Restoring Natural River Flows, Through Optimal Ground Water Recharge and Improved Drainage Prevention of Pollution in Rivers

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Abstract

Prevention of pollution in rivers and water bodies involves proper treatment of the sewage, drainage and other liquid effluents joining the river streams, as well as maintaining the natural river flows which have been diminishing due to the excessive drawl of river stream waters for the purpose of drinking water schemes, irrigation and some industrial uses, where ground water could be used, if available. Sub-soil ground water levels have also been going down on account of the excessive population growth in the last six decades, resulting into more and more dependence on river waters. This situation needs to be changed by enhancing the rain water harvesting and ground water recharge volumes with innovative and special measures so as to return to minimum drawl of river waters for drinking and other uses.

The proposed measures could be summarized as follows. (i) Restoring Natural River Flows would involve (a) Reducing the surface water Drawl to a minimum. (b) Optimal Utilization of Ground Water for Drinking Water Supply, Irrigation and other uses. (c) Enhancing River Flows through improved surface drainage. (ii) Synchronized Water Supply and Precipitation Storage-cum-Recharge Systems in Water Scarcity areas. (a) Water Supply Schemes equipped with simultaneous rain water harvesting structures. (iii) Optimal Ground Water Recharge and Improved Drainage by innovative and special methods such as (a) Optimal Ground Water Recharge through Village Ponds, equipped with precipitation overflow diversion and recharge system. (b) Waste Water Drainage Treatment at discharge points before outfall into rivers.

1. INTRODUCTION

Natural clean flow in rivers is an important part of the healthy human life on Earth. Prevention of pollution in rivers and the maintenance of natural flow are both important for healthy rivers. In the last six decades the population in India has increased from about 360 million in 1950 to about 1320 million in 2011. Water consumption for Drinking Water Schemes, Irrigation and some Industrial uses has increased manifold resulting into depletion of subsoil ground water levels and disproportionate drawl of surface water from rivers as well. A large part of the waste water finding way into rivers goes untreated through open drains, and other waste water drainage. This situation has now reached such alarming levels that if appropriate remedial measures for restoration of natural conditions are not taken up immediately and that too on war like footing it is certainly going to be disastrous in two ways i.e. shortage of clean drinking water and disastrous pollution of river waters.

2. DISCUSSION

2.1 Restoration of Clean River Flows

Now we will discuss here what needs to be done to restore natural clean flows in rivers.

a) Reducing the Surface Water Drawl to a minimum so long as sufficient sub soil ground water is available in any part of the land, it should be utilized for drinking water supply schemes, Irrigation, minor irrigation and any other such requirements so that the flow in rivers is not disturbed by excessive drawl of water from the rivers.

b) Optimal Utilization of Ground Water should be aimed at for Projects involving drinking water supply, Irrigation and such other uses.

c) Enhancing clean River flows through Improved Drainage by Innovative and new technological methods so as to ensure that any waste water drainage reaching the river streams is appropriately treated by on-site and in-situ methods of treatment before discharging into river streams.

2.2 *Synchronized Water Supply and Precipitation Storage-cum-Recharge Systems in Water Scarcity areas*

Water Supply Scheme need to be equipped with Simultaneous Ground Water Harvesting and Recharge Systems to compensate the drawl of water for Drinking Water Supply Schemes.

This arrangement could be known as the inclusive Drinking Water Supply Schemes with Provision for Rain Water Harvesting and Ground Water Recharge.

It will also make sense to include such water harvesting and recharge system in all the drinking water supply schemes irrespective of the type of source i.e. the systems will be applicable to both surface water fed schemes as well as the tube-well fed schemes. In fact the only change that is sought to be made is that detailing of the water supply projects should also include rain water harvesting and recharging systems which would be funded and implemented simultaneously with the sourcing and distribution works for drinking water schemes. (See DRG. No. 01)

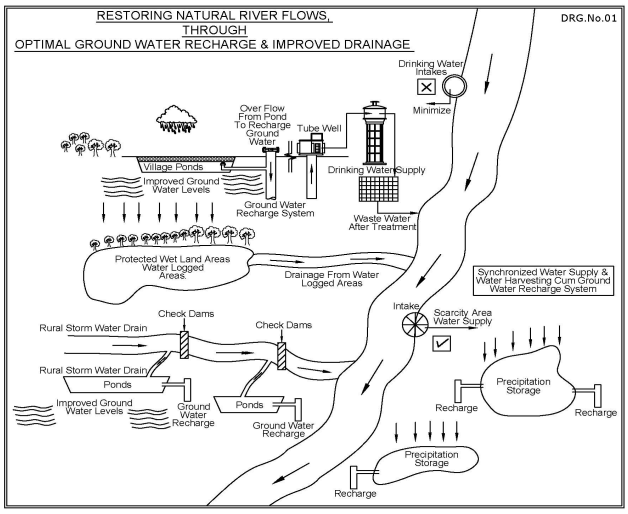

Fig.1: DRG No. 01

2.3 Optimal Ground Water Recharge

Efforts made for Ground Water Recharging during the last about two to three decades have shown that much more needs to be done to achieve a sizeable volume of ground water recharge. It may be possible by inclusion of Rural Water Harvesting and Development of Recharge Systems, in addition to the present day efforts being made anywhere generally in urban and semi urban areas.

Village Ponds generally located near the storm water drainage systems need to be properly connected to be optimally filled up will rain water during the rainy season. (DRG. No. 01A)

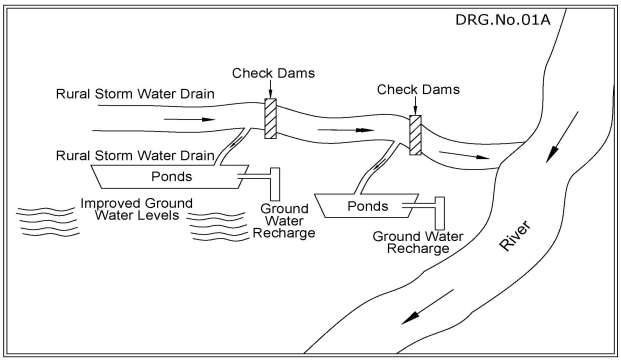

Fig.2: DRG No. 01 A

The surplus precipitation finding way into the village ponds either by run off from the village area or directly into the ponds must be diverted through

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an overflow tapping system, to the recharge bore wells or wells as may be possible, to raise the ground water levels, This arrangement will also save the village area from flooding by rain water. (DRG. No. 01B, 01C, 01D)

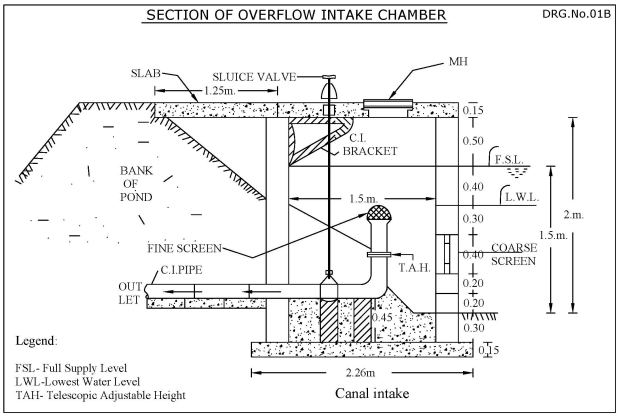

Fig.3: DRG No. 01B

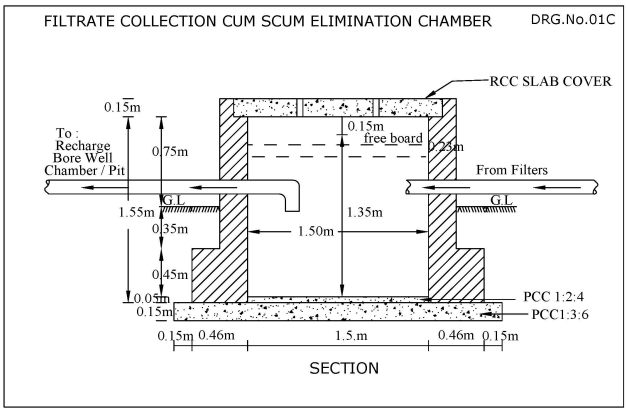

Fig.4: DRG No. 01C

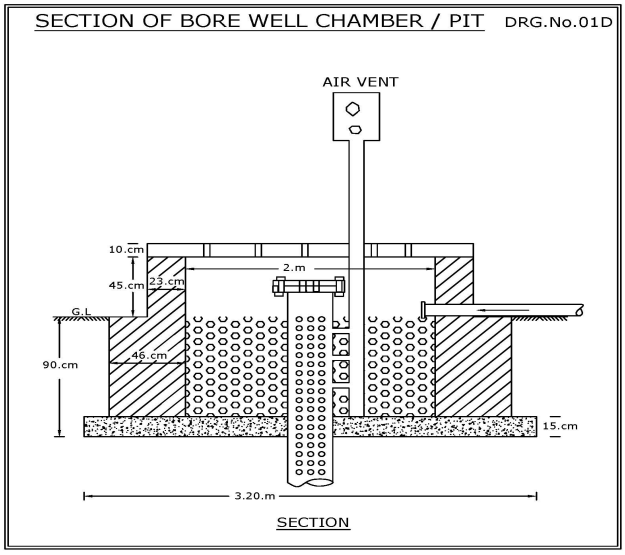

Fig.5: DRG No. 01D

Village Ponds will also help to maintain proper climate temperatures. It would also serve as support for cattle bath and other emergent social and environmental needs.

Sub-soil ground water level raised in this way will be of great value for drinking water needs and especially to reduce drawl of river water for this purpose. (See DRG. No. 02)

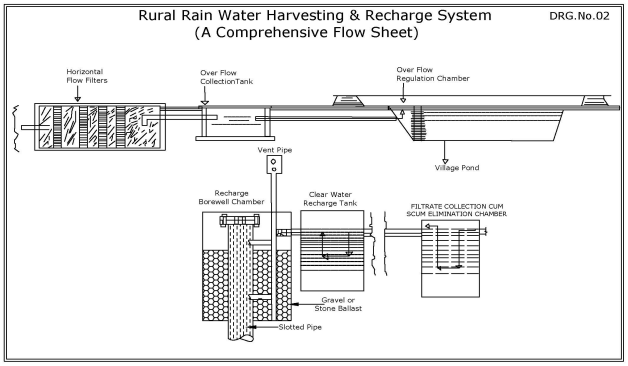

Fig.6: DRG No. 02

2.4 Waste Water Drainage Treatment at Discharge points before outfall into rivers

Drains carrying waste water from domestic and other uses, must be appropriately treated by On-Site or In-Situ methods of treatment before discharging into river streams.

New technology options available for innovative On-Site or In-Situ methods of Treatment and Removal of Solid Waste and Floating Debris from the waste water Drains is being given here in short.

(a) On Site or In Situ Methods of Waste Water Drainage Treatment

The treatment of waste water passing through drains may be carried out in two parts:-

(i) For removal of Solid Waste and Floating Debris.

(ii) For Disinfection of the Screened Fluid Part of the waste water carried through drains, reaching the river streams at various outfall points.

2.5 Removal of Solid Waste and Floating Debris By Construction of Drainage Silt and Debris Traps

This is a method of screening the waste water containing solid waste and floating debris which works on the principle of tactical diversion of the waste into a trap allowing the fluid part to pass through screens without choking the screens. (DRG. No. 03)

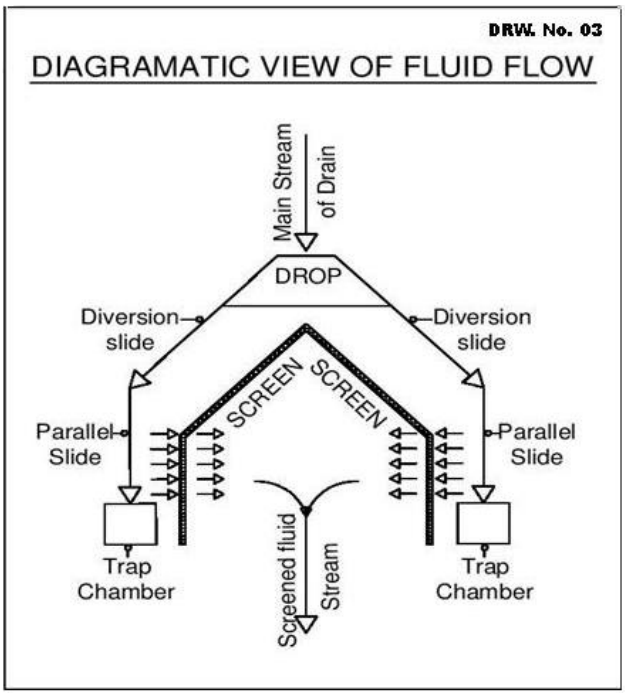

Fig.7: DRG No. 03

Two drawings for different sizes of drains and volumes of drainage are being given here for guidance. These traps can be located on various points on a drain from head to tail for comprehensive screening or simply before outfall points on drains before discharging into rivers. These traps can also be applied to serve the lakes, ponds and wet-lands from being dumped with solid waste and debris where drains are joining them. (See DRG. No. 04 and 05)

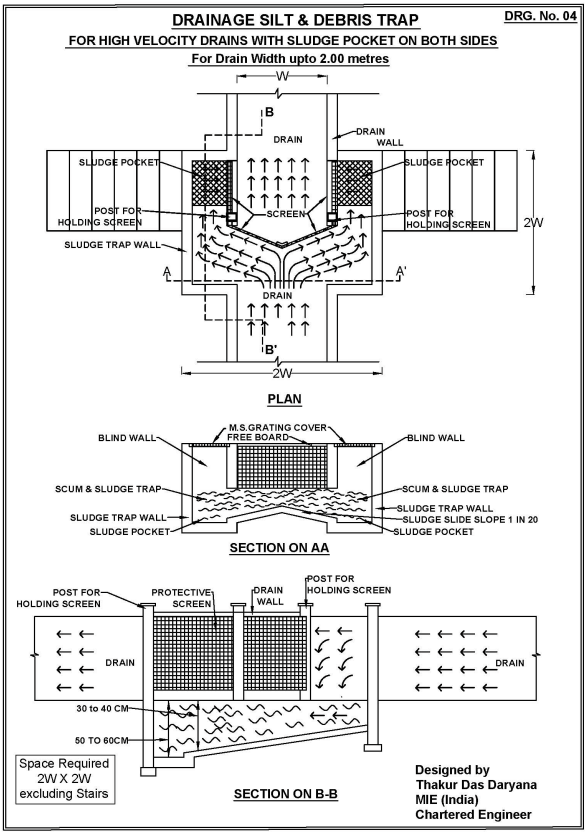

Fig.8: DRG No. 04

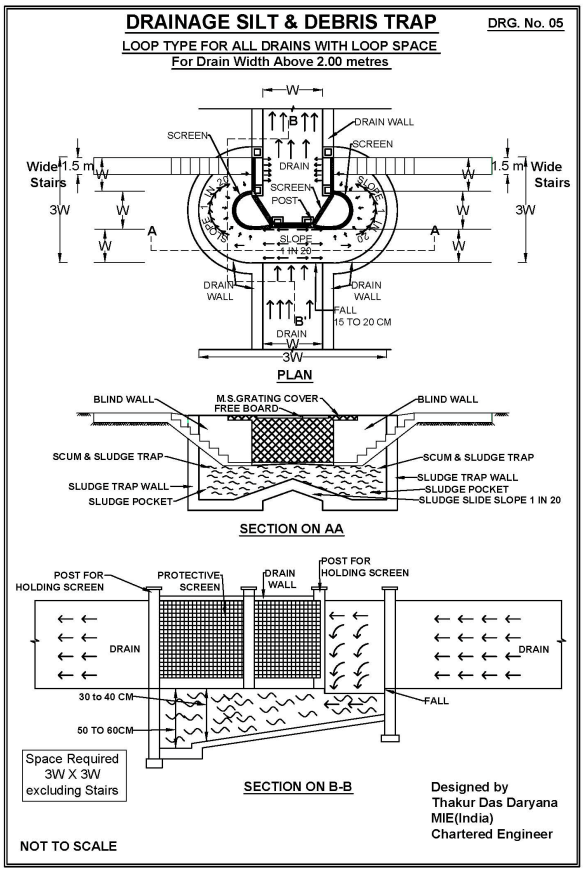

Fig.8: DRG No. 05

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2.6 Location and Siting Options for Drainage Silt and Debris Traps

Location and Siting of the Drainage Silt and Debris Traps may be done as per desired performance and the availability of sites for location of traps. Some of the options may be as given below:

a) Minimum of one to two traps about 0.5 Km before the outfall point.

b) At regular intervals of about 500 metres from beginning of the drain to the outfall point.

2.7 Chemical Dozing Option for Coagulation and Flocculation

Appropriate chemical dozing of alum may also be done where required. But due care will have to be taken in that case to render the fluid reasonably clear and free from the chemical content before discharing into the river water. Some modification in the design of trap size and especially the travel time may be necessary to meet this requirement.

2.8 Disinfection of the Screened fluid part of the Waste passing through drains

Most of the waste water passing through drainage joining with rivers would be contaminated with total and fecal coliforms. This part of contamination is so big that most river waters tested for these parameters are found to be unfit for drinking, bathing and other human uses.

The recent trends in the field would generally include the various methods being given hereunder in brief.

i. Disinfection by Ozonation and UV treatment.

ii. Neutralization of coliform by herbal additives.

iii. Neutralization of coliform by Bio-culture.

All the different methods of treatment would have their merits and demerits, but appropriate method or methods of treatment could be determined for application as per job requirements.

3. CONCLUSION

The depletion of subsoil ground water level that has taken place during the last few decades needs to be recuped with extensive work on it. The recuperation of sub-soil water through village ponds equipped with precipitation overflow diversion system and recharge bore-wells or wells as explained here can help to restore the natural flows. Besides this the treatment of all waste water passing through drains and finding way into the rivers will help to prevent pollution in rivers and water bodies rendering them fit and safe for all human use and consumption.

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