SEDIMENT CONCENTRATION AND SIZE AT GALING RIVER, KUANTAN, PAHANG

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
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LIST OF SYMBOLS

μm	Micron meter
W_s	Fall velocity
u	Shear Stress
k	Von Karman's constant
D_{50}	particle size in m, at which 50% of the bed material by the weight is finer
G	Acceleration of gravity
S_g	Specific gravity of the sediment
D_{50}	Particle size in m, at which 50% of the bed material by the weight is finer
AF	Adjustment coefficient for water temperature and concentration of the fine sediment
CF	Percentage effect for different medium particle size
V_c	Critical velocity
g_s	Unit sediment
γ_s	Unit weight of solid particles
γ	Unit weight of water
Q_s	Part of water discharge apportioned to the bed
Q	Total water discharge
D_m	Effective diameter of bed material mixture
S	Energy gradient
T_w	Width

ns	Manning's roughness value for the bed of stream
q_0	$0.00532d/S^{4/3}$
ψ	Coefficient depending on the mean size of bed sediment
τ	Bed shear stress
τ_c	Critical bed shear stress
D_{si}	Mean grain diameter
G_s	Bed load discharge
d_m	Median particle diameter
C_t	Total sediment concentration
ϖ	Critical fall velocity
q_c	Critical discharge
lb	the fraction by weight of bed material in a given size fraction
V	Kinematic viscosity
A	Coefficient associated with D_{50}

LIST OF ABBREVIATIONS

PSD	Particle Size Distribution
LD	Laser Diffraction
SHM	Sieving Hydrometer Method
PM	Pipette Method
HM	Hydrometer Method
SEM	Scanning Electron Microscopy.
GSD	Grain Size Distribution
EZS	Electrical Zone Sensing
USDA	U.S. Department of Agriculture
S1	Station 1
S2	Station 2
S3	Station 3
DDM	Degrees, Decimal Minutes
TSS	Total Suspended Solid
Q	Flow Rate
qs	Sediment Discharge
UMP	Universiti Malaysia Pahang

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ABSTRACT

A study on sediment was conducted at the Galing River. Three different days was consumed in order to take the samples which are 28/02/13, 13/03/13 and 27/03/13. This study was conducted to determine the sediment concentration, range of sediment grain sizes, sediment discharge and factors influencing sediment transportation. Three sampling stations were chosen, the first one at upstream Galing River (Station 1), mid-stream Galing River (Station 2) and downstream Galing River (Station 3). Parameter were quantified for this study, namely; river discharge values or flow rate (in m3/s), depth and wide of river (in meter). In this study, sediment grain size is acquired through sieve analysis. For sediment concentration (mg/L), it is measured by Total Suspended Solid (TSS). While, sediment discharge (tonnes/m-day) is calculated by using Engelund Hansen's sediment transport function. It is preferred to use Engelund Hansen as all samples passed this function's requirement compare than other function. Engelund Hansen function required median size (D_{50}) larger than 0.15mm. Overall, the findings of the study show that the sizes of sediment at Galing River based on Udden-Wentworth scale fall between phi 0.5 to 0 (0.71 to 1.0mm) which indicates coarse sand type. On the other hand, the average suspended sediment concentration recorded for each station shows varying values. The values were 0.010mg/L at Station 1, 0.022mg/L at Station 2 and 0.015mg/L at Station 3. For sediment discharge, the values were 0.012tonnes/m-day at Station 1, 0.046tonnes/m-day at Station 2 and 0.034tonnes/m-day at Station 3. Lastly, factors influencing sediment transportation at Galing River were identified where the factors are size of sediment, rainfall, vegetal covers, human's activities (effluent and garbage), river's hydraulic (flow rate), soil erosion and river's geometric (width and depth).

ABSTRAK

Satu kajian mengenai sedimen telah dijalankan di Sungai Galing. Tiga hari yang berlainan telah digunakan untuk mengambil sampel iaitu pada tarikh 28/02/13, 13/03/13 dan 27/03/13. Kajian ini dijalankan untuk menentukan kepekatan sedimen, pelbagai saiz sedimen bijirin, pelepasan sedimen dan faktor yang mempengaruhi pengangkutan sedimen. Tiga stesen persampelan telah dipilih, yang pertama di hulu Sungai Galing (Stesen 1), pertengahan aliran Sungai Galing (Stesen 2) dan Sungai Galing hiliran (Stesen 3). Parameter yang diukur dalam kajian ini, iaitu; arus sungai atau kadar aliran (dalam m^3/s), kedalaman dan lebar sungai (dalam meter). Dalam kajian ini, saiz butiran sedimen diperoleh melalui analisis ayak. Untuk kepekatan sedimen (mg/L), ia diukur dengan Jumlah Pepejal Terampai (TSS). Sementara itu, pelepasan sedimen (tan/meter-hari) dikira dengan menggunakan fungsi pengangkutan sedimen Engelund Hansen. Fungsi Engelund Hansen digunakan kerana semua sampel dapat melepasi syarat fungsi ini berbanding daripada fungsi lain. Fungsi Hansen Engelund menatapkan penggunaan saiz median (D_{50}) lebih besar daripada 0.15mm. Secara keseluruhannya, hasil kajian menunjukkan bahawa saiz sedimen di Sungai Galing berdasarkan skala Udden-Wentworth terletak antara phi 0.5-0 (0.71-1.0mm) yang menunjukkan jenis pasir kasar. Sebaliknya, purata kepekatan sedimen terampai yang direkodkan bagi setiap stesen menunjukkan nilai yang berbeza-beza. Di Stesen 1 nilainya adalah 0.010mg/L, di Stesen 2 nilainya adalah 0.022mg/L dan 0.015mg/L di Stesen 3. Untuk pelepasan sedimen, sebanyak 0.012tan/meter-hari di Stesen 1, 0.046tan/meter-hari di Stesen 2 dan 0.034tan/meter-hari di Stesen 3. Yang terakhir, faktor yang mempengaruhi pengangkutan sedimen di Sungai Galing telah dikenal pasti di mana faktor-faktornya adalah saiz sedimen, hujan, meliputi tanaman, aktiviti-aktiviti manusia (kumbahan dan sampah), hidraulik sungai (kadar aliran), hakisan tanah dan geometri sungai (lebar dan kedalaman).

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Sediment is the nonpoint source pollutants come from a number of sources and washed into our waterways by surface runoff. When land disturbing activities occur, soil particles are transported by surface water movement. Soil particles transported by water are often deposited in streams, lakes, and wetlands. Land disturbing activities such as road construction and maintenance, timber harvesting, mining, agriculture, residential and commercial development, all contribute to this problem.

In general, sediment comprises many shapes and sizes. The sediment size can be small, such as sand, small pebbles and silt, or large such as boulders, which are normally found upriver. Sediments found in estuaries are mostly fine-grained, such as sand and silt. The speed at which water flows in rivers plays an important part in determining its capacity to carry away sediments. Slower moving rivers will have a lower rate of sediment movement. The process of sediment deposition is also dependent on river discharge and speed of river flow. As such, a higher discharge values and water velocity would result in higher amounts of sediment. In addition, time is a factor whereby the longer the sediment deposition process, the higher the sediment loads.

The river is one of the most important sources of water for all living things in addition to lakes, seas, water catchments and underground water. Rivers are very important to humans and other organisms as they are essential resources for living. A number of processes influence the sedimentary content and quality of river water. These include erosion, transport and deposition. These processes mutually interact along the river, from the ridges up to the mouth of the river. One of the characteristics of a river is its unidirectional flow. The river will exhibit different water levels, rates of flow and rates of erosion during different seasons such as during monsoons and droughts. This situation is influenced by the frequency and intensity of rainfall in the area.

Soils that contain minerals in large quantities produce strong chemical bonds in the soil and are highly stable soils on which cover crops or vegetation grow and where soil conservation such as mulching and contour terraces are practiced, also help prevent erosion as they reduce run-offs and provide a damping effect to the kinetic energy of rainfall on soil surfaces. Nevertheless, any increase in velocity and volume of surface run-offs will also increase the rate of erosion as increasingly large quantities of soil will be swept down the slopes. This increases the amount of suspended sediments and water turbidity in stream channels, thus reducing the water quality.

River quality is assured when it is sufficiently maintained. However, river quality may be adversely affected by sudden severe flooding or drought. Therefore the characteristics of the river discharge are important in terms of its geomorphology, hydraulics, flood control, navigation, stabilization or development, depending on the purpose of the water resource for aquatic organisms, domestic use, *et cetera*.

1.2 Problem Statement

Rivers bring along sediment and silt on their way to sea and deposit it along their banks. The sediment carried by river is high especially when the heavy rainfall

occurred. Heavy rainfall will lead to surface runoff and erosion to happen. This would result to high amount of sediment concentration in river as the eroded soil goes in the river. Other than that, grain size of sediment and flow rate will affect sediment discharge in river.

In sediment transportation, high flow rate can carry much sediment and smaller size of sediment can be carried with ease along the river. Over a period of time, the high amount of sediment will settle down and the accumulated sediment will eat up the river bed thus causing the river to overflow or flooding. Thus, knowledge of the quantity, quality and dynamics of sediments is essential for managing our water resources systems and to against negative effects from happen.

1.3 Objective

(i) To determine sediment concentration in the Galing River
(ii) To determine range of sediment grain size in the Galing River
(iii) To determine sediment discharge at Galing River
(iv) To determine the factors influencing sediment transport at Galing River

1.4 Scope Of Study

(i) The research will be conducted along Galing River
(ii) Analyze sediment sample base on Udden-Wentworth scale as to get the grain size
(iii) Analyze sediment sample base on Engelund Hansen's sediment transport function as to get sediment discharge