# Irrigation Water Debit Analysis that will be used on Micro Power Plant in SEI. Rampah Sub-District of Serdang Bedagai Regency

[1]Junaidi , [2]Weriono, [3]Indra Roza
[1,2]Departemen Machine Engeneering Universitas Harapan Medan
[3]Departemen Electro Engeneering Universitas Harapan Medan

**Abstract:-Electricity crisis that occurred to encourage the implementation of energy as an effort To fulfill Micro Power Water supply one type of generator electricity that uses hydropower as the driving force of the generator so it can generate electricity generated by Power Plant Micro power depends on the flow of flow and the height of the fall or head on Installation The flow and high flows fall directly proportional to the generated power in the implementation of this design is done data collection.**

**Keywords:-**Water Discharge, High Fall. Micro Hydro Power Plant. Debit, Irrigation.

## I. INTRODUCTION

Micro hydro power plant ( PLTMH ) is one form of alternative energy that is very possible to be developed in countries with widespread water sources, such as Indonesia. Di rural areas generally have the main irrigation channel serves to dance rice fields and also potentially to be used as a powerhouse. [1] The energy utilized from water to generate electrical energy is the potential energy of water. That is energy possessed by water due to its position. The position in question is the height of the water surface to the turbine shaft to the turbine shaft in the power house. Water that has the altitude is flowed so that it has kinetic energy as the velocity of the flowing water. This kinetic energy is used to rotate. In this process there is a change of kinetic energy owned by water into mechanical energy. Furthermore , the mechanical energy is used to rotate the generator. In the generator there is a change of mechanical energy into electrical energy as a result of the presence of a magnetic field in the generator.[2] Photographic Conditions in Sei rampah Sub-districts are often flooded and many studies on available discharge and how much energy and power are generated at the site. So the focus of research researchers do lie in the calculation of available water discharge and the amount of energy and power generated that can be utilized to make a good PLTMH and meet the needs of the communit [3]Micro Hydro Power Plant(PLTMH), commonly called Micro hydro, is a small-scale power plant that uses hydropower as its driver, for Example irrigation channels, rivers or natural waterfalls, by utilizing the height of the head (in meters) and the amount of water debit (m3 / sec) [4].

## II. OVERHE & WEAKNESSES PLTMH

*A. PLTMH has Several Advantages, Namely*

- Fuel PLTU is coal. Based on the same understanding, we can say that fuel for hydropower is water (white coal). The superiority of babakar material for this hydropower is totally out of use or turned into something else and is a The PLTA does not face the problem of waste disposal, while the power plant faces the problem of waste disposal in the form of ash or coal.
- The cost of operation and maintenance of hydropower is very low when compared to PLTU or PLTN. Pada PLTU, in addition to the expenditure of costs for coal, need to be taken into account also the cost, transportation of these fuels. 3. Turbines on hydropower can be operated or stopped operation at any time.
- PLTA, simple enough to understand and quite easy to operate. The toughness of the system can be more reliable than other resources.
- The latest hydropower equipment, generally has a great chance to be operated for more than 50years. This is quite competitive when compared with the effective lifespan of the NPP about 30 years.
- With state of the art planning techniques, power plants can generate power with very high efficiency even though the load fluctuations are considerable.
- Recent developments that have been achieved in the development of water turbines, it has been possible to utilize the turbine types that are appropriate to local circumstances..
- The development of hydropower by utilizing river flow can also cause other benefits such as: tourism, Fishery and others, whereas if necessary the reservoir for the purpose can be used also for example as irrigation and flood control.

*B. The Weaknesses of PLTMH*

- As mentioned above, almost all hydroelectric is a project on other capital, the rate of return of hydropower project is low.
- The preparation period of a hydropower project generally takes a long time.
- PLTA is highly dependent on the flow very naturally, so in general the mainstay or steady power will be much smaller when compared with the total capacity.

## III. FORMULATION OF THE PROBLEM

From the back ground of the problems that have been put forward, it can be identified some matter formulation issues are:

- Why is it needed a Micro Power Plant ( PLTA ) Micro, in the Village Firdause District Sei.Rampah Serdang Bedagai Regency.
- 2. How to calculate the water debit on irrigation water which is in the village firdause subdistrict rampah district serdang bedagai.
- 3. How to choose formula of calculation of water turbine design with water debit.

## IV. SCOPE OF PROBLEM

Irrigation in the water flow analyzed is the flow of water, by searching the velocity of the water measured the distance of the flowing water velocity and the time the water flows in accordance with the specified distance, until several times the experiment, the result is aligned. Then measured the wet cross-sectional area, so that the water debit can be taken into account, as well as the selection of calculation formula component design Used.

## V. RESEARCH PURPOSES

The purpose of this study is to analyze the water debit by designing the height / head that is measured vertically until the engine laying. From the survey results of water debit and head it can be designed water turbine that will be used as a prime mover.

## VI. BENEFITS OF RESEARCH

- Can understand the working system of hydro power plant design.
- 2.Can compare , apply and can develop the science related to the existing courses in the Department of Engineering. 3.Increase knowledge and Knowledge to prepare theoretically and practically.
- 4. For the development of science in Google Scholar and in Scopus.

## VII. RESEARCH METHODS

This research was conducted at Kecamatan Rampah Sungai Serdang Bedagai, Research period between january 2017 until june 2017.

*Equipment Used in Research*

*A. Protractor*

Fig. 1 Protractor

In accordance with the definition of the above arc, in addition to be used to measure the angle, the protractor can also be used to draw angles. So it allows you to make wake up to the size you want. Here are the steps you should do to draw the angle using the protractor.

*B. Measuring Instrument*

Fig. 2 Measuring Instrument

The function of the meter is the same as the ruler, but the dimension is longer and is made of a more flexible material than a ruler in order to be rolled up and easy to carry around. Material from the meter itself is made of nylon or of bending metal that can be rolled. For the dimensions of the length, the meter can reach 10 meters, therefore the tool can be used to measure large objects such as land, buildings and others. The downside of this meter is its slightly troublesome use. Each time to measure an object that is so vast requires more than 1 person.

*C. Water Hose*

Fig. 3 Water Hose

In this case if looking for a plane of a field using a transparent hose filled with water and in mncari upright a field then use Lot (unting unting).

*D. Nylon Yarn*

Fig. 4 Nylon Yarn

This tool is used to measure the height (Head)

*E. Stop Watch*

Fig. 5 Stop Watch

This tool serves to measure the speed of water

## VIII. HEAD MEASUREMENT

Head yang diukur tersebut merupakan head kotor ( head gross) ,setelah dikurangi dengan factor gesekan dan factor kehilangan ( losses ) lainnya ketika air mengalir maka akan menjadi head bersih ( head net ).Pengukuran head ini menggunakan alat sehelai benang nilon dan selang plastic.Cara kerjanya yaitu :

- Measurement begins above the approximate elevation of the water level at a predetermined forebay position.


Fig. 6 How to Measure Water Surface with Forebay Position (Sutarno, 1993)

- Second and subsequent measurements by continuing at a point lower than the previous measurement

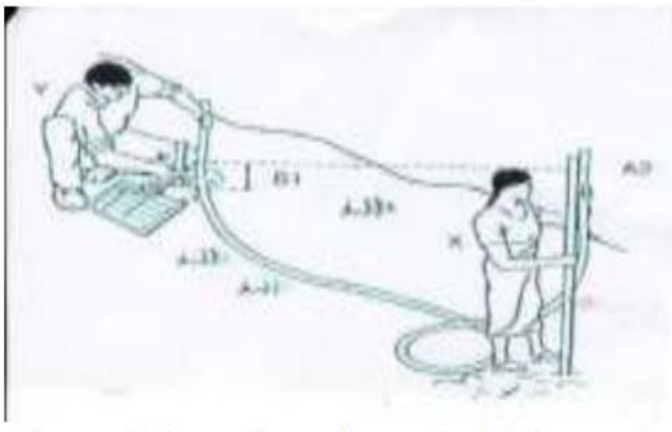

Fig. 7 Pengukran from the Highest Point of the Lowest Point (Sutarno, 1993)

- Continue measurement until turbine location will be placed. Sum the entire measurement result to get total head dirty.

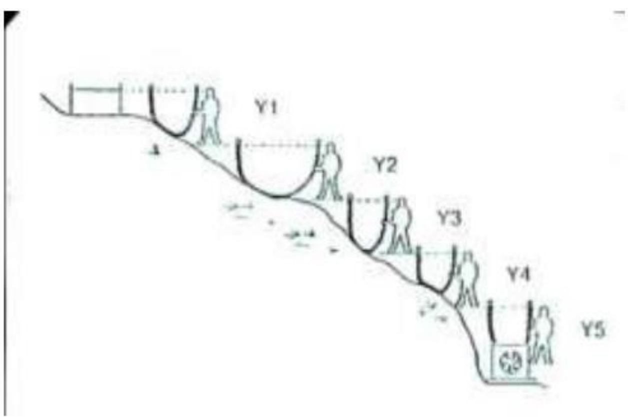


Fig. 8 The Total Number of Measurements (Sutarno, 1993)

## IX. PRIMARY WATER DEBIT MEASUREMENT

A stream will vary its flow throughout the year, measurement at the lowest flow (dry season) .The lowest flow rate is used as the basis in planning. Direct flow rate measurements to the study site (primary measurement) .The basic formula calculates the discharge (Penche, C, 1998 ):

Q = A.V where: Q = Debit (m3 / s),
A = Area of wet sectional area (m2 ),
V = Average velocity velocity in wet section area (m / s).

The Steps to Calculate Water discharge is as follows:

- Select a relatively straight river portion and a uniform cross section, and specify the display.
- Measuring the area of cross section of the irrigation section by dividing it into several segments, at least 3 segments. Then calculate the area of each segment, and the calculate the total cross section area.

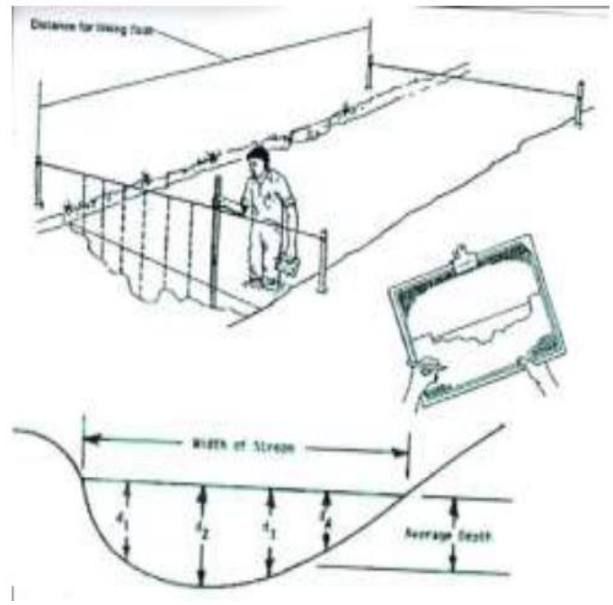


Fig. 9 Divide in Several Segments (Sutarano, 1993)

- Measure the time it takes for the float to pass the predetermined distance.
- Calculate its velocity by the formula: Vf = Distance / time (m / s).
- The velocity of the buoyancy is the velocity of the surface stream, the approximate value for the mean stream velocity can be calculated by multiplying the surface flow velocity near the center of the flow by the correction factor:
  - Concrete channel, seamless rectangle c = 0.85.
  - Vast, quiet, free flow river (> 10 m) c = 0.75.
  - shallow river, free flow (<10m) = 0.65.
  - shallow river (<0.5 m), turbulent flow c = 0.45.
  - Very shallow (<0.2 m), turbulent flow c = 0.25.

Calculate the speed of the average sugai flow rate by using the formula: Va = Vf (m / s).

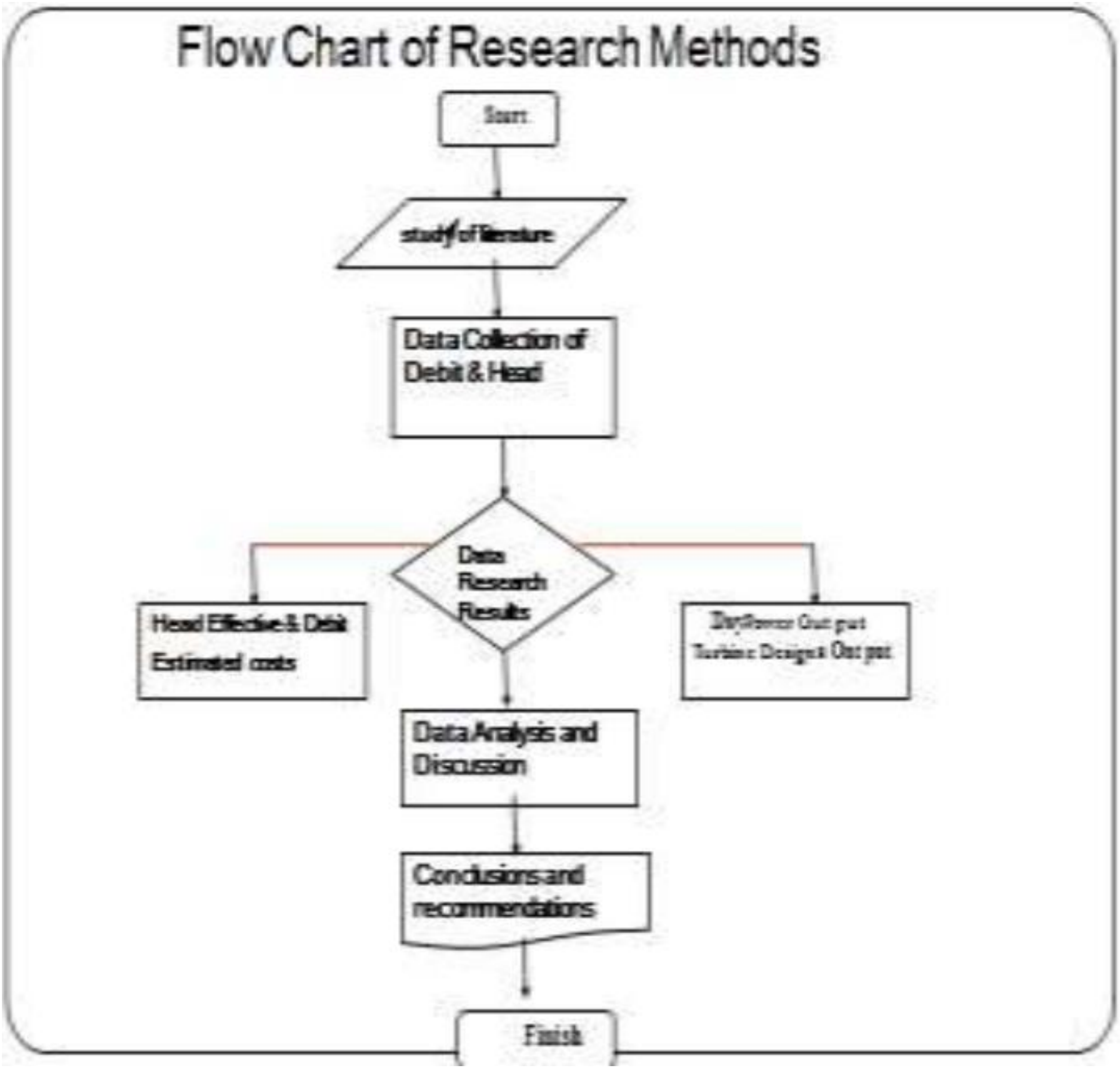


Fig. 10 Flow Chard Methods

## X. RESEARCH RESULT

### *A. Data of Debit and High Falling Water*

In the village of firdause subdistrict serdang Bedagai Bigung Kutai Barat Regency there is a slokan flow topography potentially used as Micro Hydro Power Plant, it can be concluded based on the results of measurement: By using Stopwatch, Meter, nylon and arc thread: To find the speed of water with the formula V = S / t where S = Distance of water velocity falls (m), and t = time until water at a certain distance in seconds with distance or height falling average water 2.7 m with time of 1 second then water velocity falls = 2, 7 m / s, the measured area measured 0,05 m2 then the water discharge Q = VA = 2,7 m / sec x 0,05 m2 = 0,135 m3 / sec = 135 liter / second.

Fig. 11 Water strap to Measure Distance, Height and Speed

ISSN No:-2456 –2165

Fig.12 Measuring Distance of Water Velocity Flowing = 8 Meters

Fig.13 Measure the Flowing Water Angle

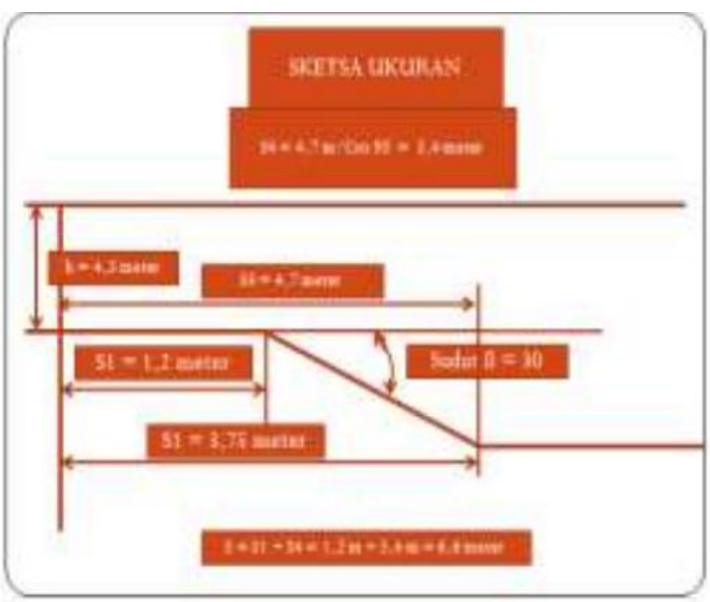


Fig.14 Data Sketsa

To find the velocity of water is v = s / t, where s is the water velocity distance (m), t = time of water velocity (seconds), t1 = 2.30 sec and s = 6.6 m then v = 6.6 m / 2.30 sec = 2.87 m / sec. For t2 = 2.52 seconds, t3 = 2.61 seconds, t4 = 2.37 seconds can be made as the table below:

| NO | S = Distance ( m ) | t = Time ( Second ) | V = Velociti(m) |
|---|---|---|---|
| 1 | 6,6 | 2,30 | 2,87 |
| 2 | 6,6 | 2,52 | 2,62 |
| 3 | 6,6 | 2,61 | 2,53 |
| 4 | 6,6 | 2,31 | 2,78 |

Average velocity V = (V1 + V2 + V3 + V4) / 4 = (2.87 + 2.62 + 2.53 + 2.78) = 2.7 m / sec To find the water debit Q = V x A where A = length x width 0.02 mx 2.5 m = 0.05m2, so Q = 2.7 m / sec x 0.05 m2 = 0.135 m3 / sec = 135 liters / sec. According to the observation and narrative of village elders pirdause kec.sei.rampah, that the water discharge Jantur almost evenly throughout the season. From topographic measurement data, that the river surface elevation before Jantur and after Jantur as far as 400 m in can elevation 15 m.Air through Jantur will be divided into two streams.

- Flow 1 (one) enters the pipeline of the Turbine spacer connectors set 85% × 135 liters / sec = 114.75 liter / second
- The water flow remains through the Jantur of 15% × 135 liters / sec = 20.25 liter / sec. Magic spell.Tabalas will keep running even if the water discharge is reduced, then the water piped through the pipeline to the Turbine will return the river bodice.

Fig.15. Scheme of Water Catching Buildings, Transmission Pipes, Turbine Houses

## XI. CONSUMER LOAD DATA

The consumer cost in Jantur Tabalas at 450 VA or 360 Watt permanent house with PT.PLN standard 0.8 working factor is obtained 360 x 113 = 40680 Watt. From the results of the census of Linggang Melapeh villagers in August 2017 the number of KK = 326. While the ability of PLTMH is for 75 consumers.

## XII. DATA TURBINE AND PLTMH CAPACITY

For transmission pipes used stell pipe DN 508 6.3 mm thickness. Turbine used Cros Flow Turbine 14 D3000.Power generated by PLTMH = 40 KW.

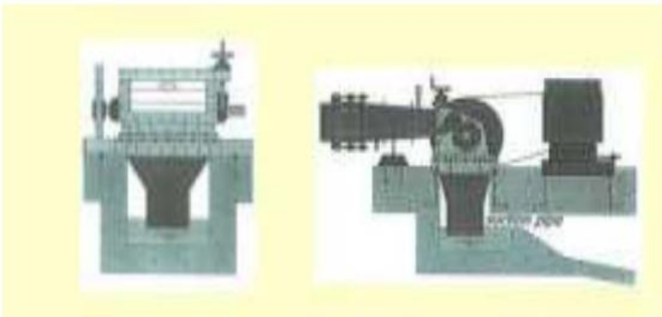

Fig.16. Turbin Cross - Flow 14 D3000

## XIII. CONCLUSION

| NO | S = Distance ( m ) | t = Time ( Second ) | V = Velociti(m) |
|---|---|---|---|
| 1 | 6,6 | 2,30 | 2,87 |
| 2 | 6,6 | 2,52 | 2,62 |
| 3 | 6,6 | 2,61 | 2,53 |
| 4 | 6,6 | 2,31 | 2,78 |

- Average velocity V = (V1 + V2 + V3 + V4) / 4 = (2.87 + 2.62 + 2.53 + 2.78) = 2.7 m / sec To find the water debit Q = V x A where A = length x width 0.02 mx 2.5 m = 0.05m2, so Q = 2.7 m / sec x 0.05 m2 = 0.135 m3 / sec = 135 liters / sec.
- From topographic measurement data, that the river surface elevation before Jantur and after jantur as far as 400 m in can elevation 15 m.Air through Jantur will be divided into two streams: The flow 1 (one) enters the pipeline of the Turbine spacer connectors is set to 85% × 135 liter / sec = 114,75 liter / second The water flow remains through the Jantur of 15% × 135 liters / sec = 20.25 liter / sec. Magic spell Tabalas will keep running even if the water discharge is reduced, then the water piped through the pipeline to the Turbine will return the river bodice.
- The electric voltage generated when serving the maximum and minimum loads ranging from 378 - 381 volts (phase-to-phase system), still meet the requirements of PUIL 2000 ie (- 5% s.d + 10%) of the effective stress.

## REFERENCES

[1]. [1] Planning and Design of Micro-Hydro Power Plants Crossflow Type " Journal Polimesin P2M unit Print: 1693-5462, ISSN Online: 2549-1199 " 2017
[2]. [2] Analysa Suply-demand at Hydro 32 Kw Micro Power Plant in Prangkareha Village, East Sumba Regency "Journal of Electrical Engineering, Vol, 9.No.1 March 2016 13 – 18.
[3]. [3] Potential of Micro Hydro Power Plant (PLTMH) in Ngantang District,Malang Regency of East Java "Jurnal Reka Buana Volume 2 No. 2, March 2017- August 2017)
[4]. [4] Feasibility Study of Development of Micro Hydro Power Plant in Lake UI Area " Ady Syuriadi, Gun Gun RG, Fachrudin (Politeknologi Vol.10 No.3, September 2011).
[5]. [5] early study planning of mechanical systems and electrical power plan mini hidro" S.Warsito, Abdul Syukur, Agus Adhi Nugroho Department of Engineering Electro Faculty of Industrial Technology Islamic University of Sultan Agung (national engineering seminar of electricity engineering 2005 electro engineering fac.teknik -university diponegoro)
[6]. [6] Study of Potential of Srinjing River for Micro Hydro Power Plant (PLTMH) of Brumbung in Kediri Regency "Agus Indarto, Pitojo Triwijoyo, Rispiningtati (Jurnal Teknik Pengairan, Vol.3 No.2, 2013).
[7]. [7] Design Analysis and regulation system of Micro Hydro Power Plant in Ciasihan River in Bogor Regency with CFD Simulation Program.10 " Entis Sutina, Wibowo Prayitno, Damera pakasywi ,, Journal of Poly Technology Vol.6, No.2, 2017 "
[8]. [8] Planning of Micro Hydro Water Turbine Type of Plate For Power Station in Kali Kali Village Pineleng with Head 12 meters " Ceri Steward Poea, GD.Soplauit, jotjerancung (Jurnal Online Piston Engineering Mechanical UNSRAT 2013) "
[9]. [9] Phase-smoothed Robust Estimation of Magnetotelluric Impedance Functions Based on A Bounded-influence Regression M estimator, D.Sutarno (Journal name: Geofisika Issue: Vol 6, No 2, June 2005 pp. 10 - 16.