

13.3.8 INVENTORY OF STORES

A reasonable assessment of the stores and spare parts of machinery required over a period of time say, one year or half a year can be made and an inventory of the same prepared. Issues and replacement of store articles could be watched and procurement procedures laid down and supervised. The aim should be that any material required for replacement is available at any time for the maintenance.

13.4 FEATURES OF OPERATION AND MAINTENANCE OF INDIVIDUAL COMPONENTS OF WATER WORKS

13.4.1 SOURCE AND INTAKE WORKS

(a) Sanitary Survey

Sanitary Surveys at regular intervals at field management levels and inspections at supervisory management level should be conducted. The catchment area of the source should be located on the maps. Potential sources of pollution observed in the catchment should be marked. The type of pollution e.g. industrial/domestic waste discharges, wastes of animal origin and agricultural run-offs should be determined.

The quality of such discharges has to be ascertained and its likely effect on water being drawn at source should be mentioned. Reports of such surveys should be promptly sent to the Pollution Control Authorities as well as water works authorities to promote corrective action. Procedure for monitoring of preventive action taken should be laid down and observed. An instant action plan for providing chlorination of raw-water should be available and brought into effect under such circumstances.

(b) Measurement of Flow

In cases of sources such as springs, rivers, canals, etc., there should be a permanent arrangement for recording daily flows near the intake works. Appropriate records in the form of graphs showing variation of flows in the source for each month in a year and for each year shall be maintained. Rain gauge stations should be established to record daily rainfall in the reservoir catchment and appropriate rainfall records should be built up and compared with discharges/storages available. In cases of reservoirs, the regime tables for filling and emptying of storages should be maintained for each year.

13.4.2 MAINTENANCE OF DAMS

- (a) Pre, during and post monsoon inspection of dams should be undertaken to observe settlement, longitudinal/transverse cracks in the embankment/masonry structures.
- (b) Behaviour of spillways should be observed during floods. Procedures for fool proof operation of spillway gates should be prescribed and observed.
- (c) In case of earthen dams, special attention should be paid to slipping of slopes, damages and water seepage. The functioning of sand galleries, drains, relief wells should be watched carefully. In case of masonry dams, sweating, leakages, leaching

of mortar of appreciable magnitude from masonry should be immediately attended to. Pointing of damaged faces of masonry should be attended to promptly.

13.4.3 MAINTENANCE OF INTAKES

- (a) It should be ensured that sufficient water level is maintained at headworks in order to ensure drawal of required quantity of water into intake works without vortex formations.
- (b) All intake strainers should be cleaned at frequent intervals particularly during monsoon to prevent entry of fish or floating matter into intake works.
- (c) All damages to structural components of intake works particularly during floods should be promptly repaired.
- (d) Sufficient stocks of rubble should be maintained at intake works site for use to temporarily overcome the problems of scours at spillways and other places.
- (e) A schedule of painting of steel and other structural parts of the intake works should be prepared and followed scrupulously to avoid damages to the structure.
- (f) All raw-water holding structures such as intake wells, jackwells and inspection wells should be desilted during and immediately after monsoon to remove settled silt.

13.4.4 MAINTENANCE OF PUMPS & PUMPING MACHINERY

(Details are given in Chapter 11)

13.4.5 MAINTENANCE OF TRANSMISSION SYSTEMS

The transmission mains would include raw/treated water pumping as well as gravity mains from source to treatment works, treatment works to master balancing reservoirs (M.B.R.) and from M.B.Rs to service reservoirs in the distribution system. The maintenance problems to be attended to for various types of pipes used in the system could be briefly summarised as follows:

(a) *M.S. Pipes Laid Above Ground*

- (i) Pipes should be painted atleast once in five years to prevent corrosion.
- (ii) Appurtenances such as sluice valves, air valves, expansion joints, rollers should be checked, cleaned atleast twice a year and worn-out parts replaced. The cleaning and lubrication of rollers should also be done twice a year, preferably pre and post monsoon.
- (iii) Expansion joints should be inspected every month.
- (iv) The catch drains provided for the portion of water mains laid in cutting should be cleaned before onset of monsoon so that no water accumulates in the cutting portion, resulting in uplift pressure on pipes.

(b) All Pipes

- (i) Sufficient stock of spare pipes and specials should be maintained for replacement of damaged ones.
- (ii) Regular leak detection surveys should be undertaken particularly for bursting of pipes and leaky joints.
- (iii) A detailed record of break downs and leaks observed and repaired should be maintained section-wise so that more vulnerable lengths could be identified and special measures to repair/replace them could be undertaken.
- (iv) A regular schedule of inspection and attendance to all valves including air and scour valves should be drawn up and the same followed scrupulously. Special attention should be given to air valves.

13.5 OPERATION AND MAINTENANCE OF WATER TREATMENT PLANTS

13.5.1 PROBLEMS

The person in charge of the maintenance and operation of water treatment plants should have a thorough knowledge of the functions of the several units under his control. The problems that may be posed before him may relate to those arising from (a) poor design, (b) faulty execution, or (c) special situation during operation.

A resourceful operator should be in a position to bring to the notice of the concerned person, any faults in design and execution giving rise to problems during the course of operation and rectify them immediately. The other problems which are to be tackled at the operational stage are mainly those which arise out of:

- (a) Fluctuation in the quality of the water;
- (b) Fluctuation in the quantity and changes in the flow pattern;
- (c) Malfunctioning of the unit(s); and
- (d) Mechanical and electrical equipment.

13.5.2 REQUIREMENTS

Maintenance should be carried out in a manner which prevents emergencies and unscheduled shutdowns. An efficient maintenance requires considerable skill which can only be acquired by experience, study and practice. Basically, any maintenance programme should observe the following general rules:

- (a) Keep a set of plans giving details of the several units and indicating the layout and position of all pipelines and appurtenances;
- (b) Establish a systematic plan of daily operations;

- (c) Establish a routine schedule for inspection of machinery and lubrication and maintain records thereof. Instructions for lubrication, the type of lubricant suggested and the frequency of lubrication should be drawn out;
- (d) Main data and record of each piece of equipment giving details of cleaning and replacement of worn parts and other data of importance such as unusual incidents on faulty operating conditions. Details for any special equipment should be obtained from the manufacturers;
- (e) Keep a record of analysis of water collected at various points from the source to the distribution system and observation on the effect of such quality on the several units of operation; and
- (f) List out safety measures including good house-keeping.

13.5.3 RAW WATER

The problem will mainly relate to the change in the quality of the raw water due to natural causes and by inadvertent pollution of the source.

In the case of a river source, a sanitary survey of the catchment area should be undertaken at regular intervals and water samples taken at significant points where pollution is likely to take place. The analysis of these samples will reveal the degree and nature of pollution and thus help in taking the necessary measures to check or control the pollution. If the fluctuations in quality are rapid, the surveys should be undertaken at shorter intervals. Turbidity is not a special problem as the dosage of the coagulant is adjusted on a daily routine. On the other hand a sudden rise in chlorides content will indicate pollution most probably due to sewage. In such cases, more confirmatory test should be undertaken such as for nitrogen in its various forms, dissolved oxygen, oxygen absorbed and chlorine demand to help the operator to decide whether pollution has taken place and to fix the dose of prechlorination needed.

In the case of a lake as a source the periodical biological and physical examination of the samples will indicate if there is any need for control of algae which may lead to taste and odour problems or clogging of filters. Samples taken at different depths in the lake will indicate the level at which water should be drawn to get the best quality of the water.

13.5.4 FLOW MEASURING DEVICES

Float sump should be periodically cleaned to see that silt does not accumulate which may affect the proper functioning of the float. Charts and pen recorders should be stocked adequately. Annual or more frequent calibration of these devices is necessary. Annual servicing and checking of the instruments is imperative.

13.5.5 CHEMICAL FEEDING UNIT

Alum preparation tank is to be painted annually by anti-corrosive paint. V-notch weirs and floats and floating arrangements should be cleaned daily. Enough spares for the mixing device in the chemical preparation should be stocked. Setting of the V-notch should be checked periodically.

Sometimes, if the alum dosing equipment is not in order, the alum slabs are just dumped in the raw water channel. This is bad practice and should not be adopted as it will mean wastage of alum and impropere dosing of alum. Alum should be made into a solution and dispensed until the dosing equipment is rectified. The optimum dosing of alum and coagulant aids should be based on a proper and detailed laboratory study including Jar Test. The chemical feeding rate should be controlled, depending upon the needs from time to time.

13.5.6 RAPID MIXER

Adequate spares should be kept ready in stock for timely replacement when necessary. Life of the equipment could be prolonged by periodical painting with anticorrosive paints.

13.5.7 SLOW MIXER

Slow Mixer should be operated continuously for avoiding sludge build-up. All equipment should be painted with anti-corrosive paints every year. Mechanical devices should be properly lubricated and worn out parts replaced. In non-mechanical type of flocculators like baffle and tangential flow tanks, desludging atleast once in six months is necessary.

13.5.8 CLARIFIER OR SEDIMENTATION TANK

Annual overhauling and repainting of the unit should be done a month or two prior to monsoon.

Sludge lines should be kept free of chokages. The lines should be flushed with high pressure water if chokages are noticed. The telescopic sludge discharge device, when provided, should be checked for free vertical movement and O-rings replaced when leaky.

The traction wheels should be checked for alignment and rubber wheels replaced, if required.

The unit should be worked continuously to protect the mechanical parts from ill-effects of corrosion, malfunctioning etc., as well as problems from sludge build-up. Outlet weirs should be kept cleaned at all times. Algicide or bleaching powder may be used for controlling biological growth on weirs.

The important features in the operation of a clarifier are:

- (a) The introduction of water into the tank with a minimum turbulence;
- (b) The prevention of short-circuiting between inlet and outlet; and
- (c) The removal of the effluent with the minimum of disturbance to avoid settled material being carried out of the tank.

Very often, a basin which is not functioning properly can be modified by making changes to the inlet and outlet devices by installing stilling baffles so as to improve any or all of the important features mentioned above. Algal growth, if any, should be controlled.

13.5.9 RAPID GRAVITY FILTERS

The common problems encountered are:

(a) Defective Gauges

Rate of flow gauges and loss of head gauges frequently get out of order. The operator should be conversant with the working of gauges and should be able to handle minor repairs. Necessary spares should be stocked.

However, even if the rate of filtration gauge is under repair, the filtration rate can be checked whenever desired by closing the inlet valve and observing the time during which the level of water in the filter falls by a measured distance.

For knowing the loss of head when the gauges are out of operation, a temporary arrangement consisting of two glass tubes on each side of a calibrated scale could be provided. One tube is to be connected to the effluent pipe between filter and controller and the other tube to the filter structure above the sand. The relative elevation of the water surfaces in these tubes indicates the prevailing hydraulic gradient or loss of head through the filter.

(b) Inadequate Media on the Filter Bed

Expansion of sand bed during backwashing should be kept within the limits to avoid carry over of sand to wash water trough which would lead to appreciable depletion of sand depth over a period of time. Sand depth should never be depleted by more than 10 cm, when the media has to be replenished. The entire bed should be raked out and additional sand mixed to give the required effective size and uniformity coefficient. Before starting the filter, the sand has to be backwashed to stratify the bed.

(c) Air Binding

This is caused due to the development of negative head and formation of air bubbles in the filter sand. This could be overcome by more frequent backwashing during these periods. Provision should also be made wherever feasible for increasing the depth of water over the bed by about 15 to 30 cm. There are chances of air being released if back-wash is carried out by direct pumping. Air release valves should be provided on the pumping mains in such cases.

The solution lies in providing adequate depth of water atleast 1.5 meters over sand. If air binding persists, loss of heads may be limited to 1.5 meters instead of normal 2 meters. This will discourage air binding and will ensure reasonable length of filter runs.

(d) Incrustation of Media

This problem may arise as in the case of water softening with lime soda when sand gets coated with material that is difficult to remove by normal backwash. The remedy lies in washing the filter occasionally with sodium hydroxide (10 kg/m² area of bed) or bleaching power (20 kg/m² area of bed).

(e) Cracking of Sand Beds.

This occurs mostly when the water is lowered below the surface of the sand. Cracks in a sand bed under water may also arise due to the cementing of the grains by some material in the applied water. The vulnerable portion is near the filter walls, since the sand is drawn away

from the walls. The rate of flow increases through such cracks allowing a heavier deposit of solids at these points, which in turn, intensifies the forces compacting the sand until a dense mass is formed. The degree of this mass may be limited, creating a dead area, resulting in an unequal distribution of the wash water. This can be overcome by the use of hand rake or by draining the bed and removing the clogged sand.

(f) Bumping of Filter Beds

Sometimes careless and indifferent operation may lead to "bumping" or "lifting" of the filter beds when switching on the back-wash for a minute to dislodge the sand bed and recommending filtration without going through the full back-wash cycle is adopted. This practice should be discouraged as the filtrate quality deteriorates considerably.

(g) Mud Balls

These are caused by the general buildup of materials not removed in back-wash. Mud balls accumulate at or near surface and in course of time clog the entire media.

By proper coagulation and settling of applied water, mud ball formation could be considerably reduced. Surface wash or surface raking, or shovelling at intervals helps reduce mud ball formation. Also compressed air scouring during backwash for periods of three minutes, instead of 1 to 2 minutes, effectively decreases mud ball concentration.

(h) Sand Boils

These are caused when disproportionately large discharges of wash water rush towards expanding the sand and displacing the gravel. The situation is encountered mostly due to the poor distribution of wash-water from the underdrain.

(i) Slime Growths

When slime growths are noticed on filters, the bed is cleared in the normal way and the water is lowered to the level of the sand bed. Then common salt is distributed evenly over the surface of the sand, using 7 kg/m² of filter area, after which the wash water valve is opened until water rises about 15 cm. above the sand level. The water is allowed to remain for 2 hours to dissolve the salt and then lowered to the bed level to be retained for 24 hours after which it is thoroughly backwashed before placing into service. If this procedure does not produce effective results, it may be necessary to replace the media.

(j) Backwash Requirements

The waste water drains carrying filter backwash should be kept free of clogging or sediment. If the backwash water is led away quickly, there will be no backing up in water channels or into the filter bed. Incidentally, it may be worthwhile to consider setting up a plain sedimentation tank to recover the supernatant from the backwash water. For the small investment, the water recovery could be appreciable.

The requisite upflow velocity of backwash water should be maintained at the design rate for proper cleaning of the sand. The practice of backwash at reduced rate for longer periods should be avoided as it leads to wastage of water and washing becoming ineffective.

Backwashing of filters should not be based on arbitrarily fixed time schedules but the frequency should be in accordance with the filtrate quality and head loss measurement. Duration should be dependent upon the turbidity of the wasted water.

13.5.10 SLOW SAND FILTERS

The inlet float valve should be periodically checked with a view to maintain the desired level in the bed.

The outlet weir arrangement should be checked periodically with a view to ensure the design rate of filtration. Where there is telescopic arrangement, it should be functioning smoothly and without drawing in water through the sides. Where manual adjustment is to be done with increasing filter heads, this should be done at specified intervals.

The filter head indicator should always be kept in working condition. When a filter is clogged, most of the head loss is restricted to the top layer of sand and if the filter head exceeds 1m, pressures below atmospheric can occur in sand gravel and in the under drains, leading to air binding or dissolved air coming out of solution. Occurrence of negative head can be avoided by placing the sill of the outlet weir in level with the top of the sand bed.

It is most important to avoid rapid fluctuations in filtering rates. Cleaned or resanded filters should be brought up gradually to the maximum filtering rate and maintained as far as possible at a constant rate until the head reaches the maximum of 1m when the bed should be taken up for cleaning.

On no account the filter bed be allowed to get reduced by disturbing the top of the sand as this will impair the bacterial efficiency of the filter.

13.5.11 CHLORINATORS

The chlorine demand of filtered water is to be satisfied and a free chlorine residual maintained to make it completely safe. Hence the operator should be careful in administering calculated doses accurately.

Bubbling the chlorine gas through the filtered water stored in the clear water reservoir by dipping rubber tubes connected to chlorine cylinder must be avoided. Chlorine application should be done through a chlorinator only. The chlorinator should be maintained properly. If the unit is out of order, the same should be repaired quickly and recommissioned.

A complete understanding of the principles of operation of chlorine gas feeders and familiarity with tests for pinpointing leakages are essential. Low capacity units require frequent cleaning of the rotameter and rate setter. Large capacity chlorinators must have vaporisers. The gas piping and feeders should be completely dismantled every one or two years to clean out accumulated impurities.

13.5.12 CLEAR WATER SUMP & RESERVOIR

Roofing should be periodically checked to ensure that no leakages are there so that pollution can be prevented. Ventilator outlets should be regularly checked and cleaned to

guard against mosquito breeding and bird droppings. Cleaning of the sump and reservoir should be done regularly. Level recorder should be kept in working order at all times.

The total capacity of clear water reservoirs should be adequate for storage of treated water, especially during low supply periods at night when reservoirs become full. Instances are reported, where water from the filters have backed up into the inspecting galleries, thus reducing the rate of filtration. The remedy lies in having additional clear water reservoir in the plant, or arrangement for the final water to be automatically pumped to the balancing reservoirs in the town.

13.5.13 TREATED WATER

The quality of the water before distribution may be controlled by adjusting the calcium carbonate balance in the water to safeguard against corrosion or excessive scale formation in pipes. The periodical analysis of the water can also indicate if there is any biological growth in the main and if any further chlorination is needed to check it. The samples of water collected from several points should be routinely examined for residual chlorine and other chemical and bacteriological parameters.

13.5.14 PROBLEMS RELATED TO THE QUALITY & FLOW PATTERN

When flow gets reduced, it may not be desirable to cut out certain units but it is preferable to operate all the units with reduced flow conditions. In any case, the flow-through condition in the several units should be periodically studied using appropriate tracers. This will help to locate if there is any short-circuiting so that corrective measures can be adopted.

The flow conditions in open channels should be examined periodically to avoid obstructions and heading up which will affect the unit process especially the efficiency of the clarification units.

13.6 AERATORS

Aerators are required to be maintained in a clean condition so that maximum water surface and agitation are provided.

Slime and algae growth on the surface would require cleaning and periodic treatment with copper sulphate with or without lime to kill growth. The porous plates or tubes used with diffusion areators may become partly clogged either from dust in the compressed air or from the collection of sediment on the outside surfaces. When areators are shutdown, appropriate cleaning with detergents or acid and brush should be attempted. Clogging of diffuser plates could be minimised by (i) maintaining air filters in effective operation, (ii) not over-lubricating air compressors and blowers, (iii) maintaining air pressure on diffusers, when compressors are shut down.

13.7 MASTER BALANCING RESERVOIRS AND ELEVATED RESERVOIRS

Important aspects to be considered during maintenance are:

- (i) Measurement of inflows & outflows : Whenever measuring devices are provided, it should be seen that discharge at inlets and outlets fairly tally. It should be seen that water level indicators and recorders are in proper working order.
- (ii) Structural Leakages : All structural damages and leakages should be promptly repaired.
- (iii) Preventing External Pollution : The manhole opening, ventilating shafts and overflow pipes should be properly closed and protected with wire gauge from external pollution.
- (iv) General cleanliness in and around the reservoirs should be maintained and observed. A garden around the reservoir structure may be provided.
- (v) A programme for periodical cleaning of the reservoirs atleast once in a year should be undertaken. During such cleaning process there should be facility to by pass the supply to distribution system.
- (vi) Appropriate safety measures to prevent climbing of unauthorised persons should be provided. All the railings provided shall be maintained in a safe and firm condition.

13.8 DISTRIBUTION SYSTEM

Important aspects of operation and maintenance of distribution system are detection and prevention of wastage due to leakage. The object is to control the waste within reasonable limits. Further in case of intermittent supply, possibility of pollution of empty pipelines cannot be ruled out. Special inspection of pipelines through marshy or high water table areas, crossings across waste channels, pipes, etc., and in the vicinity of sewers should be carried out at regular intervals. Such areas should be identified on plans and bacteriological tests of tap water in such areas need to be done more frequently and results compared.

A regular programme of leak detection should be undertaken for the entire distribution system such that each section of the system comes up for leak detection atleast once in three years. Leaks and damages detected should be promptly repaired. The causes of wastage through leakages such as (i) high pressures in distribution, (ii) corrosive soils, (iii) corrosive water, (iv) inferior quality of pipes and fittings, (v) age of pipes, (vi) gland packings of valves etc. should also be ascertained. The repair work should tackle those causes as well.

In a distribution system complaints are received frequently from consumers about

- (a) Non-availability of required quantity of water
- (b) Low pressure at the supply point
- (c) Leakages & wastages through valves & pipelines
- (d) Unauthorised connections.

One of the major causes of wastage is unauthorised connections. Procedures for granting connections need to be streamlined. The officer incharge of operation & maintenance of

distribution system should have powers to inspect any household for water supply to know as from where that household is taking water.

The entire distribution system could be divided into sub-zones served preferably from one elevated service reservoir. The maintenance and operation of each zone of distribution system should be entrusted to atleast a junior engineer who should be made the authorised official of the controlling authority to receive and deal with the complaints. Appropriate registers should be maintained by him to record the complaints and to note in it the follow-up action till the complaint is redressed. If the complaint is such that it cannot be dealt with at his level, he should at once refer the matter to higher authorities under intimation to the complainant. Frequent vigilance checks in the areas having maximum complaints should be made a part of the duty of the supervisory staff.

It is preferable to have meters provided by the water works controlling agency after charging appropriate monthly rentals to the consumer. This enables effective control over defective meters. Meter repair workshops should be established to attend to repairs of meters promptly. Surface boxes and chamber covers of valves should be frequently inspected and kept in proper condition. Billing for an out of order meter for more than three times consecutively should be avoided. All attempts should be made to repair/replace out of order meters once these are detected.

Sufficient stock of meters and spares should be available at hand to keep almost every meter in the field in working order.

Comprehensive water rules should be framed to make the maintenance operation most effective.

The consumers should be made aware of difficulties and shortcomings in the maintenance and operation of water supply system. Adequate publicity and public relations are required to be developed for this purpose.

13.9 CONTROL OF QUALITY OF WATER

For a waterworks industry, ensuring an appropriate quality of water to the consumer is its primary responsibility. Quality control is, therefore, required at every step in the water supply process. The physical, chemical and bacteriological tests of water samples need to be carried out at as frequent intervals as required. Reference may be made to Chapter 15 for more details. The results of these tests should be studied and remedial measures taken promptly as and when required.

These tests are usually needed at:

- (i) Source-to determine the raw water quality;
- (ii) Treatment Plants-to determine whether the treatment is in conformity with raw-water quality; and
- (iii) Distribution system-to determine whether adequate residual chlorine is present in the water supply to consumers.

13.10 TASTE & ODOUR CONTROL

The following measures are applicable in taste and odour control:

- (a) Routine examination of samples of raw, settled and filtered water and samples from distribution system for taste & odour;
- (b) Periodic Treatment with copper sulphate and by chlorine;
- (c) Routine maintenance by flushing distribution system, especially at hydrants served by dead-end mains; and
- (d) Maintenance of records of consumers' complaints and corrective action taken so that it can serve as guide for future.

13.11 STAFF PATTERN

Recommended Staffing Pattern for Operations & Maintenance of Waterworks for various capacities is given in Appendices 13.1 to 13.7.

CHAPTER 14

WATER WORKS MANAGEMENT

14.1 LEVELS OF MANAGEMENT

In India, 'Community Water Supply Systems' are normally managed by local bodies. In a few specific cases these are managed by State Government Departments, where the system is supplying water to more than two local body areas, the bulk supply component of the system is some times managed by statutory Water Supply Boards set up by State Governments. This service facility falls under the water supply and sanitation sector. The development of this sector is assisted at three levels.

14.1.1 GOVERNMENT OF INDIA (G.O.I.) LEVEL

Broad policies on sector development of water supply system in urban and rural areas are formulated and circulated to State Governments and Union Territories as guide lines. Technical manuals are drafted and published for use by the Water Works Industry. General progress in providing these services in the urban and rural areas is monitored. External or G.O.I. assistance as required to needy areas is offered for capital investment and implementation of water supply schemes. Certain in service training programmes for the employees of the Water Works Industry in the states are sponsored. Financial assistance for specific inservice training programmes of the states is offered.

14.1.2 STATE GOVERNMENT LEVEL

The State Governments offer to assist the local bodies in planning and implementation of water supply schemes of individual or a group of local bodies. Financial assistance is also given for these local body schemes in the form of Grant-In-Aid (GIA) and loan etc. for capital investment. In certain special circumstances, the State Governments assist the local bodies in operating and maintaining their water supply schemes wholly or upto bulk supply level through its own departments or through the statutory boards of the state governments. Trained engineers and skilled workmen are sometimes deputed to local bodies on request, to plan, implement and operate the water supply systems. The state governments monitor general progress of water supply schemes of local bodies in respect of planning, implementation, operation and maintenance.

14.1.3 LOCAL BODY LEVEL

It is the obligatory responsibility of every local body (municipality, village panchayat etc.) to provide potable water supply to the residents of the area under their respective jurisdictions. Depending upon financial status of each local body, the State/Central Governments come to the help of these local bodies to meet a part/whole of their capital investment cost on water supply augmentation/improvement schemes in the form of GIA, and/or loan. The expenditure on annual operation and maintenance of these schemes has, however, to be met by the local body out of its own revenue to be generated from water charges and water tax. As per the respective acts of local bodies, they have been empowered to levy and recover water charges and tax from the consumer to whom water facility is created by the local body.

14.2 COMMON ASPECTS OF WATER WORKS MANAGEMENT

The aspects considered in this chapter refer to management of operation and maintenance of water supply systems. There are five important aspects of management that could be considered, namely, (i) General Administration, (ii) Personnel Administration, (iii) Inventory Control, (iv) Financial Control and (v) Public Relation. The system has to work as a unit management organisation and as a business enterprise. The management in general should aim at the following achievements.

- (a) The quality of water supplied should be safe.
- (b) Service to consumers should be satisfactory.
- (c) Operations should be safe and self supporting.
- (d) Financial management should be sound.

An efficient and effective management of water supply systems is most essential for their proper functioning.

14.3 GENERAL ADMINISTRATION

This could be further sub-divided into two categories, viz; (a) Supervisory and (b) Operational. The operational level is to be subordinate to supervisory level.

The supervisory administration is expected to control all the functions of management. Water works is an engineering service. Hence it is a general practice to set up an Engineering Supervisory Organisation on the considerations of annual work load expenditure to be handled by the organisation. These units are (i) an Engineering Division Unit and (ii) an Engineering Sub-Division Unit. The 1988 norms for establishing these units and the staffing pattern could be considered approx. as shown in Appendix 14.1. Annual work load per unit could be enhanced or reduced depending upon local conditions such as high cost of power consumption or wider area to be covered e.g. for regional schemes etc. The works expenditure considered in the norms is inclusive of all expenses incurred during annual O & M of water works. It is suggested that the functions of sanction to water connections and revenue collection due to sale of water on meter/flat rate/stand post basis should be wholly entrusted to these Engineering Units for better management and control. If the annual work

load of water works or a group of water works controlled by one local body/agency is higher than that justified for one Division, then additional divisions together with apex supervisory units such as a Superintending Engineer's Unit/Chief Engineer's Unit, etc. could be established. These Engineering Units would be administratively controlled by the head of engineering department and/or the elected local bodies of the town or village and their Committees.

14.3.1 DUTIES AND RESPONSIBILITIES

The duties and responsibilities of these supervisory units could be listed as under

- (a) To supervise and manage the water works.
- (b) To develop annual operation and maintenance (A.O.M.) programme and the budget.
- (c) To implement A.O.M. Programme using appropriate planning and scheduling techniques.
- (d) To keep accounts, records of the materials and tools, work performance and money spent on work establishment.
- (e) Periodically (say monthly/quarterly) inform the owner about the status of O&M programme and budget.
- (f) Prepare special reports as required to ensure economical and efficient use of resources.
- (g) Schedule, assign and monitor work being done by personnel in the organisation.
- (h) Purchase equipment, tools and supplies required to carry out O&M programme.
- (i) Provide inservice training.

In addition to the above, it should also look into the following aspects:

- (a) That there are adequate maintenance facilities.
- (b) That the operations are smooth.
- (c) That the maintenance is efficient and economical.
- (d) That the administration is efficient and responsive (task assigned to the manager).
- (e) That the equipment and supplies are controlled properly.
- (f) That good public relations are established.
- (g) That appropriate plans for future expansions are drafted.

Some of the additional tasks that these supervisory units are required to handle could be briefly stated as under:

- (a) The entire work of O& M could be grouped into logical tasks or functions. Each function may be assigned to a group of workers.

- (b) Wherever found necessary and in the interest of work powers could be delegated to subordinates.
- (c) The organisation could be flexible in order to enable it to respond to changing work load and work conditions.
- (d) Organisation manual and charts could be developed containing (i) Role of Organisation, (ii) job descriptions, (iii) Statements; etc.
- (e) O&M schedules could be prepared assigning works to individuals.
- (f) Works could be checked to see that these are being done as required/ expected.
- (g) O & M manual could be developed to include (i) Description of system. (ii) System operation, (iii) Special items to be considered, (iv) Lubrication and maintenance, and (v) Repairs etc.
- (h) Office operations include answering telephone calls, handling correspondence, records, typing letters/statements, standardising work forms for transmission of information etc.
- (i) Compilation of statistical information: The task would include (i) Quantity of water pumped/gravitated into system, (ii) Quantity of water billed/ sold to consumers, (iii) Consumer patterns, (iv) Rate of increase in the number of consumers, (v) System losses, (vi) System maps including location of connections, (vii) Delivery capacity of the system at different stages, (viii) Relation of supply to demand in a tabular or charted form.
- (j) Number and nature of complaints received

14.3.2 GENERAL ADMINISTRATION AT OPERATING LEVEL

The establishment required at operating level of a water works is determined on the basis of physical work output to be expected from each individual. A general guide line for the creation of some of the categories of staff at operating level is indicated in Appendix 14.2. The requirements are expected to vary according to individual circumstances, like topography and geographical locations etc.

For optimum output from each of the operating staff certain modern business principles could be introduced such as:

- (a) Unity of Command - Each worker should report to only one person incharge. One person incharge may not have more than 8 to 10 person for direct control.
- (b) Each worker must have a clear understanding as to the expectations of the job from him by the supervisory units.
- (c) The worker should be given the relevant extract of the operating manual.
- (d) Regular work forms should be maintained by each worker and submitted to controlling person incharge.

- (e) Service records of each worker should be kept upto date by supervisory section and all dues paid to him on time.
- (f) All possible service facilities should be provided to the operating staff so that he can devote his full attention to work entrusted to him.
- (g) Personal grievances of workers should be attended to promptly.

14.3.3 PERSONNEL ADMINISTRATION

The personnel administration can be classified into four categories, namely:

- (a) Describing and classifying work by developing job descriptions, establishing qualifications and goals for each position and developing wage and salary structure.
- (b) Recruiting and selecting employees by evaluation.
- (c) Evaluating the work of the employee by a system of evaluation norms such as confidential reports etc. The tasks should be identified and achievements mentioned against each task. General assessment made on these basis and report prepared. The evaluation may refer to (i) Knowledge, (ii) Punctuality, (iii) Quality of work, (iv) Dependability, (v) Initiative, and (vi) Tolerance of criticism.
- (d) Inservice training of employee (described separately hereafter).

14.4 INVENTORY CONTROL

Inventory control is the process of managing supplies required for day-to-day O&M of water works. It involves (a) deciding what supplies to be stocked, (b) keeping a record of supplies and their locations, and (c) accounting for all receipts and issues of supplies.

Many of the water works failures require spare parts or supplies available instantly to put the system back in working condition. These supplies have got to be ready at hand any time the failure occurs and repairs are to be carried out. Materials of stock would pertain to items which have frequent usage and items of emergency repairs.

Inventory control cards are vital documents to serve the purpose of accountability and stock demand by reflecting usage pattern. They enable stock control and record purchasing information.

Inventory control would include tools required for O & M of the system, although new purchases for these may not be as frequent as for stock materials for repairs and replacement. Requirements have to be checked at intervals.

14.5 ACCOUNTING & BUDGETING

Accounting is the process of recording and summarising business transactions that affect the financial status of the O & M organisation of the water works. It is an important tool for monitoring revenue and expenditure activities and for interpreting the financial results of the organisation.

Budgeting is the art of interpreting the goal of O & M organisation in meaningful monetary terms. It should be used to control the financial activities of the organisation.

Accounting system would involve the following functions.

- (a) A basic chart of accounts for the organisation.
- (b) Accounting reports such as income and expenditure statements, balance sheets, cash flow statements and debt servicing, etc.
- (c) Annual O & M budget.
- (d) A frequent review say quarterly, of income analysis from customer class is desirable.

This would enable the supervisory unit and the authorities of the water works to decide at what level, a review of water tax structure is called for. It would also review ways and means of effecting recovery of outstanding dues from consumers. Legal powers of the authorities to effect full arrears recovery from consumers may have also to be examined periodically and enhanced if required by legislation. A review of expenditure pattern on the basis of revenue realised could also be simultaneously done.

It would be desirable to keep financial records of the system to include:

- (a) Updated valuation of the system.
- (b) Depreciation.
- (c) Operating expenses.
- (d) Investments in new capital improvements.
- (e) Long term debts, their servicing,
- (f) Appropriate schedules of water rates.

Development and implementation of appropriate water rates would go a long way in helping to generate adequate annual revenues of the water works.

14.6 INSERVICE TRAINING

The object of well founded short term in-service training for the employees of water works undertaking is:

- (a) To improve group level of operational efficiency.
- (b) To acquaint the group with the new developments.
- (c) To develop amongst the members of the group a better understanding of human relations and concept of their individual responsibility to the community.
- (d) To bring about and increase community awareness of water works operation.

The training could include:

- (a) Orientation courses to describe duties and responsibilities of individuals in the organisation.
- (b) Providing an employee with a handbook.
- (c) On the job training to work with experienced employee for some time.

- (d) Work shops, short courses and seminars on concerned subjects.

The subjects to be included in the training could be :

- (a) How to perform a number of specific jobs well.
- (b) Lectures on practical aspects of subjects covered under O&M of water works,
- (c) Laboratory control tests.
- (d) Physical, chemical and bacteriological examination of water and interpretation of results.
- (e) Disinfection.
- (f) Design of component works of scheme.
- (g) Supervisory control.
- (h) Systems management and Administration.
- (i) Accounting, budgeting and financial management.

Each one of the supervisory and operating staff on the water works should be subjected to appropriate training course depending upon work to be handled by him atleast once in three to five years of his service period.

14.7 LONGTERM PLANNING

One of the important functions of a water works management is to develop technical and financial plans for future expansion of the water works. For this purpose, the management should review periodically, present adequacy and future requirements. Some of the aspects to be reviewed could be:

- (a) Analyze the ability of the system to deliver water of acceptable quality, adequate quantity and under sufficient pressure at times of max. demand.
- (b) Forecast future requirements, determine the areas and population to be served and the future likely consumption.
- (c) Co-ordinating construction and financing.

It is much better to keep up and improve the system through small construction programmes undertaken yearly than to allow deficiencies to accumulate. The yearly improvement should be planned to fit in with the prospective objectives and requirements.

- (d) The planning for future expansions require knowledge of original designs and basis for present water system.

There is no harm for the local bodies in soliciting assistance from external agencies such as Governments and consultants for development of future plans and implementation programmes as required.

14.8 PUBLIC RELATION

The object of public relations is to develop:

- (a) Consumer satisfaction
- (b) Opportunity for the community to know how works are managed.
- (c) Frequent dialogue between the community, owner and management.
- (d) Art of keeping owners informed about day to day working of the system, shortfalls, if any, and assistance required.
- (e) Interpretation of articles in the news papers about O&M situation, deficiencies, deviations, etc., based on facts and figures.

Sufficient publicity needs to be given to O&M work being done by the management, difficulties experienced and cooperation required from public to make good the deficiencies, if any. Information could be given in news papers. Appropriate talks could be given on T.V., A.I.R. etc. All criticism in the press about O&M of the system could be promptly attended to and appropriate replies published, preferably in the same news papers in which criticism appeared.

In addition to the above activities, publicity of O&M work is automatically enhanced if;

- (a) Every employee of the management who makes public contacts adopts a helpful and courteous attitude towards consumers and public.
- (b) Personal interest is shown in consumer's complaints and problems and these are dealt with promptly with courtesy and commonsense.
- (c) Consumers are encouraged to visit water works which should be kept clean, tidy and in good repairs.
- (d) Good relations are established with local press by providing fullest possible information on the O&M of water works.
- (e) Contacts are established with benevolent, social, health and educational bodies.
- (f) Small pamphlets on water works are periodically published and distributed.