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CONSTRUCTION OF KHAIRWALA DRAINAGE PROJECT

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At the time of construction of the Lower Chenab Canal, subsoil water-table was at a depth of about 60 to 80 feet. With the passage of time and development of irrigation, water table gradually rose leading to waterlogging and salinity. At present about 54% of the total area of 3,33,400 acres has a subsoil water table depth of less than 5 feet. In order to provide relief to this area, the Irrigation Department conducted surveys and prepared the Khairwala Drainage Project for construction of 124 miles of trunk drains. The project area consists of alluvium, mainly unconsolidated sand and silt with small amounts of clay and kankar. The average annual rainfall is from 10 to 16 inches out of which 80% falls during the moonsoon season. Thus once one of the first agricultural lands are now faced with the problem of salinity, waterlogging, rainfall runoff, and flooding.

Salinity is due to shortage of irrigation water on the one hand and high watertable on the other hand. Waterlogging is the result of seepage from the irrigation system and infiltration of rainfall runoff due to lack of surface drainage. Similarly, flooding is caused by the accumulation of rainfall runoff for lack of storage capacity in the soils due to high water table and due to obstruction to flow and absence of proper surface drainage. The average annual loss due to flood damage in the area is estimated as Rs. 6.31 million and due to reduction in crop yields as Rs. 31.4 million.

It was therefore proposed to construct the Khairwala main drain, and the Dijkot and the Nasrana branch drains. In addition to these surface

drains, 96 tubewells of 2.5 cfs capacity each were to be installed by WAPDA in low lying pockets of Dijkot and Nasrana sub basins. Detailed field investigation and surveys were carried out to arrive at the drain alignments and capacities, design of drain sections and construction parameters. Drain design computations were based on Manning's relationship.

The drain excavation process was divided into two phases for the Dijkot and the Khairwala drains. The first phase had the excavation of the upper dry earth while the second covered wet excavation below the subsoil water level with draglines. The project included construction of bridges, aqueducts, inlets etc. Three railway bridges, were designed and constructed by the Pakistan Railways. Six AR bridges, 10 DR bridges and 49 VR bridges were envisaged, many of which have been constructed. Four falls have been constructed. Problem of well sinking and lowering of subsoil water was the main challenge. Lenses of impervious hard clay prevented sinking of wells in most cases and it became a serious problem to dislodge them. The structures were provided with pressure pipes to monitor their safety. Another special feature was the laminated construction of weir crests. The main advantage of this feature is that the slopes of these drains can be conveniently increased later by lowering the crest. The drains cross the irrigation channels at 3 points. These are trough type, the trough conveying the irrigation water over the drain. The design discharge capacity of troughs have been kept as 10 to 25% over the present requirements for future development. A trough type structure had to be constructed to provide safe crossing for the main Sui Gas Transmission, and their structure had to be provided with proper anchorage to safe guard against vibrations. About 200 inlets for rainwater were proposed to be constructed at the depression sites on the three drains. Almost all the inlets are barrel type. These have been provided with double acting flap valves to stop reverse flow from the drain into the depression.

Dewatering was the main problem during construction stage of the project. At first the working area was enclosed with a ring bund and connected with roads through a specially made track. The lowering of subsoil water level had to be done against a constant static head of water standing around the bund in addition to the sub surface flow

from a sandy aquifer with a high yield. This required heavy pumpage over a long duration.

The search for quality bricks was a serious problem, as there is no control over the manufacturing process of bricks. Steel products of low quality and uncertain properties are being produced by the manufacturers. Deformed steel with working tensile stress of 18000 psi has been used on all structures. Coarse aggregate was brought from Margalla Hills or from good quality Sikhanwala stone. Clean pit/river sand was used for general purpose but for reinforced concrete in deck slabs, coarse Haro sand was added in the ratio of 1 : 1 to the pit sand. Normal portland cement was used in all the structures. To achieve quality control, departmental specifications were followed and site offices were set up on every component work where relevant plans and other record along with inspection registers were also maintained. A complete soil laboratory was setup for monitoring of compaction of soil and determination of soil characteristics. In addition to field checks steel and concrete were tested at the central testing laboratory of the Punjab Engineering University at Lahore. Bar charts were used for preparation of work schedule and monitoring of progress. Triangular diagrams were used for monitoring of subworks. Information on financial utilization was contained in monthly progress reports.

Another problems faced during the execution of project was the land acquisition. The existing procedures caused delays in execution due to prolonged litigation in the civil courts.

From the experienced gained on the project following suggestions have been made:

(i) Land acquisition process should be simplified. Either the project Engineer should be delegated with the powers of land acquisition Collector or a proper land acquisition cell headed by an officer having full powers of District Collector may be created and attached to each major project. The land acquisition Act and relevant rules may be modified on the lines of the housing Act.

(ii) Ways and means including necessary infrastructure for control over manufacture of important construction

material is needed. To ensure quality of bricks revival of departmental kilns is necessary. Manufacturers of steel products should specify structural properties of their goods.

(iii) Funding of project should correspond phasing of expenditure as deviation results in delays and increase in cost due to escalation and higher interest charges.

The annual average benefits of the project are estimated as Rs. 37.71 million. The benefits are already apparent in the upper Dijkot Drain and Nasrana sub basin, where pools of stagnant water and marshy areas are dis-appearing rapidly.

Note :

Paper No 472 appears in the Proceedings of Engineering Congress Vol. LX, 1985 from pages 167 to 178. There are 8 tables 12 Photographs and 10 figures. The interested reader for further details may refer to the original Paper.