STUDY AND DESIGN OF LIFT CANAL IRRIGATION SCHEME AT NERLA PROJECT

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Abstract - *As global population increasing, the gap between demand and supply of water also widening. Leads to threat for human existence. Many scientists finding way to water conservation. While municipal waste water and industrial effluents cause major environmental engineers. Recycling waste water for irrigation is seems to be solution. The paper mill effluent for irrigation offers many benefits such as conservation of water resources, conversion of barren land into irrigated area. Addition of nutrition to the soil. All this reduce the pollution of inland water bodies. The extent to which effluent irrigation responsible for problem such as water logging. Salting of soil, deterioration of surface and ground water are not estimated in holistic manner. The fact effluent irrigation become necessity in arid and semi arid region demonstrate to need the impact assessment .the evaluation of effluent irrigation system for long term sustainability and monitoring major to sustain effluent irrigation is of prime importance to effluent user and public. The impact of the period of irrigation can also be assessed more precisely as the four schemes have been introduced at different periods of time viz. Odapalli Papanpalayam Lift Irrigation Scheme (OPLIS) in 1983, Odapalli Mukuparai Lift Irrigation Scheme (OMLIS) in 1986, Kattur Lift Irrigation Scheme (KLIS) in 1989 and Gravity irrigation (GI) which is more than 25 years old. The various aspects considered for the evaluation of effluent irrigation are the characteristics of the effluents and its suitability for irrigation, the long term effect of effluent irrigation on soil physical and chemical properties, nutrient availability, heavy metal accumulation in the soil, the changes in land use, the ground water quality in the effluent irrigated field, river water quality adjacent to the paper mill and above all the socio-economic condition and perception of the beneficiary farmers.*

Key Words: **Canal, Irrigation, Pumping House, Lift Irrigation, Cropping, Discharge, Line Canal**

1. INTRODUCTION

Irrigation is the Science of applying water to soil by artificial means for growth of plant. While lift irrigation would simply mean lifting of water for irrigation, the term lift irrigation scheme means a scheme in which an appreciable quantity of water would be raised by means of pump (Lifting Device) from a source of water to an appropriate height for irrigation of an area located at level higher than of the water source. In conventional lift irrigation practice water is released at an elevated location so that water flow under gravity and irrigation of desired area is performed through open canal or buried pipe lines. Both the surface and ground water reservoirs are used as the dependable source of water for irrigation. While common surface water sources are river, streams, canals and tanks, ground water resources through open dug well, the tube well and dug cum bore well can be used as a dependable source under favourable hydro geological condition. LIS can be classified by a number of criteria based on it source of water, source of power, size of command area, type of energy consumed, type of installation and management.

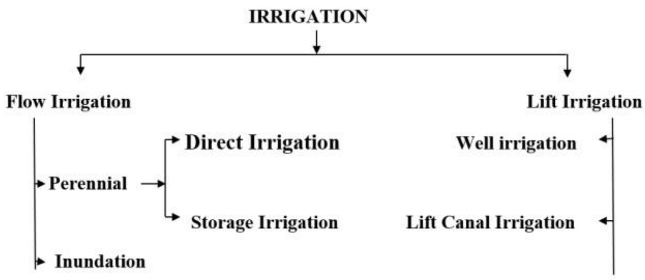

Fig -1: Types of Irrigation

FEATURES OF LIFT IRRIGATION SCHEME (LIS)

(i) LIS allow irrigation of a specified area as per as availability of water.

(ii) Irrigation can be provided in any given area as per as choice of user.

(iii) Irrigation of an elevated area is made possible which cannot be served otherwise by any normal flow irrigation.

(iv) Scheme based on dependable ground water as source is effective during the period drought.

(v) LIS depends entirely upon a timely supply of energy necessary for operating pump.

(vi) Proper management of LIS is utmost importance, lack of which would lead to financial losses and eventually failure of the scheme.

(vii) Decision relating to investment, gestation period, extends of command area, water sharing, cropping pattern, operation and maintenance of scheme etc. can be made commensurate to the capabilities of the user of the scheme.

2. PLANNING OF LIFT CANAL IRRIGATION

Planning involved making rational choices among feasible courses of investment and other developments possibilities on the basis of socio-economic consideration. In agricultural water is the most critical input .lack of time and adequate water supply not only retard crop growth but also render use of other input in effectives. Planning for LIS therefore necessarily demands matching of the available water with crop production in the overall development perspective (Micro economics). Reliable data on the irrigation potential develop so far in India through LIS alone is not available separately A study of the power consumption pattern can also indicate the trend in the growth rate of LIS. It has been estimated that electric power consumption during 1973-74 was 4242 million kilowatt hour which is expected to increase to14204 mkw-hr by the year 1988-89. The diesel consumption during the corresponding period was expected to rise from 559 to 1116 millon-litres. In order to meet the ever increasing demand of irrigation, progressively higher investment are likely to be incurred in the subsequent year. Large amount of investment are called for not only in the installation of lifting and distribution system but also meeting the operation

2.1 SITE SELECTION FOR LIFT CANAL IRRIGATION

The success of lift irrigation scheme depends upon selection of suitable site for canal lift irrigation. Following main points to be consider in selection of suitable site for canal lift irrigation. 2015-16.

(i) The site should be preferably below the confluences of distributaries and main stream so as to have large supply of water and very few cross drainage work.

(ii) If possible site should just on the upstream side of steep bed slope in the stream.

(iii) It should be within reasonable distance from the command area to be irrigated.

(iv) Hard and sound rock foundation should be available at stream bed level or slightly below the bed level at site.

(v) At the site natural banks of stream should be high enough to be avoid any submergence of marginal during floods.

(vi) The supply of water at the site should be dependable as regards to its quality land duration.

(vii) Availability of good rock at the site giving easy foundation condition.

(viii) Availability of some post monsoon flow, Discharge observation should be arranged at the place that will be selected.

(ix) Inclination of people to practice lift irrigation direct from storage or from well on bank.

2.2 LOCATION OF LIFT CANAL IRRIGATION

Canal lift irrigation system to supply water field land, the choice should be based on the considerations of the capital cost, operation and maintenance charge. Following point should receive carefully consideration. Before selecting the site, it must first be seen whether the canal is to irrigate land on one side only or on both side. In many cases the culturable land lies on one side and the canal has to be taken off only one side. If the canal have to take off one both sides of the dam it much better to site the dam on a straight reach of the stream.

3. DETAILS OF NERLA LIFT IRRIGATION SCHEME

Nerla project was selected of study and design. We have collected the following data which are required for the design of Lift Irrigation scheme. Nerla lift irrigation project has been constructed on Wainganga river under Gosikhurd national project scheme. It is situated near Nerla village District Bhandara Maharashtra. Water is conveyed through approach canal from Gosikhurd reservoir to Pump house which is 43.80 Km away from reservoir and there are 12 vertical turbine pumps of 1015 HP in the pump house. There are 4 outlets of 2500mm dia of 16mm thick having length of 0.690KM.Through these outlets a discharge of 37cumec is supplied to the supply canal. A Project is having total irrigation potential of 28680Ha out of which 21727Ha is the irrigation command area. Total water use of the project is 143.77 Mm3. Estimated cost of this project is 158.83 Corers. We have visited the project and data/information were collected:- (i) Controlling level (ii) Details of gated flood walls (iii) Details of pumps (iv) Rising mains (v) Delivery chamber (vi) Canal – Main canal bed level (vii) Command area

Table -1: Controlling Levels

MDDL of Gosikhurd Project	241.29 m
Approach canal bed level	238.98 m.
Pump house foundation level	234.47 m.
Motor floor level	251.30 m.
Delivery floor level	246.80 m.

Table -2: Details of Pump

Capacity	1015 HP
Nos	12 Nos
Pump RPM	500 RPM
Static Head	18.96 m
Friction Head	1.43 m
Total Head	20.39 m
Size Of Pump House	10.5 x 54 m

4. COMPONENT PARTS OF LIFT CANAL IRRIGATION

From the source of water, water is to be convey up to the pumping house for lifting. It is generally conveyed through the gravity using canal or the pipe line. In the Nerala project water is carried from the source i.e. Gosikhurd reservoir to the Pumping house using the approach canal. Length of approach canal is –km. and bed level of approach channel at Nerla is 238.98m

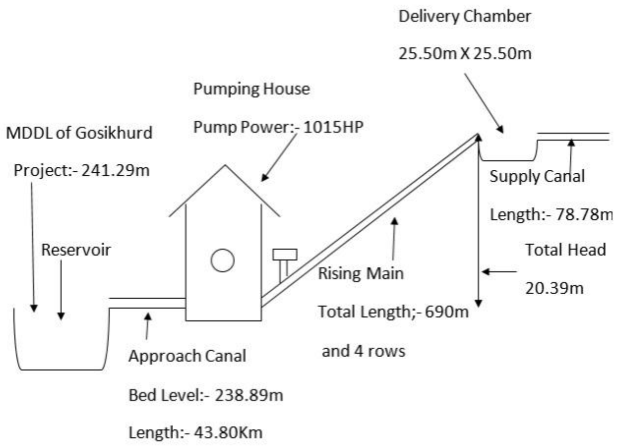

Fig -2: Elevation

In the pumping house the water which is at lower level is lifted to the desired higher level. Pumping create a pressure head which make water move from one point to another.

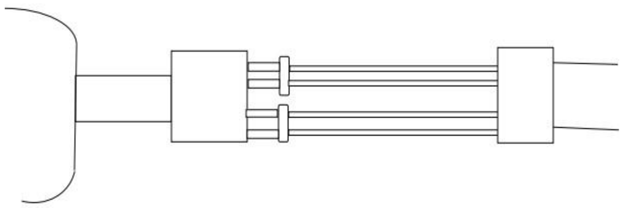

Fig -3: Plan

In Pumping process extra energy is added into a water to make it move against gravity. Pump are mechanical device in which energy from an external source is converted into hydraulic energy. In this project 12 Vertical turbine centrifugal pumps of 1015HP having 500 RPM are used. The static head observed at the site is 18.96 m, friction head is 1.43 m and total head is 20.39 m. The size of pump house is 10.5 m x 54.00 m. For designing the pump one must known the pumping head, design discharge, efficiency of pump, frictional head losses and formula used for calculating power of pump.

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4.2 PUMPING HEAD

Static Head: The static head sometimes referred as pressure head. Static head is equivalent to vertical distance from sump of water to the delivery point.

Friction Head: Friction is a energy required to overcome the frictional resistance met by water during its flow expressed in equivalent height of water column and it is given by "Darcy Weisback Equation".

$$hf = 4fLV2/2gD$$

Where, hf = Head loss due to friction, f = Friction Coefficient, V = Velocity of water in m/sec, g = Acceleration due to gravity m3/sec. D is diameter of pipe.

Total Head: It is the vertical distance between the pumping water level and discharging water level. In other word it is the sum of statics suction lift and static delivery head and is the total height by which water is to be lifted.

5. RISING MAIN

Rising main is the pipeline used for lifting the water from the sump to the supply canal in LIS. A pipe closed conduit used for carrying water or any other fluid . A pipe is made of uniform or different diameter .they join together with the help of pipe fitting as coupling ,flange ,reducer ,bend ,elbow and other pipe junction .Long pipe line are used for conveying water different kind of water ,oil, gas, in pipe are different. Water when flowing through the some losses occur and they affect on the velocity of water and power, Therefore, following points should be kept in mind while designing the pipes.

LOSSES OF HEAD IN PIPE LINES:
A) Constant Velocity Head Loss (i) Loss of head due to friction in pipe itself (ii) Loss of head at exist
B) Variable Velocity Head Losses Is Due To, (i) Pipe entrance (ii) Sudden enlargement (iii) Sudden contraction (iv) Pipe fitting When the pipe is long, the total head loss n account of entire the pipe fitting is smaller than fictional head loss in the pipe itself. It is major head loss in pipe line, while loss of head due to variable velocity is major loss. Minor loss generally neglected for rough estimates.
(1) HEAD LOSS DUE TO BEND: When the water flow through a bend its tends to move away toward the outer curve of the

bend due to centrifugal force. This cause a turbulence .Which gradually returns to normal as the flow continue beyond the bend. h=KbV2/2g Where, kb=coefficient of head loss due to bend v=velocity of water kb is depend on the ratio of radius of curvature (r) and diameter of pipe(D) of the bend

(2) HEAD LOSS DUE TO GATE VALVE : Losses due to gate valve for different position of valve will be different .Naturally loss is minimum when the gate valve is fully opened .Head loss due to gate valve is given by, H=kgV2/2g Kg is coefficient of head loss due to bend

(3) HEAD LOSS DUE TO FOOT VALVE: Head loss due to foot valve (check valve) and its strainer can be computed as h=ktV2/2g h=ksV2/2g Where, kt and ks are the coefficient of head loss due to foot valve and strainer respectively.

(4) HEAD LOSS DUE TO FITTING: The are the losses in head due to fitting such as coupling, bend etc.

(5) HESD LOSS DUE TO SUDDEN CONTRACTION: When water is made to flow a large diameter pipe to a smaller diameter of pipe ,a sudden contraction of flow takes place. Owing to this sudden contraction, the velocity of the flow increase abruptly in the smaller diameter pipe creating a local turbulence .the energy lost is h=kcV2/2g kc is the coefficient of head loss due to sudden contraction in flow.

(6) HEAD LOSS DUE TO SUDDEN ENLARGEMEMNT: When water flow from small diameter pipe to a larger diameter pipe ,the velocity if the flow in the larger diameter pipe drops abruptly causing a local turbulence h=KeV2/2g

*(7) ENTRANCE LOSS:*This occurs when water enter in a pipe from a larger tank or reservoir .Thus in the following equation h=KenV2/2g Ken is taken as 0.5

(8) EXIST LOSS: This is the a special case of sudden expansion. This occur when a pipe discharge into a tank or a reservoir full of water h=KexV2/2g Since the loss of energy is complete the value of coefficient of exist loess is taken as 1, Exist loss is therefore equal to the velocity head in its magnitude.

6. CONCLUSION

We have studied the Lift Irrigation Scheme, various component parts of LIS are observed during the visit to Nerla scheme, various technical details were noted at the time of visit. We have design various component such as No. of pump required, HP required for the pump, supply canal and related parts of lift irrigation. These designs were compared with designs given by irrigation department. We found that our design were similar to the designs were similar to the design given by irrigation department.

REFERENCES

[1] Nathan K K; Sharma RK; Singh A (2001) ‘Irrigation Development and Future Possibilities’ Yojana. Jul; 45:23-6 M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.

[2] Gadgil D.R. (1954)1 in the paper title ‘The Industrial Evolution of India in Recent Times’

[3] Punmia, B. C. & Pande, B. B. L. (2001). Irrigation and water engineering, Laxmi Publications New Delhi.

[4] Garg, S. K., (2009). Hydraulics and irrigation, Khanna Publishers, New Delhi.