Evaluation of Existing Culvert Hydraulic Design Using Remote Sensing: A QGIS Approach

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Abstract:

Culverts are mainly designed to allow for rainfall-runoff and flood water to flow without damaging traffic ways. They are common structures designed as a protection structure against flood water. If the runoff quantities exceed the capacity of the culvert, it may cause damage and threats to the vehicles and human lives. Hence, it must be ensured that the capacity of the culverts is higher than the estimated runoff of the watershed. This study evaluates the effectiveness of a culvert that is constructed on Wadi Ahin in Sohar, Sultanate of Oman. The peak flow of the wadi is estimated compared to the estimated capacity of the existing culvert. Then it is determined if the constructed culvert can accommodate the direct peak runoff flow or not. The culvert and watershed data is collected and processed using QGIS software. The rainfall data is determined through the Global Satellite Mapping of Precipitation real time version (GSMaP_NRT), which is a satellite product created by Japan Aerospace Exploration Agency (JAXA). Results show the capacity of the culvert was 218.9% in comparison to the peak runoff flow determined by the flood frequency analysis. Showing that the design of the culvert is sufficient but not economical. The results of this study can assist decision-makers in the design of culverts as well as support sustainable construction practices.

Keywords:

Culvert, Flood, GSMaP_NRT, QGIS.