Comparative Study Between CDN and PDN with Respect to Minor no. 10 of Left Bank Canal of Akkalpada Project

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Abstract- Water is life for existence of all living being on earth. Water is a vital, valuable, finite, renewable resource demanded by several sectors. The stresses due to water scarcity are increased nowadays. Irrigation sector is the biggest consumer of water thus there is scope for improving efficiency by reducing loss of water. In this paper study has been carried out to analyze traditional canal distribution system of direct minor no. 10 of left bank canal of Akkalpada project and to design pipe distribution network for the same. The cost construction is found more for pipe distribution system but in view of water thefts, conveyance losses, evaporation losses for canal distribution system, pipe distribution system is preferable for direct minor no. 10 of left bank canal of Akkalpada project. There is decrease in land acquisition cost for pipe distribution system

I. INTRODUCTION

Water is life for existence of all living being on the earth. Water ensures food security and fulfills domestic and industrial needs. Being 2nd most populated country in the world India needs water for domestic, industrial uses, recreational activities to support its growing economy. Demand of water for civilization and industrialization is increasing at an alarming rate. Increase in demand reduces the water availability for irrigation.[1] Nature has endowed our country with abundant Water Resources. However, due to limitations of topography, geology, dependability, quality and the present state of technology, only a part of available water resources can be utilized. It is a matter of great concern that this is happening at a time when there is an increased demand for various agricultural products due to phenomenal growth in the population.

To overcome this problem it is very essential to conserve the water in many ways and utilize it so that food production should be sufficient to fulfill Indian population need at reasonably low cost. To increase food production from agriculture land, irrigation is one of the tool to conserve the water and utilize it for agriculture production[5]. Irrigation sector is the largest consumer of water as more than 80 percent of available water resources in India are being presently utilized for irrigation purpose[1]. To overcome this water scarcity, optimum utilization of irrigation :water is necessary which will help in irrigating maximum area and for this purpose there is need to modernization of existing conventional CDN system[1,3]

In this paper study has been carried out to analyze traditional canal distribution system of direct minor no. 10 of left bank canal of Akkalpada project and to design pipe distribution network for the same. The paper is divided in following sections section 1 gives brief overview of current irrigation scenario and reasons for low efficiency of current cannel distribution system. Section 2 will explain necessity of PDN. In section 3 design considerations for minor no. 10 of left bank canal of Akkalpada project andcost comparison between CDN and PDN are discussed.In section 4 we conclude our paper.

Ultimate irrigation potential of India is 140 million hectare. Irrigation potential to the tune of about 102 million hectare has been created through major/medium/minor surface water irrigation projects and use of ground water[6]. However, potential utilization is about 87 million hectare only. The average water use efficiency of Irrigation Projects is assessed to be only of the order of 30 - 35%. Thus there is gap between irrigation potential created and utilized, and it is up most important to minimize the gap. This can be achieved by use of pipe distribution network[7].

The following major reasons have been identified for low Water Use Efficiency of Irrigation projects.

1. Poor or no maintenance of canals/distributaries/minors of irrigation systems resulting in growth of weed & vegetation, siltation, damages in lining etc.
2. Distortion of canal sections due to siltation or collapse of slopes resulting in some channels carrying much less and some other channels carrying much more than their design discharges.
3. Non Provision of lining in canal reaches passing through permeable soil strata.
4. Leakages in gates and shutters.
5. Damaged structures.
6. No regulation gates on head regulators of minors causing uneven distribution of water.

7. Over irrigation due to non-availability of control structures and facilities for volumetric supply of irrigation water to farmers.
8. Poor management practices.
9. Lack of awareness among farmers about correct irrigation practices and cropping pattern.

II. NECESSITY OF PDN

PDN is necessary to improve Overall Project Efficiency (OPE) ofgravity irrigation systems. With the help PDN the water use efficiency can be improved to 70 to 80 % from existingopen channelsystems efficiency of 25 to 40 %. Thus there is about two to three times increase in the water use efficiency for irrigation, which means that there will be 55 to 65 % improvement in overall water use efficiency.In other words, from the same reservoir, double the command areas could be irrigated, or additional equal volume of water is made available which can be distributed to other purposes.

The PDN system provides effective control on the distributionof water for the crops leading to achievement of diversification of croppattern namely horticultural, cash crops and other than traditional crops.Two operating systems namely, one rotational water supply (R.W.S) and theother on demand scheduling are technically reliable to ensure water at farmgate.

A strong argument against pipelines is that they are costlier to lay than digging canals, especially earthen ones. But most of such back-of-the-envelope calculus of cost-effectiveness does not consider the market value of the land that canals use and pipelines save. Despite of massive effortsby the government to acquire the land needed for the surface distribution, due to farmers'resistance to leave their agricultural land the original plan is not working. PDN system will provide solution for above stated problem.

III. DESIGN CONSIDERATION

The study area, lies at Shirdhane village in Dhule district of Maharashtra. The area comes under canal command of Lower Panzara (Akkalpada) Medium Irrigation Project . The field lies at 74º27' 22'' E longitude and 20º 56' 28'' N latitude in Shirdhane village.

Command area of this project is flat terrain, and land slope varies from 1 to 5 percent. Soil type is deep black soil. Thistype of topography is considered more suitable for PDN. The project is implemented as a CDN.The length of main canal is 32.085 km and length of direct minor no. 10 is 900 m.The head discharge for direct minor 10 is 4.32 Cusecs. Total existing area under cultivation is 98.18 ha. But in the view of all aspectssuch as topography of the area, request of farmers to recommend PDN and limitations of CDN etc. study is done for a gravity flow PDN for irrigation. Some of the important design aspects of project are compared in Table I.

TableI:Comparison of design aspects of minor no. 10 of left bank canal of Akkalpada project

Sr. No.	Description	Conventional CDN System	PDN system	Percentage Increase	Percentage Decrease
11	Discharge at head regulator	4.32 Cumecs	4.32 Cumecs	-	-
2	OPE	56.7%	81.23%	24.53%	-
3	Land acquisition	1.62ha	0.27ha	-	83.33%
4	Cultivable command area (CCA)	79.13ha	98.18 ha	24.074%	-
5	Discharge at chak head	0.1050 Cumecs	0.1220 Cumecs	16.19%	-

It is seen that with the implementation of PDN water application efficiency on farm is 85 percent, efficiency of lateral is 95 percent,efficiency of sub- main is 98 percent and efficiency of main is 98 percent, which shows that there is remarkable increase inefficiency of overall system. Likewise CCA is almost doubled with the same volume of water.

Table II: Cost comparison between conventional CDN and PDN system forminor no. 10 of left bank canal of Akkalpada project

Sr No.	**Description**	**CDN**	**PDN**	**Percentage increase**	**Percentage Decrease**
1.	Land Acquisition cost	25.92 Lac	4.32 Lac		83.33%
2.	Construction cost	199.40 Lac	329.11 Lac	65.01%	

The construction cost of PDN system includes cost of P.V.C pipes, excavation and refilling, laying and jointing, accessories, andcost of distribution chamber etc. From Table II, it is clear that the land acquisition cost by implementing PDN instead of CDN will be reduced to great extent.

IV. CONCLUSION

In this paper experimental results are presented to evaluate the feasibility of utilizing Pipe irrigation network over canal distribution network system.The present study has been

planned to assess the losses in present irrigation method and use of pipe distribution network to reduce the conveyance losses. The pipe irrigation network system is designed for the study area i.e. Direct Minor No.10 of left bank canal of Akkalpada Dam which has total length of 900 m and ICA of 79.19 Ha. The Initial cost of construction for canal distribution system is Rs.2052432.00/- where as it is Rs.59970407.98/- for Pipe irrigation network. Design and results showed that adoption of buried pipeline distribution systems will to the reduction in water conveyance and distribution losses Also there will be reduction in the land area taken up by the distribution system.

A chak of 12 ha having 900m length was selected for design of underground pipe distribution network. The inlet structure of rectangular shape having $1m^2$ area and 2.7m height is designed just below the canal bank to trap silt. A screen is fixed to the inlet through that water enters into underground pipeline to keep the thrash out of pipeline. 200 mm, 250 mm, and 300 mm diameter pipes are used . The head loss calculated from Modified Hazzen-Williams equation is 4.392 m and 3.78 m. The head loss found to be less than that of available head of 4.77 m. Air vents of 5 cm diameter were also provided at appropriate points to release entrapped air. Nine number of outlets were proposed in the design of the underground pipeline system. Two field distribution chamber, one for right hand side of fields and other for left side fields for delivering irrigation water directly to the farmer's fields.

V. REFERENCES

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