PROPOSED BOUNDARY WALL AND ANCILLARY BUILDINGS ON PLOT LR. NO 20589, MACHAKOS

FOR

NATIONAL SOCIAL SECURITY FUND (NSSF)

TENDER REF NO: NSSF/ONT/BW/24/2025/26

[redacted]

VOLUME 4 OF 5

MECHANICAL SERVICES INSTALLATIONS

[redacted]

NATIONAL SOCIAL SECURITY FUND
P.O BOX 30599 -00100,
NAIROBI, KENYA
Tel: +254 709 805 000, +254 709 805 100

Email: info@nssfkenya.co.ke

Website: www.nssf.or.ke

JUNE, 2026

PROPOSED BOUNDARY WALL AND ANCILLARY BUILDINGS ON PLOT LR. NO 20589, MACHAKOS

FOR

NATIONAL SOCIAL SECURITY FUND (NSSF)

VOLUME 4 OF 5

MECHANICAL SERVICES INSTALLATIONS

LEAD CONSULTANTS/ARCHITECTS

LEXICON + ION ARCHITECTS
P.O. BOX 2772 - 00200,
NAIROBI.

QUANTITY SURVEYORS

BILLS PARTNERSHIP LTD.
P.O. BOX 27090 - 00100,
NAIROBI.

CIVIL/STRUCTURAL ENGINEERS

WANDUA CONSULTANTS LTD.
P.O. BOX 44736 - 00100,
NAIROBI.

ELECTRICAL & MECHANICAL ENGINEERS

METROCOM CONSULTANTS LTD.
P.O. BOX 27090 - 00100,
NAIROBI.

JUNE, 2026

CONTENTS

PART B1

GENERAL MECHANICAL SPECIFICATION

PART B1

GENERAL MECHANICAL SPECIFICATION

INDEX

PART B1

GENERAL MECHANICAL SPECIFICATION

1. GENERAL

This section specifies the general requirements for plant, equipment and material forming part of the Sub-Contract Works and shall apply except where specifically stated elsewhere in the specification or on the contract Drawings.

2. QUALITY OF MATERIALS

All plant, equipment and materials supplied as part of the Sub-contract works shall be new and of first-class commercial quality, shall be free from defects and imperfections and where indicated shall be of grades and classifications designated herein.

All products or materials not manufactured by the Sub-contractor shall be products of reputable manufacturers and so far as the provisions of the Specification is concerned shall be as if they had been manufactured by the Sub-contractor.

Materials and apparatus required for the complete installation as called for by the Specification and Contract Drawings shall be supplied by the Sub-Contractor unless mention is made otherwise.

Materials and apparatus supplied by others for installation and connected by the Sub-Contractor shall carefully be examined on receipt and stored. Should any defects be noted, the Sub-Contractor shall immediately notify the Engineer

Defective equipment or that damaged in the course of installation or tests shall be replaced as required to the approval of the Engineer.

3. REGULATIONS AND STANDARDS

The Sub-Contract Works shall comply with the current edition of the following:-

(a) The Kenya Government Regulations

(b) The United Kingdom Institution of Electrical Engineering (IEE) Regulations for the electrical equipment of buildings.

(c) The United Kingdom Chartered Institute of Building Services Engineers (CIBSE) Guides.

(d) British Standards and Codes of Practice as published by the British Standards Institution (BSI).

(e) The Local Council By-laws.

(f) The Electricity supply Authority By-Laws.

(g) Local Water Authority By-Laws.

(h) The Kenya Building code of Regulations.

4. ELECTRICAL REQUIREMENTS

Plant and equipment supplied under this Sub-Contract shall be complete with all necessary motor starters, control boards, and other control apparatus. Where Control Panels incorporating several starters are supplied, they shall be complete with a main isolator.

The supply power up to and including local isolators shall be provided and installed by the Electrical Sub-Contractor. All other wiring shall be as described in the "Particular Specification".

The Sub-Contractor shall supply three copies of all schematic, cabling and wiring diagrams for the Engineer's approval.

The starting current of all electric motors and equipment shall not exceed the maximum permissible starting currents described in the Kenya Power and Lighting Company's (KP & LC) By-Laws.

All electrical plant and equipment supplied by the Sub-Contractor shall be rated for the supply voltage and frequency obtained in Kenya, that is 415 volts, 50HZ, 3-phase or 240 volts, 50HZ, 1-phase as specified in the "Particular Specification".

Any equipment that is not rated for the above voltages and frequencies may be rejected by the Engineer

5. TRANSPORT AND STORAGE

All plant and equipment shall, during transportation be suitably packed, crated and protected to minimise the possibility of damage and to prevent corrosion or other deterioration.

On arrival at site, all plant and equipment shall be examined and any damage to parts and protective priming coats made good before storage or installation.

Adequate measures shall be taken by the Sub-Contractor to ensure that plant and equipment do not suffer any deterioration during storage.

Prior to installation all piping, and equipment shall be thoroughly cleaned.

If, in the opinion of the Engineer any equipment has deteriorated or been damaged to such an extent that it is not suitable for installation, the Sub-Contractor shall replace this equipment at his own cost.

6. SITE SUPERVISION

The Sub-Contractor shall ensure that there is an English-speaking supervisor on the site at all times during normal working hours.

7. INSTALLATION

Installation of all special plant equipment shall be carried out by the Sub-Contractor under adequate supervision from skilled staff provided by the plant and equipment manufacturer or his appointed agent in accordance with the best standards of modern practice and to the relevant regulations and standards described under Clause 3 of this section.

8. TESTING

8.1 General

The Sub-Contractor's attention is drawn to Part "A", Sub-Clauses 1.44 and 1.45 Page A/13 of the "Preliminaries and General Conditions".

The following sub-clauses are intended to define the Sub-Contractor's responsibilities with respect to testing and inspection.

8.2 Material Tests

All material for plant and equipment to be installed under this Sub-Contract shall be tested, unless otherwise directed, in accordance with the relevant B.S. specification concerned.

For materials where no B.S. specification exists, tests are to be made in accordance with the best modern commercial methods to the approval of the Engineer, having regard to the particular type and application of the materials concerned.

The Sub-Contractor shall prepare specimens and performance tests and analyses to demonstrate conformance of the various materials with the applicable standards.

If stock material, which has not been specifically manufactured for the plant and equipment specified is used, then the Sub-Contractor shall submit satisfactory evidence to the Engineer that such materials conform to the requirements stated herein in which case tests of material may be partially or completely waived.

Certified mill test reports of plates, piping and other materials shall be deemed acceptable.

8.3 Manufactured Plant and Equipment - Works Tests

The rights of the Engineer relating to the inspection, examination and testing of plant and equipment during manufacture shall be applicable to the Insurance Companies or Inspection Authorities so nominated by the Engineer

The Sub-Contractor shall give two week's notice to the Engineer of the manufacturer's intention to carry out work tests and inspections.

The Engineer or his representative shall be entitled to witness such tests and inspections. The costs of such tests and inspections shall be borne by the Sub-Contractor.

Six copies of all test and inspection certificates and performance graphs shall be submitted to the Engineer for his approval as soon as possible after the completion of such tests and inspections.

Plant and equipment which is shipped before the relevant test certificate has been approved by the Engineer shall be shipped at the Sub-Contractor's own risk and should the test and inspection certificates not be approved, new tests may be ordered by the Engineer at the Sub-Contractor's expense.

8.4 **Pressure Testing**

All pipework installations shall be pressure tested in accordance with the requirements of the various section of this specification. The installations may be tested in section to suit the progress of the works but all tests must be carried out before the work is buried or concealed behind building finishes. All tests must be witnessed by the Engineer or his representative and the Sub-Contractor shall give 48 hours notice to the Engineer of his intention to carry out such tests.

Any pipework that is buried or concealed before witnessed tests have been carried out shall be exposed at the expense of the sub-contractor and the specified tests shall then be applied.

The Sub-Contractor shall prepare test certificates for signature by the Engineer and shall keep a progressive and up-to-date record of the Sections of the work that have been tested.

9. **COLOUR CODING**

Unless stated otherwise in the Particular Specification all pipework shall be colour coded in accordance with the latest edition of B.S. 1710.

10. **WELDING**

10.1 **Preparation**

Joints to be made by welding shall be accurately cut to size with edges sheared, flame cut or machined to suit the required type of joint. The prepared surface shall be free from all visible defects such as lamination, surface imperfections due to shearing or flame cutting operation, etc., and shall be free from rust, scale, grease and other foreign matter.

10.2 **Method**

All welding shall be carried out by the electric arc process using covered electrodes in accordance with B.S. 639.

Gas welding may be employed in certain circumstances provided that prior approval is obtained from the Engineer

10.3 **Welding codes and Construction**

All welded joints shall be carried out in accordance with the following specification:-

(a) Pipe Welding

All pipe welds shall be carried out in accordance with the requirements of B.S.806.

(b) General welding

All welding mild steel components other than pipework shall comply with the general requirements of B.S. 1856.

10.4 **Welders Qualifications**

Any welder employed on this Sub-contract shall have passed the trade tests as laid down by the Government of Kenya.

The Engineer may require to see the appropriated certificate obtained by any welder and should it be proved that the welder does not have the necessary qualifications the Engineer may instruct the Sub-Contractor to replace him by a qualified welder.

PART B2

GENERAL PLUMBING AND DRAINAGE SPECIFICATIONS

PART B.2

GENERAL PLUMBING AND DRAINAGE SPECIFICATIONS

INDEX

SECTION B2

GENERAL PLUMBING AND DRAINAGE SPECIFICATIONS

2.1 MATERIALS AND STANDARDS

2.1.1 GENERAL

This section specifies the general requirements for plant, equipment and materials forming part of the Plumbing and Drainage Installations.

PIPEWORK AND FITTINGS

Pipe materials are to be used as follows:-

2.1.2 Cold Water Mains

Unplasticised PVC or galvanised steel medium or heavy grade, as specified on the drawings.

2.1.3 Black steel Pipework

All black steel pipework up to 65 mm nominal bore shall be manufactured in accordance with B.S. 1387 Medium Grade, with tapered place threads in accordance with BS 21. All fittings shall be of malleable iron and manufactured in accordance with BS 143.

Pipe joints shall be screwed and socketed and sufficient couplings union shall be allowed so that fittings can be disconnected without cutting the pipe. Running nipples and long screws shall not be permitted unless exceptionally approved by the Engineer.

All black steel pipework, 80mm nominal bore up to 150mm nominal bore, shall be manufactured to comply in all respects with the specification for 65mm pipe, except that screwed and bolted flanges shall replace unions and couplings for the joining of pipes to valves and other items of plant.

All flanges shall comply with the requirements of BS 10 to the relevant classification contained hereinafter under section C of the Specification.

2.1.4 Galvanised Steel Pipework

Galvanised steel pipework shall be manufactured to comply in all respects with the standards described for black steel pipework in paragraph 2.1.3 above.

Galvanised shall be carried out in accordance with the requirements of BS 1387 and BS 143 respectively.

2.1.5 Copper Tubing

All copper tubing shall be manufactured in accordance with BS 2871 from C.160 "Phosphorus De-oxidized Non-Arsenical Copper" in accordance with BS 1172.

Pipe joints shall be made with soldered X] fittings and connections to equipment shall be with compression fitting manufactured in accordance with B.S. 864.

Short copper connections tubes between galvanised pipework and sanitary fitments shall not be used because of the risk of galvanic action.

If, as may occur in certain circumstances, it is not possible to make the connection in any other way than by the use of copper tubing, then a brass straight connector shall be positioned between the galvanised pipe and the copper tube in order to prevent direct contact.

2.1.6 Cast Iron Pipework

(a) Internal Services

Cast iron pipework and fittings for use above ground in connection with internal building services, shall be manufactured with spigot and socket joints of the weight required by the local authority and shall comply fully with the requirement of B.S. 416.

All joints on cast iron spigot and socket pipes shall be made with an approved cold caulking compound and so installed as to allow for any expansion or contraction, which may take place.

All cast iron pipework, branches, tees, bends and other fittings shall be supplied complete with inspection covers for cleaning purposes. These inspection covers shall be included as part of the fittings and shall comply with the requirements of B.S. 416.

(b) External Services

Cast iron pipework, which is used in connection with buried external services, shall be manufactured, coated and tested in accordance with the requirements of B.S. 1211.

All buried cast iron bends, elbows swept tees and other fittings, shall comply with the requirements of B.S. 1130.

Jointing on external cast iron pipes shall be carried out in accordance with one of the methods described in B.S. Code of Practice 301, Clause 505C (v), to the approval of the Engineer.

2.1.6 Pitch Fibre Pipework

Pitch Fibre Pipework and fittings for use in connection with external drainage services shall be manufactured in accordance with the requirements of B.S. 2760. Pipes shall be connected by means of purpose tapered joints manufactured in accordance with B.S. 2760.

Until such time as the use of pitch impregnated fibre is covered by a code of practice, the jointing laying and cutting of these pipes shall be carried out in accordance with the requirements of the notes contained under Appendix C of B.S. 2760.

2.1.7 Concrete Pipe

Where concrete pipe and fittings are used in connection with the conveyance surface water of sewage under atmospheric pressure, they shall be manufactured in accordance with the requirement of B.S. 556, Class l, except where otherwise stated. The joints of concrete pipe and fittings may be one of the following depending application and conditions:

(1) Flexible spigot and socket type.

(2) Flexible rebated type (Storm water drainage only)

(3) Ordinary spigot and socket type.

(4) Ordinary rebated type (Storm water drainage only)

Joints (1) and (2) shall be sealed with suitable rubber gaskets manufactured in accordance with B.S. 2494 except where they are likely to be contaminated by oil products, in which case the gaskets shall be manufactured in accordance with B.S. 3514.

Joints (3) and (4) shall be made with approved cement mortar mix.

2.1.8 Asbestos Cement Pressure Pipes

Where asbestos cement pressure pipes and fittings are used in connection with external, above ground or buried water services, they shall be manufactured in accordance with the requirement of B.S. 486.

The classification of these pipes fall into classes:

A.,B.,C., and D., respectively, and the class to be used shall depend upon the pressure conditions pertaining at site.

Where cast iron detachable joints are used for connecting pipes, the material comply with the B.S. Specification, then the materials used shall be of a quality not less than that required by this standard.

Rubber jointing rings shall be used for sealing purposes and shall comply with the requirements of B.S. 2494, except where they are likely to be contaminated by oil products, in which case the gaskets shall be manufactured in accordance with B.S 3514.

2.1.9 Concrete Pipe

Where concrete pipe and fittings are used in connection with the conveyance of surface water or sewage under atmospheric pressure, they shall be manufactured in accordance with the requirement of B.S. 556, Class l, except where otherwise stated.

The joints of concrete pipe and fittings may be one of the following depending upon application and conditions:

1) Flexible spigot and socket type

(2) Flexible rebated type (Storm water drainage only)

(3) Ordinary Spigot and socket type

(4) Ordinary rebated type (Storm water drainage only)

Joints (1) and (2) shall be sealed with suitable rubber gaskets manufactured in accordance with B.S. 2494 except where they are likely to be contaminated by oil products, which case the gaskets shall be manufactured in accordance with B.S. 3514.

Joints (3) and (4) shall be made with an approved cement mortar mix.

2.1.10 Asbestos Cement Pressure Pipes

Where asbestos cement pressure pipes and fittings are used in connection with external, above ground or buried water services, they shall be manufactured in accordance with the requirement of B.S.486.

The Classification of these pipes falls into four classes:

A.,B.,C., and D., respectively, and the class to be used shall depend upon the pressure conditions pertaining at Site.

Where cast iron detachable joints are used for connecting pipes, the material shall comply with B.S. Specifications, then the materials used shall be of a quality not less than that required by this standard.

Rubber jointing rings shall be used for sealing purposes and shall comply with the requirements of B.S. 2494, except where they are likely to be contaminated by oil products, in which case the gaskets shall be manufactured in accordance B.S. 3514.

2.1.11 P.V.C. (Hard) Pressure Pipe and Fittings

All P.V.C. pipes and fittings shall be manufactured in accordance with B.S. 3505 : 1968 or the relevant Kenya Standard.

Fittings shall comply in all respects with British Standard 4346 Part 1: 1969 or the relevant Kenya Standard. Pipes shall be supplied in plain-ended lengths.

Thickness

The Minimum acceptable wall thickness of pipe and fittings shall be as follows:-

Nom. Dia. (mm)	10	12	20	25	32	40	50	75	100
Thickness (mm)	1.5	1.7	1.9	2.2	2.7	3.1	3.9	5.7	7.3

Jointing

The method of jointing to be employed shall be that of Solvent welding, using the pipe and manufacturers approved cement. Seal rings joints shall be introduced where it is necessary to accommodate thermal expansion.

Anchoring

All bends, valves and hydrant tees etc, in the line of the water main shall be adequately anchored to resist thrust due to internal water pressure. A concrete block shall be cast under and around the pipe and between it and sides of the trench. Well-rammed material shall be used to support the pipe and either side of the concrete.

Workmanship

The installation method of jointing shall be solvent welding; and both jointing and fixing shall comply in all respects to the manufacturer' site-work instructions. The maximum intervals between pipe supports at 200C shall be as follows:-

Pipe Diameter	10mm	15mm	20mm	25mm	32mm	40mm	50mm	75mm	100mm
Horizontal	0.75m	0.90mm	1.05m	1.20mm	1.35m	1.65m	1.80m	Do	do
Vertical	1.50m	1.80m	2.10m	2.40m	2.70m	3.30m	3.60m	Do	do

Pipes passing through walls or floors shall be sleeved to allow unrestricted movements.

The works shall be inspected and tested during installation.

All work, which will be concealed, shall be tested before it is finally enclosed and verified by the Clerk of Works.

Any other test may be demanded upon completion for soundness and performance to the satisfaction of the Local Water Authority.

Pipe Bed

Pipes shall be uniformly laid on a 75mm thick bed, (Sand or red soil) and must not be allowed to rest on the joint or on stones etc.

Supports to Fittings

In underground installations care shall be taken to ensure that heavy components such as valves are fully supported so that the pipeline carries no weight.

Backfilling

For the protection of the pipe initial backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine grained material thoroughly compacted around the pipe and consolidated to depth of 6" above the crown of the pipe at no time shall heavy rocks, stones or other objects be included in the balance of the backfill that might protrude the initial backfill layer and come into contact with the pipe.

Testing

Pipelines shall be tested in sections under an internal water pressure normally one and a half times the maximum allowable working pressure of the class of pipe used. Testing shall be carried out as soon as practicable after laying and when the pipeline is anchored. Precautions shall be taken to eliminate all air from the test section and to fill the pipe slowly to avoid risk of damage due to surge.

2.1.12 MuPVC Waste Systems

All pipes and fittings shall be manufactured in accordance with B.S. 5255 : 1968 or the relevant Kenya Standard.

Pipes shall be supplied in plain-ended lengths.

Thickness

The Minimum acceptable wall thickness of pipe and fittings shall be as follows: -

Size (in)	Size (mm	Pipe and Fittings Wall Thickness (mm)
11/4	32	1.8
11/2	40	1.9
2	50	2.0

Jointing

The method of jointing to be employed shall be that of Solvent welding, using the pipe and manufacturers approved cement. Seal rings joints shall be introduced where it is necessary to accommodate thermal expansion.

Anchoring

All bends, valves and hydrant tees etc, in the line of the water main shall be adequately anchored to resist thrust due to internal water pressure. A concrete block shall be cast under and around the pipe and between it and sides of the trench. Well-rammed material shall be used to support the pipe and either side of the concrete.

Workmanship

The installation method of jointing shall be solvent welding; and both jointing and fixing shall comply in all respects to the manufacturer' site-work instructions. The maximum intervals between pipe supports at 200C shall be as follows:-

Nominal Size (in)	Nominal Size (mm)	Horizontal (mm)	Vertical (mm)
11/4	32	500	1200
11/2	40	500	1200
2	50	900	1200
3	80	900	2000
4	100	1000	2000
6	150	1000	2000

Pipes shall be fixed in straight runs and horizontal runs shall be laid to gradients in conformity with BS 5572 Code of Practise for Sanitary Pipework and in any event not less than 18mm/m unless otherwise specified.

Pipes passing through walls or floors shall be sleeved to allow unrestricted movements.

The works shall be inspected and tested during installation at any stage in accordance with BS 5572. All work, which will be concealed, shall be tested before it is finally enclosed and verified by the Clerk of Works.

Any other test may be demanded upon completion for soundness and performance to the satisfaction of the Local Water Authority.

Pipe Bed

Pipes shall be uniformly laid on a 75mm thick bed, (Sand or red soil) and must not be allowed to rest on the joint or on stones etc.

Supports to Fittings

In underground installations care shall be taken to ensure that heavy components such as valves are fully supported so that the pipeline carries no weight.

Backfilling

For the protection of the pipe initial backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine grained material thoroughly compacted around the pipe and consolidated to depth of 6" above the crown of the pipe at no time shall heavy rocks, stones or other objects be included in the balance of the backfill that might protrude the initial backfill layer and come into contact with the pipe.

Testing

Pipelines shall be tested in sections under an internal water pressure normally one and a half times the maximum allowable working pressure of the class of pipe used. Testing shall be carried out as soon as practicable after laying and when the pipeline is anchored. Precautions shall be taken to eliminate all air from the test section and to fill the pipe slowly to avoid risk of damage due to surge.

2.1.13 A.B.S. Waste System

Where indicated on the drawings and schedules, the Sub-contractor shall supply and fix A.B.S. Waster pipes and fittings.

The pipes, traps and fittings shall be in accordance with the relevant British Standards, including B.S. 3943, and fixed generally in accordance with manufacturer's instructions, and B.S. 5572 : 1978.

Jointing of pipe shall be carried out by means of solvent welding. The manufacturer's instructions, and B.S. 5572 : 1978.

Jointing of pipe shall be carried out by means of solvent welding. The manufacturer's recommended method of joint preparation and fixing shall be followed.

Standard brackets, as supplied for use with this system, shall be used wherever possible. Where the building structure renders this impracticable the Sub-contractor shall provide purpose made supports,

Expansion joints shall be provided as indicated. Supporting brackets and pipe clips shall be fixed on each side of these joints.

2.1.14 P.V.C. Soil System

The Sub-contractor shall supply and fix P.V.C soil pipe and fittings as indicated on the drawings and schedules.

Pipes and fittings shall be in accordance with relevant British Standards, including B.S. 45l4 and fixed to the manufacturer's instructions, and B.S. 5572.

The soil system shall incorporate synthetic rubber gaskets as provided by the manufacturer whose fixing instructions shall be strictly adhered to.

Connections to W.C. and pass shall be effected by the use of a W.C. connector gasket and cover, fixed to suit pan outlet.

Suitable supporting brackets and pipe clips shall be provided at maximum of metre centres.

The Sub-contractor shall be responsible for the joint into the Gully Trap on Drain Trap as indicated on the drawings.

2.1.15 uPVC Square Rainwater System Pipe and Gutter

Gutters shall be a rectilinear section 116mm or 137mm wide.

Gutters shall be supplied in plain-ended lengths.

The minimum acceptable wall thickness of gutter shall be 2.20mm.

Rainwater pipes shall be square in section 58mm or 75 mm internal diameter.

Rainwater pipes shall be supplied in plain-ended lengths.

The minimum acceptable wall thickness or rainwater pipes shall be 1.80mm.

Pipe support brackets must be adequate to screen expansion gaps.

The grade of uPVC used for gutter and pipe shall have a minimum softening point of 75^{o}C when tested by the Vicat method as described in B.S, 2782.

The pipe and gutter shall be colour grey, to BS 5252, 10.A.07, black, white or rustic.

2.1.16 uP.V.C. Rainwater Fittings

All fittings shall be injection moulded and shall be compatible with pipe and gutters and shall conform to BS 4576 or the appropriate Kenya Standard.

All gutters, pipe and fittings shall be colour grey to British Standard 5252, 10.A.07, or black, white or rustic.

Gutter connecting fittings shall have integrally moulded seal retaining cavities housing a rubber seal of hollow section.

The fitting shall incorporate a gutter-retaining clip.

Gutter shall be supplied in plain-ended lengths.

The minimum acceptable wall thickness of gutter shall be 2.20mm.

Rainwater pipes shall be circular in section, 65mm nominal diameter complying in all respects to British Standard 4576 or the relevant Kenya Standard.

Rainwater pipes shall be supplied in plain-ended lengths. The minimum acceptable wall thickness of rainwater pipes shall be 1.80mm

Pipe support brackets must be adequate to screen expansion gaps.

The grade of uPVC used for gutter and pipe shall have a minimum softening point of 75oC when tested by the Vicat method as described in B.S. 2782.

The pipe and gutter shall be colour grey, to BS 5252, 10.A.07, black, white or rustic.

2.1.17 uP.V.C. Underground Drainage System

(a) Pipes and fittings

The pipes and fittings shall comply in all respects to British Standard 4660 & 5481 or the relevant Kenya Standards.

Pipes shall be supplied in plain-ended lengths.

The minimum acceptable wall thickness of pipe and fittings will be as follows:

110mm pipe	3.0mm	
160mm pipe	3.9mm	
110mm junction only	3.50mm socket	3.80mm body
All other fittings	3.20mm socket	3.40mm body
160mm all fittings	4.30mm socket	4.70mm body

The method of jointing to be employed shall be by lip seal socketted fittings. Jointing to other materials shall be made in the manner specified by the manufacturer.

The grade of uPVC used for the pipe shall have a minimum softening point of 82oC when tested by the `Vicat` method 102D as described in British Standard 2782, and for fittings 79oC.

The pipe and fittings shall be of colour golden brown approximating to British Standard 381C:No.414. The seal retaining caps shall be black polypropylene.

The natural rubber for lip seal joints shall be to British Standard 2494:1976.

Holderbats shall be made of mild steel protected from corrosion by galvanising or search coating for optimum fit to pipe supports a special purpose made P.V.C. packing pieces may be used.

The base of soil and vent stack connection to the below ground drain shall be made with a bend of minimum centre line radius of 250mm.

Minor changes of direction where permitted shall be made with a variable bend that has a constant effective length

(b) Excavation of Trenches

The installation, method of jointing shall conform in all respects to the manufacturer's site work instruction.

Trenches shall be excavated to a sufficient depth to allow a 50mm minimum bed below the underside of the pipe. Trench width shall be not less than the outlet diameter of the pipe plus 300mm and not wider than necessary.

(c) Trench Invert

The base of the trench shall be such that even support is given to the pipe for its full length. Soft spots shall be removed and replaced with compacted granular material as described below. High spots and rock shall be removed to allow full 50mm bed depth.

(d) Pipe bed

The bed shall be composed of granular material to the specification called for below and shall for below and shall cover the full trench width and length and boned to gradient

(e) Laying and jointing

Pipes and fittings shall be laid true to gradient in straight lines and jointed in accordance with manufacturer's instructions. All pegs used for alignment and other purposes must be removed after use and before sidefilling. All joints shall be watertight complying with CP.301, Clauses 5:3.

Pipe barrels shall be in continuous contact with the trench bed when laid.

(f) Side Filling

The side filling of pipes shall be composed of hard granular material, which shall be to the requirements below.

Side fillings must be placed equally on both sides of the pipe and compacted, so as to buttress the pipes against the trench walls. Side filling shall continue up to pipe crown level as a minimum and above this level if required by the Engineer.

(g) Back Filling

The first 300mm of backfill above crown level shall be taken from selected trench spoil all passing 25mm sieve. It shall be placed in two 150mm layers each firmly tramped. Above the 300mm level mechanical filling and compaction may be used.

Where cover is less than 450mm the pipe shall be covered with 75mm of selected material laid to support a concrete tile or slab indicating the presence of a service.

(h) Granular Material for Bed and Side Fill

All material for bed and side fill shall be hard and granular passing 20mm sieve and shall contain not more than 5 per cent fines passing 3mm sieve.

The material may be composed of crushed stone, clinker, quarry scalping, ballast, gravel, shingle or all-in aggregate to British Standard 882.

The material shall have a compaction factor of 0.3 or less.

2.1.18 VALVES

(a) Draw-off Taps and Stop Valves (Up to 50mm Nominal Bore)

Draw off taps and valves up to 50mm nominal bore, unless otherwise stated or specified for attachment or connection to sanitary fitment shall be manufactured in accordance with requirement of B.S. 1010.

(b) Gate Valves

All gates valves 80mm nominal bore and above, other than those required for fitting to buried water mains shall be of cast iron construction, in accordance with the requirement of B.S. 3464. All gate valves required for fitting to buried water mains shall be of cast iron construction in accordance with the requirements of B.S. 12l8.

All gate valves up to and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of B.S. 1952.

The pressure classification of all valves shall depend upon the pressure conditions pertaining to the Site of Works.

(c) Globe Valves

All globe valves upto and including 65 mm nominal bore shall be of bronze construction in accordance with the requirements of B.S. 3061.

The pressure classification of all globe valves shall depend upon the pressure conditions pertaining to the Site of Works.

(d) Check or Non-Return Valves

All check or non-return valves 80mm nominal bore and above shall be of the swing check type of cast iron construction in accordance with the requirement of B.S. 4090.

The pressure classification of all check or non-return valves shall depend upon the pressure conditions pertaining to site of the Works.

(e) Ball Valves

All ball valves for use in connection with hot and cold water services shall be of the Portsmouth type in accordance with the requirements of B.S. 1212, constructed from bronze or other corrosion resistant materials. These valves fall into three pressure classifications as follow:-

(i)	Low Pressure	3.52Bars maximum
(ii)	Medium Pressure	7.72Bars maximum
(iii)	High Pressure	12.62Bars maximum

The pressure classification required for each ball valve will be designated in the description of its associated equipment contained in section C of the specification

(f) Manually Operated Mixing Valves

Mixing valves for shower fittings and other appliances being provided under the Sub-contractor Works shall be manufactured in accordance with the requirements of B.S. l4l5 from bronze or other corrosion resistant materials.

2.1.19 WASTE FITMENT TRAPS

(a) Standard and Deep Seal P & s Traps

Where standard or deep seal traps are specified they shall be manufactured in suitable non-ferrous materials in accordance with the full requirements of B.S. 1184.

In certain circumstances, cast iron traps may be required for cast iron baths and in these instances bath traps shall be provided which are manufactured in accordance with the full requirements of B.S. 1291.

(b) Anti-Syphonic Traps

Where anti-syphon traps are specified, these shall be similar or equal to the range of traps manufactured by Greenwood and Hughes Ltd., Deacon Works Littlehampton, Sussex, England.

The trade name for traps manufactured by this company is "Grevak".

2.1.20 PIPE SUPPORTS

(a) General

This Sub-clause deals with pipe support securing pipes to the structure of buildings for above ground application.

The variety and type of support shall be kept to a minimum and their design shall be such as to facilitate quick and secure fixings to metal, concrete, masonry or wood.

Consideration shall be given, when designing supports, to the maintenance of desired pipe falls and the restraining of pipe movements to a longitudinal axial direction only.

The Sub-contractor shall supply and install all steelwork forming part of the pipe support assemblies and shall be responsible for making good any damage to builders work associated with the pipe support installation.

The Sub-contractor shall submit all his proposals for pipe supports to the Engineer for approval before any erection work commences.

The Sub-Contractor shall submit all his proposals for pipe supports to the Engineer for approval before any erection work commences.

(b) Steel and Copper Pipes and Tubes

Pipe runs shall be secured by pipe clips connected to pipe hangers, wall brackets, or trapeze type supports. 'U@ bolts shall not be used as a substitute for pipe clips without the prior approval of the Engineer.

An approximate guide to the maximum permissible support spacing in metres for steel and copper pipe and tube is given in the following table for horizontal runs.

Size Nominal Bore	**Copper Tube To BS 659**	**Steel Tube To BS 1387**
15mm	1.25m	2.0m
20mm	2.0m	2.5m
25mm	2.0m	2.5m
32mm	2.5m	3.0m
40mm	2.5m	3.0m
50mm	2.5m	3.0m
65mm	3.0m	3.5m
80mm	3.0m	3.5m
100mm	3.0m	4.0m
125mm	3.5m	4.5m
150mm	4.5m	5.5m

The support spacing for vertical runs shall not exceed one and a half times the distances given for horizontal runs.

(c) Cast Iron and Asbestos Cement Spigot and Socket Jointed Pipes

Cast iron and asbestos cement socketed pipes shall generally be supported at every socket joint by means of either holderbats secured rigidly to the structure, or purpose made straps for attachment to rigid steel support brackets.

When holderbats are used, they shall conform to the requirements of B.S. 4l6. Suitable anchors shall be provided at all changes of pipe directions, junctions and tees, to counterpart the effect of end thrust loads.

(d) Asbestos Cement Pressure Pipes

Asbestos Cement pressure pipes with either cast iron detachable joints or asbestos cement screw joints shall be supported and anchored on either side of the joint. The joint shall remain free.

Pipe hangers and trapeze type supports shall not be suitable for the suspension of asbestos pressure pipes unless they are designated with suitable restrictions to prevent swinging while at the same time providing the necessary support requirements.

Within building, asbestos pressure pipes shall be carried either on concrete support on rigidly fixed steel wall brackets.

Suitable anchors shall be provided at all changes of pipe directions, junctions and tees to counterpart the effect of end thrust loads.

(e) Concrete and Pitch Pipes

These pipes shall not be used for above ground application.

(f) Expansion Joints and Anchors

Where practicable, cold pipework systems shall be arranged with sufficient bends and changes of direction to absorb pipe expansion providing that the pipe stresses are contained within the working limits prescribed in the relevant B.S. specification.

The Sub-contractor shall pay particular care when supporting cast iron and asbestos cement pipes in order to ensure that the settlement and building movement do not break the pipe joints.

Where piping anchors are supplied, they shall be fixed to the main structure only. Details of all anchor design proposals shall be submitted to the Engineer for approval before erection commences.

The Sub-contractor when arranging his piping shall ensure that no expansion movements are transmitted directly to connections and flanges on pumps or other items of plant.

The Sub-Contractor shall supply flexible joints to prevent vibrations and other movements being transmitted from pumps to piping systems or vice versa.

2.1.21 SANITARY APPLIANCES

All Sanitary appliances supplied and installed as part of the Sub-Contract works shall comply with the general requirements of B.S. Specification.

2.1.22 PIPE SLEEVES

Main runs of pipework are to be fitted with sleeves where they pass through walls and floors. Generally the sleeve shall be of P.V.C. except where they pass through the structure, where they shall be mild steel.. The sleeves shall have 6mm - 12mm clearance all around the pipe or for insulated pipework all around the installation. The sleeve will then be packed with slag wool or similar.

2.2 INSTALLATION

2.2.0 GENERAL

Installation of all pipework, valves, fittings and equipment shall be carried out under adequate supervision from skilled staff to the relevant codes and standards as specified herein. The Sub-contractor shall be responsible to the Main contractor for ensuring that all builders work associated with his piping installation is carried out in a satisfactory manner to the approval of the Engineer.

2.2.01 ABOVE GROUND INSTALLATION

(a) Water Services

Before any joint is made, the pipes shall be hung in their supports and adjusted ensure that the joining faces are parallel and any fails which all be required are achieved without springing the pipe.

Where falls are not shown on the contract Drawings or stated elsewhere in the Specification, pipework shall be installed parallel to the line of the buildings and as close to the walls, ceilings, columns etc., as is practicable.

All water systems shall be provided with sufficient drain points and automatic air vents to enable them to function correctly. Valves and other use equipment shall be installed with adequate access for operation and maintenance. Where valves and other operational equipment are unavoidably installed beyond normal reach or in such position as to be difficult to each from a short stepladder, extension spindles with floor or wall pedestals shall be provided.

Screwed piping shall be installed with sufficient number of unions of facilitate easy removal of valves and fittings, and to enable alterations of pipework to be carried out without the need to cut the pipe.

Full allowance shall be made for the expansion and contraction of pipework, precautions being taken to ensure that any force produced by the pipe movement are not transmitted to valves, equipment or plant.

All screwed joints to piping and fitting shall be made with P.T.F.E. Tape.

The pump shall maintain the test pressure for about one hour and if there is any leakage, it shall be measured by the quantity of water pumped into the main in that time. A general leakage of one gallon per 25mm of diameter, per 1.6 kilometres per 24 hours per 30 metres head, may be considered reasonable but any visible individual leak shall be repaired.

(b) Sanitary Services

Soil, waste and vent pipe systems shall be installed in accordance with the best standard of modern practice as described in B.S. 5572 to the approval of the Engineer.

The Sub-contractor shall be responsible for ensuring that all ground floor waster fittings are discharged to a gully trap before passing to the sewer via manhole.

The Sub-contractor shall provide all necessary roding and inspection facilities within the draining system in position where easy accessibility is available.

Where a branch requires roding facilities in a position to which normal access in unobtainable, then that branch shall be extended so as to provide a suitable purpose made roding eye in the nearest adjacent wall or floor to which easy access is available.

The vent stacks shall terminate above roof level and where stack passes through roof, a weather skirt shall be provided. The Sub-contractor shall be responsible for sealing the roof after installation of the stacks.

The open end of each stack shall be fitted with a plastic coated, or galvanised steel, wire guard.

Access for roding and testing shall be provided at the foot of each stack.

(c) Sanitary Appliances

All Sanitary appliances associated with the Sub-contract works shall be installed in accordance with the best standard of modern practice as described in B.S. 5572 to the approval of the Engineer.

2.2.02 UNDERGROUND INSTALLATION

(a) General

All underground water and drainage service installations shall be carried out in accordance with the best Standard of modern practice as described in C.P. 301 AND C.P. 310 respectively and the following clause.

(b) Sequence of Operation for Underground Service Installation

(1) Setting out

As described in B.S. Code of Practice 301 Cause 502.

(2) Breaking Up Surface (If in Roads)

As described in B.S. code of practice 301 Clause 503.

(3) Excavation and Timbering

As described in B.S. code or practice 301 Clause 503 and the following:-

Excavation shall be made to such depths and dimensions as may be required by the Engineer to obtain prior falls and firm foundations. No permanent construction shall be commenced on any bottom until the excavation to the correct level with concrete I : 4 : 8 to 38 mm maximum aggregate sizes.

The Sub-contractor's price shall have included for excavating in all materials met with, for trimming bottoms to the necessary falls and for any extra excavation required for planking, strutting and working space.

The Sub-contractor shall keep the whole of the trenches or other excavation free from water and shall execute such works and install such pumps as may be necessary to keep the excavation dry at all times.

No sub-soil water shall be discharged into the sewage system without written permission of the Engineer.

(4) Laying of Concrete Beds or Other Support for Pipes (if required)

As described in B.S. code or practice 301 clauses 504 and the following:-

All drains below buildings and roads shall be encased in concrete 150mm thick.

Concrete beds and supports shall be concrete I:3:6 to 25mm maximum aggregate size.

(5) Pipe Laying and Jointing

Drainpipe shall be laid and jointed as described under B.S. code of practice 301 Clause 505.

Pitch fibre drain pipe shall be laid, jointed and cut in accordance with the requirement or the Note contained under Appendix C of B.S. 2760.

Water pipes shall be laid and jointed as described under B.S. code of practice 310, clause 401, 402, 403 and 404.

(6) Manholes

(1) General

All manholes provided under the Sub-contract works shall be constructed or approved materials and in an approved manner.

All manholes shall be watertight and if constructed of brickwork, solid blockwork or stonework, they shall be rendered internally with a cement mortar of at least l2mm thickness and finished with a smooth surface.

The sides of all channels in every manhole shall be brought up vertically to a height of not less than the diameter of the drain and shall be benched in good concrete from the top of the channels at an angle of 30 degree to the horizontal and floated to a smooth hard surface with a coat of I:I cement mortar.

In all other respects, manholes shall be constructed in accordance with B.S. code of practice 301.

(ii) Rectangular and Square Manholes

Rectangular and square straight through manholes shall be constructed from brickwork, solid blockwork, stonework and concrete to comply with the following minimum internal dimensions (millimetres).

Depth below Ground of Outgoing Invert	Internal Access Shaft Dimensions L X W	Size of Main Shaft Diameter	Internal Chamber Dimensions L X W	Height of Chamber above Benching	Wall Thickness
Up to 740	-	100 to 150	610x460	-	150
Up to 740		230 to 460	760x760		150
Up to 1200		100 to 150	760x760		150
160 to 1200	-	230 to 460	910x910	-	150
1220 to1800	-	100 to 150	910x910	-	150
1220 to 1800	-	230 to 460	1070x910	-	150
1830 to 4550	760x760	100 to 150	1370x910	1370	230
1830 to 4550	760x760	230 to 460	1370x1070	1370	230
4570 & Over	760x760	100 to 150	1370x1140	1680	230
4570 & Over	760x760	230 to 460	1370x1140	1680	230

When branches are connected into the manhole, the length and width dimensions of the chamber shall be increased as follow: -

Length

Branch Diameter

l00mm 300mm/branch on the side with most branches.

150mm 380mm/branch on the side with most branches.

230 and 300mm 460mm/branch on the side with most branches.

460mm 610mm/branch on the side with most branches.

Width

Branch Diameter

100mm to 300mm for each side with branches plug

160mm 460mm or the diameter of the main drain which ever is the greater.

(iii) Precast Concrete Circular Manholes

Where specified straight through precast concrete manholes shall be manufactured and constructed to comply with B.S. 556 and the following dimensional requirements, (Dimensions in Millimetres).

Depth Ground Of Outgoing Invert	**Internal Access Shaft Diameter**	**Size Main Channel Diameter**	**Chamber Diameter**	**Height Chamber Above Benching**
Up to 740	-	100 to 460	910	-
760 to 2410	-	100 to 460	1070	-
2440 to 4550	760	100 to 460	1220	1370
4570 & over	760	100 to 460	1370	2680

When branches are connected into manholes the internal diameter of the chamber shall be increased, as necessary, up to a maximum chamber diameter 1830mm.

(iv) Step Irons and Covers

Access shaft to manhole of depths greater than 760mm shall be provided with approved step irons as suitable intervals.

Every manhole or manhole access shaft shall be fitted with a removable airtight cast iron cover to adequate size and strength, fixed in a manner that prevents surface water gaining access into the drainage system.

Cast manhole covers and frames shall be manufactured in accordance with the requirements of B.S. 497 and shall generally fall into the following categories:-

Heavy Duty	:	For Carriageways
Medium Duty	:	For Footpaths
Light Duty	:	For domestic premises or other places where they do not have to carry wheeled traffic.

(v) Back Drop Connections

Where the level of the branch drain entering the manhole is higher than can be suitably accommodated by the normal type benching, then the branch drain shall be connected to the manhole by means of a back drop or practice 301.

(vi) Channels

Where the branch channel connects to the main channel in the manhole, the invert of the branch channel shall be a minimum of 38mm higher than the main channel.

(7) Testing of Pipelines

After pipelines are connected up and joints have been sealed, the pipeline shall be tested before pipes are, if required, hunched or surrounded in concrete.

Methods of testing and inspection shall be in accordance with Clause 4 of the Specification.

(8) Concrete Bedding, Hunching and Surround

Concrete bedding, hunching and surround shall be provided as necessary or where called for by the Engineer in accordance with the requirements laid down in B.S. code of Practice 301, Clause 310.

(9) Backfilling

Backfilling of trenches, heading and around manholes shall be carried out in accordance with the methods described in B.S. code of practice 301, clause 508.

(10) Reinstatement of Surface

Following the final backfilling of all trenches, headings, and manhole surrounds, the surface of the excavated areas shall be fully reinstated to the approval of the Engineer.

Where excavation have been carried out in public highways or other areas are not forming part of the site, the Sub-Contractor shall be deemed to have allowed in his price for all charges associated with the temporary and final reinstatement requirements of the local of highway Authority, whether this is carried out by the Sub-contractor or by the Authority concerned.

No Claims for extra in this respect will be accepted.

(11) Sewer Connection

The Sub-contractor shall pay all charges associated with the connection by the local Authority of the drainage to the Main sewer, including necessary reinstatement.

2.3 TESTING AND INSPECTION

2.3.01 SITE TESTS - PIPEWORK SYSTEMS

(a) Underground Water Mains

After laying, jointly and anchoring, the main shall be slowly and carefully charged with water, so that all air is expelled and allowed to stand full for three days before testing under pressure.

A long main shall be tested in section as the work of laying proceeds and all joints shall be exposed for inspection during the testing.

The open end of the main may be temporarily closed for testing under moderate pressure by fitting a water pipe expanding plug, of which several types are available. The end of the main and the plug should be secured by struts or otherwise, to resist the end thrust of the water pressure in the main.

If the section of main terminates with a sluice valve, the wedge of the valve shall not be used to retain the water, instead the valve shall be fitted temporarily with a blank flange, or if a socket valve with a plug and the wedge shall be placed in the open position while testing. The Sub-contractor shall provide suitable end support to withstand the end thrust of the water pressure in the main.

(b) Above Ground Internal Water Services Installation

All water service pipe system installed above ground shall be tested hydraulically for a period of one hour to not less than one and half times the design working pressure.

If preferred, the Sub-contractor may test the pipelines in section. Any such section found to be satisfactory need not be the subject of a further test when 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 revealed shall be made good by the Sub-contractor and the section re-tested.

The Sub-contractor shall take all necessary precautions to prevent damage occurring to special valves and fittings during the tests. Any item damaged shall be repaired or replaced at the Sub-contractor's expenses.

(c) Underground Drainage System

A site test shall be carried out on all drainage pipes before concrete hunching or surrounds are applied. These tests shall be carried out preferably from manhole to manhole.

Short branch drains connected to a main drain between manholes shall be tested as one system with the main drain. In long branches a testing junction shall be inserted next to the junction with the main drain and the branch tested separately. After the test has been passed, the testing junction shall be effectively sealed..

All tests on underground drains shall be permitted on cast iron drains at the discretion and to the approval of the Engineer.

Water tests shall be carried out in accordance with the methods described under B.S. code of Practice 301, Clause 601, (b) and (c) and the test pressure shall not be less than 1,520mm head at the highest point in the pipe section and not more than 10,360mm head at any point in the section.

The test pressure shall be maintained for a period of one hour during which time the pipe and joints shall be inspected for sweating and leakage. Any leak discovered during the tests shall be made good by the Sub-contractor and the section re-tested.

In addition to pressure tests, drainpipe runs shall also be tested for straightness where applicable. This test shall be carried out in accordance with one of the two methods described in B.S. Code of Practice 301, clause 601 (e).

Testing of manholes shall be carried out in accordance with the methods described under B.S. code of Practise 301, clause 601 (f).

(d) Above Ground Soil Waste and Ventilation System

All soil, waste and ventilating pipe system forming part of the above ground installation, shall be given appropriate test procedures as described in B.S. 5572 1972.

Smoke tests on above ground soil, waste and ventilating pipe system shall not be permitted.

Pressure tests shall be carried out before any work, which is to be concealed, is finally enclosed.

In all other respects, tests shall comply with the requirements of B.S. 5572.

2.3.02 SITE TEST - PERFORMANCE

Following satisfactory pressure test on the pipework system, operational tests shall be carried out in accordance with the relevant B.S. code of practice on the systems as a whole to establish that special valves, gauges, control, fittings, equipment and plant are functioning correctly to the satisfaction of the Engineer.

All hot water pipework shall be installed with preformed fibre glass lagging to a thickness of 25mm where the pipe runs above a false ceiling or in areas where the ambient temperature is higher than normal with the result that pipe "seating", due to condensation will cause nuisance.
All lagged pipes which run in a visible position after erection shall be given a canvas cover and prepared for a painting as follows: -

(i) Apply a coating of suitable filler until the canvas weave disappears and allow drying.

(ii) Apply two undercoats of an approved paint and finish in suitable gloss enamel to colours approved by the Engineer.

All lagging for cold and hot water pipes erected in crawl ways ducts, and above false ceiling which, after erection are not visible from the corridors of rooms, shall be covered with a reinforced aluminium foil finish and banded in colours to be approved the Engineer.

In all respects, unless otherwise stated, the hot and cold-water installation shall be carried out in accordance with the best standard of modern practice and described in C.P. 342 and C.P. 310 respectively to the approval of the Engineer.

The test pressure shall be applied by means of a manually operated test pump or, in the case of long main or mains or large diameter, by a power driven test pump or, in the case of long main or mains or large diameter, by a power driven test pump which shall not be left unattended. In either case precautions shall be taken to ensure that the required pressure is not exceeded.

Pressure gauges should be recalibrated before the tests.

The Sub-contractor shall be deemed to have included in his price for all test pumps, and other equipment required under this clause of the specification.

The test pressure shall be one and a half times the maximum working pressure except where a pipe is manufactured from a material for which the relevant B.S. specification designates a maximum test pressure as in the case of cast or spun iron pipes, where the test pressure should not exceed 120, 180 and 240 metre/head of clause B, C or D pipes, respectively.

2.4.0 STERILIZATION OF HOT AND COLD WATER SYSTEMS

All underground water mains and above ground water distribution system, cisterns, tanks, calorifiers, pumps , etc shall be thoroughly sterilized and flushed out after the completion of all tests of all tests and before being fully commissioned for handover.

The sterilization procedures shall be carried out by the Sub-Contractor in accordance with the requirements of B.S. code of practice 310, clause 409, to the approval of the Engineer.

2.5.0 WATER MAINS

2.5.1 Piping

All piping shall be plain ended and suitable for use with flexible mechanical couplings (e.g. Viking Johnson, Dresser or Gibault). Steel pipes shall comply with B.S. 534 - Galvanised Steel Pipes for distribution system shall comply with B.S. 1387 - 1967 medium tubes and be supplied with flanges on pipes 75mm diameter and over.

On pipes less than 75mm diameter pipes shall be screwed and socketed, unless otherwise stated.

2.5.2 uP.V.C. Pipes

uPVC piping shall be in accordance with B.S. 3505:1968.

The maximum sustained working pressure to which the pipes and fittings will be subjected is based on water at a temperature of 20ºC .

The Contractor shall submit full details of the colour of the pipe he intends to supply. The colour of the pipe shall be such as to meet the requirements of Clause 2 `Material` and Clause 8.5 `Opacity` of B.S. 3505.

The pipes up to and including 50mm diameter shall be of solvent weld type. the pipe shall be supplied with interchangeable sockets pre-formed at the factory and of such internal diameter that it takes the plain and of the pipe with same nominal diameter.

The joint shall sustain the end thrust to which the pipe shall be submitted. The Contractor shall supply sufficient quantity of the cleaner and adhesive which shall be required to make the joints with the pipes.

The pipes of 75mm diameter and over shall consider of a grooved socket at one end of the pipe. The socket shall be designed to give a clearance fit on the outside diameter of the parent pipe. The sealing medium that shall seat in the groove shall be a rubber ring.

If the formation of the socket and groove results in the thinning of the original wall thickness of the pipe, it shall be compensated for by shrinking on to the outside of the socket area as reinforcing sleeve of the same material as the pipe.

The socket and groove shall incorporate no sharp angles where the stress points are created.

The joint shall take 10% deformation of the spigot at the point where it enters the socket without leakage from the pipe when subjected to the test pressure specified for the pipe. Thermal expansion of the pipe shall be accommodated in the joint. The joint shall be capable of lineal deflection up to 30o

The sealing ring shall be of first grade natural rubber and the physical properties of the mix shall meet the requirements of B.S. 2494.

The Contractor shall supply sufficient quantity of any lubricant or other material that shall be needed to make the joint, which shall be assembled by hand.

The fittings shall have the same type of joint as for the pipes to be used. The Contractor shall submit full details of the materials, dimensions and test pressures of the fittings offered.

Precautions shall be taken to avoid damage of the pipes and fittings.

In handling and storing the pipes and fittings, every care shall be taken to avoid distortion, flattening, scoring or other damage. The pipes and fittings shall not be allowed to drop or strike objects. Pipe lifting and lowering shall be carried out by approved equipment only.

Special care shall be taken in transit, handling and storage to avoid any damage to the ends.

All jointing of pipes and fittings shall be carried out strictly in accordance with the manufacturer's instructions.

2.5.3 Manufacturer's Instructions

The Contractor shall be responsible for obtaining copies of any manufacturer's instructions for pipe jointing and shall familiarise himself and his employees with these instructions.

All necessary tools and equipment required for the laying, jointing and testing of pipes and joints shall be provided by the contractor at no extra cost.

2.5.4 Fittings and Specials for Galvanised Steel Pipes.

All special shall be of such dimensions will mate with piping supplied. Screw down stop valves shall comply with B.S. 1010. Specials shall comply with B.S. 1740.

2.5.5 Flanged Adaptors and Flanges

Flanged adaptors shall be piece suitable for connecting a flanged sluice valve to the type of piping supplied. All flanges or special shall conform to B.S. 10 part 1 and shall be drilled to Table `C` and machined across the faces. The flanged adaptors shall comply with B.S. 78 and B.S. 3961:1965. All P.V.C. flanges shall be supplied with metal backing rings, jointing of flanges shall be carried out using the joint rings, bolts and washers as necessary.

2.5.6 Tees

The spigot ends of all tees shall be suitable for connection to the pipework supplied using the aforementioned flexible mechanical joints and branches shall be flanges drilled to B.S. 10 Table `C`.

2.5.7 Hydrants

The hydrants shall comprise a 75mm sluice valve and a 75mm Duckfoot bend with gunmetal screw connection to details shown on the detailed drawings. These specials shall comply with the requirements of B.S. 750: 1964.

2.5.8 Gate Valves

All gate valves 80mm nominal bore above, other than those required for fitting to buried water mains shall be of cast iron construction in accordance with the requirements of B.S. 3463. All gate valves required for fitting to buried water mains shall be of cast iron construction in accordance with the requirements of B.S. 1218.

All gate valves up to and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of B.S. 1952.

The pressure classification of all gate valves shall depend upon the pressure conditions pertaining to the Site of Works.

2.5.9 Air Valves

Air valves shall be of cast iron conforming to B.S. 1452 Grade 14. They shall be suitable for working pressures not less than that specified for the class of pipe to which they are connected.

2.5.10 Ball Float Valves

Ball float valves shall be to B.S. 1212 Parts 1 and 2 shall be suitable for a working pressure not than the working pressure for the class of pipe specified for connection to the ball float valve.

2.5.11 Non-Return Valves

Non-return valves shall be of cast iron with flanges and shall conform to B.S. 4090:1966.

2.5.12 Stop Cocks

Stopcocks up to 50mm diameter shall be brass and shall conform to B.S. 1010 Part 1 : 1959 Part 2 : 1973.

2.5.13 Rubber and Insertion Jointing

Rubber and Insertion Jointing for flange joints shall comply with B.S. 2494 Part 1 and no jointing rings shall be used in the Contract, which have not been supplied by manufacturers approved by the Engineer.

2.5.14 Bituminous Paints

All bituminous or tar paints for protection of buried steel bolts, pipes, specials etc. shall be the best of their respective kinds manufactured by approved makers.

2.5.15 Steel Pipe and Fittings for Rising Main

All piping shall be plain ended and suitable for used with flexible mechanical couplings (e.g.viking johnson, Dresser). The grade of steal used shall comply with the requirements of B.S. 3601: 1964. Pipes shall be welded or seamless and shall conform to B.S. 534: 1966 or an equivalent acceptable standard.

All pipes shall be externally and internally protected with bitumen in accordance with clauses 5.4 and 5.5 of B.S. 534:1966.

The external protection shall be reinforced with oven glass cloth glass tissue wrapping or by other approved material. All sheathed or wrapped pipes, fittings and specials shall be protected during transit by straw, wood wool or by other approved material.

The ends of all bitumen lined pipes, fittings and specials shall be closed by means of discs or other suitable covers firmly held in place.

2.5.16 Drain-Off Taps, Stop Valves for Water Services

Fittings for mains of size 50mm or under shall comply with B.S. 1010. Samples must be submitted to the Engineer for approval prior to installation of fittings.

2.5.17 Storage of Plants and Materials

The Contractor shall, at his own expense, make arrangements for dumps along the route of the pipe line for storage of pipes, his plant and materials, to suit his own convenience, but such arrangements shall be subject to the Engineer's approval.

2.5.18 Loading, Handling and Conveying of Pipes

The Contractor shall before commencing to lay the pipes, valves or other materials examine them and ascertain that they are in perfectly sound condition and he shall be responsible for any pipes, valves and other materials, which may be found damaged after laying. The stocking of pipes and specials on site, loading and unloading etc. shall be carried out to the satisfaction of the Engineer.

2.5.19 Interference with Fences, Drains, Pipes, Property etc

The Contractor shall ensure the proper reinstatement of fences, drains, telephone lines, K P & L. cables etc. where affected by his work. All services shall be adequately protected and propped to the satisfaction of the Engineer. The Contractor shall be liable for any damage caused to the services due to his failure to provide adequate protection.

2.5.20 Method of Excavation

(a) The Contractor shall excavate the pipe trenches in the line and to the depths indicated by the Engineer. Except where otherwise indicated on the Drawings or directed by the Engineer, it is intended that the trench shall be excavated to such a depth as will allow of a minimum cover of 500mm over top of the barrel of the pipe when laid plus or minus a tolerance of 75mm either way. All trenches shall be excavated in open cuttings.

(b) Where the trench passes through grassland, arable land or garden, whether enclosed or otherwise, the turf, if any, shall be pared off and stacked, and the productive soil shall be carefully removed for a width of 600mm greater than the nominated trench width or equal to the overall width of track of the excavating machine, whichever is greater, and laid aside to be subsequently used in reinstating the surface of the ground after the trench has been refilled.

(c) The bottom of the trench shall be properly trimmed off, and all low places or irregularities shall be levelled up with fine material. Where rock or large stones are encountered, they shall be cut down to a depth of at least 75mm below the level at which the bottoms of the barrel of the pipes are to be laid, and covered to a like depth with materials, so as to form a fine and even bed for the pipe.

(d) Joints holes shall be excavated to suit minimum dimensions as ill allow the joints to be well and properly jointed.

(e) The pipe trench shall be kept clear of water at all times.

(f) The Contractor shall, wherever necessary by means of timbering, or otherwise support the sides of the trench so as to make them thoroughly secure, and afford adequate support to adjoining roads, lands, buildings and property, during the whole time the trench remains open and shall remove such timbering or other work shall be deemed to be included in the rates for excavation. In case the Contractor is instructed by the Engineer to leave any portion of such timber in position, he will be paid for if accordingly.

(g) The clear width inside the timbering in the case of single pipes shall be at least 320mm in excess of the external diameter of the pipe being laid, in order to allow it to be freely lowered into position, in the trench without damage to the external protection.

(h) Where more than one pipe is to be laid parallel, then the clear width inside the timbering shall be at least 520mm in excess of the combined external diameters of the pipes.

(i) Should the excavation be taken out to a greater depth than is specified the bottom shall be made good to the correct level with Mix 1:3:6 concrete or other materials approved by the Engineer. No payment shall be made for any other excavation carried out by the Contractor and the coat of filling up to required levels.

(j) If a mechanical excavator is used by the Contractor, he shall indemnify the Employer against all claims for damage that in the opinion of the Engineer, may be caused by the used of this plant. When a mechanical excavator is used the bottom 230mm of excavation shall be got out by hand to ensure an even bed for the pipes.

2.5.21 Main Laying

Mains shall be laid in straight lines and/or smooth curves as indicated on the Drawings. The vertical profile of the pipes shall be to even gradients. Any pipes not so laid shall be removed if so directed by the Engineer, and relaid in proper manner at the Contractor's expense.

In laying the pipes and specials care shall be taken not to damage the protective linings and the pipes shall be handled with tackle as directed by the Engineer.

The pipes and specials shall be slung and sounded with hand hammer for flaws before they are lowered into the trench. After the pipes or specials have been checked they shall be cleaned internally and carefully lowered into trench and set to proper gradient and line so that there is a continuous rise from each washout to air valve.

2.5.22 Temporary Bench Marks and Sight Rails.

The Contractor shall fix Sight Rails for use with boning rods at intervals of not more than 65 metres and temporary Bench Marks related to the Survey of Kenya Datum shall be provided at intervals as directed by the Engineer.

2.5.23 Curves and Bends

Large diameter curves of main shall wherever possible be formed by giving a set not exceeding 3o to each joint, bends being used only where large diameter curves are not possible.

2.5.24 Cutting of Pipes

The Contractor shall, subject to approval of the Engineer, cut pipes to such lengths as directed. Pipes should be cut off clean and square with the axis. Cuts should be made with an approved from the rotary cutting machine, but the Engineer may approve cutting by oxyacetylene cutters.

2.5.25 Flanged Joints

In laying pipes and specials with flanged joints, flanges shall be brought together and bolted with the faces absolutely parallel. A rubber jointing ring 3mm thick shall be used in each flange joint and one washer with each bolt. The ring shall be a strip ring lying within the bolt circle and a full flange width ring.

The bolts shall be tightened up gradually and equally in the customary manner in order to distribute the stress evenly over the flange. If it is found necessary to slightly from the normal run of the flange piping, the deflection shall be obtained by means of bevelled gunmetal ring washer between the flanges.

2.5.26 Surface Boxes

Sluice valves, air valves and fire hydrants shall be covered with Surface Boxes in accordance with details as shown on the Drawings. In roads and footpaths the boxes shall be laid flush with the surface.

2.5.27 Fixing of Valves, Air Valves and Washout Pipes.

The Contractor shall fix the sluice valves, air valves, washout pipes complete with iron casing for spindles and surface boxes in accordance with and in position shown on the Drawings. As far as possible the cutting of pipes for this should be avoided.

2.5.28 Support and Anchor Blocks

Concrete mix 1:3:6 shall be placed around and against bends and other specials in trenches.

2.5.29 Colour Coding

All underground pipes are to be wrapped with adhesive plastic tape at each meter in colours blue for drinking water and green for untreated water. All pipework above ground and valves in valve chambers and pits are to be painted in similar colours.

2.5.30 Lettering

a) The lettering for sluice valves, fire hydrants, air valves and washout abbreviated SV, FH, Av and WO respectively shall be in accordance with the detail shown on the Drawings and colour coded as detailed hereafter:-

Untreated water:	White lettering on green background
Drinking water:	White on blue background
Fire Hydrant:	White lettering on yellow background

2.5.31 Testing

(a) The test pressure shall be one and a half the maximum working pressure except where a pipe is manufactured from a material for which the relevant B.S. Specification designates a maximum test pressure should not exceed 120, 180 and 240 metre/head for Clause B, C or D pipes, respectively.

The pump shall maintain the test pressure for about one hour and if there is any leakage, it shall be measured by the quantity of water pumped into the main that time.

(b) When a section of the main has been jointed, the ends shall be closed with caps, plugs, or flanges, which must be strongly strutted against a solid surface to the satisfaction of the Engineer. The trench shall be properly backfilled and rammed as hereinafter specified and as shown on the Drawings, for its whole length so as to cover the main to a depth of not less than 500mm, except at the joint holes which shall be kept clear of all backfilling, if necessary by the use of timbering, so that each joint is left fully exposed for inspection. No backfilling will be permitted before testing of each section.

As long a section of main as possible shall be tested at one time subject to the maximum length of open trench approved by the Engineer or permitted by the Highway Authority, and the test shall be carried out within 12 working days of the completion of such sections of mains.

Where a main is laid across a road or in such a position as to interfere seriously with the normal use of the road, the Contractor may, with the consent of the Engineer and at his own risk, fill in such joint holes as may be necessary.

He shall, at his own expense, re-excavate any or all joint holes necessary to locate a leak and carry out repair work should the results of his hydraulic test prove unsatisfactory.

The section shall then be filled with mains water, great care being taken to drive out all air through air valves, ferrules or otherwise to the approval of the Engineer.

(c) After the section to be tested has been charged and all air liberated it shall standing under moderate pressure for several days' final airing.

The leakage from the mains and connections from each section tested shall not exceed 4 litres of water per 25mm diameter of main, per 2 km. length each 24 hours, every 30 metres head of pressure, and any visible individual lea shall be repaired.

To determine the rate if leakage, the Contractor shall furnish a suitable hydraulic test pump, pressure gauge, connections and water meter or other appliance, for measuring the amount of water pumped.

If the leakage were at a greater rate than that specified, the Contractor should re-excavate the trench where necessary and shall remake the joints and replace defective work until the leakage shall be reduced to the allowable amount.

(d) The Employer shall charge the Contractor the cost of any couplings required to join up tested lengths of main if, in the Engineer's opinion, greater lengths could reasonably have been tested or if failure under test requires the pipe to be cut, or other methods of laying should have been adopted.

The Contractor shall supply water used by the Contractor in testing the main. The Contractor shall carry out all work, which may be necessary for making temporary connections to the existing mains to obtain water for testing at his own expense.

(e) In carrying out the test for water tightness the Engineer only shall authorise the operation of all valves, but the Contractor shall provide all the necessary labour to assist in the opening and closing of the valves to the Engineer's instructions, and he shall allow in his prices for all his expenses in connection with testing on completion.

The Engineer shall be the sole judge of water tightness.

2.5.32 Cleansing And Sterilizing The Main

When a pipeline is complete and where applicable, has successfully passed the test, it shall be thoroughly washed out using, if possible, an open end. Thereafter it shall be sterilized by being filled with a suitable solution containing not less than 20 p.p.m. of free available Chorine or such other sterilizing agent as the Engineer shall approve. After standing for 24 hours the main shall again be washed out and refilled with mains water prior to the taking of Bacteriological samples.

The Contractor shall provide all necessary stop-ends fittings and chemicals for this work.

Emptying and washing out of the pipes shall be done in such a manner as not damage the trench or cause undue flooding of the vicinity, and the Contractor shall supply and use such piping, specials and/or hose as may be necessary to facilitate the flow of water to the nearest drain or watercourse. Water used for washing out and sterilizing will be supplied by the Employer.

Before any section of the main is put into use a bacteriological sample or samples will be taken by the Engineer`s Representative and only on receipt of a satisfactory Certificate from the Medical Research Laboratory of the Employer will the main or section of main be permitted to be put into supply and be considered as having been substantially completed.

Any expenditure involved in providing facilities or materials for the taking of samples shall be included in the Contractor's tendered rates and the Engineer will specify and shall be the sole judge as to the number of samples required and the points at which they are to be taken.

The cost of the Bacteriological Examination will be borne by the Employer but if the sample and samples are not satisfactory the cost of any subsequent analyses will be borne by the Contractor.

2.5.33 Clearance of Site

The Contractor shall remove all surplus pipes, specials and other fittings from the side as directed by the Engineer. The site of works shall be levelled and all surplus excavation, debris, cut trees or bushes shall be carted to approved tip sites.

2.5.34 Existing Installations

(a) Cold Water

Where pipes for cold water are to be connected up to existing installations, the condition of the existing installation is to be reported to the Engineer in order to establish if part of the existing installation is to be replaced.

(b) Sanitary Fittings

Where existing sanitary fittings are to be removed or replaced, the fitting is to remove with outmost care and fittings and taps to be handed over to the client.

(c) Sealing Off Existing Drains and Manholes

Existing foul, surface water and subsoil drains exposed during progress of work are to be recorded and reported for investigation by the Architect. Where not required to be removed, seal off with concrete or grout solid as directed. Seal off connection to manholes, demolish walls to 500mm below surrounding ground level and fill remainder of manhole with consolidated approved rubber and cover to level of surrounding ground as directed.

2.6.0 COLD WATER STORAGE TANKS

Cold-water storage tanks shall include the ball valves and connectors for inlet, supply, washout, and overflow and may also include fire reel system supply pipe. The Sub-Contractor shall also include in his pricing the price of the overflow and amount pipes to a place to be indicated by the Engineer. He shall also include the washout valve.

Where paint is required tithe Sub-Contractor shall use the paint, which will not be toxic.

The tanks shall be manufactured to the following British Standards:-

(a) Galvanised Mild Steel tanks to BS 417

(b) Sectional Steel tanks to BS 1564

Where non-standard sizes shall be used, they shall be manufactured to the relevant standard but with the approval of the Engineer.

2.7.0 WATER HEATERS

Electrically Heated

Non-pressure and low-pressure types domestic electric water heaters shall comply with B.S. 843: 1964, high-pressure types shall be of a Standard not less than the appropriate B.S.

Domestic heaters shall, if nothing else is pacified, be supplied with 25mm thick fibre glass lagging and enclosed in the corrosion-proofed steel, finished in white stove enamel and be similar to manufactured `HEATRAE`.

Electric thermostatically controlled immersion heaters shall comply with B.S. 3456: Section A8:1963 and C.P. 324. 202:1948.

Purpose made storage water heaters of the specified sizes shall comply with B.S. 853 and shall be to the specified working and test pressure. The heaters shall be provided with all necessary bosses, coils etc., and shall be hot dip galvanised after manufacture. Insulation shall, if nothing else is specified, be fibreglass to the specified thickness with finish suitable for painting.

Domestic heaters for floor mounting shall, if not provided with legs, be mounted on a minimum 100mm high concrete plinth.

Floor mounted purpose made heaters shall be provided with minimum 225mm high legs of sufficient strength welded to the heaters and to suitable floor plates before galvanising. Wall mounted heaters shall be supplied with all necessary brackets.

PART C

PARTICULAR SPECIFICATIONS

FOR

PLUMBING, DRAINAGE AND FIRE FIGHTING INSTALLATIONS

PART C

PARTICULAR SPECIFICATIONS

FOR

PLUMBING, DRAINAGE AND FIRE FIGHTING INSTALLATIONS

PART C

PARTICULAR SPECIFICATIONS
FOR
PLUMBING, DRAINAGE AND FIRE FIGHTING INSTALLATIONS

3.1 INTRODUCTION

These specifications cover the execution of Plumbing, Drainage and Fire Fighting Installations and should be read in conjunction with other relevant specifications, drawings and contract documents issued to the contractor in conjunction with the Sub- Contract.

3.2 INCLUDED IN THE SUB-CONTRACT

The works include, unless otherwise specified, supply, delivery, installation, testing and commissioning, cleaning-up and setting to work all the installations described in the specifications and as shown on the contract drawings.

The provisions of all labour, materials, tools, instruments, testing apparatus and scaffolding necessary to execute the work in a first class manner, even such labour, materials, instruments or apparatus which are not specifically mentioned in the contract but are necessary for the satisfactory completion of the works, including such elements as: -

- Cold Water supply pipework and fittings to the water storage tanks from the existing water mains,

- Water storage tanks complete with all necessary covers, fittings, washout and overflow pipes and supports. The Sub-Contractor is expected to take the overflow and washout pipes to a reasonable discharge point,

- the water supply pipework to the functional and sanitary fittings as shown on the drawing plus the necessary fixing, supporting and jointing materials from the water storage tanks,

- The sanitary and operational fittings together with the fixing, supports and jointing to the supply and discharge pipes.

- The waste and soil pipework from the sanitary and operational fittings to the first manholes including all fixing, supports and jointing materials.

- All cutting away and all making good will, if nothing else is specified, be carried out by the Main Contractor but it will be the responsibility of the Sub-Contractor to ensure that this work is kept to a minimum, be responsible for the correct marking out of all chases and holes; and will provide all necessary details to the Main Contractor.

- The Sub-Contractor shall also be responsible for ensuring that runs for floor or wall chases, holes to be cut or left will be marked out at the appropriate stage of the structural work.

- The sub-contractor shall undertake all notifications demanded by the Authorities in order to comply with current regulations and produce all certificates, if any, from the authorities without extra charge.

- The Sub-Contractor shall as part of his Tender supply all necessary information such as manufacture, catalogue or type numbers, brochures or copies of catalogue pages, weight, and all other relevant information which are necessary to classify the equipment tendered for.

- All other materials, labour, tools, instruments, scaffolding, etc. which are necessary for final completion in a first class manner of the plants to the Engineers satisfaction. Excluded are only materials and workmanship especially mentioned herein as "Excluded from this Sub-Contract".

- The Sub-Contractor shall include for cables, pipes, etc from central facilities to working area.

- Provide the Engineer for his approval complete working and manufacturing drawings as specified.

- Commissioning and testing of the plants as specified.

- Supply of complete operation and maintenance manuals as specified as well as adequate instruction of the Client's maintenance personnel as specified.

- The Sub-Contractor shall include for full maintenance during initial maintenance period as specified.

3.3 **EXCLUDED FROM THE SUB-CONTRACT**

- All concrete works, inclusive of necessary holes, plinths, etc.

- All block work inclusive of necessary holes (to be marked by the Sub-Contractor) etc.

- All electrical wiring up to and inclusive of isolators and switchboards.

- The Main Contractor will provide central located facilities for supply of water and power during the construction period.

3.4 **EXTENT OF THE SUB-CONTRACTOR'S DUTIES**

At the commencement of the work, the Sub-Contractor shall investigate and report to the Engineer if all materials and equipment to be used in the work, and not specified as supplied by others, are available locally. If not available, the Sub-Contractor shall at this stage place orders for the materials in question and copy the orders to Architect and/or the Engineer. Failure to do so shall in no way relieve the Sub-Contractor from supplying the specified materials and equipment in time.

Any item or material found to be defective shall be replaced by the Sub-Contractor within seven days of his being notified and any result of defective workmanship shall be repaired including supply of new parts if necessary, immediately upon being notified.

The Sub-Contractor shall furnish at his own cost any samples of materials or workmanship required for the Sub-Contract Works, that may be called for by the Engineer for his approval, and the Engineer may reject materials or workmanship not in his opinion up to the approved standard. The Sub-Contractor shall allow in his prices for such samples.

The Sub-Contractor shall when authorized in writing by the Architect or the Engineer, make variations from the specifications and drawings. No profit will be allowed on omitted items or works.

The Sub-Contractor shall submit to the Architect or to the Engineer claims for any work for which he considers demanding extra payment before the beginning of such work.

The Sub-Contractor shall be responsible for verifying all dimensions relative to his work by actual measurements taken on the site.

The Sub-Contractor shall request any alteration to the building structures within 30 days of the awarding of the Sub-Contract. Only such alterations as deemed unavoidable by the Engineer will be considered.

The Sub-Contractor shall collaborate with the Engineer and the Main Contractor in planning the installation before work is commenced. Particular care shall be taken to ensure that there is close collaboration with the other Sub-Contractor's when installing services.

The Engineer and Architect shall have full rights to inspect the work in progress and all materials and equipment for use in the installation prior to its erection whether these are on site or the Sub-Contractor's workshop.

The Sub-Contractor shall allow for all reasonable access to the works for this purpose.

Where large items of equipment are to be installed, the Sub-Contractor shall advise the Main Contractor in good time so that access is provided for installation before work is commenced on site.

The Sub-Contractor or his responsible representative shall participate in all site meetings as and when required, in order to discuss the works, make necessary decisions, receiving relevant instructions, confirm fulfilment of time schedules, etc.

3.5 FINISH PAINTING

When all the installations have been set to work, tested and commissioned, the Sub-Contractor shall prime the pipework with an undercoat and paint 2 No. coats of paints in accordance to BS 1710 colour coding and to the satisfaction of the Engineer and the Architect.

PART D

PARTICULAR SPECIFICATIONS

FOR

PORTABLE FIRE EXTINGUISHERS

PART D

PARTICULAR SPECIFICATIONS

FOR

PORTABLE FIRE EXTINGUISHERS

INDEX

PART D

PARTICULAR SPECIFICATION FOR THE SUPPLY AND INSTALLATION

OF PORTABLE FIRE EXTINGUISHERS

4.00 General

The Particular specifications details the requirements for the supply and installation and commissioning of the Portable Fire Extinguishers which shall conform to BS 5423 : 1977. The Sub-Contractor shall include for all appurtenances and appliances not necessarily called for in this specification or shown on the Contract Drawings but which are necessary for the completion and satisfactory functioning of the equipment.

4.01 Scope of Works

The Sub-Contractor shall supply, deliver, erect, test and commission all the portable fire extinguishers which are called for in this specification and shown on the Contract Drawings and listed in these Bills of Quantities.

4.02 Water/$C0_2$ Fire Extinguishers

The portable 9-litre water filled CO_2 cartridge operated portable fire extinguishers shall comply with BS 1382 : 1977. Unless manufactured with stainless steel, bodies shall have all internal surfaces completely coated with either a lead tin, lead alloy or zinc applied by hot dipping. There shall be no visibly uncoated areas.

The extinguishers shall be clearly marked with the following:-

a) Method of operation

b) The words 'WATER TYPE' (GAS PRESSURE) in prominent letters

c) Name and address of the manufacturers or responsible vendor.

d) The nominal charge of the liquid in imperial gallons and litres

e) The liquid level to which the extinguisher is to be charged

f) The year of manufacture

g) A declaration to the effect that the extinguisher has been tested to a pressure of 350 lb/sq in (24.1 Bar).

h) The number of the British Standard "BS 1382" or "BS 5423".

4.03 **Portable Carbon Dioxide Fire Extinguishers**

The portable carbon dioxide fire extinguishers shall comply with BS 3326 : 1960 and BS 5423 : 1977

The body of the extinguishers shall be a seamless steel cylinder manufactured to one of the following British Standards, BS 401, BS 1287 or BS 1288.

The filling ratio shall comply with BS 5355 with valves fittings for compressed gas cylinders to BS 341. Where a hose is fitted it shall be flexible and have a minimum working pressure of 3000 lb/sq in (206.85 bar), the hose is not to be under internal pressure until the extinguisher is operated.

The nozzle shall be manufactured of brass gunmetal, aluminium or stainless steel and may be fitted with a suitable valve for temporarily stopping the discharge if such means are not incorporated in the operating head.

The discharging horn shall be designed and constructed so as to direct the discharge and limit the entrainment for air. It shall be constructed of electrically non-conductive material.

The extinguishers shall be clearly marked with the following:-

a) The words 5 kg carbon dioxide fire extinguishers and to include the appropriate nominal gas content.

b) Method of operation

c) The words "Re-charge immediately after use"

d) Instructions for periodical checking

e) The number of the British Standard BS 3326 : 1960

f) The manufacturers name or identification markings.

4.04 **Dry Powder Portable Fire Extinguishers**

The portable dry powder fire extinguishers shall comply with BS 3465 : 1962 and BS 5423. The body shall be constructed of steel not less than the requirements of BS 1449 or aluminium to BS 1470 : 1972 and shall be suitably protected against corrosion.

The dry powder charge shall be non-toxic and retain its free flowing properties under normal storage conditions. Any pressurizing agent used as an expellant shall be in dry state; in particular compressed air.

The discharge tube and gas tube if either is fitted shall be made of steel, brass, copper
or other not less suitable material. Where a hose is provided it shall not
exceed 1.060 m and shall be acid and alkali resistant. Provision shall be made for
securing the nozzle when not in use.

The extinguisher shall be clearly marked with the following information:-

a) The words "Dry Powder Fire Extinguisher".

b) Method of operation in prominent letters

c) The working pressure and the weight of the powder charge in kilogrammes

d) Manufacturers name or identification mark

e) The words "RECHARGE AFTER USE" if rechargeable type.

f) Instructions to regularly check the weight of the pressure container (gas cartridge) or inspect the pressure indicator on stored pressure types when fitted, and remedy any loss indicated by either.

g) The year of manufacture

h) The pressure to which the extinguisher was tested.

i) The number of this British Standard BS 3465 or BS 5423 : 1977.

j) When appropriate complete instructions for charging the extinguisher shall be clearly marked on the extinguisher or otherwise be supplied with the refill.

4.05 **Foam Spray Portable Fire Extinguishers**

The portable foam spray fire extinguishers shall comply with BS 3465 : 1962 and BS 5423. The body shall be constructed of steel not less than the requirements of BS 1449 or aluminium to BS 1470 : 1972 and shall be suitably protected against corrosion.

The foam spray charge shall be non-toxic and retain its free flowing properties under normal storage conditions. Any pressurizing agent used as an expellant shall be in dry state; in particular compressed air.

The discharge nozzle and gas tube if either is fitted shall be made of steel, brass, copper or other not less suitable material. Provision shall be made for securing the nozzle when not in use.

The extinguisher shall be clearly marked with the following information:-

a) The words "Foam Spray Fire Extinguisher".

b) Method of operation in prominent letters

c) The working pressure and the capacity of the foam charge in litres

d) Manufacturers name or identification mark

e) The words "RECHARGE AFTER USE" if rechargeable type.

f) Instructions to regularly check the weight of the pressure container or inspect the pressure indicator on stored pressure types when fitted, and remedy any loss indicated by either.

g) The year of manufacture

h) The pressure to which the extinguisher was tested.

i) The number of this British Standard BS 3465 or BS 5423 : 1977.

j) When appropriate complete instructions for recharging the extinguisher shall be clearly marked on the extinguisher or otherwise be supplied with the refill.

4.06 **Fire Blanket**

The fire blanket shall be made from cloth woven with pre-asbestos yarn or any other fire proof material and to measure 1210 x 1800 mm and shall be fitted with Special tapes folded so as to offer instantaneous single action release blanket from storing jacket.

SECTION C

TECHNICAL SPECIFICATIONS

1. BOREHOLE DRILLING

1.1 GENERAL

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

This contract comprises the drilling, construction, development; test pumping, water quality analysis and erection of a gantry. The drill sites are indicated in the zone allocation list.

1.1.1 REGULATIONS AND STANDARDS

The borehole shall be drilled at the site to be identified by the hydrogeological survey report. Each borehole shall be drilled to a depth specified in the schedule and guided by the hydrogeological survey report. It shall be drilled through all strata encountered.

The contractor will acquire the relevant permits and Government authorizations on behalf of the employer.

1.2 MOBILIZATION, DEMOBILIZATION AND RESTITUTION

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

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

1.2.3 Site re-instatement under the conditions of contract shall include the removal of all hydrocarbons spilled, leaked or otherwise released and associated packaging and cotton waste. Site re-instate56ment is deemed an integral part of mobilization. This activity shall be costed taking into account the items above and expressed as a lump sum.

1.3 DRILLING

1.3.1 Unless otherwise approved by the Project Engineer, drilling shall be by the air hammer method, by flush rotary drilling or by the percussion method. Drilling shall continue through all strata encountered. Drilling fluids and additives used must be approved by the Project Engineer prior to use.

The Contractor shall provide the appropriate tools and equipment and maintain them in good condition capable of operating to the manufacturer's rating to ensure a smooth, straight hole.

1.3.2 Drilling shall continue to the stipulated total depth at a minimum diameter of 205 mm(8 inches) to provide for a finished borehole of a cased internal diameter of 152mm after allowing for 50 mm thick gravel pack and temporary casings as found necessary. The Project Engineer reserves the right to stop drilling operation if he considers that further drilling is unlikely to be advantageous. In this event payment shall only be made for the amount of work actually executed.

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

1.3.4 The boreholes shall be drilled straight and vertical.

1.4 SAMPLE COLLECTION, STORAGE AND RECORD KEEPING

1.4.1 Samples of the drill cuttings returned to the surface shall be collected at two (2) metre intervals, dried and bagged. Each bag shall be clearly marked with the sample depth interval and borehole number. The Contractor shall record the depth and any zone of lost circulation for whichno sample was taken.

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

1.4.3 the depth of any void, or of particular rapid penetration, or significant changes in rig noise shall also be noted.

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

1.5 SUPPLY AND INSTALLATION OF CASINGS AND SCREENS

1.5.1 CASING AND SCREEN SPECIFICATIONS

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

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

1.5.2 CASINGS AND SCREEN INSTALLATION

(a) Before installations of the casings and screens, the Contractor shall ensure that the hole is clear to the total depth and shall flush out any backfilled materials present. The Project Engineer shall provide the design of the casings and screens string prior to installation by the Contractor.

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

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

(d) Burn-through and subsequent deposition of metal on the inside of the casings and screens must be avoided. The base of the casing shall be sealed, unless otherwise directed by the Project Engineer, with a circular plate of black pipe class B of thickness not less than 4.0mm ($^1/_4$ inch) fixed with a continuous weld to the casing strip. The appropriate welding electrode shall be used. The top of the casing will be made, with oxide coating removed prior to the second and third passes. The top of the casing will be straight shall terminate not less than 600mm above the highest recorded level of ground at the site.

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

1.5.3 ADMISSIBLE RATES

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

1.6. SUPPLY AND INSTALLATION OF GRAVEL PACK

1.6.1 SPECIFICATIONS

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

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

This will initiate the process of sterilizing the well bore. The Contractor shall provide the Project Engineer with the bulk density of the pack material (Kg/M^3)

(b) Installations of the filter pack/information stabilizer may be water wash down or reverse circulation methods. In the latter case a pump set or airlift string shall be installed in the bore so as to encourage material settlement. The filter pack shall terminate not less than 3.0 meters above

the uppermost screen when stabilized, or as otherwise directed by the Project Engineer. The Contractor shall provide a means by which this level may be measured.

1.6.2 ADMISSIBLE RATES

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

1.7 INSTALLATION OF BACKFILL

1.7.1 SPECIFICATIONS

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

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

1.7.2 ADMISSIBLE RATES

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

1.8 DEVELOPMENT

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

1.8.1 BOREHOLE CLEANING

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

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

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

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

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

1.8.2 CHEMICAL DEVELOPMENT

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

b). Typical dosage shall comprise of powdered sodium Hexametaphosphate dissolve in hot water. The polyphosphate shall be dosed at 10 to 15kg/$m^3$of water depending on the concentration of clays in the aquifer matrix. This shall be mixed with calcium hypochlorite at a dose of 200 grammes per cubic meter to inhibit bacteria activity. The volume of polyphosphate dosed water shall be one and a half times the volume of water within the screen section.

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

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

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

1.8.3 PHYSICAL DEVELOPMENT

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

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

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

c). The Contractor shall describe the method he proposed to adopt and the plant required for physical development in his method statement. Over pumping shall not be considered a development method. The rate submitted by the Contractor for physical development is deemed to include installation and removal of necessary plant. The quantities given in the bills of quantities only apply to actual development time. Costs for physical development shall be expressed as an Hour Rate.

1.9 AQUIFER TESTING

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

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

1.9.1 INSTALLATION, PLANT AND METHODOLOGY

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

a) PUMPING PLANT

i) Pumps used for test pumping may electrical submersible or surface-mounted turbine pumps or reciprocating pumps.

ii) Any pump used in tests must have a fully functioning non-return valve either in the pump itself or in the rising main immediately above the top of the pump.

iii) The Contractor must have pumps covering the anticipated discharge range.

iv) The water pumped from the borehole shall be discharged to waste at a distance and in such a manner that it does not pond or flow back towards the borehole.

v) The Contractor must provide a generator or other prime mover for powering the pump, as power is not necessarily available at the sites.

b) DISCHARGE MEASUREMENT AND CONTROL

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

c) WATER LEVEL MEASUREMENT

Water level measurements shall be by electric sounding and/or lighting dipper, and shall be made in a dipper tube installed alongside the test pump rising main and tied securely to it. The Project Engineer will check the dipper for stretch and any other inaccuracies prior to accepting its use. Accuracy measurements must not be less than 1.0 cm. water level measurements using an air line will not be acceptable on the grounds of poor precision.

d) TIME MEASUREMENT

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

i) PRE-TEST

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

ii) STEP DRAWDOWN TEST

- The step drawdown test will comprise five (5) steps tests of sixty (60) minutes each, with no recovery phase between successive steps. The step drawndown test shall not start until water level has returned to the true static water level, unless otherwise directed by the Project Engineer.

- Typically, individual step discharges would comprise 25%, 50%, 75, 100, and 125% of the anticipated production discharge rate.

- Discharge increments shall be effected as nearly instantaneously as possible and once set shall not be changed except by instruction of the Project Engineer.

- Discharge variations and measurement shall be effected by means of the globe valve and manometer gauge as follows;

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

iii) CONSTANT DISCHARGE TEST

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

iv) RECOVERY TEST AND REMOVAL OF PLANT

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

v) ADMISSIBLE RATES

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

1.10 WATER SAMPLING AND ANALYSIS

- In the closing hour of the constant discharge test a water sample shall be collected for chemical and bacteriological analysis by a competent laboratory. The water samples shall be collected in containers supplied by the laboratory, in the manner conventionally used by the laboratory.

- The Contractor's unit rate of sampling and analysis will include the cost of analysis and transportation to and from the laboratory for the sampling exercise.

1.11 BOREHOLE DISINFECTION

After removal of test equipment, the borehole shall be disinfected with Chlorine/Water solution at a concentration of 50 miligrams per litre or greater of free chlorine. In preparing their Tenders, Contractors should allow for one (1) cubic metre of solution per borehole. This item shall be costed as a unit Lump Sum.

1.12 BOREHOLE HEADWORKS

a) SANITARY SEAL CASING

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

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

b) GROUT SEAL

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

c) CONCRETE PLINTH

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

d) TEMPORARY CAP

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

1.13 RECORDS

After completion of all works at the borehole, the Contractor shall submit to the Project Engineer within four (4) days a complete document with the following additions:-

- Drilling penetration Log
- Geological Log
- WAB 28 Borehole Completion Record (three complete sets of Completion Reports shall be submitted).

1.14 TECHNICAL LITERATURE

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

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

PART J

BILLS OF QUANTITIES

SCHEDULE OF PRICES

GENERAL NOTE

1. The total of price in the summary of prices shall include for the whole of the Sub-Contract Works in accordance with the specification as defined before and shall be carried forward to the Form of Tender.

2. Any prices omitted from any item, section or part of the price schedule shall be deemed to have been included in another item, section or part.

3. The prices shall include for all obligations under the Sub-Contract including and not limited to:-

   a) Supply of all materials, equipment, apparatus, fittings, spares and tools

   b) Insurance

   c) Clearing and forwarding

   d) Delivery and storage at site

   e) Packing for storage

   f) Replace any defective or damaged item

   g) Installation

   h) Testing

   i) Painting

   j) Commissioning

   k) Maintenance during the defects liability period

4. The unit rates shall include **Import Duty, Sales Tax, and VAT** where applicable, and shall be expressed in Kenya Shillings..

PROPOSED BOUNDARY WALL AND ANCILLARY BUILDINGS ON PLOT L.R. NO.20589, MACHAKOS FOR NATIONAL SOCIAL SECURITY FUND

MECHANICAL INSTALLATIONS - INTERNAL PLUMBING AND DRAINAGE WORKS

SECTION I: GATE HOUSE AND ANCILLARY BUILDINGS

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
1	**BILL NO.1: INCOMING MAINS WATER PIPE AND PROVISIONS ELEVATED TANK**				
1.1	**Water metre chamber**				
i	Construct 450*450*600(d) mm internal dimensions water meter chamber with 100mm wall and base thickness built in-situ with 1:3:6 concrete supplied with 25mm GRP cover, rim, lifting lugs and greased rim to Engineers approval.	2	no.		
1.2	**Incoming Mains Council & Borehole Water to Reservoir Tank**				
	Supply, deliver, install, test and commission the following high density polyethene pressure pipe **"HDPE PN16"** (16kg/sq.cm), with a wall thickness of 10mm, SDR 11 in accordance to ISO 4427-2:2007, black in colour and UV protected.				
	All pipes should be permanently and legibly marked as **"Danco"** using a hot embossed foil stamp printing. The pipes shall contain three Equi spaced blue longitudinal stripes indicating water as the medium transported within the pipes.				
	Tenderers must allow in their pipework prices for all the couplings, connectors, unions, joints etc as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holderbats plugged and screwed, pipe sleeves through the roads and laid in trench.				
	Note: The jointing method for the pipes and fittings shall be butt fusion.				
a	HDPE Straight Run Pipe				
a.1	Ø50mm straight run pipe	200	lm		
b	Extra over pipes				
b.1	Bends				
i	Ø50mm*90 deg. bend	4	no.		
ii	Ø50mm*45 deg. bend	4	no.		
b.2	Brass adaptors				
i	Ø50mm male adaptor	8	no.		
ii	Ø50mm female adaptor	4	no.		
c	Control valves				
i	2" Gate valve as "Pegler".	2	no.		
ii	2" Flap type Non-Return valve as "Pegler".	2	no.		
iii	2" high pressure float valve with Ø200mm float ball as "Pegler"	2	no.		
d	Water pipe caution tape				
i	Supply and install 150mm wide, 100 micron thick caution tape, blue in colour with clear warning words "caution, water pipe below" and buried 200mm above pipe surface after backfill.	2	no.		

Sub-totals C/F to next page

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	Sub-totals B/F from previous page				
1.3	**Elevated Water Storage Tanks**				
a	Double layer, rotary moulded cylindrical tanks as **"Top Tank"** or equal and approved with a capacity of 10,000 litres, dim: Ø2430x2260(h)mm. The tanks to have a Ø50mm inlet connection & Ø63mm outlet connection, Ø63mm overflow Ø63mm washout and ball valve, backnuts, lid and a Ø63mm high pressure cast brass ball valve and high pressure polypropylene plastic float.	1	no.		
1.4	**Water Filters**				
a	Supply and install the following 2-stage inline water filters;				
i	Stage 1 Self cleaning strainer filter with a backwash facility activated filter c/w a cartridge, drain valve, strainer made of plastic net of 90 microns with a flow rate of 10m³/hr at a static pressure of 8 bars as **"Make: Atlas, Model: Hydra".**	1	no.		
ii	Stage 2 Self cleaning strainer filter with a backwash facility activated filter c/w a cartridge, drain valve, strainer made of pleated plastic of 50 microns with a flow rate of 10m³/hr at a static pressure of 8 bars as **"Make: Atlas, Model: Hydra".**	1	no.		
1.6	**Sterilisation**				
i	Allow for disinfection/sterilisation and flushing out of the water tank of capacity:10,000 litres and pipework with water containing 0.05g/l granular calcium hypochlorite for a minimum period of 24hrs.	1	item		
1.7	**Testing and Commissioning**				
	Allow for butt fusion of the joints, pre and post hydrostatic pressure testing not exceeding 6 Bars minimum of 24hrs Engineers approval.	1	item		
	Sub-totals for Bill No.1: Incoming Mains Water Pipe and Provisions to Water Reservoir Tanks to Collection Page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
2	**BILL NO.3: EXTERNAL PLUMBING INSTALLATIONS**				
2.1	**Site Water Reticulation Pipe**				
	Supply, deliver, install, test and commission the following high density polyethene pressure pipe **"HDPE PN16**" (16kg/sq.cm), with a wall thickness of 10mm, SDR 11 in accordance to ISO 4427-2:2007, black in colour and UV protected.				
	All pipes should be permanently and legibly marked as **"Danco"** using a hot embossed foil stamp printing. The pipes shall contain three equi - spaced blue longitudinal stripes indicating water as the medium transported within the pipes.				
	Tenderers must allow in their pipework prices for all the couplings, connectors, unions, joints etc as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holderbats plugged and screwed, pipe sleeves through the roads and laid in trench.				
a	HDPE Straight Run Pipe				
i	Ø63mm straight run pipe	100	lm		
ii	Ø32mm ditto"	50	lm		
b	Extra over pipes				
b.1	Bends				
i	Ø63mm x 90° mm bend	12	no.		
ii	Ø32mm x 90° mm bend	5	no.		
b.2	Equal Tee				
i	Ø63mm tee	5	no.		
b.3	Saddle Clamps				
i	Ø63mm x 1 1/2" clamp	8	no.		
ii	Ø63mm x 3/4" clamp	8	no.		
b.4	Adaptors				
i	Ø63mm x 2" male adaptor	6	no.		
c	Control Valves				
i	2 1/2" Gate valve as "Pegler".	5	no.		
ii	1" Gate valve as "Pegler".	3	no.		
d	Stand pipes				
i	Ø25mm GMS Pipe complete with Ø20mm Aluminium hose taps.	4	no.		
e	Water Pipe Caution Tape				
i	Supply and install 150mm wide, 100 micron thick caution tape, blue in colour with clear warning words "caution, water pipe below" and buried 200mm above pipe surface after backfill.	10	no.		
2.2	**Gate valve chamber**				
i	Construct 450*450*600(d) mm internal dimensions gate valve chamber with 100mm wall and base thickness built in-situ with 1:3:6 concrete supplied with 25mm GRP cover, rim, lifting lugs and greased rim to Engineers approval.	4	no.		
2.3	**Pipe markers**				
i	150x150x600mm long concrete pipe route markers cemented firmly on ground.	3	no.		
2.4	**Road Crossing Sleeves**				
	Allow for Ø200mm sleeves made from Class 41 PVC Pipe.	40	lm		
	Sub-totals for Bill No.2: External Plumbing Installations to collection page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
3	**BILL NO.3: INTERNAL PLUMBING AND DRAINAGE INSTALLATIONS**				
3.1	**Water Supply to Internal Facilities**				
	Supply, deliver and install **CPVC 4120, SDR 13.5** Plastic pipes and fittings as per ASTM D-2846 As **"Astral Technologies".**				
	Tenderers must allow in their pipework prices for all the couplings, connectors, unions, expansion loops, jointing materials etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holderbats plugged and screwed, and pipe sleeves through structural members.				
	The entire plumbing installation should withstand a test pressure of 6 bars.				
a	Control valves				
i	Ø32mm gate valve as "Pegler"	4	no.		
b	Brass Threaded Adaptors				
i	Ø32mm x 1" male bush	8	no.		
ii	Ø32mm x 1" female bush	8	no.		
c	Cold water pipes				
c.1	Vertical Roof pipe work				
i	Ø32mm	8	lm		
c.2	Horizontal pipe work				
i	Ø32mm	36	lm		
ii	Ø25mm	24	lm		
c.3	Extra over pipes				
	Elbow/bend				
i	Ø32mm	18	no.		
ii	Ø25mm	26	no.		
	Fittings				
c.4	Equal Tee fittings				
i	Ø32x25mm reducing tee	14	no.		
ii	Ø25x25mm equal tee	28	no.		
c.5	Brass threaded adaptors				
i	Ø25mmx1/2" female elbow	16	no.		
ii	Ø25mmx1/2" female tee	16	no.		
iii	Ø25mmx1/2" female threaded bush	12	no.		
iv	Ø32mmx1" male threaded bush	4	no.		
d	Hot water pipes				
d.1	Horizontal pipe work				
i	Ø25mm	24	lm		
d.2	Extra over pipes				
	Elbow/bend				
i	Ø25mm	12	no.		
	Fittings				
d.3	Equal Tee fittings				
i	Ø25x20x25mm equal tee	8	no.		
	Fittings				
d.4	Equal Tee fittings				
i	Ø25x20x25mm equal tee	8	no.		
d.5	Brass threaded adaptors				
i	Ø25mm*1/2" female elbow	8	no.		
ii	Ø25mm*1/2" female tee	6	no.		
iii	Ø25mm*1/2" female threaded bush	8	no.		

Sub-totals C/F to next page

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	Sub-totals B/F from previous page				
d.6	Control Valves				
i	Ø25mm gate valve as Pegler	1	no.		
2.2	**Soil and Waste Water Drainage Installations**				
	Supply & install the following soil & waste water drainage pipework as described and shown in the drawing.				
	All pipes and fittings shall be uPVC and MuPVC to BS5572:1978 and BS5750 as manufactured by 'Key Terrain' or equal and approved.				
	All joining's and fixtures shall be in accordance with the manufacturers instructions and as described.				
	Tenderers must allow for joining's, couplings, holderbats, reducers, clippings, spacers etc, necessary for the proper functioning of the installation when pricing.				
	The pipes will be pressure tested before the backfilling the trenches as per the manufacturers recommended testing pressures.				
a	Horizontal discharge pipes in Golden brown heavy duty MuPVC pipes class 41 as 'Key Terrain' or equal and approved				
i	Ø100mm	12	lm		
b	Horizontal discharge pipes in Golden brown heavy duty MuPVC pipes class 41 as 'Key Terrain' or equal and approved				
i	Ø100mm	64	lm		
ii	Ø50mm	48	lm		
iii	Ø40mm	18	lm		
c	<u>Extra fittings over pipes</u>				
i	Ø100mm WC connector	6	no.		
ii	Ø100mm seal ring adaptors	6	no.		
iii	Ø100mm sweep bend	18	no.		
iv	Ø100x50mm boss connector	3	no.		
v	Ø100x40mm boss connector	2	no.		
vi	Ø50x40mm reducer	2	no.		
vii	Ø50mm sweep bend	2	no.		
viii	Ø50mm sweep tee	2	no.		
ix	Ø50mm plug	4	no.		
x	Ø40mm sweep bend	2	no.		
xi	Ø40mm sweep tee	2	no.		
xii	Ø40mm plugs	4	no.		
xiii	Ø100mm Vent cowl	2	no.		
d	<u>Water traps/Trapped gulleys</u>				
i	Four way trapped floor gulleys ref:281.2 and all interconnecting accessories and 'PVC' cover grating or equal & approved.	9	no.		
e	Gulley trap chamber ref:1844.4.25 size 350*350*450(d) mm in glass reinforced cover etc and allow for excavation in soil or murram and making good.	9	no.		
	Sub-totals C/F to next page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	Sub-totals B/F from previous page				
2.3	**Rainwater drainage Installations**				
a	Vertical discharge heavy duty pipes in grey or white colour as 'Metro' or equal and approved.				
i	Ø100mm straight run pipes	56	lm		
b	Extra fittings over pipes				
i	Ø100mm shoe bend	7	no.		
ii	Ø100mm sweep bend	14	no.		
iii	Ø100mm paddle flange	7	no.		
iv	150x150 Roof grating c/w frame in mild steel and painted in rust free paint as rain water full Bora.	8	no.		
	Sub -Totals for Bill No.2: Internal Plumbing and Drainage Installations to Collection Page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
3	**BILL NO.3: SANITARY FITTINGS INSTALLATIONS** Supply, deliver, install, set to work, test and commission the following sanitary fittings described below and supplied by others:- The works shall include all necessary joints to services, overflow and waste pipes jointing materials, mortices, plugs, screws, bolts and making good as described and shown on the drawing. **All sanitary ware as "Miran" or equal and approved:** Note: (i) All sanitary fittings shall be in approved colour. (ii) The Model and Ref No. indicated is only a guide to the type and quality of fittings. (iii) Equivalent and Approved models may be acceptable.				
a	<u>Water closets</u>				
a.1	White vitreous China dual flush, close coupled suite (2 piece) comprising of closet "P" or "S" trap, 6 litres cistern with valveless fittings including syphon, internal overflow, 1/2" bottom inlet connection, chrome plated flushing button, heavy duty plastic seat and cover, pan plugged and screwed to concrete floor and bedded in mastic and cistern fixed to walls measuring 625x360x825mm as **"Make: Miran, Model: MN537"** or equal and approved.	8	no.		
a.2	Hand Spray Hand spray complete with a hose and angle valve as **"Make: Miran, Model: MN-DSS"** or equal and approved.	4	no.		
a.3	Angle Valve Ø15mm chrome plated angle valve as **"Make: Miran, Model: MN-AV"** or equal and approved.	12	no.		
a.4	Flexible connector 1/2*1/2*300mm long metallic woven flex connector as **"Make: Miran, Model: MN-FT1.5".**	8	no.		
a.5	Wall mounted toilet roll holder, chrome plated of size 165x165mm a flipping cover as **"Make: Miran, Model: 96710"** or equal and approved.	8	no.		
b	<u>Wash hand basin</u>				
b.1	Counter top wash hand basin				
i	Counter top wash hand basin with an overflow, 1No. Tap hole configuration, Ø40mm waste outlet measuring 600x430x145mm as: **"Make: Miran, Model: 4323"** or equal and approved.	2	no.		
b.2	Wall mount wash hand basin				
i	White vitreous China, size 515x395x825mm fitting with 1 tap hole configuration complete with dia.32mm chrome plated waste, P trap and chain waste, chain and stay, heavy duty plastic bottle trap 75mm seal, full pedestal as **"Make: Miran, Model;1088"** or equal & approved	6	no.		
b.3	WHB Taps				
i	Single lever, wash hand basin mixer pillar type tap as **"Make: Miran, Model: MN-62201"** for hot and cold water, chrome plated complete with 1/2" BSP female inlet and flexible connectors.	4	no.		
ii	Single lever, wash hand basin mixer pillar type tap as **"Make: Miran, Model: MN-1005"** for cold water, chrome plated complete with 1/2" BSP female inlet.	4	no.		
b.4	Angle Valve Ø15mm chrome plated angle valve as **"Make: Miran, Model: MN-AV"** or equal and approved.	12	no.		
	Sub-totals C/F to next page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	Sub-totals B/F from previous page				
b.4	Flexible connector 1/2*1/2*300mm long metallic woven flex connector as **"Make: Miran, Model: MN-FT1.5".**	4	no.		
b.5	Mirrors				
i	6mm thick polished plate glass, silver backed mirror with bevelled edges, size 800x600mm plugged and screwed to wall with 2No.chrome plated capped screws and 5mm thick foam back rest.	8	no.		
ii	6mm thick polished plate glass, silver backed mirror with bevelled edges, size 800x600mm plugged and screwed to wall with 2No.chrome plated capped screws and 5mm thick foam back rest.	3	no.		
b.6	Soap dispenser				
i	ABS Thermoplastic, white finish soap dispenser c/w vandal resistant casing & lock, front content viewer, s/s push button, corrosion resistant anti-drip valve, easily removable inner tank, hinged cover for the operator, suitable for disinfectant solutions and liquid soaps, measuring 100*275(mm) of capacity 1.0Ltrs as **"Tapis", Ref: ESOPDSP43,** or equal and approved.	4	no.		
b.7	Automatic Hand drier Automatic wall mounted stainless steel electric automatic touch free hand drier for electrical supply compatible with 220/240, 50Hz single phase supply and to be complete with a mounting plate, centrifugal fan and motor 2700rpm with thermal overload relay and radio suppression, total power 2750W spirally wound element with automatic re-setting thermal cut-out and wiring from local isolator as **"Make: Tapis, Model: EHNDDRY11"** or equal and approved.	4	no.		
c	Kitchen sink				
c.1	Stainless steel grade 304 kitchen sink as single bowl, single drain heavy duty finished in bright machine polish to BS 1449: part 2; 1983, size 1000*550mm as **"Make: Miran, Model: MN-851"** complete with chain waste, 1No. Hole, chain and stay, 40mm chrome plated waste, 40mm heavy duty plastic P-trap, with 75mm deep seal or equal and approved.	5	no.		
c.2	Kitchen sink pillar type mixer with swivel outlet for cold and hot water, chrome plated c/w flex. connectors as **"Make: Miran, Model: MN-851"** or equal and approved.	5	no.		
c.3	Angle Valve Ø15mm chrome plated angle valve as **"Make: Miran, Model: MN-AV"** or equal and approved.	10	no.		
d	Cleaners Sink				
d.1	Built-in single bowl stainless steel cleaners sink, satin finish to BS1449:PART 2, 1982 measuring 500*400mm, 1 no. hole, chain stay hole, Ø40mm waste hole, heavy duty PVC bottle trap and seal as **"Make: Sterling",** Ref. H16SIN0303 or equal and approved.	1	no.		
d.2	Bib Taps Long neck, chrome plated bib tap as **"Make: Plumber, Model: NEC-0203"** with 150mm wall mounted supplied with cold indices.	1	no.		
d.3	Aluminium finish bib hose tap for laundry machines as **"Make: Miran, Model: MN-GT"** or equal and approved.	1	no.		
	Sub-totals C/F to next page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	Sub-totals B/F from previous page				
e	Shower Fittings				
e.1	Single lever, concealed divertor shower mixer consisting 1/2" chrome plated brass concealed shower mixer with diverter as **Make" Miran, Model: MN-62407"** or equal and approved.	4	no.		
e.2	Single function shower rose consisting of 1/2" chrome plated single function and dia.800mm circular shower head, a 450mm long shower arm, silicon nozzles as **"Make: Miran, Model: A82C/SY-3580C"** or equal and approved.	4	no.		
e.3	Wall mounted and chrome plated spout consisting of origins bath spout as **"Make: Miran, Model: PM-4105"** or equal and approved.	4	no.		
e.4 i	Soap Dish Surface mounted, chrome plated corner type soap basket c/w screws measuring 175x175mm as **"Make: Miran, Model: MN-809"** or equal and approved.	4	no.		
e.5 i	Robe hook Chrome plated, double sided coat hook c/w screws as **"Make: Miran, Model: 51505"** or equal and approved.	8	no.		
e.7 i	Towel Ring Chrome plated towel ring as **"Make: Miran, Model: 96711"** or equal and approved.	4	no.		
f	Urinal				
f.1 i	Urinal bowl Urinal bowl with top inlet for exposed pipework, pair of supports, 1 1/2 diameter domed outlet urinal grating and plastic bottle P-trap with an extension to the wall and flange in Vitreous China as "**Make: Miran, Model: 6602"** or equal and approved.	1	no.		
f.2 i	Urinal Divider Urinal divider measuring 720(h)*320(d)mm,	1	no.		
f.3 i	Exposed Flush Valve Chrome plated, exposed and auto closing urinal flush valve as **"Make: Plumber, Model: AC8107"** or equal and approved.	1	no.		
	Sub -Totals for Bill No.3: Sanitary Fittings Installations to Collection Page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
4	**BILL NO.4: FIRE FIGHTING INSTALLATIONS** Supply, install and commission the following portable fire extinguishers complete with initial discharge and mounting brackets as per specifications. All Extinguishers must be from approved manufacturers by the Fire Protection Association of Kenya.				
4.1	**Portable Fire Extinguishers** Supply, install and commission the following portable fire extinguishers complete with initial discharge and mounting brackets as per Specifications. All Extinguishers must be from approved manufacturers by the Fire Protection Association of Kenya.				
a	9kg dry powder fire extinguisher gas cartridge type in metal casing and fixed to wall surface as **"Atlas"** or equal and approved with content gauge for Class D fires.	5	no.		
b	Fire Blanket				
i	1.8x1.8m fire blanket and container with hangers and mounting brackets as **"Zenith"** or equal and approved.	4	no.		
c	Printed fire signage to Engineers approval and as follows;				
i	Fire action signs c/w instructions and emergency number display in blue colour.	4	no.		
ii	Fire extinguisher signage in red colour.	4	no.		
	Sub -Totals for Bill No.4: Fire Fighting Installations to Collection Page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
5	**BILL No.5: HEAT PUMP INSTALLATION**				
	Supply, deliver, set to work, test and commission the following heat pump;				
5.1	**Main Kitchen**				
i	300 Litres domestic water heat pump complete with a digital controller for operational, timer settings and fault detection. The heat pump to have a coefficient of performance (COP) of more than 4 at ambient temperature and a settable hot water temperature of up to 70°C. The heat pumps to be supplied with adequate R134A refrigerant and an integral 2kW electric heating element for temperature boosting during the cold season as **"Make: Dayliff, Model: HPW300"** or equal and approved.	1	no.		
5.2	**Hot Water Plumbing Installations**				
	Supply, deliver and install plumbing pipes as described below; All water distribution pipes in building to be in **PPR PN20** for hot water laid in accordance with the manufacturers instructions. Pipe work to have suitable approval certificates and in particular the following: DIN 1988 3rd Part; Technical Rules for drinking water				
i	W 328 ;Installation of pipelines for drinking water inside buildings				
ii	WOB/c DIN 18381; Installation work for gas, water, drainage systems inside building.				
iii	Any other local / EU approvals				
a	<u>Supply to roof water tanks</u>				
a.1	Straight run pipes				
i	Ø25mm	24	lm		
	Extra fittings to pipe				
a.2	<u>Elbow/bend</u>				
i	Ø25mm	8	no.		
b	<u>Fittings</u>				
b.1	Union				
i	Ø25mm PPR Union	6	no.		
b.2	Brass threaded adaptors				
i	Ø25mm x 1" female tee	6	no.		
ii	Ø25mm x 1" female adapter	12	no.		
a.7	<u>Control valves</u>				
i	1" Brass type gate valve as "Pegler".	6	no.		
ii	1" Brass type Non Return Valves as "Pegler".	3	no.		
b	Electrical wiring.				
i	Supply, deliver and install 2.5m² power cable as "Metsec" or equal and approved.	20	lm		
c	<u>End user training</u>				
a	Allow of the end user training on how to operate, maintain, clean and flush the heat pump system.	1	item		
	Sub-totals for Bill No.5: Heat Pump Installations to Collection Page				

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
	COLLECTION PAGE - GATE HOUSE AND ANCIILLIARY BUILDINGS				
1	Sub-Totals for Bill No.1: Mains Water Pipe and Elevated Tank Installations				
2	Sub-Totals for Bill No.2: Internal Plumbing & Drainage Installations				
3	Sub-Totals for Bill No.3: Sanitary Fittings Installations				
4	Sub-Totals for Bill No.4: Fire Fighting Installations				
5	Sub-Totals for Bill No.5: Heat Pump Installations				
	Totals for Gate House and Ancillary Buildings Mechanical Installations to Main Summary Page				

PROPOSED BOUNDARY WALL AND ANCILLARY BUILDINGS ON PLOT L.R. NO.20589, MACHAKOS
FOR NATIONAL SOCIAL SECURITY FUND
MECHANICAL INSTALLATIONS - INTERNAL PLUMBING AND DRAINAGE WORKS

SECTION II: BOREHOLE DRILLING AND EQUIPPING

Item Ref.	Description	Qty	Unit	Rate (Kes)	Total Amount (Kes)
1	Mobilization of all equipment and personnel to site and later remove and clear the site of all equipment upon completion of the drilling of the borehole.	1	Item		
2	Erecting and dismantling of the drilling rig unit from the site.	1	Item		
3	Mobilization/Demobilization of all test plumbing equipment Supply, install	1	Item		
4	and retrieve 8″/9″ dia temporary steel casing in collapsing formation.	2	lm		
5	Drilling to be carried out to depth specified and of 9" Diameter as follows:-				
a	Ground level to 100M	150	lm		
b	100M to 200M	100	lm		
c	200M to 300M	100	lm		
6	Supply and inserting 168mm dia plain socketed steel casings (4.5mm thickness) Class 'B'	200	lm		
7	Supply/inserting 168mm dia plasma slotted steel socketed screens (4.5mm thickness) Class 'B'	150	lm		
8	Supply and install gravel pack 2/4mm grain and put into borehole and screen annulus.	6	Tons		
9	Borehole development work by air jetting.	6	Hrs		
10	Carry out 24 hrs constant discharge test pumping to determine the	24	Hrs		
	yield of the borehole and take measurements borehole recovery rates.	24	Hrs		
11	Extra Hours - waiting charges per hour	Rate	Hr		
12	Construct wellhead chamber and cover of 1m × 1m × 0.5 of ratio: 1:2:3 concrete mixture.	1	Item		
13	Supply and install borehole cap	1	Item		
14	Supply of anticipated drilling foam for drilling	1	Item		
15	Chemical, Biological and Physical analysis of the borehole water.by a recognized laboratory	1	Item		
16	Allow for borehole logging and Rock sample collection	1	Item		
17	Allow for a hydrogeological Survey for the site and report to be forwarded to WARMA.	1	Item		
18	Apply and Obtain Drilling and Extraction Permits including all charges from the relevant authorities.	1	Item		
19	Follow up with local authorities and utility providers for all documentation processing and records including letters of no objection and NEMA approvals	1	Item		
20	STATE ANY OTHER ITEMS				

Grand Total for Borehole Drilling to Summary Page (VAT Inc)

PROPOSED BOUNDARY WALL AND ANCILLARY BUILDINGS ON PLOT L.R. NO.20589, MACHAKOS FOR NATIONAL SOCIAL SECURITY FUND

MECHANICAL INSTALLATIONS - INTERNAL PLUMBING AND DRAINAGE WORKS

MAIN SUMMARY PAGE - MECHANICAL SERVICES INSTALLATIONS

Item Ref.	Description	Total Amount (Kes)
1	**Section I: Totals for Gate House and Ancillary Buildings Installations**	
2	**Section II: Totals for Borehole Drilling**	
3	**Working and As-Installed Drawings**	
a	Prepare and submit working drawings comprising the following to the satisfaction of the Engineer both in hard and soft copy. All soft copy drawings to be in AutoCAD format:- - Routes - types & sizes of all pipework. - Schematic diagrams. - General arrangement drawings of equipment, plant etc. - All the required operating instructions for all pipes, boards etc. - Maintenance, operational and installation Manuals for all items installed.	
4	**Provisional Sum**	
a	Borehole Equipping and Solarisation	2,500,000.00
5	**Testing and Commissioning**	
a	Allow for systems testing and commissioning to the satisfaction of the Architect/Engineer	
6	**Contingency Sum**	
a	Provisional Contingency Sum	500,000.00
13	**Preliminaries**	
a	Insurance	
b	Performance Bond	
	Grand Totals For Mechanical Installations (16% VAT Inc) to Main Works Summary Page	

Item Ref.	Description	Total Amount (Kes)

Grand total amount in words .

Kes----------

Contract Period .....Weeks

Tenderers'.

Name:----------

Official Stamp:----------

V.A.T. No.:---------- P.I.N----------

Witness:----------

Signature:----------

Date:----------