Ward Amenities Secretary (WAmS)

A. Engineering Activities

1. Job Chart of Ward Amenities Secretary

Andhra Pradesh Human Resource Development Institute
(AP HRDI)
&
Municipal Administration Department
(Govt. of Andhra Pradesh)

Online Training and Online Assessment Tests for Ward Amenities Secretariat Functionaries Under Credit Based Assessment System

Reading Material

Daily Activities Calendar – Ward Amenities Secretary

FORENOON	AFTERNOON
● Drinking water samples testing, during supply hours (Morning & Evening). ● Identification of Pipeline leakages, observation of Valve pits for leakages. ● Inspection of Open Drains choking areas and inform the sanitation secretary for rectification. ● Attending Execution of civil works including Housing, Nadu-Nedu/water leakage repairs and street light repair works. ● Inspection of WTPs, Pump houses, Service Reservoirs. ● Observation of low-pressure areas and tail end points supply. ● Recording of complaints from public regarding issues of water supply, repairs to drains and roads etc., Identification of UGD manholes overflow. ● Visiting Spandana and Puraseva grievances received and interacting with citizens regarding their problem. ● Preparation of estimates/DPRs for infrastructure works including Housing and Nadu-Nedu. ● Updation of Grievances (Spandana/PGR module) and preparation of reply reports. ● Recording of M. Books and maintenance of field registers during the execution of works, capturing work photographs, following inspection of Reporting Officers. ● Conducting quality control tests during execution of works and maintaining standards as per IS Codes. ● Road maintenance works such as identification of potholes, repairs & preparation of estimate proposals ● Receipt of New Water Tap connection & UGD connection applications from the public. ● Identification of Individual Toilets/processing for sanctions/execution. ● Updating Field Visit Register as per Check-slip.	● Attending office work such as preparation of Bills, ● Preparation of Progress Reports, ● Quality Control Reports, ● Updation of Registers (Complaint register, Roads Register, Drain Register, Water Supply pipeline, Asset Register ● Meeting with Departmental officers/ Higher Ups, ● Interaction with the drawing branch for tenders, agreement of works etc. ● Managing the counter in office as per the term schedule communicatedby the Administrative Secretary. ● Attending other duties and Govt. Flagship programmes as required by the Higher Authorities. ● File clearance.

Monthly Activities Calendar

Day	Activities (Week Wise)			
	1st Week	2nd Week	3rd Week	4th Week
Monday	Inspection of WTPs	Inspection of Municipal Schools Nadu-Nedu.	Inspection of Open spaces & proposals for development	Inspection of Housing construction.
Tuesday	Review meeting with Ward Volunteers at Secretariat office	Review meeting with Ward Volunteers at Secretariat office	Rain water Harvesting Structures in Public Buildings, Parks, open sites, Review meeting with Ward Volunteers at Secretariat office	Inspection of Burial Grounds & Its maintenance Review meeting with Ward Volunteers at Secretariat office
Wednesday	Meeting with Municipal Engineer & higher authorities.	Inspection of Community Halls/ Municipal buildings.	Inspection of Parks, Avenue plantation & Its maintenance	Inspection of roads and drains along with planning staff to prevent encroachments.
Thursday	Recording of Water Meter Readings for Commercial & resi - dential connections. Convergence meeting with ward secretaries	Convergence meeting with ward secretaries	Identification of illegal water/UGD connections and informing higher authority. Review on Service Level Indicators for water supply, Convergence meeting with ward secretaries	Mass Plantation in wards Convergence meeting with ward secretaries
Friday	Visiting community toilets & public toilets for their hygienic condition.	Capacity Building and Training related activity.	Updation of HSC connections during the month & submission to Revenue Section	Conduct of ward sabha with ERs, NGOs, RWAs and other Associates for beneficiary selection, recommendations, basic service maintenance issues and other activities.
Saturday	Inspection of ELSRs and its cleaning.	**Second Saturday**	Inspection of Greenery, beautification & maintenance works	Preparation of fortnight reports.
Sunday	**Holiday**	**Holiday**	**Holiday**	**Holiday**

Seasonal Activities Calendar

Season	Activity
Summer season (March to June)	● Focus on uniform distribution water to all areas, and tail end areas through piped supply and through water tankers. ● Special care to avoid water contamination by pipe leakages, shifting of taps, crossing of drains, etc. ● Establishment of "Cooling Water Centres" (Chalivendram) ● Providing Temporary shelters during Heat wave period. ● Providing Open Water Tubs for Animals/Birds. ● Focus on Water Quality tests to maintain the Chlorine levels in supplied water. ● Desilting of major outfall drains. In addition to the daily activities, the Ward Amenity Secretaries shall perform the Specific activities during the season, as per the priority
Rainy season (July to December)	● Readiness for clearing of blocks in the drains by keeping available with Diesel Pump-sets/Motors to avoid inundation of low-lying localities. ● Focus on Water Quality tests to maintain the Chlorine levels in supplied water. ● Monitoring of Turbidity of water ● Specific Water Tests such as e-coli, to prevent water contamination. ● Immediate action for removal of fallen trees during heavy rains. In addition to the daily activities, the Ward Amenity Secretaries shall perform the Specific activities during the season, as per the priority

Annual Activities Calendar

Month	Activity
January	Summer Action Plan Proposals for Water Supply
February	Implementation of Summer Action Plan
March	Pot Holes filling for Roads, Manholes Repairs, Valve Pit Repairs
April	Desiltation of Drains & Special focus on watering of plantation
May	Desiltation of Drains
June	Focus on Water Quality Tests and monitoring
July	Mass Plantation
August	Mass Plantation
September	Mass Plantation in respective wards, Furnishing of M. Books and other relevant records for Audit
October	Stakeholders meeting for preparation of annual action plan.
November	Budget Preparation- works proposals, maintenance proposals etc., Preparation of Administrative Report
December	Summer Action Plan Proposals for Water Supply & School repairs and provision amenities such as fans, lights, water supply for exam preparation of Students.

2. Engineering Activities in ULBs

CAPITAL WORKS

Various Programmes/Agencies funding the Projects

I. JnNURM - UIDSSMT
- UIG (Mission cities)
- IHSDP
- BSUP (Mission cities)

II. HUDCO - Loan

III. Plan Grants - State Government Grants

IV. Finance Commission Grants (National & State)

V. AP Municipal Development Project (World Bank loan)

Funding Pattern

I. **JnNURM** GoI (Grant) : 80%
Go AP (Grant) : 10%
ULB : 10%

II. **HUDCO** Loan : 90%
ULB : 10%

III. **Plan Grants** : 100% Grant by Go AP

IV. **Finance Commission Grants**: 100% Grant

V. **APMDP** Loan **:** 20%
Go AP (Grant) : 70%
ULB : 10%

I. GUIDELINES for JnNURM Projects (UIDSSMT)

AIM

Urban infrastructure Development Scheme for Small & Medium Towns aims at improvement in urban infrastructure in towns and cities in a planned manner.

OBJECTIVES

- Improve infrastructural facilities and help create durable public assets and quality oriented services in cities & towns
- Enhance public-private-partnership in infrastructure development and
- Promote planned integrated development of towns and cities.

Admissible Components

- Urban Renewal
- Water Supply (including desalination plants) and sanitation
- Sewerage and Solid Waste Management
- Construction and improvement of storm water drains
- Construction/Upgradation of roads, highways/expressways
- Parking lots/spaces on Public Private Partnership basis
- Development of heritage areas
- Prevention & rehabilitation of soil erosion/landslides
- Preservation of water bodies.

FINANCING PATTERN

- The sharing of funds in the ratio of **80:10** between Central & State Governments and **balance 10%** to be raised by **ULB**.

Requirements to be fulfilled by ULB for sanction of DPR by Government of India

- ULB resolution in respect of the Project
- Non-duplication certificate
- Land availability certificate
- Permission from line departments
- Latest reform status as on date

URBAN REFORMS

- Mandatory reforms
- Optional reforms

Note: All the mandatory and optional reforms shall be implemented by the State/ULB within the Scheme period.

MANDATORY REFORMS

- Adoption of **accrual-based double entry accounting system**
- Introduction of **e-governance** using IT applications
- **Reform of Property tax** with GIS
- Levy of reasonable **user charges** by ULBs for full cost recovery of O&M within next seven years.

MEMORANDUM OF AGREEMENT (MoA)

- Signing of **MoA** to access Central assistance.
- ULBs to sign **MoA** with State Level Nodal Agency.
- The **MoA** to be submitted with DPR.
- Implementation of **all mandatory** and at least **two optional reforms** in each year by cities/towns to access central grant under the scheme.
- All mandatory as well as optional reforms shall be required to be implemented during the scheme period.

II. HUDCO

- Assistance by way of loan will be given for Infrastructure projects taken up by Government/ Public Agencies

- Core Infrastructure Projects covering Water Supply, Sewerage, Drainage, Solid Waste Management, Urban/City Roads, Social Infrastructure etc.,

FUNDING PATTERN

Loan – 90%
ULB contribution – 10%

Rates of interest:
Fixed – 12%
Floating – 11%

III. PLAN GRANT

- State Government allocates certain budget to the Public Health Engineering Department every year in the annual Budget for taking up improvement of water supply and sewerage schemes in ULBs.
- Budgetary provisions are very meagre and is therefore allocated as per the needs.
- ULBs justifying the need may seek assistance. State Govt. sanctions budget on recommendation of ENC(PH) to the needy ULBs.

IV. State and National Finance Commission Grants

- Consequent to 74th Constitutional amendment in 1992, the State has to constitute Finance Commissions at the end of every 5 years starting from 1992 onwards on recommending devolution of funds from State Govt. to ULBs.

- Grants are expected to be received by the ULBs from State and Central Govt. under the following:
  - 3rd State Finance Commission (2005-10) and
  - 13th Finance Commission (2010-15)

Access to funds under XIII FC and III SFC

- Funds are allocated to the ULBs usually on per capita basis and other guiding features provided by the Govt. from time to time.
- ULBs seeking to submit Annual Development Plans to C&DMA in the admissible sectors along with cost estimates and justification of proposals.

XIII FC- Types of Grants

- The 13th Finance Commission recommended two types of Grants to local bodies
  - General **Basic Grants**
  - General Performance Grants
- The general performance grant will be released on fulfilment of nine conditions stipulated in XIII FC
- Every Urban Local Body has to prepare an Annual Development Plan to access the grants

Annual Development Plan

Objective:

- To ensure planned growth of the city/ town for improving the quality of life of citizens

Annual Development Plan

Admissible components

- Integrated Solid Waste Management Project
  - Preferably under PPP mode
  - Purchase of equipment for collection and transportation not permitted
- Town-wide sullage project as per city sanitation plan
  - Construction and interception of sullage outfall drains
  - Construction of STP preferably by PPP mode
- Service Level Benchmarking
- Protection of lakes/tanks by covering
  - Construction of STP
  - Strengthening of bunds
  - Green-belt around lakes/tanks
- Urban Forestry and development of Parks
- Improvement of Municipal School Buildings including facilities

V. AP Municipal Development Project (APMDP)
Eligibility criteria to access funds

Access criteria	Compliance to be assessed based on
ULB has an operation surplus and has borrowing capacity to meet debt service obligations and O&M expenses of more than 15% of the sub Project cost based on audit accounts	Audit of Municipal accounts is satisfactory (with no significant unresolved audit issues of the earlier years) and up to date.
Reform Action Plan (MRAP)	Formal MoA to carry out municipal reforms including but not limited to capacity to operate and maintain the facilities built with sub-loan/sub- grant.
Capacity Enhancement Action plan (CEAP)	Formal agreement to carry out an action plan for capacity enhancement, including ULB organization, enhancement of ULB own revenues/taxes/tariffs, installation of key staff, etc.,

Terms of Financing

Issue	Terms of financing
ULB self funding	10% of sub–project cost.
State grant funding	60% for sub–projects in Mission Cities; 70% in other ULBs.
Sub-Loan funding to ULBs	Balance as loan after the self-financing and grant
Debt servicing of Sub -Loans	Semi-annually from the ULBs to the Trust (APUFIDC).

Sanction and implementation of Project

Step -1	Identification and proposal of Sub-Project by ULB. This is called Initial Project Proposal(IPP)
Step -2	Review and assessment of IPP by 1. Municipal Strengthening Unit (MSU) 2. Andhra Pradesh Urban infrastructure fund (APUIF) 3. Public Health Engineering Department (PHED)
Step -3	Prepare and submit DPR along with MRAP & CEAP.
Step -4	Appraisal / MSU/ APUIF/PHED & PAC. Sanction by Steering Committee. APUIF Funding Agreement with ULBs.
Step -5	Procurement of Sub- Project.
Step -6	Implementation of Sub-project. Social and Environmental compliance.

Operation and Maintenance Works

O&M is a key municipal task and is important for a number of reasons.

1. Good O&M helps to **save money,** by reducing waste, ensuring that facilities and equipment continue to function over their intended design life and ensuring that inputs of labour and materials are used efficiently.

2. It can **improve the standard of service provided** to service users. For instance, good O&M should ensure that people receive water for longer and at higher pressures.

3. It helps to **protect the health and safety** of both workers and the general public.

	Operational tasks	Maintenance tasks	
		Periodical	Breakdown
Purpose	To ensure that a facility performs the task for which it was designed.	To ensure that facilities are kept in serviceable condition, function as intended and continue to function over time.	To replace or make-good components that have failed and thus compromise efforts to continue an effective operation and maintenance regime.
Examples	Routine backwashing of rapid gravity water filters. Road sweeping. Solid waste collection.	Greasing moving machinery Replacing the gland packing on pumps and valves.	Replacing worn impellers on pumps. Patching black-top roads
Frequency	Typically daily but may be more or less frequent.	Depending on task but typically at intervals ranging from one week to one year	Irregular, as and when needed, typically at intervals of several years.

Maintenance tasks subdivided into two categories:

- **Routine maintenance**

  - tasks that have to be carried out on a regular (perhaps weekly or monthly) basis; and

- **Periodic maintenance**

  - tasks that have to be carried out less regularly, perhaps at certain times of the year.

Prioritize tasks and implement improvements in O & M :

- Water supply.
- Storm and foul water drainage.
- Solid waste management.
- Roads and paving, maintenance and repair.
- Sanitation and sewerage (excreta and wastewater disposal).
- Street lighting.

ENGINEERING SECTORS

- Water Supply.
- Drains
- Roads
- Street Lighting.
- Solid Waste.
- Sanitation & Underground Sewers.
- Sanitation, Toilets & Bathrooms.

WATER SUPPLY

- SOURCE (Storage by Dams):
- Intake Well cum Pump House.
- Infiltration Works.
- Pump Sets.
- WTP
- Pipe connections to the several treatment units & other small appurtenances.

- Raw Water & Clear Water conveying mains
- Clear Water Reservoirs at the Head Works, Balancing tanks & Service Reservoirs (over head or ground level) in the distribution network.
- Distribution System.
- HSC's
- Flow Meters & Water Meters

PER CAPITA WATER SUPPLY LEVELS (LPCD)

S. No.	Classification of Towns/Cities	LPCD
1	Towns provided with piped water supply but without sewerage system	70
2	Cities provided with piped water supply where sewerage system is existing/contemplated	135
3	Metropolitan & Mega Cities provided with piped water supply where sewerage system is existing/ contemplated system	150

Quality of water in distribution system

- Un desirable material is gaining access to the water, a measure should be taken to discover and remove them.
- Free from coliform organisms.

Treatment

- To improve the raw water quality to the drinking water standard and stop water borne transmission of epidemics.
- To remove objectionable taste and odors
- For increasing the dissolved oxygen content of water
- To prevent algal growth in raw water

APPURTENANCES

- Air Valves
- Sluice Valve
- Reflex Valves
- Zero velocity valves
- Air Cushion valves
- Pressure Relief Valves
- Anchorages

Sewage treatment

- Preliminary
- Primary
- Secondary
- Low cost

DRAINS

Types of Drains

- Tertiary Drains
- Secondary Drains
- Primary Drains

ROADS

Types of Roads Based on Materials

- Earthen roads
- Gravel roads
- Murrum roads
- WBM roads
- Bituminous roads
- Concrete roads

Underground Drainage

- Connection of Sewer lines to the Households
- Manholes and Covers
- Inspection Chambers
- Outfall drain
- Sewerage Treatment Plant

Parks & Playgrounds

- Landscaping
- Soft scaping
- Open spaces

School Infrastructure

- Water facilities
- Sanitation, Toilets and Bathrooms
- Furniture
- Electrical items
- Other basic amenities
- Play grounds

Community Centers and Building

- Community Halls and Dias
- Gym Facilities
- Parking area
- Sanitation and Toilets
- Water supply and electrification
- Furniture

EMERGENCY WORKS

- WATER SUPPLY:
- Attending the heavy water leakages
- Repairs to Sluice Valves
- Repairing of Pump sets
- Repairing & Replacement of Pumps
- Replacement of damaged motor cables
- Clearing of jungle near clear water gravity mains
- Providing MS covers to the chequered plate on valve chambers
- Replacement of static tanks.

Sewerage

- Construction of damages sewer manholes.
- Heavy sewage overflows & chockages of damaged pipes.

ROADS

- **Maintenance of Water-bound Macadam Roads:**
- Un-surfaced water-bound macadam is very commonly used in India.
- **The following defects arise owing to the deterioration of a WBM surface:**
- (a) Rutting
- (b) Potholes
- (c) Corrugations
- (d) Ravelling
- (e) Edge damage.

- **Maintenance of Bituminous Roads:**
- In addition to standard causes such as traffic, weather and ingress of water for the deterioration of earth, gravel and WBM roads, loss of volatiles, oxidation of the binder material and inadequacy of the specification and construction standards also could be the reasons for distress and disintegration of bituminous pavements.

- **Depending upon the degree of deterioration of the highway facility, the nature of the maintenance operations for bituminous pavements could be:**
- (a) Patch repair
- (b) Surface treatment
- (c) Resurfacing

CC ROADS

- Sealing joints and cracks,
- Retrofitting edge drains,
- Performing partial depth repair,
- Diamond grinding,
- Retrofitting load transfer,
- Cross stitching,
- Slab undersealing, and
- Performing full depth repair.

- Park Operations, Maintenance and Safety Assessment
- Maintenance standards •Asset management of City parks and recreation facilities •Fleet services •Budget availability to meet desired outcomes •Staffing levels to achieve desired outcomes •Contract management of park elements •Facility management •Cost of services •Data management •Performance measures

PARKS & PLAYGROUNDS

- Equipment Maintenance
- Athletic Use Area Maintenance
- Turf Maintenance
- Security Maintenance
- Playground Maintenance
- Park Amenities Maintenance
- Sign Maintenance
- Park Usage Standards

- Landscape bed design, planting and maintenance standards
- Tree and shrub planting and maintenance standard
- Equipment maintenance and replacement standard
- Staff training standard.

COMMITTEES AND TYPES

Committee	Function
Committee - I	Approve the Technical Parameters such as scope, objective and Final Deliverable of the Project, IBM/Deciding basic parameters/approval of live bid documents/evaluation criteria, payment schedule
Committee - II	Approve the Tenders
Committee - III	Approve the EoT beyond 6 months price to be paid to the contractor for additional works 1. Not contingent on the main work. 2. Contingent but outside the scope of original contract

INVESTIGATION

- Preliminary Survey
- The nature and sequence of strata;
- The ground water conditions at the site;
- The physical properties of soil and rock underlying the site;
- The mechanical properties, such as strength and compressibility of different soil or rock strata, and
- Other specific information, when needed, such as the chemical composition of the groundwater, and the characteristics of foundations of the adjacent structure.

ESTIMATE :

- Preparing detailed estimate which involves taking out calculating quantities of various items of work from the Plans.
- Sanction of estimate

  The projects may be approved/implemented in two stages

Stage – I :

a) Detailed investigation, duly incorporating the correct classification by excavating trial trenches and obtaining boreholes data

b) Preparation of EIA/EMP(including R & R plan)

c) Preparation of DPR(with latest SoR and B.C Ratio) with detailed design and drawings based on the model studies

d) obtaining all clearances

e) Completion of land Acquisition

d) Funds required

Stage : II

a) once all clearances have been obtained and based on availability of funds the construction work should be grounded duly realistic time schedule

Sanction of Works Contracts

S.No.	Designation	Works Contracts value
1.	Commissioner	Not exceeding Rs. 20 lakhs
2.	Standing Committee	Exceeding Rs. 20 lakhs but not exceeding Rs. 50 Lakhs
3.	Corporation	Exceeding Rs. 50 lakhs but not exceeding Rs. 200 Lakhs
4.	Corporation and Government	Exceeding Rs. 200 lakhs after approval of the corporation shall be submitted to the Government for Sanction.

Present Technical Sanction Powers

1. Asst. Executive Engineers/Asst. Engineers upto Rs.1.00 Lakhs
2. Deputy Executive Engineers upto Rs.5.00 Lakhs
3. Executive Engineers/Municipal Engineers upto Rs.40.00 Lakhs
4. Superintending Engineers upto Rs.200.00 Lakhs
5. Chief Engineers/ ENC (PH) above Rs.200.00 Lakhs.

Registration of Contractors

- Class – I and II approval by COT
- Class – III and IV approval by SE
- Class – V approval by EE

PROCUREMENT :

- Non-EPC system through e-procurement (Below 10 Cr. Works)
- EPC system through e-procurement(above 10 Cr. Works)
- Above 10 Cr. for Non-EPC works the COT is the approving Authority.

Contract Profit and Overhead Charges :

- For WS, SWD, Roads, Building etc., - 5%
- For UGD works - 10%

Price Adjustment

- DI pipes, BWSC pipes and PSC pipes
- Steel and Cement

Duties of Field Engineers during Execution and Supervision

- The field engineers are primarily responsible for QA of the work executed by them and conduct all field tests before allowing further work.
- Shall check and produce records to inspecting officers
- Site order
- Benchmarks
- Material register
- Register of test reports
- The Mbooks have to be maintained by EPC agency and finally handed over to the Agreement authority.

QUALITY CONTROL

- Department Quality Control

  1. Shall issue quality certificates for releasing payments to the EPC agency during construction and after construction

  2. shall certify that the work has been executed as per designs and specifications(agreement) before final payment to the agency.

  3. shall conduct associate with construction staff with regard tests and frequency of tests

- **Third party Quality Control**

  1. shall conduct independent testing to assure the quality of the work as per agreement.
  2. shall submit the reports records to ENC as per agreement with the department.
  3. shall give QC certificate for each work bill executed by the EPC agency

Thank You

3. Preparation of Designs and Estimates

PREPARATION OF ESTIMATES

Topics

Lead chart
Standard Schedule of Rates
Standard data
Detailed Estimate
Abstract Estimate
Note Accompanying Estimate
Drawings

Lead Chart

Also Known as Lead Statement
Distance between the source of availability of material and construction site - Lead.
calculated in Km

The cost of conveyance of material depends on lead

Gives the total cost of materials per unit item.
Includes basic cost, conveyance loading- unloading, stacking charges etc.
Table showing Lead Statement

Table showing Lead Statement

S.No	Description of materials	Unit	Source	Lead	Basic rate	Conveyance charges	
1	2	3	4	5	6	7	

Standard Schedule of Rates

Also known as Schedule of rates (SoR)
SoR is the list of rates of various items of work.
Facilitates the preparation of estimates.
Serve as a guide in setting rates in connection with contract agreements.
Consists rates about items under different subheads like building items, water supply, Electrical & Sanitary, labor rates etc.

Need for the preparation of SoR

While working out the estimate of construction cost the engineer works out the detailed Bill of Quantities for each and every item of construction.
How to arrive at market rate to each particular item
All construction items are complex one involving more than one material and number of activities.
Example – For construction of a brick masonry wall the rates of bricks, sand, mortar, labour, scaffolding, curing etc., would determine the rate of brick masonry per cubic meter
All construction items are complex one involving more than one material and number of activities.
Example – For construction of a brick masonry wall the rates of bricks, sand, mortar, labour, scaffolding, curing etc., would determine the rate of brick masonry per cubic meter
Process of arriving at a rate of such construction items is called Rate Analysis.
All the departments work out the rates of different construction items after carrying out rate analysis after assessing contribution of each item of materials, labour, plant & equipment, tools, scaffolding, site overheads etc., to the completed item.
Further in order to serve the above objects, offers / tenders are invited.
Once the tenders are invited, how do we decide the best and right offer? How do we compare the offers and rates submitted by each bidder among themselves?
In order to compare the offers, one therefore needs to have a basic estimated rate with which the offers can be compared with.

In Andhra Pradesh, SoR is divided into four parts

Water Resources department items
Roads and Bridges items
Building items
Public Health items
The respective departments will submit their proposals to the Board of Chief Engineers and they will review and finalize the rates

Standard Data

Basic components for preparing any estimate
standard specifications,
standard data
schedule of rates.
To get the work done as per the required specifications required quantities of recommended materials, requirement of specific need based manpower, deployment of specific need based machinery and duration of its utilization are to be observed and quantified for each unit of work, and this is called standard data.

Standard Data gives the details of various inputs in terms of quantities required for one unit of any work.
When the schedule of rates and hire charges of machinery are incorporated in the inputs of standard data it will have direct bearing on the preparation of project estimates and consequent finalization of tenders

Classification of Standard data
The standard data is classified into four parts considering nature of work, location of work and magnitude of work.
Irrigation and command area development
Roads and Bridges

Buildings
Drinking water supply schemes

Detailed Estimate
Estimating is the technique of calculating or Computing the various quantities and the expected Expenditure to be incurred on a particular work or project.
Detailed estimate means calculations of Quantities of all items of work from their respective dimensions on the drawings on a measurement sheet.

Multiplying these quantities by their respective rates in a separate sheet, the cost of items of work are worked out individually and then summarized.

S.No	Description of Item	Length	Breadth	Depth or Height	Quantity

Abstract Estimate

The cost of each and every individual item of work is calculated by multiplying the quantity computed is called Abstract Estimate.

STATUTORY PROVISIONS

GST – 12% on ECV
NAC charges – 0.1% on ECV
Seigniorage charges – As per the actuals or 1% on the ECV
Physical Contingencies – 5%
Price Contingencies – 5%
Maintenance of APPMS - works module application - 0.15%
Unforeseen items

WORKSLIP

Prepared during the execution of work.
Indicates if there are any deviations from the approved estimate because of local site conditions.
The executing authority should intimate and submit the workshop proposals to the technical sanction authority and should get approval from them.

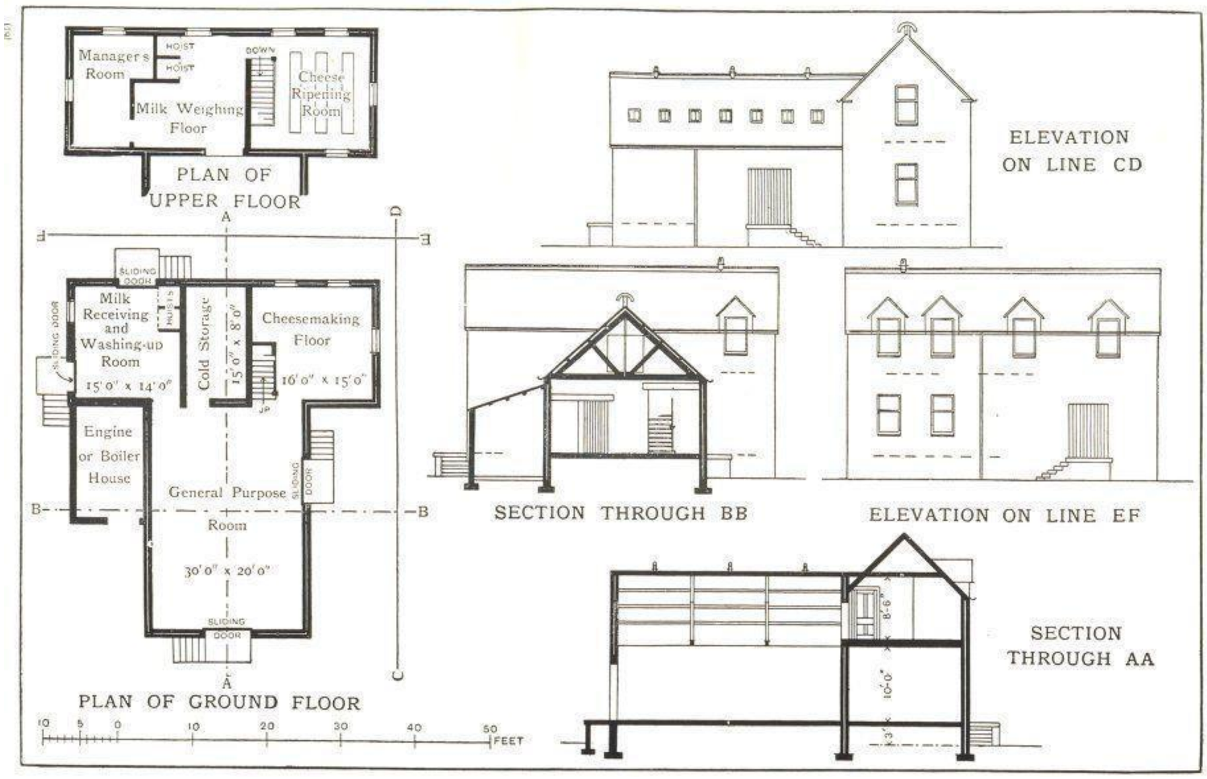
DEVIATION STATEMENT

Prepared after completion of the work
Indicates any deviations in the quantities executed from the original quantities in the approved estimate.
Supplementary items approval other than approved items.
Total cost of the project after completion of the work.
Should get approved from the technical sanction authority for closure of the work
Note accompanying estimate
Consists of description, scope and necessity of the project.
Administrative sanction details, council resolution details and funding pattern of the project.
Details of various components and specifications of items to be executed in the project.

Drawings

Drawing is the language of engineers.
No amount of words can convey civil engineering information as accurately and efficiently as a drawing.
An architect cannot describe the plan of a structure to the builder unless he draws it.

Before any structure comes into existence in real time, we first need to create the drawings of the desired structure.
A drawing will consist of all the constructional details that will be required on the field.
Structural drawings are used for reinforced concrete and structural steel.
Mechanical drawings illustrate mechanical equipment such as pumps, gates, pipes, and valves.
Architectural drawings show buildings, room layouts, and elevators
In basic terms, a **plan** is a birds-eye view of a space
Elevation of any structure is the front view, that is how you see a side of a structure when you are standing **in the** front.
Section is the view obtained after cutting the structure, for example sectional view of a room cut into two will show us the thickness of the wall, may be the doors and windows



Nowadays computers driven by powerful software's make these drawings with amazing speed and accuracy

4. Recording of Measurements and preparation of Bills

Measurement, Changes, Billing and Payment

Outline

- Measurement
- Deviations (changes/variations)
- Billing
- Payment
- Defects Liability Period
- Testing, Commissioning and Trial Run

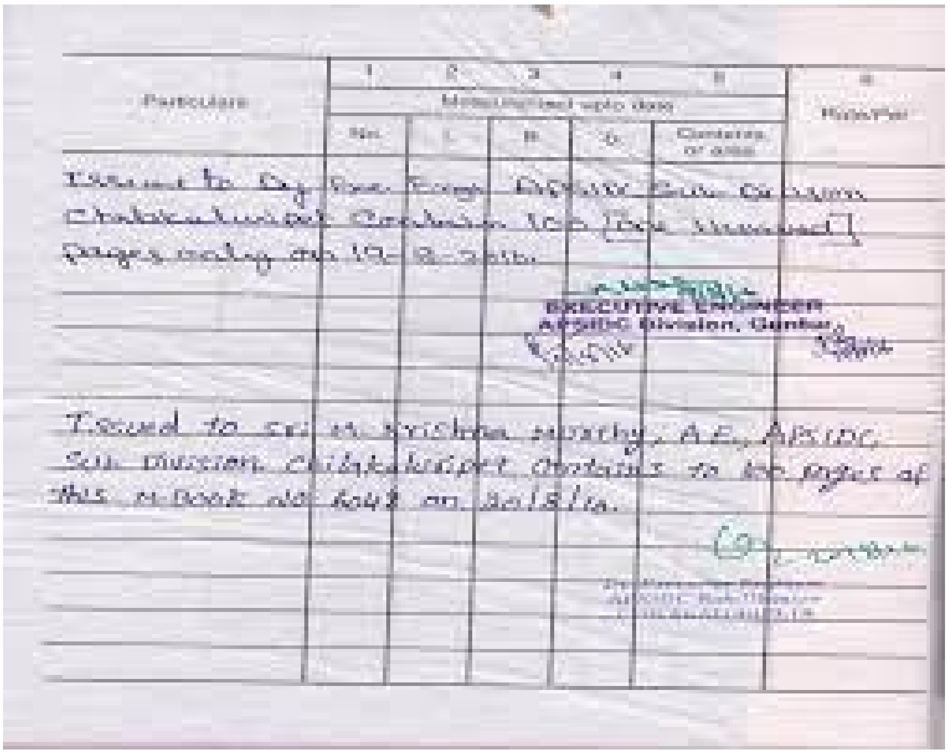
Measuring the work

- For **payment** purposes, work should be
    - **measured** regularly

- **Pre-levels** taken as necessary *and* the results recorded

- It is a good practice to draw a **rough sketch** on the right side of the M. Book of the item being measured for future reference
- This is the **responsibility** of the **Contractor**
- The work should be **checked and measured** at appropriate stages by the competent authorities based on the quantum of work, stage and items involved.
- The role of the departmental engineer / Project Manager /DSC is to check the Contractor‟s measurements.

Are there any problems and issues regarding the way works are measured at present?

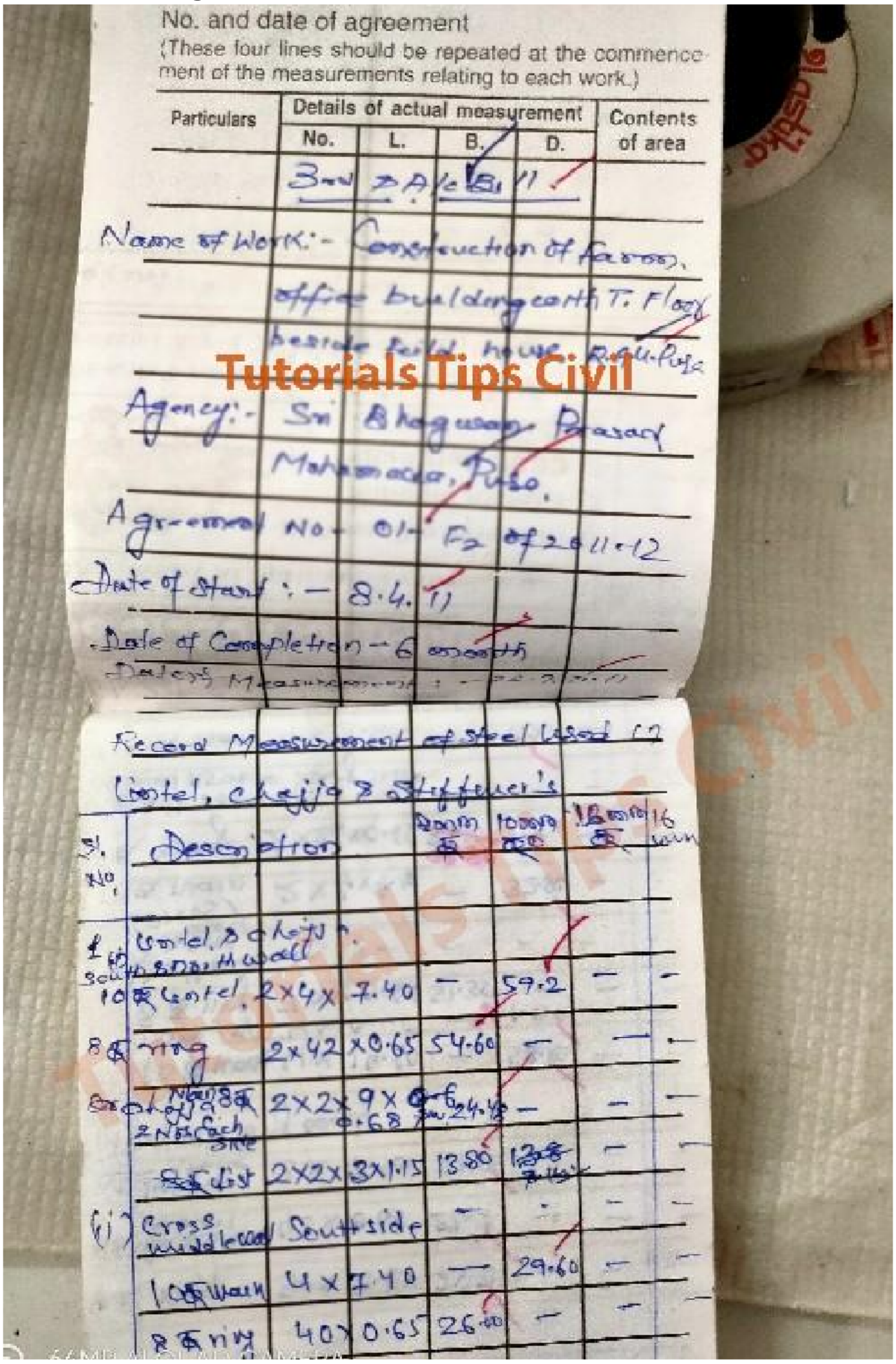


<u>Noting on M Book - for every set of</u> <u>measurements</u>
<u>recorded on a day</u>

- Date of recording of measurements, Name of work, Est. Amt., (Incl. RE/Work Slip Amt/), TS No., (incl. RE Workshop Apparel. date), Agt. No. (incl. Suppl. Agt. Nos.) Name of Contractor & Location of work.
- Date of handing over site and also agt. period on the top right hand side of the page of M. Book shall be

furnished for every set of measurements recorded in a day.

- All corrections or over writings in the measurements shall be attested by the Check-measuring officer.
- Usage of erasing liquids / solutions for corrections in the measurements is barred. All corrections to be rounded off and corrected with initials of concerned officer and check-measuring officer.


No. and date of agreement
(These four lines should be repeated at the commencement of the measurements relating to each work.)

Particulars	Details of actual measurement				Contents of area
	No.	L.	B.	D.	
	3rd RA/c Bill				
Name of Work:- Construction of Farm office building with T. Floor beside field house, R.A.U. Pusa					
Agency:- Sri Bhagwan Prasad Mahamada, Pusa.					
Agreement No. 01 F2 of 2011-12					
Date of Start :- 8.4.11					
Date of Completion - 6 month					

Particulars	No.	L	B	D	Contents or area	Rate Rs.	Total Value to date Rs. Ps.	Deduct previous measurements Page	Quantity	Since last measurement Quantity	Value Rs. Ps.	Remarks
[illegible]					[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	
					4,6598 [illegible]		[illegible]			[illegible]	[illegible]	
					14,3,962 [illegible]		[illegible]			[illegible]	[illegible]	
					[illegible]		[illegible]			[illegible]	[illegible]	
							[illegible]			[illegible]	[illegible]	
							635,87,418 [illegible]					

[illegible]

[illegible]

Total Value to date Rs. Ps.	Deduct previous measurements Page	Since last measurement Quantity	Value	Remarks
	[illegible]	[illegible]	[illegible] 530-531 [illegible]	
		Rs 2623,818		
[illegible]	64275	301383		
[illegible]	137 [illegible]			
[illegible]	[illegible]			
[illegible]	35383	2322,435		
[illegible]	[illegible]			
	301383			

[illegible]

Pay & Accounts Officer
Works & Projects
Vijayawada

[illegible]

C

Measurement upto date

Contents or area

Rate/Per

For JAYA SPUN PIPES

Authorised Signatory

oposal, if

step.

ndicating

Particulars

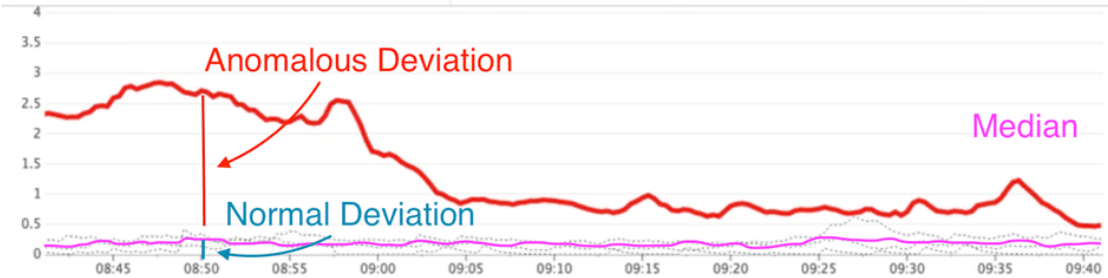
Measurement upto date

No. L B D Contents or area

Rate/Per

effect on ***a)* project completion time**, *and* ***b)* other aspects of the Contract**, as appropriate.

- **Combined effect of changes** should not normally increase or decrease the Contract value by more than **15%**.
- The **contractor** should **proceed** further **only after approval of the changes** by the competent authority, along with approved drawings showing the changes made with reference to the original drawings.



<u>Work slip & Revised Estimate (RE)</u>

- A RE /Work-slip is necessary where there is variation compared to the original estimate, even if it be due to reduction in quantities by way of substantial variations in quantities or in the value of the estimate.
- A **work slip/s** should be prepared whenever there is a deviation/change from the original agt. quantities or items during execution. It is to be approved by competent authority promptly before further execution. There **may be more than one work slip** based on exigencies of work.
- A RE is to be prepared and rev. TS be obtained whenever it is likely to exceed estimate by more than the powers of officer to pass excess over expd.(after deducting excess passable by competent authority & after excluding tender excess) & when need for Revised Adm. Approval occurs.
- An authority does not have the powers to sanction excess RE sanctioned by a higher authority.

Submitted:-

Kindly peruse paras 41 to 44 of this file.

This is with regards to the work slip for the work of "Labour required all festivals in Srivari Temple at Tirumala for the year 2009-10"

The estimate was sanctioned administratively for Rs.11,15,000/- and Technically sanctioned for Rs.6.30Lakhs vide CR No.41/SE-II/2008-09 and the work was entrusted to Sri J. Siva Sankar, Contractor, Tirupati on tender basis at (+)4.86% excess over the estimated value and also concluded agreement vide AGT No.26/EE-I/2009-10.

The EE-1 has submitted the work slip for the subject work and stated that, the work is in progress and during execution, as per the enhanced minimum wages to the labour vide AP Govt. Gazette, enhanced Minimum wages are to be paid to the contractor from March 2010. Accordingly the amount increased. Further no response for the tenders invited (for 2calls) for the work of "Labour required all festivals in Srivari Temple at Tirumala for the year 2010-11". As such to avoid hindrance to the functions in the temple the required labour has been engaged through the existing contractor duly continuing the contract. As such the amount has been increased.

The breakup details of the Revised estimate as follows:

Amount Increased due to excess Quantities:-

Item No.	Description of the item	Quantity as per estimate	Quantity as per execution	Increased quantity	Rate	Increased amount
2a	Painters II class for inside the temple works	200	335	135	300.80	40608
2b	Welder II class for inside the temple works	200	357	157	300.80	47226
2c	Carpenter II class for inside the temple works	50	80	30	300.80	9024
2d	Stone Cutter II class for inside the temple works	50	80	30	300.80	9024
2e	Mason II class for inside the temple works	100	160	60	300.80	18048
	Total amount Rs.					**123930**

Amount Increased due to Supplemental items:

Item	Description of the item	Quantity	Rate/one	Amount

Supplemental Agreement (SA)

- Whenever excess quantities are executed over and above that provided in the original estimate and the Agt. as authorized extras and also whenever new items are executed duly authorized, necessary SA shall be entered into and necessary data showing the method in which the rates in the SA have to be derived along with RE/Work slip duly sanctioned.
- All Original, SAs be concluded on Non-Judicial Stamp paper. If the SA items are found to be *contingent* on original

Agt., then only they are to be treated as „authorized extras„ and can be got executed by the same agency & paid at the rates derived as per terms & conditions of original Agt. for payment of such items.

Checking and settling bills

CONR 227 (1/13)

SUPPLEMENTAL AGREEMENT No. ___ IN CONNECTION WITH COST OF RELOCATING MUNICIPALLY OWNED FACILITIES MAINTAINED FOR PUBLIC USE (SUBDIVISION 24, SECTION 10, OF THE HIGHWAY LAW)

This Supplemental Agreement made this ________day of__________, 20___, by and between THE PEOPLE OF THE STATE OF NEW YORK (hereinafter referred to as "STATE"), acting by and through the COMMISSIONER OF TRANSPORTATION (hereinafter referred to as "Commissioner"), with the principal office in the Administration and Engineering Building, 50 Wolf Road, in the City and County of Albany, State of New York, and ______________________________, a Municipal Corporation in the County of ________ ____________ and State of New York (hereinafter referred to as "Municipality").

WHEREAS, the parties entered into a contract dated__________________ under which, among other things, the COMMISSIONER agreed to reimburse the MUNICIPALITY for the cost of relocation of certain municipally owned facilities maintained for public up to an amount not to exceed $ __________, except as such sum might be increased by a supplemental agreement, and

WHEREAS, additional work that was not contemplated in the original agreement was necessary, and

WHEREAS, the said sum of $ ______________________________set forth in the said agreement dated __________________________________ is inadequate for the purposes thereof,

NOW, THEREFORE, in consideration of the mutual benefits moving to each of the parties hereto, it is agreed as follows:

1. The amount of $ _______________set forth in paragraph ____of the agreement dated____________________ and effective __________, is hereby increased to $____________.
2. The MUNICIPALITY specifically agrees that this Supplemental Agreement shall be deemed executory only to the extent of the moneys available and that no liability shall be incurred by the STATE beyond the moneys available for the purpose.
3. Except as provided in this Supplemental Agreement, the terms and provisions of the said agreement dated __________________ and effective ____________, are and shall continue to be in full force and effect.
4. This supplemental agreement amends the test of the agreement as follows: Adds Appendix 2-S (Iran Divestment Act) attached hereto.

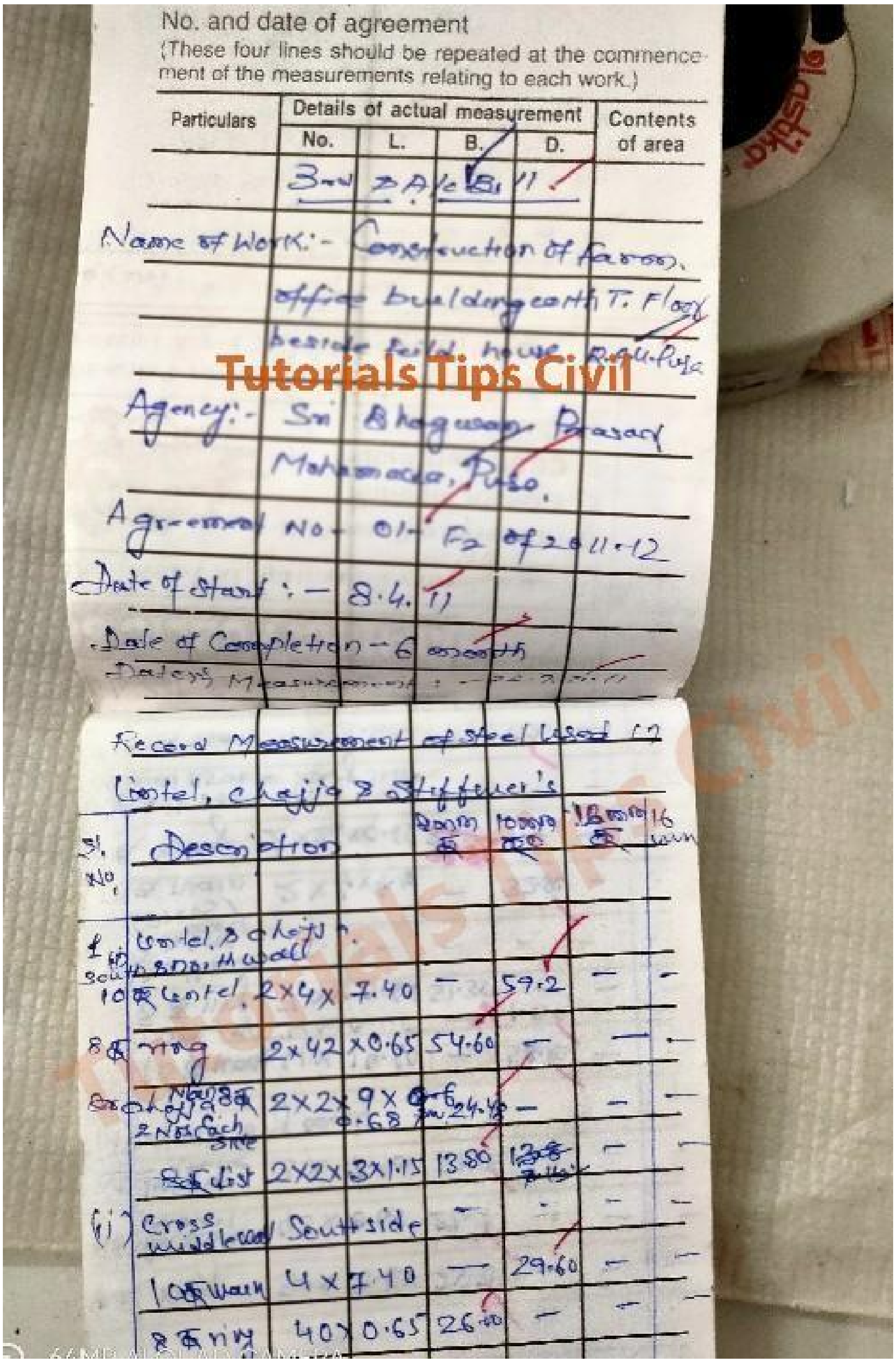
1

Checking and settling bills

- A **Contractor needs cash flow**. Without it, his business will fail and the Contract will stop.
- The Engineer should **encourage** the Contractor **to submit bills regularly** – normally at monthly intervals.

- Engineers have limited powers in a ULB relating to prompt payment of bills, but should ensure that they **do everything in their power to prepare, check and approve the bills quickly** and expedite payment.
- Where there is **disagreement** on an item, better to agree **to defer it** than to risk holding up payment of the whole bill.

  What can be done regarding problems in billing?



No. and date of agreement

(These four lines should be repeated at the commencement of the measurements relating to each work.)

Particulars	Details of actual measurement				Contents of area
	No.	L.	B.	D.	

Name of Work:- Construction of farm office building with T. Floor beside field house

Agency:- Sri Bhagwan Prasad

Agreement No- 01- F2 of 2011-12

Date of Start :- 8.4.11

Date of Completion - 6 month

Record Measurement of steel used in Lintel, chajja & Stiffener's

Preparing Running Account Bill

- Prepare the bill for the value of work done up to date – duly measured, check measured as required
- Make necessary **deductions** towards
    - Withheld amount @ --- % towards further security
    - Running Account Bills paid previously

- Income Tax & surcharge,
- Penalties / Liquidated Damages if any levied
- Installment of Mobilization Advance if any
- Seigniorage, GST, Labour Cess
- Technical personnel not engaged etc.

Reducing no. of steps to settle bills. What can be done?

FORM 26

RUNNING ACCOUNT BILL

(Referred to in paragraphs 10.2.12 and 10.2.14)

(Final payments must invariably be made on Forms printed on yellow paper which should not be used for intermediate payments)

[**For Contractors** : This form provides for (1) Advance Payments and (2) Payments for Measured Works. The form of Account of Secured Advances, which has been printed separately should be attached, where necessary]

Division ……………………………..   ……………………………..Sub-Division

Cash Book Voucher No……………………………….. dated ………………..

Name of Contractor …………………………………………………………

Name of Work………………………………………………………………

Serial No. of this bill …………………………………………………………

No. and date of the previous bill for this work ………………………………

Reference to Agreement No. …………………………… … …………………

Date of written order to commence work ……………………………………

Date of actual completion of work ……………………………………………

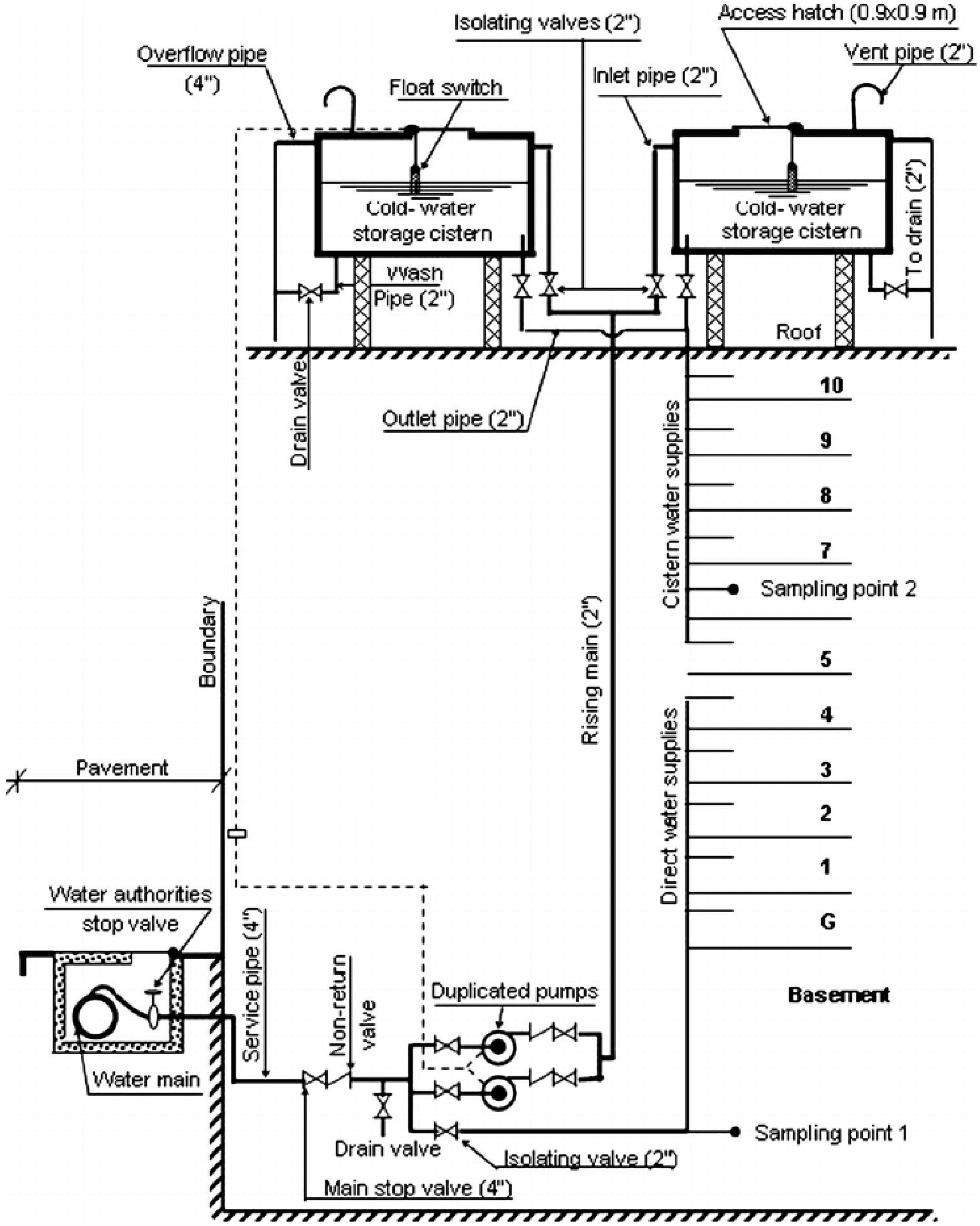
I – ACCOUNTS OF WORK EXECUTED

Items of Work	Unit	Rate	Quantity executed up-to-date as per Measurement Book	Payments on the basis of actual measurements		Remarks
				Up-to-date	Since previous bill	
1	2	3	4	5	6	7
		Rs.		Rs.	Rs.	
Total Value of work done to-date (A)						
Deduct – Value of work shown on previous bill						
Net value of work since previous bill (F)						

Figure (F) in words Rs……………………………………………………………………

As Built Drawings (Completion Plans)

- At the time of payment of the pre-final bill, the contractor shall furnish to the Project Manager the **As built drawings** (Completion Plans).
- They contain the plans / drawings as actually built on the site ***and*** **show the actual alignment, dimensions, levels and brief specifications** of various items of works.
- They are very **useful in Operation & Maintenance** of these works and in future planning of extensions to these works.
- They will provide **useful data in future integration with GIS based** base maps. They will be extremely useful in effective O&M of the facilities created and in future planning.



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Defects Liability Period (DLP)

- Usually on completion of the work, it is conditional for the contractor to **make good any defects due to faulty** construction or workmanship.
- The **Performance Guarantee** paid by the contractor at the beginning of the contract will be released only after satisfactory completion of the Defects Liability Period.
- For typical works like **Water retaining structures**, normally the above period will be increased as felt necessary based on operational requirements.
- This may be incorporated in the **Special Conditions** of Contract.

- Notification

- During DLP, contractor should be notified of any defects noticed due to bad workmanship/deficiency in materials/works quality
- Contractor should promptly rectify the defects within the specified period
- Any defect notified before the expiry of the DLP & rectified thereafter shall result in extension of DLP up to that period.
- The contractor can not claim a refund of his performance security until all the defects are rectified.

Completion Certificate

- The contractor shall request the Engineer within the last 15 days of DLP for issue of completion certificate on satisfactory completion of defects liability period.

- After the expiry of the DLP, on inspection of the works, the Engineer, if satisfied with the condition of the works, issues the completion certificate.
- Then the contractor will be entitled to claim for his performance security and the balance of the withheld amount due to him.
- This will imply the end of the contract.

PROJECT COMPLETION CERTIFICATE
(For Projects under BSUP/IHSDP)

Project Name:-

Name of Town/City:-

This is to certify that the project.. at..............................city/town) sanctioned under BSUP/IHSDP) has been completed in all respects including all components as per DPR approved by the CSMC.

Approved cost of the project (Rs. In lac)	
Date of approval by the CSMC	
Funds/ ACA provided by Government of India (Rs. In lac)	
Funds provided by the State Government (Rs. In lakhs)	
Funds provided by the ULB/implementing agency/beneficiary Share /beneficiary contribution (with dates) (Rs. In lac)	
Date of commencement of works	
Date of completion of all works as per approved DPR, it all approved works have not been completed the give details of curtailment along with reduction in cost	
Remarks if any	

The infrastructure of said scheme is with the ....ULB and handed over to taken over to / taken over by the Urban Local Body for O & M on .... (Date) for further operation and maintenance.

The actual expenditure incurred on the said scheme is Rs................. lakhs and the details are as under:-

Sl. No.	Items	No. of DUs as approved	No. of DUs completed project	Approved Cost by CSMC Government of India	Expenditure as per actual as on date
1	Works: a) Housing b) Infrastructure				
2	Established Charges				
3	Contingencies				
	Total:-				

Operational Guarantees

- Usually, **operational guarantees** are specified in Special Conditions of Contract (SCC) to satisfy the various operational parameters at works (factory) and at field for components/ equipment like:
    - Water retaining structures (ELSR/GLSR/Sump/STP etc.)

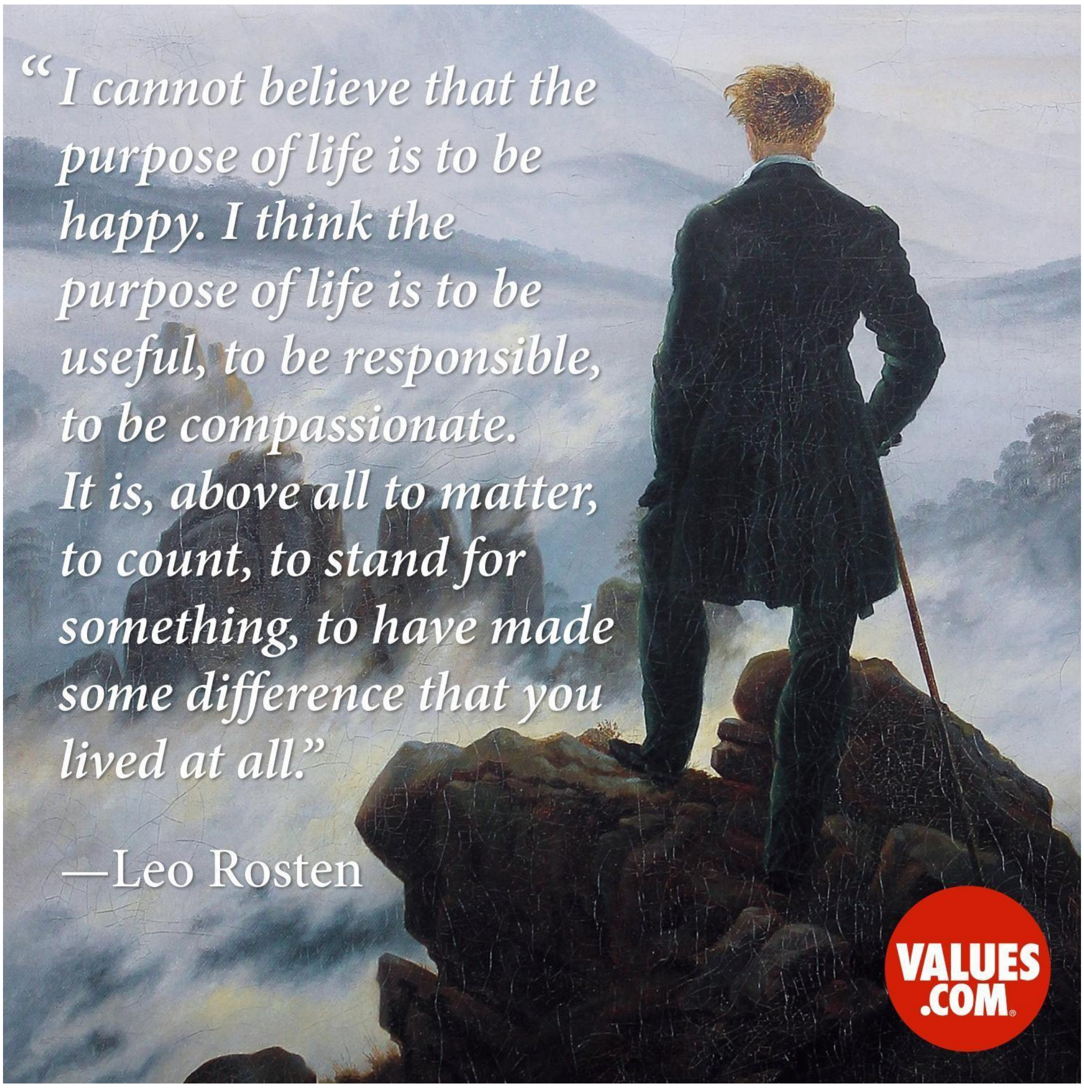
    - Pumps, motors, transformers, compressors, generators etc.
    - Flood gates, flap gates etc.
    - Chlorinators etc.
- The **contractor** shall **satisfy the operational requirements** by conducting **necessary tests** as per guarantees specified in **SCC**.
- After satisfactory performance of these tests in the presence of the Engineer, the contractor can hand over the facilities to the Employer for Commissioning and Trial run.

Testing, Commissioning and Trial Run

- Then they will be ready for **<u>commissioning</u>** which is a **process** intended to ensure compliance of the facility to satisfactory **operational, functional** and **performance** requirements as specified in the Contract.
- **Trial run** shall be successfully conducted **for the specified period** as per technical specifications.
- Only on a satisfactory **trial run** of the equipment / facilities based on a log book, the contractor **can claim refund** of **performance guarantee** & balance **withheld amount**.

- 
- Source:www.commissioning and startup.com

- Love our fellow beings? Why?
- A Stanford University Study on 1,056 people from 5 continents found that 99.9% of DNA of all of them was identical.
- Our genes are transmitted from African ancestors 60,000 years ago.
- Even the genomes of humans & chimpanzees are 98.8% identical.
- Then what is the meaning of “MY family”?
- Are WE connected? All Creation is Kin - The Buddha.
- What is the Purpose of our life?

- 

Essentials for Success & Fulfillment

- Knowledge, Skill, Attitude, Dedication, Health, Integrity, CHARACTER
- Creativity & Innovation
- Basic Human values: Satyam, Karuna, Maitri, Saha- anubhuti
- What will give happiness and fulfillment? Question yourself.
- **Time** Management
- Sharpen your saw – staying up to date.
- A Quest for **Excellence** in whatever we do.
- Initiate - Own - Learn - Share **-** Network - Lead.
- A **Goal -TEAM** work-**T**ogether **E**veryone **A**chieves **M**ore. **Work (Duty)** saturated with **Love** towards fellow beings - transforms into service & leads to Happiness & Fulfillment

5. O&M Works

Operation and Maintenance of Municipal Drainage systems

1. **Components of Drainage System**:
    a. Tertiary Drains (Local Drains)
    b. Secondary Drains (Collector Drains)
    c. Primary Drains (Major Drains/Out fall Drains)
    d. Pumping Stations
    e. Flood Prevention Structures such as I&D structures/Flap
Gates

Operation and Maintenance of Municipal Drainage systems

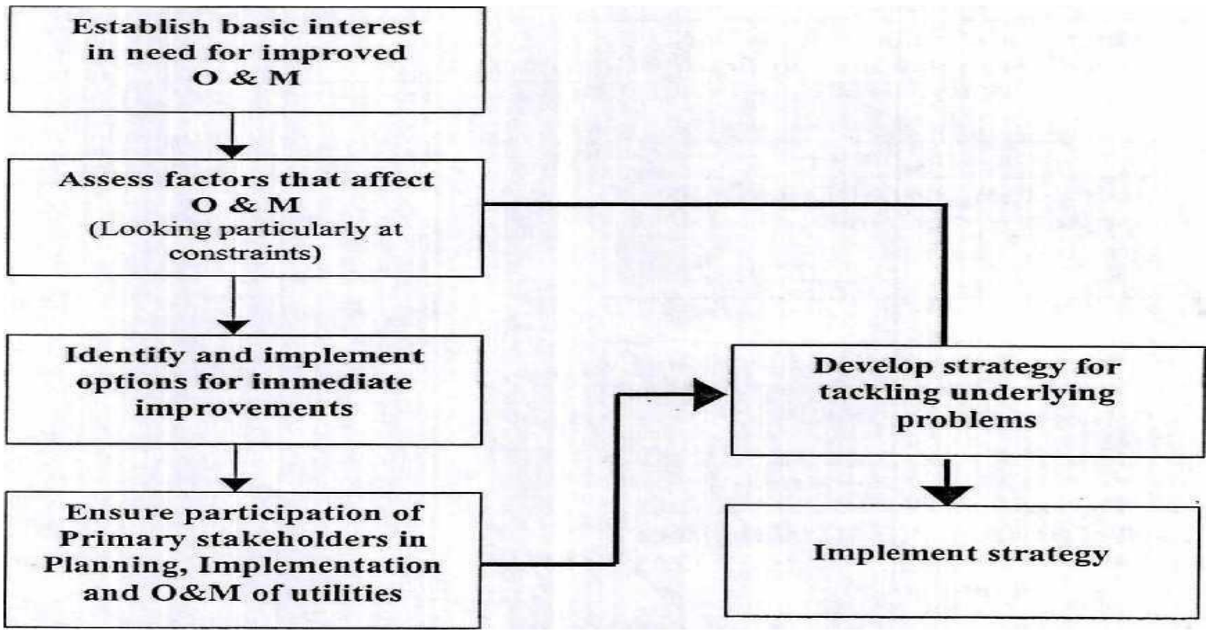
Objectives of O&M :

a. Drains run freely at all times and flooding problems are minimized
b. Effective use is made of available resources (finance, workers and equipment).
c. Equipment and facilities operate for the whole of their design life, so ensuring that investments are fully utilized.
d. Health and safety hazards to municipal sanitary workers and the General public is minimized.

Operation and Maintenance of Municipal Drainage systems

3. Developing a Strategy for improving of O&M :

Step wis



e approach

Operation and Maintenance of Municipal Drainage systems

a. Start by assessing existing systems, with particular reference to the factors that affect the quality of O&M.
b. Develop an immediate action plan (IAP), focusing on actions that are relatively easy to achieve and result in clear cost reductions, improvement in the level of service provided or both.
c. Develop a longer-term programme for O&M improvement that includes both:

efforts to overcome constraints; and

more ambitious efforts to tackle basic deficiencies in O&M.

- Operation and Maintenance of Municipal Drainage systems
- **Initial Assessment of Existing O&M Practices**:

Due to reduced the efficiency of the drainage system

Due to endanger the health and safety of sanitary workers and the public

- **Checklist for Assess the Current situation in the Town/City**

Does the system carry both foul and storm water?

Does solid waste dumping create a need for more frequent drain cleaning?

Are there lengths of drain with low flow velocities, resulting in rapid siltation and hence a need for frequent drain cleaning? If so, what is the cause? Look for evidence of restrictions caused by culverts (particularly pipe culverts), shrubs and encroachments, irregular slope and lack of fall along the drain (perhaps caused by the high water level in a downstream drain.

Is drain cleaning made more difficult by the fact that some lengths of drain are not lined and/or have broken lining?

Is it difficult to gain access to some lengths of drain, perhaps because they are covered or pass beneath buildings? Are maintenance options restricted by a lack of vehicle access to the drain?

Are there problems because storm run-off is carrying silt into the drain.

Operation and Maintenance of Municipal Drainage systems

Immediate action program:

Assign the teams responsible for cleaning local drains to individual wards.

Devolve management responsibilities for local drains to the ward level.

Develop a simple plan for each ward, showing the drain lengths assigned to each member of the team.

Develop schedules for cleaning main drains.

Provide tools that are appropriate to the task in hand.

Ensure that silt removed from drains is collected within 2 days of being deposited.

Operation and Maintenance of Municipal Drainage systems

Longer term strategy:

Obtain the information required to develop an improved understanding of the existing drainage system.

Carry out selective physical improvements in order to make O&M easier. Where possible, this may include providing improved access to larger drains.

Re-organise systems, introduce new management arrangements and re-assign duties and responsibilities in order to increase the efficiency of drain maintenance procedures,

Develop job descriptions, focusing particularly on the need for good management at the local (sanitary supervisor and sanitary inspector level). Provide training as required.

Operation and Maintenance of Municipal Drainage systems

Information for Good operation and maintenance:

The location, size, approximate capacity and condition of existing facilities

The access that is possible

Problems caused by frequent flooding and/or overflowing of the drain contents.

The cost of operation and maintenance for different types and sections of drain and different approaches to drain maintenance.

Operation and Maintenance of Municipal Drainage systems

Developing the information system

Identify priority problems

2.Respond to those problems

Preparation of Drainage System Plans:

Identify all main drains and plot them on a copy of the base map. Also plot secondary drains that connect to them.

Identify and plot the drainage boundaries between the areas served by these drains.

Identify any obvious problem areas - those where flooding or frequent drain overflows occur.

Carry out level surveys along routes of main drains and secondary drains in order to identify any lengths of drain that have limited falls.

Identify any constrictions caused by culverts and encroachments, any access problems due to the location of the drain or the fact that it is covered.

- Operation and Maintenance of Municipal Drainage systems Recording information

Management information

Developing an assets register for drainage

Identifying and dealing with physical constraints

Developing human and organizational resources

Specific training for pump maintenance Improvements in health

and safety Developing performance targets for O&

6. Deviations to the sanctioned estimates

7. Disaster Response preparedness

Training for the Ward Secretaries

Orientation & Induction Training

NATURAL CALAMITIES & DISASTER MANAGEMENT

PHMED / Public Health & Municipal Engineering Department

DISASTER MANAGEMENT – PREPAREDNESS & RESPONSE

Introduction

- India has been traditionally vulnerable to **natural calamities** on account of its unique geo-climatic conditions.
- Floods, droughts, cyclones, earthquakes and landslides have been a recurrent phenomena.
- Over the past couple of years, the Government of India have brought about a paradigm shift in the approach to disaster management.
- Disaster management occupies an important place in this country's policy framework, as it was designed to make the poor and the underprivileged resilient.

Definition

- The United Nations defines disaster as ***"The occurrence of sudden or major misfortune which disrupts the basic fabric and normal functioning of the society or community".***

- The Disaster Management Act, 2005 defines disaster as ***"A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes or by an accident or negligence which results in substantial loss of life or human suffering or damage to and destruction of property or damage to or degradation of environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area".***

- Since disasters have an adverse impact on the society or community, it is hence essential to minimise the loss of life and property.
- An effective and timely response to a disaster can reduce its worst impact on the affected.
- Disaster management teams and forces fight against the havoc of disasters and leads to the recovery of affected.
- Protection and preservation of environment against disasters is key motto.
- Disaster Management teams starts rehabilitation programs and relief measures in the affected areas.
- Disaster Management manages the situation efficiently and normalises it.
- Hence Disaster Management is crucial for sustaining the future and leading to sustainable development.

Why is Disaster Management important?

Various Types of Disaster

Natural Disasters:
Disasters that are caused by Natural causes are called as Natural Disasters.

- **Earthquakes,**
- **Landslides,**
- **Floods,**
- **River erosion,**
- **Cyclones,**
- **Tsunami,**
- **Forest Fires etc.**

Artificial/ Man-made Disasters:
These are the disasters that are occurred due to man made changes over the surface of the Earth.

- **Nuclear Disasters,**
- **Chemical Disasters,**
- **Mine Disasters,**
- **Biological Disasters.**
- **Others such as Dam or Reservoir breaches, Derailment of Trains, Aeroplanes, Sinking of Boats etc.**

Disaster Management – Case Study

- The super cyclone that hit Odisha in 1999 with a wind speed of 300 mph.
- Before the landfall, the cyclone centred over Odisha for 3 days accompanied by torrential rain as a tidal surge of about 7 to 10 metre that swept more than 20 km inland
- While the official death toll then was 9,885 people, unofficial sources estimated the toll to be above 50,000.
- At least 13 million people, including 3.3 million children, 5 million women and nearly 3.5 million elderly people were affected in 1999

Disaster Management – Case Study

- On 12 Oct 2014, Tropical Cyclone Hudhud made landfall on India's coast of Andhra Pradesh, near the city of Visakhapatnam, as a category-III storm
- Districts of Visakhapatnam, Srikakulam and Vijayanagaram sustained damage to infrastructure, communication, shelter and livelihoods
- However the human casualties were restricted to the minimum (about 22 only reported)
- This can be attributed to the sustained preparedness and mitigation measures undertaken in the past, and effective & timely response initiated by Central Government and State Government(s), right from the early warning stage
- Over 2,22,000 people were evacuated from low lying and vulnerable areas to 310 relief camps. In addition, 1688 medical camps were opened, about 2.9 million food packets and 6.5 million water packets were distributed over a period of 15 days

Disaster Management Act, 2005

- This Act provides for the effective management of disaster and for matters connected therewith or incidental thereto.
- It provides institutional mechanisms for drawing up and monitoring the implementation of the disaster management.
- The Act also ensures measures by the various wings of the Govt. for prevention and mitigation of disasters and prompt response to any disaster situation.
- The Act further provides for the constitution of different Executive Committees at national, state and district levels.
- The Act also provides specific roles to local bodies in Disaster Management.

Disaster Management Act, 2005

There are two National Level Institutions,

- National Disaster Management Authority (NDMA).
- National Executive committee (NEC).

There are two State Level Institutions,

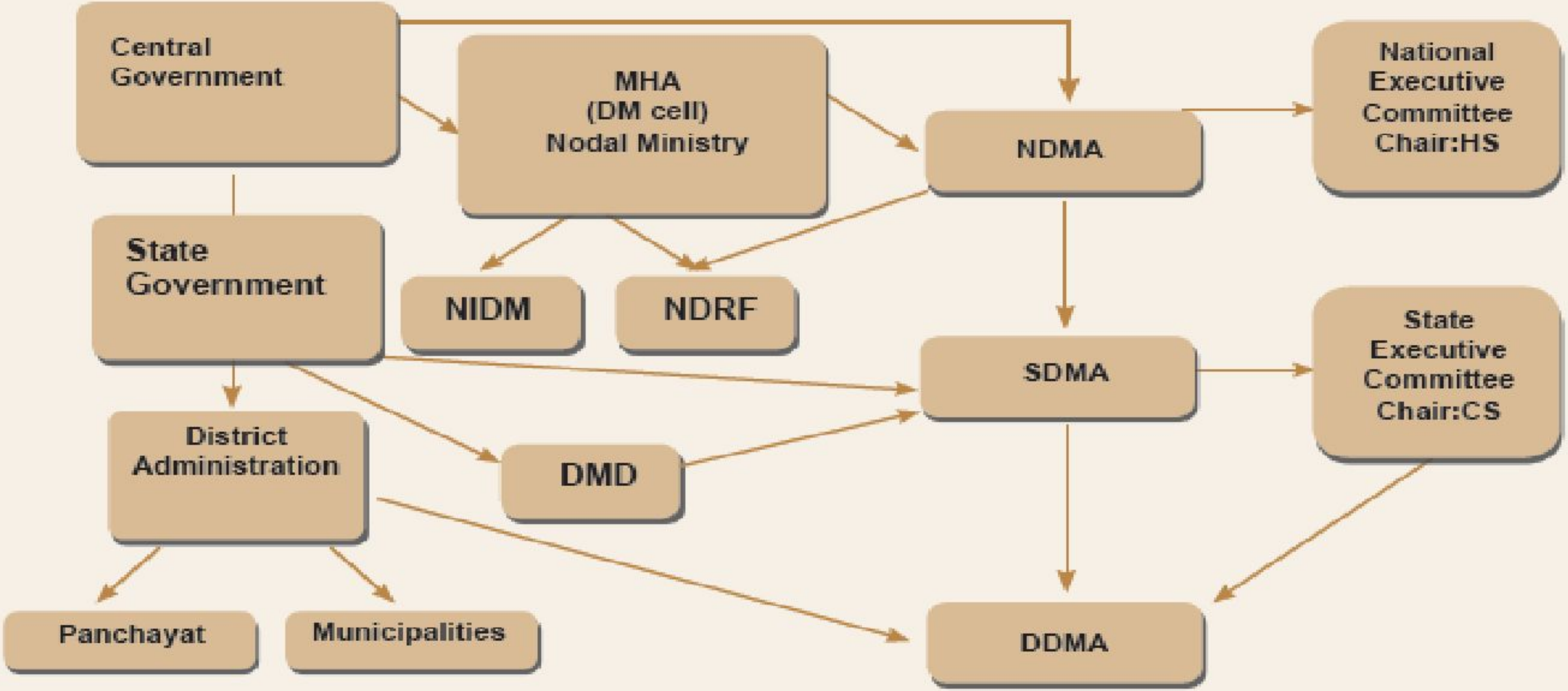
- State Disaster Management Authority (SDMA).
- State Executive Committee (SEC).

There are one District Level Institution,

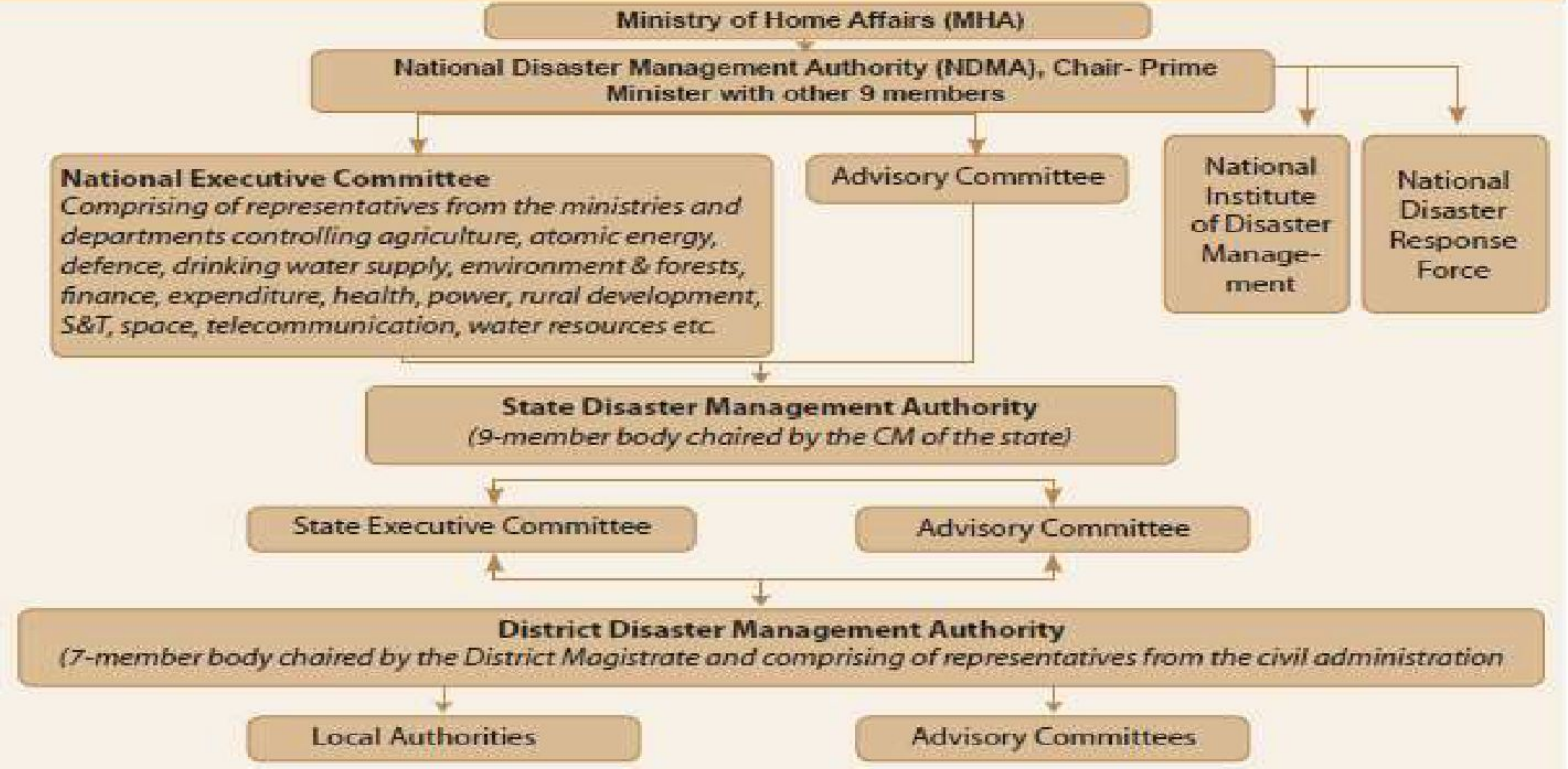
- District Disaster Management Authority (DDMA).

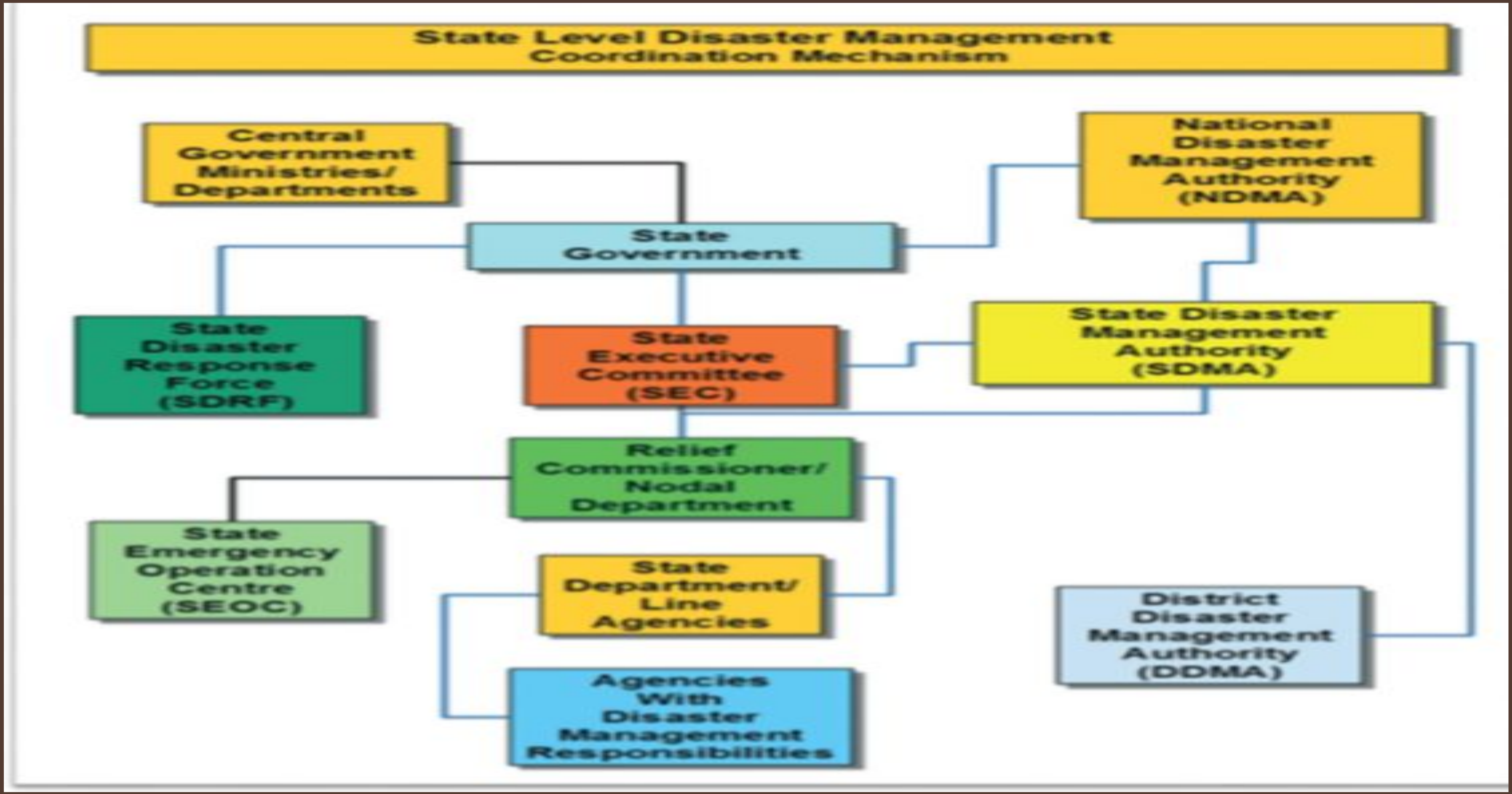
LEGAL-INSTITUTIONAL FRAMEWORK

Disaster Management Act 2005

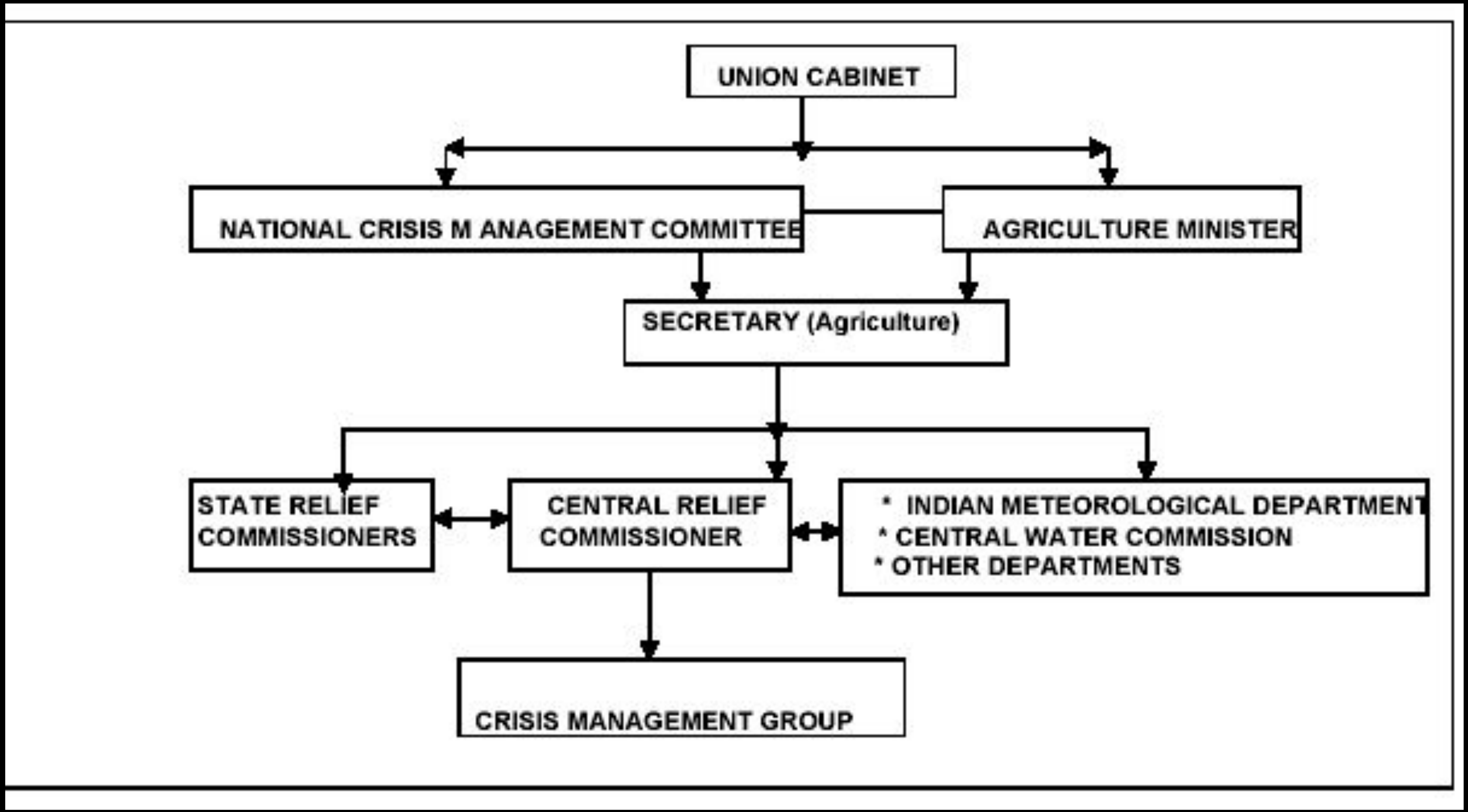


Structure of National Disaster Management

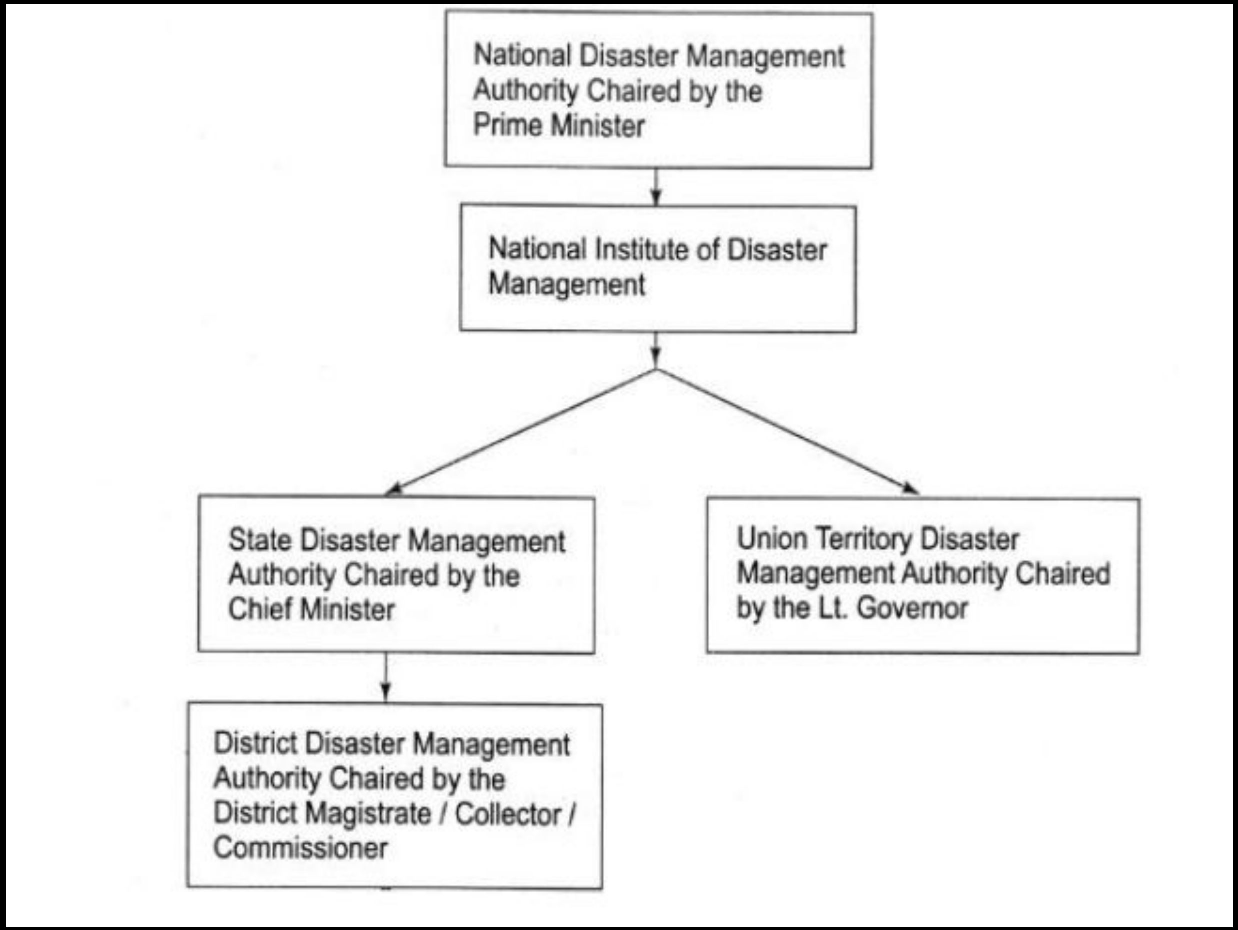



State Level Disaster Management Coordination Mechanism
Central Government Ministries/ Departments
National Disaster Management Authority (NDMA)
State Government
State Disaster Response Force (SDRF)
State Executive Committee (SEC)
State Disaster Management Authority (SDMA)
Relief Commissioner/ Nodal Department
State Emergency Operation Centre (SEOC)
State Department/ Line Agencies
District Disaster Management Authority (DDMA)
Agencies With Disaster Management Responsibilities

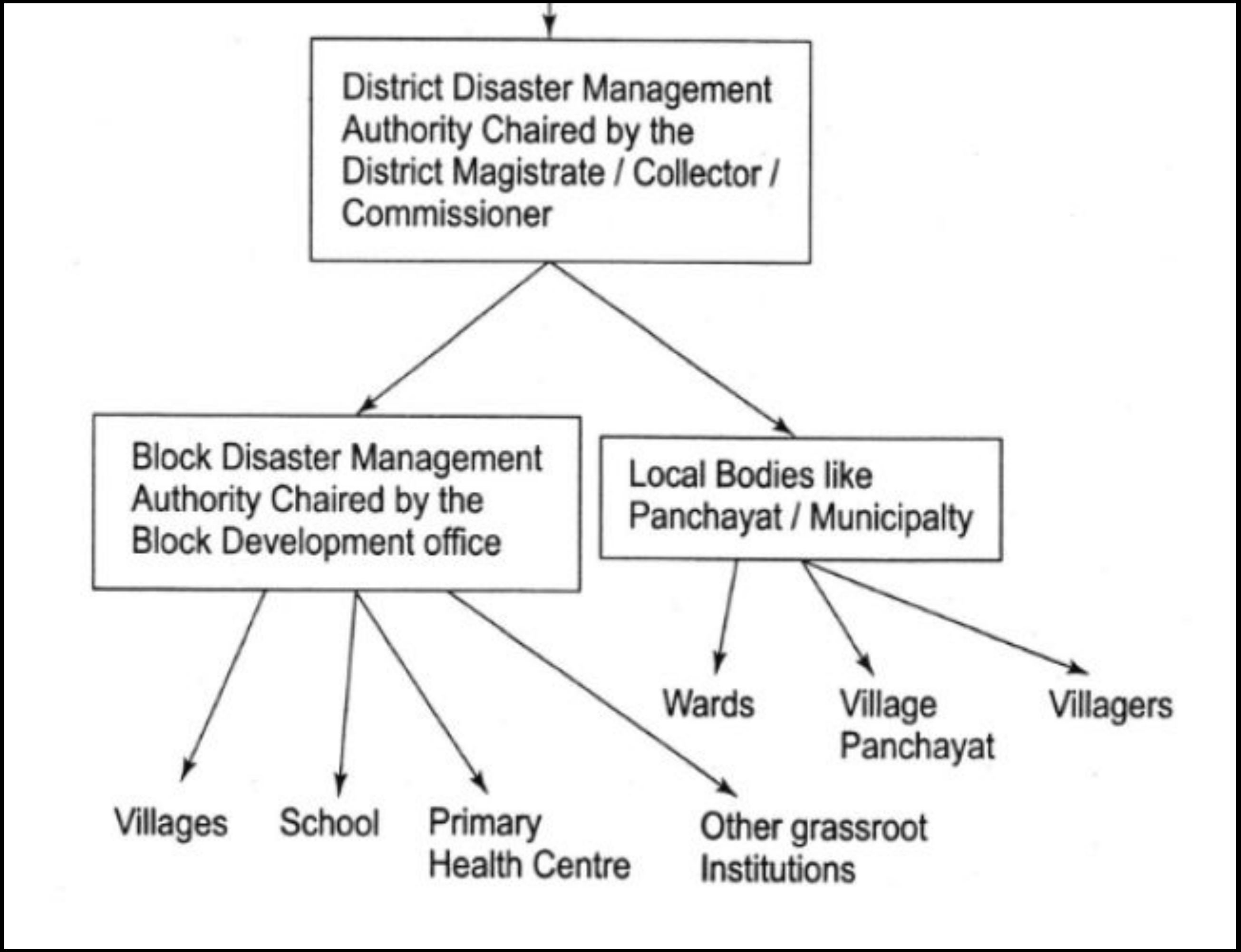
National response mechanism



Organogram of DM authorities from National to State/ District



Organogram of DM authorities from National to State/ District



Role of NDMA

- The National Disaster Management Authority in the Ministry of Home Affairs functions 24×7 to monitor the disaster or likely disaster situation.
- During the south west monsoon, daily situation reports are prepared based on the feedback received from the affected States and concerned Central Ministries and organizations and are sent to all concerned.
- During the calamities of severe nature, special situation reports are also prepared and issued to all concerned.
- It lays down policies and guidelines for the statutory authorities to draw their plans.
- Approves National Plan on Disaster Management
- The NDMA concentrates on prevention, mitigation, preparedness, rehabilitation and reconstruction.
- Formulates appropriate policies and guidelines for effective and synergised national disaster response and relief. It will coordinate the enforcement and implementation of policies and plans.

Role of National Executive Committee

- Secretary to Govt. of India in charge of Ministry or Department having administrative control of the Disaster Management is the ex-officio chairperson (usually Home Secretary)
- Acts as the coordinating and monitoring body for disaster management
- Prepares National Plan on Disaster Management
- Coordinates and monitors the implementation of National Policy
- Lays down guidelines for preparing disaster management plans by different Ministries/ Departments and State Authorities
- Monitors, coordinates and gives directions regarding the mitigation and preparedness measures to be taken by various agencies/ departments
- Coordinates response in the event of any likely disaster situation or disaster

Natural Disaster Response- Government of India

- National Crisis Management Committee(NCMC) under Cabinet Secretary
- Crisis Management Group(CMG) under Central Relief Commissioner
- Group of Ministers, Group of Secretaries and High Level Committees-Need base

Disaster Management Policies & Guidelines

National Policy on Disaster Management, 2009

National Action Plan on Climate Change-Issued by MOEF

Drought Manual –Prepared jointly by MOA/ NIDM and issued by MOA.

Guidelines-26 guidelines issued by NDMA.

National Disaster Management Plan

State and District Disaster Management Plans

Nodal Agencies for Disaster Management

Floods : Ministry of Water Resources, CWC
Cyclones : Indian Meteorological Department
Earthquakes : Indian Meteorological Department
Epidemics : Ministry of Health and Family Welfare
Avian Flu: Ministry of Health, Ministry of Environment, Ministry of Agriculture and Animal Husbandry
Chemical Disasters : Ministry of Environment and Forests
Industrial Disasters : Ministry of Labour
Rail Accidents : Ministry of Railways
Air Accidents : Ministry of Civil Aviation
Fire : Ministry of Home Affairs
Nuclear Incidents : Department of Atomic Energy
Mine Disasters : Department of Mines

DISASTER RESPONSE ARRANGEMENTS IN THE STATES

- STATE CABINET
- STATES CRISIS MANAGEMENT GROUP: HEADED BY CHIEF SECRETARY.
- INSTITUTION OF RELIEF COMMISSIONERS IN STATES
- STATES/DISTRICTS CONTINGENCY PLAN S / RELIEF CODES.

Role of Government - State

- Shall establish a State Disaster Management Authority with Chief Minister of the State as ex-officio chairperson, Chairperson of State Executive Committee and along with 8 other members
- Shall lay down state disaster management policy
- Approve state plan in accordance with the guidelines laid down by the national authority
- Approve disaster management plans prepared by the departments of the state government
- Coordinate the implementation of state plan

State Executive Committee

- The Chief Secretary to the State Government – Ex-officio chairperson and includes 4 secretaries to govt. of state as members
- Coordinates and monitors the implementation of national policy, the national plan and state plan
- Examines the vulnerability of different parts of the state to different disasters and specifies measures for their prevention and mitigation
- Lays down guidelines for preparing disaster management plans by different Ministries/ Departments of State.
- Monitors the implementation of the disaster management plans prepared by the departments of state and district authorities

Role of Government - District

- District Disaster Management Authority in every district of state with Collector or District Magistrate or Deputy Commissioner shall be ex-officio chairperson
- Elected representative of the local authority (i.e. Zilla Parishad) will be Co-Chairperson – ex-officio.
- Prepare disaster management plan including district response plan for the district
- Coordinate and monitors the implementation of the National Policy, State Policy, National Plan, State Plan and District Plan
- Identify areas in the district vulnerable to different type of disasters and take measures for their prevention and mitigation
- Review the state of capabilities for responding to any disaster or threatening disaster situation in the district and give directions to relevant departments or authorities at district level

Role of Government – Local Authority

- Shall ensure that its officers and employees are trained for disaster management
- Ensure that resources relating to disaster management are maintained to be readily available for use in the likely disaster situation or disaster
- Ensure all construction projects under it or within its jurisdiction conform to the standards and specifications laid down for prevention of disasters
- Carry out relief, rehabilitation and reconstruction activities in the affected area in accordance with the State Plan and District Plan
- Take such other measures as may be necessary for the disaster management

Role of Non-GovernmentalOrganisations

- For large relief agencies & NGOs, the main response is to provide material relief & rescue operation during times of disaster including medical relief.
- This is followed by a longer period of reconstruction activities of the physical infrastructure like roads, houses, community buildings, drinking water facilities etc. & continuation of medical aid.
- For small & localized NGOs, initial response is in the form of rescue & material relief.
- Most of larger India agencies stay back in disaster prone areas for disaster mitigation, long-term development of the people of area & especially for disaster preparedness before next disaster strikes.
- Local NGOs, who also participate in relief & reconstruction activities during times of disaster, revert back to their usual pre-disaster activities after initial phase.

National Institute of Disaster Management

- NIDM (National Institute of Disaster Management), is a premier institute for training and capacity development programs for managing natural disasters in India, on a national as well as regional basis.
- NIDM, constituted under an Act of Parliament in 1995; was re-designated to give the present name of NIDM by the Disaster Management Act 2005
- NIDM also serves as international SAARC Disaster Management Centre (SDMC) and works as focus for its operation and planning.

National Institute of Disaster Management

- **Structure**
  - Policy Planning and Interdisciplinary issues
  - Hydro-meteorological, Climate change and Environment related
  - Geological disasters and engineering related issues
  - Emergency response and administration related issues

Besides these, are envisaged/working:

- Cell on Environment and Climate change
- Indo-German Cooperation Programme on
- Environmental Knowledge for Disaster Risk Management(EKDRM).
- Training Cell.

National Disaster Response Force (NDRF)

- The Disaster Management Act, 2005 has made the statutory provision for the constitution of the Force.
- Though the units of this Force were nominated in 2003, it is only after the establishment of NDMA that their training and equipping were vigorously pursued. In lieu with the Section 44 (i) of the Act that states NDRF a specialist force.
- The **National Disaster Response Force** (**NDRF**) is a disaster response agency under National Disaster Management Authority (NDMA) created by the Ministry of Home Affairs, government of India.
- It was established in 2009, for disaster management and specialised response to natural and man-made disasters.
- Functions at state and central-level under the National Disaster Management Authority (NDMA) based.
- The force emerged as the most visible and vibrant multi-disciplinary, multi-skilled, high-tech force of the NDMA capable of dealing with all types of natural and man-made disasters.

National Disaster Response Force (NDRF)

- The head of the NDRF is designated as Director General.
- It consists of twelve battalions of Central Armed Police Forces, including two each from the BSF, CRPF, CISF, SSB and ITBP.
- Each battalion will provide 18 self-contained specialist search and rescue teams of 45 personnel each including engineers, technicians, electricians, dog squads and medical/paramedics. The total strength of each battalion is approximately 1,149.
- Twelve Battalions are stationed at Guwahati, Kolkata, Cuttack, Arakkonam, Pune, Gandhinagar, Bhatinda, Ghaziabad, Patna, Vijayawada(Mangalagiri), Varanasi, Itanagar

State Emergency Operations Center (SEOC)

- To tackle emergency situations in an efficient manner, A State Emergency Operations Center (SEOC) has been established by APSDMA in its headquarters building.
- The SEOC is equipped to monitor short-range, medium range and long range weather related natural hazards in multiple locations such as Thunderstorm, Floods, Cyclones, Earthquake etc.
- The SEOC is equipped with dedicated BSNL connectivity and AP Fibernet Connectivity. The VSAT communication system established in the centre works as a second line of contact in case of failure of any of the above mentioned connectivity.
- The SEOC is envisaged to function round-the-clock with well trained professionals including specialists from interdepartmental teams with dedicated officers from Police, Fire and Revenue Departments.

State Disaster Response Force (SDRF)

- The Govt. of Andhra Pradesh vide G.O. Rt. No. 3, Home (Legal.II) Department, dt. 13.01.2016 created the Andhra Pradesh State Disaster Response Force (APS DRF)
- APSSDRF comprises of 6 Companies with two teams each (Total 12 teams).
- Each Company consists of two teams each comprising of 47 personnel
- The 6 companies are located at Kurnool, Kakinada, Vizianagaram, Mangalagiri, Venkatagiri(Nellore), Visakhapatnam.

District Emergency Operations Center (DEOC)

- The District Emergency Operations Center (DEOC) are the emergency operations center at district level connected to the Mandal Emergency Operations Centers in the field level.
- In Andhra Pradesh, DEOCs are located in all 13 districts. DEOCs are equipped with emergency communication systems and situation monitoring facilities.
- The DEOCs are located in the District Collectors Office in each District

Disaster Management Cycle

Response

- Response measures are usually those which are taken immediately prior to and following disaster impact.
- Typical measures include :
  - Implementation of plans
  - Activation of the counter-disaster system
  - Search and Rescue
  - Provision of emergency food, shelter, medical assistance etc.
  - Survey and assessment
  - Evacuation measures

Recovery

- Recovery is the process by which communities and the nation are assisted in returning to their proper level of functioning following a disaster.
- Three main categories of activity are normally regarded as coming within the recovery segment:
    - Restoration
    - Reconstruction
    - Rehabilitation

Prevention & Mitigation

- **Prevention :**Action within this segment is designed to impede the occurrence of a disaster event and/or prevent such an occurrence having harmful effects on communities or key installations.

- **Mitigation :** Action within this segment usually takes the form of specific programs intended to reduce the effects of disaster on a nation or community. For instance, some countries regard the development and application of building codes (which can reduce damage and loss in the event of earthquakes and cyclones) as being in the category of mitigation.

Preparedness

Preparedness is usually regarded as comprising measures which enable governments, organizations, communities and individuals to respond rapidly and effectively to disaster situations.

- Examples of Preparedness measures are :
  - The formulation & maintenance of valid, up-to-date counter-disaster plans
  - Special provisions for emergency action
  - The provisions of warning systems
  - Emergency communications
  - Public education and awareness
  - Training programs, including exercises and tests.

Cyclones, Urban Floods and Droughts are major disasters that the ULBs face frequently

Preparedness & Awareness shall be brought among the people, which reduces the severity of the disaster

Cyclones – Preparedness & Relief

- **CYCLONE AWARENESS – Do’s and Don’ts for Households**
- **Do’s**
- **Before the Cyclone** season of May/June and October/November i.e., April and September every year.
- Removing dead and dying branches of trees around the house.
- Checking the condition of the house, by carrying out repairs of doors and windows, securing any loose tiles and bricks and anchoring firmly the water tanks/solar panels etc. at the roof of the house.
- A cyclone lantern filled with kerosene, battery operated torches along with the adequate number of cells for battery and radio shall be kept ready.

- **After Receipt of Early Warning:**
- Refilling emergency management kit
- Storing adequate dry non-perishable food for ready use during and after the cyclone.
- Listening to broadcasts from TV /Radio to get weather updates and warnings.
- Providing strong supports to outside doors to withstand the speed of wind.
- Based on inputs from Radio and TV and also from early warning messages as sent through SEOC/DEOC, getting in ready mode to face cyclone emergency.
- Considering only authentic official information for dissemination purpose
- Moving to places above high tide and above flood level.
- People living in vulnerable Kucha houses shall move to safer places/ cyclone shelters.

- **After landfall of Cyclone**
- Switching off electrical mains of the house.
- Remaining calm and not panicking
- Do not go out till the cyclone passes off;
- Move out only after confirmation is received from official sources.
- In case of flood situation, move to upper storey along with important valuables (including documents).
- The glass windows should be boarded up or supported with strong shutters. Paper strips can also be put on glasses to prevent splinters, which can cause injuries.

- **Post Cyclone measures**
- Those at **shelters** should remain there till informed for returning back home. Those at home should come out only when told to do so, by the official sources.
- Get **vaccinated against diseases** immediately after re-opening of hospitals/health facilities or at medical camps.
- Be cautious of any **loose or hanging electric wires**.
- **Report actual losses** to appropriate authorities at the earliest.
- **Clearing debris** from the premises immediately. Sprinkle some disinfectants to sanitize the premises
- Avoid entering or playing with flood waters at every cost. Children shall also be **moved away from flood waters**.
- Use only **boiled water** till the drinking water supply normalises.

- **Don’ts**
- Don’t leave safer places till you are sure to reach your home or some other safer destination.
- Don’t touch hanging wires, these may have electric current.
- People need not go back to houses which are vulnerable from safety standpoint
- Don’t get misled by rumours; listen to **official communication** from official agency/ies.

- **Best Practices during Cyclones**
- **General**
- Following early warning issued by IMD in advance helps in **evacuation of most of the vulnerable population including fisher men** resulting in minimal loss of life.
- Preparatory meetings with line departments shall be conducted/ attended to devise strategies to prevent/reduce potential losses/damages to life, livestock and properties
- Utilization of services from police department for **speedy evacuation** of the vulnerable public.
- Utilization of services from **Fire fighting and Disaster Response Force**
- Utilization of services from **Medical and Health department** for conducting emergency medical camps
- Coordination with **Revenue department** for utilization of timely services
- **Supply of essential food commodities** may be managed through PDS system for distribution in affected areas

- **Best Practices during Cyclones**
- **Water Supply**
- Commodities like liquid chlorine, alum shall be procured in advance and prepositioned at various strategic locations for distribution in ensuring safe drinking water
- **Generators** shall be put in place for lifting water in absence of power supply. These can also be utilized at head water works. Small generators shall be taken on hire for water supply and to fill the water tankers from nearby wells
- Supply of **water through tankers** till the restoration was normal
- **Damaged pipe lines**, pump houses, motors, infiltration wells are to be restored on war footing
- Drinking Water -**RO Plants** may be arranged through voluntary organisations (Rotary club, Lions Club, Old age homes etc.) and used for supply of clean water wherever required.
- Shall ensure safe drinking water through supply of chlorine tablets to each household and bleaching powder to all affected areas
- It is advisable to **increase residual chlorine** level to about 0.2 – 0.5 mg /litre.

- **Best Practices during Cyclones**
- **Power**
- Pre-positioning of men and material at strategic locations in all areas to be affected by cyclone, may be addressed on priority
- Inventory of electrical requirements for quick restoration may be listed and procured for use during cyclone
- Storage of electric transformers, wire and poles at strategic locations for their quick replacement after cyclone will help in early power restoration.
- Pruning of tree branches which may damage electrical lines, may be initiated within 01 hour of receiving early warning.
- Cranes should be placed at various strategic locations for immediate erection of electric poles.

- **Best Practices during Cyclones**
- **Sanitation**
  - Items like bleaching powder, lime, phenol, bitex oil etc. shall be procured and pre-positioned in strategic locations and used subsequently to prevent communicable diseases
  - Special sanitation drive shall be taken up to clear the stagnated water in vacant places/ low lying areas i.e. to kill breeding mosquitoes etc.
  - Post disaster immunisation for diseases such as Polio, Measles (especially in children) needs to be undertaken
- **Communication**
  - Fallen Trees from roads and building and electrical wires are to be removed by engaging man power & machinery like (JCBs), tippers and power saws for restoration of traffic in the shortest possible time
  - Local ward level volunteers can be involved in removing the fallen trees.
  - Repair and replacement may be undertaken of the damaged street lights; with the use of readily available stocks and procurement of further materials.

- **Best Practices during Cyclones**
- **Others**
- Small capacity generators should be arranged in advance to run the water supply systems.
- Data of wells available in various areas to be known to all concerned stakeholders.
- Electrical Power generators may be made available.
- Exclusive additional staff / Power boats may be kept
- ready, to attend to emergency damages to water supply installations in the river bed.
- Exclusive bore wells/open wells may be kept ready for supply of water through tankers.
- On and off control system may be developed in pump houses at Head Water Works in case of staggered infiltration wells.
- Sand bags may be kept ready for formation of cross bunds, arresting of breaches on roads.

- **Best Practices during Cyclones**
- **Others**
- Standby pump sets and generators may be kept ready to attend repairs to old pump sets and generators.
- Small precast readymade drains may be kept ready for drainage of water.
- Maintenance of all equipment of pump houses needs to be attended just after receiving the early warning.
- Battery operated/solar lamps may be kept ready for use later on at various strategic locations of affected area.
- Emergency medicines may be kept ready at all the dispensaries in the affected areas.

Urban Flooding

- Towns have grown faster on account of increase/influx of population.
- Owing to lack of regulation/control, there has been considerable encroachment of flood plains. Damages become serious as a result of inadequate capacity of storm water drainage system.
- The problem of urban flooding has become serious as evidenced by the floods in Mumbai, Bangalore, Chennai, Vadodara, Ahmedabad, Surat, Kolkata, Hyderabad, Visakhapatnam and Vijayawada.
- Regulation of Land Use in Flood Prone Areas
- Enforcement of Flood Plain Zoning
- Categorization and Prioritization of Structures in Flood Plains Zoning
- Implementing Bye-laws for Buildings in Flood Prone Areas

- **Best Practices during Floods**

- **Clearing the congestion of Surface water drainag**e resulted due to inadequacy of natural or manmade drainage channels
- Diverting all or a part of the discharge into a natural or artificially constructed channel
- **Proper Alignment**, Location, Design and Provision of Water way i.e. Vents, Culverts, Bridges and Causeways
- **Periodic and systematic inspection**, rehabilitation and maintenance programme to ensure that the design capabilities of culverts, Bridges etc. are maintained.
- Periodical **desilting of drains**, removal of blockages in drains etc.
- Providing **raised platforms for drinking water hand pumps** and borewells above flood level
- As soon as flood warning is received installation of removable covers such as steel or aluminum bulkheads over doors and windows, permanent closure of low level windows and other openings, keeping store counters on wheels, closing of sewer wells, anchoring and covering machinery and equipment with plastic sheets, etc.
- Relocating to safer areas
- Other practices pertaining to water supply, sanitation, medical & health adopted for cyclones can be adopted during and after floods

- **Best Practices during Droughts**
- **Preparedness**
- Judicious use of water and reduction of losses shall be promoted among the people
- Proper maintenance of distribution network shall be carried out to arrest leakages
- Existing Summer Storage Tanks should be filled to their maximum capacity before summer.
- Promotion of Rain Water Harvesting structures

- **Mitigation**
- Alternate arrangements - bore wells as water sources
  - Water Tankers for supply of water
- Proper & judicious utilization of Adverse Seasonal Grants

Earthquakes and Tsunamis

- Earthquakes and tsunamis are rare however the disaster can be very severe
- Earthquakes –
  - Adopt earthquake resistant structural designs
  - Preparing vulnerability map and educating the people of that area on minimizing the impact of disaster
  - Rescue teams and shelters along with food and water aid, disinfection
  - Risk zone mapping
- Tsunamis –
  - Early warning systems
    - Guidance for producing consistent and accurate tsunami inundation and evacuation zones
  - Plantation along shores

Roles & Responsibilities

1. Provide assistance in disaster management activities.
2. Ensure training so as to be readily available for use in the event of a disaster.
3. Ensure that all construction projects conforms to the standards and specifications laid down.
4. Coordinating with each stakeholder department of the Government.
5. Carry out relief, rehabilitation and reconstruction activities in the affected areas.

Important G.O.s of A.P. Govt.

- G.O. Ms. No. 15 Revenue (DM.II) Dept., Dt: 04-12-2015 – contains Revised List of Items and Norms of Assistance from State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF)
- G.O. Ms. No.6 Revenue [DM.OP] Department, Dt: 28-08-2015 – Establishes Standard Operating Procedures (SOPs) for Cyclone Management

THANK YOU

8. Tenders and Procurements

Training for the Ward Secretaries

PROCUREMENT PROCEDURE

PHMED Public Health & Municipal Engineering Department

Contents

- Procurement - I (Tender Procedures)
  - Procurement Types
  - Procurement Methods
  - Procurement Procedure
  - Tender Procedure as per G.O.Ms.94 I&CAD Dept.
- Procurement – II (Tender Document & Conditions)
  - General Conditions
  - Technical Conditions
  - Special Conditions

Procurement – I (Tender Procedures)

- Procurement is the Process Plan for
  - Providing Goods
  - Arrangement of Services
  - Execution of Works
- Objective :
  - To ensure that the work is implemented within time, cost effective and qualitative manner.
  - Maintaining Transparent Procedures.
  - Keeping Management Simple and clearly specifying responsibilities.

Procurement – I (Tender Procedures)

- Procurement Types:
  - 1. Conventional Procurement
  - 2. Contract Packaging

- **Conventional Procurement:**
  - Procurement from the eligible contractors listed in the Prequalification procedure.

(PQ Process – normally not practiced for ULB works)

  - Local Competitive Bidding (LCB) – Inviting tenders from the local Registered Contractors.(normally practiced as per GO No. 94 I&CAD Dept.)

- **Contract Packaging:**

  - When number of Small Schemes have to be procured, using Conventional Methods, Management tasks can be simplified and Costs reduced by Combining them into one or two larger Projects.

  Eg: Works proposed under CIIP

e- Procurement websites :

Government of Andhra Pradesh introduced the e-procurement Platform for works costing more than Rs. One lakh.(G.O.Ms.No.171 Dt:01-05-2004 of M.A.& UD. Dept.

- A.P State e-Procurement Portal :

https://tender.apeprocurement.gov.in/login.html

The Central Government and CPWD floats tenders on the following e procurement platform

- Central Public works e-procurement portal :

https://eprocure.gov.in/eprocure/app

PHMED / Public Health & Municipal Engineering Department

A.P. State e-Procurement Portal

PHMED Public Health & Municipal Engineering Department

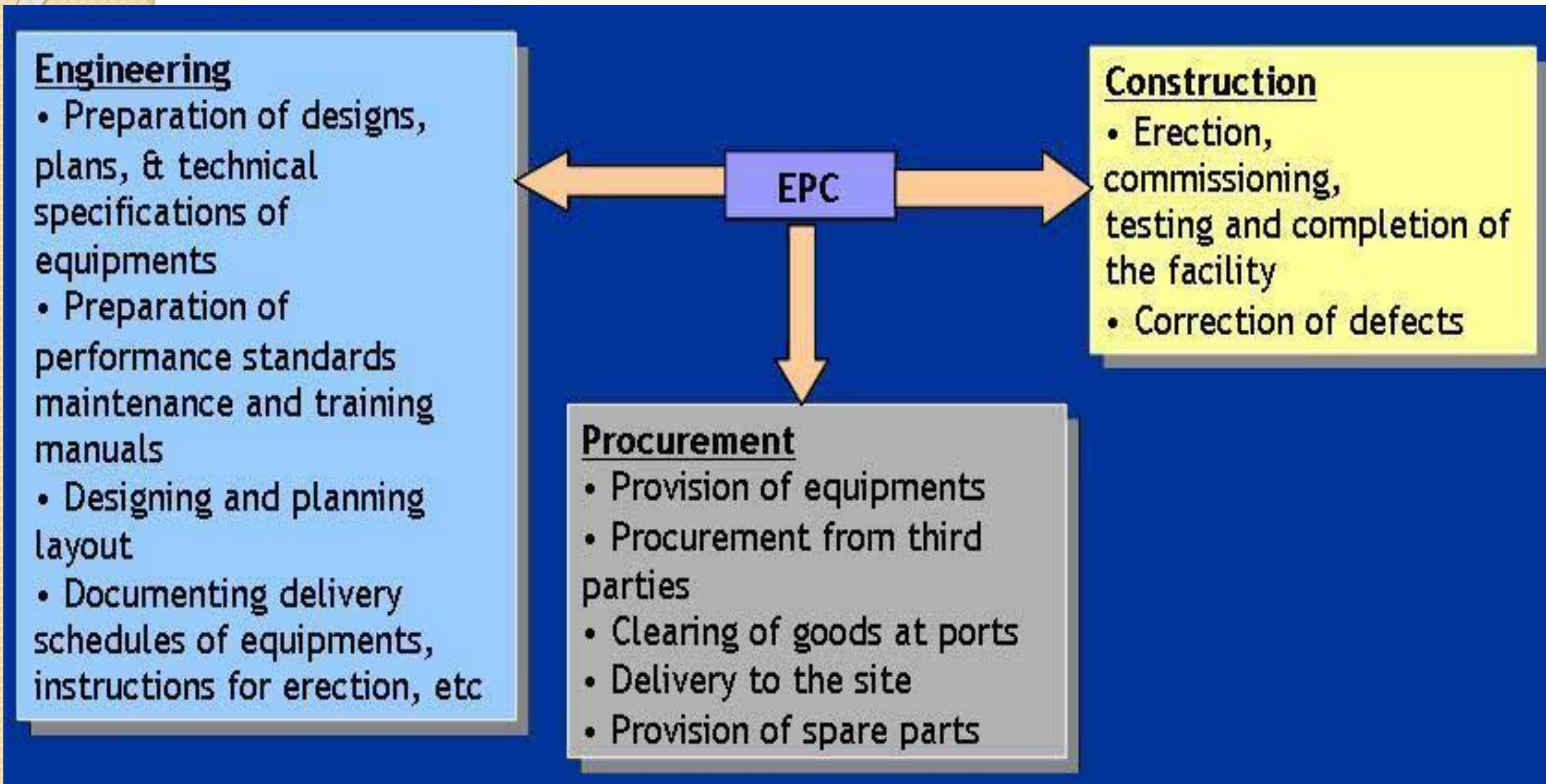
Procurement Methods

- Procurement
  - Non EPC
    - Lump sum
    - Item rate
    - (K2)
  - EPC
  - EOI/RFP/QCBS

1) Non EPC

- **Lump Sum :** The whole part of the work is considered as a single unit. In this case the total Contract Value is fixed i.e. also called as Fixed Price Contract.
- **Item Rate:** It means all the items that come under the execution of a Contract are classified into Items and Rates for processing the payment.
- Based on the field conditions variation in the quantities will be allowed by the competent authority.

2) EPC (Turn Key Contract)



2) EPC

- As per Procedure in vogue, only works costing Rs.10.00 Crores and above are to be invited through EPC Mode.
- Scope and Deliverables of the proposed project will be floated in the tender with a fixed Internal Bench Mark (IBM).
- The successful bidder has to make his own arrangements for field investigation, Preparation of designs, obtaining approvals, Bill of Quantities and execution.

PHMED / Public Health & Municipal Engineering Department

3) Expression of Interest (EOI)

- **Expression of Interest for Consultation contracts**

  An Expression of Interest (sometimes referred to as ‘Request to Participate') is a submission made by a prospective tenderer in response to an advertisement (or Contract notice) for the Supply of Goods or Services.

- Requesting Expression of Interest is a form of open tendering that allows anyone to put themselves forward. It offers the greatest competition and has the advantage of allowing new or emerging suppliers to try to secure work.

RFP Contract

- A Request for Proposal [RFP] is a Contract that is used to obtain comprehensive proposals from capable and interested companies to demonstrate their skills, experience and knowledge will enable them to take on the described project.
- An RFP is used where the request requires technical expertise, specialized capability or where the product or service being requested does not yet exist and the proposal may require research and development to create whatever is being requested.

QCBS Contract

- Quality and Cost Based Selection (QCBS)
- In this methodology, the Successful bidder is the bidder who achieves the combined highest score in the prescribed categories.
- Generally, the categories are classified in terms of administrative structure, technical capability and financial capability.
- Specific points will be earmarked for different achievements.
- Based on the combined score achieved by the Participated bidders, the bid will be awarded to the highest scorer.
- In recent period, Sanitation works were awarded in most of the ULBs in the above mode (Sanitation work under G.O.279).

Procurement Procedure

- Tender Procedure as per G.O.Ms.No.94 I&CAD Dept.,Dt:01-07-2003.
- Administrative sanction
- Technical Sanction
- Tender document covering NIT, BoQ & Eligibility Criteria
- Tender invitation
- Evaluation of Bids & approval of lowest bid
- Letter of Acceptance
- Agreement

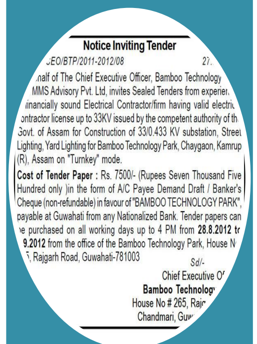
Procurement Methods following in ULBs

- Municipal Corporations
  - < 1 Lakh (Nomination Tender)
  - >1 Lakh (Lump sum)
- Municipality/ Nagar Panchayat
  - < 1 Lakh (Box Tender/Nomination Tender)
  - >1 Lakh (Lumpsum)

Tender Procedure as Per G.O.Ms.94

1) Administrative Sanction

2) Technical Sanction



3)NIT & BoQ

4)Evaluation of Bids

5)LOA

6)Agreement

Existing A.P Contract Approval Procedures as per G.O.Ms.No.668 Dt:10.07.2018

	Municipal Corporation		Municipality	
	Technical Sanction	**Award Contract**	**Technical Sanction**	**Award Contract**
5-40 Lakhs	Executive Engineer	Commissioner	Municipal Engineer (EE Cadre)	Council
40-200 Lakhs	Superintending Engineer (Corpn) / Superintending Engineer (PH)	Standing Committee	Superintending Engineer (PH)	Council
Over 200 Lakh	Chief Engineer/ Engineer-in-Chief	Council	Engineer-in-Chief	Council

PHMED / Public Health & Municipal Engineering Department

- <u>**Administrative Sanction :**</u>

Administrative approval is the Sanction of Budget to that Particular work proposal by the competent authority.

Eg:

GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Municipal Administration & Urban Development Department-Repalle Municipality, Guntur District-Proposal for providing Internal CC Roads, Drains and Water Supply Lines in the Repalle Municipality with a cost of Rs.210.41 lakhs-Adminstrative sanction-Accorded-Orders-Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (BUDGET.1) DEPARTMENT

G.O.RT.No. 216 Dated: 13-04-2016

Read the following:

1. From the ENC(PH), A.P.Hyd., Lr.No. 4207/T3/RPL/Mpty/T3/2015, Dt.22.05.2015.
2. From the DMA, A.P., Hyderabad, Lr.Roc.No.11008/2016/B3, Dt.24.03.2016.

****

<u>ORDER:</u>

In the references 1st and 2nd read above, the Director of Municipal Administration, A.P.Hyderabad and the Engineer-in-Chief(PH), A.P, Hyderabad have requested the Government for sanction of funds of Rs.210.41 lakhs for taking up the following developmental works in the Repalle Municipality, Guntur District towards restoration of roads and drains that are damaged during the Jell Cyclone and for providing water supply pipelines to un-served areas and all the extended areas in the town not covered with water supply pipeline to mitigate drinking water problem during the summer season.

Sl.No.	Name of the work	Estimate Amount (Rs.In Lakhs)
1.	Providing CC Roads and Drains	185.98
2.	Providing Water Supply Lines	24.43
	Total	210.41

2. Government after careful examination of the above proposal, hereby accord administrative sanction to the Director of Municipal Administration, A.P.Hyderabad for taking up the developmental works mentioned at para (1)

PHMED / Public Health & Municipal Engineering Department

- **Technical Sanction :**

- **Technical sanction** means the **sanction** by the competent authority to a properly prepared detailed estimate for the work to be executed.
- Sanction is based on the rates adopted from Standard Schedule of Rates (SSR/SOR) for the corresponding year. SOR is approved by Board of Chief Engineers.
- S.O.R Consists of 4 parts
  - Water Resource items (Part-I)
  - Road & Bridge items (Part-II)
  - Building works (Part-III)
  - Public Health works (Part-IV)

- **NIT (Notice Inviting Tender):**

  NIT is to be prepared as per procedure indicated in G.O.Ms.No.94 I&CAD Dept., Dt.01-07-2003 and subsequent orders.

  - Tender Notice : < 50 Lakhs – District Editions of 2 Telugu Dailies
    > 50 Lakhs – State Editions of 1 Telugu & 1 English Daily
  - EMD to be collected @1% of ECV through Online payment or Bank Guarantee payable in favour of Municipal Commissioner.
  - Eligibility criteria such as Registration, Physical eligibility, Financial eligibility, Liquid Assets, Key personnel, Key equipment and Bid Capacity has to be prepared as per above G.O.

- **<u>NIT Conditions:</u>**
- EMD : 1% of ECV
- Minimum Physical Quantity : (Qty/2)*(12/No.of Months)
- Financial Eligibility : (ECV/2)*(12/No.of Months)
- Liquid Assets : (ECV/No.of Months)*3

Bill of Quantity (BoQ)

- A Bill of Quantities is a list of descriptions and quantities that are required to be undertaken to complete a construction project. The size of a project will determine the size of the Bill of Quantities
- It is also by which the payments to the contractor are calculated through measurement of work done.
- The main contents of Conventional BoQ are
  - Work items (Part-I) = Quantities and their unit rates
  - Lump sum items (Part-II) = Statutory payments i.e. GST, NAC etc.

- **Bid Capacity:**

As per prevailing procedure in the department, the Bid capacity is to be verified in the form of 2AN-B> ECV where

A: Annual Turnover of the bidder in any one financial year during last Ten Financial Years.

N: Number of Years [Period of execution of the proposed work]

B: Value of existing commitments of the Bidder during proposed work period.

Evaluation of Bids:

- Documents uploaded by the bidders have to be downloaded from e-procurement platform.
- Evaluation of bids are to be done by considering the downloaded documents only.
- After evaluating the technical eligibility criteria, financial bids of the technically qualified bidders are to be taken in to consideration.
- The Successful bidder is the bidder who quoted the lowest rate.

Tender-cum-E Auction (Reverse Tendering)

- To conduct the reverse tender process at least two bidders would be required.
- The L1 Price Offer (Initial) shall be the maximum allowable Bid price for the reverse tendering process.
- The lowest financial bid value will be the maximum allowable bid price for conducting the Reverse tendering process as per G.O.Ms.No.67 Dt:16-08-2019.
- The Successful bidder is the bidder who quoted the lowest rate as per the above G.O.

Letter of Acceptance:

- After due procedure, Letter of Acceptance will be communicated to the successful bidder.
- Genuineness of the Credentials furnished by the bidder are to be verified
- Additional Security Deposit has to be paid by the successful bidder @1.5% of TCV (in case of Excess Tender %)
  - @ 1.5% of ECV (in case of less Tender/
  - Tender equal to ECV)

Agreement :

- Agreement= Offer + Acceptance
- Agreement has to be concluded by the Commissioner or his representative with the successful bidder

Procurement – II (Tender Document Conditions)

- **General conditions:**

All the conditions as per G.O.Ms. No.94 I&CAD Dept., Dt.01-07-2003 and subsequent amendment are to be incorporated

- **Technical Conditions**

Inline with the nature of work, conditions are to be provided which should be within the Codal provisions

- **Special Conditions:**
- Based on the speciality of work, special conditions are to be incorporated.

Principles to be followed in Procurement

The Choice of procurement method in any situation will be influenced by

- Nature and complexity of the works;
- their size and duration;
- The technical capability of each of the potential parties and their willingness to participate;
- Existing rules and regulations.


Thank
You!

9. Stormwater Management

Session -A

Public Health and Municipal Engineering Department

- Welcome to all Master Trainers
- STORM WATER DRAINS

NEED FOR AMENITY

GENERAL

- ❖ The monsoon season is the most conducive season for the outbreak and spread of diseases especially in India like tropical countries.
- ❖ Unhygienic sites are also the result of water logging,
- ❖ Submergence of some of the areas of the cities leads to severe health hazards apart from property damage and other losses.
- ❖ Efficient disposal of storm water by leading it into nearby watercourses, without affecting the people, is an important requirement for any City/Town.
- ❖ For improvement of the Living standards of People.

Design Principles for SWD

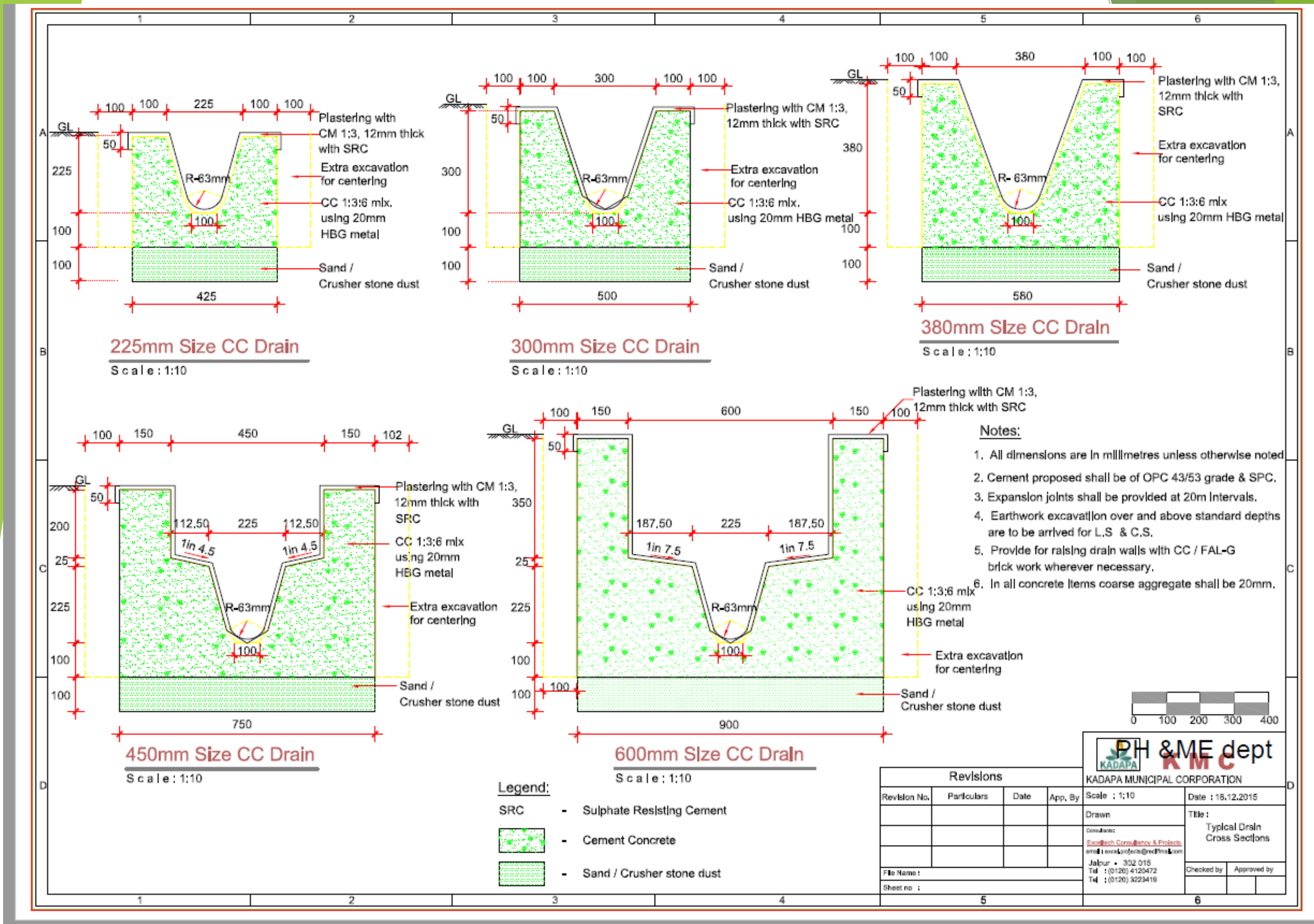
- **Design of Storm Water Drains involves**
  - Collection of Existing Data, Meteorological data like rainfall data etc.,
  - Field Surveys regarding drain sizes, drain LS, silting of drains, bed levels, types of drains, cross masonry works
  - Mapping of concerned to storm water drains and other infra structure facilities
  - Catchment area delineation based on the site conditions, Contours, physical barriers, topography, etc.,
  - Delineating the sub-catchment areas and also to identify the inundated areas
  - Identifying the catchment areas
  - Preparation of Storm Water Drainage Master Plan
  - Topo survey for the open drains /Rivers
  - Topo survey for the road side drains and survey for the sill levels of drains where ever manholes are present. This is to fix the sill level of the drains along with the road L.S

Contd.,

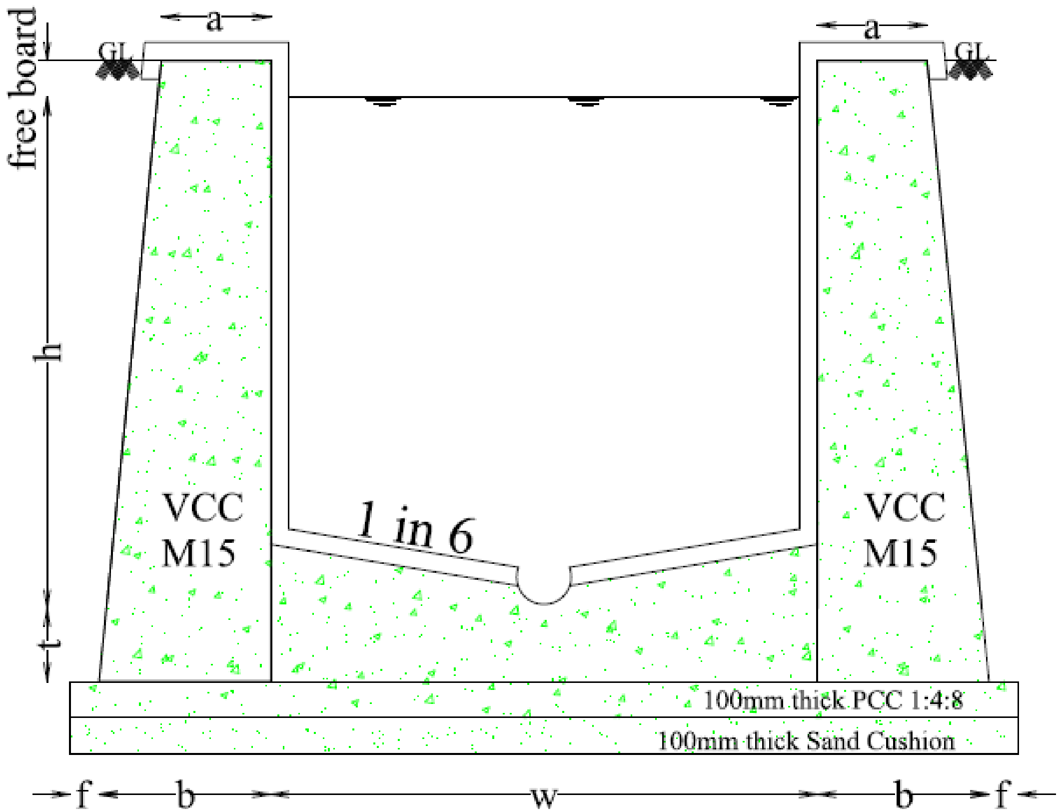
Design Principles for SWD

- Design of drains by Manning's formula/ Rational Method Approach
- Preparation of Detailed Report, Drawings and estimates
- Adoption of type designs for drains depending on the discharge and location etc.(suggested as per Sanitary Engineering Drawings)
- SED 1
- SED 2

Reference Books:


225mm Size CC Drain
Scale : 1:10
300mm Size CC Drain
Scale : 1:10
380mm Size CC Drain
Scale : 1:10
450mm Size CC Drain
Scale : 1:10
600mm Size CC Drain
Scale : 1:10
Plastering with CM 1:3, 12mm thick with SRC
Extra excavation for centering
CC 1:3:6 mix, using 20mm HBG metal
Sand / Crusher stone dust
R-63mm
GL
1in 4.5
1in 7.5
Notes:
1. All dimensions are in millimetres unless otherwise noted
2. Cement proposed shall be of OPC 43/53 grade & SPC.
3. Expansion joints shall be provided at 20m intervals.
4. Earthwork excavation over and above standard depths are to be arrived for L.S & C.S.
5. Provide for raising drain walls with CC / FAL-G brick work wherever necessary.
6. In all concrete items coarse aggregate shall be 20mm.
Legend:
SRC - Sulphate Resisting Cement
- Cement Concrete
- Sand / Crusher stone dust
Revisions
Revision No. | Particulars | Date | App. By
File Name :
Sheet no :
PH &ME dept
KMC
KADAPA MUNICIPAL CORPORATION
Scale : 1:10
Date : 18.12.2015
Drawn
Title : Typical Drain Cross Sections
Checked by
Approved by

Back to PPT



1. All dimensions are in millimetres unless otherwise noted.
2. Cement proposed shall be of OPC 43/53 grade & SPC.
3. Expansion joints shall be provided at 20m intervals.
4. Earthwork excavation over and above standard depths are to be arived for L.S & C.S.
5. In all concrete items coarse aggregate shall be 20mm.

Summary of Drain Dimensions

Width of Drain (W) in mts	Height of Drain (h) in mts	Top width of Side Wall (a) in mts	Bottom width of Side Wall (b) in mts	Offset from edge of side wall (f) in mts	Bottom thickness (t) in mts
0.75	0.75	0.20	0.40	0.15	0.20
0.90	0.90	0.20	0.40	0.15	0.20
1.00	1.00	0.30	0.45	0.15	0.20
1.20	1.20	0.30	0.45	0.15	0.20
1.50	1.50	0.30	0.45	0.15	0.20
1.80	1.80	0.30	0.45	0.15	0.20

0 100 200 300 400

Revisions

Revision No.	Particulars	Date	App. By

File Name :

Sheet no :

K M C

KADAPA MUNICIPAL CORPORATION

Scale : 1:10

Date : 18.12.2015

Drawn

Title : Typical Drain Cross Sections (0.75mts - 1.80mts)

Jaipur - 302 015

Checked by | Approved by

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Design Criteria for SWD

- Calculation of Intensity of Rainfall as per guide lines of CPHEEO
- Drawing the IDF curves
- Calculation of Time of Concentration
- Runoff – Rainfall Intensity Relationship – Rational Method Approach
- Hydraulic analysis for open/ closed channels using Software.
- Return period – 2 years,5 years,10 years
- Assessing the discharges for drains from the upper catchments and also from the tertiary drains
- Check adequacy of the existing drains and suggesting the new drains in case insufficient
- Effects of Urban population in terms of perviousness.
- Hydraulic Gradient, Self Cleaning Velocity
- Proposals for new drains, new structures and repairs for old drains
- Best Management practices and suggestions for Rain water Harvesting, Water Conservation, reservoir, delayed release practices (opening of additional mouths) etc.

Approach for Designing of Drains

Aim, Objectives, Scope of work, Study area delineation

Collection of existing data from ULB, Concerned departments and Meteorological data (rainfall)

Collection of Contour base maps/Topo sheets

Field verification of the data

Field surveys

Zoning of storm water drains. Identification of Inundated areas Preparation of Master

Plan

Conversion of all Data into GIS format in order to integrate to software

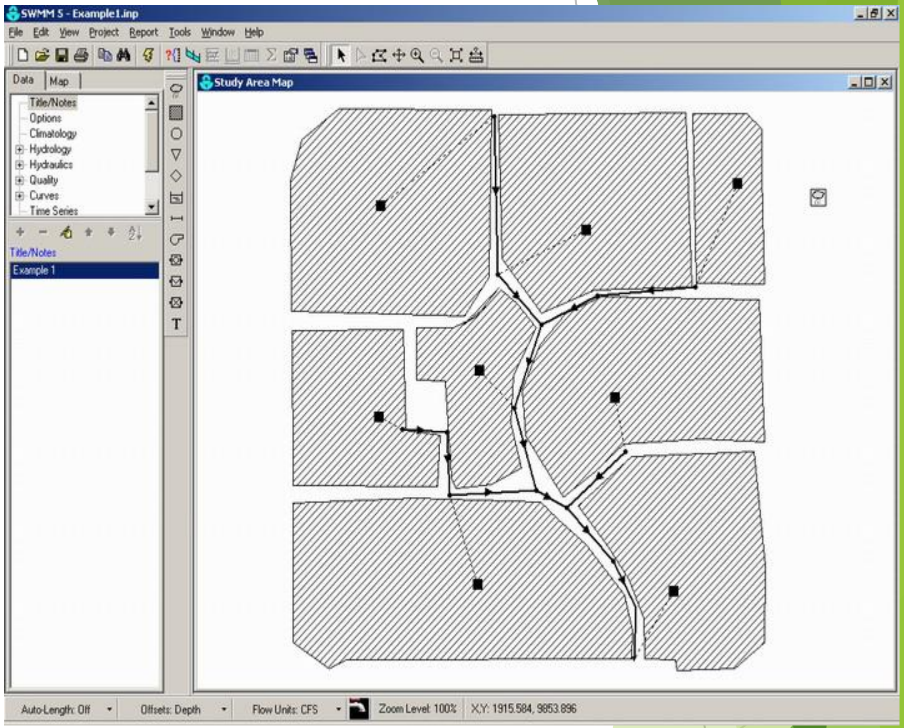
Preparation of IDF curves from the rainfall data

Hydraulic analysis

Preparation of Cost estimates, Drawings BOQ's etc

Design Criteria for Storm Water Drains

- [Runoff – Rainfall Intensity Relationship – Rational Method Approach]()
- Hydraulic analysis for open/ closed channels using Software.
- Check adequacy of the existing drains and suggesting the new drains in case insufficient
- Proposals for new drains, new structures and repairs for old drains
- Run the models, before/after the augmentation



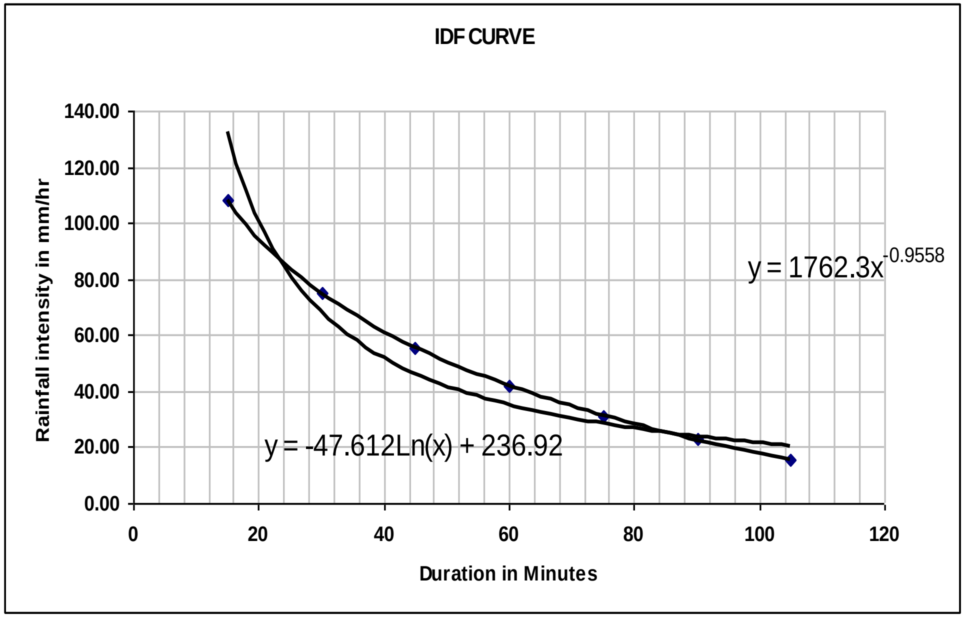
Sample Storm Water Network

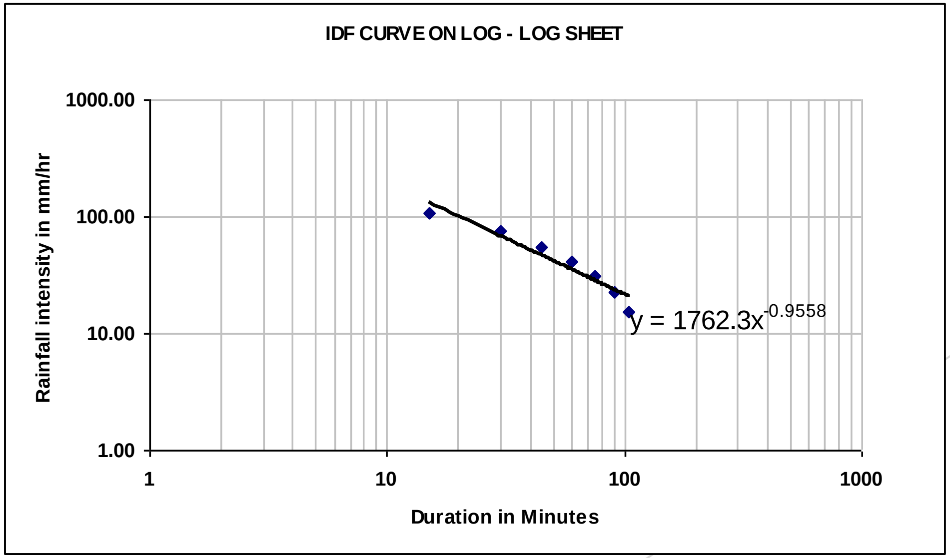
Design Criteria for Storm Water Drains

- Calculation of Intensity of Rainfall as per guide lines of CPHEEO
- Drawing the IDF curves
- Calculation of Time of Concentration

Duration – Intensity values for Storm		
Sr. No	**Duration in Minutes**	**Rainfall Intensity in mm/hr**
1	15	107.98
2	30	74.98
3	45	55.68
4	60	41.98
5	75	31.36
6	90	22.68
7	105	15.34

Design Criteria for Storm Water Drains





Thank You

Session -B
Cost Estimate for Storm Water Drain

- Various components are considered in arriving the cost of SWD

1. Earth Work Excavation
2. Bailing out of Water/ Shuttering
3. Sand/Dust filling
4. Providing the P.C.C for Drain Base
5. Providing the Steel Reinforcement for sidewalls, bottom slab
6. Providing the Reinforcement Cement Concrete for sidewalls, bottom slab.

Est. Pg-1

Est. Pg-2

Est. Pg-3

Name of work : - Construction of Storm water main disposal drain (1800 X 1800mm size)											
Detailed cum Abstract of Estimate											
S. No	**Description of Item**	**No s**			**Measurements in mts.**			**Qty**	**Rate**	**Per**	**Amount**
					L	**B**	**D**				
1	Removal of wet silt and sludge from sullage drains with aid of baskets and vessels	1	X	1	280.00	1.00	0.60	168.00	282.33	Cum	47432.00
2	Bailing out water from the pipe line trenches with oil engine driven pump sets, including hire charges, fuel charges and wages for Driver and Helper	1	X	1	-	-	-	600.00	72.71	Hp /Hour	43628.00
3	Cutting road surface including stacking of excavated materials for pipeline trench work.										
	Existing damaged old drain (1000*1000 mm)										
	Bed	1	X	1	237.00	1.30	0.15	46.22			
	walls	1	X	2	237.00	0.15	1.00	71.10			
	existing cover slab	1	X	1	62.00	1.60	0.15	14.88			
	existing low level culvert slab	1	X	1	18.00	1.60	0.60	17.28			
	existing low level culvert wall	1	X	2	18.00	0.30	1.00	10.80			
								160.28	2504.07	Cum	401341.00
4	Earthwork excavation in all types of soils as per specification, drawings and as directed by the departmental officer and protecting the walls and other structures etc., so as not to disturb the existing utility services i.e. water supply and sewer pipe lines, telephone and power supply cables /ducts, storm water drains, traffic signals, etc., during the execution taking all precautionary measures in the restricted areas including divert in to traffic and backing filling in the trenches with excavated suitable material and disposal of reaming earth up to a lead of 50m including all incidental and operational charges etc., complete for Drains/Roads.										
	for 1800mm size drain										
	New drain	1	X	1	262.00	2.40	2.15	1351.92			
	deduction for existing drain volume (-)	1	X	1	262.00	1.30	1.25	-425.75			
	deduction for existing culvert volume (-)	1	X	1	18.00	1.60	1.85	-53.28			
	new culvert	1	X	1	18.00	2.80	2.30	115.92			
								988.81			
	70% Mechanical							**692.17**	97.82	Cum	67708.00

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5	Carting away the surplus excavated earth from the work site with a lead of 2.00 Km beyond initial lead including loading, unloading and conveyance but excluding stacking charges etc. complete.										
	QTY AS PER ITEM NO#1 (80%)							**134.40**			
	QTY AS PER ITEM NO#3							**160.28**			
	QTY AS PER ITEM NO#4)(70%)							**692.17**			
	2 km lead							**986.84**	45.30	Cum	44704.00
6	Providing sand for filling in foundations with filling sand as per Technical specification including cost and conveyance of all materials from source to site and labor charges for filling,Watering,ramming etc.,										
	for 1800mm size drain cushion	1	X	1	262.00	2.40	0.10	62.88			
	for 2000mm size culvert cushion	1	X	1	18.00	2.80	0.10	5.04			
								67.92	398.30	Cum	27052.00
7	Laying C.C.(1:4:8) using 40mm (SS-5) HBG M/C metal and OPC coarse and fine aggregate conforming to IS 383 including cost and conveyance of all materials labor charges machine mixing vibrating, centering, laying in position, curing etc.,										
	for 1800mm size drain cushion	1	X	1	262.00	2.40	0.10	62.88			
	for 2000mm size culvert cushion	1	X	1	18.00	2.80	0.10	5.04			
								67.92	3192.74	Cum	216851.00
8	Supply and placing of VRCC M 20 Design Mix Concrete corresponding to IS 456 using WEIGH BATCHER / MIXER with 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate (sand) coarse aggregate, water etc., to site and including Seignior age charges, sales & other taxes on all materials including all operational, incidental and labor charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work (APSS No. 402)with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curing etc.										
	Base slab for 1800 mm size Drain	1	X	1	262.00	2.20	0.10	57.64			
	walls	1	X	2	262.00	(0.25+.15)/2	1.80	188.64			
	base slab for 2000mm size culvert	1	X	1	18.00	2.20	0.10	3.96			

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9	RCC M- 30 Design mix (Cement :fine aggregate: coarse aggregate) corresponding to Table 9 of IS 456 using 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate (sand) coarse aggregate, water etc., to site and including Seignior age charges, sales & other taxes on all materials including all operational, incidental and labor charges such as machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work, including centering, shuttering etc., as per drawing and as directed by the Engineer-in-Charge. RBR-FNDN -G 5										
	culvert slab	1	X	1	18.00	2.60	0.200	9.36			
								9.36	5111.57	Cum	47844.00
10	Supplying, fitting and placing HYSD bar reinforcement in foundation complete as per drawings and technical specifications clauses 1000 and 1202 MORD and 1100, 1600 MORTH for bars below 36mm dia including overlaps and wastage, were there they are not welded.										
	for drain bed & walls	1	X	1	269.68	70Kg/m3		18877.60			
	for drai cover slab	1	X	1	9.36	90Kg/m3		842.40			
								19720.00	64.42	Kg	1270362.00
11	Centring and scaffolding charges for RCC members including all materials and labour charges for forming and dismantling	1	X	2	280.00	-	1.800	**1008.00**	1136.15	Sq m	1145239.00
	Sub Total :										**4508432.00**

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Implementation of Drainage Infrastructure in ULBs

1. Classification of Drains:
   a. Tertiary Drains (Local Drains)
   b. Secondary Drains (Collector Drains)
   c. Primary Drains (Major Drains)
   d. Pumping Stations
   e. Flood Prevention Structures
2. Execution of Drains:
   a. Use of Concrete (not less than M15)
   b. Workability of Concrete
   c. Shuttering for Drains
   d. Workmanship of Drains (Alignment, Sill Levels, Top levels etc)
   e. Obstructions due to utility service lines , encroachments
   f. Precautionary measures (Caution Boards, Caution bands , etc)
   g. Diversion of existing drain water, traffic etc.
   i. Mesh Provision for either side of Bridges/Rivers as per NGT guide lines

Implementation of Drainage Infrastructure in ULBs

3. **QUALITY CONTROL**

- Quality Control refers to those aspects of Quality Assurance that deal specifically with the physical characteristics of materials, processes and workmanship which are responsible for the final product, which in turn provide the means to control the quality to specified requirements. The achievement of expected results within the ambit of tolerance infer the quality achieved.
- Closely controlled quality, results in direct economics in the initial cost as well as maintenance-expenditure.
- Indirect economics result from savings in time and effort, which would otherwise be required for remedial measures and rehabilitation of indifferent quality work.

QUALITY CONTROL for SWD Includes 3 stages:

a. Pre-construction Stage
b. During the Construction Process
c. Post Construction

In Pre-construction Stage following are considered

QUALITY OF MATERIALS :

All the types of material used in the work shall be strictly in accordance with the relevant Codal Provision.

The commonly used material for SWD are:

1)Coarse Aggregate:(40 mm & 20 mm) As per IS-383. (single size /graded)

2)Fine Aggregate :Natural Sand and Crushed Stone Sand.
Zone I,II ,III and IV

3)Cement :OPC and PPC.(IS-12269,8112,1489).

4). Reinforcement (HYSD Steel bars as per Design Specifications)

In During the Construction Process following are considered>

a.<u>PLACING OF CONCRETE</u>: (IS 456/2000 Clause No. 13.2)

The concrete shall be deposited as nearly as practicable in its final position to avoid much handling. The concrete shall be placed and compacted before initial setting of concrete and should not be subsequently disturbed. There should not be segregation or displacement of reinforcement form work. Generally, the maximum free fall permissible may be taken as 1.5 mts.

b.**<u>COMPACTION</u>**: (Clause No. 13.2)
Concrete shall be compacted using maximum vibrations. Over vibration and under vibrations are harmful and should be avoided. Vibration of very wet mix should also be avoided.

C.**<u>Slump Test</u>** : (Vide clause No.7 IS 456/2000)
a) Concreting of lightly reinforced sections with or without vibrations, mass concreting lightly reinforced sections and slabs, beams, walls, columns, floors etc., with very low and low degree of workability. The slump to be between 25 to 75mm.

b) Concreting with heavily reinforced sections in slabs, beams, walls, columns, slip form work, pumped concrete etc., with medium degree of workability to be between 50 to 100 or 75 to 100 as directed by Engineer-in-charge
.

FREQUENCY OF SAMPLING AND TEST RESULTS:

(as per Clause No. 15, IS-456/2000)

(a)**SAMPLING PROCEDURE**: The random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. sampling should be spread over the entire period of concreting and cover all mixing units.

(b) The minimum of frequency of sampling of the concreting of each grade shall be as follows :

QUANTITY OF CONCRETE IN THE WORK (in Cu.m)	No. of Samples
1 to 5	1
6 to 15	2
16 to 30	3
31 to 50	4
51 and above	4 + one additional sample for each additional 50 Cu.m. or part thereof.

In Post-construction Stage following are considered:

1. **<u>CORE CUTTER method for Concrete</u> :**

   For SWD side walls and bottom slabs different locations core are taken and tested for Compressive strength of Concrete

2. **<u>NDT by Digital Rebound Hammer Test:</u>**

   For estimating the compressive strength of hardened concrete this test is used. It gives the relative surface hardness and can not be taken as absolute test. This test is conducted only when proper samples are not taken in order to gauge the strength approximately.

3. **<u>NDT by Ultra Sonic Pulse Velocity Equipement:</u>**

   For estimating the compressive strength, cracking pattern , quality and density of hardened concrete this equipment is used.

Thank You

Operation and Maintenance of Municipal Drainage systems

1. **Components of Drainage System**:

    a. Tertiary Drains (Local Drains)

    b. Secondary Drains (Collector Drains)

    c. Primary Drains (Major Drains/Out fall Drains)

    d. Pumping Stations

    e. Flood Prevention Structures such as I&D structures/Flap Gates

Operation and Maintenance of Municipal Drainage systems

2. **Objectives of O&M** :

a. Drains run freely at all times and flooding problems are minimized

b. Effective use is made of available resources (finance, workers and equipment).

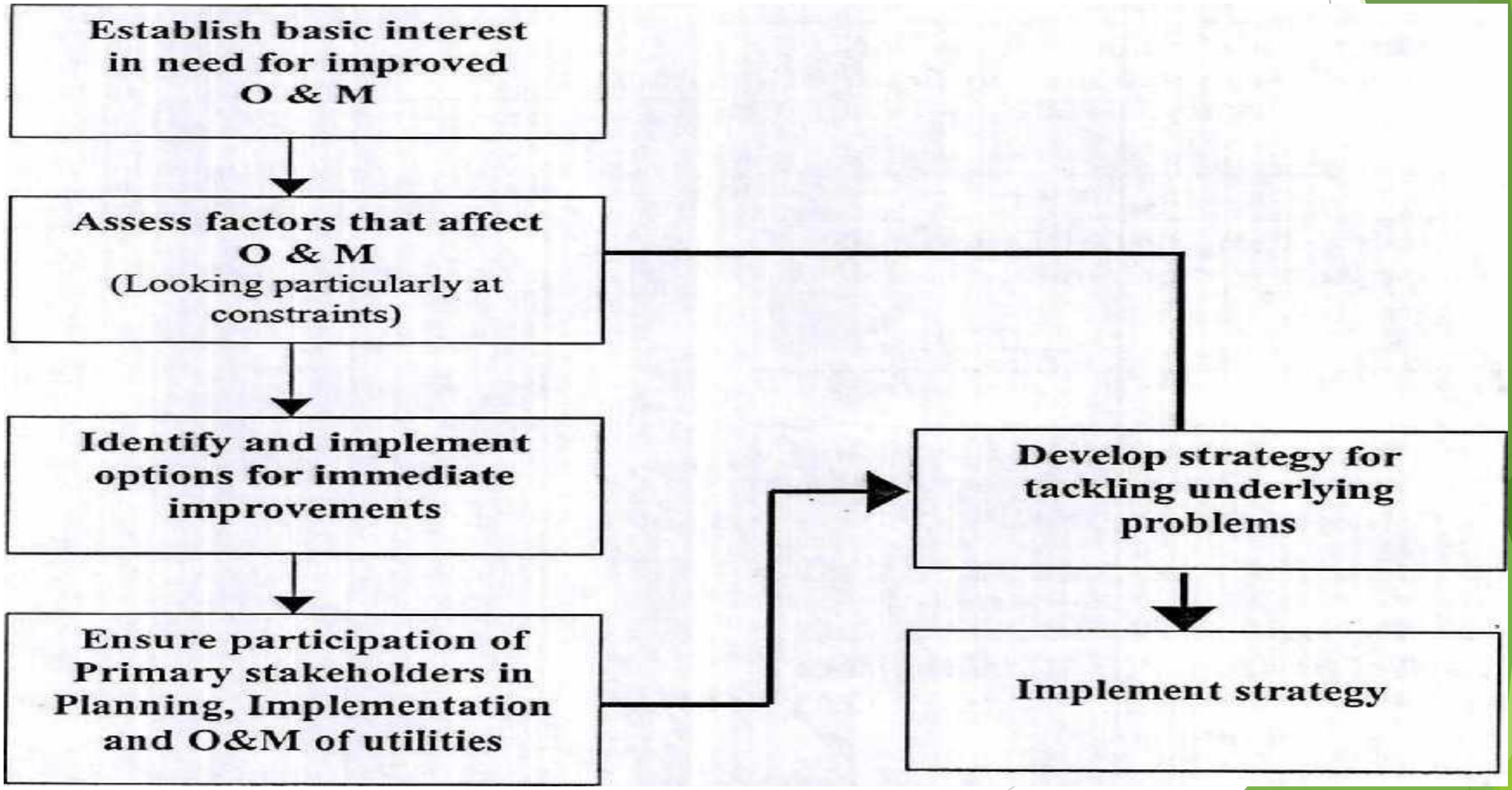
c. Equipment and facilities operate for the whole of their design life, so ensuring that investments are fully utilized.

d. Health and safety hazards to municipal sanitary workers and the General public are minimized.

Operation and Maintenance of Municipal Drainage systems

3. Developing a Strategy for improving of O&M :

Step wise approach



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Operation and Maintenance of Municipal Drainage systems

a. Start by assessing existing systems, with particular reference to the factors that affect the quality of O&M.

b. Develop an immediate action plan (IAP), focusing on actions that are relatively easy to achieve and result in clear cost reductions, improvement in the level of service provided or both.

c. Develop a longer-term programme for O&M improvement that includes both:

- ❖ efforts to overcome constraints; and
- ❖ more ambitious efforts to tackle basic deficiencies in O&M.

Operation and Maintenance of Municipal Drainage systems

4. Initial Assessment of Existing O&M Practices:

- Due to reduced the efficiency of the drainage system
- Due to endanger the health and safety of sanitary workers and the public

Check list for Asses the Current situation in the Town/City

- Does the system carry both foul and storm water?
- Does solid waste dumping create a need for more frequent drain cleaning?
- Are there lengths of drain with low flow velocities, resulting in rapid siltation and hence a need for frequent drain cleaning? If so, what is the cause? Look for evidence of restrictions caused by culverts (particularly pipe culverts), shrubs and encroachments, irregular slope and lack of fall along the drain (perhaps caused by the high water level in a downstream drain.
- Is drain cleaning made more difficult by the fact that some lengths of drain are not lined and/or have broken lining?
- Is it difficult to gain access to some lengths of drain, perhaps because they are covered or pass beneath buildings? Are maintenance options restricted by a lack of vehicle access to the drain?
- Are there problems because storm run-off is carrying silt into the drain.

Operation and Maintenance of Municipal Drainage systems

5. Immediate action program:

- Assign the teams responsible for cleaning local drains to individual wards.
- Devolve management responsibilities for local drains to the ward level.
- Develop a simple plan for each ward, showing the drain lengths assigned to each member of the team.
- Develop schedules for cleaning main drains.
- Provide tools that are appropriate to the task in hand.
- Ensure that silt removed from drains is collected within 2 days of being deposited.

l

Operation and Maintenance of Municipal Drainage systems

6. Longer term strategy:

- Obtain the information required to develop an improved understanding of the existing drainage system.
- Carry out selective physical improvements in order to make O&M easier. Where possible, this may include providing improved access to larger drains.
- Re-organise systems, introduce new management arrangements and re-assign duties and responsibilities in order to increase the efficiency of drain maintenance procedures,
- Develop job descriptions, focusing particularly on the need for good management at the local (sanitary supervisor and sanitary inspector level). Provide training as required.

Operation and Maintenance of Municipal Drainage systems

7. Information for Good operation and maintenance:

- The location, size, approximate capacity and condition of existing facilities
- The access that is possible
- Problems caused by frequent flooding and/or overflowing of the drain contents.
- The cost of operation and maintenance for different types and sections of drain and different approaches to drain maintenance.

Operation and Maintenance of Municipal Drainage systems

8. Developing the information system

1. Identify priority problems
2. Respond to those problems

Preparation of Drainage System Plans:

- Identify all main drains and plot them on a copy of the base map. Also plot secondary drains that connect to them.
- Identify and plot the drainage boundaries between the areas served by these drains.
- Identify any obvious problem areas - those where flooding or frequent drain overflows occur.
- Carry out level surveys along routes of main drains and secondary drains in order to identify any lengths of drain that have limited falls.
- Identify any constrictions caused by culverts and encroachments, any access problems due to the location of the drain or the fact that it is covered.

Operation and Maintenance of Municipal Drainage systems

9. **Recording information**
10. **Management information**
11. **Developing an assets register for drainage**
12. **Identifying and dealing with physical constraints**
13. **Developing human and organizational resources**
14. **Specific training for pump maintenance**

Improvements in health and safety

Developing performance targets for O&M

Thank You

10. APPWD Code Rules

Dear Brothers & Sisters

Welcome to a Presentation on

AP PWD (Departmental) Code

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Overview

- Duties of officers
- Measurement and Measurement

Books • Preparation of Work Bills

- Powers of Technical Sanction
- Tenders and Tender approval
- Loans and Advances
- Stores and Purchases

Measurements by AE/AEE

- **Para 292-296:** The initial recording officer (AEE/AE/Local Body Engineer) shall

record the work done on a day to day basis in the form of measurements in the M

Book directly.

- The signature of the contractor shall be taken in the M. Book page where measurements recorded by AE/AEE of the day duly mention as “Accepted the measurements' ' above his signature.
- The measurement of an item shall be recorded only for finished items of work as per specifications and standard data.
- Measurements shall be recorded in the order of their actual execution.
- Full description of every item should be recorded as found in the Schedule A of agreement for every set of measurements recorded on the day.
- Measurements generally include L, B, and D and arrive at a quantity by their multiplication.

Measurement Books…

- The M Book is the basic record for all payments made by Dept and it will be machine numbered.

- **Para 294** of **A-Code:** AEE/AE records measurements, and check measurement will be done by DEE/EE/SE.
- Nothing prevents the DEE from recording measurements in extraordinary circumstances.
- Entries in M Book are made in ink or inedible pencil.
- Date of measurement shall be noted for every set of measurements recorded on the day.
- The details like name of work, Est. Amt. (TS No.), Agt. No., Date of handing over site, agt. period, Contractor's name and Supplemental Agt. if anything be mentioned in M Book.

Measurement Books (M Book)

- If any correction warranted, it shall be attested by the check measuring office with dated initials against such a set of measurements only but not erasing fluid be used under any such circumstances and barred.
- Similar procedure is followed in case of cancelled measurements in M

Book. • Only the Metric system shall be followed in writing M Book.

- Always, over all measurements are recorded and the difference of present over all and previous over all measurements constitute running bill quantities for arranging payment. • It shall be ensured that there is no overlapping of measurements that may result in excess payment under any circumstances.
- To avoid this contingency, previous paid quantity be shown in M Book while preferring present over all measurements in the right side page of M Book.

Levels, LF Books, M Books

- For earth work items, the measurements shall be taken by levels, initially by Pre-levels and work done levels from time to time and recorded in Level Field Book (LF Book).
- Duly plotting levels in the Graph sheets, cross sectional areas be arrived and to arrive quantity, the length between cross section interval be multiplied to brought forward in to M Book

- LF Books, Cross sectional sheets, shall be authenticated initially by AEE and the contract to sign in having accepted the measurements.
- The initial recording OF Books shall be different from the LF Book used for check measurement by DEE/EE/SE.
- The LF Books and M Books shall be issued by EE from Division office duly entering in a Register meant for the same.

Preparation of Bills…

- **Para 297:** Progress Report on Works:
- The next step will be preparation of a bill by AEE/AE as per Agt. rates to arrive at the part bill amount and necessary certificates including Quality control certificate by separate QC AEE/DEE/EE/SE be appended to the work bill by AEE/AE.
- The Sub-divisional officer (DEE) after duly countersigned will be recommended to EE for passing the Bill to forward to Pay and Accounts Officer (PAO).

- Divisional Accounts Officer (DAO) working under EE of State Finance Dept. scrutinize the Bill and submit to EE for pass order.
- The PAO of Finance Department at District level after scrutiny arranges payment to contractor by Cheque or online payment of Bank Transaction

Preparation of Bills…

- As a matter of fact, the Contractor has preferred a bill by himself and submitted it to Dept. which thoroughly scrutinizes authenticate measurements to proceed further.
- But it has been a set practice for a long time that the AEE/AE is preparing bills.
- The DEE thoroughly satisfies doubly ensuring that the agreement is in force and otherwise Extension of Time (EoT) shall be applied by Contractor to the EE.

- Such EoT shall be in currency at the time of submitting the bill.
- All items of works in the bill shall appear in agreement and any new items executed as per site requirement, such items shall be covered in Supplemental Agreement or approved deviations by work slip.

Preparation of Bills

- The statutory recoveries (IT, VAT, Seigniorage charges) and recovery of advances paid to Contractor, retention amount withholding till final completion of work be reflected in the running account bill.
- The liquidated damages for slow progress and deviation of Milestones and amount required for rectification of any item of work if suggested by QC officials are ensured to safeguard financial interest of Govt.

Authorized forms of Bills

• First and Final Bill------Form 24(PWD VI-69) • Running Account Bill--Form 27 (PWD VI-74). • Lump sum Contract Bill--Form 27-A and 27-B. • Hand Receipt Form (HR Form) -- Form-28.

Certificates for LS Agreements

• Release and Discharge Certificate. (By DEE).

• Correctness of Levels and quantities from cross section sheets. (By the EE) • Check measurement by Officers: **Paras 293-297** and **309** of AP PW **'A' Code**.

Preparation of Estimates for Works…

- There are two categories of Works: Original Works and Repair/ Maintenance Works (**Para 88**)
- Repair and Maintenance works sub-divided in to Pure Maintenance (**Para 91 & 133** of D Code) and Special repairs (**Para 134**)
- The ordinary Repairs estimates lapses by last day of Financial year

(**Para 137**) • **Para 139, 148:** Special repair works; Lapse of Sanction: after

5 years **(Para 186).** • No original work should be started with out" Adm.

Approval and TS of estimate

- **Para 99-103 of D Code & Para 185 of Financial Code**: Administrative Approval & Technical Sanction
- **Para 112-121: Preparation of Estimates** - On receipt of Adm. Approval, detailed estimate to be prepared with necessary plans and designs, followed by Technical

sanction.

- **Para 196:** Water supply to Govt. buildings

Preparation of Estimates for Works

- Administrative approval not required for Maintenance & Ordinary Repair works (Para 142). Original works & Special repair works require such sanction (Para 89 & 89). • Budgetary allocation of funds is required for executing works as above. • Estimates shall accompany 1. Report Accompanying estimate, 2. Abstract Estimate, 3. Detailed Estimate, 4. Data Sheet. Also required Drawings.
- As per G.O M.S. No.94, I&CAD (PW. Code) Dept.Dt.01-07-2003, inspection by the sanctioning Authority is required before such technical sanctions. EE-Rs.50 lakhs, SE-Rs.500lakhs, ENC/ CE above Rs. 500 lakhs.
- **Powers of Technical Sanction**: AEE/AE-Rs.1 lakh; DEE-Rs.5 lakhs; EE-Rs.40 Lakhs; SE-Rs.200 lakhs, ENC/CE-up to Adm. Sanction value (GO Rt No.668 MAUD Dt.10-07-2018). • **Revised Estimates Sanction**: - **Para 214"D"** code read with GO Ms.No.242 PWD, dt.11-02- 1996 & TR&B GO Ms No.292 Dt.08-09-1980. Govt only

can sanction. But EE competent to pass up to 5% excess; SE-10% and ENC/CE-15% excess

Powers for Nomination

Para 154 of **D Code** read with GO Ms No.1007 TR&B(C-1) Dept. Dt.5-11-1976):

- If any work is proposed to be entrusted on nomination (by dispensing with tenders), it is to be entrusted at estimated rates only.
- It can be done so only in the case of emergency or other reasons to be recorded as per the delegation of powers given below:
  - Executive Engineer : Rs. 20,000/-
  - Superintending Engineer : Rs. 50,000/-
  - En-C /Chief Engineer : Rs.1,00,000/-

Execution of works

• **Para 150:** Method of execution of works

• **Para 151-153:** Contract documents and enforcement • **Para 154-156:** Tenders

• **Para 157:** Forms of scrutiny for performance of contracts • **Para 158:** Custody of accepted tenders and certified copies thereof

Tender management…

• Tender Notice: 14 days minimum time for receipt of tenders shall be followed. • EE can conclude agreements up to Rs.40 lakhs on acceptance of lowest bidder.

- SE can accept tenders up to Rs.200 lakhs and conclude all agreements above Rs.40 lakhs and above without upper limit. (GO Rt No.668 MAUD dt.10.07.2018)
- **Para 154 of D Code:** Technical sanctioning Authority got powers to accept tenders within their competency.
- **Para 177** of **D code** and **Para 170** of **Financial Code**, in case of emergency such as floods and cyclones requiring Breach closing, advance can be initiated by EE/SE to entrust the work on nomination at estimate rates by formal agreement, pending necessary sanction by competent authority duly intimating damages in Form-20.

Tender management…

- A final Agt. shall be concluded either K2 contract or LS format at the earliest opportunity and detailed estimate has been sanctioned by Sanctioning authority and said written order forms part of formal agreement so concluded.

- For K2 Contract, no measurements and time period.
- LS Contract is normally followed by Depts: It is time bound in nature. Period of contract is important and it is governed by a bill of quantities. There will be penalties for delay and deviations by supplemental agreement are possible.
- **Para 162:** Supplementary Estimate: Authorized extras will be paid and authorised deletions/omissions will reduce scope of work. A supplementary estimate is needed when the original estimate exceeds with deviation as per site conditions during execution. The EE got power to accept deviation up to 5%, SE - 10%; and CE/ENC - 15%.

Tender management

- **Para 170:** Starting works on emergency: During floods and Cyclones, there is emergency to restore breaches, damage repairs, ill afford to wait till formal sanctions. Then WE can give a word order on a piece of paper to go ahead of execution duly reporting damages in FORM-20 to AG and Govt. under intimation to SE/CE. At the earliest possible time necessary sanctions to be obtained to conclude LS agreement making the earlier work order as part of agreement.

- **Para 170:** Starting works on emergency: During floods & Cyclones there will be emergency to restore breaches, damage repairs, ill afford to wait till formal sanction.
- Then WE can give a word order (WO) on a piece of paper to go ahead with execution duly reporting damage in Form 20 to AG and to Govt. under intimation to SE/CE. At the earliest, necessary sanctions to be obtained to conclude LS agt. making the earlier WO as part of Agt. • **Para 174** deals with Measurement Books of LS contract.
- **Para 213** deals with Discretionary powers to be exercised by District Collector/Governor at state level to sanction for social needs and extraordinary events.
- **Para 215, 401 & 402:** Completion reports, Certificates and Plans

Procedures for Tools and Plants (T&P) Accounts & Register

- They are general or Ordinary T&P and Special T&P meant for specific work. • As and when the materials under T&P are purchased, a consolidated account of receipts, issues & balances of T&P should be maintained in the sub divisional office in Form No.15 (PWD-9) register of Tools and Plants.
- The Register should be closed by 30th September of each financial year duly keeping them in 3 parts.
- Part-I: - Paras on Hand.
- Part-II: - Paras temporarily lent or sent out (to other units).
- Part-II: - Shortages awaiting adjustment
- **Para 329-339: Disposal of Stores**:
    - Loss of Stores: **Para 329-330;** Sale of Stores: **Para 330-339**

Financial Code

Financial Code

- **Para 1:** Deals with all financial matters (Receipts & Disbursements).
- **Para 2:** Every Govt. Servants entrusted with the responsibility of collecting revenues should assess the demands carefully and collect the revenues promptly and similar responsibility lies in respect of loans and advances sanctioned by Govt.
- **Para 3:** Expenditure incurrence must be subject to sanction by competent authority.
- Necessary funds should have been provided in the or by way of re-appropriation by competent authority.
- **Para 4:** Accounts-Every Govt. Servant should maintain a proper account of all financial transactions with which he is concerned and render accounts accurately and promptly to the AG or competent Departmental authorities.

  He will be personally responsible for any loss caused due neglect of duties.

Financial Code: Process of works, preparation of

estimates

- **Para 147** of F-Code: Process of Works: Two categories viz. Original works and maintenance or repair works. Repair works are again of two types viz. Ordinary repairs and Spl repairs.
- **Para 157** -Preparation of estimates: The Nomination powers to Ees: Rs.20,000/-; Ses: Rs.50000/-; CEs/ENCs: Rs.1,00,000/- (GO MS NO.1007, 1978).
- Maintenance estimates include Taxes, Current bills and general maintenance charges. • **Para 163:** Methods of execution of Works:
  - Departmental execution.
  - Piece work or K2 contract.
  - Lump sum contract Method.
  - Scheduled rate of Contract.

Financial Code: Rules for Stores and Purchases…

- Following Order of preference to be followed:
- Raw material & manufacture are within the country.
- Raw material within country, production outside country;
- Production anywhere in the world, but stock available in the country. • Production anywhere in the world & stock anywhere in the world.
- Purchase of Cement: enquiry by three quotations is to be obtained and lowest quotation can accepted if other parameters are the same. Validity of quotation is also important for placing order to supply safeguarding financial interest of State.
- **Para 91:** Contingent charges- The term contingence charges or contingencies' is applied to the "incidental expenditure" which is necessarily incurred in running an office

Financial Code: Rules for Stores & Purchases

- **Para 94: Permanent Advance:** Amount kept with officers (AEEs/EEs/EEs) to meet unforeseen expenses in an emergency. The average monthly contingencies in a financial year will be given as permanent Advance to operate by subordinate.
- This ceiling amount will be reviewed once every 6 months for enhancement or reduction.
- The Permanent advance shall be rendered every month to the EE which will be reimbursed after settling previous advance.
- **Para 102** of Financial Code: Classification of Contingencies:
- Two categories viz. counter signed and Non countersigned (DDOs pay without scrutiny) • Ex: Tour advances, vehicle maintenance of fuel charges etc.
- **Para 103:** Contingent Register - Every item of contingent expenditure, whether counter signed or not, should be recorded to be maintained in an office separately

for countersigned or non countersigned contingent expenditures.

Financial Code: Loans and Advances

- **Para 219-260:** Loans and advances to govt. Servants: of Financial Code: • Two Types of advances: 1. Interest bearing 2. Non-interest bearing. • Interest Bearing Advances: House Building Advance, Motor Vehicles Marriage Advance.
- Non-Interest bearing Advances include Festival advance; Education Advance; spl Festival Advance; Pay advance; Tour advance.
- **Para 262:** Civil deposits:
  - Civil court deposits.
  - Criminal Court deposits.
  - Charity Court deposits.
  - Unclaimed GPF Funds.
  - Revenue Deposits.

- Deposits of Other departments.

Financial Code: Loss of Public Money (Paras 273-293)

- **Para 275:** Rules relating to (i) security deposits to Govt. servants and (ii) the action to be taken on a Govt. servant for any loss of public money or property while handling Govt. cash or stores due to fraud or negligence:
  - Loss while drawing money from Bank subject to theft *or*
  - Embezzlement of money by a Government servant.
- **Paras 276-277:** Forms of Security Deposits from Govt. servants: Cash; Promissory note; Post office savings; NSC-bonds; National Defence Certificate (NDC); treasury issuing certificates; Scheduled Bank DDs and Fixed deposits.
- **Para 278**: Security deposit from a contractor while tendering.
- **Para 279:** Forms of Security to be given by a Govt. servant or a Contractor and conditions. • **Para 326: Destruction of Records** - Provision of this Para to be followed (**Para 84** of **D Code** and **Para 590** of **A Code**)

Loss to Government

- Loss on account of any calamity like fire, flood, or due to any other cause other than fair wear and tear, the Government servant in the immediate charge of the property should report the matter at once to his immediate superior and to the A.G. in A.P.F.C. Form 20. (**Para 299** of **A.P.F.C**).

APPO DEEPO BHAVA!

(Be a Light unto thyself – The Buddha)

Paras 273-275:

Thank You

for a

11. Water Supply Management

Public Health and Municipal Engineering Department

Training to Ward Amenities Secretaries

Water Supply

Components, Functions & Planning

Importance of Safe Drinking Water

- Almost all life forms on earth depend on water.
- It constitutes one of the important physical environments of human beings
- Up to 60% of the human adult body is water
- Quality of drinking water directly affects human health.
- WHO refers to "*Control of water supplies to ensure that they are pure and wholesome as one of the primary objectives of environmental sanitation*"

Definition of Safe Drinking Water as per WHO

- Safe Water as "… *Water that does not contain harmful chemical substances or micro-organisms in concentrations that cause illness to human beings in any form"*
- Adequate water supply as "… *one that provides safe water in quantities sufficient for drinking, and for culinary, domestic, and other household purposes so as to make possible the personal hygiene of a human being"*

Designing of Comprehensive Water Supply System

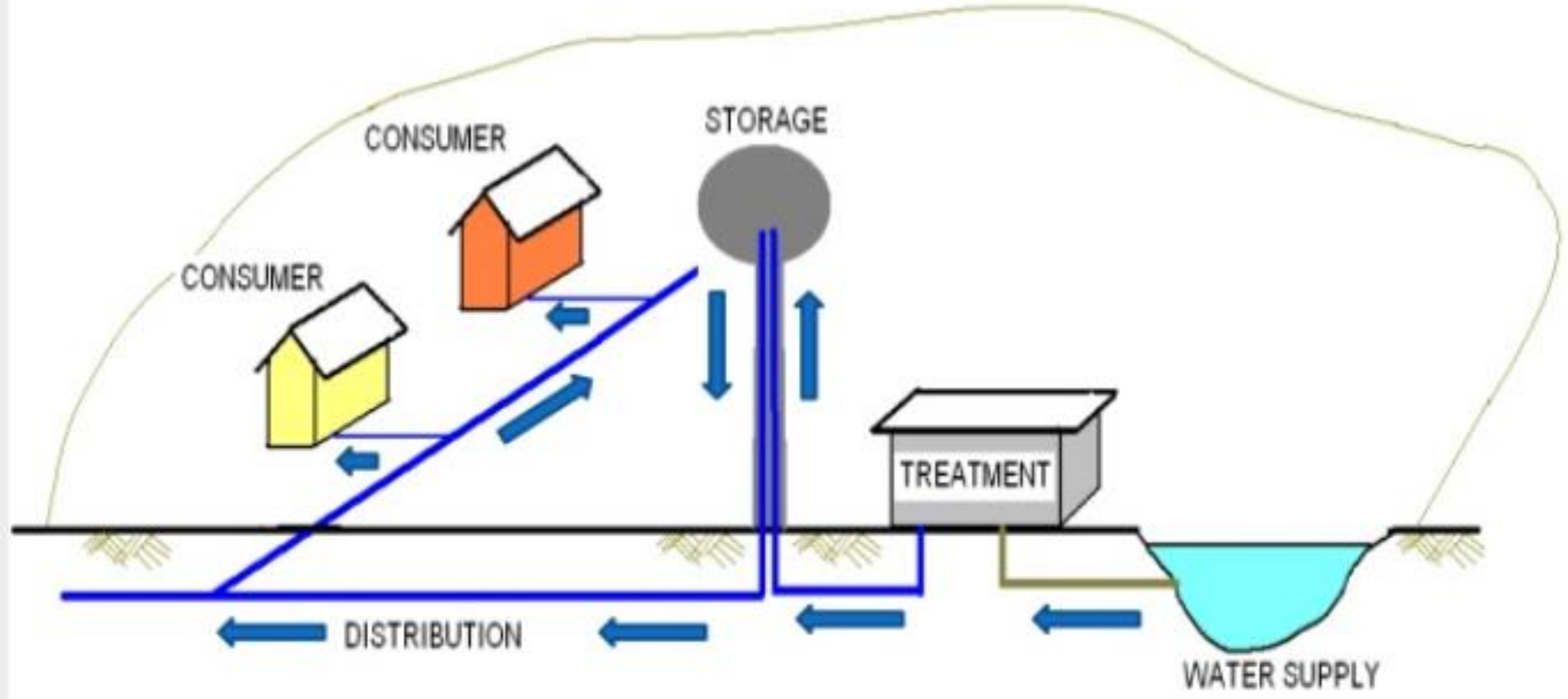
Stages in Project Preparation

- Pre-investment planning, where a project is identified
- Pre-feasibility report to establish the need as well as technical, financial, social, cultural, environmental, legal and institutional feasibility
- Preparation of Detailed Project Report (DPR) with designs, drawings, cost estimates for capital cost and O&M cost
- Review of DPRs, appraisal and sanction
- Procurement and implementation
- Operation and Maintenance

Components of centralised Water Supply System

- Source of water i.e. Rivers, Canals etc.
- Production facilities i.e. Summer Storage Tanks, Water treatment works
- Transmission facilities i.e. pumps, transmission mains from central production facilities to Elevated Level Service Reservoirs (ELSRs)
- Elevated Level Service Reservoirs (ELSRs), which supply water to individual supply zones
- Distribution systems, each supplied by an ELSR, serving a particular zone consisting of a network of pipes
- Water outlets, including house, commercial, industrial and institutional water connections and stand-posts
- In practice, the system may be more complicated than suggested by this simple hierarchy

WATER SUPPLY



Sources of Water

- **Surface Water** : Water drawn from Rivers, Lakes, Reservoirs created through impounding etc.
  - Surface water in and around urban areas will usually be contaminated and should only be supplied after treatment.
- **Ground Water**: Water percolated through soil gets stored in aquifers, which can be drawn through tube-wells or bore-wells.
  - Water is naturally filtered as it percolates from the surface, but may be contaminated by pollutants. The greater the depth, the less the chance of contamination, although contaminants may travel great depths through fissured rock.
- **Sub-Surface Water**: Type of ground water drawn from river beds, which is stored by construction of dykes etc. across the river bed.

Methods of Water Supply System

- **Intermittent Water Supply**
  - The area to be served is divided into zones and each zone is supplied with water for fixed hours in a day. As the water is supplied after intervals, it is called intermittent system
  - Advantages:
    - Reduced pressure helps lowering leakage in older distribution systems having weaker joints
    - Overall scarcity may sometimes be managed by interrupting the water supply and equally balancing the resources
    - Time is available for repair and maintenance
  - Disadvantages:
    - Inconvenience to consumers, mostly the poor
    - Pipelines are subjected to vacuum conditions, may cause contamination
    - Requires household water treatment, as well as higher doses of residual chlorine
    - Consumers need to store water between supplies and tend to throwaway remnant storage

Methods of Water Supply System

- **Continuous Water Supply**
  - Water is supplied to the consumers 24 hours a day, every day of the year, through a transmission and distribution system that is continuously full and under positive pressure.
  - Advantages:
    - Water is not stagnant in the pipes at any instant
    - Lesser pipe sizes are required
    - Fire hazards can be met within time
  - Disadvantages:
    - If there are some minor leakages etc. in the system greater volume of water is wasted due to long duration of flow
    - More water is required ate source which is difficult in tropical countries like India, which gets rain during a particular season
    - More w[illegible]tage of water due to lack of civic sense

Design Considerations of Water Supply System

- Central Public Health and Environmental Engineering Organisation (CPHEEO), has brought out manuals on Water Supply and Treatment, O&M of water supply systems.
- CPHEEO in its manuals has defined the design considerations which are to be followed in design of water supply systems
- All water supply scheme designs in India are based on the design criteria stipulated in the manuals published by CPHEEO

Design Period

Project components may be designed to meet the requirements of the following design periods:

Sl. No.	Items	Design period in years
1.	Storage by dams	50
2.	Infiltration works	30
3.	Pumping:	
	i. Pump house (civil works)	30
	ii. Electric motors and pumps	15
4.	Water treatment units	15
5.	Pipe connection to several treatment units and other small appurtenances	30
6.	Raw water and clear water conveying mains	30
7.	Clear water reservoirs at the head works, balancing tanks and service reservoirs (overhead or ground level)	15
8.	Distribution system	30

Population Forecast

- The design population has to be estimated with due regard to all the factors governing the future growth and development of the project area in the industrial, commercial, educational, social and administrative spheres.

- Special factors causing sudden emigration or immigration should also be foreseen to the extent possible

- Methods of population forecast:
  - Arithmetical Increase method
    - Gives a low value and suitable for well-settled and established communities
  - Geometrical increase method
    - Suitable for growing towns/ cities having vast scope for expansion

Population Forecast

- Incremental Increase Method
  - Increases the figures obtained by arithmetical increase method
- Decreasing rate of growth method
  - Applicable only where the rate of growth of population shows a downward trend
- Graphical method
  - Based on single city
  - Based on cities with similar growth pattern

Arithmetic method of Population Projection

- Suitable for large and old cities with considerable development
- Gives lower estimate for comparatively new and fast growing cities
- It is assumed that population is increasing at constant rate

$$\frac{dP}{dt} = C$$

- Population after nth decade $\mathrm{P_n} = P + nC$

Geometric method of Population Projection

- Suitable for new cities at beginning of development and fast-growing industrial towns
- Gives higher estimate for comparatively old cities
- Population is assumed to grow at increasing rate, however the increase in population from decade to decade is assumed to remain constant

$$P_n = (1 + r)^n$$

- Where $r = Geometric\ mean\ (\ \%\ )$

Incremental Increase method

- Suitable for average size town under normal condition
- Increase in increment is considered for calculating future population
- Average incremental increase from past decades is added to present population along with average rate of increase for projection

$$Pn = P + nX + \frac{n(n+1)}{2}Y$$

- Where

$$X = Average\ Increase$$

$$Y = Average\ Incremental\ Increase$$

Other Methods

Method	Characteristic
Graphical Method	Population curve is obtained from previous decadal information and is smoothly extended for getting future projection
Master Plan Method	For big metropolitan cities master plan is prepared for next 25-30 years and city is divided into various zones like residence, commerce, industry. Population densities are fixed for various zones in the master plan and total water and wastewater demand can be worked out accordingly for the zones.
Logistics S-Curve Method	Used when growth rate of population due to births, deaths and migrations takes place under normal situation.

Per-capita Supply

- Water supplies for communities should provide adequacy for the following as applicable:

  - Domestic needs such as drinking, cooking, bathing, washing, flushing of toilets, gardening
  - Institutional needs
  - Public purposes such as street washing, flushing of sewers, watering of public parks
  - Industrial and commercial uses
  - Fire fighting
  - Requirement of livestock
  - Minimum permissible UFW

- Factors affecting consumption
  - Size of city
  - Characteristics of population and standard of living
  - Industries and Commerce
  - Climatic Conditions
  - Metering

Per-capita Supply

a) Domestic and non-domestic needs

The recommended values for domestic and non-domestic purposes are given in Table 2.1

TABLE 2.1

RECOMMENDED PER CAPITA WATER SUPPLY LEVELS FOR DESIGNING SCHEMES

Sl. No.	Classification of towns/cities	Recommended Maximum Water Supply Levels (lpcd)
1.	Towns provided with piped water supply but without sewerage system	70
2.	Cities provided with piped water supply where sewerage system is existing/contemplated	135
3.	Metropolitan and Mega cities provided with piped water supply where sewerage system is existing/ contemplated	150

Note:

(i) In urban areas, where water is provided through public standposts, 40 lpcd should be considered;

(ii) Figures exclude "Unaccounted for Water(UFW)" which should be limited to 15%

(iii) Figures include requirements of water for commercial, institutional and minor industries. However, the bulk supply to such establishments should be assessed separately with proper justification.

Per-capita Supply

Institutional Demand

Sl.No.	Institutions	Litres per head per day
1.	Hospital (including laundry)	
	(a) No. of beds exceeding 100	450 (per bed)
	(b) No. of beds not exceeding 100	340 (per bed)
2.	Hotels	180(per bed)
3.	Hostels	135
4.	Nurses' homes and medical quarters	135
5.	Boarding schools / colleges	135
6.	Restaurants	70(per seat)
7.	Air ports and sea ports	70
8.	Junction Stations and intermediate stations where mail or express stoppage (both railways and bus stations) is provided	70
9.	Terminal stations	45
10.	Intermediate stations (excluding mail and express stops)	45 (could be reduced to 25 where bathing facilities are not provided)
11.	Day schools / colleges	45
12.	Offices	45
13.	Factories	45 (could be reduced to 30 where no bathrooms are provided)
14.	Cinema, concert halls and theatre	15

Per-capita Supply

Fire Fighting Demand

- It is usual to provide for fire fighting demand as a coincident draft on the distribution system along with normal supply.
- A provision in Kilolitres per day based on the formula $100\sqrt{P}$, where, p = population in thousands may be adopted for communities larger than 50,000.
- It is desirable that one-third of the fire fighting requirements form part of the service storage.

Industrial needs

- The per capita rates of supply recommended will ordinarily include the requirement of small industries (other than factories) distributed within a town, separate provision will have to be included for meeting the demands likely to be made by specific industries within the urban areas.
- Demand will be based on the nature and magnitude of each such industry and the quantity of water required per unit of production

Per-capita Supply

Industrial needs

Industry	Unit of production	Water requirement in Kilolitres per unit
Automobile	Vehicle	40
Distillery	(Kilolitre Alcohol)	122-170
Fertilizer	Tonne	80-200
Leather	100 Kg (tanned)	4
Paper	Tonne	200-400
Special quality paper	Tonne	400-1000
Straw board	Tonne	75-100
Petroleum Refinery	Tonne(crude)	1-2
Steel	Tonne	200-250
Sugar	Tonne (Cane crushed)	1-2
Textile	100 Kg (goods)	8-14

Pressure Requirements

- Water supplies should be designed to distribute water to consumers at adequate pressure at all points
- For towns where one-storeyed buildings are common and for supply to the ground level storage tanks in multi storeyed buildings, the minimum residual pressure at ferrule point should be 7 metres
- Where two-storeyed buildings are common, it may be 12 metres
- Where three-storeyed buildings are common, it may be 17 metres

Water Quality

- The objective of water treatment works is to ensure that the water supplied is free from pathogenic organisms, clear, palatable, free from undesirable taste and odour, of reasonable temperature, neither corrosive nor scale forming and free from minerals which could produce undesirable physiological effects

- IS 10500: 2012 prescribes the requirements and the methods of sampling and tests for drinking water

End of Session -1

Thank You

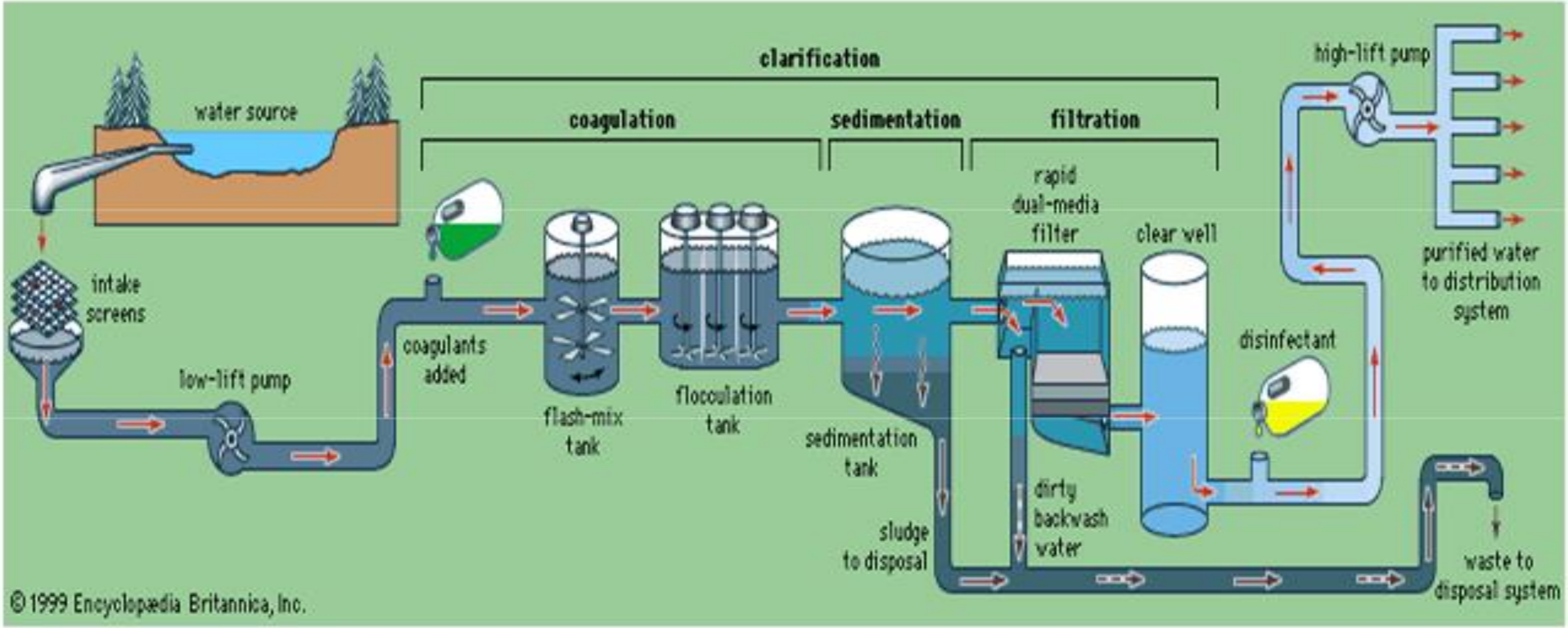
Day - 2

Session -3

Water Supply Scheme

Components, Design and Execution

Flow diagram of water treatment



Assessment of the Yield and development of the source:

- A correct assessment of the capacity of the source investigated is necessary to decide its dependability for the water supply project in view
- The capacity of flowing streams, natural lakes is decided by the area and nature of the catchment, the amount of rainfall and allied factors
- The safe yield of sub-surface sources is decided by the hydrological and hydrogeological features relevant to each case
- Methods for assessment of surface flows:
  - Use of river gauging data
  - Unit hydrograph method
  - Frequency analysis based on rainfall
  - Empirical formulae
- Methods for assessment of sub-surface/ Ground water flows:
  - The quantum of groundwater available for development is usually restricted to long term average recharge of the aquifer and is 100% dependable source of supply
  - To be estimated primarily based on normal annual recharge which could be developed by means of suitable groundwater abstraction structures and judiciously harnessed for various purposes

Summer Storage Tanks

- Irrigation Canals supply raw water for fixed period of months over a year. (the irrigation department provides information regarding the time over which no supply from a canal can be guaranteed)
- The Canal Closure period typically varies from 45 to 60 days (occasionally higher)
- Summer Storage Tanks are constructed to store raw water and utilize later.
- Their capacity shall be calculated such that raw water will be available at design standards during the months of canal closure.
- The capacity of S.S. Tank shall be designed considering raw water requirements & evaporation losses.
- Required Storage = Period of canal closure X (Water required at WTP + Losses due to Evaporation (33% of daily production) +Avg. water used per day in desludging and dewatering (5% of daily production))

Summer Storage Tanks

- The actual capacity of S.S. Tank is calculated from the formula
  - Capacity = (Max. W.L. – Min. W.L.) X Area at mid depth in Sq. M

- In the event that the storage available is less than that required to provide a full supply throughout the period of canal closure, the options for increasing S.S. Tank capacity must be considered at an early stage in the planning process

Drawl of Raw Water: Intake Structures

- **Intake structures** are used for collecting water from the surface sources such as river, lake, and reservoir and conveying it further to the water treatment plant
- These structures are masonry or concrete structures and provides relatively clean water, free from pollution, sand and objectionable floating material.

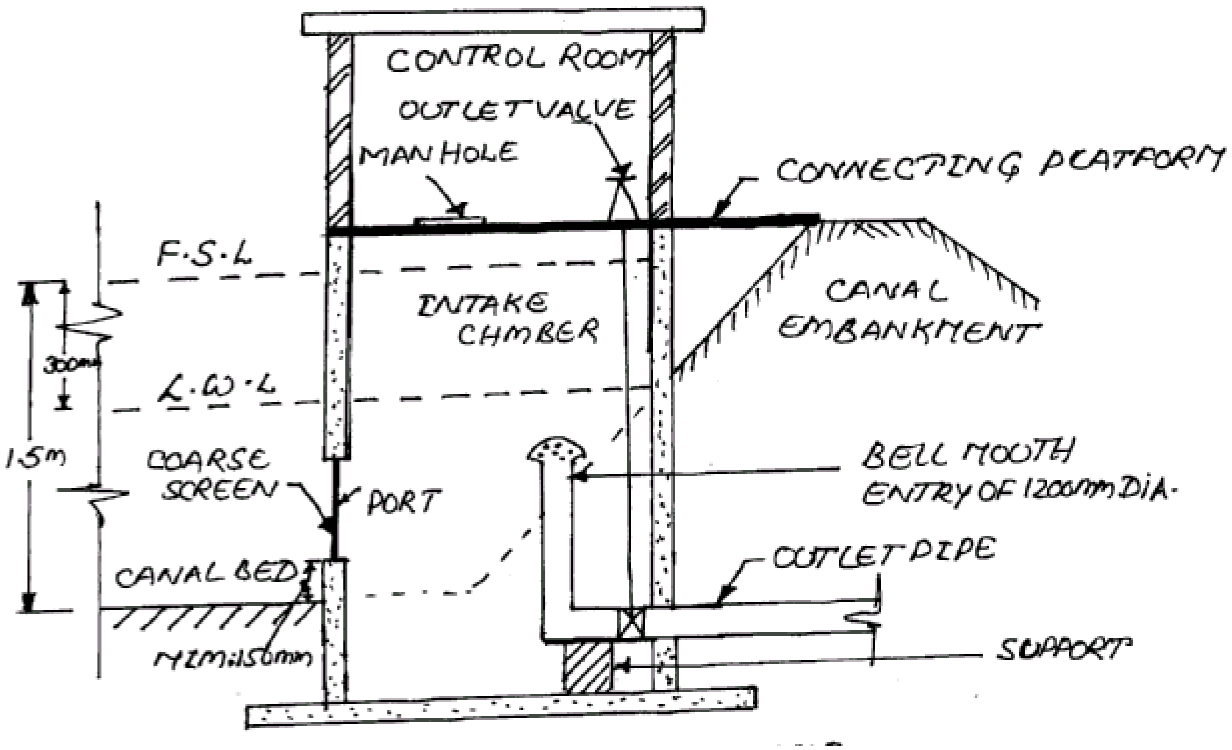
Components in Intake well

- Screen to prevent living and nonliving things from entering
- Conveying pipe or conduit
- Pump with suction pipe with stand by
- Maintenance platform
- Level indicator

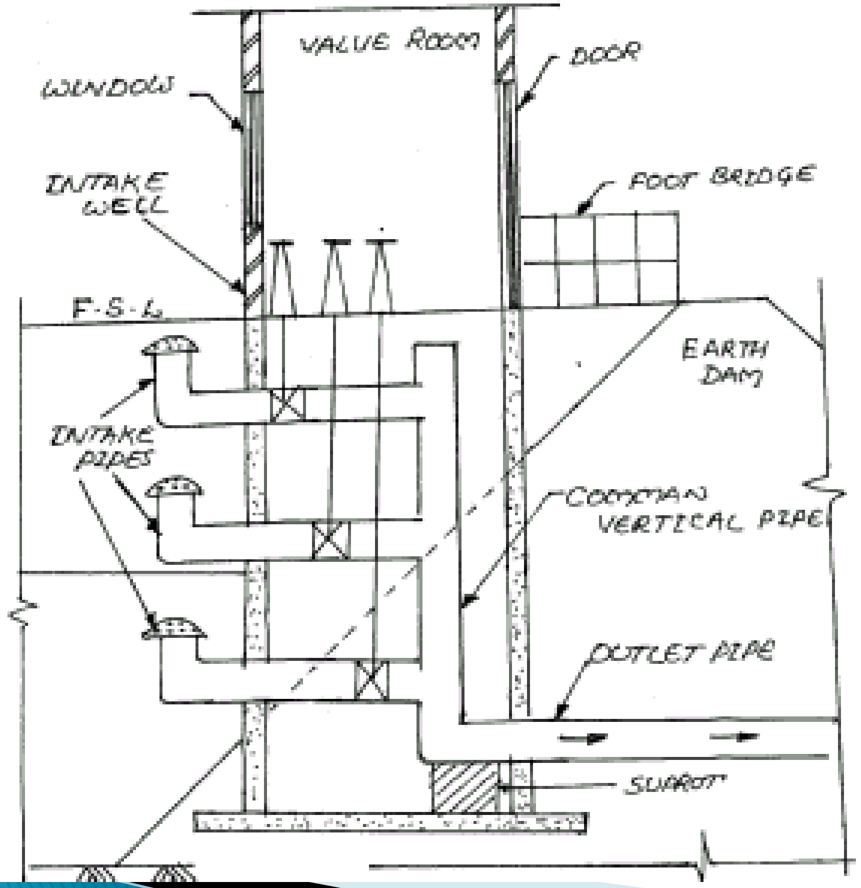
Locating Intake Well

- To be close to the water treatment plant
- To be located in turbulent and silt free zone
- On the upstream of WW disposal point
- Away from navigation channel
- Future possible expansion
- Easily accessible at all times

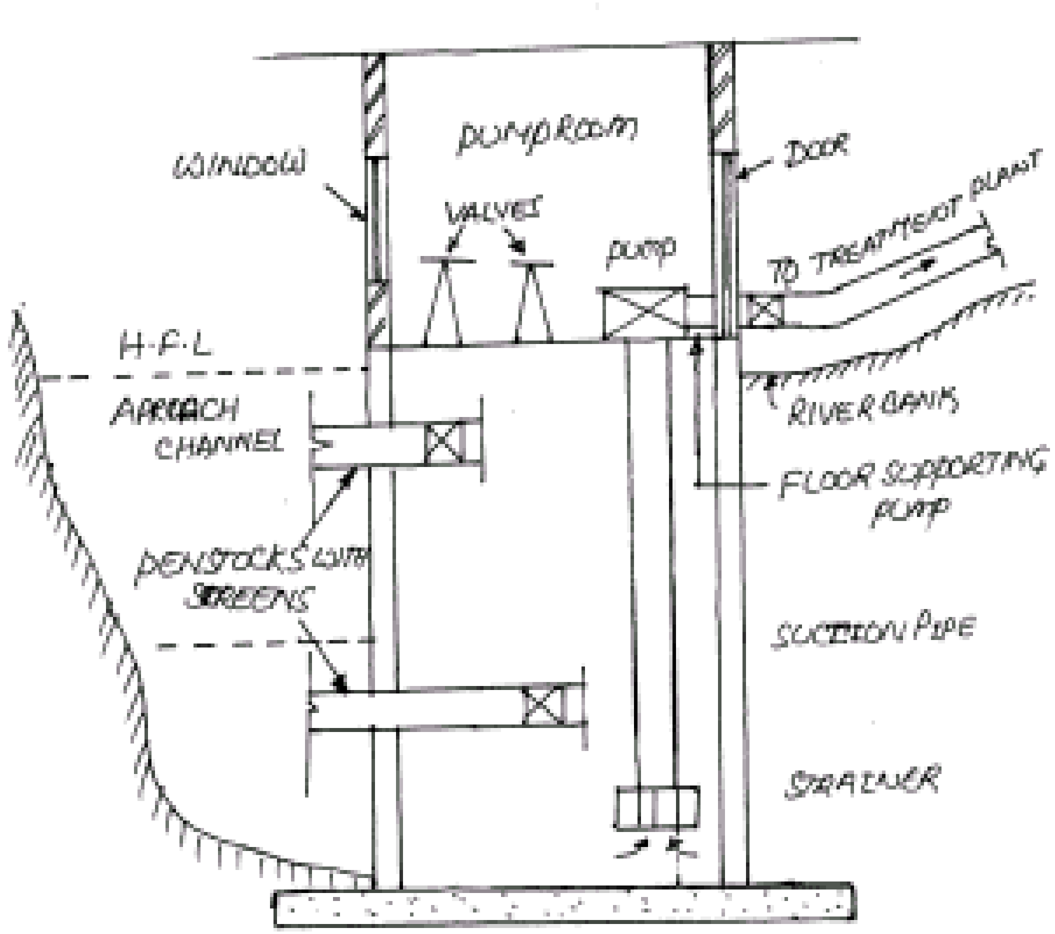
TYPICAL CANAL INTAKE WELL



RESEVOIR INTAKE WELL



RIVER INTAKE WELL



Design Considerations

- Provide for uplift pressure when intake-well is empty and the river/ canal is flowing up to full water level
- Coarse Screens: Prevent entrance of Large objects
- Fine Screens: exclusion of small fish and small objects
- Area of opening: entrance velocity < 8 m/min (avoids entry of settleable matter into intake pipe
- submerged ports: depth of water over the port = 3 X $D_{opening}$

Intake Well

- Diameter of intake well should be sufficient to house pumps and pumping arrangements
- In addition to structural aspects and floods, Intake Well is designed to resist uplift due to water for worst-case condition
- *Worst case condition for uplift pressure occurs when intake well is empty and river/ reservoir is at full water level*
- $Factor\ of\ Safety = \dfrac{Weight\ of\ intake\ well}{Uplift\ pressure\ at\ bottom\ of\ raft}$

Intake well capacity

Given Total raw water requirement				49.28	MLD
Considering detention time as				15	minutes
Quantity of water = $(49.28*10^3*15)/(24*60)$				513.33	KL
Available water depth =				3.50	m
Area of well				146.67	sqm
Dia of well				13.67	m
			Say	14.00	m

Design of intake well – Check for stability

- An 12 m diameter intake well at Thandava Reservoir is to be designed for uplift. The full water level in the reservoir is 8 m and the top of its 13.5 m diameter raft is to be placed 2 m below the soil. The intake well is proposed to be constructed with concrete with 400 mm thickness of walls and it is to house pumping machinery on 300 mm thick bottom slab. The bottom slab is to have a clear height of 3 m above full water level and the height of pump room is to be 4 m. The thickness of roof slab is 150 mm. What is the thickness of concrete slab required to counter uplift pressure with FoS = 1.2 in worst case.
- Take $\gamma_{concrete}$ = 25 kN/m^2 and $\gamma_{sub\text{-}soil}$ = 9 kN/m^2 and g = 10 m/s^2

Solution

- Total height of walls = 8 + 2 + 3 + 0.35 + 4 + 0.3 = 17.65 m
- Average diameter at centre of walls = 12.4 m
- Volume of concrete in walls (V1) = Pi*12.4*17.65 = 744.12 m^3

- Area of slab = Pi*12^2/4 = 113 M^3
- Volume of concrete in slabs (V2) = 113*(0.35+0.15) = 56.5 m^3

- Volume of concrete in raft of thickness t (V3) = Pi*13.5^2*t/4 = 143.1t

Solution – Continued

- Total Weight of concrete = (V1 + V2 + V3)*25 = (744.12 + 143.1t)*25
- Weight of submerged soil on raft = Pi*(13.5^2 – 12.8^2)*9/4 = 130.07 kN
- Total weight = 18733.07 + 3577.5t kN
- Uplift pressure at bottom of raft = (10 + 2 + t)*10 = 120 + 10t kN/m^2
- Uplift force = 143.1*(120 + 10t) = 17172 + 1431t kN

- FoS = 1.2 = $\frac{18733.07+3577.5t}{17172+1431t}$ So $t = 872.7\ mm\ say\ 875\ mm$

Drawl of Raw Water: Infiltration Wells/ Galleries

- The sub-surface includes springs, wells and galleries
- A gallery laid at an optimum depth in a shallow aquifer serves to abstract the sub-soil flow along its entire length.
- Infiltration Wells/ Galleries have to be located with in a minimum distance in between each pair, so as to avoid mutual interference under normal pumping
- The gallery is to be located sufficiently below the lowest GWL in the aquifer, under optimum conditions of pumping during adverse seasons.
- Lower than the scouring zone of the riverbed under high floods, so that the top-most sand layer of the gallery media remains undisturbed at all times.

Drawl of Raw Water: Infiltration Wells/ Galleries

- General Layout:
  - A gallery is a porous barrel inserted within the permeable layer, either axially along or across the groundwater flow.
  - A collecting well at the shore end of the gallery serves as the sump from where the infiltrated supply is pumped out.
- Structure of a gallery:
  - The normal c/s of a gallery comprises of loosely jointed or porous pipe or rows of pipes, enveloped by filter media of graded sizes.
  - The galleries consist of either a single or double row of stoneware of concrete pipes loose jointed with cement lock filters. Perforated PVC pipes can also be used.
  - The pipes enveloped with coarse aggregate in three layers followed by coarse and medium sand layers.

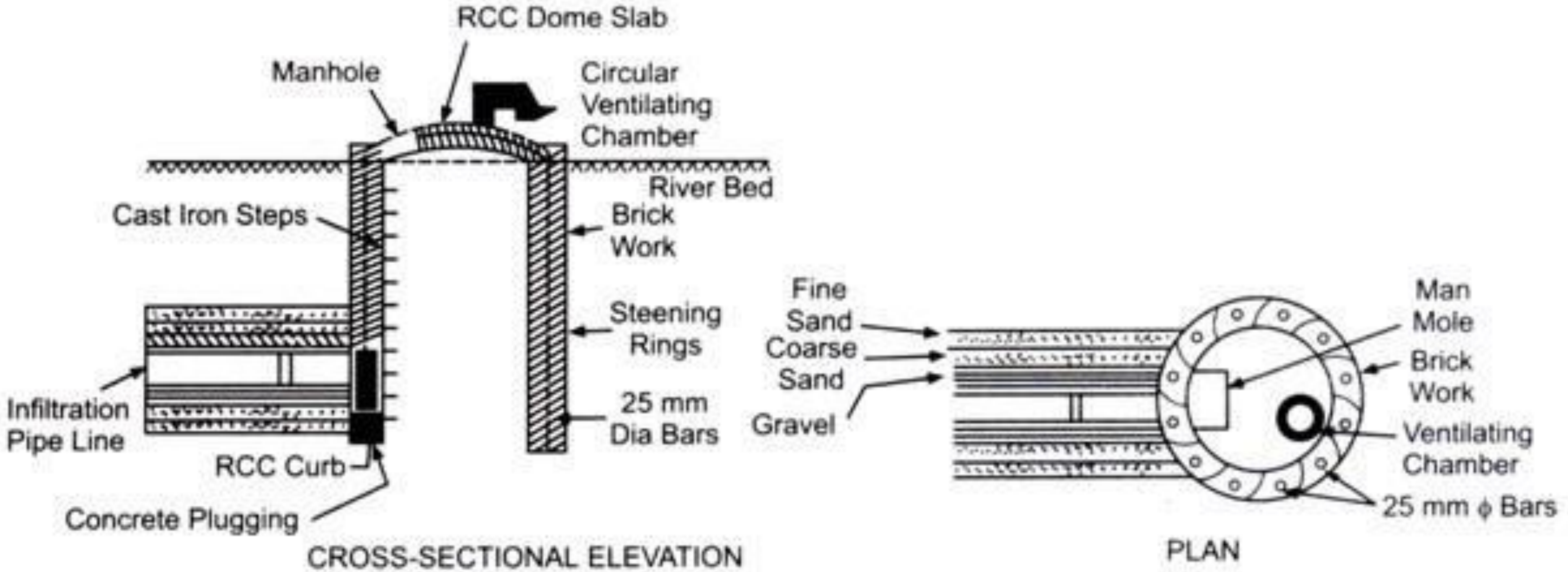


Fig. 1.6. Infiltration well

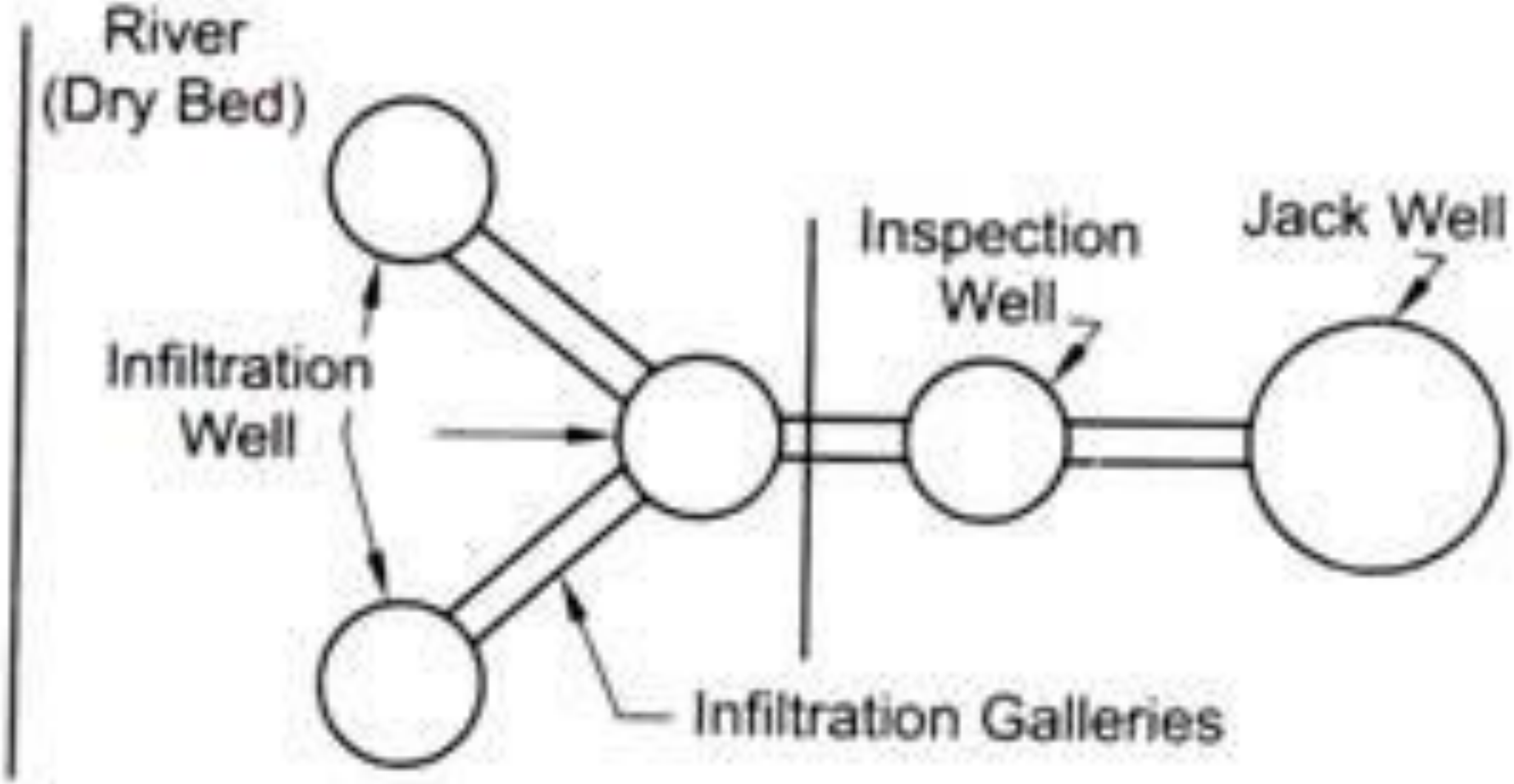


Fig. 1.7. Plan showing arrangement of wells and galleries

Infiltration wells/ Galleries

- Infiltration wells are designed based on yield of aquifer and using Thiem's Theory.

Pumping Stations and Machinery

- In a water supply system, pumping machinery serves the following purposes
  - Lifting water from the source (surface or ground) to purification works or to the service reservoir
  - Boosting water from source to service areas and to the upper floors of multistoried buildings
  - Transporting water through treatment works, draining of settling tanks and of other treatment units, supplying water under pressure and pumping chemical solutions to treatment units.
- Types of pumps:
  - Vertical Turbine Pumps
  - Horizontal Turbine Pumps
  - Centrifugal Pumps

Pumping Stations and Machinery

- Planning and operation of a pumping station embraces the following:
  - Selection of pumps
  - Intake design
  - Piping layout
  - Installation, Operation, Maintenance and Trouble shooting of pumps
  - Selection of motors
  - Selection of starters
  - Selection of cables
  - O&M of electrical equipment

Pumping Stations and Machinery

- Criteria for Pump Selection
  - Nature of liquid
  - Type of duty required i.e. continuous, intermittent or cycle
  - Present and projected demand
  - Details of head and flow rate required
  - Characteristic curves of the pump
  - The efficiency of the pump and consequent influence on power consumption and the running costs
  - Type and duration of the availability of the power supply.

Pumping Stations and Machinery

- Design of Pump Capacity
- Pump Capacity in KW = $\rho g q h/\eta$

  = {(Q X H) X 100}/{102X efficiency)

  Where,

  Q = discharge in litres / sec

  H = head in metres

  Efficiency is the combined efficiency of the pump and the motor

- **Note: <u>Power Factor shall always be greater than 0.91 during operation of Pumps or any electro-mechanical machinery</u>**

Pumps calculations

- Design pump sets for intermediate requirement of 38.50 MLD and 23.5 hours and head of 147 m

Quantity to be pumped from Intake well		38.50	MLD
Hours of pumping		23.50	Hours
Design Flow		0.4551	M^3/Sec.
No.of duty pump sets		2	Nos
No. of Stand by pump sets		1	Nos
Stand by percentage		0.50	
Total Discharge Q		0.4551	cum/sec
Q of each pump set		0.2275	cum/sec
Total Head for VT Pump sets – Provided		146.77	m HWC
	Say	147.00	m HWC
Efficiency considered as per deliverable,η		75%	
Capacity of VT Pumpsets (9810 * Q * H /η) Wats		437507.45	W
		437.51	kW
		586.47	HP

Choice of Pipes

- Pipes come in several types and sizes; they can be divided into three main categories:
    - Metallic Pipes
    - Cement pipes
    - Plastic Pipes
- Metallic pipes include Ductile Iron Pipes, Galvanized Iron (GI) Pipes, Cast Iron (CI) Pipes, Mild Steel (MS) Pipes, Bar Wrapped Steel Cylinder (BWSC), DWC pipes
- Cement Pipes includes Asbestos Cement Pipes, Reinforced Concrete Pipes, Pre-stressed Concrete pipes
- Plastic Pipes include High Density Polyethylene (HDPE) pipe, Poly Vinyl Chloride Pipes (PVC) Pipes, Glassed Fiber Reinforced Plastic (GRP) pipes

Ductile Iron Pipes

- It is made by a metallurgical process, which involves the addition of magnesium in to molten iron of low sulphur content.

Application Areas:

- Water & Sewerage.

Advantages :-

Has excellent properties of machinability

Impact resistance, high wear and tear resistance, high tensile strength

Ductility and corrosion resistance

Disadvantages :-

High Capital investment

Because of their heavy load, these pipes are made in shorter lengths, this equates to more jointing

These pipes are very heavy and it requires specific means of transportation.

Galvanized Iron Pipes

- This type of pipe is used for water supply work inside the building.
- These pipes are wrought steel pipes provided with zinc coating.

Application Areas:

- Water & Sewerage.
- Fire Fighting Installations.
- Plumbing Systems.

Advantages :-

Low installation and
Maintenance cost
Long life
Toughness
Anti-rust pipes
Useful for large construction

Disadvantages :-

Heavy to handle.
Develops blockages.
Difficult to repair.

Cast Iron Pipes

They come in various shapes such as L-shape, T-shape, I-shape etc.

Application Areas:

- Water.
- Fire Fighting Installations.
- Plumbing Systems.

Advantages :-

It is the preferred choice for handling high pressures and loads of water.

They are cheaper in cost, it has high resistance to corrosion, it is highly durable.

Disadvantages :-

It is not advisable to use cast iron pipes in inaccessible places

Because of their heavy load, these pipes are made in shorter lengths, this equates to more jointing and a more complicated layout.

These pipes are very heavy and it requires specific means of transportation.

Asbestos – Cement Pipes

- These pipes have been in use throughout the world since 1913. They are made of a mixture of 82-90% cement and 10-18% asbestos fibres.
- The use of asbestos pipes to convey potable water over the last two decades, due to increasing concern with their health hazards.

Application Areas:

- Water & Sewerage.
- Irrigation Water.

Advantages :-

- They are resistant to wear and corrosion, thereby being useful in situations involving corrosive water or soil.
- They have smooth internal surfaces, resulting in low friction losses
- They are easy to install and maintain

Disadvantages :-

- The asbestos material used in manufacturing the pipes represent a carcinogenic health hazard when used to transport water for human consumption.
- The pipes have a low resistance to vibrations from vehicular traffic passing over them;
- They have a low resistance to shocks, facilitating their breakdown during their loading, transportation, unloading and installation;
- There is a poor availability of fitting of the same material as the cylinder;
- They cannot be used in loamy soil that expands, or in liquid soils.

Concrete Pipes

- Steel reinforced concrete pipe (SRCP) has a product life of 100 years or more – one of the best service lives of any pipe product.

Application Areas:

- Water & Sewerage.
- Irrigation Water.
- Stormwater drainage

Advantages :-

- It is the low risk choice for specifies with a long history of reliability, no limits to weather exposure prior to installation and increasing strength over time.
- It is easy to join and install, self heals and performs soundly above or below the water table.
- Suitable for conveying all types of water;
- Easy to install and with flexible joints;
- Can withstand backfill pressure, as well as vehicle traffic loads taking place above it;
- Because of the smooth inner surface, there are small friction losses

Disadvantages :-

- They are heavy, with this feature being reflected in their transportation and installation costs;
- It is difficult to re-establish the inner and outer pipe coating if it is damaged during repair works;
- They require special care in its manufacturing, transportation and installation;
- They may require grounding measures in some cases.

PVC/PLASTIC/POLYTHENE Pipes

- These pipes are being used increasingly these days for supply of cold water in external and internal plumbing work.
- Unplasticized PVC (UPVC) or rigid pipes for use with cold water
- Plasticized PVC pipes which are plasticized with addition of rubber. it has lower strength and lower working temperature than UPVC pipes.
- Chlorinated PVC (CPVC) pipes which can withstand higher temperatures up to 120 centigrade (used to carry hot water).

Application Areas:

- Water & Sewerage.
- Fire Fighting Installations.
- Plumbing Systems.

Advantages :-

- Durable and usable.
- Corrosion resistant.

Disadvantages :-

- Heat constraints.
- Cost.

Tests that are to be carried out at Manufacture's works on pipe

Mandatory Tests:

- Hydraulic pressure tightness test
- Hydraulic pressure bursting test
- Transverse crushing test
- Longitudinal bending test

Optional Tests :-

- Hydraulic pressure bursting non immersed test
- Line test

Name of the Test	Permissible limit
Hydraulic pressure tightness test	There is no fissure, leakage or sweating
Hydraulic pressure bursting test	Length shall be not less than 500mm and more than 1000 mm for all diameters
Transverse crushing test	The rupture occurs after at least 15 s and not more than 30 s according to the diameter
Longitudinal bending test	This test should be for only on pipe of 150mm dia and less, at least 2.20 mt long

Field test pressure

- Field test pressure of pipeline should not be less than the greatest of the following :
  - 1 ½ times the maximum sustained operating pressure
  - 1 ½ times the maximum pipeline static pressure
  - Sum of the maximum pipeline static pressure and the maximum surge pressure subject to maximum equal to the works test pressure for any pipe fittings incorporated
- In case of gravity pipes maximum working pressure shall be 2/3rd test pressure
- Class of pipe is checked based on head requirements, friction and other losses and static head

IS codes for pipes in Gravity/ Pumping Mains

- IS 1592 – 1980 AC Pipes
- IS 458 – 1988 RCC Pipes
- IS 784 – 2001 Pre-stressed Concrete Pipes
- IS 1536 – 1989 CI Pipes Centrifugally cast
- IS 1537 – 1989 CI Pipes Vertically cast
- IS 12709 – 1989 GRP Pipes
- IS 8329 – 1994 DI Pipes
- IS 15155 – 2002 BWSC Pipes
- IS 4984 – 1996 HDPE Pipes
- IS 7181 – 1986 CIDF Pipes

Design of Gravity/ Pumping Mains

- Pipe lines generally follow ground profile. Gravity pipe lines are normally laid below the Hydraulic grade lines
- The Hydraulic design of pipe line is mainly concerned with minimum velocities required for sediment transport and high velocities causing scouring action
- The velocity of water in the pipe line should not be less than 0.60 to 0.75 m (2-2.5 ft) per second in order to prevent the deposit of silt
- For silt bearing waters there are both lower and upper limit velocities.
  - Lower limit - 0.60 to 0.76 m/sec.
  - Upper limit - 3 to 6.10 m/sec.
  - Velocities of 1.22 to 1.83 m/sec. are common.

Hazen–Williams formula for discharge

$$Q = 3.1 \times C \times (d)^{2.63} \times (s)^{0.54} \times 10^{-4}$$

Where	Q	=	Discharge in KLD
	C	=	Roughness Co-efficient
	d	=	Diameter of Pipe in mm
	s	=	Slope or gradient

Hazen-Williams formula for Velocity

$$V = 4.567 \times C \times (d)^{0.63} \times (s)^{0.54} \times 10^{-3}$$

Where	V	=	Velocity in m/sec
	C	=	Roughness Co-efficient
	d	=	Diameter of Pipe in mm
	s	=	Slope or gradient

Designing of Gravity Main – 1

- Quantity of water to be conveyed through the main = 12.32 mld (or) 12320 KLD

MWL of balancing reservoir = + 42.00 m
LWL of balancing reservoir = + 38.00 m
MWL of ELSR @ Srinagar = + 30.00 m
Fall availabe = 42.00 – 30.00 = 12.000 m
Deducting 20% for trammission losses (2.40 m)
Net fall available = 9.60 m.

Designing of Gravity Main – 2

- Length of gravity main = 9830 m
  9830x(s) = 9.6 m i.e. s=1/1023

  $$Q = 3.1 \times C \times (d)^{2.63} \times (s)^{0.54} \times 10^{-4}$$

  $$12320 = 3.1 \times 140 \times (d)^{2.63} \times (1/1023)^{0.54} \times 10^{-4}$$

  d = 491.40 mm or say 500 mm

  $$V = 4.567 \times 140\ (500)^{0.63} \times (1/1023)^{0.54} \times 10^{-3}$$
  $$= 0.76\ \text{m/sec.}$$

Designing of Gravity Main – 3

- <u>Check with 500 mm dia</u>

$$Q = 3.1 \times C \times (d)^{2.63} \times (s)^{0.54} \times 10^{-4}$$

$$12320 = 3.1 \times 140 \times (500)^{2.63} \times (S)^{0.54} \times 10^{-4}$$

$$S = 1/1113$$

$$V = 4.567 \times 140\ (500)^{0.63} \times (1/1113)^{0.54} \times 10^{-3}$$

$$= 0.73 \text{ m/sec.}$$

Designing of Gravity Main – 4

- Frictional losses = 9830/1113 = 8.83 m.
- Other losses @ 20% = 1.77 m

Total losses = 10.60 m

HL available @ Sriramnagar ELSR

= 42.00 – 10.60 = 31.40 m.

HL Required = + 30.00 m.

Residual head at Sriramanagar ELSR = 31.40 – 30.00 = 1.40m

Hence safe.

Water Hammer Control

- No device can totally prevent the development of surges, however, they merely reduce the intensity of surge pressure by 10 to 40% so that the pipe line is safe.

- The pipe line shall be *designed for maximum internal operating pressure obtaining at the lowest portion of pipe line including allowance required for surge pressure*

Water Hammer – 1

- While designing the Pumping Mains, water hammer requires careful consideration

$H_{max} = a * v_0 / g$ where,

H_{max} = Maximum Pressure rise in Pipe above the normal pressure in ‘m’.

a = Velocity of pressure wave travel in m/sec.

g = Acceleration due to gravity in m/sec^2 i.e., 9.81 m/sec^2.

Water Hammer – 2

$a = 1425 / \text{Sqrt}(1 + kd / E * t)$

where,

k = Bulk modulus of water ($2.07 * 10^{8}$ kg/m^2)

d = dia of pipe in 'm'.

t = wall thickness of pipe in 'm' and

E = Modulus of Elasticity of pipe material in kg/ m^2

Design of pumping main – example

- Propose a rising main to pump 49.28 MLD water from intake well to GLBR on hill for 5150 m length with FWL at intake well = 463.5 m and MWL at GLBR = 603.5 m and 23.5 hours of pumping and residual head of 2 m

- Quantity of water pumped = 49.28 MLD
- Hours of pumping = 23.50 Hours

- So, Design flow = 0.5825 m^3/s

Example – Continued

FVL of pumpset in intake well	+	463.50
M.W.L of GLBR on hill	+	603.50
G.L at G LBR	+	599.00
LW.L at G LBR	+	599.00
Hightest contour (or) Mwl of GLBR whichever is higher	+	603.50
Static Head = 603.5 – 463.5 m		140.00

Step – I : Select diameter based on velocity

- Consider 900 mm DI pipe and check for residual head
- $Q = 0.5285\ m^3/s$ and c/s area of pipe $= 0.636\ m^2$
- So, velocity $v = 0.92\ m/s$ (within permissible range 0.6–3 m/s)

Step – II : Hydraulic head calculations

Losses due to friction				
From the Hazen & Williams Formula				
V	$0.849*C*r^{0.63}*s^{0.54}$			
Where				
V	Velocity		0.92	m/s
C	Hazen & Williams Coefficient:		130	
r	Hydraulic radius		0.22	m
s	Slope		0.0008	
So, Losses due to friction		=	Length of pipe X Slope	
		=	4.33	m
Other losses @ 10%			0.43	m
Total head losses in the pipe line		=	4.77	m
Static Head		=	140.00	m
Residual head proposed at GLBR		=	2.00	m
So, Hydraulic head of raw water Pipe line at GLBR (This should be less than permissible head of proposed pipe)			**146.77**	**m HWC**

Step = II : Surge pressure calculations

Velocity of pressure wave travel in m/s (a)			1425/sqrt.(1+(kd/ EC_t)	
Where				
k =	bulk modulus of water		2.07*10^8	kg/m^2
D =	diameter of pipe in m		0.90	m
C_t =	wall thickness of pipe in m		0.01	m
E =	modulus of elasticity of pipe material in kg/m^2		21*10^9	
Velocity of pressure wave travel in m/s (a)			1037	m/sec
Maximum water hammer pressure (H_{max})			$a*V_o/g$	
Where				
A =	velocity of pressure wave travel in m/s		1037.32	m/sec
V_o =	normal velocity in the pipeline before sudden closure		0.98	m/sec
g =	Acceleration due to gravity		9.81	m/sec
Maximum water hammer pressure (H_{max}) =			**103.63**	**m HWC**

Step – III : Compare with allowable pressures

Allowable Opertating Pressure in 900 mm DI K9 Pipe	300.00	>	146.77	m
Allowble Maximum Operating Pressure (including Surge)	370.00	>	250.39	m

Hence, safe design

Appurtenances: Valves

- To isolate and drain pipe sections for test, installation, cleaning and repairs, a number of appurtenances or auxiliaries are generally installed in the line.
- A **valve** is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways.
- Main line valves are provided to stop and regulate the flow of water in the course of ordinary operations and in an emergency,
- There are many types of valves for use in pipelines, the choice of which depends on the duty.

Check Valve

- These are also known as reflux valves or non -return valves.
- A check valve is an automatic device which allows water to go in one direction only.
- The reflux valve is invariably placed in water pipe which obtains water directly from pump. When pump fails or stops, the water will not run back to the pump and thus the pumping equipment will be saved from damage.
- Similarly at inter-connections between a polluted water system and a potable water system, the provision of reflux valve will prevent the entry of polluted water into the pure water.

CHECK VALVE

Relief Valve

- These are also known as the automatic cut-off valves or safety valves. The load on the spring is adjusted to the maximum pressure.
- The relief valves are located at every point along the water pipe where pressure is likely to be maximum.
- When pressure of water exceeds a predetermined limit, the valve operates automatically and it will save a particular section of water pipe before bursting of pipe takes place.

RELIEF VALVE

Scour Valve

- These are also known as the blow off valves or drain valves or washout valves.
- These are ordinary sluice valves which are located at dead ends and depressions or lowest points in mains.
- They are operated to remove sand or silt deposited in the water pipe.
- They are operated with hand and closed down as soon as clear water is seen passing through them.

SCOUR VALVE

Gate Valve/ Sluice Valve

- These are also known as the gate valves or shut off valves or stop valves.
- These valves control the flow of water and are helpful in dividing the water mains into suitable sections.
- They are generally placed at a distance of about 150 m to 200 m and at all junctions.
- For long straight mains, the sluice valves can be installed at a distance of about 1 km also to divide the pipe in different sections.
- The raising or lowering of valve is carried out by rotating the handle from top.
- The installation of sluice valves is very much useful in case of intermittent system of supply of water.

SLUICE/GATE VALVE

Butterfly Valve

- These are used to regulate and stop the flow especially in large size conduits.
- They are sometimes cheaper than sluice valves for larger size and occupy less space
- They would involve slightly higher head loss than sluice valves and also are not suitable for continuous throttling.
- They offer fairly high resistance to flow even in fully open state, because the thickness of the disc obstructs flow.
- Butterfly valves as well as sluice valves are not suited for operation in partly open positions as the gates and seating would erode rapidly.

BUTTERFLY VALVE

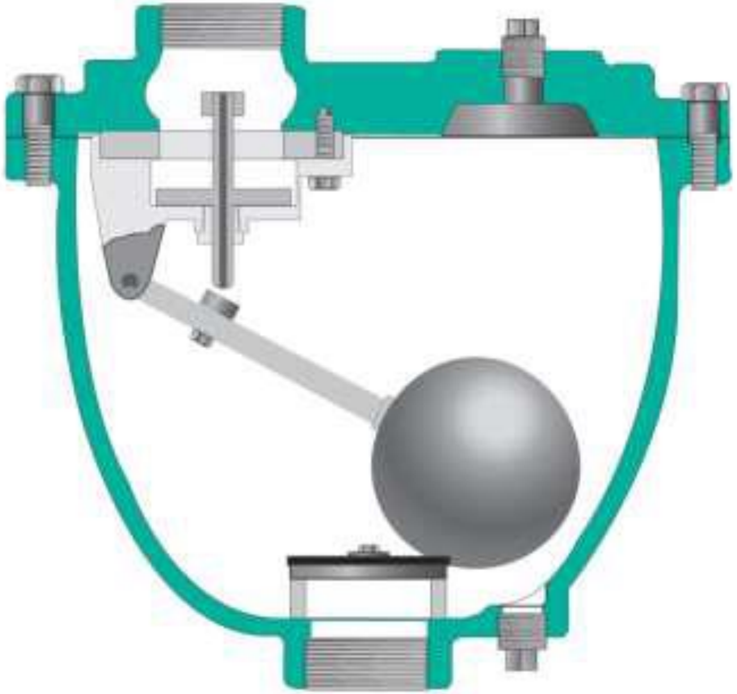
Air Valve

- These are also termed as the air relief valves. Some quantity of air is contained in the flowing water and this air tries to accumulate at high points along the water pipe.
- In order to provide an exit for such accumulated air, the air valves are provided at summits along the water pipe.
- The air valves should be located at points which are close to or above the hydraulic gradient.
- If air valves are not provided, there are chances for pipes to be air locked. The effective area of flow and consequently the discharge through water pipe are greatly reduced due to air locking.
- The provision of air valves along water pipe also helps in admitting air quickly when vacuum occurs in water pipe due to sudden breakdown of water pipe at low points.
- An air valve consists of a cast iron chamber, float, lever and poppet valve. The chamber may be rectangular in shape. A poppet valve is valve that is lifted bodily.

Air Valve

- The following ratios of air valves to conduit diameter provide common but rough estimates of needed sizes:
  - For release of air only - 1:12
  - For admission as well as lease of air - 1:8
- Air release valves should be installed at all along ascending lengths of pipeline where air is likely to be released from solution due to lowering of the pressure, again especially at points of decrease in gradient, Discharge side of pumps, U/S of orifice plates and reducing tapers
- Air inlet valves should be installed at peaks in pipeline, both relative to the horizontal and relative to the hydraulic gradient.

AIR VALVE



SECTION OF AIR VALVE

Appurtenances: Fittings

- These are special type of elements used for interconnections, facilitate bends in pipeline layout etc.
- These include
  - Flanged Socket
  - Flanged Spigot
  - Collars
  - Double Socket 90°/ 45°/ 22.5°/ 11.25° Bends
  - Double Flanged 90°/ 45°/ 22.5°/ 11.25° Bends
  - All Socket Tees
  - Double Socket Branch Flanged Tees

Appurtenances: Fittings

- These are special type of elements used for interconnections, facilitate bends in pipeline layout etc.

90 Degree all Flanged Bend

Duck Foot Bend

All Socket Tee

Double Socket Branch Flanged Tee

IS codes for Specials

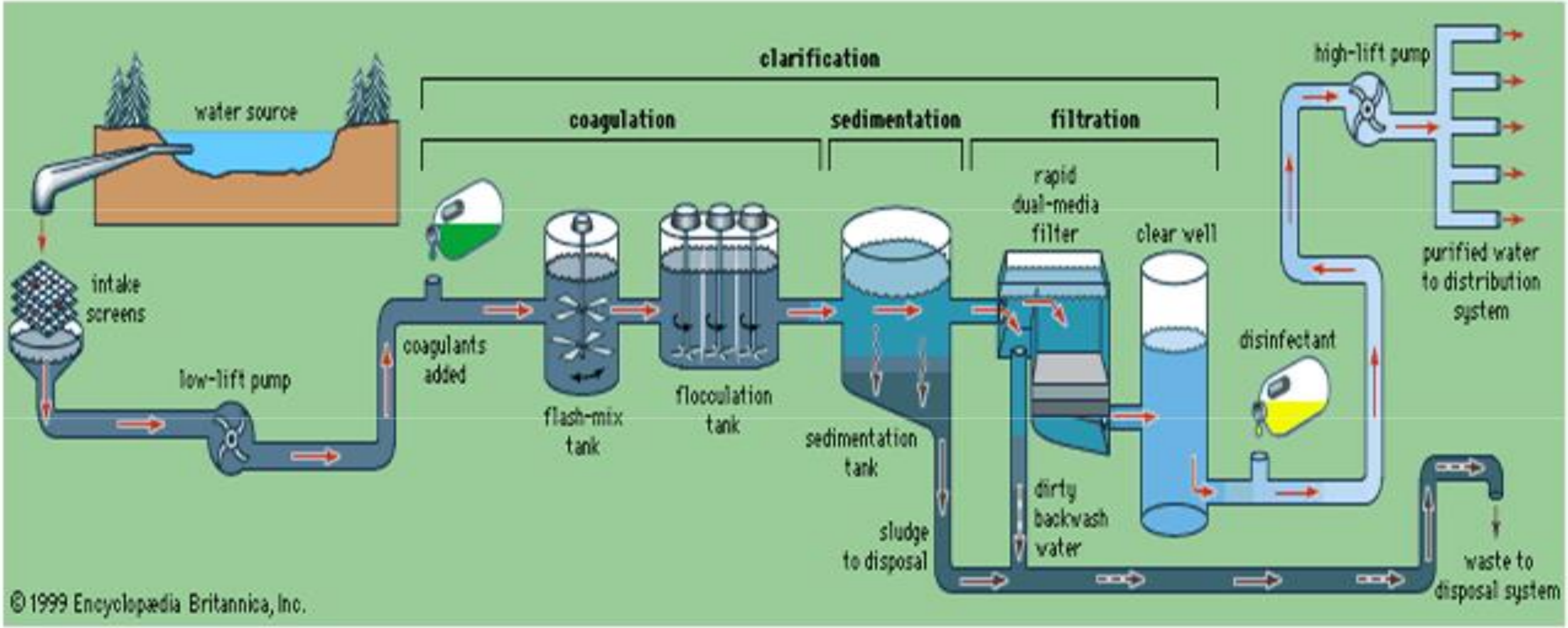
- IS 5531 Suitable to AC Pipes
- IS 7322-1985 Suitable to RCC & PSC Pipes

- IS 1538-1993 Suitable to CI Pipes
- IS 9523-1980 Suitable to DI Pipes

Water Treatment

- Water Treatment is required when the quality of the raw water is below the standards required for potable water.
- The aim of water treatment is to produce water that does not contain harmful chemical substances or micro-organisms in concentrations that cause illness to human beings in any form.
- Treatment may be required to remove floating, suspended and dissolved solids, remove excess colour and kill pathogens.
- The quality of treated water shall conform to BIS 10500: 2012

Flow diagram of water treatment



Aerator

1. Removes Odour and tastes due to volatile gases like Hydrogen Sulphide, algae etc
2. Oxidises Iron and Manganese thereby reducing corrosion
3. Increases oxygen content and reduces carbon dioxide in water

- Types – Gravity aerators (Cascades)

  - Fountain aerators

  - Diffused aerators

  - Mechanical aerators

Sedimentation tank

- Helps in removal of coarse solid particles of size greater than 0.01 mm by gravity settlement
- Types – 1. Intermittent

  2. Continuous
- Rectangular tanks are preferred over circular tanks
- L = 2 to 4 times of B and Depth = 2.5 to 5 m
- Detention period – 3 to 4 hours

Flash mixer – Coagulation and flocculation

- For removal of colloidal particles smaller than 0.01 mm diameter
- Optimum dose of alum is adopted based on ***jar test***
- Conc. of alum in treated water shall not be more than 0.03 ppm

- Mixing of coagulants is either by creation of hydraulic jump (ex. Baffle walls) or by mechanical means (flash mixers)
- Detention period = 30 to 60 seconds

Filtration Plant

- Types – Slow sand filter
  – Rapid sand filter
- Rapid Sand filter – Mostly used
  - Advantageous due to space requirement and sand can be cleaned without removing it from filter
  - More efficient than slow sand filter and highly efficient with turbid and coloured waters
  - Side dimensions are in range 6 to 9 m and depth of 3 m
  - Filter bed depth is 1.2 to 1.3 m
  - Size of sand used is based on D_{10} and D_{60} and $D_{10} <= 0.5$ mm and $\frac{D_{60}}{D_{10}} <= 1.5$

Backwashing – Filtration plant maintenance

- Filter media is cleaned by backwashing with filtered water or with air and water which is forced up through the bed
- Backwashing required when
  - Filter no longer produces water at desired rate
  - Turbidity in filter effluent increases

Disinfection

- To kill harmful pathogens and prevent future contamination
- Methods –
  - Boiling
  - Treatment with excess lime
  - Treatment with ozone
  - Chlorination

- Chlorination is preferred because it stays longer in the water supply system and provides safety against future contamination

Chlorination

- Chlorine dose should be such that break point chlorination is achieved with residual chlorine of minimum 0.2 ppm
- Methods of chlorination–
  - Solid form – Bleaching powder
  - Gaseous form – Addition of chlorine gas

Tests to ensure Residual Chlorine

- The chlorine residual is usually tested at the following points:
- Just after the chlorine has been added to the water to check that the chlorination process is working.
- At the outlet of the consumer nearest to the chlorination point to check that residual chlorine levels are within acceptable levels (between 0.5and 0.2 mg/l).
- At the furthest points in the network where residual chlorine levels are likely to be at there lowest. If chlorine levels are found to be below 0.2 mg/l it might be necessary to add more chlorine at an intermediate point in the network.

Tests to ensure Residual Chlorine

- The most common test is the dpd (diethylparaphenylene diamine) indicator test, using a comparator. This test is the quickest and simplest method for testing chlorine residual.
- With this test, a tablet reagent is added to a sample of water, colouring it red. The strength of colour is measured against standard colours on a chart to determine the chlorine concentration. The stronger the colour, the higher the concentration of chlorine in the water.

Tests to ensure Residual Chlorine

Chlorination checklist

- Chlorine needs at least half an hour contact time with water to disinfect it. The best time to apply it is after any other treatment process, and before storage and use
- Never add any solid form of chlorine directly to a water supply, as it will not mix and dissolve. Always make up as a paste first, mixing the chlorine compound with a little water
- Disinfection is only one defence against disease. Every effort should be made to protect water sources from contamination, and to prevent subsequent contamination during collection and storage
- Water supplies should be monitored regularly to ensure that they are free from bacteria. Otherwise, people may be misled to believe that the water is safe to drink when, in fact, it is hazardous to do so.
- The chlorine dose required to disinfect a supply will increase if the water is very turbid. In such circumstances, it is best to treat the water to reduce turbidity before chlorination.

Service Reservoirs

- Capacity based on daily zonal requirements
- Should absorb hourly variations in demand
- Should maintain constant pressure in the distribution main
- Staging is based on minimum of 12 m residual head availability throughout the zone

- For a zonal population of 10000 and 170 lpcd requirement including household, institutional and storage, the capacity of service reservoir
- $Q = 10000 * \frac{170}{1000} = 1700\ kL$

Distribution System

- To deliver water to consumer with appropriate quantity and pressure
- Requirement of good distribution system
  - Should be able to supply water with sufficient pressure at all intended places
  - Water quality should not get deteriorated
- Design –
  - To be designed in such a way as no consumer is left without water during repair of any section
  - Should be at least 1 m above or away from sewer lines
  - Minimum losses

Types of Distribution Networks

1. Dead end system – Suitable for old towns and cities with no definite pattern of roads
   - Causes stagnation due to dead ends
2. Radial system – Areas are divided into different zones and ELSR is located in middle of each zone
   - Advantage is quick service, quick calculation of pipe sizes
3. Grid iron system – Suitable for cities with rectangular layouts
   - Water is kept in good circulation and can be diverted during repairs
   - Disadvantage is that pipe size calculation is cumbersome
4. Ring system – Supply main is laid along peripheral roads and sub-mains branch out from main supply
   - Water can be supplied from any two directions, pipe size calculation is easy

Methods of distribution

1. Gravity – Suitable when source of supply is at sufficient height
   - Most reliable and economical
   - Water head available at consumer end is just minimum required
2. Pumping – Treated water is directly pumped to distribution main without storing
   - High lift pumps are required causing high operation costs
   - Power failure causes complete stoppage of water supply
3. Combined pumping and gravity – Treated water is pumped and stored in ELSRs and then supplied to consumers by action of gravity
   - Economical, efficient and reliable system

Design of Distribution Network

- Software – EPANet, Water Gems
- Design is based on conservation of flow at nodes and conservation of head along loops

End of Session -3

Thank You

O&M of Water Supply, Water Audit
&
Energy Conservation

Water – Losses

- 15 to 25 % of water supplied is lost in leakages in the system at various stages
- 15 to 20% of water is lost in houses
- India already a water stressed country with per capita availability about 1000 cum/annum
- Do you see opportunities for saving water?
- 80% of diseases are Water Borne & Water Related
- India - IMR – 49/1000 live births
- 12 lakh children under 5 yr. age dying/year - due to WATSAN related diseases!
- $1 Investment in WATSAN – return $3-$34 – WHO

Operation - Maintenance

- **Operation:**
  - Operation deals with the actual running of a system/facility
- **Maintenance**:
  - Deals with the activities that keep the system in proper working condition.

  - Preventive maintenance:

    - Pre-scheduled systematic inspection and consequent actions
    - Minor repair and replacement

  Ex: *Running of a pump set; gland packing for a valve*

  - Breakdown maintenance:

    - Maintenance only in response to breakdowns and/ or public complaints - leading to poor service level; high O&M costs; faster wear & tear of equipment; low user satisfaction.

  Ex: *Damage to pumps during floods; damage to transmission main*

Causes of poor O&M

- Poor condition of facilities
- Lack of information on existing facilities
- Lack of O&M Manual, Guidelines and SOPs
- Lack of knowledge & skills
- No buy-in from political, admn. and O&M staff
- Design does not enable effective O&M
- Only Break down maintenance
- Inadequate fund allocation for O&M
- Lack of delegation of powers
- Inadequate staff, systems, Tools and plant
- Inadequate leadership, management & Motivation
- Lack of O&M Plan and strategy
- Lack of Environmental consciousness

Requisites for Good O&M

- Maps and plans
  - Town map – WS trunk facilities, zones, reservoirs etc.
  - Layout plans – of various components and system
  - Flow diagram, distribution network plan, etc.
  - Location, size, rated & actual capacities; Pressures, flows & levels
- Guidelines, SOPs, history books, log books etc.
- Availability of O&M Plan and Strategy
- Trained, adequate man power: Jr, Sr. & operational staff
- Adequate finances
- Good condition of facilities
- Proper management, leadership, motivation among staff
- Environmental and financial sustainability

Operation & Maintenance Plan – Aim and Objectives

Aim:

- Improved quality of life for the Citizens

Objectives:

- Improved service levels & service delivery to the citizens
- Enhanced recovery due to improved customer satisfaction
- Reduced O&M expenditure to the ULB in a longer time frame

O&M plan - outputs

- Provides necessary data & plans to enable effective O&M
- Advance, prioritized, costed action plan for O&M
- Prepared using consultative processes
- Immediate, short & medium-term actions
- Sector wise O&M allocations in municipal budget
- GIS & utility mapping during preparation – better O&M
- Specific water, energy & cost saving measures
- Service level improvement proposals
- Capacity building plan
- Grievance redressal – monitoring mechanism

O&M Plan - Strategy

- Assess the factors that affect Quality of O&M

- Develop Immediate Action Plan (IAP)
  - Identify easy/no-cost/low-cost actions
  - Water, energy & cost savings
  - Improvement in service levels

- Develop a Short- and Medium-Term plan for O&M that includes:
  - Efforts to overcome constraints
  - Tackle basic deficiencies in O&M

- Coordinated action between Commissioner, Engineer, Council, citizens & NGOs
- Identify Funds needed

Immediate action plan

- Identify visible leaks, tampering, wastages, their causes & replace/rectify *(passive leakage control)*
  - Glands in sluice valves
  - Balls in air valves
  - Pipe and Joint leakages
- Identify invisible leaks through leak detectors later on *(active leak control using leak detection equipment)*
- Carefully review monthly power bills, *identify excess payments & rectify*
  - PF surcharges if PF > 0.90
  - Excess tariff for pumping loads due to non-segregation of L&F loads
  - Excess demand charges for variation of actual demand from CMD
  - Avoid TOD Charges
  - Late payment charges etc.
- Train the staff in simple tests for turbidity, pH, TDS, Colour, DO & RC
- Verify all meters [illegible]ges – ensure they work

Medium- & Long-term Strategy

- Collect information & analyze to develop O&M improvements
- Develop improved O&M procedures
- Deal with physical constraints - old pumps
- Conduct Energy Audit – improve pump & motor efficiency
- Develop human & organizational resources
- Take action to bring about improvements in health & safety – contamination etc.
- Develop performance indicators
- Identify priorities - impact - ease - success
- Treat implementation as a Continuous program - review activities periodically, obtain Municipal budget provision for O&M.

Pre-requisites - successful O&M contract

- Performance indicators - monitoring implementation
- 3rd party quality inspection - of supplies & O&M works
- Reliable Base line data - service levels
- Performance parameters may be:
  - Bulk quantity pumped
  - No. of breakdowns permitted in specified time
  - Time for restoration of pumping / supply
  - No. of additional connections given
  - Customer satisfaction survey base
  - Energy efficiency / conservation
- No. of operators, electricians engaged/ KL of water produced
- Energy consumed per KL of water pumped

Water Safety Plan

- To ensure public health and to ensure that the water meets the required standards
- To ensure safety of water *at every stage* – source, treatment, transmission, storage, distribution and point of use
- Involves
  - Establishing a water safety plan task force
  - Assessment of existing system,
  - Identifying hazards
  - Analyzing existing system & assess risks,
  - Planning control measures,
  - Implementing, monitoring & evaluation,
  - Assessing Impact and further improvements

O&M of the Source/ Summer Storage Tank

- Catchment management - Tree plantation
- Identify Pollution from
  - Domestic & Industrial wastes
  - Drainage
  - Agricultural wastes
  - Faecal matter thro' open defecation
  - Algae, fungi water hyacinth etc.
- Arresting / Diversion of drainage, pollutants
- Treatment of drainage / sewage to standards
- Sedimentation, Pre-chlorination and dosage
- Reduction of evaporation, algae, colour & odour

Intake Well-cum-Pump house

- Diversion of drainage / pollutants
- Proper O&M of
  - pumps, motors, inlet/outlet valves, piping
  - panel boards/switchgear/cabling
  - transformers and sub-stations
  - water body and its surroundings
- Preventive/repair, & breakdown maintenance
- Preparedness to face hazards & minimize risks
- Identify and plug leakages, overflows etc.
- Maintain logbook, schedule for operators, electricians
- Preventive maintenance schedule for pumps and motors

Operation Schedule for Transmission/Distribution

- Mapping & inventory of pipes & fittings in WS system
- Routine operations of WS transmission / distribution system
  - To match flows, pressures, levels & pump operation
- Operations during – breakdowns/emergencies?
- Evaluation of hydraulic parameters
  - System pressures
  - Sluice valves left closed/partly closed/blocked
  - High velocities in small pipelines
  - Low water levels in service reservoirs
  - Failure of pumps due to power/mechanical failure
- Simulation of transmission network
- Sampling for quality of water

Maintenance Schedule for Transmission mains

- System surveillance & Maintenance Schedule thro' O&M teams to detect and rectify:
  - Sanitary condition of pipes, joints, valves, drain/sewer/ culvert crossing
  - Deterioration of transmission/ distribution mains due to age
  - Leaking mains, joints, valves, over flows, tampering, sabotage- Analyze
  - Air entry points thro' joints, leaks, valves, openings
  - Availability of Records – log books, records, alignment plan, LS, history books, location, size & type of valves, spares, T&P
  - Siltation, corrosion and lack of cleaning of pipe lines
  - Install water hammer control devices in transmission mains
  - Direct tappings on transmission mains
  - Evidence of low pressures

- Formulate Preventive & Breakdown maintenance schedules

Chlorine residual testing

- Testing of residual chlorine
- Checking chlorination equipment at the start of transmission system
- Search for source of contamination along the transmission system
- Immediate rectification of source of contamination
- Identify cross connections of water mains with sewers & drains
- Provide horizontal & vertical separation between water mains & sewers and drains
- Check chlorine availability in stores for next 3 months
- Are safety precautions taken and safety equipment for operators available?
- Can you involve the community in this regard?

Analyzing Pump O&M Procedures

Basic requirements	**Regular Operational Tasks**	**Requirements for good operation**
1. Suction not >max NPSH	Check water level regularly	Install level recorder
2. No silt near foot valve	Check silt levels	Remove silt from intake
3. Pumps operate within range	Compare current used with rated current & pressure	1. Information ok 2. Close delivery valve for radial flow pumps before start & stop

Checklist - Electrical controls and wiring

- Are ammeters and voltmeters working with proper Readings?
- Are cables supported at terminals?
- Is **power factor > 0.9?**
- Compare Current used with rated current as per design
- For Radial flow pumps, is the delivery valve closed before starting and stopping?
- Are auto power on-off switches used?
- Condition of switchgear, cabling & ingress of moisture into cabling, switch fuse units
- Condition of Autotransformer / star-delta starters
- Provide suitable Crane/ Gantry for lifting of motors

Motors

- Preferably use high efficiency motors for >75 KW pumps
- Design pump sets to give min. input (KW) efficiency of pumps & motors at a lower frequency of 48.5 HZ
- Use anti-friction bearings
- The temperature rise shall not exceed 65^{o}C.
- Maximize energy savings & costs to pay for facility upgrades
- Consider O&M by PPP mode where necessary for savings
- Use best retrofits & rehabilitation so save energy and water
- Adopt preventive maintenance as per CPHEEO O&M manual
- Impart trainings periodically to maintenance staff.

Adverse Scenarios in pumping

- Energy consumption is higher than optimum value due to reduction in efficiency of pumps
- Operating point of pump is away from best efficiency point.
- Clogging of strainer & encrustation in pipes
- Operation of equipment at low voltage or low PF
- Dissimilar pumps
- Energy audit suggested every year for large installations & once in 3 years for small installations

Preventive Maintenance

- **EVERY 6 MONTHS**
- Check gland packing and replace if necessary
- Check shaft or shaft sleeve for scoring
- Check alignment of pump and motor
- Check holding down bolts for tightness
- Check coupling for wear

- **EVERY YEAR**
- Check rotating element for wear
- Check wear ring clearances
- Clean and re-grease bearings
- Measure total dynamic suction and discharge

- **OVERHAULING**
- After about 5000 Working hours

Water Treatment Plant – O&M

- Aeration as needed
- Record flow, turbidity, pH, color, odor,
- De-sludge if excess sludge is settled in clarifiers
- Check:
  - condition of flocculator paddles, alum dozers and motors
  - water level in the filter, pure water quality
  - condition of filter bed, walls, clariflocculator, wash water tank
  - filter media for clay lumps, cracking of sand, waviness
  - condition of chlorinator; if chlorine cylinder is under shade; and there is no chlorine leakage
  - condition of alum dozers, motors, air blowers, sludge pumps, float, loss of head and rate of flow meters
  - clariflocculator bridge, motors, flocculator paddles,
  - condition of inlet/outlet/overflow/drain valves;
- Clean clariflocculator every 6 months.
- Correlate back washing of filter with head-loss meter
- Schedule for operators; Maintain log book

Clear Water Reservoir/Sump

- Structural soundness, leakages if any
- Foot valve
- Post-chlorination
- Proper air management
- Monitor levels and prevent overflows
- Siltation and algal growth if any

Clear Water Pump house

- Condition of pumps and motors,
- Leakages, corrosion of base plate,
- Alignment of piping, condition of valves
- Condition of foot valves, priming pumps
- Condition of cabling, panel board/switchgear, capacitor bank
- Transformer and sub-stations
- Schedule for operators, electricians etc.
- Preventive maintenance schedule for pumps and motors
- Schedule of cleaning of CWR

Distribution Reservoirs

- Structural soundness of SR, staircase etc.
- Leakages, overflows if any
- Condition of valves, chambers etc.
- Proper air management
- Condition of piping etc.
- Condition of phenial, water level indicator, lightning arrestor etc.
- Schedule of cleaning, whether being followed
- Schedule of operation of SR & duties
- Booster chlorination if any, its mode & dosage

Distribution mains – Points to look

- Any evidence of low pressures like pit taps?
- Locations of valves, leakages, covers?
- Glands of leaking valves, and balls in air valves replaced?
- Are motors fixed to HSCs on distribution mains?
- Are pressure zones separate? Are there cross-connections?
- Valve operation schedule while switching between zones
- Are there bulk meters & pressure gauges at zonal ELSRs
  - To measure flows & usage
  - To detect leaks
  - To manage network
- Is Residual Cl_2 regularly monitored?
- Are there repair procedures in place for standard services?
- How do you measure the water supplied and analyze the system?

Recording and monitoring problems

- History book on each transmission & distribution mains
- Record problems by placing maps of WS system on walls
- Record Information on the maps using coloured pins.
  - Red pin – Complaint about quality of water
  - Green pin – Complaint about availability of water
  - Yellow pin – Reported pipe leak
  - Black pin – Inadequate residual chlorine

- Transfer data from complaints cell & results of routine monitoring - to the maps, using the coloured pins.

Leak detection - techniques

- Reporting visible leaks on priority
- Detecting invisible leaks using leak detection equipment
- Conventional leak detection techniques are based on analysis of night flows.
- But this approach is impossible unless continuous supply is there.
- Investment for leak detection is around Rs. 15,000 to 35,000 per km

Types of leakage in distribution mains

When considering response to a problem, ask the following questions:

- *Is leakage from joints a general problem?* - Consider replacing mains due to poor workmanship usually for RCC/uPVC main
- *Is leakage occurring where house connections join the main?* Consider repair/new tapping for the connection. If leakage cannot be prevented, it is better to replace the main.
- *Is leakage occurring from the HSCs themselves?* Replace GI pipes with MDPE pipes for HSCs.
- *Is leakage occurring at discrete points along the main?* Repair/replace defective joints/fittings/length off main.
- *Is leakage occurring due to abrupt change in direction at a joint?* If possible, relay on a better alignment. Or provide concrete/ RCC thrust blocks where necessary.

Probable areas/causes for leakage

- Nature of pipes and joints
- Corrosion
- Mains laid under heavy traffic roads
- Inadequate/damaged air valves on transmission mains
- At frequent leaks & low pressure
- Consistent low levels of residual chlorine – contamination thro' leakage/ drawl thro' motors etc.
- No Hydrostatic Testing of pipeline before commissioning

WATER AUDIT & UFW - NRW

- UFW = (System demand – Billed Consumption)/ System demand x 100

- NRW= System Input Volume – Billed Authorized Consumption = Unbilled Authorized Consumption + Apparent loss + Real Losses.

Unbilled Authorized consumption = Unbilled Metered Consumption + Unbilled Unmetered Consumption.

Apparent Losses = Unauthorized Consumption + Metering Inaccuracies

Real Losses = Leakage in Transmission & Distribution Mains + Leakage and Overflows in Utility's Storage tanks

Service Level Benchmarks – Performance Indicators

- Benchmarks and Performance Indicators help O&M improvement
- They must be measurable; Objectively Verifiable (OVIs)
- Indicators at the city scale on
  - Overall Expenditure
  - Amount of water actually produced
  - Amount of water actually reaching the reservoirs

INDICATORS AND GOALS

Water	Benchmark
Coverage of water supply connections	100%
Per capita supply of water	135 lpcd
Extent of metering of water connections	100%
Extent of Non-Revenue Water (NRW)	20%
Continuity of water supply	24 hours
Efficiency in redressal of customer complaints	80%
Quality of water supplied	100%
Cost recovery in water supply services	100%
Efficiency in collection of water supply related charges	90%
No. of people receiving less than 70 lpcd of water	0%

Water Meters

- Types –
  1. Mechanical
  2. Electro-magnetic
  3. Ultrasonic

- Water meters are necessary to quantify NRW

- Public opposition


9 12:20PM


PHYSICAL WING
Water Testing Laboratory

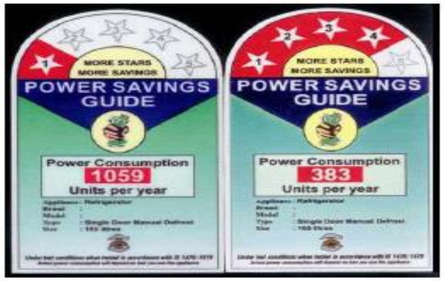
Energy Audit

- To explore various possibilities for energy conservation
- Aims at reducing amount of energy input into system without negatively affecting output
- Steps –
  1. Collect and analyse historical energy usage
  2. Study pumping systems and their operational characteristics
  3. Identify potential modifications that will reduce energy usage
  4. Preparation of rank-ordered list with appropriate modifications

- Main energy consuming unit in water systems is Pumps
- Power factor should be > 0.9

Energy Conservation - stages

- **Planning Stage –** Consider Environmental angle
- **Design stage**
  - Energy efficient appliances -BEE star rated products – motors – transformers
  - Renewable / Green energy consuming appliances
  - Energy efficient motors
- **Procurement stage**
  - Proper specifications and contract conditions for QA & QC
  - O&M commitment from supplier
- **During Implementation - Quality Control**



Energy-Efficient Motors

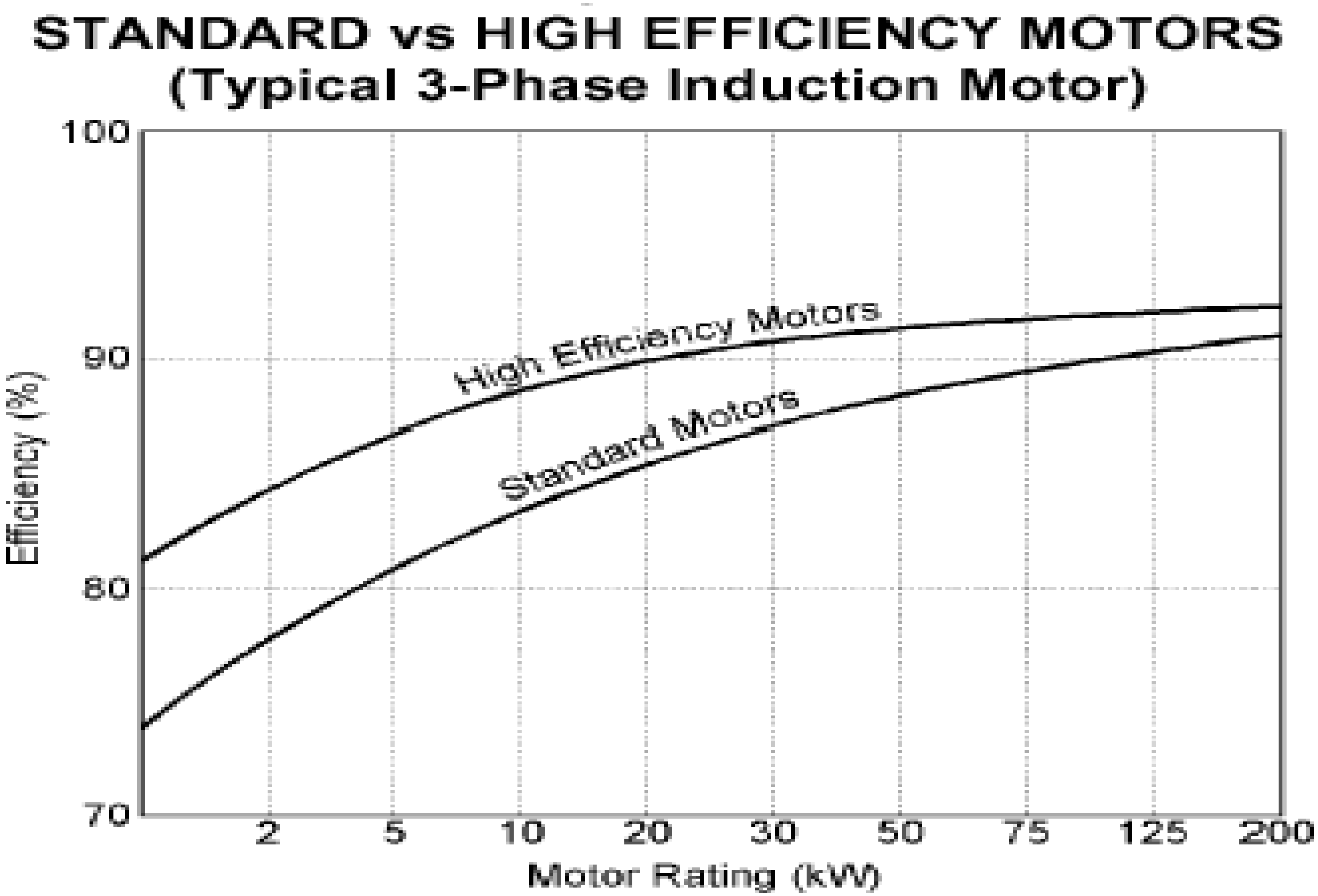


Figure 2.3 Standard vs High Efficiency Motors

Improvement of energy efficiency

- Surrendering of excess contract demand
- Improvement of power factor
- Separation of HT and LT load
- Leak detection and repair
- Replacement of low efficiency pumps and use of suitable pumps
- Metering and monitoring
- Use of automated systems - SCADA

Supervisory Control and Data Acquisition (SCADA)

- Supervisory Control and Data Acquisition
- Aims at providing wireless digital flow metering for water and power auditing and water quality monitoring
- utilised to know round the clock status of water supply through internet and mobile app.
- Can be utilised to know level and volume of water in Sumps, Service reservoirs in an ULB
- To remotely check the quality of water
- the status of pumping system, quality and availability of power can be known remotely
- To manage equitable distribution of water to all.
- Prevents water wastage by controlling overflows of service level reservoirs automatically

Components of SCADA

- Electromagnetic flow meter – to measure flow
- Level transmitter – to monitor water level in reservoirs
- Pressure transmitters – to monitor head at various critical points
- Chlorine analyser – to measure chlorine content in water
- Chlorine booster – when chlorine concentration falls below required
- Turbidity analyser – to measure turbidity of water
- pH analyser – to check pH of water
- Electronic valve actuators – to control automated opening and closing of valves
- PLC – Programmable Logic Controller
- GPRS Modem – for relaying data from PLC to Command Centre
- Command Control Centre – for monitoring data and performance of system
- Remote Terminal units
- Web/ Mobile application

Communication process in SCADA

- Electronic signals from measuring devices such as level transmitter/ chlorine analyser are transmitted to PLC.
- From PLC the signals are transmitted to Command Control Centre via GPRS network.
- At Command Control Centre the data/ information received from the PLC is logged.
- The logged data is analysed by the manned personnel at CCC in real-time basis and specific instructions can be relayed back to the measuring devices. e.g. releasing of chlorine from chlorine booster, closing/opening of valves by usage of electronic valve actuators
- Alternatively some of the measuring devices can be automatized in such a way that if water level rises/ falls below certain mark, valves can be made automatically actuated or if chlorine content fall below permissible level, chlorine booster can be activated without any manual presence or interference from human beings

Advantages of SCADA

- UAFW/ NRW can be estimated accurately
- Entire Water supply system can be automated thereby reducing loses
- Man power can be reduced
- Data can be logged continuously without any failure, which can be used for water audit and future planning

End of Session – 1

Thank You

Public Health and Municipal Engineering Department

Training to Ward Amenities Secretaries

Water Supply

HSCs, Billing, Consumer Grievances & Redressal

House Service Connections

- It is the final part of water distribution system
- Components of HSC
  - Ferrule
  - Goose Neck
  - Service Pipe
  - Stop Cock
  - Water Meter

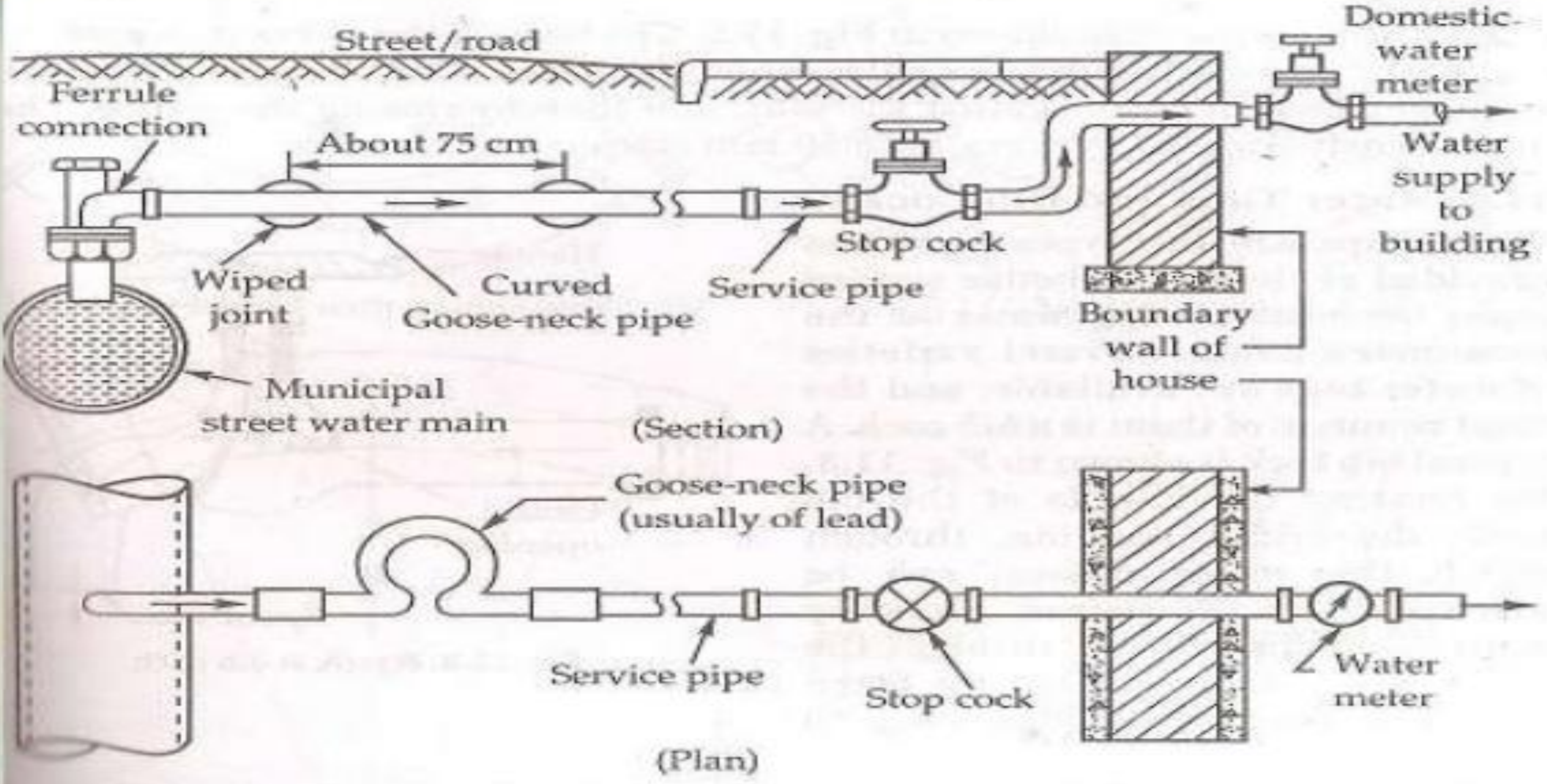
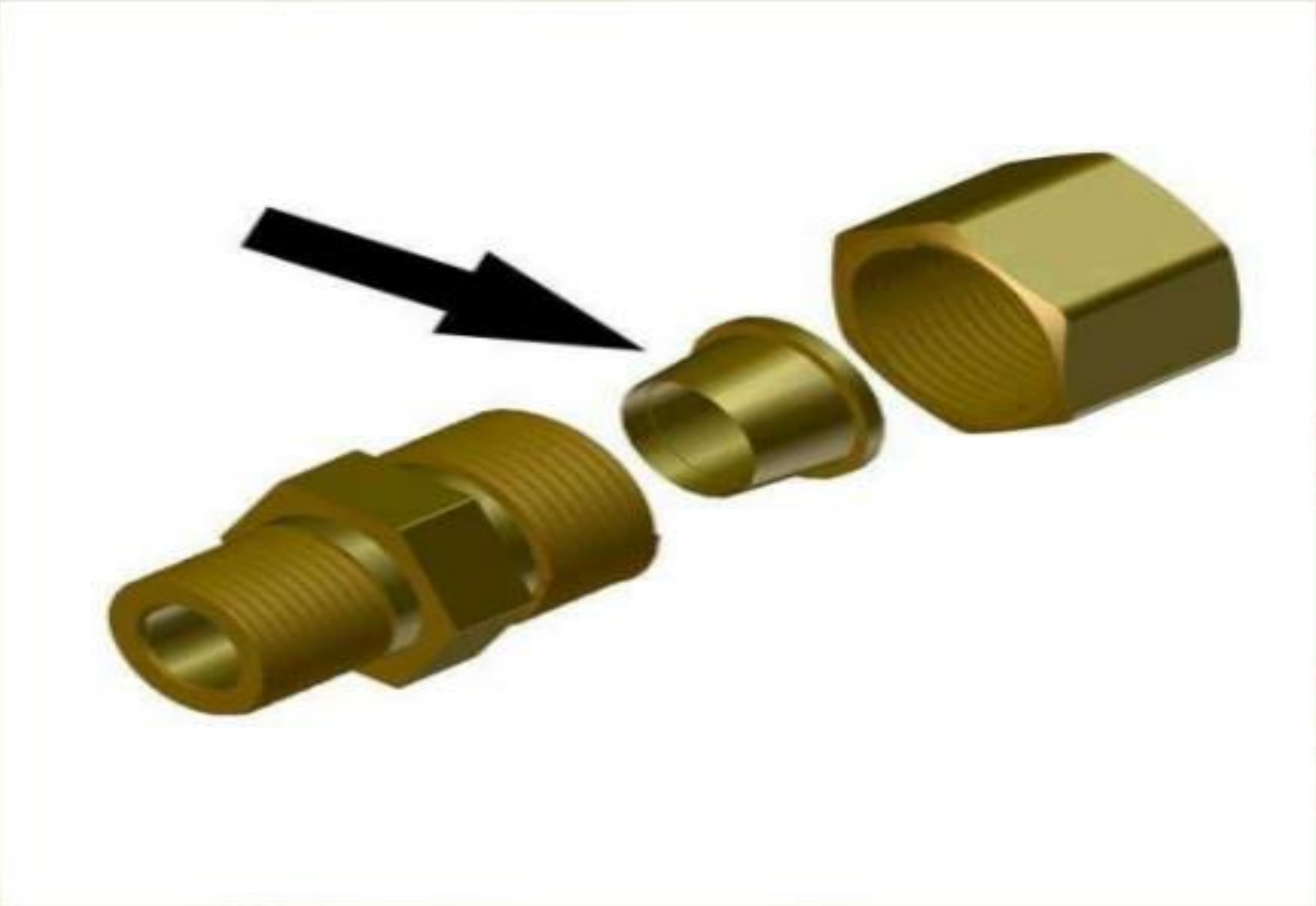


Fig. 11.1. The Water Connection.

ferrule

- Right angled sleeve made of brass and gun metal
- Size: 10 to 50 mm dia



Goose neck

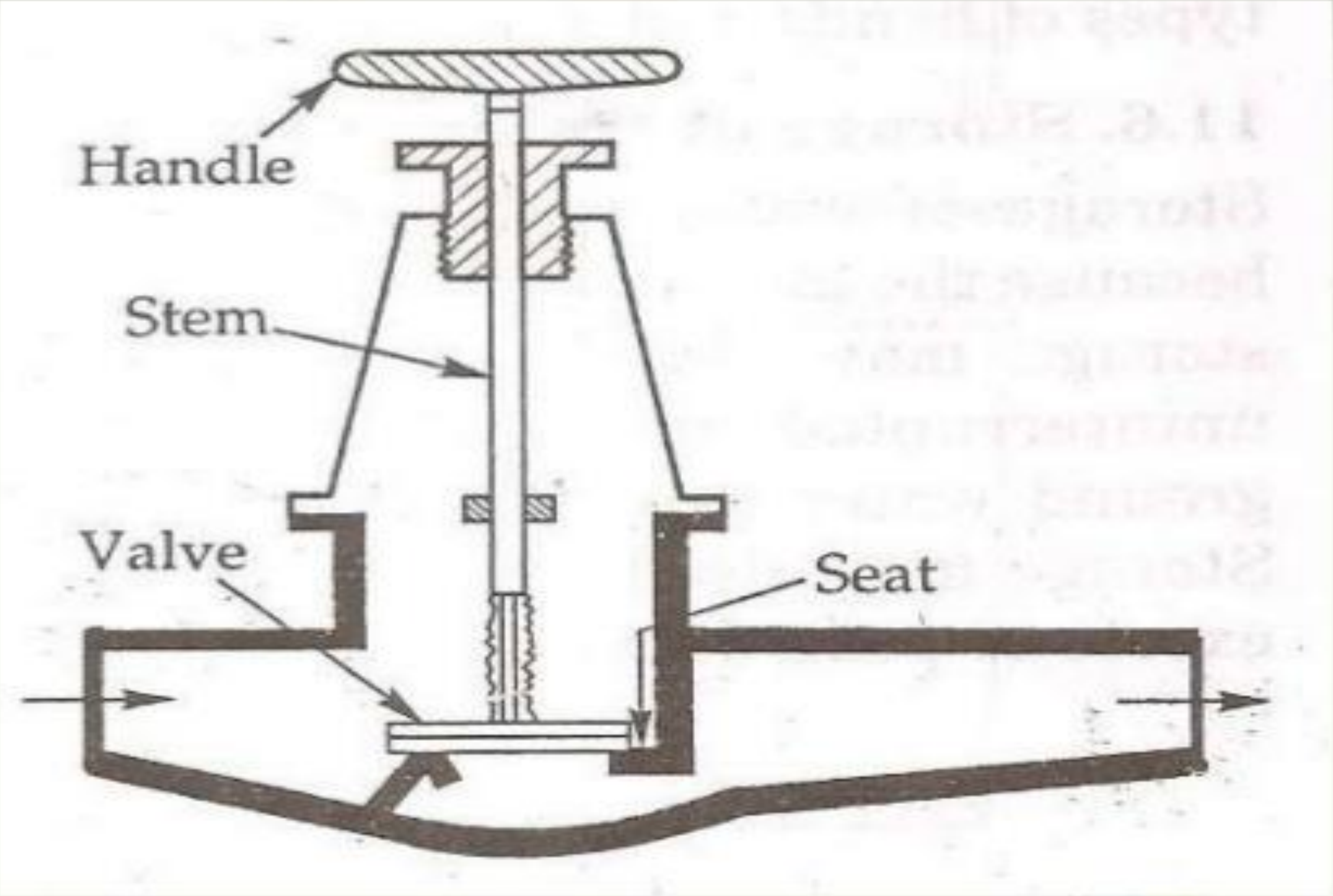
- Small curved pipe made of flexible material
- Length : about 75mm
- Forms flexible connection between the water main and the service pipe

Service pipe

- Galvanized iron pipe of size less than 50mm dia
- Laid underground
- Connected to main through ferrule and goose neck

Stop cock

- Screw down type valve used for stopping and opening water supply
- Generally provided before the water enters the water meter
- Also provided inside the building


Handle
Stem
Valve
Seat


Water meter

- Measures and records the quantity of water consumed
- Generally fixed in an iron box fitted in an opening or cavity and covered with movable iron cover
- 2 types : Velocity meters

  Positive meters


CUBIC FEET
5/8"
Master
Meter
1-800-765-6518

diaphragm

- A flexible, pressure responsive element that transmits force to open close or control a valve
- Repairs can be made without interrupting pipe line

Diaphragm valve

Issues regarding HSCs

- HSCs can be a major cause of pollution, if old HSCs/ ferrules are left over after giving a new one
- If water is drawn through HSCs by means of Pumps, negative pressures will build up in the pipelines which is not desirable.
- Proper care against pollution should be taken in the areas having UGD Network and HSCs are crossing SWD
- Combined Valves for Municipal HSC and Borewell can lead to pollution in the distribution network.

Noteworthy points regarding HSCs

- HSCs shall always be fitted on upper side of the Distribution Pipeline
- Consumers shall not be allowed to draw water through HSCs by means of Pumps. Penalty must be imposed.
- Old ferrules shall not be leftover after giving a new HSC connection
- Old defective HSCs shall be identified and removed as soon as possible.
- Whenever Tap Connection/ HSCs are shifted, the old one's shall be properly made dummy to prevent possible future contamination.
- Combined Valves for Municipal HSC and Borewell shall not be allowed.

Water Supply Grievances and Redressal

- Citizens can submit grievances through any of following –
  1. Through Spandana Program
  2. Through C&DMA website
  3. Complaint submitted directly to Ward Secretariat
- Redressal-
  - Officer responsible to render services – Assistant Engineer
  - Water Supply Leakages – 1 Day
  - Water Supply Connection – 15 Days

Water Supply – HSCs Tariff, Bye-laws

House Service Connections - Types

- Based on Usage
  - Domestic HSCs
  - Commercial SCs
  - Bulk Industrial Connections
- Size of HSCs
  - 15mm
  - 20mm
  - 25mm
  - 40mm

◦ In areas and situations where HSCs cannot be provided by Municipalities, public stand posts are provided free of cost and water tax is collected along with property tax

House Service Connections - Billing

- Necessity – It is ideal that the income from Water should cover O & M expenditure
- At present, water charges are collected under following categories –
    1. Residential – Unmetered
    2. Commercial – Through metered connections
    3. Bulk supply to industrial units – Metered connections
- In addition to water charges the municipality also collects pipeline service charges to defray capital cost of pipeline service works (donation charges)
- Present water charges in municipal corporations –
    1. Residential – 60 to 125 rupees per tap per month
    2. Commercial connections – Rs. 10 to 50 per kL
    3. Donation charges – Rs. 2000 to 10000 in Municipalities

       - Rs. 6000 in Municipal corporations
- In addition to above, Municipalities also collect road cutting charges, supervision charges, advanced water charges before sanction of water supply connections

HSCs – Bye-laws

- As per existing procedure for fixation of revision of water charges the Municipal Council has to take provisional division and issue a draft notification calling for objections/ suggestions duly fixing a specified date
- After the stipulated time, the water supply bye-laws taking suggestions/ objections into considerations are to be submitted to ENC[PH] for approval, who is the competent authority to approve the water supply bye-laws.
- The following items are considered as income from water supply –
  - Water Charges
  - Donation charges

- The Govt. vide GO Ms 159 MA&UD (UBS) Dept. Dt: 17-05-2018 has issued orders on fixation of user charges for water supply in ULBs
- As per above GO, water supply is broadly categorized into four categories –

1. Domestic category
   1. Domestic household
   2. Bulk Domestic (Apartments)
2. Commercial
3. Industrial

HSCs – Bye-laws

- In the above G.O., the Govt. have issued orders to take water supplied to industrial category as criteria for fixation of water charges.

Steps for fixation of water charges:

Step-1

- Water consumed by Bulk Domestic, Commercial and Industrial categories shall be worked out.
- Water consumed by domestic household category is then calculated by deducting the water consumed other three categories from total water supplied.

HSCs – Bye-laws

- Step-2
  - Total O&M cost incurred for water supply per annum has to be worked out. Then, the O&M cots be apportioned among the four categories of water users based on the percentage water consumed arrived as per Step-1
- Step-3
  - The revenue realised from water charges including water consumption charges, donations etc. also need to be worked category wise as is done in the case of O&M cost
- Step-4
  - The next sept is to find out the percentage of O&M cost realized with reference to the revenue from various categories from Step-2
- Step-5
  - The first exercise in fixation of rate is to meet 100 % of O&M cost (Self-sufficiency rate) for each category of water consumption
- Step-6
  - Differential rates to individual and institutional assessments and to safeguard the interests of vulnerable sections

Category	Rate
Domestic – Buildings with property tax upto Rs. 250 per month	50% of self-sufficiency rate per tap per month
Domestic – Buildings with property tax more than Rs. 250 per month	100% of self-sufficiency rate per tap per month
Bulk domestic	150% of self-sufficiency rate per 1 kL
Commercial	200% of self-sufficiency rate per 1 kL
Industrial	150 % of self-sufficiency rate per 1 kL

Guidelines on ease of getting water tap connection in ULBs

- BPL households - The House Hold having White Ration Card may be considered as BPL House Hold for sanction of Water Tap connection, irrespective of whether he/she is paying Property Tax of Rs.500/- or less per year
  - For BPL households, HSCs shall be granted on payment of Rs. 2001/- per connection
- Non-BPL households –
  - HSCs shall be sanctioned by collecting connection charges, pipeline charges, road cutting charges, other charges as per water supply bye-laws in eight equal half-yearly instalments along with property tax

Regularization of unauthorized water tap connections

a) By collecting an amount equivalent to 50% of water connection charges (donation) as penalty in addition to normal water connection charges applicable to the Municipality.

(b) By collecting the usual water charges for a period of 12 months prior to the date of regularization

(c) Suitable awareness campaigns shall be conducted about regularization of unauthorized water tap connections

(d) A suitable register shall be maintained regarding regularization of unauthorized water tap connections.

(e) Payment of arrears of property tax shall not be insisted as a condition for sanction of water tap connection or regularization of unauthorized water tap connection.

End of Session -3

Thank You

Water Pollution – Causes, Effects & Rectification Measures

- As per the eleventh five year plan document of India (2007-12), there are about 2.17 lakh quality affected habitations in the country with more than half affected with excess iron, followed by fluoride, salinity, nitrate and arsenic in that order.
- Further, approximately, 10 million cases of diarrhoea, more than 7.2 lakh typhoid cases and 1.5 lakh viral hepatitis cases occur every year a majority of which are contributed by unclean water supply and poor sanitation.
- Top-most priority shall be given for addressing water quality problems in all quality affected habitations with emphasis on community participation and awareness campaigns.
- It is mandatory to conduct timely water quality surveillance and monitoring by setting up of water quality testing laboratories strengthened with qualified manpower, equipment and chemicals.

Causes of Water Pollution

- Water Pollution can occur either in Raw Water or in Distribution Network
- Raw Water
  - Discharging of Industrial Effluents nearby source
  - Presence of metals & harmful chemicals in source water. Ex: Lead, Manganese, Iron, Fluoride, Arsenic etc.
  - Biological contamination due to open defecation, leachate from dump yards, disposal of animal carcasses near sources
  - Excessive use of Pesticides and Insecticides, which find their way through run-off
- Treated Water in Distribution Network
  - Water Contamination can occur due to leakages in pipelines accountable to old/ rusted pipes
  - Presence of defective joints/ improper maintenance of HSCs
  - Seepage of sullage/ septage due to presence of leaks or build up of negative pressures in the distribution system
  - Possibility of contamination increases in areas having UGD network

Health Hazards posed by contaminated water

- Biological contamination causes Explosive Diarrhoea, Dysentery, Cholera, Polio and may even lead to death
- Lead poisoning causes anaemia
- Fluoride causes Fluorosis
- Arsenic causes Encephalopathy, Diarrhoea, Heart diseases and may even lead to cancer

Rectification – Preventive Measures

- **BIS 10500: 2012** specifies the acceptable limits and the permissible limits in the absence of alternate source.
- It is recommended that the acceptable limit is to be implemented as values in excess of those mentioned under **Acceptable** render the water not suitable. Such a value may, however, be tolerated in the absence of an alternative source.
- However, if the value exceeds the limits indicated under **permissible limit in the absence of alternate source**, the sources will have to be rejected.

Table 1 Organoleptic and Physical Parameters
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, *Max*	5	15	Part 4	Extended to 15 only, if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	*p*H value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU, *Max*	1	5	Part 10	—
vi)	Total dissolved solids, mg/l, *Max*	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts

(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, *Max*	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, *Max*	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, *Max*	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, *Max*	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, *Max*	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, *Max*	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl_2), mg/l, *Max*	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, *Max*	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, *Max*	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, *Max*	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, *Min*	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l

xii)	Iron (as Fe), mg/l, *Max*	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, *Max*	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, *Max*	0.1	0.3	IS 3025 (Part 59)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, *Max*	0.5	No relaxation	Clause **6** of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO_3), mg/l, *Max*	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C_6H_5OH), mg/l, *Max*	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, *Max*	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO_4) mg/l, *Max*	200	400	IS 3025 (Part 24)	May be extended to 400 provided that Magnesium does not exceed 30
xxi)	Sulphide (as H_2S), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 29)	—

xxii)	Total alkalinity as calcium carbonate, mg/l, *Max*	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as $CaCO_3$), mg/l, *Max*	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, *Max*	5	15	IS 3025 (Part 49)	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 3 Parameters Concerning Toxic Substances
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, *Max*	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, *Max*	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, *Max*	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, *Max*	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, *Max*	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, *Max*	0.000 5	No relaxation	ASTM 5175*	— or APHA 6630
ix)	Polynuclear aromatic hydro-carbons (as PAH), mg/l, *Max*	0.000 1	No relaxation	APHA 6440	—
x)	Total arsenic (as As), mg/l, *Max*	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 52)	—

xii) Trihalomethanes:				
a) Bromoform, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
b) Dibromochloromethane, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
c) Bromodichloromethane, mg/l, *Max*	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
d) Chloroform, mg/l, *Max*	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 6 Bacteriological Quality of Drinking Water[1]

(*Clause* 4.1.1)

Sl No. (1)	Organisms (2)	Requirements (3)
i)	*All water intended for drinking*:	
	a) *E. coli* or thermotolerant coliform bacteria[2), 3)]	Shall not be detectable in any 100 ml sample
ii)	*Treated water entering the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria[2)]	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample
iii)	*Treated water in the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample

1) Immediate investigative action shall be taken if either *E.coli* or total coliform bacteria are detected. The minimum action in the case of total coliform bacteria is repeat sampling; if these bacteria are detected in the repeat sample, the cause shall be determined by immediate further investigation.

2) Although, *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests shall be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies, particularly in tropical areas where many bacteria of no sanitary significance occur in almost all untreated supplies.

3) It is recognized that, in the great majority of rural water supplies in developing countries, faecal contamination is widespread. Under these conditions, the national surveillance agency should set medium-term targets for progressive improvement of water supplies.

;

Collection of Water Samples for testing – IS 3025: Part-I

- In the case of samples for the determination of physico-chemical parameters one simple precaution is to fill the flasks completely and stopper them in such a way that there is no air above the sample.
- Use of opaque containers or brown (non-actinic) glass containers to reduce the photosensitive activities to a considerable extent
- Clean new containers thoroughly in order to minimize possible contamination of the sample
- For samples for determination of pesticides, herbicides and their residues —Clean the containers with water and detergent, followed by thorough rinsing with distilled water, then oven dry and cool before rinsing with hexane or petroleum ether. Finally dry with a stream of carefully purified air or nitrogen.
- For samples for microbiological analysis — The containers shall withstand a 100^{o}C sterilization and shall not produce or release at this temperature any chemicals which would either inhibit biological activity, induce mortality or encourage growth.

Collection of Water Samples for testing

- Sample Volume: A two-litre sample is normally sufficient for most physical and chemical analysis. However, the quantity may be varied depending upon the type of analysis, methods used etc.
- Types of Samples:
  - Spot Samples
  - Periodic Samples at fixed time intervals
  - Periodic samples taken at fixed flow intervals
  - Continuous samples taken at fixed flow rates
  - Continuous samples taken at variable flow rates
  - Composite Samples

Sample Locations

- *Rivers, streams and canals* - Samples should be collected. as far as possible, from midstream at mid depths.
- *Ground water* - Whenever possible, sample should be collected after pumping the well or bore hole for a period of at least an hour or two. This ensures drawal of new water from aquifer. Depth below ground level or reference level at which the sample is taken, should be recorded.
- *Drinking water supply* - The sampling point should be located at a place where all reactions of the disinfecting agent are completed and also some residual disinfectant is present. The usual sampling position is a tap on a pipe connected directly to the pumping main, as close as possible to the reservoir. Many service reservoirs fill and empty through the same main. Sampling should be made when reservoir is being emptied.

WATER SUPPLY – PREPARATION OF ESTIMATES

Procedures for Preparation of Detailed Project Reports for Infrastructure Development in Urban Local Bodies – Awareness

Prime responsibility of any Urban Local Body

- To provide better living standards
- To improve service delivery to the Citizens

Basic needs:

- Water Supply,
- Roads,
- Storm Water Drains
- Under Ground Drainage,
- Solid Waste Management,
- Street Lighting
- Social Infrastructure (Community Halls, Parks, Shopping Complexes, Sports Stadia etc,.)

Identification of Needs:

- Prioritized requirements of residents
- Affordability of Financial status for seeking Financial assistance

Certain Procedures to be followed for preparation of DPR

- Identify the prioritized sector duly taking the suggestions of the all Stakeholders.

- Entrust the work of preparation of DPR to a reputed Consultant duly following the tendering procedures for entrustmen

- The DPR shall be prepared for a projected population of 30 years as per the guidelines stipulated in the respective manuals of Central Public Health Environmental & Engineering Organization, New Delhi (CPHEEO).

- The DPR shall be prepared with number of alternatives, duly checking the pros and cons of each alternative, and finalize the alternative.

- The DPR shall contain the financial viability of the ULB and Internal Rate of Return, to get approval of the Project by any funding agency.

- The DPR should speak about the requirements of Land for construction of Infrastructural Components of the Project. The details of land particulars such as extent of area, ownership of the land, usage of the land etc,.

- The PH engineering authorities will be involved in the preparation of proposals.

DPR approval process

- The DPRs prepared by the ULBs shall be submitted to the Funding Agency through State Level Nodal Agency (SLNA) for getting approval with the accepted funding pattern.
- The DPRs need to be technically appraised by the ULB to the Appraisal Agency, for sanction.
- The ULBs need to enter Memorandum of Agreement (MoA) with the SLNA for implementation of all mandatory and at least two optional reforms in each year to access central assistance.

Implementation of Projects

- After sanction of the Project by the Funding Agency, the State Government will accord Administrative Sanction with all provisions made in the estimate/DPR.
- The Competent Technical Authority will give Technical sanction for the Project
- The ULB/ PH dept will float tenders as per the GOs, in force and issue LoAs to the Executing Agencies.
- The Executing Agency will conclude the Agreement, with the competent authority.
- The SLNA/ULB will employ the Third-Party Quality Assurance Consultants to monitor the quality of work under implementation.
- Based on the reports furnished by the TPQA/ Departmental Quality Wing, the APUFIDC Ltd, Hyderabad will release funds to the extent of work done.

Points to be considered while preparing DPR

- Reviewing the existing situation, and undertaking necessary assessments
- Feasibility Analysis and detailed planning
- Capacity Enhancement and Sustainability

Reviewing existing situation

- The proposals shall conform to the guidelines issued by the GOI and GOAP including CPHEEO manual on water supply and treatment, CPHEEO manual on O&M. and as per check list.
- Planning shall be done for the horizon of at least next 30 years (aiming at year 2043), unless justified otherwise. Rehabilitation measures on the existing system shall also be given due consideration based on feasibility before proposing any new investments.
- The designs shall be in compliance with the relevant Indian Standards (as amended up to date, with all correction slips) and CPHEEO manual. Wherever such standards are not available, appropriate standards shall be followed after discussions with the ULB
- All documentation for obtaining permissions from the Pollution Control Board (PCB), CPHEEO etc. wherever required shall be prepared and necessary assistance will be provided by the client. The ULB will obtain the permissions.

Feasibility analysis and detailed planning

- To collect data on ULBs service area, economic growth, urban growth, physical and hydro-geological parameters, population growth and factors influencing
- Calculate demands and availability of water, water resources, source sustainability, conditions on water drawls, alternate vendors/sources used by the beneficiaries
- Validate Infrastructure to serve the demands, along with key system components to maintain it efficiently
- Keep in mind the status of existing assets and their rehabilitation needs
- Asses whether typical system management components such as bulk flow meters, pressure regulating valves, transmission mains without illegal connection of distribution lines, energy efficient usage tools/equipment, domestic meters etc. are available and functioning

Water Audit and Estimation of Non-Revenue water

- The Water Audit exercise , shall inform the overall production of water (not to be based on just rated capacity of pumps), flows in different parts of water service area to determine areas of high/low consumption, losses – both physical and revenue.
- An analysis of this information along with the system status shall inform possible areas of high physical/revenue losses and priority areas of intervention and possible demand management options.

Aspects of analysis

- *Service Levels*: Establish the present and Desired Service levels in a consultative manner, backed up by costs and impacts.
- *Population*: Population projections based on appropriate projection technique based on the growth status of the municipality and economic factors;
- *Development Factors*: Municipal development plans and developmental factors influencing water demands and their impact on the infrastructure planning;
- *Water Demands*: Demands based on sample analysis carried out in the Information collection exercise, and based on population growth and municipal development;
- *Water Resources*: Water Resource availability, quality and sustainability to serve the demands for the horizon year. For Source improvement,
  - Study the properties of the existing sources with regard to catchment's, hydrological details etc.
  - Identify new potential sources (if required) for water in co-ordination with various departments to cater for ultimate demand.
  - Evaluate the method of treatment required.
  - *Infrastructure planning* that is technically feasible, meets the growth needs of the municipal development, integrates into city development plan, economically effective and has least environmental and social impacts.

Points to consider while planning

- Reorganize the existing network to suit efficient O&M practices,
- promote optimal/effective utilization of the existing infrastructure (e.g., reservoir capacities, trunk mains, water sources etc).
- Provide for adequate flow and pressure control/regulation utilities, flow measurement devices.
- Replace / Upgrade the consumer connections with appropriate material (e.g., MDPE) (as these are the most vulnerable portions of the system where the physical losses are more); and provide for consumer meters – replacing the non-functional meters (since there should be provision for measuring the supplies and raising revenues). The cost will be borne by the ULB initially as part of the project and will be recovered from the consumers later.
- consider technological advancements, including new pipe / construction materials, variable speed drive pumps for energy efficiency, improved methods of water treatment with better clarifiers, plate and tube settlers, dual media and declining rate and high rate filters, new chemicals and poly –electrolytes, alternative methods of disinfection etc.
- Integrate the services to the poor with the trunk infrastructure; review free supplies through stand-posts and plan for managing them;
- Ensure a minimum residual pressure of 7m
- Consider feasibility of 24/7 supplies, if not, plan for maximum possible supply hours with necessary peak factor. Justify the reasons for non-achievability of 24/7 currently and indicate a plan of action with cost implications.

Preparation of estimates

- Prepare detailed items and quantity schedules and cost estimates based on the market rates.
- Prepare detailed cost estimates item wise (AP PWD / PHED Schedule of Rates), with necessary road restoration charges wherever needed.
- Follow the AP Standard Data for costing and yearly SoR. Take into consideration the monthly cement and steel rates published on www.appublichealth.gov.in
- For items not covered under schedule of rates, market rates are to be assessed. However this should be the last resort.
- There should not be any lump sum items in the bill of quantities.
- Provide unit costs of various infrastructure components based on the estimated costs.

12. Roads & Buildings Construction, Culverts, Bridges, Borewells

13. Providing Street Lighting

Public Health & Municipal Engineering Department

Contents

Street Lighting

Objectives of street lighting

The objectives of street lighting are to,

- Ensure that fast traffic moves safely
- facilitate pedestrian movements;
- ensure that pedestrians and vehicle drivers recognize obstacles; and
- enhance security
- The first is only important for through routes. In residential areas, where traffic moves slowly, it will not be an important concern.

Definitions and descriptions

The lamp is the source of light, which converts electrical energy into radiation. The main types of lamp in use are:

- Tungsten lamps (designated GLS), in which a small wire contained in a glass bulb is heated to a high temperature in a vacuum.
- Fluorescent lamps (designated MCF and TL) in which ultra-violet radiation causes phosphor powder to glow inside a tube.
- Discharge lamps, in which an electric current is passed through a mixture of gases in a sealed tube. Examples are low-pressure sodium, high pressure sodium and high pressure mercury (designates SOX, SON and MBF or HPL-N respectively).
- The lantern refers to the complete street lighting fixture, including the lamp and the pole or other means of raising it above the street
- The luminous flux represents the quantity of radiation emitted by a lamp, measured in units of lumens.
- The intensity of light emitted by a lamp is measured in units of candelas.

- The luminance of a point on the road surface that is receiving light from a lantern equals the intensity of the light emitted by the lamp divided by the square of the distance of the point from the lamp.
- It relates to the incident light falling on a surface and so is higher close to the lamp. It is measured in terms of lux (lumens per square metre).
- Another measure of the intensity of light is luminance, which is a measure of the light reflected from the road surface. It is measured in candelas per square metre.
- It is most commonly used to assess lighting requirements for heavily trafficked roads and has limited relevance to the needs of low-income areas.

Basic design information

- The key parameters to be established before design starts include the a) lamp type and intensity, b) the lantern height and c) the minimum level of luminance.
- The following design standards are recommended:

Location	Lamp Type	Minimum Height	Preferred Height
Main Road	Sodium (or) Mercury Vapour	6.0 Metres	7.0 Metres
Side Road	Fluorescent tube	3.5 Metres	5.0 Metres

- Information on lamp characteristics must be obtained from the lamp manufacturer. Approximate light intensity (I) values for twin fluorescent tubes are as follows:

- Two no. 20 watt fluorescent 200 candelas (I)
- Two no. 40 watt fluorescent 400 candelas (I)

Design procedure

- The steps in the design procedure are as follows:
- Select an appropriate level of lighting in terms of luminance (lux).
- Decide on the most appropriate lamps for the local situation.
- Determine the lantern height and spacing required to give the required luminance for an access way of known width.
- Specify the details of the lamp, the pole or other method of fixing and the power supply arrangements.

Lighting level in ULB

- The level of lighting provided should be sufficient to achieve the objectives without incurring unnecessary capital and operating costs. The levels of luminance required to achieve the various objectives are as follows:
- 2 lux Minimum in order to positively detect obstacles
- 1 lux Satisfactory recognition of obstacles and irregularities
- 5 lux Human features are recognizable.
- The selection of suitable lighting levels is complicated by the fact that the above figures refer to 'overall' or 'average' levels of lighting. As already indicated, luminance reduces in direct proportion to the square of the distance from the lanterns.

- the aim for local access streets used mainly by pedestrians and with a limited amount of slow-moving traffic should be to provide a minimum luminance of 0.5 lux at any point. This will mean that the average luminance exceeds 1 lux and that levels in excess of 5 lux are achieved close to lanterns.
- Lamp selection - Use fluorescent tubes in most locations and sodium vapour lamps on main roads carrying through traffic.
- Street width – 2 to 4 metres Two no. 20 watt fluorescent tubes wall-mounted at 3.5 metre height.
- Street width 4 metres and greater. Two no. 40 watt fluorescent tubes, normally pole mounted at height of 5 metres.
- Main through roads, Sodium vapour lamps, pole mounted at height of 6 or 10 metres.
- The required lantern spacing to achieve a minimum lighting level of 0.5 lux at the mid-point between two lanterns can be calculated for a given mounting height and lamp intensity (I), using the following procedure.
- Step 1 Calculate the distance factor (DF) = 25/I
- Step 2 Read off the value of spacing corresponding to the

Safety and Security

- Live power lines should be insulated if they are run along the walls of buildings or are otherwise easily accessible.
- Other metal parts of lanterns, such as the lamp housing and other fixtures should be earthed to ensure automatic disconnection of the supply in case they become live.
- Any control gear that is not inside the lantern should be housed in strong containers which are waterproof and difficult to tamper with, secured to either the wall or a pole.
- Any wiring between the control gear and lantern should be protected by galvanized steel conduit in accordance with the requirements of the power utility.

Are the Street Lights competing with the Sun Light?

ENERGY – SAVINGS POTENTIAL
STREET LIGHTING – SUN SYNCHRONISATION

- LED Lights in each ULB 5000 Nos (approx.)
- MV / SV Lamps 500 Nos (approx.)
- Average Consumption 5000 x 10w + 500 x 250w= 175000 W/Hr

  = 175 KW/Hr
- Energy Consumption for two Hrs

  (Morning 1hr,evening 1hr) 2 x 175 = 350 kwh
- Energy Charges for two hrs 350 x 4.40 = Rs. 1540/-
- For 1 month 30 x Rs. 1540=Rs.0.462 lakh or

  Rs. 0.5 Lakh/month/ULB
- Cost Savings per ULB Rs .6.00 lakhs / Annum
- 110 ULBs of AP Rs.6.6 Cr. Per Annum

ENERGY SAVING POTENTIAL – INDIA
STR. LTG. – SUN SYNCHRONISATION

Energy Savings – 5000 ULBs – 350 KW/day/ULB

Total Energy Saving – India = 5000 x 350 x 365 = 339 Mn. Units

With the Saved Energy, more than 32 Million Agricultural pumps can be energized in INDIA

Total Cost Saving: 5000 x Rs.6 lakh/yr./ULB= Rs.300 Cr.

Total Cost Saving – India: Rs. 300 Crores

Recommended lux for street lighting

Classification	Avg. illumination, lux	Ratio Minimum/Average illumination	Type of Luminaire	
			Preferred	Permitted
Group A1: Important traffic routes	30	0.4	Cut-off	Semi-cut-off
Group A2: Main roads carrying mixed traffic like main city roads, arterial roads etc.	15	0.4	Cut-off	Semi-cut-off
Group B1: Principal local trafic routes, shopping streets etc	8	0.3	Cut-off or semi-cut-off	non-cut-off
Group B2: Secondary roads with light traffic	4	0.3	Cut-off or semi-cut-off	non-cut-off

IS 1944 (Part I & II)-1970 categorise the streets)

Street Lighting: Issues & Remedies

1	Non-sun synchronization - on/off switches	Reduce no. of switches/operator - increase no. of operators/ engage unemployed youth/redeploy staff
2	Lack of awareness on energy issues	Awareness programs to staff and public representatives
3	Lights glowing past mid-night- central, high mast	Adopt Dual Circuits (Alternate Lighting Pattern) - or voltage controllers
4	Jumping/mal functioning of meters	Daily meter reading - recording - Joint meter reading at month end
5	Wastage - due to 250W SV lamps in internal lanes	Replace–250 W HP SV lamps with 150 W HP SV lamps. Maintain required lux levels as per IS 1944

Street Lighting: Issues & Remedies – Contd.

6	24 hrs Lighting on direct feeder	Install street light phase & boxes with main switches, MCBs etc.
7	No tool for verification of energy bills	Use energy bills checklist - verify different items in bills
8	No street ltg. on/off Boxes, MCBs – unsafe	Provide switch boxes with MCBs and energy meters – ensure safety
9	40W (T12) FTLs being used. Cu/Al chokes consume upto 14 W	Install 36W (T8) FTLs with BEE 5 or 4 Star rating. Use electronic ballasts which consume upto 4 W
10	Poor O&M of street lighting system	Provide maintenance tools, safety kits, measuring equipment & ensure effective monitoring of energy bills

Electrical Installations

- Electrical installation Is installing of whole new electrical wires and electrical outlets in the residential, commercial or any institutional buildings.
- According to capacity of feeders different type of Electrical installation is done. For example if it is a residential building then wiring is done with the wires which is meant for residential buildings and the electrical outlets are putted according to the home appliances such as TV, Fridge and Washing machine.
- But in commercial and residential buildings heavy amount of electricity is used , so their wiring is done with the wire which can resist heavy flow of electricity. And the outlets with high ampere is adopted.

- The testing, installation and commissioning of electrical equipment is a specialized task which requires that every installation is properly installed and tested by trained professionals.
- The entire erection, installation and commissioning process is a continuous process. The ultimate objective of the commissioning process is to ensure delivery and has reduced cost of delivery and meets the requirements of being a fully operational system.
- Taking care of safety standards in our installations and that is one of the top most priorities for us. Municipalities take visual inspection, do various types of tests as well as take proper measurements.

Vehicle Depot

- Vehicle Depot for maintaining the all vehicles in the ULB.
- Different types of vehicles are dumper placers, Tippers , Hook loaders, Autos, Compactors, Tractors, Air tech machines, cars etc.,
- In Vehicle Depot the mechanics, helpers, welders, electricians, vulcanizers and painters are works for maintenance of ULB owned vehicles round the clock.
- Daily repairs are attending whenever repair arise on war-foot basis by obtaining local quotations from suppliers and registered contractors for spare parts and work will be entrusted to the lowest quoted Suppliers / Contractors.
- For new vehicles, repairs to be carried out through Authorized dealer's.
- On emergency basis repairs will be carried out through Departmental execution duly by drawing advance.

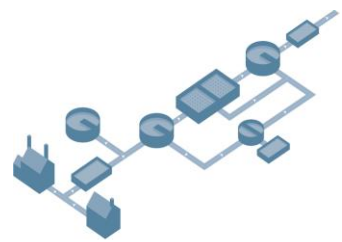
14. Parks & Burial Grounds, Community Toilet Buildings, Traffic Islands

15. UGD, WasteWater Treatment

Wastewater Management in Urban Local Bodies

Orientation Program for Master Trainers of PHED

Waste Water Generation



Waste Water Treatment

Wastewater Reuse & Recycle

Safe sanitation for enhanced public health and environmental outcomes

Sewerage Network / Under Ground Drainage (UGD)

Objective:

- Improvement in the environment by removing the sewage as it originates
- Preventing inundation of low lying areas that may be otherwise caused by not providing sewers
- Prevention of vector propagation by sewage stagnations
- Avoiding cross connections with freshwater sources by seepage

What is a Sewer System?

- A piped system to transport wastewater (and sometimes storm water) from the source (households, industry, runoff) to a treatment facility.
- There are several designs, depending on topography, amount and kind of wastewater, size of community, etc.

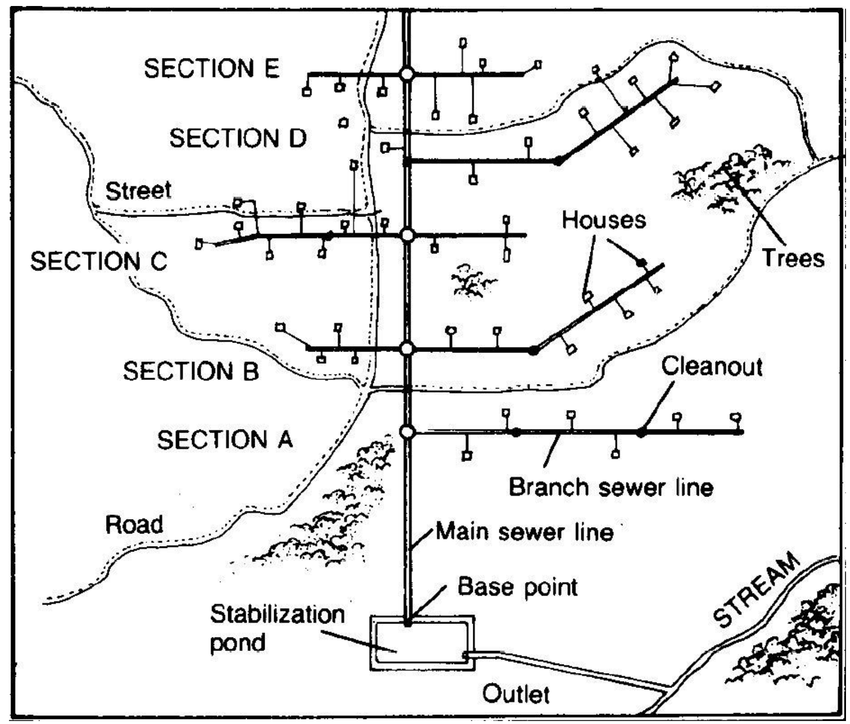
Types of Sewerage System

- Types of sewerage systems are :-
  - Combined sewerage system
  - Separate sewerage system
  - Partially combined sewerage system

- Principles of Transport :-
  - Gravity
  - Pressure
  - Vacuum

Combined Sewers

- Large networks of underground pipes, mostly in urban areas.
- Collection of blackwater, brownwater, greywater and stormwater.
- The system contains three types of sewer lines:
    - Main line (primary): the centre of the system, all other lines empty into it.
    - Branch lines (secondary): extend from the main.
    - House laterals (tertiary): bring wastewater from the houses to the branch lines.



Design Principle

- Conventional sewers shall be designed for a minimum sewage flow of 100 litres/day or higher
- For the purpose of hydraulic design estimated peak flow factor are adopted
- Peak factor or the ratio of maximum to average flows depends on contributory population as follows
  - Upto 20,000 – 3.00
  - Upto 20,001-50,000 – 2.50
  - Upto 50,001-75,000 – 2.25
  - Above 75,000 – 2.00
- Flow Velocity:
  - Min. velocity at initial peak flow – 0.6m/s
  - Min. velocity at ultimate peak flow – 0.8m/s
  - Maximum velocity - 3m/s

Design Principle

- Sewers are designed using Manning's formula either for gravity flow or for pumping using sewage pumping stations.
- Manning's formula

  $V=1/n \times R^{2/3} S^{1/2}$

  For circular conduits

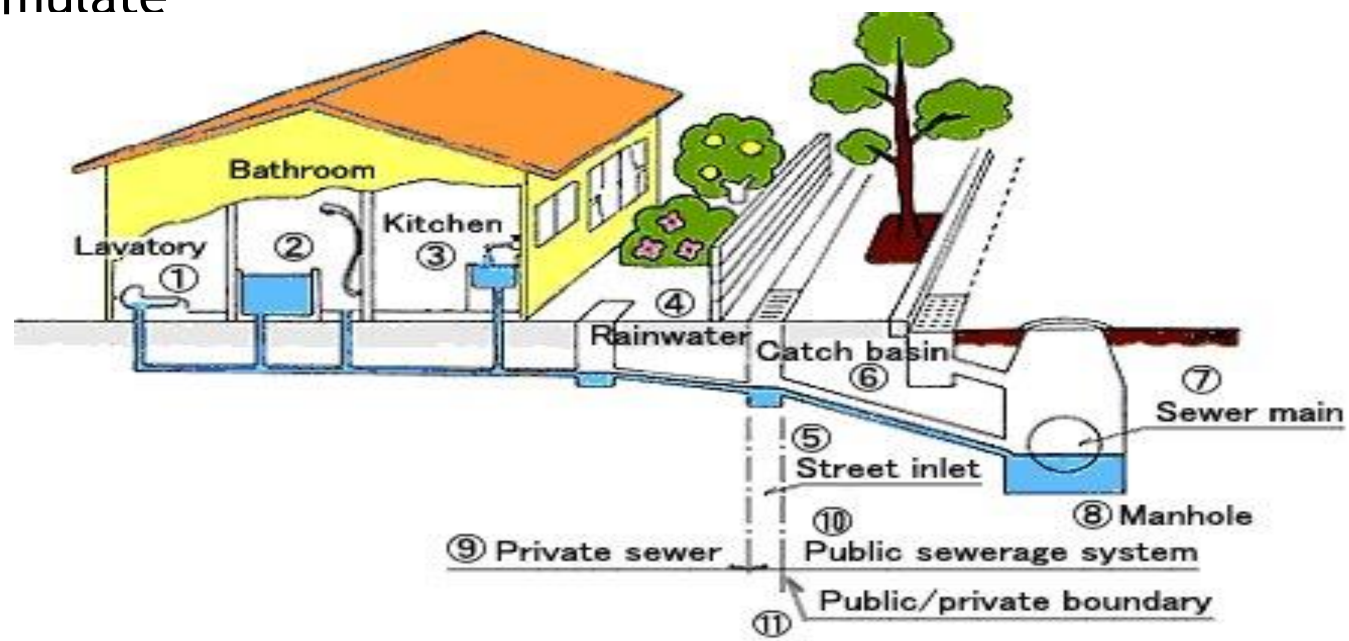
  S: Slope of hydraulic gradient

  R: Hydraulic radius in m

  V: velocity in m/s.
- Because the wastewater is not treated before it is transported, the sewer must be designed to maintain self-cleansing velocity (i.e. a flow that will not allow particles to accumulate), generally obtained with a minimal flow of 0.6 to 0.75m/s
- A constant downhill gradient must be guaranteed along the length of the sewer to maintain self-cleansing velocity

Design

- Wastewater is transported to a centralised treatment facility by gravity.
- Depending on topography, sewer pumping stations are necessary.
- Primary sewers are laid beneath roads, at minimal depths of 1.5 to 3 m to avoid damages caused by traffic loads
- It must be designed to maintain “self-cleansing” velocity that no particles accumulate



Design

- Access manholes are set at regular intervals along the sewer, at pipe intersections, at changes in pipeline direction and at drops
- When the required slope cannot be maintained, a pumping station must be installed

Costs

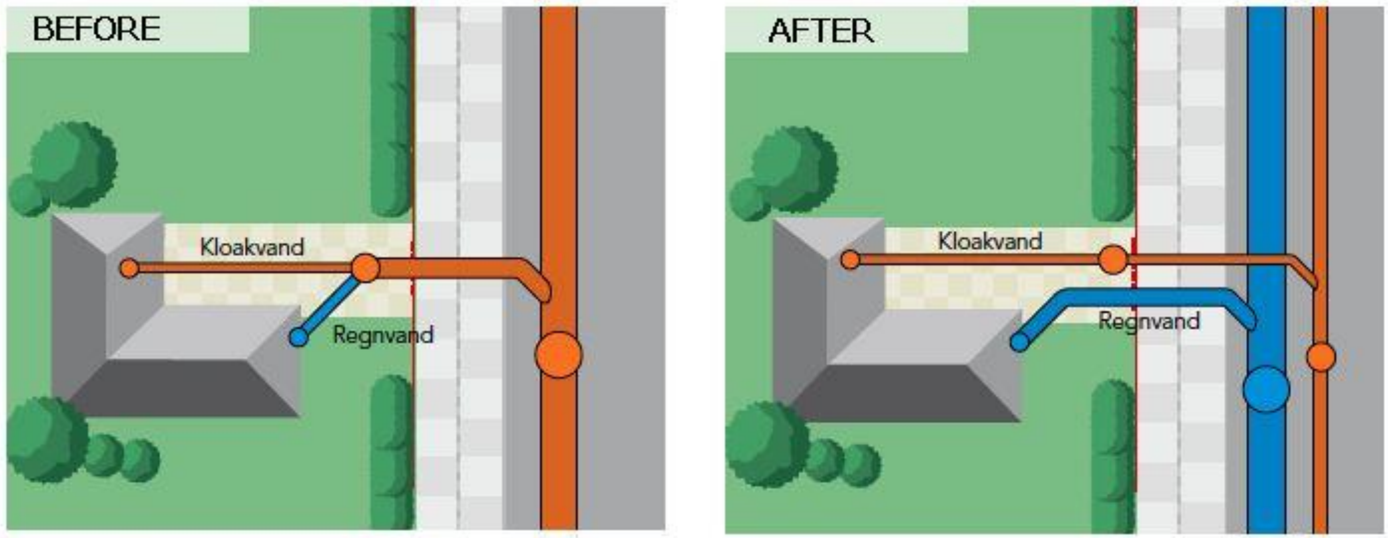
- The initial cost is high (50 to 80% more than simplified sewer systems)
- Maintenance costs are high compared to decentralised systems and consists mainly inspection, unblocking and repair
- Extension of the system can be difficult and costly

Applicability

- Suitable for urban areas with resources to implement, operate and maintain the system
- Appropriate when a centralised treatment facility is available
- Infiltration may hamper the performance combined sewers

Design Principle

•In contrast to conventional sewer systems, wastewater (e.g. from households or industries) and stormwater are transported separately.



- ➢ During heavy rains, overflow contains no harmful blackwater.
- ➢ Stormwater in general is less contaminated.

Separate Sewers

Costs

- Construction costs might be higher than for the combined sewer system because two separated networks are necessary.
- They must also be maintained and operated separately.
- A replacement of a combined system by a separated system is very costly.

Health Aspect

- More secure than a conventional system, because blackwater is transported in a closed network.

Applicability

- Suitable for urban areas that have the resources to implement, operate and maintain such systems plus provide adequate treatment to avoid pollution at the discharge end. Enough water for transportation must be available.
- Especially suitable during monsoon –> large amounts of stormwater can be treated separately.

Health Aspect

Open drains bear a high health risk, because water in open channels can contain all sorts of contaminants and pathogens

- Ponding enforces mosquito breeding
- Illegal disposal of solid waste leads to clogging

Operation & Maintenance

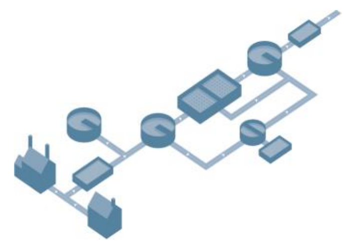
- Racks (screens) must be cleaned frequently.
- Sand and grit must be periodically removed.
- The pad and loading area should be cleaned regularly to minimise odours.
- Sludge from transfer or sewer discharge stations is treated in an appropriate secondary treatment facility and not be illegally dumped.

Thank you

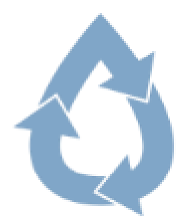
Wastewater Management in Urban Local Bodies

Orientation Program for Master Trainers of PHED

Waste Water Generation



Waste Water Treatment



Wastewater Reuse & Recycle

Safe sanitation for enhanced public health and environmental outcomes

1. Wastewater and its characteristics

What is domestic wastewater?

- Greywater is the wastewater generated from kitchens, bathrooms and other wash areas
- Blackwater is the wastewater generated from toilets
- Greywater + Blackwater = Wastewater

Wastewater quantity and quality

- Generally, 80% of the water used by the population comes out as wastewater
- If the water availability at user end is 135 lpcd (municipal + other sources), we can consider 108 lpcd as the wastewater generation
- Characteristics of wastewater is presented below:

Parameter	High	Medium	Low
COD total	1,200	750	500
COD soluble	480	300	200
COD suspended	720	450	300
BOD	560	350	230
VFA (as acetate)	80	30	10
N total	100	60	30
Ammonia-N	75	45	20
P total	25	15	6
Ortho-P	15	10	4
TSS	600	400	250
VSS	480	320	200

What is faecal sludge or septage?

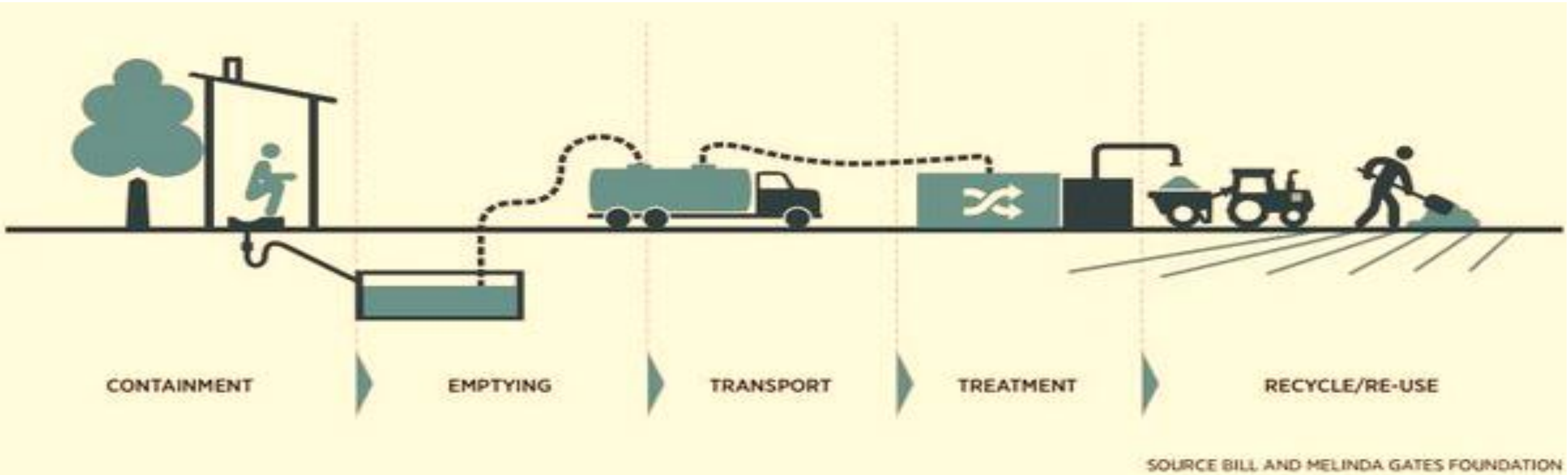
- The sludge produced by on-site sanitation systems like septic tanks is called Septage
- The sludge produced from pit toilets is called Faecal Sludge
- Its is also an important component of wastewater
- It highly polluting than domestic wastewater

Faecal sludge quantity and quality

- Supply based - It is estimated that 230 litres of FS is produced per capita per year
- Demand based – No. of septic tank emptying incidents X capacity of the septic tank cleaning truck
- Characteristics of FS/septage is presented below:

Constituent (all units but for pH are in mg/l)	Average
pH	1.5-12.6
Total Suspended Solids	12,862
Biochemical Oxygen Demand	6,480
Chemical Oxygen Demand	31,900
Ammonia-Nitrogen	97

Faecal Sludge Management (FSM)

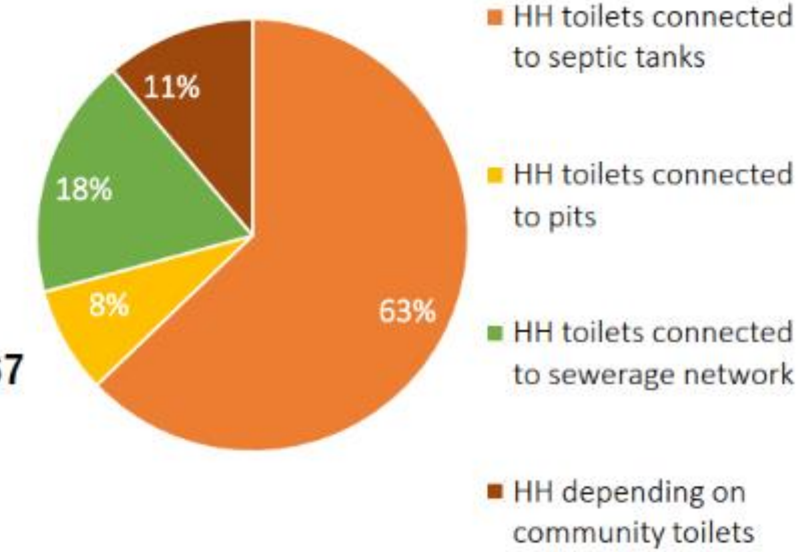


2. Wastewater scenario in urban AP

Access to Toilets in urban AP

- Total Urban Population (2011): 1.46 Cr
- Urbanization rate (2011): 29.6%
- Projected Population (2019): 1.49 Cr
- No. of ULBs:110
  - Municipal Corporations: 16
  - Municipalities: 69
  - Nagar Panchayats: 25
- Over 2.2 lakh individual toilets, 585 public and 867 community toilet blocks were constructed under Swachh Bharat Mission (SBM)
- > 72% of household toilets are connected to on-site sanitation systems (septic tanks/pit latrines)

Access to toilets in Andhra Pradesh

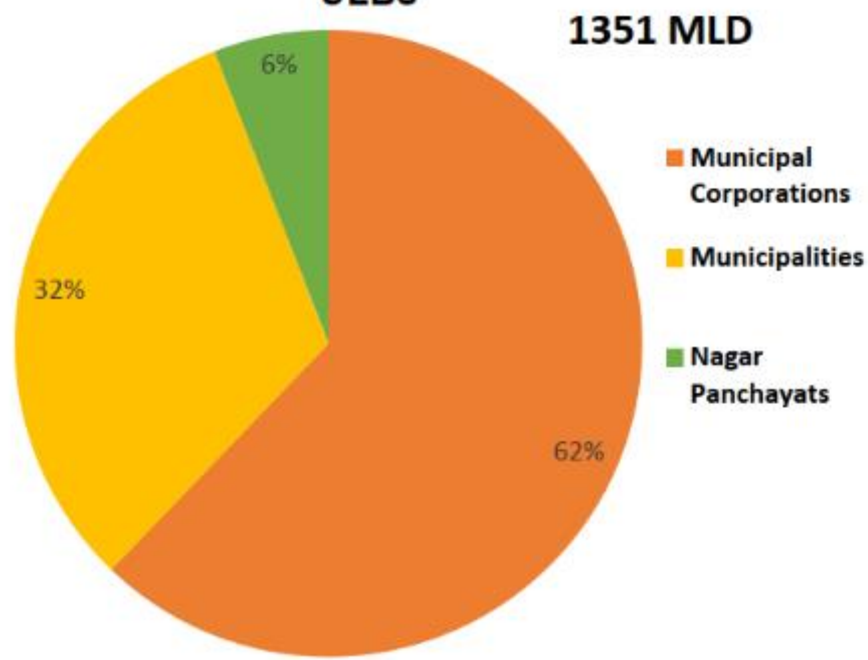


Source: www.sac.ap.gov.in

Wastewater Management in urban AP

- Waste water generation is estimated based on the per-capita water supply[1] and estimated population of ULBs
- Total no. of ULBs are 110
- Estimated waste water load in 110 ULBs is 1351 MLD
- Of this, more than 62% of waste water is generated from 16 Municipal Corporations.
- Municipalities and Nagar Panchayats accounts for 32% and 6% respectively.

Estimated waste water generation in ULBs



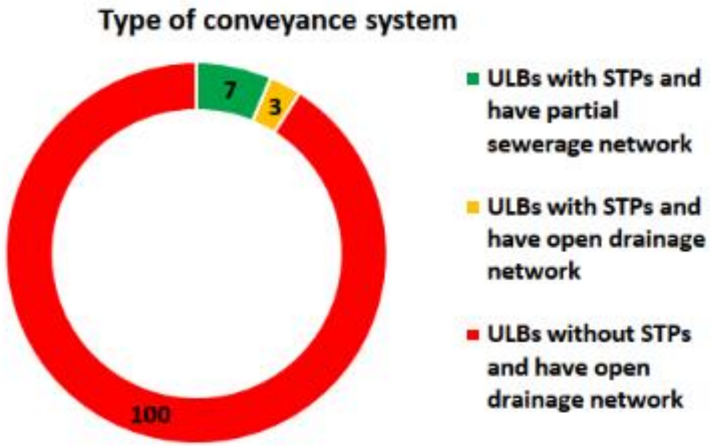
Methodology for estimation of waste water generation:

Waste water= 80% of per-capita water supply * total population of the ULB

[1]*Source: http://appublichealth.gov.in*

Contd...

Conveyance System



- **Only 7 ULBs in the state have partial under ground drainage network. Details are:**
  - **Greater Vishakhapatnam Municipal Corporation: 40%**
  - **Vijayawada Municipal Corporation: 70%**
  - **Tirupati Municipal Corporation: 70%**
  - **Narasaraopet Municipality: 60%**
  - **Tadipatri Municipality: 85%**
  - **Pulivendula Municipality: 70%**
  - **Puttaparthi Nagar Panchayat: 100%**
- **Rest 103 ULBs have open drainage network as conveyance system**

Source: ASCI Consortium, July 2019

Typesof waste water conveyance systems

Sewer network

- Water Intensive
- Capital Intensive
- Land Intensive
- Waste water transported in a closed environment
- Less impact on open environment
- Durable

Open drainage network

- Potential to cause threat to public health (breeding spots for mosquitos and other parasites)
- Tendency for citizen to discard solid waste into drains
- Odour
- Direct impact on open environment

Treatment Infrastructure

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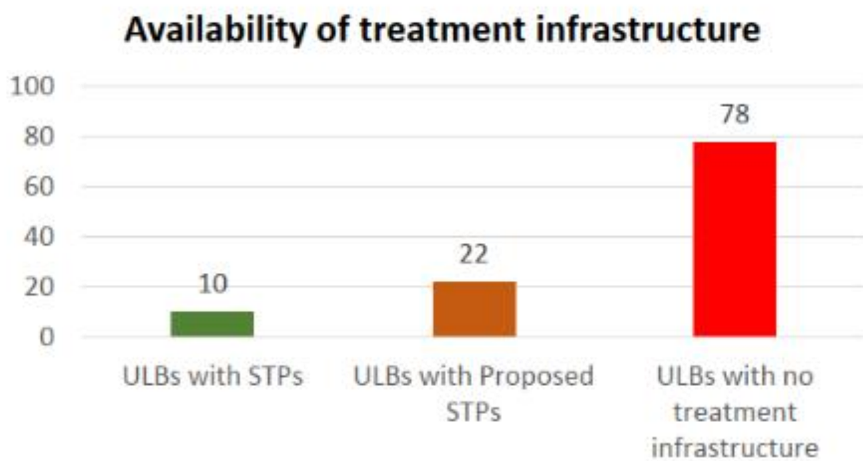


- Total estimated waste water load in 110 ULBs is 1351 MLD
- Only 10 ULBs (9%) in the state have treatment infrastructure
- Capacities of existing STPs (38 No's) is 536 MLD
- Capacities of proposed STPs (22 No's) is 424 MLD (AMRUT+ Other funding)
- Gap in treatment of waste water generated is 391 MLD

Contd...

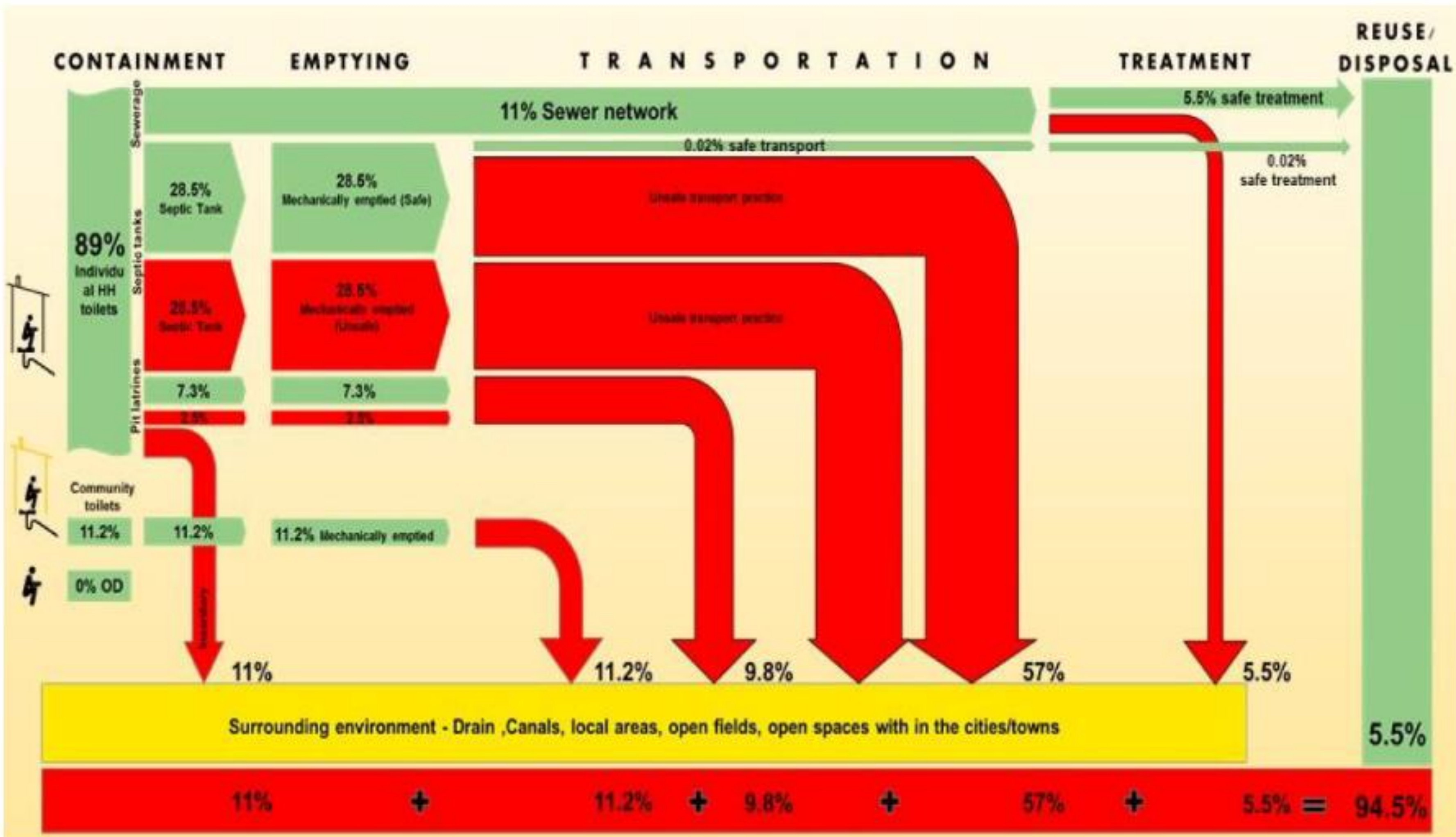
Coverage of STPs in ULBs of AP

Sl. No.	Name of the ULB	No. of STPs	Combined Capacity (in MLD)
1	Greater Visakhapatnam Municipal Corporation	19	231
2	Vijayawada Municipal Corporation	8	150
3	Tirupati Municipal Corporation	1	50
4	Narasaraopet Municipality	1	15.5
5	Rajamahendravaram Municipal Corporation	1	30
6	Kadapa Municipal Corporation	1	20
7	Tadipatri Municipality	2	11.5
8	Yemmiganur Municipality	1	19.80
9	Pulivendula Municipality	1	6.5
10	Puttaparthi Nagar Panchayat	3	1.5
	Total	38	535.8

Source: ASCI Consortium, July 2019

1 MLD STP, Bakkannapalem, Vishakapatnam

FSM in urban AP



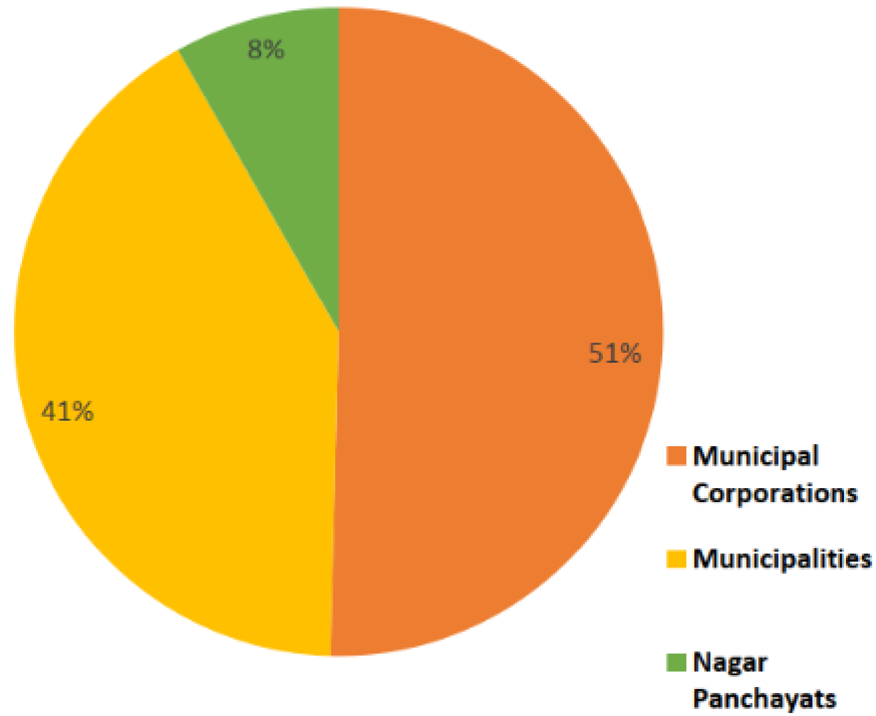
95% of the faecal waste generated is disposed into open environment without any treatment

Source: Secondary data collected from all ULB by ASCI team, 2018-19

Contd...

- Faecal waste generation is estimated based on the projected population and per-capita faecal waste[1] generation
- Total no. of ULBs: 110
- Estimated faecal waste load in 110 ULBs is 3260 KLD.
- Of this, 51% is generated from 16 Municipal Corporations
- Municipalities and Nagar Panchayats accounts for 41 % and 8 % respectively.
- ULB-wise estimated faecal waste is presented in Annexure-II

Estimated faecal waste generation in ULBs



Methodology for estimation of faecal sludge generation:

Faecal Waste= 230 litres per-capita * total projected population

[1] *Per capita faecal waste considered as 230 l as per CPHEEO/USEPA norms*

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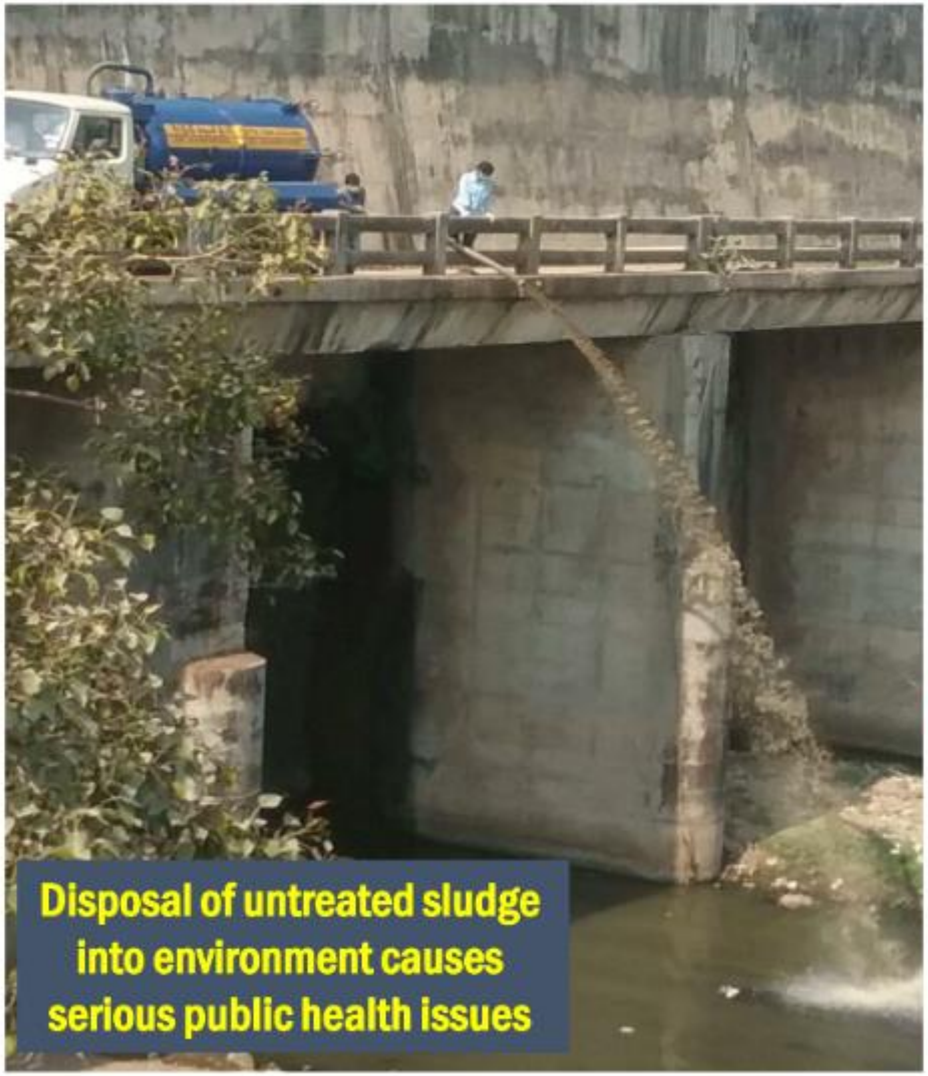
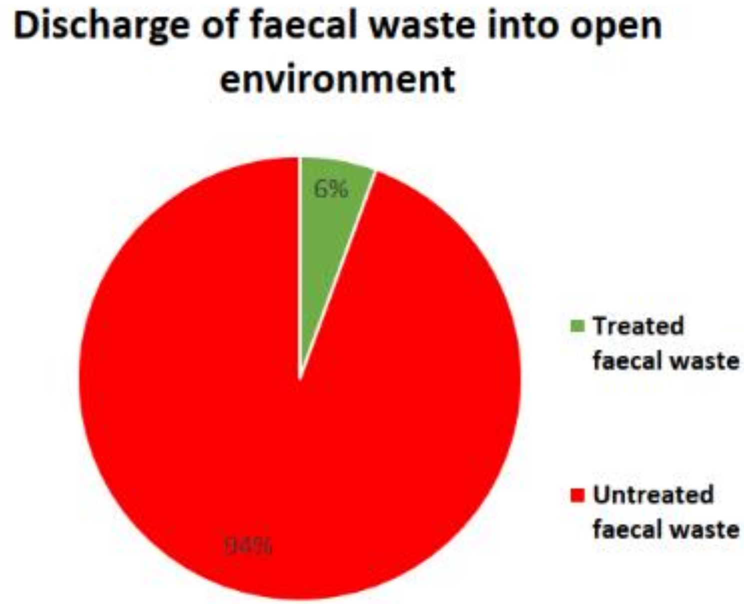
Faecal Waste Discharge





- Only 6% of faecal waste generated is treated and safely disposed into open environment
- Untreated faecal waste discharged into open environment is 3115 KLD

3. National & State Policies

SBM - Moving beyond ODF

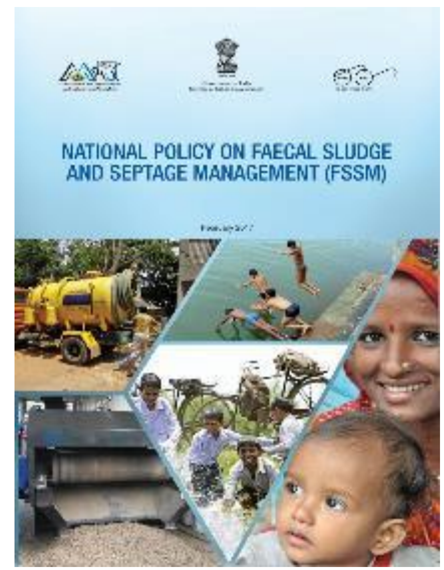
- **ODF** – Open Defecation Free
- **ODF+** - A city / ward / work circle can be notified/declared as SBM ODF+ city/ SBM ODF+ ward/SBM ODF+ work circle if, at any point of the day, not a single person is found defecating and/or urinating in the open, AND all community and public toilets are functional and well maintained.
- **ODF++** - A city / ward / work circle1 can be notified/ declared as SBM ODF++ city/ SBM ODF++ ward/ SBM ODF++ work circle if, at any point of the day, not a single person is found defecating and/ or urinating in the open, all community and public toilets are functional and well maintained, AND faecal sludge/septage and sewage is safely managed and treated, with no discharging and/or dumping of untreated faecal sludge/septage and sewage in drains, water bodies or open areas.

Recycle and Reuse Policy (GO-135) - AP

- The key objective of the policy moving from theory to action to recycle and reuse the wastewater produced by urban areas.
- This policy is intended to:
  - Direct the water sector towards more efficient use of water resources.
  - It details the intention to reuse treated wastewater in irrigation that enables freeing fresh water to be utilized for municipal uses.
  - It also provides for using the treated wastewater in other economic activities.
  - It calls for expanding collection and treatment of wastewater, updating and development of standards and practices for substituting fresh water used in irrigation and industry by treated wastewater after blending it.
  - The policy aims also at increasing surface water utilization for municipal uses and thus decreasing the strain on groundwater.

National Policy on FSSM

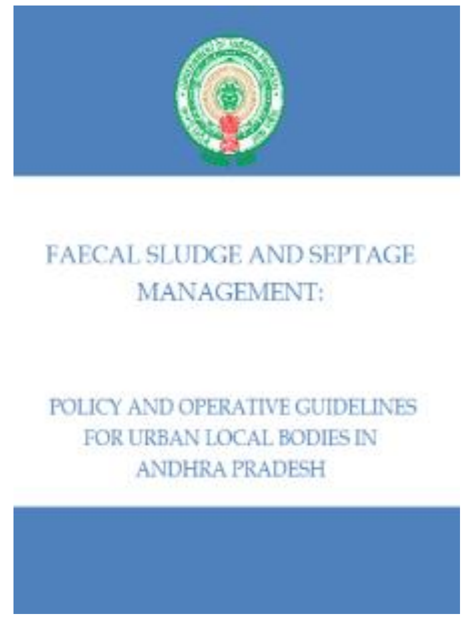
- The Ministry of Housing & Urban Affairs (MoHUA) issued National Faecal Sludge and Septage Management (FSSM) policy in 2017
- Objective is to direct and facilitate nation-wide implementation of FSSM services in all ULBs
- Key components of the national policy are:
  - **Leveraging FSSM to achieve 100% access to safe sanitation**
  - **Achieving Integrated Citywide Sanitation**
  - **Sanitary and Safe Disposal**
  - **Awareness Generation and Behaviour Change**



FSSM guidelines (GO-134) - AP

Key components:

- Study of current toilets and on-site sanitation systems in the city
- Estimation of faecal sludge generation
- Ensuring desludging frequency of 3 years
- Licensing of private cesspool operators
- Scientific treatment of faecal sludge
- Resource recovery from treated sludge
- Capacity building
- Information, Education and Behaviour Communication (IEBC)



4. Strategy for wastewater treatment

Strategy for treatment of Faecal Sludge

- Co-treatment at existing and proposed STPs in AMRUT cities
- Establishment of 76 Faecal Sludge Treatment plants (FSTPs) in non-AMRUT towns (HAM model)

Proposed FSTPs

Package No	Total no of ULBs	Design Capacity KLD	ULBs	Technology proposed
1	11	175	Gooty, Kadiri, Kalyanadurgam, Madakasiri, Pamidi, Puttaparthi , Rayadurgh, Rayachoti, Pulivendula, Dhone, Jammalamadugu	Thermophilic Digestion and IR Radiation
2	10	140	Badvel, Mydukuru, Rajampet, Yerraguntla, Allagada, Atmakur, Gudur, Nandikotkur, Palamaner, Punganur	Microbial remediation
3	11	180	Nagari, Puttur, Atmakur, Gudur, Naidupet, Sulurpet, Venkatagiri, Kandukur, Kanigir, Markapur, Giddalur	Microbial degradation process along with thermal treatment
4	11	185	Bapatla, Repalle,Piduguralla, Macherla, Chirala, Ponnur, Addanki, Sattenpalli, Vinukonda, Chimakurthi, Mangalagiri	Pyrolysis
5	11	175	Palcole, Yeleswaram, Nidadavole, Tanuku, Pedana, Jangareddygudem, Vyurru, Nandigama, Tiruvuru, Jaggaiahpet, Tadepalli	Pyrolysis
6	11	140	Ramachandrapuram, Gollaprolu, Kovvur, Pithapuram, Peddapuram, Samalkot, Mandapeta, Mummidivaram, Amalapuram, Tuni	Pyrolysis
7	11	150	Yellamanchali, Narsipatnam, Bobbili, Nellimarla, Salur, Amadalavalasa, Ichapuram, Palakonda, Palasa Kasibugga, Parvathipuram, Rajam	Geo-tube bags
Total	76	1145		

Strategy for treatment of wastewater

- Improving sewerage/UGD coverage – increasing last mile connectivity
- Improve utilization rates of existing STPs
- Establishing decentralized wastewater treatment systems

5. Regulation on wastewater

Standards for wastewater discharge

PARAMETER	INLAND	PUBLIC	ON LAND	MARINE
.PH	5.5 TO 9.0	5.5 TO 9.0	5.5 TO 9.0	5.5 TO 9.0
SUSPENDED SOLIDS Mg/Lit.	100.0	600.0	200.0	100.0
TDS Mg/Lit	2100.0	-	2100.0	-
BIO LOGICAL OXYGEN DEMAN Mg/lit.	30.0	350.0	100.0	100.0
CHEMICAL OXYGEN DEMAND Mg/lit	250.0	-	-	250.0
SULPHATES Mg/lit	1000.0	1000.0	1000.0	-
CHLORIDES Mg/lit	1000.0	1000.0	600.0	-
OIL & GREASE Mg/lig	10.0	20.0	10.0	20.0
LEAD (as pb) Mg/lit.	2.0	-	2.0	2.0
TOTAL CHROMIUM	2.0	-	2.0	2.0

For on-land irrigation, the requirement of the land is 10,000 liters / acre / day.

6. Technology options

Decentralized wastewater treatment

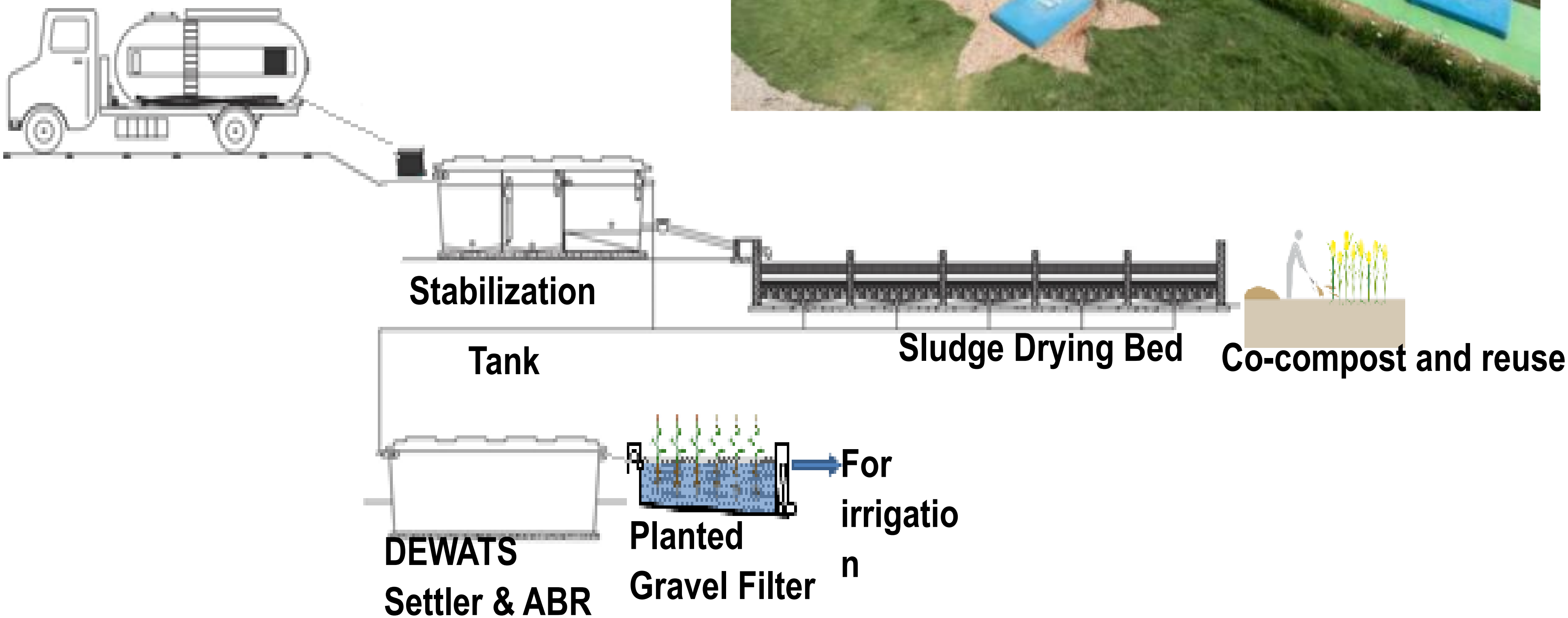
Natural systems

- DEWATS
- Tiger Bio Filter
- Natural biological systems
- Wetland systems
- Phytorid

Emerging technologies

- Johkasou Packaged Sewage Treatment Plant

DEWATS

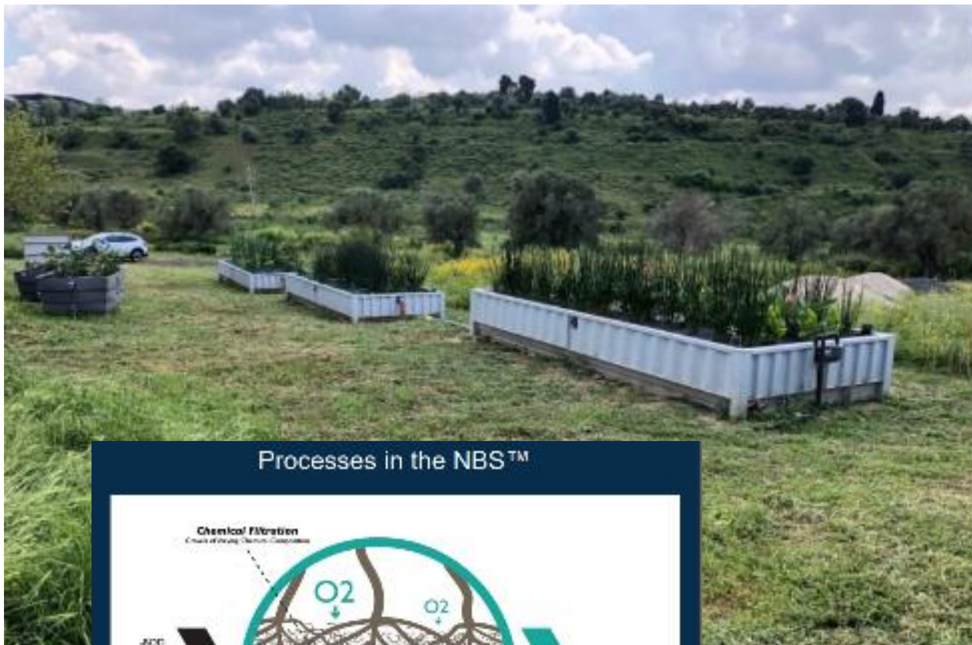

Stabilization
Tank
Sludge Drying Bed
Co-compost and reuse
DEWATS
Settler & ABR
Planted
Gravel Filter
For
irrigatio
n

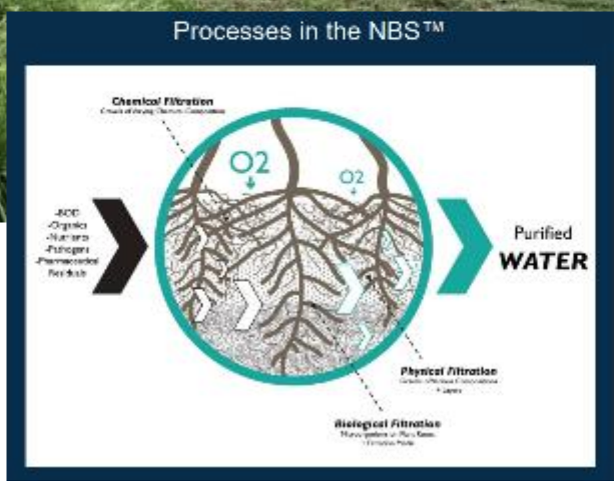
Tiger Bio Filter

- 50-70% less Capital Cost
- >90% water recovery
- NO Odor problem.
- Less Electricity Consumption.
- Natural and Eco Friendly Technology.
- Less Operation and Maintenance Cost.
- No Need for Sludge Treatment.
- Unskilled labour can operate the plant
- No Chemicals used or generated.

Natural biological systems

- a plant and aggregate based treatment system



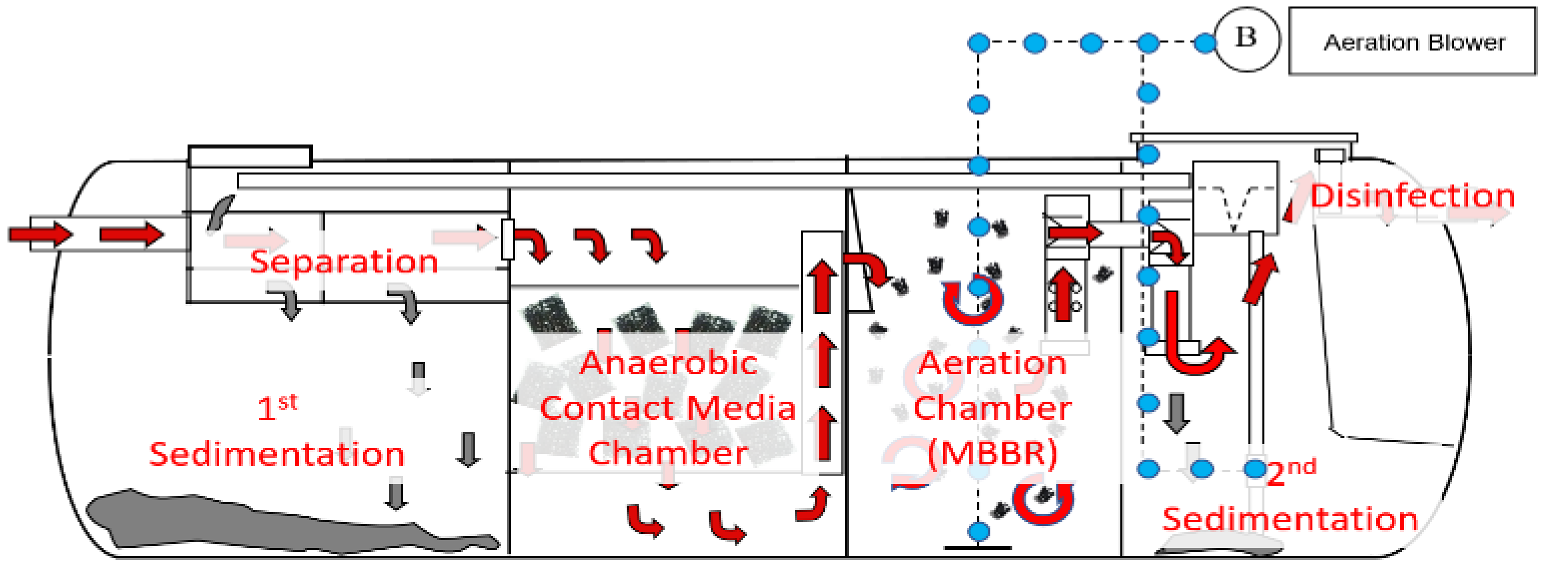


Wetland systems

Phytorid system

- Phytorid is a modification of constructed wetland technology- basic concept is removal of the pollutants in waste water with the help of plants.
- Basic units are: i) sedimentation tank, ii) Planted bed (phytorid chamber) and iii) treated water collection tank
- It's a system with both <u>aerobic</u> and <u>anaerobic</u> treatment in one STP

Johkasou Packaged Sewage Treatment Plant



Apartment complex (60KLD)

Individual house (1KLD)

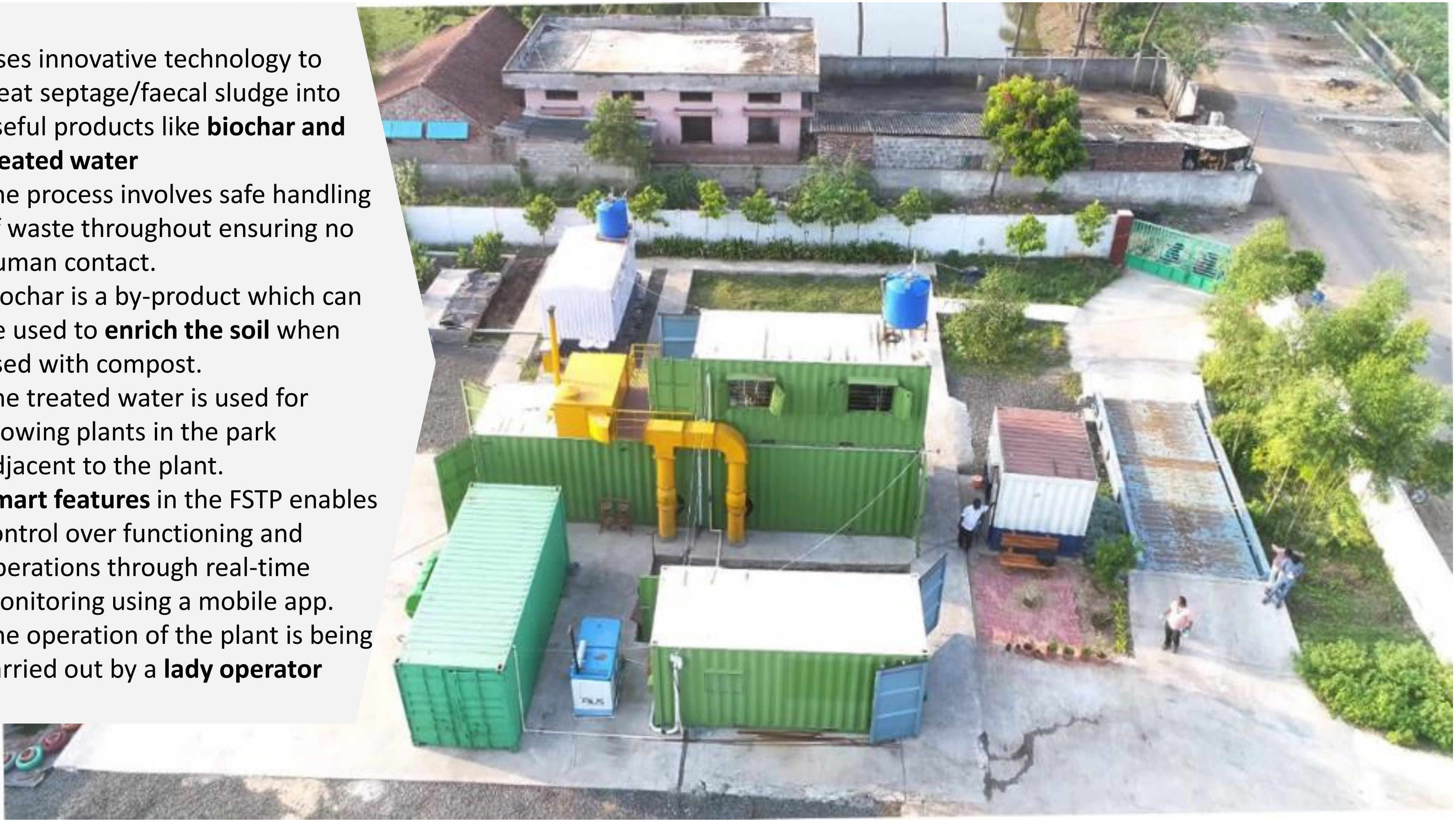
Factory (30KLD)

Commercial building (40KLD)

7. Pilot interventions

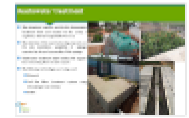
Thermal FSTP - Narsapur

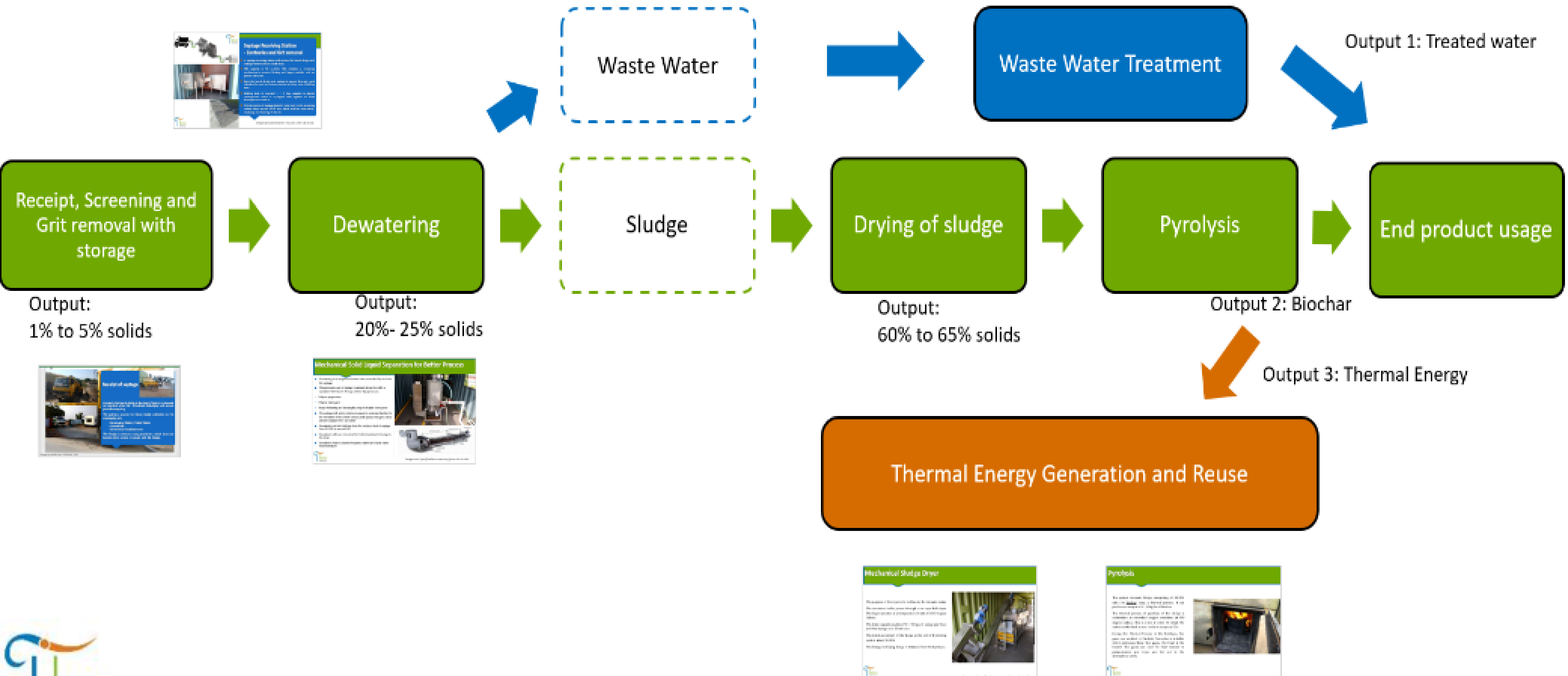
- Uses innovative technology to treat septage/faecal sludge into useful products like **biochar and treated water**
- The process involves safe handling of waste throughout ensuring no human contact.
- Biochar is a by-product which can be used to **enrich the soil** when used with compost.
- The treated water is used for growing plants in the park adjacent to the plant.
- **Smart features** in the FSTP enables control over functioning and operations through real-time monitoring using a mobile app.
- The operation of the plant is being carried out by a **lady operator**



Contd...

The Thermal Faecal Sludge and Septage treatment process goes through 6 stages:





GeoTube based FSTP - Rajam

- FS collected by cesspool vehicles is received through the collection chamber and screened for solid waste.
- FS is stored in a specially designed geo-tube.
- Solid-liquid separation happens inside this bag and the liquid leaches out of the bags membrane.
- Solids remain inside the bag and upon drying, it converts into rich compost which can be used as a solid conditioner.
- The wastewater leaching from the geo bags is treated using sand and carbon filter and later using UV radiation.

Co-treatment at Tirupati and Anakapalli

- Current spare capacity at STP in Tirupati can be used to adopt co-treatment.
- It will not require additional land or manpower, thereby significantly reducing the capital and operational expenditures.
- A septage reception facility with a capacity of 100 KLD is recommended and implemented.
- The cost for establishing this facility is about Rs. 14 lakhs only.
- Similarly, a 15 MLD capacity Sullage Treatment Plant in Anakapalli (Vizag) has also been improved to receive and treat 25 KLD of septage. It involved establishment of a receiving facility with similar capital expenditure.

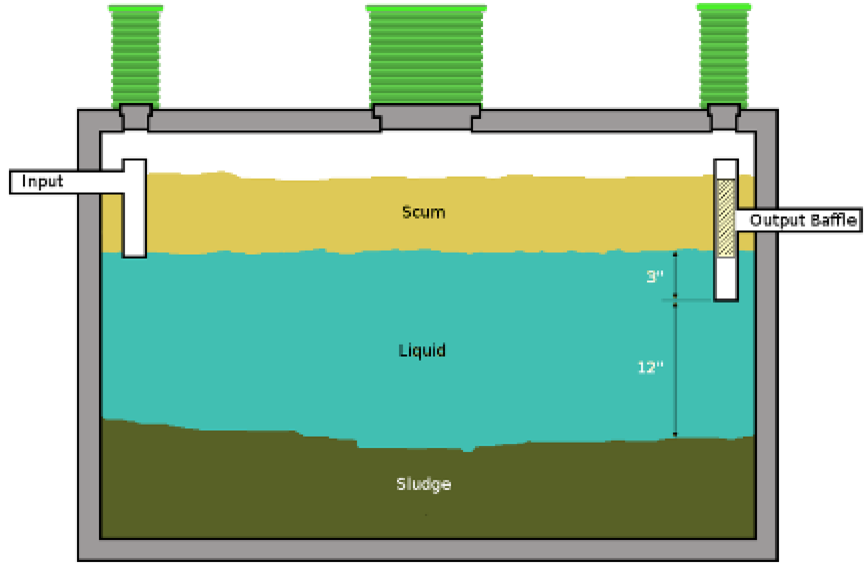
8. Way forward

Activities at ULB level for effective WWM

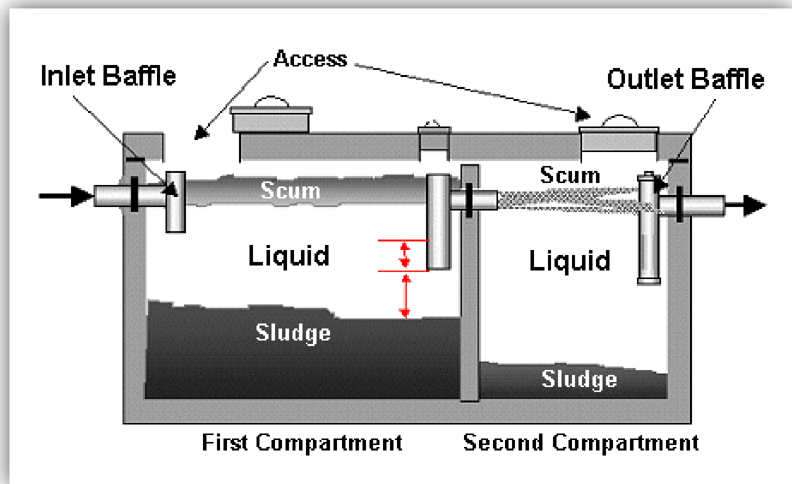
- Formation of NSS Cell in the ULB
- Formation of City Sanitation Task Force
- Formation of Emergency Response Sanitation Unit
- Formation of Gender Cell with MEPMA Involvement
- Registration of De sludging operators, sewer cleaning workers, supervisors, contractors (both Govt. and Private)

Septic Tank

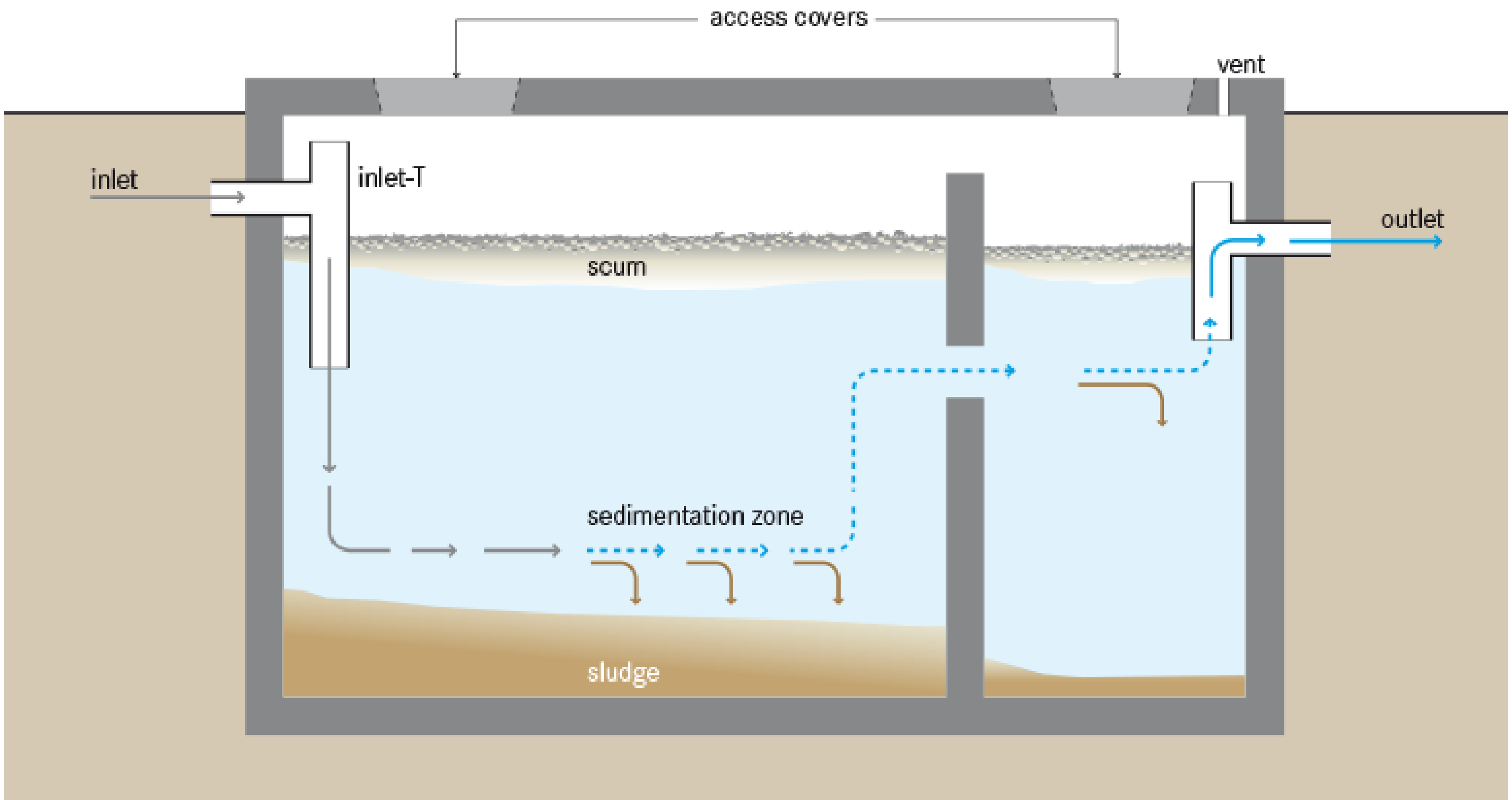
Septic Tank means a **water-tight receptacle** which receives the discharge of a plumbing system or part thereof, and is designed to accomplish the **partial removal and digestion of the suspended solid matter** in the sewage through a period of detention.

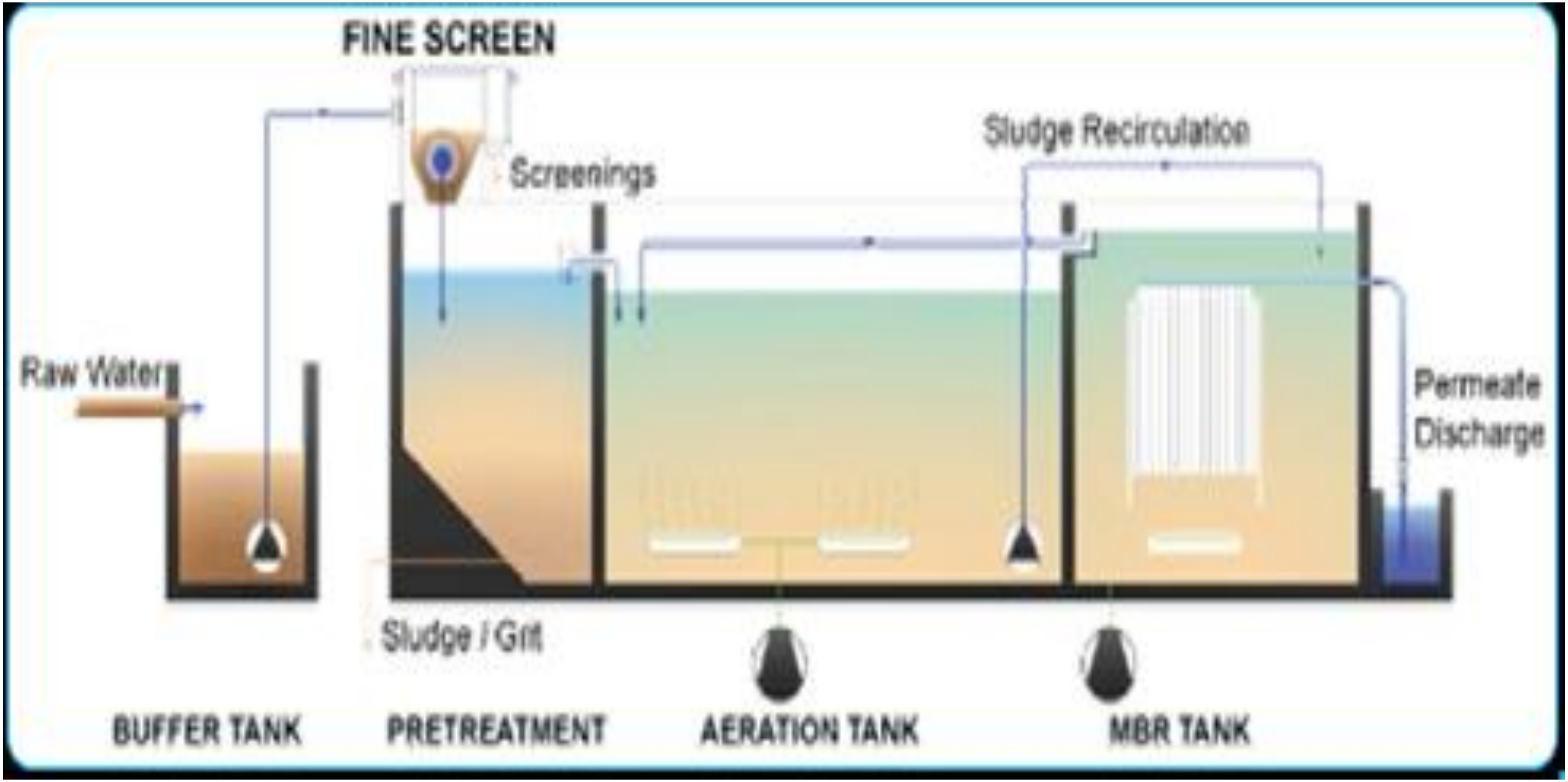


Single Pit



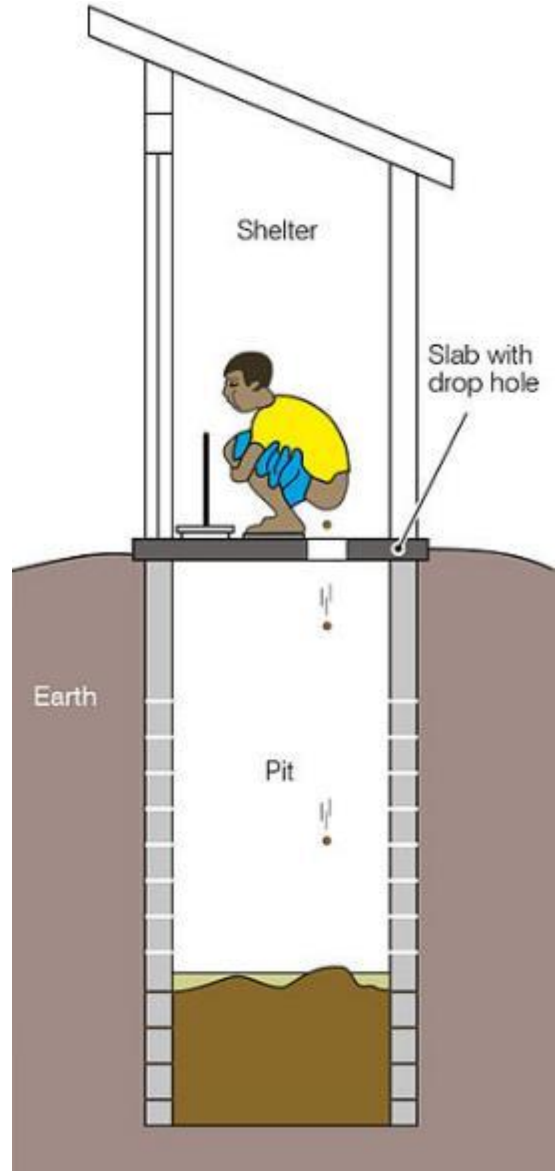
Twin Pit


access covers
vent
inlet
inlet-T
outlet
scum
sedimentation zone
sludge


FINE SCREEN
Screenings
Sludge Recirculation
Raw Water
Permeate
Discharge
Sludge / Grit
BUFFER TANK
PRETREATMENT
AERATION TANK
MBR TANK

Pit Latrines

A pit latrine or pit toilet is a type of toilet that **collects human feces in a hole in the ground**. They use either **no water or one to three liters per flush** with pour-flush pit latrines.




जल शक्ति मंत्रालय
Ministry of Jal Shakti
Government of India
स्वच्छ भारत
एक कदम स्वच्छता की ओर
save water
Save water before it's too late
#NalSeJal






PEMSA 2013

Prevention of Employment of Manual Scavenging Act 2013

NATIONAL

88 manual scavenging deaths in 3 years

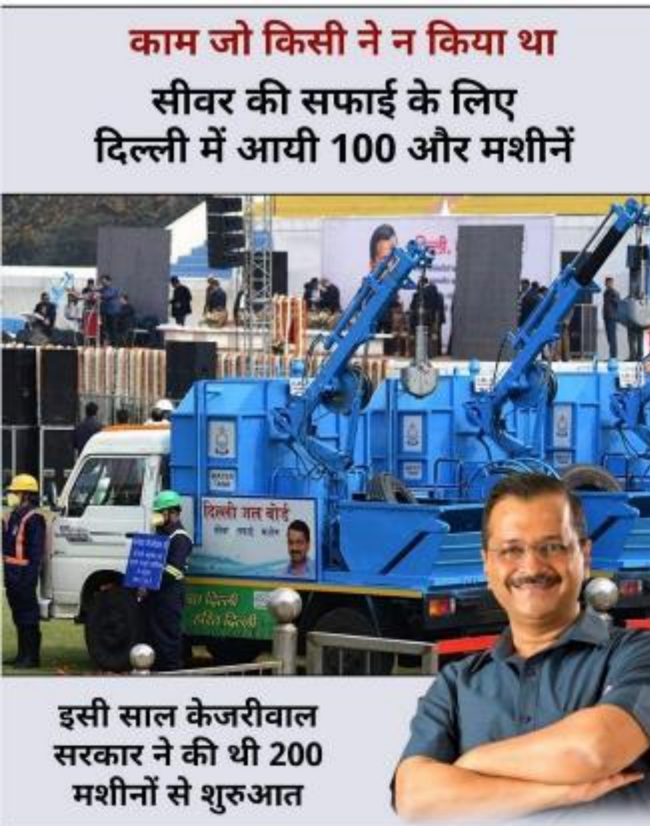
Damini Nath

NEW DELHI, JULY 10, 2019 01:21 IST
UPDATED: JULY 10, 2019 01:22 IST

The MPs had questioned the government over whether it planned on amending the Prohibition of Employment as Man Scavengers and their

x

Insanitary Latrines
and
Manual Scavenging


काम जो किसी ने न किया था
सीवर की सफाई के लिए
दिल्ली में आयी 100 और मशीनें
इसी साल केजरीवाल
सरकार ने की थी 200
मशीनों से शुरुआत

DELHI JAL BOARD
SEWER CLEANING MACHINE

WATER TANK
दिल्ली जल बोर्ड
स्वच्छ दिल्ली
हरित दिल्ली

Vacuum Trucks

Vehicles used for cleaning septic tank mechanically

Process of licensing as per GO-134- Usage of PPE

Current practice of desludging

Emptying and Transportation of Septage

- The operators involved in the cleaning of septic tanks should be registered with the local municipal body

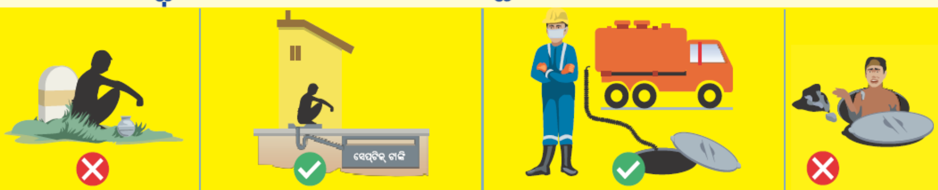
- The registered/licensed operators should be equipped with **uniforms, safety gear, tools and vacuum trucks**. Desludging workers shall wear appropriate **personal protective equipment, including rubber gloves, rubber boots, a face mask, and eye protection**.

Safety Equipment's

- బహిరంగ మల విసర్జన చేయకుండా ఉండటం.
- నిత్యం మరుగుదొడ్డి పైపుల నుండి వచ్చే పైపుని సెప్టిక్ ట్యాంక్‌కి అనుసంధానం చేయటం.
- మరుగుదొడ్ల పైపు నుండి వచ్చే మల వ్యర్థాలని నీటి కాలువలో అస్సలు విడుదల చేయరాదు.

స్వచ్ఛాంధ్రప్రదేశ్ మిషన్, ఆంధ్రప్రదేశ్ ప్రభుత్వము

మల వ్యర్థాల నిర్వహణ అనుచరిద్దాం, నగరాన్ని పరిశుభ్రంగా ఉంచుదాం.



బహిరంగ మల విసర్జన చేయరాదు.	మరుగుదొడ్లలో మల వ్యర్థాలను నీటి కాలువలోకి వదలకండి. ఎల్లప్పుడూ సెప్టిక్ ట్యాంక్‌కి అనుసంధానించండి	సెప్టిక్ ట్యాంకులను కనీసం 3 సంవత్సరాలకొక సారి నిర్ధారిత సెస్ పూల్ వాహనాల ద్వారా ఖాళీ చేయించండి.	మల వ్యర్థాలను చేతులతో తాకరాదు అది హానికరం, చట్టానికి వ్యతిరేకం

మల వ్యర్థాలను బహిరంగ ప్రదేశాలలో వదలకుండా ట్రీట్మెంట్ ప్లాంట్ కి చేరేలా చూడండి.

స్వచ్ఛాంధ్రప్రదేశ్ మిషన్, ఆంధ్రప్రదేశ్ ప్రభుత్వము

వ్యక్తిగత భద్రతా పనిముట్లను వాడాలి.

ఏ విధమైన వ్యర్థాలు వలన కంటికి నష్టం కలుగకుండా కళ్ళజోడు ఉపయోగించాలి.

శబ్ద కాలుష్యాల బారిన పడకుండా హెడ్ ఫోన్స్ వాడాలి.

పని ప్రదేశములలో తల భద్రతకోసం హెల్మెట్ ఖచ్చితంగా వాడాలి.

చెడు వాసన కలిగిన వాయువుల నుండి రక్షణ కొరకు మాస్కులు వాడాలి.

శరీరాన్ని మొత్తాన్ని షూట్‌తో కవర్ చేయాలి.

గ్లౌజులు తప్పకుండా వాడాలి.

ఖచ్చితంగా కాలిగి బూట్లను వాడాలి.

వ్యక్తిగత భద్రత పాటిస్తే వ్యక్తితో పాటు వ్యవస్థ బాగుంటుంది.

ఎమ్.ఎస్.యాక్ట్ 2013 ప్రకారము ఎవరైనా మల వ్యర్థాలను చేతితో తాకరాదు.

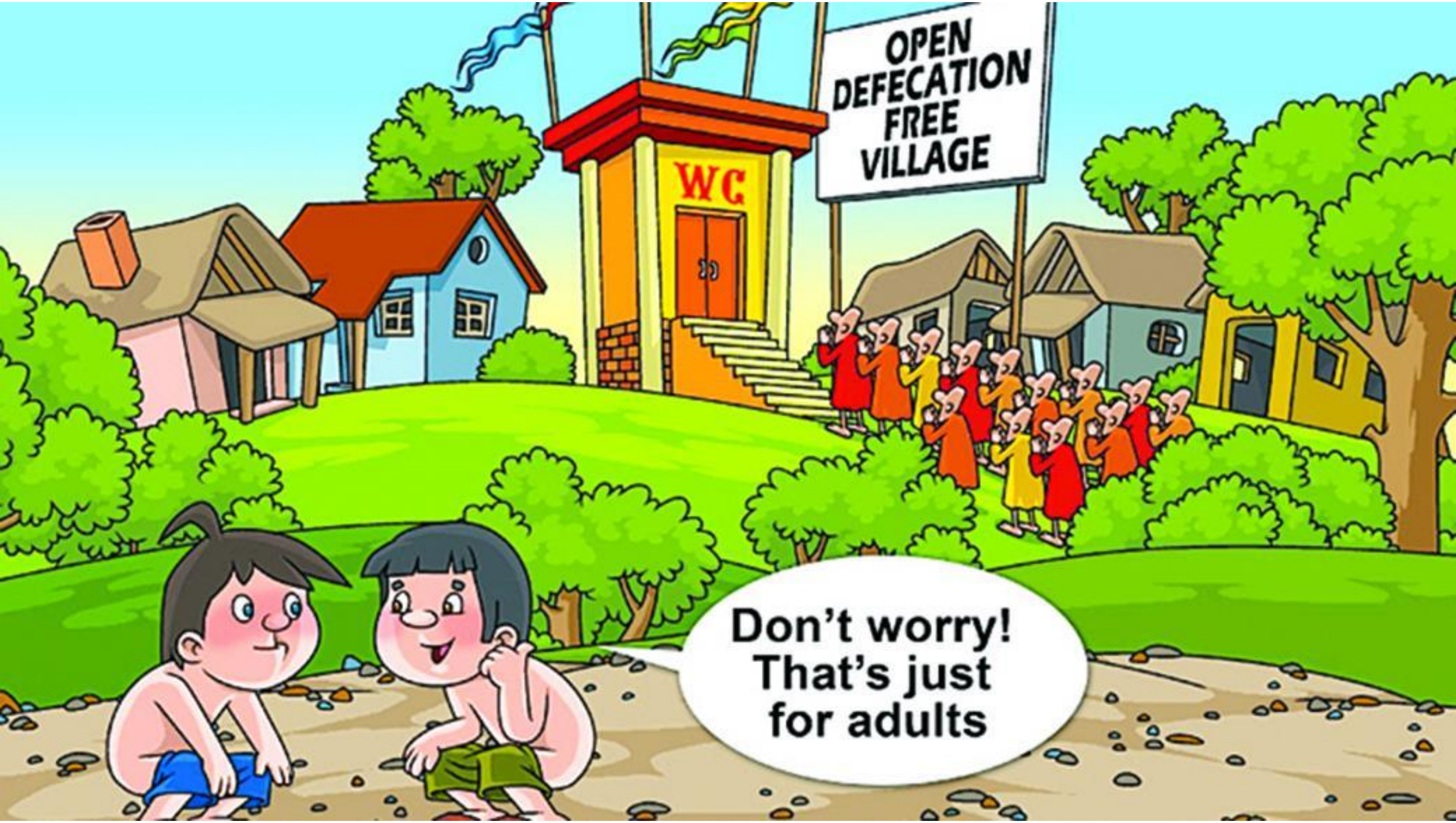
జి.ఓ. 134 ప్రకారం మల పదార్థాలు చేతితో తాకరాదు.

స్వచ్ఛాంధ్రప్రదేశ్ మిషన్, ఆంధ్రప్రదేశ్ ప్రభుత్వము

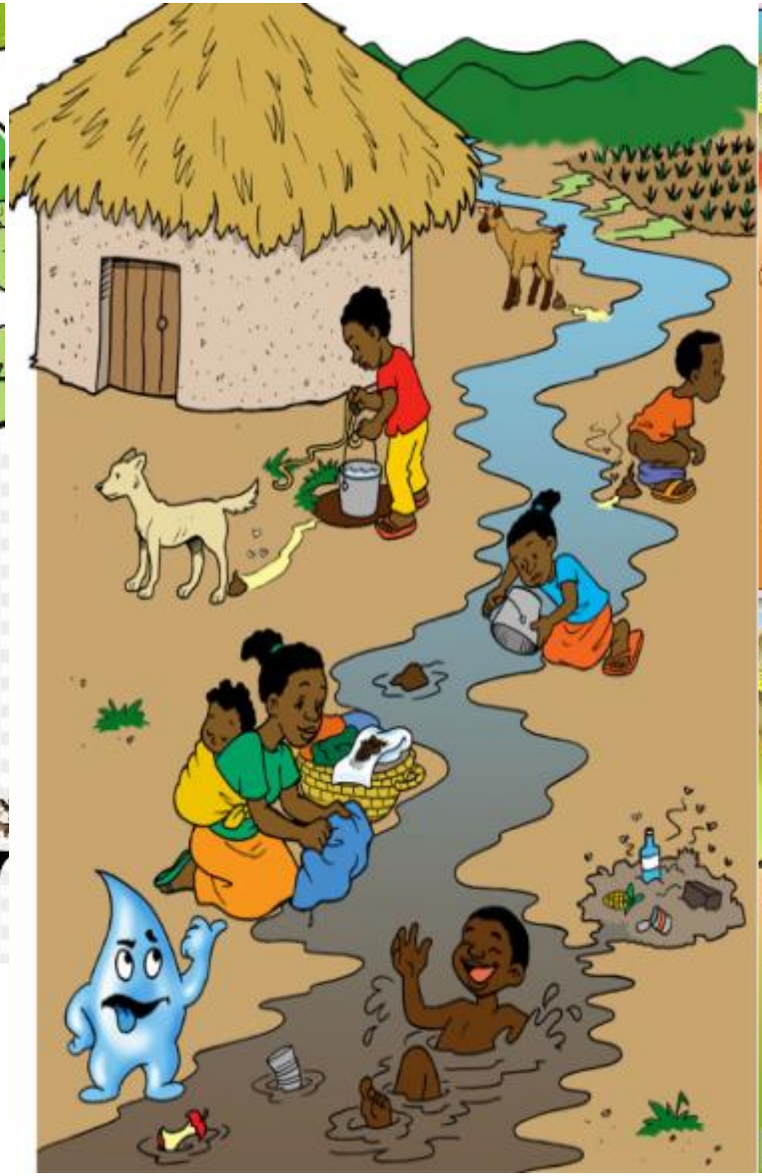
Process of licensing as per GO-134- Usage of PPE

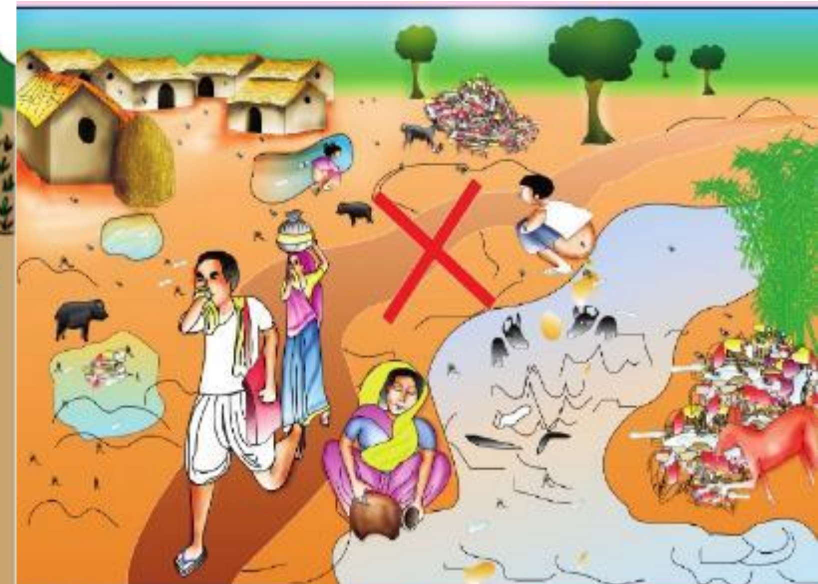
PPE to be used by operators

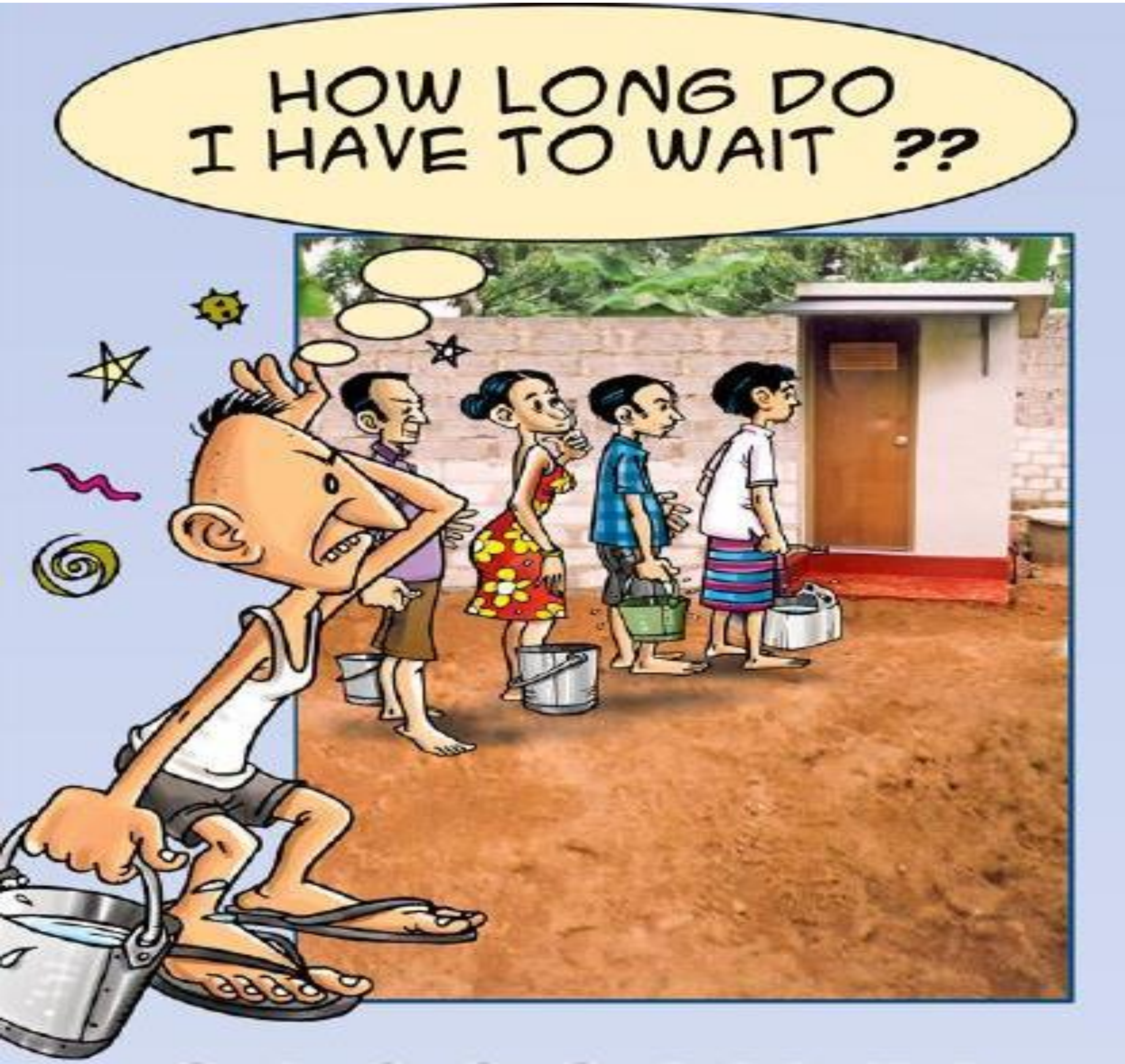
Sustainability


OPEN DEFECATION FREE VILLAGE
WC
Don't worry! That's just for adults

Continue IEC Activities







Norms
For every 25 Women - 1 Seat
For every 35 Men - 1 Seat

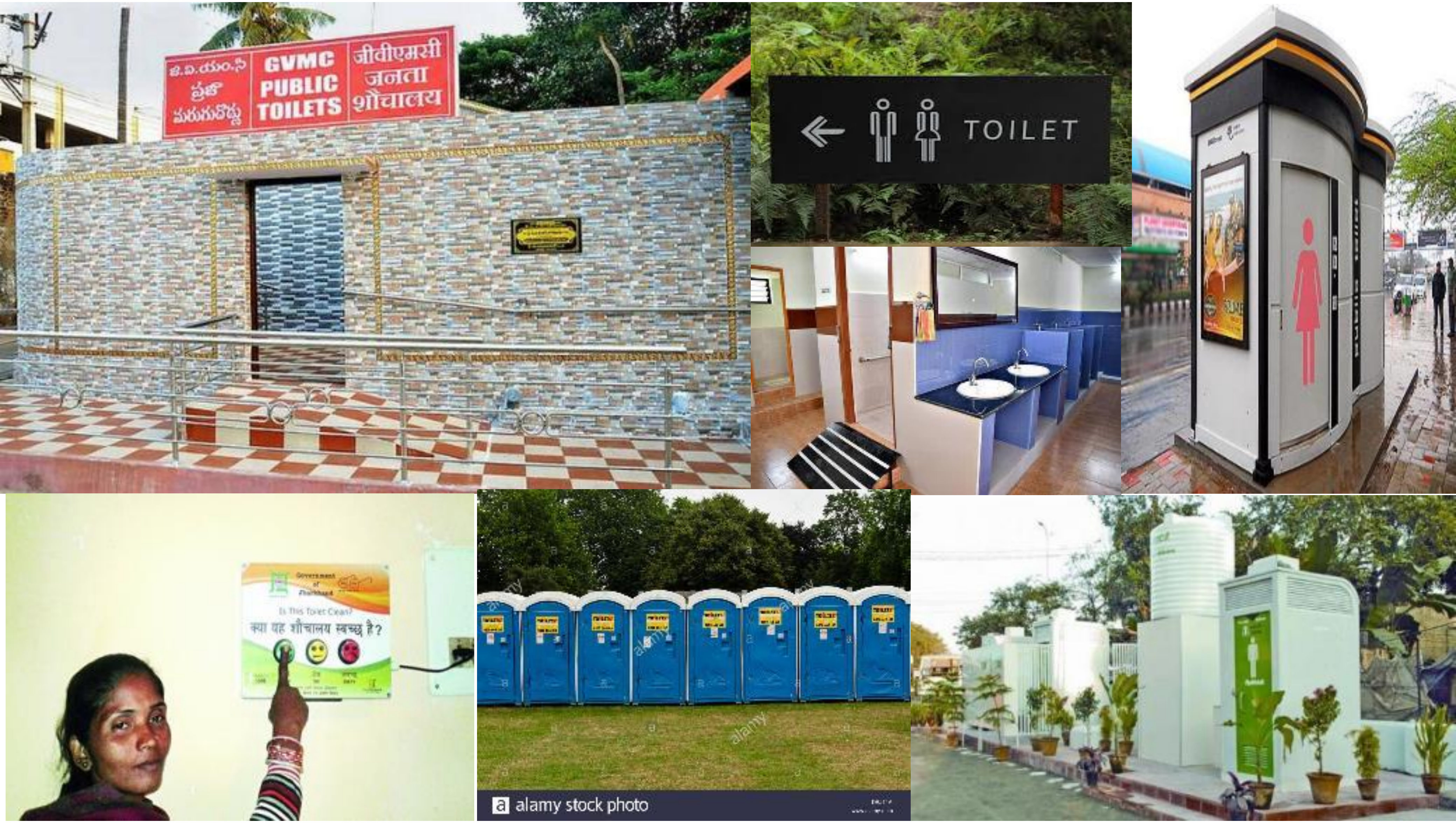

BEST
POOP
POSITION?
SciShow

Signage's for Universal Sanitation Access

Separate Entrance for Men and Women

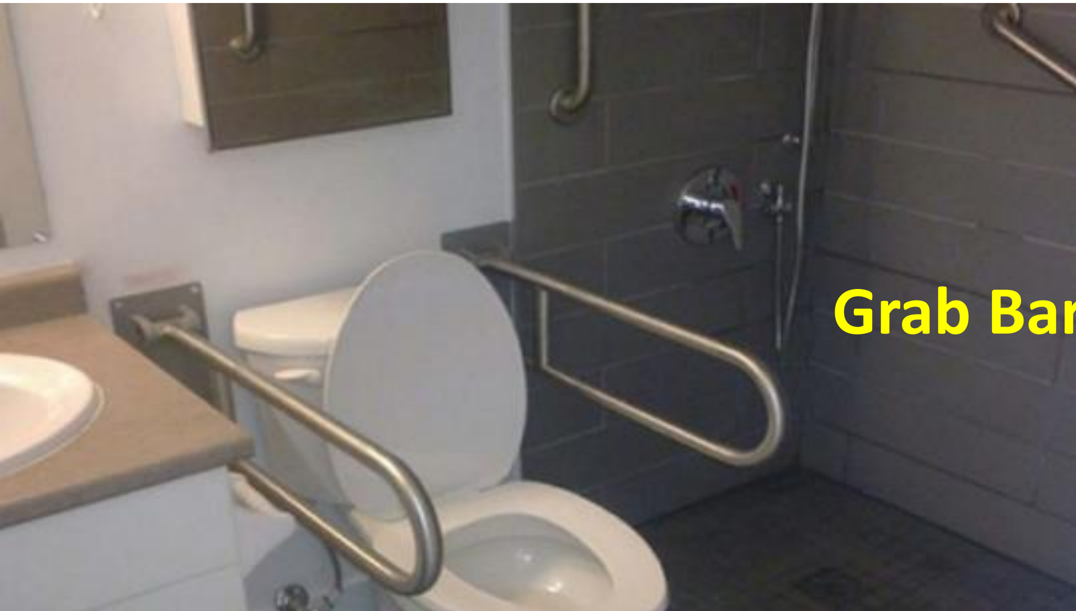

shutterstock

Open Urination is to be eradicated by constructing the Public Urinals



GVMC
PUBLIC
TOILETS
जीवीएमसी
जनता
शौचालय
TOILET
Is This Toilet Clean?
क्या यह शौचालय स्वच्छ है?
alamy stock photo

Grab Bars





కార్పొరేట్ సంస్థల సామజిక బాధ్యత క్రింద నిధుల శోధన మరియు కేటాయింపు

initiated by

funding

unde
r

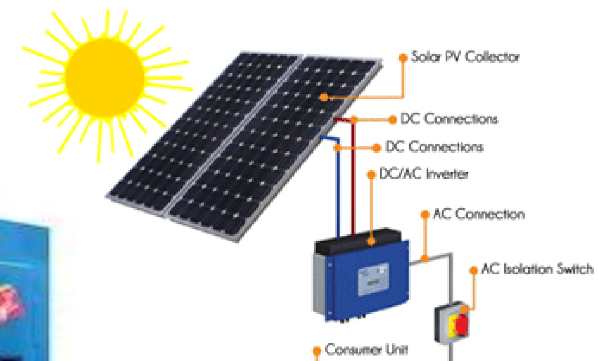
sampoorna
swachhta
sankalp

Andhra Pradesh

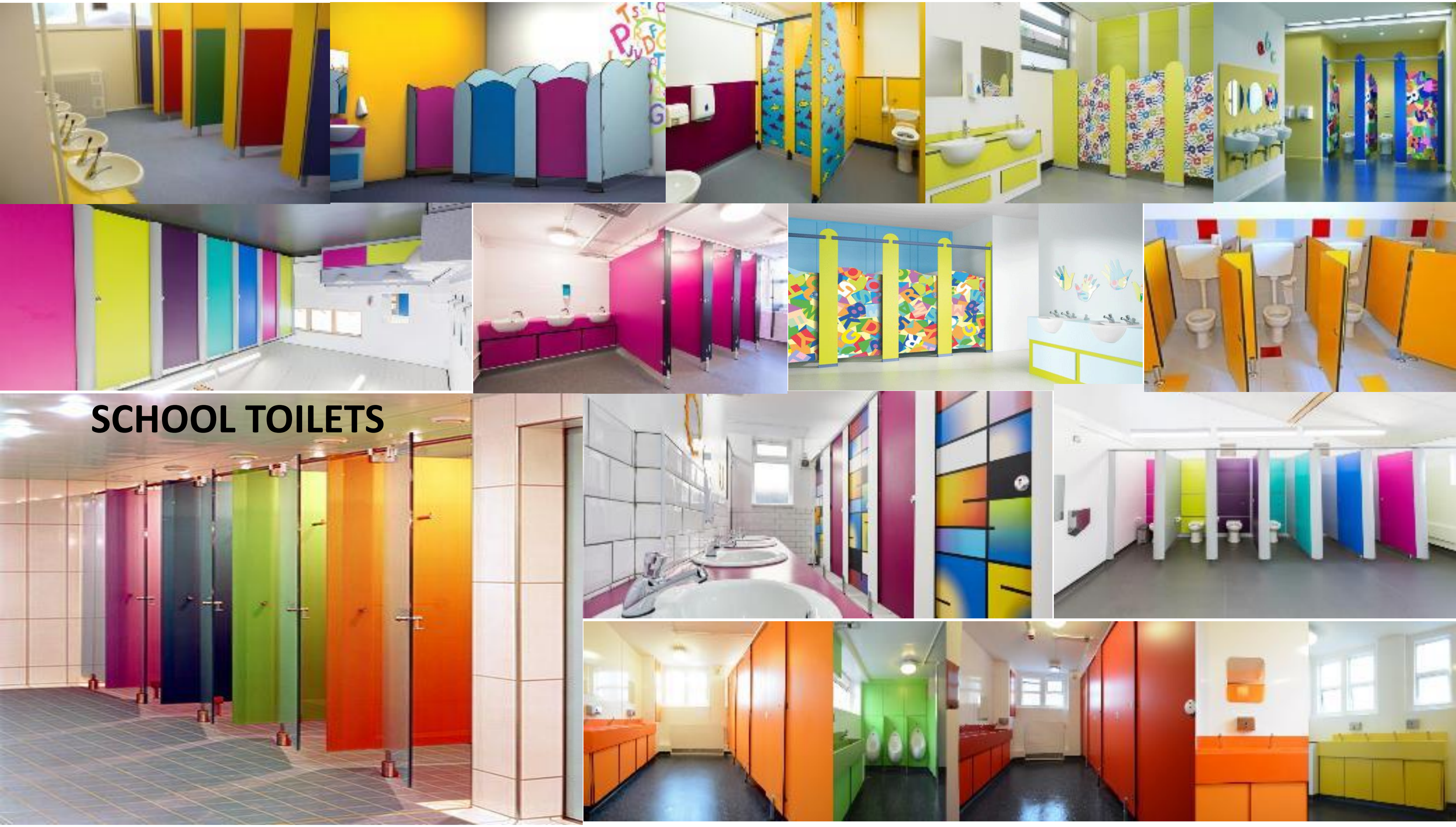
Technical & Knowledge Partners

EY asci THE UNIVERSITY OF CHICAGO

Community and Public Toilets



Construction or Modernization and retrofitting of School Toilets (preferably Model High Schools or schools in slums on the issues of special toilets for girls)


SCHOOL TOILETS

Construction, Repairs, Up gradation, Renovation, Modernization and Retrofitting of SHE toilet complex with modern facilities (preferably in slums if CT or in public places in case of PT)


SheToilet
- Toilet for Ladies -

delight


eToilet

PPE equipment to De sludging operators

Painting of De sludging trucks




- Helmet
- Visor
- Ear Defenders
- Protective Material Clothing
- Safety Gloves
- Safety Trousers
- Steel Toecap Boots


Always wear
your



BIG VAC
WASTE
BIGVAC WASTE
936-872-9062
suez
13 13 35
TANK SERVICES
VICPLANT
LIQUID WASTE
Piggy's
SEPTIC SERVICES

Thank you

16. STPs and FSTPs

17. Prevention of Communicable Diseases