CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Flood inundation analysis is done in this research using the combination of ArcGIS 10.8.1, HEC-GeoRas 10.8, and HEC-RAS 6.2. A high-resolution DTM data is required to create the simulation of flood inundation. According to the result, several conclusions are obtained as follows:

1. After comparing the elevations between DJI Phantom 4 RTK and DEMNAS, this research used the DTM data from DEMNAS with 8 m resolution. The DTM data from DEMNAS that is used for flood inundation simulation using HEC-GEORAS produces results that are pretty good and quite resemble the actual situation of flood events at the research site.
2. According to the simulations, the flood that occurred in Batang Mahat in 2017 is the flood phenomenon that occurred once in 50 years, with the discharge that flowed to the Batu Kisok at about 2003.07 m^3/s which inundated an area of about 2.47 km^2 out of 9.26 km^2 area in total.
3. By looking at the flood inundation map, it can be seen that the flood started to spread widely to the land and settlement at the discharge of the Q_{25} return period (1812.07 m^3/s), where the increase of flood area is about 84.44% from the Q_{10} return period. This condition implies insufficient channel capacity to carry the flood water discharge.
4. In the downstream part of the model, there is a narrowing location surrounded by cliffs and the existence of a big rock called Batu Kisok that is not affected by floods which can cause a “bottleneck”. In the Batu Kisok, the riverbed elevation is the deepest (+75.45 m) that can reach about 17 m, which is caused by the high flow velocity of about 9.164 m/s at Q50 and 7.600 m/s at Qnormal.
5. The land use changes can also be the reason for the flood in Batang Mahat, which causes the increase of critical land and erosions in the Mahat watershed every year.

Based on the conclusions above, it can be said that the flood incident in Batang Mahat, especially in the Pangkalan Koto Bharu district, was an event that could be considered severe and urgently needed to be addressed. Therefore, the result of this research can be considered in determining proper flood management in Batang Mahat.

5.2 Recommendations

Based on this research, several recommendations are given as follows:

1. Working with HEC-GeoRAS extensions in ArcGIS is quite sensitive. It requires identical versions of the software. However, in this research author tried several versions of ArcGIS. The one that can work well without any error is ArcGIS version 10.8.1 and HEC-GeoRAS 10.8.
2. HEC-GeoRAS required high-resolution DTM data, which will later be converted into the TIN. The DTM data from DEMNAS with 8 m resolution can already be used and produces pretty good results close to the actual conditions. However, suppose a more accurate result is needed. In that case, the author suggests combining the DTM data from DJI Phantom 4 RTK with the data from terrestrial surveys and overlying both. Or, the use of new technologies such as LIDAR (Light Detection and Ranging), which improves the quality of the digital terrain representations, can be used for further study. This way is to get an update and accurate elevations of the ground and riverbed of the research site.
3. The simulation is limited to only the area of 9.26 km^2. For better visualisation of flooding in the Mahat area in 2017, it is recommended to expand the observed area for further research.
4. This research can be used as a consideration for the government or stakeholders in determining proper flood management and mitigation in Batang Mahat. One of the flood management that can be taken is river normalisation at the upper reaches of Batang Mahat and Blasting at the location of Batu Kisok.