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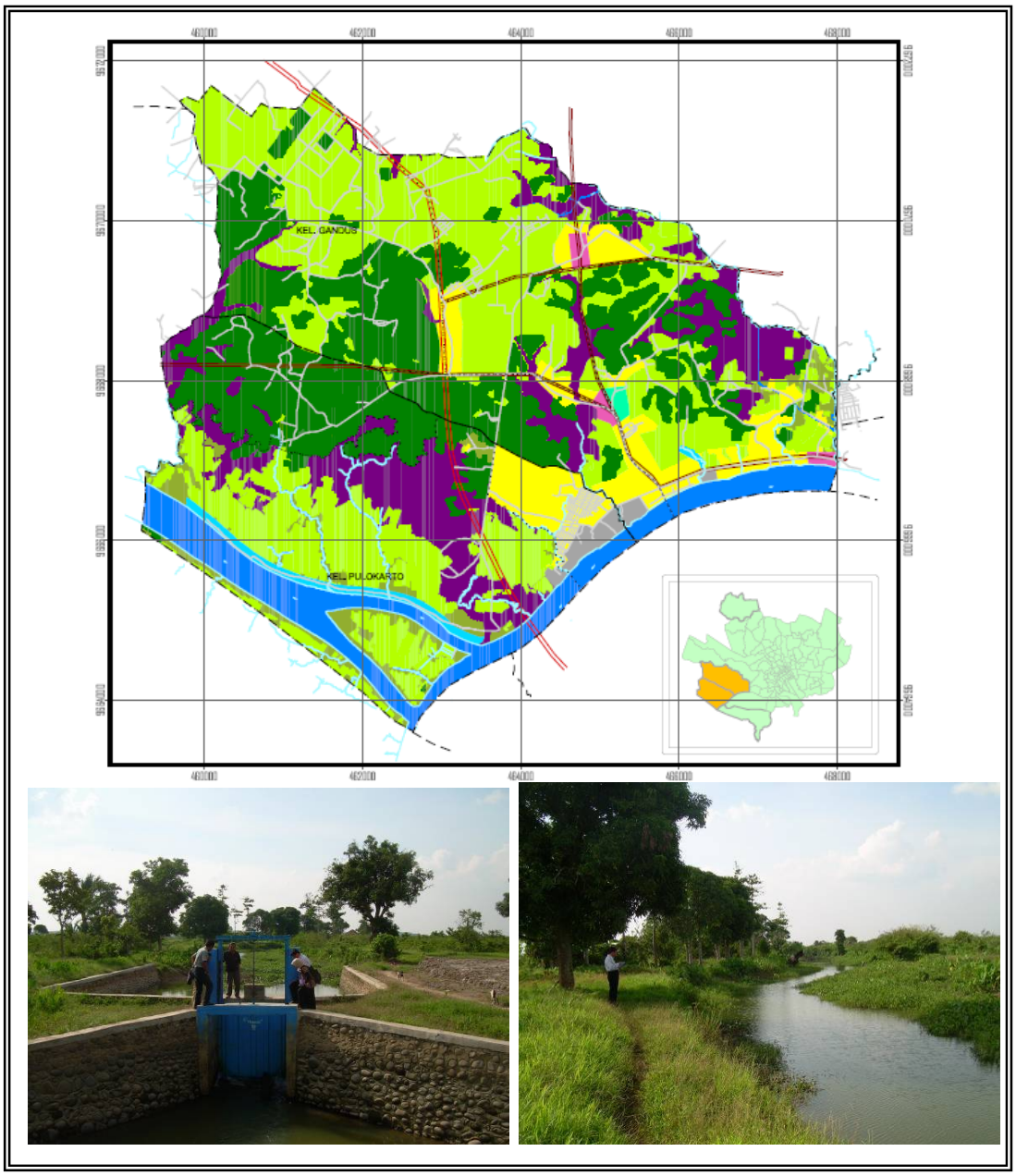

Options for Water Management and Flood Protection of Agropolitan Gandus for Agricultural Development

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MSc Thesis WSE-HE-LWD-09.17
October 2009

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Master of Science Thesis
by

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This research is done for the partial fulfilment of requirements for the Master of Science degree
at the UNESCO-IHE Institute for Water Education, Delft, the Netherlands
and the Magister Sains degree at the Sriwijaya University, Palembang, Indonesia

Delft
October 2009

SUMMARY

Population growth is the biggest threat to the environment not only in Indonesia but also in the world. The more population we have, the more food demand needs to be fulfilled. With the increasing population and need for food, agricultural production needs to be increased to meet this demand. With the conditions of land and water resources in Indonesia at this time, which are becoming increasingly scarce because of competition of these resources with other needs such as urbanization and industrialization, one alternative to coping with the problem is lowland development.

The study area for this research is called Agropolitan Gandus area and is located southwest of Palembang City, about 12 km from the city centre. The area belongs to the inland swamp area of South Sumatra. The scope of the research area is located between two rivers, Lacak River and Rengas River.

There are several developments of infrastructure and public facilities to support Gandus as an agropolitan area, such as the development of roads, an electricity network, clean water processing unit, a gateway, a mosque, floating medical clinics, an agribusiness school, a waste disposal container, the relocation of 150 units of slum housing, etc. Due to all the facilities, the products from the agricultural area in Gandus can be easily transported to the city centre to be marketed. Unfortunately all of the facilities are not supported by the available quantity and quality of agricultural output to be marketed to other areas, or at least to fulfil self sufficiency in Palembang itself.

In the present conditions, the agricultural area in Gandus is provided with an inadequate open water management system. It only has two sliding gates as water control, which are not operated properly yet. Therefore, the agricultural yield of this area was only around 1.5 ha/ton of rice per year. Farmers still conduct agriculture using an adapted system with the nature, but most of the time they make a wrong estimate about the weather, which causes water shortage to the crops in the dry season and flooding in the rainy season.

The area is waterlogged because of rainfall, tides, river discharges and low topography. The biggest flooded situation is in the wet season, when there is a lot of rainfall with spring high tide in the river. The situation forces the farmers to wait until the water decreases making the area suitable to be cropped, but when they cultivate in the end of the wet season, the plants will suffer of drought in the coming dry season. As a result the farmers only can do one harvest per year with a low expectation of agricultural output.

Regarding these constraints, this study mainly focuses on the development of design criteria and an indicative layout for a water management system with its control structures and for a flood protection system in order to improve the agricultural output of the Agropolitan Gandus Area.

To support this land and water development planning, data collection has been carried out to cover primary, secondary and supporting data. Primary hydro meteorology data are water level fluctuation by using 4 staff gauges in two rivers and 1 diver in the middle upper part of Lacak River and cross sections using water pass. Secondary data of hydrology and topography that needed to be obtained are rainfall, climate, and topography, while supporting data gained in this study are Spatial Planning Master Plan of Palembang, existing land use, and socio economic data.

Water level observations using staff gauges were conducted at different locations in Lacak River and Rengas River. The readings were done every hour for a period of 55 days to be able to cover high water and low water as well as one tidal cycle.

Based on this data, a land suitability analysis has been carried out in order to find the best options for developing the area.

Calculation of 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 soybean.

Using DUFLOW model simulations, several water management development options with and without sea level rise and land subsidence effect have been studied. In designing flood protection, future Sea Level Rise (30 cm/century) and Land Subsidence (0.5 cm/year) have been taken into account in this study. These factors are considered having a big influence to the water level in the study area.

Based on data analysis, the amounts of rainfall in the area is abundant during the wet season, even it causes flood in some part of the study area. However, during the dry season another source of water is required to supply the agricultural development. In this study, the water source from high tides is considered to be able to fulfil the water requirement.

The results of DUFLOW show that the tide has a big influence on flooding in the area. The output is used to design flood protection structures, such as dikes and flap gates. With dike the flood from the river will not overflow into the field. Combined with flap gate the drainage and supply can be managed. The minimum dike height results and scenarios conditions of DUFLOW modelling are presented in the table below:

No	Scenarios	Dike Lacak (m+MSL)	Dike Rengas (m+MSL)	Flap gates position	Rainfall	Sea level rise & Land subsidence
1	Existing condition	n/a	n/a	n/a	√	-
2	Dike only	2.65	2.50	n/a	√	-
3	Flap gate in river Wet Season	2.35	2.00	Drainage	√	-
4	Flap gate in river Dry Season	2.35	2.00	Supply	-	-
5	Flap gate in channels Wet Season	2.65	2.50	Drainage	√	-
6	Flap gate in channels Dry Season	2.65	2.50	Supply	-	-
7	Flap gate in river Wet Season-future	2.55	2.20	Drainage	√	√
9	Flap gate in channel Wet Season-future	2.85	2.70	Drainage	√	√

Inflow from DUFLOW is compared to required supply from CROPWAT to know whether the available water is enough for the crop water requirement. Based on the

results, Gandus area can be developed for agriculture development where rice and soybean can be cultivated, and will result in a better yield production by a proper water management.

In case for sea level rise and land subsidence, in this study 0.20 m within 25 year, water management systems have to be adapted in order to avoid flooding and to improve the drainage conditions of Gandus area. In this case, a combination of an improved dike and flap gate still can accommodate the problem.

*Keywords**: water management, flood protection, agropolitan.** DUFLOW, modelling, CROPWAT*