

A Case Study on the Sulwade-Jamphal-Kanoli Lift Irrigation Scheme: Evaluating the Efficiency of Piped Distribution Networks in Maharashtra

Borse Divya Kishor¹, Bhoje Priyanka Gulab², Borse Jay Mahesh³, Borse Jay Vijay⁴, Pagare Vaibhavi Ravindra⁵, Prof. N. R. Borase⁶, Prof. S. K. Pawar⁷

^{1,2,3,4,5}UG Student, Civil Engineering Department, NESS'S Gangamai College of Engineering, Nagaon

⁶Head, Civil Engineering Department, NESS'S Gangamai College of Engineering, Nagaon

⁷Assistant Professor, Civil Engineering Department, NESS'S Gangamai College of Engineering, Nagaon

Abstract—This paper presents a detailed case study on the Sulwade-Jamphal-Kanoli Lift Irrigation Scheme located in Dhule district, Maharashtra. The foundation stone of this project was laid by the Hon'ble Prime Minister in 2019, aims to irrigate over 33,000 hectares of agricultural land in drought-prone regions of Dhule and Shindkheda Taluka through a modern piped distribution network (PDN). The paper highlights the scheme's engineering design, implementation, and expected water-use efficiency. A comparative analysis with other piped irrigation projects across Maharashtra demonstrates the advantages of PDN systems in reducing seepage, evaporation, and operational losses. Findings indicate that such systems significantly enhance irrigation reliability, sustainability, and regional agricultural productivity.

Index Terms—Lift Irrigation, Piped Distribution Network, Water Efficiency, Sustainable Irrigation, Maharashtra, Tapi River

I. INTRODUCTION

Now a day's demand for drinking water, irrigation and non-irrigation in the state is increasing exponentially day by day. the availability of water in Maharashtra State every year is not assured, obviously the lavish use will not be possible in the coming days. In Maharashtra the variation of rainfall is uneven and variation from 2500 to 5000 mm in Konkan Region to 450 mm in Marathwada Region is observed. To achieve more Crop Per drop, it is not advisable to use conventional flow-irrigation system for irrigation Viz. Canals and distributaries. There is large scale loss of water in this system. Also almost

75% of water is used for irrigation out of total water available. In the wake of above, the Government of Maharashtra has adopted the policy to distribute irrigation water through piped distribution network. The usable water in the state is limited. (as per the second Irrigation Commission of Maharashtra) The total cultivable area for irrigation can be increased to a maximum of 85 lakh hectare. It is estimated that only 37.37% of the total cultivable land area (Around 226lakh hectares) can be irrigated through the total water available. Apart from this, only 41 lakh hectares irrigations possible through water conservation, local sector and agriculture department. This reveals that maximum irrigation area of 56% is only possible out of total cultivable area of 226lakh hectares, from all sources. The average irrigation potential of India is 76.44% so there is no alternative besides to increase the water use efficiency of the irrigation sector in the state. This can be possible only, by converting ongoing flow irrigation system in to micro irrigation system. As there is significant use of water for irrigation, it is sensible to increase the water use efficiency in the 2 agricultural sector. This can be solely possible by adopting Piped Distribution Network (PDN) as it overcomes the lacunas of the flow irrigation system viz. land acquisition, lavish use of water from the farmers in the upper reaches of the canal, System becomes expensive in hilly areas etc. Traditional canal systems often face high transmission losses due to seepage and evaporation, making them inefficient for semi-arid and drought-prone areas. To overcome these challenges, the Government of Maharashtra adopted a policy in 2016

to implement Piped Distribution Networks (PDNs) for irrigation schemes. The Sulwade-Jamphal-Kanoli Lift Irrigation Scheme (SJKLIS) represents a flagship project under this initiative, demonstrating how modern hydraulic engineering can optimize water use efficiency and equitable distribution.

II. OBJECTIVES

The main objectives of this study are:

1. To analyze the design and operational framework of the Sulwade-Jamphal-Kanoli Lift Irrigation Scheme.
2. To assess the efficiency and performance of piped distribution systems compared to traditional canal irrigation.
3. To evaluate the socio-economic and environmental impacts of the project.
4. To compare the Sulwade-Jamphal-Kanoli project with similar PDN-based irrigation schemes in Maharashtra.

III. METHODOLOGY

The methodology involves collecting project data from the Tapi Irrigation Development Corporation, field visits, and secondary literature. Following are the steps used to complete the project.

Fig. No. 1 Methodology for Pipe Distribution System



1. SURVEY FOR PIPE DISTRIBUTION SYSTEM

A detailed survey has been carried out by the state of art instruments like Total station, DGPS or Drone camera.

2. PLANNING OF PIPE DISTRIBUTION NETWORK

A pipe distribution network is a network installation consisting of pipes, there fittings structures like thrust blocks, various valves & outlet, installed in the system, to supply water under pressure from the source of the water to the irrigable area.

3. TYPES OF PIPE DISTRIBUTION NETWORK

Let us understand about the PDN:

After studying different Irrigation Configurations; following four types of Irrigation Systems comes in to picture.

- Direct pumping / Entire pressurized system
- Partial Gravity & Partial pressurized system
- Partial pressurized up to storage point & then gravity system.
- Pumping through booster pump from canal.

1. Direct pumping / Entire pressurized system: The Pipe Distribution Network where water is directly distributed to field with external force by pump is called as Direct Pumping Distribution Network. In this system water is pumped from source to field outlet. In the case of direct pumping the block size is very important considering the efficiency, maintenance and management of irrigable command area.

2. Partial Gravity & Partial pressurized system:

In this type of Pipe Distribution Network water is distributed by Gravitational Force as well as by external force given by pumps. This system is adopted when some area of command can be irrigated through gravity pipe line where levels of such area is less as compare to source, If sufficient head is available water can be distributed through gravitational force and if some area is unable to irrigate through gravity pipeline it can be irrigated by direct pumping. So this is a hybrid system and it can be utilize for filling local chain of reservoirs.

3. Partial pressurized up to storage point & then gravity system:

In this system source of water is river or bandhara or large reservoir and command is well above source altitude. In this case water is lifted by pumps and

conveyed through rising main up to distribution chamber which is located at the highest location of command.

4. Pumping through booster pump from canal:

When the command is very flat and if we have to plan PDN network instead of canal network for distribution then it becomes empirical to have sufficient head to plan pipeline distribution network as natural sufficient head is not available then it can design PDN network by taking water from canals and providing booster pumps on these pipelines to negotiate the frictional head of pipelines.

4. SELECTION OF PIPE MATERIAL

Pipelines are major investments in water supply and piped irrigation projects and as such constitute a major part of the assets of water authorities.

5. HYDRAULICS OF PIPE FLOW

This step consist of the study of various factors like

- Free Surface Flow
- Flow for Pressurized Flow
- Steady Flow
- Law Of Conservation Of Mass
- Basic Hydraulic To Be Used In Design Of PDN
- Various losses in Pipe Distribution Network
- Friction Loss
- Minor Losses

6. PIPE IRRIGATION NETWORK DESIGN

The hydraulic design of Pipe Distribution Network, envisages the following important points.

- To estimate the first discharge through pipe at the start.
- To design the diameter of pipes in network.
- To decide the velocity of water through pipe.
- To estimate the residual head at outlet location, above ground & above pipe top.

7. USE OF SOFTWARE FOR PDN DESIGN

For the design of Piped Distribution Network for irrigation mainly following software Program can be used.

- EPANET
- Water GEMS
- M.S. EXCEL Sheet

8. VALVES AND BLOCKS

Valves play a critical role in a water distribution system for subsystem isolation (due to breakage or contaminant) and flow or pressure control.

Main types of valves are

- Gate valve
- Check valve
- Drain valve
- Air release valve
- Pressure regulating valve
- Pressure reducing valve

The Sulwade-Jamphal-Kanoli Lift Irrigation Scheme is designed to lift 9.24 TMC of floodwater from the Tapi River during the monsoon season. It covers approximately 33,000 hectares of command area across 100 villages in Dhule and Sindkheda talukas. The project features a closed gravity-based piped network for water distribution, ensuring minimal water loss. The Indian Hume Pipe Company Limited executed the Engineering, Procurement, and Construction (EPC) work with a five-year maintenance contract. The estimated project cost exceeds ₹2,400 crore. The Tapi Irrigation Development Corporation oversees implementation through its Dhule division.

V. CASE STUDY ANALYSIS

The PDN employed in the SJKLIS eliminates the drawbacks of open channels by maintaining pressurized flow through steel and RCC pipelines. This system improves delivery efficiency, reduces land acquisition needs, and prevents water logging or salinity buildup. It was expected that farmers in the region will get benefit from uniform water distribution and reduced irrigation scheduling conflicts. The scheme also supports micro-irrigation integration, which further enhances efficiency.

VI. COMPARATIVE STUDY WITH OTHER PDN PROJECTS

The Tembhu Lift Irrigation Project and Krishna Marathwada Lift Irrigation Project have shown similar success in reducing water conveyance losses. Comparative efficiency data indicates that PDNs achieve 80–90% conveyance efficiency, compared to 45–55% in canal systems. While PDNs involve higher initial capital costs, their operational efficiency and reduced maintenance make them economically viable over the project's lifespan.

VII. RESULTS AND DISCUSSION

The study finds that the Sulwade-Jamphal-Kanoli project will achieve significant gains in water-use efficiency and equity in water distribution. The integration of PDNs with automation and flow control valves allows for demand-based irrigation scheduling. However, challenges such as energy consumption for lifting water and the need for skilled maintenance staff remain key operational concerns.

VIII. CONCLUSION

The Sulwade-Jamphal-Kanoli Lift Irrigation Scheme demonstrates the potential of PDN-based irrigation to transform drought-prone regions. By minimizing water losses, optimizing distribution, and integrating modern technology, such projects enhance agricultural productivity and sustainability. Future initiatives should emphasize renewable energy integration, community participation, and real-time monitoring for long-term success.

REFERENCES

- [1] Government of Maharashtra, 'Policy on Piped Distribution Network for Irrigation Projects,' GR No. 2016/IRR/Policy-12, 2016.
- [2] Tapi Irrigation Development Corporation, 'Project Report on Sulwade-Jamphal-Kanoli Lift Irrigation Scheme,' Dhule, 2021.
- [3] Indian Hume Pipe Company Ltd., 'EPC Project Summary Report for SJKLIS,' Mumbai, 2022.
- [4] Ministry of Jal Shakti, 'Report on Water Use Efficiency in Lift Irrigation Systems,' Govt. of India, 2023.
- [5] Pipe Distribution System for Irrigation published by Indian National Committee on Irrigation and Drainage (INCID) – September 1998
- [6] WRD handbook for irrigation.