TECHNICAL APPROACH OF EROSION AND SEDIMENTATION ON CANAL (CASE STUDY IN DELTA TELANG I, BANYUASIN, SOUTH SUMATRA PROVINCE)

by Achmad Syarifudin

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Achmad Syarifudin[1)]

Momon Sodik Imanudin[2] ;Arie S Moerwanto[3)]; Muhammad Yazid[3)]; FX Suryadi[3)]

[1)] **Doctoral Candidate of Environmetal Science, Sriwijaya University**
Jl. Padang Selasa No 524 Palembang 30139
South Sumatra Province, Indonesia
[1)] **Lecture of Bina Darma University**
achmad_syarifudin@mail.binadarma.ac.id
Syarifachmad6080@yahoo.co.id
[2)] Promoters
[3)] Co-Promoter

ABSTRACT

The dynamics of water in a swamp area in both tertiary and in the canal influenced by several conditions, among others: the amount of rainfall, hydro-topography land, the potential flood tide, the potential for drainage, water system network conditions, and operation of water system construction. Therefore all components must be evaluated and analyzed to support the water needs of plants. Required data in its own canal of direct observations in the field to the observational data can be accurate. But this way takes time, effort and considerable expense. Therefore the use of computer models to predict and evaluate the performance of the network is an appropriate solution. In connection with the above problems, it needs to be a study in addition to evaluating the performance of the existing drainage system in the control of water levels in tidal marsh areas also need to canal stability analysis in an effort to support the operation and maintenance of the canal.

Keywords: canal in the wetlands, cohesivity of particle, sedimentation

INTRODUCTION

Tidal marsh areas are generally areas that have relatively flat topography, situated near the beach at the mouth of the river and formed naturally also influenced by tides on a periodic basis. Characteristic of the tidal marsh area is very unique when compared to the technical irrigation area because tidal marshes supply availability of water is always of high tide and low tide the sea water. Condition of the land has unique properties that are acidic, containing pyrite, peat and found the salt water intrusion during the dry season.

Based on the results of data collection conducted by the Directorate General of Coastal Wetlands and Water Resources in 2006, through studies of inventory data swampland west and the east, the conclusion that the total area of wetlands that have been reclaimed 1.8 million ha are included 0 , 8 million ha of wetlands are abandoned or unused land. Abandoned land is caused by many things including water system existing network of sub-optimal in providing its function in water management, because the flow system are not appropriate. Canal conditions and the water was too old buildings are not rehabilitated, and so are not optimal in terms of canal maintenance. In terms of maintenance of the canal, one of which is necessary to increase the water system through a network of channels associated with the maintenance of stability of the channel itself. This problem concerns related to issues other than technical, field conditions, the network infrastructure is still weak institutions manage the field level.

For that, we need a way out so that all problems can be solved in a comprehensive manner. Besides, it should be understood also that the construction of a system of water / water in the tidal marshes today are mostly located on the first stage, which was at the completion of construction of the network only. While the construction of support facilities (waterworks) is still not widely applied. Control of water levels in wetlands reclamation process is a key process that must be done properly and correctly. In this connection, swamp reclamation should use the concept of "shallow-intensive drainage" (Skaggs, 1982; Skaggs, 1991; Susanto, 1996) and not "intensive-deep drainage". These two concepts should be combined with control of the disposal and containment of water (Susanto, 2002, Imanudin, 2010).

However, according to Suryadi (1998), reclamation of tidal marsh when associated with water management and design criteria can be done with two approaches, namely the minimum reclamation (minimum disturbance), and total reclamation (maximum disturbance). For the conditions in Indonesia, minimum disturbance approach is still the best (Imanudin and Susanto, 2004).

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The dynamics of water in a swamp area in both tertiary and in the canal influenced by several conditions, among others: the amount of rainfall, hydro-topography land, the potential flood tide, the potential for drainage, water system network conditions, and operation of water system construction. Therefore all components must be evaluated and analyzed to support the water needs of plants. Required data in its own channel of direct observations in the field to the observational data can be accurate. But this way takes time, effort and considerable expense.

Therefore the use of computer models to predict and evaluate the performance of the network is an appropriate solution. Meanwhile, to evaluate the condition of the water system network in the capacity of the supply and disposal has developed a computer model of DUFLOW (Suryadi, 1996). DUFLOW the model simulation results can provide practical recommendations in terms of improving the network and operating system of water management (Suryadi and Schultz, 2001; Imanudin and Susanto, 2003; Suryadi et al., 2010).

This study will use one-dimensional SOBEK software. SOBEK simulation program can also be used to: 1). Support program decision-making on a wide river, such as the Watershed or controlling the flow of the water gate; 2). Predicted daily water levels along the river; 3). Calculation of water level rise to levee safety check; 4). Calculation of saltwater intrusion in the dry season period;

In connection with the above problems, it needs to be a study in addition to evaluating the performance of the existing drainage system in the control of water levels in tidal marsh areas also need to canal stability analysis in an effort to support the operation and maintenance of the canal. The use of computer models have been tested and developed as it can save time, effort and money. However, the calibration process needs to be done to get good results with other words that the results of the modeling is almost equal to the results of field measurements (Suryadi, 2010).

MATERIALS AND METHODS

Description of Research Areas Delta Telang I was in the swamps of South Sumatra which also reclaimed following the generation of second-generation design of double-grid layout (Rib System) along with Telang II, Delta Saleh and Sugihan. (Bogor Agriculture Institute (IPB, 1976). The next design for the open channel system is prepared by the Institute of Technology Bandung (ITB). The system consists of the main canal (also used for navigation), secondary canals and tertiary canals.(Figure 1. Map of study site).

Figure 1. Map of Research Sites (BPSDA, 2010)

Stability of alluvial canals with non-cohesive particles described in relative terms between the lowlands and the shear weight of the particles. Comparison between the two styles can be defined as a factor lengthwise movement also called the figures 'shields' τo * as follows:

$$\tau_o^* = \frac{\tau o}{(\rho s - \rho)\, g\, ds} \quad (1)$$

τs is the mass density of sediment particles. The numerical value of the critical shields, τo * = 0.047, this figure is marking the beginning of a non-cohesive particle motion in turbulent flow over rough boundaries. To shield the numeric values below a critical value (τo * ≤ τo * cr), the particle looks wet alluvial channel is stable. If the value of τo * ≥ τo * cr, we can conclude that the particle starts to move and transport sediment increases with the number 'shields'.

Two significant concepts of numerical shields: (1). Described by τo * cr for surface non-cohesive particle motion, and (2) this concept also depends on the value at which sediment transport increases with the number 'shields', and agradasi and degradation processes that occur in the alluvial canal.

The forces acting on a permanent uniform flow can be categorized as the driving force in the form of hydrostatic pressure force mutually exclusive, atmospheric pressure force, gravity, and the style of inhibitors that are the driving force of resistance to force. Drag commonly called the drag force base. Based on the principle of force equilibrium or Newton's laws of motion, then the decrease in both types of styles over the width of the channel produces drag force base (τo) is expressed as:

$$\tau_o = \rho\, g\, R\, S_o \quad (2)$$

where:
ρ = mass density of water (t/m3),
g = gravity (m/s2), So = hydraulic gradient;
R = hydraulic radius ≈ h = depth of flow to the canal width (m)
Figure 2 shows the distribution of the stress distribution on the basis of both drag and trapezoidal shaped canal walls.

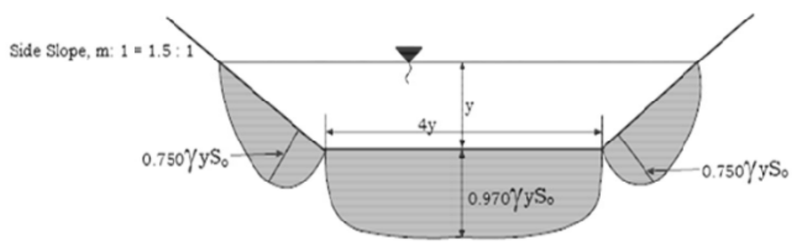

Figure 2. Drag stress distribution on the walls and bottom of the channel (Chow, 1999)

RESULTS AND DISCUSSION

In general, grain size finer, more cohesive. Sediment smaller than 2 μm (clay) is generally considered cohesive sediments. Coarse sediment with a size greater than 60 μm are non-cohesive sediments. Silt (2µm - 60 µm) is considered among the sediment cohesive and non-cohesive. In practical because of the cohesive nature of the sludge which is mainly caused by the presence of clay, silt and clay are both considered cohesive sediments. Cohesive Sediment composed of inorganic minerals and organic matter (Hayter, 1983). Figure 3 shows the results of the distribution of grains in the SPD-canal and the SDU at P8 13S Telang I.

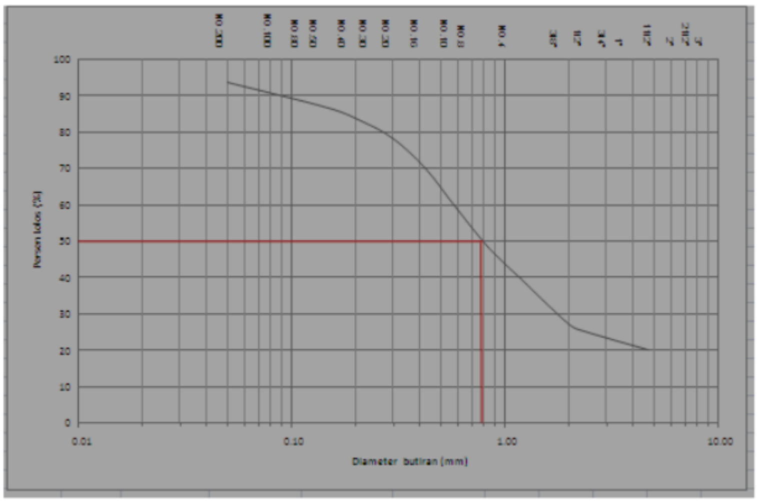

Figure 3. The average particle diameter on the canals SPD and SDU

CONCLUSION

This study shows that to achieve the desired objectives in the development of Operation and Maintenance in the reclamation of tidal marsh, it is necessary to step-by-step activities, which must be done to each other in an integrated manner, it can be done separately. Stages are:

- Increased resource farmers, interpreters and observers is done with the training and direct assistance in the field;
- Development of practical guidance for farmers to make a schedule of activities in the Operation and Maintenance of existing water system and water well construction, and is also equipped with sufficient knowledge of farmers in managing land and water including the connection with the operation of building floodgates to create the desired water status of plants . This model should be adjusted to current development conditions, and conditions hydro-topography region (A: B: C / D). Model Operation and Maintenance manual is also divided in the tertiary level (field level) and the main system (primary and secondary);
- Improved food crop farming systems in locations that were examined;

- Planning Operations and Maintenance expenses, it should be done with a participatory approach, especially for the secondary level. While in secondary and primary level is strongly influenced by the physical condition of the local land environment, and;

- Monitoring and evaluation activities are aimed to see how far the success of the program and the model is applied in the field. This monitoring system is also recommended where and how the minimum amount of water in the canal observations and the observations of farm land and climate data. Observed climate data minimal rainfall and air temperature around the site.

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