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CALCULATION OF CANAL LOSSES IN NIRA LEFT BANK CANAL AND SUITABLE METHOD TO REDUCE IT

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ABSTRACT
Water is a very precious natural resource. When this precious resource moves through the canals certain part of the water is lost by seepage, evaporation etc. This loss is known as conveyance loss. In present paper, study of Nira Left Bank Canal (NLBC) is done which is situated in Pune district. Total length of canal is 162 Km out of which 30 Km is our study area. Discharge calculations at the head of canal and at 30^{th} Km is done, two standing wave flumes are present at these two locations. Percentage loss in discharge is calculated and to reduce these losses Cement Concrete Lining is suggested. Lining design is done based upon IS 10430:2000. Due to lining section of canal will get enlarged and discharge carrying capacity also gets increase which will result in increasing intensity of irrigation. At present, discharge carrying capacity of canal is 20.39 cumec and area to be irrigated is only 45 percentage of the available area so irrigable area can be enhanced by lining. Cost estimate of lining is done and benefit cost ratio of project is calculated.

KEYWORDS: Nira Left Bank Canal; Conveyance Loss; Standing Wave Flumes; Cement Concrete Lining; Discharge**.**

I. INTRODUCTION
Water is a precious natural resource. It is required by human in doing different daily activities. This precious resource while travelling through the canal is lost from the canals through seepage from the sides and bottom of the canals and by evaporation from the top of the canals. The seepage rates from the unlined canals can be extremely large, even lined canal never seem to eliminate water loss through side and bottom, but by lining we can reduce the water loss. Water loss from these canals has major impacts on surface water supplies and needs management, and should be minimized, if not altogether be eliminated. The main causes responsible for water losses are sediment deposition, siltation problem, leakage, lack of maintenance, sharp curve. Water losses comprises of both evaporation and seepage loss. The evaporation loss is the function of temperature, humidity and wind velocity. Practically, evaporation loss can't be controlled but seepage loss can be controlled by providing impervious medium such as brick, concrete, asphalt, etc between porous soil and water flowing in the system. Seepage loss in a canal is a major reason of water loss from the canal as compared to the other form of water losses. So, it becomes important to reduce this seepage loss for increasing conveyance efficiency i.e. the reason why lining have became a choice for reducing this water loss. Canal lining is done not only to reduce seepage loss it reduces erosion of canal banks and beds, reduce flow resistance i.e. hydraulic roughness, avoid water logging of adjacent areas, reduce piping of canals. With time different lining material came as an option. Concrete used in lining is durable but cost of applying it is very high whereas, geo-synthetic material used is easy to apply and less costly but some protective covering required to resist weathering action and other physical and environmental impacts. The conveyance and distribution of water are an integral part of any irrigational project. Irrigation system should be built in such a way that they operate in maximum efficiency. Many surface irrigation projects in most developing

countries are performed at levels much below their potential in terms of crop productivity, water dependability, equity and efficiency. The efficiency of the conveyance and distribution system, that is the transport of water at minimum cost and with minimum water loss, essentially affects the total economy of an irrigation project. Seepage losses may be and have been satisfactorily reduced through the installation of relatively impervious linings. In India different type of canal lining materials are commonly used namely brick, concrete tile, cement concrete, membrane etc. The materials are selected as per the following criteria such as Discharge, Soil condition, Material availability, Labor availability, Out of the above mentioned materials, concrete tile lining and cement concrete lining are very commonly used worldwide.

APPLICATION

Canals having same kind of problem i.e. water loss through canal section can be treat by same method. If benefit/cost ratio of this project is greater than one the same suggestion can be given to remaining length of canal. As per project plan, out of net CCA of 60,656 ha. The area to be irrigated is only 27,328 ha. i.e. 45% of available area. Due to lining irrigable area will get increase.

II. RESEARCH SIGNIFICANCE

Irrigation in Nira Valley started a century ago. In year 1889, pick up weir at Veer on Nira River constructed and Nira Left Bank Canal off-taking from that weir at Veer. Canal capacity in first stage was 12.88 cumecs. In second stage canal was enlarged in 1926 to carry a designed discharge 20.39 cumecs. Another addition ti this project was made during the period 1954 to 1962 by constructing a storage dam at Veer but at that time remoulding of Nira Left Bank Canal does not takes place. It is now universally agreed that modernisation of old irrigation system gives better returns on investment as compared to construction of new schemes. Generally modernisation is taken up after about 20 years. The Nira Left Bank Canal is now 100 years old and 60 years have elapsed after it was enlarged last. Therefore, it should get a high priority in modernisation.

III. REVIEW OF LITERATURE

A. K. D. Uchdadiya1, Dr. J. N. Patel [1]

In this paper study includes, The reduction or eliminate of seepage losses in irrigation canals by means of linings assures better utilization of the conveyed water and an improved economic situation, seepage losses from earthen irrigation channels depend on a number of factors. The exact analysis of seepage loss from the canals is quite complex. Theoretical, laboratory and fieldwork has confirmed that seepage rates from canals are affected by the following Factors: Depth of water in the canal, Age of canal, permeability of soil etc.

B. Pradeep Sahu1, A. K.Saxena, Dr. M. K.Travadi [2]

In this paper study includes, Canal linings are expensive. In usual terrain a lined canal may cost twice as much as an equivalent unlined earth canal. This paper discuss In addition to a possible saving in construction costs, the more common benefits derived from canal lining are : Reduced damage to lowlands from seepage or reduced drainage cost, saving in water, Greater safety and Reduced operation and Maintenance costs. Cost analysis of the topic Cement concrete lining more cost effective then other types of lining methods. In Indian scenario and resultant of the study shows that we can save and evolve new methodology of lining (Concrete & tile) So that we can reduce estimating cost of lining project on urban & rural level lining .

C. Bikram Saha [3]

This paper discusses the main causes responsible for water losses which are high density of vegetation, sediment deposition, siltation problem, leakage, lack of maintenance, sharp curves. Water losses comprises of both evaporation and seepage loss. The evaporation loss is the function of temperature, humidity and wind velocity. Practically, evaporation loss can’t be controlled but seepage loss can be controlled by providing impervious medium such as brick, concrete, asphalt, geosynthetic material etc between porous soil and water flowing in the system. Concrete used in lining is durable but cost of applying it is very high whereas, geo-synthetic material used is easy to apply and less costly but some protective covering required to resist weathering action and other physical and environmental impacts. In study it has seen that the aging of the thermoplastic polymers has been considered to occur in three distinct zones. Antioxidants present in the resin prevent polymer degradation. Thus, the polymer containing more antioxidant will have more service life. Out of HDPE, LLDPE, PVC, CSPE, EPDM resin. HDPE is the material which lifetime is more.

Material recommendation for canal lining depends on locally available material, budget, most importantly soil characteristics to infiltration

IV.STUDY AREA

As Nira Left Bank Canal off takes from Veer 27 km below Bhatghar Dam district Pune. It is situated in Krishna Basin – Nira Valley. Maximum annual rainfall on dam site is 1998 mm and mean annual rainfall is 953 mm. total length of canal is 162 km. net CCA under this canal is 60,656 ha out of which 27,328 is irrigable area. Out of 162 km length we are focusing on first 30 km length.

V. METHODOLOGY

In this paper study includes, study of 30 km stretch of Nira Left Bank Canal, as it is now 100 years old. So that we can know material used for construction of bank work. Depending on material used for construction of bank we can comment on quality of material. Calculation of discharge at head of canal and at 30 km is done with standing wave flume, daily and its average for each month is calculated. From this reading we can calculate % loss in discharge. To minimize this discharge Cement Concrete Lining is suggested. For design of lined canal IS 10430: 30 is referred. Parameters for design of lined canal are Side Slope, Free Board, Berm, Bank Top Width, Dowel 'Dwarf Bund', Roadway and Drainage, Typical Cross Section, Cross-Section, Discharge and Velocity. Water which is saved due to lining can be given to more irrigable area which will increase intensity of irrigation.

Analysis for determining the maximum rate of expenditure on lining that is economically justifiable, the following notations and formulae are applied:

p and P : Wetted perimeter in meters of unlined and lined section respectively.

lc and Lc : losses in unlined and lined canal respectively in cubic meters per square meter of wetted surface per day.

L : Length of the canal in meters.

d : Number of running days of the canal per year

W : Value of water saved in rupees per cum.

M : Annual saving in rupees in operation and maintenance due to lining.

B : Annual estimated value in rupees of other benefit for the length of canal under consideration. These will include prevention of water logging, reduced cost of drainage for adjoining lands, reduced risk of breaching, etc.

The annual value of Water lost by seepage From the unlined section = (p L lc d W) Rs

The annual saving by Lining in value of Water otherwise lost

By seepage if unlined = (p L lc d W-P L Lc d W) Rs

= {L d W (p lc-P Lc)} Rs

Total annual benefits Resulting from the Lining of canals = {L d w (p lc-P Lc) +B+M} Rs

From above formulae annual benefits resulting from lining of canal are achieved. Simultaneously Cost estimate of lining is done so that we can calculate benefit cost ratio of the project. If ratio is greater than one it means economically project is feasible.

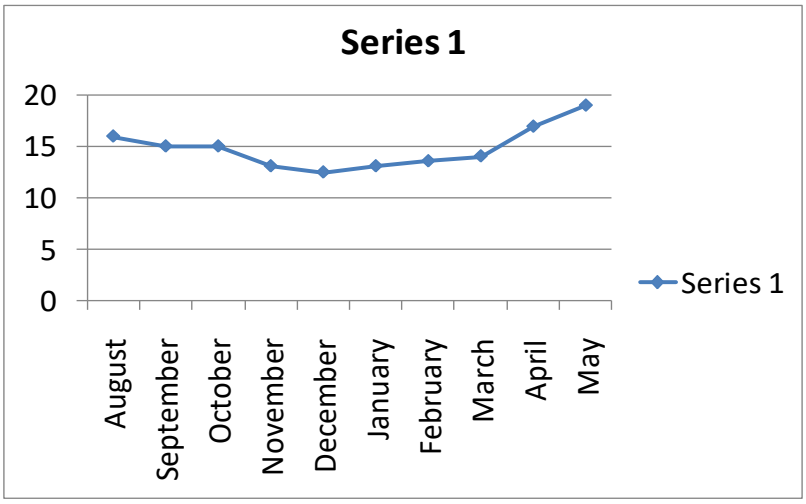
VI. RESULTS

In this paper depth of water present at head of canal and at 30 km at standing Wave flume is observed. And from Nira Left Canal GES table [IS: 6063-1971] we can calculate discharge at respective position. Day wise discharge calculation is done and from that monthly average discharge is calculated from which we can calculate % loss in discharge.

Fig.1 Scale Provided At Standing Wave Flume to Observe Depth of Water

Table.1 Observed and % Loss in Discharge

Sr. No	Month	Q at head (Cusecs)	Q at 30 km (Cusecs)	Observed loss	% loss
1	August	827	695	132	15.96
2	September	827	703	124	14.99
3	October	827	703	124	14.99
4	November	827	719	108	13.05
5	December	827	724	103	12.45
6	January	827	719	108	13.05
7	February	827	715	112	13.54
8	March	827	711	116	14.02
9	April	827	687	140	16.92
10	May	827	670	157	18.95



VII. CONCLUSION

If losses in canal get control then we can utilise this amount of water to irrigate more area. From reference of project plan, out of net CCA of 60,656 ha. The area to be irrigated is only 27,328 ha. i.e. 45% of available area. If amount of water is saved then intensity of irrigation get increased resulting into increasing in yielding of crop. To control these losses C.C. Lining is suggested which also results in increase in discharge capacity of canal.

VIII. REFERENCES

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