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IDENTIFICATION OF DAMAGING ASSETS IRRIGATION LEVELS OF THE TERTIARY TO THE AREA BISSUA BASED ON GEOGRAPHIC INFORMATION SYSTEM (GIS)

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ABSTRACT

Damage to one of the buildings of irrigation will affect the performance of existing systems, resulting in the efficiency and effectiveness of irrigation to decrease. Bissua dam is one of the dam in South Sulawesi which drains approximately 10.785 hectares of rice fields by making capacity of 25 m^3 / sec. Disruption of irrigation channels in this area either primary channels, secondary channels, or tertiary channel may result in a decrease in agricultural production and negative implications for farmers' income. This study is located at the point B.Bi5 or rather the Bi tertiary channels 5 (Left) Bissua Irrigation Area, District Bajeng, Regency of Gowa and aims to provide information as well as one source of data to formulate policies in managing the irrigation network and the local communities. This research-based geographic information system (GIS) where the results of this research data in the form of software such as Map Source, Arc GIS and Google Earth. To identify tissue damage tertiary irrigation survey using GPS, then take the coordinates, dimensions and damage photo at the point of damage. Based on Ministry of Public Works the Republic of Indonesia, No. 32 in 2007, obtained the degree of damage to Bi tertiary channels 5 (Left) with 7.84% the percentage of damage is categorized in good condition (damage level <10%).

Keywords: damaging assets irrigation, tertiary channel, bissua dam, geographich information system.

INTRODUCTION

Irrigation infrastructure is a key enabler in order to improve the welfare of farmers in particular through agriculture. This sector can be achieved if irrigation infrastructure functioning optimally. The physical condition of the infrastructure must be maintained their function so that the optimization function can still be maintained. Achieving optimization function cannot be separated from the asset management system good irrigation, through systematic management of irrigation assets, expected will produce a product / output as a reference in the context of optimizing irrigation infrastructure through improvement / rehabilitation. In principle, irrigation asset management is a structured process management as a material planning, maintenance, financing irrigation systems in order to achieve optimum service levels and sustainable for the users of irrigation water and the irrigation network users [1].

In general, water is one of the determining factors in the process of agricultural production; therefore irrigation investment is very important and strategic in order to provide water for agriculture. In meeting the water demand for various purposes of farming, the capacity of water for irrigation should be given in the amount, timing, and good quality, if it is not met then the plants will be stunted, which in turn will affect agricultural production [2].

Disruption or destruction of one of the buildings of irrigation will affect the performance of existing systems, resulting in the efficiency and effectiveness of irrigation to decrease. The damage is caused by natural factors and human error. If this condition is allowed to continue and not addressed, it will have an impact on the expected decrease in agricultural production, and the negative implications of the condition of the farmer's income [3].

Decreasing environmental carrying capacity is caused by flooding, the limited role of the community in operational, and maintenance of irrigation networks forced us to be more wise and sensible to develop, utilize, and maintain the function of water resources from the aspect of management (demand / user) as well as from the aspect of supply without prejudice output productivity targets [2].

Land development is highly depended on the availability of irrigation water, so it takes data about the condition of irrigation networks and related information required. Accordingly, this research aims to identify damage to assets tertiary level irrigation channels based on geographic information systems (GIS) to support the needs of the data so that the function of irrigation networks can be maximized.

LITERATURE REVIEW

Irrigation asset condition assessment component

Regulation of the Minister of Public Works No.32/PRT/M/2007 assessing the percentage of damage to irrigation assets into four criteria of damage, namely [4]:

1) Good condition, if the level of damage <10% of the initial condition of the building/channel;
2) The condition of minor damage,if the damage level of 10%-20% of the initial condition of the building/channel;
3) Moderately damaged condition, if the level of damage of 21%-40% of the initial condition of the building/channel;

4) The condition severely damaged, if the level of damage > 40% of the initial condition of the building/channels.

Geographic Information System (GIS)

GIS is an information system based on geographic spatial data that used to store and manipulate information-geographic information. The virtue of GIS using digital or computer systems, among others: (1) minimize human error; (2) the ability to call; (3) combining overlaying; and (4) renew the data by observing changes in the environment, statistics and the visible area. GIS has fundamental differences from other information systems are its ability to integrate any data related spatially and data attributes. Supporting GIS sub-systems have as many as three pieces, namely geodatabase, geoprocessing, and each geovisualization of which has a different function [5].

Global Positioning System (GPS)

GPS or Global Positioning System is a tool or a navigation system that utilizes satellite and can be used to in form the user where he is (globally) surface of the earth-based satellite to be able to know a person's position would require a tool called GPS receiver which serves to receive signals sent from GPS satellites. Transmitted data from satellites in the form of radio signals with digital data. Satellites that orbit around the earth on this short composition consists of 24 satellites, with 21 active satellites and three satellites as a backup. With the arrangement of certain orbit, the GPS satellites can be received all over the earth's surface with the appearance of four to eight satellites. GPS can provide positioning information and time with very high accuracy [6].

RESEARCH METHODS

The location and timing of research the study is conducted in the irrigation of Bissua in point 5.B.Bi or rather the Bi tertiary channels 5 (Left), District Bajeng, Regency of Gowa. The research is conducted for three months from October 2015 to December 2015.

Tools and software used

1. Field survey tool

The tools areused in this study are following:

a) Vehicles
b) GPS Garmin GPSMAP 78s
c) Meters
d) Camera
e) PPE (Personal Protective Equipment)

2. Software data processing

The software / computer applications used are:

a) Microsoft Word 2010
b) Arc GIS 10.1
c) Map Source
d) Google Earth

Research procedure

The research procedure includes collecting data, field survey, data analysis up to the manufacture of geographical information systems.

The research procedure following:

1. Phase I: Preparation/Preliminary include:
a) An application in writing to the licensing authority and irrigation.
b) on the investigation/review of the field.
2. Phase II: Primary Data collection consists of:
a) Searching along the tertiary irrigation channels B.Bi Bissua from point 3 to point B.Bi 7 and mark any damage using GPS Geodetic R10.
b) Recording and capturing imagesas research documentation at each point of damage.
c) Measurement of the dimensions of the damage.
3. Phase III: Data gathering primary and secondary data
4. Phase IV: Processing data

RESULTS

Based on the results are obtained, both the primary data (coordinate measuring results and long damage tertiary canals intertiary Bi5 the irrigation of Bissua) and secondary data (The irrigation of Bissua Scheme) is obtained results in the formof spatial data and attribute data, following;

a. Spatial data

This spatial data in the form of tracking the results of Bi tertiary channel 5 the irrigation of Bissua uses GPS input on Map Source software. Tracking result can be seen in Figure-1, following:

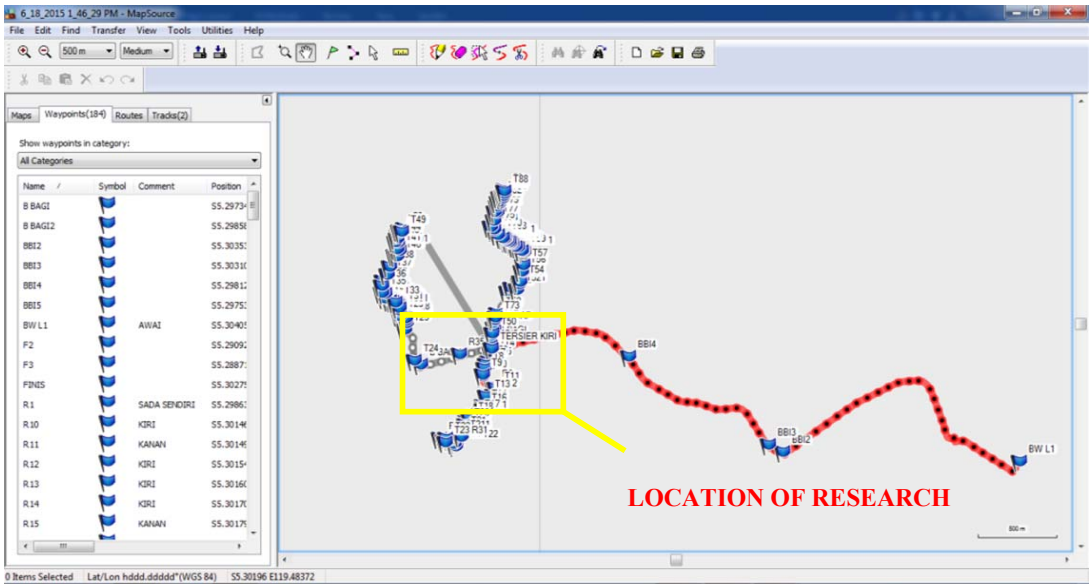

Figure-1. Tracking result on software mapsource

b. Attributes data

Table-1. Results coordinate and length measurements damage Bitertiary channels 5 (Left) on tertiary Bi 5 in the irrigation of Bissua.

No.	Name	Description	Position			Long damage (m)
			Zone UTM	x	y	
1	Tertiary channel Bi 5 (Left)	BBI 1	50 M	-5.30211	119.53521	-
2	Tertiary channel Bi 5 (Left)	BBI 2	50 M	-5.30353	119.51677	-
3	Tertiary channel Bi 5 (Left)	BBI 3	50 M	-5.30310	119.51578	-
4	Tertiary channel Bi 5 (Left)	BBI 4	50 M	-5.29812	119.50609	-
5	Tertiary channel Bi 5 (Left)	BBI 5	50 M	-5.29753	119.49660	-
6	Tertiary channel Bi 5 (Left)	R 1	50 M	-5.29863	119.49620	20
7	Tertiary channel Bi 5 (Left)	R 2 Right	50 M	-5.29918	119.49601	10
8	Tertiary channel Bi 5 (Left)	R 3 Right	50 M	-5.29977	119.49673	1
9	Tertiary channel Bi 5 (Left)	R 4 Left	50 M	-5.29993	119.49694	1.70
10	Tertiary channel Bi 5 (Left)	R 5 Left	50 M	-5.30033	119.49675	2.60
11	Tertiary channel Bi 5 (Left)	R 6 Left	50 M	-5.30118	119.49602	1
12	Tertiary channel Bi 5 (Left)	R 7 Left	50 M	-5.29105	119.49047	11.60
13	Tertiary channel Bi 5 (Left)	R 8 Left	50 M	-5.30140	119.49588	0.6
14	Tertiary channel Bi 5 (Left)	R 9 Left	50 M	-5.30141	119.49586	2.9
15	Tertiary channel Bi 5 (Left)	R 10 Left	50 M	-5.30146	119.49582	0.7
16	Tertiary channel Bi 5 (Left)	R 11 Right	50 M	-5.30149	119.49578	1.1
17	Tertiary channel Bi 5 (Left)	R 12 Left	50 M	-5.30154	119.49572	2.6
18	Tertiary channel Bi 5 (Left)	R 13 Left	50 M	-5.30160	119.49527	1.49
19	Tertiary channel Bi 5 (Left)	R 14 Left	50 M	-5.30170	119.49498	4.4
20	Tertiary channel Bi 5 (Left)	R 15 Right	50 M	-5.30179	119.49490	1.2
21	Tertiary channel Bi 5 (Left)	R 16 Left	50 M	-5.30204	119.49481	1
22	Tertiary channel Bi 5 (Left)	R 17 Left	50 M	-5.30206	119.49481	0.5

23	Tertiary channel Bi 5 (Left)	R 18 Left	50 M	-5.30223	119.49471	1.98
24	Tertiary channel Bi 5 (Left)	R 19 Right	50 M	-5.30238	119.49463	0.4
25	Tertiary channel Bi 5 (Left)	R 20 Right	50 M	-5.30242	119.49459	1.1
26	Tertiary channel Bi 5 (Left)	R 21	50 M	-5.30244	119.49460	5.5
27	Tertiary channel Bi 5 (Left)	R 22 Left	50 M	-5.30308	119.49424	2.4
28	Tertiary channel Bi 5 (Left)	R 23	50 M	-5.30318	119.49418	12.4
29	Tertiary channel Bi 5 (Left)	R 24	50 M	-5.30308	119.49403	6.5
30	Tertiary channel Bi 5 (Left)	R 25 Left	50 M	-5.30288	119.49378	0.6
31	Tertiary channel Bi 5 (Left)	R 26 Right	50 M	-5.30286	119.49374	1.74
32	Tertiary channel Bi 5 (Left)	R 27 Left	50 M	-5.30281	119.49364	1.6
33	Tertiary channel Bi 5 (Left)	R 28 Right	50 M	-5.30275	119.49354	0.7
34	Tertiary channel Bi 5 (Left)	R 29 Left	50 M	-5.30275	119.49353	0.9
35	Tertiary channel Bi 5 (Left)	R 30 Left	50 M	-5.30287	119.49349	0.5
36	Tertiary channel Bi 5 (Left)	R 31 Left	50 M	-5.30296	119.49343	0.7
37	Tertiary channel Bi 5 (Left)	R 32 Right	50 M	-5.30292	119.49339	0.7
38	Tertiary channel Bi 5 (Left)	R 33 Left	50 M	-5.30290	119.49338	2.5
39	Tertiary channel Bi 5 (Left)	R 34 Left	50 M	-5.30287	119.49333	2.5

Table-2. The results of damage identification tertiary channel Bi 5 (Left) tertiary swathBi 5 in the irrigation of Bissua.

No.	Name	Description	Long damage (m)	Extensive (m^2)	Volume damage (m^3)	Status damage
1	Tertiary channel Bi 5 (Left)	BBI 1	-	-	-	-
2	Tertiary channel Bi 5 (Left)	BBI 2	-	-	-	-
3	Tertiary channel Bi 5 (Left)	BBI 3	-	-	-	-
4	Tertiary channel Bi 5 (Left)	BBI 4	-	-	-	-
5	Tertiary channel Bi 5 (Left)	BBI 5	-	-	-	-
6	Tertiary channel Bi 5 (Left)	R 1	20	0.1050	2.1000	Slightly damaged
7	Tertiary channel Bi 5 (Left)	R 2 Right	10	0.1050	1.0500	Serverely damaged
8	Tertiary channel Bi 5 (Left)	R 3 Right	1	0.1050	0.1050	Serverely damaged
9	Tertiary channel Bi 5 (Left)	R 4 Left	1.70	0.1050	0.1785	Slightly damaged
10	Tertiary channel Bi 5 (Left)	R 5 Left	2.60	0.1050	0.2730	Slightly damaged
11	Tertiary channel Bi 5 (Left)	R 6 Left	1	0.1050	0.1050	Serverely damaged
12	Tertiary channel Bi 5 (Left)	R 7 Left	11.60	0.1050	1.2180	Slightly damaged
13	Tertiary channel Bi 5 (Left)	R 8 Left	0.6	0.1050	0.0630	Slightly damaged
14	Tertiary channel Bi 5 (Left)	R 9 Left	2.9	0.1050	0.3045	Moderately damaged
15	Tertiary channel Bi 5 (Left)	R 10 Left	0.7	0.0900	0.0630	Slightly damaged
16	Tertiary channel Bi 5 (Left)	R 11 Right	1.1	0.0900	0.0990	Slightly damaged
17	Tertiary channel Bi 5 (Left)	R 12 Left	2.6	0.0900	0.2340	Slightly damaged
18	Tertiary channel Bi 5 (Left)	R 13 Left	1.49	0.1111	0.1655	Slightly damaged
19	Tertiary channel Bi 5 (Left)	R 14 Left	4.4	0.1111	0.4888	Slightly damaged
20	Tertiary channel Bi 5 (Left)	R 15 Right	1.2	0.1111	0.1333	Serverely damaged
21	Tertiary channel Bi 5 (Left)	R 16 Left	1	0.1111	0.1111	Serverely damaged
22	Tertiary channel Bi 5 (Left)	R 17 Left	0.5	0.1111	0.0556	Slightly damaged

23	Tertiary channel Bi 5 (Left)	R 18 Left	1.98	0.1111	0.2200	Slightly damaged
24	Tertiary channel Bi 5 (Left)	R 19 Right	0.4	0.1111	0.0444	Slightly damaged
25	Tertiary channel Bi 5 (Left)	R 20 Right	1.1	0.1111	0.1222	Serverely damaged
26	Tertiary channel Bi 5 (Left)	R 21	5.5	0.1111	0.6111	Slightly damaged
27	Tertiary channel Bi 5 (Left)	R 22 Left	2.4	0.1349	0.3238	Slightly damaged
28	Tertiary channel Bi 5 (Left)	R 23	12.4	0.1349	1.6728	Serverely damaged
29	Tertiary channel Bi 5 (Left)	R 24	6.5	0.1349	0.8769	Serverely damaged
30	Tertiary channel Bi 5 (Left)	R 25 Left	0.6	0.1349	0.0809	Slightly damaged
31	Tertiary channel Bi 5 (Left)	R 26 Right	1.74	0.1349	0.2347	Slightly damaged
32	Tertiary channel Bi 5 (Left)	R 27 Left	1.6	0.1349	0.2158	Serverely damaged
33	Tertiary channel Bi 5 (Left)	R 28 Left	0.7	0.1349	0.0944	Slightly damaged
34	Tertiary channel Bi 5 (Left)	R 29 Left	0.9	0.1349	0.1214	Slightly damaged
35	Tertiary channel Bi 5 (Left)	R 30 Left	0.5	0.1349	0.0675	Slightly damaged
36	Tertiary channel Bi 5 (Left)	R 31 Left	0.7	0.1349	0.0944	Slightly damaged
37	Tertiary channel Bi 5 (Left)	R 32 Right	0.7	0.1349	0.0944	Slightly damaged
38	Tertiary channel Bi 5 (Left)	R 33 Left	2.5	0.1349	0.3373	Serverely damaged
39	Tertiary channel Bi 5 (Left)	R 34 Left	2.5	0.1349	0.3373	Slightly damaged

Based on the results of data processing and calculation in The irrigation of Bissuain Bitertiary channels5 (Left) with atertiary channel lengthis obtained, can be seen in Table-3, while the percentage level of damageBitertiarychannels5(left) can be seen in Table-4, the following:

Table-3. Channel length.

Drainage sample	Channel length
Tertiary Channel Bi 5 (Left)	1114.64 m

Table-4. The percentage of tertiary channel level Bi 5 (Left) the irrigation of Bissua.

No.	Damage levels	Percentage of tertiary channels Bi 5 (Left) (%)
		$\frac{\text{Each long damage channel}}{\text{Total long channel}} \times 100\%$
1	Good	92.158
2	Slightly damaged	3.545
3	Moderately damaged	-
4	Serverely damaged	3.185
5	Totally damaged	1.112

The data attribute in the form; digital maps, GPS data, and data from remote sensing and field survey data that has been analysed and managed in Arc GIS Software.

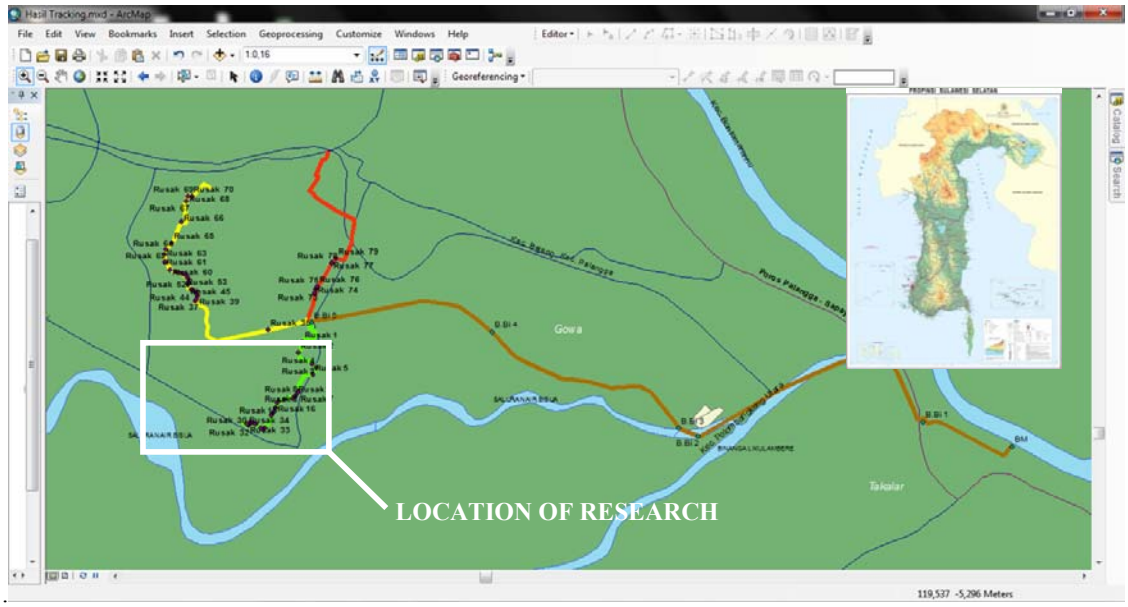

Figure-2. Map of the identification result of damage.

DISCUSSIONS

Based on research results that have been obtained, either in the form of photographs or other supporting data is inputted in the software geographic information system (GIS) that has been installed.

Here is away to see the results of the final data is entered into the software, are following;

a) Running the program Arc GIS.
b) Click on the folder icon Add data connection select the folder where the shape file that you want to insert save, click Add, and then select the desired shape file.
c) To add information, right click on the layer name, select Open Atributte Table there Figure-3.

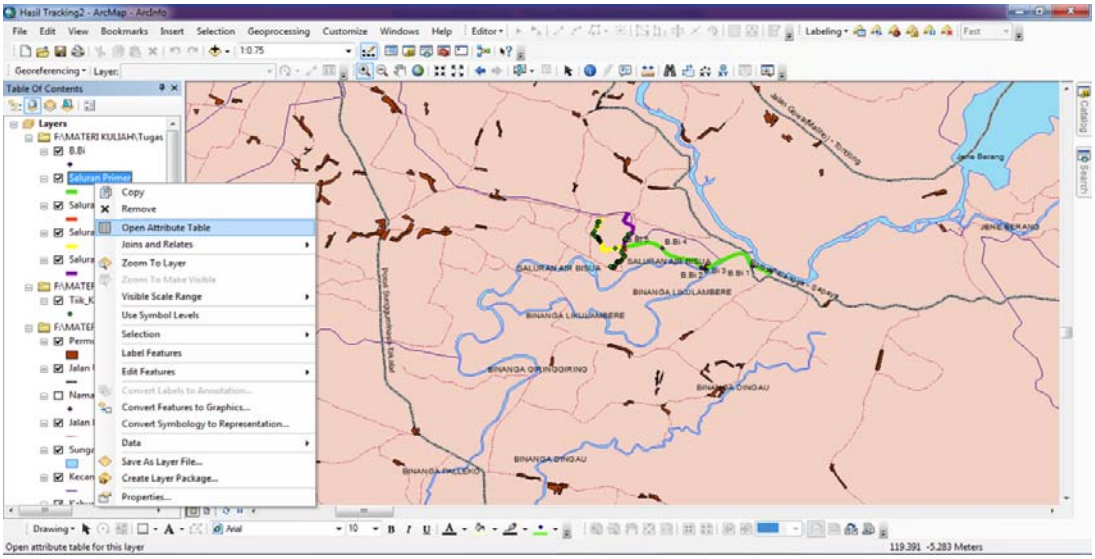

Figure-3. Display screen while performing open attribute table.

d) Activate one layer, click the HTML Popup icon, then click on a point to bring up the information (images, types of damage, costs, etc.), as shown in Figure-4, following;

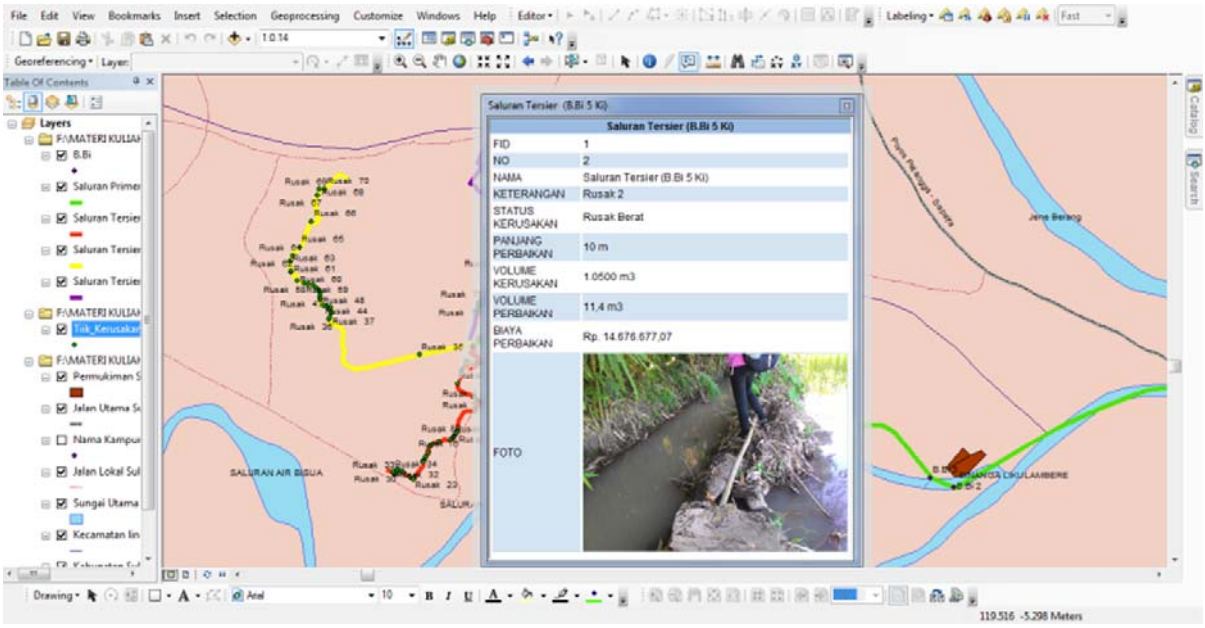

Figure-4. Photo display of software.

From the results of this Reasearch, it can be described condition of Bi tertiary channel 5 left the irrigation of Bissua, following;

At the tertiary channel Bi 5 left the irrigation of Bissua, irrigated area is 49.60 hectares with water needs of 44.96 liters/sec. Based on Table-4, there are some points that are damaged, both heavily damaged and lightly damaged. If it were presented, the amount of total damage amounting to 1.112%, heavily damaged 3.185%, damaged 0%, with minor damage 3.545% and good condition 92.158%, the main problem on the line on this one is the amount of damage is caused by the people who do the tapping of irrigation water on parts that are not permitted.

CONCLUSIONS

Based on theresults obtainedas describedin the discussion, it can beinthe following conclusion;

a) To identify damage tertiary irrigation network B.Bi point 5, on Bi tertiary channels 5 (Left The irrigation of Bissua survey using GPS, then takes the coordinates, dimensions and photo damage at the point of damage.
b) Preparation ofa Geographic Information System (GIS) used some software such as Map Source, ArcGIS and Google Earth. The data inputted in to the software is a spatial data in the form of data from tracking using GP Sand data such as photo and other supporting data.
c) Based on regulation Ministry of Public Works No.32 In 2007, the extent of damage to the tertiary channel B.Bi 5 (Left) with 7.84% the percentage of damage can be categorized good condition (damage level <10%)

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