

M.Sc. Thesis

**HYDROLOGICAL AND TOPOGRAPHICAL MODELING OF NEW
DAM SITE USING GIS AND REMOTE SENSING TECHNIQUES**



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ABSTRACT

Water storage is essential for existence of human beings. Usage of water has been increased progressively due to growing demand for agriculture crops, municipal, industries, and for fishing which is going to deplete our ground water reserves day by day. The water demand can be satisfied by constructing a large reservoir or small reservoirs in series to prevent water dearth issues throughout the country. So, it is advisable to find suitable sites for small dams.

This study was carried out on the hydrological and topographical modeling for new dam site using Geographic Information System (GIS) and Remote Sensing (RS) techniques. These techniques are very much feasible and quick. Topographic and landuse/landcover data can be acquired through satellite images. This study was first tested on the existing dam site subsequently validated with the observed data. Further, it was applied to proposed dam site. Existing dam site, Domeli dam, is located in Jhelum district whereas second site, Chamak Mira dam, is proposed near Abbottabad district.

Location for Chamak Mira dam site is based on the topographical, landuse and hydrological behavior of this area consisting of slope, contour, stream network maps and landuse pattern. These attributes or parameters were generated in ArcGIS environment. Hydrologic characteristics of the study area were analyzed by developing the relationship among annual, maximum, minimum, and Monsoon rainfall series versus average rainfall series for four decades starting from 1971 to 2010. Average rainfall of five and ten years was also attained for four decades to check the wet and dry periods of the study area.

Runoff data at the both dam sites was synthesized from the nearby catchment having same hydrologic similarities in the catchments' characteristics. Obtained observed annual average flows were then calibrated with the annual average flows generated by HEC-HMS model from 1971 to 1980. Subsequently, the model was validated from 1981 to 1990. Flood frequency study was applied for attaining the maximum flood events for Domeli and Chamak Mira dam against different return periods.

Two types of Digital Elevation Models, SRTM and ATER, were used to check the authentication of satellite image for determining the capacity of dams, Domeli, Baral (Lehri) and Chamak Mira dam. Study revealed that there was percentage decrease in capacity estimation with respect to observed values using SRTM DEM, whereas percentage increase using ASTER DEM. In case of area, SRTM underestimated while ASTER DEM overestimated it. It is recommended that ASTER DEM is better than SRTM DEM for area and capacity estimation. It is concluded that modeling through GIS and Remote Sensing is more feasible for small reservoirs in Pothwar area of Pakistan.