THESIS

ANALYSIS OF BAGLIHAR DAM OPERATIONS FOR PEAKING POWER PRODUCTION ON MARALA HEADWORKS OF RIVER CHENAB

BY

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ABSTRACT

Pakistan relies heavily on the Indus basin water to meet its domestic, agricultural and industrial needs. Chenab River is major tributary of the Indus River with average annual flow of 12.38 MAF. Pakistan and India signed Indus Water Treaty in 1960 to adjudicate Indus basin water uses. According to Indus Water Treaty Pakistan was given exclusive rights on the western rivers, i.e. Indus, Jhelum and Chenab. Baglihar dam is a runoff river hydro project on Chenab River, and to be operated for peak hour power production. India has ability to accelerate, decelerate or block flow of the river by modifying peaking hours for power production.

Peaking operations of Baglihar affects and strongly disturb the continuous inflow at Marala. Fluctuating Marala pond level affects canal outflows for Upper Chenab Canal and Marala Ravi Link Canal. Constant flow of river water is essential for efficient canal operation. This study was carried out to evaluate the affects of the possible peaking releases from Baglihar on Marala pond level variability and also determine the effect of pond level variability due to Baglihar dam operations of UC canal discharges. The study was carried out for low flow period of October to March.

HEC-RAS computer model was used to determine the affects of the peaking operations on Marala barrage. Study reach from Marala to Baglihar with length of 162 km was marked and 162 cross sections extracted through Google Earth. Marala Headworks was incorporated in the model as gated Inline structure. Upper Chenab canal was simulated as lateral gated structure. The upstream and downstream boundary condition for study reach was assigned as flow hydrograph and normal depth respectively in the model. Model results were obtained on hourly basis without and with peaking operation at Baglihar. Model was also simulated for peaking

operation with interventions at Marala in the form of modified gate setting of headworks gates.

With peaking operations pond level varied from 3.0 to 3.3 ft in October, 3.3 to 3.5ft in November, 3.6 to 3.8 ft in December, 3.6 to 3.8 ft in January, 3.8 to 4.2 ft in February and 2.8 to 3.4 ft in March in comparison to without peaking operation condition. Whereas, with peaking operation flow variation in UCC was 2607 to 2830 cusec in October, 2815 to 3000 cusec in November, 3035 to 3193 cusec in December, 3000 to 3150 cusec in January, 3275 to 3708 cusec in February and 2517 to 2916 cusec in March.

After interventions results showed that pond level variability reduced to 1.2 to 1.4 ft in October, 1.4 to 1.6 ft in November, 1.6 to 1.7 in December, 1.7 to 1.8 ft in January, 1.7 to 1.9 ft in February and 1.1 to 1.6 ft in March. Whereas, after interventions flow variation in UCC is 879 to 1176 cusec in October, 1208 to 1384 cusec in November, 1392 to 1456 cusec in December, 1390 to 1450 cusec in January, 1200 to 1650 cusec in February and 735 to 1135 cusec in March.

It is concluded that peaking operations of Baglihar hydropower project has pronounced affect on Marala water levels. Fluctuations in pond level in comparison to non peaking operation of Baglihar were in between 2.8 and 4.2 ft with flow variations in UCC between 2517 and 3708 cfs during October to March. After interventions flow variation in pond level was reduced between 1.1 and 1.9 ft with flow variations in UCC from 808 and 1650 cfs, but not totally diminished. It was recommended that Pakistan should chart a safe gate operation strategy on daily basis to minimize flow variations in UCC. Study should be performed to determine the affects on Chenab River flow regime in terms of sedimentation and bank scouring downstream of Marala due to these flow variations at Marala.