Design Criteria for RWSS as finalized by the representatives of implementing agencies and SWSM as on 4-4-2013

S.N.	*Existing Design Criteria*	*Proposed Design Criteria*
1	**Design Period and Population:-**The design period for the schemes was finalized as 15 years. The base year shall be the year of the commissioning of the scheme. The base year population shall be projected from 2001 census population of the villages and increase in the population from 2001 to the base year shall be taken the same as of respective Tehsil from the year 1991 to 2001. Increase in the population from the base year to the design period of 15 years shall be taken as 30% of the base year population. In case the 2001 census population of the individual villages is not available then the design population shall be taken as 150% of the 1991 population or in case of habitation, as per pre-feasibility study.	1 **Design Period and Population:-**The design period for the *gravity* schemes should be taken as *15 years and for pumping schemes it should be 30 years*. The base year shall be the year of the commissioning of the scheme. The base year population shall be projected from *2011* census population of the villages and increase in the population from *2011* to the base year shall be taken the same as of respective Tehsil from the year *2001* to *2011*. Increase in the population from the base year to the design period of 15 & 30 years shall be taken as 30% *and 50%* of the base year population *respectively*. *In exceptional cases where Census population is not available then the actual present population should be taken as verified by Tehsil/Block level officers.*
2	RATE OF WATER SUPPLY AND WATER DEMAND The rate of water supply shall be 40 lpcd through stand post and 15% additional provision for water loss in distributions system may be taken in water demand. The raw water demand should be kept 10% above the treated water requirement. In case of multi stage pumping, the treated water requirement shall be kept 10% above the actual demand.	2 RATE OF WATER SUPPLY AND WATER DEMAND *The rate of water supply shall be 55 lpcd through stand post and 70 LPCD for private connections and 15% additional provision for water loss in distributions system may be taken in water demand* The raw water demand should be kept 10% above the treated water requirement. In case of multi stage pumping, the treated water requirement shall be kept 10% above the actual demand *Schemes should be designed for minimum 50% private water connections at initial stage which should be gradually raised to 75% in order to improve financial sustainability of RWSS schemes .*
3	SOURCE : 3.1 SURFACE SOURCE:- The discharge of the surface source shall normally be measured for 3 consecutive years in the driest season and lowest discharge shall be adopted. In case the scheme is to be prepared urgently if 2 years discharges is available 75% of the lower discharges shall be adopted and if only one year discharge is available then 50% of year's driest discharge shall be taken as available discharges. In no case the adopted discharge should be more than 75% of total discharge of source. It was decided to keep minimum safe yield as 9 LPM. 3.2 TUBE WELL SOURCE 3.2.1. The requirement of tube wells shall be worked out to fulfill the demand	Agreed

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	up to 15 years, taking each tube well to be working for 16 hours. 3.2.2. Data regarding discharge and depth in respect of tube wells already exiting in the neighborhood of the proposed water works shall have to be collected and the discharge and other particular of the proposed tube wells should be based on such data 60% of sand free discharge available at 4.5 meters draw down should normally be adopted. Where ever possible the central ground water board or state ground water Organization must be consulted for pin pointing the position of the tube well. Specially for those areas where the possibility of good discharges is in doubt or where there is no existing tube well near-by, maximum help must be taken from the Ground Water Survey Reports. 3.2.3. Where ever success of tube well is in doubt, first a pilot bore be sunk and the strata chart should be prepared and sent to the Ground Water Board for advice regarding the suitability of the bore for obtaining potable water. 3.2.4. The tube well should be harnessed to the requirement of scheme only.	
4	PUMPING PLANTS :- 4.1 FOR TUBE WELLS:- Suitable Electric driven pump shall be provided on the tube well. Submersible pumps are generally being proposed rather than VT pumps for w/s schemes under this programme. 4.2 RAW WATER PUMPING PLANT(For Surface Sources) The raw water pump shall be proposed for low head and as far as possible the head shall not exceed 30 meters.	4 PUMPING PLANTS :- *The pumping plants should be designed for technical life as 15 years.* 4.1 FOR TUBE WELLS:- Suitable Electric driven pump shall be provided on the tube well. Submersible pumps are generally being proposed rather than VT pumps for w/s schemes under this programme. *As per GoI norms, the stars rated-electric motors-energy efficient and pumps may be used.* 4.2 RAW WATER PUMPING PLANT(For Surface Sources) The raw water pump shall be proposed for low head and as far as possible the head shall not exceed 30 meters.
5	STAGE OF PUMPING FOR MULTI STAGE PUMPING :- In one stage head for pumps shall not exceed 300 meters. And numbers of stage shall be so evenly distributed so that the pumps of almost same duty are proposed at each stage as for possible for the ease of the maintenance	5 STAGE OF PUMPING FOR MULTI STAGE PUMPING :- In one stage head for pumps shall not exceed *500 meters (Since due to advancement of technologies pumps are readily available in more than 500 mts range)*. And numbers of stage shall be so evenly distributed so that the pumps of almost same duty are proposed at each stage as far as possible for the

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		ease of the maintenance.
6	**PUMPING HOURS:-** **6.1 SURFACE SOURCE:-** The economics of the system from raw water intake to storage reservoir at the final stage for 16 hours working shall be worked out keeping in view that either the filter be designed for 24 hours operation with raw water & clear water storage or the filters are also designed for 16 hours operation with no Raw Water or clear water storage. The economical system of the two shall have to be adopted. Any how the minimum capacity of the clear water storage of 2 hours at the treatment works and ½ hours storage at each Intermediate pumping station is absolutely essential. **6.2 TUBE WELL:-** The tube well shall be proposed to work 8 hours at the end of 15 years.	6 **PUMPING HOURS:-** **6.1 SURFACE SOURCE:-** The economics of the system from raw water intake to storage reservoir at the final stage for 16 hours working shall be worked out keeping in view that either the filter be designed for 24 hours operation with raw water & clear water storage or the filters are also designed for 16 hours operation with no Raw Water or clear water storage. The economical system of the two shall have to be adopted. Any how the minimum capacity of the clear water storage of *4 hours* at the treatment works and *1hours* storage at each Intermediate pumping station is absolutely essential. **6.2 TUBE WELL:-** The tube well shall be proposed to work *16* hours at the end of 15 years.
7	**NUMBER OF PUMPS:-** **7.1 RAW WATER:-** Number of pumps will depend upon the availability and efficiency of the indigenous make pumps available in the market if efficient full capacity pumps are available then 2 pumps of full capacity should be installed, there by giving 100% stand bye. Otherwise 3 numbers of ½ capacity pumps should be provided, giving 50 % stand bye. In both cases, spares required for 2 years shall be arranged but in no case spare pump should be provided. The efficiency and performance should be as per I.S.I. specifications. The specified rating should be chosen at which the pump shall have to work for most of the time **7.2 CLEAR WATER PUMPING PLANTS:-** ½ capacity pump, 3 no. or 1/3 rd capacity 4 no. shall be provided. The choice will depend upon the availability and efficiency of the pumps. The efficiency and performance should be as per I.S.I. specification. The specified rating	Agreed

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	should be chosen at which the pump shall have to work for most of the time.	—
8	**INTAKE WELL:-** Size of the intake well shall be so chosen as to fulfill the minimum distance requirement between pumps as per electricity rules and it shall be able to accommodate switch board, starters etc. Space for over hauling or major repair of the pumps. In no case it shall be less than 4 meters dia. The lay out shall be befitting to the site conditions. The intake shall be located at a safe place above H.F.L.where water is either available throughout the year or though an approach channel and is not subjects to vagaries when the steam is in floods.	Agreed
9	**ECONOMIC SIZE OF RISING MAIN:-** For working out the economic size of rising main 10% rate of interest should be taken in to account irrespective of the interest rates prescribed for any particular scheme.	9 **ECONOMIC SIZE OF RISING MAIN:-** For working out the economic size of rising main 10% rate of interest or ***as per Manual of CPHEEO*** should be taken in to account irrespective of the interest rates prescribed for any particular scheme.
10	**SIZE OF PUMP HOUSE:-** 10.1 The size of pump house for tube well as given below may be adopted up to 10BHP pumps, 2.4m.x3m.x3.6m. 12.5BHP to 40BHP pumps 3.6m.x3m.x3.6m. Above 40 BHP as per requirement. 10.2 The size of the pump house for clear water pumps shall be so chosen as to accommodate the pumps, switch board, starters and other appurtenances satisfying the provisions of electricity rules and befitting to the site conditions with adequate space for over hauling and major repairs of one pump at a time.	Agreed
11	**TREATMENT:-** **11.1 GADHERA TAPPING:-** In case of gravity schemes in hills, where the water is being taken from Gadhera, tapping be done by using French well, to be installed along the bank/shore of gadhara as per norms circulated vide L.No. 167/App-III/2 Dt. 23-10-2001(copy enclosed). No separate roughening filter shall be provided as the French well will it self work as roughening filter.	**TREATMENT:-** **11.1 GADHERA TAPPING:-** In case of gravity schemes in hills, where the water is being taken from Gadhera, tapping be done by using French well ***as far as possible***, to be installed along the bank/shore of gadhera as per norms circulated vide L.No. 167/App-III/2 Dt. 23-10-2001(copy enclosed). No separate roughening filter shall be provided as the French well will it self work as roughening filter.

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	11.2 SPRING SOURCES:- In case of spring source in hills, steel intake chamber of 0.6x0.6 meter. normally be provided and the water from this chamber shall be led to the screening chamber whose literature has already been circulated vide Lt. no. 167/App-111/2, Dt.23.10.01. **11.3 FOR STREAM AND RIVER WATER:-** The design of treatment plant shall be a per criteria given in the Manual of Water Supply of Govt. of India. The choice of type of filter shall be under: (i) First choice should be given to slow sand filters. (ii) Where slow sand filter is not feasible the next choice should be given to the pressure filters. (iii) If the above two are not feasible then the next choice be given to rapid gravity filters. (iv) In remote area where man power can not be utilized to operate the filter, provision for auto wash filter can be tried on approval of higher authorities. The feasibility will also depend upon the availability of land, capacities in which pressure filter are available in the market and the economics of each type.	**11.2 SPRING SOURCES:-** In case of spring source in hills *as far as possible*, steel intake chamber of 0.6x0.6 meter. normally be provided and the water from this chamber shall be led to the screening chamber whose literature has already been circulated vide Lt. no. 167/App-111/2, Dt.23.10.01. **11.3 FOR STREAM AND RIVER WATER:-** The design of treatment plant shall be as per criteria given in the Manual of Water Supply of Govt. of India. The choice of type of filter shall be under: *(i) Efforts should be made to avoid the treatment of water by constructing infiltration well as per river bank filteration technology. Keeping in view the scarcity of community land at the village level slow sand filters are not very practical.* *(ii)* Where *infiltration well* is not feasible the next choice should be given to the *slow sand filters and the pressure filters* *(iii)* If the above *three* are not feasible then the next choice be given to rapid gravity filters. *(iv)* In remote area where man power can not be utilized to operate the filter, provision for auto wash filter can be tried on approval of higher authorities. The feasibility will also depend upon the availability of land, capacities in which pressure filter are available in the market and the economics of each type.
12	**STORAGE CAPACITY OF CLEAR WATER RESERVOIR:-** **12.1 FOR PLAINS:-(PUMPING SCHEMES)** 8 hours demand at the end of design period. **12.2 FOR HILLS:- (PUMPING SCHEMES)** 12.2.1.The minimum storage of clear water at treatment works shall be for 2	12 **STORAGE CAPACITY OF CLEAR WATER RESERVOIR:-** **12.1 FOR PLAINS:-(PUMPING SCHEMES)** 8 hours demand at the end of design period. **12.2 FOR HILLS:- (PUMPING SCHEMES)** 12.2.1.The minimum storage of clear water at treatment works shall be for *4*

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	hours pumping but at each intermediate of final pumping station shall be ½ hour pumping. Beside above 8 hours storage at average flow shall be provided at each village with the provision that at no place a storage tank less then 2 Kl shall be proposed. 12.2.2 In case of gravity scheme where the source has a discharge of more then 2.4 times of the required average discharge and if 25mm pipe is sufficient to take the peak discharge (peak factor 2.4) and financially economical then there is no need of providing any storage reservoir but suitable arrangements for chlorination at source will be made for disinfection. In case the discharge of the source is less than 2.4 times or is equal to the average discharge required for the scheme, ½ day's storage should be provided.	***hours*** pumping but at each intermediate of final pumping station shall be ***1 hour*** pumping. Beside above ***12 hours*** storage at average flow shall be provided at each village with the provision that at no place a storage tank less then 2 Kl shall be proposed. 12.2.2 In case of gravity scheme where the source has a discharge of more than 2.4 times of the required average discharge and if 25mm pipe is sufficient to take the peak discharge (peak factor 2.4) and financially economical then there is no need of providing any storage reservoir but suitable arrangements for chlorination at source will be made for disinfection. In case the discharge of the source is less than 2.4 times or is equal to the average discharge required for the scheme, half day's (12 hours) storage should be provided.
13	**CHLORINATORS:-** 13.1. For disinfection, chlorinator should be provided on the roof of CWR near Inlet Pipe as far as possible. Chlorination should be done at the CWR so as to provide sufficient contact period for the chlorine to react. 13.2 Differential pressure feed type chlorinators should be provided in case of T.W. source for 15 years requirement as these can be added or replaced after 15 years as the case may be. For deciding the capacity of the chlorinators total daily requirement of chlorine should be estimated on the basis of the daily average consumption during summers. The peak and the minimum rate requirements should be taken in to consideration. All chlorinator shall have a range of ten times between the maximum and the minimum dose that they can administer. 13.3 Chlorination chamber and control system should be made at the top of the reservoir as far as possible to facilitate effective chlorination. Normal chlorine dose required to disinfect water is not to exceed 2 PPM as for minimum capacity the chlorinator should be able to give a dose of 0.5 PPM so that 0.2 PPM is available as residual chlorine. In case pre-chlorination of surface water is considered necessary, chlorinator of suitable capacity may be	Agreed

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	proposed at a suitable point.	
14	**DISTRIBUTION SYSTEM:** 14.1 The location of stand posts in each individual village shall be identified and the distribution shall be so proposed as to give a minimum head of 3 mtr at each stand post(at peak time). The minimum size of the distribution main shall normally be 20 mm(I.D.) but on the branch line leading to a stand post, the pressure should be reduced by choosing a ferrule and insertion of check tubes so that the terminal pressure at the stand post remains almost the same at the first and the last stand post. 14.2 A minimum of one stand post shall be provided for the weaker section residing in the village. Each Hamlet should have at least one stand post. The number of stand posts shall generally be one for five households or 25 design population of the agglomeration. But in the case of scattered population in the hills where the houses may be at different elevation the stand posts should be located in such numbers that no persons is required to negotiate a vertical height of 50 meters up or down. It was also decided that keeping in view the habitations in hilly areas there will be one pubic stand post for every 5 house holds/25 no. of population. 14.3 Suitable provision for disposal of waste water from the stand posts shall be made in the scheme so that no waste water collects and creates nuisance in the vicinity of any stand post.	**14 DISTRIBUTION SYSTEM:** 14.1 ***For plain areas (peri urban areas) distribution network guidelines as given in NRDWP guidelines (Annnexure 4) should be adhered to for network design. For other areas following may be followed:*** ***14.2*** The location of stand posts in each individual village shall be identified and the distribution shall be so proposed as to give a minimum head of 3 mtr at each stand post(at peak time***) for private connection minimum head should be 6 mtr.*** The minimum size of the distribution main shall normally be 20 mm(I.D.) but on the branch line leading to a stand post, the pressure should be reduced by choosing a ferrule and insertion of check tubes so that the terminal pressure at the stand post remains almost the same at the first and the last stand post. ***14.3*** A minimum of one stand post shall be provided for the weaker section residing in the village. Each Hamlet should have at least one stand post. The number of stand posts shall generally be one for five households or 25 design population of the agglomeration. But in the case of scattered population in the hills where the houses may be at different elevation the stand posts should be located in such numbers that no persons is required to negotiate a vertical height of ***10 meters*** up or down. 14.4 Suitable provision for disposal of waste water from the stand posts shall be made in the scheme so that no waste water collects and creates nuisance in the vicinity of any stand post.

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15	APPURTENANCES:- 15.1 FIRE HYDRANTS:- Only in plain area these should be provided, these should be provided one in each revenue village having design population of more than 200 provided the minimum size of distribution main as per design is not less than 110mm O.D. and village in approachable by a road fit for movement of fire brigade vehicle. 15.2 AIR VALVES:- These shall be provided at all summits in the pipe lines and other suitable places. 15.3 SCOUR VALVES:- They shall be provided at low points in such a way that the entire distribution system could be washed and water drained out with out causing any nuisance. 15.4 SLUICE VALVES:- They shall be suitably provided to control flow and to isolate suitable section of distribution system. On mains larger than 300 mm dia the size of sluice valves shall be 2/3rd of the dia of pipe line. 15.5 REFLUX VALVES:- These shall be provided on the delivery side of the pump and at other suitable points. In case of mains of more than 300mm dia. They shall be of 2/3rd dia of the main.	APPURTENANCES:- 15.1 FIRE HYDRANTS:- Only in plain area these should be provided, these should be provided one in each revenue village having design population of more than 200 provided the minimum size of distribution main as per design is not less than 110mm O.D. and village in approachable by a road fit for movement of fire brigade vehicle. 15.2 AIR VALVES:- These shall be provided at all summits in the pipe lines and other suitable places. 15.3 SCOUR VALVES:- They shall be provided at low points in such a way that the entire distribution system could be washed and water drained out with out causing any nuisance. 15.4 SLUICE VALVES:- They shall be suitably provided to control flow and to isolate suitable section of distribution system. On mains larger than 300 mm dia the size of sluice valves shall be 2/3rd of the dia of pipe line. 15.5 REFLUX VALVES:- These shall be provided on the delivery side of the pump and at other suitable points. In case of mains of more than 300mm dia. They shall be of 2/3rd dia of the main.
16	STAFF QUATERS:- 16.1 Provision for the residential quarters for only one operator and one chowkidar for each pumping station should be made as per approved type design. 16.2 For surface water supply scheme in plains in addition to the residential quarters for operator and chowkidar as given above the accommodation for residential quarters for a water works engineer should also be provided conforming so the standards for Junior Engineer and in the case of 4 to 5	16 STAFF QUATERS:- 16.1 Provision for the residential quarters for only one operator and one chowkidar for each pumping station should be made as per approved type design. ***The State Govt. policies should also be taken in to account for this item.*** 16.2 For surface water supply scheme in plains in addition to the residential quarters for operator and chowkidar as given above the accommodation for residential quarters for a water works engineer should also be provided conforming so the standards for Junior Engineer and in the case of 4 to 5

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	scheme for groups of village, one staff quarters for A.E. should be provided	scheme for groups of village, one staff quarters for A.E. should be provided.
17	**DEVELOPMENT OF WATER WORKS SITE:-** 17.1 Barbed wire fencing as per type design be provided around the water works compound. 17.2 Proper drainage of water works compound should be ensured. 17.3 The length of the proposed roads inside the compound should be minimum. However, access to the pump house, chlorinating plant or O.H.Tank should not pose a problem in rainy season. 17.4 The compound gate should be 3.6 metr. wide. A separate 1.2m wide wicket gate may also be provided as an approach for the staff quarters. 17.5 For a tube well scheme 2500 Sq. meters area for the water works may normally be sufficient. In case more than one tube well is proposed in the scheme then land for other tube wells should be arranged separately at the rate of about 400 sq. meters per tube well at suitable sites.	**17 DEVELOPMENT OF WATER WORKS SITE:-** 17.1 Barbed wire fencing/*boundary wall* as per type design be provided around the water works compound. 17.2 Proper drainage of water works compound should be ensured. 17.3 The length of the proposed roads inside the compound should be minimum. However, access to the pump house, chlorinating plant or O.H.Tank should not pose a problem in rainy season. 17.4 The compound gate should be 3.6 metr. wide. A separate 1.2m wide wicket gate may also be provided as an approach for the staff quarters. 17.5 For a tube well scheme *adequate* area for the water works may normally be sufficient. In case more than one tube well is proposed in the scheme then land for other tube wells should be arranged separately at the rate of about 400 sq. meters per tube well at suitable sites. *Due to scaracity of community land it needs to be suitably amended as per site conditions.*
18	**DESIGN FORMULA FOR FLOW IN CONDUITS AND COEFFICIENT OF ROUGHNESS:-** 18.1 Hazen & William's formula for pressure conduits and Manning's formula for gravity flow conduits are to be adopted. It is given below:- $V=1.318\ CR^{0.63}\ S^{0.54}$ Where V is average velocity of flow in fps. R is hydraulic radius in ft = $\frac{\text{area of flow}}{\text{Wetted perimeter}}$ =D/4 D is diameter in ft. S is hydraulic gradient. C is Hazen William coefficient and depends on the pipe material and age.	**DESIGN FORMULA FOR FLOW IN CONDUITS AND COEFFICIENT OF ROUGHNESS:-** 18.1 Hazen & William's formula for pressure conduits and Manning's formula for gravity flow conduits are to be adopted. It is given below:- $V=1.318\ CR^{0.63}\ S^{0.54}$ Where V is average velocity of flow in fps. R is hydraulic radius in ft = $\frac{\text{area of flow}}{\text{Wetted perimeter}}$ =D/4 D is diameter in ft. S is hydraulic gradient. C is Hazen William coefficient and depends on the pipe material and age.

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	The following values of coefficient of 'C' in Hazen William's formula be adopted. | Conduct Material	Recommended Value for design purposes | |---|---| | a) Cast Iron | 100 | | b) Galvanized Iron | 100 | | c) Steel pipes with riveted joints | 95 | | d) Steel pipes with welded joints | 100 | | e) Concrete pipes | 110 | | f) Asbestos Cement pipes | 120 | | g) P.V.C. pipes | 140 | **18.2 PEAK FACTOR:-** Peak factor of 2.4 is to be provided. **18.3 TERMINAL PRESSURE:-** The terminal pressure shall be kept as 6 meters but reduced to 3 meters at stand posts.	The following values of coefficient of 'C' in Hazen William's formula be adopted. | Conduct Material	Recommended Value for design purposes | |---|---| | h) Cast Iron | 100 | | i) Galvanized Iron | 100 | | j) Steel pipes with riveted joints | 95 | | k) Steel pipes with welded joints | 100 | | l) Concrete pipes | 110 | | m) Asbestos Cement pipes | 120 | | n) P.V.C. pipes | 140 | *Note: The coefficient C should be suitably modified as per Table attached as **Annexure 1 to** take in account age and material of the pipe. **If the value of modified C is less than 50 then the old pipe shall not be used.*** **18.2 PEAK FACTOR:-** Peak factor of 2.4 is to be provided. **18.3 TERMINAL PRESSURE:-** The terminal pressure shall be kept as 6 meters but reduced to 3 meters at stand posts.
19	**INFLATION:-** 19.1 Inflation factor for water supply has been decided as 10% per year after the year of preparation of project.	**19 INFLATION:-** 19.1 Inflation factor for water supply has been decided as 10% per year or ***as per GoI norms*** after the year of preparation of project.
20	**IN ADDITION TO THE ABOVE FOLLOWING DECISIONS WERE TAKEN AFTER DUE CONSIDERATION.**	**IN ADDITION TO THE ABOVE FOLLOWING DECISIONS WERE TAKEN AFTER DUE CONSIDERATION.**

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1) The water demand for cattle is not to be added in total water demand of water supply schemes.	1) The water demand for cattle is not to be added in total water demand of water supply schemes.
2) Additional provisions for water shall be made for schools and other Government buildings @ 10 LPCD in water supply schemes.	2) Additional provisions for water shall be made for schools and other Government buildings @ 10 LPCD in water supply schemes.
3) Additional provisions will be made for water demand for primary health centre @ 1000 liters per day.	3) Additional provisions will be made for water demand for primary health centre @ 1000 liters per day. *For institutional/industries/commercial demand 5% extra will be added in the water demand.*
4) The biological and chemical tests shall be conducted to ensure the quality of drinking water from the source before the start of the construction activities, and necessary treatment plants shall be constructed so that an odourless drinking water with maximum 5 NTU turbidity is available in CWR. The quality norm for drinking water will be as per IS 10500:1991 code.	4) The biological and chemical tests shall be conducted to ensure the quality of drinking water from the source before the start of the construction activities, and necessary treatment plants shall be constructed so that an odourless drinking water with maximum 5 NTU turbidity is available in CWR. The quality norm for drinking water will be as per IS 10500:1991 code.
5) The CWR shall be constructed with RCC.	5) The CWR shall be constructed with RCC. *For smaller size prefabricated readymade storage tanks should be preferred.*
6) The minimum diameter of pipeline shall be 20 MM.	6) The minimum diameter of pipeline shall be 20 *mm for distribution network.*
7) In hilly areas the GI pipe of medium class (B), MS, ERW and CI pipes and in plane area PVC pipes of 6 kilogram/cm^2 capacity, HDPE and MDPE pipes shall be used.	7) In hilly areas the GI pipe of medium class (B), MS, ERW and CI pipes and in plane area PVC pipes of 6 kilogram/cm^2 capacity, HDPE and MDPE pipes shall be used.
8) A minimum of 0.6 meter of terminal pressure shall be maintained in the pipe feeding the CWR and BPT.	8) A minimum of 0.6 meter of terminal pressure shall be maintained in the pipe feeding the CWR and BPT.
9) The minimum working pressures in medium class GI pipes are as follows:-	9) The minimum working pressures in medium class GI pipes are as follows:-

Pipe diameter	Working pressure (Minimum)
25 mm	210 meter
32 – 40 mm	176 meter
50 – 80 mm	140 meter
80 – 100 mm	105 meter
125 mm	105 meter

Pipe diameter	Working pressure (Minimum)
15-25 mm	210 meter
32 – 40 mm	176 meter
50 – 80 mm	140 meter
80 – 100 mm	105 meter
125 mm	105 meter

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	150 mm	88 meter
	PVC pipes	60 meter
	10) The minimum velocity of flow of water in the pipelines shall be 0.6 meter per second. 11) The minimum value of C in HDPE/MDPE/LDPE shall be 140. 12) The depth of the trench shall be 0.6 meter in hilly areas and 1.0 meter in plains. 13) A provision of 100% additional standby pumps shall be made in raw water pump house and 50% - 75% standby pumps shall be made for CWR.	150 mm | 88 meter PVC pipes | 60 meter 10) The minimum velocity of flow of water in the pipelines shall be 0.6 meter per second. 11) The minimum value of C in HDPE/MDPE/LDPE shall be 140. 12) The depth of the trench shall be 0.6 meter in hilly areas and 1.0 meter in plains. 13) A provision of 100% additional standby pumps shall be made in raw water pump house and 50% - 75% standby pumps shall be made for CWR.
21	GENERAL:- Where the feeder main passes through a low lying village a separate main should be provided for the demand of the low lying region with adequate pressure reducing and control devices, so that the villages further beyond this low lying village are able to get water at adequate pressure and in adequate quantity only one tapping from the feeder main shall be made for each village and if necessary distribution mains of suitable sizes shall be laid with in the village. Index plan should be prepared on survey map and proposal works should be shown on survey map.	Agreed

Enclosure: Annexure 1.

(S D S Mehta) G.M. Appraisal UJN	(G. C. Pandey) G.M. SWAp UJN	(H. K. Pandey) S. E, UJS	(R. K. Rajwar) Unit Co-ordinator (Eng.) PMU	(P. K. Goel) Executive Engineer SWSM	(S. K. Goel) Chief Engineer SWSM

Value of 'C' for GI Pipes at different Ages

Annexure 1

$$C1 = \frac{C}{(1+0.03 \times n)^{0.54}} \times \left(1 - \frac{0.254 \times n}{d}\right)^{2.63}$$

n - no. of year
D- dia of pipe in mm
C value for GI new pipe=100

Age of PIPE (Years)	Valve of 'C' with no allowance for reduction in diameter	PIPE DIAMETER (mm) Valve of 'C' after making allowance for decrease in diameter								
		15	20	25	32	40	50	65	80	100
1	98	94	95	96	96	97	97	97	98	98
2	97	89	91	92	93	94	94	95	95	96
3	95	83	86	88	90	91	92	93	93	94
4	94	78	82	84	86	88	89	90	91	92
5	93	73	78	81	83	85	87	88	89	90
6	91	69	74	78	80	83	84	86	87	88
7	90	65	71	74	78	80	82	84	85	86
8	89	61	67	71	75	78	80	82	83	84
9	88	57	64	68	72	75	78	80	81	83
10	87	53	61	65	70	73	76	78	80	81
11	86	50	58	63	67	71	74	76	78	80
12	86	47	55	60	65	69	72	75	76	78
13	84	44	52	58	63	67	70	73	75	77
14	83	41	49	55	61	65	68	71	73	75
15	82	38	47	53	59	63	66	70	72	74
16	81	35	45	51	57	61	65	68	71	73
17	80	33	42	49	55	59	63	67	69	71
18	79	30	40	47	53	58	62	65	68	70
19	78	28	38	45	51	56	60	64	67	69
20	78	26	36	43	49	54	59	63	65	68

Note- (i) Assume that the increase of loss of head due to tuberculation etc. amount to 3 percent per year.

(ii) Assume that the diameter of the pipe is reduced by tuberculation at the rate of 0.010 inch per year and that the value of 'C' must be modified to correct for this.

(iii) Calculation based on assumption that Intial value of 'C' for GI Pipes as 100.