

THESIS

HYDROLOGICAL ANALYSIS AND OPTIMIZATION OF WATERWAYS
FOR DARMODAR HYDROPOWER SCHEME



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ABSTRACT

The Darmodar nullah is the left tributary of Gilgit River, with annual flow of $4.96 \text{ m}^3/\text{s}$ and average gradient of 9%. A run of river hydropower scheme has been planned on the right bank of Darmodar nullah. Weir site and powerhouse site is located 7 km and 5 km respectively upstream of confluence with Gilgit River.

Darmodar River has adequate discharge and a head of 145 meter that can be harnessed to produce electricity. In this study hydrological analysis for flow availability and optimization of waterways was carried out.

In the absence of stream flow measurements at the Darmodar Gah, data of Gilgit River at Gilgit was considered. Data from Gilgit station was utilized for extension of flow series at Darmodar nullah for further use in Darmodar Hydropower Project. Low flow measurements made by Hydro Electric Planning Organization WAPDA during February, March and April 1991 and March and April 1993 were used for correlation purposes. From the data series mean monthly flows were calculated which predicted that about eight months in a year the available flows were more than $2 \text{ m}^3/\text{sec}$. The study site is located in the regions moderately or even less affected by monsoon rains. The flood values calculated at proposed weir site for 10, 100 and 1000 year flood were $258 \text{ m}^3/\text{sec}$, $473 \text{ m}^3/\text{sec}$ and $647 \text{ m}^3/\text{sec}$ respectively.

The project layout includes diversion weir, power intake, Sedimentation basin, headrace channel, forebay, penstock and surface powerhouse. The optimization of water ways was carried by considering Topographic, Geological and Economic aspects.

The selected design and layout was based on the results of design calculations. The weir with Tyrolean Intake had 41 m width and 11 m height. The gravel trap having length of 15.2 m was proposed in the right abutment of weir Connection Canal (free-flow) of 53 m length between the Gravel trap and sedimentation basin had size of 1.0 x 1.0 m. A single chamber sedimentation basin with dimensions of 55 m x 4.0 x 4.0 m for removal of grains coarser than 0.2 mm was proposed. The design size of approx. 620 m long Concrete lined headrace canal was 1.5 x 2.0 m. The channel is open however, cover was proposed at crossing of small nullahs and for crossing of humans and animals. Some part was covered due to unstable right bank slope. The proposed Forebay structure was pond type and had 18.0 m length and 10.0 m width with Spill weir in the left bank of headrace channel to lead the water in to a spill channel.