PART I

Executive Summary

Experiences from river basin aquifer management, where water harvesting and artificial recharge strategies are adopted, are rare and scarcity of data is a commonly encountered problem. Therefore, there is today a growing need for acquiring knowledge about systems capable of making use of ephemeral runoff waters and river base flows. Importance of such data increases manifold when such facility is implemented and managed by local peoples at village level (Raju, 1992). Therefore keeping the value such data this project was proposed for funding to the Kerala Research Programme for Local Level Development and implemented by Integrated Rural Technology Centre.

On experiencing severe drinking water problem in the mid-eighties and nineties ever increasing problems of groundwater depletion and the people of Vaniamkulam Panchayat and Panjal Panchayat which are located on either side of Bharathapuzha river, have decided to start a common water management plan for the area that would include rainwater harvesting and artificial groundwater recharge. The precondition was that the structures should be as simple as possible and be constructed with material locally available only. Another priority was that the structures should be easy to maintain. It was also agreed from the start to actively solicit the participation and the involvement of the water resources users as direct actors and build the project upon their own skills and knowledge of their local environment. This approach would reinforce local village

organization, involve villagers in technology generation and employ village facilitators for appraisal, planning, implementation and monitoring. A group of engineers from Indian Institute of Technology Chennai would act as a support organization playing a catalytic role of facilitation technology for sub-surface dam. Together, the stakeholders and the engineers of IIT-Chennai designed and started project in 1998 a pilot project plan where the idea was to harvest the large amounts of floodwaters drained by the streams and the Bharathapuzha during each monsoon showers. It was also decided that where possible, recharge and store water as much as possible in the underlying aquifers. A proposal was prepared with substantial contributions from the Government of Kerala's minor irrigation, water authority, Palakkad District Panchayat and Member of Parliament's fund. In the stream-way with the largest width immediately down stream of the Pangal meandering and at a point, which carries important masses of floodwater after monsoon showers, a "subsurface dyke" was constructed in 1998/99 partly based on the principle of groundwater subsurface check dams. Here the entire width of 75m was excavated down to 2m. The downstream wall of the excavated portion was made impervious with a sheet of bentonite filled rubble mounts, in order to arrest the important base flow occurring under the riverbed. The entire excavated dyke was then filled with fine pervious sand taken from the riverbed. A check-dam built with sand bags and with a height of about 2m was provided on the river bed, with the function to arrest the flood water so that it can be allowed to infiltrate into the sand filled dyke and available during base flow season.

The construction of the subsurface dyke appeared to have created a total maximal flood resistance syndrome, which had resulted in the failure of the surface structure. The structural damage was noticed as early as the monsoon of the year 2000. With the failure of the structure, the very objective of the project which was to monitor the benefits of the subsurface check stood defeated. However, monitoring of the wells was continued in order to ensure if the remnant structure has any effect on the ground water level fluctuation. The hydrographs constructed fail to indicate any such influence of the check dam remnants either. Therefore, no meaningful inference could be made and the raw data on the water level fluctuation observed in all the 42 observation wells is tabulated

and given as annexure herewith. All the wells in the village are monitored regularly between April 1999 and June 2003. The fluctuations in water level appear to be in tandem with the precipitation intensity. The data obtained suggest that if the district receives good rainfall there can be significant temporal improvements in groundwater quality. However, the discharge rate in the area appears to be equal to recharge. The decline in groundwater levels is therefore still very important. Today groundwater levels have reached 20m in Pangal area in Quadrant 1, and the recharge activities have not resulted in substantial increases in groundwater levels. The results obtained shows that the issue of water use and access is the most important to handle with the farmers and concerned authorities because the effects of over exploitation which have occurred due to heavy irrigation cannot be overcome solely by water harvesting and artificial recharge. Encouraging though, is that awareness of the problems is increasing among the resource users.

While proposing this project certain indicator monitoring exercises and indices were commonly recommended as tools for assessing the impact of the sub-surface check dam on local cropping pattern (through PRM), ground water rechargeability (by well water fluctuation monitoring) as attainment of development. It is claimed that such indices of development can facilitate impact assessment in policy terms by appealing to those who may not necessarily have technical expertise in data collection, analysis and interpretation.

However the damage of the check dam had affected the efficiency and so had not been able to achieve the objectives.

Extend of damage to the surface and the sub-surface structures are photographically documented and reproduced in the following pages Figs: 1, 2, 3. The damage to check dam had made the inferences of the database difficult. In order to avoid criticisms of over-simplification, those advocating such Indices also suggest that the raw data be provided so as to allow desegregations into component parts and hence facilitate a more subtle interpretation if a reader so desires and so the raw data are produced as such in

Tables from 1 to 52. The enclosed copies of newspaper cuttings would substantiate the inference.

PART II

Background

The subsurface check dam was constructed with peoples' participation at Thrangali; a village on the banks of Bharathapuzha situated about 13 km east of the Shoranur town. This check dam is situated on a gentle slope gradient of the river on the down stream of two abuts meandering. This check dam is located on the immediate down stream of the second meandering in the Panchayat. The left bank is occupied by the steeper sloping lateritic massive of the Panjal Panchayat. The right bank has comparatively lesser slope and devoid of any lateritic high in the vicinity. The surface material on the right bank, generally, is recent sand with siliceous material, whereas the left bank is covered either by lateritic crest or lateritic (red) soil. In general it can be said that the right bank is permeable and the left is not. This contrast between the right and left banks persists at least for about 5 km. downstream. There are about 45 open dug wells on the upstream side of the check dam and about 22 well on the down stream. There are a few intake points of lift irrigation system located on the left and right banks upstream.

Real time monitoring system of Integrated Rural Technology Centre (IRTC):

With increase in water availability, a paradigm shift in land use, water usage are likely to set in. Therefore, at IRTC we have initiated a comprehensive monitoring system right from the planning stage of the Thrangali check dam project i.e., April 1999 onwards. Most of the parameters required for a systematic monitoring of changing hydrological regime such as land-use, geomorphologic condition, vegetation cover were documented. The dynamism of the ground water table is also being monitored by monthly observation of water level in all the open wells in the vicinity of the check dam both up and down streams.

Objectives of the project

A detailed Environmental Impact Assessment (EIA) of the Thrangali check dam

1. To record the impact of the Thrangali check dam on the water table fluctuation as recorded from the wells in the vicinity.
2. To monitor the synoptic changes in the crop pattern, which can be related to the check dam.
3. To monitor the synoptic changes in socio-economic status of the user group
4. To monitor down stream – upstream conflict, in any, in connection with the check dam.

The following are the work during carried out during the first year:

Resource Map for the area in the vicinity of the check dam

1. The main thrust of the first year activities are to record the existing land use pattern around the check dam. A detailed land use map was prepared on a cadastral map. For convenience the area of interest had been divided in to four quadrants. The area on the southern bank and on the upstream of the check dam was termed as quadrant:1, and the southern bank and down stream of the check dam was labeled as quadrant:2. These two quadrants are located in the Panjal panchayat of Thrissur district. The quadrant 3 & 4 are situated on the downstream and upstream of northern bank

respectively. These quadrants are in the Vanniamkulam panchayat of Palakkad district. Approximately one km. radius was covered for resource appraisal.

2. On demarcating the area of influence based on geo-morphological and socio-political influence, efforts were made to establish some control wells in each of the quadrant, which were of an approximate area of 1.0 Km^2.

   Water levels in each of these wells were measured once in a month. Rainfall data for Bharathapuzha basin, which were available with the Irrigation Department, was collected.

3. Nineteen control wells on the northern bank and 33 wells on the southern bank were identified for monthly observation. Water level in these wells are being monitored during second week of every month.

Preliminary Inferences

Quadrant-1, though an elevated lateritic terrace is bordering the river, 50% of the area is used for paddy cultivation. Wells are sparse and so only 4 wells are being monitored. Two crops are being produced in the paddy fields. Mixed trees with a pocket of rubber plantation occupies the hinterland. The average water column versus time curve appears to be coherent with the annual rainfall curve (Fig:1)
Watershed

Quadrant-2, this quadrant is occupied by mixed crops mostly tree crops. Lateritic cliffs and crests are prominent physical features. Of the 16 wells monitored only four are perennial. Rest of the 12 wells even fail to meet drinking water demand during summer. Sparse pockets of rubber plantation could also be noted. Fluctuation in water column of control wells is found to be in unison with the fluctuation in rainfall intensity. Emphasis is being given to the wells in this quardrant because the geo-physical situation indicates that this sector is to be effected most.

Quadrant-3 is on the southern bank of the Bharathapuzha situated in the Vanniamkulam Panchayat of Palakkad district. Generally, the southern bank is

comparatively lower elevation than the northern bank. Mixed crops and paddy field are evenly distributed. Seven control wells are notified for periodic monitoring, 5 of them are perennial. This is the quadrant to be mostly benefited because of the suitable lithologic and geomorphologic nature. However, in spite of congenial conditions for recharge the wells are found to be behaving like that of other wells, i.e. the water level rise and fall with increase or decrease in rainfall. In spite of the riverine neighborhood a few cultivable wasteland patches are seen.

Quadrant-4, this quadrant is situated on the upstream side of the check dam on the Vanniamkulam panchayat. This contains maximum number of wells and so number of control wells are also high. Twenty six control wells are being monitored to understand ground water level fluctuation in this quadrant. As commonly seen in other quadrants, in this also, the water level in wells fluctuate with the monthly rain fall intensity

PART III

1. Table showing data regarding the water level of each wells in every quadrant
2. Graph showing the water level of wells each quadrant
3. Graph showing the water level of wells of 4 quadrant (a comparison of pre & post condition)