GOVERNMENT OF THE PUNJAB
IRRIGATION DEPARTMENT

CASE STUDY
ON
DIMINISHING WATER SHORTAGE IN CHOLISTAN AREA, PLANNING AND MANAGEMENT

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ABSTRACT

Irrigation Engineering is a key to efficient and timely water management / distribution in canal command areas keeping in view the crop factors, and for irrigation management adequate and always updated information regarding the irrigation system is needed. This paper illustrates a tool for Irrigation Engineers which provides information interactively for decision making process on how to diminish water shortage by conserving / enhancing water resources. This Interactive Information has been developed to facilitate the operation and management of the command area development and to calculate the irrigation efficiency in the Cholistan area in Irrigation Zone Bahawalpur. It also provides support to the Irrigation Engineers to assess the impact of the design parameters of a System which can enhance the Irrigation efficiency in the peek demand of water by using minimum source of water available.

INTRODUCTION

A major part of Irrigation Engineering is deciding when to irrigate and how much water to apply. Many irrigation projects throughout the world never fulfill the expectations envisioned at planning, designing and management stages. The land eventually irrigated is often more than planned, efficiencies are lower, and crop yields are not as high as expected. A major reason is the lack of incentives and a working knowledge about proper water management, including scheduling at the farm level on the part of project planners, designers, system operators, and agricultural personnel, as well as farmers. To maximize returns from irrigation development and from efficient on farm water application in developing countries, there is a recognized need for knowing how water deficits and surpluses influence crop production, how to determine water requirements, and the best methods and proper timing of irrigation applications.

Irrigation agencies also recognize that of equal importance is their capacity to evaluate existing irrigation schemes, to analyze systems for rehabilitation, and to improve the management of water on the farm for increased yields and benefits, and for good decision and analysis require good information. This paper will help engineers, agriculturalists, and Irrigation managers to understand water needs in the Cholistan area in Bahawalpur Irrigation Zone to conserve water recourses by constructing water storage tanks to be filled in during the available surplus supply in the flood channels.

OBJECTIVES

Objectives of writing a paper on the topic, “Diminishing Water Shortage in Cholistan Area, Planning and Management” are to develop a framework:

- To know the methods for conserving water to be utilized during short supplies / drought season.
- To decide how to store water to sustain an equilibrium among demand and supply.
- To save absorption and evaporation losses.
- To know the process of implementation of suitable operation and maintenance of an Irrigation System to obtain optimum results.
- To know how to boost up yield by using minimum water resources.
- To estimate how to enhance prosperity and uplift social values of the inhabitants of the Cholistan area.
- To minimize human sufferings by diminishing water shortage in Cholistan area.
- To introduce new Irrigation Networks to enhance economic conditions of the people of the Cholistan area.

CHAPTER 1

IRRIGATION SYSTEM IN SOUTHERN PUNJAB

EXECUTIVE SUMMERY

Area falling between Indian Border on the Southern side and boundaries of the River Sutlej from Suleimanki to Panjnad and River Chenab from Panjnad to Guddu on the northern side constitutes Bahawalpur Division (Ex-Bahawalpur State). This entire area (about 20,000 sq miles), adjacent to Great Indian Desert, was at one time a desert itself except small patches and pockets along the Rivers, which were irrigated by inundation Canals. Table – 1 gives detail of the area in Bahawalpur Civil Division:

Total area of Bahawalpur Division	=	11.2 Million acres
C.C.A. being irrigated by Canal	=	3.8 Million acres
Uncultivable area within canal boundaries	=	0.9 Million acres
Desert area (Cholistan)	=	6.6 Million acres
Cultivable area in Cholistan	=	3.5 Million acres
High sand dunes in Cholistan	=	3.0 Million acres

Table – 1

Sutlej Valley Project comprising three barrages viz Suleimanki, Islam and Panjnad, came into operation during 1920 – 1933. Canals were excavated which brought extensive area under Irrigation. At present these canals Irrigate about 3.8 million acres area. Details of areas Irrigated by different Canals are given in table – 2

CHAPTER 1

IRRIGATION SYSTEM IN SOUTHERN PUNJAB

Sr. No.	Headworks	Canals.	Gross Area (M. Acres)	Culturable Area (M. Acres)
1	Suleimanki	1. Eastern Sadiqia Canal (Perennial)	1.23	1.04
		2.Fordwah Canal	0.46	0.43
2	Islam	3. Bahawal Canal (Perennial and non-perennial) Now being fed from Sidhnai Mailsi Bahawal Link	0.89	0.89
		4. Qaim Canal (Non perennial)	0.05	0.04
3	Panjnad	5. Panjnad Canal (Perennial + non perennial)	1.51	1.35
		6. Abbasia Canal (Perennial + Non perennial	0.30	0.24
		Total	4.44	3.83

Table – 2

The system was commissioned in 1932-33. With the passage of time, the channels and structures deteriorated and at present the system requires complete rehabilitation.

The Bahawalpur Irrigation Zone basically comprises three Districts i..e Bahawalnagar, Bahawalpur and Rahimyarkhan, and the area in these systems mostly fall within jurisdiction of Bahawalnagar, Bahawalpur and Rahimyarkhan Canal Circles respectively.

At present Bahawalpur Irrigation Zone gets irrigation supplies from Terbela and Mangla Command. Panjnad Canal system receives water from Terbela command while the Bahawalpur and Bahawalnagar Districts receive supplies from Mangla command. Sometimes the water from Terbela command is diverted to Mangla command via CJ Link.

District Bahawalnagar, District Bahawalpur and District Rahimyarkhan receive supply from Suleimanki Headworks, Islam Headworks / SMB Link Canal and Panjnad Headworks respectively.

CHAPTER 2

DIMINISHING OF WATER SHORTAGE IN CHOLISTAN

Water for Irrigation purposes can by saved by the following methods from the available resources:

LINING OF CHANNELS

The main advantages of lining a channel are saving in irrigation water, avoiding water logging, stability of section and reduction in maintenance cost. Improvement of command owing to flatter slops is also possible. It is the most effective and economical method of preventing absorption losses through the irrigation channel.

Financial analyses of lined channels scheme has been made in regard to benefits achieved from savings in water. This is based on the presumption that the area irrigated would increase proportionally with the increase in supply.

CONSERVING WATER RECEIVED FROM FLOOD SUPPLIES

The Sutlej Valley Project was commissioned in the year 1932 and Cholistan desert was left un-irrigated except smaller Cholistan (about 5.0 acres) which was also deprived off irrigation facility. On the recommendation of Darley Commission about 2000 Cfs. water was transferred to Bekaner State. Similarly another area of about 5.0 lac acres was excluded from the greater Cholistan at tail Bahawal Canal. For reopening some area, a scheme was implemented in 1981 and an area of about 3.15 lac acres was reopened for flood period (77 days) when surplus supply was available at Panjnad Headworks. Out of this area, 1,85,000 acres has to be abandoned due to non allotment.

CHAPTER 3

PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

CONSERVATION OF WATER BY CONSTRUCTING STORAGE PONDS

At present 2,14,000 acres area situated at tail Abbasia Canal and tail Desert Branch is getting flood waters for 77 days (15th July to 30th September). It is now proposed that 2.0 lac acres area on the tail Abbbasia Link will further be reopened for using surplus flood supplies from Panjnad Headworks. It is now planned that beyond 77 days this area should get water from storage reservoirs which are popularly known as Irrigation Tanks. In addition to supplying surplus flood water, storage tanks will be provided so that after 30th September, the farmers can get water from these storages tanks for irrigating Rabi crops.

PRIORITY AREAS

Following four areas irrigated from surplus flood supplies for 77 days are candidates for irrigation Tanks:

1. Existing area on tail Abbasia Canal measuring 1,17000 acres, District Rahimyarkhan.

2. New proposed area measuring 2,00,000 acres adjacent to the above area on tail Abbasia Link, District Rahimyarkhan.

3. 3,00,000 acres area at tail Desert Branch, District Bahawalpur.

4. 9000 acres area on tail Hakra Flood Channel, District Bahawalnagar.

It is proposed that 400 No. irrigation tanks will be provided for the area in District Rahimyarkhan, 400 No. for areas in District Bahawalpur and 20 No. for areas in District Bahawalnagar.

CHAPTER 3

PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

PROPOSALS

The proposal to provide system storage ponds and lining on flood channels at tail Abasia Canal and at tail Desert Brach to diminish the water shortage particularly in the Cholistan area is thus feasible.

It was recommended that, the Flood Channels at tail Abasia Canal should be taken up first because due to available supply in Abasia Link Canal, the surplus flood supply from Panjnad Headworks can readily be conveyed to these channels for filling ponds. On the other hand, the flood channels at tail Desert Branch cannot be supplied extra flood supply from Sidhnai Headworks, unless another barrel is constructed at Mailsi Siphon and the Sudhnai – Mailsi – Bahawal (SMB) Link Canal is remodeled for 6,700 cusecs.

It was to be noted that in the first phase, the following channels (132 miles long) situated at tail Abasia Canal will be lined, and on each outlet (359 No.), system ponds will be constructed:

1. Javid Disty	5. 7R/AC	9. 2R/1L/AC	13. 3L/1L/AC
2. 4R/AC	6. 1R/7R/AC	10. 1L/1L/AC	
3. 5R/AC	7. 1L/AC	11. 1R/1L/1L/AC	
4. 6R/AC	8. 1R/1L/AC	12. 2L/1L/AC	

Similarly, in the second phase, the following flood channels situated at tail Desrt Branch (139 miles long) will be lined and on each outlet (305 No), system ponds will also be constructed:

1. Ladamsar Dy	5. 1L Derawar	9. 2R Mithra	13. New 1L Shahiwala
2. 2L Salary	6. 2L Derawar	10. Mithra N.P	14. Quraish Feeder
3. 1L/2L Salary	7. 3L Derawar	11. Dhari Dy:	15. Shahiwala Feeder
4. Derawar Br:	8. Mithra Derawar Link	12. New Shahiwala	

CHAPTER 3

PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

CRITERIA FOR CONSTRUCTION OF WATER STORAGE POND

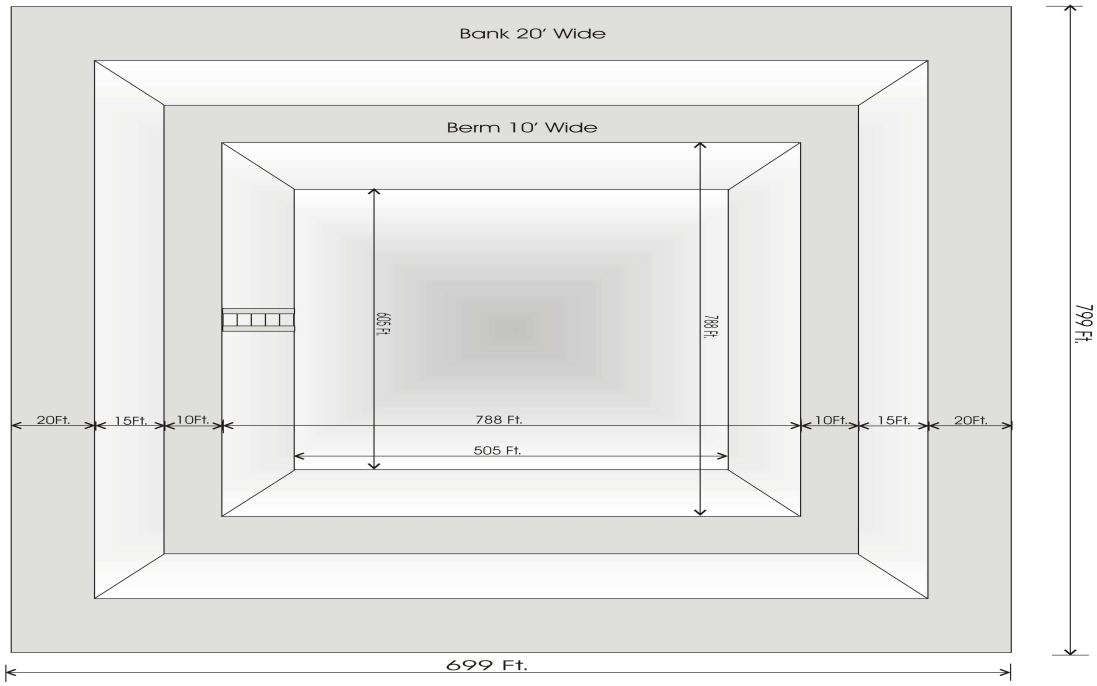
The Irrigation Ponds / Tanks, as water storage structure, are made by constructing a dam, abutment or pit. The purpose is to conserve water by holding it in storage until it is used for crops to meet irrigation requirements. This practice applies to irrigation water storage structures that meet all the following criteria:-

1. The water supply available to the irrigated area is insufficient to meet with irrigation requirement during the irrigation season.
2. Water is available for storage from surface run off, stream flow or a sub surface source.
3. Suitable site is available for the construction of a storage reservoir.

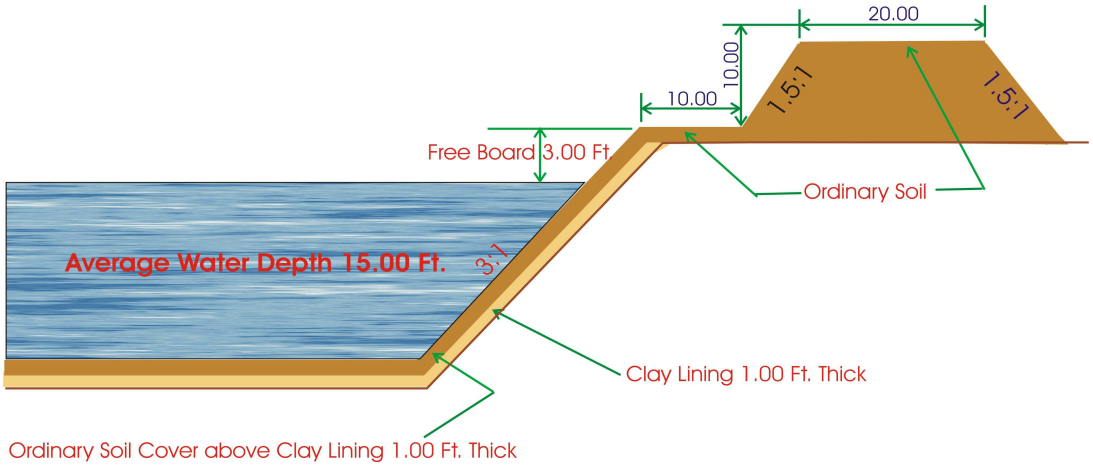
This standard pertains to the planning and functional design of irrigation storage reservoirs. The storage reservoirs shall be planned and located to serve as an integral part of irrigation system. The capacity of the reservoir is calculated to satisfy the Irrigation requirements, according to the length of the storage period, the anticipated inflow and out flow during this period and the expected seepage and evaporation losses.

DESIGN OF WATER STORAGE POND

TYPICAL PLAN OF PROPOSED CANAL WATER STORAGE POND TO BE CONSTRUCTED IN CHOLISTAN



TYPICAL X-SECTION OF PROPOSED CANAL WATER STORAGE POND TO BE CONSTRUCTED IN CHOLISTAN



PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

PONDS ON DESERT BRANCH

Three No. Pilot Ponds were constructed in 2003 at Derawar Branch and Ladamsar Disty. The ponds were 17 ft deep, with 1:3 side slope. The excavated earth was utilized to make banks around the pond for maintenance purposes. A layer of local clay, 1 ft deep was utilized as sealant. It has been observed that the clay sealant proved to be the excellent option, cost wise and performance wise. Depending upon size of the outlets, the capacities of the ponds vary from 200 Acre-ft to 500 Acre-ft. With clay sealant, the average cost came out to be Rs. 20 million.

VIEW OF POND IN CHAK NO. 117-DNB

CHAPTER 3

PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

PONDS ON ABBASIA LINK CANAL

It was suggested that at Tail Abbasia Canal (1,17,000 Acres), area should be taken up for the purpose because the feeding channel i.e. Abbasia Link Canal have sufficient additional capacity to divert required supply from the Panjnad Headworks.

Hence, 2 No. Pilot Ponds proposed to be constructed at RD. 21000/R of 7R/Abbasia and at RD. 41300/L of 1L/Abbasia. The first pond was designed to be unlined and the second will be lined with the latest insulation i.e. Geo-membrance, and concrete filling on sides, and gravel filling at bottom.

Both the above mentioned ponds were got approved as, “Construction of System Storage Ponds in Cholistan (Pilot Project) under the Annual Development Programme (ADP) 2009-10 with the estimated cost of Rs. 117.821 Million. Presently the work is under progress.

SCOPE OF WORK OF EARTHEN POND AT RD. 21000/R, 7R/ABBASIA

Inlet Discharge	= 2.04 Cfs
CCA	= 480 Acres
Losses	= 20%
Capacity	= 404 Acre ft
Pond Area	= 23.75 Acre
Base width	= 957’ x 957’
Free Board	= 3 ft
Depth	= 17 ft
Top width	= 1077’ x 1077’
Side Slope of Pond	= 3:1
Side Slop of Bank	= 1.5:1
Bank Width	= 20 ft
Bank Hight	= 20 ft
Berm Width	= 20 ft

Work under progress

SCOPE OF WORK OF GEO-MEMBRANCE POND AT RD. 41300/L, 1L/ABBASIA

Inlet Discharge	= 1.14 Cfs
CCA	= 283 Acres
Losses	= 20%
Capacity	= 242.33 Acre ft
Pond Area	= 14.25 Acre
Base width	= 728’ x 728’
Free Board	= 3 ft
Depth	= 17 ft
Top width	= 848’ x 848’
Side Slope of Pond	= 3:1
Side Slop of Bank	= 1.5:1
Bank Width	= 20 ft
Bank Hight	= 20 ft
Berm Width	= 20 ft

Work under progress

CHAPTER 3

PLANNING FOR CONSTRUCTION OF WATER STORAGE PONDS

ADDITIONAL STRUCTURES TO BE CONSTRUCTED ON THE POND SITES

1. Inlet and Outlet
2. Operator Room
3. Connecting watercourse
4. Stairs
5. Jetty for Lift Pumps

Pond completion, ponds will be filled during the flood season i.e. 15th July to 30th September and Village Farmer's Organization (VFO) will manage to lift water as per their requirements by pumps / tractor standing on the jetty and throwing the water into the connecting watercourse, which will lead to main watercourse. The warabandi will be framed by the VFO with the help of staff of Irrigation Department. VFO will be constituted by the Cholistan Development Authority (CDA)

CHAPTER 4

IRRIGATION MANAGEMENT

Irrigation Management can be defined as the process of implementation of suitable operation and maintenance in order to meet the objectives of the concerned irrigation system and monitoring of the activities to assure that the objectives are met.

It also can be defined as a process of making decisions about using an organization's resources in order to achieve the organization's objectives. Three implications can be drawn from the above definition. First of all, that irrigation management is not a routine job. The management decisions have to be made with great care, as they have to match with the operation and maintenance objectives. Secondly, even though the overall goal may be the same, O&M objectives varies from system to system, hence management decisions have to take account of these inter system differences. Thirdly, that monitoring is an integral part of management thus management decisions have to be continuously refined according to the feed back obtained from monitoring and evaluation.

Irrigation Management is one of the major challenges for the irrigation professionals, as it is important to decide the benefits derived from the irrigation system. The job is difficult, as it can not be conducted with any blueprint approach. Moreover, shortcomings of the different phase of irrigation development e.g. identification of system characteristics, system design and construction are reflected while conducting this job. Hence, if to be done properly, it is complex task as a lot of factors have to be taken into consideration.

CHAPTER 4

IRRIGATION MANAGEMENT

IRRIGATION WATER NEEDS

When planning and managing to develop an Irrigation System, it is worth considering what crops are growing in the area. This is based on both the temperature range of climate and the amount of precipitation. If the ground tends to be very moist, choose plants that can tolerate constantly wet soil, and even standing water. If an area that suffers from frequent droughts, however, select plants that can tolerate going long periods without water, especially in light of the frequent watering restrictions imposed on such areas and if the Irrigation System is being designed for an area that has a balanced climate, a wider range of choices for plants can be selected.

LOW-LEVEL WATER REQUIREMENT CROPS

Plants / crops that require low levels of water are often called drought tolerant. Drought-tolerant plants can thrive in hot, dry conditions with very little water. Most drought-tolerant plants need little amount of water when they are planted and while they are establishing themselves, they can be left to the natural cycle of the elements. Popular drought tolerant trees include the date-tree, *bair,* and all citrus trees are also drought tolerant. Moreover, in the winter season wheat, *raia* and vegetables are drought tolerant crops in the Cholistan area.

MID-LEVEL WATER REQUIREMENT CROPS

Most plants / crops in this range when it comes to water requirements, do not need to be watered every day, but they need to be watered when the soil has been dry for over a week or two. Sometimes these plants are classified as plants lying in the "occasional water zone". These include popular crops such as Onion, Sunflower, Potato, Maize and Soybean.

HIGH-LEVEL WATER REQUIREMENT CROPS

Some plants / crops require large amounts of water. These plants typically grow in the moist areas. The soil for these plants should always be kept moist. Popular perennials for wet soil include Sugarcane, Rice, Cotton, Citrus, Bananas and some vegetables like *Arvi* etc.

CONCLUSION

Fruitful results for constructing 3 No. ponds on Desert Branch and Ladamsar Disty could not be achieved because of the insufficient flood supplies due to non construction of additional Barrel in the Mailsi Syphon. Therefore, the area at Tail Desert Branch (97000 Acres) should be taken up after the construction of the addition barrel. However, during the heavy rains in the area, surplus supply of Desert Branch is diverted in to the ponds which is being used in the Cholistan area at the peak demand. PC-1 for constructing additional barrel in Mailsi Syphon is under process with CDWP Islamabad. As soon as the work of construction of additional barrel is completed, further ponds will be constructed on Desert Branch.

Upon completion of the ponds at RD. 21000/R of 7R/Abbasia and RD. 41300/L of 1L/Abbasia, the ponds will be filled in from the additional flood supplies of feeding channel i.e Abbasia Link Canal which has sufficient capacity to divert from Panjnad Headworks. However, it is hoped that after completion of the project the stored water will be utilized during the short supply / draught season. This storage will sustain an equilibrium among demand and supply of water. It will also meet the requirements of crops especially *Rabi* season.

RECOMMENDATIONS AND SUGGESTIONS

In view of the above mentioned facts and discussions, conservation of water for Irrigation is the key element to diminish water shortage in the Cholistan area. Planners, Engineers, Agriculturalists, and Irrigation Managers to understand water needs in the Cholistan area for designing any Irrigation System. While planning and managing of an Irrigation System in Cholistan area, the following suggestions will definitely leave better effects on the area and are recommended to be taken into account:

1. Source for extra supply be developed as ponds constructed on Desert Branch / Ladamsar Disty cannot give the optimum results because of the non construction of additional Barrel in Mailsi Syphon.

2. All the channels at tail Desert Branch should be lined.

3. Capacities of all channels in the Cholistan area are doubled that there should be two outlets for each Chak, one for providing flood water to the crops and the other for filling the ponds.

4. Perennial Systems should be separated from flood supply system so that all the channels get their authorized discharge and theft of water be stopped.

5. For each pond VFO should be constituted by the Cholistan Development Authority.

6. Arranging land for ponds on head reach of the outlets in cooperation with CDA and giving ownership of such land to Government.

7. Low-Level water requirement crops should be cultivated in the Cholistan area to achieve maximum benefits by using minimum water.