prospective Tenderers reasonable time in which to take the effective of the addendum into account when preparing their Tenders the Employer may, at his discretion, extend the deadline for the submission of Tenders.

Note: All tenderers/bidders are requested to register (leave their contacts i.e. email & telephone numbers) with the Head of Supply Chain Management office for efficient and effective communication regarding 2.2.3 3rd Floor Maji House room 322

2.3 Preparation of Tenders

2.3.1 Tender documents to be completed.

The Tenderer shall complete the Tender Form, its Appendix and the Parts and Summary of the Bill of Quantities in ink with the whole of the information and prices called for there on. Each place provided for the purposes shall be completed with the date and signature of the person or persons authorized to sign Tender Document and of the witness thereof. Every document accompanying the Tender, except that pertaining to the Tender Surety, shall be dated and signed by the same person or persons.

2.3.3. Tender Prices

Price Adjustments

The Tenderer shall price separately each item in the Bills of Quantities and shall follow the instructions regarding transference of totals to the Summary given in Bills of Quantities. Items against which no rate or amount is entered by the Tenderer will not be paid for by the Employer when executed and shall be deemed to be covered by the other rates and amounts in the Bill of Quantities.

The prices filled in the schedule of Basic Prices should be the prevailing market prices for the particular items at the time of tendering. If the price filled is different from the market price the higher of the two prices shall be used as the basic price. Failure to complete the Schedule of Basic Prices and to submit quotations or other supporting documents at the time of Tender shall result in no price variation being allowed for items or materials not priced or supported.

The difference between the tendered rate and the basic price will be fixed amount which will not affect the price variation.

2.3.4. Variation of Tender

No alteration shall be made in the form of Tender, Bill of Quantities or other documents, and the Tender shall be deemed to comply entirely with the terms of the accompanying documents except in so far as any term is expressly varied by a letter attached by the Tenderer to the Form of Tender, stating the variations in terms on which the Tender is based, but any such variations may render the tender liable to disqualification.

2.3.5. Tender Validity

The Tender shall remain valid and open for acceptance for a period of 120 days from the specified date of Tender closing. In exceptional circumstances prior to expiry of the original Tender validity period, the Employer may request the Tenderer for a specified extension in the period of validity. The request and the response there to shall be made in writing. A Tenderer may refuse the request without forfeiting his tender bond. A Tenderer agreeing to their request will not be permitted to modify his Tender and will be required to extend the validity of his tender bond correspondingly.

2.3.6. Tender Surety

Each Tenderer must enclose with his Tender a Bank/insurance Guarantee drawn in Kenya Shillings for the sum of Kshs 2% OF THE TENDER SUM and the validity should be at least 28 days beyond the tender validity period (≥ 148 days from date of tender opening). This amount is required as a Tender Surety, and in the event of the Tenderer withdrawing his tender before the expiry of the period laid down in Clause 2.4.4. Below, or failing to execute the formal Contract Agreement in accordance with Clause 2.4.4. Below, thus sum shall become forfeit to the MINISTRY OF WATER, SANITATION AND IRRIGATION to defray its expenses incurred in soliciting the Tenders (including consequential damages in delay to the commencement of works).

The Tender Sureties of unsuccessful Tenderers will be refunded when a formal Contract Agreement has been concluded, or earlier, at the discretion of the Employer.

2.3.7 Alternative tenders

The tenderer must submit a basic offer which complies with the requirement of the tender documents. However, the tenderer may submit in addition to the base tender an alternative proposal which differs in whole or in part from that specified and which offer to provide additional economic financial and /technical merits. Such an alternative offer will be given consideration provided it is submitted with full particulars including detailed design calculations, relevant technical specifications, a priced bill of quantities and proposed construction methodology to enable a complete evaluation to be made. An alternative proposal provided not accompanied by the base tender with the specifications will be treated as an incomplete tender and will be rejected. Alternative offers will be considered when submitted by any tenderers who also submit a substantially completed basic offer.

2.3.8 Completion of form of tender

The form of tender following these instructions and including the appendix there to shall be properly and completely filled up with all the blanks in the appendix filled in.

2.3. Signing of tender

All copies of the tender shall be signed by the tenderer or a person or persons dully authorized to bind the tenderer to the contractor. Proof of authorization shall be furnished in the form of a written power of Attorney which shall accompany the tender. All pages of the tender, where entries are made, shall be initiated by the person or persons signing the tender

2.3.10 Joint venture

In the absence of the pre-qualification, and where a tender is submitted by two or more firms forming a consortium or joint venture, the tender must be supported by adequate documentary evidence that all partners or members of the consortium agree that the tender is binding upon each member of the consortium or joint venture, jointly and severally. The proposed arrangement between the firms forming the consortium or joint venture for the management and execution of the contract should be set out in a document which should accompany the tender.

2.3.11 Negligence to obtain information

Tender Document for Kanini Irrigation Project

Any negligence or failure on part of the tenderer to obtain relevant information at the site or elsewhere upon the foregoing or any other matters affecting the execution, completion and maintenance of the works, the bill of quantities and the contract, shall not release the tenderer from any risks or liabilities or from the responsibility of completion and handing over the works all as defined in the contract.

No claims for alteration of the tender sum will be entertained if lodged on the grounds of failure to obtain accurate information or of alleged misrepresentation or misinformation.

2.4. SUBMISSION OF TENDERS

2.4.1 Sealing and Marking of Tenders

The Tenderer shall submit two copies of the Tender (except the Drawings) one of which shall be marked "original" and the other "copy". In the event of any discrepancy between them, the original shall govern. Each Tender shall be sealed in an inner and outer envelope with the outlet envelope marked as follows:

- (a) It shall be addressed to:-

**PRINCIPAL SECRETARY,
MINISTRY OF WATER, SANITATION AND IRRIGATION
P. O. BOX 49720 - 00100
NAIROBI.**

- (b) It shall bear the following identification

- (i) Tender for construction of Kanini Irrigation Project

- (ii) The words "**DO NOT OPEN**" **BEFORE 17th November, 2020 at 10 00 hrs.**

The inner envelope shall be similarly marked but shall, in addition, bear the name and address of the Tenderer in the top right hand cover.

If the outer envelope is not sealed and marked as instructed above, the Employer will assume no responsibility for the misplacement or premature opening of the Tender. A premature opening of the Tender may lead to it being rejected by the Employer. The Book of Drawings shall be returned separately from the Tender to the above address, and shall be marked for the attention of the Principal Secretary, State Department of Irrigation, Ministry of water and Irrigation.

2.4.2. Deadline for Submission of Tenders

All Tenders must reach and be received by the Employer on or before the prescribed deadline of **10.00a.m. (East Africa time) on 17th November, 2020** Proof of posting will not be accepted as proof of delivery and any Tender delivered after the above stipulated time from whatever cause arising will not be considered.

The Employer may, at his discretion, extend the dead line for the submission of Tenders through the issue of an addendum amending the Tender document in which case all rights and obligations of the Employer and the Tenderers previously subject to the deadline shall thereafter be subject to the new deadline as extended.

2.4.3 Late Tenders

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Any Tenders received by the Employer after the prescribed date and time will be returned with the inner envelope unopened to the Tenderer.

2.4.4 Modification to and Withdrawal of Tender

No alterations shall be made to the Form of Tender, Bills of Quantities or other documents except as expressly provided for. The Tenderer may, however, modify his Tender insertions or withdraw his Tender after Tender submission provided that written notice of the modification or withdrawal is received by the Employer prior to the prescribed date and time for submission of Tenders. The Tenderer's modification or withdrawal notice shall be prepared, sealed, marked and dispatched as for the Tender itself. No Tender may be modified subsequent to the date and time for submission of Tenders.

No Tender may be withdrawn in the interval between the date and time for submission of Tenders and the expiration of the period of validity. Withdrawal of a Tender during this interval may result in the forfeiture of the Tenderer's Tender Bond.

Subsequent to the expiration of the period of validity of Tenders prescribed by the Employer, a successful Tenderer who has not been notified by the Employer of the award of the contract may withdraw his Tender without penalty.

TENDER OPENING AND EVALUATION

2.5.1. Tender Opening

The Employer will open the Tenders in the presence of Tenderers or their representatives who choose to attend, at 1000hours (East African Time) on 17th November,2020 at Maji House board Room 6th floor. The Tenderer's names, total amounts of Tenderers, Tender price modification and Tender withdrawals if any, and the presence of the requisite Tender bond will be announced at the Tender opening.

2.5.2. Acceptability of Tenders

After opening the Tenders but not necessary at the Tender opening, the Employer will decide whether each

Tender is substantially in accordance with the requirements of the Tender Documents.

For the purpose of this clause, the Tender shall be substantially in accord if it conforms to all the terms, conditions and specifications of the Tender Documents without material deviation. A material deviation is one which affects in any substantial way the price, scope, quality, completion or timing of the works to be undertaken by the Tenderer under the Contract, or which limits in any substantial way, inconsistent with the Tender Documents, the Employer's rights or the Tenderer's obligation under the contract, and the rectification of which would affect unfairly the competition position of other Tenderers who have presented Tenders substantially in accordance with the requirements of the Tender Documents at reasonable prices, unless they were provided the same opportunities.

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A Tender determined to be not substantially in accordance with the requirements of the Tender Documents will be rejected by the Employer and may not subsequently be amended by the Tenderer by correction of the non-conformity.

The Employer may waive any minor non-conformity or irregularity in a Tender which does not constitute a material deviation, provided that the waiver does not prejudice or affect the relative ranking order of any Tenderer.

2.5.3 Clarification of Tenders

To assist in the examination, evaluation and comparison of Tenders the employer may ask Tenderers for clarification of their Tenders' including break downs of unit prices. Their quest for clarification and the response shall be in writing or fax, telex, but no change in the price or subsistence of the Tender shall be sought, offered or permitted.

2.5.4 Correction of Errors in Tender

The total Tender Sum as submitted and read out during the tender opening shall be absolute and final and shall not be the subject of correction, adjustment or amendment.

2.5.5 Evaluation and Comparison of Tenders

Only those Tenders deemed to be subsequently in accordance with the requirements of the Tender Documents will be evaluated.

2.5.6 Variation of Price

The Tenderers attention is drawn to Clause 70 Conditions of Contract Part II and to the "Schedule of Basic Prices" in the Bills of Quantities

Competitive quotations and other documents supporting the basic prices entered by the Tenderer in the Schedule of Basic Prices shall accompany the Tender. Failure to complete the Schedule of Basic Prices and to submit quotations or other supporting documents at the time of Tender shall result in no Price Variation being allowed for its items or materials which have not been priced and supported by quotations or other supporting documents in the Schedule of Basic Prices.

2.6 Post-qualification

2.6.1 Post-qualification Questionnaires and other Schedules and Certificates.

The Tenderer shall submit with his Tender the following completed schedules which shall form the basis of evaluation and contract.

- a) Site Visit Certificate (where necessary)
- b) Structure and Organization of Company
- c) Financial Statement
- d) Head Office Personnel
- e) Schedule of the proposed Supervisory Staff
- f) Schedule of Project Plant
- g) Construction

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This Schedule shall both indicate the main plant and equipment considered necessary for undertaking the works, its age and reliability if already in company ownership and if not whether it is to be procured outright or through hire purchase or hired for the Contract.

(g) Schedule of Relevant Experience—completed projects. This schedule shall list water supply and reinforced concrete works satisfactorily carried out by the Tenderer during the last five years indicating in each instance the value of the works together with the names of Employer and Consulting Engineers or other Engineers responsible in supervision.

(h) Schedule of Relevant Experience—on going projects. This schedule should list projects generally similar to those in Schedule (g) but which are in progress, or for which a letter of intent has been received.

(i) Construction Schedule

A programme of works shall be provided indicating how the Tenderer would carry out the various aspects of the works so as to ensure completion within the time stated. Where any portion of the works is to be sub-contracted this shall be indicated.

(j) Schedule of Cash Flow

A schedule of anticipated cash flow related to the Construction Schedule shall be provided, giving the tenderer's best estimate of the values of his monthly certificates for the duration of the Works. Refer to the Table on Financial statements in the Evaluation criteria section.

(k) Schedule of Insurance

The Tenderer shall provide a Schedule of Insurance indicating the name and registered address of the Insurance Company (or Companies) which will effect the insurances required under the Contract. The otherwise successful Tenderer, if so requested shall produce such Insurance for inspection by the Employer.

(l) Schedule of business questionnaire.

2.7.1 Award Criteria

Subject to assessment of the information described in Clause 2.6.2, the Employer will award the contract to the successful tenderer whose tender has been determined by the Employer to be substantially complete in accordance with the requirements of the Tender Documents and has been selected by the Employer as the lowest evaluated tender, having met the evaluation criteria.

The successful Tenderer shall indicate his acceptance in writing and shall then proceed to obtain the necessary insurance and bonds and to execute the formal Contract Agreement within the time stated. The Employer however, reserves unto himself the right to extend the period for executing the formal Contract Agreement, if satisfied that adequate reasons exist for so doing, and in such a case the letters of notification to and written acceptance by the successful Tenderer shall be legally binding on both parties until such time as the formal Contract Agreement is executed.

2.7.2 Employer's Right to accept or to reject any or All Tenders.

The Employer reserves the right to accept or reject any tender, and to annul the Tendering process and reject all Tenders, at any time prior to award of Contract, without there by incurring any liability

Tender Document for Kanini Irrigation Project

to the affected Tenderer of Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

2.7.3 Notification of Award

Not later than the expiration of the period of Tender validity prescribed by the Employer will notify the successful Tenderer in writing that his Tender has been accepted. The notification of award will constitute the formation of the Contract. Upon the successful Tenderer furnishing a Performance Bond, the Employer will promptly notify the unsuccessful and will return their Tender Bonds.

2.7.4 Signing of Contract

At the same time that the Employer notifies the successful Tenderer that his Tender has been accepted, the employer will send the Tenderer the Contract Form provided in the Tender documents, incorporating all agreements between the parties. Within 21 days of the successful Tenderer's receipt of the Contract Form, he shall sign and date the Form and return it to the Employer.

2.7.5 Training Levy

The Tenderers attention is drawn to the Industrial Trading (Building and Civil Engineering) Training Levy Order 1971, details of which are contained in Legal Notice 237 issued by the Government of Kenya. The amount of the levy is one quarter of one percent of the total contract price, and Tenderers must provide for all costs arising or resulting there from. No separate payment shall be made for these costs and the Tenderer shall be deemed to have included for the min his rates in the various items of the Bill of Quantities.

2.7.6 Standard specifications

The works to be constructed under this contact shall as minimum standards meet the requirements of appropriate standards issued by the international standards organization. In addition and where so indicated in the specifications for this contract they shall further comply with the standards of the international standards indicated or of any technical equivalent or superior national standards. All standard specification used shall be available in English language and the contractor shall be required to maintain one complete set of the standard specifications he is adhering to at the site of works during the whole period of construction.

Tender Document for Kanini Irrigation Project

SECTION IIB: APPENDIX TO INSTRUCTIONS TO TENDERERS

The following appendix to instructions to tenderers shall complement or amend the provisions of the instructions to tenderers (Section II). Wherever there is a conflict between the provisions of the instructions to tenderers and the provisions of the appendix, the provisions of the appendix herein shall prevail over those of the instructions to tenderers.

Appendix Reference Number	ITT Clause Number	Amendments of, and Supplements to, Clauses in the Instruction to Tenderers
A. Introduction		
1.	1.1	The Procuring Entity is Ministry of Water, Sanitation and Irrigation
2.	1.1	Name of Project is Construction of Kanini Irrigation Project
3.	1.2	The expected completion date of the works is 6 months after signing the contract
4.	1.3	The Objectives of the Projects is to increase food security
5.	2.1	Name of financing institution is GOK Name of the Procuring entity is Ministry of Water, Sanitation and Irrigation Financial year is 2020/21 Describe works under the contracts The main works to be undertaken under this contract comprise the following: KANINI IRRIGATION PROJECT will comprise of the following: A. Construction of Headworks. B. Construction of sedimentation basin. C. Conveyance D. Construction of main pipeline E. Construction of Distribution lines F. Construction of infield system.
	2.2	The loan/credit number is N/A
7.	5.1	Alternative Tenders are Not Allowed
8.	5.2	Alternative time for completion Not Applicable
9.	3.1	Only Tenderers registered with the – NCA 6 Water works
10.	7.3	Pre-tender meeting shall not be held
11.	7.5	N/A
	7.6	N/A

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B. Tendering Documents			
12.	8.2	The number of copies to be completed and returned with the Tender is Two	
13	8.1	Address for clarification of Tendering Document is Principal Secretary Ministry of Water, Sanitation & Irrigation Department of Irrigation P.O. Box 49720-00100 NAIROBI	
14.	8.2	Period to Respond to request for clarification by the Procuring Entity 7 days Periods Prior to deadline for submission of Tenders for Tenderers to request clarification 7 days	
C. Preparation of Tenders			
15.	11.1	Language of Tender and all correspondence shall be English	
16.	13.3	Other information or materials required to be completed and submitted by Tenderers and of which will form the EVALUATION CRITERIA The following requirements must be met by the tenderer notwithstanding other requirements in the tender documents, bidder Must serialize all the pages of each bid submitted. Mandatory Requirements (MR)	
		Requirement	Responsive or Non Responsive
		MR 1 Must submit a copy of certificate of Registration/Incorporation MR 2 Must submit a copy of valid tax compliance certificate MR 3 Must fill the bill of quantities in the format provided (incomplete Boqs will be rejected) MR 4 Must fill the form of tender in the format provided and signed by the authorized person MR 5 Must submit a tender security of 2% of the tender price valid 30 days beyond the bid validity period i.e. 150days MR 6 Power of attorney proof authorizing the signatory of the tender to commit the tender. MR 7 Must submit a copy of valid registration by NCA water works	

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		At this stage, the tender's submission will either be responsive in the entire mandatory requirement (MR) above or non - responsive. The non – responsive submission will be eliminated from the entire evaluation process and will not be considered further.	
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		Technical Evaluation		
		No	Parameter	Maximum Score
		1	Relevant Experience Experience as prime contractor in the construction of at least one project of a similar nature and complexity equivalent to the works in the last five years of value as follow Equal or over 100 million 30 Equal or over 50 million 20 Equal of over 10 million 10	30
		2	Equipment Backhoe loader, Excavator, Tipper, Roller, pickup owned (Max 25 marks) - 50% owned and lease leased 50% (max 20 -100% leased	

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		Proposed program (work methodology and cash schedule)	10
		Total	100%

		Only bidders who score 70% and above will be subject to financial evaluation. Those who score below 70% will be eliminated at this stage from the entire evaluation process and will not be considered further. The authority will verify information submitted. Any form of forgery or misinformation will lead to cancellation of the bid
17.	13.4	In the case of joint venture each partner shall submit information required under Clause ITT Clause 13.4 in addition the Tenderer shall furnish the following, a) The power of attorney b) Audited books of account with a turnover of at least Kshs. 100 m Million for the last three years.
18.	16.4	The price shall be fixed Information to be submitted with the Tender are: i. The basic rates of materials and services
19.	17.1	The currency in which the prices shall be quoted shall be: Kenya shilling
20.	17.2	The authority for establishing the rates of exchange shall be N/A
	30.2	The applicable date for exchange rates for tendering and evaluation purposes N/A
21.	18.1	The Tender validity period shall be 120 days
22.	19.1	The amount of Tender Security shall be 2% of Tender price and valid for 120 days
23	20.1	In addition to the original of the Tender, the Tenderer should submit 2 copies of the Tender – original + 1 copies
24.	20.2	Written confirmation of authorization are; - Power of attorney – copies of original documents to be provided as proof authorizing the signatory of the tender to commit the tenderer. The form of tender must be fully filled and signed by the authorized person

D. Submission of Tenders		
25	21.2 a)	Tenders shall be submitted to Principal Secretary, Ministry of Water, Sanitation & Irrigation P.O. Box 49720 -00100 Nairobi
26	21.2 b)	Project name: Construction of Kanini Irrigation Project Tender Number MWSI/ONT/003/2020-2021

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27	22.1	The deadline for tender submission is on or before 17th November, 2020 at 10.0aam
28	22.3	The extension of the deadline for submission of Tenders shall be made not later than N/A
29	24.4	Expiry date of tender validity is 120 days
E. Opening and Evaluation of Tenders		
29	25.1	The Tender opening shall take place at: Ministry of Water, Sanitation & Irrigation Offices (Maji House) P.O. Box 49720 -00100 NAIROBI
30	32.3	Addition preference <i>not applicable</i>
31	34.1	Post – qualification <i>will be undertaken</i>
32	38.1	Percentage for quantities increase or decrease is 15%
F. Award of Contract		
33	41.1	The amount of performance security shall be 10% of the contract price
34	42.1	There shall be NO ADVANCE PAYMENT
35	43.1	The proposed adjudicator for the project is: Chattered Institute of Arbitrators (Kenya Branch) [insert name of the proposed adjudicator] whose hourly rate shall be determined by the institution
G. Review of Procurement Decisions		
37	46.1	The address for submitting appeals to Administrative Review Board: The secretary, Public Procurement Administrative Review Board, The Public Procurement Oversight Authority, 10 th Floor, National Bank House P.O BOX 58583-00200, NAIROBI, Kenya. Tel: 254 (0) 20 3244000

SECTION III: CONDITIONS OF CONTRACT

1. Definitions

1.1 In this Contract, except where context otherwise requires, the following terms shall be interpreted as indicated;

"Bill of Quantities" means the priced and completed Bill of Quantities forming part of the tender.

"Compensation Events" are those defined in Clause 24 hereunder.

"The Completion Date" means the date of completion of the Works as certified by the Project Manager, in accordance with Clause 31.

"The Contract" means the agreement entered into between the Employer and the Contractor as recorded in the Agreement Form and signed by the parties including all attachments and appendices thereto and all documents incorporated by reference therein to execute, complete, and maintain the Works,

"The Contractor" refers to the person or corporate body whose tender to carry out the Works has been accepted by the Employer.

"The Contractor's Tender" is the completed tendering document submitted by the Contractor to the Employer.

"The Contract Price" is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

"Days" are calendar days; **"Months"** are calendar months.

"A Defect" is any part of the Works not completed in accordance with the Contract.

"The Defects Liability Certificate" is the certificate issued by Project Manager upon correction of defects by the Contractor.

"The Defects Liability Period" is the period named in the Contract Data and calculated from the Completion Date.

"Drawings" include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

"Dayworks" are Work inputs subject to payment on a time basis for labour and the associated materials and plant.

"Employer", or the "Procuring entity" as defined in the Public Procurement Regulations (i.e. Central or Local Government administration, Universities, Public Institutions and Corporations, etc) is the party who employs the Contractor to carry out the Works.

"Equipment" is the Contractor's machinery and vehicles brought temporarily to the Site for the execution of the Works.

"The Intended Completion Date" is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

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"Materials" are all supplies, including consumables, used by the Contractor for incorporation in the Works.

"Plant" is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

"Project Manager" is the person named in the Appendix to Conditions of Contract (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract and shall be an "Architect" or a "Quantity Surveyor" registered under the Architects and Quantity Surveyors Act Cap 525 or an "Engineer" registered under Engineers Registration Act Cap 530.

"Site" is the area defined as such in the Appendix to Condition of Contract.

"Site Investigation Reports" are those reports that may be included in the tendering documents which are factual and interpretative about the surface and subsurface conditions at the Site.

"Specifications" means the Specifications of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

"Start Date" is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with the Site possession date(s).

"A Subcontractor" is a person or corporate body who has a Contract with the Contractor to carry out a part of the Work in the Contract, which includes Work on the Site.

"Temporary works" are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

"A Variation" is an instruction given by the Project Manager which varies the Works.

"The Works" are what the Contract requires the Contractor to construct, install, and turnover to the Employer, as defined in the Appendix to Conditions of Contract.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning in English Language unless specifically defined. The Project Manager will provide instructions clarifying queries about these Conditions of Contract.

2.2 If sectional completion is specified in the Appendix to Conditions of Contract, reference in the Conditions of Contract to the Works, the Completion Date and the Intended Completion Date apply to any section of the Works (other than references to the Intended Completion Date for the whole of the Works).

2.3 The following documents shall constitute the Contract documents and shall be interpreted in the following order of priority;

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1. Agreement,
2. Letter of Acceptance,
3. Contractor's Tender,
4. Appendix to Conditions of Contract,
5. Conditions of Contract,
6. Specifications,
7. Drawings,
8. Bill of Quantities,
9. Any other documents listed in the Appendix to Conditions of Contract as forming part of the Contract.

Immediately after the execution of the Contract, the Project Manager shall furnish both the Employer and the Contractor with two copies each of all the Contract documents. Further, as and when necessary the Project Manager shall furnish the Contractor [always with a copy to the Employer] with three [3] copies of such further drawings or details or descriptive schedules as are reasonably necessary either to explain or amplify the Contract drawings or to enable the Contractor to carry out and complete the Works in accordance with these Conditions.

3. Language and Law

3.1 Language of the Contract and the law governing the Contract shall be English language and the Laws of Kenya respectively unless otherwise stated.

4 Project Manager's Decisions

4.1 Except where otherwise specifically stated, the Project Manager will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5 Delegation

5.1 The Project Manager may delegate any of his duties and responsibilities to others after notifying the Contractor.

6 Communications

6.1 Communication between parties shall be effective only when in writing. A notice shall be effective only when it is delivered.

7 Subcontracting

7.1 The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations.

8 Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities etc. as listed in the Appendix to Conditions of Contract and also with the Employer, as per the directions of the Project Manager. The Contractor shall also provide facilities and services for them. The Employer may modify the said List of Other Contractors etc., and shall notify the Contractor of any such modification.

9 Personnel

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9.1 The Contractor shall employ the key personnel named in the Qualification Information, to carry out the functions stated in the said Information or other personnel approved by the Project Manager. The Project Manager will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel listed in the Qualification Information. If the Project Manager asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the Work in the Contract.

10 Works

10.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings. The Works may commence on the Start Date and shall be carried out in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

11 Safety and Temporary Works

11.1 The Contractor shall be responsible for the design of temporary works. However before erecting the same, he shall submit his designs including specifications and drawings to the Project Manager and to any other relevant third parties for their approval. No erection of temporary works shall be done until such approvals are obtained.

11.2 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary works and all drawings prepared by the Contractor for the execution of the temporary or permanent Works, shall be subject to prior approval by the Project Manager before they can be used.

11.3 The Contractor shall be responsible for the safety of all activities on the Site.

12. Discoveries

12.1 Anything of historical or other interest or of significant value unexpectedly discovered on Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

13. Work Program

13.1 Within the time stated in the Appendix to Conditions of Contract, the Contractor shall submit to the Project Manager for approval a program showing the general methods, arrangements, order, and timing for all the activities in the Works. An update of the program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining Work, including any changes to the sequence of the activities.

The Contractor shall submit to the Project Manager for approval an updated program at intervals no longer than the period stated in the Appendix to Conditions of Contract. If the Contractor does not submit an updated program within this period, the Project Manager may withhold the amount stated in the said Appendix from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue program has been submitted. The Project Manager's approval of the program shall not alter the Contractor's obligations. The Contractor may revise the program and submit it to the Project

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Manager again at any time. A revised program shall show the effect of Variations and Compensation Events.

14. Possession of Site

14.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Appendix to Conditions of Contract, the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.

15. Access to Site

15.1 The Contractor shall allow the Project Manager and any other person authorised by the Project Manager, access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

16. Instructions

16.1 The Contractor shall carry out all instructions of the Project Manager which are in accordance with the Contract.

17. Extension or Acceleration of Completion Date

17.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a variation is issued which makes it impossible for completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining Work, which would cause the Contractor to incur additional cost. The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager in writing for a decision upon the effect of a Compensation Event or variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay caused by such failure shall not be considered in assessing the new (extended) Completion Date.

17.2 No bonus for early completion of the Works shall be paid to the Contractor by the Employer.

18. Management Meetings

18.1 A Contract management meeting shall be held monthly and attended by the Project Manager and the Contractor. Its business shall be to review the plans for the remaining Work and to deal with matters raised in accordance with the early warning procedure. The Project Manager shall record the minutes of management meetings and provide copies of the same to those attending the meeting and the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

19. Early Warning

19.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the Work, increase the Contract Price or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract

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Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

19.2 The Contractor shall cooperate with the Project Manager in making and considering proposals on how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the Work and in carrying out any resulting instructions of the Project Manager.

20. Defects

20.1 The Project Manager shall inspect the Contractor's work and notify the Contractor of any defects that are found. Such inspection shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a defect and to uncover and test any Work that the Project Manager considers may have a defect. Should the defect be found, the cost of uncovering and making good shall be borne by the Contractor, However, if there is no defect found, the cost of uncovering and making good shall be treated as a variation and added to the Contract Price.

20.2 The Project Manager shall give notice to the Contractor of any defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the Appendix to Conditions of Contract. The Defects Liability Period shall be extended for as long as defects remain to be corrected.

20.3 Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified by the Project Manager's notice. If the Contractor has not corrected a defect within the time specified in the Project Manager's notice, the Project Manager will assess the cost of having the defect corrected by other parties and such cost shall be treated as a variation and be deducted from the Contract Price.

21. Bills Of Quantities

21.1 The Bills of Quantities shall contain items for the construction, installation, testing and commissioning of the Work to be done by the Contractor. The Contractor will be paid for the quantity of the Work done at the rate in the Bills of Quantities for each item.

21.2 If the final quantity of the Work done differs from the quantity in the Bills of Quantities for the particular item by more than 25 percent and provided the change exceeds 1 percent of the Initial Contract price, the Project Manager shall adjust the rate to allow for the change.

21.3 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bills of Quantities.

22. Variations

22.1 All variations shall be included in updated programs produced by the Contractor.

22.2 The Contractor shall provide the Project Manager with a quotation for carrying out the variations when requested to do so. The Project Manager shall assess the quotation, which shall be given within seven days of the request or within any longer period as may be stated by the Project Manager and before the Variation is ordered.

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22.3 If the work in the variation corresponds with an item description in the Bills of Quantities and if in the opinion of the Project Manager, the quantity of work is not above the limit stated in Clause 21.2 or the timing of its execution does not cause the cost per unit of quantity to change, the rate in the Bills of Quantities shall be used to calculate the value of the variation. If the cost per unit of quantity changes, or

if the nature or timing of the work in the variation does not correspond with items in the Bills of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of Work.

22.4 If the Contractor's quotation is unreasonable, the Project Manager may order the variation and make a change to the Contract price, which shall be based on the Project Manager's own forecast of the effects of the variation on the Contractor's costs.

22.5 If the Project Manager decides that the urgency of varying the Work would prevent a quotation being given and considered without delaying the Work, no quotation shall be given and the variation shall be treated as a Compensation Event.

22.6 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

22.7 When the Program is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast.

23. Payment Certificates, Currency of Payments and Advance Payments

23.1 The Contractor shall submit to the Project Manager monthly applications for payment giving sufficient details of the Work done and materials on Site and the amounts which the Contractor considers himself to be entitled to. The Project Manager shall check the monthly application and certify the amount to be paid to the Contractor within 14 days. The value of Work executed and payable shall be determined by the Project Manager.

23.2 The value of Work executed shall comprise the value of the quantities of the items in the Bills of Quantities completed, materials delivered on Site, variations and compensation events. Such materials shall become the property of the Employer once the Employer has paid the Contractor for their value. Thereafter, they shall not be removed from Site without the Project Manager's instructions except for use upon the Works.

23.3 Payments shall be adjusted for deductions for retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 30 days of the date of issue of each certificate. If the Employer makes a late payment, the Contractor shall be paid simple interest on the late payment in the next payment. Interest shall be calculated on the basis of number of days delayed at a rate three percentage points above the Central Bank of Kenya's average rate for base lending prevailing as of the first day the payment becomes overdue.

23.4 If an amount certified is increased in a later certificate or as a result of an award by an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

23.5 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

23.6 The Contract Price shall be stated in Kenya Shillings. All payments to the Contractor shall be made in Kenya Shillings and foreign currency in the proportion indicated in the tender, or agreed prior to the execution of the Contract Agreement and indicated therein. The rate of exchange for the calculation of the amount of foreign currency payment shall be the rate of exchange indicated in the Appendix to Conditions of Contract. If the Contractor indicated foreign currencies for payment other than the currencies of the countries of origin of related goods and services the Employer reserves the right to pay the equivalent at the time of payment in the currencies of the countries of such goods and services. The Employer and the Project Manager shall be notified promptly by the Contractor of any changes in the expected foreign currency requirements of the Contractor during the execution of the Works as indicated in the Schedule of Foreign Currency Requirements and the foreign and local currency portions of the balance of the Contract Price shall then be amended by agreement between Employer and the Contractor in order to reflect appropriately such changes.

23.7 In the event that an advance payment is granted, the following shall apply:-

a) On signature of the Contract, the Contractor shall at his request, and without furnishing proof of expenditure, be entitled to an advance of 10% (ten percent) of the original amount of the Contract. The advance shall not be subject to retention money.

b) No advance payment may be made before the Contractor has submitted proof of the establishment of deposit or a directly liable guarantee satisfactory to the Employer in the amount of the advance payment. The guarantee shall be in the same currency as the advance.

c) Reimbursement of the lump sum advance shall be made by deductions from the Interim payments and where applicable from the balance owing to the Contractor. Reimbursement shall begin when the amount of the sums due under the Contract reaches 20% of the original amount of the Contract. It shall have been completed by the time 80% of this amount is reached.

The amount to be repaid by way of successive deductions shall be calculated by means of the formula:

$$R = \frac{A(x_1 - x_{11})}{80 - 20}$$

Where:

R = the amount to be reimbursed
A = the amount of the advance which has been granted

X₁ = the amount of proposed cumulative payments as a percentage of the original amount of the Contract. This figure will exceed 20% but not exceed 80%.

X₁₁ = the amount of the previous cumulative payments as a percentage of the original amount of the Contract. This figure will be below 80% but not less than 20%.

d) with each reimbursement the counterpart of the directly liable guarantee may be reduced accordingly.

24. Compensation Events

24.1 The following issues shall constitute Compensation Events:

- (a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Appendix to Conditions of Contract.
- (b) The Employer modifies the List of Other Contractors, etc., in a way that affects the Work of the Contractor under the Contract.
- (c) The Project Manager orders a delay or does not issue drawings, specifications or instructions required for execution of the Works on time.
- (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon the Work, which is then found to have no defects.
- (e) The Project Manager unreasonably does not approve a subcontract to be let.
- (f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to tenderers (including the Site investigation reports), from information available publicly and from a visual inspection of the Site.
- (g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer or additional work required for safety or other reasons.
- (h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.
- (i) The effects on the Contractor of any of the Employer's risks.
- (j) The Project Manager unreasonably delays issuing a Certificate of Completion.
- (k) Other compensation events described in the Contract or determined by the Project Manager shall apply.

24.2 If a compensation event would cause additional cost or would prevent the Work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

24.3 As soon as information demonstrating the effect of each compensation event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager will assume that the Contractor will react competently and promptly to the event.

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24.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having co-operated with the Project Manager.

24.5 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the Appendix to Conditions of Contract.

24.6 The Contractor shall give written notice to the Project Manager of his intention to make a claim within thirty days after the event giving rise to the claim has first arisen. The claim shall be submitted within thirty days thereafter.

Provided always that should the event giving rise to the claim of continuing effect, the Contractor shall submit an interim claim within the said thirty days and a final claim within thirty days of the end of the event giving rise to the claim.

25. Price Adjustment

25.1 The Project Manager shall adjust the Contract Price if taxes, duties and other levies are changed between the date 30 days before the submission of tenders for the Contract and the date of Completion. The adjustment shall be the change in the amount of tax payable by the Contractor.

25.2 The Contract Price shall be deemed to be based on exchange rates current at the date of tender submission in calculating the cost to the Contractor of materials to be specifically imported (by express provisions in the Contract Bills of Quantities or Specifications) for permanent incorporation in the Works. Unless otherwise stated in the Contract, if at any time during the period of the Contract exchange rates shall be varied and this shall affect the cost to the Contractor of such materials, then the Project Manager shall assess the net difference in the cost of such materials. Any amount from time to time so assessed shall be added to or deducted from the Contract Price, as the case may be.

25.3 Unless otherwise stated in the Contract, the Contract Price shall be deemed to have been calculated in the manner set out below and in sub-clauses 25.4 and 25.5 and shall be subject to adjustment in the events specified thereunder;

(i) The prices contained in the Contract Bills of Quantities shall be deemed to be based upon the rates of wages and other emoluments and expenses as determined by the Joint Building Council of Kenya (J.B.C.) and set out in the schedule of basic rates issued 30 days before the date for submission of tenders. A copy of the schedule used by the Contractor in his pricing shall be attached in the Appendix to Conditions of Contract.

(ii) Upon J.B.C. determining that any of the said rates of wages or other emoluments and expenses are increased or decreased, then the Contract Price shall be increased or decreased by the amount assessed by the Project Manager based upon the difference, expressed as a percentage, between the rate set out in the schedule of basic rates issued 30 days before the date for submission of tenders and the rate published by the J.B.C. and applied to the quantum of labour incorporated within the amount of Work remaining to be executed at the date of publication of such increase or decrease.

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(iii) No adjustment shall be made in respect of changes in the rates of wages and other emoluments and expenses which occur after the date of Completion except during such other period as may be granted as an extension of time under clause 17.0 of these Conditions.

25.4 The prices contained in the Contract Bills of Quantities shall be deemed to be based upon the basic prices of materials to be permanently incorporated in the Works as determined by the J.B.C. and set out in the schedule of basic rates issued 30 days before the date for submission of tenders. A copy of the schedule used by the Contractor in his pricing shall be attached in the Appendix to Conditions of Contract.

25.5 Upon the J.B.C. determining that any of the said basic prices are increased or decreased then the Contract Price shall be increased or decreased by the amount to be assessed by the Project Manager based upon the difference between the price set out in the schedule of basic rates issued 30 days before the date for submission of tenders and the rate published by the J.B.C. and applied to the quantum of the relevant materials which have not been taken into account in arriving at the amount of any interim certificate under clause 23 of these Conditions issued before the date of publication of such increase or decrease.

25.6 No adjustment shall be made in respect of changes in basic prices of materials which occur after the date for Completion except during such other period as may be granted as an extension of time under clause 17.0 of these Conditions.

25.7 The provisions of sub-clause 25.1 to 25.2 herein shall not apply in respect of any materials included in the schedule of basic rates.

26. Retention

26.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Appendix to Conditions of Contract until Completion of the whole of the Works. On Completion of the whole of the Works, half the total amount retained shall be repaid to the Contractor and the remaining half when the Defects Liability Period has passed and the Project Manager has certified that all defects notified to the Contractor before the end of this period have been corrected.

27. Liquidated Damages

27.1 The Contractor shall pay liquidated damages to the Employer at the rate stated in the Appendix to Conditions of Contract for each day that the actual Completion Date is later than the Intended Completion Date. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not alter the Contractor's liabilities.

27.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rate specified in Clause 23.30

28. Securities

28.1 The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a reputable bank

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acceptable to the Employer, and denominated in Kenya Shillings. The Performance Security shall be valid until a date 30 days beyond the date of issue of the Certificate of Completion.

29. Dayworks

29.1 If applicable, the Dayworks rates in the Contractor's tender shall be used for small additional amounts of Work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

29.2 All work to be paid for as Dayworks shall be recorded by the Contractor on Forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the Work being done.

29.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

30. Liability and Insurance

30.1 From the Start Date until the Defects Correction Certificate has been issued, the following are the Employer's risks:

- (a) The risk of personal injury, death or loss of or damage to property (excluding the Works, Plant, Materials and Equipment), which are due to;
 - (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works, or
 - (ii) negligence, breach of statutory duty or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.
- (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in Employer's design, or due to war or radioactive contamination directly affecting the place where the Works are being executed.

30.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is the Employer's risk except loss or damage due to;

- (a) a defect which existed on or before the Completion Date.
- (b) an event occurring before the Completion Date, which was not itself the Employer's risk
- (c) the activities of the Contractor on the Site after the Completion Date.

30.3 From the Start Date until the Defects Correction Certificate has been issued, the risks of personal injury, death and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risk are Contractor's risks.

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The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts stated in the Appendix to Conditions of Contract for the following events;

- (a) loss of or damage to the Works, Plant, and Materials;
- (b) loss of or damage to Equipment;
- (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract, and
- (d) personal injury or death.

30.4 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation required to rectify the loss or damage incurred.

30.5 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

30.6 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager. Both parties shall comply with any conditions of insurance policies.

31. Completion and taking over

31.1 Upon deciding that the Works are complete, the Contractor shall issue a written request to the Project Manager to issue a Certificate of Completion of the Works. The Employer shall take over the Site and the Works within seven [7] days of the Project Manager's issuing a Certificate of Completion.

32. Final Account

32.1 The Contractor shall issue the Project Manager with a detailed account of the total amount that the Contractor considers payable to him by the Employer under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 30 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 30 days a schedule that states the scope of the corrections or additions that are necessary. If the final account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a Payment Certificate. The Employer shall pay the Contractor the amount due in the Final Certificate within 60 days.

33. Termination

33.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. These

fundamental breaches of Contract shall include, but shall not be limited to, the following;

- (a) the Contractor stops work for 30 days when no stoppage of work is shown on the current program and the stoppage has not been authorized by the Project Manager;

- (b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days;
- (c) the Contractor is declared bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- (d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 30 days (for Interim Certificate) or 60 days (for Final Certificate) of issue.
- (e) the Project Manager gives notice that failure to correct a particular defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;
- (f) the Contractor does not maintain a security, which is required.

33.2 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under Clause 33.1 above, the Project Manager shall decide whether the breach is fundamental or not.

33.3 Notwithstanding the above, the Employer may terminate the Contract for convenience.

33.4 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible. The Project Manager shall immediately thereafter arrange for a meeting for the purpose of taking record of the Works executed and materials, goods, equipment and temporary buildings on Site.

34. Payment Upon Termination

34.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the Work done and materials ordered and delivered to Site up to the date of the issue of the certificate. Additional liquidated damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable by the Contractor.

34.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the Work done, materials ordered, the reasonable cost of removal of equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works.

34.3 The Employer may employ and pay other persons to carry out and complete the Works and to rectify any defects and may enter upon the Works and use all materials on the Site, plant, equipment and temporary works.

34.4 The Contractor shall, during the execution or after the completion of the Works under this clause remove from the Site as and when required, within such reasonable time as the Project Manager may in writing specify, any temporary buildings, plant, machinery, appliances, goods or materials belonging to or hired by him, and in default the Employer may (without being responsible

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for any loss or damage) remove and sell any such property of the Contractor, holding the proceeds less all costs incurred to the credit of the Contractor.

Until after completion of the Works under this clause the Employer shall not be bound by any other provision of this Contract to make any payment to the Contractor, but upon such completion as aforesaid and the verification within a reasonable time of the accounts therefore the Project Manager shall certify the amount of expenses properly incurred by the Employer and, if such amount added to the money paid to the Contractor before such determination exceeds the total amount which would have been payable on due completion in accordance with this Contract the difference shall be a debt payable to the Employer by the Contractor; and if the said amount added to the said money be less than the said total amount, the difference shall be a debt payable by the Employer to the Contractor.

35. Release from Performance

35.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop Work as quickly as possible after receiving this certificate and shall be paid for all Work carried out before receiving it.

36. Corrupt gifts and payments of commission

The Contractor shall not;

- (a) Offer or give or agree to give to any person in the service of the

Employer any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other Contract for the Employer or for showing or forbearing to show favour

or disfavour to any person in relation to this or any other contract for the Employer.

- (b) Enter into this or any other contract with the Employer in connection with which commission has been paid or agreed to be paid by him or on his behalf or to his knowledge, unless before the Contract is made particulars of any such commission and of the terms and conditions of any agreement for the payment thereof have been disclosed in writing to the Employer.

Any breach of this Condition by the Contractor or by anyone employed by him or acting on his behalf (whether with or without the knowledge of the Contractor) shall be an offence under the provisions of the Public Procurement Regulations issued under The Exchequer and Audit Act Cap 412 of the Laws of Kenya.

37. Settlement of Disputes

37.1 In case any dispute or difference shall arise between the Employer or the Project Manager on his behalf and the Contractor, either during the progress or after the completion or termination of the Works, such dispute shall be notified in writing by either party to the other with a request to submit it to arbitration and to concur in the appointment of an Arbitrator within thirty days of the notice. The dispute shall be referred to the arbitration and final decision of a person to be agreed between the parties. Failing agreement to concur in the appointment of an Arbitrator, the Arbitrator

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shall be appointed by the Chairman or Vice Chairman of any of the following professional institutions;

- (i) Architectural Association of Kenya
- (ii) Institute of Quantity Surveyors of Kenya
- (iii) Association of Consulting Engineers of Kenya
- (iv) Chartered Institute of Arbitrators (Kenya Branch)
- (v) Institution of Engineers of Kenya

On the request of the applying party. The institution written to first by the aggrieved party shall take precedence over all other institutions.

37.2 The arbitration may be on the construction of this Contract or on any matter or thing of whatsoever nature arising thereunder or in connection therewith, including any matter or thing left by this Contract to the discretion of the Project Manager, or the withholding by the Project Manager of any certificate to which the Contractor may claim to be entitled to or the measurement and valuation referred to in clause 23.0 of these conditions, or the rights and liabilities of the parties subsequent to the termination of Contract.

37.3 Provided that no arbitration proceedings shall be commenced on any dispute or difference where notice of a dispute or difference has not been given by the applying party within ninety days of the occurrence or discovery of the matter or issue giving rise to the dispute.

37.4 Notwithstanding the issue of a notice as stated above, the arbitration of such a dispute or difference shall not commence unless an attempt has in the first instance been made by the parties to settle such dispute or difference amicably with or without the assistance of third parties. Proof of such attempt shall be required.

37.5 Notwithstanding anything stated herein the following matters may be referred to arbitration before the practical completion of the Works or abandonment of the Works or termination of the Contract by either party:

37.5.1 The appointment of a replacement Project Manager upon the said person ceasing to act.

37.5.2 Whether or not the issue of an instruction by the Project Manager is empowered by these Conditions.

37.5.3 Whether or not a certificate has been improperly withheld or is not in accordance with these Conditions.

37.5.4 Any dispute or difference arising in respect of war risks or war damage.

37.6 All other matters shall only be referred to arbitration after the completion or alleged completion of the Works or termination or alleged termination of the Contract, unless the Employer and the Contractor agree otherwise in writing.

37.7 The Arbitrator shall, without prejudice to the generality of his powers, have powers to direct such measurements, computations, tests or valuations as may in his opinion be desirable in order to

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determine the rights of the parties and assess and award any sums which ought to have been the subject of or included in any certificate.

37.8 The Arbitrator shall, without prejudice to the generality of his powers,

have powers to open up, review and revise any certificate, opinion, decision, requirement or notice and to determine all matters in dispute which shall be submitted to him in the same manner as if no such certificate, opinion, decision requirement or notice had been given.

37.9 The award of such Arbitrator shall be final and binding upon the parties.

SECTION IV – APPENDIX TO CONDITIONS OF CONTRACT

Name of Employer: **Ministry of Ministry of Water, Sanitation and Irrigation**

Address: P.O. Box 49720-00100, Nairobi

Name of Employer's Representative: **PRINCIPAL SECRETARY,**

P.O. Box 49720-00100, Nairobi

Name of Engineer: **DIRECTOR, IRRIGATION AND DRAINAGE,**

P.O. Box 49720 - 00100, Nairobi

Name of Resident Engineer:_____

The name (and identification number) of The Contract is:

Tender No MWSI/ONT/003/2020-2021

The Works consist of the works described in the Tender Documents.

The Start Date shall be: **as stated in the Engineer's or his Representative's Notice to commence work.**

The Intended Completion period for the whole of the Works shall be 365 days (Contractor to indicate period of construction).

The following documents also form part of the Contract: As stated in Clause 2.1 of the Instruction to Tenderers.

The site Possession Date shall be the date site is handed over by the Employer or his Representative.

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The site is Located at The

Defects Liability Period is **6 MONTHS**

Amount of Tender Security is **Kshs.....(2% of the Tender Price)** in the Form of Tender Security or a Bank guarantee, from a reputable Commercial bank or insurance, to **Principal Secretary, Ministry Water, Sanitation and Irrigation.**

The amount of performance security is 5% of Contract Price in form of a Performance Bank Guarantee, from a reputable Commercial bank, acceptable to the Employer.

SUB-CLAUSE

Amount of bond of guarantee	10.1	5%.....Percentage of the Contract price
Minimum amount of third party insurance	23.2	...N/A.....Per Occurrence with the number of occurrence unlimited
Period of commencement for Engineers order to commence	41.1	...14.....days
Liquidated Damages		0.15% of contract price per day
Amount of liquidated	47.1	
Period of maintenance	49.1	6.....months
Percentage of retention period % of tender sum	60.3	10.....percent
Minimum amount of interim certificate	60.2	3 million.....Kshs

Date thisday of.....2020

Signature.....in the capacity of

Duly authorized to sign tenders and for and behalf of.....

.....

Witness.....

Address.....

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SCHEDULE OF THE MAJOR PLANT TO BE USED ON THE CONTRACT:

ITEM	NO:	MAKE	MODEL & YEAR	OWNED / HIRED	PRESENT LOCATION

We here by certify that this list is not exhaustive and notwithstanding the plan detailed above, we will provide suitable and adequate planning good working order for the timely and successful completion order for the timely and successful completion of the works.

Tenderer:_____

Name:_____

Designation:_____

Signed: _____

Date:_____

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SCHEDULE OF MANPOWER:

1. Tenderer to give an estimate of the manpower he intends to employ subdivided categories.
2. Tenderer to give names, qualifications, status and experience records of all executive personnel he proposes to employ on the works especially their curriculum vitae.
3. Tenderer can attach additional sheets.

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SCHEDULE OF RELEVANT

-

PROJECTS COMPLETED:

Please fill in information about the relevant projects completed over the past five years.

NAME OF EMPLOYER	NAME, LOC. & TYPE OF PROJECT	NAME OF ENGINEER SUPERVISING	VALUE OF CONTRACT & DATE	% PARTICIPATION OF COMPANY	WAS CONTRACT SATISFACTORILY COMPLETED ON TIME PROVIDED

Sufficient information including addressee should be provided to permit Employer approach the individual or firm for a confidential report on the Contractor's performance during the execution of the project. ***The Contractor should submit Completion Certificates.***

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SECTION V: TECHNICAL SPECIFICATIONS

1 GENERAL

1.1 General Description of the Works

1.1.1 Works to be undertaken by the Contractor

The main works to be undertaken under this contract comprise the following:

- A. Construction of Headworks.
- B. Construction of sedimentation basin.
- C. Conveyance
- D. Construction of main pipeline
- E. Construction of Distribution lines
- F. Construction of infield system.

1.2 Location of the Works

Kanini irrigation project is situated in Gakui sub-location, Chogoria location, Chogoria ward, Mara Sub-County of Tharaka Nithi County. It is approximately 25.0km North of Chuka town on the way to Meru town.

1.3 Climatic Conditions

Kanini Irrigation Project lies in Agro-Ecological Zone UM2 according to the Farm Management Handbook. This is mainly the major coffee zone. The annual rainfall ranges from 900 – 1450mm per annum and a 60% reliability of 800mm. Peak rainfall occurs in November while the months of June to September have the lowest rainfall. The annual mean temperature varies between 15^oC - 25^oC. Except for four months in a year (April – May and November – December) the evaporation surpasses the rainfall in all the rest. The potential evapo-transpiration is 4.5mm/day.

1.4 Drawings and Documents

The drawings listed in Section 6 of the Tender Documents and any other modifications to those drawings and any other drawings that may be prepared by the Contractor and approved by the Engineer shall subsequently become the Contract Drawings.

For the purpose of carrying out the Contract, the Contractor will be provided with 2 sets of the Contract Documents and full size (A1) Contract Drawings.

1.5 Standard Specifications

For convenience and in order to establish the necessary standards of quality, reference has been made to specifications issued by national or other widely recognised bodies. Such specifications shall be referred to as 'Standard Specifications' and shall be the latest editions of such specifications issued prior to the issue of these Tender documents together with such additions or amendments as may have been issued prior to the same date. Subject to the written approval of the Engineer, any other internationally accepted Standard Specification which requires an equal quality of work may be used.

If the Contractor proposes to use a Standard Specification other than that specified, three copies of the proposed Standard Specification in English, shall be submitted to the Engineer not less than 28 days before approval of Standard Specification is required.

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In referring to Standard Specifications, the following abbreviations are used:

BS	British Standard
ISO	International Organization for Standardization
ASTM	American Society for Testing and Materials
ASA	American Standards Association
KBS	Kenya Bureau of Standards
KS	Kenya standard

1.6 Works Designed by the Contractor

All drawings, calculations, plans, reports, instruction manuals, pamphlets, data and all other documents required to be submitted by the Contractor under the Contract shall be clear and readable. The Contractor shall submit these drawings and documents in a logical order to the Engineer for review or approve at least fifty-six (56) calendar days prior to execution of the Works.

All shop drawings, including field erection, layout and construction details shall be furnished by the Contractor for the approval of the Engineer.

All the drawings and calculation to substantiate the design shall be checked, signed and approved by the Contractor prior to submission. The drawings shall also be signed by a qualified engineer responsible for the design.

Approval of the drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method and detailing is satisfactory. The approval by the Engineer shall not relieve the Contractor of the requirement of the Contract or responsibility for correct installation and assembly of parts in final position or responsibility for the quality of method of construction.

All the cost thereof will be deemed to be included in the Contractor's unit rates and Contract sum.

1.7 As Built Drawings

Within forty five (45) days after the receipt of the Completion Certificate, the Contractor shall submit to the Engineer all the approved drawings and documents (including operation and maintenance manuals), clearly revised and brought up to date by the Contractor to show the permanent construction actually made. The submission shall be made in the following manner and quantity:

- One (1) set of the A1 size reproducible drawings on high quality polyester transparent film or similar material,
- One (1) set of the A1 size blue print.
- The submission shall contain the drawing index.
- No separate payments will be made for the provision of the drawings as the cost thereof shall be deemed to be included in the unit rates and the Contract Sum.

1.8 Site Meetings

The Contractor shall be obliged to attend all meetings at the appointed time. The discussions of such meetings shall include but not be limited to the progress of work and problems having direct bearing on the immediate and long term activities (construction, procurement, transport, labor etc).

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The Engineer shall invite the Employer for such meetings.

1.9 Progress Photographs

The Contractor shall furnish the Engineer with coloured photographs (not less 8cm x 12cm size) of the work in progress throughout the Contract period. The photographs shall be taken at the start, during and at the completion of each major task of the work as directed by the Engineer. A brief description and date of each photograph shall be included.

All negatives shall be numbered, retained on the site and on completion of the Works the negatives shall become the property of the Employer.

1.10 Level Datum

The survey control points and benchmarks shown on the drawings shall be handed over to the Contractor as basis for surveying and setting out of Works. The Contractor shall be responsible for carrying out the field surveys for the performance of the Works.

Before using the control points and bench marks for setting out of the Works, the Contractor shall carry out a check survey thereon and satisfy himself as to their accuracy. The Employer shall bear no responsibility for the accuracy of any control point or benchmark.

The Contractor may establish additional temporary bench marks for his own convenience but each temporary bench mark shall be of a design and in a location approved by the Engineer and shall be accurate in relation to the bench marks established by the Engineer.

The Contractor shall protect the reference points and level bench marks and in the event of any damage he shall re-survey and re-establish the points and bench marks.

1.11 Setting Out

The Contractor shall appoint and employ the necessary qualified and experienced staff to set out the Works accurately. The Contractor shall establish and locate all lines and levels and be responsible for the correct location of all Works.

Where directed by the Engineer, the Contractor shall take such levels and dimensions as may be required for the purposes of measurements prior to disturbance of the ground. These shall be agreed between the Contractor and the Engineer in writing before any of the surface is disturbed or covered up.

1.12 Construction and Checking of Work

The Contractor shall be solely responsible for and shall provide all labor, tools, lifting tackle and other equipment required for the construction and checking of the Works.

No operatives shall be allowed to execute any type of work, which is normally carried out by a skilled tradesman, unless the operative is thoroughly experienced and proficient in the trade concerned. Supervisors and operatives may be required to demonstrate their proficiency or produce certificate of competence to the satisfaction of the Engineer.

As each part of the work is carried out it shall be subject to the approval by the Engineer.

1.13 Supervision and Labour

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The Contractor will be required to maintain a competent supervisor and staff on site throughout the construction period until completion of the Works, and thereafter as may be required during the defects liability period. The Engineer shall give prior approval to the appointment of this supervising Site Agent and key staff and shall have authority to withdraw the approval at any time in accordance with the Conditions of Contract.

All staff and labor employed on the Works shall be employed in accordance with the local labor and employment laws and regulations.

1.14 Works Executed by the Employer or by other Contractors

The Employer reserves the right to execute, on the site, works not included under this Contract and to employ for this purpose either his own employees or other contractors whose contracts may be either a sub-contract under this Contract, or an entirely separate contract. The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operations of the Employer, or his contractors employed on such works and the same obligations shall be imposed on the Employer or other contractors in respect of work being executed under this Contract.

1.15 Contractor's Site Offices, Workshops, Storage and Working Areas

The Employer shall provide, free of charge, areas of land where the Contractor shall establish the office, housing, workshop, stores, accommodation and camp for himself and his employees. In which case, the Contractor shall provide erect, service and maintain all necessary buildings as offices, housing or workshop/stores for himself, his staff and his employees. These buildings shall form the time of their erection until the completion of the Contract be the property of the Employer and the Contractor shall not demolish or remove any buildings or part of any buildings without the written permission of the Engineer.

All huts, buildings, fixtures and fittings provided by the Contractor shall be removed and the site reinstated at the end of the Contract.

The Employer reserves the right to allocate areas of land less than the Contractor may require. In such case, the Contractor shall make his own arrangement for obtaining the use of the additional areas that he requires.

The location of all the offices, stores and the like shall be to the approval of the Engineer.

1.16 Definition and Use of the Site

1.16.1 Definition of the Site

The Site shall include all those areas of land which, being public or private:

- Are being provided by the Employer for the purpose of constructing the permanent works.
- Are being provided by the Employer for Temporary Works, including camps, offices and stores.
- Are acquired, leased, or operated by the Contractor as borrow pits or spoil tips for the Permanent Works, including all access roads.

1.16.2 Use of the Site

The lands and other places outside the Site which are the property of or under the control of the Employer shall not be used except with the approval of the Engineer.

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The Contractor shall at any time remove any vehicle or vessel or any other obstruction under his control that may be required to be removed by the Engineer for any purpose. The Contractor shall move such obstruction promptly on instruction being given.

The Contractor shall maintain access for the inspection, operation and maintenance of any of the Employer's plant or works which lies within the Site or elsewhere.

The Contractor shall not use any portion of the Site for any purpose not connected with the Works unless the written permission of the Engineer has been obtained.

Except with the written permission of the Employer, to be given when necessary for the execution of the Works, the Contractor's employees will not be permitted to enter any of the Employer's buildings or lands, or sites under the control of other contractors or the Engineer. The Contractor shall warn his employees that any person found within such buildings or sites without authority is liable to be removed from the Works in accordance with the Conditions of Contract.

1.17 Possession of the Site

The Contractor shall restrict to those areas of the Site adjacent to the works being executed and shall avoid any encroachment upon lands outside the areas for which possession has been given. Any trespass or damage or any claim arising from such encroachment shall be the Contractor's sole responsibility and he shall hold the Employer indemnified against all claims arising from such trespass or damage.

1.18 Interference with the Works

The Contractor shall not interfere in any way with any existing works, whether the property of the Employer or of a third party, whether or not the position of such works is indicated to the Contractor by the Engineer, except where such interference is specifically described as part of the Works, either in the Contract or in an instruction from the Engineer.

1.19 Material for the Works

All material shall comply with appropriate Standard Specifications unless otherwise required hereinafter.

The Contractor shall, before placing any order of materials, manufactured articles or machinery for incorporation in the Works, submit for the approval of the Engineer the names of the suppliers from whom he proposes to obtain such materials, manufactured articles or machinery, together with a list of the same, giving the origin, quality, weight, strength, description and other relevant details. No materials, manufactured articles or machinery shall be ordered or obtained from any suppliers which the Engineer has not approved in writing.

All materials shall be delivered to the Site a sufficient period of time before they are required for use in the Works, to enable the Engineer to take such samples as he may wish for testing and approval.

Notwithstanding the fact that approval has been given to the source of supply, the Engineer may forbid the use of any materials if, upon delivery, they are found to be defective, or he considers them unsuitable for incorporation in the Works. Such rejected materials shall be removed from the site forthwith.

The Contractor may propose alternative materials of equivalent quality to those specified, and subject to the approval, such materials may be used in the Works.

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The Contractor shall have no claim against the Employer in respect of any financial loss which he may suffer as a result of the rejection of any such materials, and he shall also bear the cost of removing them from the Site.

The Engineer shall have the right to inspect materials and plant for the permanent works during the course of manufacture. The Contractor shall arrange for the right of access to manufacturing premises for the Engineer and his staff during normal working hours. The Engineer shall be given sufficient notice by the Contractor to allow him to observe the testing of any materials for the works at the place of manufacture. The Engineer shall also be given the opportunity to inspect any material or plant in their completed state prior to packing for transport to the site.

If requested by the Engineer, the Contractor shall provide to the Engineer copies of orders for the supply of goods or materials required in connection with the works.

1.20 Rejected Materials and Defective Work

Materials or work which, in the opinion of the Engineer, do not comply with the Specification, shall be classified as rejected materials or defective work, and shall be cut out and removed from the Works and replaced as directed by the Engineer.

1.21 Existing Works and Services

The Contractor shall acquaint himself with the positions of all existing works and services including water mains, storm water drains, cables, and service poles before any excavation is commenced.

The Contractor will be held responsible for any damage, however caused, in the course of the execution of the Works, to such existing works and services.

Such existing works and services, where exposed by the execution of the works, shall be properly shored, hung-up and supported to the satisfaction of the Engineer and of the authority concerned.

Poles supporting cables and the like adjacent to the Works shall be kept securely in place until the Works are completed and shall then be made as safe and permanent as before.

Notwithstanding the foregoing requirements and without lessening the Contractor's responsibility, the Contractor shall inform the Engineer immediately any existing works have been exposed and shall comply with any requirements of the authority concerned.

Only when and as directed by the Engineer shall the position of existing works or services be changed by the Contractor to meet the requirements of the proposed work.

The Contractor shall make adequate provision so that when carrying out his work, no interference, damage or pollution is caused to roads and footpaths, or to any mains, drains, and the like or other parts of the Works. Wherever loads have to be carried over ground in which pipes, valves, culverts, and the like are buried, the Contractor shall take all precautions including where necessary, the provision and use of sleepered roads, light gauge railways or other means to prevent damage occurring to such underground works. The Contractor shall not store any plant or materials or spoil heaps over existing water mains, or in such positions that interference with access to the mains, control gates and the likes is created. Approval by the Engineer to the means of protection employed shall not relieve the Contractor of any responsibility in respect of damage occasioned by his operations.

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The laying of pipework, ducts, drains, and the like shall be arranged so as to cause as little interference as possible with the smooth operation of existing works.

When breaking out and making good existing structures, the Contractor shall disturb the existing structures as little as possible. All structures shall be made good with materials similar to those used in the existing works, or such materials which are considered by the Engineer to be of similar appearance and suitable in all other respects.

1.22 Existing Access

Existing access to lands, property and all other places shall be maintained by the Contractor during the continuance of the Works to the Engineer's satisfaction.

1.23 Liaison with Police and other Officials

The Contractor shall keep in close contact with the police and other officials in the areas concerned regarding their requirements for the control of workmen, movement of traffic, or other matters and shall provide all assistance and facilities which may be required by such officials in the execution of their duties.

1.24 Water and Power for Use on the Works

The Contractor shall be solely responsible for the location, procurement and maintenance of a water supply adequate in quality and quantity to meet his obligations under the Contract.

The Contractor shall be solely responsible for the location and continuity of the supply of water for use on the Works. Supplies may be derived from rivers and streams, but shall in all cases be to the Engineer's approval, and the abstraction of water from any sources shall not interfere with any permanent water supply. The Contractor shall be solely responsible for the transporting of water from its source to the point at which it is required for construction purposes, and in such quantities and quality as to enable the Works to proceed without hindrance due to the shortage of adequate water supplies.

The Contractor shall make his own arrangements for power supplies and shall be solely responsible for the location, procurement and maintenance of a power supply, adequate to meet his obligations under the Contract.

The Contractor shall make his own arrangements for the supply of adequate safe drinking water, electricity and other services to the Permanent Works, Temporary Works and Contractor's equipment and shall provide and maintain all pipes, cables and fittings which may be necessary to carry such services to his operations.

1.25 Inspection by Engineer during the Defects Liability Period

The Engineer will give the Contractor due notice of his intention to carry out any inspection during the defects liability period. The Contractor shall, upon receipt of such notice, arrange for suitable representatives to be present at the times and dates named by the Engineer. This representative shall render all necessary assistance and shall take note of all matters and things to which his attention is directed by the Engineer.

1.26 Site Offices for the Engineer

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The Contractor will construct and equip the site office as specified by the Engineer. See attached drawing.

1.27 Accommodation for the Engineer

The Engineer and his staff will arrange for their accommodation.

1.28 Survey Instruments and Chainmen for the Engineer

The Contractor shall provide and maintain in first class working order, for the sole use of the Engineer and his staff for the duration of the Contract, the following minimum survey instruments complete with all accessories, tapes, poles, staves, stagings, moulds, templates, profiles, and requisites necessary for checking and setting out, and measurement of the Works. The equipment shall revert to the Contractor at the end of the Contract period.

The survey equipment shall include the following or similar approved as a minimum:

Table 1-1: Survey Equipments

Description	Quantity
Automatic level machine	1
Tripod stand	1
Levelling staff	2
GTS 225 TOPCON Total station	1
Single Prism and target	3
Plumbing Pole tripod with	3
50m measuring tape	1

1.29 Engineer's Laboratory

There will be no site laboratory. All samples will be taken to recognised laboratories approved by the Engineer. The Contractor shall allow for all the necessary labor and equipment necessary for the sampling.

1.30 Transport for the Engineer

The Engineer and his staff will be responsible for own transport arrangements.

1.31 Sign Boards

Before the erection of any sign boards or posters by the Contractor, the Contractor shall obtain the approval of the Employer and the Engineer to the size, location and wording of such sign boards or posters.

Unless otherwise agreed, the signboard shall be in seven sections. Section one shall contain:

Name of financing governments

- In white lettering on a blue background.
- The second section shall bear the words:

Names of the Program and Project

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- in white lettering on a blue background.
- The Third section shall bear the words:

Name of the financiers

- in white lettering on a blue background.
- The Fourth section shall bear the words:

Name of the Employer

- in white lettering on a blue background.
- The fifth section shall bear the words:

Name of the implementing agency

- in blue lettering on a white background.
- The sixth section shall bear the words:

Name of the executing agency

- in blue lettering on a white background
- The Seventh section (Contractors' Board) shall bear the words:-

Name of the Contractor

- in blue lettering on a white background.
- Lettering on these boards shall be as directed by the Engineer.
- Further boards may be added with the names of sub-contractors.

1.32 Tracked Contractor's Equipment

The Contractor's tracked equipment may not be run on any public or private road without the written permission of the owner or authority concerned.

1.33 Fuel supplies

The Contractor shall arrange for obtaining, storing and distributing all fuel oils required for the completion of the Works. The storage of fuel on site shall comply with the Petroleum Act and or Factories Act applicable in Kenya. Copies of this can be purchased by the Contractor at the Government Printer.

1.34 Telephone and Communications

The Contractor shall obtain suitable means of communications during the course of the Contract. The use of radio communications may be permitted but the Contractor shall be responsible for obtaining all the necessary permission and licences.

1.35 Preservation of trees

No tree shall be removed without prior written permission of the Engineer who will limit the removal of trees to the minimum necessary to accommodate the Permanent Works.

If trees are removed or damaged by the Contractor or his employees, without approval, then the Contractor shall replace such trees.

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Replacement of trees shall be with those more than two years of age, obtained from a reputable nursery and of a species approved by the Engineer. The Contractor shall plant, water and ensure that the replacement trees are properly established, all at his own cost.

1.36 Protection from water

The Contractor shall keep the whole of the Works free from water and shall be deemed to have included in his Contract Sum all costs for pumping, shoring, temporary drains, sumps and other measures and provisions necessary for such purposes and for clearing away and making good to the satisfaction of the Engineer any damage caused thereby.

1.37 Protection against Fires

The Contractor is advised that, at all times, it is necessary to guard against fires starting within the Site or in the environs thereof, particularly as the result of the Works or from the actions of his employees. The Contractor shall have available, at all times, a trained fire-fighting team provided with adequate fire-fighting equipment and shall deal with all fires on the Site howsoever caused.

The Contractor shall be responsible for maintaining qualified fire fighting crew on the Site at all times as well as maintaining an efficient fire alarm system. The Contractor shall also submit a fire prevention and fire-fighting program for the Engineer's approval.

The Contractor shall provide suitable and adequate fire fighting equipment, to the satisfaction of the Engineer, for ready use at all the times in all the Engineer's site establishment including Contractor's residential quarters, labor camps and ancillary buildings. These shall be maintained until the completion of the construction and handing over of the works to the Employer.

The Contractor shall comply with laws and regulations regarding fires and with respect to the prevention of fires. No fire may be lit in the dry season without written permission from the Engineer and/or the relevant Authority.

1.38 Safety precautions

The Contractor's attention is drawn to the Circular Ref: KA/17/A/2(4) from Factories Inspectorate, Ministry of Labour, Notice No. 79 gazetted in the Kenya Gazette No. 56 (Legislative Supplement No. 38) in respect of the appointment of Safety Supervisors on Building and Works of Engineering Construction. In accordance with this requirement, the Contractor shall appoint a Safety Supervisor who shall be qualified in safety and familiar with the works being performed. The Safety Officer shall ensure that adequate measures and rules for the protection of health and safeguarding against accidents are enforced.

The Contractor shall take all necessary precautions against risks of loss of life or of injury to any person employed on the Works or to employees of the Employer and to the Engineer or to visitors or to persons having good and sufficient reasons to be about the Works, and to this end he shall properly safeguard the Works to the satisfaction of the Engineer.

The Contractor shall at all times comply with any accident prevention regulations and any safety regulations peculiar to the various trades employed on the Works, and any safety regulations published by the Government.

The Contractor shall report promptly to the Engineer all accidents involving the death of or serious injury to any person on the Site or resulting from the Contractor's operations.

The Contractor shall, at his own expense, educate all his employees on safety precautions based on good practice on site. This shall be done in both English and Kiswahili

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languages. Safety instructions shall deal with all safety measures including but not be limited to the following; protective clothing, helmets and footwear, use of lifting equipment, precautions against electrical shock, welding, routine procedures in case of accidents, fires, etc., watchmen, warning notices and barriers, use of drilling equipment and dust suppression and use and storage of explosive.

1.39 Explosives and Fuels

The Contractor shall make arrangements to transport, store and handle explosives and fuels in a safe manner for protecting the public in accordance with the laws and regulations in force in Kenya. In this regard, he shall submit a program to the Engineer for approval for the safe handling and storage of explosives and fuels. When approved, the Contractor shall issue a copy to each of his personnel involved with the handling of explosives and fuels.

The Contractor shall obtain all necessary licenses and shall pay all fees and charges in respect of the same as may be necessary for the purpose of moving explosives and fuels from place to place and storing the same, and shall make all applications and obtain approvals from the relevant authorities of the Government of Kenya.

The Contractor shall construct his explosives magazines at locations and in a manner complying with the relevant regulations of Kenya and approved by the Engineer. Detonators and fuse shall be stored in a separate magazine away from explosives. In no case shall they be transported in the same vehicle with explosives.

The Contractor shall provide adequate protective facilities to safely store and to prevent the loss or theft of explosives. Overnight storage of explosives and detonators outside of the magazines will not be permitted. Magazines shall be securely locked when not in use.

The Contractor shall maintain an inventory record of storage and withdrawal of all explosives including detonators. This record shall be available to the Engineer, and the Engineer shall be promptly notified of any loss or theft of explosives.

The Contractor shall supply and install sirens and loudspeakers systems, so that adequate warning may be given to all persons who may be endangered when explosives charges are to be fired. The Contractor shall ensure, prior to discharging explosives, that the area to be blasted is clear of all workmen, residents, pedestrians etc. In addition he shall post flagmen on each of the roads entering the said area so as to stop and prevent any traffic from entering into the area until "all clear" notification is given.

During thunderstorms and other electrical disturbances, no charging will be permitted.

1.40 Above Ground Fuel Storage Tanks

The fuel storage tank shall comply with BS 21, 1387, 799, 2594 and 5410 and shall have internal working pressure up to and including 0.4 bars, measured at the top of the tank, and a maximum internal vacuum of 10m bar. Unless otherwise shown on the drawings, the tank shall have a manhole whose centre shall be 450mm from one end. Filling point shall be fitted to the highest point in the tank shell and vent and dip point shall be fitted preferably at the centre of the manhole lid. The Contractor shall supply the dip stick.

The drain point shall be fitted at the lowest point in the tank and flush with the inside of the shell. This shall be at a minimum of 150mm from the ground level. The draw off shall be welded near the base of the tank on the vertical centre-line and at the opposite end to the drain.

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The tank shall be suspended from the ground by saddle supports and the bond between the tank and the supports shall be broken by application of bituminous paint on the tank and the saddles. The tank shall be fitted with lifting tugs/hooks of sufficient strength at locations shown on the drawings. The location of the tank shall be firm ground with reinforced concrete slab with a provision of catch pits and sumps of sufficient capacities and to the satisfaction of the Engineer. A bund wall shall be provided round the hard standing concrete slab.

The tank shall be earthed in accordance with BS 7430 AND 6651. The earth system shall terminate with copper earth rod in earth test pit.

1.41 Watching, Fencing and Lighting

The Contractor shall employ competent watchmen to guard the Works both by day and night.

Any excavations, material dumps, spoil dumps or other obstructions likely to cause injury to any person or thing shall be suitably fenced off and at night marked by red warning lights.

Fences shall consist of at least three 15mm diameter hemp ropes or 4mm diameter wires, or more if required, stretched tightly between poles, and standards secured in solid ground, well clear of the excavation. The poles, and standards shall not be more than 15m apart, and where circumstances require, they shall be placed close together. Ropes or wires shall be stretched tight approximately 0.4m, 0.8m and 1.2m respectively above the ground. Banks of spoil may be accepted by the Engineer in lieu of fencing if of suitable height and form.

Fences and spoil banks shall be clearly marked at the ends, all corners, and along the length at intervals of not more than 15m by means of white lime washed boards, discs, stones or oil drums during the daytime and by red lamps burning at night. Markers shall be freshly lime washed at regular intervals to ensure that they are white and clean.

If a road is closed, or partly closed to traffic, temporary traffic and barricades shall be erected by the Contractor to the satisfaction of the Engineer and the police, or other relevant authority, to give proper warning to traffic and the public. Lettering on road signs shall be black on a yellow background and shall incorporate reflective material. The signs shall be adequately illuminated at night.

1.42 Soil Conservation

All precautions shall be taken by the Contractor to prevent the erosion of soil from any lands used or occupied by the Contractor for the purpose of the execution of the Temporary Works.

If in the opinion of the Engineer, the Contractor's operations in areas other than the permanent works caused soil erosion, the Contractor shall undertake soil conservation measures in these areas as directed by the Engineer. The details of the proposed soil conservation measures shall be submitted by the Contractor for the Engineer's approval prior to the execution of the said works.

All soil conservation measures shall be carried out at the earliest possible time, as approved by the Engineer, to ensure that the required protection is established most effectively during the progress of Works.

No separate payment will be made for the soil conservation measures and such costs shall be deemed to be included in the respective unit rates and the Contract Sum.

1.43 Dust Abatement

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During the performance of the work the Contractor shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance resulting from his operations. Measures shall include, but not be limited, to installation of dust suppression units on his rock drilling equipment, watering down of excavated material during loading operations, and use of water tankers to sprinkle access roads, disposal areas, etc.

The Contractor shall be held liable for any damage to crops, cultivated fields and dwellings of persons in the neighbourhood of the Works resulting from his operations.

No separate payment will be made for the dust abatement measures and the costs thereof shall be deemed to be included in the respective unit rates and the Contract Sum

1.44 Noise Control

All work shall be carried out without unreasonable noise. Compressors used on site shall be silenced either by using only full silenced models or fitted with effective exhaust silencers and properly lined and scaled acoustic covers all to the design of the manufacturers of the compressor or by the use of effective acoustic screens to enclose the noise source. Pneumatic percussion tools used on Site shall be fitted with silencers of a type recommended by the manufacturers of the tools. Compressors, silencers or other equipment shall be maintained in good and efficient working order.

No separate payment will be made for noise suppression measures and the costs thereof shall be included in the unit rates and the Contract Sum.

1.45 Sanitation

The Contractor shall provide adequate sanitation and refuse collection and disposal facilities complying with state laws and local by-laws for all houses, offices, workshops, and the like, erected on the site, all to the satisfaction of the Engineer.

The toilet facilities provided at the site by the Contractor shall be made available, free of charge, to the employees of the Contractor and any other contractors.

The Contractor shall warn his employees and sub-contractors that any employee found fouling the site shall be removed from the site immediately in accordance with the Conditions of Contract.

The Contractor shall remove all rubbish and to this end shall provide adequate number of covered garbage bins/containers placed at convenient points around the site establishments. The Contractor shall institute and maintain a regular garbage collection and disposal system. Garbage shall be disposed of by burial or by other means approved by the Engineer.

No separate payment will be made for such sanitary arrangements and all such costs will be deemed to be included in the unit rates and Contract Sum.

1.46 First Aid and Medical Services

The Contractor shall provide and maintain all equipment necessary to render First Aid in case of accidents, snakebites or other emergencies. This equipment shall be kept in readiness at the sites of the works, at camps and wherever the Contractor's staff may regularly live and work. The Contractor shall ensure that there are persons available to all such places with knowledge of simple First Aid procedures and able to administer snakebite treatment.

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Notwithstanding the minimum requirements prescribed above, the Contractor shall be responsible for the adequacy of all the arrangements made.

1.47 HIV/AIDS Awareness

The Contractor shall implement an HIV/AIDS awareness programme for his Personnel.

1.48 Pollution

During the execution of the Works, the Contractor shall ensure that no pollution of existing watercourses is allowed to take place as a result of his operations. The Contractor shall take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the republic or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

1.49 Restoration of Drains, Streams, Canals etc

Subject to any requirement of the Works whereby a permanent change is to be made, all drains, canals, pipes, channels, water-courses or streams temporarily cut through or disturbed by the excavation of the Works are to be restored so that the water flowing in them may continue to flow in as full and free manner as it did before the disturbance.

1.50 Site Clearance

On completion of the Works, the Contractor shall clear the site and remove all temporary buildings, equipment and debris. The Contractor shall level off and grade all areas used for haul roads and all building, store and workshop areas. The whole of the site shall be left in a clean and tidy condition.

1.51 Weather Records

The Contractor shall erect a rain gauge ("Nylex 600" or similar approved) and a double bulb, minimum/maximum thermometer (0.1°C accuracy) at a site agreed with the Engineer. The Contractor shall be responsible for the daily measurement of rainfall and minimum and maximum temperature to be taken at 8:00a.m each day.

1.52 Tolerances

All works shall be constructed to the tolerances shown in Section 8 of these specifications.

1.53 Units and Abbreviations

The units of measurement used in these Contract Documents are metric.

The following abbreviations have been used for units and for other words or phrases as indicated.

Abbreviations in the Contract Documents shall have the following meanings:

mm	millimetre
m	meter
km	kilometre
sq.m,m ²	square metre
ha	hectare

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cu m,m ³	cubic metre
sec,s	second
hr	hour
min	minute
wk	week
l	litre
gm	gram
kg	kilogram
t	tonne
No	Number
nr	Number (in bill of quantities)
dia	diameter
max	maximum
min	minimum
AD	above datum (levels in metres)
ch	chainage (distance in metres)
eo	extra over
e	exceeding
ne	not exceeding
PQ	Provisional Quantity
PS	Provincial Sum
Do	Ditto
fob	free on board
cif	cost, insurance, freight
wt	weight
%	percent
mh	manhole
ic	inspection chamber
HYS	high yield steel
PCC	precast concrete
uPVC	uplasticised polyvinylchloride
GMS	galvanised mild steel
DI	ductile iron
SV	sluice valve
ISO	International Standards Organisation.
S	Kenyan Standard
BS	British Standard
KShs.	Kenya Shillings

2 EARTHWORKS

2.1 Site Clearance and Stripping

General clearance is defined as the clearing, grubbing, (removal and disposal of all vegetation, grass, debris, bushes, dense bush, trees, hedges, undergrowth, stumps, roots, shrubs, plants and backfilling of holes left by the removal of stumps and roots.

The widths and lengths over which site clearance is to be carried out shall be instructed by the Engineer. Site clearance over the area of quarries, borrow pits, stockpiles and spoil tips shall be carried out where instructed by the Engineer. The Engineer may give instructions that specific trees, stumps or objects shall not be removed during site clearance operation.

If termite moulds are excavated, the whole of the mould shall be removed.

Where the Engineer instructs that site clearance is required, the entire area shall be cleared and all materials thus cleared shall become the property of the Employer. Unless otherwise instructed, vegetation and perishable materials shall be carted to spoil areas, which spoil areas shall be provided in accordance with requirement of this Specification.

If the Contractor clears the Site in advance of the main Works such that the grass and other vegetation re-grows prior to the main Works commencing at any particular location then any additional, or repeating of, site clearance required shall be at the Contractor's expense.

When instructed by the Engineer, the Contractor shall demolish wholly or in part, remove and dispose of all buildings, foundations, structures, fences and any other obstructions which have not been designed to remain.

The Contractor shall carefully take down such buildings, structures, fences etc. and the components shall be dismantled, cleaned and stacked in separate heaps. All materials which, in the opinion of the Engineer, are not fit for re-use shall be removed from the site to spoil areas provided in accordance with the requirements of this Specification. All materials, which are re-usable, shall remain the property of the Employer and shall be preserved and protected by the Contractor until removed by the Employer or until the expiry of the Defects Liability Period.

All existing paths, fences, walls, hedges, trees, shrubs, lawn and other features which the Engineer instructs not to be removed or otherwise dealt with, shall be protected from the damage, and any damage which occurs due to the Contractor's failure to take adequate precautions shall be repaired at the Contractor's expense.

Site clearance shall be measured in square metre, calculated as the plan area instructed by the Engineer to be cleared. The rate for the site clearance shall include for the cost of complying with the requirements of Clauses 2.1, 2.13 and 2.14.

Stripping work shall basically consist of removal of top soil, grasses, vegetative material to a depth of 150mm below ground level and its disposal to a stockpile. Stripping shall include for removal, stockpiling and for reinstatement or spreading as directed by the Engineer.

Measurement and payment of this shall be in square metres, calculated as the plan area instructed by the Engineer.

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2.2 Surface Levels

After the area of any section of the Works has been cleared and after trees have been felled, stumps removed and termite mounds excavated to the satisfaction of the Engineer, but before any other work is commenced, surface levels of the ground shall be taken. The levels shall be taken at spacing agreed with the Engineer. Levels shall similarly be taken on the surface of the ground after the removal of unsuitable overburden prior to placing fill and at the interface between natural ground, rock or artificial hard material layers. The levels shall be agreed with the Engineer. The Contractor shall prepare plans and sections which shall, when finally and mutually agreed, be signed by the Engineer and Contractor as truly representing the configurations of the areas in question at the commencement of excavation or fill construction.

2.3 Definition of Earthworks

The following definitions of earthworks materials shall apply to this and other Clauses of the Specification in which reference is made to the defined materials:

- “top soil” shall mean the top layer of soil that can support vegetation;
- “Suitable material” shall comprise all material which arises from excavations within the Site and which is approved by the Engineer as acceptable for use in the works;
- “Unsuitable material” shall mean material other than suitable material and shall comprise:
 - material from swamps, marshes and bogs,
 - logs, stumps and perishable materials,
 - material susceptible to spontaneous combustion,
 - clay of liquid limit exceeding ninety (90) and/or plasticity index exceeding sixty five (65).

“Rock” or “hard material” shall be material which cannot be ripped to an average depth of greater than 300 mm by a track type crawler tractor complying with the following:

- in good order complete with all equipment and accessories as supplied;
- rated 300 BHP flywheel power or over;
- with an operating weight of not less than 37.2 tonnes;
- equipped with a hydraulically operated single tine ripper compatible with the tractor used; and
- operated by a qualified operator in accordance with the manufacturer's recommendations and to the satisfaction of the Engineer.

Where it is impractical to prove hard material by the above method then the quantity of hard material, if any, shall be determined by the Engineer.

Where excavation contains individual boulders of hard material greater than 0.3m³ each in volume then such boulders shall be classified as hard material.

- (d) “soft material” material shall mean all material other than that defined as “rock” or “hard material”.

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2.4 Removal of Unsuitable Material

Where directed by the Engineer the Contractor shall remove unsuitable material to the depth as ordered or agreed by the Engineer and shall dispose of it in approved spoil tips.

2.5 Excavation General

Excavation shall be carried out with the allowances for working space given in the Method of Measurement to the Bill of Quantities, unless otherwise shown as lines, levels and profiles on the Drawings or to such other lines, levels and profiles as the Engineer may direct or approve in writing. The work shall be carried out by the Contractor in such a way as to avoid disturbance to the surrounding ground. Particular care shall be taken to maintain stability when excavating in close proximity to existing works.

The work shall be carried out in a careful manner to ensure that the exposed surfaces are as sound as the nature of the material permits and that no point shall protrude inside the lines shown on the Drawings except as otherwise specified or agreed by the Engineer. In soft excavation, which is to remain open permanently, exposed faces shall be formed accurately to the required slopes and profiles. Excavations in rock where the faces shall remain open permanently shall be trimmed so that no point protrudes within the required profile.

The Contractor shall examine all excavated faces regularly and shall remove all insecure material or materials resulting from any falls. Where instructed in writing by the Engineer, the Contractor shall wash down exposed surfaces of excavated rock for inspection.

The Contractor shall dispose of all material arising from excavations. If it is suitable and required for the Permanent Works it shall be placed directly in such Works or set aside for use as and when required in suitable approved dumps, otherwise it shall be removed to tips provided by the Contractor unless otherwise provided or directed by the Engineer.

The Contractor shall be responsible for keeping all excavations free from water from whatever cause arising and shall provide such pumping capacity and other measures as may be necessary for this purpose. The Contractor shall make good any damage that may result from his failure to keep the excavations free from water.

All excavation shall be carried out with care and the method and Contractor's equipment to be used in execution thereof shall be to the satisfaction of the Engineer. The Contractor shall be responsible for the safety and security of all excavations at all times during the execution of the contract and where necessary shall provide timbering, shoring or other measures required by the Engineer to prevent movement or loss of ground outside the boundaries, settlement of or damage to property, or injury to persons. The Contractor shall make good any damage to structures, services or other properties caused by such movement, loss of ground and settlement. The Contractor shall also take precautions to route his equipment in such a manner as to minimise the likelihood of slips occurring due to vibration or surcharge from the working or movement of heavy machinery.

The Contractor will be permitted, subject to the approval of the Engineer, to adjust side slopes of excavations in soft materials which are to remain open temporarily in preference to shoring or strutting. However no payment shall be made for extra excavation volume as a result of these measures.

The Contractor shall notify the Engineer without delay of any permeable strata, fissures or unusual ground encountered during excavation.

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2.6 Blasting

The Contractor shall not be permitted to use explosives for rock excavation without the approval of the Engineer. The Contractor shall only employ suitably qualified and experienced personnel to manage and supervise blasting operations. For each blasting operation, the Contractor shall submit to the Engineer for approval a statement detailing the type of explosives to be used, method of transport, storage, blasting procedures, safety precautions to be observed and the names and experience of the personnel who will supervise the work. Notwithstanding the Engineer's approval, the Contractor will be responsible for the blasting operations and shall accept full and absolute liability for any claims resulting either directly or indirectly from the use of explosives on the Site.

The blasting operations shall comply in every respect with the regulations and laws covering the use of explosives and the Contractor shall be responsible for obtaining all necessary permits.

2.7 Excavation beyond Line or Level

If from any cause whatsoever excavations are carried out beyond their true line and level other than on the instructions of the Engineer, the Contractor shall make good to the required line and level with the appropriate grade of filling to be contained in the true excavation, or with concrete or other approved material in such a manner as the Engineer may direct. This shall be at the Contractor's expense.

2.8 Approval of Excavation

When excavations have been taken out accurately to the profiles or dimensions required for the work the Contractor shall inform the Engineer who shall carry out an inspection of the excavation. If, after his inspection the Engineer requires additional excavation to be carried out, the Contractor shall do so to such new profiles or dimensions as the Engineer may direct.

2.9 Excavation for Structures

Open excavation to form a foundation for a structure shall be carried out to the lines necessary to permit the proper construction of the structure to the approval of the Engineer.

Where a structure is to be founded on soft ground, the excavation shall be taken down until the required formation is exposed and prepared to the approval of the Engineer. Where concrete has to be placed on a soft foundation, the Engineer may direct that a blinding layer of lean concrete be placed beneath the structural concrete immediately after completion and approval of the excavation, or require the Contractor to remove the last 100mm of excavation immediately prior to placing the concrete. If foundation conditions are very soft the Engineer may instruct that additional material be excavated and replaced with compacted gravel or hardcore.

Where a structure is required to be founded on rock but is not required to penetrate into it, all soft overburden shall be removed and the surface of the rock cleared of any loose material by barring and wedging. Where the foundation is required to penetrate into the rock, excavation of the rock may be carried out by blasting but in such a manner as to prevent the shattering of the rock which is to remain. The Engineer may direct that the last 300mm of rock be left and be removed by barring and wedging or by the use of approved pneumatic tools so that the exposed surface is sound.

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The Contractor shall report to the Engineer whenever excavations are ready to receive concrete. No concrete shall be placed in the foundations until the Contractor has obtained the Engineer's agreement that a secure foundation has been reached and that the excavation has been carried out to the lines and levels required.

2.10 Excavation for Fill Foundation

Foundations for embankments shall be excavated to the depths or to the soil or rock grade indicated on the Drawings or described in the Specification. The suitability of each part of the foundation for placing fill thereon shall be determined by the Engineer. No fill shall be placed before acceptance of the foundation by the Engineer and recording of the geology.

Where specified in the Drawings or Specification or directed by the Engineer, seams and other defects below the general level of the foundations shall be excavated and filled or covered with materials including mortar and concrete to the satisfaction of the Engineer before fill is placed thereon.

Where embankments are to be constructed on sloping ground, and where shown on the Drawings, benches shall be excavated in the foundations to the dimensions shown on the Drawings.

Except where specifically permitted by the Engineer all foundations for fill shall be kept free of water when placing fill thereon.

Earth foundations shall have the top 150mm sufficiently moistened and, if necessary, harrowed or scarified and compacted to at least ninety five per cent (95%) of the maximum dry density as determined by the AASHTO T99. Material too wet to be so compacted shall, as directed by the Engineer, be allowed to dry, harrowed or scarified to reduce the moisture content to the required amount and then be re-compacted.

2.11 Trench Excavation

Trench excavation shall be performed by the use of hand tools and approved mechanical equipment, in such manner as to minimise disturbance of the sides and bottom of the excavation.

Trenches for pipes shall be excavated to a sufficient depth to enable the pipe and the specified joint, bedding, haunching and surround to be accommodated. Unless otherwise stated, the width of the trench shall be equal to the nominal diameter of the pipe plus 600mm.

The Contractor shall fill any over excavation beneath the pipe or bedding at his own cost with well rammed selected general excavation material as per requirement of this Specification. The Contractor shall dispose of surplus excavated material not required for backfill to spoil tips.

The sides of trenches shall be adequately supported at all times. Alternatively where the Contractor has to excavate the trenches in open cut the Contractor shall ensure that the side slopes of the excavation are sufficient for stability.

Where rock or boulders are present in the sides or base of a trench in which a pipe is to be installed, the trench shall be trimmed so that when the pipeline is laid, no projection of rock comes within 200mm of the outside of the pipe at any point. The over excavated portion shall be backfilled as set out in this Specification with approved granular material at the Contractor's expense.

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The Contractor shall be entirely responsible for the sufficiency of all temporary supports and side slopes to the excavations. The excavation shall be carried out in such a way as to maintain the stability of all roads and other adjacent structures or works.

2.12 Channel Excavation

The excavation of all channels shall be executed in such a manner as to ensure that the stability of side slopes is not endangered. Should slips or undercutting occur for reasons attributable to the Contractor's negligence or method of working, the Engineer will give instructions for remedial works to be carried out by the Contractor at the expense of the Contractor.

Where channels are to be reshaped, cleared and trimmed, the width, depth, side slopes and centre line radius shall be as shown on the Drawings. The Contractor shall clear all weeds and growth from existing channels and grade the beds to required levels. The area of waterway shown is the minimum required and sides of channels shall be trimmed to the required slope so as to provide widths not less than those shown on the Drawings.

Any channels, streams, drains or pipes taking water to or from cultivated land shall be diverted so as to maintain their flow before being moved or broken into unless express permission to the contrary is given by the Engineer. All diversions and their subsequent reinstatement are to be carried out to the satisfaction of the Engineer. The Contractor shall be deemed to have included the cost of dealing with this in his rates.

Side banks of channels shall be trimmed to a neat appearance and even surface.

In the construction of channels and embankments a local balance of cut and fill shall be maintained as far as possible unless the cut is unsuitable material or is specified in the drawings that the fill should be imported. A deficiency of fill material shall be made up by bed borrow or gleaning. Surplus material, if suitable and approved by the Engineer may be used for an increased width of embankment otherwise it may be spread at the toe of the embankment or placed on spoil tips as directed by the Engineer.

Where required the Contractor shall control the rates of filling and draw-down of water in channels so as not to endanger the stability of earthworks.

2.13 Disposal of Excavated Material

Material obtained from excavations which are suitable for forming embankments or other fill areas shall be placed directly in the Works or set aside for use as and when required in suitable approved dumps. Any such suitable material which may be surplus to the total requirements of the Works shall be taken to spoil in tips provided by the Contractor, unless otherwise provided or permitted by the Engineer.

If the Contractor is permitted to remove suitable material from the site to suit his operational procedure or to take such material for purposes other than forming embankments or other fill areas, he shall make good any consequent deficit of filling arising there from, unless otherwise agreed by the Engineer.

All material not suitable for embankments or other filling shall, unless otherwise directed by the Engineer, be taken to separate spoil tips provided by the Contractor.

The cost of disposal of surplus or unsuitable materials shall be deemed to be included in the respective unit rates for the excavation work and the Contract Sum.

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2.14 Spoil Tips

The Contractor shall be responsible for the provision and sufficiency of tips for the permanent disposal of spoil and shall select their location within the general areas indicated on the Drawings or as otherwise designated or approved by the Engineer. The Contractor shall submit his proposals for the locations and detailed treatment of tips to the Engineer for approval, which will in no way relieve the Contractor of his responsibilities and obligations under the Contract, whether or not locations are shown on the Drawings or otherwise designated.

No spoil shall be permanently deposited elsewhere than on approved spoil tips unless approved by the Engineer. Spoil tips shall be built up and compacted and trimmed and regulated to levels and profiles approved by the Engineer. Where directed by the Engineer, upper surfaces and slopes of the tips shall be soiled to specified thickness.

2.15 Borrow Pits and Quarries

Where there may be an insufficiency of suitable material from excavations for filling or is specified on the drawings, the Contractor shall obtain such material from borrow pits or quarries approved by the Engineer where the filling is required for Permanent Works. The Engineer may propose a borrow pit for exploration by the Contractor, however, it shall be entirely the responsibility of the Contractor to locate suitable sources of borrow material for fills.

The Contractor shall investigate the site or sites which they propose to open up and shall provide full and detailed information by means of boreholes, trial pit testing reports, etc. to satisfy the Engineer that the quality of the material meets Specification requirements and that the quantity is adequate for the Works.

Notwithstanding the foregoing, the Engineer shall have the right to order the Contractor to obtain materials from a particular designated source or by widening cuttings for permanent works beyond specified profiles.

The Contractor shall provide equipment and make all other arrangements for excavating, loading and transporting material of the specified quality for completion of the Works in accordance with the agreed programme. These provisions shall include where necessary for any operations involving selection, stockpiling and rehandling of suitable material, the disposal of unsuitable material or overburden and any other operations which may be found necessary due to the nature and disposition of the excavated materials.

The pits and quarries shall be operated in a safe manner provided with ample drainage leaving no stagnant pools. On completion of the Works they shall be left free-draining and in a tidy and regular state. All loose material shall be barred down and no face shall be left overhanging except with the approval of the Engineer.

The removal of vegetation, topsoil and overburden at the borrow pits shall not be paid for separately. Contractor will be deemed to have allowed for the costs elsewhere in his rates. The same applies to any works required to access the borrow pits.

The rate for fill shall include for the supply of material inclusive of extraction, loading and transportation to Site for a maximum haulage distance of 30km, one way. Where suitable borrow pit is not available within this distance, overhaul will be paid for. Measurement shall be the product of the volume of compacted material insitu and the haulage distance in excess of 30km, one way, along the shortest route, as determined by the Engineer. The Contractor shall be responsible for the maintenance of this selected route, at his own cost.

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2.16 Earth Filling

Material for filling shall be obtained from approved sources and shall not contain more than 1% of vegetation matter, rubbish and humus material and shall contain no boulders or rock of a size greater than half the compacted thickness of the layer. No material shall be used which is so uniformly graded that D_{60} divided by D_{10} is 4 or less, where D_{60} and D_{10} are sizes such that 60% and 10% by width of the particles are finer than D_{60} and D_{10} respectively.

Unless otherwise specified the fill material for the stilling basin embankments shall meet the following requirements:

- CBR after 4 days soaking compacted to 100% of AASHTO T99 at optimum moisture content of not more than 3%.
- Plasticity Index (PI) of more than 40%.
- Permeability of less than 1×10^{-6} mm/s

Prior to commencement of filling, the Contractor shall submit in writing to the Engineer for approval his proposals for carrying out the work such that the optimum use may be made of excavated material as far as possible. The proposals shall include the compaction equipment and methods for adjusting the moisture content of the material which he intends to use. No filling shall be carried out until the proposals and the material intended to be used are approved by the Engineer.

Fill shall be placed in layers not exceeding 150mm compacted thickness, each layer being scarified and thoroughly compacted to obtain a dry density not less than 95% of the maximum dry density as determined by AASHTO T99. The moisture content shall be adjusted as necessary to achieve the compaction standards.

The Contractor shall take all necessary measures to prevent any damage or defects to the Works which may be caused by settlements, slips or falls of embankments and shall make good such damage or defects as may occur to the satisfaction of the Engineer, all at his own cost.

Any instability of any adjacent excavation resulting from the embankment not being formed to the lines, levels and profile shown in the Drawings or as ordered by the Engineer will be the responsibility of the Contractor. Where double-handling of excavated material is necessary, the Contractor will be responsible for the temporary disposition of the material such that it does not endanger the stability of the excavation.

2.17 Backfilling of Structural Excavations

Backfilling of structural excavations shall be carried out with excavated material selected or approved by the Engineer. The material shall be placed in layers not exceeding 150mm compacted thickness or such other thickness as the Engineer may approve or direct and shall be compacted as specified in Clause 2.16.

When material is filled up to or over any structure, the filling shall be brought up equally on each side or as otherwise agreed by the Engineer so that no unequal pressures likely to cause damage to the structure are applied.

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2.18 Filling under raised foundations

The material to be used as filling under raised foundations shall consist of suitable material obtained from adjacent excavations or approved borrow sources, and shall be placed in layers not exceeding 100mm compacted thickness. The material shall be compacted in accordance with Clause 2.16.

2.19 Frequency of Testing

Testing will be carried out as instructed by the Engineer with the following being the minimum testing frequencies:

- Field Dry Density Moisture Content Test. Every 500m² of compacted fill layer placed or at least 2 tests in any one length of compacted fill, whichever is greater.
- Particle Size Sieving Analysis, Atterberg Limits and AASHTO T99 test. Every 1000 cubic meters of compacted fill or at least 2 tests in any one length of compacted fill, whichever is greater.
- The apparatus for these tests and the manner in which they are carried out will be as described in BS 1377/1990 and AASHTO T99. All results of these tests shall be submitted to the Engineer with the least possible delay.

2.20 Granular Bedding

Granular bedding material shall comply with BS EN 12620 for aggregates within the sizes range 14mm to 5mm. Material complying with BS EN 12620 except in respect of grading may be used provided that it has a maximum size not exceeding 14mm.

2.21 Grassing

Before planting grass, all areas to be planted shall be cleared of stones and any other non-organic matter. Planting shall be carried out when directed, and the Contractor shall keep all grassed areas watered and weed free until the expiry of the Defects Liability Period. Any areas which have failed shall be replanted by the Contractor, at his own expense.

2.22 Slopes and Batters

Where a slope is given in the Specification or on the Drawings as a ratio of vertical and horizontal components, it shall be understood that the first component is vertical in all cases example. a “slope of 1 in 2” will mean one vertical in two horizontal and a “batter of 4 to 1” will mean four vertical to one horizontal. This meaning will be attributed to all other terms such as “inclination” and “gradient”.

2.23 Trial Pits

The Contractor shall excavate, maintain and afterwards refill any trial pits ordered by the Engineer. The sides of the pits shall, where deemed necessary by the Engineer for safety purposes, be supported by sheeting or boarding with adequate framing. A ladder shall be provided for inspection purposes.

2.24 Sheet Piling

Where shown on the drawings or instructed by the Engineer the construction of sheet piling shall comply with the codes of practice for earth retaining structures, BS 8002: 1994.

3 CONCRETE

3.1 Concrete General

Concrete shall consist of cement, graded aggregate and water carefully proportioned, thoroughly mixed, placed and compacted as specified.

The Contractor shall obtain formal approval from the Engineer before pouring any concrete for the permanent works. The Engineer shall allow concreting after ascertaining the required lines and levels, suitability of formwork, availability of required equipment and labor, proper fabrication and spacing of the steel bars and quality and quantity of cement and aggregates.

3.2 Cement

Cement for use in the permanent works shall be Ordinary Portland Cement from an approved manufacturer and shall be type CEM I 32,5N complying with BS EN 197-1. Where sulphate-resisting cement is specified, it shall comply with BS 4027.

All cements shall be certified by the manufacturers as complying with the requirements of the specification. Before orders are placed the Contractor shall submit details of the proposed supplier(s) together with such information on the proposed methods of transport, storage and certification so that the Engineer may satisfy himself that the quantity and quality required can be supplied and maintained throughout the construction period. Where necessary the Engineer may require representative samples of the proposed cement to be taken and forwarded to a nominated laboratory for analysis and testing before the source is approved.

No cement shall be used in the Works until deemed satisfactory by the Engineer.

3.3 Supply of Cement

Cement shall be obtained from one manufacturer unless otherwise authorised by the Engineer. Should the use of cement from different manufacturers be authorised, the different supplies of cement shall be stored separately and shall not be mixed.

The Contractor shall supply to the Engineer copies of the manufacturer's test certificates certifying that each consignment of cement has been tested and analysed, and that the results comply in all respects with the above standards. Each certificate shall state clearly the date of despatch and the number of bags despatched in each consignment.

Bagged cement shall be delivered in sealed 50kilogrammes sacks. Each bag shall be marked with the parcel number of the cement contained. Bagged cement shall be transported so that at no time is it exposed to damp and so that moisture cannot be absorbed from the atmosphere. Cement in bulk shall be transported in totally enclosed water tight and sealed containers.

If cement is obtained from an intermediate agent, such agent's arrangements for transporting and storing cement shall be to the approval of the Engineer.

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3.4 Storage of Cement

The Contractor shall provide sufficient storage capacity on Site to ensure that his anticipated programme of work is not interrupted due to lack of cement. Factors outside the Contractor's control such as transport, weather conditions, holidays and breakdowns shall be taken into account.

Cement delivered to the Site in bulk shall be stored in dry, well ventilated weather proof silos or bins which shall be self clearing. Cement delivered to the Site in bags shall be stored in dry, weather-proof sheds which shall have floors of damp proof construction raised at least 150mm above the surrounding ground.

Cement of different consignments shall be stored separately and consignments shall be used in the same order as they are delivered to the site. No cement shall be stored on the site for longer than three months from the date of despatch by the manufacturer. If not used within that period, the cement shall be removed from the site.

Any bag of cement which is damaged or found to contain cement which has set or partly set, shall be discarded and not used in the Permanent Works.

3.5 Testing of Cement

Cement shall be tested by the manufacturer. If the manufacturer's test certificate is not made available, representative samples shall be taken from different bags or containers of each consignment. They shall be suitably packed and sent to an approved laboratory for testing to prove the cement's compliance with the specified standards.

The Engineer may require cement to be tested after its delivery to the site. Any cement which has been in store at the site for longer than one month shall be re-tested.

The Engineer may take samples of cement from cement bins or bagged cement, from a parcel of cement after its delivery to the site, or from a parcel of cement which has been stored at the site for longer than one month.

In addition to the manufacturer's tests the Engineer may require the following tests to be carried out to BS EN 196-3:

- Comprehensive strength;
- Soundness.

Any cement which fails to meet the specified requirements shall not be used in the Permanent Works.

3.6 Aggregate for Concrete

3.6.1 General

Aggregates for concrete shall comply with BS EN 12620, and shall be obtained from a source or sources approved by the Engineer and shall be transported and stored in such a manner as will prevent:

- Contamination of the aggregates from the ground, rubbish, vegetation, dust or any other foreign material.
- Segregation.
- Intermixing of aggregates of differing characteristics.

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Before aggregates from each source are approved for use in the Permanent Works, tests shall be carried out at an approved testing laboratory on representative samples submitted by the Contractor to check that the aggregates comply with the requirements of the Specification.

During concreting operations, tests shall be carried out to check that aggregates delivered for use in the Permanent Works comply with the requirements of the Specification.

Sampling and testing of aggregates for concrete shall be carried out in accordance with the requirements of BS 812 except where described otherwise.

Moisture contents of aggregates shall be determined as the moisture content of the aggregate compared with that of the aggregate in the saturated surface-dry condition. Specific gravities of aggregate shall be determined on aggregate in the saturated surface-dry condition.

Aggregates shall be stored on a clean, free draining surface. The various types and sizes of aggregates shall be kept separate from each other and each stockpile shall be kept as large as possible to maintain a reasonably uniform content in the aggregate.

3.6.2 *Fine Aggregates*

Fine aggregates shall be clean and durable and shall be natural sand, crushed gravel sand or crushed rock sand complying with BS EN 12620. All the material shall pass through a 5 mm BS sieve. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source.

As an alternative, fine aggregate for mortar only shall comply with BS 1199 and 1200.

The fine aggregate shall not contain iron pyrites or iron oxides. It shall not contain mica, shale, coal or other laminar, soft or porous materials unless the Contractor can show by tests on finished concrete as set out in BS EN 12390 that the presence of such materials does not adversely affect the properties of the concrete.

The proportion of clay, silt and other impurities passing a 75 microns BS sieve shall not exceed three per cent for natural or crushed gravel sand or 15 per cent for crushed rock sand. The shell content shall not exceed 15 per cent by weight.

Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.05 per cent by weight expressed as chloride ion when tested as set out in BS 812, subject to the further restriction given in the note on total chloride content in sub-clause 3.5.5.

Soundness: After five cycles of the test set out in ASTM C88-76, the aggregate shall not show a weight loss of more than 10 per cent.

Samples taken from the fine aggregate shall pass the colour test for organic impurities described in Sub-Clause 3.6.4.

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Tests on fine aggregates shall be carried out daily or as required by the Engineer on site during concreting operations as follows:

- Sieve analysis
- Moisture content. An approved “rapid” test may be used for this test.
- Percentage of material passing a 75 microns BS sieve by the Field Settling Test, checked when necessary by the Decantation Method.
- Test for organic impurities as described in sub-clause 3.5.4.
- The Contractor shall arrange to carry out the following tests when requested by the Engineer:
 - Specific gravity and water absorption.
 - Bulk density.
 - Other tests described in BS 812.

3.6.3 Coarse Aggregates

Coarse aggregates shall be clean, hard and durable crushed rock, crushed gravel or natural gravel complying with the requirements of BS EN 12620. The material shall be frost resistant and shall not contain any iron pyrites, iron oxides, flaky or laminated material, hollow shells, coals or other soft or porous material, or organic matter. The pieces shall be predominantly angular, rounded or irregular as defined in BS 812.

Coarse aggregate shall be supplied in the nominal sizes called for in the Contract and shall be graded in accordance with BS EN 12620 for each nominal size.

The proportions of clay, silt and other impurities passing a 75 microns BS sieve shall be not more than one per cent by weight.

The content of hollow and flat shells shall not be such as will adversely affect the concrete quality when tested as set out in BS 1881. The total shell content shall not be more than the following:

- | | |
|-------------------------------|---------------------------|
| • 40mm nominal size and above | 2 per cent of dry weight |
| • 20mm nominal size | 5 per cent of dry weight |
| • 10mm nominal size | 15 per cent of dry weight |

Chlorides soluble in a 10 percent solution by weight of nitric acid shall not exceed 0.03 per cent by weight, expressed as chloride ion when tested as set out in BS 812 but subject also to the further restriction on total chloride content given in sub-clause 3.5.5.

When tested in accordance with ASTM C289, the aggregate shall be non-reactive.

Soundness: After 5 cycles of the test set out in ASTM C88-76, the aggregate shall not show a weight loss of more than 12 per cent.

Flakiness Index: When tested in accordance with BS 812 shall be as set out hereunder:

- | | |
|-------------------------------|------------------|
| • 40mm nominal size and above | Not more than 40 |
| • 20mm nominal size and below | Not more than 34 |

If the flakiness index of the coarse aggregate varies more than five units from the average value of the aggregate used in the approved trial mix, a new set of trial mixes shall be carried out in the workability of the mixes have been adversely affected by such variation.

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Impact Value: Not more than 45 per cent when tested in accordance with BS 812.

Ten per cent fines value: Not less than 50 kN when tested in accordance with BS 812.

Shrinkage: When mixed with other ingredients in the approved proportions for concrete and tested as set out in BS 1881, the shrinkage factor shall not exceed 0.05 per cent.

Water absorption: The aggregate shall not have water absorption of more than 2.5 per cent when tested as described in BS 812.

Tests on coarse aggregate shall be carried out daily or as required by the Engineer on site during concreting operations as follows:

- Sieve analysis
- Moisture content: An approved “rapid” test may be used for this test.
- Percentage of materials passing a 75 microns BS sieve by the Field Settling Test, checked when necessary by the Decantation Method.

The Contractor shall arrange to carry out the following tests when requested by the Engineer:

- Determination of Flakiness Index.
- Specific gravity and water absorption.
- Determination of “ten per cent fines” and of Los Angeles Abrasion.
- Other tests described in BS 812.

3.6.4 *Test for Organic Impurities*

Aggregates shall be tested for organic impurities by means of discoloration of a sodium hydroxide solution as follows:

A 340ml graduated prescribed bottle shall be filled to the 123ml mark with a sample of the aggregate to be tested. A 3 per cent solution of sodium hydroxide in water shall be added until the volume of the aggregate and liquid after shaking gives a total volume of 194ml. The bottle shall be stoppered, shaken thoroughly and allowed to stand for 24hours. Should the liquid then be darker than the standard colour solution the aggregate shall not be used for making concrete.

The standard colour solution shall be prepared in a 340ml prescription bottle as follows:

- 2.5ml of a 2 per cent solution of tannic acid in 10 per cent alcohol shall be added to 97.5ml of a 3 per cent solution of sodium hydroxide in water. The mixture shall be shaken and allowed to stand for 24 hours.
- A glass of the standard colour may be used in place of the standard solution.

3.6.5 *Total Chloride and Sulphate Contents*

The total chloride content arising from all ingredients in a mix, expressed as chloride ions as a percentage of the weight of cement in a mix, shall not exceed 0.5 per cent in any one sample or 0.3 per cent in 95 per cent of the samples tested. For prestressed concrete, steam cured concrete or concrete containing sulphate resisting cement or super sulphated cement, the total chloride content shall not exceed 0.5 per cent of the weight of cement in the mix.

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The total sulphate content arising from all ingredients in a mix shall not exceed 0.4 per cent by weight of the aggregates or 4 per cent of the weight of cement in the mix, whichever is less. For this purpose the sulphate contents shall be expressed as SO_3 and shall be calculated from the sulphate contents of the cement, aggregates and any admixtures. Where applicable, sulphate contents shall be determined in accordance with tests described in BS 1047 and 3892.

Pulverised fuel ash shall not be used in conjunction with a cement complying with the requirements of BS 4027 in concrete required to be resistant to sulphates.

3.7 Admixtures

Admixtures for improving workability, accelerating or retarding setting of concrete, or for any other purpose, shall comply with BS EN 934 and only be used with the Engineer's written approval. Calcium chloride or admixture containing chlorides will, however, not be approved.

The Contractor shall submit samples of the admixtures he proposes to use to the Engineer for testing. If an admixture is approved for use it shall be obtained from an approved supplier and the Contractor's arrangement for measuring, mixing and adding the admixture to the concrete batch shall be strictly in accordance with the manufacturer's instructions or recommendations and subject to the approval of the Engineer.

The proportions of the concrete mixes and water/cement ratio shall be adjusted to the satisfaction of the Engineer so that the strength of the concrete with admixture is at least equal to the strength of the equivalent concrete without admixture.

3.8 Water for Concrete

Clean fresh water complying with BS EN 1008 is to be used for the mixing of all concrete and mortar, and is to be from a source approved by the Engineer.

3.9 Concrete Mixes

The design of concrete mixes shall be the sole responsibility of the Contractor, but may be undertaken in conjunction with the Engineer. Concrete mixes shall be designed mixes in accordance with the requirements of BS 5328 having the characteristics specified in Table 3.1 of this Specification. Concrete for use in water retaining structures shall comply with BS 8007.

Evidence shall be submitted to the Engineer, for all classes of concrete to be used, showing that at the intended workability the proposed mix proportions and production methods will produce concrete of the required quality.

The following information shall be provided before any designed mix is supplied:

- Nature and source of each material.
- Full details of tests on trial mixes including workability.
- Proposed quantities of each ingredient for one cubic metre of fully compacted concrete.

No change in the approved mix design will be permitted, unless the Contractor carries out trials on the proposed mix design to show that compliance with this Specification can be maintained.

Mix design shall in all cases be subject to the approval of the Engineer, but such approval shall in no way relieve the Contractor of his responsibility for the design and production of concrete in compliance with this Specification.

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3.10 Trial Mixes

At least six (6) weeks before commencing the placing of any concrete in the works, trial mixes shall be prepared for each class of concrete to be used on the works. Three (3) batches of each class of concrete shall be made using materials typical of the proposed supply and under full scale production conditions.

The workability of each of the trial batches shall be determined and three (3) cubes made from each batch for testing at 28 days. A further three (3) cubes made from each batch may be made for tests at an earlier age if required.

The trial mix proportions shall be approved if the average compressive strength of the nine (9) cubes tested at 28 days exceeds the specified characteristic strength by 3 Newtons per square millimetre, or if nine tests at an earlier age indicate that it is likely to be exceeded by this amount.

To demonstrate that the maximum free water/cement ratio is not exceeded, two batches of concrete shall be made in a laboratory with cement and surface-dry aggregate known from past records of the supplier of the material to be typical. The proposed mix proportions will not be accepted unless both batches have the cement content specified and free water/cement ratio below the maximum specified in Table 3.1.

Table 3-1: Classes of Concrete

m	Class	Characteristic Compressive Strength N/mm ²	Maximum Free Water/cement Ratio	Minimum Cement Content kg/m ³	Maximu	Maximum Aggregat e Size mm
					Cement Content kg/m ³	
	C25/10/A	25	0.55	360	400	10
	C25/20/A	25	0.55	360	400	20
	C25/20/B	25	0.55	290	400	20
	C25/20/C	25	-	240	540	20
	C20/20/B	20	0.55	290	400	20
	C20/40/B	20	0.55	260	400	40
	C20/40/C	20	-	220	540	40
	C15/40/C	15	-	180	540	40
	C15/20/C	15	-	180	540	20
	C10/40/C	10	-	150	540	40

A, B and C denote exposure conditions for the finished concrete as defined in BS 8007.

3.11 Testing of Concrete

3.11.1 General

All concrete shall be sampled and tested in accordance with the requirements of BS EN 12350 and BS EN 12390 unless otherwise stated in this Specification or instructed by the Engineer.

The Contractor shall allow for all the necessary labor, materials and equipment necessary for the regular sampling and testing of concrete to be placed in the Works.

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3.11.2 Cement Content

Tests shall be carried out as required by the Engineer to determine the cement content of the mix. The cement content of any batch of concrete shall not be less than the specified minimum value minus 5 per cent of that value nor more than the specified maximum value plus 5 per cent of that value.

3.11.3 Workability

The workability of the concrete shall be measured as required by the Engineer by slump tests or compaction factor tests and shall be within the following limits:

Slump	$\pm$	25mm or $\pm$ one third of required value whichever is greater.
Compacting	$\pm$	0.03 where required value is 0.90 or more
Factor	$\pm$	0.04 where required value is 0.90 to 0.80
	$\pm$	0.05 where required value is 0.80 or less

The required value shall be that which has been accepted under Clause 3.8 of this Specification.

3.11.4 Water/Cement Ratio

The water/cement ratio shall be determined as required by the Engineer and shall not exceed the specified maximum value by more than 5 per cent of that value.

3.11.5 Compressive Strength

Samples of concrete shall be taken for compressive strength at a rate of one sample per 15m³ of concrete placed or 15 batches of concrete placed whichever is the lesser volume. A greater frequency of sampling may be instructed by the Engineer until compliance with specified strength requirements has been confirmed for each class of concrete used in the Works.

Two test specimens shall be prepared from each sample and shall be cured for 28 days, or by any other method approved by the Engineer that enables the prediction of 28 day strength at an earlier time.

On completion of curing, the two test specimens shall be tested. Provided the difference between the two results does not exceed 14 per cent of the mean of the two results, the mean shall be taken as the test result. Where the difference between the two results exceeds 14 per cent of their mean, the lower of the two results shall be taken as the test result.

Compliance with the specified strength may be assumed if the conditions given in both (a) and (b) below are satisfied.

The average compressive strength determined from any one group of four consecutive 28 day test results exceeds the specified characteristic strength by not less than 3N/mm² for classes of concrete C20, C25 and C30 and not less than 2N/mm² for class C15 concrete.

Each individual 28 day test results is greater than the specified characteristic strength minus 3N/mm² for classes of concrete C20, C25 and C30 or 2N/mm² for class C15 concrete.

If only one tests result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that sample was taken provided the average strength of the group satisfies the first requirement.

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If more than one result in a group fails to meet the second requirement or if the average strength of any group of four consecutive test results fails to meet the first requirement, then all the concrete in all the batches represented by all such results shall be deemed not to comply with the strength requirements. For the purposes of this Clause, the batches of concrete represented by a group of four consecutive test results shall include the batches from which samples were taken to make the first and the last tests in the group of four, together with all the intervening batches.

3.12 Failure to Comply with Specified Requirements

Failure of concrete to comply with the specified requirements will result in it being classified as defective work. Immediately on notification by the Engineer that concrete work is defective, the Contractor shall take all measures necessary to improve concrete quality before further concrete is placed in the Works. If required by the Engineer, the rate of sampling of concrete shall be increased until adequate control is again established. Tests shall be carried out on the defective concrete or test cores taken from it to establish its in-situ strength. If the results of these tests satisfy the Engineer that the defective concrete will fulfil its design function then it may be accepted. If not, the Contractor shall propose strengthening or remedial work where possible or shall remove the defective concrete from the Works.

3.13 Concrete Returns and Records

The Contractor shall send weekly to the Engineer a return showing the quantities of cement and the number of mixings of each class of concrete used in each section of the Works.

Records shall be kept by the Contractor of the positions in the Works of all batches of concrete, of their class and of all test cubes or other specimens taken from them. Copies of these records shall be supplied to the Engineer.

3.14 Equipment and Construction Procedure

The design, layout, installation and operation of equipment for processing, handling, transporting, storing and proportioning concrete ingredients and for mixing, transporting and placing concrete shall be to the satisfaction of the Engineer. Before the equipment is ordered or delivered to site, the Contractor shall submit to the Engineer drawings showing the proposed arrangements of the equipment together with detailed descriptions of the equipment proposed.

3.15 Batching

The aggregates and cement shall be proportioned by means of efficient weigh batching machines except when the Engineer has approved the use of volume batching. The machines shall be carefully maintained and cleaned and they shall be provided with simple and convenient means of checking the accuracy of the weighing mechanism, and they shall be checked when required by the Engineer.

For volume batching suitable gauge boxes shall be used.

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3.16 Mixing Concrete by Machine

Where the concrete is to be mixed in machines, these shall be of the batch mixing or other approved type. The machines shall ensure that all the concreting materials including the water are thoroughly mixed together before any portion of the mixture is discharged. The mixing time shall not be less than thirty seconds per cubic foot (30sec/cft) of concrete, with a minimum of three minutes (3min) mixing time per batch. The machines must be capable of discharging their contents while running.

3.17 Mixing Concrete by Hand

Where it is not possible to employ machine mixing and approval has been obtained from the Engineer, concrete shall be mixed by hand as near as practicable to the site where it is to be deposited. Clean mixing bankers or platforms of sufficient area for the proper execution of the work shall be provided. These platforms if constructed of timber shall consist of planks closely jointed so as to avoid the loss of any grout or liquid from the wet concrete. The whole of the aggregate and cement shall be turned over on the banker in a dry state at least twice. The water shall then be added gradually through a rose head, after which the materials shall again be entirely turned over in a wet state at least three times.

3.18 Preparation of Surface to Receive Concrete

Foundations which are to receive concrete shall be properly drained and dewatered so that no water runs over or stands on a surface on which concrete is being placed. If required by the Engineer drains provided through or beneath concrete for the temporary conveyance of water shall afterwards be completely sealed to the Engineer's approval.

Before deposition of concrete against rock, the rock surface shall be thoroughly wetted and cleaned by the application of water, or of water and air, under pressure. No concrete shall be deposited until the surface has been cleaned and passed as satisfactory by the Engineer.

Faults or seams in the rock shall be cleaned to a depth satisfactory to the Engineer and if necessary stemmed with cement mortar of an approved mix.

Before any steel reinforcement is embedded in the concrete any loose mill scale, loose rust and any oil, grease or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operations shall likewise be removed.

3.19 Authority to Commence Placing of Concrete

The Contractor shall give the Engineer at least 24 hours notice of his intention to place concrete in a particular section of the Works. Before concrete is placed the Contractor shall apply to the Engineer for approval of the cleanliness, alignment and suitability of surfaces against which the new concrete is to be placed and of the fixing of formwork, reinforcement, embedded parts and the like and he shall obtain written permission from the Engineer to proceed with concreting.

The Contractor shall carefully plan his concreting operation to ensure, where possible, that these operations are completed within the normal working day.

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3.20 Dimension of Concrete Pours and Programme of Placing

Unless otherwise approved by the Engineer concrete shall be cast in one operation between external faces of concrete and joints shown on the Drawings or between construction joints or both.

The Contractor shall submit and obtain the Engineer's approval to a detailed concreting programme and his proposals for the location of construction joints.

3.21 Transport and Deposition of Concrete

Concrete shall be transported and deposited in such manner as to prevent segregation, loss of materials or contamination with foreign matter. The means of transport of concrete shall be subject to the approval of the Engineer. The containers for conveying the concrete shall be thoroughly cleaned immediately after use and sides dampened before work is started or restarted to prevent cement and fine material in the first batch adhering to the sides. Adequate precautions shall be taken to protect the concrete against wetting or drying out through exposure to the weather and to prevent segregation and consolidation of the mix due to prolonged jolting of the concrete. Concrete shall be placed in its final position and fully compacted before the onset of initial set. Wherever possible, concrete shall be deposited vertically in the final position required and shall not be dropped through a greater height than 1.5m. Where necessary, bins, drop chutes, downpipes or baffles shall be provided to prevent segregation of the material. Drying out of fresh concrete before deposition shall be prevented by the provision where necessary of suitable covers. Loss of slump during transport and deposition of the concrete shall not exceed 25mm.

Concrete shall not be placed in standing or running water unless so specified. Where concrete has to be placed under water, the Contractor shall submit to the Engineer his proposals indicating the methods and equipment to be employed. The concrete shall be deposited by bottom discharging watertight containers or through funnel shaped tremies which are kept continuously full with concrete up to a level above the water and which shall have the discharging bottoms immersed in the concrete in order to reduce to a minimum the contact of the concrete with the water. Special care shall be taken to avoid segregation and additional cement of about 25% must be added.

3.22 Distribution and Spreading of Concrete

Concrete shall be placed in layers not exceeding 500mm in depth approximately parallel to the horizontal or inclined construction joint planes. These layers shall be deposited from one face to the other until the full height of the lift is reached. Each layer shall be deposited on the previous one before the latter has taken its initial set and the exposed area of fresh concrete shall be maintained to the practical minimum. In order to accomplish this timing a new layer may be started before the previous layer is completed.

The face from which placing of concrete is to commence shall be selected so that if an emergency should occur which prevents the layer being completed the vertical construction joint will be formed in a structurally acceptable position.

Concrete shall not be placed during rain sufficiently heavy or prolonged to wash mortar form coarse aggregate on the exposed sloping faces of fresh concrete unless adequate shelter is provided.

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Concrete shall not be placed against any surface (including formwork, reinforcement, embedded steelwork, adjacent concrete or rock) which during hot weather is not adequately dampened to prevent excessive absorption of water from the fresh concrete.

Once commenced, concreting shall be carried on as continuous operation between pre-arranged construction, expansion or contraction joints save only if an emergency occurs and interruption is unavoidable. The Contractor shall have readily available suitable prefabricated formwork for stop ends to form emergency vertical construction joints and, in the event of such an interruption occurring, the concrete already placed shall be properly finished up to the stop end and to a horizontal or inclined surface as directed by the Engineer. In water retaining structures the Contractor shall propose methods of making the joint watertight.

Concrete shall be placed carefully so as not to displace the formwork or reinforcement.

3.33 Compaction of Concrete

The Contractor shall thoroughly compact all concrete immediately after it has been placed in position. Unless otherwise authorised by the Engineer, compaction shall be accomplished with the aid of immersion vibrators as specified below, together, if necessary, with rods, shovels and the like. Particular care shall be taken to fill all voids and to work the concrete against rock and existing concrete surfaces, round any reinforcement and embedded fixtures and into the corners of the formwork.

If the Contractor does not wish to use immersion vibrators for any portion of the works he shall submit his proposals for alternative vibrators or compaction equipment and shall receive the Engineer's approval to the equipment before commencing to concrete the portion concerned.

Vibrators shall be of a type and size adequate for the portion placed. Vibrators shall operate at a frequency of between 7000 and 10000 impulses per minute. The Contractor shall ensure that vibrators are operated at pressures and voltages not less than those recommended by the manufacturer in order to ensure that the compactive effort is not reduced.

A sufficient number of vibrators shall be operated to enable the entire quantity of concrete being placed to be vibrated for the necessary period and in addition stand-by vibrators shall be available for instant use at each concreting place. The length and diameter of the vibrating element of immersion vibrators shall be sufficient to penetrate through the layer of concrete being placed and re-vibrate the upper portion of the underlying layer of concrete. Only men experienced in the use of vibrators shall be employed on this type of work.

Vibration shall be continued at each point until the concrete ceases to contract, a thin layer of mortar has appeared on the surface and air bubbles have ceased to appear. The period of vibration necessary shall be determined by trial in the presence of the Engineer. Vibration shall then be continued for this period at each point before any further concrete is superimposed.

Immersion vibrators shall be inserted vertically to penetrate into the layer underneath at regular intervals, which shall not exceed the distance from the element over which vibration is visibly effective and in any case shall not exceed 700mm. Vibrators shall not be used to move concrete laterally and shall be withdrawn slowly to prevent the formation of voids. Vibrators shall not be applied to reinforcement or other embedded items.

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3.24 Protection of Concrete

Freshly placed concrete shall be protected from rainfall and from water running over the surface until it is sufficiently hard to resist damage from this cause.

No traffic shall be allowed on any concrete surface until such time as it is hard enough to resist damage by such traffic.

Concrete placed in the Permanent Works shall not be subjected to any structural loading until it has attained at least its nominal strength.

If the Contractor desires to impose structural loads on newly placed concrete, he shall make at least three test cubes and cure them in the same conditions as the concrete they represent. These cubes shall be tested singly at suitable intervals in order to estimate the time at which the nominal strength is reached.

3.25 No Partially Set Concrete shall be used

All concrete must be placed and compacted in its final position within thirty minutes (30min) of discharge from the mixer unless otherwise approved. No partially set material shall be used in this work.

3.26 Plum Concrete

Plums shall be hard clean natural stones embedded in mass concrete during the placing of the concrete. Unless otherwise shown on the drawings, the plums shall not be larger than one third of the cross section of the concrete and should not be placed closer than 150mm to each other vertically and 100mm horizontally. The volume of plums shall unless otherwise specified, not exceed forty per cent (40%) of the mass concrete volume and care shall be taken to ensure that the minimum cover over any plums is 100 mm.

3.27 Concreting in Adverse Weather

No concreting will be allowed to take place in the open during storms or heavy rains. Where strong winds are likely to be experienced additional precautions to ensure protection from driving rain and dust shall also be taken.

The Engineer may withhold approval of commencement of concreting until he is satisfied that full and adequate arrangements have been made.

3.28 Concreting at Night or in the Dark

Where approval has been given to carry out concreting operations at night or in places where daylight is excluded, the Contractor is to provide adequate lighting at all points where mixing, transportation and placing of concrete are in progress.

3.29 Concreting in High or Low Ambient Temperature

Where the ambient temperature exceeds thirty two degrees Celsius (32°C), the Contractor shall take special measures in the mixing, placing and curing of concrete. The temperature of the concrete when deposited shall not exceed thirty degrees Celsius (30°C). The Contractor shall carry out all necessary special measures to ensure that the maximum concrete temperature after placing shall not exceed fifty degrees Celsius (50°C) or thirty degrees Celsius (30°C) above the concrete temperature at the time of placing, whichever is lower.

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During placing suitable means shall be provided to prevent premature stiffening of the concrete placed in contact with hot surfaces.

The Contractor shall not mix and place concrete when the ambient temperature falls below three degrees Celsius (3°C).

3.30 Curing and Protection

Concrete shall be protected during the first stage of hardening from the harmful effects of sunshine, drying winds, cold, rain or running water. The Contractor shall pay particular attention to the need to protect concrete immediately after the finishing operation and prior to its final set and shall submit their proposals to achieve this protection for the Engineer's approval. Protection of concrete which has achieved its final set shall consist of one or more of the following:

- (a) A layer of sacking, canvas, hessian, straw mats or similar absorbent material or a layer of sand, kept constantly moist by spraying with water as necessary for fourteen (14) days or such periods as may be directed by the Engineer.
- (b) After thoroughly wetting, a layer of approved waterproof paper or plastic membrane kept in contact with the concrete for fourteen (14) days or such period as may be directed by the Engineer.

The use of saline water for curing purposes will not be permitted.

3.31 Steel Reinforcement

3.31.1 Materials

Unless otherwise directed or otherwise shown on the Drawings, hot rolled high yield reinforcement shall be used throughout the works.

Where required, mild steel reinforcement, medium tensile steel reinforcement and high tensile steel reinforcement shall comply with BS 4449. Cold twisted steel wire for the reinforcement of concrete shall comply with BS 4482.

All reinforcement shall be from an approved manufacturer and, if required by the Engineer, the Contractor shall submit a test certificate of the rollings. The Contractor shall, when requested by the Engineer, provide sample pieces 1.0m long for testing.

Tying wire shall be 1.6mm diameter soft annealed iron wire.

Before any steel reinforcement is embedded in the concrete any loose mill scale, loose rust and any oil, grease or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operations shall likewise be removed.

3.31.2 Fabricating Reinforcement

Bar reinforcements shall be bent to the shapes shown on the Drawings and bending schedules. All bars shall be bent cold, unless otherwise permitted by the Engineer. All hooks, bends, and the like, unless otherwise shown on the Drawings, shall be to BS 4666. The Contractor shall satisfy himself as to the accuracy of any bar bending schedules supplied and shall provide all reinforcement in accordance with the Drawing. Bar reinforcement shall be bundled and each bundle of steel shall be tagged with identifying tags, showing the size and mark of the bar. The bundles shall be stacked clear of the ground in easily accessible positions that do not in any way hinder the progress of work and shall be kept clean.

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3.31.3 Fixing Reinforcement

When placed in the work reinforcement shall be free from coatings or dirt, detrimental scale, paint, oil or other foreign substances. When steel has on its surface rust, loose scale and dust which is easily removable, it may be cleaned by a method approved by the Engineer.

All reinforcing bars, ties, links and fabric shall be fixed in the positions shown on the Drawings within the tolerances specified in BS 8666. In no case shall the cover specified on the Drawings be increased by more than 5mm.

Displacement of reinforcement beyond the specified tolerance shall be prevented by supporting the bars sufficiently and securely fixing them together at intersections where necessary.

The ends of all tying wires shall be turned into the body of the concrete and not allowed to project towards the surfaces of the concrete.

Spacers shall be used to maintain the cover to all steel and shall be made of dense cement mortar of one part cement and two parts sand.

Spacers shall be triangular in section and only one acute edge shall bear against the formwork, the flat side shall bear against the steel. Wire cast into the blocks to fix them to the reinforcement shall be 1.6mm diameter soft annealed iron. Spacers shall not be used on the wet face of water retaining or water excluding structures. Chairs, stools, etc. shall be used to maintain clearance between two or more layers of reinforcement.

Nothing shall be allowed to interfere with the specified position of reinforcement. The fixing of reinforcement shall be checked before and during concreting, and particular attention shall be given to the position of top steel in cantilever sections. During concrete placing a competent steel fixer shall be in attendance to adjust and correct the position of any reinforcement which may be displaced.

3.31.4 Splicing and Lapping

All reinforcement shall be provided in full lengths as indicated on the Drawings or bending schedules. Splicing of bars, except where shown on the Drawings, shall not be permitted without the written approval of the Engineer. Splices shall be staggered as far as possible. Bar reinforcement shall not be welded without the Engineer's written permission.

In lapped splices, the bars shall be placed in contact and wired together in such manner as to maintain a clearance between bars of not less than 50mm.

Mesh or bar reinforcement shall overlap sufficiently to maintain a uniform strength and shall be securely fastened at ends and edges. The edge lap shall not be less than 40 diameters of the mesh reinforcement bar or two mesh widths whichever is greater.

3.32 Cover to Reinforcement

The concrete cover to reinforcement shall be 50mm unless otherwise shown on the Drawings.

The Contractor shall provide any necessary concrete pads for ensuring the cover is attained and in no case shall timber packing be used.

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3.33 Formwork

3.33.1 Definitions

Forms, formwork or shuttering shall mean all temporary moulds forming the concrete to the required shape together with any special lining that may be required to produce the concrete finish specified.

Falsework or centering shall mean the furnishing, placing and removal of all temporary construction such as framing, props and struts required for the support of forms.

3.33.2 Materials

The formwork may be of seasoned, planed, tongued and grooved timber, plywood, blockboard, tempered hardboard, steel or as specified on the Drawings.

All timber used for formwork shall be sound wood, well seasoned and free from loose knots, shakes, large checks, warping and other defects. Before use on the work, it shall be properly stacked and protected from injury from any source. Any timber which becomes badly warped or cracked, prior to the placing of concrete shall be rejected. All formwork for outside surfaces before final ground level shall be either tongued and grooved or provided with a suitable lining to produce a smooth surface finish.

3.33.3 Forms

All forms shall be of wood or metal and shall be built grout-tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the openings of joints due to shrinkage of the timber.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.

All formwork shall, unless otherwise directed, be provided with 25mm by 25mm angle fillets (chamfers) so as to form splays on internal and external angles.

A grout check formed from 25mm square hardwood timber shall be incorporated in the formwork to provide a clean, level, horizontal joint on exposed concrete surfaces at the top of each lift.

All joints in the formwork shall be either horizontal or vertical. End formwork shall be square across the mass of concrete.

Where concrete is to be deposited to a slope steeper than 20 degrees to the horizontal, top formwork shall be used to enable the concrete to be properly compacted unless the Engineer agrees otherwise.

Openings for the inspection and cleaning of the inside of formwork for walls, piers and columns shall be formed in such a way that they can be closed conveniently before commencing to place concrete.

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Form clamps, tie bolts and anchors shall be used to fasten forms. The use of wire ties to hold forms in position during placing of concrete will not be permitted. Tie bolts and clamps shall be positive in action and of sufficient strength and number to prevent spreading or springing of the forms. They shall be of such type that no metal part shall be left within the specified concrete cover. For water retaining sections, methods of fixing the forms which result in holes through the concrete section when the formwork is removed shall not be used and built-in wall ties shall be fitted with water baffles.

All forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

The shape, strength, rigidity, grout tightness and surface smoothness of forms which are re-used shall be maintained at all times. Any warped, bulged or otherwise damaged timber shall be replaced. Forms which are unsatisfactory shall not be re-used. If the surface finish on the formed concrete deteriorates as a result of deterioration of the faces of the forms, the Engineer shall instruct that forms be resurfaced, or discarded.

All forms shall be treated with approved mould or similar oil or be soaked with water immediately before placing concrete to prevent adherence of concrete. Any materials which adhere to or discolour concrete shall not be used.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods which shall be as specified in Clause 3.26. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer shall order the work stopped until the defects have been corrected.

All formwork shall be approved by the Engineer before concrete is placed within it. The Contractor shall, if required by the Engineer, provide copies of calculations of the strength and stability of the formwork and falsework. Notwithstanding the Engineer's approval of these calculations, the Contractor shall be held responsible for the safety and adequacy of formwork.

3.33.4 Falsework and Centering

Detailed plans for a falsework or centering shall be supplied by the Contractor to the Engineer at least 14 days in advance of the time the Contractor begins construction of the falsework. Notwithstanding the approval of the Engineer of any designs for falsework submitted by the Contractor, the Contractor shall be solely responsible for the strength, safety and adequacy of the falsework or centering.

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads from the weight of green concrete and shuttering and incidental construction loads.

Falsework or centering shall be founded upon a solid footing safe against undermining and protected from softening. Falsework which cannot be founded on satisfactory footings shall be supported on piling which shall be spaced, driven and removed in a manner approved by the Engineer. The engineer may require the Contractor to employ screw jacks, or hard wood wedges to take up any settlement in the formwork either before or during the placing of concrete.

Falsework shall be set to give the finished structure the required grade and camber shown on the
Drawings.

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3.33.5 Forms for Joints

Where permanent or temporary joints are to be made in horizontal or inclined members, stout stopping off boards shall be securely fixed across the mould to form a water-tight joint. The form of the permanent joint shall be as shown on the Drawings.

Where reinforcement or waterstops pass through the face of a joint the stopping off board shall be drilled so that the bars or waterstop can pass through, or the board shall be made in sections with a half round indentation in the joint faces for each bar so that when placed the board is neat and accurate fit and no grout leaks from the concrete through the bar holes, joints or around the waterstop.

3.33.6 Release Agents

Only approved chemical release agents, mould creams (emulsions of water in oil) or oils containing a proportion of surfactant not exceeding 2 percent will be permitted. Water soluble emulsions and oils without surfactant shall not be used. Oil based release agents shall be applied at a rate of 7 square metres per litre one day in advance of concreting, preferably by spray or roller. Chemical release agents shall be applied in accordance with the manufacturer's recommendations.

New timber face work shall be given three coats of release agent before use on the work to ensure uniformity of porosity on the surface.

On no account shall the release agent come into contact with the reinforcement.

3.34 Removal of Formwork

Formwork shall be carefully removed without shock or disturbance to the concrete. No formwork shall be removed until the concrete has gained sufficient strength to withstand safely any stresses to which it may thereby be subjected.

The minimum periods which shall elapse between completion of placing concrete and removal of forms are given in the following Table 3.2, and apply to ambient temperatures higher than 10°C. At lower temperatures or if cements other than ordinary Portland are involved, the Engineer may instruct longer periods.

Compliance with these requirements shall not relieve the Contractor of his obligation to delay removal of formwork until such removal can be completed without damage to the concrete.

Table 3-2: Formwork Striking Time

Position of formwork	Striking Time
Beam sides, walls and columns	1 to 2 day
Slab soffits - props remain undisturbed	4 days
Beam soffits - props remain undisturbed	7 days
Removal of slab props	14 days
Removal of beam props	21 days

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3.35 Surface Finishes

3.35.1 General

After removal of the formwork no treatment of any kind other than that required for curing the concrete shall be applied to the concrete faces until after inspection by the Engineer. All honeycombed areas, deformed surfaces or other defective surfaces shall then be repaired at the direction of the Engineer. Immediately following the Engineer's inspection of surface finish, all tie bolt cavities shall be filled with sand cement mortar and the surface left smooth, sound, even and uniform in colour.

Should the finishes surface either as-stuck or after repair exhibit a non uniform colour or texture, the Engineer shall have the right to order that the surface be given a skim coat and then painted.

3.35.2 Formed Surfaces

All joints between panels shall be vertical and horizontal unless otherwise directed. Suitable joints shall be provided between sheets to maintain accurate alignment in the plane of the sheets.

For warped surfaces, facings shall be built up of laminated splines cut to make a tight surface which shall then be dressed and sanded to the required curvature.

Type F1: This finish is for surfaces against which backfill or further concrete will be placed. Formwork shall consist of sawn boards, sheet metal or any other suitable material which will prevent the loss of grout when the concrete is being placed.

Type F2: This finish is for surfaces which are permanently exposed to view but where the highest standard of finish is not required. Forms to provide a Type F2 finish shall be faced with wrought thicknesses tongued and grooved boards with square edges arranged in a uniform pattern and close jointed or with suitable sheet material. The thickness of boards or sheets shall be such that there shall be no visible deflection under the pressure exerted by the concrete placed against them. Joints between boards or panels shall be horizontal and vertical unless otherwise directed. This finish shall be such as to require no general filling of surface pitting, but fins, surface discoloration and other minor defects shall be remedied by methods agreed by the Engineer.

Type F3: This finish is for surfaces which will be in contact with water flowing at high velocity and for surfaces permanently exposed to view where good appearance and alignment are of importance. To achieve this finish, which shall be free of boardmarks, the formwork shall be faced with plywood complying with BS 1088 or equivalent material in large sheets. The sheets shall be arranged in an approved, uniform pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features or changes in direction of the surface. Suitable joints shall be provided between sheets to maintain accurate alignment in the place of the sheets. Unfaced wrought boarding or standard steel panels will not be permitted for Type F3 finish. The Contractor shall ensure that the surface is protected from rust marks, spillages and stains of all kinds.

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Type F4: This finish is similar to that required for type F3 but is used in places where a first class alignment and a dense surface free from airholes and other defects is required, suitable for the application of decorative finishes, in very high velocity water channels and in other similar circumstances.

3.35.3 Unformed Surfaces

Type U1: This is screed finish for surfaces of roads of foundations, beds, slabs, and structural members to be covered by backfill, subsequent stages of construction, bonded concrete topping or cement mortar beds to receive pavings, and on exposed surfaces of paving where a superior finish is not required. It is also the first stage of Type U2 and U3 finishes. The finishing operations shall consist of levelling and screeding the concrete to produce a uniform, plane or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.

Type U2: This is a floated finish for exposed surfaces where a hard smooth steel trowelled surface is not required. Floating shall be done only after the concrete has hardened sufficiently, and may be by hand or machine. Care should be taken that the concrete is worked no more than is necessary to produce a uniform surface free from float marks.

Type U3: This is a hard smooth steel trowelled finish for surfaces exposed to water flowing at high velocity. Trowelling shall not commence until the moisture film has disappeared and the concrete has hardened sufficiently to prevent excess laitance from being worked to the surface. The surface shall be trowelled under firm pressure and left free from trowel marks.

Type U4: This finish is similar to Type U3 finish but the permissible tolerances are smaller.

3.35.4 Surface Tolerances

All parts of concrete surfaces shall be in the positions shown on the Drawings within the tolerances set out in Table 3.3 or Table 3.4.

In cases where the Drawings call for tolerances other than those given in Table 3.3 or Table 3.4, the Drawings shall rule.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to provide a satisfactory straight or curved line. When the Engineer has approved the alignment, the Contractor shall fix the units so that there is no possibility of further movement.

Table 3-3: Surface Tolerance for Formed Surfaces

Type of	Tolerance in mm (See Note 1)		
	A	B	C
F1	10	10	+25 to -10
F2	5	10	+15 to -15
F3	2	5	+10 to -10
F4	See Note 2	2	+5 to -5

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Note 1:

The tolerances, A, B and C given in the table are defined as follows:

- A** is an abrupt irregularity in the surface due to misaligned formwork or defects in the face of the formwork.
- B** is a gradual deviation from a plane surface as indicated by a straight edge 3 metres long. In the case of curved surfaces, the straight edge shall be replaced by a correctly shaped template.
- C** is the amount by which the whole or part of a concrete face is displaced from the correct position shown on the Drawings.

Note 2:

Abrupt irregularities are not permitted in a Type F4 finish. Any residual irregularities which remain after removal of formwork shall be removed by grinding to achieve a transition of 1 in 50 between the surfaces adjacent to the irregularity.

Table 3-4: Surface Tolerances for Unformed Surfaces

Type of Finish	Tolerance in mm (See Note 1)		
	D	E	F
U1	-	10	+20 to -10
U2	Nil	10	+20 to -10
U3	Nil	5	+12.5 to -7.5
U4	Nil	2	+6 to -4

Notes:

- D** is the maximum allowable value of any sudden change of level in the surface.
- E** is the maximum allowable value of any gradual irregularity of the surface, as indicated by the gap between the surface and a 3m long straight edge or correctly shaped template placed on the surface.
- F** is the maximum allowable value of the difference in level or position between a straight edge or correctly shaped template placed on the surface and the specified level or position of that surface.

3.36 Conduits, Box-outs and Apertures

The layout of conduits, box-outs, grooves, apertures and the like shall be as shown on the Drawings or as directed by the Engineer, and shall be subject to inspection and approval by the Engineer before commencing concreting.

Conduits shall be placed as near the centres of members as possible and sufficient space shall be provided between adjacent conduits to prevent difficulties in the placing of concrete.

Box-outs, holes, grooves, apertures and the like shall be accurately set out in the formwork prior to placing the concrete. Fixing blocks, ends of brackets, bolts and, where possible, built in parts shall be cast into the concrete at the time of placing. No part of the concrete works shall be cut out for any such item, or for any other reason, without the Engineer's permission.

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The Contractor shall ensure that all sub-contractors are informed of his programme for the structural works at the commencement of the Contract and that such sub-contractor's requirements relating to concrete members are approved well in advance. The Contractor shall obtain from all such sub-contractors complete information of their requirements regarding conduits, pipes, fixing blocks, ducts, holes and any other items to be cast into or formed in the concrete members. Failure of a sub-contractor to supply such information shall not be allowed to delay the progress of the Works.

3.37 Construction joints

Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be as indicated on the Drawings or as previously approved by the Engineer. The Contractor is to allow for working beyond the ordinary working hours where necessary in order that each section of concrete may be completed without any lapse while the work is in hand. All construction joints are to be formed square to the work.

Where vertical construction joints are required, the joint face of the first stage concrete shall be finished against a stopping-off board, or vertical end shutter, suitably notched to pass the reinforcement. When the concrete is hard and the shutter is removed, the whole joint surface shall be thoroughly hacked and roughened or scabbled with suitable tools so that no smooth skin of concrete is visible and that all aggregates and solid matrix around them is exposed.

For horizontal or slightly inclined construction joints, the surfaces shall preferably be prepared when the concrete has set but not hardened by jetting with a fine spray of water and brushing with a stiff brush to remove the smooth skin and expose the aggregate without disturbing it. Where this treatment is impractical and work is resumed after the concrete surface has hardened, a similar procedure shall be adopted as on vertical joints.

If, in the opinion of the Engineer, any deleterious material has come into contact with the concrete of the construction joint or if the concrete is honeycombed or unsound for any reason, the concrete shall be cut back to such a depth as the Engineer shall order and the roughened surfaces shall be thoroughly cleaned by compressed air and water jets or other approved means.

Immediately before concreting is resumed, the roughened joint surface shall be thoroughly cleaned with compressed air and water jets and slightly wetted and cement grout placed. The Contractor shall take precaution to avoid segregation of the concrete along the joint plane and to obtain thorough compaction.

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3.38 Movement joints

Movement joints shall be formed in the position and manner shown on the Contract Drawings or instructed by the Engineer. In the case of water retaining structures, joints shall be made water-tight by the provision of a continuous waterstop, with suitable water resistant filler material and sealant. The materials and workmanship utilised in movement joints shall comply with the following:

- (a) Compressible filler shall be self-expanding cork filler consisting of cork granules bonded together with an insoluble, synthetic resin. When subject to wet or moist conditions the filler shall be capable of swelling to occupy a larger volume than that of the material supplied. The expansion properties of the filler shall not be less than one hundred and forty per cent (140%) when immersed in boiling water for one hour (1hr). The filler shall be supplied and stored in sealed moisture resistant wrappings. Compressible filler shall be secured to the first cast concrete surface using an approved adhesive.
- (b) Waterstops, either centrally or externally placed, shall be Polyvinyl Chloride (PVC) of the dimensions and type shown on the Drawings. PVC waterstops shall have an elongation of at least 300% at rupture with a tensile strength of more than 12.3N/mm^2 . Glueing temperature shall be about 150°C . The PVC waterstop shall accommodate a transverse movement of at least 50mm. For expansion joints the waterstops shall incorporate a centre bulb or box to allow movement to be accommodated. Centrally placed waterstops shall have reinforced eyelets on the outer flange to facilitate the positioning of the water stops by wiring to the surrounded steelwork. Externally placed waterstops shall include a wide reinforced nailing flange for positive fixing to formwork or adjacent concrete faces. Waterstop shall be firmly supported by split stop-end shuttering where appropriate, and in no case shall the waterstops be pierced to assist in fixing. Special care should be taken to ensure that the concrete is well worked against the embedded part of the waterstops and is free from honeycombing. Precautions shall be taken to protect any projecting portions of the waterstops from damage during the progress of the work and from sunlight and heat. Where waterstops are required to be jointed, this shall be undertaken using approved heat welding equipment. The waterstops shall be installed in accordance with the manufacturer's instructions and to the approval of the Engineer.
- (c) Joint sealant shall be bitumen-rubber sealing compounds and shall be pourable and in accordance with BS 2499 for horizontal joints and shall be an approved solvent type gun grade applied by suitable for vertical joints.
- (d) Miscellaneous materials necessary for the installation of movement joints such as adhesives for securing filler materials, bond breaking tapes, bituminous paints for creating a discontinuity between concrete surfaces and primers shall be compatible with the compressible filler, waterstops and sealant specified previously.

Contraction joints where specified shall be formed in the position and manner shown on the Drawings. The reinforcement shall be discontinuous across the joint. Dowel bars, waterstops and sealant shall be provided as shown. The face of the first stage concrete shall be finished fair faced and after curing painted with two coats of bituminous paint. Casting of waterstops and sealing of joints is to be carried out in accordance with the manufacturer's instructions. Dowel bars shall be round mild steel of the dimensions shown on the Drawings. The bars shall be cast into the first stage concrete and the protruding part shall be painted with two coats of bituminous paint.

Expansion joints where specified shall be formed in the position and manner shown on the Drawings. The reinforcement shall be discontinuous across the joint. Dowel bars, waterstops, compressible filler and sealant shall be provided as shown. The face of the first stage concrete shall be finished fair faced and after curing the compressible filler shall be fixed in position in a manner to the approval of the Engineer. Casting in of waterstops and sealing of joints is to

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be carried out in accordance with the manufacturer's instructions. Dowel bars shall be round mild steel of the dimensions shown on the drawings. The bars shall be cast into the first stage concrete and the protruding part shall be painted with two coats of bituminous paint. An end cap shall be fixed to the end of each bar prior to pouring the second stage concrete, in order to create a void at the end of the bar to accommodate any movement.

3.39 Precast Concrete Units

Precast concrete units shall be provided by an approved specialist supplier or may, subject to the Engineer's written approval, be manufactured by the Contractor. The Engineer may require the Contractor to supply samples of precast concrete units for testing prior to the approval of the proposed supply for each type of unit and such samples shall be supplied and tested as directed by the Engineer.

Precast concrete units shall be made in accordance with the provisions of this Specification covering concrete work. Precast concrete units shall be manufactured under shed roofs and protected from the weather. The units shall remain in the moulds for seven days and shall remain protected for a further seven days, during which periods the concrete shall be shielded by sacking or other approved material which shall be kept wet. The units shall then be moved from the sheds and stacked in the open for at least a further seven days to season before being set in position.

Precast concrete work shall be tested as directed by the Engineer and work failing to meet the requirements of the Specification shall be rejected. Precast units that become damaged during handling shall likewise be rejected.

The Contractor shall, when required, make arrangements with his supplier for access to the supplier's work for the Engineer to inspect and carry out tests on precast concrete units.

All precast units shall be marked with individual identification. Lifting hooks are to be attached only to those positions shown on the Drawings or detailed by the Engineer. The Contractor shall be deemed to have included in their rates for all measures required to handle and stack units safely and without undue stressing.

3.40 Breaking out Existing Concrete or Block work

Well in advance of the commencement of the work the Contractor shall seek the approval of the Engineer regarding the proposed method of breaking out existing concrete or blockwork in the positions shown on the Drawings or as directed by the Engineer.

3.41 Cement Grout

Cement grout for general purposes shall consist of Portland cement and water mixed in the proportion of one (1) part by volume of cement and one and a half (1.5) parts by volume of water. The grout shall be used within one hour (1hr) of mixing.

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3.42 Cement Mortar

Cement mortar shall be machine mixed and unless otherwise specified, consist of three (3) parts of sand to one (1) part of Ordinary Portland cement mixed and thoroughly incorporated together. Just enough water will be added to give a workability appropriate to its use. The above proportions are by volume. Mortar shall be used whilst freshly mixed and no softening or retempering will be allowed.

3.43 Concrete Block and Bricks Masonry

Concrete blocks and bricks shall comply with BS 6073: Part 1 and shall have a minimum 28 days compressive strength of 3.5N/mm^2 and 7N/mm^2 respectively. The concrete blocks and bricks shall be laid in a staggered pattern such that the vertical joints between two consecutive layers are offset by half a block length. Joints on the inside faces shall be rendered in which case the joints shall be raked out at a depth of 5mm. Rendering shall consist of 1:2 mortar applied to a thickness so as to ensure professional finish

The mix used to manufacture concrete blocks shall not be leaner than 1:9 by volume and the maximum size of aggregate shall be 10mm. The standard size of the concrete block shall be 400mm x 200mm x 200mm and 300 x 100 x 100 for bricks. However blocks and bricks of other sizes may be used if approved by the Engineer for proper bonding at corners and openings

The concrete blocks and bricks shall be wetted before laying and shall be set in mortar, which complies with the specifications given in Clause 3.42. Unless otherwise stated, the maximum joint thickness shall be 12mm and the horizontal and vertical joints shall be filled with mortar. Joints shall be finished flush with the face of the blocks and bricks. The Concrete block and brick masonry shall be cured for a period of seven days by covering the work with two layers of hessian, which is kept permanently saturated. Provision shall be made to clean all exposed faces both as the work proceeds and on completion so that they are left in a neat, tidy and clean condition.

Building masonry will not be permitted in heavy rain without the approval of the Engineer. In such instances the Contractor shall make provision to protect materials and the newly placed mortar from the rain.

Concrete blocks shall either be obtained from an approved manufacture or made on site in approved block making machines. When casting of the concrete blocks is done at site, these shall be removed from the casting machine and deposited on edge on covered racks and left for 3 days, during which time they shall be kept constantly wet. Afterwards they may be placed on racks in the open provided they are protected by hessian cloth or similar and kept wet for a further 5 days. Thereafter they shall not be moved or used in the works until they are 28 days old.

Chambers shall be constructed after pipes have been laid, except the bases may be constructed earlier to avoid deterioration of the formation.

Backfilling around completed chambers shall be with suitable material deposited equally all round and compacted in accordance with the Specifications.

Where any pipes are built into concrete or block work the pipe shall be surrounded in two layers of polythene sheeting unless a puddle flange has been shown on the Drawings.

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3.44 Rendering Work

3.44.1 Material

Cement, water and fine aggregate shall conform to the requirements specified in the concrete works. Mesh reinforcement shall be plain diamond expanded steel lathing to BS 1369 where specified. Lime shall be to BS 980 and shall be mixed with water and allowed to stand prior to use according to the manufacturer's recommendations.

The mix proportion of the cement mortar by volume shall be as follows:

- For rendering coat, Cement : Sand = 1:5
- For finishing coat, Cement : Sand = 1:3

Lime putty may be mixed in mortar for finishing coat at 10% of sand by volume.

3.44.2 Waterproof Cement Mortar

Waterproof mortar shall be made by mixing a waterproof agent into ordinary cement mortar. The Contractor shall be responsible for selection and quality of the waterproof agent and this shall be approved by the Engineer before use. The mixing and application shall be in accordance with the manufacturer's instructions.

3.44.3 Application

The surface which are to receive a rendering coat shall be free from all laitance, scum, loose carbonate scale, loose aggregate dirt and other foreign matters. Concrete block, brick or stone surfaces shall be sufficiently and uniformly damped immediately before application of mortar. Concrete surfaces shall be kept thoroughly wet for 24 hours prior to the application of mortar.

Where shown on the drawings or directed by the Engineer, steel wire lath shall be fixed to the brick, concrete block or concrete walls before applying cement mortar plaster.

Cement mortar shall be used within 30 minutes from the time of mixing. Retempering shall not be permitted.

The total thickness of rendering plus finishing coat shall be 30mm for the floors and 20mm for wall. Cement mortar finish shall be trowel finished unless otherwise specified. When the finishing coat is applied, the entire surface of floor or wall shall be finished in one operation in order to minimise joint marks.

When expansion and control joints exist in the base structure, provision shall be made to prevent cracking of the mortar by inserting metal expansion beads within the coating thickness in a manner approved by the Engineer.

The finished surface shall be perfectly plumb or level as the case may be except where otherwise specified without any bulging, runs, bruises or stains.

After application of the finishing coat, the surfaces shall be kept continuously damp for not less than 48 hours and then allowed to become thoroughly dry. Moistening shall be started as soon as the surface has hardened sufficiently not to cause displacement or damage.

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3.45 In Situ Concrete Chambers

In situ concrete chambers shall be constructed generally in accordance with Section 3 of this Specification.

3.46 Chamber Covers and Slabs

Covers and slabs shall be the type, size and weight shown in the drawings. Care shall be taken to see that slabs are even so that the cover can seat without rocking.

Covers and frames shall be provided as shown on the drawings. The tops of the covers shall be flush at all points with the surrounding surface of paved areas or as directed in unpaved areas. Any slight adjustment of the slab level which may be necessary to accomplish this shall be effected by topping the side walls with concrete.

4 STONWORK

4.1 Stones

Stone for all purposes shall be the best of its kind, sound and durable, free from flaws and from soft, weathered or decomposed parts. The stone and the quarry from which it is obtained shall be subject to the approval of the Engineer, samples shall be submitted by the Contractor of the stone he proposes to use in the Works and the Engineer's approval shall be obtained before such stone is used or any order is placed. The stone used shall be clean and must be washed if deemed necessary in the opinion of the Engineer.

Stones for face work shall be as far as possible quarry split and not bullnosed or hammer dressed. A moderate amount of dressing to trim off large projections will however be permitted. Exposed faces of stones for masonry shall be free from tool marks except such as are inherent in the nature of any dressing that may be specified. In rock-faced work the roughness on the surface shall not project more than 40 mm for stone less than 0.3 m² face area and not more than 60 mm for large stones.

4.2 Stone Masonry

Masonry shall be built to the lines and levels shown on the Drawings.

For face work the stones shall show a face of not less than 0.025 m² and not more than 0.1 m² in area and none shall be less than 100 mm in depth; they shall be laid to give a uniformly random appearance and shall be selected in laying so as to present an even distribution of large and small stones on the face.

For the arises, stones shall be roughly squared, quarry split and of a size to give outbands varying from 300mm to 500mm in length and inbands from 150mm to 250mm. The alignment of arises shall be set true to the required lines.

The stones shall be set in mortar with their natural bedding plane (if any) as near normal as possible to the face or normal to the line of thrust in the case of load bearing structures. Particular care must be given to obtaining a sound bond both longitudinally and transversely and there shall be at least one bonder, or length not less than two-thirds of the wall thickness, in each square yard of wall face.

The mortar, unless otherwise specified, shall be machine mixed cement and sand in the proportion of one part to three (1:3) parts generally as described in the specification. Mortar shall completely fill all interstices between the stones.

The face joints in rubble masonry may vary in thickness from 10mm to 20mm. They shall be finished as a neat weathered joint with mortar while the work proceeds where the masonry is specified to be "unpointed". Where pointing is specified, the joints in each day's work shall be raked out to a depth of not less than 25mm before the mortar has set. Subsequently the joint shall be filled with mortar and finished in accordance with Clause 4.6. The face of the masonry is to be kept wet while the pointing is proceeding. Provision shall be made to clean all exposed faces both as work proceeds and on completion so that they are left in a neat, tidy and clean condition.

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Building of masonry will not be allowed in heavy rain without the written consent of the Engineer. Building shall only proceed when suitable precautions to the satisfaction of the Engineer shall be taken against the action of rain on newly placed mortar. If for any reason of urgency the consent of the Engineer should be desired to a departure from these provisions, the Contractor shall submit to the Engineer for approval their proposals for protecting the materials and work from the weather.

4.3 Types of Masonry

The arrangement of the stones on the exposed face or faces of the masonry shall be as described below according to which type is called for on the Drawings.

Random rubble uncoursed masonry shall be built with stones of irregular shapes taken generally as they come from the quarry, preparation being limited to the removal of inconvenient corners and excrescences. They shall be selected as the work proceeds to give a uniformly random appearance and no attempt shall be made to form courses.

Random rubble masonry brought to courses shall be generally as the preceding type except that it shall be levelled up to courses between 300mm to 400mm in depth and coinciding with the quoin stones.

Squared rubble coursed masonry shall be built in courses between 100mm to 250mm in depth of stones squared to rectangular shapes and selected so that all stones in one course are of approximately the same height.

4.4 Bedding of Stone Masonry

Unless otherwise directed by the Engineer, all masonry stones, when incorporated in the Works shall be laid on its natural bed, except in the case of arches where the natural bed shall be radial.

4.5 Special Stonework

Special stonework shall consist of approved stones dressed to the shapes and dimensions and with the faces tooled, all as shown on the Drawings. All stones shall be laid true to line and centre with mortar joints as shown on the Drawings.

4.6 Pointing of Joints in Masonry

Unless otherwise shown on the Drawings, pointing to masonry joints shall be flush and shall be formed by raking the joint clean and then filling it with pointing consistency mortar which shall be given a flush face with a steel trowel.

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4.7 Hand Placed Rubble Filling

Hand placed rubble filling shall consist of stones individually selected and placed by hand firmly in place in bearing contact with each other or with the sides of the space to be filled; the voids shall be carefully filled with small rocks and spalls wedged together to form a compact mass. The sides of stones shall be roughly trimmed if necessary with a spalling hammer to obtain a reasonably close fit. On the exposed face the stones shall be placed with their flattened sides uppermost and in the plane of the face.

4.8 Tipped Rock/Pitching

Rock protection on embankment slopes and around structures shall be to the lines and levels shown on the contract Drawings. The terms “tipped rock” and “pitching” refer to the manner in which the rock is placed.

The different classes of rock are specified on the Drawings according to nominal size and the maximum and minimum size of the individual particles. Within the size limits of each class, the rock fragments shall be well graded with not more than forty per cent (40%) of the rocks being smaller than the stated nominal size. The shape of the rock shall be roughly uniform with no dimension less than sixty percent (60%) of the largest dimension. The individual rock pieces shall be dense, durable and abrasion resistant.

The Contractor shall submit bulk samples of not less than 2m³ of each class of rock for approval by the Engineer prior to placing. These samples shall be retained for comparison with material being placed in order to ensure a reasonable degree of uniformity within each class.

The base on which rock protection is to be placed shall be compacted and trimmed to the lines and levels shown on the drawings. Where two or more classes of rock are specified, the lower layers shall be completed to the Engineer's approval before the placing of subsequent layers.

Tipped Rock shall be tipped directly into place and roughly trimmed to the required profile. The thickness, lines and levels of each class of tipped rock is shown on the Drawings.

Pitching will be used where a finished horizontal or inclined surface is required. It shall consist of hand placed stones, with spalls wedged into the interstices to produce an even surface, without projection above the neat lines shown on the Drawings. Care shall be taken to ensure that the stones are well bedded and the percentage of spalls shall not exceed forty percent (40%) of the total rock volume. Pitching on slopes shall be built upwards from the toe, unless otherwise directed by the Engineer. A coping consisting of large flat stones shall be laid along the top of stone pitching on slopes to produce a firm edge.

Tipped Rock and Stone Pitching shall consist of selected hard durable rock free from weathered or decomposed parts to the approval of the Engineer, containing no flaky stone and being well graded within the limits shown below. The class and the thickness of the layer shall be as shown in Table 4.1 below

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Table 4-1: Classification of stone pitching materials

Class	Size of stone d	Percentage by weight smaller than stone sized (%)
A	300	100
	125	40-50
	45	0
B	150	100
	63	40-50
	31.5	0
C	63	100
	22	60-85
	8	20-40
	4	0
D	31.5	100
	16	50-80
	8	20-50
	4	0
E	350	100
	200	0
F	225	100
	90	35-55
	45	0
G	850	100
	500	30-60
	300	0

Tipped rock/stone pitching shall be placed in an approved manner in order to produce a uniform well knit unsegregated layer in which all sizes are held in position.

4.9 Gabions

Gabions shall be of the types and sizes shown on the Drawings. The cages shall be constructed from mild steel wire complying with BS 1052, "Specification for mild steel wire for general engineering purposes", galvanised in accordance with BS 443, "Specification for testing zinc coatings on steel wire and for quality requirements". The wire shall be 3mm diameter formed into a fabric having a mesh of 75mm x 100mm for baskets and 60 mm x 80 mm for mattresses.

Stone filling for gabions shall consist of hard durable rock, free from weathered or decomposed parts. The minimum dimensions of each stone shall not be less than half its maximum dimension. For mattresses the stone shall be 200mm to 150mm for baskets the stone shall be 300mm to 200mm. The stone shall be obtained from a source approved by the Engineer. No stone shall be smaller than the size of the gabion mesh. In carrying out the filling, selected pieces of stone of elongated shape shall be placed with their flatter and elongated faces in contact with the mesh wherever possible.

The empty gabions shall be placed to line and level as shown on the Drawings or as directed by the Engineer and then stretched so that the gabions regain their shape on being filled. Diaphragms shall be provided at not more than 1m intervals for baskets and not more than 0.6m intervals for mattresses. A gabion shall not be completely filled until the adjacent basket or mattress has been half filled, unless otherwise directed, in order not to cause displacements from bulging during filling.

For baskets at least two horizontal connection wires shall be tied between front and back of the gabion in each 1m compartment, at a height of 300mm and 600mm from the bottom as

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the stone fill reaches these levels. Additional tie wires shall be provided if necessary and in no case shall the gabion basket bulge by more than 40mm. Where a continuous line of gabions is required, adjacent gabions shall be securely tied together at the top and bottom of the gabions with tying wire.

The gabions shall be filled to a level just sufficient to require the lid to be forced into place with a bar. The lid and all joints between baskets and between diaphragms and baskets shall each be tied down with a continuous running wire.

Where gabions are to be shaped, the shape shall be formed by folding the mesh internally and tying it with a continuous running wire.

All tying wire shall be galvanised and of same gauge as specified for the cages above.

The surface upon which gabions are to be laid shall be compacted to a minimum dry density of 95% of the maximum dry density (AASHTO T99).

4.10 Geotextile Filter Cloth

Geotextile filter cloth shall be made of non-woven polyester material with a minimum weight of 270g/m² and minimum thickness of 2.3mm.

The material shall be placed carefully on suitably cleared surfaces, such that tearing or piercing is avoided at all times.

Continuity at horizontal and vertical joints shall be achieved with a minimum overlap of 0.6m. Overlaps may be physically sealed using spot welds with an open flame and subject to approval of the Engineer. On a horizontal join, the new layer shall be placed on the outside and backfilling shall proceed carefully to ensure that full contact of the join overlap is maintained. On a vertical join, the new layer shall be placed on the inside, and backfilling shall proceed such that contact is first on the outside layer, thereby sealing the inside layer to prevent soil migration between the overlap.

4.11 Graded Filters

The filter shall consist of well graded natural or manufactured aggregate having the following gradation. In the following ratios, FM represents the filter material and BM the base material.

For graded filters of sub-rounded particles:

50% size FM

$R_{50} = \frac{\text{50\% size FM}}{\text{50\% size BM}} = 12 \text{ to } 58$

50% size BM

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and

15% size FM

$R_{15} = \text{-----} = 12 \text{ to } 40$

15% size BM

For graded filters of angular particles:

50% size FM

$R_{50} = \text{-----} = 9 \text{ to } 30$

50% size BM

and

15% size FM

$R_{15} = \text{-----} = 6 \text{ to } 18$

15% size BM

The filter material should pass a 7mm for minimizing particle segregation and bridging during placement. Also the filter must not have more than five per cent (5%) of material finer than that passing a 60 micron sieve to prevent movement of fines within the filter.

The graded filters shall consist of stone graded to meet the requirements indicated in Table 4.2 below.

Table 4-2: Classification of Filter material

Class	Size of stone d (mm)	Percentage by weight smaller than stone sized (%)
A	63	100
	31	70-100
	8	10-80
	2	0-25
	1.4	0
B	16	100
	4	64-100
	15	15-64
	0.009	0-025

The filter shall be placed in layers and tamped into place in such a manner that mixing between layers or between the filter material and the formation to be protected, shall not occur.

Care shall be taken to ensure that segregation of sizes does not occur. The minimum thickness of each filter layer shall be 250mm unless otherwise shown on the Drawings. Where the term “gravel backing” is used on the drawings or Bills of Quantities, this shall be taken to mean graded filter class A material.

4.12 Hardcore

Hardcore shall consist of broken rock, concrete or other approved hard material, clean and free from extraneous matter, having a maximum particle size of 100mm. It shall be spread and levelled, watered and compacted, and then blinded with a layer of fine material of grading 3mm to dust, watered and compacted all to the Engineer's approval.

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5 PIPEWORK

5.1 General

The Contractor shall construct pipelines to the lines and levels using grades, classes, or designs of pipe, bedding, haunching and surrounding as shown on the Drawings or directed by the Engineer.

Unless otherwise described in the Contract or agreed by the Engineer only one type of pipe shall be used within any individual length.

All materials shall be subject to the approval of the Engineer prior to procurement and delivery. Upon delivery, the Engineer shall inspect the delivered material for compliance with the specifications. In case of non-conformity, the Contractor shall replace the material at his own cost.

The pipes and fittings shall comply in all respects with British Standards and jointing of pipes and fittings shall be carried out in accordance with the manufacturers' instructions and to the approval of the Engineer.

5.2 Storage and Protection of Materials

Pipes shall be stacked on a firm base using two timber packers only under the barrel of rigid pipes such as concrete.

Flexible pipes such as PVC-U shall be stacked closely side by side on a firm plane base so that the whole length of the barrel is uniformly supported and sockets are clear of the ground. Each succeeding layer shall be placed at right angles to the previous layers. The height of any stack shall be not more than six layers of pipes and in the case of steel, not more than two layers.

Each class and size of pipe shall be stored separately in its own stockpile.

Fittings and specials of any type shall be stored in a single layer only.

Pipes and fittings shall at all times be adequately protected from damage during transport, storage and handling. Cracked or chipped pipes shall not be used in the permanent works. Steel and large diameter plastic pipes shall be fitted in the factory with end caps or reinforcement adequate to prevent distortion during transport, storage and handling.

Plastic pipes and fittings shall be protected from direct sunlight and excessive heat. Deformed pipes and fittings shall not be used in the permanent works.

All rubber rings or other materials that may deteriorate under the action of sunlight, ozone or inclement weather shall be stored in permanent shade in lockable weatherproof sheds. Care shall be taken at all times to prevent contamination of rubber or plastic products or other petroleum-derived solvents.

Granular bedding shall be stored on a firm impermeable base so that it does not become contaminated with deleterious matter.

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5.3 Handling Pipes and Fittings

Before any pipes are delivered to site the Contractor shall submit details to the Engineer of his proposals for handling pipes during transport, in store and during laying.

Pipes and specials shall only be transported on properly constructed or adapted vehicles containing correctly shaped and padded cradles or with strong, sawdust filled bags separating pipes and vehicle body. During transport and in store, pipes shall not rest on narrow traverse supports likely to cause damage to the pipe or its coating. Pipes shall not be unloaded from a vehicle by tipping or dropping.

Pipes, specials and fittings shall not be subjected to rough handling at any time. Under no circumstances shall they be dropped during loading or off-loading or be allowed to collide with one another. Any materials that have been dropped from a vehicle shall immediately be rejected for use on the Works. The same shall apply for any pipes found defective before laying.

The handling of any pipes exceeding 200kg mass other than by means of a crane is specifically forbidden. The Contractor shall maintain a suitable mobile crane on the Site and shall use it for all loading, unloading, transferring between vehicles and lowering into the trench of such pipes. The crane shall be fitted with a sling of ample width. Wire rope slings or hooks in the ends of pipes shall not be used for pipes or fittings of any diameter or mass.

In making arrangements for handling pipes, the Contractor shall take into account any recommendations made by the pipe manufacturer.

Where appropriate the requirements of this Clause shall apply to fittings and other components.

5.4 Cutting Pipes

The cutting of pipes for making up lengths shall be carried out by a method which leaves a clean square end.

Concrete pipes shall be cut with a concrete saw or by hand. If cut by hand the end of the pipes shall be trimmed even and square and if reinforced, the steel shall be cut flush with the face of the concrete. If instructed by the Engineer the exposed ends of the steel shall be protected with bitumen or a cement grout.

Steel pipes to be cut shall have the line to be cut clearly marked round the pipe. Cutting shall be carried out by cutting disc or by oxy-acetylene and the cut end shall subsequently be ground to the correct profile for the method of jointing in use.

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5.5 Pipes and Fittings

5.5.1 Concrete Pipes

Concrete pipes shall comply with BS 5911 “Specification for concrete cylindrical pipes, bends, junctions and manholes, unreinforced or reinforced with steel cages or hoops” save that the crushing test loads for the various diameters of pipe shall be as follows:

Table 5-1: Pipes and Fittings

Nominal size of pipe (mm)	Works proof load kN/m effective length
300	23 (Class M equivalent)
450	35 (Class M equivalent)
600	46 (Class M equivalent)
800	54 (Class M equivalent)
900	85 (Class M equivalent)
1000	73 (Class M equivalent)
1200	110 (Class M equivalent)
1500	132 (Class M equivalent)

Works proof loads shall be 80% of the maximum loads for each size of pipe.

Damaged pipes showing signs of visible cracking either on the inside or outside surface shall not be used.

5.5.2 Steel Pipes

Steel pipes and fittings shall comply with BS EN 10224:2003 Non-alloy steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption – technical delivery conditions.

Pipe shall be either seamless, electric welded or submerged arc welded. However the manufacturing process shall not be beyond their allocated diameter ranges:

Table 5-2: Steel Pipes

Manufacturing process	Outside diameter range, mm	Thickness range, mm
Seamless (S)	26.9 – 711	2.0 – 100
Electric Welded (EW)	26.9 – 610	1.4 – 16
Submerged Arc Welded (SAW)	168.3 - 2743	2.9 - 50

Seamless (S) pipe is formed by a method of hot working steel to form a tubular product without a welded seam. If necessary, the hot worked tubular product may be subsequently cold finished to produce the desired shape, dimension and properties.

Electric Welded (EW) pipe formed continuously from a steel strip with a longitudinal seam. This seam is joined by electric resistance or electric induction welding wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of the electric current.

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Submerged Welded pipe (SAW) formed from a steel strip with a longitudinal or helical (spiral) seam. The seams are then welded together by a coalescence of metals caused by heating them with an arc or arcs between a bare consumable electrode or electrodes. The arc and molten metal are shielded by a blanket of granular, fusible material on the work. Welding shall include at least one pass on the inside and one pass on the outside of the pipe.

Pipes shall not include welds used for joining lengths of steel strip together prior to forming except for helical welded pipe provided that such weld is made using the same method of welding as the helical seam.

Pipes shall not contain circumferential welds. Pipes shall not be manufactured on site.

Pipes formed from, plate, strip or coil shall have edges mechanically sheared before forming. In the case of pipes thicker than 10mm to be manufactured by the Submerged Arc Process (SAW), the edges of plate, strip or coil shall be chamfered by mechanical milling.

Pipe shall be delivered in 12m exact lengths for DN 250 and above and 6m exact lengths for DN 200 and below. The tolerances on pipe length shall be in accordance to Table 9 of BS EN 10224.

Unless otherwise specified, pipe shall be supplied with spigot and socket push-fit joints with elastomeric seals. The joints shall be flexible joints as defined in BS EN 805:2000 and the allowable angular deflection of the joints shall comply with the Class B limits given in Table 5 of EN 805.

Steel pipes and fittings larger or equal to DN 200 shall be internally lined throughout their entire length internally with either:

- (a) Fusion bonded epoxy to AWWA C213 (400 µm dry film thickness);
- (b) Solvent free liquid epoxy to AWWA C210 (400 µm dry film thickness);
- (c) Polyurethane to AWWA C222 (500 µm dry film thickness).

The materials and application process shall be subject to the Engineer's approval.

Steel pipes and fittings smaller or equal to DN 150 may be lined in cement mortar to AWWA C205.

For steel pipes DN 500 and below, the external protection shall be fusion-bonded epoxy to AWWA C213.

Dimensions for fittings shall comply with BS EN 10224. In the case of fittings such as reducers, laterals and washout tees not covered in BS EN 10224, the dimensions shall comply with AWWA C208.

Calculation of thickness of bends and reinforcement of tees and laterals shall comply with AWWA C208 and AWWA M11. The Contractor shall submit details of such calculations.

Flange jointed pipes shall have flanges complying with BS EN 1092: 2002.

All steel flanged pipes and fittings shall be supplied complete with hot dipped galvanised bolts, nuts to BS EN ISO 1461 (minimum 305g/m²) and appropriate gaskets. Gaskets shall be EPDM rubber and conform to BS EN 681. They shall be suitable for potable water.

The Contractor shall make available to the Engineer the manufacturer's certificates covering the chemical analysis and physical properties of each cast of steel used in the manufacture of

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pipes. In addition, a product analysis shall be conducted on the steel coils, plates, billet or blanks prior to pipe manufacture.

All pipes shall be hydraulically tested before leaving the factory to induce a hoop stress equal to 70% of the minimum yield stress pressure as specified in BS EN 10224.

All pipes shall be tested according to Table 14 of BS EN 10224 and at the frequency stipulated in Table 15.

All tests shall be carried at the expense of the Contractor at the place of manufacture and the Contractor shall supply a signed certificate on delivery of the goods concerned giving results of the tests and certify that the goods concerned have been manufactured in accordance with this Specification.

5.5.3 *Galvanised Steel Tubes*

Galvanised mild steel tubes and fittings shall comply with BS 1387 Class B or “Medium Grade”. Threading for screwed and socketed joints shall be in accordance with the requirements of BS 21.

Joints shall be made with an approved pipe-jointing compound in accordance with the manufacturer’s instructions. Red lead compounds shall not be used. Joints in underground piping shall be coated with bitumen or other approved composition.

All underground sections of pipework to be protected against corrosion by treating with K1-60 bitumen emulsion primer, and wrapped with fibreglass and coated with two coats of bituminous top coats all to manufacturer’s specification.

The bituminous paint is to be manufactured to ASTM D1187-82.

All fittings for galvanised steel water pipework shall be galvanised heavy weight fittings in accordance with BS EN 10241. All fittings shall be subject to the approval of the Engineer.

Brass or gunmetal fittings shall be subject to the approval of the Engineer.

5.5.4 *PVC-U Pipes*

Unplasticized Polyvinyl Chloride (PVC-U) pressure pipes shall have outside diameters, laying lengths and wall thickness complying with KS-06-149 Part 2: 2000. Joints shall be of the spigot and integral socket type. Solvent weld joints are not permitted in buried PVC-U pipelines.

Fittings for use with PVC-U pressure pipe shall be manufactured from either PVC-U or cast iron with socketed joints and shall comply with ISO 727. Cast iron fittings shall be bitumen coated. Aluminium alloy fittings are not permitted.

The metal adaptor fittings shall comply with ISO 4132.

5.5.5 *PE Pipes*

Polyethylene (PE) pipes and fittings shall comply with ISO 4427:1996.

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5.6 Valves

5.6.1 Gate Valves

Gate valves shall conform to BS 5153-1:2004. The valves shall be tested in accordance with BS EN 1074-2:2000.

Non-return valves	BS EN 1074-3:2000
Air valves	BS EN 1074-4 :2000
Hydrants	BS EN 1074-6 :2004

All gate valves shall close in a clockwise direction and the direction of opening and closing shall be cast on the handwheels or valve casing with the words 'OPEN' and 'CLOSE' respectively. All gate valves shall be capable of being operated manually with a maximum applied torque of 100 Nm for valves with a nominal diameter less than 450mm. The Contractor shall ensure that the gate valves supplied are fitted with appropriate thrust bearing guides and gearing to fulfil these requirements, ensuring that when reduction gearing is employed, the gear ratio shall not exceed 4:1.

Isolating gate valves shall permit manual closing off of the raw water supply.

5.6.2 Butterfly Valves

Butterfly valves shall conform to BS EN 593:1998: "Industrial valves. Metallic butterfly valves." The valves shall be tested in accordance with BS EN 1074-2:2000.

The use of butterfly valves as main line valves shall not be permitted.

5.6.3 Check Valves

Check valves shall comply with BS EN 12334:2001: "Industrial valves. Cast iron check valves." The valves shall be tested in accordance with BS EN 1074-3:2000.

The valves shall be installed in a horizontal position to avoid malfunctioning of the check.

5.6.4 Single Air Valves

Single air release valves shall be of the small orifice type and shall have bodies of cast iron. The inlet shall be 25mm diameter fitted with an isolating plug cock and shall be screwed in an 80mm diameter blank flange drilled and tapped to BS 21. Single air valves shall be of pattern and manufacture approved by the Engineer for the conditions under which they will operate, and be fitted with a pressure gauge tapping and plug. Floats are to be manufactured from high-density polyethylene.

The valves shall be tested in accordance with BS EN 1074-4:2000.

5.6.5 Double Air Valves

Air release and vacuum break valves shall be of a compact, single chamber design with solid cylindrical high density polyethylene control floats housed in a tubular stainless steel body with stainless steel ends secured by stainless steel tie rods.

The valves shall have integral surge alleviation mechanisms that shall operate automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of separated water columns. The limitation of pressure rise must be achieved by deceleration of approaching water before valve closure.

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The intake/discharge orifice area shall be equal to the nominal size of the valve.

The valve design shall incorporate an overpressure safety feature that will fail without an explosive effect. This feature shall consist of easily replaceable components such as gaskets, seals or the like.

The valves shall be tested in accordance with BS EN 1074-4:2000.

5.6.6 *Flow Control Valves*

Pressure and flow control valves shall be installed as shown on the Contract Drawings and be suitable for the operating conditions specified.

The basic valves shall be either of the pressure compensating globe valve design with externally arranged spring and diaphragm assembly or of the streamline two chamber concentric plunger and pilot valve regulating assembly enclosed within the valve body as required for the particular applications.

Valve bodies shall be of a suitable grade of close-grained cast iron to BS EN 1561:1997.

Valves shall be sized such that the fully open capacity is more than adequate to accept the specified maximum flow at the minimum differential pressure.

The globe valve design shall have the main seat in the stream flow and an upper cylinder for the valve element control piston type and shall have the required number of bosses drilled and tapped to receive strainer unit, relay valves and pressure gauges. The cover plate shall include an air vent and lifting eyes. The main seat shall have a renewable element and the upper portion shall be in the form of a piston and the lower portion shall have a face ring and ported guide.

Valves shall be fitted with an external control relay system which shall be capable of controlling the required parameter of flow or pressure within + or -5 per cent of the set value. The relay system shall include connecting piping couplings and isolating valves to permit maintenance or replacement without interrupting supply.

The rate of response of opening and closing of the main valve shall be adjustable and means for external indication of the main valve element position shall be fitted.

The particular control system for the different duties shall be as specified below.

a) *Altitude Valves*

The main valve shall be controlled by a slave ball cock mounted in the controlled tank at top water level and connected to the valve operating mechanism by small-bore pipework. The level of the ball shall be adjustable in service so that the main valve is fully drop-tight closed when the water level in the tank reaches top water level.

b) *Flow Control Valves*

Flow control valves shall be designed to prevent the flow downstream rising above that specified in the Particular Specification or shown on the Drawings for the particular application, regardless of the operating pressures in the system upstream or downstream of the valve. The relay system valve shall be operated by the pressure differential measured across the main flow orifice which shall be fitted at the upstream end of the flow control valve.

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c) Pressure Reducing Valves

Pressure reducing valves shall be designed to reduce a constant or variable inlet pressure to a predetermined constant outlet pressure, at flows varying from the maximum capacity of the valve to zero flow. Adjustment of the outlet pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating downstream pressure shall be incorporated.

d) Pressure Sustaining Valves

Pressure sustaining valves shall be designed to maintain the pressure in the pipeline immediately upstream of the valve at or above a preset value, irrespective of the flow and pressure conditions downstream of the valve. Adjustment of the upstream pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating upstream pressure shall be incorporated.

e) Pressure Relief Valves

Pressure relief valves shall be designed to prevent the pressure in the pipeline immediately upstream of the valve rising above a preset value. The valve shall remain closed at lower pressures. Adjustment of the pressure at which the valve opens to relieve pressure shall be made by a screw on the relay valve or by changing weights as appropriate. A pressure gauge indicating upstream pressure shall be incorporated.

5.6.7 Float Valves

Float operated valves shall comply with BS 1212 and BS 1968 and BS 2456 “specifications for float ball valves”.

Ball valves shall be the plastic diaphragm type or similar approved with seatings to suit the working pressure of 5 bars with plastic float to BS 2456 and internal overflow.

5.6.8 Painting of Valves

All valves shall be painted internally and externally to give the same standard of protection as for steel pipes and fittings. Surface protection shall be all to the approval of the Engineer.

5.7 Laying Pipes in Trenches and Headings

Immediately before pipes are placed in any trench, the bottom shall be cleared of all stones and other debris and shall be in a condition acceptable to the Engineer. Prior to placing in the trench, all pipes shall be inspected for damage. Damaged pipes which in the opinion of the Engineer cannot satisfactorily be made good shall not be used in the permanent works. End caps or discs placed on the pipes for protection during transit shall not be removed until immediately before the pipes are jointed.

Pipes shall be laid in straight lines unless otherwise shown on the drawings. No pipe shall deviate from the true line and level by more than 5mm. Pipes shall be firmly bedded throughout their length to the required alignment and level so that they are concentric at each joint. All pipes shall be suitably wedged, shored or otherwise restrained to prevent movement during testing and backfilling but such restraints shall not be left in place permanently unless instructed or agreed by the Engineer.

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Pipes which are to receive a concrete bed and haunch or surround shall be set on suitable concrete blocks or bricks with a pad of hessian based damp proof course two millimetres thick interposed between the pipe and the block. Setting blocks shall not be used with other forms of bedding.

Unless otherwise agreed by the Engineer a close fitting brush or swap shall be placed in pipelines having nominal diameters of 650mm or less and shall be drawn forward progressively as pipe laying proceeds by means of a suitable rope which shall be threaded through each pipe as it is laid. Pipelines having nominal diameters greater than 650mm shall be kept clean by suitable means as pipe laying proceeds. No debris of any kind shall be allowed to remain in the pipeline. Where the pipeline has internal lining, persons entering shall wear rubber boots and equipment trolleys shall have rubber tyred wheels. Pipes and joints shall be kept free of dirt, mud and other deleterious matter at all times. If pipe laying is stopped at any time, a cap shall immediately be placed on the end of the last pipe laid to exclude dirt.

Suitable precautions shall be taken to prevent the floating of pipes due to flooding of trenches. If floating should occur, the whole of the pipe run affected shall be removed and trench prepared again. No pipes shall be re-laid in trenches which have flooded until the trenches and the pipes have been inspected by the Engineer. The Contractor shall be entirely responsible for the sufficiency of all temporary supports and side slopes to the excavations. The excavation shall be carried out in such a way as to maintain the stability of all roads and other adjacent structures or works.

Pipes having integral sockets shall be laid with sockets facing upstream unless otherwise agreed or instructed by the Engineer.

Pipes in headings shall be laid in accordance with the requirements of this clause but pipe lengths shall not exceed 1.5m unless otherwise agreed by the Engineer.

5.8 Pipes Laid on Natural Ground

Filling shall commence with selected fill consisting of easily compacted material from which all stones larger than 25mm and all lumps of clay larger than 75mm have been removed. The selected fill shall be deposited equally on each side of the pipe carefully compacted in layers not more than 150mm thick. Care shall be taken to ensure that no voids are left under the pipe. The filling shall be continued to a level of 300mm above the crown of the pipe

In the case of steel, ductile iron and plastic pipes, the Contractor shall ensure that no distortion of the pipe takes place during the backfilling operation.

The remainder of the trench shall be filled with excavated material and compacted in 150mm thick layers by means of a vibrating plate compactor or a mechanical rammer. The trench shall be filled flush with the surrounding ground surface.

5.9 Pipes laid on Granular Bedding

Granular bedding material shall be placed and compacted generally on both sides of the pipe up to the horizontal diameter of the pipe. Care shall be taken to ensure that no voids are left under the pipe. Thereafter the selected fill shall be as described in Clause 5.8 above.

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5.10 Pipes with Concrete Bedding and Surround

The configuration of the concrete bedding, surround or arch shall be as shown on the drawings including the location of reinforcement if any is required. Pipes to be set in concrete shall be supported as set out in Clause 5.7. Small diameter pipes in short lengths shall be supported behind pipe socket. Large diameter pipes and long lengths shall be supported on two packers.

After jointing and testing as set out in the appropriate parts of this section, concrete of the class shown on the drawings shall be carefully placed and compacted under the pipes making sure that no voids are left, and brought up to the configuration shown on the drawings. The Contractor shall ensure that the pipes do not float or are in any way disturbed during concrete placing. The remainder of the backfill shall be placed as set out in Section 2 of this Specification.

Where pipes, which are laid on a bed of granular material, are to be protected by a concrete arch, the laying and jointing shall proceed as set out in the appropriate parts of the Specification and granular material shall be brought up to the horizontal diameters of the pipes.

After testing, concrete shall be placed over the pipes to the configuration shown on the drawings and the remainder of the backfill shall hereafter be placed as set out in Section 2 of this Specification.

Flexible joints shall be formed in concrete beddings, arches or surrounds in the location shown on the drawings. Such joints shall coincide with the pipe joint in such a way that the end of the socket is flush with one face of the joint and the socket faces into the joint space.

Joints in concrete beddings, arches and surrounds shall be 18 mm wide unless otherwise instructed by the Engineer and shall be filled with a compressible material such as a sheet of cane fibre board or cork board. The material used shall be subject to the approval of the Engineer.

5.11 Special Accessories for the Buried Pipe Network

5.11.1 Scope

This section of the specification concerns the supply and installation of accessories for the buried pipe network at the locations shown on the approved Drawings or as directed by the Engineer.

The several parts of the accessories, as described below, shall be considered as a complete unit, which will serve to supply water to the hydrant outlets from the underground distribution network. Each part shall be fabricated by an internationally recognised manufacturer and shall conform to the conditions of operation, the characteristics, the testing and other requirements described below.

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The several parts of the accessories, as described below, shall be considered as complete unit, which will serve to supply water to the hydrant outlets from the underground distribution network. Each part shall be fabricated by an internationally recognized manufacturer and shall conform to the conditions of operation, the characteristics, the testing and other requirements described below.

The Contractor shall at the time and place required, submit to the Engineer proposals concerning the manufacturers selected by him for the supply of the accessories, accompanied by a detailed report, specifications and certificates showing that the proposed components have been successfully used in similar sprinkler systems, so as to prove that the proposed accessories conform to the requirements of this specification in a satisfactory manner.

Subsequent to the provision and acceptance of the proposals as above, the Engineer may agree to the use of the proposed accessories, but his consent cannot be interpreted in any case whatsoever, as relieving the Contractor of his responsibilities for the supply of accessories which shall prove adequate and efficient during the testing procedure and the operation of the network.

The Engineer reserves the right, on the other hand to reject the Contractor's proposals if he finds them incomplete or vague or if the proposed accessories do not conform to the requirements of this specification.

In such a case, within a reasonable period, not longer than one month, after communication of the above decision of the Engineer to the Contractor, the latter is required to supplement and improve his original proposals and submit his revised recommendations.

If the Contractor fails to submit, within the above time limit, his final recommendations, or if the Engineer for the same reasons rejects these for which his original proposals were rejected, he is required to supply accessories, which will satisfy the Engineer. If, however, he does not agree and insists on supplying the accessories which he has proposed, he must deposit a guarantee to an amount equal to the value of these accessories. This guarantee will remain in the hands of the Employer until the final acceptance and will be forfeited to the latter if, during the test procedure and the operation of the network, it is ascertained that the accessories supplied by the Contractor are not satisfactory. It is understood that the Contractor is, in addition, required to fulfill all his other obligations for the restoration of all defective construction until final acceptance by the Engineer.

5.11.2 Acceptance Tests

Included with the specifications submitted by the Contractor, shall be copies of any relevant international standards to which the items are to be constructed. The Engineer reserves the right to request independent authenticated tests at the point of manufacture and also similar tests in situ under operating conditions. All costs shall be borne by the Contractor who will promptly replace any components which, in the judgement of the Engineer are found, either after testing or during operation and until final acceptance, as not conforming to the requirements of this Specification.

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5.11.3 Measurement and Payment

Measurement shall be by assessing the number of satisfactorily installed and accepted accessories.

Payment will be made for the number of accessories measured as described above and on the basis of the respective contract unit prices. Such prices and payment constitute full compensation to the Contractor for supplying, hauling, storing and installing the accessories, for paying patent rights, for furnishing the equipment, materials and labor required for installing and checking the operation of the accessories in accordance with the foregoing requirements, and for any other related expense even if not explicitly stated above but necessary for the complete and proper performance of the work and the satisfactory operation of the accessories.

5.11.4 Irrigation Hydrants

There are generally two types of hydrants as shown on the Drawings:

- Type 1 Plot hydrant
- Type 2 Field hydrant

5.11.5 Pressure Reducing Valves

There is a requirement for Pressure Reducing Valves, which will protect the installed pipelines against high pressures.

The Contractor shall submit to the Engineer proposals referring to the valves to be used and the name of the manufacturer with whom he intends to place the purchase order, accompanied by a detailed report, specifications and certificates showing that the proposed valves have been successfully used in similar cases so as to prove that the proposed valves conform to the requirements of this specification in a satisfactory manner.

Following completion of the construction of the pipe network, and prior to its final acceptance, the engineer may demand the performance of tests to ascertain the efficiency and adequacy of the installed valves. To this effect, the Contractor shall, at his own expense, place at appropriate locations of the network to be designated by the Engineer automatic recording manometers with the minimum possible inertia of moving parts so as to ascertain in an unquestionable manner, the adequacy of the valves, especially during filling and draining of the network as well as on sudden opening and immediate shut down of a riser located at a relatively unfavourable point.

The Contractor shall take into account the fact that the valves must be "drop tight" or "sealed" at no flow conditions and that the seals and operating mechanisms must be proof against suspended solids in the supply water (untreated river water). The valves shall operate automatically, hydraulically, without electricity.

5.12 Joints in Pipelines

5.12.1 Concrete Pipes

Rigid Joints

When laying rigidly jointed pipelines with pipes having integral sockets, before entering a pipe spigot into its socket, both spigot and socket shall be clean and free from mud, oil, grease or other deleterious matter. A gasket of tarred hemp yarn, cut to length so that it forms a butt joint at the crown of the pipe shall be wrapped round the spigot which shall then be fully entered into the socket and the gasket caulked up hard into the joint. The joint shall then be filled completely with a plastic mortar composed of one part of cement to two parts of sand.

The pipes shall not be pressure tested or disturbed in any way for at least 48 hours after jointing.

Rigidly jointed sleeves used to join two spigots shall be jointed in the same manner as integral sockets.

If the drawings require ogee jointed pipes to be laid with a mortar joint, the joint shall be made at the time of laying. Mortar as described above shall be applied to the lower semi-circumference of the socket and to the upper semi circumference of the spigot and the pipe shall be drawn hard into the socket. Excess mortar squeezed out of the joint shall be removed from both the inside and outside of the joint.

Flexible Joints

Flexible joints between pipes having integral socket may be formed by a shaped rubber gasket fitted within the socket or by a rubber ring of circular cross section (O-ring) placed on the pipe spigot. The type of flexible joint to be used shall be subject to the approval of the Engineer and shall be made strictly in accordance with the manufacturer's recommendations.

5.12.2 PVC-U Pipes

Flexible jointed PVC-U pipes shall be jointed in accordance with the manufacturer's instructions.

Solvent welded joints shall be made strictly in accordance with the manufacturer's instructions using solvent supplied by him for exposed pipes.

5.12.3 Steel Pipes

These shall be caulked in thread seal for rigid joints. Flexible joints incorporating rubber O-rings shall be made in accordance with the manufacturer's instructions. Joints incorporating bolted or screwed glands or couplings shall be made in accordance with the manufacturer's instructions.

Components of flexible joints from different manufacturers shall not be used together.

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5.13 Connections to Existing Pipelines

Where a connection is to be made to an existing water pipe other than that at a chamber, a pipe saddle of the correct size shall be used for this purpose. The hole in the pipe shall be cut precisely to fit the saddle.

Saddles for uPVC pipes shall be made of the same material as the pipes and shall be fixed with a solvent in accordance with the manufacturer's instructions.

5.14 Pipes through Structures

Where a pipeline passes into or out of a structure, including a manhole cover or similar chamber, two flexible joints shall be formed. The flexible joint shall consist of a 500mm long pipe section connected along the main pipe, with the nearest end 500mm from the face of the structure. One joint will be made on the incoming pipe and another joint on the outgoing pipe.

When the structure is less than one pipe length wide, the above requirement shall not apply and a sleeve shall be formed through the structure so that there is a clear space at least 75mm wide all round the pipe. Adequate means shall be provided to prevent soil from entering this gap.

5.15 Pipelines within Concrete Structures

Sections of pipelines which are to be cast into concrete may be installed in advance of the remaining parts of the pipeline subject to the agreement of the Engineer. Such sections shall be placed accurately into position and fixed so that they can not move during placing of concrete around them.

5.16 Pipes under Roads

All pipes at the crossing of driveways and roads shall be surrounded with concrete for the entire length of crossing before trench backfilling.

Concrete surround shall be approved by the Engineer on satisfactory compliance with protection of pipes as detailed in Section 5.9.

5.17 Cleaning

The insides of all pipes, valves, tanks and fittings shall be clean, smooth, and free from blister, loose scale and dirt when erected. All lines shall be cleaned after all installation work.

When pipes are installed all ends shall be suitably plugged until final fixing of fixtures can be carried out. Pieces of cloth or stone will not be permitted.

5.18 Pressure Testing of Pipelines

As the installation of the pipework proceeds, the various sections shall be tested before they are built in, concealed, or finally connected. The Contractor shall advise the Engineer in writing at least three days in advance of the carrying out of such tests, and such tests shall, if considered necessary by the Engineer, be carried out in his presence.

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All tests shall be at the expense of the Contractor and it shall be the responsibility of the Contractor to make all necessary records of the tests and results and submit these to the Engineer in the final form agreed.

All pipe systems shall be tested hydraulically for a period of one hour to not less than one and a half times the design working pressure. Testing shall comply with BS EN 805:2000 for standard field testing of pipelines.

If preferred, the Contractor may test the pipelines in sections. Any such section found to be satisfactory need not be the subject of a further test when the system has been completed, unless specifically requested by the Engineer.

During the test, each branch and joint shall be examined carefully for leaks and any defects observed shall be made good by the Contractor and the section re-tested.

5.19 Painting of Exposed Pipes and Fittings

All metal surfaces within chambers shall be mechanically wire brushed to remove all loose scale, grease etc. Within two hours of cleaning a primer shall be applied, followed after two hours by a first coat of heavy consistency bitumen paint all to the approval of the Engineer. A second coat of the heavy consistency paint shall be applied after 24 hours. The final coating thickness shall not be less than 250 microns.

Preparation and application of the coating system shall be strictly in accordance with the Manufacturer's instructions.

This clause shall not be applied to chemically or thermally bonded coatings on steel pipes.

5.20 Marker Posts

Precast concrete marker posts shall be set in concrete and fixed near valves, fire hydrants, washouts, changes in direction of the mains and where directed by the Engineer. The posts shall be detailed as directed by the Engineer.

5.21 Portable Sprinkler Irrigation Equipment

5.21.1 Scope

The Tender involves the supply of sprinkler irrigation equipment for overhead irrigation.

The contractor shall have submitted with his Tender detailed specifications as to the dimensions, type and materials utilized in sprinkler construction, together with any detail that the Contractor may consider to be relevant.

The Contractor shall at the time and place required submit to the Engineer proposals concerning the manufacturers selected by him for the supply of the portable sprinkler-irrigation equipment accompanied by a detailed report, specifications and certificates showing that the proposed components have been successfully used in similar sprinkler systems so as to prove that the proposed equipment conforms to the requirements of this specification in a satisfactory manner.

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Subsequent to the provision and acceptance of the proposals as above, the Engineer may agree to the use of the proposed equipment, but his consent cannot be interpreted in any case whatsoever, as relieving the Contractor of his responsibilities for the supply of equipment which shall prove adequate and efficient during the testing procedure and the operation of the network.

The Engineer reserves the right, on the other hand, to reject the Contractor's proposals if he finds them incomplete or if the proposed equipment does not conform to the requirements of this specification.

In such a case, within a reasonable period, not longer than one month, after communication of the above decision of the Engineer to the Contractor, the latter is required to supplement and improve his original proposals and submit his revised recommendations.

If the Contractor fails to submit, within the above time limit, his final recommendations or if these are rejected by the Engineer for the same reasons for which his original proposals were rejected, he is required to supply portable sprinkler irrigation equipment which will supply the Engineer. If, however, he does not agree and insists on supplying the equipment which he has proposed, he must deposit a guarantee to an amount equal to the value of the equipment. This guarantee will remain in the hands of the Employer until the final acceptance and will be forfeited to the latter if during the test procedure and the operation of the network, it is ascertained that the portable sprinkler irrigation equipment supplied by the Contractor is not satisfactory. It is understood that the Contractor is, in restoration of all defective construction until final acceptance by the Engineer.

5.21.2 Acceptance Tests

Included with the specifications submitted by the Contractor shall be copies of any relevant international standards to which the items are to be constructed. The Engineer reserves the right to request independent authenticated tests at the point of manufacture and also similar tests at the point of manufacture and also similar tests in situ under operating conditions. All costs shall be borne by the Contractor who will promptly replace any equipment which in the judgment of the Engineer is found, either after testing or during operation and until final acceptance, as not conforming to the requirements of this Specification.

5.21.3 Measurement and Payment

Measurement shall be made by assessing the number of satisfactorily installed and accepted items of portable sprinkler irrigation equipment.

Payment will be made for the number of items measured as described above and on the basis of the respective contract unit prices. Such prices and payment constitute full compensation to the Contractor for supplying, hauling, storing and installing the equipment for paying patent rights for furnishing the equipment, materials and labor required for installing and checking the operation of the items in accordance with the foregoing requirements, and for any other related expense even if not explicitly stated above, but necessary for the complete and proper performance of the work and the satisfactory operation of the portable sprinkler irrigation equipment.

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5.21.4 *Portable Sprinkling Irrigation Equipment*

This equipment comprises the following as shown in the drawings:

- HDPE pipes of 6 m lengths, 20 -25mm diameter and of class 4 (6 bar),
- HDPE/GI adaptors,
- GI equal tee,
- ½ inch (12.5mm) diameter GI riser pipe with support (tripod or equivalent),
- ½ inch sprinklers (double or single nozzle) to deliver on average 0.63m³/hr at between 15 – 40m heads and of highly durable material (not plastic) and corrosion resistant,

Also refer to sub-sections 5.21.1, 5.21.2 and 5.21.3.

All equipment should be of recognised standards.

6 STEELWORK

6.1 General

Except where otherwise specified, structural steel shall be grade 43, complying with BS 7668, “Specification for weldable structural steels”.

All structural rolled steel members shall comply in dimension, weight and tolerance with that shown on the drawings and with BS 4, “Structural steel sections” and BS EN 10056, 10067 and 10210.

6.2 Bolts, Nuts and Fastenings

Bolts, studs, nuts and washers etc, shall be of mild steel unless otherwise specified. The dimensions and tolerances of nuts and bolts shall comply with BS 4190, “Specification for ISO metric black hexagon bolts, screws and nuts” or where specified to BS 3692, “Specification for ISO metric precision hexagon bolts, screws and nuts” and the threads shall be to BS 3643, “ISO metric screw threads”. The heads of the bolts shall be forged out of the solid bar and the ends shall be cleanly cut with standard threads and the nuts must fit the bolts accurately and tightly. Washers of the shape and type indicated on the drawings shall comply with BS 4320, “Specification for metal washers for engineering purposes”

Where nuts, bolts and washers are required to be galvanized, the galvanizing shall be to BS 3382, “Specification for electroplated coatings on threaded components”.

6.3 Electrodes

Electrodes used in welding mild steel shall comply with the requirements of BS 639, “Specification for covered carbon and carbon manganese steel electrodes for manual metal-arc welding”.

6.4 Contractor’s Shop Drawings

Where the Contractor is required to undertake the detailed design of the steelwork components, he shall provide the Engineer with copies of detailed shop drawings for approval at least fourteen (14) days before commencing fabrication. The Contractor shall be responsible for the detailed design of all connections and these shall be fully detailed on the shop drawings together with all dimensions, clearances, welding details and procedures, machining, marking, etc. The Contractor shall not commence fabrication until he has received the Engineer’s written approval of the shop drawings. Approval of such drawings shall in no way relieve the Contractor of his responsibility for accuracy or the correct operation of the component.

6.5 Fabrication and Erection of Steelwork

The standard of workmanship and engineering practices to be adopted for fabrication and erection shall conform to BS 449, “Specification for the use of structural steel in building” and BS 5531, “Code of practice for safety in erecting structural frames”.

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The Contractor shall supply samples of materials and standards of workmanship as required by the Engineer. All samples approved by the Engineer shall be retained and shall be considered as setting the standard for all subsequent work.

Inspection of work will be carried out by the Engineer and the Contractor shall give sufficient notice of the date when fabricated steelwork is ready for inspection. The Contractor shall provide particulars of places and dates of manufacture of all materials for the Permanent Works and the names of the manufactures. Copies in duplicate of all orders for materials shall be sent to the Engineer at the time of placing such orders.

The Contractor shall ensure that all foundation bolts and supports including built-in bolts, etc upon which the steelwork is to be erected are in the correct position and that the steelwork fits correctly in required positions without forcing or straining in any way. Any check by the Engineer of the Contractor's measurements shall not relieve him of his responsibility for obtaining this fit unless any errors in position are clearly not attributable to him.

No permanent bolting or site welding shall be done until proper alignment has been obtained. The Contractor may use temporary jigs, anchors or supports during erection, but must allow for thermal movement to take place freely at all times.

If the Contractor wishes to drill holes in or fix attachments to the steelwork to carry temporary work such as shuttering, he shall obtain the Engineer's approval of the positions and details of all such holes or attachments and shall close such holes and remove the attachments to the satisfaction of the Engineer.

On completion of erection of any part of the steelwork on which the Contractor wishes to add further works, such as roofing, he shall first obtain the Engineer's approval of the steelwork and remedy any defects required by the Engineer. Any approval given shall in no way relieve the Contractor of his responsibility for ensuring the subsequent correct positioning and behaviour of the steel work of other parts of the structure.

6.6 Welding

All shop welds shall be carried out by qualified welders who shall be under competent supervision. All welding is to be carried out in accordance with BS 5135, "Specification for arc welding of carbon and carbon manganese steels". The Contractor's proposals for welding shall be submitted to the Engineer for approval before any work is undertaken.

The Engineer may call for a test of a welder's capabilities in accordance with BS 4872, "Specification for approval testing of welders when welding procedure is not required".

In the case of site welds, the welding procedure for making each type of joint shall be approved by the Engineer before the work is commenced and the Contractor shall make such trial welds as the Engineer may require to demonstrate the soundness of the proposed method and the competence of his workmen.

Where site welding is used all welded joints shall be subject to inspection by the Engineer. Any welds that are in the opinion of the Engineer defective shall be cut out and the welds remade to the satisfaction of the Engineer. The cost of such corrective measures including any resultant delays shall be borne by the Contractor.

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6.7 Painting General

The Contractor shall submit to the Engineer for his approval details of the types and manufacturers of paints he is proposing to use, together with the manufacturer's recommendations concerning preparation of surfaces, primers and undercoats, application methods, safety precautions and drying times for each type of paint. All paints used in the Works must be supplied ready-mixed in unbroken, sealed containers, which clearly show the type, colour and manufacturer of the paint and carry detailed "instructions for use".

All metal surfaces on which paint is to be applied shall be blast cleaned as laid down in BS 7079, "Preparation of steel substrates before application of paints and related products", or other mechanical means and fully prepared in accordance with the manufacturer's recommendations. Applications of paint coatings on external work shall not be carried out or continued in mist, rain or excessively damp conditions. The Contractor shall take all necessary precautions to prevent dust and dirt coming into contact with freshly applied paint before it has dried.

Paints shall be applied either by brushing or spraying in accordance with the manufacturer's instructions. The thinning of paints shall not be permitted without the approval of the Engineer. Unless otherwise recommended by the manufacturer, the minimum interval between the application of a first coat of paint and the second shall be twenty four hours (24 hrs). Special care shall be taken to ensure complete coverage of all corners, arises and openings without causing an excessive build-up of paint and avoiding runs.

Steelwork to be painted shall be clean and free from all rust, grease, oil and mill scale.

6.8 Painting Steelwork Immersed in Water

Steelwork subject to immersion in water shall be blast cleaned or thoroughly mechanically cleaned by an approved alternative process and immediately coated before leaving the factory with zinc phosphate or similar compatible metallic inhibitive primer with a minimum dry film thickness of 50 microns. Following drying of the primer, the steelwork shall be coated with one coat of non-toxic, non-tainting, high build bituminous paint to BS 3416, "Specification for bitumen-based coating for cold application, suitable for use in contact with potable water", having a minimum dry film thickness of 100 microns.

After erection, damaged areas of steelwork shall be mechanically cleaned and touched up with primer and bituminous paint to fully restore the factory applied coating system and thickness.

Finally, two overall finish coats of bituminous paint with a minimum dry film thickness per coat of 100 microns giving an overall minimum dry film thickness of the complete coating system of 350 microns.

6.9 Painting other steelwork

Where steelwork, which is not galvanized and not subject to immersion in water is required to be painted, it shall be thoroughly cleaned and painted prior to leaving the factory with:

- One coat of zinc phosphate or similar compatible metallic inhibitive primer with a minimum dry film thickness of 50 microns.
- One coat of red lead primer with a minimum dry film thickness of 50 microns.
- Two coats of micaceous iron oxide undercoat paint with a minimum dry film thickness per coat of 50 microns.

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After erection, damaged areas of steelwork shall be mechanically cleaned and touched up with primer and under coat to fully restore the factory applied coating system and thickness.

Finally, one overall finish coat of enamel gloss micaceous iron oxide paint with a minimum dry film thickness of 50 microns giving an overall minimum dry film thickness for the complete coating system of 250 microns.

6.10 Galvanising

All steel and ironwork of whatever kind required to be galvanised is to be pickled in dilute hydrochloric acid and then washed, fluxed and stoved and coated with zinc by dipping in a bath of molten zinc. All components are to be immersed in the bath only for the time sufficient for them to attain the temperature of the bath, they are then to be withdrawn at such a speed that a coating of 80 microns thickness is achieved, or such other practical maximum thickness for the component as defined in BN EN ISO 1461:1999, "Specification for hot dip galvanised coatings on iron and steel articles".

The galvanising is to be carried out after all drilling, chipping, trimming, filing; fitting and bending operations are complete and shall cover all faces evenly.

After erection of galvanised steel components, damaged or welded areas shall be painted immediately after cleaning with two coats of metallic zinc primer with each coat having a thickness of 50 microns. The paint shall be applied strictly on accordance with the manufacturer's instructions and shall be compatible with any subsequent paint systems to be applied.

6.11 Galvanised Handrails

Handrail tubes shall be 38mm nominal diameter steel tube to BS 1387, "Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads". The top and bottom rails shall be 900mm and 450mm respectively above floor level. The rails and vertical standards shall be connected using screwed steel pipe fittings to BS 1740, "Specification for wrought steel pipe fittings (screwed BS 21 R-series threads)", where practical with the final connections being welded in accordance with Clause 6.6.

The handrail assembly shall be securely mounted on base plates fabricated of mild steel and attached to the base or foundation slab in a manner to be approved by the Engineer.

All sharp edges and rough areas shall be carefully ground off and the entire handrail assembly cleaned and galvanised in accordance with Clause 6.10.

6.12 Gates

Gates of the types and sizes shown on the drawings shall be supplied and installed where indicated on the drawings. The gate, shall be drop-tight and shall be suitable in all respects for use in raw water. The gates shall have flush invert.

Gates shall be supplied complete with all frames, cills, gates, seals, spindles, handwheels and headstocks as required.

The frames and gates shall be fabricated in galvanised steel.

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All gates shall have rising spindles with protection tubes, headstock, handwheel etc. and intermediate supports where the spindle is longer than 1500mm. Intermediate guide brackets are to be located 600mm above the gate frame, 400mm below the base of the headstock and at a maximum spacing of 1500mm, to suit or as recommended by the manufacturer and as approved by the Engineer.

6.13

Stoplogs

Where shown on drawings the stop-logs shall be hardwood of the stated dimensions and shall be approved by the Engineer before supplying to site. Where shown on the drawings stop-logs shall be bolted to steel frames of stated dimensions to form hardwood gates.

SECTION VI - DRAWINGS

- Note
1. A list of drawings should be inserted here
 2. The actual drawings including Site plans should be annexed in a separate booklet.

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SECTION VII - BILL OF QUANTITIES

Grand Summary sheet		

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Bill No.	Description	Total Amount (Kshs)
1	Preliminaries and Generals	
2	Intake Works	
3	Sedimentation basin	
4	Conveyance	
5	Mainline	
6	Submains total	
7	Infield system	
	Sub Total	
	Contingencies @ 15%	
	Grand Total	

Bill No .1- PRELIMINARY AND GENERALS

ITEM	DESCRIPTION	UNIT	QTY	RATE (KShs)	AMOUNT (KShs)
1.1	Engineer's Office/Scheme Office:				
1.1.1	Construction, maintenance, operation and repair of the office in accordance with the Specifications. See Clause 2.2.1 of Particular instructions for measurement and payment.	Lump Sum	1	850,000	850,000

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1.1.2	Furniture and Equipment for the Engineer's Office and in accordance with Specifications. See Clause 2.2.1 of Particular instructions for measurement and payment.	Lump Sum	1	65,000	65,000
1.1.3	Allow for Engineer & Clerk of works construction supervision cost to be expended as directed by the program manager	Lump Sum	1	750,000	750,000
1.1.4	Allow for confirmatory surveys and design review	Sum	1	600,000	600,000
1.2	Photographs				
	Provision of photographs on progress of the works in accordance with the specification. See Clause 1.9 of Specifications.	Lump Sum	1	3,000	3,000
1.3	Concrete Strength Tests				
	Concrete Strength tests (six cubes / test) in accordance with the Specifications. See clause 3.11 of Specifications.	No.	30	100	3,000
1.4	Signboards				
	Provision, erection and maintenance of project signboards in accordance with the Specifications. See Clause 1.31 of Specifications.	No.	2		
1.5	Survey Equipment:				
1.5.1	Provide and maintain automatic level and accessories as listed in Clause 1.28 of the Specifications (hire charges).	Lump Sum	1	20,000	20,000
1.5.2	Provide and maintain total station and accessories as listed in Clause 1.28 of the Specifications (hire charges).	Lump Sum	1	30,000	30,000
	Sub Total carried forward				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KShs)	AMOUNT (KShs)
	Sub Total brought forward				
1.6	Mobile telephones for the Engineer's site staff:				

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1.6.1	Reimbursement for cost of airtime used on mobile telephones.	Prov. Sum	1	5,000	5,000
1.6.2	Add percent on Item 1.6.1 for overheads and profits	%	10%		
1.6.3	Provide marker posts as specified and as shown in the drawings prior to handing over including all costs.	No.	25		
1.7	Contractual Requirements				
1.7.2	Allow for the insurance of the works, plant and materials in accordance with Clause 13 (a).	LS			
1.7.3	Allow for the insurance against loss of or damage to equipment in accordance with Clause 13 (b).	LS			
1.7.4	Allow for insurance of or damage to people's property in accordance with Clause 13(c)	LS			
1.7.5	Allow for the insurance against accident or personal injury or death to workmen and third party in accordance with clause 13 (d).	LS			
1.8	Contractor's Camp				
	Provide for establishment, mobilization and demobilization of the Contractor's camp together with all the required equipment	LS			
1.8.2	Provide for statutory requirements and other costs to be expended as directed by program manager	LS	1	300,000	300,000
	TOTAL CARRIED OVER TO GRAND SUMMARY				

BILL NO 2-HEAD WORKS BOQ					
Item No.	Description	Unit	Quantity	Rate (Ksh)	Amount (Ksh)

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2.1	Earthworks				
2.1.1	Site clearance for Bushes, shrubs, plants etc.	m ²	600		
2.1.2	Excavation on soft Soil	m ³	90		
2.1.3	Excavation in Rock	m ³	50		
2.1.4	Backfill with Soil	m ³	29		
2.1.5	Disposal of excess soil	m ³	50		
2.2	Concrete Works				
2.2.1	Concrete Grade 25/20	m ³	17.0		
2.2.2	Concrete Grade 20/20	m ³	21.0		
2.2.3	Concrete Grade 15/40	m ³	18.0		
2.3					
2.3.1	Formwork for structures	m ²	150.0		
2.3.2	Formwork for blinding concrete	m ²	6.1		
2.4	Reinforcement bar				
2.4.1	Deformed Mild Steel bars dia 10 mm	kg	650		
2.4.2	Deformed Mild Steel bars dia 12 mm	kg	250		
	Handrail				
2.5	GI Pipe	m	43		
	Step				
2.6	Mild steel(R16)	m	37		
2.8	Stone Works				
2.8.1	Riprap	m ³	15.0		
2.9	Pipe Works				
2.9.1	Flushing pipe				
2.9.1.1	GI pipe 200mm dia.,2.5m long	no.	2		
2.9.1.2	GI pipe 100 mm dia.,0.5m long	no.	2		
	Sub Total carried over				

Item No.	Description	Unit	Quantity	Rate (Ksh)	Amount (Ksh)
	Sub Total brought forward				
2.10	Metal Works				

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2.10.1	Scouring gate (Sluice gate),600x600mm	set	1		
2.10.2	Intake gate (Sluice gate),600x600mm	set	1		
2.10.3	Trash rack(100mm c/c)at intake orifice,1200x1500mm	set	1		
2.10.4	Screen(30mm c/c)at inlet of main pipe,1050x1200mm	set	1		
2.11	Temporary Works - Cofferdam, River diversion works				
2.11.1	Embankment	m ³	200		
2.11.2	Sand bags	m ³	40		
2.11.3	Excavation	m ³	180		
2.11.4	Disposal of soil	m ³	180		
	TOTAL CARRIED OVER TO GRAND SUMMARY				

BILL NO.3 SEDIMENTATION BASIN BOQ					
Item No	Description	Unit	Qty	Rate (Ksh)	Ammount (Ksh)
3.1	Earthworks				
3.1.1	Site clearance for Bushes, Shrubs, plants etc.	m ²	200		
3.1.2	Excavation on Soil	m ³	254		
3.1.3	Excavation on Rock	m ³	80		
3.1.4	Soil Backfill	m ³	20		
3.1.5	Soil Disposal	m ³	200		
3.2	Concrete Works				
3.2.1	Concrete Grade 25/20	m ³	30.0		
3.2.2	Grade 20/20	m ³	10.0		
3.2.3	Grade 15/40	m ³	4.0		
3.3	Form work				
3.3.1	for structures	m ²	250.0		
3.3.2	for blinding concrete	m ²	3.1		
3.4	Reinforcement bar				
3.4.1	Deformed mild steel bars dia 10 mm	kg	680		
3.4.2	Deformed mild steel bars dia 12	kg	120		

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3.4.3	Deformed mild steel bars dia 16mm	kg	0		
3.5	Handrail: GI Pipe	m	135		
3.6	Step Mild steel (R16mm)	m	37		
3.7	Stone Works				
3.7.1	Stone pitching: Hard river rocks (black)	m ²	25.0		
3.8	Pipe Works (valve chamber)				
3.8.1	Main pipe (fittings c/w gaskets,nuts bolts, etc.				
3.8.1.6	Flanged GI 45° smooth bend: 200 mm dia.	no.	2		
3.8.1.8	Flanged adaptor: 200/200 mm dia. Steped	no.	1		
3.8.1.9	Sluice valve: 200mm dia	no.	1		
3.8.1.10	Master meter: 200mm dia	no.	1		
3.8.1.11	Flanged GI pipe piece, 0.4m long :200 mm dia.	no.	3		
3.8.1.12	Flanged bell mouth (offtake): 200 mm dia.	no.	1		
	Sub Total carried over				

Item No	Description	Unit	Qty	Rate (Ksh)	Ammount (Ksh)
	Sub Total brought forward				
	Flushing pipe				
3.9.1	GI pipe: 200 mm dia.class B	m	3.0		
3.9.2	Burterffly valve :200mm dia.	no.	1		
3.9.3	uPVC pipe: 200 mm dia.PN8	m	12		
3.10	Steel Works				
3.10.1	SB manhole covers : Lockable steel cover(G-16)	set	8		
	TOTAL CARRIED TO GRAND SUMMARY				

Bill No .4- CONVEYANCE					
ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
4.1	Excavation and Backfilling				

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	Rates for excavation and backfilling in trench shall include for trimming trench bottom and for providing selected bedding and surround materials from the excavations with the specifications.				
4.1.1	Excavation and backfilling in trench normal material for Dia 200 mm pipe for depth not exceeding 1.5 m	m ³	446		
4.1.2	Excavation and backfilling in trench normal material for Dia 160 mm pipe for depth not exceeding 1.5 m	m ³	685		
4.1.3	E.O for excavation in soft rock (provisional)	m ³	57		
4.1.4	E.O for excavation in hard rock (provisional)	m ³	113		
4.2	Pipework				
	Provide, lay, joint and test the following flexible spigot and socket pipe and fittings with rubber ring joints. Rates to include for all jointly materials, cutting wastage.				
	Note: The following have been used on the drawings to specify pipe diameters/types/classes. Pipe dimensions/working pressures shall conform to KS-06-149 Part 2:2000.				
	Class Working Pressure (m)				
	PN6 60	m			
	PN8 80	m			
	PN10 100	m			
	PN12 120	m			
	uPVC pipes				
	Class PN6				
4.2.1	200 mm diameter	m	520		
	Sub Total carried over				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
4.2.2	160 mm diameter	m	1000		
	STEEL pipeworks				
4.2.3	200 mm dia double flanged GI pipes	m	100		
4.2.4	150 mm dia double flanged GI pipes	m	20		
	Reducer				
4.2.5	200 x 160 mm dia	no.	1		
4.3	VALVE CHAMBER				

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4.3.1	Excavate for, provide all materials and construct complete inspection valve chambers at the pipe junctions. Internal dimensions 1200 x 1200 x 1200 mm. Rates to include for all thrust blocks , pipe supports, inspection covers, etc as detailed in the drawings.	No.	1		
	1 No. Valve Chamber at Ch. 1500m(isolation valves)				
4.3.2	160/150 mm dia VJ stepped coupling	No	2		
4.3.3	150 mm dia single flanged steel spigot (400mm Long)	No	2		
4.3.4	150 mm dia double flanged sluice valve	No	1		
4.4	Gulley crossing				
	Provide supports and anchor for the GI pipes as specified				
	Provide, place and test the following concrete including form work:				
4.4.1	grade 20/20	m ³	4.5		
	Provide, fit and test following reinforcement bars as per drawings				
4.4.2	Y10	Kg	70		
	SUB-TOTAL CARRIED FORWARD TO NEXT PAGE				

ITEM No.	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB-TOTAL BROUGHT FORWARD FROM PREVIOUS PAGE				
4.5	Air Valves				
	Excavate for, provide all materials and construct complete air valve chamber of internal dimensions 1000 x 1000 x 1000 mm. Rates to including thrust blocks, pipe supports as shown in the drawings.	No.	3		
	Provide, handle, install and test the following steel pipes and fittings, valves and specials. Special rates shall include for completing all pipe joints as specified in the specification				
	3 No air valves at chainages 820, 1100 & 1450 m				
4.5.1	160 x 65 mm dia flanged saddle clamps	No	3		
4.5.2	65mm dia, 0.4 m long double flanged GI pipe	No.	3		
4.5.3	65mm dia sluice valve	No.	3		
4.5.4	65mm single air valve	No.	3		
4.6	Wash Outs				

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4.6.1	Excavate for, provide all materials and construct complete w/o spillway chambers of internal dimensions 750 x 750 x 1200 mm. Rates to including thrust blocks, pipe supports as shown in the drawings.	No.	1		
	Provide, handle, install and test the following steel and uPVC pipes and fittings, valves and specials. Special rates shall include for completing all pipe joints as specified in the specification				
	1No. Washouts at Chainages 1350m				
4.6.2	160 X 100 mm dia flanged underscoar saddle clamps	No.	1		
4.6.4	100 mm dia flanged GI elbow	No.	1		
4.6.5	100 /110 mm dia uPVC / GI adaptor	No.	1		
	Sub Total carried over				

ITEM No.	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	Sub Total brought forward				
4.6.6	110 mm UPVC pipe Class PN6	m	90		
4.6.7	100 mm dia double flanged steel spigot (0.3m long)	No.	1		
4.6.8	100 / 110 mm dia V/J stepped couplings	No	1		
4.6.9	100 mm dia flanged sluice valve	No.	1		
4.6.10	100mm flanged GI pipe (500 mm long) with a flap valve	No.	1		
4.8	BENDS (PROVISIONAL)				
	uPVC fittings (Horizontal Bends)				
	22.5 degrees				
4.7.1	200 mm dia	No.	3		

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	22.5 degrees				
4.7.2	160 mm dia	No.	8		
	11.25 degrees				
4.7.3	200 mm dia	No.	7		
4.7.4	160 mm dia	No.	10		
	TOTAL CARRIED OVER TO GRAND SUMMARY				

Bill No .5- Mainline

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
5.1	Excavation and Backfilling				
	Rates for excavation and backfilling in trench shall include for trimming trench bottom and for providing selected bedding and surround materials from the excavations with the specifications.				
5.1.1	Excavation and backfilling in trench normal material for Dia 200 mm pipe for depth not exceeding 1.5 m	m ³	0		
5.1.2	Ditto 160 mm dia	m ³	980		
5.1.3	Ditto 125 mm dia	m ³	236		
5.1.4	Ditto 110 mm dia	m ³	125		
5.1.5	Ditto 75mm dia	m ³	275		
5.1.6	Ditto 63 mm dia	m ³	300		
5.1.7	Ditto 32 mm dia	m ³	50		
5.1.8	Ditto 25mm dia	m ³	10		

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5.1.8	E.O for excavation in soft rock (provisional)	m ³	99		
5.1.9	E.O for excavation in hard rock (provisional)	m ³	198		
5.2	Pipework				
	Provide, lay, joint and test the following flexible spigot and socket pipe and fittings with rubber ring joints. Rates to include for all jointly materials, cutting wastage.				
	Sub Total carried over				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	Sub Total brought forward				
	Note: The following have been used on the drawings to specify pipe diameters/types/classes. Pipe dimensions/working pressures shall conform to KS-06-149 Part 2:2000.				
	Class Working Pressure (m)				
	PN6 60	m			
	PN8 80	m			
	PN10 100	m			
	PN12 120	m			
	uPVC Straights				
	Class PN6				
5.2.1	160 mm diameter	m	950		
5.2.2	125 mm diameter	m	450		
5.2.3	110 mm diameter	m	250		
5.2.4	75 mm diameter	m	300		
	Class PN8				
5.2.5	160 mm diameter	m	800		
5.2.6	75 mm diameter	m	250		
5.2.7	63 mm diameter	m	600		

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	Class PN10				
5.2.8	32 mm diameter	m	100		
5.2.9	25 mm diameter	m	20		
	Reducers, mm				
5.2.10	160x 125	no.	1		
5.2.11	125 x 110	no.	1		
5.2.12	110 x 75	no.	1		
5.2.13	75 x63	no.	1		
5.2.14	63 x 32	no.	1		
5.2.15	32 x 25	no.	1		
	Sub Total carried over				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	Sub Total brought forward				
5.3	Offtakes fittings				
5.3.1	Excavate for, provide all materials and construct complete inspection valve chambers at the pipe junctions. Internal dimensions 1000 x 1000 x 1000 mm. Rates to include for all thrust blocks , pipe supports, inspection covers, etc as detailed in the drawings.	No.	8		
	4 No. Section Valve Chamber for offtake toGikui subs A, B, C, D, E at Chainage 1400, 1600, 1700 &1750m				
5.3.2	160 x 63mm dia saddle clamp	No	5		
5.3.3	65mm x63 mm dia GI/UPVC adaptor	No	10		
5.3.4	63 mm dia Upvc PN6 piece	m	6		
5.3.5	65 mm dia threaded steel spigot (400mm long)	No	10		
4.3.6	65 mm Dia Gate valve	No	5		
5.3.7	65 mm dia GI nipple	No	5		

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5.3.8	65 mm dia GI union	No	5		
	3No. Section Valve Chambers- offtake to gatubi B, Mbugini and Dos office at Ch.2200m, 2450m & 3450m Respectively				
5.3.9	110 x 63mm dia saddle clamps	No	2		
5.3.10	63 x63 x 63 mm dia equal tee	No	1		
5.3.11	65/ 63mm dia GI/UPVC adaptor	No	3		
5.3.12	40 / 40mm dia GI/UPVC adaptor	No	1		
5.3.13	63mm dia Upvc pn6	m	6		
5.3.14	63mm dia single flanged steel spigot (400mm long)	No	3		
5.3.15	65 mm Dia flanged sluice valve	No	3		
5.3.16	40 mm dia GI nipple	No	1		
5.3.17	40 mm dia GI union	No	1		
5.3.18	65mm dia GI nipple	No	2		
5.3.19	65mm dia GI union	No	2		
5.4	AIR VALVES				
5.4.1	Excavate for, provide all materials and construct complete air valve chambers. Internal dimensions 1000 x 1000 x 1200 mm. Rates to include for all thrust blocks , pipe supports, inspection covers, etc as detailed in the drawings.	No.	2		
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
	Provide, handle, install and test the following steel pipes fittings, valves and specials. Special rates shall include for completing all pipe joints as specified in the specification				
	2 No. Single Air Valves (SAV) at Chainages 1000 & 1750m				
5.4.2	160 x 65 mm dia flanged saddle clamp	No	2		
5.4.3	65mm dia, 0.4 m long double flanged GI pipe	No.	2		
5.4.4	65mm dia sluice valve	No.	2		

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5.4.5	65mm single air valve	No.	2		
5.5	Pressure reducing valves (PRVs)				
5.5.1	Excavate for, provide all materials and construct complete PRV chambers of internal dimensions 1000 x 1000 x 1000 mm. Rates to including thrust blocks, pipe supports as shown in the drawings.	No.	1		
	Provide, handle, install and test the following steel and uPVC pipes and fittings, valves and specials. Rates shall include for completion and pipe protection at all pipe joints as specified in specifications and drawings				
	For 1No. PRV Chambers at Chainage 1500m				
5.5.2	160 / 150 mm dia V/J step couplings	No.	2		
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
5.5.3	150 mm dia, 500mm long single flanged GI piece	No.	2		
5.5.4	150 mm dia flanged sluice valve	No.	1		
5.5.5	150 mm dia flanged pressure reducing valve	No.	1		
5.6	Saddle clamps/Tees (Provisional)				
	Direct offtakes from mainline				
5.6.1	160 x 20 mm dia	No	30		
5.6.2	125 x 20 mm dia	No	20		
5.6.3	110 x 20 mm dia	No	35		
5.6.4	75 x 20 mm dia	No	20		
5.6.5	50 x 20 mm dia	No	25		

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	GI/uPVC Adaptors for Saddle clamps				
5.6.6	20 x 20 mm dia	No	130		
5.7	BENDS (PROVISIONAL)				
	uPVC fittings (Horizontal Bends)				
	22.5 degrees				
5.7.1	160 mm dia	No.	11		
	22.5 degrees				
5.7.2	125 mm dia	No.	7		
	11.25 degrees				
5.7.3	160 mm dia	No.	13		
	11.25 degrees				
5.7.4	125 mm dia	No.	10		
5.8	MINOR ROAD CROSSING				
	Provide for road crossings as per drawings and in accordance with specifications. Rates to include for excavation and backfilling, culvert, concrete surround and all jointing materials and other fittings as per the specifications.				
	SUB TOTAL CARRIED OVER				

ITEM No	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
5.8.1	At various road crossings	lumpsum			
5.90	MAIN ROAD CROSSING (Nturiri road)				
5.9.1	160 / 150 mm dia V/J step couplings	No.	2		
5.9.2	150 mm dia, 500mm long single flanged GI pipe piece	No.	2		
5.9.3	150 mm dia, 1500mm long double flanged GI pipe piece	No.	2		
5.9.4	150 mm dia flanged GI 90 deg. elbow	No.	4		
5.9.5	150 mm dia flanged GI pipes	m	40		
	TOTAL CARRIED OVER TO GRAND SUMMARY				

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Bill No .6.1- Mbugimi

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
6.1.1	Excavation and Backfilling				
	Rates for excavation and backfilling in trench shall include for trimming trench bottom and for providing selected bedding and surround materials from the excavations with the specifications.				
6.1.1.1	Excavation and backfilling in trench normal material for Dia 75 mm pipe for depth not exceeding 1.5 m	m ³	250		
6.1.1.2	Ditto 63 mm dia	m ³	100		
6.1.1.3	Ditto 50mm dia	m ³	100		
6.1.1.4	Ditto 40mm dia	m ³	65		
6.1.1.5	Ditto 25 mm dia	m ³	25		
6.1.1.6	E.O for excavation in soft rock (provisional)	m ³	27		
6.1.1.7					
6.1.1.8	E.O for excavation in hard rock (provisional)	m ³	27		
6.1.2	Pipework				
	Provide, lay, joint and test the following flexible spigot and socket pipe and fittings with rubber ring joints. Rates to include for all jointly materials, cutting wastage.				
	Note: The following have been used on the drawings to specify pipe diameters/types/classes. Pipe dimensions/working pressures shall conform to KS-06-149 Part 2:2000.				
	Class Working Pressure (m)				
	PN6 60	m			
	PN8 80	m			
	PN10 100	m			

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	PN12	120	m		
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
	uPVC Straights				
	Class PN6				
6.1.2.1	75 mm diameter	m	400		
	Class PN8				
6.1.2.2	75 mm diameter	m	100		
6.1.2.3	63 mm diameter	m	200		
	Class PN10				
6.1.2.4	50 mm diameter	m	200		
6.1.2.5	40 mm diameter	m	130		
6.1.2.6	25 mm diameter	m	50		
6.1.3	Reducers, mm				
6.1.3.1	75 x 63	no.	1		
6.1.3.2	63 x 50	no.	1		
6.1.3.3	50 x 40	no.	1		
6.1.3.4	40 x 25	no.	1		
6.1.4	AIR VALVES				
6.1.4.1	Excavate for, provide all materials and construct complete air valve chambers. Internal dimensions 1000 x 1000 x 1200 mm. Rates to include for all thrust blocks, pipe supports, inspection covers, etc as detailed in the drawings.	No.	1		
	Provide, handle, install and test the following steel pipes fittings, valves and specials. Special rates shall include for completing all pipe joints as specified in the specification				
	1 No. Single Air Valves (SAV) at Chainage 50m				

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6.1.4.2	75mm x 65 mm dia flanged saddle clamps	No	1		
6.1.4.3	65mm dia, 0.4 m long double flanged GI pipe	No.	1		
6.1.4.4	65mm dia sluice valve	No.	1		
6.1.4.5	65mm single air valve	No.	1		
6.1.4.6	65mm valve socket adaptor	no	1		
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
6.1.5	Saddle clamps/Tees				
	Direct offtakes from sub-mainline				
6.1.5.1	75x 20 mm dia	No	28		
6.1.5.2	63x 20 mm dia	No	25		
6.1.5.3	50x 20 mm dia	No	30		
6.1.5.4	40x 20 mm dia	No	12		
6.1.5.5	25x 20 mm dia	No	5		
	GI/uPVC Adaptors for Saddle clamps				
6.1.7.5	20 x 20 mm dia	No	100		
6.1.8	BENDS (PROVISIONAL)				
	uPVC fittings (Horizontal Bends)				
	22.5 degrees				
6.1.8.1	75 mm dia	No.	10		
	22.5 degrees				
6.1.8.2	63 mm dia	No.	8		
	11.25 degrees				
6.1.8.3	75 mm dia	No.	13		
	11.25 degrees				
6.1.8.4	63 mm dia	No.	15		
6.1.9	MINOR ROAD CROSSING				

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	Provide for road crossings as per drawings and in accordance with specifications. Rates to include for excavation and backfilling, culvert, concrete surround and all jointing materials and other fittings as per the specifications.				
6.1.9.1	At various road crossings	lumpsum			
6.1.10	GULLEY /RIVER CROSSING				
	Provide supports and anchor for the GI pipe as specified				
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
	Provide, place and test the following concrete including form work:				
6.1.10.1	grade 20/20	m ³	3		
	Provide, fit and test following reinforcement bars as per drawings				
6.1.10.2	Deformed Mild steel bars dia 10	Kg	60		
	SU TOTAL CARRIED OVER TO COLLECTION FOR BILL No. 6				

Bill No .6.2- Gatubi

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
6.2.1	Excavation and Backfilling				
	Rates for excavation and backfilling in trench shall include for trimming trench bottom and for providing selected bedding and surround materials from the excavations with the specifications.				
6.2.1.1	Excavation and backfilling in trench normal material for Dia 75 mm pipe for depth not exceeding 1.5 m	m ³	400		
6.2.1.2	Ditto 63 mm dia	m ³	125		
6.2.1.3	Ditto 50mm dia	m ³	0		

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6.2.1.4	Ditto 40mm dia	m ³	50		
6.2.1.5	Ditto 25 mm dia	m ³	15		
6.2.1.6	E.O for excavation in soft rock (provisional)	m ³	30		
6.2.1.7	E.O for excavation in hard rock (provisional)	m ³	30		
6.2.2	Pipework				
	Provide, lay, joint and test the following flexible spigot and socket pipe and fittings with rubber ring joints. Rates to include for all jointly materials, cutting wastage.				
	Note: The following have been used on the drawings to specify pipe diameters/types/classes. Pipe dimensions/working pressures shall conform to KS-06-149 Part 2:2000.				
	Class Working Pressure (m)				
	PN6 60	m			
	PN8 80	m			
	PN10 100	m			
	PN12 120	m			
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
	uPVC Straights				
	Class PN6				
6.2.2.1	75 mm diameter	m	800		
6.2.2.2	63 mm diameter	m	200		
	Class PN8				
6.2.2.3	63 mm diameter	m	50		
6.2.2.4	40 mm diameter	m	100		
	Class PN10				
6.2.2.5	25 mm diameter	m	30		
6.1.3	Reducers, mm				
6.2.3.1	75 x 63	no.	1		

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6.2.3.2	63 x 40	no.	1		
6.2.3.3	40 x 25	no.	1		
6.2.4	AIR VALVES				
6.2.4.1	Excavate for, provide all materials and construct complete air valve chambers. Internal dimensions 1000 x 1000 x 1200 mm. Rates to include for all thrust blocks , pipe supports, inspection covers, etc as detailed in the drawings.	no	1		
	Provide, handle, install and test the following steel pipes fittings, valves and specials. Special rates shall include for completing all pipe joints as specified in the specification				
	1 No. Single Air Valves (SAV) at Chainage 400m				
6.2.4.2	75mm x 65 mm dia flanged saddle clamps	no	1		
6.2.4.3	65mm dia, 0.4 m long double flanged GI pipe	no	1		
6.2.4.4	65mm dia sluice valve	no	1		
6.2.4.5	65mm single air valve	no	1		
6.2.4.6	65mm valve socket adaptor	no	1		
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
6.2.5	Saddle clamps/Tees				
	Direct offtakes from sub-mainline				
6.2.5.1	75x 20 mm dia	No	40		
6.2.5.2	63x 20 mm dia	No	32		
6.2.5.3	40x 20 mm dia	No	22		
6.2.5.4	25x 20 mm dia	No	6		
	GI/uPVC Adaptors for Saddle clamps				
6.2.7.5	20 x 20 mm dia	No	100		
6.2.8	BENDS (PROVISIONAL)				
	uPVC fittings (Horizontal Bends)				
	22.5 degrees				
6.2.8.1	75 mm dia	No.	12		

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	22.5 degrees				
6.2.8.2	63 mm dia	No.	10		
	11.25 degrees				
6.2.8.3	75 mm dia	No.	15		
	11.25 degrees				
6.2.8.4	63 mm dia	No.	7		
6.2.9	MINOR ROAD CROSSING				
	Provide for road crossings as per drawings and in accordance with specifications. Rates to include for excavation and backfilling, culvert, concrete surround and all jointing materials and other fittings as per the specifications.				
6.2.9.1	At various road crossings	lumpsum			
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	SUB TOTAL BROUGHT FORWARD				
6.2.10	GULLEY /RIVER CROSSING				
	Provide supports and anchor for the GI pipe as specified				
	Provide, place and test the following concrete including form work:				
6.2.10.1	grade 20/20	m ³	2		
	Provide, fit and test following reinforcement bars as per drawings				
6.2.10.2	Deformed Mild steel bars dia10 mm	Kg	60		
	SUB TOTAL CARRIED OVER TO COLLECTION FOR BILL NO.6				

Bill No .6.3- Feeders A, B, C, D, E and F

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ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
6.3.1	Excavation and Backfilling				
	Rates for excavation and backfilling in trench shall include for trimming trench bottom and for providing selected bedding and surround materials from the excavations with the specifications.				
6.3.1.1	Excavation and backfilling in trench normal material for Dia 75 mm pipe for depth not exceeding 1.5 m	m ³	0		
6.3.1.2	Ditto 63 mm dia	m ³	425		
6.3.1.3	Ditto 50mm dia	m ³	750		
6.3.1.4	Ditto 40mm dia	m ³	200		
6.3.1.5	Ditto 40mm dia	m ³	100		
6.3.1.6	Ditto 25 mm dia	m ³	150		
6.3.1.7	E.O for excavation in soft rock (provisional)	m ³	81		
6.3.1.8	E.O for excavation in hard rock (provisional)	m ³	81		
6.3.2	Pipework				
	Provide, lay, joint and test the following flexible spigot and socket pipe and fittings with rubber ring joints. Rates to include for all jointly materials, cutting wastage.				
	Note: The following have been used on the drawings to specify pipe diameters/types/classes. Pipe dimensions/working pressures shall conform to KS-06-149 Part 2:2000.				
	Class Working Pressure (m)				
	PN6 60	m			
	PN8 80	m			
	PN10 100	m			
	PN12 120	m			
	SUB TOTAL CARRIED OVER				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
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	SUB TOTAL BROUGHT FORWARD				
	uPVC Straights				
	Class PN8				
6.3.2.1	63 mm diameter	m	850		
6.3.2.2	50 mm diameter	m	1500		
	Class PN10				
6.3.2.3	40 mm diameter	m	400		
6.3.2.4	32 mm diameter	m	200		
6.3.2.5	25 mm diameter	m	300		
6.3.3	Reducers, mm				
6.3.3.1	63 x 50	no.	1		
6.3.3.2	50 x 40	no.	1		
6.3.3.3	40 x 32	no.	1		
6.3.3.3	32 x 25	no.	1		
	Direct offtakes from sub-mainline				
6.3.4.1	63x 20 mm dia	No	28		
6.3.4.2	50x 20 mm dia	No	45		
6.3.4.3	40x 20 mm dia	No	12		
6.3.4.3	32x 20 mm dia	No	10		
6.3.4.4	25x 20 mm dia	No	5		
	GI/uPVC Adaptors for Saddle clamps				
6.3.7.5	20 x 20 mm dia	No	100		
6.3.8	BENDS (PROVISIONAL)				
	uPVC fittings (Horizontal Bends)				
	22.5 degrees				
6.3.8.1	63 mm dia	No.	8		
	22.5 degrees				
6.3.8.2	50 mm dia	No.	10		
	11.25 degrees				
6.3.8.3	63mm dia	No.	12		
	11.25 degrees				
6.3.8.4	50 mm dia	No.	15		
	SUB TOTAL CARRIED OVER TO COLLECTION FOR BILL NO.6				

Bill No.6 collection sheet

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Item	Description	Total Amount (Kshs)
	Submains	
6.1	Mbugimi	
6.2	Gatubi	
6.3	Feeders A, B, C, D, E and F	
	Total Carried to Grand summary	

Bill No. 7: In-field System for 200 No. Plots each (80 m X 25 m)					
ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	Supply and install the following materials and fittings				
7.1	Plot Hydrants (1 x 200)				
7.1.1	25/20 mm dia uPVC/GI adaptor	No.	200		
7.1.2	20 mm dia GI elbow	No.	800		
7.1.3	20 mm dia GI straight threaded on both sides 750 mm long	No.	400		
7.1.4	20 mm dia GI nipple	No.	800		
7.1.5	20 mm dia gate valve	No.	200		
7.1.6	20 x 20 mm dia GI tee	No.	200		
7.1.7	20 mm dia plug	No.	200		
7.1.8	20 mm dia GI union	No.	200		
7.2	Field Hydrants (4 x 200)				
7.2.1	20/20mm dia uPVC/GI adaptor	No.	1600		
7.2.2	20x20mm dia GI tee	No.	800		
7.2.3	20mm dia GI riser (0.75m long)	No.	800		
7.2.4	20mm dia Equal tee	No.	800		

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7.2.5	20mm dia GI piece (0.1m long)	No.	1600		
7.2.6	20mm dia GI end caps	No.	1600		
7.2.7	20mm dia uPVC end cap/plug	No.	200		
	Sub Total carried over				

ITEM	DESCRIPTION	UNIT	QTY	RATE (KSh)	AMOUNT (KSh)
	Sub Total brought forward				
7.3	Sprinkler System Arrangement (1 x200)				
7.3.1	20mm dia HDPE pipe	m	4000		
7.3.2	20/20mm dia HDPE / GI Adapter	No.	400		
7.3.3	20mm dia GI equal tee	No.	200		
7.3.4	1m high,20mm dia GI riser with support	No.	200		
7.3.5	Sprinklers as specified complete with valve sockets (Dia 20 mm Naan sprinkler 3.2 mm nozzle size, 2.0 bar)	No.	200		
7.3.6	20/20mm dia HDPE line coupler	No.	200		
7.3.7	20mm dia GI plug	No.	200		
7.3.8	20/20mm dia HDPE/GI female adapter	No.	200		
7.4	In-field Supply Pipeline (Buried)				
7.4.1	20mm dia x 72m long uPVC pipe per plot	m	14400		
7.4.2	20 mm dia connecting uPVC pipe per plot (from plot hydrant to farm)	m	12000		
7.4.3	Excavation in normal soil to depth 0.6m. Rates to include backfilling	m3	7920		
	Hose pipes				
7.4.4	Dia 20mm rubber hose pipe (20m each)	M	4000		
7.4.5	Dia 20mm jubilee clips	No	400		

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	TOTAL CARRIED OVER TO COLLECTION SHEET	
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SECTION VIII – STANDARD FORM

- (i) Form of Invitation for Tenders
- (ii) Form of Tender
- (iii) Letter of Acceptance
- (iv) Form of Agreement
- (v) Form of Tender Security
- (vi) Performance Bank Guarantee
- (vii) Bank Guarantee for Advance Payment
- (viii) Qualification Information
- (ix) Tender Questionnaire
- (xi) Confidential Business Questionnaire
- (x) Statement of Foreign Currency Requirement
- (xi) Details of Sub-Contractors
- (x) Request for Review Form

FORM OF INVITATION FOR TENDERS

_____ *[date]*

To: _____ *[name of Contractor]*
_____ *[address]*

Dear Sirs:

Reference: _____ *[Contract Name]*

You have been prequalified to tender for the above project.

We hereby invite you and other prequalified tenderers to submit a tender for the execution and completion of the above Contract.

A complete set of tender documents may be purchased by you from _____

_____ *[mailing address, cable/telex/facsimile numbers].*

Upon payment of a non-refundable fee of Kshs _____

All tenders must be accompanied by _____ number of copies of the same and a security in the form and amount specified in the tendering documents, and must be delivered to

_____ *[address and location]*

at or before _____ *(time and date)*. Tenders will be opened immediately thereafter, in the presence of tenderers' representatives who choose to attend.

Please confirm receipt of this letter immediately in writing by cable/facsimile or telex.

Yours faithfully,

_____ Authorised Signature

_____ *Name and Title*

FORM OF TENDER

TO: _____[Name of Employer] _____[Date]
_____ [Name of Contract]

Dear Sir,

1. In accordance with the Conditions of Contract, Specifications, Drawings and Bills of Quantities for the execution of the above named Works, we, the undersigned offer to construct, install and complete such Works and remedy any defects therein for the sum of Kshs. _____[Amount in figures]Kenya Shillings _____[Amount in words]
2. We undertake, if our tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Project Manager's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Conditions of Contract.
3. We agree to abide by this tender until _____[Insert date], and it shall remain binding upon us and may be accepted at any time before that date.
4. Unless and until a formal Agreement is prepared and executed this tender together with your written acceptance thereof, shall constitute a binding Contract between us.
5. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this _____ day of _____ 20_____

Signature _____ in the capacity of _____

duly authorized to sign tenders for and on behalf of
_____ [Name of Employer]
of _____ [Address of Employer]

Witness; Name _____

Address _____

Signature _____

Date _____

LETTER OF ACCEPTANCE

i. **[letterhead paper of the Employer]**

_____ [date]

To: _____
[name of the Contractor]

[address of the Contractor]

Dear Sir,

This is to notify you that your Tender dated _____
for the execution of _____
[name of the Contract and identification number, as given in the Tender
documents] for the Contract Price of Kshs. _____
[amount in figures]/[Kenya Shillings _____ (amount in
words)] in accordance with the Instructions to Tenderers is hereby
accepted.

You are hereby instructed to proceed with the execution of the said Works in
accordance with the Contract documents.

Authorized Signature

Name and Title of Signatory

Attachment : Agreement

FORM OF AGREEMENT

THIS AGREEMENT, made the _____ day of _____ 20 _____
between _____ of [or whose
registered office is situated at] _____
(hereinafter called “the Employer”) of the one part AND
_____ of [or whose
registered office is situated at] _____
(hereinafter called “the Contractor”) of the other part.

WHEREAS THE Employer is desirous that the Contractor executes

_____ *(name and identification number of Contract)* (hereinafter called “the Works”) located at _____ *[Place/location of the Works]* and the Employer has accepted the tender submitted by the Contractor for the execution and completion of such Works and the remedying of any defects therein for the Contract Price of Kshs _____ *[Amount in figures]*, Kenya Shillings _____ *[Amount in words]*.

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 shall be read and construed as part of this Agreement i.e.
 - (i) Letter of Acceptance
 - (ii) Form of Tender
 - (iii) Conditions of Contract Part I
 - (iv) Conditions of Contract Part II and Appendix to Conditions of Contract
 - (v) Specifications
 - (vi) Drawings
 - (vii) Priced Bills of Quantities
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby

Tender Document for Kanini Irrigation Project

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 thereto have caused this Agreement to be executed the day and year first before written.

The common Seal of _____

Was hereunto affixed in the presence of _____

Signed Sealed, and Delivered by the said _____

Binding Signature of Employer _____

Binding Signature of Contractor _____

In the presence of (i) Name _____

Address _____

Signature _____

[ii] Name _____

Address _____

Signature _____

FORM OF TENDER SECURITY

WHEREAS(hereinafter called “the Tenderer”) has submitted his tender dated for the construction of
..... (*name of Contract*)

KNOW ALL PEOPLE by these presents that WE having our registered office at(hereinafter called “the Bank”), are bound unto(hereinafter called “the Employer”) in the sum of Kshs..... for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents sealed with the Common Seal of the said Bank this Day of20.....

THE CONDITIONS of this obligation are:

1. If after tender opening the tenderer withdraws his tender during the period of tender validity specified in the instructions to tenderers
Or
2. If the tenderer, having been notified of the acceptance of his tender by the Employer during the period of tender validity:
 - (a) fails or refuses to execute the form of Agreement in accordance with the Instructions to Tenderers, if required; or
 - (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Tenderers;

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including thirty (30) days after the period of tender validity, and any demand in respect thereof should reach the Bank not later than the said date.

[date]

[signature of the Bank]

[witness]

[seal]

PERFORMANCE BANK GUARANTEE

To: _____(Name of Employer) _____(Date)
_____(Address of Employer)

Dear Sir,

WHEREAS _____(hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ (hereinafter called "the Works");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognised bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Kshs. _____ (amount of Guarantee in figures) Kenya Shillings _____ (amount of Guarantee in words), and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Kenya Shillings _____ (amount of Guarantee in words) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change, addition or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this Guarantee, and we hereby waive notice of any change, addition, or modification.

This guarantee shall be valid until the date of issue of the Certificate of Completion.

SIGNATURE AND SEAL OF THE GUARANTOR _____

Name of Bank _____

Address _____

Date _____

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ *[name of Employer]* _____ *(Date)*
_____ *[address of Employer]*

Gentlemen,

Ref: _____ *[name of Contract]*

In accordance with the provisions of the Conditions of Contract of the above-mentioned Contract, We, _____ *[name and Address of Contractor]* (hereinafter called "the Contractor") shall deposit with _____ *[name of Employer]* a bank guarantee to guarantee his proper and faithful performance under the said Contract in an amount of Kshs. _____ *[amount of Guarantee in figures]* Kenya Shillings _____ *[amount of Guarantee in words]*.

We, _____ *[bank or financial institution]*, as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ *[name of Employer]* on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding Kshs _____ *[amount of Guarantee in figures]* Kenya Shillings _____ *[amount of Guarantee in words]*, such amount to be reduced periodically by the amounts recovered by you from the proceeds of the Contract.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between _____ *[name of Employer]* and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

No drawing may be made by you under this guarantee until we have received notice in writing from you that an advance payment of the amount listed above has been paid to the Contractor pursuant to the Contract.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ *(name of Employer)* receives full payment of the same amount from the Contract.

Yours faithfully,

Tender Document for Kanini Irrigation Project

Signature and Seal _____

Name of the Bank or financial institution _____

Address _____

Date _____

Witness: Name: _____

Address: _____

Signature: _____

Date: _____

QUALIFICATION INFORMATION

1. Individual Tenderers or Individual Members of Joint Ventures

- 1.1 Constitution or legal status of tenderer (attach copy or Incorporation Certificate);

Place of registration: _____

Principal place of business _____

Power of attorney of signatory of tender _____

- 1.2 Total annual volume of construction work performed in the last five years

Year	Volume	
	Currency	Value

- 1.3 Work performed as Main Contractor on works of a similar nature and volume over the last five years. Also list details of work under way or committed, including expected completion date.

Project name	Name of client and contact person	Type of work performed and year of completion	Value of Contract
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

- 1.4 Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below.

Item of Equipment	Description, Make and age (years)	Condition(new, good, poor) and number available	Owned, leased (from whom?), or to be purchased (from whom?)
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	

Tender Document for Kanini Irrigation Project

(etc.)			
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- 1.5 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data.

Position	Name	Years of experience (general)	Years of experience in proposed position
Project Manager			
(etc.)			

- 1.6 Financial reports for the last five years: balance sheets, profit and loss statements, auditor's reports, etc. List below and attach copies.

- 1.7 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List below and attach copies of supportive documents.

- 1.8 Name, address and telephone, telex and facsimile numbers of banks that may provide reference if contacted by the Employer.

- 1.9 Statement of compliance with the requirements of Clause 1.2 of the Instructions to Tenderers.

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- 1.10 Proposed program (work method and schedule) for the whole of the Works.

2 Joint Ventures

- 2.4 The information listed in 1.1 – 1.10 above shall be provided for each partner of the joint venture.
- 2.5 The information required in 1.11 above shall be provided for the joint venture.
- 2.6 Attach the power of attorney of the signatory(ies) of the tender authorizing signature of the tender on behalf of the joint venture
- 2.7 Attach the Agreement among all partners of the joint venture (and which is legally binding on all partners), which shows that:
 - a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;
 - b) one of the partners will be nominated as being in charge, authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture; and
 - c) the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

Tender Document for Kanini Irrigation Project

TENDER QUESTIONNAIRE

Please fill in block letters.

1. Full names of tenderer
.....
2. Full address of tenderer to which tender correspondence is to be sent
(unless an agent has been appointed below)
.....
3. Telephone number (s) of tenderer
.....
4. Telex address of tenderer
.....
5. Name of tenderer's representative to be contacted on matters of the
tender during the tender period
.....
6. Details of tenderer's nominated agent (if any) to receive tender notices.
This is essential if the tenderer does not have his registered address in
Kenya (name, address, telephone, telex)
.....
.....

Signature of Tenderer

Make copy and deliver to: _____ (*Name of Employer*)

CONFIDENTIAL BUSINESS QUESTIONNAIRE

You are requested to give the particulars indicated in Part 1 and either Part 2 (a), 2 (b) or 2 (c) and 2 (d) whichever applies to your type of business.

You are advised that it is a serious offence to give false information on this Form.

Part 1 – General

Business Name

Location of business premises; Country/Town.....

Plot No..... Street/Road

Postal Address..... Tel No.....

Nature of Business.....

Current Trade Licence No..... Expiring date.....

Maximum value of business which you can handle at any time: K. pound.....

Name of your bankers.....

Branch.....

Part 2 (a) – Sole Proprietor

Your name in full..... Age.....

Nationality..... Country of Origin.....

*Citizenship details

Part 2 (b) – Partnership

Give details of partners as follows:

	<i>Name in full</i>	<i>Nationality</i>	<i>Citizenship Details</i>	<i>Shares</i>
1.				
2.				
3.				

Part 2(c) – Registered Company:

Private or public.....

Tender Document for Kanini Irrigation Project

State the nominal and issued capital of the Company-

Nominal Kshs.....

Issued Kshs.....

Give details of all directors as follows:

Name in full. Nationality. Citizenship Details*. Shares.

1.
.....

2.
.....

3.
.....

4.
.....

Part 2(d) – Interest in the Firm:

Is there any person / persons in(Name of Employer)
who has interest in this firm? Yes/No.....(Delete as
necessary)

I certify that the information given above is correct.

.....
(Title)

.....
(Signature)

.....
(Date)

- Attach proof of citizenship

STATEMENT OF FOREIGN CURRENCY REQUIREMENTS

(See Clause 23] of the Conditions of Contract)

In the event of our Tender for the execution of _____
_____ (*name of Contract*) being accepted, we would
require in accordance with Clause 21 of the Conditions of Contract,
which is attached hereto, the following percentage:

(Figures)..... (Words).....

of the Contract Sum, (Less Fluctuations) to be paid in foreign
currency.

Currency in which foreign exchange element is required:

.....

Date: The Day of 20.....

Enter 0% (zero percent) if no payment will be made in foreign
currency.

Maximum foreign currency requirement shall be
_____(percent) of the Contract Sum, less Fluctuations.

(Signature of Tenderer)

DETAILS OF SUB-CONTRACTORS

If the Tenderer wishes to sublet any portions of the Works under any heading, he must give below details of the sub-contractors he intends to employ for each portion.

Failure to comply with this requirement may invalidate the tender.

(1) Portion of Works to be sublet:

[i] Full name of Sub-contractor
and address of head office:

.....

(ii) Sub-contractor's experience
of similar works carried out
in the last 3 years with
Contract value:

.....

.....

(2) Portion of Works to sublet:

(i) Full name of sub-contractor
and address of head office:

.....

.....

(ii) Sub-contractor's experience
of similar works carried out
in the last 3 years with
contract value:

.....

[Signature of Tenderer)

Date

LETTER OF NOTIFICATION OF AWARD

Address of Procuring Entity

To: _____

RE: Tender No. _____

Tender Name _____

This is to notify that the contract/s stated below under the above mentioned tender have been awarded to you.

1. Please acknowledge receipt of this letter of notification signifying your acceptance.
2. The contract/contracts shall be signed by the parties within 30 days of the date of this letter but not earlier than 14 days from the date of the letter.
3. You may contact the officer(s) whose particulars appear below on the subject matter of this letter of notification of award.

(FULL PARTICULARS) _____

SIGNED FOR ACCOUNTING OFFICER

FORM RB 1

REPUBLIC OF KENYA
PUBLIC PROCUREMENT ADMINISTRATIVE REVIEW BOARD

APPLICATION NO.....OF.....20.....

BETWEEN

.....APPLICANT

AND

.....RESPONDENT (*Procuring Entity*)

Request for review of the decision of the..... (*Name of the Procuring Entity*) of
.....dated the...day of20.....in the matter of Tender
No.....of20...

REQUEST FOR REVIEW

I/We.....,the above named Applicant(s), of address: Physical
address.....Fax No.....Tel. No.....Email, hereby request the
Public Procurement Administrative Review Board to review the whole/part of the
above mentioned decision on the following grounds , namely:-

- 1.
 - 2.
- etc.

By this memorandum, the Applicant requests the Board for an order/orders that: -

- 1.
 - 2.
- etc

SIGNED(Applicant)

Dated on.....day of/ ...20...

FOR OFFICIAL USE ONLY

Lodged with the Secretary Public Procurement Administrative Review Board on
..... day of20.....

SIGNED
Board Secretary