TENDER DOCUMENT

TENDER No.: DLI/ CON/BAILHONGAL/419

FOR

Providing Screen Chamber, Grit chamber, Wet Well (2 No’s) Construction of 8.28mld Capacity Aerated Lagoon and Allied Works (Pkg-2)

VOLUME – II

ADDITIONAL CONDITIONS OF CONTRACT

CLIENT DOCUMENTS
(CLIENT GCC, SCC & SPECIFICATIONS)

DRAWINGS
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of General Conditions of Contract, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 INTRODUCTION

Karnataka Urban Water Supply & Drainage Board is a separate body under the Urban Ministry, Government of Karnataka involved in providing Water supply and Drainage facilities to Urban areas of Karnataka.

3.0 Scope of work:

The project site for the work is available.

The brief scope of work in this tender shall include (but not limited to) Construction of 10.50 Mtr Dia RCC wetwell cum pump house in Zone -1, Inlet and Screen Chambers of Wet Well in Zone-1, Piping, Mechanical and Electrical works for Wetwell in Zone -1, Construction of valve chamber for Wetwell in Zone -1, Construction of 6.00 Mtr Dia RCC wetwell cum pump house, Inlet and Screen Chambers at Wetwell for zone 2 & 3, Piping, Mechanical and Electrical works for Wetwell, Supply and laying of 300mm DI K-7 class pipe, Supply and laying of 400mm DI K-7 class pipe, Construction of valve chamber for Wetwell, Construction of Diesel Generator Room of size 4 m x 6 m for both wetwells, Providing 100mm,300mm & 500 mm dia Ductile Iron class K-7 Pumping Mains from wet well to STP, Construction of Primary treatment units at STP, Construction of Sewage Treatment Plant of 8.28 MLD capacity consisting of,

a.i) Construction of Aerated Lagoons at STP Site.
a.ii) Construction of Interconnecting RCC Channel From Division Box to Aerated Lagoon.
a.iii) Construction of 2 Nos Interconnecting RCC Channel From Aerated Lagoon to Basin.
b.i) Construction of Northern & Southern Sedimentation Basins at STP Site.
b.ii) Construction of Interconnecting RCC Outlet Channel From Basin to Outlet Chamber for Northern and Southern Sedimentation Tank.
c) Construction of DG Room of Size 4 M X 6 M.
d) Construction of laboratory room of size 6 M X 10 M near STP.
e) Construction of Switch gear room of size 6 M X 9 M near STP.
f) Construction of Type 'A' Staff Quarters.
g) Mechanical and Electrical Equipments at STP consisting of Motors for Aerator 9HP capacity, Reduction Gear Boxes, Paddle Assembly, Diesel Generator set-125 KVA.
h) Providing Approach road at STP site.
i) Providing Barbrd wire fencing allround STP site

Apart from above, any other services not covered above but required as per direction of EPI are deemed to be included in the scope of work. The work is to be carried out on item rate basis as per bill of quantities and tender conditions.
4.0 ORDER OF PRECEDENCE

i. NIT
ii. MEMORANDUM, ACC
iii. BOQ, TECHNICAL SPECIFICATION AND DRAWINGS
iv. EPI GCC
v. CLIENT DOCUMENTS (GCC, SCC AND CLARIFICATIONS ETC.)

5.0 DISQUALIFICATION

The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if:

a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their on going / past projects.

c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

d) If the tenderers attempt to influence any member of the selection committee.

EPI reserves its right to take appropriate action including disqualification of tenderer(s) as may be deemed fit and proper by EPI at any time without giving any notice to the contractor in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the Tenderers.

6.0 The set of tender documents shall contain one set of hard copy of tender drawings. The original hard copy of tender drawings shall be returned along with the tender documents duly signed and stamped by the tenderer and shall form part of agreement.

7.0 SPECIFICATIONS

i) All works in general are to be carried out in accordance with the KUWS & DB Specifications which are detailed in technical specification separately attached with this tender.

ii) This contract shall be governed by the Indian Laws for the time being in force. The contract is confidential and must be strictly confined to the purposes of the contract.

iii) The contractor shall provide everything necessary for the proper execution of the works according to the intent and meaning of the specifications and drawings taken together whether the same may or may not be particularly shown or described therein provided that the same can be reasonably be inferred there from and if the contractor finds any discrepancy in the specifications and drawings and between the drawings,
he shall immediately and in writing refer the same to the employer who shall decide which is to be followed.

vi) The work order/LOI will be issued by EPI and handing over of the site and date of commencement of the contract shall be within 10 (ten) days of issue of such letter.

8.0 PRICE ESCALATION
Escalation shall be payable as per relevant Clause no 70.2 of Client with base Index same as fixed by KUWS & DB.

9.0 MOBILIZATION ADVANCE – Clause no. 8.0 (8.1 – 8.6) of General Conditions of Contract (GCC) is Deleted.

10.0 WATER & ELECTRICITY – The required water and electricity to be arranged by the tenderer only.

11.0 RETENTION MONEY - As per Client conditions Clause no 60.5 (GCC) Retention money has been deleted and Performance BG is kept for defect liability period. Also the Performance BG is increased from 5% to 6%.

12.0 TAXES AND DUTIES :
All Taxes and Duties are included as per Clause 13.0 of EPI's GCC. Client’s GCC Clause No 73.1,73.2 & 73.3 shall also be applicable.

13.0 Joint ventures are not allowed.

14.0 (a) Work related queries-
Bidders are advise to visit site and go through the EPI/CLIENT documents before quoting rates however for any query bidders are advise to contact EPI Chennai office/ Site. The work is to be carried out in accordance with technical specifications, drawings and approved make/vendors of client.

(b) Payment against deviation/ extra items-
Deviations/ extra items shall be carried out with prior approval of client/ EPI. On Approval & receipt of payment of such items from client, 93% payment shall be released after deducting 7% EPI's overhead and profit margin.

15.0 Terms of Payment: In addition to Clause nos 37.1,37.2.37.3 & 37.4 of GCC (EPIL) the following clauses nos 60.1( Chapter 2 General Conditions of Contract, Page no 59),Clause no 35.1 and sub clauses (a),(b),(c),(d) & (e) (under Special conditions of Contract , Page no 105)of Client are also applicable.

16.0 PLANT MACHINERY SHUTTERING MATERIAL ADVANCE
An advance for plant, machinery & shuttering material required for the work and brought to site by the contractor m,ay be given if requested by the contractor in writing within one month of bringing such plant and machinery to the site subject to the approval by the client. Such advance shall be given on such plant & machinery, which
in the opinion of the EIC will add to the expeditious execution of work and improve the quality of work. The amount of advance shall be restricted to 5% of the order value. In case of new plant & equipment to be purchased for the work, the advance shall be restricted to 90% of the price of such new plant & equipment paid by the contractor for which the contractor shall produce evidence satisfactory to the EIC. In the case of second hand & used plant & equipment, the amount of such advance shall be limited to 50% if the depreciated value of plant and equipment as may be decided by the EIC. The contractor shall if so required by the EIC, submit the statement of value of such old plant and equipment duly approved by a registered valuer recognized by the Central Board of Direct Taxes under the IT act -1961. No such advance shall be paid on any plant and equipment on perishable nature and on any plant and equipment of a value less than Rs. 50,000/-.

Leasing of equipment shall be considered at par with purchase of equipment and shall be covered by tripartite agreement with the following:

1. Leasing company, which has given certificate of agreeing to lease equipment to the contractor.
2. Engineer-In charge, and
3. The contractor.

The advance shall further be subject to the condition that such plant and equipment (a) are considered by the EIC to be necessary for the work, (b) and are in working order and are maintained in working order, (c) hypothecated to the Government as specified by the EIC before the payment of advance is released. The contractor shall not be permitted to remove from the site such hypothecated plant and equipment without the prior written permission of the EIC. The contractor shall be responsible for maintaining such plant and equipment in good working order during the entire period of hypothecation failing which such advance shall be entirely recovered in Lump sum. For these purpose, steel scaffolding and formwork shall be treated as plant and equipment.

The contractor shall insure the plant and equipment, machinery for which mobilization advance is sought and given, for a sum sufficient to provide for their replacement at site. Any amount not recovered from the insurer will be borne by the contractor.

The advance shall bear simple interest at the rate of 10% per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive. The entire advance shall be recovered by the time eighty percent of the gross value of work is executed and paid.

17.0 COMPLETION AND TAKING OVER

As soon as the project is finally completed, the Contractor shall inform EPI and EPI shall in turn inform to KUWS & DB. KUWS & DB shall nominate a Board of Officers for checking/ verification of completed work as per the scope of work for final taking over the project.
18.0 A final certificate of rectification of all defects pointed out by the handing over taking over board detailed by KUWS & DB /EPI and / or during defect liability period shall be obtained from the nominated officer of KUWS & DB /EPI prior to releasing of the Security deposit by EPI.

19.0 Clause No. 72.4.1 of GCC stands modified as under:

Within 10 (Ten) days of date of Letter of Intent, the contractor shall submit a Time and Progress Chart (CPM/PERT/Quantified Bar Chart) and get it approved by the Engineer-in-Charge. The Chart shall be prepared in direct relation to the time stated in the contract documents for completion of items / scope of the works. It shall indicate the forecast (milestones) of the dates of commencement and completion of various items trades, sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the contract documents, to ensure good progress during the execution of the work. The physical report including photographs shall be submitted by the contractor on the prescribed format & the intervals (not later than a month) as decided by the Engineer-in-Charge. The compensation for delay as per clause 72.1 (revised as per ACC) shall be livable at intermediate stages also, in case the required progress is not achieved to meet the time deadlines of the completion period and / or milestones of time and progress chart provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the tendered value of work.

In case entire work is completed within the total time period of completion or extended period of completion allowed, the compensation for delay due to not achieving progress at intermediates stage, if any, shall be refunded without any interest charges.

20.0 PLANT & MACHINERY

All plant & machinery required for execution of work shall have to be arranged by the contractor at his own cost. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as per contract documents.

The contractor will not be allowed to take out equipments from the site without the written permission of Engineer-in-Charge.

21.0 The final bill will be submitted by the contractor within 90 days from the date of acceptance of completion of work accompanied by the following documents:

a) Completion certificate issued by the Engineer-in-Charge specifying the handing over of the work including list of inventories (fittings & fixtures).
b) Computerized stage wise payment schedule.
c) No claim certificate by the contractor.
d) No claim certificate from the sub-agencies / vendors engaged by the contractor.
e) ‘As built’ drawings.
f) Periodical services and measurement books.
g) Drawings for layout of underground cables and details showing location of sluice valves, electric cable joints etc.
h) All operation and maintenance manuals.
i) All statutory approvals from various state / central govt. local bodies, if required for completion & handing over of the work as included in scope of Contractor.
j) Manufacture’s guarantee of various machines / equipments installed as part of works.

22.0 **Clause no 45 of GCC stands modified as under:**

EPI shall supply major Materials such as DI Pipes, Stone ware pipes, RCC pipes, UPVC pipes & valves on actual cost recovery basis. The Contractor shall submit the samples of materials to be tested or analyzed and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications.

23.0 **Clause no. 45.1 & 45.2 of GCC stands modified as under:**

**Steel & Cement** shall be procured by EPI directly from the Manufacturer / Dealer and shall be issued to the contractor and the actual cost of material (total quantity) shall be recovered from the RA Bills of contractor on consumption basis. **Permissible wastage / excess consumption of cement& Steel** calculated as per PWD specification shall be recovered at actual cost / rates of procurement by EPI and any wastage beyond this permissible limit shall be recovered at double the market rates.

Unloading, proper storage of all the materials procured by EPI shall be the responsibility of the contractor. In case contractor fails to take action for unloading or proper storage of material brought to site by EPI, the same shall be arranged by EPI at the risk and cost of contractor. In case there is delay in supply of material by EPI, the contractor will have no claim on its account. In case of non-supply of materials by EPI due to any reason, the party may be permitted to procure the materials with the prior written approval from EPI without any claim on EPI. Payment to approved cement manufacturer / dealer may be paid by EPI on the request of PARTY against submission of invoice on behalf of PARTY.

The contractor shall submit RA Bills / Pre-Final / Final Bill along with the reconciliation statement of materials and no payment shall be released to the contractor in absence of such documents. Excess consumption shall be recovered at the rates mentioned elsewhere in the contract.

Consumption of materials shall be calculated as per the provision of contract / specification / standards and the contractor shall solely be responsible for any additional or less consumption of materials. In case material is consumed less than that calculated as per the co-efficient of consumption as per the contract / relevant specification / PWD codes / manuals, the contractor shall identify the portion of work / whole work where material consumed is less than that specified above and dismantle such work and redo the same at his own cost.

24.0 **SITE LABORATORY**

A field Laboratory will be established in a room of suitable size equipped with the following, with adequate labour and materials required for carrying out tests therein:

(i) Set of standard sieves for testing grading of sand and a 75 micron sieve for testing silt content.
(ii) Sieves with openings respectively of 5mm, 10mm, and 20mm for testing grading of aggregates.
(iii) Balance of capacity 10 Kg reading to 5 gm, with weights.
(iv) Primus stove and pans for drying of sand and aggregates.
(v) Glass measuring flasks of 1/2 and 1 litre capacity
(vi) Flask for determining moisture content of sand.
(vii) Slump cone for slump test.
(viii) Minimum 24 steel moulds for 150 x 150 mm test cubes. It may be necessary to provide more steel cube moulds depending upon concreting programmed.
(ix) Work benches, shelves, desks, sinks and any other furniture and lighting as required by the ENGINEER-IN-CHARGE.
(x) Cube testing machine.
(xi) Any other equipment not specifically mentioned above which can reasonably be held necessary for the completion of the contract works to the satisfaction of the ENGINEER-IN-CHARGE. NOTE: The requisite tests shall be conducted in field Laboratory as per CPWD Specifications and other related I.S. Codes. All such tests shall be conducted in presence of the ENGINEER-IN-CHARGE and the proper Test Records shall be maintained by CONTRACTOR with the attestations by the ENGINEER-IN-CHARGE. The CONTRACTOR shall bear all expenses for installing, running and maintenance of this Field Laboratory.

25.0 The Tenderers must understand that the items marked in schedule of work are actual items to be executed. Alteration, omission, deduction or addition from/to these items is at the discretion of the employer without effecting the terms of the contract. The rates have to be quoted on the basis of percentage (%) above, below or at par on the estimated value of the work.

26.0 Financing/ Bank charges for guarantees furnished/to be furnished to HLL Lifecare Limited by EPI which have to be paid for the entire contract as a whole shall be borne by the contractor.

27.0 Custody of Drawings

All the approved Drawings shall remain in the sole custody of the Engineer-in-Charge but two copies thereof shall be furnished to the Contractor free of charge. The Contractor shall provide and make at his own expenses any further copies required by him. At the completion of Contract the Contractor shall return to the Engineer-in-Charge all drawings provided under the Contract.

One copy of the Drawings, furnished to the Contractor as aforesaid, shall be kept by him on the site and the same shall at all reasonable times be available for inspection and use by the Engineer-in-Charge and his Representatives and by any other person authorised by the Engineer-in-Charge.

28.0 Survey : Layout and Access

The Contractor shall satisfy himself regarding the correctness of the site Layouts, levels etc. as shown in the drawings or given in the specifications. Before starting the work he shall also carry out at his own cost survey of the whole work site jointly with the Department. Surveying and Designs of sewerage system/WSS to be submitted and got approved by the competent authority before execution of the work. Any deviations as may arise out of the survey shall not viti ate the provisions of contracts and shall not entitle the Contractor to any extra payment of claim in any way.

After the joint survey a survey plan shall be prepared by the Contractor at his cost and got approved by the Engineer-in-Charge. Reference line and points shall be
established by the Contractor at his own cost so as to serve as reference and “Dimensional Checking” of works. He shall prepare and submit a plan in quadruplicate to the E.I.C. showing such reference points with their full description at his cost.

The Contractor shall provide for all arrangements labour, equipments and materials needed for carrying out survey, setting out, layout checking, inspections measurements, testing at his own cost for which no separate payment will be made.

The Contractor shall also provide proper approach and access to all the works and stores including clearance of sites at his own cost.

29.0 Time of Completion

The entire work as per offer shall be completed within 22 (twenty two) months from the date of issue of work order. The time of completion is firm and final and supersedes any other time mentioned elsewhere in any clause(s) of tender document.

The period of completion given includes the time required for mobilization and testing as well, rectifications, if any, re-testing and completion in all respects to the entire satisfaction of the Engineer-in-Charge including the monsoon season.

The Contractor shall scrupulously adhere to the targets/program as envisaged in his micro-plan of work program by deploying adequate personnel and construction tools and tackles and he shall also supply all materials of his scope of supply in time to achieve the targets set out.

The Contractor shall give every day a report on category-wise labour and equipment deployed along with the progress of work done on previous day. The progress of work shall be proportionate to completion time.

Time is the essence of this contract and the allotted work must be completed within the specified time. Extension of time may be granted in very exceptional circumstances if the work gets delayed due to the reasons beyond the control of the successful bidder. This clause of extension of time will have precedence over any other similar clauses if they are at variance with this clause. There will be penalty for non-completion of the work in time as indicated elsewhere.

In case the successful bidder i. e. the contractor fails to execute the work as per agreed schedule of progress of work and as per specified quality and/or lags behind in activities required for timely completion of work, as determined by EPI/Client, then EPI shall give 15 days’ notice to the contractor in writing to achieve the specified quality and/or deploy adequate resources to the satisfaction of EPI, for timely completion of work. Upon expiry of the notice period, if the contractor fails to achieve specified quality and/or fails to action for timely completion of work, then EPI shall have option to withdraw the remaining work PARTLY or in FULL from the contractor and get the same executed at the risk and cost of the from alternative agencies with 10% EPI Overheads besides encashment of guarantees submitted by the parties to EPI. The decision of EPI in this regard shall be final and binding on the contractor.

The contractor work programme should demonstrate minimum progress as per the milestones given below.

I Milestone :- 12.5% of the work in 12.5% of the tender period and 15% quantity of
materials required for the work to be supplied

II Milestone :- 25% of the work in 25% of the tender period and 30% quantity of materials required for the work to be supplied

III Milestone :- 37.5% of the work in 37.5% of the tender period and 45% quantity of materials required for the work to be supplied

IV Milestone :- 50% of the work in 50% of the tender period and 60% quantity of materials required for the work to be supplied

V Milestone :- 62.5% of the work in 62.5% of the tender period and 75% quantity of materials required for the work to be supplied

VI Milestone :- 75% of the work in 75% of the tender period and 100% quantity of materials required for the work to be supplied

VII Milestone :- 87.5% of the work in 87.5% of the tender period

VIII Milestone :- 100% of the work in 100% of the Tender Period

30.0 The Contractor shall comply with all the provisions of the following statutory acts or any modifications thereto and the rules made there under from time to time.

- Indian Factories Act 1948
- Payment of Wages Act 1936
- Minimum Wages Act 1948
- Employers Liability Act 1938
- Apprentices Act 1961
- Workmen's Compensation Act 1923
- Industrial Disputes Act 1947
- The Maternity Benefits Act 1961
- Contract Labour (Regulation and Abolition) Act 1970
- Employment of Children Act 1933
- Provident Funds and Miscellaneous Provisions Act 1952
- The Employee's Pension Scheme 1995

31.0 Should a report be made by an Inspecting Officer, as defined in the Contract Labour (Regulation and Abolition) Act 1970, the Developer shall have the right to deduct from any money due to the Contractor any sum required, or estimated to be required, for making good the loss(es) suffered by a worker or workers by the reason of non-fulfillment of the Conditions of the Contract relating to the benefits of workers, non-payment of wages or of deduction made from their wages which are not justified by the terms of the Contract or non-observance.

32.0 The Contractor shall indemnify the employer against any payments to be made as hereunder and for the observance of the provisions of the aforesaid Acts.

33.0 FACILITIES TO BE PROVIDED BY PARTY TO EPI

Immediately on placement of LOI/Work order (whichever is earlier) by EPI on the PARTY, the PARTY at its own cost shall provide furnished office, facilities etc. exclusively for the use of personnel of EPI as per details given below. The PARTY shall make his rates/prices in his offer sufficiently comprehensive to cover the cost of the facilities as per details shown below and the PARTY shall not be entitled for any extra payment for the same.
### 34.0 Liquidated Damages

**a)** The penalty at the rate of 1% (one percent) of the amount put to tender for every 100% (hundred percent) of delay on part of contractor will be imposed subject to a maximum of 7.5% (seven point five percent) of the amount put to tender.

**b)** The work should progress according to the milestones fixed as per CPM/PERT chart and the Contractor is responsible to achieve these approved milestones. The progress will be revived once in every Three months. In case of any delay which is not beyond the control of the Contractor, Liquidated Damages shall be levied as per Clause 36.0 (a).

### 35.0 Security Deposit Cum Performance Guarantee

6.00% (Six percent only) of contract value to be submitted by Contractor within 10 days from the date of issue of telegram / letter / telex / FAX of intent of acceptance of tender. The Security Deposit Cum Performance BG shall be kept as 6% instead of 5% valid upto defect liability period. All other conditions shall be same given in EPI's GCC Clause no.9.0

### 36.0 Defects Liability Period (GCC Clause no 74.0 modified as under)

Defect Liability Period shall be 24 Months from the date of taking over as per Clause no 49.0 to 49.5 of Client GCC.

### 37.0 Royalties (GCC Clause no 14.0 modified as under)

The Employer/EPI shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the
Karnataka Minor Minerals Concession Rules - 2007” as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1 as given below,

ANNEXURE-I

SUB: THE KARNATAKA MINOR MINERALS CONCESSION (AMENDMENT) RULES, 2003

COMMERCe AND INDUSTRIAL SECRETARIAT

NOTIFICATION NO. CI 56, MMN 2006, BANGALORE, DATED: 23rd June, 2007

SCHEDULE – I

(See Sub. Rule (1) of Rule 36)

“DEAD RENT”

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Name of the Minor Mineral</th>
<th>Rate per Unit/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ORNAMENTAL AND DECORATIVE BUILDING STONES - as defined under clause (m) of rule 2.</td>
<td>25000</td>
</tr>
<tr>
<td>2.</td>
<td>Felsite and its varities suitable for use as Ornamental Stores.</td>
<td>25000</td>
</tr>
<tr>
<td>3.</td>
<td>Quartzite and Sand stone and their varieties suitable for use as Ornamental Stones.</td>
<td>25000</td>
</tr>
<tr>
<td>4.</td>
<td>Marble or crystalline lime stone as Ornamental Stone</td>
<td>25000</td>
</tr>
<tr>
<td>5.</td>
<td>Bentonite</td>
<td>25000</td>
</tr>
<tr>
<td>6.</td>
<td>Fullers Earth</td>
<td>25000</td>
</tr>
<tr>
<td>7.</td>
<td>Lime Stone under title “Shahbab stone”</td>
<td>15000</td>
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<tr>
<td>8.</td>
<td>Lime Stone (Non Cement)</td>
<td>15000</td>
</tr>
<tr>
<td>9.</td>
<td>Ordinary building stones - Entire state</td>
<td>Rate per Unit/quantity</td>
</tr>
<tr>
<td>a</td>
<td>Bangalore, Kolar, Mysore, Mandya and Tumkur</td>
<td>15000</td>
</tr>
<tr>
<td>b</td>
<td>Other Districts</td>
<td>10000</td>
</tr>
<tr>
<td>10.</td>
<td>Lime Shell</td>
<td>15000</td>
</tr>
<tr>
<td>11.</td>
<td>Lime Kankar</td>
<td>15000</td>
</tr>
<tr>
<td>12.</td>
<td>Agate and Chalcedony</td>
<td>15000</td>
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<tr>
<td>13.</td>
<td>Ordinary sand</td>
<td>10000</td>
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<tr>
<td>14.</td>
<td>Brick and Tile clays</td>
<td>5000</td>
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<tr>
<td>15.</td>
<td>Steatite and sand stone used for making household utensils/articles - Entire state</td>
<td>10000</td>
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<tr>
<td>16.</td>
<td>Sand stone used for making house hold articles</td>
<td>10000</td>
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<tr>
<td>17.</td>
<td>Murram</td>
<td>3000</td>
</tr>
<tr>
<td>18.</td>
<td>All other minor minerals - Entire state</td>
<td>5000</td>
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</table>
## SCHEDULE – II
*(See Sub. Rule (1) of Rule 36)*

### ROYALTY

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Name of the Minor Mineral</th>
<th>Rate per Unit/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ORNAMENTAL AND DECORATIVE BUILDING STONES-as defined under clause (m) of rule 2.</td>
<td></td>
</tr>
<tr>
<td>(A)</td>
<td>DYKE ROCKS</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Black granites</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Mysore and Chamarajanagar Districts.</td>
<td>Rs.3000 per M³</td>
</tr>
<tr>
<td>b)</td>
<td>All other Districts other than (a) above.</td>
<td>Rs.2500 per M³</td>
</tr>
<tr>
<td>ii)</td>
<td>Other varieties of dykes other than black granites</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td></td>
<td>(Entire State)</td>
<td></td>
</tr>
<tr>
<td>(B)</td>
<td>(1) PINK and Red granites (ILKAL PINK VARIETY)</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Hungund Taluk of Bagalkot and Badami taluk of Bijapur Dist., Kushtagi of Koppal Dist.</td>
<td>Rs.2500 per M³</td>
</tr>
<tr>
<td>ii)</td>
<td>PINK and Red granites, gneisses and their textural &amp; structural varieties (other than ILKAL Pink variety)</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td>(C)</td>
<td>GREY &amp; WITH GRAINTES and Their varieties</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Very fine grained grey Granite (SIRAGREY variety) Chintamani, Siddalaghatta of Kolar Dist., Hoskote of Bangalore District.</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td>ii)</td>
<td>Grey &amp; white granites &amp; their textural varieties having shades of grey, black &amp; white colours, (other than (i) above)</td>
<td>Rs.1000 per M³</td>
</tr>
<tr>
<td></td>
<td>(Entire State)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Felsite and its varieties suitable for use as ornamental stones - Entire state.</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>3.</td>
<td>Granite and sand stones and their varieties suitable for use as Ornamental stones- Entire State.</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>4.</td>
<td>Marble or crystalline lime stone as ornamental stone - Entire state</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>5.</td>
<td>Bentonite – Entire state</td>
<td>Rs.200 per MT</td>
</tr>
<tr>
<td>6.</td>
<td>Fullers earth - Entire state</td>
<td>Rs.200 per MT</td>
</tr>
<tr>
<td>7.</td>
<td>Lime stone under the title “Shahabad stone”</td>
<td>Rs.80 per 10 Sq.m</td>
</tr>
<tr>
<td>8.</td>
<td>Lime stone (Non cement) when used for building stone - Entire state</td>
<td>Rs.20 per MT</td>
</tr>
<tr>
<td>9.</td>
<td>Ordinary building stones - Entire state as defined under clause (g) of rule 2.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>10.</td>
<td>Lime Stone - Entire state</td>
<td>Rs.60 per MT</td>
</tr>
<tr>
<td>11.</td>
<td>Lime Kankar (Non- Cement) - Entire state</td>
<td>Rs.25 per MT</td>
</tr>
<tr>
<td>12.</td>
<td>Agate Chalcedony Flint- Entire state</td>
<td>Rs.120 per MT</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Rate</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>13</td>
<td>Ordinary sand – Entire state</td>
<td>Rs. 30 per MT</td>
</tr>
<tr>
<td>14</td>
<td>Steatite and sand stone used for making household utensils/articles – Entire state</td>
<td>Rs.20 per MT</td>
</tr>
<tr>
<td>15 a)</td>
<td>Murrum (All types of soils) – Entire state</td>
<td>Rs. 10 per MT</td>
</tr>
<tr>
<td>b)</td>
<td>Clay used for manufacturing tiles and bricks</td>
<td>Rs. 20 per MT</td>
</tr>
<tr>
<td>16</td>
<td>All other minor minerals - Entire state</td>
<td>30% of sale value at mouth</td>
</tr>
<tr>
<td>17</td>
<td>Waste rocks generated in ornamental stone quarry - Entire state (See explanation under Rule 36)</td>
<td>Rs.200 per Tonne Or Rs. 600 Per M³</td>
</tr>
<tr>
<td>18</td>
<td>Irregular shaped waste rock, Generated in Stone quarry which is not suitable for ornamental purposes- Entire state.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>19</td>
<td>Waste rocks generated in Shahabad stone quarries- Entire state See explanation under Rule 36.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>20</td>
<td>Finished kerb stones/cubes not exceeding 30 cms. Each face – Entire State</td>
<td>Rs.80 per MT</td>
</tr>
</tbody>
</table>

By Order and in the name of the Governor of Karnataka

Sd/-
H.V.RAMACHANDRARAO
Desk Officer (Mines),
Commerce & Industries Department.

38.0 Karnataka Building and other construction worker’s welfare cess:
As per Government of Karnataka Order No. LD/300/LET/2006 Bangalore dated 18-01-2007. The employer will deduct 1% (One percent) cess on the total tender amount from the bills of the Contractor towards Building and other construction workers Welfare Cess act 1996.

39.0 Insurance : As per EPI’s GCC Clause no 17.0,18.0 & 19.0.

40.0 The contractor shall make arrangements for Project Sign Board as per the format attached
CLIENT DOCUMENTS

➢ GENERAL CONDITIONS OF CONTRACT
➢ SPECIAL CONDITIONS OF CONTRACT
➢ SPECIAL SPECIFICATIONS
KARNATAKA URBAN WATER SUPPLY AND DRAINAGE BOARD BANGALORE

BID DOCUMENT FOR

UGD SCHEME TO BAILHONGAL TOWN OF BELGAUM DISTRICT

CONSTRUCTION OF 8.28MLD CAPACITY AERATED LAGOON AND ALLIED WORKS

GENERAL CONDITIONS OF CONTRACT

OFFICE OF THE
CHIEF ENGINEER (NORTH)
KARNATAKA URBAN WATER SUPPLY AND DRAINAGE BOARD, DHARWAD
# GENERAL CONDITIONS OF CONTRACT

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GENERAL CONDITIONS OF CONTRACT

DEFINITIONS AND INTERPRETATION

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

(a) (i) “Board” shall mean the Karnataka Urban Water Supply & Drainage Board and its successor if any.

(ii) “Government” shall mean the Government of Karnataka State.

(iii) “Chairman” shall mean Chairman Karnataka Urban Water Supply and Drainage Board, Bangalore.

(iv) “Managing Director” shall mean Managing Director Karnataka Urban Water Supply and Drainage Board, Bangalore.

(v) “Employer” means the person named as such in Chapter 3, Special Conditions of Contract and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.

(vi) “Contractor” means the person whose tender has been accepted by the Employer and the legal successors in title to such person but not (except with the consent of the Employer) any assignee of such person.

(vii) “Subcontractor” means any person named in the Contract as Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted with the consent of the Engineer or employer and the legal successors in title to such person, but not any assignee of such person.

(viii) “Engineer” shall mean the CHIEF ENGINEER (NORTH), Karnataka Urban Water Supply and Drainage Board or such other officer as maybe appointed to at as Engineer for the purpose of Contract and shall also mean and include Superintending Engineer and Executive Engineer or officers of equivalent drawing directly in-charge of work or any part of there.

(i) “Engineer’s Representative” shall mean the Executive Engineer or Assistant Executive Engineer directly in-charge of the works or is duly authorized representatives.

(b) (i) “Contract” means these General Conditions, the Special Conditions, the Specification, the Drawings, the Bill of Quantities, the Bid, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).

(ii) “Specification” means the specification of the Works included in the Contract and any modification thereof or addition thereto made by the Engineer or submitted by the Contractor and approved by the Engineer.

(iii) “Drawings” means all drawings provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.

(iv) “Bill of Quantities” means the priced and completed bill of quantities forming part of the Tender.

(v) “Tender” means the Contractor’s priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance. The word ‘Tender’ is synonymous with ‘Bid’ and the word ‘Tender Documents’ with ‘Bidding Documents’.

(vi) “Letter of Acceptance” means the formal acceptance by the Employer of the Tender.

(vii) “Contract Agreement” means the contract agreement (if any) referred to in Sub-Clause 9.1.

(viii) “Appendix to Tender” means the appendix comprised in the form of Tender annexed to these Conditions.

(c) (i) “Commencement Date” means the date specified in the notice to commence issued by the Engineer to the Contractor.
(ii) “Time for Completion” means the time for completing the execution of and passing the Tests on Completion of the Works or any Chapter or part thereof as stated in the Contract (or as extended by the Employer) calculated from the Commencement Date.

(d) (i) “Tests on Completion” means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works or any Chapter or part thereof are taken over by the Employer.

(ii) “Taking-Over Certificate” means a certificate issued pursuant to Sub-Clause 48.1 to 48.5.

(e) (i) “Contract Price” means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.

(ii) “Works” means the Permanent Works and the Temporary Works or either of them as appropriate.

(iii) “Permanent Works” means the permanent Works to be executed (including Plant) in accordance with the Contract.

(iv) “Temporary Works” means all temporary Works of every kind (other than Contractor’s Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

(v) “Plant” means machinery, apparatus and the like intended to form or forming part of the Permanent Works.

(vi) “Contractor’s Equipment” means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.

(vii) “Chapter” means a part of the Works specifically identified in the Contract as a Chapter.

(viii) “Site” means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.

(g) (i) “Cost” means all expenditures properly incurred or to be incurred, whether on or off the Site, including overhead and other charges properly allocable thereto but does not include any allowance for profit.

(ii) “Day” means calendar day.

(iii) “Writing” means any hand written, type written, or printed communication, including telex, cable and facsimile transmission.

1.2 Headings and Marginal Notes
The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

1.3 Interpretation
Words importing persons or parties shall include firms and corporations and any legal entity and any organisation having legal capacity.

1.4 Singular and Plural
Words importing the singular only also include the plural and vice versa where the context requires.

1.5 Notices, Consents, Approvals, Certificates and Determinations
Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words “notify”, “certify” or “determine” shall be construed accordingly. Any such consent, approval, certificate or determination shall not unreasonably be withheld or delayed.

2.0 Engineer and Engineer’s Representative
2.1 Engineer’s Duties and Authority
(a) The Engineer shall carry out the duties specified in the Contract.

(b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority, particulars of such requirements shall be set out in Chapter 3,
Special Conditions of Contract. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority by the Engineer.

(c) Except as expressly stated in the Contract, the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract.

2.2 **Engineers’ Representative:**

The Engineer’s Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority as may be delegated to him by the Engineer under Sub-Clause 2.3.

2.3 **Engineer’s Authority to Delegate:**

The Engineer may from time to time delegate to the Engineer’s Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing with prior consent of the employee and shall not take effect until a copy thereof has been delivered to the Employer and the Contractor. Any communication given by the Engineer’s Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that:

(a) any failure of the Engineer’s Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof;

(b) if the Contractor questions any communication of the Engineer’s Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

2.4 **Appointment of Assistants**

The Engineer or the Engineer’s Representative may appoint any number of persons to assist the Engineer’s Representative in the carrying out of his duties under Sub-Clause 2.2. He shall notify to the Contractor the name, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been given by the Engineer’s Representative.

2.5 **Instructions in Writing:**

Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall be deemed to be an instruction of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer’s Representative and any assistants of the Engineer or the Engineer’s Representatives pursuant to Sub-Clause 2.4.

2.6 **Engineer to Act Impartially.**

Wherever, under the Contract, the Engineer is required to exercise his discretion by:

a) giving his decision, opinion or consent, or

b) expressing his satisfaction or approval, or

c) determining value, cost or extension of time, or

d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor, he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent, expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Sub-Clause 67 to 67.5.
3.0 Assignment and Subcontracting

3.1 Assignment of Contract
The Contractor shall not, without the prior consent of the Employer (which consent notwithstanding the provisions of Sub-Clause 1.5, shall be at the sole discretion of the Employer), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:
(a) a charge in favour of the Contractor’s bankers of any moneys due or to become due under the Contract, or
(b) assignment to the Contractor’s insurers (in cases where the insurers have discharged the Contractor’s loss or liability) of the Contractor’s right to obtain relief against any other party liable.

4.1 Subcontracting
The Contractor shall not sub-contract the whole of the Works. The Contractor shall not subcontract any part of the Works without the prior consent of the Engineer, except where otherwise provided by the Contract. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen.
Provided that the Contractor shall not be required to obtain such consent for:
a) the provision of labour, or
b) the purchase of materials which are in accordance with the standards specified in the Contract, or
c) the subcontracting of any part of the Works for which the Subcontractor is not in the Contract.
In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer’s request and cost, the benefit of such obligation for the unexpired duration thereof.

5.0 Contract Documents

5.1 Language and Law
(a) The English or Kannada language shall be used in the Contract documents and all official correspondence.
(b) The law which shall apply to the Contract and according to which the Contract shall be construed is that in force in Karnataka.

5.2 Priority of Contract Documents
The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows
(1) The Contract Agreement
(2) The Letter of Acceptance
(3) The Bid Document & Drawings
(4) Chapter 3; Special Conditions of Contract.
(5) Chapter 2; General Conditions of Contract
(6) Chapter 4; Special Specifications (including written instructions of the Engineer)
(7) Chapter 6; Priced Bill of Quantities
(8) Chapter 10; Standard Specifications
(9) Chapter 9; Drawings

6.0 Drawings and Documents

6.1 Custody and Supply of Drawings and Documents:
The Drawings shall remain in the sole custody of the Engineer. The Contractor shall make at his own cost any number of copies required by him. Unless it is strictly necessary for the purposes of the Contract, the drawings, Specifications and other documents provided by the Employer or the
Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate, the Contractor shall return to the Engineer all Drawings, Specifications and other documents provided under the Contract. The Contractor shall supply to the Engineer six copies of all Drawings, Specifications and other documents submitted by the Contractor and approved by the Engineer in accordance with Sub-Clause 7.1 to 7.3, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specifications and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.

6.2 One Copy of Drawings to be Kept on Site:
One copy of Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.

6.3 Disruption of Progress:
The Contractor shall give notice to the Engineer, with a copy to the Employer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within a reasonable time. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

6.4 Delay and Cost of Delay of Drawings
If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay then the Engineer shall, after due consultation with the Employer and the Contractor, determine any extension of time to which the Contractor is entitled under Sub-Clause 44.1 to 44.3, and shall notify the Contractor accordingly, with a copy to the Employer. Any price adjustment which may be applicable for such time extension granted by the Engineer will be determined in accordance with the provision of Sub-Clause 70.1 to 70.8.

6.5 Failure by Contractor to Submit Drawings:
If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings, Specifications or other documents which he is required to submit under the Contract, the Engineer shall take such a failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.

7.1 Supplementary Drawings and Instructions
The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defects therein. The Contractor shall carry out and be bound by the same.

7.2 Permanent Works Designed by Contractor
Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval:
(a) such Drawings, Specifications, Calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and
(b) operation and maintenance manuals, together with Drawings of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design.
The Works shall not be considered to be completed for the purpose of taking over in accordance with Sub-Clause 48.1 to 48.5 until such operation and maintenance manuals together with "As-built" Drawings on completion, have been submitted to and approved by the Engineer.

7.3 Responsibility Unaffected by Approval
Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.
8.0 **General Obligations**

8.1 **Contractor's General Responsibilities**

The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, materials, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

The Contractor shall promptly notify the Employer and the Engineer of any error, omission, fault or any other defect in the design of or specifications for the Works which he discovers when reviewing the Contract documents or in the process of execution of Works.

8.2 **Site Operations and Methods of Construction**

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction for the Works provided that the Contractor shall not be responsible (except as stated hereunder or as may otherwise be agreed) for design or specification of permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

9.0 **Contract Agreement**

The Contractor shall, if called upon so to do by the Employer, enter into and execute the Contract Agreement in the form annexed to these conditions with such modifications as may be necessary.

10.0 **Bid Security**

The bidder shall furnish as part of his Bid a bid security of Rs. **54,04,000/-** (Rupees Fifty Four lakhs Four Thousand Only) of the estimated amount put to tender. The cost of bid security amount shall be paid through e-payment only i.e., credit card (VISA/MASTER) or debit card or NEFT or RTGS. The payment of bid security amount through NEFT/RTGS shall be made at least two days prior to the closing date and time for submission of the bids. No interest will be paid on Bid Security.

Any bid not accompanied by an acceptable bid security shall be rejected by the Employer as non-responsive.

The Bid securities of the unsuccessful bidder shall be returned as promptly as possible, but not later 45 days after the expiration of the period of bid validity.

The successful bidder will have to furnish additional bid security for the difference amount of award amount and estimated amount put to tender at the time of entering into the agreement.

The Bid security shall be forfeited.

1) if the bidder withdraws his bid during the period of bid validity.

2) if the bidder does not accept the correction of his bid price, as per Sub-Clause 36, of Chapter 1.

3) in the case of a successful bidder, if he fails within the specified time limit to:

   a) sign the Agreement, or

   b) furnish the required performance security.

4) If any of the Certificates furnished by the bidder found to be forged, bogus or not genuine the EMD of such bidders shall be forfeited and legal action will be initiated.
10.1 Performance Security
Total 6% of the Contract Price in the form of an Unconditional Bank Guarantee from any Nationalised Banks or any Banking Company Registered under the Companies Act 1956 to be provided within 28 days of the date of the Letter of Acceptance, to be valid until completion of the Project and defects liability period. The forms of performance security provided in Chapter 8 of the bidding document shall be used. Such guarantee shall be subject to verification by the Employer. No interest will be payable on the Performance Security.

10.2 Period of Validity of Performance Security
The performance security shall be valid until the Contractor has executed and completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made after the issue of the Defect Liability Certificate, and such security shall be returned to the Contractor within 14 days after the issue of the said Defects Liability Certificate.

10.3 Claims under Performance Security
Prior to including a claim under the Performance Security the Employer shall, in every case, notify the Contractor stating the nature of the default in respect of which the claim is to be made.

11.1 Inspection of Site
The Employer shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for collection of any additional data, for carrying out any additional surveys and tests, and for his own interpretation thereof.

The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself so far as is practicable before submitting his Tender, as to
(a) the form and nature thereof, including the sub-surface conditions,
(b) the hydrological and climatic conditions,
(c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and
(d) the means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

11.2 Access to Data.
Data made available by the Employer in accordance with Sub-Clause 11.1 shall be deemed to include data listed in Chapter 3, Special Conditions of Contract, which shall be open for inspection at the specified location.

12.1 Sufficiency of Tender
The Contractor shall be deemed to have based his Tender on the data made available by the Employer and on his own inspection and examination, all as aforementioned. The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

12.2 Adverse Physical Obstructions or Conditions.
If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions, were in his opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer, with a copy to the Employer. On receipt of such notice, the Engineer shall, if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Employer and the Contractor determine any extension of time to which the Contractor is entitled under Sub-Clause 44.1 to 44.3, and shall notify the Contractor accordingly, with a copy to the Employer. Any price adjustment which may be applicable for such time extension granted by the Engineer will be determined in accordance with Sub-Clause 70.1 to 70.2.
13.1 **Work to be in Accordance With Contract**
The Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer’s instructions on any matter, whether mentioned in the Contract, or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer or, subject to the provisions of Sub-Clause 2.2 to 2.6, from the Engineer’s Representative.

14.1 **Programme to be Submitted**
The Contractor shall, within 28 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a programme, in such form and detail as acceptable to the Engineer, for the execution of the Works. The Contractor shall also provide in writing for the information the Engineer a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

14.2 **Revised Programme**
If any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under the preceding Sub-Clause 14.1, the Contractor shall produce a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion.

14.3 **Cash Flow Estimate to be Submitted**
The Contractor shall, within 28 days after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to be made to the Contractor for the works entrusted to him and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer.

14.4 **Contractor Not Relieved of Duties or Responsibilities**
The submission to and consent by the Engineer of such programmes or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

14.5 **Reports to be Submitted**
The Contractor shall maintain a daily log of the labour, equipment and materials supplied to and used at the site, and shall prepare monthly progress reports in such form and detail as acceptable to the Engineer.

15.1 **Contractor’s Superintendence**
The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor’s obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer or, subject to the provisions of Sub-Clause 2.1 to 2.6, the Engineer’s Representative.

If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.

16.1 **Contractor’s Employees**
The Contractor shall provide on the Site in connection with execution and completion of the Works and the remedying of any defects therein:

(a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works; and

(b) such skilled, semiskilled and unskilled labour as are necessary for the proper and timely fulfilling of the Contractor’s obligations under the Contract.

16.2 **Engineer at Liberty to Object**
The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the performance of his duties, or whose presence on Site
is otherwise considered by the Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible.

16.3 Language Ability of Contractor’s Staff.
If the Contractor’s authorised representative is not, in the opinion of the Engineer, fluent in English or Kannada the Contractor shall have available on site at all times a competent interpreter to ensure the proper transmission of instructions and information. The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour from within the State of Karnataka. A reasonable proportion of the Contractor’s superintending staff shall have working knowledge of Kannada, or the Contractor shall have available on site at all times a sufficient number of interpreters to ensure the proper transmission of instructions and information.

17.1 Setting-out
The Contractor shall be responsible for
(a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing;
(b) the correctness, subject as above mentioned, of the position, levels, dimensions and alignment of all parts of the Works; and
(c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.
If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Sub-Clause 52.1 to 52.3 and shall notify the Contractor accordingly, with a copy to the Employer. The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and Contractor shall carefully protect and preserve all benchmarks, sight-rails, pegs and other things used in setting-out the Works. The Contractor, shall give to the Engineer not less than 48 hours notice of his intention to set out or give levels for any part of the Work so that timely arrangement may be made for checking and issuing instructions.

18.1 Boreholes and Exploratory Excavation
If at any time during the execution of the Works the Engineer requires the Contractor to make boreholes or to carry out exploratory excavations in excess of the requirement specified elsewhere in the Contract, such requirements shall be the subject of an instruction in accordance with Sub-Clause 51.1 to 51.2 unless an item or provisional sum in respect of such Works is included in the Bill of Quantities.

19.1 Safety, Security and Protection of the Environment
The Contractor shall, throughout the execution and completion of the Works and remedying of any defects therein
(a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons
(b) provide and maintain at his own cost all lights, guards, fencing, warning signs, watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others
(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation and
(d) screen all lights provided by the Contractor so as to not to interfere with any signal light on the railways or with any traffic or signal lights of any local or other authority.

19.2 Employer’s Responsibilities
If under Sub-Clause 31.1 to 31.2 the Employer shall carry out work on the site with his own workmen he shall, in respect of such work
(a) have full regards to the safety of all persons entitled to be upon the Site,
keep the site in an orderly state appropriate to the avoidance of danger to such persons. 
If under Sub-Clause 31.1 to 31.2 the Employer shall employ other contractors on the site he shall 
require them to have the same regard for safety and avoidance of danger.

20.1 Care of Works 
The Contractor shall take full responsibility for the care of the Works and materials and Plant for 
incorporation therein from the Commencement Date until the date of issue of the Taking-Over 
Certificate for the whole of the Works, when the responsibility for the said care shall pass to the 
Employer. Provided that:
(a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent 
Works the Contractor shall cease to be liable for the care of that Chapter or part from the date 
of issue of the Taking -Over Certificate, when the responsibility for the care of that Chapter or 
part shall pass to the Employer, and
(b) the Contractor shall take full responsibility for the care of any outstanding Works and materials 
and Plant for incorporation therein which he undertakes to finish during the Defects Liability 
Period until such outstanding Works have been completed pursuant to Sub-Clause 49.1 to 49.5 
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20.2 Responsibility to Rectify Loss or Damage 
If any loss or damage happens to the Works, or any part thereof, or materials or Plant for 
incorporation therein, during the period for which the Contractor is responsible for the care thereof, 
from any cause whatsoever other than the risks defined in Sub-Clause 20.4, the Contractor shall, at 
his own cost, rectify such loss or damage so that the Permanent Works conform in every respect 
with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be 
liable for any loss or damage to the Works occasioned by him in the course of any operations 
carried out by him for the purpose of complying with his obligations under Sub-Clauses 49.1 to 49.5 
and 50.1. 

20.3 Loss or Damage Due to Employer’s Risk 
In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 
20.4 or in combination with other risks, the Contractor shall, if and to the extent required by the 
Engineer, rectify the loss or damage and the Engineer shall determine an addition to the Contract 
Price in accordance with Sub-Clause 52.1 to 52.3 and shall notify the Contractor accordingly, with 
a copy to the Employer. In the case of a combination of risks causing loss or damage any such 
determination shall take into account the proportional responsibility of the Contractor and the 
Employer.

20.4 Employer’s Risks 
The Employer’s risks are
(a) insofar as they directly affect the execution of Works in the country where the Permanent 
Works are executed:
(i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies;
(ii) rebellion, revolution, insurrection, or military or usurped power, or civil war;
(iii) ionizing radiation, or contamination by radioactivity from any nuclear fuel, or from any 
nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other 
hazardous properties of any explosive nuclear assembly or nuclear component thereof;
(iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic 
speeds
(v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or 
of his Subcontractors and arising from the conduct of the Works;
(b) loss or damage due to the use or occupation by the Employer of any Chapter or part of the 
Permanent Works, except as may be provided for in the Contract
(c) loss or damage to the extent that it is due to the design of the Works, other than any part of 
the design provided by the Contractor or for which the Contractor is responsible and
(d) any operation of the forces of nature (in so far as it occurs on the site) which an experienced 
contractor
(i) could not have reasonably foreseen, or
(ii) could reasonably have foreseen but against which he could not reasonably have taken at 
least one of the following measures:
(a) prevent loss or damage to physical property from occurring by taking appropriate measures, or
(b) insure against.

21.0 Insurance
21.1 Insurance of Works and Contractor’s Equipment
   Not included
21.2 Scope of Cover
   Not included
21.3 Responsibility for Amounts Not Recovered
   Not included
21.4 Exclusions
   Not included
21.5 War Risk Insurance
   Not included.

22.1 Damage to Persons and Property
   Not included.
22.2 Exceptions
   Not included.
22.3 Indemnity by Employer
   Not included.

23.1 Third Party Insurance (including Employer’s Property)
   Not included
23.2 Minimum Amount of Insurance
   Not included
23.3 Cross Liabilities
   Not included

24.1 Accident or Injury to Workmen
   Not included
24.2 Insurance Against Accident to Workmen
   Not included

25.1 Evidence and Terms of Insurance
   Not included
25.2 Adequacy of Insurance
   Not included
25.3 Remedy on Contractor’s Failure to Insure
   Not included
25.4 Compliance with Policy Conditions
   Not included
25.5 Source of Insurance
   Not included

26.0 Contractor’s Obligations

26.1 Compliance with Statutes, Regulations

The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of
(a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remedying of any defects therein, and
(b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works, and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provision. Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub- Clause 22.3.
27.1 **Fossils**

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine any extension of time to which the Contractor is entitled under Sub-Clause 44.1 to 44.3, and shall notify the Contractor accordingly, with a copy to the Employer. Any price adjustment which may be applicable for such time extension granted by the Engineer will be determined in accordance with Sub-Clause 70.1 to 70.2.

28.1 **Patent Rights**

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent right, design trademark or name or other protected rights in respect of any Contractor’s Equipment, materials or Plant used for or in connection with or for incorporation in the Works from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

28.2 **Royalties**

Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

28.3 **Karnataka Building and other construction worker’s welfare cess**

Karnataka Building and other construction worker’s welfare cess at 1% of contract value as per G.O.No.LD/30/LET/2006. Bangalore Dated:18.1.2007 will be recovered from the Bills.

29.1 **Interference with Traffic and Adjoining Properties**

All operations necessary for execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to, use and occupation of public or private roads, railways, footpaths and any other right of way to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters insofar as the Contractor is responsible thereof.

30.1 **Avoidance of Damage to Roads**

The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor’s Equipment or temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.

30.2 **Transport of Contractor’s Equipment or Temporary Works**

Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor’s Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for
damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising solely out of such damage.

If it is found necessary for the Contractor to move one or more loads of heavy constructional and equipment, materials or pre-constructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items are not normally allowed to be moved, the Contractor shall obtain prior permission from the concerned authorities. Payments for complying with the requirements, if any, for protection of or strengthening of the roads, highways or bridges shall be made by the Contractor and such expenses shall be deemed to be included in his Contract Price.

30.3 Transport of Materials or Plant

If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road communication with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer with a copy to Employer as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the hauler of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto.

30.4 Waterborne Traffic

Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of the Clause shall be construed as though “road” included a lock, dock, sea wall or other structure related to a waterway and “vehicle” included craft, and shall give effect accordingly.

31.1 Opportunities for Other Contractors

The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:
(a) any other contractors employed by the Employer and their workmen,
(b) the workmen of the Employer, and
(c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works.

31.2 Facilities for Other Contractors

If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:
(a) make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or
(b) permit the use, by any such, or Temporary Works or Contractor's Equipment on the Site, or
(c) provide any other service of whatsoever nature for any such Works
the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

32.1 Contractor to Keep Site Clear

During the execution of the Works the Contractor shall keep the Site free from all unnecessary obstruction and shall store or dispose of any Contractor’s Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

33.1 Clearance of Site on Completion

Upon the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor’s Equipment, surplus material, rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such
materials, Contractor’s Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

33.2 Epidemics
In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with such regulations and carry out such orders as are issued by the Government or Local Authority.

34.0 Labour

34.1 Engagement of Staff and Labour
The Contractor shall make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding, water and transport.

34.2 Compliance with Labour Regulations
The Contractor and his Sub-contractors shall abide by the local laws and regulations governing labour as detailed in Annexure A and Annexure A-I.

35.1 Returns of Labour and Contractor’s Equipment
The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information in respect of Contractor’s Equipment as the Engineer may require. For Contractor’s Labour Regulation, refer to Annexure A and A-I.

36.0 Materials, Plant and Workmanship

36.1 Quality of Materials, Plant and Workmanship
All materials, Plant and workmanship shall be:
(a) of the respective kinds described in the Contract and in accordance with the Engineer’s instructions, and
(b) subjected from time to time to such tests as the Engineer may require at the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.

The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or Plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.

The Contractor is encouraged, to the extent practicable and reasonable, to use plant and materials from sources within India.

36.2 Cost of Samples
All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

36.3 Cost of Tests
The cost of making any test shall be borne by the Contractor if such test is:
(a) clearly intended by or provided for in the Contract, or
(b) particularized in the Contract (in cases only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

36.4 Cost of Tests Not Provided For
If any test required by the Engineer which is:
(a) not so intended by or provided for, or
(b) (in the cases above mentioned) not so particularized, or
(c) (though so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested,
shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor.

37.1 Inspection of Operations
The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access.

37.2 Inspection and Testing
The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.

Testing: The testing shall includes both pre & post testing.
Pre-testing: Each ingredient of the finished product shall be tested as per relevant IS guiding the quality of ingredient.
Post Testing: The finished product shall be subjected to non-destructive testing, including ultrasonic testing for the cavitations, the cavity shall within the permissible limits as prescribed for the material as per relevant IS.

37.3 Dates for Inspection and Testing
The Contractor shall agree with the Engineer on the time and place for inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the test readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate.

37.4 Rejection
If, at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as a result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer’s objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the Engineer so requests, the tests of rejected materials of Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the tests shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

37.5 Independent Inspection
If the Engineer so desires, he may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub-Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.

38.1 Examination of Work Before Covering Up
No part of the Works shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such
part of the Works which is about to be covered up or put out of view and to examine foundations
before any part of the Works is placed thereon. The Contractor shall give notice to the Engineer
whenever any such part of the Works or foundations is or are ready or about to be ready for
examination and the Engineer shall, without unreasonable delay, unless he considers it unnecessary
and advises the Contractor accordingly, attend for the purpose of examining and measuring such
part of the Works or of examining such foundations.

38.2 Uncovering and Making Openings
If, for any reason whatsoever, the Contractor fails to comply with the provisions of Sub-Clause 38.1
before covering up the works, the Contractor shall uncover any part of the Works or make openings
in or through the same as the Engineer may from time to time instruct and shall reinstate and make
good such part. All costs shall be borne by the Contractor.

39.1 Removal of Improper Work, Materials or Plant
The Engineer shall have authority to issue instructions from time to time, for:
(a) the removal from the Site, within such time or times as may be specified in the instruction, of
any materials or Plant which, in the opinion of the Engineer, are not in accordance with the
Contract,
(b) the substitution of proper and suitable materials or Plant, and
(c) the removal and proper re-execution, notwithstanding any previous test thereof or interim
payment therefor, of any work which, in respect of
   (i) materials, Plant or workmanship, or
   (ii) design by the Contractor or for which he is responsible,
is not, in the opinion of the Engineer, in accordance with the Contract.

39.2 Default of Contractor in Compliance
In case of default on the part of the Contractor in carrying out such instruction within the time
specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and
pay other persons to carry out the same and all costs consequent thereon or incidental thereto
shall, after due consultation with the Employer and the Contractor, be determined by the Engineer
and shall be recoverable from the Contractor by the Employer, and may be deducted by the
Employer from any monies due or to become due to the Contractor and the Engineer shall notify
the Contractor accordingly, with a copy to the Employer.

40.0 Suspension
40.1 Suspension of Work
The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any
part thereof for such time and in such manner as the Engineer may consider necessary and shall,
during such suspension, properly protect and secure the Works or such part thereof so far as is
necessary in the opinion of the Engineer.
Unless such suspension is:
(a) otherwise provided for in the contract, or
(b) necessary by reason of some default of or breach of Contract by the Contractor or for which
   he is responsible, or
(c) necessary by reason of climatic conditions on the site, or
(d) necessary for the proper execution of the Works or for the safety of the Works or any part
   thereof (save to the extent that such necessity arises from any act or default by the Engineer
   or the Employer or from any of the risks defined in Sub-Clause 20.4),
Sub-Clause 40.2 shall apply.

40.2 Engineer’s Determination Following Suspension
Where, pursuant to Sub-Clause 40.1 this Sub-Clause applies the Engineer shall after due
consultation with the Employer and the Contractor, determine any extension of time to which the
Contractor is entitled under Sub-Clause 44.1 to 44.3 and shall notify the Contractor accordingly,
with a copy to the Employer. Any price adjustment which may be applicable for such time extension
granted by the Engineer will be determined in accordance with Sub-Clause 70.1 to 70.2.
40.3  Suspension Lasting More than 180 Days

If the progress of the Works or any part thereof is suspended on the written instructions of the Engineer and if permission to resume work is not given by the Engineer within a period of 180 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1 the Contractor may give notice to the Engineer requiring permission, within 28 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Sub-Clause 51.1 to 51.2 by giving a further notice to the Engineer to that effect, or where it affects the whole of the Works, treat the suspension as an event of default by the Employer and suspend his work under the Contract.

41.0  Commencement and Delays

41.1  Commencement of Works

The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect by the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

Provided that:

(a)  the Engineer will, whenever possible, endeavour to issue the notice to proceed on the same day as the formal agreement is signed, subject to provision by the Contractor of a satisfactory Performance Security pursuant to Sub-Clause 10.1 to 10.3 and proof of insurance pursuant to Sub-Clause 25.1; and

(b)  the Contractor will commence the Works not later than 28 days after issue by the Engineer of the notice to proceed.

42.0  ACCESS TO SITE

42.1 Possession of Site and Access Thereto

Save insofar as the Contract may prescribe:
(a)  the extent of portions of the Site of which the Contractor is to be given possession from time to time and,
(b)  the order in which such portions shall be made available to the Contractor and subject to any requirement in the Contract as to order in which the Works shall be executed, the Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of
(c)  so much of the Site, and
(d)  such access as, in accordance with the Contract, is to be provided by the Employer as may be required to enable the Contractor to commence and proceed with the execution of the Works. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with the agreed programme or proposals, as the case may be.

42.2  Failure to Give Possession

If the contractor suffers delay and / or incurs cost from failure on the part of the employer to give possession in accordance with the items of sub-clause 42.1, the Engineers shall after due consultation with the employer and the contractor, determine any extension of time to which the contractor is entitled and clause 42 and shall notify the contractor accordingly with a copy to the employer.

42.3  Way leaves and Facilities

The Contractor shall bear all costs and charges for special or temporary way leaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.
43.0 TIME

43.1 Time for Completion

The whole of the Works and, if applicable, any section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Sub-Clause 48.1 to 48.5, within the time stated in the Appendix to Tender for the whole of the Works or the Chapter (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Sub-Clause 44.1 to 44.3.

44.1 Extension of Time of Completion

In the event of
(a) the amount or nature of extra or additional work, or
(b) any cause of delay referred to in these Conditions, or
(c) exceptionally adverse climatic conditions, or
(d) any delay, impediment or prevention by the Employer, or
(e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor for which he is responsible,

being such as fairly to entitle the Contractor to an extension of the Time for Completion of the Works, or any Chapter or part thereof, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of such extension and shall notify the Contractor accordingly, with a copy to the Employer.

44.2 Contractor to Provide Notification and Detailed Particulars

Provided that the Engineer is not bound to make any determination unless the Contractor has:
(a) within 28 days after such event has first arisen notified the Engineer with a copy to the Employer, and
(b) within 28 days, or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

44.3 Interim Determination of Extension.

Provided also where an event has a continuing effect such that it is not practicable for the Contractor to submit detailed particulars within the period of 28 days referred to in Sub-Clause 44.2 (b), he shall nevertheless be entitled to an extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 28 days and final particulars within 28 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and on receipt of the final particulars, the Engineer shall review all the circumstances and shall determine an overall extension of time in regard to the event. In both such cases the Engineer shall make his determination after due consultation with the Employer and the Contractor and shall notify the Contractor of the determination, with a copy to the Employer. No final review shall result in a decrease of any extension of time already determined by the Engineer.

45.1 Restriction on Working Hours

Subject to any provision to the contrary contained in the Contract, none of the Works shall, save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shifts.

46.1 Rate of Progress

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Chapter is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally
recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the Employer in additional supervision costs, such costs shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

47.0 Liquidated Damages

47.1 Liquidated Damages for Delay

If the Contractor fails to comply with the Time for Completion in accordance with Sub-Clause 48.1 to 48.5 for the whole of the Works or, if applicable, any Chapter within the relevant time prescribed by Sub-Clause 43.1, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix to Bid as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every week or part of a work which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Chapter, subject to the applicable limit stated in the Appendix to Bid. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

47.2 Reduction of Liquidated Damage

If, before the Time for Completion of the whole of the Works or, if applicable, any Chapter, a Taking-Over Certificate has been issued for any part of the Works or of a Chapter, the liquidated damages for delay in completion of the remainder of the Works or of that Chapter shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Chapter, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

48.0 Taking over

48.1 Taking-Over Certificate

When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer, with a copy to the Employer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall, within 21 days of the date of delivery of such notice, either issue to the Contractor, with a copy to the Employer, a Taking-Over Certificate stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all work which, in the Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

48.2 Taking Over Of Section or Parts

Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in respect of

(a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender, or
(b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or
(c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contractor has not been agreed by the Contractor as a temporary measure).

48.3 Substantial Completion Parts
If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contract, the Engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the permanent Works during the Defects Liability Period.

48.4 Surfaces Requiring Reinstatement
Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking-Over Certificate shall expressly so state.

48.5 Prevention from Testing
If the Contractor is prevented from carrying out the Tests on Completion by a cause for which the Employer or the Engineer or other contractors employed by the Employer are responsible, the Employer shall be deemed to have taken over the Works on the date when the Tests on Completion would have been completed but for such prevention. The Engineer shall issue a Taking-Over Certificate accordingly. Provided always that the Works shall not be deemed to have been taken over if they are not substantially in accordance with the Contract.

If the Works are taken over under this Sub-Clause the Contractor shall nevertheless carry out the Tests on Completion during the Defects Liability Period. The Engineer shall require the tests to be carried out by giving 14 days notice.

49.0 Defects Liability
49.1 Defects Liability Period
In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:
(a) the date of completion of the Works certified by the Engineer in accordance with Sub-Clause 48.1 to 48.5, or
(b) in the event of more than one certificate having been issued by the Engineer under Sub-Clause 48.1 to 48.5, the respective dates so certified and in relation to the Defects Liability Period the expression "the Works" shall be construed accordingly.

49.2 Completion of Outstanding Work and Remedying Defects
To the extent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:
(a) complete the work, if any, outstanding on the date stated in the Taking-Over Certificate as soon as practicable after such date, and
(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkage or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

49.3 Cost of Remediying Defects
All work referred to in Sub-Clause 49.2 shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the Engineer, due to:
(a) the use of materials, Plant or workmanship not in accordance with the Contract, or
(b) where the Contractor is responsible for the design for part of the Permanent Works, any fault in such design, or
(c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor’s part under the Contract.

If, in the opinion of the Engineer, such necessity is due to any other cause, he shall determine an addition to the Contract Price in accordance with Sub-Clause 52.1 to 52.3 and shall notify the Contractor accordingly, with a copy to the Employer.

49.4 Contractor’s Failure to Carry Out Instructions

In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

49.5 Extension of Defect Liability

The provisions of this Clause shall apply to all replacements or renewals of Plant carried out by the Contractor to remedy defects and damages as if the replacements and renewals had been taken over on the date they were completed. The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works could not be used by reason of a defect or damage. If only part of the Works is affected the Defects Liability Period shall be extended only for that part. In neither case shall the Defects Liability Period extend beyond 2 years from the date of taking over.

When progress in respect of Plant has been suspended under Sub-Clause 40.1 to 40.3, the Contractor’s obligation under this Clause shall not apply to any defects occurring more than 2 years after the Time for Completion established on the date of the Letter of Acceptance.

50.1 Contractor to Search

If any defect, shrinkage or other fault in the Works appears at any time prior to the end of the Defects Liability Period, the Engineer may instruct the Contractor, with a copy to the Employer, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Sub-Clause 49.1 to 49.5.

51.0 Alterations, Additions and Omissions

51.1 Variations

The Engineer shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following

(a) increase or decrease the quantity of any work included in the Contract,
(b) omit any such work (but not if the omitted work is to be carried out by the Employer or by another contractor),
(c) change the character or quality or kind of any such work,
(d) change the levels, lines, position and dimensions of any part of the Works,
(e) execute additional work of any kind necessary for the completion of the Works,
(f) change any specified sequence or timing of construction of any part of Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Sub-Clause 52.1 to 52.3. Provided that where the
issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

51.3 Instructions for Variations

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.

52.1 Valuation of Variations

All variations referred to in Sub-Clause 51.1 to 51.2 and any additions to the Contract Price which are required to be determined in accordance with Sub-Clause 52.1 to 52.3 (for the purpose of this Clause referred to as "varied works") shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the Contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Employer and the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Sub-Clause 60.1 to 60.14.

52.2 Power of Engineer to Fix Rates

Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then, after due consultation by the Engineer with the Employer and the Contractor, a suitable rate or price shall be agreed upon. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Sub-Clause 60.1 to 60.14.

52.3 Variations Exceeding 10 percent

If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:

(a) all varied work, valued under Sub-Clauses 52.1 and 52.2, and
(b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, day works and adjustments of price made under Sub-Clause 70.1 to 70.2.

but not from any other cause, there have been additions to or deductions from the Contract Price which taken together are in excess of 10 percent of the "Effective Contract Price" (which for the purpose of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for day works, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sum as may be agreed between the Contractor and the Engineer or, failing agreement, determined by the Engineer having regard to the Contractor's Site and the general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 10 percent of the Effective Contract Price.
53.0  Procedure for Claims

53.1  Notice of Claims

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer, with a copy to the Employer, within 28 days after the event giving rise to the claim has first arisen.

53.2  Contemporary Records

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

53.3  Substantiation of Claims

Within 42 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under the Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event. The Contractor shall copy to the Employer all accounts sent to the Engineer pursuant to this Sub-Clause.

53.4  Failure to Comply

If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer considers to be verified by contemporary records (whether or not such records were brought to the Engineer's notice as required under Sub-Clause 53.2 and 53.3).

53.5  Payment of Claims

The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Sub-Clause 60.1 to 60.14 such amount in respect of any claim as the Engineer, after due consultation with the Employer and the Contractor, may consider due to the Contractor provided that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payments in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

54.0  Contractor’s Equipment, Temporary Works and Materials

54.1  Exclusive Use for the Works

All Contractor’s Equipment, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. Provided that consent shall not be required for vehicles engaged in transporting any staff, labour, Contractor’s Equipment, Temporary Works, Plant or materials to or from the Site.
54.2 **Employer Not Liable for Damage**

The Employer shall not at any time be liable, save as mentioned in Sub-Clause 20.1 to 20.5 and 65.1 to 65.8, for the loss of or damage to any of the said Contractor’s Equipment, Temporary Works or materials.

54.3 **Incorporation of Clause in Sub-Contracts**

The Contractor shall, where entering into any subcontract for the execution of any part of the Works, incorporate in such subcontract (by reference or otherwise) the provisions of this Clause in relation to Contractor’s Equipment, Temporary Works or materials brought on to the Site by the Subcontractor.

54.4 **Approval of Material Not Implied**

The operation of this Sub-Clause 54.1 to 54.4 shall not be deemed to imply any approval by the Engineer of the material or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

55.0 **Measurement**

55.1 **Quantities**

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

56.1 **Works to be Measured**

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the Works in accordance with the Contract and the Contractor shall be paid that value in accordance with Sub-Clause 60.1 to 60.14. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor’s authorised agent, who shall

(a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and

(b) supply all particulars required by the Engineer.

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare such records and drawings as the work proceeds as he deems necessary or appropriate and the Contractor, as and when called upon to do so in writing, shall within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawing are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

57.1 **Method of Measurement**

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

57.2 **Breakdown of Lump Sum Items**

For the purpose of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 28 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall be subject to the approval of the Engineer.

58.1 **Not Included**

59.1 **Not Included**
60.0 Certificates and Payments

60.1 Monthly Statements and Bills

The Contractor shall submit a statement in 3 copies to the Engineer by 7th day of each month for the work executed up to the end of previous month in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

(a) the estimated Contract value of the Temporary and Permanent Works executed up to the end of the month in question, at base unit rates and prices
(b) the actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous month, at base unit rates and prices
(c) the estimated Contract value at base unit rates and prices of the Temporary and Permanent Works for the month in question, obtained by deducting (b) and (a)
(d) the value of any variations executed up to the end of the month in question, less the amount certified in the previous Interim Payment Certificate, pursuant to Sub-Clause 52.1 to 52.3
(e) amount reflecting changes in cost and legislation, if any, pursuant to Sub-Clause 70.1 to 70.2
(f) any amount to be deducted as repayment of the Advance under the provisions of Sub-Clause 60.7
(g) any other sum, to which the Contractor may be entitled under the Contract
(h) any deduction for the advance income tax, advance works contract tax and Royalties on materials as per the relevant act and as provided in the Appendix to Tender.

i. As per the Government of Karnataka Order No. LD/300/LET / 2006 Bangalore dated 18-01-2007, 1% (One Percent) Cess on the total tender amount will be recovered from the Bills of the Contractor under building and other Construction Worker’s Welfare Cess act 1996.

60.2 Monthly Payments.

The said statement shall be approved or amended by the Engineer in such a way that in his opinion, it reflects the amounts due to the Contractor in accordance with the Contract after deduction, other than pursuant to Sub-Clause 47.1 to 47.2, of any sums which may have become due and payable by the Contractor to the Employer. In case where there is a difference of opinion as to the value of any item the Engineer’s view shall prevail. Within 30 days following the receipt of the monthly statement referred to in Sub-Clause 60.1, the Engineer shall determine the amounts due to the Contractor and shall issue to the Employer and the Contractor a certificate, herein called the “Interim Payment Certificate”, certifying the amount due to the Contractor.

Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the billed amount is less than the Minimum Amount of Interim Payment Certificate stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the performance security has been provided by the Contractor and approved by the Employer.

60.3 Material and Plant for the Permanent Works

With respect to procurement and delivery of major items of materials and Plant brought by the Contractor to the Site for incorporation in the Permanent Works which are specifically listed in the Special Conditions of Contract, the Contractor shall be paid for the reasonable cost of procurement and delivery in accordance with the stipulated proportion of his quoted rates under the monthly progress payment, subject to satisfactory compliance with the following conditions:

(i) the materials and Plant delivered to the site are those which are reasonably required by the Contractor for accomplishing the smooth and timely performance of the Works, and the delivery schedule for such materials and Plant has been approved in advance by the Engineer;
(ii) the materials and Plant are in accordance with the specification for the Works;
(iii) the materials and Plant are properly stored and protected against loss, damage or deterioration;
(iv) the Contractor’s records of the requirements, orders, receipts and use of materials and Plant are kept in a form approved by the Engineer and such records are available for inspection by the Engineer;
the Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the Site, together with such documents as may be required for the purpose of evidencing such cost; and

the Contractor has adequately indemnified the Employer against loss or damage to the materials and Plant during the period between delivery to the site and incorporation into the Works.

Payment by the Employer under this Clause for materials and Plant delivered to the Site does not, in any way, relieve the Contractor of his responsibility to ensure the safety and protection of such materials and Plant during the period between delivery to the site and their incorporation into the Permanent Works. In the event that any materials and Plant are lost, damaged or deteriorated between their delivery to the site and their incorporation into the Permanent Works, the Contractor shall be fully responsible to replace such materials and Plant, or to make such repairs as may be required to restore the materials and Plant to the specified condition, at his own cost.

60.4 Place of Payment

Payments to the Contractor by the Employer shall be made into a bank account or accounts nominated by the Contractor, or as may otherwise be agreed.

60.5 Retention Money

Not included.

60.6 Refund of Retention Money

Not included.

60.7 Advance Payment -DELETED-

60.8 Time for Payment

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract shall, subject to Sub-Clause 47.1, be paid by the Employer to the Contractor within 60 days after the Contractor's monthly statement has been submitted to the Engineer for certification or, in the case of the Final Certificate, pursuant to Sub-Clause 60.13 within 90 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification.

60.9 Correction of Certificate

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificate which has been issued by him, and shall have the authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

60.10 Statement at Completion

Not later than 42 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a statement at completion with supporting documents showing in detail, in the form approved by the Engineer:

(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over-Certificate;
(b) any further sums which the Contractor considers to be due; and
(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

Estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.2.

60.11 Final Statement

Not later than 28 days after the issue of the Defect Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer:

(a) the value of all work done in accordance with the contract; and
(b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and
submit to the Engineer the Final Statement as agreed (for the purpose of these Conditions referred to as "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall issue to the Employer an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67. The final statement shall be agreed upon settlement of the dispute.

60.12 Discharge

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Certificate issued pursuant to Sub-Clause 60.13 has been made and the performance security referred to in Sub-Clause 10.1 has been returned to the Contractor.

60.13 Final Certificate

Within 28 days after receipt of the Final Statement and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Certificate stating:

(a) the amount which, in the opinion of the Engineer, is finally due under the Contract; and
(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled under the Contract other than Sub-Clause 47.1 and 47.2, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

60.14 Cessation of Employer’s Liability

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.10.

61.0 Defects Liability

61.1 Approval Only by Defects Liability Certificate

Only the Defects Liability Certificate, referred to in Sub-Clause 62.1 and 62.2, shall be deemed to constitute approval of the Works.

62.1 Defects Liability Certificate

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects therein to the Engineer’s satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period or, if different defects liability periods shall become applicable to different Sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Sub-Clauses 49.1 and 49.5 and 50.1, have been completed to the satisfaction of the Engineer.

62.2 Unfulfilled Obligations

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfillment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defects Liability Certificate is issued and, for the purpose of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.
63.0 Remedies

63.1 Default of Contractor

If the Contractor is deemed by law unable to pay his debts as they fall due, or enters into voluntary or involuntary bankruptcy, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or becomes insolvent, or makes an arrangement with, or assignment in favour of, his creditors, or agrees to carry out the Contract under a committee of inspection of his creditors, or if a receiver, administrator, trustee or liquidator is appointed over any substantial part of his assets, or if, under any law or regulation relating to reorganisation, arrangement or readjustment of debts, proceedings are commenced against the Contractor or resolutions passed in connection with dissolution or liquidation or if any steps are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if any act is done or event occurs with respect to the Contractor or his assets which, under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods or if the Engineer certifies to the Employer with a copy to the Contractor, that, in his opinion, the Contractor:

(a) has repudiated the Contract, or
(b) without reasonable excuse has failed
   (i) to commence the Works in accordance with Sub-Clause 41.1, or
   (ii) to proceed with the Works, or any Section thereof, within 28 days after receiving notice pursuant to Sub-Clause 46.1, or
(c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4 or an instruction issued pursuant to Sub-Clause 39.1 within 28 days after having received it, or
(d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the Contract, or
(e) has contravened Sub-Clause 4.1,

then the Employer may, after giving fourteen days notice to the Contractor, enter upon the Site and terminate the employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the Contract or affecting the rights and powers conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works at the risk and cost of the defaulting Contractor. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Plant, Temporary Works and materials which have been deemed to be reserved exclusively for the execution of the Works under the provisions of the Contract as he or they may think proper and the Employer may at any time sell any of the said Contractor's Equipment, Temporary Works and unused Plant and materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.

63.2 Valuation at Date of Termination

The Engineer shall, as soon as may be practicable after any such entry and termination by the Employer, fix and determine expert, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify:

(a) what amount (if any) had, at the time of such entry and termination, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and

(b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.

63.3 Payment after Termination

If the Employer shall enter and terminate the employment of the Contractor under this Clause, the Contractor shall forfeit the Performance Security provided under the terms of Clause 10. The Employer shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution, completion and remediying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him.
after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

63.4 Assignment of Benefit of Agreement
Unless prohibited by law, the Contractor shall, so instructed by the Engineer within 14 days of such entry and expulsion referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the Contract which the Contractor may have entered into.

64.1 Urgent Remedial Works If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period any remedial or other work is in the opinion of the Engineer, urgently necessary for the safety or progress of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other persons to carry out such work as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof.

65.0 SPECIAL RISKS
65.1 No Liability for Special Risks
The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2 whether by way of indemnity or otherwise, for or in respect of: (a) destruction of or damage to the Works, save to work condemned under the provision of Sub-Clause 10.12 prior to the occurrence of any of the said special risks, or (b) destruction of or damage to property, whether of the Employer or third parties, or (c) injury or loss of life.

65.2 Special Risks
The special risks are the risks defined under Para (a) sub-para’s (i) to (v) of Sub-Clause 20.4

65.3 Damage to Works by Special Risks
If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractors Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for completion of the Works, to payment for:

(a) rectifying any such destruction or damage to the Works, and
(b) replacing or rectifying such materials or Contractor’s Equipment,
and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 (which shall in the case of the cost of replacement of Contractor’s Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.

65.4 Projectile, Missile
Destruction, damage, injury or loss of life caused by the explosion or impact whenever and wherever occurring, of any mine, bomb, shell, grenade or other projectile, missile, munitions, or explosive of war, shall be deemed to be a consequence of the said special risks.

65.5 Increased Costs Arising from Special Risks
Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Works (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39 prior to the occurrence of any special risks) which are howsoever
attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of the Contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer.

65.6 Outbreak of War
If during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provision of this Clause, continue to use his best endeavors to complete the execution of the Works. Provided that the Employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and upon such notice being given, the Contractor shall, except as to the rights of the parties under this Clause and to the operation of Clause 67, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

65.7 Removal of Contractor’s Equipment on Termination
If the Contract is terminated under the provisions of Sub-Clause 65.6, the Contractor shall, with all reasonable dispatch, remove from the Site all Contractor’s Equipment and shall give similar facilities to his Subcontractors to do so.

65.8 Payment if Contract Terminated
If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer, insofar as such amounts or items have not already been covered by payments on account made to the Contractor, for all Works executed prior to the date of termination at the rates and prices provided in the Contract and in addition:

a) The amounts payable in respect of any preliminary items referred to in the Bill of Quantities so far as the Work or service comprised therein has been carried out or performed and a proper proportion of any such items which have been partially carried out or performed.

b) The cost of materials, Plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him.

c) A sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payment referred to in this Sub-Clause.

d) Any additional sum payable under the provisions of Sub-Clause 65.3 and 65.4

e) Such proportion of the cost as may be reasonable, taking into account payments made or to be made for work executed, of removal of Contractor’s Equipment under Sub-Clause 65.7 and if required by the Contractor, return thereof to the Contractor’s main plant yard in his country of registration or to other destination at no greater cost.

f) The reasonable cost of repatriation of all the Contractor’s staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Contractor’s Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the Employer from the Contractor under the terms of the Contract. Any sums payable under this sub-Clause shall, after due consultation with the Employer and the Contractor, be determined by the Engineer who shall notify the Contractor accordingly, with a copy to the Employer.

66.1 Payment in Event of Release from Performance.
If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either party to fulfill his contractual obligations, or under the law governing the Contract the parties are released from further performance, then the sum payable by the Employer to the Contractor in respect of the work
executed shall be the same as that which would have been payable under Sub-Clause 65.1 to 65.8 if the Contract had been terminated under the provisions of Sub-Clause 65.1 to 65.8.

67.0 Settlement of disputes

67.1 Engineer’s Decision
If any dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of Works or after their completion, and before or after repudiation or other termination of the Contract, including any dispute as to:

a) the meaning of the specifications, designs, drawings and instructions herein before mentioned,
b) the quality of the workmanship or materials,
c) any opinion, instruction, determination, certificate or valuation of the Engineer, or
d) any other question, claim, right, matter or anything whatsoever in any way arising out of or relating to the contract, designs, drawings, specification, estimates, instructions, conditions, orders or the failure to execute the same, the dispute shall, in the first place, be referred in writing to the Engineer who has jurisdiction over the Works specified in the Contract, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. Not later than the forty second day after the day on which he received such reference the Engineer shall give written notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause. Subject to other forms of settlement hereinafter provided, the Engineer’s decision in respect of every dispute or difference so referred shall be final and binding upon the Contractor and the Employer. Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer until or unless the same shall be revised in an amicable settlement or as hereinafter provided.

67.2 Remedy When the Engineer’s Decision is Not Accepted
If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the forty second day after the day on which he received the reference, then either the Employer or the Contractor may, on or before the twenty eighth day after the day on which he received notice of such decision, or on or before the twenty eighth day after the day on which the said period of 42 days expired, as the case may be, give notice to the other party, with a copy to the Engineer, of his intention to approach the law courts of the State of Karnataka for settlement of the dispute.
If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no written notice to approach the law court has been given by either the Employer or the Contractor on or before the twenty eighth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

67.3 Amicable Settlement
Where notice of intention to commence legal action as to a dispute has been given in accordance with Sub-Clause 67.2, legal action shall not be commenced unless an attempt has first been made by the parties to settle the dispute amicably. Provided that, unless the parties otherwise agree, legal action may be commenced on or after the fifty-sixth day after the day on which the notice of intention to commence legal action of such dispute was given, whether or not any attempt at amicable settlement thereof has been made.

67.4 Legal Action
Any dispute in respect of which:
a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 67.1, and
b) amicable settlement has not been reached within the period stated in Sub-Clause 67.3 shall be finally settled, unless otherwise provided in the Contract, in the Municipality or District in which the Contract is being executed, and under the laws of the State of Karnataka. Legal action may be commenced prior to or after completion of the Works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the legal action being conducted during the progress of the Works.
67.5 Contractor to Execute Work Pending Settlement

Whether the dispute is referred to the Engineer, to amicable settlement, or to the law courts, as the case may be, the Contractor shall, unless the Contract has been repudiated or terminated, proceed to execute and complete the Works with all due diligence pending settlement of the said dispute or differences.

68.0 Notices

68.1 Notice to Contractor

All certificates, notices or instruction to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to, or left at, the Contractor’s principal place of business or such other address as the Contractor shall nominate for that purpose.

68.2 Notice to Employer and Engineer

Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to, or left at, the respective addresses nominated for that purpose in the Special Conditions of Contract.

68.3 Change in Address

Either party may change a nominated address to another address in the Country where the Works are being executed by prior notice to the other party, with a copy to the Engineer, and the Engineer may do so by prior notice to both parties.

69.0 Default of Employer

69.1 Contractor’s Entitlement to Suspend Works

Without prejudice to the Contractor’s entitlement to payment under Sub-Clause 60.8 the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer within 56 days after the expiry of the time stated in Sub-Clause 60.8 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days prior notice to the Employer, suspend work or reduce the rate of work.

If the Contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub-Clause and thereby suffers delay or incurs cost the Engineer shall, after due consultation with the Employer and the Contractor, determine any extension of time to which the Contractor is entitled under Sub-Clause 44.1 to 44.3, and shall notify the Contractor accordingly, with a copy to the Employer. Any price adjustment which may be applicable for such time extension granted by the Engineer will be determined in accordance with Sub-clause 70.1 to 70.2.

69.2 Resumption of Work

Where the Contractor suspends work or reduces the rate of work, having given notice in accordance with Sub-Clause 69.1, and the Employer subsequently pays the amount due pursuant to Sub-Clause 60.8, the Contractor’s entitlement under Sub-Clause 69.1 shall, lapse and the Contractor shall resume normal working as soon as is reasonably possible.

70.0 Changes in cost and legislation

70.1 Price Adjustment:

As per G.O. No. FD/ 59 / Pro CELL /2004, dt. 26-11-2004 Price Adjustment clause shall be included in all works contracts whose estimated cost put to tender is Rs. 100.00 lakhs or more and the period of completion is 12 months or more. The Price Adjustment & the formulae for Price Adjustment shall be as per Annexure- 1 to Govt. Order Dated 26-11-2004. Further, in modification of the Government Order dated 26-11-2004, The Government has issued the following Orders for Price Adjustment vide G. O.No. FD / 03 / PCL /2008, dt. 21-11-2008.

(a) For all works costing more than Rs.50.00 lakhs, if the period of execution is more than 12 months, the price adjustment will be calculated as prescribed in Annexure to G.O. No .FD 59 PRO Cell/2004, dt. 26.11.2004.

(b) If the period of execution is more than 6 months but less than or equal to 12 months for work costing more than Rs.50.00 lakhs, Star rates in respect of specified materials (cement, steel
and bitumen) only shall be payable to the contractor based on the all India average wholesale price index for the said materials. The star rates adjustment shall be as per the increase or decrease in the index as applied to the said materials between the last date for receiving bids and the date of execution as per the approved programme of works submitted by the contractor at the time of execution of agreement which shall mandatorily be a part of the agreement.

(c) If the period of execution is less than or equal to 6 months, for all works irrespective of the cost of the works, price adjustment or star rates shall not be applicable.

(d) In works contracts where, Price Adjustment clause is provided, the Price Adjustment shall be admissible from the date of opening of tenders (Original or extended).

(e) Price Adjustment clause shall not be included in Goods and equipment tender documents. However, in respect of tender documents for procurement of Electric cables, Transformers, Generators, Motors that have raw material component subject to price fluctuations, appropriate Price Adjustment clauses may be incorporated by the Tender Inviting Authority in the tender documents, with the specific approval of the concerned Head of the Department or Managing Director of the Public Undertaking Board.

Consequent to the clarification issued by the Finance Department vide their letter No.FD/876/expenditure-12/2010 Dated:23.10.2010 regarding price adjustment for M.S. pipes and reinforcement steel, the following guidelines are issued for calculating the price adjustment for M.S. pipes and reinforcement steel;

a) In the wholesale price index with base period as 1993-94, price indices for M.S. bars and rounds are included but price indices for M.S. pipes are not included. Hence, for determining the Price Adjustment for M.S. pipes, indices pertaining to steel sheets, plates and strips may be adopted.

For determining the Price Adjustment for Reinforcement steel, indices pertaining to M.S. Bars and rounds from the wholesale price index may be adopted.

b) Further, the wholesale price index with base period as 2004-05 has been notified and is applicable from April-2005 for Research and Analysis work and for other works, indices are applicable from August – 2010. In this new series, price indices for Steel: pipes and tubes (for M.S. Pipes), rebars (for reinforcement steel), steel structures (for structural steel), Grey cement (for ordinary Portland cement), construction machinery (for plant and machinery spares), polythene / plastic Granules (for HDPE pipes), Plastic/PVC pipes (for PVC pipes) and Pig iron (for DI pipes, CI pipes & DI/CI Valves) are included, which may be adopted for determining the Price Adjustment pertaining to the category.

70.2 Price Adjustment:

Contract price shall be adjusted for increase or decrease in rates and prices of labour, materials, fuels and lubricants in accordance with the following principles and procedures and as per formulae given hereunder.

1) The Price Adjustment shall apply for the work done from the date of commencement up to the end of original period of completion or extensions granted by the Employer and shall not apply to work carried out beyond the stipulated period of completion for reasons attributable to the contractor.

2) The price adjustment shall be determined during each quarter from the formula given hereunder.

3) Following expressions and meanings are assigned to the work done during the quarter:

\[ R = \text{Total value of work done during the quarter. It would include the amount of secured advance for materials paid for (if any)} \] during the quarter, less the amount of the secured...
advance recovered during the quarter. It will exclude value for works executed under variations for which price adjustment (if any) will be worked out separately based on the terms mutually agreed.

4) To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

70.2 Price Adjustment Formula

Adjustment of Labour component

1) Price adjustment for increase or decrease in the cost due to Labour shall be paid in accordance with the following formula.

\[ V_L = 0.85 \times P_L/100 \times RX \times \frac{(L_i - L_o)}{L_o} \]

where,

- \( V_L \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local labour;
- \( L_o = \) The average consumer price index for industrial workers for Hubli-Dharwad Centre for the quarter preceding the date of opening of tenders as published by the Labour Bureau, Ministry of Labour, Government of India,
- \( L_i = \) The average consumer price index for industrial workers for Hubli-Dharwad Centre for the quarter under consideration as published by the Labour Bureau, Ministry of Labour, Government of India,
- \( P_L = \) Percentage of Labour component of the work

Adjustment for Cement Component:

ii) Price adjustment for increase or decrease in the cost of cement component procured by the contractor shall be paid in accordance with the following formula.

\[ V_c = 0.85 \times P_c/100 \times RX \times \frac{(C_i - C_o)}{C_o} \]

where,

- \( V_c \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for cement;
- \( C_o = \) All India average wholesale price Index for grey cement (Ordinary Portland cement) for the quarter preceding the date of opening of the tenders as published by the Office of Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- \( C_i = \) All India average wholesale price Index for grey cement (Ordinary Portland cement) for the quarter under consideration as published by the Office of

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1 The formula has some normal components, it should be changed if need be to suit the nature of the work.
2 The index numbers are available in the Web site http://labourbureau.nic.in
3 Insert the name of centre for which the indices presently available for Karnataka State are Bangalore, Belgaum, Hubli-Dharwad, Mysore. Choose the centre nearest to the work for which tenders are invited.
Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;

$P_c$ = Percentage of cement component of the work

**Adjustment for Steel Component:**

(iii) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula.

\[ V_s = 0.85 \times P_s / 100 \times R \times (S_i - S_o) / S_o \]

Where,

- $V_s$ = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for steel;
- $S_o$ = All India average wholesale price Index for steel (Rebars for reinforcement steel, steel structures for structural steel, steel pipes and tubes for MS pipes, Iron and steel/pig iron for DI pipes, CI pipes and DI/CI valves) for the quarter preceding the date of opening of Bids as published by the Office of Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- $S_i$ = All India average wholesale price Index for steel (Rebars for reinforcement steel, steel structures for structural steel, steel pipes and tubes for MS pipes, Iron and steel/pig iron for DI pipes, CI pipes and DI/CI valves) for the quarter under consideration as published by the Office of Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- $P_s$ = Percentage of steel component of the work

**Adjustment of Bitumen Component:**

(iv) Price adjustment for increase or decrease in cost of bitumen shall be paid in accordance with the following formula:

\[ V_B = 0.85 \times P_B / 100 \times R \times (B_i - B_o) / B_o \]

Where,

- $V_B$ = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for bitumen;
- $B_o$ = The official Retail price of Bitumen at the IOC/HPCL/BPL or other depot at Bailhongal 7 on the day 30 days prior to the date of opening Bids.
- $B_i$ = The official Retail price of Bitumen at the IOC/HPCL/BPL or other depot at Bailhongal 7 on the day 30 days prior to the date of opening Bids.

7 Insert the nearest location of POL Depot

**Adjustment for PVC Component:**

(v) Price adjustment for increase or decrease in the cost of PVC materials procured by the contractor shall be paid in accordance with the following formula.

\[ V_M = 0.85 \times P_p / 100 \times R \times (M_i - M_p) / M_p \]

Where,

- $V_M$ = Increase or decrease in cost of work during the quarter under consideration due to changes in rates for PVC materials
- $M_p$ = The all India average wholesale price index for PVC pipe for the quarter preceding the date of opening of bids, as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi;
- $M_i$ = The all India average wholesale price index for PVC pipe for the quarter under consideration as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi;
- $P_p$ = Percentage of PVC materials of the work.
**Adjustment of Fuel and Lubricant Component:**

v) Price adjustment for increase or decrease in cost of Fuel and Lubricants shall be paid in accordance with the following formula:

\[ VF = 0.85 \times \frac{PF}{100} \times RX \frac{(Fi - Fo)}{Fo} \]

where,

- \( VF \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for Fuel and Lubricant;
- \( Fo \) = The official Retail price of High Speed Diesel (HSD) at the IOC/HPCL/BPL or other consumer pump at **Bailhongal town** on the day 30 days prior to the date of opening Bids.
- \( Fi \) = The official Retail price of HSD at the IOC/HPCL/BPL or other consumer pump at **Bailhongal town** for the 15th day of middle calendar of the month of the quarter under consideration.
- \( PF \) = Percentage of Fuel and Lubricant Component of the work

Note: For the application of this clause, index of HSD 9 has been chosen to represent Fuel and Lubricant group.

**Adjustment for Plant and Machinery Spares Component:**

(vi) Price adjustment for increase or decrease in the cost of Plant and Machinery Spares procured by the contractor shall be paid in accordance with the following formula.

\[ VP = 0.85 \times \frac{PP}{100} \times RX \frac{(Pi - Po)}{Po} \]

where,

- \( VP \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for Plant and Machinery Spares;
- \( Po \) = All India average wholesale price Index for Construction Machinery and parts for the quarter preceding the date of opening of Bids, as published by the Office of Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- \( Pi \) = The All India average wholesale price Index for Construction Machinery and parts for the quarter under consideration as published by the Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- \( PP \) = Percentage of Plant and Machinery Spares component of the work 

Note: For the application of this clause, index of Construction Machinery and parts 10 has been chosen to represent Plant and Machinery Spares

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8 Insert the location of the nearest POL Consumer pump
9 This could be appropriately changed to any other item depending on the nature of
10 This could be appropriately changed to any other item depending on the nature of work.

**Adjustment of other Materials:**

(vii) Price adjustment for increase or decrease in the cost of other Materials other than cement, steel, bitumen and Fuel and Lubricants11 procured by the contractor shall be paid in accordance with the following formula.

\[ VM = 0.85 \times PM /100 \times RX (Mi – Mo)/ Mo \]

where,

- \( VM \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local Materials other than cement, steel, bitumen and Fuel and Lubricants;
- \( Mo \) = The All India average wholesale price Index for all commodities for the quarter preceding the date of opening of Bids as published by the Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- \( Mi \) = The All India average wholesale price Index for all commodities for the quarter under consideration as published by the Office of Economic Adviser, Ministry of Commerce and Industry, Government of India, New Delhi;
- \( PM \) = Percentage of other material component (other than cement, steel, bitumen and Fuel and Lubricants) of the work.

The following percentages12 will govern the price adjustment for the entire contract 13

<table>
<thead>
<tr>
<th>Component</th>
<th>UGD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Labour – ( P_L )</td>
<td>29%</td>
</tr>
<tr>
<td>2 Cement – ( P_C )</td>
<td>15%</td>
</tr>
<tr>
<td>3 Steel – PS</td>
<td>4%</td>
</tr>
<tr>
<td>4 Bitumen – PB</td>
<td>0.5%</td>
</tr>
<tr>
<td>5 Fuel and Lubricant – PF</td>
<td>5%</td>
</tr>
<tr>
<td>6 Plant &amp; Machinery Spares – PF</td>
<td>15%</td>
</tr>
<tr>
<td>7 PVC-U Pipes ( P_p )</td>
<td>4%</td>
</tr>
<tr>
<td>8 Other Materials – PM (Inclusive of SWG pipes, specials etc, M.H.frames, Foot steps)</td>
<td>27.5%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

11 Add delete or change depending on the nature of work.

12 The percentage has to be approximately worked out on the estimates of cost and incorporated in the tender document before the issue. It shall not be changed even if there is change of scope of work during execution.

13 The components could be added or deleted or changed depending on the nature of work.

14 The total of the percentage for the various components of the work should be 100.
70.2 Other Changes in cost
Not included.

70.3 Adjustment Formulae
Not included

70.4 Sources of Indices
Not included

70.5 Base, Current and Provisional Indices
Not included

70.6 Adjustment After Completion
Not included

70.7 Weightings
Not included

70.8 Subsequent Legislation
Not included

71.1 Not Included

72.1 Not Included

73.0 Taxation

73.1 Foreign Taxation
The prices bid by the Contractor shall include all taxes, duties and other charges imposed outside the Employer’s country on the production, manufacture sale and transport of the Contractor’s Equipment, Plant, materials and supplies to be used on or furnished under the Contract, and on the services performed under the Contract.

73.2 Local Taxation
The prices bid by the Contractor shall include all customs duties, import duties business taxes, income and other taxes that may be levied in accordance to the laws and regulations in being as of the date 28 days prior to the closing date for submission of bids in the Employer’s country on the Contractor’s Equipment, Plant, materials and supplies (permanent, temporary and consumable) acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in the Employer’s country on profits made by him in respect of the Contract.

73.3 Income Taxes on Staff
The Contractor’s staff, personnel and labour will be liable to pay personal income tax in the Employer’s country in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.

74.1 Bribes
If the Contractor, or any of his Subcontractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to the Contract or any other contract with the Employer, or for showing or forbearing to show favour or disfavour to any person in relation to the Contract or to any other contact with the Employer, then the Employer may enter upon the Site and the Works and expel the Contractor and the provisions of Sub-Clause 63.1 to 63.4 hereof shall apply as if such entry and expulsion had been made pursuant to that Clause.

75.1 Termination of Contract for Employer’s Convenience
The Employer shall be entitled to terminate this Contract at any time for the Employer’s convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor
(a) shall proceed as provided in Sub-Clause 65.7, and
(b) shall be paid by the Employer as provided in Sub-Clause 65.8

76.1 Restriction on Eligibility
Not included.

77.1 Joint and Several Liability
-Deleted-
78.1 Details to be Confidential
The Contractor shall treat the details of the Contract as private and confidential, save insofar as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the previous consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract the same shall be referred to the decision of the Employer whose award shall be final.

79.1 CONTRACTOR'S TEMPORARY MOORINGS
Should the Contractor for the purpose of the Contract desire to provide temporary mooring for his craft and floating plant, he will be allowed to do so in positions and manners approved by the Engineer. The Contractor shall not lay such moorings so as to interfere with traffic in the waterways and such moorings shall be removed if and when required by the Engineer.

80.1 LIFE-SAVING APPLIANCES AND FIRST-AID EQUIPMENT
The Contractor shall provide and maintain upon the Works sufficient, proper and efficient life saving appliances and first aid equipment to the approval of the Engineer and in accordance with the requirements of ILO Convention 62. The appliances and equipment shall available for use at all time.

81.1 DRAWINGS AND PHOTOGRAPHS OF THE WORKS
The Contractor shall not disclose details of drawings furnished to him and works on which he is engaged without the prior approval of the Engineer in writing. No photograph of the Works or any part thereof or Plant employed thereon shall be taken or permitted by the Contractor to be taken by any of his employees or any employees of his Subcontractors without the prior approval of the Engineer in writing, and no such photographs shall be published or otherwise circulated without approval of the Engineer in writing. Provided however, that the provisions of this Clause will not prevent the Contractor from taking such photograph as are necessary or desirable for maintaining proper records of the work progress and site conditions, and provided further that the approval of the Engineer shall not unreasonably be withheld.

82.1 THE APPRENTICES ACT 1961
The Contractor shall duly comply with the provisions of the Apprentices Act 1961 (III of 1961), the rules made there under and the orders that may be issued from time to time under the said Act and the said Rules and on his failure or neglect to do so he shall be subject to all liabilities and penalties provided by the said Act and said Rules.
Extracts of Contract Labour (Regulation and Abolition) Act 1970

ANNEXURE - A
(Reference Clause 34.2 and 35.1)

(a) The Contractor shall, at all times during the continuance of the Contract, comply fully with all existing Acts, regulations and byelaws including all statutory amendments and re-enactment of State or Central Government and other local authorities and any other enactments, notifications and acts that may be passed in future either by the State or the Central Government or local authority, including Indian Workmen's Compensation Act, Contract Labour (Regulation and Abolition) Act 1970 and Equal Remuneration Act 1976, Factories Act, Minimum Wages Act, Provident Fund Regulations, Employees Provident Fund Act, schemes made under the same Act and also Labour Regulations mentioned in Annexure A to Section IV, Health and Sanitary Arrangement for Workmen, Insurance and other benefits and shall keep Employer indemnified in case any action is commenced by competent authorities for contravention by the Contractor. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated henceforth on the part of the Contractor, the Engineer shall have the right to deduct from any moneys due to the Contractor, his amount of performance security or recover from the Contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer, responsibility in connection with the employees of the Contractor, who shall, in no case, be treated as the employees of the Employer at any point of time.

Fair Wages

(b) The Contractor shall pay the labourers engaged by him on the work not less than fair wage which expression shall mean, whether for time or piecework, the respective rates of wages fixed by the Public Works Department as fair wages for the area payable to the different categories of labourers or those notified under the Minimum Wages Act for corresponding employees of the Employer, whichever may be higher.

(c) The Contractor shall, notwithstanding the provisions of a contract to the contrary, cause to be paid a fair wage to labourers indirectly engaged on the Works, including any labour engaged by sub/contractors in connection with the sand works as if the labourer had been directly employed by him.

NOTICES

(d) The Contractor shall, before he commences the work, display, and correctly maintain, in a clean and legible condition at a conspicuous place on the Site, notices in English and in a language spoken by the majority of the workers, stating therein the rate of wages which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Engineer.

Wages Records

(e) The contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be convenient and as per the requirements of the Employer/Engineer and the Conciliation Officer (Central), Ministry of Labour, Government of India, or such other authorised person appointed by the Central or State Government and the same shall include the following particulars of each worker:
(i) Name, worker’s number and grade;
(ii) Rate of daily or monthly wage;
(iii) Nature of work on which employed;
(iv) Total number of days worked during each wage period;
(v) Total, amount payable for the work during each wage period;
(vi) All deduction made from the wage with details in each case of the
Ground for which the deduction is made;
(vii) Wage actually paid for each wage period.

(f) The Contractor shall provide a Wage Slip for each worker employed on the Works.
(g) The Wage records and Wage Slips shall be preserved for at least 12 months after last entry;

Inspection of Wage Records

(h) The Contractor shall allow inspection of the aforesaid Wage Records and Wage Slips to the Engineer and to any of his workers or to his agent at a convenient time and place after due notice is received or to the Employer or any other person authorised by him on his behalf.

(i) The Employer, the Engineer or any other person authorised by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the Fair Wages Clause. He shall also have the Power to investigate into any complaint regarding any default made by the Contractor or sub-contractor in regard to such provision.

(j) The Employer shall have the right to deduct from the money’s due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-payment of the aforesaid fair wage, except on account of any deductions that may be permissible under any law for the time being in force.

(k) (i) A workman shall be entitled to be represented in any investigation or enquiry under this Clause by:

(a) An officer of a registered Trade Union of which he is a member.

(b) An officer of a federation of Trade Unions to which the Trade Union referred to in previous sub-clause is affiliated.

(c) Where the worker is not a member of any registered Trade Union, by an officer of a registered Trade Union connected with or by any other workmen employed in the industry in which the worker is employed.

(ii) The Contractor or sub-contractor shall be entitled to be represented in any investigation or inquiry under this Clause by an office of an Association of Employers of which he is member.

(iii) No party shall be represented by a legal practitioner in any investigation or inquiry under this Clause, unless all parties agree otherwise.

Safety Provisions

1) The Contractor shall comply with all the precautions as required for the safety of the workmen by the I.L.O. Convention No.62 as far as they are applicable to the contract.
The Contractor shall provide all necessary safety appliances, gears like goggles, helmets, masks, etc., to the workmen and the staff.

(i) Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground, or from solid construction except for such short period work as can be done safely from ladders. When a ladder is used, an extra labour shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and hand-holds shall be provided on the ladder, which shall be given an inclination not steeper than 1/4 to (1/4) horizontal in 1 vertical).

(ii) Scaffolding or staging more than 3.25 meters above the ground or floor, swing or suspended from an overhead support or erected with stationary support shall have guard rail properly attached bolted, braced and otherwise secured 1 meters high above the floor or platform of such scaffolding or staging and extending along the entire length may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the support for structure.

(iii) Working platform, gangways, and stairways shall be so constructed that they do not sag unduly or unequally and if a height of a platform or gangway or stairway is more 3.25 meters above ground level or floor level, it shall have closely spaced boards, have adequate width and be suitably provided with guard rails as described in (ii) above.

(iv) Every opening in floor of a structure or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of one meter.

(v) Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a rung ladder shall in no case be less than 30 cm for ladders up to and including 3 meters in length. For longer ladders the width shall be increased at least 6mm for each additional 30cm of length. Spacing of steps shall be uniform and shall not exceed 30cm.

Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defending every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceeding to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

(vi) Excavation and Trenching: All trenches, 1.5 meters or more in depth, shall at all times be supplied with at least one ladder for each 20 meters in length or fraction thereof. Ladder shall be extended from bottom of trench to at least 1 meters above surface of the ground. Sides of trench which is 1.5 meters or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of collapsing of sides. Excavated material shall not be placed within 1.5 meters of edge of trench or half the depth of trench, whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.

(vii) Demolition: Before any demolition work is commenced and also during the process of the work:
A. All roads and open areas adjacent to the work site shall either be closed or suitably protected.

B. No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by operator shall remain electrically charged.

C. All practical steps shall be taken to prevent danger to persons employed by the Employer, from risk of fire or explosion, or flooding. No floor, roof or other part of a building shall be so overloaded with debris or materials as to render it unsafe.

(viii) All necessary personal safety equipment as considered adequate by the Engineer shall be available for use of persons employed on the Site and maintained in a condition suitable for immediate use and the Contractor shall take adequate steps to ensure proper use of the equipment by those concerned.

A. Workers employed on mixing asphaltic materials, cement, lime mortars/concrete shall be provided with protective footwear and protective goggles.

B. Those engaged in handling any material which is injurious to eyes shall be provided with protective goggles.

C. Those engaged in welding works shall be provided with welder’s protective eye-shield.

D. Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

E. When workers are employed in sewers and manholes, which is in use, the Contractor shall ensure that manhole covers are open and manholes are ventilated at least for an hour before workers are allowed to get into them. Manholes so open shall be cordon off with suitable railing and provide warning signals or boards to prevent accident to public.

The Contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 years are employed on the work of lead painting, the following precautions shall be taken.

No paint containing lead or lead products shall be used except in the form of paste or ready made paint.

Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable workers to wash during and on close of day’s work.

(ix) When work is done near any place where there is risk of drowning all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

(x) Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following:
(A)  (i) These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good adequate strength and free from patent defects and shall be kept in good working order and properly maintained.

(ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from defects.

(B) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 shall be in charge of any hoisting machine including scaffold or of signals to operator.

(C) In case of every hoisting machine and of every chain hook, shackle swivel and pulley block used in hoisting, lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of a hoisting machine or a variable safe working load each safe working load and conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in the paragraph shall be loaded beyond safe working load except for the purpose of testing.

(D) In case of the Employer's machine, safe working load shall be notified by the Engineer or his representative. As regards Contractor's machines, the Contractor shall notify safe working load of each machine to Engineer or his representative whenever he brings it to site of work and get it verified by him.

(xi) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliance shall be provided with efficient safeguards hoisting appliances shall be provided with such means as will reduce the risk of accident during descent of load to the minimum. Adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energised, insulating mats, working apparel such as gloves, sleeves and boots, as may be necessary, shall be provided, workers shall not wear any rings, watches and carry keys or other material which are good conductors of electricity.

(xii) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of work.

(xiii) These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named therein by the Contractor.

(xiv) To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Engineer or his representative and the Inspecting Officer as defined in the Contractor's Labour Regulation mentioned in thereafter these Documents as Annexure A of Section IV.
(xv) Notwithstanding anything contained in conditions (i) to (xiv) above, the Contractor shall remain liable to comply with the provisions of all Acts, rules, regulations and byelaws for the time being in force in India and applicable in this matter.

(m) The Contractor shall be responsible for observance, by his sub/contractors, of the forgoing provisions.

(n) For work carried out in the vicinity of any wharf or quay, the Contractor shall abide by all the provisions of the Dock Workers (Safety, Health and Welfare) Scheme, 1961.

**Footwear**

(o) The contractor shall at his own expense provide footwear for all labour engaged on concrete mixing work and other types of work involving the use of tar, cement, etc., to the satisfaction of the Engineer or his Representative, and on his failure to do so, the Employer shall be entitled to provide the same and recover the cost from the Contractor.

**Local Labour**

(p) The Contractor is encouraged as far as possible to employ, in the execution of the Contract, qualified Indian citizens as workmen. Employment of expatriate personnel is subject to the Indian Laws and Regulations. In case the contractor wishes to employ expatriate personnel in any particular trade or skill required to execute the contract, the Employer will assist the Contractor in obtaining permission for which the Contractor shall submit requisite data.

**Model Rules for Labour Welfare**

(i) **Definitions:**

(A) Workplace means a place at which, on an average, twenty or more workers are employed.

(B) Large workplace means a site at which, on an average, 250 or more workers are employed.

(ii) **First Aid:**

At every workplace, there shall be maintained in a readily accessible place first aid appliances including an adequate supply of sterilized dressings and sterilized cotton wool as prescribed in the Factory Rules of the State in which the work is carried on. The appliances shall be kept in good order and, in large work places, they shall be placed under the charge of a responsible person who shall be readily available during working hours.

At large workplaces, where hospital facilities are not available within easy distance of the Works, First Aid Posts shall be established and be run by a trained compounder.

Where large workplaces are remotely situated and far away from regular hospitals, an indoor ward shall be provided with one bed for every 250 employees.
Where large workplaces are situated in cities, towns or in their suburbs and no beds are considered necessary owing to proximity of city or town hospitals, suitable transport shall be provided to facilitate removal of urgent cases to these hospitals. At other workplaces, some conveyance facilities shall be kept readily available to take injured person on persons suddenly taken seriously ill, to the nearest hospital.

At large workplaces, there shall be provided and maintained an ambulance room containing the prescribed equipment and in the charge of such medical and nursing staff as may be prescribed. For this purpose, the relevant provisions of the Factory Rules of the State government of the area where the work is carried on, may be taken as the prescribed standard.

(iii) **Accommodation for Labour:**

The Contractor shall during the progress of the Work provide, erect and maintain necessary temporary living accommodation and ancillary for labour at his own expenses to the standards and scales as approved by the Engineer.

(iv) **Drinking Water:**

In every workplace, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.

Where drinking water is obtained from an intermittent public water supply, each workplace shall be provided with storage of cold water fit for drinking.

Every water supply storage shall be at a distance of not less than 15 meters from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well, which is within such proximity of latrine, drain or any other source of pollution, well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust-proof and water-proof.

A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

(v) **Washing and Bathing Places:**

Adequate washing and bathing places shall be provided separately for men and women. Such places shall be kept in clean and drained condition.

(vi) **Scale of Accommodation in Latrines and Urinals:**

There shall be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each of these, shall not be less than at the following scale:

<table>
<thead>
<tr>
<th></th>
<th>No. of Seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Where number of persons does not exceed 50</td>
<td>2</td>
</tr>
<tr>
<td>(b) Where number persons exceed 50 but does not exceed 100</td>
<td>3</td>
</tr>
</tbody>
</table>
(c) For additional persons per 100 or part thereof 3

In particular cases, the Engineer shall have the power to increase the requirement, wherever necessary.

(vii) Latrines and Urinals:

Except in workplaces provided with water/flushed latrines connected with a water borne sewage system, all latrines shall be provided with receptacles on dry-earth system which shall be cleaned at least four times daily and at least twice during working hours and kept in a strictly sanitary condition. Receptacles shall be tarred inside and outside at least once a year.

If women are employed, separate latrine and urinals, screened from those for men and marked in the vernacular in conspicuous letters. "For Women Only" shall be provided on the scale laid down in rule (vi). Those for men shall be similarly marked "For Men Only". A poster showing the figures of a man and a woman shall also be exhibited at the entrance to latrines for each sex. There shall be adequate supply of water, close to latrines and urinals.

(viii) Construction of Latrines:

Inside walls shall be constructed of masonry or other non-absorbent material and shall be cement washed inside and outside at least once a year. The dates of cement washing shall be noted in a register maintained for the purpose and kept available for inspection. Latrines shall have at least thatched roof.

(ix) Disposal of Excreta:

Unless otherwise arranged for by the local sanitary authority, arrangement for proper disposal of excreta by incineration at the workplace shall be made by means of suitable incinerator approved by the local medical, health and municipal or cantonment authorities. Alternatively, excreta may be disposed off by putting a layer or night soils at the bottom of a pucca tank prepared for that purpose and covering it with a 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn into manure).

The Contractor shall, at his own expense, carry out all instructions issued to him by the Engineer to effect proper disposal of soil and other conservancy work. The Contractor shall be responsible for payment of any charges which may be levied by municipal or cantonment authority for execution of such work on his behalf.

(x) Provisions of shelters during rest:

At every workplace, there shall be provided, free of cost, four suitable sheds, two for meals and two others for rest, separately for use of men and women labour. Height of each shelter shall not be less than 3 meters from floor-level to lowest part of roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 0.5 sqm per head.
(xi) Crèches:

At a place at which 20 or more women are ordinarily employed, there shall be provided at least one hut for use of children under the age of 6 years belonging to such women. Huts shall not be constructed to a standard lower than that of thatched roof, mud floor and wall with wooden planks spread over mud floor and covered with matting.

Huts shall be provided with suitable and sufficient openings, for light and ventilation. There shall be adequate provision of sweepers to keep the places clean. There shall be two maid-servants in attendance. Sanitary utensils shall be provided to the satisfaction of local medical, health and municipal or cantonment authorities. Use of huts shall be restricted to children, their attendants and mothers of children.

Where the number of women workers is more than 25 but less than 50, the Contractor shall provide at least one hut and one maid-servant to look after children of women workers.

Size of creche(s) shall vary according to the number of women workers employed.

Creche(s) shall be properly maintained and necessary equipment like toys, etc., provided.

(xii) Canteen:

A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered necessary.

(xiii) Planning, setting and erection of the above mentioned structures shall be approved by the Engineer or his representative and the whole of such temporary accommodation shall at all times during the progress of the work be kept tidy and in a clean and sanitary condition to the satisfaction of the Engineer or his representative and at the Contractor's expense. The Contractor shall conform generally to sanitary requirements of local medical, health and municipal or cantonment authorities and at all times adopt such precautions as may be necessary to prevent soil pollution of the site.

On completion of the Works, the whole of such temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the whole of site left clean and tidy at the contractor's expense to the entire satisfaction of the Engineer.

(xiv) Anti-malarial precautions:

The Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer, including filling up any borrow pits which may have been dug by him.

(xv) Enforcement:

Inspecting Officer mentioned in the Contractor's Labour Regulations or any other Officer nominated on his behalf by the Engineer shall report to the Engineer all
cases of failure on the part of the Contractor and/or his sub-contractor to comply
with the provisions of these Rules either wholly or in part and the Engineer shall
impose such fines and other penalties as are prescribed in the conditions of
contract.

(xvi) **Interpretations, etc.:**

On any question as to the application, interpretation or effect of these Rules, the
decision of the Chief Labour Commissioner or Deputy Chief Labour Commissioner
(Central) shall be final and binding.

(xvii) **Amendments:**

The Employer may, from time to time, add to, or amend these Rules and issue
such directions as it may be considered necessary for the proper implementation
of these Rules or for the purpose of removing any difficulty which may arise in
the administration thereof.
Regulation 1 - Definition

In these regulations, unless otherwise expressed or indicated, the following words and expression shall have the meaning hereby assigned to them:

a) “Labour” means workers employed by a contractor directly, or indirectly, through a sub-contractor, or by an agent on his behalf on a payment not exceeding Rs. 1,600/- per month.

b) “Wages” means wages, which shall include wages for weekly day of rest and other allowance, whether for time or piece work, after taking into consideration prevailing market rates for similar employments in the neighborhood but shall not be less than the minimum rates of wages fixed under the Payment of minimum Wages Act.

c) “Contractor” for the purpose of these regulations shall include an agent or sub-contractor employing labour on the work taken on contract.

d) “Inspecting Officer” means any Labour Enforcement Officer, or Assistant Labour Commissioner of the chief labour Commissioner’s Organisation.

e) “Form” means a form appended to these Regulations.

Regulation 2 - Notice of Commencement

The Contractor shall within SEVEN days of commencement of the Work, furnish in writing to the Inspecting Officer of the area concerned the following information:

a) Name and situation of the work
b) Contractor’s name and address
c) Particular of the Department for which the work is undertaken
d) Name and address of sub-contractors as and when they are appointed
e) Commencement and probable duration of the work
f) Number of workers employed and likely to be employed
g) Fair wages for different categories of workers

Regulations 3 - Hours of Work and Weekly Day of Rest

I. Number of hours of work which shall constitute normal working day: The number of hours which shall constitute a normal working day for an adult shall be NINE hours. The working day of an adult worker shall be so arranged that, inclusive of intervals, if any, for rest, it shall not spread over more than Twelve hours on a day. When an adult worker is made to work for more than nine hours on any day or for more than FORTY EIGHT hours in a week, he shall in respect of overtime work, be paid wages at double the ordinary rate of wages.

II. Weekly day of Rest: Every worker shall be given a weekly day of rest which shall be fixed and notified at least TEN days in advance. A worker shall not be required or allowed to work
on the weekly rest day unless he has or will have a substituted rest day, one of the five days immediately before or after the rest day. Provided no substitution shall be made which will result in the worker working for more than ten days consecutively without a rest day for a whole day.

Where in accordance with the foregoing provisions, a worker works on the rest day and has been given a substituted rest day, he shall be paid wages for the work done on the weekly rest day at the overtime rate of wages.

NOTE : The expression "ordinary rate of wages" means the fair wage the worker is entitled to.

**Regulations 4 - Display of Notice Regarding wages, Weekly day of Rest, etc.,**

The Contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clean and legible condition in conspicuous places on the works, notice in English and in the local language spoken by majority of workers, giving the rate of fair wages, the hours of work for which such wages are payable, the weekly rest days workers are entitled to and name and address of the Inspecting Officer. The Contractor shall send a copy of each of such notice to the Inspecting Officer.

**Regulation 5 - Fixation of Wage periods**

The Contractor shall fix wage periods in respects of which wages shall be payable. No wage period shall normally exceed one week.

**Regulation 6 - Payment of wages**

1. Wages due to every worker shall be paid to him direct. All wages should be paid in current coins or currency or in both.
2. Wages of every worker employed on the Contract shall be paid where the wage period is one week, within THREE days from the end of the wage period; and in any other case before the expiry of the 7th day or 10th day from the end of the wage period according as the number of workers does not exceed 1,000 or exceeds 1,000.
3. When employment of any worker is terminated by or on behalf of the Contractor, the wages earned by him shall be paid before expiry of the day succeeding the one on which his employment is terminated.
4. Payment of wages shall be made at the Work Site on a working day except when the work is completed before expiry of the wage period in which case final payment shall be made at the Work Site within 48 hours of the last working day and during normal time.

Note: The term “Working Day” means a day on which the work on which the labour is employed is in progress.

**Regulation 7 - Register of Workmen**

A register of workmen shall be maintained in the Form appended to the regulations and kept at the work site or as near to it as possible and relevant particulars of every workman shall be entered therein within THREE days of his employment.

**Regulation 8 - Employment Card**

The Contractor shall issue an Employment card in the Form appended to these regulations to each worker on the day of work or entry into his employment. If a worker already has any such card with him issued by the previous employer, the Contractor shall merely endorse that Employment Card with relevant entries. On termination of employment, the Employment Card shall again be endorsed by the Contractor and returned to the worker.

**Regulation 9 - Register of Wages etc.**

1. A Register of Wages cum Muster Roll in the Form appended to these regulations shall be maintained and kept at the Work Site or as near to it as possible.
2. A wage slip in the form appended to these regulations shall be issued to every worker employed by the Contractor at least a day prior to disbursement of wages.

**Regulation 10 - Fines and Deductions which may be made from Wages.**

1. Wages of a worker shall be paid to him without any deductions of any kind except the following:
   a) Fines
   b) Deductions for absence from duty; i.e. from the place of his employment where he is required to work. The amount of deduction shall be in proportion to the period for which he was absent;
   c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money which is required to be accounted for, where such damage or loss is directly attributable to his neglect or default.
   d) Deductions for recovery of advances or for adjustment of overpayment of wages, advance granted being entered in a register; and
   e) Any other deductions which the Employer may from time to time allows.

2. No fines shall be imposed on any worker save in respect of such acts and omissions on his part as have been approved by the Chief Labour commissioner.

3. No fine shall be imposed on a worker and no deductions for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.

4. The total amount of fines which may be imposed in any one wage period of a worker shall not exceed an amount equal to 0.3% of the wages payable to him in respect of that wage period.

5. No fine imposed on a worker shall be recovered from him on installments, or after expiry of sixty days from the date on which it was imposed. Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

6. The Contractor shall maintain both in English and the local language a list, approved by the Chief Labour Commissioner, clearly stating the acts and omissions for which penalty or fine may be imposed on a workman and display it in good condition in a conspicuous place on the Work Site.

7. The Contractor shall maintain a register of fines and the register of deductions for damage or loss in the forms appended to these regulations which should be kept at the place of work.

**Regulation 11 - Register of Accidents.**

The Contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars:

a) Full particulars of the labourers who met with accident.
b) Rate of wages
c) Sex
d) Age
e) Nature of accident and cause of accident
f) Time and date of accident
g) Date of Time when admitted to hospital
h) Date of discharge from the hospital
i) Percentage of loss of earning capacity and disability as assessed by the medical Officer.
j) Claim required to be paid under Workmen’s Compensation Act.
k) Date of payment of compensation.
l) Amount paid with details of the person to whom the same was paid
m) Authority by whom the compensation was assessed
n) Remarks

**Regulation 12 - Preservation of Register**

The Register of workmen and the Register of wages cum Muster Roll required to be maintained under these Regulations shall be preserved for 3 years after the date on which the last entry is made therein.

**Regulation 13 - Enforcement**

The Inspecting Officer shall either on his own motion or on a complaint received by him carry out investigations and send a report to the Engineer specifying the amounts representing Workers Dues and amount of penalty to be imposed on the Contractor for breach of these regulations, that have to be recovered from the Contractor, indicating full details of the recoveries proposed and the reason therefor. It shall be obligatory on the part of the Engineer on receipt of such a report to deduct such amounts from payments due to the Contractor.

**Regulation 14 - Disposal of Amounts Recovered from the Contractor**

The Engineer shall arrange payment to workers concerned within FORTY FIVE days of receipt of a report from the Inspecting Officer except in cases where the Contractor had made an appeal under Regulation 16 of these regulations. In cases where there is an appeal, payment of workers dues would be arranged by the Engineer wherever such payment arise, within THIRTY days from the date of receipt of the decision of the Regional Labour Commissioner (RLC).

**Regulation 15 - Welfare Fund**

All moneys that are recovered by the Engineer by way of worker’s dues which could not be disbursed to workers within the time limit prescribed above, due to reasons such as whereabouts of workers not being known, death of workers, etc., and also amounts recovered as penalty, shall be credited to a Fund to be kept under the custody of the Employer for such benefit and welfare of workmen employed by Contractors as the Engineer may deem fit.

**Regulation 16 - Appeal against decision of Inspecting Officer**

Any person aggrieved by a decision of the Inspecting Officer may appeal, against such decision of the Regional Labour Commissioner concerned with THIRTY days from the date of the decision forwarding simultaneously a copy of this appeal of the Engineer.

The decision of the Regional Labour Commissioner shall be final and binding upon the Contractor and the Workmen.

**Regulation 17 - Representation of Parties**

1. Workmen shall be entitled to be represented in any investigation of enquiry under these Regulations by an officer of a registered trade union of which he is a member or by an officer of a Federation of Trade Unions to which the said trade union is affiliated or where the workman is not a member of any registered trade union by an officer of a registered trade union, connected with, or by any other workmen employed in the industry in which the worker is employed.

2. A contractor shall be entitled to be represented in any investigation or enquiry under these Regulations by an officer of an association of Contractors of which he is a member or by an officer of a Federation of associations of Contractors to which the said association is affiliated or by an officer of association of employees connected with or by any other employer engaged in the industry in which the Contractor is engaged.
3. No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these Regulations.

**Regulation 18 - Inspecting of Books and Other Documents**

The Contractor shall allow inspection of the Registers and other documents prescribed under these Regulations by Inspecting Officers and the Engineer or his authorised representative at any time and by the worker or his agent on receipt of due notice at a convenient time.

**Regulation 19 - Interpretation etc.**

On any question as to the application, interpretation or effect of these regulations, the decision of the Chief Labour Commissioner or Deputy Chief Labour Commissioner (Central) as the case may be, shall be final and binding.

**Regulation 20 - Amendments**

The Employer may, from time to time, add to or amend these Regulations and issue such directions as it may consider necessary for the purpose of removing any difficulty which may arise in the demonstration thereof.
REGISTRATION OF WORKMEN

SECTION IV
(Regulation 7)

1. Name and address of the Contractor ________________________________
2. Number and date of Contract ______________________________________
3. Name and address of the Department awarding the Contract ______________
4. Nature of the Contract and location of the work _________________________
5. Duration of the Contract _______________________

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name and Surname</th>
<th>Age &amp; Sex</th>
<th>Father’s/Husband’s name</th>
<th>Nature of Employment</th>
<th>Designation</th>
<th>Permanent Home Address of Employee (Village, Dist Thana)</th>
<th>Present Address</th>
<th>Date of commencement of employment</th>
<th>Date of termination or leaving of employment</th>
<th>Signatur e or thumb impression of the employee</th>
<th>Remarks</th>
</tr>
</thead>
</table>


SECTION IV

A - 13

EMPLOYMENT CARD
(Regulation 8)

1. Name and Sex of the Worker ________________________ ___________________
2. Father’s / Husband’s Name _________________________ ___________________
3. Address ___________________________________________ ________________
4. Age or Date of Birth _________________________________________________
5. Identification marks _________________________________________________

Particulars of next kin (wife/husband and children, if any, or of dependent next of kin in case the worker has no wife/husband or child).

Name _____________________
Full address of Dependent
(Specify Village, Dist and State _________________________________________)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name and address of Employer (specify whether a contractor or a subcontractor)</th>
<th>Particulars of location of work site and description of work done</th>
<th>Total period for which the worker is employed (from ----- to -----)</th>
<th>Actual number of days worked</th>
<th>Leave taken (No. Of days should be specified)</th>
<th>Nature of work done by the worker</th>
<th>Wage rate with particulars of unit in case of piece</th>
<th>Total wages earned by the worker the period shown under</th>
<th>Remarks</th>
<th>Signature of the employer</th>
</tr>
</thead>
</table>

N.B. For a worker employed at one time on piece work basis and at another on daily wages, relevant extra in respect of each type of employment should be made separately.
**WAGE SLIP**  
*(Regulation 9)*

**SHEET NO. A-9**

Name of Contractor

Place:

<table>
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<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Name of the Worker with father/husband’s name</td>
</tr>
<tr>
<td>2.</td>
<td>Nature of Employment</td>
</tr>
<tr>
<td>3.</td>
<td>Wage Period</td>
</tr>
<tr>
<td>4.</td>
<td>Rate of Wages Payable</td>
</tr>
<tr>
<td>5.</td>
<td>Total attendance/Unit of work done</td>
</tr>
<tr>
<td>6.</td>
<td>Date(s) on which overtime worked</td>
</tr>
<tr>
<td>7.</td>
<td>Overtime Wages</td>
</tr>
<tr>
<td>8.</td>
<td>Gross Wages Payable</td>
</tr>
<tr>
<td>9.</td>
<td>Total Deductions (including nature of deductions)</td>
</tr>
<tr>
<td>10.</td>
<td>Net Wages Payable</td>
</tr>
</tbody>
</table>

Signature/Thumb Impression of Contractor

Signature/Thumb Impression of employee

---

63
## REGISTER OF FINES
(Regulation No. 10 (vii))

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name</th>
<th>Father’s/ Husband’s name</th>
<th>Sex</th>
<th>Department</th>
<th>Nature and date of the offense for which fine imposed</th>
<th>Whether workman showed cause against fine or not, if so enter date</th>
<th>Rate of wages</th>
<th>Date &amp; amount of fine imposed</th>
<th>Date on which fine realized</th>
<th>Remarks</th>
</tr>
</thead>
</table>

64
KARNATAKA URBAN WATER SUPPLY AND DRAINAGE BOARD BANGALORE

BID DOCUMENT FOR

UGD SCHEME TO BAILHONGAL TOWN OF BELGAUM DISTRICT

CONSTRUCTION OF 8.28MLD CAPACITY AERATED LAGOON AND ALLIED WORKS

SPECIAL CONDITIONS OF CONTRACT
## SPECIAL CONDITIONS OF CONTRACT

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<td>14.(A)</td>
<td>Karnataka Building and other construction workers welfare cess</td>
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<tr>
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<td>Price Variation</td>
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<tr>
<td>16.0</td>
<td>Site Order book</td>
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<td>17.0</td>
<td>Quarry Materials</td>
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<tr>
<td>18.0</td>
<td>Construction Documents</td>
</tr>
<tr>
<td>19.0</td>
<td>As-Built drawings</td>
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<td>20.0</td>
<td>Taking Over Certificate</td>
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<td>21.0</td>
<td>Third Party Inspection &amp; Testing</td>
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<td>Re-measurement</td>
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<td>24.0</td>
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<td>25.0</td>
<td>Storage of Materials &amp; plant</td>
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<td>26.0</td>
<td>Extension of Completion Time</td>
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27.0 Liquidated Damages
28.0 Change in Cost & Legislation
29.0 Advance payment for mobilization only for the works, where the amount put to tender exceeds 5 crores
30.0 Payment of advance towards materials for the permanent works
31.0 Progressive payment to contractor
32.0 Major crossings of Raw / pure water rising main / feeder main
33.0 Contractor to Co-ordinate his Work with Other Contractors
34.0 Currency of Payment
35.0 Mode of Payment
36.0 Procurement of Materials
37.0 Prices
38.0 Schedule of Materials

Annexure - I – Royalty

Annexure – II – QAP for SWG pipes, RCC manhole frames and cover, RCC pipes, PVC pipes, DI pipes, CI sluice valve, GI pipes-6Nos
Annexure - III – Approved vendor list
SPECIAL CONDITIONS OF CONTRACT

1. Interpretation of the Clauses of Special Conditions

1.1 In these Special Conditions of Contract, the word Contractor shall be understood to mean the successful bidder. Responsibilities and bindings of the Contractor as described under different clauses shall be understood to be applicable after the successful bidder has been awarded the work. Further, the Clauses and Sub-Clauses under these Special Conditions of Contract shall prevail over the relevant Clauses and Sub-Clauses of Chapter 1, Instructions to Bidders, and Chapter 2, General Conditions of Contract, in case there are any discrepancies.

2 Brief Description of the work

2.1 General

Introduction:

The estimate for providing Under Ground Drainage arrangements to Bailhongal town is administratively approved by the Govt. of Karnataka vide order No UDD/08/UDS/2009 dated 08.02.2010 for Rs. 5700.00 Lakhs. Technical sanction to the above project was accorded by the Chairman & Managing Director, KUWS&D Board, Bangalore vide order No:2730 ,Dated: 26.11.2010 for the same amount. The scheme is designed for a intermediate population of 38000 expected by the year 2026 and for the ultimate population 42100 expected in the year 2041. The scheme is taken up with the Funding Pattern of 50% loan from Financial Institutions,30% Loan from State Government and 20% contribution from Local Body.

3. Scope of Work:

Pursuant to Sub-clause 1.1 of Chapter-I, the scope of work under this Contract includes carrying out detailed Total Station Survey, Establishing sufficient Benchmarks, Design & Preparation of working drawing along with soft copy submit and obtain necessary approval from competent authority before execution of the following works: I the employer feel the necessity to get technically verified the above design and drawings by the third party, the cost should be borne by the Board.

PART-A

I) UGD Scheme to Bailhongal town of Belgaum District-

a) Providing laying and jointing of Sewer lines, construction of Manhole chambers, Screen Chamber, Grit chamber and Wet well.

<table>
<thead>
<tr>
<th>Dia (mm)</th>
<th>Description</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>SWG pipeline</td>
<td>30125.70</td>
</tr>
<tr>
<td>160</td>
<td>PVC-U SN4</td>
<td>36283.00</td>
</tr>
<tr>
<td>160</td>
<td>PVC-U SN8</td>
<td>36281.00</td>
</tr>
<tr>
<td>200</td>
<td>PVC-U SN4</td>
<td>1812.00</td>
</tr>
<tr>
<td>200</td>
<td>PVC-U SN8</td>
<td>1813.00</td>
</tr>
<tr>
<td>250</td>
<td>PVC-U SN4</td>
<td>1185.00</td>
</tr>
<tr>
<td>250</td>
<td>PVC-U SN8</td>
<td>1185.00</td>
</tr>
<tr>
<td>300</td>
<td>RCC S&amp;S NP3 class pipeline</td>
<td>58.00</td>
</tr>
<tr>
<td>350</td>
<td>RCC S&amp;S NP3 class pipeline</td>
<td>824.00</td>
</tr>
<tr>
<td>400</td>
<td>RCC S&amp;S NP3 class pipeline</td>
<td>748.00</td>
</tr>
<tr>
<td>450</td>
<td>RCC S&amp;S NP3 class pipeline</td>
<td>461.00</td>
</tr>
<tr>
<td>500</td>
<td>RCC S&amp;S NP3 class pipeline</td>
<td>29.00</td>
</tr>
<tr>
<td>Description</td>
<td>Quantity</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Construction of 1.2 m dia BBM Manholes</td>
<td>3619 Nos.</td>
<td></td>
</tr>
<tr>
<td>Construction of 1.5 m dia BBM Manholes</td>
<td>124 Nos.</td>
<td></td>
</tr>
<tr>
<td>Construction of 1.5 m dia RCC Manholes</td>
<td>173 Nos.</td>
<td></td>
</tr>
<tr>
<td>Providing and fixing ventilating shaft</td>
<td>15 Nos.</td>
<td></td>
</tr>
<tr>
<td>Providing flushing tank 900Liters capacity</td>
<td>12Nos</td>
<td></td>
</tr>
<tr>
<td>Providing laying RCC NP3 pipes for culverts</td>
<td>3500 m</td>
<td></td>
</tr>
<tr>
<td>Providing and insertion of 100mm dia Ms pipes for Roads crossings</td>
<td>30m</td>
<td></td>
</tr>
<tr>
<td><strong>2 Shifting of 200 mm dia D.I. and 90, 110, 160mm dia PVC pipe distribution system in ZONE -1,2 &amp; 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply and laying of 200mm DI K-7 class pipe</td>
<td>300m</td>
<td></td>
</tr>
<tr>
<td>Supply and laying of PVC Pipes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 160 mm dia PVC pipeline-6Kg/sq</td>
<td>600m</td>
<td></td>
</tr>
<tr>
<td>b) 110 mm dia PVC pipeline-6Kg/sq</td>
<td>1200m</td>
<td></td>
</tr>
<tr>
<td>c) 90 mm dia PVC pipeline-6Kg/sq</td>
<td>1500m</td>
<td></td>
</tr>
<tr>
<td>Supplying and Laying og GI pipes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15mm dia</td>
<td>900m</td>
<td></td>
</tr>
<tr>
<td>20mm dia</td>
<td>600m</td>
<td></td>
</tr>
<tr>
<td>Supply and fixing of CI sluice valves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 150mm dia</td>
<td>3Nos.</td>
<td></td>
</tr>
<tr>
<td>b) 100mm dia</td>
<td>6Nos.</td>
<td></td>
</tr>
<tr>
<td>c) 80mm dia</td>
<td>15Nos.</td>
<td></td>
</tr>
<tr>
<td>Supplying and fixing of CI valve box</td>
<td>24Nos.</td>
<td></td>
</tr>
<tr>
<td><strong>3 Dismantling and reconstruction of CD Works and drains IN ZONE -1, 2 &amp; 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4 Construction of 10.50 Mtr Dia RCC wetwell cum pump house in Zone -1</strong></td>
<td>1No</td>
<td></td>
</tr>
<tr>
<td><strong>5 Inlet and Screen Chambers of Wet Well in Zone-1</strong></td>
<td>1Nos.</td>
<td></td>
</tr>
<tr>
<td><strong>6 Piping, Mechanical and Electricalworks for Wetwell in Zone -1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7 Construction of valve chamber for Wetwell in Zone -1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>8 Construction of 6.00 Mtr Dia RCC wetwell cum pump house</strong></td>
<td>1 No</td>
<td></td>
</tr>
<tr>
<td><strong>9 Inlet and Screen Chambers at Wetwell for zone 2 &amp; 3</strong></td>
<td>1Nos</td>
<td></td>
</tr>
<tr>
<td><strong>10 Piping, Mechanical and Electrical works for Wetwell</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply and laying of 300mm DI K-7 class pipe</td>
<td>15m</td>
<td></td>
</tr>
<tr>
<td>Supply and laying of 400mm DI K-7 class pipe</td>
<td>5m</td>
<td></td>
</tr>
<tr>
<td><strong>11 Construction of valve chamber for Wetwell</strong></td>
<td>1No</td>
<td></td>
</tr>
<tr>
<td><strong>12 Construction of Diesel Genrator Room of size 4 m x 6 m for both wetwells</strong></td>
<td>2Nos</td>
<td></td>
</tr>
</tbody>
</table>
Providing individual house connections

19200 Nos

Note- All electrical items should be of Board Approved Make and IE specification. The detailed specifications designs and drawings are to be prepared and approved by the employer before supply and erection.

(ITEM RATE TENDER)

b) Construction of 8.28 MLD Capacity waste Aerated Lagoon and allied works under providing UGD arrangements to Bailhongal Town.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply and laying 500 mm dia DI K-7 Class</td>
<td>1240.00 m</td>
</tr>
<tr>
<td>1</td>
<td>300 mm dia DI rising main dia DI K-7 Class</td>
<td>2100.00 m</td>
</tr>
<tr>
<td>1</td>
<td>100 mm dia DI rising main dia DI K-7 Class</td>
<td>172.50 m</td>
</tr>
<tr>
<td>2</td>
<td>Construction of Primary treatment units at STP</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Construction of Sewage Treatment Plant of 8.28 MLD capacity</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>a.i) Construction of Aerated Lagoons at STP Site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a.ii) Construction of Interconnecting RCC Channel From Division Box to Aerated Lagoon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a.iii) Construction of 2 Nos Interconnecting RCC Channel From Aerated Lagoon to Basin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b.i) Construction of Northern &amp; Southern Sedimentation Basins at STP Site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b.ii) Construction of Interconnecting RCC Outlet Channel From Basin to Outlet Chamber for Northern and Southern Sedimentation Tank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Construction of DG Room of Size 4 M X 6 M</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>d) Construction of laboratory room of size 6 M X 10 M near STP</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>e) Construction of Switch gear room of size 6 M X 9 M near STP</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>f) Construction of Type 'A' Staff Quarters</td>
<td>4 Nos.</td>
</tr>
<tr>
<td></td>
<td>g) Mechanical and Electrical Equipments at STP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motors for Aerator 9HP capacity</td>
<td>14 sets.</td>
</tr>
<tr>
<td></td>
<td>Reduction Gear Boxes</td>
<td>14 sets.</td>
</tr>
<tr>
<td></td>
<td>Paddle Assembly</td>
<td>14 sets.</td>
</tr>
<tr>
<td></td>
<td>Diseal Generator set-125 KVA</td>
<td>1 Set.</td>
</tr>
<tr>
<td></td>
<td>h) Providing Approach road at STP site</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Providing Barbrd wire fencing allround STP site</td>
<td></td>
</tr>
</tbody>
</table>

A Key map showing the various components of the works under the scope of the tender is presented in Chapter 9, drawings.

3.1 Earth work excavation laying of bedding wherever specified, dry rough stone revetment to the slopes wherever the slopes are of loose soil back filling the trenches and restoring and making good all surfaces which are damaged during excavation, disposal of excavated earth as directed by the Engineer in charge.
3.2 Filling the ground with available approved earth including watering and compaction layers of 15cms.

3.3 Maintenance of all the works under the scope of the tender for 12 months after commissioning. During this period, the contractor has to set right the defect of any kind in the manufacture, laying, jointing of the sewer lines and in construction of any other works in this scope of tender.

3.4 Dismantling and reconstruction of the structures such as culverts, storm water drains, utility lines such as water supply pipe lines, sewer pipe lines or any other structure in the way of proposed alignment.

3.5 Testing and commissioning of the Stoneware and RCC sewer lines and Manholes and any other components executed under the scope of the tender.

3.6 Construction of suitable culverts at valley points and at suitable places as directed by the Engineer.

3.7 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

3.8 The alignment and the general arrangements of the Sewer lines and Manholes are furnished in Chapter-9 Drawings. Further details shall be furnished in the construction drawings during the construction stage.

4. **Time for Completion**

4.1 Pursuant to Sub-Clause 1.2 of Chapter 1 and Sub-Clause 43.1 of Chapter 2 the Contractor shall complete the Works, including testing, commissioning and completion period, within 24 (Twenty Four) months, including monsoon period, from the date of notice to commence the Works. The Taking-Over Certificate will be issued upon successful completion of the Trial Run and rectification of any defects which are observed during this period.

4.2 In connection with this, the Contractor shall be required to complete the following Chapters of the Works, and to meet the milestones indicated, in accordance with the time limits stipulated in the Appendix to tender as summarized below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Milestones</th>
<th>Time for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Commencements of the works, including mobilization to site and establishment of site office (Sub-clause 12.1 of chapter 2, General condition of contract) and commencement of survey work.</td>
<td>28 days of the date of the Notice to proceed.</td>
</tr>
<tr>
<td>ii)</td>
<td>Submission of design calculations, drawings and other documents (clause 12.0 of this chapter)</td>
<td>28 days of the date of the letter of acceptance.</td>
</tr>
<tr>
<td>iii)</td>
<td>Completion of installation of plant and equipment</td>
<td>28 days before start of the trail run</td>
</tr>
<tr>
<td>iv)</td>
<td>Completion of Testing and commissioning and commencement of trial run.</td>
<td>Fifteen days before the end of the time for completion</td>
</tr>
<tr>
<td>v)</td>
<td>Completion of trial and hand over to the Employer</td>
<td>After the satisfactory completion of defects liability period.</td>
</tr>
</tbody>
</table>

5. **Issue of Tender Forms**: -Deleted-
6. Alternative Proposals by Bidder -Deleted

7. Employer, Engineer and Engineer’s Representatives

7.1 Reference to the Sub-Clause 1.1 of Chapter 2

(a) The Employer is: Chief Engineer (North),
Karnataka Urban Water Supply and Drainage Board,
Jalamandali Compound, Dharwad
Tel. Ph. 0836 – 2447090  FAX : 0836 – 2446890

(b) The Employer Representative : Executive Engineer
KUWS &D .Board ,Division ,Belgaum
Any communication given by the employer’s representative shall have the same effects
as though it had been given by the employer

(c) The Engineer is: Executive Engineer,
Karnataka Urban Water Supply and Drainage Board
Division, Belgaum .
Tel. Ph. 0831 – 2472542 FAX : 0831 – 2461438

(d) Without limiting the authority of the Engineer to appoint Engineer’s Representatives from
time to time as may be required, the Engineer’s Representatives shall include authorized
representatives of : Assistant Executive Engineer, KUWS & D Board Sub
Division, Deshnur Building, Mrutyunjaya Nagar, Bailhongal - 591102.
Tel. Ph. 0822 – 237788
Or his duly authorised representative: Any communication given by the Engineer’s
representative shall have the same effect as though it had been given by the engineer.

8. Engineer’s Duty and Authority

8.1 Reference to Sub-Clause 2.1 of Chapter 2, (Engineer's Duties and Authority), the Engineer shall
obtain the specific approval of the Employer before taking any of the following actions
specified in Chapter 2, General Conditions of Contract::

(a) Approving subletting of any part of the Works under Sub-Clause 3.1 & 4.1 of Chapter 2;
(b) Certifying additional costs determined under Clause 52.2 of Chapter 2;
(c) Determining an extension of time under Sub-Clause 44.1 of Chapter 2;
(d) Issuing a variation order under Clause 52.1 of Chapter 2, except:
(e) Fixing rates or prices of the variation item.
9. **Access to Data / Information**

9.1 Reference to Sub-Clause 11.2 of Chapter 2 (Access to Data), additional information, if any, in connection with Employer's scheme and design considerations shall be made available for inspection by the bidder at the office of, The Chief Engineer (North), Karnataka Urban Water Supply and Drainage Board, Jalamandali Compound, Dharwad, during normal office hours. The Employer make this information available on the understanding that they are not responsible for the accuracy or sufficiency of the data collected, or for the interpretation of said data. The successful bidder shall be fully responsible for collecting any additional data, and for carrying out any additional investigations which he may deem necessary without any extra cost. The standards shall be as per CPHEEO Norms relevant I.S. The working levels and drawings shall be got approved by the Employer before execution. The contractor has to carryout the work as per the construction drawing approved by the Board and quantities mentioned in the B.O.Q is for Tender purpose only.

9.2 Data available includes the following:

i. Leveling and Contour Plan,

ii. Chapter 10: Standard Specifications

iii. Copies of Tender drawings

iv. Tentative Longitudinal Section drawing of pumping main.

v. wet well drawings

vi. STP drawings

10. **Work Programme**

Reference to Sub-Clause 14.1 of Chapter 2 (Programme to be Submitted), the Contractor shall submit his detailed work programme in PERT/CPM form which shall clearly set out his proposed schedule for the whole of the Works, the times for completing the major sections of the Works, and his schedule for mobilizing the materials and equipment necessary for implementing the Works in a timely and efficient manner. In developing the work programme, the Contractor shall give paramount importance in minimizing any inconvenience to the public, and to ensure that the various sections of the Works are completed and the affected areas are restored as expeditiously as possible. The Contractor's work programme will be subject to the approval of the Engineer, and the approved programme shall be adhered to during execution of the Works. The contractor work programme should demonstrate minimum progress as per the milestones given below.

I Milestone :- 12.5% of the work in 12.5% of the tender period and 15% quantity of materials required for the work to be supplied

II Milestone :- 25% of the work in 25% of the tender period and 30% quantity of materials required for the work to be supplied

III Milestone :- 37.5% of the work in 37.5% of the tender period and 45% quantity of materials required for the work to be supplied

IV Milestone :- 50% of the work in 50% of the tender period and 60% quantity of materials required for the work to be supplied

V Milestone :- 62.5% of the work in 62.5% of the tender period and 75% quantity of materials required for the work to be supplied

VI Milestone :- 75% of the work in 75% of the tender period and 100% quantity of materials required for the work to be supplied

VII Milestone :- 87.5% of the work in 87.5% of the tender period

VIII Milestone :- 100% of the work in 100% of the Tender Period
11. REPORTS TO BE SUBMITTED:

Reference to sub-clause 14.5 (Reports to be submitted) of Chapter 2, the contractor shall prepare and submit monthly progress reports to the Engineer in six copies within 14 days following the end of the previous month. Reporting shall continue until the contractor has completed all work which is known to be outstanding as on the completion date as stated in the Taking over certificate for the works each report shall include:

a) Photographs and detailed description of the progress, including the works completed and in progress, the status of supply and delivery of major materials and plant to be incorporated in the works, and the supply of major items of the contractor's equipment on site.

b) records of personnel and contractor's equipment on site;

c) copies of quality assurance documents, test results and certificate of materials.

d) Surveying and Designs of sewerage system/WSS to be submitted and got approved by the competent authority before execution of the work

e) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations, and

f) Comparison of actual and planned progress, with details of any aspects which may jeopardize the completion in accordance with the contract, and the measures being (or to be) adopted to overcome such aspects.

12. Contractor’s Employees

12.1 Reference to Sub-Clause 16.1 of Chapter 2 (Contractor's Employees), the Contractor shall not employ any person who is under the age of 18 years.

13. INSURANCE. -Deleted.-

14. Royalties

14.1 Reference to Sub-Clause 28.2 of Chapter 2 (Royalties), the Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the Karnataka Minor Minerals Concession Rules - 2007" as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached at the end of this Chapter.

14 A ) Karnataka Building and other construction worker's welfare cess

Reference to sub clause 60.1 of Chapter 2 (Royalties), as per Government of Karnataka Order No. LD/300/LET/2006 Bangalore dated 18-01-2007. The employer will deduct 1% (One percent) cess on the total tender amount from the bills of the Contractor towards Building and other construction workers Welfare Cess act 1996.

15. Price Variation

Except as under the situation stipulated in Sub-Clause 51.1 (Variations) and Sub-Clause 51.2 of Chapter 2, the rates and prices quoted by the Bidder shall be fixed for the entire duration of the Contract and not be subjected to variation under any circumstances, except as under clause 70.1 to 70.2 of Chapter-2.

16. Site Order Book

16.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the Contractor. After compliance with the instruction the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer
shall retain the original copy of the Site Order Book, while the Contractor shall retain the
duplicate one.

17.0 Quarry Materials

17.1 The Contractor shall be wholly responsible to identify the suitable sources for quarry materials
required for the Works, such as earth, sand, stone, murrum, etc., and to make his own
arrangements for collection and transportation of the materials irrespective of the leads and lifts
required. The quarry thus identified by the Contractor should have proper license from the
Government of Karnataka. All materials supplied by the Contractor shall satisfy the requirements
set forth in the Specifications and shall be subject to the approval of the Engineer. The Contractor
shall take this into account while offering his rates, and no claims whatsoever shall be entertained
for extra costs on this account.

18.0 Construction Documents

18.1 The Contractor will provide the construction drawings after award of the job according to the
agreed programme for construction. The Contractor shall not commence the construction of any
part of the work unless he receives from the engineer signed approval of the construction
drawing/document relevant to such part of the work.

19. As-Built Drawings

19.1 The Contractor shall be responsible to maintain accurate records of all works completed and to
prepare detailed “As-Built” drawings, and As built Site Registers incorporating all changes and/or
modifications made to the works during construction. The Contractor shall provide the employer
with one original set of “As-Built” drawings on a reproducible media along with two record copies
prior to acceptance of the works and issuance of the Taking-Over Certificate. Also the As-built-
drawings shall be furnished in six sets and also in C.D. media.

20. Taking-Over Certificate

20.1 Reference to Sub-Clause 48.1 (Taking Over Certificate) of Chapter 2, the Engineer shall, within 21
days of the date of delivery of the request by the Contractor to issue a Taking-Over Certificate,
conduct a joint Final Inspection of the works with the Contractor to determine the date of
substantial completion and to identify all work which is required to be done, or defects which are
required to be corrected, by the Contractor prior to issuance of the Taking-Over Certificate. The
above provisions notwithstanding, successful completion of any Tests on Completion prescribed
by the Contract will be a condition to issuance of the Taking-Over Certificate.

21. Third Party Inspection and Testing

21.1 The employer will fix the 3rd party agency for inspection of materials at Manufacturer’s works and
site and also construction activities at site. The inspection charges will be paid directly by the
Board to the third party agency only for the successful visits and the offer shall be exclusive of
the 3rd party inspection charges. The inspection charges for the unproductive visits if any are to
be borne by agency. The 3rd party agency has to carry out the inspections as per QAP (enclosed)
and IS standards.

22.0 Technical Specifications

22.1 Engineer shall have the right to modify/alter the Particular Specifications and/or Standard
Specifications at any time which promise to confer equal or better quality than the standard
specified in the tender document. Such modification or alteration shall be acceptable to the
Contractor subject to no additional financial burden to either the Contractor or the Employer. The
inspection will be carried out as per relevant IS standards.

23.0 Re-measurement

23.1 Reference to Clause 55 of Chapter 2 (Measurement), the Engineer shall ascertain and determine
by measurement the value of those parts of the Works which are to be re-measured in
accordance with the Contract. Such parts of the Works shall be measured net, notwithstanding
any general or local custom, except where otherwise provided for in the Contract. The Engineer
shall, when he requires any such part of the Works to be measured, give reasonable notice to the
Contractor, who shall promptly:

• attend or send a qualified representative to assist the Engineer in making such measurement,
  and supply all particulars required by the Engineer.
23.2 Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works.

24.0 Extra Work
24.1 It is binding on the Contractor to carry out such extra work(s) as may be ordered by the Engineer when, in the opinion of the Engineer, the same can conveniently and economically be carried out by the Contractor and when such extra work forms an integral part of the main work which can not be conveniently carried out by other Bidder. The payment against such extra works shall be decided by the Engineer on the basis of prevailing PWD or KUWSDB Schedule of Rates of Karnataka, as appropriate, and by mutual agreement.

25.0 Storage of Materials and Plant
25.1 The Contractor shall provide appropriate storage facilities for materials like cement, steel, aggregates, consumable supplies, equipment, mechanical and electrical items, etc., and shall take all safety and security measures against theft and deterioration in quality, at his own cost.

26.0 Extension to Completion Time
26.1 Pursuant to Sub-Clause 44.1 of Chapter 2 (Extension of Completion Time), extension to the scheduled completion time may be granted in favor of the Contractor by the Employer on the recommendation of the Engineer for the delay in completion of the work, provided such delay is beyond the control of the Contractor. Contractor, for this purpose, shall maintain a hindrance register recording cause of every delay in the work, its time of occurrence and time up to which such delay prevailed, duly signed by the Engineer in token of acceptance. The extension of the completion time in all cases shall however be without prejudice to the right of the Employer to recover liquidated damages from the Contractor.

27.0 Liquidated Damages
27.1 The penalty at the rate of 1% (one percent) of the amount put to tender for every 100% (hundred percent) of delay on part of contractor will be imposed subject to a maximum of 7.5% (seven point five percent) of the amount put to tender.

27.2 The work should progress according to the milestones fixed as per CPM/PERT chart and the Contractor is responsible to achieve these approved milestones. The progress will be revived once in every Three months. In case of any delay which is not beyond the control of the Contractor, Liquidated Damages shall be levied as per Clause 27.1 of this Chapter.

The decision of the Employer will be final and binding on the Contractor.

28.0 Change in cost and Legislation:
Price adjustment calculated in accordance with Sub-clause 70.1 to 70.2 of Chapter-2, General Conditions of contract is applicable, for payment of the works under the contract.

29.0 Advance Payment
-- Deleted --

30.0 Payment of Advance towards materials for the permanent works:
-- Deleted --

31.0 Progressive Payment to Contractor
31.1 Progressive payment shall be released to the Contractor on the basis of executed quantity and contracted rates on certification of the Engineer. Generally the progressive payment will be released monthly for which the Contractor shall raise his monthly on account invoice.

32.0 Contractor to Co-ordinate his Work with Other Contractors
32.1 The Contractor has to connect the outfall sewer to Wetwell and necessary blank flanges/end connections at Wetwell and STP. The Contractor has to obtain the details and exact locations of these connections from the Engineer. The Contractor has to co-ordinate with the other concerned Contractors for all such works as per the Engineer's directions at no extra cost.
33. **Major Crossings of Sewer lines/sewage pumping main**
If any additional civil structures are to be constructed other than those specified/given in the BOQ for the purposes of crossing these utility lines, the same shall be constructed by the Contractor and the payment for the same shall be as per the rates quoted by the tenderer for similar items of work.

34. **Currency of Payment**
All payments made under this Contract shall be in Indian Rupees.

35. **MODE OF PAYMENTS:**

35.1 a) **For RCC and SWG / PVC-U/DI/PVC Pipes**
(i) 75% of quoted rates against supply of finished pipes and after due third party inspection
(ii) 10% of quoted rates after laying & jointing of these pipes as per tender specification
(iii) 10% of quoted rates after successful hydraulic testing of pipeline in sections
(iv) Balance 5% of quoted rates after successful commissioning of entire pipeline.

b) **Payment for Manhole Chambers including Frames & Covers and Foot Steps:**
(i) 90% of the quoted rates after successful completion.
(ii) Balance 10% of the quoted rates after successful hydraulic testing.

For civil work based on the progress of work, payment shall be made based on running bills.
(iii) The rates for finished manholes including cost of frames, covers & foot steps shall be paid as per actuals, for any fractional increase in the depth of the manholes on decimeter basis shall be paid by adding the difference in rates between the immediately proceeding and succeeding depths of such fractional depth of manhole on linear basis.

For example to pay for 1.20 M depth Manhole

Rate for 1.00 Mt. depth Manhole -------------- Rs. X

Rate for 2.00 M depth Manhole -------------- Rs. Y

Therefore Rate for 1.20 M depth Manhole

\[ = Rs. X + \left( Y - X \right) \times \frac{2}{10} \]

35.1 c) **For House Service Connection Equipments and water meters:**
(i) 60% against supply of tapping equipments with water meters.
(ii) 30% after fixing and successful hydraulic test.
(iii) 10% after successful commissioning.

35.1 d) **For Valves:**
(i) 75% of quoted rates against supply of valves after third party inspection.
(ii) 10% of quoted rates after laying and jointing of valves as per tender specifications.
(iii) 10% of quoted rates after successful hydraulic testing.
(iv) 5% of quoted rates after successful commissioning of entire pipeline.

35.1 e) **For electrical and Mechanical Items**
(i) 60% against supply and delivery after duly inspected by the third party.
(ii) 20% after erection.
(iii) 10% after commissioning and trial running
(iv) 10% after successful completion of defect liability period.

36.0 **Procurement of Materials:**
(i) The Contractor shall use only Rajashree, Raasi, Zuari, Coromandel, Ultratech, Vasavadatta, Penna, Madras cement, Kittu cement or any other approved brand of 43 grade cement conforming to IS 8112 / 89 with latest amendments with ISI mark. The Contractor should furnish the manufacturer test certificate for the above brand of cement for having manufactured the cement as per relevant, IS standard and guarantee certificate before using the cement. The Executive Engineer of the Board will also test cement brought to the site.
from the reported testing laboratory / Engineering college for which the contractor has to bear the testing charges.

(ii) The Contractor shall procure the steel from VISL / SAIL / VSP / TISCO / LLOYD/ M/s SUJANA METALS/ M/s SRMB/ M/s SHYAM STEEL and manufacturer test certificate is to be produced. The Executive Engineer of the Board will also test the Steel bought to site from the reputed testing Laboratory / Engineering College for which the contractor has to bear the testing charges.

(iii) The contractor shall procure other materials from vendors as per list of Approved Vendors enclosed in document.

NOTE:-
1) It is mandatory for the bidder to quote for all the items indicated in the bill of quantities which includes all the works under the scope of the tender. The decision of the Chief Engineer(North), is final.
2) The Contractor shall submit the Hydraulic and structural designs and drawings of the sewer network, Wetwell, STP , head works and any other component under the scope of the Tender and the same shall be got approved from the Employer before execution. And if the employer feel the necessity to get verified the above design and drawings from the third party the cost should be borne by the contractor
3) If there is any delay on the part of the Board in handing over the land to the Contractor suitable time extension for the above delay period will be considered without penalty and no extra cost / escalation or compensation will be paid by the Employer / Board. However the Price Adjustment shall be paid as per terms and conditions.
4) It is understood from the information and certificates furnished by you for qualification to get the eligibility, you are capable of executing the work by yourself without sub-letting.
5) While executing the work care should be taken to avoid any damages to the existing water supply pipelines, Sewer lines, Telephone cables, HESCOM Power lines & any other structures. The concerned authorities should be intimated in advance in writing before executing the work. Any damages made to the above structures, the Contractor will be held responsible and the Contractor has to make good to original at his own cost.

37.0 PRICES:

The offer of the Bidder shall be inclusive of all Taxes, duties, Cess, sales tax, octroi, freight, transit, insurance, packing and handling charges, sales tax, work contract tax etc., and shall be for destination project site. In case any import license is necessary the supplier shall arrange for the same and the department shall not take any responsibility whatsoever.

NOTE:
Pursuant to Sub-clause 1.1 of Chapter-I, the scope of work under this Contract includes carrying out detailed Total Station Survey, Establishing sufficient Benchmarks, Design & Preparation of working drawing along with soft copy submit and obtain necessary approval from competent authority before execution of the following works. The employer feel the necessity to get technically verified the above design and drawings by the third party, the cost should be borne by the Board.

1) Hydraulic designs of Sewer network
2) Construction of Wetwell Cum Pumphouse
3) Construction of Aerated Lagoon/STP including treatment units .
4) Construction of DG Room
5) Rising Main
38.0 SCHEDULE OF MATERIALS:

SCHEDULE “A”

Schedule showing (approximate) the materials to be supplied from the Karnataka Urban Water Supply & Drainage Board free of cost for the works contracted to be executed from Divisional/Sub-Divisional stores

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Approx. Qty.</th>
<th>Unit</th>
<th>Place of Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

39.0 Terms and conditions:

1) The semi pervious/impervious soil for casing of the bund shall be taken out of the excavated soil of the borrow area ie, STP. If the quantity of the available selected soil for casing is less than the quantity of soil required for casing of the bund, the impervious/semi pervious soil from the adjoining area of the bund shall be utilized. However while excavating for borrowing of the semi pervious within the STP, the excavation shall be as per the sections required for the design storage of the sewage, as approved by the employer/engineer. The surplus earth if any out of the excavation within the STP, shall be utilized for leveling of the pond area wherever required with specific approval of the Engineer. The work includes all lead and lift etc.,

2) The excavated earth from bund and Key trench shall be used for filling the pond area required for leveling lagoons/ponds wherever required.

3) It is the responsibility of the agency to identify the borrow areas at his own responsibility. The soil should be tested from reputed laboratory for its characteristics suitable for Hearting/casing/key trench and the work shall only be taken up only after approval of soil from competent authority. After obtaining the soil reports, only soils from approved borrow areas shall be used. The contractor should identify/ascertain the borrow areas to assess its available quantity and should quote the rates including all lead and lift while submitting the bid.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Component/ Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 RAW MATERIAL CONTROL</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1.1 Cement</td>
<td>I. Chemical</td>
<td>Critical</td>
<td>Chemical Analysis</td>
<td>1/lot</td>
<td>IS:12330 (See note 2)</td>
<td>Supplier's TC</td>
<td>1. Supplier 2. IA</td>
<td>1. Scrutiny of record by IA 2. Counter Check by IA on receipt at manufacturer's place</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II Physical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fineness</td>
<td>-do-</td>
<td>By sieve</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Standard consistency</td>
<td>-do-</td>
<td>Lab test</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Setting time consistency</td>
<td>-do-</td>
<td>Lab test</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Soundness</td>
<td>-do-</td>
<td>Lab Test</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Compressive Strength</td>
<td>-do-</td>
<td>-do-</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Soundness</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>c. Specific gravity</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Water</td>
<td>Solubility of water in concrete works</td>
<td>Major</td>
<td>-do-</td>
<td>Once in a year</td>
<td>IS 456</td>
<td>IS:456</td>
<td>Government test lab</td>
<td>Manufacturer</td>
<td>Scrutiny of TC by IA (See Note 3)</td>
<td></td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>b. Physical</td>
<td>Major</td>
<td>UTM</td>
<td>1/lot</td>
<td>IS:432 Pt.I or IS:432 Pt.II or IS 2862 any grade (See Note 4)</td>
<td>IS:432 Pt.I or IS:432 Pt.II or IS 2862 any grade</td>
<td>1. Supplier's TC 2. Manufacturer's Register</td>
<td>1. Supplier 2. IA</td>
<td>1. Scrutiny of record by IA 2. Counter check by RITES at manufacturer's place</td>
</tr>
<tr>
<td>1.5</td>
<td>Rubber rings</td>
<td>a. Dimension</td>
<td>Critical</td>
<td>-do-</td>
<td>-do-</td>
<td>IS 5382 Type I, Natural or Isoprene</td>
<td>IS 5382 Type I, Natural or Isoprene</td>
<td>Supplier's Report</td>
<td>1. Supplier 2. Manufacturer</td>
<td>1. Scrutiny of reports by IA (See note 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Physical test</td>
<td>Critical</td>
<td>Lab test</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>Supplier's TC</td>
<td>1. Supplier 2. IA</td>
<td>Scrutiny of TC by IA 2. Counter check by IA on receipt at manufacturer place</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Polyeaer Identification</td>
<td>Critical</td>
<td>Lab test</td>
<td>1/lot</td>
<td>-do-</td>
<td>-do-</td>
<td>Supplier's TC</td>
<td>1. Supplier 2. IA</td>
<td>Scrutiny of TC by IA 2. Counter check by IA on receipt at manufacturer place</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Corrosion test</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Details are yet to be advi</td>
</tr>
</tbody>
</table>

2.0 PROCESS CONTROL

2.1 Concrete or Mortar a. Quantity of Cement | Critical | Analysis of concrete | 1/batch or shift | IS:458 CL 4.5.1 | IS:458 CL 4.5.1 | Manufacturer's Register | 1. Manufacturer 2. IA | 1. Scrutiny of record by IA 2. Random check IA |
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Caging</td>
<td>a. Weight of cage</td>
<td>Critical</td>
<td>By weighing M/C</td>
<td>One per design IS:458 IS:458</td>
<td>Manufacturer's Register</td>
<td>Manufacturer</td>
<td>1. Scrutiny of record by IA 2. Random test to IA (see note 1)</td>
</tr>
<tr>
<td>2.3 Concreting of pipe</td>
<td>a. Speed</td>
<td>Major</td>
<td>RPM indicator</td>
<td>On each pipe/mould Manufacturer's own standard IS:458</td>
<td>Manufacturer's Register</td>
<td>Manufacturer</td>
<td>1. Manufacturer 2. IA</td>
</tr>
<tr>
<td></td>
<td>b. Thickness of core</td>
<td>Major</td>
<td>Spike Gauge</td>
<td>On each pipe/should IS 458 IS 458</td>
<td>Manufacturer's Register</td>
<td>1. Manufacturer 2. IA</td>
<td>1. Scrutiny of record by IA 2. Random test to IA</td>
</tr>
<tr>
<td>3.0 FINAL INSPECTION &amp; TESTS</td>
<td>3.1 Final cured pipe</td>
<td>Major</td>
<td>Visual</td>
<td>100% IS:458 IS:458</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td>Audit check on sample by IA</td>
</tr>
<tr>
<td></td>
<td>b. Dimension</td>
<td>Major</td>
<td>Measuring instruments &amp; Gauges</td>
<td>100% IS:458 IS:458</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td>Audit check on sample by IA</td>
</tr>
<tr>
<td></td>
<td>c. Straightness of bore</td>
<td>-do-</td>
<td>Gauge</td>
<td>100% IS:458 IS:458</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td>Audit check on sample by IA</td>
</tr>
<tr>
<td></td>
<td>d. Hydrostatic test</td>
<td>Critical</td>
<td>Pressure test with pump</td>
<td>2% IS:458 IS:458</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td>See note 6</td>
</tr>
<tr>
<td></td>
<td>e. Absorption test</td>
<td>Critical</td>
<td>As per IS 3597 on specimen</td>
<td>for each pipe IS:458 IS:458</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Three edge bearing test</td>
<td>Critical</td>
<td>As per IS:3597</td>
<td>On samples as per IS:458 IS:3597 IS:3597</td>
<td>Manufacturer's Register and test reports</td>
<td>1. Manufacturer 2. IA</td>
<td>See note 7</td>
</tr>
<tr>
<td></td>
<td>g. Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>IS:458</td>
<td>IS:458</td>
<td>Manufacturer's Register and test reports</td>
</tr>
<tr>
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<td>---------------------------------------------</td>
</tr>
<tr>
<td>4.0</td>
<td><strong>Stamping &amp; Sealing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Stenciling IA stamp</td>
<td>Legibility of stamp and proper location for easy identification</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5.0</td>
<td><strong>Packing and Dispatch</strong></td>
<td>To ensure no damage to pipes during transit, loading and unloading</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**NOTE:**

1. Proper co-relation must be established by approved agency for cube strength between vibratory and centrifugal process in case pipes are manufactured by Centrifugal process. In absence of the same, conversion factor for 28 days compressive strength of cube shall be taken as 1.25 (refer clause 4.5.1 of IS:458)

2. Only sulphate resisting Portland cement to IS:2330/1988 shall be used if the RCC pipes are used for UGD works

3. Manufacturer should confirm the bore well and co-relate with test certificate. In case new bore wells are planned to be added, the water from the same shall be tested before being used.

4. The manufacturer shall advise in advance the type of polymer proposed to be used for Rubber rings and shall maintain the same polymer for the entire project

5. Sample of Rubber Rings procured shall be used for Hydrostatic test

6. Pipes used for Three Edge Bearing test shall not be included in the accepted lot. In case no failure occurs during this test, the maximum test load shall be recorded. The Sl Nos of these pipes shall be indicated in Inspection Certificate to ensure that these are not received at site and laid by mistake

7. Manufacturer shall give a copy of Internal test reports before inspection is concerned by IA

8. All measuring instruments and test equipments shall be calibrated periodically and records shall be put upto to IA for verification.
## ANNEXURE-I

**SUB: THE KARNATAKA MINOR MINERALS CONCESSION (AMENDMENT) RULES, 2003**

**COMMERCE AND INDUSTRIAL SECRETARIAT**

**NOTIFICATION NO. CI 56, MMN 2006, BANGALORE, DATED: 23rd June, 2007**

**SCHEDULE – I**

*(See Sub. Rule (1) of Rule 36)*

### "DEAD RENT"

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Name of the Minor Mineral</th>
<th>Rate per Unit/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ORNAMENTAL AND DECORATIVE BUILDING STONES- as defined under clause (m) of rule 2.</td>
<td>25000</td>
</tr>
<tr>
<td>2.</td>
<td>Felsite and its varieties suitable for use as Ornamental Stores.</td>
<td>25000</td>
</tr>
<tr>
<td>3.</td>
<td>Quartzizite and Sand stone and their varieties suitable for use as Ornamental Stones.</td>
<td>25000</td>
</tr>
<tr>
<td>4.</td>
<td>Marble or crystalline lime stone as Ornamental Stone</td>
<td>25000</td>
</tr>
<tr>
<td>5.</td>
<td>Bentonite</td>
<td>25000</td>
</tr>
<tr>
<td>6.</td>
<td>Fullers Earth</td>
<td>25000</td>
</tr>
<tr>
<td>7.</td>
<td>Lime Stone under title “Shahabab stone”</td>
<td>15000</td>
</tr>
<tr>
<td>8.</td>
<td>Lime Stone (Non Cement)</td>
<td>15000</td>
</tr>
<tr>
<td>9.</td>
<td>Ordinary building stones - Entire state As defined under clause (g) of rule 2</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Bangalore, Kolar, Mysore, Mandya and Tumkur</td>
<td>15000</td>
</tr>
<tr>
<td>b.</td>
<td>Other Districts</td>
<td>10000</td>
</tr>
<tr>
<td>10.</td>
<td>Lime Shell</td>
<td>15000</td>
</tr>
<tr>
<td>11.</td>
<td>Lime Kankar</td>
<td>15000</td>
</tr>
<tr>
<td>12.</td>
<td>Agate and Chalcedony</td>
<td>15000</td>
</tr>
<tr>
<td>13.</td>
<td>Ordinary sand</td>
<td>10000</td>
</tr>
<tr>
<td>14.</td>
<td>Brick and Tile clays</td>
<td>5000</td>
</tr>
<tr>
<td>15.</td>
<td>Steatite and sand stone used for making household utensils/articles - Entire state</td>
<td>10000</td>
</tr>
<tr>
<td>16.</td>
<td>Sand stone used for making household articles</td>
<td>10000</td>
</tr>
<tr>
<td>17.</td>
<td>Murram</td>
<td>3000</td>
</tr>
<tr>
<td>18.</td>
<td>All other minor minerals - Entire state</td>
<td>5000</td>
</tr>
<tr>
<td>SL. No.</td>
<td>Name of the Minor Mineral</td>
<td>Rate per Unit/quantity</td>
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<tr>
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</tr>
<tr>
<td>1.</td>
<td>ORNAMENTAL AND DECORATIVE BUILDING STONES- as defined under clause (m) of rule 2. (A) DYKE ROCKS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) Black granites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Mysore and Chamarajanagar Districts.</td>
<td>Rs.3000 per M³</td>
</tr>
<tr>
<td></td>
<td>b) All other Districts other than (a) above.</td>
<td>Rs.2500 per M³</td>
</tr>
<tr>
<td></td>
<td>ii) Other varieties of dykes other than black granites (Entire State)</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td></td>
<td>(B) (1) PINK and Red granites (ILKAL PINK VARIETY)</td>
<td></td>
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<tr>
<td></td>
<td>i) Hungund Taluk of Bagalkot and Badami taluk of Bijapur Dist., Kushtagi of Koppal Dist.</td>
<td>Rs.2500 per M³</td>
</tr>
<tr>
<td></td>
<td>ii) PINK and Red granites, gneisses and their textural &amp; structural varieties (other than ILKAL Pink variety)</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td></td>
<td>(C) GREY &amp; WITH GRAINTEES and Their varieties</td>
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</tr>
<tr>
<td></td>
<td>i) Very fine grained grey Granite (SIRAGREY variety)</td>
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<tr>
<td></td>
<td>Chintamani, Siddalaghatta of Kolar Dist., Hoskote of Bangalore District.</td>
<td>Rs.1500 per M³</td>
</tr>
<tr>
<td></td>
<td>ii) Grey &amp; white granites &amp; their textural varieties having shades of grey, black &amp; white colours, (other than (i) above) (Entire State)</td>
<td>Rs.1000 per M³</td>
</tr>
<tr>
<td>2.</td>
<td>Felsite and its varieties suitable for use as ornamental stones - Entire state.</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>3.</td>
<td>Granite and sand stones and their varieties suitable for use as Ornamental stones- Entire State.</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>4.</td>
<td>Marble or crystalline lime stone as ornamental stone - Entire state</td>
<td>Rs.1200 per M³</td>
</tr>
<tr>
<td>5.</td>
<td>Bentonite – Entire state</td>
<td>Rs.200 per MT</td>
</tr>
<tr>
<td>6.</td>
<td>Fullers earth - Entire state</td>
<td>Rs.200 per MT</td>
</tr>
<tr>
<td>7.</td>
<td>Lime stone under the title “Shahabad stone”</td>
<td>Rs.80 per 10 Sq.m</td>
</tr>
<tr>
<td>8.</td>
<td>Lime stone (Non cement) when used for building stone - Entire state</td>
<td>Rs.20 per MT</td>
</tr>
<tr>
<td>9.</td>
<td>Ordinary building stones - Entire state as defined under clause (g) of rule 2.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>10.</td>
<td>Lime Stone - Entire state</td>
<td>Rs.60 per MT</td>
</tr>
<tr>
<td>11.</td>
<td>Lime Kankar (Non- Cement) - Entire state</td>
<td>Rs.25 per MT</td>
</tr>
<tr>
<td>12.</td>
<td>Agate Chalcedony Flint- Entire state</td>
<td>Rs.120 per MT</td>
</tr>
<tr>
<td>13.</td>
<td>Ordinary sand – Entire state</td>
<td>Rs. 30 per MT</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Rate</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>14.</td>
<td>Steatite and sand stone used for making household utilities/articles – Entire state</td>
<td>Rs.20 per MT</td>
</tr>
<tr>
<td>15 a)</td>
<td>Murrum (All types of soils) – Entire state</td>
<td>Rs. 10 per MT</td>
</tr>
<tr>
<td>b)</td>
<td>Clay used for manufacturing tiles and bricks</td>
<td>Rs. 20 per MT</td>
</tr>
<tr>
<td>16.</td>
<td>All other minor minerals - Entire state</td>
<td>30% of sale value at mouth</td>
</tr>
<tr>
<td>17.</td>
<td>Waste rocks generated in ornamental stone quarry - Entire state (See explanation under Rule 36)</td>
<td>Rs.200 per Tonne Or Rs. 600 Per M^3</td>
</tr>
<tr>
<td>18.</td>
<td>Irregular shaped waste rock, Generated in Stone quarry which is not suitable for ornamental purposes- Entire state.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>19.</td>
<td>Waste rocks generated in Shahabad stone quarries- Entire state See explanation under Rule 36.</td>
<td>Rs.30 per MT</td>
</tr>
<tr>
<td>20.</td>
<td>Finished kerb stones/cubes not exceeding 30 cms. Each face – Entire State</td>
<td>Rs.80 per MT.</td>
</tr>
</tbody>
</table>

**By Order and in the name of the Governor of Karnataka**

_Sd/-_

H.V.RAMACHANDRARAO  
Desk Officer (Mines),  
Commerce & Industries Department.
List of approved manufacturers for different materials

1. D.I. Pipes

1. M/s. Electrosteel Casting Ltd., 30, B.T. Road, Kharda, P.O. Sukhchar, Dist. 24, Paraganas(N)- 700 115 – West Bengal

2. STONEWARE PIPES

3. M/s. Maruthi Ceramics (P) Ltd., 2-4-123, Ram Nagar, Hanamkonda- 506 001. Andhra Pradesh
4. M/s. South India Corporation (A) Ltd., P.B. No. 11, Walajpet, Vellore District
5. M/s. The Mysore Stoneware pipe & Potteries Ltd., Soladevanahalli Chickbanavar P.O., Bangalore-90

3. S & S RCC PIPES

1. M/s. Karnataka Cement Pipe Factory, RCC Unit, Spl.Shed 23, Industrial Estate, Gokul Road, Hubli- 580 030
2. M/s. Chetana Concrete Products, National Highway, No.4, Avaragere, Davanagere
3. M/s. Tanvi Cement Products, No. 128, Lakkenahalli, Bhadrapura Road, Solar Hobli, Magadi Taluk, Bangalore
10. M/s. Aradhaya Concrete Products, No.301, Hebbal Industrial Area, Mysore-570016

4. DI SPECIALS

2. M/s. Electrosteel Casting Ltd., 30, B.T. Road, Kharda, P.O. Sukhchar, Dist. 24, Paraganas(N)- 700 115 – West Bengal
3. M/s. Kejriwal Castings, P-200, Benaras Road, Netajigarh, Howrah – 711 108
5. SFRC MANHOLE FRAMES AND COVERS
1. M/s. Indo Precast Industries, C-5, IDA, Uppal, Hyderabad - 500 039
2. M/s. Tanvi Cement Products, No. 128, Lakkenahalli, Bhadrupura Road, Solar Hobli, Magadi Taluk, Bangalore Rural Dist.
3. M/s Southern Concrete Industries, Plot No.22, C, KIADB Industrial Area, Doddaballapur, Bangalore Rural District.

6. SLUICE VALVES
1. M/s. VAG Valves (India) Pvt. Ltd., Flat A, 1st Floor, Krupa Ashirwad Complex, Hyderabad, R.P. Road, Secunderabad- 500 003
2. M/s. Kirloskar Brothers Ltd., Gat No.252/253, Village Kondhapuri, Shirur, Dist- Pune
3. M/s. Mayur Valve Co., W-95 (A), M.I.D.C. Satpur, Nashik- 422 007
6. M/s. Upadhaya Valves, P 280, Binaras Road, Kolkata
8. M/s. Indian Valve International, 84B, Bhupendra Bose Avenue, Kolkata- 700 004
9. M/s. Kamala Casting and Engineering Works, #41/2, ‘Q’ Road, Belgachia, Howrah- 711 108
11. M/s. Kejriwal Castings, P-200, Benaras Road, Netajigarh, Howrah – 711 108
12. M/s. Steam & Mining Ltd., 1, A.J.C. Brase Road, III Floor, Kolkata- 700 020
13. M/s. Durga Engineering Co., 22/2, Deshpnan Susmal Road, Howrah- 711 101
15. M/s. Juneja Metal Works, Village-Variana, Kapurthala Road, PO Nagara, Jalandhar-144013 (Punjab)
16. M/s. Ventil Engineers, Belgaum
19. M/s. Calsens Pvt Ltd., 6/1 A, British India Street, Kolkata – 700 069
22. M/s. Sachideva Metal works, C-33, Extension Focal Point, Jalandhar-144004, Punjab

7. GATE VALVES
2. M/s. Juneja Metal Works, Village Variana, Kapurthala Road, P.O. Basti Guzan, Jalandhar (Punjab)
3. M/s. Kirloskar Brothers, Udyog Bhavan, Tilak Road, Pune- 411 002
4. M/s. H. Sarker and Co., Balitkuri Balkultala, Howrah- 711 113
5. M/s. Audco India Ltd., Marai Malai Nagar, B-8, Industrial Area, Chennai
8. M/s Calsens Pvt Ltd., 6/1A, British India Street, Kolkata – 700 0

8. CEMENT
2. M/s.Pena Cement Industries Ltd., Talaricheruvu Village,Tadpatri Mandal,Ananthapur Dist.A.P.
3. M/s Madras Cement,Flat No.100-100/1, M-Floor,Eden Park, No.20, Vittal Mallya Road, Bangalore-560001.

9. FOOT STEPS
2. M/s. TV Plastics Ltd., 488, Kamakshipalya New Extension, Bangalore- 560 079
3. M/s. Rajvaibhav Enterprises Pvt Ltd., No. 18, KIADB, Industrial Area, Chintamani Road, Hosakote- 14, Bangalore

10. SURFACE AERATOR
2. M/s. Voltas Ltd., Business Division, 2nd Pokran Road, Thane- 400 601.

11. SCREEN FOR STP
1. M/s. Voltas Ltd., Business Division, 2nd Pokran Road, Thane- 400 601.

12. MECHANICAL BAR SCREEN
1. M/s.Jash Engineering Ltd.,31, Sector ‘C’, Industrial Area, Sanwer Road, Indore-452 015

13. SCREEN FOR TUBEWELL
1. M/s. Johnson Screens (India) Ltd., Block No. 53, Mr.Khatraj Char Rasta, Village Khatraj, Taluka Kalol, District Gandhinagar- 382 721.

14. PIPE COATING
1. M/s. STP Ltd., Mirgadih, Dimna Road, P.O. MGM Medical College, Jamshedpur- 831 018, Jharkhand

15. KNIFE GATE
1. M/s.Jash Engineering Ltd.,31, Sector ‘C’, Industrial Area, Sanwer Road, Indore-452015
KARNATAKA URBAN WATER SUPPLY AND DRAINAGE BOARD, BANGALORE

BID DOCUMENT FOR

UGD SCHEME TO BAILHONGAL TOWN OF BELGAUM DISTRICT

CONSTRUCTION OF 8.28MLD CAPACITY AERATED LAGOON AND ALLIED WORKS

SPECIAL SPECIFICATION
1.0 GENERAL

1.1 Equivalency of Standards and Codes

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 stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.2 Sign Board

The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description of the Project, (iv) the amount of the Contract Price; and (v) the starting and completion dates.

1.3 Samples and Tests

Pursuant to Clause 36 of Chapter 2, the Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contractor. Without limiting the generality of the foregoing, the Contractor shall either (i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and/or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, or (ii) arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer up to 5% of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

The Contractor shall, within 28 days after the date of the Letter of Acceptance, submit...
to the Engineer for his consent a detailed description of the arrangements for conducting the quality control programme during execution of the Works, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor’s quality control programme is not adequate to ensure the quality of the Works, the Contractor shall produce a revised programme which will be adequate to ensure satisfactory quality control.

1.4 Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiry’s with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not claim for extra time that may be required to protect or facilitate relocating such utilities, only water supply pipelines works will be paid as per the item of measurement. If any major shifting or realignment of gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer.

In case the alignment of the pipeline crosses the high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd., (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

2.0 SCOPE OF WORK:-

2.1 Pursuant to Sub-clause 1.1 of Chapter-I, the scope of work under this Contract includes: carry out detailed total station survey, establishing sufficient bench marks, design and drawing alongwith soft copy submit and obtain necessary approval from the concerned authority before execution of the following works. And if the employer feel the necessity of technical assistance for verification of design and drawings submitted by the contractor, the cost should be borne by the contractor.

I) UGD Scheme to Bailhongal town of Belgaum District-

a) Providing laying and jointing of Sewer lines, construction of Manhole chambers, Screen Chamber, Grit chamber and Wet well.
<table>
<thead>
<tr>
<th>I</th>
<th>Providing laying, jointing, testing and commissioning of SWG/PVC-U / RCC Sewer line network and construction of BBM/ RCC man hole chambers in all Zone.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150 mm SWG pipeline</td>
</tr>
<tr>
<td></td>
<td>160 mm dia PVCU SN4 pipeline</td>
</tr>
<tr>
<td></td>
<td>160 mm dia PVCU SN8 pipeline</td>
</tr>
<tr>
<td></td>
<td>200 mm dia PVCU SN4 pipeline</td>
</tr>
<tr>
<td></td>
<td>200 mm dia PVCU SN8 pipeline</td>
</tr>
<tr>
<td></td>
<td>250 mm dia PVCU SN4 pipeline</td>
</tr>
<tr>
<td></td>
<td>250 mm dia PVCU SN8 pipeline</td>
</tr>
<tr>
<td></td>
<td>300 mm dia RCC S&amp;S NP3 class pipeline</td>
</tr>
<tr>
<td></td>
<td>350 mm dia RCC S&amp;S NP3class pipeline</td>
</tr>
<tr>
<td></td>
<td>400 mm dia RCC S&amp;S NP3class pipeline</td>
</tr>
<tr>
<td></td>
<td>450 mm dia RCC S&amp;S NP3class pipeline</td>
</tr>
<tr>
<td></td>
<td>500 mm dia RCC S&amp;S NP3class pipeline</td>
</tr>
<tr>
<td></td>
<td>Construction of 1.2 m dia BBM Manholes</td>
</tr>
<tr>
<td></td>
<td>Construction of 1.5 m dia BBM Manholes</td>
</tr>
<tr>
<td></td>
<td>Construction of 1.5 m dia RCC Manholes</td>
</tr>
<tr>
<td></td>
<td>Providing and fixing ventilating shaft</td>
</tr>
<tr>
<td></td>
<td>Providing flushing tank 900Liters capacity</td>
</tr>
<tr>
<td></td>
<td>Providing laying RCC NP3 pipes for culverts</td>
</tr>
<tr>
<td></td>
<td>Providing and insertion of 100mm dia Ms pipes for Roads crossings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II</th>
<th>Shifting of 200 mm dia D.I. and 90, 110, 160mm dia PVC pipe distribution system in ZONE -1,2 &amp; 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply and laying of 200mm DI K-7 class pipe</td>
</tr>
<tr>
<td></td>
<td>Supply and laying of PVC Pipes</td>
</tr>
<tr>
<td></td>
<td>a) 160 mm dia PVC pipeline-6Kg/sq</td>
</tr>
<tr>
<td></td>
<td>b) 110 mm dia PVC pipeline-6Kg/sq</td>
</tr>
<tr>
<td></td>
<td>c) 90 mm dia PVC pipeline-6Kg/sq</td>
</tr>
<tr>
<td></td>
<td>Supplying and Laying og GI pipes</td>
</tr>
<tr>
<td></td>
<td>15mm dia</td>
</tr>
<tr>
<td></td>
<td>20mm dia</td>
</tr>
<tr>
<td>III</td>
<td>Dismantling and reconstruction of CD Works and drains IN ZONE -1, 2 &amp; 3</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>IV</td>
<td>Construction of 10.50 Mtr Dia RCC wetwell cum pump house in Zone -1</td>
</tr>
<tr>
<td>V</td>
<td>Inlet and Screen Chambers of Wet Well in Zone-1</td>
</tr>
<tr>
<td>VI</td>
<td>Piping, Mechanical and Eletricalworks for Wetwell in Zone -1</td>
</tr>
<tr>
<td>VII</td>
<td>Construction of valve chamber for Wetwell in Zone -1</td>
</tr>
<tr>
<td>VIII</td>
<td>Construction of 6.00 Mtr Dia RCC wetwell cum pump house</td>
</tr>
<tr>
<td>IX</td>
<td>Inlet and Screen Chambers at Wetwell for zone 2 &amp; 3</td>
</tr>
<tr>
<td>X</td>
<td>Piping, Mechanical and Electrical works for Wetwell</td>
</tr>
<tr>
<td>XI</td>
<td>Construction of valve chamber for Wetwell</td>
</tr>
<tr>
<td>XII</td>
<td>Construction of Diesel Genrator Room of size 4 m x 6 m for both wetwells</td>
</tr>
<tr>
<td>XIII</td>
<td>Providing individual house connections</td>
</tr>
</tbody>
</table>

b) Construction of 8.28 MLD Capacity waste Aerated Lagoon and allied works under providing UGD arrangements to Bailhongal Town.

<table>
<thead>
<tr>
<th></th>
<th>Providing 100mm,300mm &amp; 500 mm dia Ductile Iron class K-7 Pumping Mains from wet well to STP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply and laying 500 mm dia DI K-7 Class</td>
</tr>
<tr>
<td></td>
<td>1240.00 m</td>
</tr>
<tr>
<td></td>
<td>300 mm dia DI rising main dia DI K-7 Class</td>
</tr>
<tr>
<td></td>
<td>2100.00 m</td>
</tr>
<tr>
<td></td>
<td>100 mm dia DI rising main dia DI K-7 Class</td>
</tr>
<tr>
<td></td>
<td>172.50m</td>
</tr>
<tr>
<td>2</td>
<td>Construction of Primary treatment units at STP</td>
</tr>
<tr>
<td></td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Construction of Sewage Treatment Plant of 8.28 MLD capacity</td>
</tr>
<tr>
<td></td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>a.i) Construction of Aerated Lagoons at STP Site</td>
</tr>
<tr>
<td></td>
<td>a.ii) Construction of Interconnecting RCC Channel</td>
</tr>
<tr>
<td>From Division Box to Aerated Lagoon</td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>a.iii) Construction of 2 Nos Interconnecting RCC Channel From Aerated Lagoon to Basin</td>
<td></td>
</tr>
<tr>
<td>b.i) Construction of Northern &amp; Southern Sedimentation Basins at STP Site</td>
<td></td>
</tr>
<tr>
<td>b.ii) Construction of Interconnecting RCC Outlet Channel From Basin to Outlet Chamber for Northern and Southern Sedimentation Tank</td>
<td></td>
</tr>
<tr>
<td>c) Construction of DG Room of Size 4 M X 6 M</td>
<td>1No.</td>
</tr>
<tr>
<td>d) Construction of laboratory room of size 6 M X 10 M near STP</td>
<td>1No.</td>
</tr>
<tr>
<td>e) Construction of Switch gear room of size 6 M X 9 M near STP</td>
<td>1No.</td>
</tr>
<tr>
<td>f) Construction of Type 'A' Staff Quarters</td>
<td>4Nos.</td>
</tr>
<tr>
<td>g) Mechanical and Electrical Equipments at STP</td>
<td></td>
</tr>
<tr>
<td>Motors for Aerator 9HP capacity</td>
<td>14sets.</td>
</tr>
<tr>
<td>Reduction Gear Boxes</td>
<td>14sets.</td>
</tr>
<tr>
<td>Paddle Assembly</td>
<td>14sets.</td>
</tr>
<tr>
<td>Diesel Generator set-125 KVA</td>
<td>1 Set.</td>
</tr>
<tr>
<td>h) Providing Approach road at STP site</td>
<td></td>
</tr>
<tr>
<td>11 Providing Barbrd wire fencing allround STP site</td>
<td></td>
</tr>
</tbody>
</table>

Key map showing the various components of the system is presented in Chapter 9, drawings.

2.2 Earth work excavation laying of bedding wherever specified, protection works to the slopes wherever the slopes are of loose soil back filling the trenches and restoring and making good all surfaces which are damaged during excavation, disposal of excavated earth as directed by the Engineer in charge.

2.3 Construction of all apprentices, structures such as manholes with cover, frames, ventilating shaft, pipe supports, drain and road crossings etc.,

2.4 Filling the ground with available approved earth including watering and compaction layers of 15mm.

2.5 Maintenance of all the works under the scope of the tender for 12 months after commissioning. During this period, the contractor has to set right the defect of any kind in the manufacture, construction and in any other works in this scope of tender.

2.6 Dismantling and reconstruction of the structures such as culverts, storm water drains, utility lines such as water supply pipe lines, sewer pipe lines are any other structure in the way of proposed alignment.

2.7 Testing and commissioning of Sewer Network, Sewage Treatment Plant / other components under the scope of the tender.
2.8 Construction of suitable culverts at valley points and at suitable places as directed by the Engineer.

2.9 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

2.10 The alignment and the general arrangements of Sewer Network, Sewage Treatment Plant are furnished in Chapter-9 Drawings. Further details shall be furnished in the construction drawings during the construction stage. The details given in the tender drawings are tentative and are only for the guidance of the contractor, actual level shall be taken at site for submission and approval of designs.

3. TECHNICAL SPECIFICATION FOR VARIOUS COMPONENTS OF SEWER NETWORK, SEWAGE TREATMENT PLANT.

3.1 The Sewage treatment plant shall have the following components:

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing, laying, jointing of PVC-U/SWG/RCC sewer lines network, construction of manhole chambers, inlet chambers, receiving chambers, screen chambers, wet well cum pump house.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Construction Aerated Lagoons</td>
<td>2 No.</td>
</tr>
<tr>
<td>3</td>
<td>Construction Sedimentation Basins</td>
<td>2 No.</td>
</tr>
<tr>
<td>4</td>
<td>Construction of Diesel Generator room 4x6 m</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Construction of Laboratory Room</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Construction Switch Gear Room</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Construction Staff Quarters</td>
<td>4 No.</td>
</tr>
<tr>
<td>8</td>
<td>Mechanical and Electrical Equipments</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Providing Approach road</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Also connecting pipes for inlet chamber to Aerated lagoon &amp; sedimentation ponds, to collection chamber and then through effluent pipes to the final discharge point. Bypass arrangements between the various units shall also be provided.</td>
<td></td>
</tr>
</tbody>
</table>

3.2 CIVIL WORKS

3.2.1 Civil Works

The scope - of work for civil works under this Contract includes the following. All general requirements, technical specifications, civil specifications etc., mentioned hereinafter in the tender documents shall be considered as part of scope of work:

DETAILED SPECIFICATIONS

3.2.2 The manufacture, supply, laying, jointing, testing and commissioning of pipes used for sewer lines shall generally conform to specifications under Sub-Clauses 15.1, 15.2, 15.3, 15.5 & 15.7 of chapter to and construction of manholes shall conform to Clause
3.2.3 Salt Glazed Stone Ware (SGSE) Pipes

3.2.4 Manufacture of pipe

The spigot end of stoneware pipes shall conform to IS: 651 and IS: 4127. The method of manufacture shall be such that the form and dimensions of the finished pipes are accurate. The pipe shall be free from visible defects such as fire cracks or hair cracks without any broken blisters. The thickness of barrel and socket for various diameters of pipes shall be as specified in IS:651.

Each pipe unit shall be of 0.6-0.9mtr length, exclusive of the internal depth of socket.

3.2.5 Laying of Pipe

Laying of SGW pipes shall conform to the code of practice IS: 4127. Pipes shall be laid underground with a minimum earth cover of 1m, unless otherwise specified. Laying of pipes shall be as per Clause 15, Section 10, standard specifications for procurement of project works. All pipes, fittings and material shall be tested and approved by the Engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material.

RCC/SGSW Pipes and fittings shall be as per Standard Specifications of Chapter 10.

3.2.6 Jointing of pipes

Jointing between SGSW Pipes

Jointing between SGSW pipes shall be cement joint as given below.

In each joint, spun yarn soaked in tar shall be passed round the joint and inserted in it by means of a caulking tool. More skeins of yarn shall be added if necessary and shall be added if necessary and shall be well caulked. Yarn of gasket so rammed shall not occupy more than one-fourth of the depth of socket. After that cement mortar 1:1.5 (one part of cement and one and half part of sand) shall be slightly moistened and carefully inserted by hand into the remaining space of the joint after caulking of yarn. The mortar shall then be caulked into the joint with caulking tool. More cement mortar shall be added until the space of the joint has been completely filled with tightly caulked mortar. The joint shall then finished off nearly outside the socket at an angle of 45 degrees. The cement mortar joint shall then be cured for at least seven days before testing.

Jointing between SGSW pipe and any other type of pipes.

Jointing between SGSW pipes and other pipes shall be of cement joint as specified in Sub-Clause of this section.

3.2.7 Unplasticized polyvinyl chloride (PVC-U ) pipes

3.2.8 Manufacture of Pipe

The PVC-U pipes with ISI mark intended for underground (buried) non-pressure gravity drain and sewer applications confirming to IS 15328:2003 with latest amendment for the sizes and stiffness classes. The pipe shall be in 3 Mtr. and 6 Mtr. Lengths. the pipes may be joined using elastomeric sealing rings. The elastomeric sealing rings. The elastomeric sealing rings required for jointing of ringtite PVC pipes shall be supplied free of cost and shall in accordance with one of the types( Type 1 to Type 6) of IS 15328:2003
3.2.9 Laying of pipe
Laying of PVC-U pipes shall conform to the relevant IS code. Pipes shall be laid underground with a minimum earth cover of 1 mtr, unless otherwise specified. Laying of pipes shall be as per Clause 15, section 10, standard specifications for procurement of project works. All pipes fittings and material shall be tested and approved by the engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material. PVC-U pipes and fittings shall be as per Standard Specifications of Chapter 10.

3.2.10 Jointing of pipes
Jointing between PVC-U Pipes
The pipes may be joined using elastomeric sealing rings and shall in accordance with one of the type (Type 1 to Type 6) of IS 5382.

3.2.11 Testing
Testing at site
All the pipelines shall be subjected to a test pressure of at least 2.5m head of water at the highest point of the section under test. The tolerance of two liters per centimeter of diameter per kilometer is allowed during a period of 10 minutes.

Before commencing the hydraulic test, the pipelines shall be filled with water and maintained full for 24 hours by adding water, if necessary, under a head of 0.6m of water. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend with shall be temporarily jointed-in at the top end and a sufficient length of vertical pipe jointed to it so as to provide required head, or the top end may be plugged with a connection to a hose ending in a tunnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

A slight amount of sweating which is uniform is allowed. Any joint found leaking or sweating shall be rectified or embedded into 150mm layer of 1:2:4 cement concrete 300mm in length and the section retested at no extra cost.

1. Hydrostatic testing.
2. Three edge bearing test
3. Absorption test.

3.2.12 MANUFACTURING / SUPPLYING LAYING AND JOINTING OF PIPES:-
Reinforced Cement Concrete (RCC) Pipes

3.2.13 Manufacture of pipe
The RCC pipes to be used for carrying sewers shall be of class NP3, spigot and socket (S&S) type, with rubber gasket jointing, manufactured in conformity with IS 458. Sulphate resistant cement shall be used in manufacture of pipes. The ends of the pipes shall conform to Clause 5.3 of IS 458 as applicable for S&S joints. The rubber ring shall conform to IS 5382 and IS 12820 as applicable for sewer lines and shall of type “IA”. The diameters of pipes shall be as required for various trunk/outfall sewers as per designs and drawings.

The method of manufacture shall be such that the form and dimensions of the finished pipes are accurate within the limits specified in relevant IS:458. Pipes
manufactured in compliance with IS 458 shall be either water cured or stream cured in accordance with the relevant requirements of IS:458.
The internal diameter, wall thickness, length of barrel, reinforcement (longitudinal and spiral), type of ends and minimum clear cover to reinforcement, strength test requirements, tolerances on overall length, internal diameter or dimensions of sockets/ spigots of pipes shall be as per the relevant clauses/ tables of IS:458. Minimum clear cover to reinforcement shall be 15cms.
Each pipe unit can be in lengths of 2mtr to 4mtr based on availability, ease in handling transportation and laying.

The workmanship and finish for the pipe will conform to the relevant Sub-clauses of clause 15.1 of section10.

Cleaning of pipes shall conform to sub clause 15.1.11 of clause 15 of section 10.

Jointing of pipes with spigot and socket joints shall conform to the relevant sub-clauses of clause 15.1.10 of Section 10.

3.2.14 Testing of pipes during manufacture
During manufacture, tests on concrete shall be carried out as per IS: 456.
The specimen of pipes for the following tests shall be selected in accordance with sub-clause 9.1 of IS:458 and tested in accordance with the methods described in IS:3597.
1. Hydrostatic testing.
2. Three edge bearing test
3. Absorption test.

3.2.15 Scope
This specification covers the requirements jointing and testing at work sites of Reinforced Cement Concrete (RCC) pipes of both pressure and non pressure varieties used for sewers.

3.2.16 Applicable Codes
The jointing and testing at work sites of RCC pipes shall comply with all currently applicable statutes, regulations, standards and Codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the Codes shall be referred to. If requirements of this specification conflict with the requirements of the Codes and Standards, this specification shall govern.

3.2.17 Laying:
Laying of concrete pipes shall conform to the code of practice of IS:783. Pipes shall be laid under ground with a minimum earth cover of 1.0mtr. Pipes shall be generally laid in sections of 500mtr each. Laying of pipes shall be as per Clause 15, section 10, standard specifications for procurement of project works. All pipes, fittings and material shall be tested and approved by the Engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material. Before laying the pipe, necessary bedding
shall be provided wherever required as per sub-clauses 3.3.1, 3.3.2 and 3.3.3.

3.2.18 Laying of pipe shall conform to Clause 15.7 of Chapter 10.

3.2.19 Jointing

Jointing of RCC pipes shall be done as per the requirements of following Specifications and as per the relevant IS. The type of joints shall be as specified in the Contract/Drawing. After jointing extraneous material if any, shall be removed from the inside of the pipe and newly made joints shall be thoroughly cured. In case, rubber sealing rings are used for jointing, these shall conform to IS:5382. The pipe joints shall be flexible joints jointed by rubber ring as per IS 783-1985. The sections of the pipe shall be jointed in such a manner that there shall be as little unevenness as possible along the inside of pipe. Care should be taken while jointing to provide the correct gap between the end of spigot and back of the socket to ensure flexibility at each joint and correct location. The joints shall be finished as directed by the Engineer.

3.2.20 Spigot and Socket Joint (Flexible)

The RCC pipe with the rubber ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipes. The manufacturer instructions shall be used, and the manufacturers instructions shall be deemed to form a part of this Specifications. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

3.2.21 Flush Joint (Internal)

This joint shall be generally used for culvert pipe of 60-cm diameter and over. The ends of the pipes are specially shaped to form a self-cantering joint with an internal jointing spaces 1.3 cm wide. The finished joint is flush with both inside and outside with the pipe wall. The jointing space is filled with cement mortar in the proportion of 1:1.5, mixed sufficiently dry to remain in position when forced with a trowel or rammer.

3.2.22 Flush Joint (External)

This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against the other and adjusted in correct position. The jointing space shall then be filled with cement mortar in the proportion of 1:1.5, sufficiently dried and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

3.2.23 Cleaning of pipes

As soon as a stretch of RCC pipes has been laid complete from manhole to manhole or for a stretch as directed by Engineer, Contractor shall run through the pipes both
backwards and forwards a double disc or solid or closed cylinder 75mm less in
diameter than the internal diameter of pipes. The open end of an incomplete stretch
of pipe line shall be securely closed as may be directed by Engineer to prevent entry
of mud or silt etc.

If as a result of the removal of any obstruction, Engineer considers that damages may
have been caused to the pipe lines, he shall be entitled to order the stretch to be
tested immediately. Should such test prove unsatisfactory Contractor shall amend the
work and carry out such further tests as are required by Engineer.

It shall also be ascertained by Contractor that each stretch from manhole to manhole
or the stretch as directed by Engineer is absolutely clear and without any obstruction
by means of visual examination of the interior of the pipeline suitably enlightened by
projected sunlight or otherwise.

3.2.24 Testing at work site

After laying and jointing of RCC pipes is completed the pipe line shall be tested at
work site as per the following Specifications and as directed by Engineer. All
equipment for testing at work site shall be supplied and erected by the Contractor and
shall be rectified by him/her to the full satisfaction of Engineer. Water used for test
shall be removed from pipes and not released to the excavated trenches.

After the joints have thoroughly set and have been checked by Engineer and before
backfilling the trenches, the entire section of the sewer (or storm water drain) shall be
proved by Contractor to be water tight by filling in pipes with water to the level of
1.50m. above the top of the highest pipe in the stretch and heading the water up for
the period of one hour. The apparatus used for the purpose of testing shall be
approved by Engineer. Contractor if required by Engineer shall dewater the excavated
pit and keep it dry during the period of testing. The loss of water over a period of 30
minutes should be measured by adding water from a measuring vessel at regular 10
minutes intervals and noting the quantity required maintaining the original water
level. For the approval of this test the average quantity added should not exceed 1
litre/hour/100 linear meters/10 mm for nominal internal diameter. Any leakage
including excessive sweating which causes a drop in the test water level will be visible
and the defective part of the work should be removed and made good.

In case of pressure pipeline the completed stretch of pipeline shall be tested for site
test pressure of 0.15g/sq.cm. The site test pressure should not be less than the
maximum operating pressure plus the calculated surge pressure, but in no case
should it exceed the hydrostatic test pressure, as specified in IS:458.

3.2.25 Measurement of pipes.

The length of the sewer pipes shall be measured between the inner surfaces of
consecutive chambers at the invert level of the pipes along the central line of pipeline
to the nearest centimeter.
3.2.26 Designing, constructing, testing, commissioning, three months trial run and maintenance for 12 months with performance guarantee of 8.28 MLD capacity sewage treatment plant consisting of Aerated Lagoons, Sedimentation basins, provision of sewer pipeline, 2 No’s of wet well cum pump house, laying of 100, 300mm & 500 dia DI class K-7 rising main from TSPS (wet well) to STP. and other allied works, as per tender specification including providing & installing all required civil, material, labour, tool & plants all complete item rate tender basis.

The sewage from Zone A, B, and Zone-C flows through trunk mains with maximum dia. of 500mm RCC NP-3 pipe along the side of Nala to pre-treatment units before terminal sewage pumping station of wet well.

3.2.27 The sewage treatment plant is designed for the intermediate stage population of 72,000 for the year 2027, covering Zone A, B, and Zone-C respectively. The scope of the contracts includes all the connected works mentioned in the package & ends with providing suitable discharge arrangements for the final treated effluent into natural valley through the lead of pipe. The wet well are designed for sewage contribution from entire town for a projected Population of Ultimate year for the year 2042.

3.2.28 Process, hydraulic, structural designs and preparation of all drawings for civil construction including architectural drawings.

3.2.29 Topographic surveying, levelling and gradation of the sewer network, plant area, construction of roads and clearing debris and left over materials, after construction.

3.2.30 Earth Filling

For earth fill for embankment of roads, the contractor shall supply good quality earth. The earth shall be leveled, watered and consolidated with mechanical rollers in layers of not exceeding 250mm thickness. The natural ground levels are shown in the block levels.

3.2.31 EARTH WORK - GENERAL:-

The earth work excavation for laying of pipe and for construction of bund shall be carried out, in general, as per Chapter 10, Standard Specifications for Procurement of Project Works. Any additions or modifications specified in this Chapter shall be followed. The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required by the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc., before quoting the rates.
3.2.32 Services to Be Provided by the Contractor.

The Contractor shall take the responsibility for all the testing and inspection to be conducted in a manner as specified in these specifications. Transportation of all equipments from manufacturers work to the project site inclusive of all intermediate handling and unloading / storage at site. The Contractor after complete erection and testing shall do application of the final paints of approved colour. The Contractor shall also arrange technical experts of equipments from proprietary supplier as and when necessary until the commissioning and guarantee run of the plant are completed.

As the equipment is intended for sewage treatment plant under corrosive / H2S atmospheric conditions, the design and material of equipment will be such that it can withstand these conditions to minimize wear and tear.

The details of equipments, various units, their specifications, makes, standard to be followed and the material of construction are mentioned in the following paragraphs. The scope of work includes all items of work hereinafter specified.

3.3 GENERAL TECHNICAL AND OTHER REQUIREMENTS

a) The Contractor should ensure technical feasibility of their tender offer, after inspecting the site. The firm shall be required to execute every items of work which are necessary for satisfactory completion and commissioning of the plant, which are specified in the tender document.

b) All the works under the scope are to be designed and executed as per the technical specifications and requirements.

c) Time of completion of above-mentioned scope of works shall be 24 months (inclusive of monsoon period(s)) from the date of issue of work order.

d) The Contractor can take up the works of site clearance and grading and other mobilization works with the permission of the Engineer after the award of the Contract. However, before taking up the construction work, the Contractor shall be responsible for preparing and submitting for checking and approval of the following:

I. A levelling, gradation plan of the entire site.

II. Design and sizing of Sewer lines shall be based on the ultimate stage population of 96,000 in the year 2042. All design and sizing shall be made on the basis of CPHEEO manual and relevant IS codes and the latest amendments. The sewage flow is considered at 110 LPCD with a peak factor of 2.25, d/D ratio limited to 0.80, a minimum self cleaning velocity of 0.60 m per/second and non scouring velocity of 3 m per second are to be adopted. Manholes shall be constructed on the basis of CPHEEO manual.

III. Design and sizing of various units of the primary treatment units shall be based on the ultimate stage population of 9600 in the year 2042. All design and sizing shall be made on the basis of criteria and specification mentioned under various specifications.
The waste water flow shall be considered at the rate of supply of 110 LPCD and a peak factor of 2.25.

IV. Layout plan of entire site showing the location of 8.28 MLD sewage treatment plant, on the basis of sizing, design indicating sizes and locations of various units, channels, rising mains, roads, drainage layouts, etc within the area of the site, including various buildings, disposal points of screenings, grit, sludge, etc.

V. Hydraulic flow diagram for the present and intermediate requirements on the basis of hydraulic head loss calculations, indicating floor level, minimum and maximum water levels of the pump house, ground levels, invert levels and hydraulic gradient lines of rising main, top water levels of each unit from inlet chamber to the final discharge body, water depths, bed levels, invert levels, top of wall of each unit including those of bye pass connections etc, based on the design parameters given in Annexure-I to this Section and relevant Sub-Clauses of this Section.

e) Hydraulic head loss design calculations to arrive at the total head of the pumping sets, on the basis of criteria mentioned in the latest Manual on Sewerage and Sewage Treatment of Ministry of Urban Development, Government of India.

f) General arrangement drawings for each unit and all buildings showing existing and finished ground levels based on the levels given herein after in Sub-Clause 5, necessary provision for civil Structural works and electrical mechanical works separately.

g) Civil structural design calculations and reinforcement drawings for each unit, buildings, pump house, etc., for approval and execution purposes. Structural design for all liquid retaining structures shall be done in accordance with the provisions in IS:3370 (Part I to IV) and for other structures/building it shall be done on the basis of IS:456 –2000 unless otherwise stipulated so.

h) Architectural drawings for all buildings, pumping stations etc.

i) Schedule for designs, drawings & execution, Bar Charts-CPM I PERT charts for stage wise activities of Sewer Network sewage treatment plant, pumping station, building works, etc.

j) During the course of construction and its completion, the Contractor shall submit the following drawings/documents for civil works:

1) Revised drawings and design according to requirements of the Engineer.
2) Six sets of final and approved drawings and designs duly bound.
3) Six sets of manual of Operation and Maintenance of the treatment plant and pumping station.

k) The following data are enclosed for the guidance of the Contractor:
1. Contour plan of the site.
2. Any additional investigations required shall be done by the Bidder at his own cost.
3.4 BROAD DESIGN DATA

3.4.1 Characteristics of Raw Sewage

a. Characteristics of raw sewage are available with the Employer for reference of the Contractor and for design purpose BOD of sewage shall be considered at 300 mg/l.
b. Any additional data required shall be collected by the Contractor at his own cost for design of the Treatment Plant.

3.4.2 Quality of Treated Effluent

The quality of treated sewage should always be within the acceptable limits /KSPCB Guideline as described below,

1) The BOD in the final treated effluent shall be 20mg/l.
2) The suspended solids in the final treated effluent shall be less than 30 mg/l.
3) PH shall be in range of 6.5 to 8.5
4) All other characteristics shall conform to IS:4764

3.5 VARIOUS LEVELS AND OTHER DATA

a) A tentative hydraulic flow diagram is attached for reference in Section 9- Drawings. This is not binding and the Contractor have to give the hydraulic flow diagram based on his hydraulic designs for the STP.
b) The design parameters for design of various units of the treatment plant & other connection works are given in subsequent Sections.
c) The ground level at the point of final effluent disposal may be ascertained by the contractor

3.6 TECHNICAL SPECIFICATIONS FOR VARIOUS COMPONENTS OF SEWAGE NETWORK AND SEWAGE TREATMENT PLANT.

**Sewer Network.**

a) Construction of Manholes – BBM, RCC,
b) Providing and laying SWG /PVC-U sewer lines.
c) Providing and laying RCC NP-3 class sewer lines & other connected works as per BOQ.

**Sewage Treatment Plant.**

The sewage treatment plant shall have following components:
a) AERATED Lagoon.
b) Sedimentation Basin
c) Inlet chamber, screen chamber, grit chamber.
d) Parshall flume, division box.
e) Outlet chamber at outlet of primary treatment unit.
f) Receiving chamber before W.S.P’s.
g) Connecting channels and pipes for flow from receiving chamber to screen chamber, grit chamber, parshall flume and from there to receiving chamber at Wetwell and to Anaerobic ponds, facultative ponds and to natural valley through a lead off pipe.

h) In addition, the following accessory structures shall also be constructed:

i) Wet well cum pump house- 2 Nos.

j) DI rising main of 100, 300 & 500 mm dia from the wet well.

k) SSM chambers, Thrust, Anchor Blocks/Supporting Pillars/Structures for crossings of nala, & Canals.

l) Internal service road around STP.

m) Approach road to STP.

The units of the treatment plant shall be designed considering the design parameters given in Annexure I unless otherwise specified in Sub-Clauses of Clause 6. The specifications for various as follows:

3.6.1 Inlet & Outlet Chamber in Primary Treatment Unit.

a. The inlet chamber shall be designed for a detention time of 15 seconds. The inlet chamber shall be contacted for the ultimate peak flow requirement of 24.84 MLD. The receiving chamber shall have a free board of 0.75 m. The chamber shall have PVC encapsulated foot steps as specified in sub clause 3.17.30, fixed in the side faces of wall to provide access.

b. The sewage will flow to the screen chamber through two nos. of sluice gates. The gates shall be provided for control of flow.

c. The chamber shall be of RCC with CC M-30 grade concrete mix conforming to IS: 3370. The minimum thickness of the walls of the chamber shall be 200 mm. The columns and foundation supporting the chamber shall be of RCC with minimum CC M-30 grade concrete, conforming to IS :456-2000. The top surface, inside and outside faces and floor of the inlet chamber shall be finished smooth with cement mortar 1:3, 20 mm thick, mixed with approved quality water proof compound in requisite proportion.

3.6.2 Screen Chamber

a. The screen chamber shall be designed as two units, for a peak flow of 24.84MLD for the STP. The medium screen shall consist of 50 mm x 10 mm MS flats with 25 mm clear space in between and arranged in inclined position at 60- 80° to horizontal. One unit shall be fitted with mechanical cleaning equipment and the other unit shall be manually cleaned.

b. The maximum velocity of flow through the screens shall be between 0.6 m — 1.2 m /sec at peak flow. A minimum velocity of 0.3 m/s during lean flow shall be maintained in the approach channels.

c. The mechanically cleaned screen shall be provided with toothed rake and motor driven mechanism for operating the rake. The mechanism shall be mounted on a platform of suitable height. The contractor shall find a suitable place for the disposal of screenings.
d. Both the units shall be provided with PVC encapsulated foot rests as specified in sub clause 3.17.30. 1.2 m wide RCC platform shall be provided with suitable GI Pipe rails as specified in sub clause 8.27.1 of this section to facilitate inspection and maintenance of the screen.

e. The screen chamber units shall be of RCC with M-30 mix conforming to IS : 3370. The minimum thickness of the screen chamber walls shall be 200 mm. The columns and foundation supporting the unit shall be of RCC with minimum CC M-30 mix, conforming to IS:456-2000. The top surface, inside and outside faces and floor of the screen chamber shall be finished smooth with cement mortar 1:3, 20 mm thick, mixed with approved quality water proof compound in requisite proportion.

3.6.3 Grit Chamber

a) The flow from screen chamber shall be allowed into the grit chamber for removal of grit / inorganic matter by means of a RCC transition channel designed as per relevant IS : 3370. There shall be one grit channel for the designed for peak flow of 24.84 MLD at the STP capable of removing grit of particle size 0.15 mm and above, and specific gravity of 2.65. The chambers shall be designed for surface loading rate as applicable for a detention time of 60 sec.

b) The horizontal velocity of flow shall not be greater than 0.3 m/s at peak flow and the variation in velocity for lean and peak flow shall not be more than 10%. Critical velocity shall always be higher than the horizontal velocity of flow.

c) The grit storage space shall be designed for four days. The grit collected on the floor shall be manually cleaned and disposed off at a suitable site identified by the contractor and approved by the Engineer. The grit removed shall be free from moisture and organic matter.

d) The grit chambers & channels shall be of RCC, constructed in CC M-30, conforming to IS:3370. The minimum thickness of wall shall be 150mm. The internal surfaces of the grit channels shall be finished smooth with cement plaster of 1:3, 20 mm thickness, with an admixture of approved quality water proofing compound. The other surfaces of concrete shall be of form work finish with smooth rendering as specified in Sub-Clause 3.17.4. MS rectangular weir shall be provided at entry and exit at grit channel.

e) MS ladder with hand railing shall be provided both inside and outside, on one side of the grit chamber for access to cleaning of grit. 0.90 m wide RCC walkway shall be provided on the sidewalls of Grit Chamber.

3.6.4 Parshall flume with connecting channel

One number of parshall flume shall be designed as discharge measuring units besides velocity control in the grit chamber. The unit shall be designed for a peak flow of 24.84 .00 MLD at the STP. The flow meter shall be suitable for measuring the flow through open channel and shall consist of a float mechanism installed in the float chamber near the throat. It shall comprise of a set of reading instrument including an indicator, integrator and recorder. The range of measurement shall be 0 to 20 MLD. The tenderer shall submit design along with calculation and GAD, etc., for approval by the Engineer before starting fabrication / execution of the work.
The Parshall flume shall be of RCC, constructed in CC M-30 mix, conforming to IS:3370. The minimum thickness of wall shall be 200mm. The internal surfaces of the parshall flume shall be finished smooth with cement plaster of 1:3, 20 mm thickness, with an admixture of approved quality water proofing compound. The other surfaces of concrete shall be of formwork finish with smooth rendering as specified in Sub-Clause 3.17.4.

3.6.5 Division box
a) The division box where the flow gets diverted equally into two lagoons which shall have for diversion of flow equally into two W.S.Ps shall be controlled by two gates. These gates shall facilitate isolation of one of the W.S.Ps whenever required for sludge removal or for other maintenance purposes.

b) It shall be of RCC, constructed in CC1:1.5:3, conforming to IS:3370. The internal faces of the box shall be finished smooth with cement plaster of 1:3, 20mm thick with an admixture of approved quality water proofing admixture. The other surfaces of concrete shall be of formwork finish with smooth rendering as specified in Sub clause 3.17.4.

3.6.7 Facultative Aerated Lagoon.
3.6.7.1 General
The Facultative Aerated lagoons shall be designed for a detention period of 5 days and for 8.28 MLD. For better efficiency and dispersion of flow baffle walls are to be provided in the lagoons. The lagoons shall be constructed with slope of 1V:2H on sewage side and 1V:1.5H on non-sewage side.

3.6.7.2 Sedimentation Basin
The Sedimentation basin is designed for an average flow by considering 5 day detention period for lagoon and 1 day detention period for basin and also interconnecting RCC channels have been proposed for division box to lagoon and lagoon to sedimentation basin and again from basin to Nala.

**Annexure – 1**

<table>
<thead>
<tr>
<th>Description of the Unit</th>
<th>Design Parameter</th>
<th>Range value</th>
<th>Preferred / Indicative value for the STP</th>
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<tr>
<td>Wet well</td>
<td>Capacity</td>
<td>7.92/3.12 MLD</td>
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<tr>
<td></td>
<td>Detention time</td>
<td>15-30 Min</td>
<td>30 Min</td>
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<tr>
<td>Inlet chamber</td>
<td>Capacity</td>
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<td>Detention time</td>
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<td>15 Sec</td>
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<td>Free board</td>
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<tr>
<td>Screen chamber</td>
<td>Capacity</td>
<td>24.84 MLD</td>
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</tr>
<tr>
<td></td>
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<td>10 Sec</td>
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<td>Medium Screens</td>
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<td>0.025 m</td>
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<td></td>
<td>Velocity through</td>
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<td>1.0 m/s</td>
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<td></td>
<td>Nos of Units</td>
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<tr>
<td></td>
<td>Free board</td>
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<td>0.5 m</td>
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<tr>
<td>Grit chamber</td>
<td>Capacity</td>
<td>12.15 MLD</td>
<td>24.84 MLD</td>
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<tr>
<td><strong>Detention time</strong></td>
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<td>60 Sec</td>
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<tr>
<td>--------------------</td>
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</tr>
</tbody>
</table>
| **Surface loading rate**  
(Average flow) | 900 to 1555 Cum/Sqm/day | 920 Cum/Sqm/day |
| **Maximum Horizontal velocity** | 0.3 m/s |
| **Settling velocity** | 1.80 cm/sec |
| **Specific gravity of particles** | 2.65 |
| **Diameter of grit particle** | 0.15 mm |
| **Grit production rate** | 0.05 to 0.15 Cu.m/ML | 0.1 Cum.ML |
| **Allowable Head loss** | 0.01-0.6m | 0.3m |
| **Free board** | 0.5 m |
| **Nos. of Units** | 1 (Each for peak flow) |
| **Parshal Flume**  
**Capacity** | 24.84 MLD |
| **Dimensions** | As per CPHEEO manual |
| **Division Box**  
**Capacity** | 24.84 MLD |
| **Detention time** | 10 sec |
| **Free board** | 0.5 m |
| **Faculative Aerated Lagoon**  
**Capacity** | 8.28 MLD |
| **No of Units** | 2 (each for half flow) |
| **Ambient temperature of air in winter** | 20 Deg. C |
| **Temperature of sewage** | 23 Deg C |
| **BOD removal rate at (K)**  
20 | 0.6 to 0.8 | 0.7 |
| **Sludge Volume**  
0.03 to 0.05 Cu.M/capita/year | 0.03 Cu.M/capita/year |
| **Desludging frequency** | 2 to 6 Years | 3 Years |
| **No of Longitudinal baffles** | 2 |
| **Effective Depth** | 2.5m to 5.0m | 3.0 m |
| **Length: Breadth ratio** | 8:1 |
| **Dispersion Number** | 0.2 to 0.6 | 0.2 |
| **Detention time** | 2 to 5 days | 5 days |
| **SS removal efficiency** | 80 to 90% | 85% |
| **BOD removal efficiency** | 80 to 90% | 90% |
| **Aerator oxygenation capacity**  
1 to 2 kg/ kg BOD removed | 1.4kg/kg BOD removed |
| **Sedimentation**  
**Capacity** | 8.28 MLD |
<table>
<thead>
<tr>
<th>Basin</th>
<th>No of Units</th>
<th>2 (each for half flow)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Detention time</td>
<td>1 to 1.5 days</td>
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<td></td>
<td>Depth</td>
<td>1 to 1.5m</td>
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<td></td>
<td>De-sludging period</td>
<td>2 to 6 year</td>
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<td></td>
<td>Free board</td>
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<tr>
<td>Inter connecting channels</td>
<td>Velocity</td>
<td>0.8-0.3 m/s</td>
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<tr>
<td></td>
<td>Free board</td>
<td>0.25m to 0.5m</td>
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### 3.7 OTHER FACILITIES / ACCESSORY STRUCTURES

#### 3.7.1 Wet Wells:

The wet wells shall be designed for a detention time of maximum 30 minutes for an average flow. Suitable ventilation for the wet well shall be provided at the entry of sewers into wet well, a framed wire mesh of suitable gauge with openings of 25 mm shall be provided. The wet well shall be constructed conforming to IS:3370, using CCM-30 concrete. The minimum size of the wet well shall be 6. m dia and required depth. The details are furnished in the drawing annexed to the bid. The wet well shall be covered with galvanized chequered plate. The wet well shall be provided with MS ladder as per Sub-Clause 3.17.29, to have access for cleaning.

#### 3.7.2 Pump House.

a) The size of the pump house shall be fixed so as to accommodate series of pump sets for different flow conditions. The pump house will be located on the top of the wet well. The pump house shall be part of wetwell of RCC framed structure designed on the basis of IS 456-2000. It shall be of minimum 6.0 Mtr & 6.00Mtr height. The floor of the pump house where pumps are located, walls, columns and roof of the pump house shall be in RCC grade minimum CC1:1.5:3. The building shall be provided with plinth protection as per specification in Sub-Clause 3.17.18.

b) Centre to centre distance of pumps shall not be less than 1.2m. Pump and motor assembly shall be located on suitably designed RCC foundations, conforming to IS:2974 (Part III) and other relevant codes. The design of the floor of the pump house shall take care of all the loads coming over it.

c) RCC roof shall be provided for the pump house. The roof shall project 600 mm from the wall of the pump house. Roof shall be provided with water proof coating and rain water pipes as per Sub-Claus 3.17.27 and 3.17.33.

d) Necessary provision shall be made in the civil structure of the pump house for installation of electrical panels, starters and piping arrangements etc.

e) The pump house shall have one manually operated rolling shutter of size 2.0 m (w) x 4.0 m (h) at one side wall. The size of canopy shall be 1.50m wide for the rolling
shutter at side. Painting over rolling shutters shall be provided as per Sub-Clause 3.17.25.

f) The area of windows and ventilators shall not be less than 20% of the floor area of the pump house. Necessary piping, electrical and mechanical equipment shall be provided.

3.8 SIZE STONE MASONRY CHAMBERS AND OTHER MISCELLANEOUS STRUCTURES.

a. Size stone masonry chambers and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed and of such form, dimensions and materials as are shown in the standard details or a may be specified or directed shall be executed by the contractor. These structures shall also include the installation of such specials and connections to pipes and other structures as may be required to complete the construction as shown.

b. The depth of chamber may vary for every 0.5m depth and the contractor shall be paid within the specified depth range. The depth shall be measured from the top of cover to the invert level of the deepest outgoing sewer from the chamber.

c. It should be fixed with medium duty circular steel fibre reinforced cover (SFRC) and frames of 560 mm dia conforming to IS:1726. Foot rests should be mm. 3 mm thickness plastic encapsulated (IS: 10910) or 12mm dia grade Fe 415 steel bar (IS: 1786).

3.9 Laying Of RCC Pipe

a) Laying of concrete pipes shall conform to the Code of practice of IS:783. Pipes shall be laid underground with a minimum earth cover of 1M. Pipes shall be laid in sections of 500 m each. Laying of pipes shall be as per Clause 15, Section 10, Standard Specifications for Procurement of Project Works.

b) The alignment of sewer line shown in Drawing of Section 9, is only indicative and the exact alignment will he as per construction drawings as directed by the Engineer.

3.10 Jointing Of Pipes.

The pipe joints shall be flexible joints jointed by rubber ring as per IS 783-1985. The sections of the pipe shall be jointed in such a manner that there shall be as little unevenness as possible along the inside of pipe. Care should be taken while jointing to provide the correct gap between the end of spigot and back of the socket to ensure flexibility at each joint and correct location. The joints shall be finished as directed by the Engineer.

The quality of rubber ring, tolerances, etc., shall be in conformity with IS 5382-1985, “Type 1A”.
3.11 RISING MAIN

The work of rising main from the TSPS (wet well) to STP involves supplying, laying and jointing of 300/500 mm DI along with matching specials, valves etc. Thrust blocks, anchor blocks, valve chambers, supporting pillars, structures for carrying pipe line over/below nala / canal crossing should be provided along the alignment as per actual requirement.

3.12 DI Pipes

The manufacture, supply, laying, jointing, testing and commissioning of DI pipes used for Sewage shall generally conform to IS 8329/94 & IS 12288/1987 with latest amendments for procurement of project works. Any additions and/or modifications specified in this section shall also be followed.

3.12.1 Material

The materials used in the manufacture of pipes and fittings shall comply with IS 8329 and IS 9523.

3.12.2 Tests

Tests on pipes and fittings shall be carried out in accordance with IS 8329 and IS 9523.

The Engineer shall be permitted free access to the place of manufacture for the purpose of examining and witnessing the testing of pipes and fittings.

3.12.3 Joints

a) Spigot and Socket Joints

These shall have sockets which are integral with the pipe and incorporate an elastomeric rubber ring gasket conforming to IS 12820.

b) Flanged Joints

These shall comply with dimensions and drilling details in IS 8329 for PN 10 flanges. All flanged joints between steel and ductile iron pipe work shall be electrically isolated joints. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All materials shall be supplied by a specialist manufacturer and be to the approval of the Engineer.

3.12.4 Cement Mortar Lining

All pipes and fittings shall be internally lined with cement mortar in accordance with ISO 4179/IS:11906. Cement mortar lining shall be applied at the factory in conformance with the above mentioned standards. No admixtures in the mortar shall be used without the approval of the Engineer.
3.12.5 Coatings

a. General

Ductile iron pipes and fittings shall be zinc coated with bitumen over coatings, all in accordance with the following Specifications. Buried pipes and fittings shall also have a site or factory applied polythene slewing. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected on site and any damage or defective areas made good to the satisfaction of the Engineer.

b. Zinc Coating

Zinc coating shall comply with ISO 8179 and shall be applied as a spray coating. The mass of sprayed metal shall not be less than 130 g/m² as described in Clause 5.2 of ISO 8179.

c. Bitumen Coating

Bitumen coating shall be of normal thickness 75 microns unless otherwise specified. It shall be a cold applied compound complying with the requirements of BS 3416 Type II, suitable for tropical climates, factory applied in accordance with the manufacturer’s instructions. Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe. The bidder should make his own arrangements for procuring water for testing purpose.

3.13 Laying Of The pipe

The DI pipes should be conveyed rolled, lowering in to the trenches, laying true to line leveling, with perfect linking at joints, testing and commissioning including loading and unloading at both destination and cuts of pipe wherever necessary including jointing of DI pipes and specials with rubber gaskets conforming to relevant ISS including cleaning the socket, spigot ends with soap solution and applying soap solution to the spigot and socket ends before insertion of jacking an fixing in perfect condition. The pipe should be hydraulically tested confirming to relevant ISS. The bidder should make his own arrangements for procuring water for testing purposes. Laying of DI Class K-7 pipes shall conform to the Code of practice of IS:12288/1987, with latest amendments. Pipes shall be laid underground with a minimum earth cover of 1m. Pipe shall be laid in sections of 500 m each.

The length of the 350 mm dia DI rising main is 300m from the TSPS(wet well) to WSPS. The alignment of rising main of Section 9, is only indicative and the exact alignment will be as per construction drawings/ as directed by the Engineer.

3.14 SAFETY MEASURES

Pursuant to Clause 15.7.5.1, item 2, 4 and 5 of Section 10, Standard Specifications for Procurement of Project Works, the Contractor shall provide adequate safety measures. They shall include:

1. Barricading all sides of the open trenches.
2. Red danger lights as can be easily visible from dusk to dawn at an interval of 20 m and at all the road crossings.
3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequately safe wooden plank I board or steel plate over the trenches at every 15 meters interval to facilitate crossing by the public residing on either side of the trench.
5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorized intrusions.

3.15 BACKFILLING OF TRENCHES AND AROUND FOUNDATIONS OF STRUCTURES

3.15.1 General.
Pursuant to clause 5.15.4.1, 5.15.4.2, 5.15.4.3, 5.15.4.6 and 15.7.23.1 of Section 10, Standard Specifications documents of Project Works, the Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer’s air removal and shall be conforming to Clause 5.15.4.2 of Section 10, Standard Specifications for Procurement of Project Works. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS:3114-1994.

3.16.1 LEVELLING PLAN AND GRADATION PLAN
Before preparing the layout plan of treatment plant, the Contractor shall prepare and submit a leveling and gradation plan of the complete site for approval and the site shall be graded accordingly.
The gradation plan shall be prepared on the basis of Contour plan given in Section 9: Drawings. The proposal of the gradation of the area should be on the following lines:
1. Minimum cutting and filling is involved.
2. The finished level of the roads in the plant area shall be minimum 300 mm higher than adjoining finished ground level.
3. The gradation should be such that an effective drainage system can be provided in the plant area.

3.17. CIVIL SPECIFICATIONS
The following civil specifications shall be applicable for providing and executing all such items which are not mentioned in foregoing paras but are necessary to be provided and for the items which are mentioned above but require some elaboration. No extra cost shall be paid for such items.
It should clearly be understood by the Contractors / tendering firms that all civil specifications mentioned here below shall be treated as part of the technical specifications already mentioned. The specific requirement of different items of work involved in the construction, completion and commissioning of the plant as a whole, shall be provided in accordance with the requirement given in these civil specifications.
The superstructure and substructure of all building works shall be as specified, for
which and prior approval from the Engineer is to be obtained before setting out for
the work.

3.17.1 Site Clearance
Before taking up construction, site shall be cleared of all jungles, bushes and
unwanted vegetation growth. After completion of plant, the entire site area shall be
cleared of all left over material and debris.

3.17.2 Design Of Structures
The design of all structures shall take into account the weight of equipment, wind
forces and seismic forces and shall be designed as per relevant, latest IS codes. The
depth of water including free board in the liquid retaining structures shall be
considered for designing. The design of pump houses shall take into account the
vibrational effect due to running of the pumps.

3.17.3 Materials
All materials used in the work shall be subjected to mandatory tests in accordance
with relevant IS codes, and before using them on the work, the test reports shall be
submitted to the Engineer.

3.17.4 Form Work
Form work, shuttering, centering, scaffolding etc., shall be of steel plates or plywood,
line with MS-sheets and for scaffolding steel tubulars shall be used. Joints should be
sufficiently tied to adjoining members to prevent loss of cement slurry from the
concrete. All forms, shuttering shall be levelled, aligned, and thoroughly cleaned,
before they are used for concreting.
Form work shall be removed after specified days of curing. The surface of RCC after
removal of form work / shuttering shall be smooth, even and without honeycombing
or undulations.

3.17.5 Finishing of RCC Surfaces
To give an even finish to the concrete surfaces, unless otherwise specified, the
outside faces of walls and inside surfaces of ceiling shall be of form work finish,
smoothly rendered and other inside faces shall be finished with cement plaster 20 mm
thick in 1:3 cement mortar. All concrete surfaces coming in contact with liquid shall be
provided with cement plaster 20 mm thick in 1:3 cement mortar with approved quality
water proofing compound in requisite proportion.

3.17.6 Minimum Clear Cover Over Reinforcement
Minimum clear cover over the steel reinforcement shall be in conformity with IS :3370
in the case of water retaining structures. For other structures the clear cover over the
reinforcement shall be as per IS:456-2000.

3.17.7 Minimum Reinforcement
For liquid retaining structures, the minimum reinforcement in walls, floors and roofs in
each of the two directions at right angles shall have an area of 0.3 percent of the area
of concrete section. For HYSD bars, the above percentage of reinforcement can be
reduced by 20 %. For other structures, the minimum reinforcement shall be based on
3.17.8 Minimum Thickness of RCC
The minimum thickness of all RCC members viz., walls, roofs, floors etc., shall not be less than 150 mm.

3.17.9 Tested Steel
Only tested steel reinforcement shall be used on the work, and the Contractor shall produce the test certificate of the manufacturer to the Engineer. The grade of steel shall be Fe:415 conforming to IS: 1786.

3.17.10 Cement Concrete
For all liquid retaining concrete structures and other concrete structures, cement concrete mix of 1:1.5:3 grade shall be used.

3.17.11 Lean Concrete
Lean concrete mix of 1:3:6, 150 mm thick shall be provided under all foundations and floors of structures, other buildings and pump houses.

3.17.12 Earth Work
While carrying out earthwork in excavation in foundation and trenches in all kinds of soil, including boulders, soft and hard rock etc., the work shall be carried out as per Section,10 Standard Specifications. Wherever necessary, shoring and strutting as specified in the above mentioned specifications shall be provided.
Wherever allowed with prior written permission, blasting of hard rock may be done after taking all the necessary precautions as provided in the local Laws and By-laws.
Excavated earth in trenches shall not be dumped within 1.5 m distance from both sides of the trench. Barricading on the sides of the trenches shall be provided with caution sign board and sufficient red light arrangement during night.
Earthwork in backfilling the trenches with selected earth and with the earth taken from borrow pits shall be done in layers of 150 mm, watered and well consolidated.
The Contractor would be responsible for making fool-proof dewatering arrangement. The arrangement for the disposal of the water pumped out from the trenches up to the nearby drain shall be the responsibility of the Contractor.

3.17.13 Disposal of Surplus Excavated Material
The Contractor shall have to cart the surplus excavated material from the site and dispose off to the place decided by the Engineer with all lead and lift from the site of work. Nothing extra will be paid.

3.17.14 Cross Sections
For excavation for all underground structures and pipe lines contractor shall prepare sectional drawings showing the details of excavation for all underground structures and pipe lines, in all kinds of soils, boulders, soft and hard rock etc., based on test results of soil testing and investigation reports and shall submit to the Engineer for review and approval, prior to starting of the work. If during excavation any change in section is considered necessary for reasons of safety of workers, the Engineer will issue directions for compliance by the Contractor. The Contractor shall comply with the Engineer’s directions without any extra charge or payment.
3.17.15 Brick Work
All brick work in foundation, substructure or superstructure, including partition walls shall be done with table moulded bricks of standard size, with necessary centering, scaffolding and cuing, in accordance with the Section 10: Standard Specifications. Nothing extra would be paid for any lift and minor architectural work required to be done as per drawings and directions of the Engineer. All partition walls shall be built in 115 mm brick masonry, in 1:4 cement mortar with two numbers of 6 mm diameter MS bars at every third course embedded in cement mortar. The cuter walls of room shall be built in 230 mm brick walls, in cement mortar 1:6.

3.17.16 Cement Plaster Over Brick Work
Cement mortar plastering shall be done on all brickwork at any height or depth. The thickness of cement plaster shall be 12 mm for walls of 115 mm thick and it shall be 20 mm thick for walls greater than 115 mm thick. The mix of cement mortar for plastering shall be 1:6. The work shall include providing and removing necessary scaffolding, curing, and rounding of corners etc., complete.

3.17.17 Stone Masonry In Sub-Structure And Super-Structure
Stone masonry shall be built in granite or trap or basalt stone in 1:6 cement mortar in substructure and 1:4 cement mortar in superstructure in courses not less than 15 cm high each, with bond stones 2m apart in each course. The edges of stone shall be chisel dressed on all faces and all quoins shall be two line dressed, 5 cm wide on each face. The work shall include scaffolding and curing etc. Pointing to stone masonry shall be done in 1:3 cement mortar, 20 mm to 25 mm deep including raking of joints and lining as per above mentioned specifications.

3.17.18 Plinth Protection
Plinth protection shall be provided for all the structures of treatment plant. The plinth protection shall be full wide, 50 mm thick in CC(1:2:4) overlaid on a compacted base of CC(1:3:6), 100 mm thick. The outer edge shall be lined with brick laid on edge and joined with 1:3 CM.

3.17.19 Flooring And Finishing
The flooring of all the buildings, unless otherwise specified, shall be laid in PCC 1:2:4, 40 mm thick using 20mm and down size granite jelly on a bed of 150mm thick 1:5:10 CC, with 40mm and down size jelly with topping of cement mortar 1:3 plastering 12 mm thick, finished with red oxide and cut to required pattern, including curing.

3.17.19.1 Flooring With Mosaic Tiles
Flooring with Mosaic tiles shall be with 20 mm thick tiles of approved quality and colour, fixed in cement mortar 1:3. The flooring shall be finished with matching colour cement and shall be machined and polished neatly. Over the polished surfaces, wax polish of approved quality shall be applied after the surface is dried completely using wax polishing machine.
3.17.19.2 Filling Below Flooring
The portion below the flooring should be provided with approved earth filling including watering and compacting in layers of 150 mm thick, for a depth of 450 mm minimum.

3.17.19.3 Skirting
Wherever the flooring is provided, it should be accompanied with the skirting of same material as that of flooring, 125 mm high for walls set in CM 1:3 and pointed with CM 1:3, flush with wall surface.

3.17.20 Water Proof Treatment Over The Roof
The RCC roof shall be cast in such a manner that rain water can be drained towards outside where AC draining pipes are to be provided. Roof of all the structures shall be provided and laid with six standard courses of water proofing treatment with bituminous felt in accordance with the IS specifications 1322-1983. It shall include the cost of all material, skilled and unskilled labour, transportation, etc.

3.17.21 Doors, Windows And Ventilators
The Contractor shall submit the drawings for approval and upon approval shall provide and fix the doors, windows and ventilators. The work shall include cost of cartage, manufacturing, all skilled and unskilled labour, tools and plants, all fittings including painting with enamel paint of approved quality with two coats over the primer coat. The area of windows and ventilators shall be 20..% of ceiling area of the building units.

3.17.23 MS Rolling Shutters
These shall be provided and fixed as per relevant Indian Standard specification. All the rolling shutters shall be of the sizes specified or as given in the Drawings. The rolling shutter shall be of pull and push type made out of 18 gauge x 7.50 cm MS lathers of convex corrugations complete with side guides and bottom rails with inter locking arrangements for steel lathers by means of alternate and clips. The suspension shafts shall be provided with high Tension coil type springs. The rolling shutters shall be provided with top cover, locking arrangements, pulling hooks, handles with all fittings and other accessories. The rolling shutter shall be painted with two coats of red oxide factory finish and two coats of synthetic enamel painting over shop painting etc., complete.

3.17.24 Chejjas And Canopies
RCC box type chejjas of inclined type shall be provided over the external windows and ventilators, projecting 600 mm wide all round, unless otherwise specified. The RCC canopies over the main entrance door and rolling shutter shall have a minimum projection of 2 m over the full width of the door / roIIing shutter + 500 mm.

3.17.25 Painting Steel Work
All steel doors, windows, ventilators, rolling shutters, pipe railing, MS grills etc., shall be painted with two or more coats of superior quality enamel paint of approved shade and make over a priming coat of superior quality primer. The surface shall be cleaned, rubbed and made smooth and even, before applying a priming coat and enamel paint. This painting will include cost of all material, skilled and unskilled labour, cartage and applying wherever required as mentioned above.
3.17.26 Finishing
Distempering On the inner faces of the walls and ceiling of the buildings, two coats of washable oil bound distemper of approved quality, manufacture and shade shall be provided. Before distempering, the surface shall be rubbed, cleaned and made smooth and even. This will include cost of materials, skilled and unskilled labour, transportation etc.

3.17.27 Water Proofing Cement Paint
The external faces of all walls, chejjas and parapets of all structures and buildings from ground level to the top of the structure shall be provided with two coats of water proofing cement paint of approved make, quality and shade. This cement painting shall be done over one coat of primer of approved make, quality and shade. Before applying primer coat, the surface shall be rubbed, cleaned and made even. Any paint stains wherever not necessary shall be cleaned. The work shall include cost of all material, necessary centering, scaffolding, skilled and unskilled labour, tools, brushes, transportation etc.

3.17.28 Hand Railing

3.17.28.1 GI Pipe Hand Rail
All balconies, platforms, shall be provided and fixed with 40 mm internal diameter GI pipe hand railing in three rows fixed to 1:2:4 vibrated RCC post of size 100 mm x 150 mm at top and 150 mm x 150 mm at bottom placed at 2 m intervals for a height of 750 mm including curing, finishing the posts smooth curing, painting GI pipe with two coats of anticorrosive steel paint over a prime coat, etc., complete.

3.17.29 MS Ladder With Hand Railing
Ladders shall be of MS, 45 cm wide using angle iron of 65 mm x 65 mm x 8 mm size and 20 mm MS bars at 25 cm C/C with necessary supports of same angle iron as directed including hand railing on both sides with 25 mm dia GI pipes with angle iron props at 2 m intervals and 0,5 m height with two coats of non poisonous anti corrosive bituminous paint.

3.17.30 Footrests
PVC encapsulated MS footrests shall be provided and fixed at all such units already mentioned in the technical specifications. It shall comprise steel bar of 23 mm x 25 mm minimum cross-section encapsulated with minimum 5 mm thick plastic all-round as per IS 10910 with the overall minimum length of 263 mm and width 165 mm and anchored in cement concrete and fixed.

3.17.31 Parapet Walls
Parapet wall over the finished level of the roof all-round shall be provided over all buildings and other structures wherever required as per technical specifications. These will be 750 mm high, constructed with approved quality of table moulded bricks of standard size of 20 mm thk, in cement mortar 1:6, including coping and plastering with cement mortar 1:6 with necessary scaffolding, curing as per design and specifications. The work includes cost of all materials and skilled and unskilled labour.
3.17.32 Nuts And Bolts
All nuts and bolts shall be of mild steel but shall have coating of zinc-cadmium conforming to IS-1364.

3.17.33 Rain Water Pipes
For draining rain water, all roofs shall be provided with 100 mm dia. Asbestos cement down water pipes of ISI brand. These shall be provided with necessary bends and shoes wherever required. Necessary iron strips to hold the pipe tightly to the wall. The work includes cost of all material, necessary centering, scaffolding, skilled and unskilled labour, tools, transportation etc.

3.17.34 Protection Against Floatation Due To Uplift Pressure
The Contractor shall ensure that all structures constructed underground by lowering sub water level, shall be protected against uplift and consequent floatation and tilting. Adequate measures including non stop dewatering shall be taken as per relevant IS codes.

3.17.35 Water For Hydraulic Testing
The Contractor shall have to make all arrangements for water supply at his own cost for construction hydraulic testing of pipes and structures valves. Under ground water, if found suitable shall be permitted for testing. Nothing extra shall be payable for above mentioned hydraulic testing.

3.17.36 Water For Drinking And Construction Work
The Contractor shall have to make all arrangements at his own cost for water fit for consumption purposes and also water fit for drinking purposes as per norms of IS codes and nothing extra will be paid.

3.17.37 Power For Construction Work And Stand By Diesel Generator Set
The Contractor shall make all arrangements at his own cost for providing power supply to the site of work, site office and for construction activities.

3.17.38 Surveying Instruments
Contractor shall keep at least two accurate levelling instruments at each of the site and all be responsible for checking all the levels as per designs before starting the construction, during construction and after completion. The Contractor shall be fully responsible for rectifying any mistake noticed at any time at his own cost:

3.17.39 Site Engineer Of The Contractor
Contractor shall depute at each site of work at least one qualified graduate civil Engineer and one diploma Engineer having experience in the construction of RCC water retaining structures, deep sewer and trunk water mains for supervising the execution and also for receiving instructions from the Engineer.

3.17.40 Site Office
At each site of work, the Contractor shall construct and provide a suitable electrified temporary office with two steel tables, six steel chairs and one steel almirah, for the
supervisory staff of the Employer. The cost of all these shall be deemed to have been included in the tendered rates.

3.17.41 Materials Not To Be Issued By The Employer
Contractor must keep in mind at the time of tendering that NO material or equipment/except the materials included in the schedule-A required for the construction and timely completion of the work shall be issued by the Employer. The Contractor shall be fully responsible for arranging all material / equipment in advance of the total requirement for construction purposes.

4. Earth work

5.1 General
The earth work excavation shall be carried out, in general, as per Chapter 10, Standard Specifications for Procurement of Project Works. Any additions or modifications specified in this Chapter shall be followed. The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required by the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc., before quoting the rates.

5.2 Classification of Excavation
All materials involved in excavation shall be classified in three categories as follows.

5.3 Ordinary soil
This includes excavation in all types of soil including soil containing gravels, murrum, loose boulders, viz., ordinary gravely soil, hard gravely soil, wet soil, stiff slushy soil, chettu soil and calcareous strata, but exclusive of disintegrated rock, soft rock/shale;

5.4 Soil Containing Disintegrated Rock, Soft Rock and Soft Shale
This category includes excavation in soil containing disintegrated rock, soft rock or soft shale which can be cut by shovel and no hand or mechanical chiselling is required.

5.5 Medium Hard rock:-
This category includes excavation in lime stone, sand stone, hard shale and schist, fissured rock without restoring to blasting.

5.6 Hard Rock
This category includes excavation in hard rock requiring hand or mechanical chiselling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiselling, wedging, the decision of the Engineer shall be final and binding on the Contractor.
5.7 **Limits of excavation**
The Contractor shall be responsible to ensure that the widths and depths of the trenches do not exceed the limits shown in the construction drawings. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Contractor on account of this.

5.8 **Trial pits**
The details of trial pits as shown on the alignment plans are only for general information. There is no expressed or implied agreement or guarantee that depths or character of materials are correctly shown or the conditions affecting the work will not differ from those shown on the plans. Trial pits may be dug by the Contractor, without being directed to do so, along the lines of the trenches as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of underground obstructions or soil conditions.

5.9 **Slips and slides**
Pursuant to Clause 5.8 of Chapter 10, Standard Specifications for Procurement of Project Works, the Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost.

5.10 **Stacking of excavated material**
Pursuant to Clause 15.7.5.1, item 7 of Chapter 10, Standard Specifications for Procurement of Project Works, the excavated material shall be stacked at least 600 mm away from the sides of the trench.

5.11 **Safety measures**
The Contractor shall provide adequate safety measures during excavation. They shall include:

i) Barricading all sides of the open trenches.

ii) Red danger lights as can be easily visible from dusk to dawn at an interval of 20 m and at all the road crossings.

iii) Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.

iv) Adequately safe wooden plank / board or steel plate over the trenches at every 15 metres interval to facilitate crossing by the public residing on either side of the trench.

v) Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorised intrusions.

5.12 **Shoring and Bracing**
Pursuant to Clauses 5.7, 15.7.5.1 (item 9), 15.7.11 and 15.7.12 of Chapter 10, Standard Specifications for Procurement of Project Works, the Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as
may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground. Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at the Contractor's request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench. All sheathing, shoring and bracing which is left in place under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

5.13 **Excavation in Rock**

Excavation in rock shall be carried out to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus minimum working space on either side as given in drawing. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 20 m in advance of the pipe length proposed to be laid.

5.14 **Blasting of Rock**

Excavation of rock by blasting may be carried out if permitted by the Engineer depending upon the location and circumstances. Contractor shall submit a detailed plan and methodology for such blasting operation to the Engineer for approval. The responsibility of the Contractor with respect to the use of explosives in blasting includes compliance with all laws, rules and regulations of the State or Local Municipalities governing the storage, use, manufacture, sales, handling, transportation or other disposition of explosives. All operations involving the handling, storage and use of explosives, shall be conducted with every precaution by trained and reliable men under experienced supervisors. Blasting shall not be undertaken until all persons in the vicinity have had ample notice and have reached positions out of danger there from. The Contractor shall take special precautions for blasting at and near the top of trench as well as for the proper use of explosives in the trench to prevent damage to surface, structures, water supply mains, sewers, storm drains or other buried structures. The Contractor shall advice the department in advance when charges are to be set off.

After blasting, the Contractor shall thoroughly seal the excavated trench/pit, remove all loose and shattered rock or other loose materials and make the excavation safe before proceeding with further work. The Contractor shall not be entitled to compensation for removal of loose or shattered rock or other loose materials resulting from the enlargement of the excavation beyond the required limits. Rock requiring blasting or chiselling shall exclude all rocks such as soft rock, small boulders which can be removed either with pickaxe or crow bars, and shall apply to only rocks which cannot be removed by any of these means. In case of differences in opinion, the decision of the Engineer shall be final and binding on the Contractor.
5.15 **Excavation for Inlets, Junction Chambers and Other Appurtenant Structures**

The Contractor shall excavate as required for all structures with foundations to firm, undisturbed earth up to the level of the under side of the structure. If the excavation is in rock, the Contractor shall excavate all rock at least to the minimum limits shown on the standard details for trenches and to the grade of the bottom of inlets, junction chambers or other structures as required. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built. The Contractor shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

5.16 **Contractor's Responsibility**

The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water from the excavation. In case of failure to make such provisions or any other provisions which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item.

5.17 **Works Included in Excavation**

Pursuant to Clause 15.7.6.1 of Chapter 10, Standard Specifications for Procurement of Project Works, the following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

1. Provision of side space or additional space in the trench/pit for working and/or accommodating sheathing, shoring, bracing, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to protect the excavation where required or where such work is recommended by the Engineer.
3. Protection of excavations.
4. Providing adequate safety measures.
5. Additional work in connection with overhead wires and poles.
7. Change of trench location in accordance with Clause 15.7.7 of Chapter 10.
8. Additional work in conducting blasting operations as required, in case the excavation is in rock.
9. Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work.

5.18 **Bedding for the pipe**

Bedding shall be provided all along the stretch of the pipe line, which differs based on the area through which the pipe line passes. Pipe shall be generally laid on earth bedding. When rock is met with, it shall be provided with gravel/sand bedding.
Concrete arch bedding shall be used in situations where the pipeline crosses the road below and the pipe may be subjected to damage from passing vehicles. However, the type of bedding to be provided shall be as decided by the Engineer. The various types of beddings are specified below:

5.19 **Earth Bedding**
The pipes shall be placed on the natural, undisturbed earth bedding, which has been carefully shaped to fit the lower part of the pipe for a width of at least 50 % of its external diameter. The trench shall be excavated to an extra breadth and depth, wherever weld joints are coming and the bedding shall be given to the weld joint such that it is relieved of all loads, permitting the pipe Chapter to be firmly bedded through out its length. Filling and removing earth or similar materials beneath the pipe to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum.

5.20 **Gravel Bedding**
Wherever rock is met with, it shall be removed upto 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel. The granular material shall be filled in the trench upto the level of ¼ the outer diameter of the pipe line, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

5.21 **Concrete Arch bedding**
Wherever concrete bedding is proposed to be provided, it shall be provided as per the approved drawings or as directed by the Engineer. The sub-grade shall be prepared to dimension as shown in the Drawings. The pipe shall be provided with sand bedding below and concrete arch above. The dimensions and thickness of bedding etc., shall be as per the approved Drawings.

The bottom of the trench may be slopped on the sides or kerbed. The sand bedding shall be provided below the pipe. The sand used shall be clean, medium grained and free from impurities. The sand shall be compacted by hand compaction, by watering and ramming, in layers not exceeding 150 mm.

The minimum thickness of concrete for the arch portion shall be as specified in the Drawings or as directed by the Engineer. Dry mix will not be permitted. The slump for concrete for the arch portion shall not be more than 25 mm. All water in the trench must be bailed out prior to taking up bedding work. When concrete is to be placed over the pipe for arch portion, it shall be placed carefully so as not to damage or injure the joints or displace the pipe. Back filling shall be done in a careful manner and at such time after the concrete is set, so as not to damage the concrete. Joints shall be avoided under the roads, but they shall be located on either side of the roads.

The concrete arch bedding shall only be used when the pipe line crosses the road below and where directed by the Engineer.
5.22 Special Bedding in poor subgrades
During the progress of work, if the subgrade is observed to be of poor quality which is unsuitable for laying the pipe line and which is not the result of the Contractor's negligence, the Engineer may direct the Contractor to strengthen the subgrade as per Clause 15.7.10 of Chapter 10, Standard Specifications for Procurement of Project Works. The strengthening shall be done either by crushed stone or local lime stone, with depth not exceeding 450 mm (ref. Clause 15.7.10.4 of Chapter 10, Standard Specifications for Procurement of Project Works); or by gravel, with depth not exceeding 225 mm (ref. Clause 15.7.10.5 of Chapter 10, Standard Specifications for Procurement of Project Works); or by concrete of mix 1:4:8 (ref. Clause 15.7.10.6 of Chapter 10, Standard Specifications for Procurement of Project Works).

5.23 Backfilling of Trenches and around foundations of structures.

5.23.1 General
Pursuant to Clauses 5.15.4.1, 5.15.4.2, 5.15.4.3, 5.15.4.6 and 15.7.23.1 of Chapter 10, Standard Specifications for Procurement of Project Works, the Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer’s approval and shall be conforming to Clause 5.15.4.2 of Chapter 10, Standard Specifications for Procurement of Project Works. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS:3114-1994.

5.23.2 Method of Backfilling
Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship. Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimise future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

Backfilling in trenches shall be done as pipe laying progresses, with the permission of the Engineer, after the pipe or conduit is properly bedded, jointed and inspected and all measurements for the location of Y-Junctions, tees, etc., are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. However the joints shall be left open for inspection during testing, which shall be backfilled after successful completion of testing, after obtaining permission from the Engineer. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure.

For the purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:
i. **Zone A**: From bottom of trench to the centre line of pipe,

ii. **Zone B**: From the level of centre line of pipe to a level of 300 mm above the top of pipe,

iii. **Zone C**: From a level of 300 mm above the top of pipe to the top of trench.

Backfilling in the trenches and around structures shall be carried out in horizontal layers of uniform thickness of not more than 150 mm when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling with water. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. Even in this case the backfill material shall be placed in uniform horizontal layers of not more than 150 mm thickness. Small pebbles of size less that 50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. The backfill material shall be tamped with mechanical tamping equipment, after moistening the backfill by sprinkling with water to obtain maximum compaction. Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment.

If the trench is subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure.

Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

Pursuant to Clauses 5.15.4.2 and 15.7.5.1 (item 17) of Chapter 10, Standard Specifications for Procurement of Project Works, if from the excavated spoil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits is required to be placed for backfill, on approval of the Engineer. Pursuant to Clause 15.7.5.1 (item 16) of Chapter 10, Standard Specifications for Procurement of Project Works, backfilling of trenches where the excavation is in the rock shall be with the surplus soft soil, with all lead and lift.

### 5. 23.3 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread at places shown by the Engineer, with all lead and lift from the site of work, for which no extra payment shall be made. No surplus or excess material shall be disposed in a stream / channel nor in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer.
5. 23.4 Measurement and Payment for Excavation

5. 23.5 For Excavation

The measurement for excavation shall be considering the allowable widths, depths with allowed side slopes (if any) for different classes of soils as per approved classification. The measurement for excavation shall be based on “neat line” dimensions as specified in the drawing or Specifications, for different types of soils and depth of excavation. The total volume of excavation shall be computed as a square bottomed trench of width equal to the outer diameter of the pipe, with minimum working space as given in the drawing, added to it, length up to the length of the trench being measured and depth of trench being average depth taken at 30 m intervals, between the level of bottom of trench and the original surface of the ground. The length of the trench shall be measured as per the actual length of pipes and fittings / specials laid at work site. However depth shall be measured at closure intervals at vulnerable places. The volume of excavation for structures like valve chambers, thrust blocks and anchor blocks etc., shall be computed and measured for payment as per the bottom area of the particular structure on outer periphery multiplied by the average depth between the level of the finished bottom of the structure and the original surface of the ground. The quantity shall be measured in cubic metres correct to two decimal places. The method of measurement for excavation for different classes of soils shall be as follows:

5. 23.6 In Ordinary Soil and Soil Mixed with Disintegrated Rock and Soft Rock / Shale

In this category of soils, the excavation quantity shall be computed as specified above.

5. 23.7 In Hard rock

In case of hard rock requiring chipping or chiseling, measurements shall be taken prior to and after chiseling and the volume of rock excavation shall be measured based on this difference. In case of excavation in hard rock by blasting, the quantity of rock excavated shall be stacked along the side of the trench, which will be cross checked with the trench dimensions. The excavation in rock shall be paid on stack measurements with a deduction of 40% in volume for voids. However, the payment for rock excavation by blasting shall be limited so as not to exceed the volume computed based on the trench dimensions as per specifications.

5. 23.8 For Excavation in Combination of Ordinary Soil, Disintegrated Rock, Soft Rock/Shale and Hard Rock

Wherever the excavation is undertaken in combination of ordinary soil, disintegrated rock, soft rock /shale and hard rock, the hard rock part shall be measured and paid as explained in Sub-Clause 3.8.1.2 and the soil part shall be measured and paid for the total measurable excavated quantity deducting the quantity measured for the hard rock. The total computed volume of excavation shall be equal to the sum of the computed volumes for each category of excavation undertaken.
5. 23.9 For Bedding
Pursuant to Sub-Clause 3.6.1 of this Chapter, the Contractor shall include the cost of earth bedding required for the pipeline in the tendered rate for pipe laying. For providing gravel and Concrete arch beddings in accordance with Sub-Clausess 3.6.2 and 3.6.3 respectively of this Chapter, the Contractor shall be paid at his tendered rates under the relevant items for the quantities of bedding actually used based on the neat line dimensions of the trench and considering the volume occupied by the pipe.

For the extra cost of over excavation in poor soils and strengthening the subgrade pursuant to Sub-Clause 3.6.4 of this Chapter, the Contractor shall be paid extra in accordance with Clause 23 of Chapter 3, Special Conditions of Contract.

5. 23.10 For Backfilling
Measurement of consolidated back filling shall be recorded and paid, deducting the space occupied by the pipeline and/or the permanent structure buried below the ground or any bedding in accordance with its dimensions indicated in the project drawings from the total quantity of measurable and payable excavation. The surplus quantity of excavated earth shall be disposed off as specified in the Sub-Clause 3.7.3 of this Chapter without any extra cost. The quantity shall be measured in cubic meter correct to two decimal point.

6.00 Structural Concrete and Mortar

6. 1 Grade of Concrete

6. 2 Controlled Concrete
For controlled concrete, design of the mix shall be arrived at after preliminary tests and in its production. All necessary precautions shall be taken to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in nine grades designated. .

6. 3 Ordinary Concrete
In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades. It can also be specified by volumetric mix as given in Table-4 below. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic meter in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for 'bulk age' shall be made as per IS:2386 (Part III).

Ingredients required for ordinary concrete containing one bag of cement for different proportions of mix shall be as given in Table-4 below.
Table-4

**Ingredients Required for Ordinary Concrete**

<table>
<thead>
<tr>
<th>Nominal Mix by volume</th>
<th>Total quantity of dry aggregates in kg (max) by mass per 50 kg of cement (to be taken as the individual masses of fine and coarse aggregates)</th>
<th>Quantity of water in litre (max) per 50 kg of cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:4:8</td>
<td>625</td>
<td>45</td>
</tr>
<tr>
<td>1:3:6</td>
<td>480</td>
<td>34</td>
</tr>
<tr>
<td>1:2:4</td>
<td>350</td>
<td>32</td>
</tr>
<tr>
<td>1:1.5:3</td>
<td>250</td>
<td>30</td>
</tr>
</tbody>
</table>

* In the designation of a concrete mix, letter 'M' refers to the mix and the number refers to the specified 28 days' works compressive strength of that mix on 150 mm cubes, expressed in N/ sq. mm.

** The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

*** The amount of water should be kept minimum required for proper workability. The quantity given in the column is not to be exceeded.

6.4 **Strength Requirement of Concrete**

Where Ordinary Portland Cement conforming to IS:269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table-5. Where rapid hardening Portland Cement is used, the 28 days compressive strength requirements specified in Table-5 shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests for concrete up to and including M 25, and 25 per cent higher for higher grades. Preliminary tests need not be made in case of 'ordinary concrete'.
Table-5
Strength Requirements of Concrete

<table>
<thead>
<tr>
<th>Nominal Mix by volume Cement</th>
<th>Compressive test Strength on 150mm cubes after testing in accordance with IS : 516 (N/sq.mm)</th>
<th>Minimum at 7 days</th>
<th>Minimum at 28 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-10</td>
<td></td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>M-15</td>
<td></td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>M-20</td>
<td></td>
<td>13.5</td>
<td>20</td>
</tr>
<tr>
<td>M-25</td>
<td></td>
<td>17</td>
<td>25</td>
</tr>
<tr>
<td>M-30</td>
<td></td>
<td>21</td>
<td>30</td>
</tr>
</tbody>
</table>

In all cases, the 28 days compressive strength specified in Table-5 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table-5, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

6.5 Use of Plums in Ordinary Concrete

Stone Plums shall not be used unless specified in the drawings. When stone plums are used, the size may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substances in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete-laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave portion upwards. The thickness of the next and successive layers of concrete shall be at least twice that of
the largest plums. The total volume of plums shall not exceed 15% of the volume of the finished concrete.

6.6 **Design Mix Concrete**
In case of Design Mix concrete, mix is required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume or weight. The design mix concrete shall be by weigh batch mix the cement requirement is given in Table 5 below. For cement which normally supplied in 50 Kg bags and is used by weight, volume shall be worked out taking 50 Kg of cement as 0.035 cubic meter in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume / weight as per design and in case it is damp, allowance for ‘bulkage’ shall be made as per IS:2386 (Part III).

Cement requirement for the proposed design mix concrete shall be as given in Table-5.1 below

| Table-5.1 |
|---|---|---|
| Nominal Mix by volume Cement : Fine : Aggregate : Coarse Aggregate ** | Characteristic Cube strength after 28 days curing N/mm² | Min Quantity of cement per cum of concrete Kgs *** |
| M25 | 25 | 360 |
| M30 | 30 | 400 |

* In the designation of a concrete mix, letter ‘M’ refers to the mix and the number refers to the specified 28 days works compressive strength of that mix on 150mm cubes, expressed in N/sq.mm.
** The proportions of the aggregate shall be adjusted from upper limit to lower limit Progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.
*** The amount of water should be kept minimum required for proper workability. the quantity given in the column is not to be exceeded.

7.0 **Ancillary Structures**

9.1 **Valve Chambers, Thrust Blocks/Anchor blocks etc.**

The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. The specifications of these ancillary structures shall generally be as enumerated in
Clause 17 of the Chapter 10, Standard Specifications for Procurement of Project Works, unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor. The contractor should submit the designs and drawings of thrust and anchor blocks for approval.

9.1.1 Pipe Supports

Pipe supports shall be constructed as per Clause 17.6 of Chapter 10, Standard Specifications for Procurement of Project Works, wherever needed, as per the directions of the Engineer. Pipe supports shall be of saddle type. Pipe supports shall also be provided for the stretches of the pipe, where the pipe is to be gradually brought above the ground for crossing any obstructions as shown in the drawings. The distance between pipe supports shall not exceed 5.0 m centre-to-centre. The contractor should submit the designs and drawings of pipe support for approval.

Pipe supports shall be as per the approved designs and to be taken to a depth of at least 1.30 mtrs. below ground level as shown in the drawing and shall have sufficient height above ground to be able to support the pipe. 20 mm dia tor steel clamp shall be provided all round the pipe and fixed to the pipe supports using appropriate means as shown in the drawings or as directed by the Engineer.

There shall be no joints at the location of the pipe supports. The joints shall be located on any one side of the support, at a minimum distance of 200 mm from the face of the support.

The successful bidder should execute the pipe supports as per the approved designs obtained from the Employer.

- Manholes
Manholes shall be constructed at places as shown in the drawings or as directed by Engineer for which payment shall be made at quoted rates. Any manholes required to be provided extra, at the locations shown by the Engineer, shall be provided by the Contractor, for which payment shall be made extra at the quoted rates. The manholes have been divided into different depth categories. The minimum depth of manhole shall be one meter. The depth of manhole shall be measured from the top of cover to the invert level of the deepest outgoing sewer from manhole. The bricks used shall be confirming to IS: 1077-1992 average compressive strength of 50Kg/cm2. The bricks used shall be table moulded and should be of well burnt quality and should be soaked well before use. Bricks shall take an initial cracking load of at least 50 kg/sq.mt. The bricks should not absorb water more than 20% of their weight after 24 hours immersed in water.
The table moulded brick masonry circular and tapered manholes should be fixed with heavy duty circular fiber reinforced concrete manhole covers and frames of 560 mm diameter conforming to IS 1726. Foot rests should be of minimum 3 mm thick plastic encapsulated (as per IS 10910) on 12mm dia grade Fe 415 steel bar (as per IS 1786). The specifications for manholes shall be as per clause 16 of Chapter 10, Standard Specifications for Procurement of Project Works.

- Vent Shafts
  Vent shafts shall be erected at places or as directed by Engineer, CI Vent shaft shall be constructed as per Drawings.

### 9.1.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends greater than 5°, to effectively transfer the hydrostatic thrust developed during the operation of the rising main, to the ground. They shall be constructed at the locations shown in the alignment drawings, and are of the respective dimensions shown therein, depending on the angle of bends, and the pressures developed in the main. They shall be constructed as per Clause 17.5 of Chapter 10, Standard Specifications for Procurement of Project Works. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

### 9.1.3 Valve chambers

Valve chambers shall be provided for all valves. The specifications of the valve chamber shall generally confirm to Clause 17.4 of Chapter 10, Standard Specifications for Procurement of Project Works. These valve chambers are of different sizes suitable for air valves & scour valves with RCC pre-cast slabs covering. They shall be constructed as per the details shown in the drawings. The stone masonry valve chamber with RCC pre-cast cover, shall be constructed as shown in the Drawings for all Valves. It shall have a opening in the side wall for access into it. Outside the valve chambers, for scouring of water, draft channels shall be provided.

### 9.2 Structures for Crossing Canal/ Nala and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in Chapter 6: Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications for Procurement of Project Works as given in Chapter 10. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

### 9.3 Pipe line Connections
The Contractor is responsible for giving suitable connections at the inlet and outlet ends of the STP, pipelines, etc.,

9.4 Crossings of Roads and Culverts

Under major roads, as directed by Engineer, the rising main shall be provided with concrete arch bedding. Steel pipe shall be used for such crossings and for culvert crossings. The details of such crossings shall be furnished in construction drawings.

9.5 Other Specials and Instruments

The Contractor is responsible to provide sufficient number of specials, as required for completing the work satisfactorily. The exact number of specials specified in Chapter 6: Bill of Quantities, may increase or decrease depending on the requirement.

10.0 TECHNICAL SPECIFICATIONS:-

10.1. Before earth work of the bund is commenced the ground to be occupied by the base shall be thoroughly cleared of all trees, shrubs, grass, prickly poor, rubbish of all sorts and soft stuff stumps and roots being entirely grubbed up.

10.2. As for as possible the foundation of deep bunds shall be taken to depths where impervious soils is met with the depth in important cases is decided by the Chief Engineer. A series of longitudinal grip trenches should be cut on the base of foundation grip trenches should be cut on the base of foundation every 20 feet apart so that the vertical face acts as buttress to the embankment and faces the central lines.

10.3. The surfaces of sloping ground on which the embankment is to be constructed shall be prepared to receive the new earthwork by cutting in the slope a sufficient number of footings or benches forming a right angles with the base of the embankment.

10.4. The earth removed from the foundation trenches as well as that from the puddle trenches and all other trenches shall be taken away and deposited beyond the rear toe of the bund earth useful for making embankment being stacked separately for reusing.

10.5 Before commencing the embankment the foot of the slopes on either sides shall be marked by the pegs firmly driven into the ground at an interval of 30 mtr. On straight portions and shorter intervals in curves care being taken to place them at right angle to the CL of base. The toe line of the slopes shall be marked by a trenches at least 30 cms. Deep.

10.6 Profiles made of bamboos and string or if necessary earth profile shall be set for the guidance of the workmen at intervals of 30 mtr. Along the embankment on the
straight bits and shorter intervals on curves. The profiles shall show the total height of
the bank and slopes including allowance for final settlement. This height of the bank
and slopes including allowance for final settlement. This allowances for statement
shall be bring the bank upto its full designed dimensions. Unless other settlement of
embankment of earth.

i) Where consolidation is done either by manual labors of light roller.
ii) In firm and compact earth-1/12 of height of new embankment.
iii) In case of power roller consolidation about half of the above mentioned figure is
    sufficient since under modern practice by power roller. Consolidation there is likely
    hood of settlement for some years. In raising the embankment it is necessary to got
    some what slow in order to allow sufficient time for the embankment to settle by its
    own weight ordinarily embankment should not be raised higher than 10 mtr to 13
    mtrs in season of the year.

10.7 Borrow pits from which earth is procured for embankment shall be confined to the
position indicated by to Executive Engineer. In no case shall the edge of such
excavation be nearer to the toe of the embankment than three times the height of the
embankment with a minimum of 30 Mtrs.

10.8 No mud slush or watery from wells of springs and no decayed vegetables matter or
rotten stuff of any kind shall be allowed too be used for the embankment. All such
materials taken out of the borrow pit excavations shall be placed on one side and
used to fill up borrow pits which are no longer required. As a general side and used to
fill up borrow pits which are no longer required. As a general rule. The top soil from
borrow pits for a depth of 9 to 12 inches should be thrown away and not used for the
bund. It is the responsibility of the agency to identify the barrow areas at his own
responsibility. The soil from barrow areas shall be got tested in the reputed laboratory
directed by the Board .After obtaining the soil reports, only soils from approved
barrow areas shall be used . The contractor should identify/ascertain the barrow areas
to assess its available quantity before quoting the tender.

10.9 For making the embankment earth should be thrown down from the sides towards in
the center and not vice versa and slightly concave towards the center.

10.10 CONSOLIDATION OF EARTH:-
Consolidation of earth shall be made by power roller of minimum 8 to 10 MT capacity
preferably with vibration. The embankment shall be done in layers of 25 to 30 cms
before compaction. The spreading shall be done by bulldozing ensuring optimum
moisture content. The compaction shall be done using 8 to 10 Tonne capacity power
roller preferably with vibrator and compaction shall be done to achieve 95% proctor”s
density.

10.10.1. Shrinkage:
In carrying up embankment the full allowance for shrinkage shall be made at first as
may be laid down for the specific class of soil so that no addition of earth will be
required after the settlement to bring the bank up to its full dimensions.
i) Unless otherwise directed the following allowance will be made for shrinkage of earth work.

- In firm compact earth 40,\text{m per 300mm}
- In ordinary loose earth – 50mm per 300mm
- In black condition soil – 75mm per 300mm

The agency is entirely responsible for quality control and execution of works as per the relevant specifications as per ISS, approved design and drawing. The agency should submit test certificates as per ISS for having consolidated properly.

10.10.1.1 When power rolling resorted to earth may be laid in 20 cm. Thick layers compacted to 15 cm.

The roller must pass at least 6 times for good consolidation f moist earth. The roller should travel parallel to length of the earth bund. On the control puddle section the layers of the earth should not exceed 20 cms. And rolled down to 15cms. And the roller should be roller should pass at least eight depending upon the moisture content of soil. About 15\% by weight is good proportion for moisture it should not be less than 10\% or more 15\% of absolutely dry weight of earth.

Before the next layer of earth is spread the previous consolidation surface should be well watered and closely picked to ensure satisfactory binding between the two layers.

If the earth available clay or loom sufficient proportion of murrum or gravel should be added as directed by the Executive Engineer. The Executive Engineer should approve Murrum or gravel for the mixture. By gravel mixture it is understood that the earth and the gravel will be laid in layers as is required and mixed intimately before consolidation the layers

As for possible the earth fill in rear of the central core should consist of previous materials so as to form a drainage layer. This material should contain not less than 40\% murrum. The greater the proportion the better.

A top of embankment should be brought up to the level setout and should be neatly leveled off. The slopes are to be dressed to the required inclination and neatly leveled off. The slopes are to be dressed to the required inclination and neatly trimmed. This should be done by making the embankment about 60 cm. Wider to begin with an then cutting away the extra earth from trimming to final profile. The top of bund shall be barreled with slope of 1:18 for drawing of rainwater.

When new embankments are joined to the old the surface of the old work should be cut at the junction to a slopes with stops and gripe trenches 60- cms. Deep and 90 cms. Wide slopping inwards and both new and old earth well watered and renamed.

In the case of long slopes or where from for any other reason there may appear to be risk of slips taking place benches shall be formed of the dimension formed as prescribed by Executive Engineer. The benches shall be at right angles to the slopes of the bank
and neatly cut. As for as possible the benches should have slight slope towards the center of the bund.

Unless otherwise ordered, measurement of earth work of embankment and paid at the scheduled rates for embankment if however if it is not possible to do so and if it becomes absolutely necessary to measure by borrow pits the following deductions should be made from the quantities measured by pits.

a) 2 2/1% wastage of earth, for all kinds of embankment
b) If the consolidation is made for dray embankments as for road if the consolidation is made for dry embankments as for road embankments.

10.11 SPECIFICATION:-

10.11.1 ROUGH STONE REVEMENT:-

The minimum thickness of the stone revetment at the top should be ordinarily 45 cms. Measured at right angles to the slope and gradually increasing in thickness by 22.5 cms. For every 4 Mtrs of vertical height. The stone for revetment should be hard verify and good big sized stones and brought from approved quarries 75% of face stones should be:

a) Not less than 75 cms. Length in course below 9.00 M from the top
b) Not less than 60 cms. Between 6 Mtr. And 9 Mtr. Below up.
c) Not less than 45 cms. In length above 6 Mtrs. level.

With the necessary jelly to fill up all interactive well and for backing to make up the thickness of the revetment.

Stones must be laid through i.e., with their length into the work or at any right angles to the slope. The practice of putting in a number of through stones as binders sticking out 15 cms. Of 20 cms. Beyond the slope of the revetment may be encouraged. The work shall be built to the exact slope, which must be frequently tested by applying the slope board. The level of revetment during constructions should at no time be lower than 90 cms. Below the front edge of new earth work and 60 cms. Below the gravel.

No stone work shall be allowed to start unless the required quantity of hard and small jelly is first collected and stacked.

The face should be well wedged as the work progresses wedged in with hard chips beaten down with hammer into the interstices this best done during construct- in before a new layer is started over the two layers over laying the treated third layer (The wedging should not be left to be done till the close of the work) No jelly should be allowed to stream over the face as it will all be drawn into the bed by waves.

The top of revetment must be made horizontal with enough jelly backing.

The revetment should have foundation 90 cms to 120cm and should be built abutting against a horizontal rough stone pail. Which serves as butters to the toes of revetment
and prevent slips. Enough of small jelly backing should be used. The jelly of standard size to be used edges of stones chisel dressed. The 43 grade grey cement of L&T/Rajashree/Coromandal/Rasi make to be used and certificates to be enclosed. With the bill. The cube strength testes for cement concrete to be carried out and the same to be enclosed with the bill-

10.11.2 DESILTING (IF NECESSARY)

1. Regular blocks of 50 m. X 50 m. Shall be made for the area of the tank where silt is to be removed. Demarcation stones shall be fixed at 50mx50m blocks and duly indicating the changes on X & Y axes. Further block level plan shall be prepared at 15m intervals by taking levels before taking up de-silting

2. The contractor should remove only the silt portion by leaving at least 30 cms. Blanket at the bottom.
3. The removed silt should be dumped at specified dumping yard only.
4. After desilting levels shall be taken jointly by Agency and Departmental Engineer and another set of block level plans shall be prepared & drawings should be submitted by Agency.

10.11.3 COREWALL:-

The puddle clay should be preferably potters clay if this is not procurable at an economical distance the best available clay be got freed from stones lime stones, vegetable matter and this may be compounded with as much sand or fine gravel as will make it sufficiently tenacious to hold water.

This several process in making this are:
1) Thoroughly mixed dry making all clods.
2) Watered and allowed to soak for 24 hours.
3) Watered and well worked up with the material and men’s feet unit it becomes a perfectly uniformly and compactness.

It shall be raised in 25 cm. Layers well trodden by feet. Before laying any course previous dry surface shall be thoroughly watered and picked closely to ensure satisfactory binding between two layers. The entire puddle work shall be kept water and wet and not allowed to dry and crack. The level of the puddle should always be kept at 15 cms. to 30 cms. In advance of the adjoining earth work. Puddle wall shall be paid on section measurement only. The roller should not be taken 60 to 90cm from either end of the puddle core.

**Note:** to test the quality of the puddle make receptacle form the sample of the puddle and allow water to stand in. The receptacle will retain its shape and hold the water if it is of good puddle.

10.11.4 JELLY DRAINS:

The boulders shall be of good hard stones varying from 15 cm to 20 cm size but not flat chips. The drains shall be built into regular walls on the two sides with smaller
stones and the shapes between shall be filled in with rough stone and rounded pieces. The top of drain and sides shall be covered with single. On the top large and wide flat stones (as per drawing enclosed) should be placed. There should be one longitudinal drain quite adjacent to puddle wall and a number cross drains about 15 M apart connections. The central longitudinal drain with similar drain beyond the rate toe so as to form a good filter bed. Care should be taken that the drains have sufficient slope for quick discharge of seepage well above the level of natural ground in rear toe for away from the rear toe.

10.11.5 GRAVEL BACKING:-

The earthen slope to receive the backing should be properly formed watered and then thoroughly picked. To this surface must be applied gravel previously watered and mud balls into the consistency of puddle top the specified thickness and the stuff should be made well rammed with wooden beaters and then the surface formed to the required slope.

Gravel backing must not be allowed to the full height of the bund as it is likely to be disturbed by stones being rolled down the surface. The work may be kept 20 cms. Above the stone work and carried up as the later advantage.

11.0 Earthen Bund

11.1 Bund:

Earthen Dams’ generally termed as Bunds’ in Minor Irrigation Tank Projects, are built across natural rivers/ streams to impound water for beneficial use. Bunds are constructed using selected naturally available soils to required slopes and heights.

11.1.1 Bunds are classified as follows:

a) Homogeneous Type:
Homogeneous section of bund is best suited where the available soils in selected borrow areas have little variation in gradation and permeability. The bund is constructed using uniform type of soils through out its section and has relatively flatter side slopes for stability.

b) Zonal Type:
Zonal Section of bund is best suited where the available soils in selected borrow areas have varied soil characteristics with regard to density and permeability. The bund section comprises of inner impervious zone called “Hearting” and encased with semi-pervious/ pervious soils called “Casing”.

11.1.2 Seating of Bund:
All natural vegetation with roots, organic materials, kankar, lime etc., in the seat of bund shall be removed. The original ground surface shall be stripped to a depth of about 0.30 mtr., for the entire base width of bund to provide a proper seating with the natural ground. All loose soil and silty soils in the seating of bund shall be completely removed.

11.1.3 Height of Bund:

The height of bund is the vertical distance from the stripped level upto the top of bund taking the centerline of bund as reference. The maximum height of bund is the height at the deepest portion of the valley or gorge portion.

11.1.4 Section of Bund:

(A) For bund less than 10 Mtrs height:

In places where good foundations and suitable soils with desirable properties are available in borrow areas, as confirmed by test results, the following section shall be adopted.

i) Top Width:

The top width of bund shall be 2.50 Mtrs. In case a road is running on top of bund the width shall be suitable for vehicular traffic.

ii) Free board:

Free board is the vertical distance between maximum water level (MWL) and the top level of bund (TBL). Free board is provided to protect the bund from overtopping by severe wave action.

The Freeboard shall be as follows.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Catchment Area</th>
<th>Free Board</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sq.Miles</td>
<td>Sq.Kms</td>
</tr>
<tr>
<td>1</td>
<td>25 and below</td>
<td>65 and below</td>
</tr>
<tr>
<td>2</td>
<td>25 to 75</td>
<td>65 to 195</td>
</tr>
<tr>
<td>3</td>
<td>Above 75</td>
<td>Above 195</td>
</tr>
</tbody>
</table>

Note: For major tanks free board requirement in embankment dam may be done by as per guidelines of IS 10653-1993 considering effective fetch. But for the construction of WSP purpose 0.90m freeboard should be considered.

iii) Side slopes of bund

<table>
<thead>
<tr>
<th></th>
<th>Upto 9 Mtrs Height</th>
<th>Above 9 Mtrs. height</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) CASING</td>
<td>Upstream slope Downstream slope.</td>
<td>0 to 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 ½ : 1} below 9 mtrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 to 1 } height.</td>
</tr>
<tr>
<td>b) HEARTING</td>
<td>Top width</td>
<td>1.80 Mtrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.30 Mtrs above MWL</td>
</tr>
</tbody>
</table>
iv) Berm

In bunds more than 9 mtrs, height, burm of 2.50mtrs width shall be provided on the down stream slope to increase slope to increase the stability of slope, and to break the continuity of downstream slope and also to reduce surface erosion. A stone gutter shall be provided at the inner edge of the rear berm with slight slope to drain off rainwater from the downstream slope.

B) For bunds more than 10mtrs., height :

The soils to be used for the bund and foundation soils shall be tested for their characteristics and the section of bund is to be determined by 'Slip Circle Analysis'.

i) For casing, hearting and homogeneous materials test results of disturbed samples from borrow areas at optimum moisture content and saturation are necessary. For foundation materials, test results of under-disturbed samples as saturation are necessary.

ii) 75% dependable value of $\phi$ (Phi-angle of internal friction) and corresponding value of $C$ (cohesion) and dry density shall be considered for the casing material of bund for analysis.

iii) 75% dependable values of $C$ and corresponding value of $\phi$ (Phi) and dry density shall be considered for hearting homogeneous and foundation materials of bund for analysis.

iv) For casing, hearting and homogeneous materials under saturation, the values of $C$ and $\phi$ (Phi) for saturated condition are considered for analysis.

The minimum desired values of factor of safety and type of shear strength recommended for various loading conditions (IS 7894- 1975).

<table>
<thead>
<tr>
<th>Condition of Analysis</th>
<th>Type of Shear Strength Test to be adopted</th>
<th>Minimum desired factor of safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream slope – sudden draw down condition</td>
<td>RS*</td>
<td>Without Earthquake condition: 1.30</td>
</tr>
<tr>
<td>Downstream slope – steady seepage condition</td>
<td>RS*</td>
<td>1.50</td>
</tr>
</tbody>
</table>

R - Test - is consolidated un-drained test.
S* - Test - is consolidated drained test.

**Note:** S* test may be adopted in cases where the material is cohesion less and free draining.
For bunds resting on soft foundations, shear stress in foundation shall also be calculated and slope flattened if necessary, to prevent over stress in the foundation. Average overall factor of safety against horizontal shear shall be at least 2.00 and minimum factor of safety against foundation shear to be 1.50.

11.2 Cut-Off Trench:

Cut Off trench is provided at the upstream toe of the hearting zone. This is a trapezoidal trench excavated into the foundation of bund, filled and compacted with impervious soils as used in hearting zone. The cut off trench shall be;

a) Taken upto ½ full storage depth or 0.6 mtr in impervious strata whichever is met with earlier.
b) Restricted to length below F.T.L. irrespective of hearting
c) Bottom width to be not less than 2.50Mtrs.
d) Side slopes:
   ½ to 1 in stiff clay, gravel murrum.
   ¾ to 1 in silty or sandy soil
   1 to 1 in very loose sand.
e) Concrete/ masonry key wall should be provided if hard rock is met with. The key wall should be properly encased with good hearting materials with proper compaction.

11.3 Foundation Treatment:

The foundation of bund shall be tested for its permeability by carrying out in situ permeability tests. The following criteria are to be adopted for classification of.

(a) Impervious: Permeability less than 1 foot per year.
(b) Semi-pervious: Permeability between 1 foot & 100 feet year.
(c) Pervious: Permeability greater than 100 feet per year.

Treatment of foundation is necessary to arrest the seepage flow through previous foundations. Types adopted are:

(a) Curtain grouting: This is done by injunction of cement and bentonite (clay) mixtures, silicate and other chemicals. The selection of grout and appropriate technology required considerable field exploration and testing.
(b) Upstream clay blanket: The clay blanket is provided below the upstream casing zone in continuation with the hearting zone and extended upstream side. The purpose is to increase the path of percolation and decrease the quantity of seepage resulting in reduction of exit gradient. The length of blanket shall be not less than 10H where H is the full storage depth above blanket with a minimum thickness of one meter.

The type adopted shall be based on its effectiveness and economic consideration.

11.4 Criteria for Design of Bund:
The following criteria shall be satisfied for design of an earthen bund.

(a) There should be no possibility of overtopping of bund by floodwater/Sewage.
(b) The phreatic line should be well within the downstream face.
(c) The upstream and downstream slopes should be stable under worst conditions.
(d) The upstream slope should be safe under sudden draw down conditions, and the downstream slope should be safe under steady seepage conditions.
(e) The shear stresses in foundation should be within the safe limits.
(f) The dams and foundation should be safe against piping.

12.0 Selection of soils

The soils for hearting shall be clayey, plastic and impervious. The soils for casing shall be gritty, have higher density, more angle of internal friction and semi pervious.

<table>
<thead>
<tr>
<th>Relative Suitability</th>
<th>Homogeneous dams</th>
<th>Zoned Dam</th>
<th>Impervious Blanket</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Impervious Core</td>
<td>Pervious Casing</td>
</tr>
<tr>
<td>Very suitable</td>
<td>GC</td>
<td>GC</td>
<td>SW2, GW</td>
</tr>
<tr>
<td>Suitable</td>
<td>CL, CI</td>
<td>CL, CI</td>
<td>GM</td>
</tr>
<tr>
<td>Fairly suitable</td>
<td>SP, SM, GH</td>
<td>GM, GC, SM, SC, CH</td>
<td>SP, GP</td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>ML, MI, MH</td>
<td>-</td>
</tr>
<tr>
<td>Not Suitable</td>
<td>-</td>
<td>OL, OI, OH, Pt.</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Refer to IS : 1498/1970 – Classification and identification of soils for general engineering purposes

13.0 Stability Analysis.

The slopes of the embankment shall be stable under all loading conditions. They should also be flat enough so as not to impose excessive stresses on foundation. For small dams stability analysis may not be necessary provided a good foundation is available and the designer with his experience can decide adequate side slopes. However, where weak foundation conditions viz., fissured clay, expansive soils, shales, over consolidated highly plastic clays, soft clays dispersive soils etc., are met with the substratum in the dam seat, extensive investigations of the foundation soils, etc., and borrow area soil are required to be carried out and the design of the embankment/dam carried out in accordance with IS 7894-1975.
The design of small embankment/dam sections may be divided into the following three categories based upon the height of the embankment in its deepest portion.

(a) Embankment where the height is below and upto 5 m:
(b) Embankment where the height is more than 5m & upto 10m; and
(c) Embankment where the height is above 10m

For small dams under category (a) and (b) above, the stability analysis may not be necessary. General guidelines of the sections and the recommended slopes are given below. However, the designer, with his experience and judgment may decide the adequate side slopes where special technical or economic considerations may have to be taken into account. Stability analysis may be carried out in accordance with IS 7894-1975 (Code of practice for stability analysis of earth dams), in the following cases:

2. If the height of bund is more than 10 Mtrs.
3. If the soils strata below the bund seat consist of weak foundation confirmed by soil test.

14.0 Drainage Arrangements:
Drainage arrangements shall be provided in the bund to drain off the water seeping through the bund without disturbing the soil particles. This drainage shall be provided in the form of filters using graded materials like jelly and sand. The filter materials shall conform to:

<table>
<thead>
<tr>
<th>Filter Material Specifications</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) $D_{15}$ of the Filter</td>
<td>5 to 40 provided that the filter does not contain more than 5 percent of materials finer than 0.074 mm (No. 200 sieve)</td>
</tr>
<tr>
<td>$D_{15}$ of the base material</td>
<td></td>
</tr>
<tr>
<td>(2) $D_{15}$ of the Filter</td>
<td>5 or less</td>
</tr>
<tr>
<td>$D_{85}$ of the base material</td>
<td></td>
</tr>
<tr>
<td>(3) $D_{85}$ of the Filter</td>
<td>2 or more</td>
</tr>
<tr>
<td>Maximum size of pipe drain</td>
<td></td>
</tr>
</tbody>
</table>

The grain size of the filter materials should be roughly parallel to that of the base materials.

The drainage arrangements shall be provided as follows: -

a) Sloping filters for Zonal Type:
Sloping filters shall be provided on the rear slope of hearting upto 1 Mtr., below full tank level and shall consist of 30 cms., thick graded jelly encased with layers of 20 cms., thick coarse and on either side.

b) Filter for Homogeneous Type:
In case of Homogeneous section vertical or sloping filters with the above specifications shall be provided. The location shall be as under;

i) Conforming to the imaginary rear slope of hearting section.
ii) Vertical at imaginary down stream toe of the hearting section.
15.0 Cross Drains:  
The cross drains shall be provided at 15 mtrs., intervals on the down stream casing zone, with a slope of 1 in 100 towards main valley and connected to the toe drain at the downstream toe of bund. The cross drain shall be provided in trapezoidal section of 60cms., base width, 70 cms, height and side slopes ½ :1 The inner core comprises of 30cms., thick 20mm., and down size jelly encased around with an outer layer of sand of 20 cms thick.

16.0 Toe Drain:  
A Toe drain at the downstream toe of bund shall be provided connecting the cross drains and sloping towards main valley. The toe drain shall be provided in a trapezoidal section of 90cms., base width, 60 cms., deep below stripped ground level and side slopes of ½ :1. The inner core comprises of 40mm, and down size graded jelly and surrounded on three sides by a layer of 20cm, thick sand layer. In case of high bund more than 10 mts height, pipe with open joints shall be provided inside the drain.

17.0 Rock Toe:  
Rock toe shall be provided over the toe drain to prevent saturation and consequent soughing downstream toe of bund. The height of rock toe shall be 1.50 mtrs., above the stripped ground level or 0.60 m above tail water level whichever is greater. The downstream slope of rock toe shall conform to the downstream slope of bund.

18.0 Revetment:  
Revetment shall be provided to protect the upstream slope of bund from the effect of wave action. The revetment shall be provided as follows:-

a) The top of revetment is to be taken up to 0.30mtrs. below top level of bund.
b) The revetment shall consist of 30cms., thick rough stones laid over a filter of 20cms., thick graded jelly of 40mm, and down size and 20 cms, thick coarse sand (all measurements to be perpendicular to the upstream slope of bund)

19.0 Turfing:  
Turfing to the downstream slope of bund shall be provided to safeguard against erosion bund due of rain.

20.0 Bricks  
Burnt clay bricks shall conform to the requirement of IS:1077 except that the minimum compressive strength when tested flat shall not be less than 8.4 MPa for individual baricks and 10.5Mpa for average of 5 specimens. They shall be free from cracks and flaws and nodules of free lime. The brick shall have smooth rectangular faces with sharp corners and emit a clear ringing sound when struck. The size may be according to local practice with a tolerances of +/- per cent.
21.0 Stones:

21.1 Stones shall be of the type specified. It shall be hard, sound, free from cracks, decay and weathering and shall be freshly quarried from an approved quarry. Stone with round surface shall not be used.

21.2 The stones, when immersed in water for 24 hours, shall not absorb water by more than 5 per cent of their dry weight when tested in accordance with IS: 1124.

21.3 The length of stones shall not exceed 3 times its height nor shall they be less than twice its height plus one joint. No stone shall be less in width than the height and width on the base shall not be greater than three fourth of the thickness of the wall nor less than 150mm.

22.0 Cement:

22.1 Cement to be used in the works shall be any of the following types with the prior approval of the Engineer:

1. Ordinary Portland Cement 33 Grade conforming to IS :269
2. Rapid Hardening Portland Cement conforming to IS :8041
3. Ordinary Portland Cement 43 Grade conforming to IS :8112
4. Ordinary Portland Cement 53 Grade conforming to IS :12269
5. Sulphate Resistant Portland Cement conforming to IS :12269

22.2 Cement conforming to IS :269 shall be used only after ensuring that the minimum required design strength can be achieved without exceeding the maximum permissible cement content of 540 Kg/cum of concrete.

22.3 Cement conforming to IS: 8112 and IS : 12269 may be used provided the minimum cement content mentioned elsewhere from durability considerations is not reduced. From strength considerations, these cements shall be used with a certain caution as high early strengths of cement in the 1 to 28 day range can be achieved by finer grinding and higher constituent ratio of $C_3S/C_2S$, where $C_3S$ is Tricalcium Silicate and $C_2S$ is Dicalcium Silicate. In such cements the further growth of strength beyond say 4 weeks may be much lower than that traditionally expected. Therefore, further strength tests shall be carried out for 56 and 90 days to fine tune the mix design from strength considerations.

22.4 Cement conforming to IS : 12330 shall be used when sodium sulphate and magnesium sulphate are present in large enough concentration to be aggressive to concrete. The recommended threshold values as per IS :456 are sulphate concentration in excess of 0.2 percent in soil substrata or 300 ppm (0.03 percent) in ground water. Tests to confirm actual values of sulphate concentration are essential when the structure is located near the sea coast, chemical factories, agricultural land using chemical fertilizers and sites where there are effluent discharges or where soluble sulphate bearing ground water level is high. Cement conforming to IS :12330 shall be carefully selected from strength can be considerations to ensure that the minimum required design strength can be achieved without exceeding the maximum permissible cement content of 540 Kg/cum of concrete.

22.5 Cement conforming to IS :8041 shall be used only for precast concrete products after specific approval of the Engineer.
22.6 Total chloride content in cement shall in no case exceed 0.05 percent by mass of cement also, total sulphur content calculated as sulphuric anhydride (SO\textsubscript{3}) shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminate percent by mass is upto 5 or greater than 5 respectively.

23.0 Coarse Aggregates:

23.1 For plain and reinforced cement concrete (PCC and RCC) or prestressed concrete (PSC) works coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone, crushed gravel, natural gravel or a suitable combination thereof of other approved inert material. They shall not consist pieces of disintegrated stones soft flaky, elongated particles, salt alkali vegetable matter or other deleterious materials in such quantities as to reduce the strength and durability of the concrete or to attack the steel reinforcement. Coarse aggregates shall conform to IS :383 and tests for conformity shall be carried out as per IS :2386 Parts I to VIII.

23.2 The Contractor shall submit for the approval of the Engineer, the entire information indicated in Appendix A of IS :383.

23.3 Maximum nominal size of coarse aggregate for various structural components in PCC, RCC or PSC, shall conform to Chapter 9.

23.4 The maximum value for flakiness index for coarse aggregate shall not exceed 35 percent. The coarse aggregate shall satisfy the following requirements of grading:

<table>
<thead>
<tr>
<th>IS Sieve Size</th>
<th>Present by Weight Passing the Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40mm</td>
</tr>
<tr>
<td>63mm</td>
<td>100</td>
</tr>
<tr>
<td>40mm</td>
<td>95-100</td>
</tr>
<tr>
<td>20mm</td>
<td>30-70</td>
</tr>
<tr>
<td>12.5mm</td>
<td>-</td>
</tr>
<tr>
<td>10mm</td>
<td>10-35</td>
</tr>
<tr>
<td>4.75mm</td>
<td>0-5</td>
</tr>
</tbody>
</table>

23.5 Sand / Fine Aggregates

23.6 For masonry work sand shall conform to the requirements of IS :2116.

23.7 For plain and reinforced cement concrete (PCC and RCC) or pre-stressed concrete (PSC) works, fine aggregate shall consist of clean hard strong and durable pieces of crushed stone crushed gravel, or a suitable combination of natural sand crushed stone or gravel. They shall not contain dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete or to attack the embedded quantities as to reduce the strength and durability of the concrete or to attack the embedded steel. Motorised sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregate shall conform to IS :383 and test for conformity shall be carried out as per IS:2386 (Part I to VII). The contractor shall submit to the Engineer the entire information indicated in Appendix A of IS:383. The fineness modules of fine aggregate shall neither be less than 2.0 nor greater than 3.5.
23.8 Sand / fine aggregate for structural concrete shall conform to the following grading requirements:

23.9 Sand / fine aggregate for structural concrete shall conform to the following grading requirements:

<table>
<thead>
<tr>
<th>IS Sieve Size</th>
<th>Percent by Weight Passing the Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone I</td>
</tr>
<tr>
<td>10mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75mm</td>
<td>90-100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60-95</td>
</tr>
<tr>
<td>1.18mm</td>
<td>30-70</td>
</tr>
<tr>
<td>600mm</td>
<td>15-34</td>
</tr>
<tr>
<td>300mm</td>
<td>5-20</td>
</tr>
<tr>
<td>150mm</td>
<td>0-10</td>
</tr>
</tbody>
</table>

25.0 Water

25.1 Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing permissible values:

1. To neutralise 200ml sample of water using phenolphthalein as an indicator it should not require more than 2 ml of 0.1 normal Na OH.
2. To neutralise 200ml sample water using methyl orange as an indicator it should not require more than 10ml of 0.1 normal HCl.
3. The permissible limits for solids shall be as follows when tested in accordance with IS :3025.

<table>
<thead>
<tr>
<th></th>
<th>Organic</th>
<th>200mg/lit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Inorganic</td>
<td>3000mg/lit</td>
</tr>
<tr>
<td>3</td>
<td>Sulphates (SO₄)</td>
<td>500mg /lit</td>
</tr>
<tr>
<td>4</td>
<td>Chlorides (Cl)</td>
<td>500 mg /lit</td>
</tr>
<tr>
<td>5</td>
<td>Suspended matter</td>
<td>2000mg /lit</td>
</tr>
</tbody>
</table>

* In case of structures of lengths 30m and below, the permissible limit of chlorides may be increased upto 1000 mg /lit.

All samples of water (including potable water) shall be tested and suitable measures may be where necessary to ensure conformity of the water to the requirements states herein.

4. The pH value shall not be less than 6.

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26.0 Stone Masonry

26.1 Description

26.1.1 This work shall consist of the construction of structures with stones jointed together by cement mortar in accordance with the details shown on the Drawings and these Specifications or as approved by the Engineer.

26.2 Materials

26.2.1 All materials used in stone masonry shall confirm to Chapter 7 except cement mortar for stone masonry which shall confirm to Clause 10.5.

26.3 Personnel

26.3.1 Only trained personnel shall be employed for construction and supervision.

26.4 Type of Masonry

26.4.1 The type of masonry used for structures shall be random masonry (coursed or un-coursed) or cours ed rubble masonry (First sort). However for bridge work generally, course rubble stone masonry shall be used. The actual type of masonry used for different parts of structures shall be specified on the Drawings.

26.4.2 For facing work ashlar masonry shall be used where indicated on the Drawings.

26.5 Construction Operations

26.5.1 General Requirements

26.5.1.1 The dressing of stone shall be as specified for individual type masonry work and it shall also conform to the general requirements of IS:1957 and requirements are covered separately with respect to particular types of rubble stone work.

26.5.2 Laying

26.5.2.1 The masonry work shall be laid to lines, levels, curves and shapes as shown in the plan. The height in each course shall be kept same and every stone shall be fine tooled on all beds joints and face full and true. The exposed faces shall be gauged out, grooved, regulated and sunk or plain moulded as the case may be. The faces of each stone between the draft be left rough as the stone comes from quarry except where sacrificial layer is to be provided or plastering is resorted to due to aggressive environment.

26.5.2.2 Stones shall be sufficiently wetted before laying to prevent absorption of water from mortar.

26.5.2.3 Stratified stones must be laid on their natural beds. All bed joints shall be normal to the pressure upon them.

26.5.2.4 Stones in the hearting shall be laid on their broadest face that gives a better opportunity to fill the spaces between stones.

26.5.2.5 The courses of the masonry shall ordinarily be pre-determined. They shall generally be of the same height of courses, the larger courses are to be placed at lower levels, heights of courses decreasing gradually towards the top of the wall. The practice of placing loose mortar on the course and pouring water on it to fill the gaps in stones is
not acceptable. Mortar may be fluid mixed thoroughly and then poured in the joints. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar.

26.5.2.6 In tapered walls the beds of the stones and the planes of course should be at right angles to the batter. In case of bridge piers with batter on both sides the course shall be horizontal.

26.5.2.7 The bed which is to receive the stone shall be cleaned wetted and covered with a layer of fresh mortar. All stones shall be laid full in mortar both in bed and vertical joints and bed wherever necessary to avoid thick beds or joints of mortar. When the foundation masonry is laid directly on rock, the face stones of the first course shall be dressed to fit into rock snugly when pressed down in the mortar bedding over the rock. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar. For masonry works over rock, a levelling course of 10mm thickness and in concrete M 15 shall be laid over rock and then stone masonry work shall be laid without foundation concrete block.

26.5.2.8 Face works and hearting shall be brought up evenly but the top of each course shall not be levelled up by the use of flat chips.

26.5.2.9 For sharp corners specially in skew bridges through stones shall be used in order to avoid spalling of corners.

26.5.2.10 In case any stone already set in mortar is disturbed or the joints broken, it shall be taken out without disturbing the adjoining stones and joints. Dry mortar and stones thoroughly cleaned from the joints and stones and the stones reset in fresh mortar. Attempt must never be made to slide one stone on top of another freshly laid.

26.5.2.11 Shaping and dressing shall be done before the stone is laid in the work No. dressing and hammering which will loosen the masonry will be allowed after it is once placed all necessary chases for joggles, dowels and clamps should be formed before hand.

26.5.2.12 Sufficient transverse bonds shall be provided by the use of bond stone extending from the front to the back of the wall and in case of thick wall from outside to the interior and vice versa. In the latter case bond stones shall overlap each other in their arrangement.

26.5.2.13 In case headers are not available pre-cast headers of M 15 concrete shall be used. Cast in situ- headers are not permitted.

26.5.2.14 Stones shall break joint on the face for at least half the height of the course and the bond shall be carefully maintained throughout.

26.5.2.15 In band work at all angle junctions of walls the stones at each alternate course shall be carried into each of the respective walls so as to unite the work thoroughly.

26.5.2.16 The practice of building up thin faces tied with occasional through stones and filling up the middle with small stuff or even dry packing is not acceptable.

26.5.2.17 All quoins and angles of the opening shall be made from selected stones carefully squared and bedded and arranged to bond alternately long and short in both directions/
26.5.2.18 All vertical joints shall be truly vertical. Vertical joints shall be staggered as far as possible. Distance between the nearer vertical joints of upper layer and lower shall not be less than half the height of the course.

26.5.2.19 Only rectangular shaped bond stones or headers shall be used. Bond stones shall overlap each other by 150 mm or more.

26.5.2.20 All connected masonry in a structure shall be carried up nearly at one uniform level throughout but when breaks are unavoidable the masonry shall be raked in sufficiently long steps to facilitate jointing of old and new work. The stepping of raking shall not be more than 45 degree with the horizontal.

26.5.3 Random Masonry (Uncoursed and Coursed)

26.5.3.1 **Dressing:** Stone shall be hammer dressed on the face the sides and beds to enable it to come in proximity with the neighbouring stone. The bushing on the exposed face shall not be more than 40mm.

26.5.3.2 **Insertion of Chips:** Chips and spalls of stone may be used wherever necessary to avoid thick mortar beds or joints and it shall be ensured that no hollow spaces are lets anywhere in the masonry. The chips shall not be used below hearting stones to bring these up to the level of face stones. Use of chips shall be restricted to filling of interstices between the adjacent stones in hearting and they shall not exceed 20 percent of the quantity of stone masonry.

26.5.3.3 **Hearting stones:** The hearting or interior filling of the wall face shall consist of rubble stones not less than 150mm in any direction carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar. The hearting should be laid nearly level with facing and backing.

26.5.3.4 **Bond Stones:** Through bond stones shall be provided in masonry upto 600mm thickness and in case of masonry above 600mm thickness a set of two or more bond stones overlapping each other at least by 150mm shall be provided in a line from face to back. In case of highly absorbent types of stones (porous limestone and sand stones etc.,) the bond stone shall extend only about two-third into the wall, as through stones in such cases may give rise to penetration of dampness and therefore, for all thicknesses of such masonry a set of two or more bond stones overlapping each other by at least 150mm shall be provided. One bond stones or a set of bond stones or a set of bond stones or a set of bond stones shall be provided for every 0.50 sqm. of the masonry surface.

26.5.3.5 **Quoin Stone:** Quoin stone i.e., stone specially selected and nearly dressed for forming an external angle in masonry work, shall not be less than 0.03 cubic meter in volume.

26.5.3.6 **Plum Stone:** The plum stones are selected long stones embedded vertically in the interior of the masonry to form a bond between successive courses and shall be provided at about 900mm intervals.
26.5.3.7 **Laying**: The masonry shall be laid with or without courses as specified. The quoin shall be laid header and stretcher alternately. Every stone shall be fitted to the adjacent stone so as to form neat and close joint. Face stone shall extend and bond well in the back. These shall be arranged to break joints as mish as possible and to avoid long vertical lines of joints.

26.5.3.8 **Joints**: The face joints shall not be more than 20mm thick, but shall be sufficiently thick to prevent stone to stone contact and shall be completely filled with mortar.

**26.5.4 Square Rubble – Coursed Rubble (First Sort)**

26.5.4.1 **Dressing**: Face stones shall be hammer dressed on all beds and joints so as to give them rectangular shape. These shall be square on all joints and beds. The bed joints shall be chisel drafted for at least 80mm back from the face and for at least 40mm for the side joints. No portion of dressed surface shall show a depth of gap more than 6mm from the straight edge placed on it. The remaining unexposed portion of the stone shall not project beyond the surface of bed and side joints. The requirements regarding bushing shall be the same as for random rubble masonry.

26.5.4.2 **Hearting Stones**: The hearting or interior filling of the wall face shall consist of flat bedded stone carefully laid, on prepared beds in mortar. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10 percent of the quantity of masonry. While using chips it shall be ensured that no hollow spaces are left anywhere in the masonry.

26.5.4.3 **Bond Stones**: The requirements regarding through or bond stone shall be the same as for random rubble masonry, but these shall be provided at 1.5 meter to 1.8 meter apart clear in every course.

26.5.4.4 **Quoin Stone**: The quoins shall be of the same height of the course in which these occur and shall be formed of header stones not less than 450mm in length. They shall be laid length wise alternately along each face, square in their beds which shall be fairly dressed to a depth of at least 100mm.

26.5.4.5 **Face Stone**: Face stones shall tail into the work for not less than their heights and at least one-third of the stones shall tail into the work for a length not less than twice their height. These shall be laid as headers and stretchers alternately.

26.5.4.6 **Laying**: The stoners shall be laid on horizontal courses and all vertical joints should be truly vertical. The quoin stones should be laid header and stretcher alternately and shall be laid square on their beds, which shall be rough chisel dressed to a depth of at least 100mm.

26.5.4.7 **Joints**: The face joints shall not be more than 10mm thick but shall be sufficiently thick to prevent stone to stone contact and shall be completely filled with mortar.

26.5.4.8 **Pointing**: Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the Drawing. The mortar shall be filled and
pressed into the raked out joints before giving the required finish. The pointing shall conform to the standard specification. The work shall conform to IS:2212. The thickness of joints shall not be less than 3 mm for Ashlar masonry. However the maximum thickness of joints in different works shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Rubble</td>
<td>20</td>
</tr>
<tr>
<td>Coursed Rubble</td>
<td>15</td>
</tr>
<tr>
<td>Ashlar Masonry</td>
<td>5</td>
</tr>
</tbody>
</table>

26.6. **Curing**

26.6.1 Green work shall be protected from rain by suitable covering and shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. Top of the masonry work shall be left flooded with water at the close of the day. Watering may be done carefully so as not to disturb or wash out the green mortar.

26.6.2 During hot water all finished or partly completed work shall be covered or wetted in such a manner as will prevent rapid during of the brick work.

26.6.3 During the period of curing of brick work it will be suitably protected from all damages. At the close of day’s work or for other period of cession watering and curing shall have to be maintained. Should the mortar perish i.e., become dry white or powdery, through neglect of curing, work shall be pulled down and rebuilt as directed by the Engineer. It any stains appear during watering the same shall be removed from the face.

26.7 **Scaffolding**

26.7.1 The Scaffolding shall be sound, strong and safe to withstand all loads likely to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one meter in width or immedia tely near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good. Scaffolding shall be got approved by the Engineer. However, the Contractor shall be responsible for its safety.

27.0 **Commissioning**

After satisfactory construction of the sewer network, Wet well cum Pump house, Rising main and STP, the units shall be commissioned for operation.

27.1 **DETAILED TECHNICAL SPECIFICATIONS CONTENTS FOR EMBANKMENT**

27.1 SCOPE OF WORK

a. The work to be done under these specification consists of all Waste Stabilisation pond embankments, backfilling of cut-off trench, dyke embankments for nala/drain. back filling around the Waste Stabilisation structures rock toe and filters of different type and
sizes. The contractor shall furnish all materials, tools, plants and labour and execute the work satisfactorily.

27.2 INDIAN STANDARD FOR REFERENCE

<table>
<thead>
<tr>
<th></th>
<th>IS Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS 1888-1971</td>
<td>Methods of load test on soils.</td>
</tr>
<tr>
<td>3</td>
<td>IS 2809 : 1972</td>
<td>Glossary of terms and symbols relating to soil engineering.</td>
</tr>
<tr>
<td>4</td>
<td>IS 4332 – 1967 Part – I I 978</td>
<td>Method of sampling and preparation of stabilised soils for (Part-I )-i 978 Reaffirmed</td>
</tr>
<tr>
<td>8</td>
<td>IS : 8237-1976</td>
<td>Code of practice for protection of slope for reservoir</td>
</tr>
<tr>
<td>9</td>
<td>IS : 8414-1977</td>
<td>Guidelines for design of under seepage control measures</td>
</tr>
<tr>
<td>10</td>
<td>IS :8419-1977</td>
<td>Filtration media sand and gravel.</td>
</tr>
<tr>
<td>11</td>
<td>IS :8826-1978</td>
<td>Guidelines for design of larte earth and rockfill dams.</td>
</tr>
</tbody>
</table>

In addition to the above, Indian standards mentioned under para 1.2 of Section 1 may also be referred to, where relevant.

27.3 STRIPPING

27.3.1 GENERAL

Before the embankment works commence, the base shall be stripped of unsuitable surface soil, including all vegetation, grass, organic matter, bushes, roots and other unsuitable matter and shall dispose off the same as directed with all lead and all lifts. Similar operations shall be done in the borrow areas and in such cutting reaches of Waste Stabilisation pond which yield useful embankment materials. Stripping shall be done to such depth as directed.

27.3.2 RECORDING OF CROSS SECTIONS

After clearing the site for embankment and prior to stripping, the natural ground surface cross sections shall be surveyed (as described in para 1.5). After stripping is completed, the initial cross sections shall be taken as described in para 1.5. The natural ground surface cross sections and initial cross sections shall form the basis for arriving at the quantities of excavation for stripping.
27.3.3 MEASUREMENT AND PAYMENT FOR THE SEAT OF EMBANKMENT

The payment will be done on the basis of the volume of excavation involved in stripping at the contract price quoted in Schedule B which includes cost of all labour, implements and plants and all incidental expenses involved in the work. No payment shall be made for the stripping of borrow areas.

27.4 PREPARATION OF FOUNDATION UNDER EMBANKMENT

No materials shall be placed for the earth fill of the embankment until the foundation of the embankment has been dewatered, suitably prepared and approved by the Engineer-in-charge. All portions of excavation made for test pits or other sub-surface investigations and any existing cavities below the foundation of the embankment shall be filled with soil of same quality as specified for the earth in and suitably compacted. Pools of water shall not be permitted in the foundation of the embankment and any water, shall be drained off and cleared prior to placing, the first layer of embankment materials.

(C) SOIL FOUNDATION

Soil foundations of the embankment shall be scarified and loosened by means of the Engineer-in-charge. Roots or other debris turned up during scarifying shall be removed from the foundation area which thereafter shall be moistened to slightly above the optimum moisture content of the foundation soil and shall be compacted by the compaction equipments to the same degree of compaction as that of the embankment. The purpose of using higher moisture than optimum is to ensure forcing of the soil into any soft zones existing below the surface. The first four layers of the fill for the embankment shall be 10 cms to 15 cms. thick and shall be carefully placed and uniformly compacted to form satisfactory bond between the foundation and the fill. These layers in the heating zone should be composed of most impervious materials. Sheep foot roller shall preferably be used for the compaction of impervious soil and vibratory type rollers for compaction of pervious and semipervious soils and rock.

(D) ROCK FOUNDATION

The treatment of the rock surface under the embankment shall be so done as to ensure a tight bond between embankment and the foundation. This shall be attained by the following procedure.

ii. The area of the rock surface which is to be in contact with the embankment shall be fully exposed by removing all the loose and disintegrated rock leaving a rugged rock surface. Hard rock projections and overhangs shall be knocked off and removed. If blasting is to be resorted to, care shall be taken to avoid objectionable shocks to foundation rock. As far as possible the whole contact area shall be exposed at one time to enable examination of the surface characteristics of the rock and for planning the method of treatment,

iii. If the foundation rock is fairly impervious but has a highly rugged surface, it shall be treated by laying embankment material in 10cms thick layers at a moisture content
slightly above the O.M.C. and compacted with mechanical equipment / small tampers to ensure that all irregular depressions in the rock surface are filled with soil to create an effective and complete bond

(e) **SAND FOUNDATION**
Sand encountered in foundation shall be tested for its natural relative density. It shall be compacted by any approved methods to obtain a minimum relative density of 70% before the filling commences.

(F) **PAYMENT**
No separate payment will be made for the preparation of the foundation under embankment as cost of this operation is deemed to have been included in the respective embankment, items.

27.4.1 BACK FILLING OF CUT-OFF TRENCHES

(a) The cut-off trench shall be back filled with same kind of materials and in same manner, as the earthfill of the impervious core of the waste stabilization pond embankment. Each layer of the fill shall be continuous and approximately horizontal layer of specified thickness and compacted under optimum moisture content to the specified degree of compaction.

(b) During placing and compaction of impervious materials in the cut-off trench where dewatering is involved, the water level at every point in the cut-off trench shall be maintained below the bottom of the earthfill until the compacted fill in the cut-off trench at that point has reached a height of 3 mtrs after which the water level shall be maintained at least 1.5 mtrs. below the top of compacted fill.

27.5 **BORROW AREAS**
27.5.1 **GENERAL**

a. All materials required for the construction of impervious or pervious zones of embankment and backfill for cut-off trench and around structures which are not available from canal excavation, for excavation structure or from excavation of other ancillary works, shall be obtained from the designated borrow areas, or as designated by the Engineer-in-charge in consultation with field laboratory. The depth of cut in all borrow areas shall be designated by the Engineer-in-charge and the cut shall be made to such designated depth only. Each designated borrow area shall be fully exploited before switching over to the next designated borrow area. Haphazard exploitation shall not be permitted. The type of equipment used and the operations in the excavation of materials in borrow areas shall be such as to produces the required uniformity of the iii mixture of materials for the embankment layer.

27.5.2 **STRIPPING OF BORROW AREAS**

a) Borrow areas shall be stripped of top soil, and any other objectionable materials to the required depth. Stripping operations shall be limited only to designated borrow areas. Materials from stripping shall be disposed of in the exhausted borrow areas or in the approved adjacent areas.
b) Stripping of borrow area shall not be measured and paid for separately. The cost of stripping is to be included in the unit rate for the respective embankment layer item in Schedule B.

### 27.5.3 BORROW AREA WATERING

a. Borrow areas watering shall be done by the Contractor wherever necessary and in the manner specified by the Engineer-in-charge.

b. The initial moisture content of the material in the borrow areas shall be estimated with the help of laboratory tests. The optimum moisture content for the material in the particular borrow areas shall be determined field tests. The additional moisture requirements if any shall be introduced into the borrow areas by watering well in advance of the excavation to ensure uniformity of moisture content. All care shall be taken reduce excessive moisture in any of the locations of a borrow area before or during excavation to secure the materials with moisture contents close to the optimum. To avoid formation of pools in the borrow areas during excavation operation, drainage ditches from borrow areas to suitable outlets shall be excavated, wherever necessary. On exhausting all useful materials or and abandoning borrow areas the, pits shall be fully drained to ensure no ponding of water.

### 27.5.4 MEASUREMENT AND PAYMENT

a) The material required for the construction of embankments material shall be transported from approved borrow areas after all available suitable material shall be arrived at by the quantity of bank work executed, utilising the borrow are material shall be arrived at by cross-sectional measurements of the bank work as Mentioned under para 2.6.7. The payment shall be made on the volumetric basis under relevant item of Schedule B adopting the sliding shall be rate and the shrinkage allowance for quantities as given in para 2.6.7.

### 27.6. EMBANKMENT

#### 27.6.1 GENERAL

The embankment may comprise of different zones viz

- (i) Impervious zone of earth fill controlled compaction at controlled moisture content,
- (ii) Semi-pervious / pervious earthfill of controlled compaction at controlled moisture content and
- (iii) All in fill of controlled compaction at random moisture content.

#### 27.6.2 EARTH FILL

1. Bushes, roots, sods or other organic or unsuitable materials shall not be placed in the embankment. The suitability of each part of the foundation for placing embankment materials thereon and of all materials use in embankment construction will be determined by the Engineer-in-charge on the basis of field laboratory tests. Embankment section to be as per tender conditions, drawings and relevant codes.

2. Placement of fill within the zones as shown on the drawings shall be performed in an orderly sequence and in an efficient and workmanlike manner.

3. Chemical and physical tests of the soil in tile embankment shall be carried out by tile Quality Control Organisation of the Department / Third party to ensure that the soil does not contain soluble lime, soluble salts cohesionless fines and alterable and unsound materials all
quantities harmful to the embankments. Useful materials from waste stabilization pond excavation and excavation of structures and from borrow areas shall be classified, transported and placed in the specified zones of embankment as directed by the Engineer-in-charge.

4. Normally, the Contractor shall utilise not less than 80% of suitable excavated material from the waste stabilization pond and structures to construct embankment, whenever such utilization is economical in the opinion of the Engineer by conveying from the spoil heaps with all leads and lifts as mentioned in Schedule B and he will not be authorised to obtain material from borrow areas until he does so. The balance of soils shall be obtained from borrow areas approved by the Engineer-in-charge. If the Contractor fails to utilise at least 80% of the usable excavated materials from the Aerated Lagoon and key trench area and obtains instead material from the borrow area, payment for this material shall be made as if obtained from Aerated Lagoon excavation with all leads mentioned in Schedule B. The decision of the Engineer about the usability of soils available from the Aerated Lagoon excavation shall be final and binding upon the Contractor.

5. Embankment materials shall be spread in successive horizontal layers extending to the full width of the embankment plus 45 cms either side to facilitate satisfactory compaction in the full designed width. No payment shall be made for placing the additional 45 cms width or for their subsequent removal. No addition shall be allowed to the slopes of the bank after the bank is raised. Trimming inside slopes to final dimensions, lines and grades shall precede the lining work. This shall be done not more than two days prior to lining.

Thickness of embankment layers may be adjusted by the Engineer-in-charge if the Contract by carrying and trial compaction and requisite tests satisfies the department that the type of contractors used by him provide required density. The thickness of loose layers in embankment shall be normally as under.

<table>
<thead>
<tr>
<th>SI. No.</th>
<th>Type of Compacting Machine</th>
<th>Weight</th>
<th>Thickness of loose layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5 mtrs. dia. drum sheep foot roller 6,000 kgs./ running mtr</td>
<td>25 cms. to 30 cms</td>
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<tr>
<td>2</td>
<td>1 mtrs. dia. drum sheep foot roller 3,000 kgs./ running mtr</td>
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<tr>
<td>3</td>
<td>Pneumatic tamper -</td>
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</tr>
<tr>
<td>4</td>
<td>D.R.R. -</td>
<td>20 cms. to 25 cms</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Vibratory -</td>
<td>30 cms. to 45 cms</td>
<td></td>
</tr>
</tbody>
</table>

7. No embankment layer shall be laid until the previous layer is properly watered, compacted and tested as per requirement. The work of spreading, and compaction shall be so adjusted as not to interfere with each other and in such a way—that neither of the operations is held up because of non—completion of the rolling and watering. If the work is held up due to failure of machinery, no claim whatsoever will be entertained even in case the machinery is supplied by the Department. The surface of embankments shall at all time, of construction be
maintained true to required cross section.

8. The distribution of materials in each layer shall be such that the compacted materials will be homogeneous and free from lenses, pockets or other imperfections. The excavating and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability.

9. The material of the earth fill zones of controlled compaction and moisture content shall be compacted to a density as specified on the drawings but not less than 96% of the standard proctor density. The material having less than 1.5 gms / cc standard proctor density shall not be used unless specifically permitted by the Engineer-in-charge.

10. In the above zones, no lumps or stone or pebbles having larger dimension than 7.5 cms in impervious core and 13 cms in pervious / semipervious zones shall be permitted. The total percentage of lumps of stones or pebbles of permissible size shall not exceed 5% in the case of impervious core and 15% elsewhere in Zone M. The percentage is in respect of every 3 cubic metre of batch material conveyed to the site of placement.

11. The homogeneous section for Aerated Lagoon embankment shall be provided in the reaches where design requirements are met with without heating the homogeneous zone shall be formed of materials with a permeability of less than 3 mtrs. per year and with a standard proctor’s dry density not less than 1.5 gms/cc. The soil for the embankment shall generally be in accordance with recommendations contained in 18:8826-1978 (para 8). The available coarser and more pervious material shall be placed near the outer slopes in order to have increasing permeability from inner to outer side.

12. The impervious hearting zone wherever shown in the drawings shall be constructed of material have required percentage of clay so that it can be compacted at optimum moisture content by suitable compacting equipment to achieve not less than 96% of the standard proctor density. Water tightness of material shall be checked by carrying out permeability tests both at site and laboratory. Permeability of impervious materials shall not be greater than 30 cms/ year.

13. The casing zone shall consist of material which provides support to impervious core under various conditions of saturation and drawdown. The distribution of material shall be such that the compacted material shall be homogeneous, free from cracks, pockets or other imperfections. The excavating and placing operations shall be such that the material when compacted shall be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability. The casing material should normally have a standard proctor density not less than 1.75 gms / cc

14. All suitable material with dry density greater than 1.35 gms/cc. shall be used in all-in-fill zone. Suitable sub zones shall be formed within the all-in-fill if so directed by the Engineer-in-charge by depositing materials of different type, texture and particle size in different sub-zones. In general, fragments of smaller size shall be deposited towards the inner slope and larger fragments towards the outer slope of all—in-fill. Formation of service roads and inspection paths in reaches of full cutting will be treated as all-in-fill and will be paid for accordingly.
15. The Aerated Lagoon embankment shall be constructed to the top width and height equal to designed height shown on the drawing, plus 2.5% of the designed height to allow for settlement. The embankment width at various levels should be regulated accordingly. However, the bottom width of embankment shall as shown on the drawing or as directed by the Engineer-in-charge.

16. For proper bond between embankment placed in a previous season with the current embankment, work shall be carried out and finished as under:

i. Where an existing embankment is to be extended horizontally it shall be cut to a slope not steeper than in 3 and the surfaces so prepared shall be scarified loosened at least to a depth of 5 cms. and wetted. Flowingly the embankment material shall be laid in layer and compacted to the required degree of compaction.

ii. If the old bank is to be raised vertically vegetation shall be cleared followed by scarifying, and watering and placing of the new earth layer as specified above. Raising shall be done after the bottom layer is tested. No extra payment will be made in this regard for the operations of clearing, scarifying and watering etc.

iii. The surfaces which are damaged due to rain shall be repaired by filling with proper material duly compacted by tampers.

17. The finished fill shall be free from lenses, pockets, streak of layers of materials differing substantially in texture or gradation from the surrounding material. Successive loads of the materials shall be dumped on the earthfill so as to produce best practicable distribution of the materials subject to the approval of the Engineer-in-charge.

27.6.3 MOISTURE CONTROL

i. Prior to and during compacting operations the material in each layer of earthfill zones of controlled compaction and moisture content shall have optimum moisture content. The permissible variation in the OMC is +/-3.

ii. As far as possible, the material excavated from the borrow area shall have adequate moisture content. If additional moisture is required, it shall be added preferably at the borrow area, and only to a limited extent, if required, the embankment by sprinkling water before placement. If moisture content is more than required, the material shall be allowed to dry before compaction. The moisture content shall be uniform throughout the layer of material for which plough, disc harrowing or other methods of mixing shall be applied. If the moisture content is more than the required moisture content specified above or if it is not uniformly distributed throughout the layer, rolling shall be stopped and shall be started again only when the above conditions are satisfied.

27.6.4 COMPACTION

i. Material shall be placed in layers of specified thickness as shown in the table under para 2.6.2.6. The proper moisture content where prescribed shall be uniformly distributed throughout the material, before it is compacted. Compaction shall be done in strips overlapping not less than 0.30 mtr. The compacting equipment shall travel in a direction parallel to the axis of the
Aerated Lagoon. Turns shall be made carefully to ensure uniform compaction. Each layer of soil placed on the bank as specified above shall be compacted with 8 to 10 tonnes power rollers or suitable crawler tractor drawn, heavy sheep foot rollers. The compaction shall have to be uniform over the full width of the bank. The roller shall be made to travel over the entire designed width of each layer so that the soil is uniformly compacted to the required degree and it leave no visible marks on the surface. Where flat roller are used, the surface of each layer of compacted materials shall be roughened with a borrow or thoroughly furrowed / pick-marked as directed before depositing the succeeding layer of material and care shall be exercised to avoid the occurrence of horizontal seams.

ii. In those parts of the structure which are inaccessible to the specified rolling equipments, or around and in contact with structures and in proximity' to structures where' the rolling equipment is not permitted to operate compaction shall be accomplished by mechanical or pneumatic rammers of approved type as directed. Rollers shall not be permitted to operate within 0.60 metre of concrete or masonry structures and the earth fill within this, distance shall be tamped by mechanical or pneumatic rammers. All materials to be so tamped shall be spread in layers-7.5 cms. to 10 cms, thick when loose and the moisture, content of the material and the amount of tamping shall be such as to produce a degree of compaction equal to the specified degree of compaction for rolled fill portion. Special care shall be exercised to obtain good contact and bond with surface of concrete or masonry structures.

iii. Where Aerated Lagoon embankment covers barrels of cross drainage structures first 45 cms. of the embankment shall be compacted with pneumatic hand tampers in loose layers 7.5 cms. to 10 cms. thick. Further fill shall be compacted by using suitable light rollers to avoid damage to the structures, by adjusting the thickness of layers until sufficient height is achieved to permit compaction by heavy rollers. Density test shall be conducted from time to time on site to ascertain whether the compaction is attained as specified above. Separate tests shall be conducted for each layer of hearting and casing zone of the embankment. At least one field density test shall be taken in each zone for every 30 mtrs. or less of compacted earth work. A minimum of three density tests one in hearting, one in inner casing and one in outer casing shall be taken per day. In case the specified densities are not attained, suitable measures shall be taken by the contractor either by moisture correction or by removal and relaying of layer or by additional rolling so as to obtain the specified density which shall be checked again at the same locations. In addition, tests shall also be carried out at the limits of the embankment and adjacent to filters at the discretion of the Engineer-in-charge. Necessary unskilled labour required for collection of saw pies shall be provided by the contractor at his cost. However, testing charges shall be borne by the Department.

iv. At least three standard proctor tests shall be carried out at regular intervals for the material to be used to account fix variations in the borrow area material as well as excavated material. Wherever material from different sources are used for embankment i.e., material from borrow areas or from excavation, at least three tests shall be carried out to determine standard proctor density of each material.

v. The Department might review the design if necessary on examination of density and the other tests results the Contractor shall have no claim arising out of such a review and consequent change if any in the design.
vi. Where compaction of cohesionless free draining materials such as gravel is required, the materials shall be deposited in horizontal layers and compacted to the specified relative density. The excavating and placing operations shall be such that the material, when compacted, shall be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

27.6.5 COMPACTION OF ALL-IN-FILL

The All-in-fill Zone of the bank wherever shown in the drawings or instructed to provide, shall be formed in layers of uniform thickness and for the full width of zone. The thickness of loose layer shall not be more than that given in the table m para 7 in Clause 262. When construction of controlled earth fill zone precedes the formation of the all-in-fill zone the slope of the earth fill zone at the junction shall be stepped if so ducted to ensure proper bonding between this zones.

All clods and lumps of soil shall be broken to a size not exceeding 75 cms. The finer of the materials available shall be deposited on the inner side and the coarser materials towards the outside of the embankment. Each layer shall be well compacted by the flat rollers sheep foot rollers vibriatory rollers, crawler tractor or by combination of any of the above as is best suited to, the type of the fill material, as directed the minimum relative density of the compacted material shall not be less than 70% of the dry density as determined in laboratory tests. In the case of cohesionless materials, the degree of compaction should not be less than 90% of the proctor's density, minimum number of passes of the compacting equipment would be prescribed and followed to obtain optimum compaction.

27.6.6 LAYING AND COMPACTING COHESIVE NON-SWELLING MATERIAL:

i. Where the Aerated Lagoon is excavated through soils, a layer of cohesive non-swelling (CNS) material shall be placed between the expansive soil and the concrete lining in accordance with paragraph 5.2 of IS:9451:1985. The CNS material shall have the following properties:
   - Gradation
   - Clay (Less than .2 micron) 15 to 20%.
   - Silt (0.06mm.-0. 002mm) 30 to 40%
   - Sand (2mm.-0.006.) 30 to 40%
   - Gravel (Greater than 2mm.) 0 to 10%

   - Index Properties
     - Liquid limit - less than 55% but greater than 30%
     - Plastic Index - less than 30% but greater than 15%

   ii. If the CNS material does not conform to above properties, it should be suitably blended with suitable soils to achieve the properties as directed by the Engineer-in-charge.

   iii. Immediately prior to placing the first layer of CNS - material, the surface of the excavation and embankment to receive the material shall be adequately wetted, as approved by the Engineer-in-charge.

   iv. After the Aerated Lagoon prism has been shaped to a reasonably true and even surface, CNS material - shall be placed and compacted to not less than 96% of Standard Proctor Density unless otherwise specified, on adequately wet surface in specified layers.
depending upon the type of compacting equipment employed. Each layer of CNS material shall be moistened before compaction.

v. Further layers shall be compacted by power rollers. In case of wider sections of the distributaries, the placing and compaction of the CNS layers shall be done on both the side slopes independently. After compaction is done, the Aerated Lagoon section shall be cut to the required neat lines and the excavated CNS material shall be re-used in further reaches. Laying and compaction of CNS layers shall be done as per drawings to achieve specified filed densities.

27.6.7 MEASUREMENT AND PAYMENT

i. Levels of the stripped base of the bank / CNS layer shall be taken before forming the compacted embankment / CNS layer at intervals 30 mtrs. The blank CNS layer quantities shall be calculated with reference to these levels. Levels shall be taken for the compacted embankment CNS layer to evaluate the quantity of work done.

ii. Payment for the compacted embankment / CNS layer shall be limited to the neat line profile excluding filters and filter drains and rock toe.

iii. In case of curves the quantities will be evaluated along the centroid of sub-zones of cross section and quantities worked out accordingly.

iv. The unit rate for forming embankment CNS layer shall include setting out, clearing site, preparation of base for Embankment /CNS layer including dewatering and desilting, if necessary, removal of top soil in the borrow area, sorting out materials, dewatering and desilting if required, conveying soil with all leads and all lifts including loading and unloading spreading in layers, breaking clods, watering to optimum moisture content wherever prescribed, compacting, hand packing where specified, sectioning, neat finishing of the bank, maintenance of haul roads, maintenance of embankment CNS layer during construction, final clearance of work site etc.

v. In case of the intermediate running payment bills and the final bill deductions shall be made in the quantity of embankment / CNS layer towards settlement and shrinkage in accordance with the proceeding of the Govt of Karnataka given in Annexure D.

vi. Further, the running bills will be paid at reduced rates as per the scale given below depending upon on the percentage of the quantity of work turned out.

<table>
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<tr>
<th>SI. No</th>
<th>Percentage of cumulative total quantities, Payable under running bills to the total tender</th>
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<td>1.</td>
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<td>2.</td>
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<td>3.</td>
<td>Final bill on completion of work</td>
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27.10 BACKFILL IN FOUNDATION TRENCHES AND AROUND STRUCTURES

27.10.1 GENERAL

(a) The type of material used for backfill and the manner of depositing the material, shall be subject to approval. As far as practicable, backfill material shall be obtained from the excavation for Aerated Lagoon and key trench or from adjacent Aerated Lagoon excavation, or from excavation of other ancillary works.

(b) Backfill material shall contain no stones larger than 7.5 cms. size, or as prescribed by engineer-in-charge.

(c) The backfill material shall be placed to the lines and grades as shown on the drawings or as prescribed in this paragraph or as directed by the Engineer-in-charge.

(d) The backfill material shall be placed carefully and spread in uniform layers of specified thickness and each layer will be moistened and compacted to required degree of compaction at specified moisture contents. The backfill shall be brought up as uniformly as practicable on both sides of walls and all sides of structures to prevent unequal loading. The backfill material shall be placed at about the same elevation on both sides of the pipe portions of the structures. The Contractor shall be responsible for providing earth adequate cover wherever necessary such as over the pipes or pipe culverts, to prevent damage due to loads of construction equipments.

(e) If a haul road is built over a pipe, all backfill around and over the pipe shall be placed to a uniform surface and no humps or depressions shall be permitted at the pipe crossings.

27.10.2 COMPACTION OF BACKFILL

When compacting soil against abutment of masonry or concrete structures, width to an extent of 0.6 mtr. shall be compacted with pneumatic tampers. Roller shall not be used close to structures to avoid damage. The size and weight of compacting equipment, shall depend on nature of material, the height and load assumed in design of a structure. The backfill close to the structure upto the rolled layer shall be compacted in suitable uniform layers, using pneumatic tampers to a dry density of at least 90% of Standard Proctor. The moisture content of the earth fill placed against the rock or structures shall be about 2% higher than O.M.C. to allow for penetration into cavities. Compaction at joints of earthwork and backfill around structures shall be carried out with special care without claiming any extra cost.

27.10.3 MEASUREMENT AND PAYMENT

(a) Measurement for payment, for backfill in foundation trenches and around structures shall be made restricting to the pay lines shown on the drawings. Any over excavation and consequent extra backfill outside paylines will be at the cost of the Contractor. The payment shall be made on a volumetric basis under the relevant items of Schedule B.

(b) The first 45 cms. of Aerated Lagoon embankment compacted with pneumatic / hand tampers over the barrels of cross drainage structures shall be paid at the rate quoted for backfill around structures.
27.11 WEATHER CONDITIONS

(a) Embankment material shall be placed only when weather conditions are satisfactory accurate to permit control of the moisture content in the embankment material. Before closing the work on embankment, in any continuous reach prior to monsoon, the top surface shall be graded away from the canal and rolled with a smooth wheeled roller to facilitate runoff. Prior to resuming work, the top surface shall be scarified and moistend or allowed to dry as the case may require.

(b) The Contractor shall provide suitable protection works to protect the slopes from erosion due to rain. No payment whatsoever shall be made for providing such protection work and repairing any monsoon damages.

27.11.1 INSPECTION AND TESTS
27.11.1.1 GENERAL

a) The Engineer-in-charge would exercise a thorough check on the quality of fill material delivered to the embankment and on the degree of compaction. He would further arrange to obtain and record the data of in-situ properties of the high banks after compaction, for comparison with design assumptions. To achieve these objectives, a programme of field testing and inspection shall be planned,

b) The Scope of Testing and Inspection is as under:
I. The quality of materials used for bank work will be checked periodically
II. Checks on the effectiveness of placement and compaction procedures shall be made by field density tests at prescribed intervals, and
III. Record tests of compacted fill shall be made at regular intervals.

27.12 BEFORE COMPACTION

Materials delivered to the fill shall be visually examined and their properties estimated by way of inspection.

27.12.1 Borrow Area
i. Excavation of borrow areas shall be limited in extent and depth as indicated on plans,
ii. Estimation of moisture content of materials shall be made by visual examination and feel,
iii. Samples shall be taken for laboratory analysis in case the soil is of different characteristics,

b) These inspection / checks shall be supplemented by sampling the materials at prescribed intervals and by testing the samples in the laboratory for gradation and moisture content etc.

27.12.2 Embankment
i. Moisture content tests shall be carried out in the laboratory while placing the till materials.
ii. Moisture content shall be controlled by adding water or allowing the soil to dry up to the extent required,
iii. It shall be ensured that the methods of dumping, spreading and moisture conditions are such as will result in reducing segregation and variation of moisture content to a minimum
27.12.3 DURING COMPACTION

**Inspection during compaction shall ensure:**

i. That the layer thickness of the material is as specified.

ii. That the fill is compacted at least up to 96% of Standard Proctor density or as otherwise specified 70% relative density as the case may be.

iii. That no excessive rutting, waving or scaling of the fill occurs during compaction.

27.12.4 AFTER COMPACTION

The condition of the till after compaction shall be observed and recorded particularly with respect to rutting or waving. However, the properties of materials after compaction shall be determined primarily by field density tests. Routine tests on samples taken from constructed embankment shall include, density tests, and moisture content tests. The record tests shall include grain size distribution, Atterburg limits, permeability & consolidation characteristics.

27.12.5 FREQUENCY OF TESTING

a) Before and after compaction, the sampling and testing of materials shall be done in sufficient frequencies so that effective checks on the full operations are maintained. Testing frequencies shall be as per standards prescribed by the department. However, the actual frequencies shall be adjusted to suit the nature and variability of materials placed and the rate of fill placement as per the directions of the Engineer-in-charge.

b) Testing shall be performed at higher frequencies than those specified above during initial stages of construction in order to establish control and testing techniques. Testing shall be conducted additionally, as and when required in case of special problems such as variation in the construction materials in equipment performance and weather.

c) In addition, these tests shall be made

i. In areas where the degree of compaction is doubtful. and

ii. In areas where embankment operations are concentrated.

(d) Locations of likely insufficient compaction shall cover the following or any other areas so determined by the Engineer-in-charge

i. The junction between areas of mechanical tamping and rolled embankment along structures

ii. Areas where rollers turn.

iii. Areas where improper water content has been encountered

iv. Areas where dirt clogged rollers have been encountered

v. Areas containing material differing substantially from the average

27.12.6 RECORD AND REPORT

The Contractor shall maintain chronological and location wise record of the source of materials and the embankment placing operations in order to have a continuous check on the works. Thus it should be possible to have a concrete description of materials that has gone into in an version of the embankment.
27.13 PRODUCTION

The Contractor shall take all precautions necessary for the protection of all works by diversion of adjacent streams, surface drainage, rain water etc. Any damage to earth work due to any reasons whatsoever shall be repaired by the contractor at his cost till the work is certified as completed and taken over by the Department.

Note: The impervious soil for hearting of the bund shall be taken out of the excavated soil of the borrow area i.e., STP. If the quantity of the available selected soil for hearting is less than the quantity of soil required for hearting of the bund, the impervious soil from the adjoining area of the bund shall be utilized. However, while excavating for borrowing of the impervious soil within the STP, the excavation shall be as per the sections required for the design storage of the sewage, as approved by the employer / engineer. The surplus earth if any out of the excavation within the STP area, shall be utilized for leveling wherever required with specific approval of the Engineer.

28.0 Maintenance

The sewer network, wet well cum pump house, rising main and sewage Treatment Plant / other structures executed by the Contractor shall be maintained for a period of 12 months from the date of commissioning. During this period of maintenance, any defects of any kind in manufacture, laying, jointing of the rising main & connecting pipe lines, valves and construction of the Wet well cum Pump house, STP etc., shall be rectified by the Contractor as per the same specification as that of the item of work done at no Extra Cost.
## QUALITY ASSURANCE PLAN

### RAW MATERIALS CONTROL:

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<th>Quantum of Check</th>
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<th>Acceptance Norms</th>
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<td>Major</td>
<td>Physical</td>
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<td>Manufacturer's IA</td>
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<td>Marking</td>
<td>Major</td>
<td>Physical</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>Report</td>
<td>Manufacturer's IA</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE :**
1. Copies of material reports shall be given to I.A. for scrutiny before commencement of inspection.
2. All measuring instruments and testing equipments shall be calibrated periodically and put up to IA for scrutiny.
3. The minimum cement content in the concrete shall be 360 Kgs/m3 with maximum water cement ratio of 0.45
# QUALITY ASSURANCE PLAN

FOR MANUFACTURE OF DUCTILE IRON PIPES, INSPECTION AND TESTING PLAN

<table>
<thead>
<tr>
<th>SL NO.</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Raw Material</td>
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<tr>
<td>1.</td>
<td>BF Liquid Metal or Pig Iron</td>
<td>%C, %SI, %MN, %S, %P</td>
<td>Major</td>
<td>Chemical</td>
<td>One Per Lot or Batch</td>
<td>As per Manufacturers standard</td>
<td>As per Manufacturers standard</td>
<td>MTC</td>
<td>W</td>
<td>R</td>
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<tr>
<td>2.</td>
<td>Ferro Silicon</td>
<td>%SI, %AL</td>
<td>Major</td>
<td>Chemical</td>
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<td>As per Manufacturers standard</td>
<td>MTC</td>
<td>W</td>
<td>R</td>
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<tr>
<td>3.</td>
<td>Silica Sand / River Sand</td>
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<td>Chemical</td>
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<td>As per IS 8329 - 2000</td>
<td>MTC</td>
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<td>R</td>
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<td>4.</td>
<td>Magnesium</td>
<td>Purity of Mg</td>
<td>Major</td>
<td>Chemical</td>
<td>One Per Lot or Batch</td>
<td>As per IS 8329 - 2000</td>
<td>As per IS 8329 - 2000</td>
<td>MTC</td>
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<td>R</td>
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<td>Zinc</td>
<td>Purity of Zn</td>
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<td>As per Manufacturers standard</td>
<td>As per Manufacturers standard</td>
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<td>W</td>
<td>R</td>
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<td>6.</td>
<td>Cement</td>
<td>Material Conformation</td>
<td>Major</td>
<td>Physical and Chemical</td>
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<td>As per IS 8112</td>
<td>As per IS 8112/IS 12330</td>
<td>MTC</td>
<td>W</td>
<td>R</td>
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<td>7.</td>
<td>Bitumen Paint</td>
<td>Specific Gravity</td>
<td>Major</td>
<td>Specific Gravity</td>
<td>One Per Lot or Batch</td>
<td>As per Manufacturers standard</td>
<td>As per Manufacturers standard</td>
<td>MTC</td>
<td>W</td>
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<td>II</td>
<td>Process Control</td>
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<tr>
<td>1.</td>
<td>Heat Treatment</td>
<td>Temperature Recording Time Cycle</td>
<td>Major</td>
<td>-</td>
<td>100%</td>
<td>As per Manufacturers standard</td>
<td>As per Manufacturers standard</td>
<td>Heat Treatment Chart</td>
<td>W</td>
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<td>2.</td>
<td>Zinc Coating</td>
<td>Deposit of Zn</td>
<td>Major</td>
<td>-</td>
<td>One Per Batch</td>
<td>IS 8329 - 2000</td>
<td>IS 8329 - 2000</td>
<td>Manufacturers internal Record</td>
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<td>SL NO.</td>
<td>Component / Material</td>
<td>Characteristics Check</td>
<td>Category</td>
<td>Type of Check</td>
<td>Quantum of Check</td>
<td>Reference Documents</td>
<td>Acceptance Norms</td>
<td>Format of Record</td>
<td>Agency</td>
<td>Remarks</td>
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<tr>
<td>1</td>
<td>Visual</td>
<td>As per IS - 8329 - 2000</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
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<td>As per IS 8329-2000</td>
<td>M TPI B</td>
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<td>2</td>
<td>Dimensional</td>
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<td>Major</td>
<td>Measurement</td>
<td>100%</td>
<td>As per IS 8329-2000</td>
<td>As per IS 8329-2000</td>
<td>M TPI B</td>
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<td>3</td>
<td>Mechanical test</td>
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<td>Major</td>
<td>Physical</td>
<td>One test per lot or batch</td>
<td>As per IS 8329-2000/ IS 11606</td>
<td>As per IS 8329-2000</td>
<td>M TPI B</td>
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<td>Hydrostatic test</td>
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<td>As per IS 8329-2000</td>
<td>M TPI B</td>
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<td>5</td>
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<td>As per IS - 8329 - 2000</td>
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<td>Random Check</td>
<td>As per IS 8329-2000</td>
<td>As per IS 8329-2000</td>
<td>W W R</td>
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<td>6</td>
<td>Bitumen Coating Thickness</td>
<td>As per IS - 8329 - 2000</td>
<td>Major</td>
<td>Random Check</td>
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<td>As per IS 8329-2000</td>
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<td>7</td>
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<td>As per IS 8329-2000</td>
<td>W W R</td>
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<td>8</td>
<td>Gasket Fitment and leak tightness test</td>
<td>As per IS - 8329 - 2000</td>
<td>Major</td>
<td>One Per Lot or Batch</td>
<td>As per IS 8329-2000</td>
<td>As per IS 8329-2000</td>
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<td>9</td>
<td>Marking on Pipes</td>
<td>As per IS - 8329 - 2000</td>
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<td>As per IS 8329-2000</td>
<td>W W R</td>
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</table>

**Note:**
1. Manufacturer shall carry out 100% inspection on final product.
2. All measuring instruments should be calibrated.
3. Cement used for lining shall conform to IS 8112 or IS 12330 depending on the usage of pipeline.
4. The rubber gasket shall conform to IS 5382 / 1985.

Reviewed items may be randomly witnessed by the concerned if necessary. All measuring instruments and testing equipments shall be calibrated periodically and put up for verification to Third Party Inspection agency.
## QUALITY ASSURANCE PLAN

**PRODUCT NAME:** MILD STEEL TUBULARS AND OTHER WROUGHT STEEL FITTINGS (G.I.PIPES)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Component Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
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<td>Dimensional</td>
<td>Major</td>
<td>Measurement</td>
<td></td>
<td></td>
<td></td>
<td>Report</td>
<td>Check by M &amp; witness by IA</td>
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<td></td>
<td>Threading</td>
<td>Major</td>
<td>Measurement by Gauging</td>
<td>IS 554-1985</td>
<td>IS 554-1985</td>
<td>Report</td>
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<td></td>
<td>Mass</td>
<td>Major</td>
<td>Weightment</td>
<td>IS 1239 PI-1990</td>
<td>IS 1239 PI-1990</td>
<td>Report</td>
<td>Check by M &amp; and witness by IA</td>
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C:\Users\ADMINI~1\AppData\Local\Temp\WzE9F4.tmp\QAPGiPipe.xls
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<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
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<td>b) Uniformity of Coating</td>
<td>b) CuSO4 solution</td>
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<td>IS 1239 PI-1990</td>
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<td>c) Adherence</td>
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<td>Hydraulic leak tightness test or Eddy Current test</td>
<td>Major</td>
<td>Physical</td>
<td>100% by Manufacturer</td>
<td>IS 1239 PI-1990</td>
<td>IS 1239 PI-1990</td>
<td>Audit Check in presence of IA</td>
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<td></td>
<td>Marking</td>
<td>Minor</td>
<td>Visual</td>
<td>IS 1239 PI-1990</td>
<td>IS 1239 PI-1990</td>
<td>Report</td>
<td>Audit Check by information of IA</td>
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</tbody>
</table>

Note:
1) Copy of internal report should be handed over to IA before inspection.
2) All measuring instruments and test equipment shall be calibrated regularly and put up to IA for verification.
# QUALITY ASSURANCE PLAN

## RAW MATERIAL CONTROL

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
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<th>Type of Check</th>
<th>Quantum of Check</th>
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<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
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<td>1.1</td>
<td>Cement</td>
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<tr>
<td>1.2</td>
<td>Aggregatge</td>
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</table>

### 1.1 Cement

- **1. Chemical**
  - Critical Chemical Analysis
  - Quantum: 1 / Lot
  - Reference: IS : 12330 (See note 2)
  - Acceptance: Supplier's TC
  - Agency: 1. Supplier 2. IA

- **2. Physical**
  - a. Fineness
    - By sieve
    - Quantum: 1 / Lot
    - Agency: Scrutiny of records by IA
    - Remarks: 1. Counter check by IA on receipt at manufacturer's place.
  - b. Standard consistency
    - Lab Test
    - Quantum: 1 / Lot
    - Agency: Scrutiny of records by IA
  - c. Setting Time consistency
    - Lab Test
    - Quantum: 1 / Lot
    - Agency: Scrutiny of records by IA
  - d. Soundness
    - Lab Test
    - Quantum: 1 / Lot
    - Agency: Scrutiny of records by IA
  - e. Compressive strength
    - Lab Test
    - Quantum: 1 / Lot
    - Agency: Scrutiny of records by IA

### 1.2 Aggregate

- **a. Deleterious materials**
  - Major Lab Test
  - Quantum: 1 / Lot
  - Reference: IS : 383
  - Acceptance: a. Supplier's TC b. Manufacturer's Register
  - Agency: Scrutiny of records by IA

- **b. Soundness**
  - Lab Test
  - Quantum: 1 / Lot
  - Agency: Scrutiny of records by IA

- **c. Specific gravity**
  - Lab Test
  - Quantum: 1 / Lot
  - Agency: Scrutiny of records by IA

- **d. Grading & size**
  - Lab Test
  - Quantum: 1 / Lot
  - Agency: Scrutiny of records by IA
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
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<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
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<tr>
<td>1.3</td>
<td>Water</td>
<td>Solubility of Water in concrete works</td>
<td>Major</td>
<td>- do -</td>
<td>Once in a year</td>
<td>IS : 456</td>
<td>IS : 456</td>
<td>Govt. Test Lab</td>
<td>Manufacturer</td>
<td>Scrutiny of TC by IA</td>
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<tr>
<td>1.5</td>
<td>Rubber Rings</td>
<td>a. Dimensions</td>
<td>Critical</td>
<td>- do -</td>
<td>- do -</td>
<td>IS : 5382 Type I, Natural or Isporene</td>
<td>IS : 5382 Type I, Natural or Isporene</td>
<td>Supplier's Report</td>
<td>1. Supplier 2. Manufacturer</td>
<td>1. Scrutiny of reports by IA (see note 5)</td>
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<td></td>
<td>b. Physical Test</td>
<td>Critical</td>
<td>Lab Test</td>
<td>1 / Lot</td>
<td>- do -</td>
<td>- do -</td>
<td>Supplier's TC</td>
<td>1. Supplier 2. IA</td>
<td>1. Scrutiny of TC by IA  2. Counter check by IA on receipt at manufacturer place</td>
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<td>Critical</td>
<td>Lab Test</td>
<td>1 / Lot</td>
<td>- do -</td>
<td>- do -</td>
<td>Supplier's TC</td>
<td>1. Supplier 2. IA</td>
<td>1. Scrutiny of TC by IA  2. Counter check by IA on receipt at manufacturer place</td>
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<td>d. Corrosion Test</td>
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<td>2.1</td>
<td>Concrete or Mortar</td>
<td>a. Quality of Cement</td>
<td>Critical</td>
<td>Analysis of concrete</td>
<td>1 / Batch or shift IS: 458 CL 4.5.1</td>
<td>IS: 458 CL 4.5.1</td>
<td>Manufacturer's register</td>
<td>a. Manufacturer b. IA</td>
<td>1. Scrutiny of records by IA  2. Random check IA</td>
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Note 4: IS: 432 Pt.I or IS: 432 Pt.II or IS: 2862 any grade
Note 5: IS: 5382 Type I, Natural or Isporene
<table>
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<tr>
<th>Sl. No.</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
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<tr>
<td></td>
<td>b. Weight of cage</td>
<td>Critical</td>
<td>By weighing M/C</td>
<td>One per design</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register</td>
<td>a. Manufacturer b. IA</td>
<td>1. Scrutiny of records by IA 2. Random test to IA (see note 1)</td>
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<tr>
<td>2.3</td>
<td>Concreting of pipe</td>
<td>a. Speed</td>
<td>RPM Indicator</td>
<td>One each pipe/mould</td>
<td>Manufacturers own std</td>
<td>Manufacturer's register</td>
<td>1. Manufacturer 2. IA</td>
<td>1. Scrutiny of Register by IA 2) Random check by IA</td>
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<td>b. Thickness of core</td>
<td>Major</td>
<td>Spike Guage</td>
<td>One each pipe/mould</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register</td>
<td>1. Manufacturer b. IA</td>
<td>3.0 3.1 Final Cured Pipe</td>
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<td>c. straightness of bore</td>
<td>-do-</td>
<td>Gauge</td>
<td>100%</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register</td>
<td>1. Manufacturer r 2. IA</td>
<td>1. Audit check on sample by IA</td>
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<td></td>
<td>d. Hydrostatic test</td>
<td>Critical</td>
<td>Pressure test with pump</td>
<td>2%</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register and test report</td>
<td>1. Manufacturer r 2. IA</td>
<td>1. Audit check on sample by IA</td>
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<td></td>
<td>e. Absorption test</td>
<td>Critical</td>
<td>As per IS: 3597 on specimen</td>
<td>for each pipe</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register and test report</td>
<td>1. Manufacturer r 2. IA</td>
<td>See note 6</td>
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<td>Type of Check</td>
<td>Quantum of Check</td>
<td>Reference Documents</td>
<td>Acceptance Norms</td>
<td>Format of Record</td>
<td>Agency</td>
<td>Remarks</td>
</tr>
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</tr>
<tr>
<td>f.</td>
<td>Three Edge Bearing test</td>
<td>Critical</td>
<td>As per IS: 3597</td>
<td>On samples as per IS : 458</td>
<td>IS: 3597</td>
<td>IS: 3597</td>
<td>Manufacturer's register and test report</td>
<td>1. Manufacturer 2. IA</td>
<td>See note 7</td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td>Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>IS : 458</td>
<td>IS : 458</td>
<td>Manufacturer's register and test report</td>
<td>1. Manufacturer 2. IA</td>
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</tbody>
</table>

4.0 STAMPING & SEALING

4.1 Stencilling IA stamp

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legibility of stamp and proper location for easy identification</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1. Manufacturer 2. IA</td>
</tr>
</tbody>
</table>

5.0 PACKING & DESPATCH :- To ensure no damages to pipes during transit, loading & unloading.

**NOTE:**

1. Proper co-relation must be established by approved agency for cube strength between vibratory and centrifugal process in case pipes are manufactured by Centrifugal process. In absence of the same, conversion factor for 28 days compressive strength of cube shall be taken as 1.25 (refer clause 4.5.1 of IS : 458)

2. Only sulphate resisting portland cement to IS:2330/1988 shall be used if the RCC pipes are used for UGD works.

3. Manufacturer should conform the bore-well and co-relate with test certificate. In case new borewells are planned to be added, the water from the same shall be tested before being used.

4. The manufacturer shall advise in advance the type of polymer proposed to be used for Rubber rings and shall maintain the same polymer for the entire batch.

5. Sample of Rubber Rings procured shall be used for Hydrostatic Test.

6. Pipes used for Three Edge Bearing test shall not be included in the accepted lot. In case no failure occurs during this test, the maximum test load shall be recorded. The Sl. Nos. of these pipes shall be indicated in Inspection Certificate to ensure that these are not received at site and laid by mistake.

7. Manufacturer shall give a copy of Internal test reports before inspection commenced by IA

8. All measuring instruments and test equipments shall be calibrated periodically and records shall be put upto IA for verification.
## QUALITY ASSURANCE PLAN

**PRODUCT NAME : STONE WARE PIPES**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(iii) Salt Content</td>
<td>1 sample per lorry</td>
<td>IS : 651/1992</td>
<td>IS : 651/1992</td>
<td>Manufacturer's Registers &amp; Certificate</td>
<td>by Manufacturer</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
<tr>
<td>4.0</td>
<td>C Quartz</td>
<td>Silica content</td>
<td>Major</td>
<td>Analysis</td>
<td>1 per Batch</td>
<td>IS : 651/1992</td>
<td>IS : 651/1992</td>
<td>Manufacturer's Registers &amp; Certificate</td>
<td>by Manufacturer</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Component / Material</td>
<td>Characteristics Check</td>
<td>Category</td>
<td>Type of Check</td>
<td>Quantum of Check</td>
<td>Reference Documents</td>
<td>Acceptance Norms</td>
<td>Format of Record</td>
<td>Agency</td>
<td>Remarks</td>
</tr>
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<tr>
<td>II</td>
<td>PROCESS CONTROL</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size</td>
<td>Major</td>
<td>Saving</td>
<td>1 sample per lorry</td>
<td>IS : 651/1992</td>
<td>IS : 651/1992</td>
<td>Manufacturer's Registers &amp; Certificate</td>
<td>by Manufacturer</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
<tr>
<td>B</td>
<td>Mixing</td>
<td>Proportion of clay to Grog</td>
<td>Major</td>
<td>By weightment</td>
<td>Continuous</td>
<td>Manufacturer standards</td>
<td>80% Clay 20% Crog</td>
<td>Internal Records</td>
<td>by Manufacturer</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
<tr>
<td>C</td>
<td>Firing</td>
<td>Temperature</td>
<td>Major</td>
<td>Temperature</td>
<td>Furnace check for every firing</td>
<td>Manufacturer standards</td>
<td>Manufacturer standards</td>
<td>Internal Records</td>
<td>by Manufacturer</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
</tbody>
</table>

2.0 FINAL INSPECTION AND TESTING:

<p>| A      | Dimensions           | Major    | Measurement | Samples as per table 1.3 of IS 651:1992 | As per IS 651/1992 | IS 651/1992 | Report | by Manufacturer  | Verification of record by 3rd party I.A. |
| b)     | Thickness of barrel &amp; sockets | Major | Measurement | Samples as per table 1.3 of IS 651:1992 | As per IS 651/1992 | IS 651/1992 | Report | by Manufacturer  | Verification of record by 3rd party I.A. |
| c)     | Length of pipe       | Major    | Measurement | Samples as per table 1.3 of IS 651:1992 | As per IS 651/1992 | IS 651/1992 | Report | by Manufacturer  | Verification of record by 3rd party I.A. |</p>
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Surface defects</td>
<td>Major</td>
<td>Visual</td>
<td>Measurement</td>
<td>100% by manufacturer</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
</tr>
<tr>
<td>C</td>
<td>Hydraulic Test</td>
<td>Water leakage</td>
<td>Major</td>
<td>Visual</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Absorbtion test</td>
<td>Increase in size</td>
<td>Major</td>
<td>Analysis</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Test for Acid resistance</td>
<td>Loss in Mass not less than 0.25%</td>
<td>Major</td>
<td>Analysis as per Annexure-A of IS 651:1992</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Test for Alkali resistance</td>
<td>No pitting or softening crack</td>
<td>Major</td>
<td>Analysis as per Annexure-B of IS 651:1992</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
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<tr>
<td>G</td>
<td>Crushing strength</td>
<td>Crushing strength to with stand minimum 16 KW/M</td>
<td>Major</td>
<td>Analysis as per Annexure-C of IS 651:1992</td>
<td>As per IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100% by manufacturer</td>
<td>IS 651/1992</td>
<td>IS 651/1992</td>
<td>Report</td>
<td>by Manufacturer IA</td>
<td>Verification of record by 3rd party I.A.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**
1. Copies of Internal record should be made available to Inspection Authority (I.A.) for scrutiny before commencement of inspection.
2. All measuring instruments and testing equipments shall be calibrated periodically and put up to IA for verification.
## QUALITY ASSURANCE PLAN

**PRODUCT NAME: AC PIPES & SPECIALS**

### RAW MATERIAL CONTROL

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Component/ Material</th>
<th>Characteristics check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Asbestos Fibre</td>
<td>Conformance to TA(P) Standards</td>
<td>Critical</td>
<td>Physical Tests</td>
<td>One per consignment</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>Test certificate from supplier &amp; fiber test records</td>
<td>Manufacturer</td>
<td>Review by IA</td>
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</table>

### PROCESS CONTROL FOR A.C. PRESSURE PIPES & COUPLINGS

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Component/ Material</th>
<th>Characteristics check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
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<tr>
<td>2.1</td>
<td>Milling of Asbestos Fibre</td>
<td>Moisture Cement</td>
<td>Major</td>
<td>Physical test</td>
<td>Once in shift</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>Lab records</td>
<td>Manufacturer</td>
<td>Review by IA</td>
</tr>
<tr>
<td>2.2</td>
<td>Vat &amp; Slurry consistency</td>
<td>Percentage / volume</td>
<td>Major</td>
<td>Physical test</td>
<td>4 times per shift</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>Lab records</td>
<td>Manufacturer</td>
<td>--do--</td>
</tr>
<tr>
<td>2.3</td>
<td>Sieve filtrate &amp; cone water colids</td>
<td>Percentage / volume</td>
<td>Major</td>
<td>Physical test</td>
<td>1 times per shift</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>Lab records</td>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Forming Thickness</td>
<td>Measurement</td>
<td>Major</td>
<td>Potentiometer control</td>
<td>100%</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>process records</td>
<td>Manufacturer</td>
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<tr>
<td>2.5</td>
<td>Felt speed Control</td>
<td>Major</td>
<td>Speed Control</td>
<td>Round the clock control</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>Lab records</td>
<td>Manufacturer</td>
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<td>2.6</td>
<td>Calendering Control</td>
<td>Major</td>
<td>Time Control</td>
<td>Round the clock control</td>
<td>Manufacturers own Standard</td>
<td>Manufacturers own Standard</td>
<td>process records</td>
<td>Manufacturer</td>
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<td>2.7</td>
<td>Dimensional check at Green stage</td>
<td>Measurement by vernier calipers</td>
<td>Major</td>
<td>Measurement</td>
<td>100%</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<tr>
<td>2.8</td>
<td>Temp control at Dwell and roller conveyors</td>
<td>Control</td>
<td>Major</td>
<td>Thermo couple sensing</td>
<td>Continuous</td>
<td>--do--</td>
<td>--do--</td>
<td>Lab records</td>
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<td>2.9</td>
<td>Curing of green pipes</td>
<td>Recording the QTY size and period</td>
<td>Major</td>
<td>Counting the maturity date</td>
<td>100%</td>
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<td>--do--</td>
<td>curing day records</td>
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<td>3.0 MACHINING &amp; TESTING OF PIPES</td>
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<td>3.3 Work Hydraulic Pressure tightness Test</td>
<td>Pressure tightness test as per the class of pipes</td>
<td>Major</td>
<td>Hydraulic pressure test as per IS 5913/89</td>
<td>--do--</td>
<td>--do--</td>
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<td></td>
<td>3.4 Hydraulic Bursting Test</td>
<td>Bursting stress</td>
<td>Major</td>
<td>Bursting Test</td>
<td>As per IS 7639/75</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<td></td>
<td>3.5 Transverse Crushing Test</td>
<td>Crushing stress</td>
<td>Major</td>
<td>Chemical Test</td>
<td>As per IS 7639/75</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<tr>
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<td>3.6 Longitudinal Wending Test (Upto 150mm dia pipe only)</td>
<td>Beding Test</td>
<td>Major</td>
<td>Bending Test</td>
<td>As per IS 7639/75</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<td></td>
<td>3.7 Straightness Test</td>
<td>Measurement</td>
<td>Major</td>
<td>Physical Measurement</td>
<td>As per IS 7639/75</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<tr>
<td></td>
<td>3.8 Internal Regularity Test</td>
<td>Regularity</td>
<td>Major</td>
<td>Physical Measurement</td>
<td>As per IS 7639/75</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<tr>
<td></td>
<td>3.9 Other dimensions like diameter, length, thickness etc..</td>
<td>Major</td>
<td>Measurement</td>
<td>Samples as per IS 2500 PPI/Level/ AQL 2.5</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
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<td>4.0 A.C. COUPLINGS</td>
<td>Cutting the required length</td>
<td>Length Measurement</td>
<td>Major</td>
<td>Physical</td>
<td>100%</td>
<td>TA(P) Standard</td>
<td>TA(P) Standard</td>
<td>PF Section</td>
<td>Manufacturer</td>
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<td></td>
<td>4.2 Coring, Grooving &amp; Chamfering</td>
<td>Uniformity</td>
<td>Major</td>
<td>Measurement with calipers</td>
<td>100%</td>
<td>TA(P) Standard</td>
<td>TA(P) Standard</td>
<td>PF Section</td>
<td>Manufacturer</td>
<td></td>
</tr>
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<td></td>
<td>4.3 Curing of Couplings</td>
<td>Counting of Qty. size &amp; period</td>
<td>Major</td>
<td>Counting the maturity period</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>Lab records Manufacturer IA</td>
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<td></td>
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<tr>
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<td>4.4 Testing of Couplings</td>
<td>Testing Hydraulically with pipe</td>
<td>Major</td>
<td>Visual check for any leak</td>
<td>As per IS 7639/1975</td>
<td>--do--</td>
<td>--do--</td>
<td>Lab records Manufacturer IA</td>
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<td>4.5 Dimensions</td>
<td>Major</td>
<td>Measurement</td>
<td>IS:2500 P&amp;J/IL II/AQL 2:5 Normal</td>
<td>Firms own design</td>
<td>Firms own design</td>
<td>Inspection Report</td>
<td>Manufacturer IA</td>
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<td>4.6 Marking</td>
<td>Marking</td>
<td>Major</td>
<td>Stenciling</td>
<td>100%</td>
<td>--do--</td>
<td>--do--</td>
<td>As per contract Manufacturer IA</td>
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5.0 RUBBER SEALING RINGS FOR AC COUPLING & CID JOINTS:

<table>
<thead>
<tr>
<th>5.1</th>
<th>Visual Examination</th>
<th>Smooth Finish and Identification</th>
<th>Visual checking</th>
<th>As per IS 5382-1985</th>
<th>IS 5383-1985</th>
<th>IS 5383-1985</th>
<th>Test Report</th>
<th>Manufacturer IA</th>
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<tbody>
<tr>
<td>5.3</td>
<td>Hardness</td>
<td>Measurement</td>
<td>Major Physical</td>
<td>As per IS 5382-1985</td>
<td>IS 5382-1985</td>
<td>IS 5382-1985</td>
<td>Test Report of supplier</td>
<td>--do--</td>
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<td>5.4</td>
<td>Stretch Test</td>
<td>----</td>
<td>----</td>
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<td>----</td>
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<td>----</td>
<td>--do--</td>
</tr>
<tr>
<td>5.5</td>
<td>Compression set Test</td>
<td>&quot;Tests will be conducted at any reputed Laboratories of India, on samples drawn by IA&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5.6</td>
<td>Water Immersion Test</td>
<td>&quot;Tests will be conducted at any reputed Laboratories of India, on samples drawn by IA&quot;</td>
<td></td>
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6.0 CID JOINTS

<table>
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<tbody>
<tr>
<td>6.2</td>
<td>Dimensional verification</td>
<td>Measurement</td>
<td>Major Measurement with calipers</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>6.3</td>
<td>Mass of joints</td>
<td>Weightment</td>
<td>Major Weightment</td>
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<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>6.4</td>
<td>Hydrostatic Test</td>
<td>Hydraulic Test with respect to class of joints</td>
<td>Major Hydraulic pressure test</td>
<td>--do--</td>
<td>As per IS 8794:1988 and IS 1592-1989</td>
<td>As per IS 8794:1988 and IS 1592-1989</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>6.6</td>
<td>Tensile Test</td>
<td>Major UTM</td>
<td>1/Lot</td>
<td>IS 8794:1988</td>
<td>IS 8794:1988</td>
<td>--do--</td>
<td>--do--</td>
<td></td>
</tr>
<tr>
<td>6.7</td>
<td>Hardness Test</td>
<td>Hardness</td>
<td>Major BHN</td>
<td>IS 2500 PE II Level IV/AQL 2.5</td>
<td>IS 8794:1988</td>
<td>IS 8794:1988</td>
<td>--do--</td>
<td>--do--</td>
</tr>
</tbody>
</table>

RUBBER SEALING RINGS FOR AC COUPLING & CID JOINTS:

"Tests will be conducted at any reputed Laboratories of India, on samples drawn by IA"
## 7.0 ACCEPTANCE CRITERIA TESTS
Final Inspection/Test for A.C. Pressure Pipes

<table>
<thead>
<tr>
<th>7.1 Visual Examination</th>
<th>Finish and marking</th>
<th>Major</th>
<th>Visual</th>
<th>100% by Manufacturers</th>
<th>As per IS 1592-1989 and SO norms</th>
<th>As per IS 1592-1989 and SO norms</th>
<th>Inspection Report</th>
<th>--do--</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 Dimensions and Tolerances</td>
<td>Measurement</td>
<td>Major</td>
<td>measurement by calipers</td>
<td>100% by Manufacturers</td>
<td>As per IS 1592-1989 and SO norms</td>
<td>As per IS 1592-1989</td>
<td>Inspection Report</td>
<td>--do--</td>
</tr>
<tr>
<td>7.3 Straightness Test</td>
<td>--do--</td>
<td>Major</td>
<td>Measurement by straightness tester</td>
<td>Samples as per IS:7639/1975</td>
<td>As per IS 1592-1989 and SO norms</td>
<td>As per IS 1592-1989</td>
<td>Inspection Report</td>
<td>--do--</td>
</tr>
<tr>
<td>7.4 Internal Regularity Test</td>
<td>Uniformity</td>
<td>Major</td>
<td>Disc Test</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>7.5 Work Hydraulic Pressure Tightness Test</td>
<td>Hydraulic pressure as per the class of pipes</td>
<td>Major</td>
<td>Hydraulic pressure test</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>7.6 Transverse Crushing Test</td>
<td>Crushing stress</td>
<td>Major</td>
<td>Physical Test</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>7.7 Hydraulic Bursting Test</td>
<td>Bruising Stress</td>
<td>Major</td>
<td>Physical Test</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
<tr>
<td>7.8 Longitudinal Bending Test (Upto 150mm dia pipe only)</td>
<td>Beding stress</td>
<td>Major</td>
<td>Physical Test</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
<td>--do--</td>
</tr>
</tbody>
</table>

### Note:
1. Internal report shall be submitted to IA for scrutiny before commencement of inspection.
2. All measuring instruments & test equipments shall be calibrated regularly and put to IA for scrutiny.
3. Manufacturer shall submit safely as per IS 11769 P&I/1987 to IA for scrutiny.
## QUALITY ASSURANCE PLAN

### QUALITY ASSURANCE PLAN FOR THE MANUFACTURE OF DUCTILE IRON PIPES, INSPECTION & TESTING PLAN

<table>
<thead>
<tr>
<th>SI No</th>
<th>Component/ Material</th>
<th>Characteristics check</th>
<th>Category Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAW MATERIAL CONTROL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BF Liquid Metal or pig Iron</td>
<td>% C, % SI, % MN, S, % P</td>
<td>Major Chemical</td>
<td>1/lot or Batch</td>
<td>Asper Manufacturers Standard</td>
<td>Asper Manufacturers Standard</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ferrosilicon</td>
<td>% S, % AL</td>
<td>Major Chemical</td>
<td>1/lot or Batch</td>
<td>Asper Manufacturers Standard</td>
<td>Asper Manufacturers Standard</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silica Sand</td>
<td>Sieve Analysis Compaction</td>
<td>Major Chemical</td>
<td>1/lot or Batch</td>
<td>As per IS 8329 - 2000/ IS-383</td>
<td>As per IS 8329 - 2000</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Magnesium</td>
<td>Purity of Mg</td>
<td>Major Chemical</td>
<td>1/lot or Batch</td>
<td>As per IS 8329 - 2000</td>
<td>As per IS 8329 - 2000</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Zinc</td>
<td>Purity of Zn</td>
<td>Major Chemical</td>
<td>1/lot or Batch</td>
<td>Asper Manufacturers Standard</td>
<td>Asper Manufacturers Standard</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cement</td>
<td>Material conformation</td>
<td>Major Physical &amp; Chemical</td>
<td>1/lot or Batch</td>
<td>As per IS 8112</td>
<td>As per IS 8112</td>
<td>MTC</td>
<td>T V W</td>
<td>Samples could be drawn from finished pipes also</td>
</tr>
<tr>
<td>7</td>
<td>Butumen Paint</td>
<td>Specific Gravity</td>
<td>Major Specific gravity</td>
<td>1/lot or Batch</td>
<td>Asper Manufacturers Standard</td>
<td>Asper Manufacturers Standard</td>
<td>MTC</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td><strong>PROCESS CONTROL</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Heating Treatment</td>
<td>Temperature recording time cycle</td>
<td>Major Physical</td>
<td>100%</td>
<td>Asper Manufacturers Standard</td>
<td>Asper Manufacturers Standard</td>
<td>Heat Treatment Chart</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Zinc coating</td>
<td>Deposit of zinc</td>
<td>Major Physical</td>
<td>1 per Batch</td>
<td>As per IS 8329 - 2000</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture rs Internal Record</td>
<td>T V V</td>
<td></td>
</tr>
<tr>
<td>Sl No</td>
<td>Component/Material</td>
<td>Characteristics check</td>
<td>Category</td>
<td>Type of Check</td>
<td>Quantum of Check</td>
<td>Reference Documents</td>
<td>Acceptance Norms</td>
<td>Format of Record</td>
<td>Agency</td>
</tr>
<tr>
<td>-------</td>
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</tr>
<tr>
<td>1</td>
<td>Visual</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>As per IS 8329 - 2000</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>2</td>
<td>Dimensional</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Measurement</td>
<td>100%</td>
<td>As per IS 8329 - 2000</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>3</td>
<td>Mechanical Test</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>As per IS 8329 - 2000 One test/ Batch</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>4</td>
<td>Hydrostatic Test</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>100%, As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>5</td>
<td>Lining Thickness</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>6</td>
<td>Bitumen Coating</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>Random Check</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>7</td>
<td>Compression Test of Cubes</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>8</td>
<td>Gasket fitment &amp; leak tightness test</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>One per lot</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
<tr>
<td>9</td>
<td>Marking on pipes</td>
<td>As per IS 8329-2000</td>
<td>Major</td>
<td>Physical</td>
<td>Random Check</td>
<td>As per IS 8329 - 2000/IS 11606</td>
<td>As per IS 8329 - 2000</td>
<td>Manufacture Report</td>
<td>T</td>
</tr>
</tbody>
</table>

**Legend:-**
- T = Testing
- M = Manufacturer
- B = KUWS&D Board
- W = Witness
- TPI = Third Party Inspection

**Note:**
1. The manufacturer shall carry out 100% inspection on final product.
2. All measuring instruments & test equipments shall be calibrated periodically and record shall be put to IA for verification.
3. Cement used for lining shall conform to IS 8112 or IS 12330 depending on the usage of pipeline.
4. The rubber gasket shall conform to IS 5382 / 1985.
5. The tolerance shall be brought to the notice of employer before accepting the pipes.
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>RAW MATERIALS CONTROL:</td>
<td>Material Identification</td>
<td>Major</td>
<td>Lab Test &amp; T.C. Review</td>
<td>1 per lot or Batch</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td>DI CI Gr:GGG 40 IS : 6603,Gr.12,Cr.12, and as per R.C.MOC</td>
<td>Manufacturer's Test Certificates</td>
<td>M C TP</td>
</tr>
<tr>
<td>1.1</td>
<td></td>
<td>Physical, Chemical &amp; Mechanical Properties</td>
<td>Major</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>W V V</td>
</tr>
<tr>
<td>2.0</td>
<td>FINAL INSPECTION AND TEST:</td>
<td>Visual Inspection</td>
<td>Major</td>
<td>Surfaces (Cast &amp; machined)</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td>Free from surface defects</td>
<td>Internal inspection report / record</td>
<td>W V V</td>
</tr>
<tr>
<td>2.1</td>
<td></td>
<td></td>
<td>Major</td>
<td>Measurement by instruments</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td></td>
<td>Final Inspection report</td>
<td>W W W</td>
</tr>
<tr>
<td>2.2</td>
<td></td>
<td>Dimensional check</td>
<td>Major</td>
<td>Operational (3 times in each direction full open &amp; full close)</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td>smooth operation</td>
<td></td>
<td>W W W</td>
</tr>
<tr>
<td>2.3</td>
<td></td>
<td>Performance</td>
<td>Major</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>W W W</td>
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<tr>
<td>2.4</td>
<td></td>
<td>MASS</td>
<td>Major</td>
<td>Weighment</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td></td>
<td>- do -</td>
<td>W W W</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td>Hydrostatic Pressure Test</td>
<td>Critical</td>
<td>Measurement of body &amp; seat pressure as per IS 14846/2000</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td>No leakage</td>
<td></td>
<td>W W W</td>
</tr>
<tr>
<td>2.6</td>
<td></td>
<td>Coating / Painting</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td></td>
<td>- do -</td>
<td>W V V</td>
</tr>
<tr>
<td>2.7</td>
<td></td>
<td>Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>BS:5163-89/ IS 14846/2000 DIN3202 F4/f5</td>
<td></td>
<td>- do -</td>
<td>W V V</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Copies of Internal reports should be handed over to the TP before commencement of Inspection.
2. All measuring instruments and testing equipments shall be periodically calibrated and the validity of calibration certificate should be verified by the TP before testing.

**Legend:**
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- **C** = Contractor
- **TP** = Third Party
- **V** = Verification
- **W** = Witness
## QUALITY ASSURANCE PLAN

**PRODUCT NAME:** C. I. SLUICE VALVE

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Component / Material</th>
<th>Characteristics Check</th>
<th>Category</th>
<th>Type of Check</th>
<th>Quantum of Check</th>
<th>Reference Documents</th>
<th>Acceptance Norms</th>
<th>Format of Record</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>RAW MATERIALS CONTROL :</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Material Identification</td>
<td>Major</td>
<td>Lab Test &amp; T.C. Review</td>
<td>1 per lot or Batch</td>
<td>IS : 210 FG 200 IS : 320 HT 2, IS : 318 LTB, IS : 1538 (flanges)</td>
<td>IS : 210 FG 200 IS : 320 HT 2, IS : 318 LTB, IS : 1538 (flanges)</td>
<td>Manufacturer's Test Certificates</td>
<td>M C TP</td>
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</tr>
<tr>
<td></td>
<td>Physical, Chemical &amp; Mechanical Properties</td>
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<td>W V V</td>
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</tr>
<tr>
<td>2.0</td>
<td>FINAL INSPECTION AND TEST :</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2.1</td>
<td>Visual Inspection</td>
<td>Major</td>
<td>Surfaces (Cast &amp; machined)</td>
<td>100% IS: 14846/2000</td>
<td>Free from surface defects</td>
<td>Internal inspection report / record</td>
<td>W V V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Dimensional check</td>
<td>Major</td>
<td>Measurement by instruments</td>
<td>100% IS: 14846/2000</td>
<td>In accordance with IS:14846 / 2000.</td>
<td>Final Inspection report</td>
<td>W W W</td>
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<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Performance</td>
<td>Major</td>
<td>Operational (3 times in each direction full open &amp; full close)</td>
<td>100% IS: 14846/2000</td>
<td>smooth operation</td>
<td>- do -</td>
<td>W W W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>MASS</td>
<td>Major</td>
<td>Weightement</td>
<td>100% IS: 14846/2000</td>
<td>IS: 14846/2000</td>
<td>- do -</td>
<td>W W W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl. No</td>
<td>Component / Material</td>
<td>Characteristics Check</td>
<td>Category</td>
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<td>Format of Record</td>
<td>Agency</td>
</tr>
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<tr>
<td>2.5</td>
<td>Hydrostatic Pressure Test</td>
<td>Critical</td>
<td>Measurement of body &amp; seat pressure as per IS 14846/2000</td>
<td>100%</td>
<td>IS: 14846/2000</td>
<td>No leakage</td>
<td>- do -</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Coating / Painting</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>IS: 14846/2000</td>
<td>As per IS: 14846/2000</td>
<td>- do -</td>
<td>W    V V V V V</td>
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</tr>
<tr>
<td>2.7</td>
<td>Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>IS: 14846/2000</td>
<td>In accordance with IS: 14846/2000</td>
<td>- do -</td>
<td>W V V V V V</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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<th>Format of Record</th>
<th>Agency</th>
</tr>
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<tbody>
<tr>
<td>1.0</td>
<td>RAW MATERIALS CONTROL :</td>
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<td></td>
<td>M C TP</td>
</tr>
<tr>
<td>1.1</td>
<td>Material Identification Physical, Chemical &amp; Mechanical Properties</td>
<td>Major</td>
<td>Lab Test &amp; T.C. Review</td>
<td>1 per lot or Batch</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>In accordance with GGG 40</td>
<td>Manufacturer's Test Certificates</td>
<td>W V V</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>FINAL INSPECTION AND TEST :</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Visual Inspection</td>
<td>Major</td>
<td>Surfaces (Cast &amp; machined)</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>Free from surface defects</td>
<td>Internal inspection report / record</td>
<td>W V V</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Dimensional check</td>
<td>Major</td>
<td>Measurement by instruments</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>In accordance with GGG 40</td>
<td>Final Inspection report</td>
<td>W W W</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Performance</td>
<td>Major</td>
<td>Operational (3 times in each direction full open &amp; full close)</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>smooth operation</td>
<td>- do -</td>
<td>W W W</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>MASS</td>
<td>Major</td>
<td>Weighment</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>In accordance with GGG 40</td>
<td>- do -</td>
<td>W W W</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Hydrostatic Pressure Test</td>
<td>Critical</td>
<td>Measurement of body &amp; seat pressure as per IS 14846/2000</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>No leakage</td>
<td>- do -</td>
<td>W W W</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Coating / Painting</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>In accordance with GGG 40</td>
<td>- do -</td>
<td>W V V</td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>Marking</td>
<td>Major</td>
<td>Visual</td>
<td>100%</td>
<td>GGG 40/ SG IRON 420/12</td>
<td>In accordance with GGG 40</td>
<td>- do -</td>
<td>W V V</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: 1. Copies of Internal reports should be handed over to the TP before commencement of Inspection.  
2. All measuring instruments and testing equipments shall be periodically calibrated and the validity of calibration certificate should be verified by the TP before testing.

Legend:  
M = Manufacturer  
C = Contractor  
TP = Third Party  
V = Verification  
W = Witness