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Study of Irrigation Water Supply Efficiency to Support the Productivity of Farmers (Case Study at Kobisonta North Seram Central Maluku District)

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***Abstract*— *The need of water is a major media of irrigation in order to support the effectiveness of agricultural business which is manifested as the supporting of food provision. The purpose of this study is to analyze the amount of discharge in each channel and the efficiency in Kobisonta irrigation area, Seti North Seramsubdistrict, Central Maluku district with area of 3,150 ha. The study was conducted on secondary channels Kobisonta includes BKS7, BKS8, BKS9, Kobisonta Secondary Channel includes BKS10, BKS11, BKS12 and Seti Secondary Line includes BS1, BS2 and BS3*

The water debit requirement in the rice field and the efficiency in the irrigation area of Kobisonta was analyzed by using the incoming debit - discharge method based on flow velocity measurement. Providing irrigation water for efficiently is not simple because many factors affect the way and the process, besides that if the water supply and irrigation on the channel is inefficient, then it can reduce or decrease agricultural productivity.

From the result of actual debit analysis on channel BS3, BKS9, BKS11, and BKS12, they are able to meet therequirement of irrigation water thoroughly in irrigation area. In BS1, BS2, BKS8 and BKS10 channels, actual discharge has not been able to meet the irrigation water needs in its irrigation area. The efficiency of irrigation channels in Kobisonta Irrigation Area varies by channel. According to the efficiency standard by the Directorate General of Irrigation, the secondary Saluaran in Irrigation Area is categorized as efficient where for BKS7 is 90%, BKS8 is 97% and BS2 is 91%.

Keywords*— *discharge, efficiency, irrigation.

I. INTRODUCTION

Irrigation is an effort to supply and regulate water with the purpose of agriculture supporting that can include surface water irrigation, underground water irrigation, pump irrigation and local irrigation. Kobisonta is located in East Seram District Seti, Central Maluku district with a population of 14,923. It is one of the rice production centers.

The construction of Kobi weir which is located in the village of Kobisonta, North Seram District Seti, Central Maluku District which in this case, has a water catchment area of 145.4 km2, is expected to meet the water needs for irrigated rice fields of 3,150 ha. So here, researchers use the object of research located in one of the villages located in the Central Maluku District.

In supporting the water needs in the agricultural sector with irrigation system, indeed there will be some problems that arise. One of them is the loss of water that occurs in each channel on the way to the rice field. This study is conducted can give contribution in completing the existing irrigation network study information, by focusing more on the efficiency and effectiveness of irrigation network operating system on the level of service of primary channel, secondary and tertiary channels to water requirements in rice crops.

II. LITERATURE REVIEW

The meaning of Irrigation

Irrigation is a watering activity on an agricultural land that aims to create moist conditions in the root of the plant to meet the water needs for plant growth. According to Basri, 1987 irrigation is the provision of water in plants to meet the water needs for its growth. According to Karta Saputro, 1994 irrigation is an activity of supply and regulation of water to meet the interests of Agriculture by utilizing water from surface water and soil. According to Suharjono, 1994 irrigation is a number of water that is generally taken from

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rivers or weirs that flowed through the irrigation system to maintain balance the amount of water in the soil.

2.1 Irrigation Network

The irrigation network is the unity of the canals and structures necessary for the regulation of irrigation water from the provision, collection, distribution, delivery and use. There are two kinds of irrigation networks:

1. The main irrigation network: irrigation network that is located in an irrigation system, starting from main building, main / mainline, secondary channel, and tapping building and its complementary building.
   a. Main / primary channel
   b. Secondary irrigation channels
2. Tertiary Irrigation Network: a network that serves as a water service infrastructure within a tertiary grid consisting of a carrier channel called a tertiary channel, a dividing channel called a Quaternary channel, and a drainage channel and auxiliary channels.

2.2 Irrigation Efficiency

Irrigation efficiency shows the use of water that is the ratio between the amount of water used and the amount of water given expressed in percent (%).

$$EfisiensiIrigasi = \frac{debitairyangkeluar\ (m^3\ /detik)}{debitairyangmasuk\ (m^3/detik)} \times 100\% \quad \text{(eq 1)}$$

Estimated efficiency of irrigation is set as follows (KP-01, 1986: 10):

1. tertiary network = 80%
2. secondary network = 90%; and
3. primary network = 90%.

While the overall irrigation efficiency factor is 80% x 90% x 90% = 65%.

2.3 Water Discharge

The amount of liquid that flowing through a cross-section of flow per one unit of time is called flow discharge (Q).

$$Q = A \cdot V \quad \text{(eq.2)}$$

2.4 Water Loss

Water loss is generally divided into 2 categories, among others:

1. Loss of physical consequences where water loss occurs due to water seepage in the channel and percolation at farm level (paddy field); and
2. Operational loss occurs due to exhaust and excess water discharges during channel operation and waste of water used by farmers.

The loss of water on each inlet measurement (Inflow - Outflow) is calculated as the difference between inlet and outflow discharge. (IPB Water Management Research Team, 1993: 1-05):

$$h_n = I_n - O_n \quad \text{(eq 3)}$$

Table.1: Flow Velocity Measurement Method

Depth (m)	Velocity Observation	Average Velocity
0.00 - 0.60	0.6d	$= V_{0.6d}$
0.60 - 3.00	0.2d	$= 0.5\,(V_{0.2d} + V_{0.8d})$
	0.8d	
3.00 - 6.00	0.2d	$= 0.25\,(V_{0.2d} + V_{0.6d} + V_{0.8d})$
	0.6d	
	0.8d	
> 6.00	S	$= 1/10\,(V_s + 3V_{0.2d} + 2V_{0.6d} + V_b)$
	0.2d	
	0.6d	
	0.8d	

2.5 Water Requirement

Parameters that is used in water demand analysis are:

1. Coefficient of plant (Kc)
   The magnitude of Kc varies, in this study used the numbers suggested by FAO (Irrigation Planning Standards, KP-01 p. 164).
2. Irrigation efficiency (e)
   The need for water in rice fields for rice crops can be determined by the following factors (MawardiEman 2007: 103);
   - How to prepare the land
   - Water needs for plants / consumtive used
   - Percolation and seepage
   - Replacement of water layers
   - Effective rainfall

2.6 How to prepare the land

Water requirements for land preparation were calculated using the methods of Van de Goor and Zijlstra (1968) as follows:

IR = M (e ^ k / (e ^ k-1) (eq 4)

2.7 Water requirements for plants / consumtive use

The water requirement for plants is water that is used up for plant growth. This water requirement is calculated by multiplying the crop coefficient with potential evapotranspiration.

Etc= Kc x Etp (eq 5)

2.8 Effective rainfall

A. Water Requirement for Irrigation Irrigation water demand in paddy field is calculated for rice-rice planting pattern with the following conditions:

- Need for clean water in paddy fields (NFR):

NFR = ET c + P - Re + WLR (eq 6)

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- Irrigation water needs for rice (WRD):

IR = NFR / e (eq7)

- Irrigation water needs for crops (WRP):

IR = (ET c - Re) / e (eq 8)

The determination of effective rainfall is based on monthly rainfall that is using R80, which means 20% probability is unavailable. The amount of effective rainfall for rice plants is 70% of the minimum monthly rainfall with a 5 year re-period (Irrigation Network Planning, KP-01, 1986,165), with the following equation:

$Re = 0.7 \times 1/15 \times (R_{80})$ (eq 9)

Effective rainfall is a plumper rainfall that falls in an area and is used for growth crops.

III. METHOD

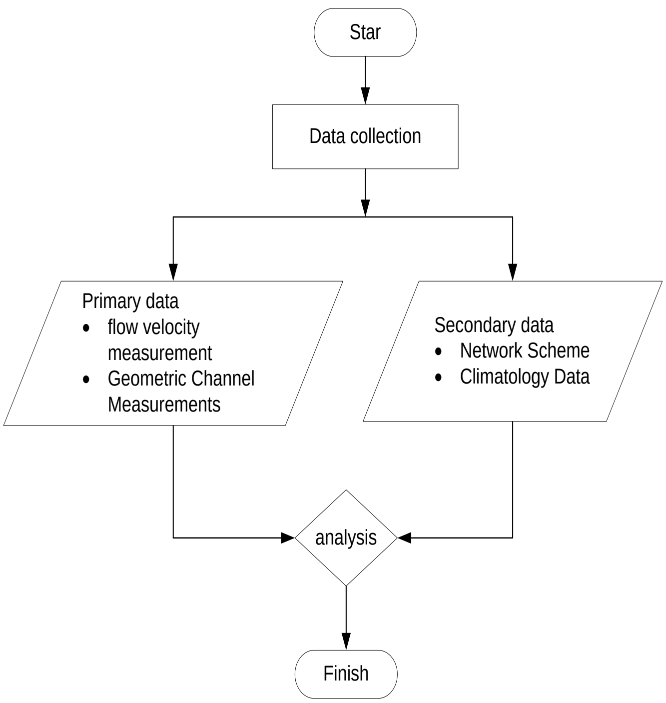

Fig.1: Flowchart Metodologi

3.1 Tools

The tools that are used in this study are: current meter, meter roll, stopwatch, measuring ruler.

3.2 The Measurement Steps are:

Measurement Steps on the Ground:

1. Current Meter

Current velocity measurements are illustrated by the following measurement procedures:

a) Measure the depth of the channel with the measuring pole of the current meter device

b) Select the propeller corresponding to the channel depth, so it can be used for some vertical dots ie (0.2h, 0.6h, 0.8h) where h is the channel depth.

c) The current meter is mounted on a static mast with a depth of 0.2h, 0.6h, and 0.8h, then the measuring rod is inputted into the water until the baseband is located at the bottom of the duct with the propeller facing the flow direction (water current).

d) The number of turns per unit of time, which occurs at each water depth, is calculated.

3.3 Source of Data

Source of data used in this research are:

1. Primary Data

Primary Data is data obtained by measuring the Geometric cross section of the velocity flow channel (V), and the channel length (L).

2. Secondary Data

Secondary data obtained from other parties or from existing reports and research, and which have relevance to the issues discussed, including the number and types of irrigation networks studied, the network scheme of the P3A existing in the Kobisonta Irrigation Area, data on water demand on irrigation area kobisonta, as well as data from several government agencies related among others Office of Public Works.

3.4 Data Analysis Technique

Data analysis techniques in this writing done through the stages as follows:

1. Analyze flow velocity by measuring instruments Current meters and or buoys.
2. Analysis of inlet and outflow discharge on secondary channel kobisonta, channel kobisonta, and channel setunder secondary, (equation 3).
3. Analysis of water loss in secondary channel kobisonta, channel kobisonta, and secondary channel seti, by the difference between inlet and outflow (equation 3)
4. Efficiency analysis on the secondary channel kobisonta, channel kobisonta, and secondary channel seti (equation 1).
5. Analysis of water needs in rice plants in Kobisonta Irrigation Area.

IV. RESULT

Description about the location

Administratively, Kobisonta Irrigation Area is located in Kobisonta village, North Seramsubdistrict of Seti, Central Maluku regency. This sub-district is an expansion of the District of North Seram through the Regional Regulation

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(Perda/region regulation) of Central Maluku Number 9 of 2010, with a population of 14,923 inhabitants. The village of Kobisonta is one of the rice production area centers where almost all the local people live as farmers. The construction of Kobi Dam is located in Kobisonta Village, North Seram District Seti, Central Maluku Regency. The Kobi River has a water catchment area of 145.4 km2 on the site dam position with a river length of 12.3 km.

Kobidam is expected to meet the water requirement for irrigation 3.150 ha of rice fields equal to 31.5 km2. Irrigation water management at farmer level in Kobiosonta Irrigation Area conducted by Water User Farmers (P3A), which is summarized into the Water User Farmers 'Margorejo'

The working area of this association is the Tertiary Plot with a working area of 52 Ha. The source of water used comes from WaiKobi's Bend water which is tapped through the primary channel to the secondary door and then distributed three secondary channels. The first secondary channel is the Seti secondary channel that includes the areas of BS.1, BS.2 and BS.3, the second secondary channel of Kobisonta secondary channel covers the area BKS.7, BKS.8 and BKS.9 and for the secondary secondary channel secondary channel Kobisonta's face covers the area of BKS.10, BKS.11 and BKS.12.

4.1 Flow Rate Analysis In Irrigation Channels

Measurements of velocity on the irrigation can be done directly by using a buoy or indirectly which usually uses a current meter. Measurement of flow velocity in the Kobisonta Irrigation area the researchers used the Current Meter type C2 tool. Here the researcher uses propeller type current meter, this type rotates to the horizontal axis.

The number of turns per unit time can be converted to current velocity. To shorten the time and save costs, measurements can be made only at some point on the vertical, ie at 0.6 d; 0.2 d; and 0.8 d; with d is the flow depth.

The average velocity performed on the intake door is done by using two (2) points method because the depth of the intake door ranges from 0.6 to 3 meters, where the average velocity is the average of velocity at 0.2 and 0.8 depth.

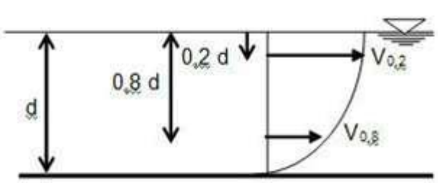

Fig.2: Measurement method of flow velocity

The research that is conducted at the intake door by using the Current Meter obtained the formula of the tool on the propeller current meter type that is:

v = 0.2397.n + 0,018 ...... (n <1,01)

v = 0.2556 .n + 0.002 ...... (1.01≤n <8.06)

v = 0.2494 .n + 0,052 ...... (8.06≤n <9.82)

To prove the measurement data available with the formula of the tool then the researchers will describe the example calculation to get the value of speed on each segment:

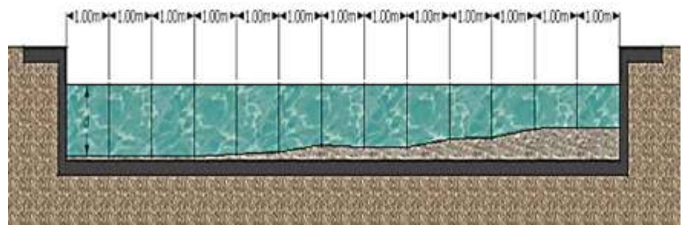

Fig.3: Division of flow rate measurement segments in the field

While the mean velocity on the secondary channel that the researchers do only use the method one (1) point because the depth is at 0.0 - 0.6 meters, which can only be used for shallow water where the method of two or more points can not be done. Speed is measured at 0.6 water depth.

Table.2: Data flow recapitulation dataon channel BS.2

Point (m)	Wide (m)	Depth (m)	Depth of mill (m)	number of rounds	Time (Sec)	Velocity (m/sec) at Point	Velocity (m/sec) Average
0	LW Left	0.30					
0.28	0.28	0.30	0.60	96	40	0.615	0.615
0.56	0.28	0.30	0.60	84	40	0.539	0.577
0.84	0.28	0.30	0.60	93	40	0.596	0.568
1.12	LW Right	0.30					
Average							0.587

Table.3: Average velocity on each channel

Channel code	Velocity (m/sec)
Intake	0.203
BKS 7	1.0692
BKS 8	0.368
BKS 9	0.3077
BKS 10	0.5633
BKS 11	0.3517
BKS 12	0.3854
BS 1	0.4068
BS 2	0.5867
BS 3	0.5143

2 Sectional area of the flow For cross-sectional area of the intake is obtained by multiplying the width of the intake cross-sectional area by the depth of the intake channel.

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Table.4: cross-sectional area of the intake door

Segmen	Wide (w) (m)	Depth (d) (m)	Area (A) (m2)
A1	1	0.95	0.95
A2	1	0.95	0.95
A3	1	0.95	0.95
A4	1	0.92	0.92
A5	1	0.89	0.89
A6	1	0.80	0.80
A7	1	0.83	0.83
A8	1	0.83	0.83
A9	1	0.72	0.72
A10	1	0.70	0.70
A11	1	0.58	0.58
A12	1	0.57	0.57
A13	1	0.57	0.57

4.3 Sectional area of the secondary channel

The recapitulation data of the cross-sectional area for the entire channel in the Kobisonta Irrigation Area is included in table 4

Table.5: Sectional area on the intake door

Channel code	Area (m2)
Intake	10.26
BKS 7	0.35
BKS 8	0.48
BKS 9	0.53
BKS 10	0.27
BKS 11	0.39
BKS 12	0.29
BS 1	0.40
BS 2	0.25
BS 3	0.24

4.4 Flow Debit Analysis

Calculation of the discharge in the channel in Kobisonta Irrigation area is intended to know how far the effectiveness of these channels in fulfilling the water requirement for paddy crop in paddy field. Based on the measurements with current meter in the field obtained the flow of water of each channel on the DI. Kobisonta as follows:

Table.6: Debit recapitulation data on each channel

Channel code	Area (m2)	Velocity (m/sec)	Discharge (m3/sec)
Intake	10.26	0.203	2.083
BKS 7	0.35	1.0692	0.374
BKS 8	0.48	0.368	0.177
BKS 9	0.53	0.3077	0.163
BKS 10	0.27	0.5633	0.152
BKS 11	0.39	0.3517	0.137
BKS 12	0.29	0.3854	0.112
BS 1	0.40	0.4068	0.163
BS 2	0.25	0.5867	0.147
BS 3	0.24	0.5143	0.123

4.5 Irrigation Efficiency

Table.7: Standard Efficiency Levels for Irrigation Channels

Channel	efficiency (%)
Primary	90
Secondary	90
Tertiary	80

From the results of research conducted then researchers get the value of efficiency on each channel, which is appropriate (equation 1):

Table.8: Percentage of Irrigation Efficiency

Channel code	Inflow (m3/sec)	Outflow (m3/sec)	efficiency (%)
BS 2	0.126	0.148	85
BS 1	0.148	0.161	92
BKS 11	0.113	0.137	83
BKS 10	0.137	0.152	90
BKS 9	0.152	0.164	93
BKS 8	0.164	0.177	93
BKS 7	0.338	0.375	90

4.6 Water Loss

To calculate the amount of water loss that occurred in secondary channel in Kobisonta Irrigation area, the following equation is used : $h_n = I_n - O_n$

Table.9: Percentage of Water Loss on DI Channels. Kobisonta

Channel code	Inflow (m3/sec)	Outflow (m3/sec)	Losses (%)	Percentage (%)
BS 2	0.126	0.148	0.022	15
BS 1	0.148	0.161	0.013	8
BKS 11	0.113	0.137	0.024	17
BKS 10	0.137	0.152	0.015	10
BKS 9	0.152	0.164	0.012	7
BKS 8	0.164	0.177	0.013	7
BKS 7	0.338	0.375	0.037	10

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4.8 Effective rainfall

Calculates effective rainfall for rice by 70% of R80 of time in a period, with the following equation: $Re = 0{,}7 \times \frac{1}{15} \times (R_{80})$

4.9 Estimated evaporation

Evaporation is expressed as the evaporation rate given in millimeters per day. Evaporative measurements of the water surface can be done in several ways. The most used way to know the evaporative volume of the free water surface is to use an evaporating pan. The method used in kobisonta irrigation area is using class evaporation pans tool. The result of ET0 analysis using Software Cropwat 8.0

Table.10: Results of Effective Rainfall Recapitulation

Month	R 80% (mm)	comparative number	R 80% 1/2 month (mm)	multiplier factor Re %	Re-Rice (mm/15 day)	Re-Rice (mm/day)
Des 1	157.90					
Jan 1	154.70	155.50	84.54	70.00	59.18	3.95
Jan 2		129.05	70.16	70.00	49.11	3.27
Peb 1	52.10	77.75	25.51	70.00	17.86	1.19
Peb 2		81.03	26.59	70.00	18.61	1.24
Mrt 1	167.80	125.85	76.76	70.00	53.73	3.58
Mrt 2		149.25	91.04	70.00	63.73	4.25
Apr 1	93.60	70.20	42.08	70.00	29.46	1.96
Apr 2		85.95	51.52	70.00	36.06	2.40
Mei 1	63.00	47.25	30.48	70.00	21.34	1.42
Mei 2		50.40	32.52	70.00	22.76	1.52
Jun 1	12.60	9.45	2.68	70.00	1.88	0.13
Jun 2		35.00	9.92	70.00	6.94	0.46
Jul 1	102.20	76.65	43.80	70.00	30.66	2.04
Jul 2		102.20	58.40	70.00	40.88	2.73
Ags 1	102.20	76.65	42.57	70.00	29.80	1.99
Ags 2		107.35	59.63	70.00	41.74	2.78
Sep 1	122.80	92.10	55.98	70.00	39.18	2.61
Sep 2		109.95	66.82	70.00	46.78	3.12
Oct 1	71.40	53.55	30.63	70.00	21.44	1.43
Oct 2		71.28	40.77	70.00	28.54	1.90
Nov 1	70.90	53.18	25.85	70.00	18.10	1.21
Nov 2		92.65	45.05	70.00	31.53	2.10
Dec 1	157.90	118.43	67.87	70.00	47.51	3.17
Dec 2		157.10	90.03	70.00	63.02	4.20

Table.11: Calculation of ET0

Country Indonesia Station Kobisonta

Altitude 3 m. Latitude 3.00 °N Longitude 129.00 °E

Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	°C	°C	%	km/day	hours	MJ/m²/day	mm/day
January	24.0	31.7	60	64	8.0	20.6	4.35
February	22.9	30.4	45	73	7.0	19.9	4.41
March	23.7	30.4	36	62	6.0	18.8	4.19
April	25.0	32.3	53	62	8.0	21.6	4.71
May	21.0	31.7	48	47	9.0	22.1	4.39
June	21.0	31.5	41	54	7.0	18.6	3.92
July	20.0	30.3	43	63	8.0	20.3	4.16
August	20.0	30.3	61	70	10.0	24.1	4.73
September	20.0	29.5	53	78	8.0	21.7	4.47
October	22.0	31.1	53	70	9.0	23.0	4.74
November	22.0	28.8	48	65	8.0	20.7	4.21
December	23.7	28.0	41	57	7.0	18.0	3.80
Average	22.1	38.5	49	64	7.9	20.9	4.34

4.10 Water requirements for land preparation

Calculation of water requirements during land preparation, used methods developed by Van de Goor and Zijlstra (irrigation planning standard KP-01, 1986) with the formula:

IR = M (e ^ k / (e ^ k-1))

Table.12: Calculation of Water Requirement Processing Period

Month	Et_0	E_0=1.1*Et_0	P	M=E_0+P	k=M*T/S		LP=(M*e^k)/(e^k-1) mm/day	
					T=45 day		T=45 day	
	mm/day				S=250 mm	S=300 mm	S=250 mm	S=300 mm
Jan	3.88	4.27	2.00	6.27	1.13	0.94	9.27	10.28
Feb	4.55	5.01	2.00	7.01	1.26	1.05	9.78	10.77
Mar	5.39	5.93	2.00	7.93	1.43	1.19	10.43	11.40
Apr	4.86	5.35	2.00	7.35	1.32	1.10	10.02	11.00
May	4.68	5.15	2.00	7.15	1.29	1.07	9.88	10.87
Jun	3.96	4.36	2.00	6.36	1.14	0.95	9.33	10.34
Jul	4.15	4.57	2.00	6.57	1.18	0.98	9.47	10.48
Aug	4.63	5.09	2.00	7.09	1.28	1.06	9.84	10.83
Sep	4.56	5.02	2.00	7.02	1.26	1.05	9.78	10.78
Oct	5.20	5.72	2.00	7.72	1.39	1.16	10.28	11.26
Nov	4.30	4.73	2.00	6.73	1.21	1.01	9.58	10.59
Dec	4.21	4.63	2.00	6.63	1.19	0.99	9.52	10.52

4.11 Water requirements for each field

Water requirement for rice crops seen from the maximum requirement that is at age of rice aged two months. The results of field measurements obtained data on the water requirement of each rice field plot in the age of paddy aged 0.5 months to 4 months as follows.

Table.13: Water Requirements for each Plot

Plot	Water needd (Lt/s)								extensive
Code	*0.5*	*1*	*1.5*	*2*	*2.5*	*3*	*3.5*	*4*	rice fields (Ha)
BS3	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	179.80
BS2	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	95.80
BS1	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	50.90
BKS12	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	72.00
BKS11	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	45.00
BKS10	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	84.70
BKS9	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	39.50
BKS8	0.21	0.71	0.40	1.04	0.66	0.33	0.21	0	26.30

Plot	water needs of each field (m3/s)								extensive
Code	*0.5*	*1*	*1.5*	*2*	*2.5*	*3*	*3.5*	*4*	rice fields (Ha)
BS3	0.04	0.13	0.07	0.19	0.12	0.06	0.04	0.00	179.80
BS2	0.02	0.07	0.04	0.10	0.06	0.03	0.02	0.00	95.80
BS1	0.01	0.04	0.02	0.05	0.03	0.02	0.01	0.00	50.90
BKS12	0.02	0.05	0.03	0.07	0.05	0.02	0.02	0.00	72.00
BKS11	0.01	0.03	0.02	0.05	0.03	0.01	0.01	0.00	45.00
BKS10	0.02	0.06	0.03	0.09	0.06	0.03	0.02	0.00	84.70
BKS9	0.01	0.03	0.02	0.04	0.03	0.01	0.01	0.00	39.50
BKS8	0.01	0.02	0.01	0.03	0.02	0.01	0.01	0.00	26.30

4.12 Water Requirement (Q Actual) on Channels and Rice Fields

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The water requirements in the canals and areas in the study were performed when the actual 2-month-old rice was calculated by the following scheme:

Table.14: Comparison of water requirements in the plot rice field with actual water discharge

Channel code	Area (Ha)	Needs Water debit (m3/sec/ha)	Actual debit (m3/sec)
BS 3	179.8	0.19	0.125
BS 2	95.8	0.1	0.148
BS 1	50.6	0.05	0.161
BKS 12	72	0.07	0.113
BKS 11	45	0.05	0.137
BKS 10	84.7	0.09	0.152
BKS 9	39.5	0.04	0.164
BKS 8	26.3	0.03	0.177

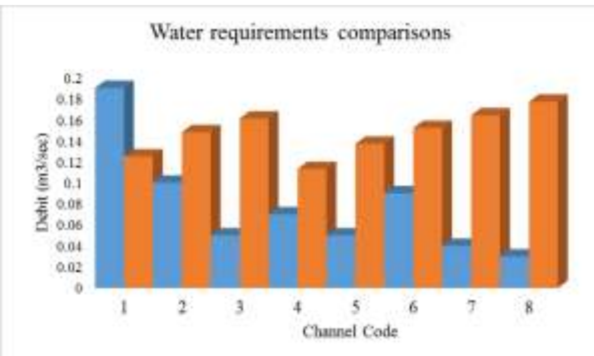

Fig.4: Graph of Water Requirement comparisons

Based on the graph above, the actual debit on BS3, BKS9, BKS11 and BKS12 channels can meet the overall requirement of irrigation water in the irrigation area. In BS1, BS2, BKS8 and BKS10 channels, actual discharge has not been able to meet the irrigation water needs in its irrigation area.

4.13 Discussion

The area of rice fields in Kobisonta irrigation area of 3,150 ha has three secondary channels namely kobisonta secondary channel (BKS7, BKS8, and BKS9), secondary channel faces kobsionta (BKS10, BKS11 and BKS12) and secondary channel seti (BS1, BS2 and BS3) which take water from Bend WaeKobi. Each of the secondary channels studied has different irrigation areas, channel lengths, and wet cross-sectional areas.

In the dry season the farmers in Kobisonta village still plant rice, this is because the water supply in BendungWaeKobi is considered still able to meet the needs of irrigation. Management of irrigation water distribution that is less good or optimal cause some of its debit channel is not sufficient to meet the needs of irrigation of rice crops in the village kobsionta.

Lacks of the farmer's discipline in the distribution of water were found in many fields. Distribution of irrigation water in Kobisonta Village is done by opening the water gate as high as possible without taking into account the water requirement in every irrigation area.

At each of irrigation in secondary irrigation area kobisonta has different efficiency value. According to Irrigation Secondary Irrigation Planning Standart is said to be efficient if the efficiency rate of irrigation above 90%.

Based on the results in Table 8 Channel BKS7 which has irrigation area of 185.10 ha and channel length 697.55 meters with actual discharge 0.37528 m3 / s has a watering efficiency of 90%. In BKS8 channel with 700 meters channel length with actual discharge 0.17664 m3 / s has a watering efficiency of 93%. In BKS10 channel which has irrigation area of 39.5 ha with actual discharge 0.1639 m3 / s has water efficiency of 93%. In BKS11 channel which has an irrigation area of 84.7 ha with actual discharge of 0.1521 m3 / s has irrigation efficiency of 90% and In channel BS1 with irrigation area 50.9 ha and a length of 800 meter channel with actual discharge 0.1611 m3 / watering by 92%. In BKS7, BKS8, BKS9, BKS10 and BS1 value efficiency above 90% then the channel can be said to be efficient.

In BS2 channel which has irrigation area 95,8 ha and channel length 1000 meter with actual discharge 0,1478 m3 / s has watering efficiency equal to 85%. And Channel BKS11 with irrigation area 45 ha and channel length 700 meters with actual discharge 0.1372 m3 / s has 83% efficiency value. Secondary channel BS1, and BKS11 value of efficiency below 90%. Then the channels have an efficiency value below the standard. This is due to the amount of mud deposits along the channel and leaks along the channel.

For the percentage of losses in each channel in the Kobisonta Irrigation Area has a different percentage values per channel. According to DPU Repulik Indonesia KP-03 (1986: 7), generally water loss in the irrigation network on the secondary channel 5 - 10%.

Based on the results of the data in table 9 On the secondary channel BKS7 the percentage value of water loss of 10%, channel BKS8 percentage value of water loss of 7%, channel BKS9 water loss percentage value of 7%, channel BKS10 percentage value of water loss by 10% and secondary channel BS1 percentage value of water loss of

8%. For BKS7, BKS8, BKS9, BKS10 and BS1 meet the standard according to the Public Works Department.

In BKS11 channel the percentage value of water loss is 17% and BS2 channel value of water loss percentage is 15%, so for BKS11 and BS2 channels do not meet DPU standard because water loss percentage value is below 5-10%. This is due to the seepage on a part of the bottom of the drained channel, the amount of soil deposits, sand, loads of loads in the form of wood, foliage, the amount of garbage and the theft of water made by farmers that slows the flow of water in the secondary channel in the irrigation area kobisonta.

Based on 15 comparisons of debit requirements with the actual water debit, the actual debit on channel BS3, BKS9, BKS11, and BKS12 able to meet the requirement of irrigation water as a whole in irrigation area. In BS1, BS2, BKS8 and BKS10 channels, actual discharge has not been able to meet the irrigation water needs in its irrigation area

In water supply for irrigation, there needs to be efficiency and effectiveness of water supply. Efforts that need to be made to improve the efficiency and effectiveness of irrigation are:

1. To reduce the impact of vegetation damage and channel cracking in Kobisonta Irrigation Area it is necessary to maintain by Margorejo P3A either regularly or periodically on each channel.
2. Need to be socialized about the process of water distribution by P3A to farmers so that farmers are expected to be more disciplined in implementing irrigation water taking schedule.

V. CONCLUSION AND SUGGESTIONS

5.1 Conclusions

Based on the results and discussion, then we obtained the following conclusions:

1. The efficiency of discharge in every secondary channel in Kobisonta Irrigation area has different value. On the secondary channel BKS.7 efficiency value 90%, BKS.8 93% efficiency value, BKS.9 efficiency value 93%, BKS.10 value of efficiency 90% and BS. 1 efficiency value of 92% on average has met the efficiency standard according to Planning Standards of Secondary Irrigation Planning for the efficiency of irrigation above 90%. While for secondary channel BKS.11 83% efficiency value, and BS.2 85% efficiency value does not meet the standard of efficiency because the average value of efficiency on the channel is below 90%.
2. Total water loss in Kobisonta Irrigation area for secondary channel BKS.7 10%, BKS.8 7%, BKS.9 7%, BKS.10 10% and BS.1 8% have met the planning criteria which is the standard of Public Works Service. In general, water loss in irrigation networks in the 5-10% secondary channel while in the 17% BKS.11 channel, and BS.2 15% has exceeded the water loss planning criteria. This is due to the seepage of some of the bottom of the eroded channel, the amount of soil sediment (sedimentation), waste and also because of the theft of water conducted by farmers resulted in the slow speed of water flow in the secondary channel DI. Kobisonta

5.2 Suggestions

1. The need for socialization to the water users farmers (P3A) Margorejo to understand and adhere to the way of distribution of irrigation water so as not to harm other farmers.
2. To improve the efficiency and effectiveness of water distribution there needs to be cooperation between the Public Works Department and the P3A.
3. Margorejo P3A is expected to always review the conditions of existing channels in the Kobisonta Irrigation System and repair the damaged channels, clean up the sludge, waste along the canal.

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