Analysis of Katon weir water availability to planting patterns and regional water supply systems of Katon irrigation, Janapria sub district, Central Lombok

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Analysis of Katon weir water availability to planting patterns and regional water supply systems of Katon irrigation, Janapria sub district, Central Lombok

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Abstract. The objective of the study was to determine the condition of the irrigation area and water balance of the Katon Weir and how to use water more efficiently as an evaluation material to obtain optimal results in managing the irrigation water network with a 'rice-rice-secondary' cropping system. The analysis of continuous water supply is carried out continuously in K1, tertiary rotation in K2, secondary rotation in K3, and primary rotation in K4. The results show that by rotating the four systems of the group, according to the K factor for Q80%, K1 is obtained 2 times, K2 and K3 do not exist, and K4 is 22 times. The availability of water is Q50%, K1 is 3 times, then K2 is not available, K3 is 2 times, K4 is 19 times. Meanwhile, water availability of Q20%, K1 as much as 5 times, then K2 once, K3 4 times, K4 as much as 14 times. It can be suggested that the need of water balance in Katon area for irrigation is still experiencing a lot of water shortages.

Keywords: Water needs; water availability; water balance

1. Introduction

Katon weir is located in Lengarak hamlet, Langko Village, Janapria District, Central Lombok Regency with an area of 1885 ha of rice fields. The availability of water in the last 10 years in the dam has decreased very drastically, the decrease in the amount of water that is quite drastic is shown by the unsuccessfulness of farmers in the irrigation area of the Katon Dam[1]. The Katon Dam, which has been operating for about 25 years, has experienced disruption in the irrigation network system caused by the accumulation of sediment along the primary, secondary and tertiary channels, as well as in the upper reaches of the Katon Dam and its surroundings, inundation and sediment accumulation. Silting and accumulation due to sediment in the channel and upstream of the Katon Weir have resulted in a decrease in the performance of the Katon Dam Irrigation Network, where the performance of the irrigation network due to silting has resulted in a decrease in the income of farmers. During the dry season, farmers often experience water shortages due to network conditions and complementary

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buildings that are not functioning optimally. So that this impact causes farmers to often experience crop failure.

The water source for the Katon Irrigation Area comes from the Katon Weir which is located on the Renggung Perempung River with one intake door to channel water[2]. In order to increase agricultural production, a water balance analysis is carried out in order to reduce the potential for irrigation water loss and can be used more efficiently as an evaluation of optimal irrigation water management. [3].

2. Methodology

The analysis was carried out in the Renggung Watershed (DAS), Central Lombok Regency at the position of 116 ° 05 '- 116 ° 24' East Longitude and 8 ° 24 '- 8 ° 57' South Latitude. Renggung watershed area 192.91 $km2$. Meanwhile, the secondary data used are Rainfall Data, Irrigation Area Data Climatological Data. By way of direct observation in the field, and from related agencies, namely the Nusa Tenggara I River Basin, West Nusa Tenggara Province, the data obtained is in the form of primary data and secondary data. The location of the analysis can be seen in Figure 1 below. Hydrological data analysis includes data consistency test, analysis of average rainfall with Theissen polygon methodology, effective rainfall analysis, climatological data evapotranspiration analysis, water demand analysis, reliable discharge analysis, water balance analysis, and analysis of water supply for Katon irrigation areas.

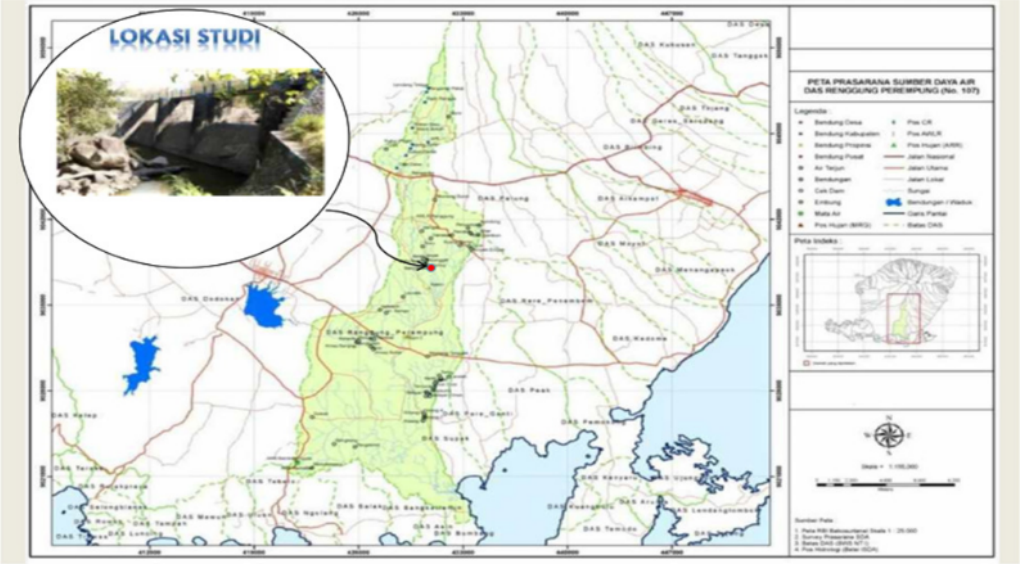


Figure 1. The location area Katon weir Observation

3. Results and discussion

The rain station which is influential according to the analysis of the Thiessen Polygon method according to Figure 2, to the Renggung river flow area, is as follows: Loang Make station area 60,766,402 m2, Perian station area 26,336,692 m2, Lingkok Kapur station area 42,626,611 m2, Station The barrier is 44,999,719 m2 and the Rembitan station is 87,536,261m2 [4]. The results of the

recapitulation of annual rainfall data for each rain station using the Rescaled Adjusted Partial Sums (RAPS) method show consistent results [5]. Analysis of the need for irrigation water in rice fields with a reliability probability of 80% for rice plants in December is 2.146 liters / second, while with a probability of 50% for rice plants in April is 1.76 liters / second. Analysis of water availability in the Katon irrigation area using a measured flowrate from the Automatic Water Level Recording (AWLR) data[6]. The results of the analysis of water availability data processing in the Katon Dam can be seen in Tables 1, 2 below.

Figure 2. Location of Rain Station Which affects the Katon weir.

Table .1. water needs in the fields

Need for Irrigation Water at the intake (l / sec / ha) In KATON WEIR						
Pattern Planting	Rice-Rice-Crops					
irrigation Area	Katon					
Area Irrigation	1885 ha					
Early Planting	1-Dec					
Mon	Needs Fields Rice (N ltr/sec/ha		Water Needs Fields in Intak litr/sec		Needs Fileld Rice (NFR) litr/sec in land of 1885 ha	
1-Dec	0.536	0.000	0.852	0.000	907.556	0.000
2-Dec	0.677	0.000	1.041	0.000	1145.230	0.000
1-Jan	1.395	0.000	2.146	0.000	2360.960	0.000
2-Jan	1.115	0.000	1.716	0.000	1887.751	0.000
1-Feb	1.036	0.000	1.595	0.000	1753.970	0.000
2-Feb	1.520	0.000	2.339	0.000	2573.119	0.000
1-Mar	1.249	0.000	1.921	0.000	21113.634	0.000
2-Mar	0.783	0.000	1.205	0.000	1324.964	0.000
1-Apr	0.000	0.000	0.000	0.000	0.000	0.000
2-Apr	1.110	0.000	1.078	0.000	1878.677	0.000
1-May	1.956	0.000	3.009	0.000	3310.072	0.000
2-May	1.545	0.000	0.377	0.000	2614.473	0.000
1-Jun	1.248	0.000	1.919	0.000	2111.174	0.000
2-Jun	1.186	0.000	1.825	0.000	2006.968	0.000
1-Jul	1.139	0.000	1.752	0.000	1927.425	0.000
2-Jul	1.171	0.000	1.801	0.000	1981.442	0.000
1-Aug	0.678	0.000	1.043	0.000	1146.817	0.000
2-Aug	0.000	0.222	0.000	0.342	0.000	376.300
1-Sep	0.000	0.532	0.000	0.819	0.000	900.998
2-Sep	0.000	0.949	0.000	1.460	0.000	1605.700
1-Oct	0.000	1.144	0.000	1.760	0.000	1935.619
2-Oct	0.000	1.134	0.000	1.745	0.000	1919.389
1-Nov	0.000	0.474	0.000	0.729	0.000	802.407
2-Nov	0.000	0.000	0.000	0.000	0.000	0.000
Max needs	1.956	1.144	3.009	1.760	3310.072	1935.619
Min needs	0.000	0.000	0.000	0.000	0.000	0.000

source of analysis results

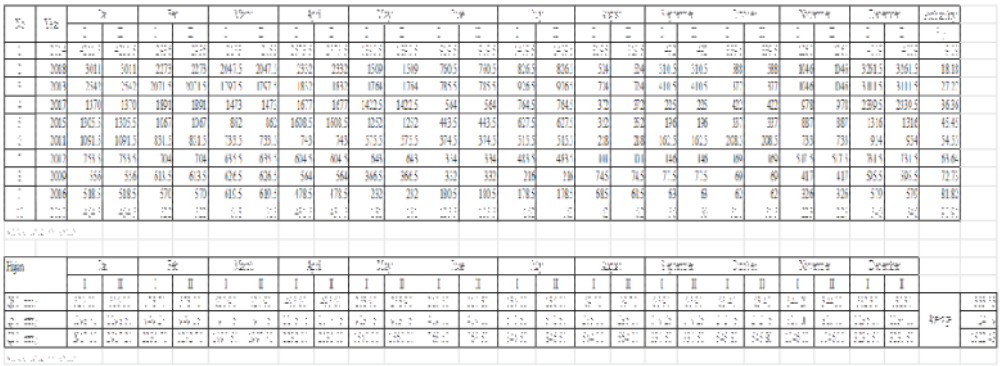
Table 2. Water Availability Data in the Katon Weir

Source of analysis results

Water balance analysis at Katon Weir aims to measure the volume of water available to irrigate 1,885 ha of rice fields. The results of the analysis show that on January 1, 2009 there was a deficit of 94%, with the total demand coming through the intake of 2146 liters / second, the demand for water in

the fields was 4045.83 liters / second and the simulation results of dammed water availability data were 241 liters. / sec. So it is said that the availability of water in the weir has a considerable deficit.

Table.3. Reliable Discharge of Q80% and Q50% Probability at Katon Weir (liter/second) With The Interpolation Method



In the irrigation network planning system, water deficits can be overcome by using a water rotation system as regulated in KP-01 of 1986.

Table 4. Value of K Factor in Irrigation Water Supply System According to KP 01-1986

K	Score	Provision of Water	Information
0.70 – 1.25	Good	Continuous	K1
0.50 – 0.70	Enough	Tertiary Rotation	K2
0.25 – 0.50	Bad	Secondary Rotation	K3
< 0.25	Very bad	Primary Rotation	K4

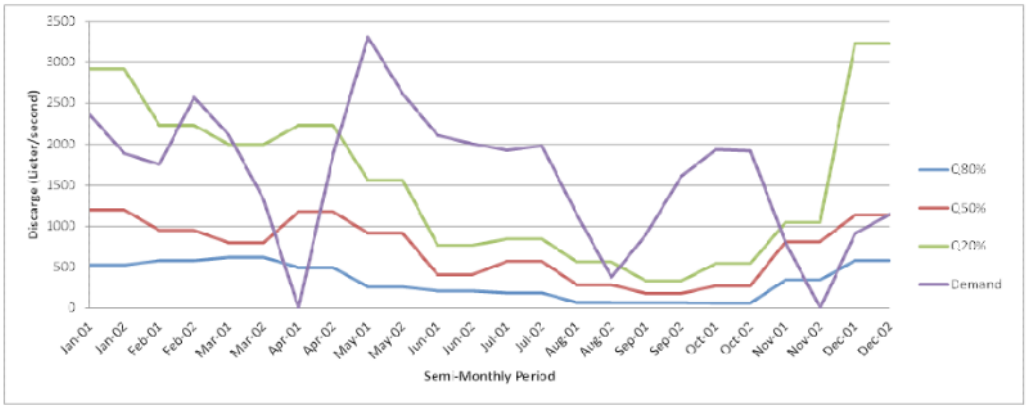
Source: KP 01- 1986[1], [2], [3]

With reference to KP-01 1986[1], [2], [3], the results of the analysis in the last ten years in the Katon Dam have experienced a water availability deficit, both in conditions of water availability of 80%, 50%, and 20%. Where the results of the above analysis can be seen in Table 5 below. Graph of the relationship between water balance in Katon Weir and irrigation needs can be seen in Figure 3. The value of the K factor in the irrigation class system according to KP-01 1986 from the results of the Water Balance analysis is shown in Table 6 below.

Table 5. Water Balance according to Demand at Katon Weir.

Period	Probability Katon Weir			Demand	Defisit		
	Q80%	Q50%	Q20%		Q80%	Q50%	Q20%
Jan-01	526.00	1198.50	2917.20	2360.96	78%	49%	0%
Jan-02	526.00	1198.50	2917.20	1887.75	72%	37%	0%
Feb-01	578.70	949.25	2232.70	1753.97	67%	46%	0%
Feb-02	578.70	949.25	2232.70	2573.12	78%	63%	13%
Mar 01	620.90	797.75	1997.50	2113.63	71%	62%	5%
Mar-02	620.90	797.75	1997.50	1324.96	53%	40%	0%
Apr-01	495.60	1175.75	2232.00	0.00	0%	0%	0%
Apr-02	495.60	1175.75	2232.00	1878.68	74%	37%	0%
May-01	258.90	913.75	1560.00	3310.07	92%	72%	53%
May-02	258.90	913.75	1560.00	2614.47	90%	65%	40%
Jun-01	210.80	409.00	765.50	2111.17	90%	81%	64%
Jun-02	210.80	409.00	765.50	2006.97	89%	80%	62%
Jul-01	186.00	571.50	846.50	1927.43	90%	70%	56%
Jul-02	186.00	571.50	846.50	1981.44	91%	71%	57%
Aug 01	69.70	285.00	561.00	1146.82	94%	75%	51%
Aug-02	69.70	285.00	564.00	376.30	81%	24%	0%
Sep-01	65.90	179.25	330.50	901.00	93%	80%	63%
Sep-02	65.90	179.25	330.50	1605.70	96%	89%	79%
Oct-01	63.40	272.75	545.80	1935.62	97%	86%	72%
Oct-02	63.40	272.75	545.80	1919.39	97%	86%	72%
Nov-01	344.20	810.00	1046.00	802.41	57%	0%	0%
Nov-02	344.20	810.00	1046.00	0.00	0%	0%	0%
Dec-01	582.30	1135.00	3231.50	907.55	36%	0%	0%
Dec-02	582.30	1135.00	3231.50	1145.23	49%	1%	0%

Source: analysis results



Source: analysis results

Figure 3. Graph of Relationship of Water Demand in Certain Months

Table 6. K factor values of Katon Weir discharge (%) and water supply system

Period	Category			Factor K		
	Q80%	Q50%	Q20%	Q80%	Q50%	Q20%
Jan-01	K4	K4	K1	0.22	0.51	1.00
Jan-02	K4	K3	K1	0.28	0.63	1.00
Feb-01	K4	K4	K1	0.33	0.54	1.00
Feb-02	K4	K4	K2	0.22	0.37	0.87
Mar-01	K4	K4	K2	0.29	0.38	0.95
Mar-02	K4	K3	K1	0.47	0.60	1.00
Apr-01	K1	K1	K1	1.00	1.00	1.00
Apr-02	K4	K3	K1	0.26	0.63	1.00
May-01	K4	K4	K4	0.08	0.28	0.47
May-02	K4	K4	K4	0.10	0.35	0.60
Jun-01	K4	K4	K4	0.10	0.19	0.36
Jun-02	K4	K4	K4	0.11	0.20	0.38
Jul-01	K4	K4	K4	0.10	0.30	0.44
Jul-02	K4	K4	K4	0.09	0.29	0.43
Aug-01	K4	K4	K4	0.06	0.25	0.49
Aug-02	K4	K3	K1	0.19	0.76	1.00
Sep 01	K4	K4	K4	0.07	0.20	0.37
Sep-02	K4	K4	K4	0.04	0.11	0.21
Oct-01	K4	K4	K4	0.03	0.14	0.28
Oct-02	K4	K4	K4	0.03	0.14	0.28
Nov-01	K4	K1	K1	0.43	1.00	1.00
Nov-02	K1	K1	K1	1.00	1.00	1.00
Dec-01	K3	K1	K1	0.64	1.00	1.00
Dec-02	K4	K2	K1	0.51	0.99	1.00

Information	Water Requirements			Percentage (%)		
	Q80	Q50	Q20			
K1	2 kali	4 kali	11 kali	8.3%	16.7%	45.8%
K2	0 kali	1 kali	2 kali	0.0%	4.2%	8.3%
K3	1 kali	4 kali	0 kali	4.2%	16.7%	0.0%
K4	21 kali	15 kali	11 kali	87.5%	62.5%	45.8%
Σ				100%	100%	100%

Source: analysis results [7]

From Table 6 above, it can be analyzed that with a deficit of more than 40%, the Katon Irrigation Area is in quite bad condition with a factor value (K) of 20% -40%. Katon Irrigation Area is said to be sufficient if the rotation is applied in the tertiary channel. If the water flow conditions in the Renggung watershed enter a dry year with Q80%, the Katon Irrigation Area will carry out a water cycle system K1 = 3 times, K2 = 0 times, K3 = 0 times and K4 = 21 times. If the water flow conditions in the Renggung watershed enter a normal year with Q50%, then the Katon Irrigation Area will carry out a water cycle system K1 = 4 times, K2 = 0 times, K3 = 2 times, and K4 = 18 times. If the water flow conditions in the Renggung River Basin enter a wet (rainy) year with Q20%, the Katon Irrigation Area will carry out a water cycle system K1 = 5 times, K2 = 1 times, K3 = 4 times, and K4 = 14 times.

4. Conclusion

The results of the water balance analysis can be concluded as follows:

1. 1. Under normal water conditions, with a rice-rice cropping pattern, 3310,072 liters / second of water are required. While the second planting season for rice - secondary crops 1,935,619 liters / second.
2. Average water availability in Katon Dam with a discharge of Q80% 333.53 1 / second, Q50% 724.79 1 / second, and Q20% 1522.43 1 / second.
3. The results of water balance analysis show that for Q80% there is a water deficit 22 times in a

period of half a month per year, and there is a surplus of 2 times in a period of half a month per year. For Q50% there is a water deficit 20 times in a half month period per year, and a surplus occurs 4 times in a half month period per year. Then for the 20th Quarter there was a water deficit 13 times in a half month period per year, and there were 11 times a surplus in a half month period per year.

4. The results of the analysis of the water supply system according to the available discharge are carried out with 4 criteria, namely: Q80%, K1 2 times, then K2 is absent, K3 1 time, K4 21 times. Q50%, K1 4 times, then K2 once, K3 4 times, K4 15 times. Q20%, K1 11 times, K2 2 times, K3 0 times, K4 11 times.

Acknowledgment

Suggestions that can be given as input for further research are as follows: We hope that all agencies related to similar research and all Water User Farmer organizations, in the effort to manage water availability, can be further improved so that the management of water availability in the weir and its network can be utilized as much as possible by maintaining all available infrastructure and can provide benefits and more accurate information to local governments.

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