MODELING GLACIAL LAKE OUTBURST FLOOD IMPACT ON SHOGO-SIN HYDROPOWER PROJECT AND SETTLED AREAS

---

by

Muhammad Ahsan
2017F-MS-WRE-112

Research Supervisor:
Dr. Muhammad Kaleem Sarwar

2022

Centre of Excellence in Water Resources Engineering
University of Engineering and Technology, Lahore

MODELLING GLACIAL LAKE OUTBURST FLOOD IMPACT ON SHOGO-SIN HYDROPOWER PROJECT AND SETTLED AREAS

by

MUHAMMAD AHSAN

A THESIS

presented to the University of Engineering and Technology, Lahore

in partial fulfillment of the requirements for the degree of

Master of Science

in

Water Resources Engineering

APPROVED BY:

[Primary Advisor/Internal Examiner] [Official Title & Department]	[External Examiner] [Official Title & Department]
[Chairman of the Department]	[Dean of Faculty]

Approval Date

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
UNIVERSITY OF ENGINEERING & TECHNOLOGY, LAHORE

ABSTRACT

Hindukush region of the great Hindukush-Karakoram-Himalayas Mountainous range has experienced a vast amount of glacier mass loss in recent decades. These Glaciers' meltdown, starting from the growth of glacial lakes at the valleys of these immense glaciers, gives rise to a Glacial Lake Outburst Floods (GLOFs) threat to the settled areas, infrastructures, and any potential Hydropower project. The Global Change Impact Studies Center, Islamabad, Pakistan has identified nine (09) potential GLOF hazardous lakes in the catchment of the proposed Shogo-Sin Hydropower Project, Chitral District, Pakistan. Previously no efforts have been made to model glacier lake outburst flood downstream to these lakes. Freely available 30m SRTM DEM through USGS source has been used to initiate a numerical model of GLOF (HEC-RAS 6.0). To reproduce flood depths and inundation the model was first verified against a comprehensive Glacial Lake Outburst Flood on Golen-Gol HPP located in Chitral Pakistan. The model parameters were applied to produce GLOF events through each of the nine (09) lakes, with a combination of three (03) adjacent lakes and all lakes bursts. If all the lakes burst, a total of 04 villages could be affected by the GLOF. The model was also executed for 03 scenarios (optimistic, intermediate, and pessimistic) which gave a range of 02 - 90 buildings and 01 - 10 bridges affected by flooding with a flow depth greater than 2m. The flood level at Shogo-Sin Dam was 22.6m which caused a great threat to localities and infrastructure but had a low impact on the proposed 37m high CFRD dam. It was concluded that GLOF due to the burst of all nine lakes had a greater threat. It is recommended that the infrastructure along the GLOFs course should be considered for risk management.