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WATER, ENVIRONMENT AND MANAGEMENT

Canal based gravity water supplies

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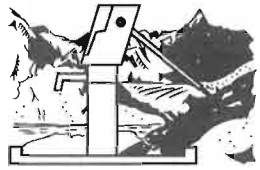


PROLOGUE

The 445 km long Indira Gandhi Canal (IGN) is a very ambitious canal system which brings Himalayan water to the North Western and Western regions of Rajasthan State of India situated in the Thar desert. It envisages to bring prosperity to this economically backward area by bringing 15.4 million hactare desert area under cultivation. For an integrated development of the area, the Command Area Development Authority undertakes work of construction of field channels, approach roads, afforestation, pasture development, fishries, agriculture research and extension, development of marketing facilities and providing drinking water supplies for the abadies (basic community units).

NECESSITY OF DRINKING WATER SUPPLY

The prime objective of multifarious development cannot be achieved unless people settle in the area and start utilising the available canal water by undertaking agricultural works. For promo ting settlement of people, availability of potable and wholesome drinking water supply is a prerequisite.

MACROLEVEL PLANNING

The whole area lying in command of the IGN canal system is divided into number of small units of about 214 hactare culturable command area (CCA) named as "Chak". Between 5 to 6 Chaks, one "Abadi" has been planned. People, having their field in various chaks belonging to that abadi, live here. For the purpose of providing drinking water supply, an abadi is considered as individual entity and drinking water supply is provided through "Sanitary Diggi (S.D.) Units".

MICROLEVEL PLANNING

The planned prospective population of an abadi is 1000 souls. The rate of water supply is taken as 70 litres / capita / day, which also includes requirement of drinking water for the cattle. Since the canal system runs on rotational basis, raw water storage facility capable of storing water required for closure period is provided. The source water predominantly contains impurities like turbidity, taste and odour and sometimes bacterilogical impurities. As such, unit treatment processes of plain sedimentation, filteration and disinfection are adopted.

CONSTRUCTION

The SD Unit is a structure which does not have any mechanical parts. The water from canal flows under gravity and no pumping is required. Various elements of a SD Unit are as follows :

Outlet :

A pipe outlet is fixed in the source canal. The outlet is designed to discharge quantity of water adequate enough to fill the storagae tanks during canal running days.

Inlet Chamber :

It is an RCC/Brick masonary cylinderical structure open from the top. It is constructed near the source canal and has a height equal to the top level of canal so as to avoid overflow. A baffle wall is constructed in it so as to reduce some of the silt load.

Conveyance System :

For conveyance of raw water from inlet chamber to storage tanks, invariably pipe line of sufficient size is provided, as an open channel would be subjected to frequent choking due to wind blown sand.

Storage Tank :

Two storage, tanks each having capacity equal to half of the required capacity, are provided to facilitate alternate cleaning. The storage tank is an underground frustum of cone shapped structure

lined with 250 micron thick Low Density Polyethelene film overlaid by single layer of clay bricks fixed in cement mortar and sandwich layer of cement mortar. The tank is open to sky.

Filter Unit :

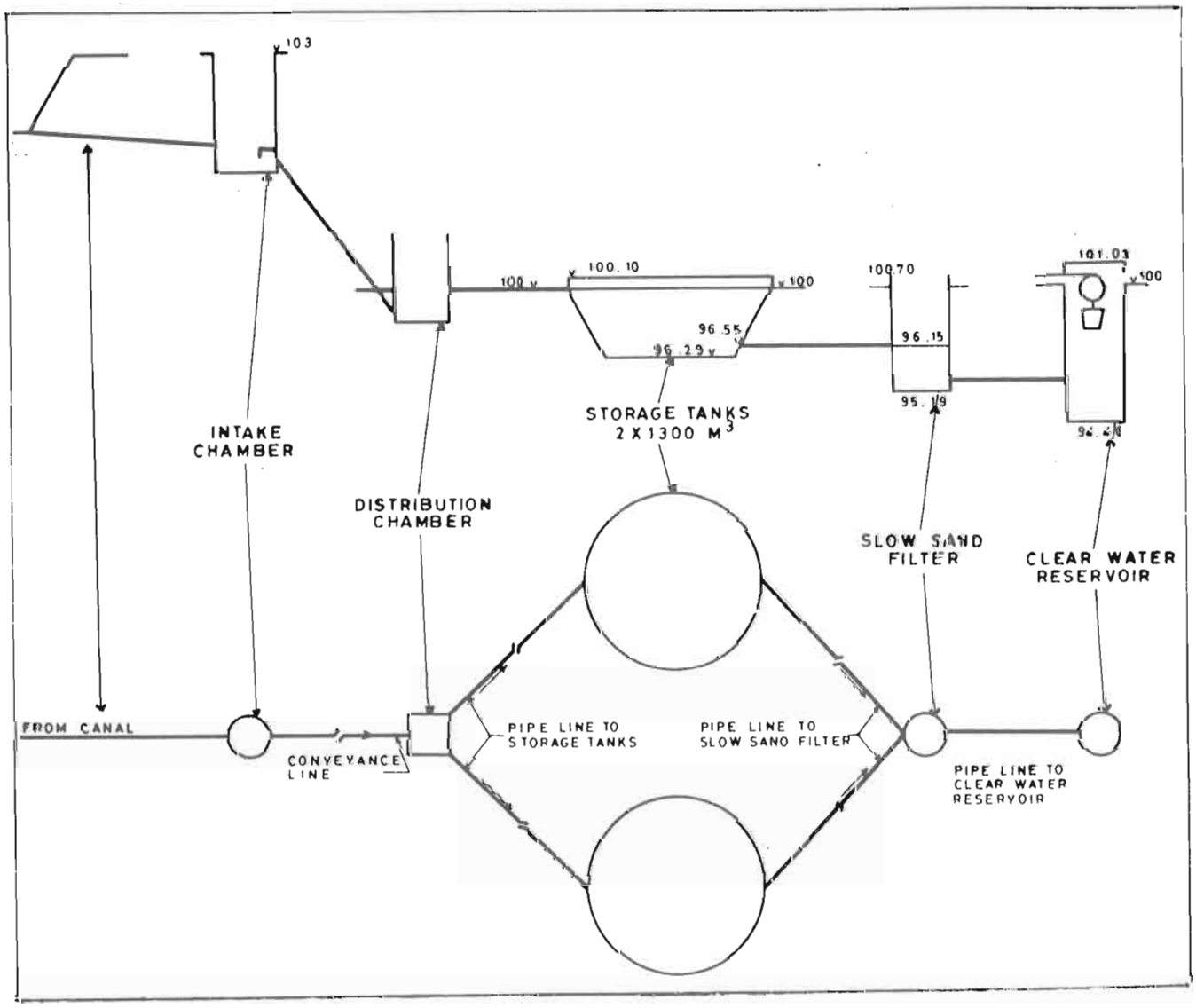
A slow sand filter (SSF), constructed in a cylinderical R.C.C. structure open to sky, is provided. The filter sand has an effective size of 0.2 to 0.3 and uniformity cofficient of 2 to 3. A collection system of perforated pipes and a central channel is provided at the bottom of filter unit. Water from storage tanks flows in filter through pipes under the force of gravity.

Clear Water Reservoir :

An RCC structure covered from top is provided to store the filtered water. The water from filter unit flows through pipe to clear water reservoir (CWR) under gravity. A traditional method of bucket and pulley is provided for drawl of water.

Cattle Water Trough :

A float operated RCC/Brick masonary Cattle Water Trough connected to raw water pipe line is provided to cater for the cattle load.



DESIGN FEATURES OF DIGGI UNIT

COST AND C/B RATIO

The capital cost and the operation and maintenance (O&M) cost of a S.D. unit is Rs. 850,000/= (1 £ sterling = Rs. 54.93 as on 7-4-92) and Rs. 50,000/= per year respectively. The benefits of providing potable and wholesome water supply cannot be directly measured, but it may be assessed in terms of manhours lost due to water borne disease in absence of a safe water supply. Based on rough statistics available, this loss is around 150 manhours/ family/ year. The average number of families are 200 in an abadi and @ Rs. 5/= per manhour the loss comes to Rs. 200x15x5 = Rs. 150,000/= per year. For capitalising the recurring O&M cost and loss over a period of 15 years (useful life of a unit) @ 7.5% of interest rate per year the factor for capitalising is 8.827. Thus we have

i) capitalised O&M cost = 8.827x50,000 = Rs. 441,350/=

ii) capitalised O&M cost + capital cost of S.D. = Rs. 441,350/= + 850,000 = Rs. 1.291 million

iii) The capitalised loss if S.D. unit is not constructed (or indirectly the benefit of S.D. unit) = Rs. 8.827x150,000/= Rs. 1.324 million

$$\text{C/B ratio} = \frac{1.291}{1.324} = 0.975$$

As such it is beneficial to provide S.D. unit, rather than to lose precious manhours.

RISK FACTORS & POSSIBLE REMEDIES

It has been experienced that following risk factors exists in satisfactory working of a S.D. unit.

Chocking in pipe line :

The velocity of flow in conveyance line fluctuates with the available head of water in the source canal. If the velocity goes below the silting limit, in course of time, the pipe line may get choked up and flow stops. The choking may be reduced by decreasing the silt load of raw water. It is being experimented to trap the silt load as much as possible by introducing a reverse flow filter in the intake chamber and bringing down the velocity of rising water below the silting level.

Choking of filter :

The duration of filter run was increased to a considerable extent by converting fixed outlet from storage tank to SSF, to a flexible outlet by using PVC hose pipe and float. This arrangement allows flow of comparatively decanted water to SSF. It is experienced that still the average filter run is about 25 days. For increasing the filter run, it is being experimented to replace the existing SSF by a high rate SSF and introducing a horizontal filter between storage tank and SSF.

Possible contamination in CWR :

Use of bucket and rope system for drawl of water, has some inherent chances of possible contamination. Previously low duty hand pumps (HP) used to be provided at CWR top for drawl of water, but it was experienced that the HPs go out of order frequently and the people revert to using raw water. Thus it was felt beneficial to resort to the traditional and socially acceptable system of bucket and rope rather then to take risk of people using raw water when the HPs go out of order. A heartening factor is the result of a recent survey conducted by the Operation Research Group, Baroda (an independent consulting group) in which the quality of CWR water in bacteriological examination in all the surveyed SD's was found satisfactory.

Necessity of community participation and Health Education :

It is experienced that psychologically people prefer flowing raw water or the water which they can see. Since the CWR is a covered structure and water contained is not visible, even when the SD is running satisfactorily, people in majority of cases, take water either from field channel or from storage tanks or filter tops. This can be eliminated to a considerable extent if an element of health education is introduced to explain the significance of filtered water to the beneficiaries. Further, community participation in O&M is essentially required. A sense of ownership has to be inculcated among the beneficiaries which will avoid misutilisation of assets and ensure

proper upkeeping of the unit. Recently a proposal of involvement of Non Governmental Organisation (NGO) is under consideratioin with government to ensure imparting health education and obtaining community participation in O&M of SD units.

EPILOGUE

In the command area of Indira Gandhi Canal in Rajasthan State of India, canal based gravity flow "Sanitary Diggi" Water supply schemes are constructed for new settlements. These units involve the unit treatment processes of sedimentation, filteration and disinfection. The average capital and O&M cost of the unit is Rs. 850,000/= and Rs. 50,000/= per year respectively. The C/B ratio is 0.975 which proves its cost effectiveness. Introduction of some modifications in design and elements of health education and community participation can ensure the long term utility of these units. It is hoped that NGOs can play a very useful role in regards to proper O&M of SD units.