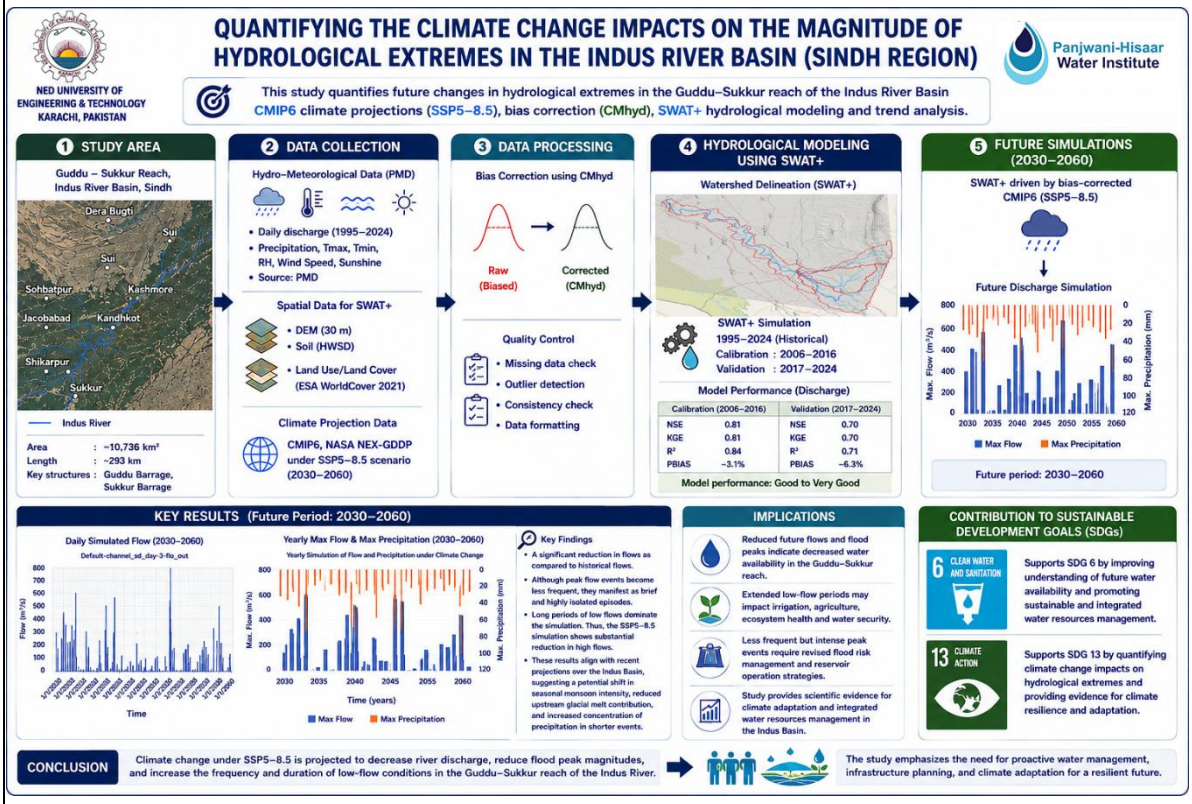
NED University of Engineering & Technology

Masters Thesis Information Showcase
Fall Semester-2025
Year 2025

Department: Panjwani-Hisaar Water Institute

Programme: Masters in Engineering Management

Specialization: Climate Change Management

1	**Title of the Thesis** QUANTIFYING THE CLIMATE CHANGE IMPACTS ON THE MAGNITUDE OF HYDROLOGICAL EXTREMES IN THE INDUS RIVER BASIN FOR SINDH SPECIFIC REGION
2	**Abstract** (min 300 to 500 words) Climate change is increasingly disrupting hydrological systems worldwide, with semi-arid and river-dependent regions such as Sindh being particularly vulnerable. This study quantifies the climate-change-induced variations in the magnitude of hydrological extremes in the lower Indus River Basin, focusing on the Guddu–Sukkur reach. A comprehensive methodological framework was adopted, integrating observed hydro-meteorological data (2000–2024), bias corrected climate projections from CMIP6 (NEX-GDDP) under the SSP5–8.5 scenario, and hydrological modeling using the Soil and Water Assessment Tool Plus (SWAT+). Bias correction of precipitation, temperature, humidity, and wind speed was performed using CMhyd and linear scaling methods. The calibrated SWAT+ model—optimized primarily through a 30% increase in CN2, the most sensitive parameter—achieved a substantial performance improvement, increasing Pearson correlation from 0.75 to 0.90 and providing a reliable basis for climate impact assessment. Historical simulations indicated that observed flows frequently exceeded 1,000 m^3/s, driven by monsoon intensity and upstream hydrological contributions. In contrast, future simulations (2030–2060) projected a marked decline in extreme flow magnitudes, with peaks generally ranging between 100–700 m^3/s. Results show a significant reduction in high-flow events, emergence of shorter and more isolated peak flows, and a pronounced increase in prolonged low-flow periods. These shifts reflect weakening monsoon-driven runoff, reduced upstream glacial melt contributions, and increasing evapotranspiration under warming conditions. The projected hydrological regime exhibits greater variability and an overall transition toward drought-dominated conditions. The findings imply substantial challenges for water resource management in Sindh. While lower peak discharges may reduce large-scale flood hazards, persistent low flows threaten irrigation reliability, food production, ecological health, and downstream water security. The study underscores the need for climate-resilient planning—incorporating improved flow regulation, multi-model climate ensembles, strengthened monitoring networks, and integrated provincial water governance. This research fills a critical regional knowledge gap by providing localized, model-based evidence of how climate change may reshape hydrological extremes in the lower Indus Basin, offering scientifically grounded insights for adaptation, policy development, and sustainable water management in the decades ahead.
3	**Impact on SDG# 6 & 13"** (min 500 words) (Please mention the impact of the relevant attained SDG) This thesis contributes to **SDG 6** by supporting sustainable and integrated management of freshwater resources under changing hydrological conditions, while contributing to **SDG 13** by quantifying climate-change impacts on hydrological extremes and providing evidence for climate adaptation and resilience planning in the Indus River Basin.

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6	**Graphical Abstract**