

The Contractor shall be required to maintain proper record of receipt and normal use of all materials issued to him and submit extracts when called for by the Engineer, in such manner and form as the latter may prescribe.

2.4 **Cement**

2.4.1 The Cement shall be Ordinary Portland Cement 33 grade complying with IS: 269. The unit weight of cement would be taken as 1440 kg/cubic meter in accordance with IS 875 Part-I-1987.

2.4.2 The issue rate includes the cost of container bags. Cement shall be issued as standard weight bags i.e. each bag of 50 kg. The Contractor shall have to satisfy himself of its content both quantitatively and qualitatively at the point of lifting. Once accepted, the Contractor shall have to account for on the basis that each bag contained 50 kg. However, cement shall be used in the work on the basis of weight.

2.4.3 If at the time of issue the Contractor is apprehensive that the quality of the cement does not comply with the relevant standards specified, he may ask for the cement to be tested. The Engineer shall then have representative sample of the particular consignment sent for test.

If the result of the test be found to be satisfactory the Contractor shall have to accept the said consignment and the responsibility of the Employer shall cease.

If the result of the test be unsatisfactory, the Contractor may refuse to accept the said consignment, in which case, the Engineer shall arrange issue of cement of requisite quality from other consignments. Nevertheless, the Engineer may at his discretion still direct that the cement be used in unimportant items of work where the strength consideration is not very important. The Contractor shall in that case take delivery of such cement and store the same separately for use in such works as the Engineer or his Representative may direct. In respect of works done with such cement of sub-standard quality, the responsibility of the Contractor to produce finished products of the specified requirements shall cease. Issue rate of such cement will be different from normal one and at reduced cost determined by the Employer.

2.4.4 If, on the other hand, the Engineer or his Representative is apprehensive that the quality of cement (of specified standard) which had been issued to the Contractor, has since deteriorated due to long or defecting storage by the Contractor or for any reason whatsoever, he may similarly have the cement tested before the cement is used in the works. If the results of the test indicate that the cement does no longer comply with the specified standards, the cost of such test shall be borne by the Contractor and he would have to abide by the directions of the Engineer in respect of the disposal or utilization of the cement thus damaged but full recovery rate will be applied.

2.5 **Steel**

2.5.1 Steel bars for use in reinforcement required for the permanent works shall be issued in lengths as available with the Employer. These may be either mild steel bars or cold-twisted deformed bars. The recovery shall be on the weight calculated on the basis of length issued and the standard sectional weight for the particular diameter.

In all cases, the Contractor is to utilize the steel materials in such a way as to minimize wastage on account of cut pieces. All wastage shall be to the Contractor's account. Any straightening, cleaning etc. of the steel materials received from the Employer, shall also be done by the Contractor at his own cost.


The tenderer should quote the rates with excess weight if any due to Rolling Tolerance of Steel materials (M.S., cold Twisted Bars or TMT Steel bars). No additional payment in this regard will be entertained. Consumption of the Steel Bars will be based on approved drawings and Standard Chart. Consumption for Steel materials shall be computed in the table of the chart subject to a variation of plus/minus five (5%) percent.

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3. **NO INTEREST ON DUES**

No interest will be payable by the Development Authority on the amount due to the Contractor pending final settlement.

4. **DISPOSAL OF THE EXCAVATED MATERIALS**

All materials obtained from any excavation required to be carried out under this contract will be the property of the Development Authority and the Contractor shall not have any claim on it. It will not be used for any purpose other than refilling the excavations as needed or leveling the compound or in construction of any embankment or in any manner as directed by the Engineer. After completion of work or earlier if so directed by the Employer the surplus excavated materials shall be disposed off by the contractor within a distance of 13 km without any extra cost, but only after being so directed by the Employer. Transportation cost beyond 13 km will however be paid at the rate to be approved by the Employer.

5. **POSSESSION OF WORK**

The Development Authority shall have the right to take possession for use of any completed or partly completed part of the work. Such possession or use shall not be deemed to be an acceptance of any work not completed in accordance with the agreement.

6. **TENDER TO STRICTLY COMPLY WITH SPECIFIED CONDITIONS AND ALL OTHER SPECIFICATIONS**

It should be clearly noted that the tenderer have to strictly comply with the specifications and other terms and conditions laid down in this document and no variations are permissible. This is necessary for the purposes of comparison of tenders received.

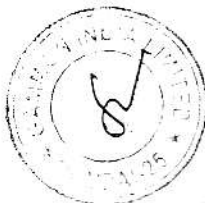
The Contractor shall stand guarantee for the works carried out under this contract.

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## CAPACITY OF RESERVOIR / SUMP

Name	Location	Type of Reservoir / Sump	Capacity Required (Cum)
South Guwahati (West)	At WTP Location at Sadilapur	Clear Water Sump	1100
<b>West Kamakhya</b>			
West Kamakhya (Main)	Kamakhya Hill top	Hill Top UGR	6300
West Kamakhya	Kamakhya Hill top	Hill Top UGR	9300
Kamakhya Hill Top (By Boosting)	Near Bhubaneswari Temple	Hill Top UGR	450
	Kamakhya Hill top	Sump for Boosting	100
<b>Ganeshpara</b>			
Ganeshpara East	Fatasil Hill	Hill Top UGR	5700
Ganeshpara West	Madhavdev Nagar	Hill Top UGR	3400
Ganeshpara Central (By Boosting)	Durga Sarubar	Hill Top UGR	1700
	Fatasil Hill	Sump for Boosting	380
Jalukbari	G U Hill Top	Hill Top UGR	6400
Mirjapur (ESR)	Mirjapur	ESR	1600
Borjhar (ESR)	Jogipara	ESR	1600

There may be variations in details and sizes of pump bases and cable trenches depending on the Specification of the suppliers of Pump, Motor etc. which should be accommodated by the successful Tenderer during construction without any extra cost to Employer. The final working drawings will be vetted by the pump motor suppliers in order to satisfy their requirements.

- 3.2 A tentative Lay-out Drawing for the shape and different levels of the reservoir and pump house is enclosed in the tender document. The Tenderer has to quote his Rate for whole project. While calculating the effective capacity of the underground reservoir, dead storage of water and free board will not be taken into account and the volume of R. C. C. columns etc. shall be deducted. The tenderer has to quote his rate on the basis of his own design as per Tender

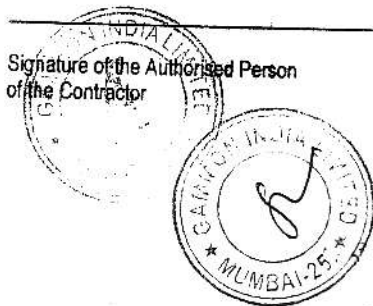
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**SECTION - E**  
**GENERAL TECHNICAL SPECIFICATIONS**

**GENERAL**

**1.0 SITE CONDITION**

The site of the Intake structure for raw water has been shown in location Map. The site of Water Treatment Plant and underground sump cum pumping station are also shown in enclosed Maps. The main distribution reservoir is at hill top. Six new hill top reservoirs are to be constructed and firm foundations are to be designed. Two ESR on plane ground are to be constructed on suitable foundation. Two service reservoirs are at plain land and will be elevated service reservoir. Two booster pumping station will be constructed. The Tenderer shall verify the location of the intake structure, Raw Water pump House, Water Treatment Plant, Semi underground reservoir, and booster pumping station, service reservoirs and alignment of pipeline and shall apprise himself of the local condition before submitting the Tender.

**2.0 SUB-SOIL REPORT**

Sub-soil investigation was carried out by soil-experts engaged by the Employer's Consultant at the site of the proposed intake structure and has been made available to the bidders.

The Tenderer should satisfy himself about the adequacy of the data for the design of pile foundation for different structures. The tenderer may carry out soil investigation before submission of his tender by drilling bore hole at work site at his own cost for his own satisfaction and to assess the safe bearing capacity. The successful Tenderer shall have to undertake fresh investigation of soil at the exact location of the structure at his own cost to design the foundation properly. Records of such sub-soil investigation such as bore hole logs, soil samples, SPT values etc., shall be done by the contractor duly witnessed and authenticated by the Engineer or his competent authorised representative. When approved by the Engineer the data can be utilized for design purpose.

In the event of variation in soil data those obtained by the contractor during execution, the more conservative values obtained from the two sets of reports shall be adopted for design without any extra claim over the quoted price as accepted by the Department, unless otherwise permitted by the Engineer, Guwahati Metropolitan Development Authority.

**3.0 TENDER DRAWINGS**

**3.1** The Site Layout Plan, general arrangement of the proposed project is shown in Tender Drawings. These drawings are meant for giving the Tenderer a general idea of the proposed Project. The various levels and dimension of the raw water intake structure, raw water pump house, water treatment plant, clear water sump, pump house and pump station and hill top reservoirs and elevated service reservoirs are fixed. Effective capacity of reservoir and sump are given below -

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Stipulations, which is not to be submitted with the tender. Effective volume is therefore the quantity of water to be stored in excess of dead storage.

However a tentative design and lay-out drawing different from the tender drawing, showing the scope of civil work including size, shape, inlet and outlet arrangements, overflow arrangements etc. as proposed by him, shall have to be submitted with the tender. The work will however, be executed on the basis of the detailed designs and drawings submitted by the successful Tenderer which will be prepared by on the basis of the Technical Parameters and the terms and conditions of the tender document duly approved by the Engineer.

The RCC pile founded has to be in such a manner that the same can withstand all dead loads, live loads, effect of earthquake and service loads. The pile foundation must satisfy the settlement criteria.

**Requirement of Floor Spaces and tentative Room Sizes are to be provided by the successful bidders**

Description	Size of Room in MM
At R. L	
(i) Unloading Platform	
At R. L	
(i) Pump Floor, Pump Bay including Repair Bay	
(ii) Stair Block	
At R. L.	
L. T. Panel Fore Bay cum Control Room /	
Office Room	
Store Room	
Battery Room	
Lavatory	
Stair block	
At R. L.	
WBSEB Room, H. T. Room	

Note : Dimensions are in Millimeters.

**Mandatory Levels in Meters ( to be provided by the successful bidders):**

Existing Ground Level (Average)  
Finished Ground Level

Top Water Level in CWR  
Lowest water Level in CWR

Top of Concrete of Reservoir Roof

R. L. of Plinth of Entrance Lobby

Repair Bay

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- Top R. L. of Crane rail
- R. L. of Hook Level of Crane
- Clear height of WBSEB Room / H. T. Room
- Clear height of Control Room / Office Room /
- L. T. Panel Room
- Clear Opening for Roller Shutter for unloading Bay

**SUCCESSFUL BIDDERS SHALL HAVE TO SPECIFY LEVEL, SIZES AND HEIGHTS**

**4. 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 and 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 and codes specified will be acceptable subject to the Engineer's prior-view 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.

**5. SIGN BOARD & BARRICADING**

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 address 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 subject to the approval of the Employer.

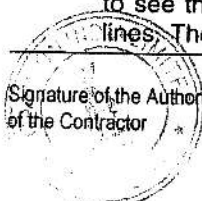
All sites shall be well barricaded with metallic sheets strongly supported and with reflectors, red lightings etc. during execution of work.

**6. PROTECTION OF UTILITIES**

The contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries 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 make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, 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 when such interferences are examined and recorded by the Engineer and approved by the Employer.

In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the ASEB 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

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in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be responsibility of the contractor.

**7. EARTH WORK**

**7.1 GENERAL:**

The earth work excavation for laying of pipe shall be carried out. The contractor shall make all excavations required for laying and joining 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 open cut to the specified widths and depth. The contractor is advised to satisfy himself with the likely conditions that may be met with the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering requirements etc., before quoting the rates.

**7.2 CLASSIFICATION OF EXCAVATION**

All materials involved in excavation shall be classified in three categories as follows:

**7.3 ORDINARY SOIL**

This includes excavation in all types of soil including soil containing gravels, moorums, loose boulders, viz. ordinary gravelly soil, hard gravelly soil, wet soil, stiff slushy soil, chettu soil and alacritous strata, but exclusive of disintegrated rock, soft rock/shale.

**7.4 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 chiseling is required.

**7.5 Medium Hard Rock**

This category includes excavation in time stone, sand stone, hard shale and schist fissured rock, without resorting to blasting

**7.6 HARD ROCK**

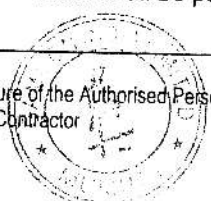
This category includes excavation in hard rock requiring hand or mechanical chiseling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiseling, wedging, the decision of the Engineer shall be final and binding on the contractor.

**7.7 LIMITS OF EXCAVATION**

The trench for laying D.I. pipes of all sizes shall have minimum width as per standards stipulated or as directed by the Engineer – in charge wherever joints are to be made, an additional excavation for pits of size 0.3 m wide X 0.3 m deep or to provide sufficient working space shall be in the bottom of the trench along the width, to facilitate jointing. A minimum cover of 1.0 m shall be maintained above the pipe top, unless otherwise specified or shown in the alignment drawings. Any extra excavation required for providing suitable bedding for the pipeling or for maintaining the grade of the pipeline, shall be paid extra at actual, based on the quoted rates.

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.

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7.8 TRIAL PITS

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 under ground obstructions or soil conditions.

7.9 SLIPS AND SLIDES

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.

7.10 STACKING OF EXCAVATED MATERIAL

The excavated material shall be stacked at least 600 mm away from the sides of the trench.

8. SAFETY MEASURES

The contractor shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.
2. Red lights/ reflectors as can be easily visible from night to dawn. There are to be placed at an interval of 20 m and at all the road crossings or at suitable interval directed by the Engineer.
3. Traffic and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequate safe wooden plank/ board or steel plate over the trenches are to be placed 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 intrusion shall be provided by the Contractor at his cost.

9. 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 by 20m in advance o the pipe length proposed to be laid.

10. 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 reasonability of the contractor with respect to the use of explosives in blasting includes compliance with all laws, rules and regulations or other 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 very 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 thereform. 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,

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sewers, storm drains or other buried structures. The contractor shall advise 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 chistelling 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.

#### 11. CONTRACTOR'S RESPONSIBILITY

The contractor shall be responsible for the adequate pumping, drainage and bailing out 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 extra item.

#### 12. WORKS INCLUDED IN EXCAVATION

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such 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, branching, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to project 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.
6. Excavation for socket hollows.
7. Change of trench location.
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.

#### 13. DISPOSAL OF SURPLUS EXCAVATED MATERIAL

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread 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



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a stream / channel or in any place where the pre-construction surface shall be disposed neither 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. Carriage for lead beyond 13 KM, will, however, be paid by the employer.

**TECHNICAL SPECIFICATION**

**2.0 CODES AND DESIGN AIDS**

All design will be based on BIS or equivalent other international standards and codes (latest revisions), with amendments, if any, as on date. Apart from these codes, specific design guidelines laid in this documents shall be followed.

**2.1 General**

IS : 875-1987 Code of Practice for Design loads (other than Earthquake) for Building & Structures (Part 1 to 5)

IS : 1983 (Part I) – 2002 - Criteria for Earthquake Resistant Design of Structures

IS : 1983 – 1984 Criteria for Earthquake Resistant Design of Structures

SP : 7 – 1983 National Building Code (NBC) of India

**2.2 Concrete Structures**

IS : 456 – 2000 Code of practice for plan & Reinforced Concrete

IS : 3370 (Part I & II)–1965 &  
IS : 3370 (Part III & IV)–1967 Code of practice for Concrete structures for storage of liquids.

SP : 16 – 1980 Design aids for Reinforced concrete to IS : 456

IS : 2974 – 1992 Code of practice for design and construction of raft foundations (Part III)

IS : 2950 – 1981 Code of practice for general construction of raft foundations

**Steel Structures**

IS : 800 – 1981 Code of practice for general construction in steel.

**2.3 Masonry works**

All masonry works shall be as follows :

➤ 230mm thk Brick Masonry using last class brick work in C.M. 1:6 for CW Pump house & HT Panel room, Rapid Gravity Filter house, Dirty Backwash Recycle Pump house & Chemical house.

➤ 115mm thk Brick Masonry using 1<sup>st</sup> class brick work in C.M. 1:6 for Partition Walls & Parapet Walls of pump house & HT Panel room, Dirty Backwash Recycle Pump house & Chemical house.

**2.4 MATERIALS**

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2.5 **Cement**

Ordinary Portland Cement – 33 grade IS269 shall be used-

2.6 **Plain Cement Concrete**

The mud mat/ base lean concrete except UGR, sump, pump house & intake structure shall be as follows –

Elements	Thickness (mm)	Grade
Under base slab of Water Retaining Structures & Footing of Non- Water Retaining Structures	75	1:3:6
All Masonry Wall Foundations	150	1:3:6
Damp proof course at plinth level of masonry walls	40	1:2:4

2.7 **Reinforcement bars**

Reinforcement bars shall be of high yield strength (Fe415) bars conforming to IS:1786-1985.

2.8 **LOADS AND FORCES**

**General**

Buildings and structures shall be designed for the most critical combination of dead loads, superimposed loads, equipment loads, crane loads, wind loads, seismic loads etc.

Design loads and combinations shall comply with the requirements of IS:875 (Part 1 to 4). The following types of loads shall be considered in general for analysis and design of structures and foundations

- Dead Load
- Live Load/ Imposed loads including monorail load
- Wind load
- Seismic load



**2.9 Dead load**

Dead load shall include the weight of all structural and architectural components and other permanent equipments. Unit weight of various materials shall be in accordance with IS:875 (Part-I)

**2.10 Live load/ Imposed loads**

Live loads shall be in general as per IS : 875 (Part II) . However the following minimum live load shall be considered.

- i) **Process Building** (Pump Operating Floor & Filter Gallery)
  - Operating area : 500 kg/m<sup>2</sup>
  - Maintenance area : 500 kg/m<sup>2</sup>
- ii) **Service Platform**
  - Isolated Platform (for valve operation) : 250 kg/m<sup>2</sup>
  - Access Way : 250 kg/m<sup>2</sup>
- iii) **HT Panel room**
  - Panel Floor : 1000 kg/m<sup>2</sup>
- iv) **Office Floor on Filter Gallery** : 300 kg/m<sup>2</sup>
- v) **Staircase**
  - All locations : 300 kg/m<sup>2</sup>
- vi) **Flat roof of Building (accessible)** : 150 kg/m<sup>2</sup>
- vii) **Flat roof Building (inaccessible)** : 75 kg/m<sup>2</sup>
- viii) **Sloped roof Building (inaccessible)** : 75 kg/m<sup>2</sup>
- ix) **Roof slab of reservoir** : 150 kg/m<sup>2</sup>

Reduction in live load shall be as per IS : 875 (Part - 2) and IS: 1893  
 Monorail load shall be considered under live loads . Impact factors for the design of structure supporting monorail hoist shall be as per IS : 875

**2.11 Wind load**

Wind load on building/ structures shall be computed as per IS : 875 (Part - 3) . The parameters for calculation of design wind speed as per IS : 875 (Part - 3) are as follows -

- Basic wind speed, V<sub>b</sub> : 50 m/sec
- Risk Coefficient, k<sub>1</sub> : 1.0
- Terrain, Height, Structure size factor, k<sub>2</sub> : To suit the height of the structure for terrain category-3 and class-B or as appropriate.
- Topography factor, k<sub>3</sub> : 1
- Design wind Speed, V<sub>z</sub> : V<sub>b</sub> X k<sub>1</sub> X k<sub>2</sub> X k<sub>3</sub>
- Design wind Pressure, P<sub>z</sub> : 0.6 X V<sub>z</sub><sup>2</sup>

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The external and internal pressure co-efficient shall be as per respective clauses of IS : 875 (Part-3)

## 12 Seismic load

### Buildings :

Earthquake Load is considered as per IS : 1983 (Part-I) : 2002

- Seismic Zone : (v)
- Damping for Concrete Structure shall be considered as 5%
- Importance Factor : 1
- Response Reduction Factor : 3

- Note : 1. In calculating,  $W_1$ , the weight of walls and columns in any storey is assumed to be shared half between the top and bottom supports and all weights are assumed to be lumped at the level roof or any floor/ plinth beam at column beam junctions. The analysis of frame for seismic will be done using STAAD-Pro software and response spectrum method.
2. Calculation of base shear and distribution of seismic force shall be done using STADD-pro.
  3. Seismic load may be calculated for maximum dead load & appropriate amount of live load to get worst effect on the structure.

## 13 LOAD COMBINATIONS

Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion etc resulting from the most critical combinations of loads as specified below. Permissible stresses for different load combinations shall be taken as per relevant IS codes. Wind and earthquake forces shall not be considered to act simultaneously.

Load combination for design purposes shall be the one that produces maximum forces and effects from the following combination of loads.

- a) Dead Load + Live Load
- b) Dead Load + Live Load + Wind/ Seismic Load
- c) Dead Load + Wind / Seismic Load

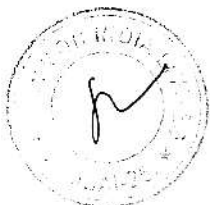
In case of structures bearing monorail loads, live load shall include monorail loads also. Values of partial safety for Limit State Design are considered as per Table 18 of IS : 456-2000

## 14 DESIGN CRITERIA – CIVIL & FOUNDATION WORKS

### BASIS OF DESIGN

i) Except for liquid retaining structures, Limit state method of design, as per IS: 456-2000, shall be adopted for the design of concrete structures.

ii) Liquid retaining structures shall be designed as per IS : 3370.



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b) **FINISHED GROUND LEVEL (FGL) AND FINISHED FLOOR LEVEL (FFL)**

These levels will be determined during approval of design.

c) **SOIL DENSITY**

Unit weight of soil considered in design is  $1.8 \text{ T/m}^3$  (dry).  
Submerged unit weight of soil considered is  $0.8 \text{ T/m}^3$  (sub).

d) **DESIGN GROUND WATER TABLE**

Design Ground water level is considered with reference to existing ground level as per Report on Soil Investigation work to be done by the Contractor to supplement such information given in this document in Section P(I).

e) **BEARING CAPACITY & TYPE OF FOUNDATIONS**

Net safe bearing capacity of soil shall be considered as per Report on Soil Investigation report.

Structures like Clear Water Reservoir with Suction sump, Pump House, HT Panel Room, Rapid Filter House, Flocculation tank, Inclined Plate Settlers & Chemical House are founded on BCIC Pile Foundation.

Lightly loaded Structures like Collection Well, Parshall Flume, Flash Mixer, Clarified Water Channel, Dirty Backwash Water Sump, Sludge Sump & Recycle Pump House & Boundary Wall are founded on Open foundation as per recommendations of above mentioned soil report.

Increase in Net Safe bearing capacity of soil up to 25% is allowable, when the load combination Dead Load + Live Load + Wind/ Seismic Load governs the foundation design. Percentage loss of contact area of footings with the soil for gross pressure is limited to 30%.

f) **DEFLECTION**

The deflection criteria shall conform to clause 23.2 of IS : 456-2000

g) **COVER TO REINFORCEMENT (As per Table-16 of IS : 456-2000)**

Clear cover to main reinforcement shall be as follows.

**Footings and rafts**

Earth Face : 50 mm

Others : 30 mm

**Columns/ Pedestals** : 40 mm

**Beams** : 30 mm

**Slabs**

For moderate exposure : 30 mm

**Liquid retaining structures**

(a) Face in contact with liquid : 30 mm

(b) Face away from liquid but in contact with earth : 40 mm

(c) Free face : 30 mm

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**h) SAFETY FACTORS FOR STABILITY**

Stability against Sliding : 1.5  
Stability against Overturning : 2.0

**2.15 DESIGN CRITERIA – STRUCTURAL STEEL WORKS**

**a) GENERAL**

Structural steel rolled sections and plates shall conform to specified grade "A" of IS : 2062. All materials shall conform to the specifications as per the list of standards given below –

IS : 226/ IS : 2062 Hot rolled sections and plates  
IS : 1363 Hex head bolts, screw and nut of production grade C  
IS : 1364 Hex head bolts, screw and nut of production grade A & B  
IS : 1367 Tech Supply conditions of threaded fasteners  
IS : 2016 Specs for plain washers  
IS : 3502 Specs for chequered plates

Bolts, nuts and washers shall confirm to the requirement of IS : 800

Slop of roof truss shall be 1V : 3H

Roof covering and side cladding for structural steel shed over flocculation tank and inclined plate settlers shall be provided with translucent sheets.

Handrails – 1000 mm high with 32 NB (M) M.S tubes as top-rail, mid-rail and upright.

Toe Plate (100 mm X 5 mm ) shall be provided for all hand railing, except for staircase. Spacing of uprights shall be 1500 mm maximum.

**b) Permissible Stresses**

Permissible stresses in structural members and bolts shall be as specified in IS : 800. Permissible stresses in welds shall be as per IS : 813

**c) Permissible deflections**

The permissible vertical deflections for structural members shall be as specified below -

Sl. No.	Description	Allowable deflection
1	Grider/ beam for supporting dynamic equipment/ hoist	L/ 500
2	Grating/ Chequered plates	L/ 200 or 6 mm whichever is less
3	Other structures/ Structural components	As per relevant IS codes

L represents span of member

**d) Minimum Thickness**

Sl. No.	Description	Minimum Thickness
1	Trusses, purlins, side girts and bracings	6 mm

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Sl. No.	Description	Minimum Thickness
2	Column, Beams	7 mm
3	Gussets	8 mm
4	Stiffeners	8 mm
5	Base Plates	16 mm
6	Chequered plate	6 mm (over plane)
7	Grating	3 mm
8	Structural components (except gratings and chequered plates) which are directly exposed to weather and in - accessible to repainting	8mm

e) **INCREASE IN PERMISSIBLE STRESSES**

Increase in permissible stresses for steel members and connections shall be as per relevant clauses of IS : 800

3.0 **DESIGN CRITERIA**

3.1 The basic layout of the Intake structure, Raw Water Pump House, Water Treatment Plant, Clear Water Reservoir and Pump House, Booster pumping Stations, hill top reservoirs and service reservoirs shall be as per Tender Drawings. The Elevation of the Pump House building and the Reservoir shall be of suitable Architectural design and Drawings and detailing have to be provided by the tenderers. The Tenderer shall submit with his Tender, the Architectural Elevation of the building and the Reservoir. However, the architectural Elevation may have to be modified at the time of approval by the Chief Engineer, Guwahati Development Department for which no extra charge will be paid.

Design and construction of all R. C. C. Structures, brick masonry walls and Foundation shall conform to the latest edition of the following IS Codes.

- a) Loading Standards IS : 875
- b) Earthquake Resistant Design IS : 1893 & IS : 4326
- c) Reinforced and Plain Concrete IS : 456
- d) Foundations IS : 1080, IS : 2950  
IS : 2911 & IS : 2974
- e) Liquid Retaining Structures IS : 3370
- f) Structural Steel IS : 800
- g) Reinforcement  
Mild Steel IS : 456 & IS : 432  
Ribbed Tor Steel IS : 1786 & IS : 1139
- h) Masonry and Brickwork IS : 1905 & ISS : 2212
- i) National Building Code of India

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3.2. The clear water reservoir including inlet control chamber and Overflow Pits, the Pump House Building the Pump Suction Sump and Unloading Bay shall be designed with deep Cast-in-situ RCC bored Pile Direct Mud Circulation Foundation. It is to be noted that no foundation other than Pile Foundation will be accepted.

Such piles shall be bored Cast-in-situ R. C. C. Piles (bidder to design diameter, compression, tension & shear capacities of pile foundation). The design, construction and workmanship for these piles shall fully conform to and satisfy the codal requirements of IS 2911 (Latest Edition). Concrete to be used in Piles shall be of M-20 Grade having a Cement content not less than 400 kg/m<sup>3</sup>. Reinforcement in piles shall be in conformity with the requirements contained in IS:2911 (Latest Edition). The minimum area of Longitudinal Reinforcements shall be as per Codal requirements and such requirements shall be provided for the full length of piles. For piles subject to Upward Tension, reinforcement shall be provided throughout the full length and such reinforcement shall be designed on the basis of upward load they are supposed to carry.

The safe working loads of the R. C. C. Cast-in-situ bored piles should be that as computed as per IS:2911 on the basis of Sub-soil Parameters of the Site with a minimum Factor of Safety 2.5 (Compression) and 3.0 (Up lift) applied there on or that indicated in the following table, whichever is less.

Chart showing pile capacities :

Av. Ground Level (more or less)

Cut off level

Termination depth

Length of pile

Pile diameter (mm)

Cut off Level R. L.

Safe Working Load (Tonns) under

Compression

Safe Working Load (Tonns) under

Up lift

Pile Termination depth below

Cut off level (m)

\* F.S. stands for Factor of Safety

**SUCCESSFUL BIDDERS SHALL HAVE TO SPECIFY LEVEL, SIZES AND HIGHTS**

3.3 In case of any change in Cut off levels, necessary adjustment in the safe working load will be made. Pile Termination levels shall be chosen carefully. The safe working load of the piles shall be substantiated by Routine Load Test. Sub-soil investigation after award of contract by the Tenderer shall be witnessed by the Engineer-in-Charge or his authorized Representative. The Pile Termination Level shall be fixed by the successful bidders.

These Piles shall be designed for Seismic Condition also. The Important factor for Seismic Analysis of Structure shall be 1.50. The Tenderer shall include in his Lump Sum price the cost for Load Test of at least working pile (Routine Test) per 100 piles or part thereof. The testing

should be as per codal Stipulations. The Tenderer shall also included in his price the cost of installation of one R. C. C. cast-in-Situ, Bored Non working pile having same Structural Details as of Working Pile and Pull out Test of the same as per Codal Stipulations.

- 3.4 If during initial pile load testing at site, the safe load bearing capacity is found to be more than what has been tabulated in the table under "chart showing pile capacities", the safe load as furnished by the department in the table shall be followed for which no extra claim will be entertained. In case, the safe load bearing capacity during load testing of piles of site is found to be less than what has been provided in the table furnished by the department, the lesser value shall be followed, in this case also, no extra claim be entertained .
- 3.5 While design the Foundation of different structures, the Tenderer may use the Soil Investigation results provided in the Tender.

The successful Tenderer shall have to undertake fresh investigation of soil at 3 (three) locations at each site of construction as approved by the Department at his own cost for design of the Foundation properly and for detailing the piles in conformity with the Soil Test Report. In no case, extra claim over the Quoted price as accepted by the Department, will be entertained.

In the event of variation in soil Data between NIT Bore Hole Logs and those obtained by the Contractor during execution, the more Conservative Values obtained from the two sets of Reports shall be adopted for design prorata additional claim over the Quoted Price shall be considered in case the SE is convinced and allows additional or increased dia of piles in the event of soil being found unfavourable to what had been in the NIT Bore Hole Log.

**4. DESIGN PARAMETERS**

**4.1 Loadings**

**A) Clear Water Reservoirs**

A park is proposed to be constructed on the roof of the Reservoir at main reservoir of WTP and reservoir at BPS-II and II. The roof is to be designed for a live load of 500 kg/M<sup>2</sup> and the superimposed Load of saturated earth of 450 mm. depth No. relief shall be allowed due to this Superimposed Load of saturated earth while computing the Uplift on the reservoir.

B) i) Live Load on Roof	150 Kg./Sq.m.
ii) Live load on pump house Floor	500 Kg./Sq.m.
iii) Live load on Control Room Floor	300 Kg/Sq.m.
Weight of each Empty Pump (approx.)	2000 Kg.
Weight of each Motor (approx.)	2000 Kg.
Weight of 400 mm dia Sluice Valve (approx.)	900 Kg.
Weight of 300 mm diameter Sluice Valve (approx.)	500 Kg.
Weight of 300 mm diameter P. D. V. (approx.)	300 Kg.
Load due to Electric Panel (approx.)	1200 Kg. / Sq.m.
Weight of 400 mm dia pipe (approx.)	300 Kg./m

N.B. Loading details given herein above are tentative and subject to verification during final execution. No extra cost will be paid to the Contractor on account of variation within +- 30 % limit.

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