

Training for AEs, A.A.Es(Civil)-GWSSB

Timing & Vanue:5th Sept 2018, G.J.T.I., Gandhinagar

Contents

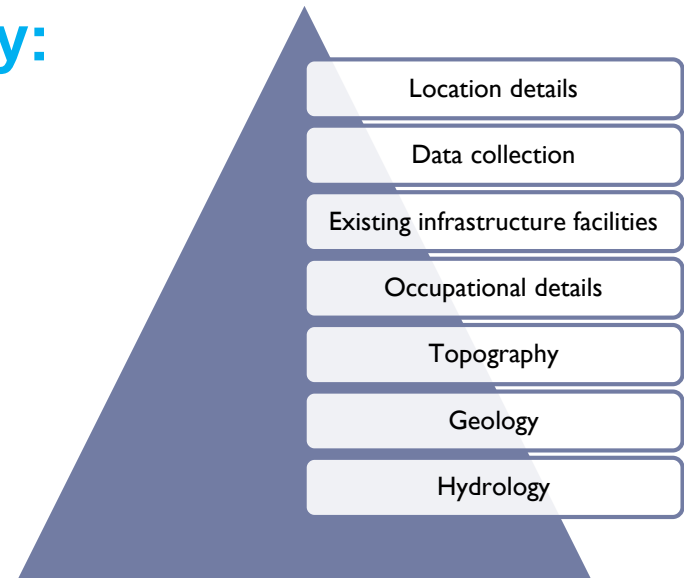
1. Project Preparation by different Govt. Agencies
2. Administrative Approval – Stages
3. Project Preparation - Stages

PWD Procedure:

- Overall Technical Sanctioned (OTS)
- Administrative Approval(AA)
- Detailed Technical Sanction(DTS)
- Draft Tender Papers(DTP)

Project Preparation - Chronology:

- Location details
- Data collection
- Existing infrastructure facilities
- Occupational details
- Topography
- Geology
- Hydrology



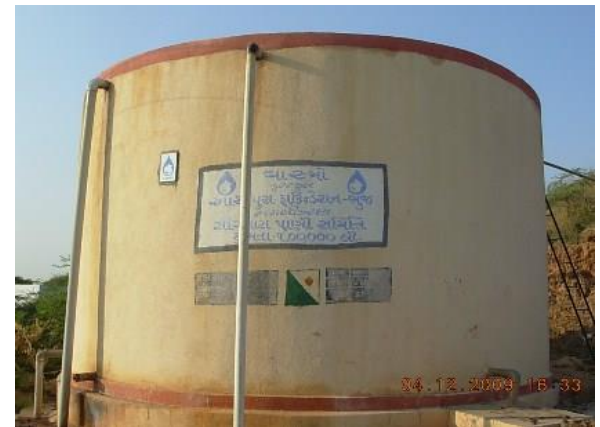
Water Supply Project Preparation

Project Preparation:

- Existing water supply facilities
- Population forecast
- Water demand projection
- Proposed water supply scheme
- Drawings

PWD Procedure:

- Overall Technical Sanctioned (OTS)
- Administrative Approval(AA)
- Detailed Technical Sanction(DTS)
- Draft Tender Papers(DTP)



Water Supply Project Preparation

Govt. Departments

Roads & Building
Public Health Engineering Dept.
S.T. Dept.
W/S Dept. etc

S.T. Department

Public transportation work
Staff – Drivers/Conductors/Mech. wing for repairs etc.
Vehicles – Buses
Bus stand/Bus stops
No civil engineering staff/ knowledge

R & B Department

Roads, Buildings, other public infrastructures – construction & maintenance
Technical staff – Engineers



Water Supply Dept. (GWSSB)

Preparation of water supply project

Execution of water supply projects

Maintenance of water supply project

Technical know how of public health – water supply engineering

Civil engineers – experts in w/s & sanitation field



Example:

S.T. Dept. wants to make a **bus stand** for a particular town

He knows only

- Name of town

- Numbers of routes

- Numbers of passengers

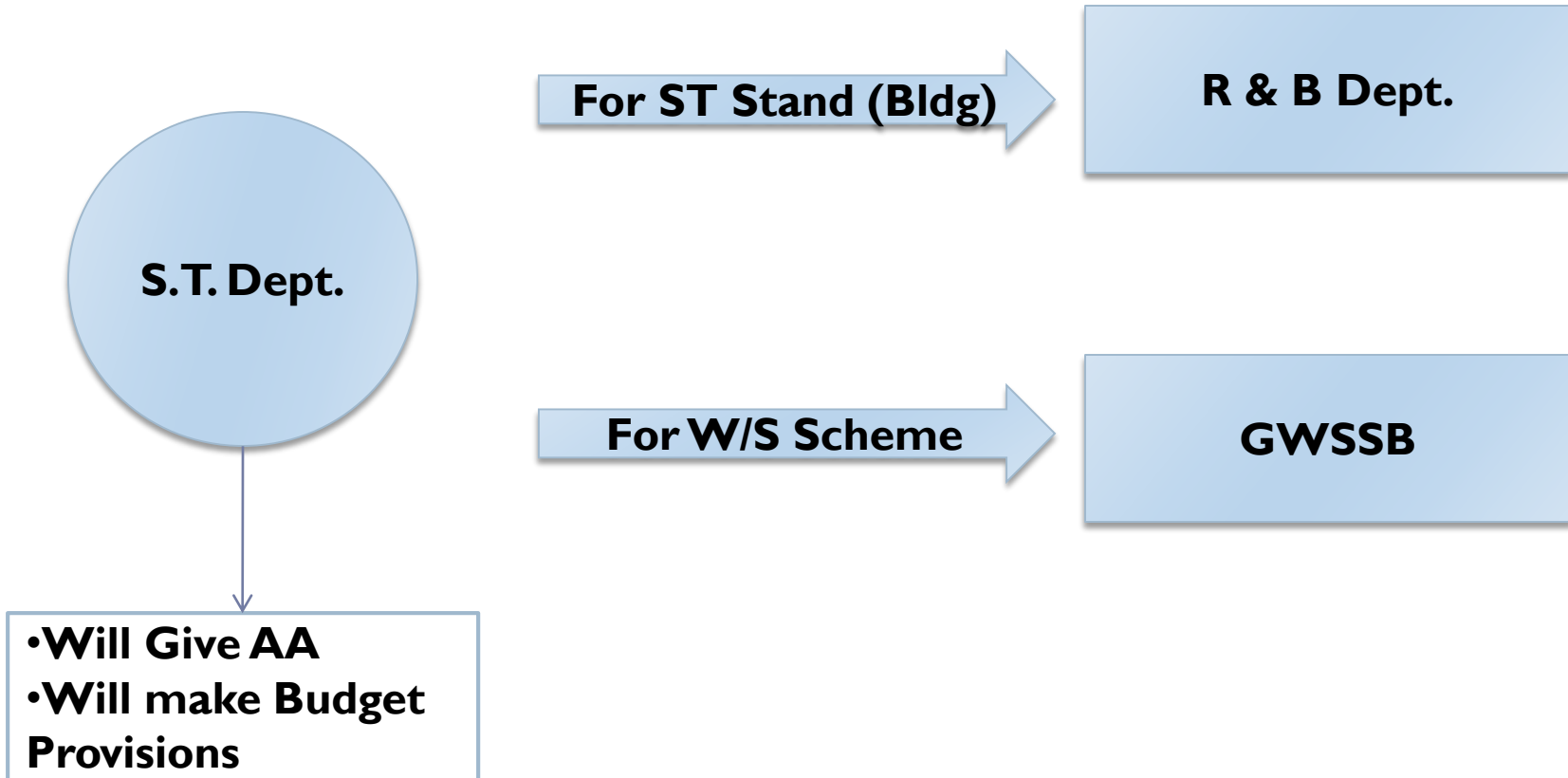
- With workshop/with out workshop

- Staff quarters/colonies



It has **no technical knowledge** or **engineering knowledge**

Water Supply Project Preparation



Step.1. R&B & GWSSB

- Will prepare estimates on LS basis or sqmt basis – ESR/lit. bases with ETP / Centage / Supervision etc. charges
- Will give **Overall Technical Sanctioned** to the estimates prepared on pro-rata basis
- Send it to ST Dept. for Administrative Approval

Step.2. S.T. Dept.

- Will make budgetary provision for the estimated amount
- Give **Administrative approval**
- Send the letter to R&B/GWSSB for preparing detailed proposal for ST Stand or water supply arrangement

Step.3. R&B & GWSSB:

- Will prepare detailed estimates for the work
- Give **detailed technical sanctioned(DTS)** to the detailed estimates
- Will prepare draft tender papers(DTPs)
- Invites the tenders on behalf of ST Dept.
- Will execute the work of ST Stand or w/s scheme
- Will pay the bills of quantities to the contractor
- Will raise the bills against ST Dept. with ETP / Centage charges etc.
- Give completion certificates
- Hand over to the ST Department

Administrative Approval:

Points to take under consideration

- Estimated cost – recapitulation sheet as an annexure
- Delegation of powers
- Budget provision – Action plan provision
- Weather source or important structures are successful/completed or not
- Programmes – ARP/MNP/Scarcity/Flood damages/Special component plan etc.
- Head of account
- Other important conditions like road/canal/railway crossing etc.

In form of ‘Office Order’

Water Supply Project Preparation

References to be given for

- Delegation of power – order with number & dates
- Budget provision / Action plan provision
- SFC agenda approval
- Empowered committee approval
- Technical committee approval

Sample of AA for flood damages / Individual village w/s schemes / regional w/s schemes



Overall Technical Sanctioned:

Points to take under consideration

- Estimates may be lump sump bases or pro rata bases or for ESR – per lit. bases.
- Delegation of powers

In form of ‘Office Order”

References to be given for

- Delegation of power – order with number & dates
- Budget provision / Action plan provision
- Administrative approval order No/date

Detailed Technical Sanction:

Points to take under consideration

- Weather administrative approval is given or not ?
- Weather OTS given or not ?
- Detailed Estimated cost –No lump sump or per lit. estimates
- Detailed drawings
- Delegation of powers
- Budget provision – Action plan provision
- Weather source or important structures are successful/completed or not
- Weather Land required for construction is acquired or not ?
- Weather permission for road/railway/canal crossing is given by the concern dept.
- Programmes – ARP/MNP/Scarcity/Flood damages/Special component plan etc.
- Head of account

In form of ‘Office Order’

References to be given for:

- Delegation of power – order with number & dates
- Budget provision / Action plan provision
- Administrative approval – order with number & dates
- OTS
- Any other important details
- In form of conditions
- Sample of AA/OTS/DTS/DTPs for flood damages / Individual village w/s schemes / regional w/s schemes

Draft Tender Papers(DTPs):

Points to take under consideration

- Weather administrative approval is given or not ?
- Weather OTS given or not ?
- Detailed technical sanction is accorded or not?
- Delegation of powers
- Budget provision – Action plan provision
- Weather source or important structures are successful/completed or not
- Weather Land required for construction is acquired or not ?
- Weather permission for road/railway/canal crossing is given by the concern dept.
- Programmes – ARP/MNP/Scarcity/Flood damages/Special component plan etc.
- Head of account

In form of ‘Office Order”

Water Supply Project Preparation

References to be given for,

- Delegation of power – order with number & dates
- Budget provision / Action plan provision
- Administrative approval – order with number & dates
- OTS
- DTS
- Any other important details
- In form of conditions

DRAFT TENDER PAPERS (DTPs)

Types of Tenders:

- Item Rate Tender – Form - B-1
- Percentage Rate Tender – Form- B-2
- Labour tender - Form-A-1
- Material tender – Form – D
- Lump Sump tender-Form-C
- Piece work tender
- e-Tendering

How to prepared draft tender papers?

Components of tender papers:

- Tender notice
- B-1/B-2/A-1/D/C etc. Form-Generally booklets**
 - Conditions of contracts
 - Clauses for excess/saving/EIRL etc.
 - Standard forms
- Memorandum of Works(Abstract)**
 - Name of work
 - Tender cost
 - Earnest Money Deposit
 - Security Deposit
 - Time limit
 - How to post
- Schedule-A – Materials supplied by the dept.
- Schedule-B – Items with quantities
- Instruction for filling the tenders
- Conditions of contract
- General conditions
- Item wise specification



Project preparation - Chronology:

- Location details
- Data collection
- Existing infrastructure facilities
- Occupational details
- Topography
- Geology
- Hydrology

Now we are public health engineers,
Every public health engineers must have a manual.



“MANUAL ON WATER SUPPLY AND TREATMENT”

Prepared by

THE EXPERT COMMITTEE

Constituted by

THE GOVERNMENT OF INDIA

CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING
ORGANISATION

(CPHEEO)

MINISTRY OF URBAN DEVELOPMENT, NEW DELHI

MAY-1999

PROJECT PREPARATION

PLANNING:

Objective of a public protected water supply system is to supply safe and clean water in adequate quantity, conveniently and as economically as possible.

Basic design considerations:

- Engineering decisions are required;
- To specify the area to be served;
- Population to be served;
- The design period;
- The per capita rate of water supply;
- Other water need in the area – industrial, commercial;
- To select the source of water;
- Quality & quantity of water;
- The machinery required;
- Conveyance of water & distribution;
- The nature and location of facilities to be provided;

Water Supply Project Preparation

Basic design considerations: (cont..)

- Treatment facilities;
- Points of water supply intake; and
- Waste water disposal;
- To work out the capital cost of the scheme;
- To work out the financial forecast;
- To work out annual burden & revenue;
- To work out cost/capita, cost/'000 lit.

Projects have to be identified and prepared in adequate details in order to

- Enable timely and proper implementation;
- Optimization for planning – phases;
- Plant capacity & degree of treatment required;
- Different units capacities;
- Capital cost required;
- Interest charges, period of repayment of loans;
- Water tax/rate

What should be the Basic design considerations:

- **Water quality & quantity**

Quality & quantity may vary seasonally, monthly, daily or some times hourly;
Water conservation –possible through optimal use of available water resources, prevention & control of wastage and effective demand management.

- **Plant siting**

- **Mechanization** – SCADA system implementation

- **Service building** – Pumping station, chemical house etc.

- Other utilities like electricity, approachability, telephone, staff quarters etc.

Water Supply Project Preparation

Design period

-Storage by dams	50 years
-Infiltration work	30 years
-Pumping	
i) Pump house (Civil works)	30 years
ii) Electric motors & pumps	15 years
-Water treatment units	15 years
-Pipe network (RM/Distribution)	30 years
-Clear water reservoir at h/w balancing tanks and service reservoir (U/G & over head)	15 years

-Overall w/s scheme's life is considered as 30 years. Individual units are designed as per actual life.



Population Forecast

Design population – Governing Factors

- Growth & development of the project area
- Industrial, commercial, social and administrative

Methods of population forecast:

a) Demographic method of population

Three ways – births, deaths & migration

b) Arithmetical increase method

c) Incremental increase method

d) Geometric increase method

e) Decreasing rate of growth method

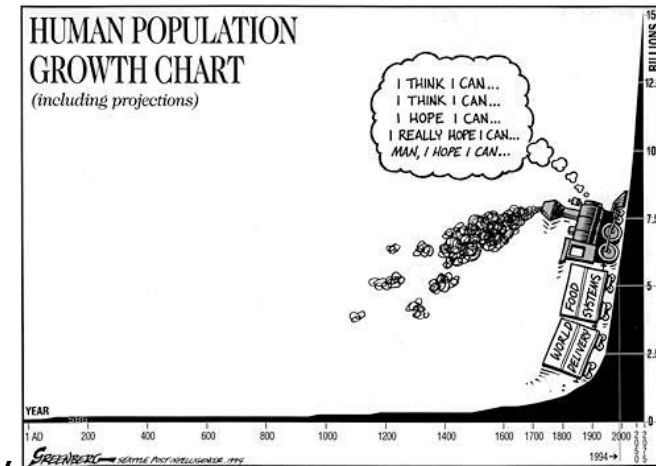
f) Graphical method

g) Graphical method based on single city & similar city

h) Logistic method

i) Method of density

Final forecast –carefully done after careful study of development of the area



Water Supply Project Preparation

Per capita water supply

Basic need:

- Domestic – drinking, cooking, bathing, washing, flushing of toilets, gardening and individual air conditioning
- Industrial needs
- Public purposes – street washing-watering, flushing of sewer, watering of public park
- Industrial & commercial incl. central A/C
- Fire frightening
- Livestock's requirement
- Minimum permissible UFW

Factors affecting water consumption:

- Size of the city
- Characteristics of the population & standard of living
- Industries & commerce
- Climate conditions
- Metering



Water Supply Project Preparation

Recommendation:

Classification of towns/cities	Recommended maximum w/s levels (lpcd)
Towns provided with pipe w/s but w/o sewerage system	70
Towns provided with pipe w/s where sewerage system is existing/contemplated	135
Metropolitan and mega cities provided with pipes water supply where sewerage system is existing /contemplated	150
In urban area where water is provided through public stand posts	40

Note:

1.0 The above fig. excludes Unaccounted for water (UFW) should be limited to 15%

2.0 Fig. includes requirement for commercial, institutional and minor industries.

However the bulk supply to such establishment should be assessed separately with proper justification.

Firefighting Demand: = $100\sqrt{p}$, where, p =pop. In '000 for city having population larger than 50000.

Water Supply Project Preparation

Quality standards

Table – I : Drinking water standard

No.	Parameter	Acceptable	Cause for rejection
1	Turbidity (NTU)	1	10
2	Colour (On pt. -co- sclae)	5	25.00
3	Taste	Unobjectionable	Unobjectionable
4	Odour	Unobjectionable	Unobjectionable
5	PH	7.0 to 8.50	< 6.5 or > 9.2
6	Total dissolved solids (mg/l)	500	1500
7	Total hardness (mg/l as CaCO ₃)	200	600
8	Chlorides (kg/l as Cl)	200	1000
9	Sulphate (mg/l as SO ₄)	200	400
10	Fluorides (mg/l as F)	1.00	1.5
11	Nitrates (mg/l as No ₃)	45	45
12	Calcium	75	200
13	Magnesium (mg/l as Mg ⁺⁺)	<=30	150
14	Iron (mg/l as Fe)	0.100	1.000
15	Magnese mg/l as Mn.	0.050	0.500
16	Copper (mg/L as cu)	0.050	1.500
17	Zinc (mg/l as Zn)	5	15
18	Phenolic (mg/l as phenol)	0.001	0.002
19	Anionic detergents (mg/l as MBAS)	0.200	1.000
20	Mineral oil (mg/l)	0.01	0.30



Water Supply Project Preparation

Table – I : Drinking water standard Cont..

21	Arsenic mg/l as As	0.050	0.050
22	Cadmium (mg/l as Cd)	0.010	0.010
23	Chromium (mg/l as Cr)	0.05	0.05
24	Cynidies	0.05	0.05
25	Lead (mg/l as CN)	0.100	0.100
26	Selenium (Total) (mg/l as mg)	0.01	0.01
27	Mercury (total) (mg/l as mg)	0.001	0.001
28	Polynuclear aromatic hydrocarbons (PHA mg/l)	0.200	0.200
29	Gross alpha activity	3 P ci/l	3 P Ci/l
30	Gross Benta activity Pcl/l)	30 P Ci/l	30 P Ci/l
31	E coil count	0	0
32	Coliform organisms (per 1000ml)	0 should not be detected in any 2 consecutive sample.	

Pressure requirement:

+	One storeyed Building	7 m residual head at ferrule point
	Tow storeyed Building	12 m
	Three storeyed Building	17 m



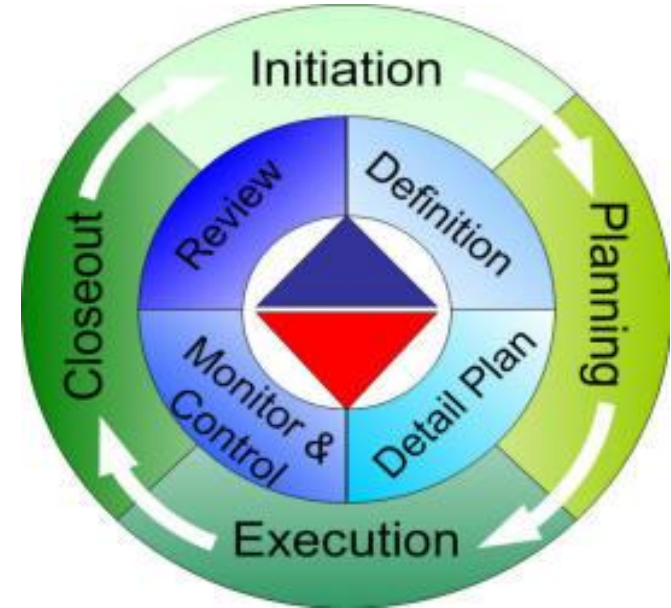
PROJECT REPORT

Stages for any projects:

- Pre-investment planning
- Identification of a project
- Preparation of the project
- Appraisal and sanction
- Construction of facilities and carrying out support activity
- Operation and maintenance
- Monitoring and feedback

Project report should be feasible

- Technically
- Financially
- Socially
- Culturally
- Environmentally
- Legally
- Institutionally



Water Supply Project Preparation

Project should be prepared in three stages:

Identification report – ‘desk study’ – from existing information available – with possible alternates / tentative flow diagram – with an idea of cost – bringing the project in planning and budgetary stage/cycle – for next stage of

Pre-feasibility report – after clearance of identification report from authority – further studies – screening & ranking all possible alternatives with recommendation for detailed feasibility study

Feasibility report – study with greater details – enough additional data and information required for construction or execution work – priority/implementation schedule of component

Note:

For small project or small town – feasibility report may not required, but may include detailed engineering in the report.

Water Supply Schemes – Three types

1.0 Hand Pump Scheme

- Installation by Mech. Wing
- For small population – scattered population – best
- Economical & easy– Rs. 50000 to 80000/HP
- 1 HP for first 150 souls & then add 1 HP/100 souls
- Less discharge
- Not permanent solution



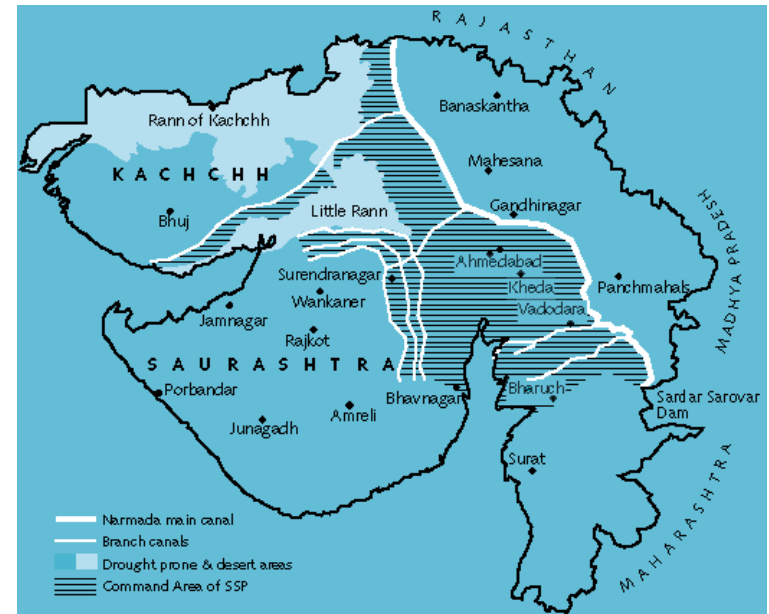
2.0 Individual pipe water supply scheme

- For individual village/habitation – more population
- Based on individual/separate source/storage/pipe line/stand posts or house connections
- Executed & handed over to local body for O&M

Water Supply Project Preparation

3.0 Regional water supply scheme

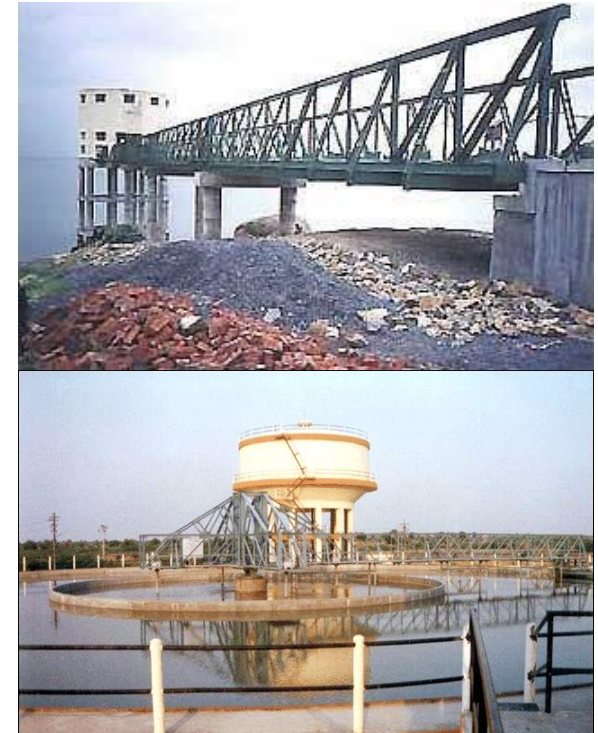
- If individual sources are not available potable and/or with sufficient discharge in nearby vicinity of a villages/habitations
- Common authentic source like perennial river / reservoir / canal etc. are available in nearby vicinity of the group of villages/habitations
- Common source/intake/treatment/head works / pumping / distribution to individual village storages.
- Executed & maintained by GWSSB.



Water Supply Project Preparation

Possible Components of Regional w/s scheme

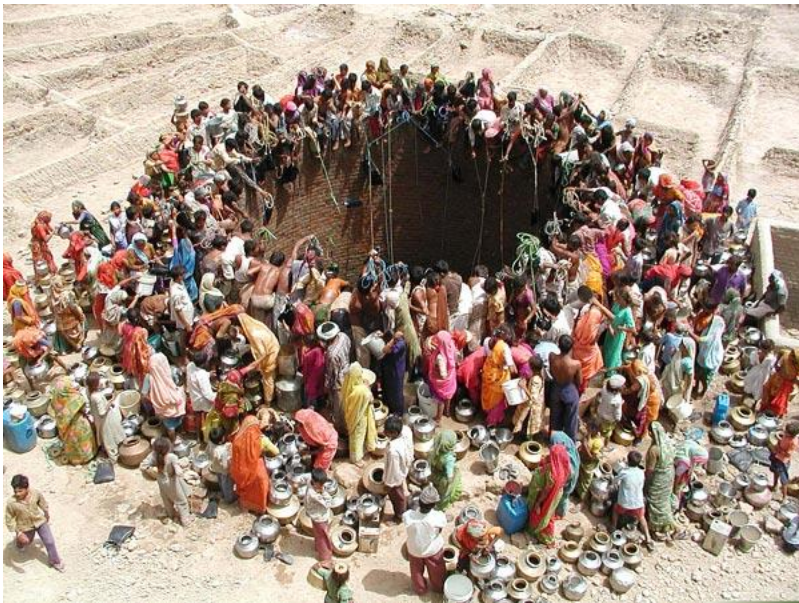
- Source –Tube Wells / Reservoir / Canal / River Pond / Tank
- Intake Well / Intake arrangement or structure
- Pumping machinery–Vertical Turbine / Centrifugal Submersible
- Raw water rising main or pumping main
- Water Treatment plant
- Clear water rising main or pumping main
- Head works with Storages
- Storages
 - Under Ground – Under Ground Sump(UGS)
 - Overhead – Elevated service reservoir(ESR)
- Pump House
- Gravity distribution form h/w to diff .village storage
- Distribution System
- Chlorination arrangement-for disinfections
- Stand post
- Cattle trough
- Power supply
- Land acquisition
- Staff quarters
- Tools & plants
- Railway/road/canal/drain crossing
- Area grading – h/w development



Water Supply Project Preparation

For a small water supply projects – ‘village water supply scheme’, may include:

- General report
- Annexure
- Designs
- Estimates
- Drawings

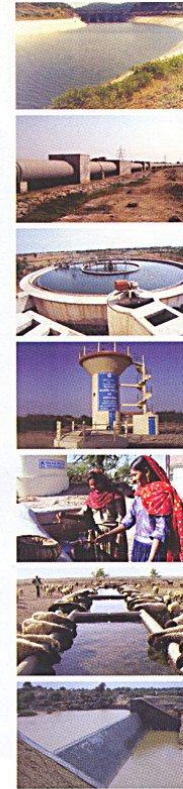


Water Supply Project Preparation

General report

- Introduction/General
- Topography
- Rainfall details
- Existing water supply details
- Need for the project
- Objective of the project
- Design consideration adopted - for each components
- Population projection
- Rate of water supply
- Water demand
- Proposed water supply scheme
- Operation & maintenance cost
- Annual burden
- Existing & proposed water tariff structure
- Cost per capita
- Cost per '000 lit.
- Financial forecast

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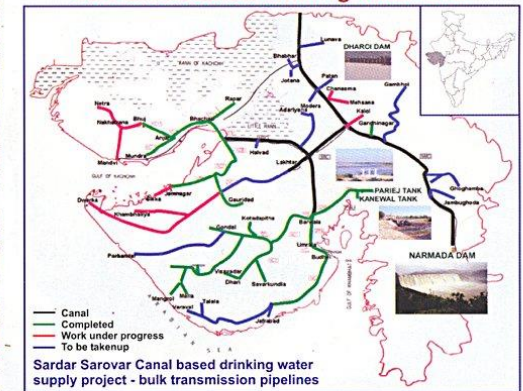


Gujarat: Changing rural landscapes and lives

Government of Gujarat has stepped up efforts to achieve drinking water security through a combination of local and bulk water supply system as well as revival of traditional water sources.

Enabled and empowered by WASMO, rural communities plan, construct, manage and maintain their own water supply and sanitation facilities making it truly a people's movement.

Safe and assured drinking water to all



Building partnerships and working together



Water and Sanitation Management Organisation

3rd Floor, Jalseva Bhawan, Sector 10 - A, Gandhinagar - 382 010
Tel.: 079 - 2324 7170 - 71, 2323 7075 Fax: 2324 7485 Website: www.wasmo.org e-mail: wasmo@gujarat.gov.in



Water Supply Project Preparation

Annexure

- Principal features
- Area/village profile
- Population forecast
- Water demand
- Operation & maintenance cost
- Annual burden

Designs

- Storage capacity computation
- Design of pumping machinery
- Design of rising main
- Design of distribution system

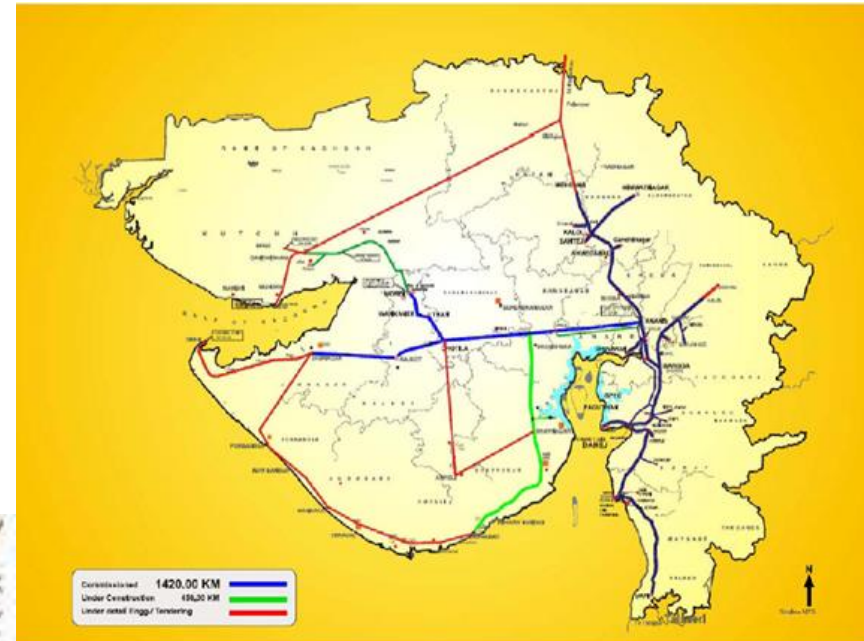
Estimates

- Source/TW/Well
- Pump House
- Pumping machinery
- Manifold system
- Rising main
- Storages
- Distribution system
- Stand posts
- Cattle trough
- Chlorination arrangement
- Power supply
- Other like wire fencing etc.

Water Supply Project Preparation

Drawings

- District map showing taluka
- Taluka map showing village
- Layout plan
- Flow diagramme
- Nodal plan for distribution system
- Pump House
- Storage – ESR-UGS
- Stand post
- Cattle trough



Source: GSPL

Water Supply Project Preparation

SOURCE:

- Most important – basic requirement for the project
- Must be authentic/sustainable with required discharge/quality
- Given by Geohydrologiest after detailed survey of the area
- Survey of sources with SWL/PWL/Discharges/Quality
- Also study of geology/hydrology of the area

Then he will suggest proper pinpoint for the source with

- Layout
 - Type of source
 - Size of source – dia/depth
 - Expected discharge
 - Quality
 - SWL
 - PWL
 - Casing pipe/blank pipe/screen pipe
- Generally Mech. Wing will prepare estimates for TW/Pmcry/Electrification –we consider this as a Part-I of the scheme file

PUMPING MACHINERY:

Types:

Submersible – For tube wells

Turbine – on well

Vertical turbine – On Intake Well

Centrifugal – on UGS

Design of pumping machinery:

DESIGN OF WATER SUPPLY DISTRIBUTION NETWORK USING COMPUTER SOFTWARE

- Water is supplied from an elevated service reservoir by gravity and the flow in the pipes is under pressure.
- Gravity pipelines have to be laid below the hydraulic gradient.
- Design of water supply distribution pipelines involves determination of pipe sizes to meet the physical and operational needs at minimum cost.
- The design depends upon resistance to flow, available pressure (head), velocity of flow, relative cost, etc.

Water Supply Project Preparation

Water supply networks are designed using Hazen-Williams formula which is expressed as:

$$V = 0.849 C r^{0.63} S^{0.54}$$

For circular conduits, the expression becomes,

$$V = 4.567 \times 10^{-3} C d^{0.63} S^{0.54} \text{ and}$$

$$Q = 3.1 \times 10^{-4} \times C d^{2.63} \times S^{0.54} \text{ Where,}$$

Q = discharge in cumec

d = diameter of pipe in mm,

V = Velocity in mps,

r = hydraulic radius in m,

S = slope of hydraulic gradient and

C = Hazen and Williams roughness coefficient.

Equation of continuity : **Q = AV**

Head loss: **H_f = S X L**

Water Supply Project Preparation

- A chart for Discharge vs. Slope as per Hazen-Williams formula is given in the Manual on Water Supply **and** Treatment **published by CPHEEO.**
- The recommended values of C for various pipe materials for design purposes varies from 100 for non-metallic CI pipes to 145 for AC/PVC pipes.
- The function of the distribution system is to convey wholesome water upto the consumer end at adequate pressure and quantity at convenient locations.
- The cost of distribution network ranges between 40-70% of the cost of the scheme.

Water Supply Project Preparation

•The requirements of the distribution system are functional and hydraulic.

=>The **functional** requirements are the geometrical configurations of the pipes, reservoirs, selection and location of valves etc. for efficient O&M and economy in cost.

=> The **hydraulic** requirement is to take care of adequate pressure at maximum demand.

•The distribution system is designed as a continuous system but operated intermittently. For convenience and equitable distribution of water, a grid (loop) pattern of network is

preferred. This system facilitates any one point is being fed from, atleast, two directions.

•For water supplies of smaller communities, the tree or branch system of network is sufficient.

•Zoning is done to minimize the elevation difference between two zones and equalization of the supply. Zoning depends upon population density, topography, etc. If there is an elevation difference of 15 to 25 meters between the zones, then each zone should be served by a separate system.

Water Supply Project Preparation

• **Location** of service reservoirs is for regulation of pressure and to meet the fluctuation in water demand. In a system fed by a single reservoir, the ideal location is the centre place. **When** the system is fed by direct pumping the reservoirs may be located at the tail end.

• Design Guidelines

Consumption of water varies with respect to **season, month, day & hour**.

Peak factor is the ratio between the maximum rate of hourly consumption and the average rate of consumption

A peak factor of:

- 3 is considered for a town with population less than 50,000,
- 2.5 for a city with population 50,000 to 2 lakh
- 2 for city having a population above 2 lakhs

Water Supply Project Preparation

•The distribution system should be designed for the following minimum residual pressures at the ferrule.

⇒Single storey building - 7 meters

⇒2 storey building -12 metres

⇒3 storey building - 17 metres.

•The distribution system should not be designed for pressures exceeding 22 metres, otherwise it becomes uneconomical.

Minimum pipe size

⇒100 mm for towns having population upto 50,000

⇒150 mm for towns having population above 50,000.

⇒If it is a grid system, pipes less than 100 mm can be used.

• For multi-storeyed buildings and distant localities, boosters may be provided.

Water Supply Project Preparation

Preparation of data for network design:

- Draw the network drawing of the proposed area of the city.
- A network contains a series of nodes connected by links (pipelines).
- Each link and nodes must be a unique integer no.
- Avoid linking a source to more than one link.
- Calculate average daily water demand for the design year within the region to be served by the and distribute the demand among various nodes.
- The demand may be assigned to individual nodes by many ways:
 - Based on population density
 - No. of hours.
 - Extent of area to be served
 - Furnish the ground elevation at each node.
 - Include source nodes, demand nodes and junction nodes.
 - Furnish:
 - Length
 - Trial size of the pipes
 - Hazen – William’s friction co – efficient for each pipe in the network.
 - If cost summery of the completed design is desired, then install unit cost per liner diameter of each pipe.

“SAVE WATER
SAVE LIFE”

Thank You..

▶ By: D.M.Dalwadi , Dy. Ex. Engineer

