CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

This study aimed to analyze the hydraulic capacity of the Simpang Kiri River located in Mukim Seri Medan, Batu Pahat, Johor, using a one-dimensional (1D) hydraulic model built in HEC-RAS. The analysis focused on assessing the river's ability to convey floodwaters during 20-year and 100-year average with and without Climate Change Factors (CCF). The conclusions are presented according to the achievement of each study objective.

The first objective was determining the design of flood discharges for 20-year and 100-year return period. Using the Snyder Unit Hydrograph method and rainfall data from the Empangan Sg. Sembrong station, for a 20-year return period, the peak discharge jumps from 263.80 m^3/s to 398.98 m^3/s when climate change is factored in. Even more strikingly, for a 100-year return period, the peak discharge more than doubles, rising from 383.54 m^3/s to 818.96 m^3/s with climate change considerations. These discharges were used as inflow boundary conditions in the hydraulic model, forming the basis for evaluating the river's performance under different flood magnitudes.

The second objective was to construct a hydraulic model of the Simpang Kiri River using HEC-RAS. This was successfully achieved by integrating terrain data, channel geometry, and synthetic hydrographs into the modeling environment. The 1D HEC-RAS model was able to effectively simulate flood dynamics in the relatively flat topography of the study area, including river channel interactions.

For the third objective, which was to analyze the hydraulic capacity of the river under design flood conditions, the simulation results showed that the Simpang Kiri River is unable to fully convey floodwaters during both 20-year and 100-year return period events. The profile plot shows that in several river sections, the simulated water surface elevation exceeded the riverbank elevation. These findings indicate flood risk in these areas under current channel conditions.

In conclusion, this research demonstrates that the Simpang Kiri River lacks sufficient hydraulic capacity to manage design floods, especially under extreme scenarios. The application of 1D HEC-RAS modeling has proven effective in visualizing flood behavior. These

outcomes are valuable for local authorities in formulating flood risk management strategies, such as river improvement works and improvement of water resources management.

5.2. RECOMMENDATIONS

Based on the findings and limitations identified in this study, the following recommendations are proposed to enhance future research and improve flood management strategies in the Simpang Kiri River basin:

1. Implementation of Structural Flood Mitigation Measures

   Given that several sections of the river are unable to convey flood discharges during major storm events, it is recommended that structural measures such as river widening, levee construction, or channel deepening be implemented, particularly in segments identified as overtopping. These interventions will improve the river's capacity to handle future flood events.
2. Expansion of Hydrological Monitoring Network

   The accuracy of hydrologic inputs can be improved by installing additional rain gauges and streamflow measurement stations throughout the watershed. A denser monitoring network would enhance calibration efforts and support more detailed hydrologic modeling using tools such as HEC-HMS.
3. Further Research Using Coupled Hydrologic-Hydraulic Models

   Future studies should consider coupling HEC-HMS with HEC-RAS to simulate the full rainfall–runoff–flood process. This will provide a more realistic representation of catchment responses under varying rainfall scenarios and improve the reliability of flood predictions.