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WATER BALANCED ANALISYS TO DECISION THE GROWING SEASON AT KARANGMUMUS RIVER BASIN AREA EAST KALIMANTAN

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ABSTRACT

This geographical area position 0°17'30"-0°30'00" LS dan 117°06'00"-117°22'00" BT, with the 31 475 Ha, to the defragment in 9 sub RBA, i.e. sub-sub RBA Karangmumus, sub-sub RBA Lantung, sub-sub RBA Pampang, sub-sub RBA Muang, sub-sub RBA Karangasam, sub-sub RBA Bayur, sub-sub RBA Jayamulya, and sub-sub RBA Siring.

Sub RBA Karangmumus have the Area Class III (1500 – 2000 mm/ year). With the Bimodel or Double Wave rainfall models with C patern. The hight rainfall depth periode at December and April, therefore the low rainfall depth at September andn November. Have level Q = ± 9.9 %, or rainfall tipe A (very wet area with tropical wet vegetation) and E1 agroclimte zone. Water Balance monthly indicated that this area have potential growing season about 9 months, have to water surplus 7 month (478, 8 mm year^{-1}) and water deficits about 4 months (44.5 mm/year).

Keywords : Water Balanced, Growing Season

INTRODUCTION

Water is a natural resource that can be renewable and can be found everywhere, although still limited in quantity and quality of presence and availability both geographically and reviewed according to the season. Therefore, increased use will result in human intervention against the greater water resources. It will allow the change order and the hydrological cycle as more and more territory and the presence of uneven distribution of water, both in spatial and temporal as well as decreasing water quality. At the same time the utilization efficiency and lower water use and often ignore areas where water flow is derived, or river basin area (RBA).

Along with the development of the city, most of the upstream region of sub-watersheds have experienced pressure river Karangmumus degradation mainly due to logging, housing needs, and changes in regional function. Conditions are very obvious on a swamp area that stretches along the banks of the river downstream and the downstream Karangmumus sub-river of other rivers, a large part has been transformed into economic zones and settlements.

Management of sub-watershed with good manners and right is an attempt at controlling the reciprocal relationship between natural resources such as vegetation, soil and water by humans and all its activities. So that the basin management objectives to ensure sustainability and harmony of the ecosystem and increase the benefits of natural resources contained therein for human life can be achieved. It is intended as an effort to maintain the Mahakam river water discharge in the dry season which can prevent the intrusion of sea water. It also avoids increasing the flow rate of surface water in the rainy season which can lead to the high frequency of flooding in the area of the city of Samarinda (Trisusanto, 2002).

The direct impact that is felt is the change in the basin water balance Karangmumus tangible with the occurrence of droughts and floods are more widespread and more frequently lashed various aspects of life (Suyitno, 1989; Anonymous, 2001)

MATERIALS AND METHODS

Time and Place Research

The study was conducted for approximately 6 (six) months (July-December 2008) in the basin covering an area of approximately Karangmumus river ± 31 475 hectares.

Data Collection

Data collected from both primary and secondary data related to the research, include:

a. Climate, particularly rainfall and evaporation
b. Physiographic characteristics, particularly land slope
c. Soil conditions, especially those related to water status in soil
d. The vegetation, especially the dominance of vegetation, land cover
e. Hydrological conditions, river runoff

Water Balance Analysis

Analysis of water balance of land stated in the form of integral equations by simplifying some similarities, so that the water balance of a land area can be expressed in the form of the equation:

$$CH = ETA \pm \Delta SWC \pm Li$$

Where: CH = rainfall (mm months^{-1})
ETA = actual evapotranspiration (≤ETP)
Δ SWC = soil water content changes (mm months^{-1})
Li = runoff (surplus or deficit depending on its value) (mm months^{-1})

Analysis of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) delakukan using equations from Buckman and Braddy (1969), quoted by Sujalu (1997), as follows:

$$EPTi = 616 \times \left(10 \times \frac{Ti}{I}\right)^{al}$$

$$I. = \sum_{jan}^{des}\left(\frac{Ti}{5}\right)^{1.514}$$

$$a = 6.75 \times 10^{-7}\ I^3 - 7.71 \times 10^{-5}\ 1^2 + 1.792 \times 10^{-2}\ 1 + 0.492$$

where; ETP = Evapotranspiration
Ti = temperature of the month to the first monthly
I = Index monthly heat
a = Constant

Analysis of Soil Water Content (SWC)

Changes in Water Content of Soil (SWC) is the difference in soil moisture content on a period to prior periods between sequential. For each change in soil water content, can be calculated with the formula R - ETP that if a negative value, there will be a deficit (lack of) water for (ETP = Eta). Conversely, if (R - ETP) is positive, then there will be a surplus/excess of water (R-ETP-ΔSWC), so that soil water availability decreases water exponentially and expressed by the equation:

$$SWA = WHC \times k^a,$$

$$WHC = FC - PWP,$$

$$SWC = PWP + ASW$$

Where:

SWC = Actual Soil Water Content (mm)
ASW = Availability of Soil Water Actual (mm)
WHC = water holding capacity or availability of Maximum Soil Water (mm)
FC = Field Capacity (mm)
PWP= Permanent Wilt Point (mm)
k = Constant (obtained k = $((Po + P_1) / WHC)$,

with

Po = 1.000412351 and P_I = -1.073807306
a = accumulation of potentially lost water (Accumulate Potential Water Loss, APWL), which represents the accumulated value (R-ETP) when the value of CH <ETP

RESULTS AND DISCUSSION

Preview Area watersheds Karangmumus

Karangmumus sub-watershed is part of the Mahakam river basin is located at coordinates between $0^0$17'30"-$0^0$30'00" SL and $117^0$06'00"-$117^0$22'00" EW with a total area reaches 31 475 ha. Divided into 9 (nine) sub-watershed areas, namely sub-sub-watershed Karangmumus, sub-sub-watershed Lantung, sub-sub-watershed Pampang, Muang sub-watershed, sub-sub-watershed Karangasam, sub-sub-watershed Bayur, sub-sub-watershed Jayamulya, sub-sub-watershed Siring and sub-sub watershed Betapus as well as several other small rivers.

Sub-watershed area Karangmumus includes 5 (five) districts, namely sub-district of North Samarinda, Samarinda Ilir, Samarinda Ulu and sub-district of Muara Badak and Lempake. Sub-watershed area Karangmumus has varied topography, with elevation ranging from topographic region 10-120 m above sea level with a diverse variety of heights.

Table 1. The total area of the basin based on gradient class Karangmumus

The range of slope (%)	Slope Class Size	Area Hectares	Area (%)
0 ~ 8	I (Flat)	4.907,85	15,59
8 ~ 15	II ((flat)(Landai)	2.780,66	8,83
15 ~ 25	III (Rather Steep)	18.134,51	57,62
25 ~ 40	IV (Steep)	6.398,13	20,33
>40	V (Very Steep)	472,93	1,50
	Σ amount	31.475	100.00

Source : Anonim (2001)

Table 2. The Area Land Use Type at sub-watershed area Karangmumus

No.	The Area Land Use Type	Area (ha)	Area (%)
01.	Farm (dry land farming)	203,13	0,65
02.	Forest	146,15	0,46
03.	Shrub	6.996,25	22,23
04.	Mixed Garden	4.473,44	14,21
05.	Bush	14.501,36	46,07
06.	Wetland	648,99	2,06
07.	Garden	1.106,64	3,52
08.	Settlements	2.267,78	7,21

No.	The Area Land Use Type	Area (ha)	(%)
09.	Settlement expansion (Pp)	215,61	0,69
10.	Slough/swamp area	915,63	2,91
	Amount	31.475,00	100

Source : Anonim (2001)

Condition Elements The climate in the sub-watershed Karangmumus

Based on rainfall data from 3 (three) climate observation station in the basin area Karangmumus year period from 2001 to 2005 showed that rainfall monthly average ranged from 104-214 mm month^{-1} or an average of 168 mm month^{-1}, whereas The average rainfall ranging from 1510-2850 mm year^{-1} or average of 2018 mmyear^{-1}. Rainfall occurred on rainy days (rd) monthly rates ranging from 9-14 rd with an average rainfall occurred 11 rd month^{-1}.

Analysis of rainfall characterization includes four main components, namely:

1. Annual Rainfall spread of this area falls within Class Region III (rainfall between 1500-2000 mm year^{-1}).
2. Spread Type Rainfall Karangmumus sub-watershed area has a period of dry months (months with rainfall of <100 mm month^{-1}). Thus obtained value of Q = ±9.9%, or rain type A (which may imply that the basin area Karangmumus is very wet areas with dense vegetation of tropical rain
3. Rainfall patterns or Bimodel Dual (Double Wave) with the notation Pattern C, periods of high rainfall occurred in December and April, while periods of low rainfall occurred in September and November.
4. Agro-climate zones, the basin has a dry months Karangmumus (DM), 8 months humid (HM) and three wet months (WM), including agro-climate zones E1.

Table 3: Climate Data Average Monthly Karangmumus sub-watershed area $0^0 17'30''$- $0^0 30'00''$ SL and $117^0 06'00''$-$117^0 22'00''$ EW

Climate Elements	Month 1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm month^{-1})	194	123	233	333	183	113	178	121	104	134	198	214
Rainy Days (days)	12	11	12	14	12	11	9	10	9	11	11	12
Temperature (^{0}C)	26.8	26.7	27.0	27.2	27.0	26.6	26.2	26.5	26.6	26.9	26.9	26.9
Humidity (%)	87.2	86.3	89.2	90.2	88.6	86.5	85.6	86.2	83.4	85.9	87.1	86.3
Sun Radiation (Kkal cm^{-2})	0.55	0.48	0.51	0.53	0.53	0.51	0.51	0.49	0.41	0.44	0.44	0.52

Calculation of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) conducted monthly by using equations from Buckman and Braddy (1969), quoted by Sujalu (1997) in the basin area Karangmumus ranged from 137.2-140.2 mm or an average of 138.8 mm month^{-1}, the highest point in months April amounted to 140.2 mm and the lowest points in July amounted to 137.2 mm.

Water Balance

The calculation result in soil water status were obtained from analysis of soil physical properties in the laboratory soil Prop BPTP. Kaltim from Heriansyah (2004) showed that soil available water content (SWC) in the range between 244-299mm or average 268 mm.

Water equilibrium implies about the details of the input (input) and outputs (output) of water in one place at a certain time period, compiled in the form of quantitative equations, which provide information in the form of quantitative values of each component of input and output water.

Monthly Water Equilibrium analysis of the results mentioned above can be seen that these areas have a surplus during the eight months that occurred in a period of months from January to June and in November-December. The monthly water surplus in detail is in January amounted to 27.0 mm, 57.3 mm in February amounted, in March amounted to 119.7 mm (the highest monthly surplus), in April amounted to 72.8 mm, 48.4 mm in May, months of June amounted to 19.6 mm (the lowest monthly surplus), the month of November amounted to 58.7 months in December and amounted to 75.3 mm in overall water surplus reached 478.8 mm / year.

In addition to having monthly water surpluses, the region normally monthly cumulative water deficit in a period of months from June to October as a whole as much as 44.5 mm year^{-1}, with details of the deficit in June amounted to 0.4 mm month^{-1}, July amount 0.3 mm month^{-1}, the month of August amounted to 3.9 mm month^{-1}, the month of September amounted to 13.6 mm month^{-1} and in October of 26.7 mm month^{-1}.

As has been previously communicated its position Karangmumus river divides the city of Samarinda, and considering the amount of potential run-off that occurred in the region and also by considering the conditions Karangmumus area topography, the basin area Karangmumus very possible to build dams or reservoirs, which have various functions. Although the main function is to accommodate the construction of the dam monthly surplus water run off resulting in the potential is big enough in this area, as well as water reserves in the period in the months of water deficit that can be utilized by a variety of purposes including drinking water

Analysis of Cropping Periods (Growing Season)

To determine the length of cropping period (the length of growing season) can be done based on the ratio P/PE (ratio between precipitation and potential evapotranspiration), defined as the time interval in a year that have a ratio P/PE>0.5 plus the time needed for evapotranspiration 100 mm of ground water is considered available in the soil (FAO, 1978). Results of analysis ratio P/PE can be seen in Table 4 below.

Table 4.Ratio rainfall (R) and potential evapotranspiration (EP) monthly

Climate Elements	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm / month)	194	123	233	333	183	113	178	121	104	134	198	214
Evapotr.Pot. / ETP (mm)	139.0	138.7	139.6	140.2	139.6	138.4	137.2	138.1	138.4	139.3	139.3	138.7
Ratio P/PE	1.4	0.9	1.7	2.4	1.3	0.8	1.3	0.9	0.8	0.9	1.4	1.5

Based on this analysis the ratio P / PE ratio of the above in mind that the P / PE in the rain fall average monthly cumulative throughout the year (12 months) is always> 0.5. Therefore, according to the restrictions provided FAO (1978), the sub-watershed areas have Karangmumus planting period (the length of growing season) for 12 months or all year round.

CONCLUSION

Based on the description as a whole can be concluded that sub-watershed Karangmumus area has a all year round (12 month) potential planting period (growing season) which is supported by the surplus water during 7 (seven) months or cumulatively amounted to 478.8 mm year-1 and a deficit of water for four months or cumulative 44, 5 mm years^{-1}.

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