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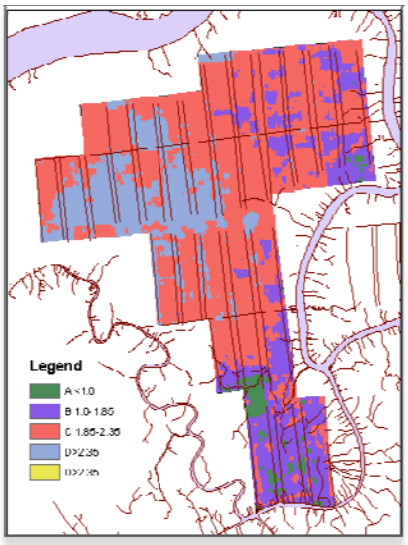

Optimizing Water Management Systems in Lowland Areas to Maximize Agricultural Production
Case Study: Telang II area, South Sumatra

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Master of Science Thesis
by

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Summary

The need of food production is increasing by day along with the population growth. To cope with that the government of Indonesia develops lowland areas to support food production and to anticipate the decreasing of agricultural area in Java. Lowland development for agricultural use can be an alternative to increase food production in Indonesia. Indonesia will face a food crisis in the future if there is no new solution in developing the agricultural sector. Many problems on land holding, especially in Java where agricultural land is diminishing continuously by the extension of residential and industrial development, made that the country has to find other areas instead of Java to be cultivated area to avoid the lack of food sources.

The problems of the lowland areas commonly occur due to natural conditions of areas with low topography, the influence of tidal fluctuation from the sea and river, the possibility of land subsidence due to the soil conditions and might be also the effect of sea level rise due to climate change. These factors make the lowland areas very vulnerable to water management problems such as flooding or even drought.

As one of lowland reclamation areas in South Sumatra, rice yield production in the Telang II area is still low where the yield is around 2-4 t per ha. Farmers only can cultivate the land once a year due to constraint of poor water management. The condition on field level should be analyzed to find out what kind of water management strategy would have to be applied in the area. The condition of water management in Telang II area needs to be improved based on its optimal design to achieve better yield of crops and possibilities on crops diversification and furthermore increase of farmer income.

One of the strategies to design and implement proper water management in tidal lowlands is water management zoning. Water management zoning is defined as zones of certain areas that have similar water management based on their physical characteristics. The need of GIS application in defining water management zoning is important. Water management proposed by equipping the system with the control structures is the way out to achieve the purposes.

In this research, GIS modelling has been used to generate three maps i.e hydro topographical map, drainability map and soil type map, based on the map of topography. Furthermore, these maps have been used to determine the land suitability of the area, which is useful to assess the water management option that would have to be applied in the area.

Crop water requirement was carried out using CROPWAT 8, which can be used for rice and dry food crops. Inputs of climatic data, crop data and soil data, and also cropping patterns, which consist of planting date and crop characteristics, were needed. Two main crops grown in the study area were used for the CROPWAT calculations, rice and dry food crops i.e, corn.

DUFLOW modelling simulation was carried out to define the existing conditions of one secondary block in the area and then to simulate possibilities of water management options in that particular block related to the amount of drainage and irrigation water need.

Four categories have been carried out to find out an appropriate combination to meet the purposed, namely;

1. Scenario 1 : Structure on secondary canal (half structure)
2. Scenario 2 : Structure on tertiary canal (half structure)
3. Scenario 3 : Structure both on secondary canal and tertiary canal (complete structure)
4. Scenario 4 : Considering the impact of land subsidence and climate change for Scenario 3

The scenarios above were conducted both for wet season and dry season, to determine capability of the system in supplying and draining the water. By setting up the control structures, keeping water level in the field when it is needed by the rice crop to grow and drain the water to the preferred ground water table when it is needed for the dry food crop can be attained. Furthermore, the significantly improved yields of the area are visible.

GIS analysis prove that hydro topography of the area most be occupied by C type 50%, B and D 22% each and the rest is A type. The effect of land subsidence and sea level rise would be trigger the shifting type of hydro-topography of the area from D to C, C to B and B to A. Furthermore, as the result, the area would be dominated by A type 48%, B and C type 24% and 27% respectively and only 1% of D type. These changes also need an effort to reanalyse an appropriate water management system would be best applied in the Telang II area.