

# Feasibility Study on Replacement of Existing Canal Water Distribution System by Pipeline System

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**ABSTRACT:** Irrigation is basically known as the process of artificially supplying water to soil for raising crops. India is basically an agricultural country and all its resources depend on the agricultural output. Water is evidently the more vital element in the plant life. In order to get maximum yield it is necessary to supply the optimum quantity of water, and to maintain correct timing of water. This is possible only through systematic irrigation system.

Canal is an artificial channel constructed on the ground to carry water to the fields either from the river or from reservoir. The losses in canal comprise evaporation from the surface and seepage through the bed and the sides of the drain etc. These types of losses cannot be reduced easily but it is increasing day by day. Hence for overcoming these losses the pipe line system is very effective technique but due to the peoples or farmers conflict this system does not adopted by irrigation department.

In this project we are going to study about the replacement of canal irrigation system by pipeline system and to compare this pipeline technique with open canal irrigation system. We are taking case study on present condition of Nira Left Bank Canal and checking socio-economic benefits by application of pipeline system.

**KEYWORDS:** Agriculture, Canal, Irrigation, Pipeline.

## I. INTRODUCTION

Irrigation is the artificial application of the water to the land or soil. It is used to contribute in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

Types of irrigation system

### 1. Surface irrigation system

Surface irrigation is known where water is applied and distributed over the soil surface by gravity.

Types of surface irrigation system

A) Basin irrigation B) Border irrigation C) Furrow irrigation D) Open canal irrigation

### 2. Sub-surface irrigation system

A method of providing water to plants by raising water table to the root zone of the crop or by carrying moisture to the root zone by perforated underground pipe known as subsurface irrigation.

Types of sub-surface irrigation system

A) Natural sub-irrigation B) Artificial sub-irrigation

Canal irrigation system

An open canal, channel, or ditch, is an open waterway whose aim is to carry water from one place to another. Channels and canals refer to main waterways supplying water to one or multiple farms. Field ditches have shorter dimensions and convey water from the farm entrance to the irrigated fields.

Losses occurring in open canal irrigation system

A) Major Losses

1. Seepage losses or percolation losses
2. Leakage through super passage
3. Illegal use of water by farmer
4. Velocity losses

B) Minor Losses

1. Evaporation losses
2. Leakage at mouth of distributaries

Pipeline system

A pipe line system or water supply network is a system of engineering hydrologic and hydraulic components which provide water supply. A pipe network for distribution of water to the consumers (which may be private houses or industrial, commercial and for irrigation) and other usage point.

Details of NLBC

In western Maharashtra a village named Veer consists of Veer dam. In the year 1964 the Veer Dam is constructed. This dam supplies water through NLBC and NRBC to the area of Pune, Satara, and Solapur District for various purposes. The storage capacity of this dam is 9.41 TMC. Nira Left Bank Canal about 150 km is one of the main parts of Veer Dam. Under this irrigation system different crops are taken in various seasons. Due to this system the yields of crops is increased.

Present condition of NLBC

The main problems that can be found in NLBC irrigation network include; Failure of canal Lining, Seepage through NLBC, Leakage through super passage, Weed growth in NLBC.



Fig. 1 Failure of canal lining



Fig. 2 Seepage through NLBC



Fig. 3 Leakage through Super Passage



Fig. 4 Weed Growth in NLBC

## II. LITERATURE REVIEW

The various literatures have been referred to understand the present condition of canal irrigation system. The study of literature helps in finding out scope for pipe line system area to replacement of canal irrigation system by pipe line system.

Shah T. et al (2010) in this paper, they have argued that there are at least ten strong reasons why Gujarat should seriously consider the 'IWMI Proposal' for pipelining the water distribution system down the minors in the SSP command area. The 'IWMI Proposal', in brief, argues that: (a) SSNNL should abandon the construction of sub-minors below the outlet; (b) instead, encourage, facilitate and incentivize private or cooperative service providers to invest in water distribution systems based on buried pipelines; (c) SSNNL should focus its management effort on delivering the bulk of the water at the minor level on a volumetric basis in a strictly enforced, predictable rotational schedule rather than delivering water to each field. Doing this will develop the SSP command area faster and preferable. In addition, besides saving land, water, energy and public funds, pipelining opens up huge possibilities for public-private partnerships and farmer participation in irrigation management in ways that surface canals have failed to provide.

Denise Fort et al (2012) recommended that, there is a new generation of pipeline projects proposed around the West. Many of these projects rely on water sources that are far less reliable than past water projects. The analysis of proposed pipeline projects frequently overlooks key issues related to cost, reliability of water sources, energy impacts and alternatives, particularly improvements in water use efficiency. Pipeline projects can be very energy intensive. The use of fossil fuel sources to provide this energy would further increase greenhouse gas emissions and further increase the pressure on western water resources by exacerbating climate change. Proposed pipeline projects should include an analysis of all of the below issues. The capital and operating cost of the propose project, in comparison with the benefits. (This should include an analysis of the external costs of proposed projects, such as environmental impacts.)

Mahesh M. Karad et al (2013) Research on Seepage Losses through Canals & Minors, An experiment entitled, "studies on seepage losses through canals and minors" was undertaken at the site of Paithan Left Bank Canal and Lassina Left Bank Canal.

Seepage losses were calculated by inflow-outflow method. Roughness coefficients such as (Manning, Chezy and Darcy Weisbach) were computed using the data, velocity, hydraulic radius and slope of canal and minor.

## III. METHODOLOGY

1. Data / Documents collection about the project. (NLBC).
  - a. Information about Veer dam.
  - b. Information about distributaries of NLBC.
  - c. Map/Topography of NLBC.
  - d. Construction and survey details of NLBC.
  - e. Water management schedule.
2. Taking out permission for the carrying out the survey of canal from irrigation dept.
3. Carrying out survey of canal.
  - a. Carrying out 8 km. survey of canal at an interval of 500 m for finding the present cross section of NLBC.
  - b. Carrying out survey with the help of various instruments like auto level, tape or chain, leveling staff, plumb bob, ranging rod, pegs, etc.
  - c. Finding the discharge, velocity, amount of silting, etc.
  - d. Finding the losses of water through open canal.
4. Comparing previous data (cross section, discharge, silting, etc) with present data about canal.
5. Social feasibility
  - a. Create awareness in peoples/farmers about this project and importance of water conservation.
6. Choose the effective pipe line system according to design parameters.

IV. RESULTS AND DISCUSSION

In NLBC huge amount of water losses are observed due to the bad condition of NLBC. The NLBC is not properly maintained by irrigation department and in aspects of this which leads to various problems like leakage of water through embankment; super passages, theft of water, etc. are occurred.

Improper lining is provided throughout the canal and hence there is erosion of slope and bed of canal, and this leads to decrease in the velocity, capacity of canal and chances of overtopping.

In this project we found out the present cross section of canal (NLBC) by a detailed survey work of 8 km at an interval of 500 m. and compared present cross section with original cross section with respect to discharge, velocity, amount of silting etc. following figures shows the present and original profile of canal.

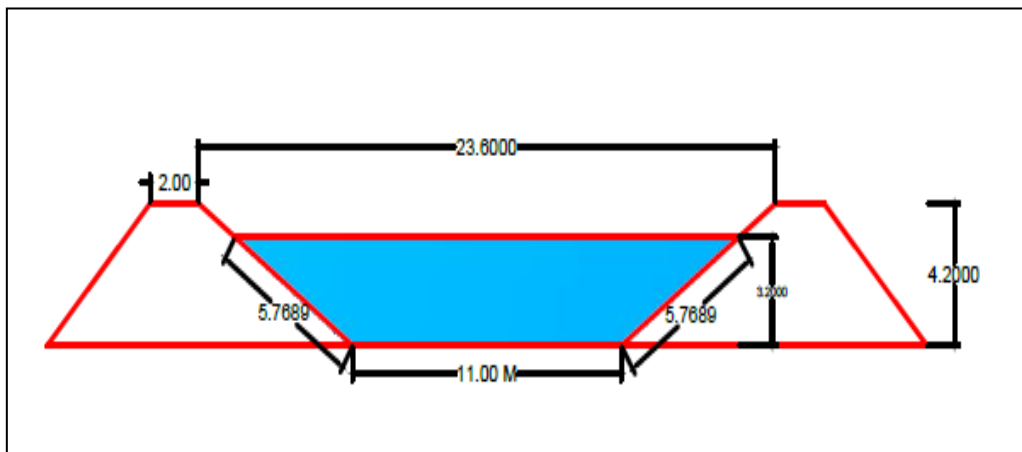


Fig. 5 Original canal cross section at 30 km chainage.

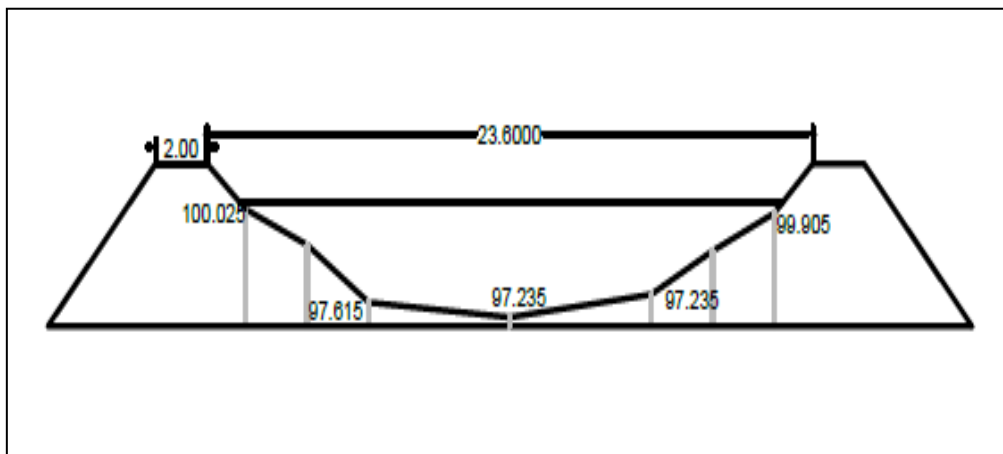


Fig. 6 Present canal cross section at 30 km chainage.

According to cost analysis the pipe line system is 9.036 % expensive than lined canal also initial construction cost of pipe line system is more but maintenance cost is less or negligible because system providing is a gravity pipeline system and hence due to this there is no any pressure and energy losses occurs. And hence according to some specifications and advantages this system is a very effective system and after the replacement of open canals by pipeline system all problems and losses are able to control or minimize easily.

V. CONCLUSION

In this project we observed that the present condition of NLBC and found the problems which are frequently encountered in irrigation canal systems. We observed that the some problems arises in present NLBC irrigation system like decreased velocity of canal flow and discharge capacity of canal, increase seepage loss through canal bed, erodes



the cross section of canal, increase leakages through canal structures, weed growth. This project could increase the water supply for irrigation purpose and economic vulnerability of communities in the long term. The pipeline system is very effective than open canal irrigation system which leads to consume more amount of water and speed of irrigation system can be increases. In summer season and in famine situation this system can improve role of water supply and distribute the consumed water to each water users easily.

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