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INTERPRETATION OF HIGH-RESOLUTION IMAGES FOR IDENTIFICATION OF DAMAGE TO RASANG AND LOST SHIP IRRIGATION CHANNEL KOTO TANGAH SUB-DISTRICT, PADANG CITY

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ABSTRACT: This type of research is quantitative descriptive, with image interpretation through high-resolution images, and primary data as a source of data obtained through field surveys. The technique for determining informants is Total Sampling. The population in this study are villages in the Koto Tangah District, Padang City. This analysis uses quantitative analysis, namely on-screen digitization using the Arcgis application. Based on the results of research and discussion on High-Resolution Image Interpretation for Identification of Irrigation Channel Damage in Kasang and Kapalo Hilalang, Koto Tangah District, Padang City, the results obtained, namely the identification of irrigation canals using high-resolution imagery produces sufficient data in accordance with the conditions field. Based on the field survey, the condition of the network damage for the Hilalang Headquarters, starting from the weir building to BKH 1 was heavily damaged, BKH 2 to BKH 6 was moderately damaged. Starting from BKH 7 to BKH 8 still has good conditions. While the condition of the Kasang II irrigation canal from the weir to BKD 5 is still in good condition. BKD 6 to BKD 7 is moderately damaged. In contrast to BKD 4, it is in good condition, while parts of BAA 1 to 3 are in moderately damaged condition. The shape of the irrigation image in the city of Padang is tortuous, this is influenced by the topography of the area around the river which consists of community rice fields. The pattern shown in the image of the irrigation canal in the city of Padang is elongated, this shows the flow of the river from the upstream area to the downstream area of the river. The texture that is displayed in the image of the irrigation canal in the city of Padang has a smooth texture. The site shown in the image of the irrigation canal in the city of Padang is side by side with the rice fields belonging to the community in the Koto Tangah District.
Keywords: Image Interpretation, Identification of Irrigation Canal Damage, Causes

1. INTRODUCTION

In connection with the facts that the earth's surface (especially the land area) is always changing dynamically from time to time, both changes caused by natural disasters such as earthquakes, tsunamis, abrasion, landslides, and so on as well as changes caused by activity and movement and growth people, whose movements are influenced by safety, economic and socio-cultural factors. Then the changes that occur both spatially or changes in information that are always related to spatial changes will be very important in the process of planning and monitoring and management carried out by the community, stakeholders, and local governments.

Irrigation is an important supporting factor in increasing the production of agricultural products, especially food products. 1977, (Norton, 2004). In Sumatra, the government has invested heavily in building dams for irrigation purposes.

Irrigation Networks are canals, buildings, and complementary structures which constitute a single entity required for the supply, distribution, administration, use, and disposal of irrigation water (PP No.20 of 2006). The systems and structures for carrying out irrigation water to service areas are interconnected according to water availability and water flow characteristics. This resulted in each irrigation network having a flow limit (Godalyadda and Renault, 1999). Irrigation networks are divided into several types based on their size and capacity as follows; primary channels, secondary channels, tertiary channels, quarter channels, and tributaries (Asawa, 2005). The management of irrigation networks is divided into two, namely the main network and the tertiary network (JICA, 1997). As for each management as follows:

a. Main Network

The main network consists of primary and secondary irrigation networks. The primary irrigation network consists of the main building, the building for tapping, the building for tapping, the building for tapping, and the

supporting buildings. Secondary irrigation networks consist of secondary canals, drainage channels, buildings for tapping, tapping buildings, and complementary buildings (Sari, 2016).

b. Tertiary Network

The tertiary network is an irrigation network that functions to drain water from the tertiary canal to the paddy fields. Tertiary irrigation networks consist of tertiary canals, quarter canals and exhaust canals, tertiary boxes, quarter boxes, and their complementary buildings.

Based on network management, network assets are different. The management of main network is managed by government agencies starting from the Provincial Government, Regency/City Government in accordance with their area of authority. While the tertiary irrigation network is managed by HIPPA. Identification of damage to irrigation canals based on the functional condition of irrigation assets. Rehabilitation of damaged classes of secondary irrigation canals is carried out under the authority of the District/City Public Works and Public Housing Office. Irrigation with alightly damaged class is obtained from the condition of irrigation assets that are still functioning but need light maintenance, while the heavily damaged class is obtained from the condition of irrigation canals that are no longer functioning and need to be repaired or procure damaged irrigation structures.

The city of Padang is the capital of the Province of West Sumatra which has quite rapid changes and urban development, with an average population growth of 1% annually and a population density of 1,220 people/km2 and accompanied by quite high population dynamics. So reference data is needed to support the activities of the residents of Padang City and the carrying capacity of the land in accordance with urban planning. Of the area of Padang City which is 694.96 km2 (according to PP No. 17 of 1980), there was land use as rice fields covering an area of 6627 Ha in 2011, which consisted of rice fields that had technical irrigation of 2577 Ha, semi-technical irrigation of 1403 Ha and the others include paddy fields with village irrigation and rain-fed irrigation. (Source: Padang Draft in Figures 2012).

Koto Tanggah District is the gateway to Padang City from Minangkabau International Airport (BIM), and the northern part of Padang City, where Kota Tangah District is located. It is located at 00°58 South Latitude and 99°36'40"- 100°21'11" East Longitude. This sub-district has an area of 232.25 km2 and is located 0-1600 meters above sea level, with rainfall of 384.88 mm/month.

Currently, the collection of spatial data and information on a fairly large area as well as demands for accurate and up-to-date data can be carried out by utilizing remote sensing technology by carrying out the process of recording datavia satellite imagery (image) which has high spatial resolution capabilities. high, along with processing and analysis processes that can be used and utilized easily and interact so as to produce information both in the form of actual maps of the earth and thematic features. In accordance with current technological developments, especially in the fields of computer graphics, databases, information technology, and satellite technology, the need for data storage, data management, analysis, and presentation of data is quite complex both spatially and at the same time as information. required an integrated system capable of processing it effectively and efficiently.

GIS and PJ have very good abilities in visualizing spatial data and its attributes, modifying the color, shape, and size of symbols needed to represent elements of the earth's surface can be done easily and supported by processes of transformation and registration of spatial data. And also shape manipulation and visual display of spatial data with a variety of different scales can be easily and flexibly done.

In accordance with the government Regulation no
10 of 2000, which regulates the level of accuracy of maps used for the preparation of regional spatial planning maps and the accuracy of regional spatial planning maps, where this arrangement aims to create a unified system of presenting data and information in regional spatial planning. In addition, setting the level of map accuracy for regional spatial planning is determined based on the minimum scale needed to reconstruct information on maps on the surface of the earth.

Based on the problems above, the authors are interested in conducting research with the title "High-Resolution Image Interpretation for Identification of Channel Damage Irrigation Kasang II and Kapalo Hilalang Koto Tangah District, Padang City.

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2. RESEARCH METHODOLOGY

a. Types of research

This study uses a descriptive method with a quantitative approach. According to Sugiyono (2011), the quantitative research method is a method used to examine an object with systematic or statistical calculations that are appropriate to the object with the aim of testing a predetermined hypothesis. While descriptive research is research that describes the naturethe nature or character of a particular individual, condition, symptom, or group. The purpose of descriptive research is a systematic and accurate description of facts and characteristics regarding populations or events. The data collected is purely descriptive in nature so it does not intend to seek explanations, test hypotheses, or make predictions.

b. Time & Location of Research

This research was conducted in the odd semester of the 2020/2021 academic year. The research was conducted in the District of Koto Tangah. Koto Tanggah District is the gateway to Padang City from Minangkabau International Airport (BIM) and the northern part of Padang City. This district is located at 00°58 South Latitude and 99°36'40"- 100°21'11" East Longitude.
This sub-district has an area of 232.25 km2 and is located 0-1600 meters above sea level, with rainfall of 384.88 mm/month.

3. RESULTS AND DISCUSSION

The city of Padang has 29 irrigation canals and an area of 4,240 hectares. This study explains the causes of damage to irrigation canals and the shape of irrigation networks in Kasang and Hilalang Heads, Koto Tangah District, Padang City. Next, the writer will present the data obtained from the results of research on irrigation canals in the form of documentation as well as primary data and secondary data. The following table presentation.1

Table 1. Irrigation area of the city of Padang

No.	Name of the City of Padang Irrigation Area	Size n (Ha)
1	IN Sei Bangek	117
2	IN Kasang II	585
3	IN Kapalo Hilalang	81
4	IN Sei Latung	105
5	IN Lubuk Minturun	106
6	IN Sei Guo	657
7	IN Banda Duku	28

3.1. Image Interpretation

Image interpretation is an activity to identify objects in the image. To facilitate the activity of identifying objects in the image, an understanding of the characteristics or attributes of objects in the image is needed.

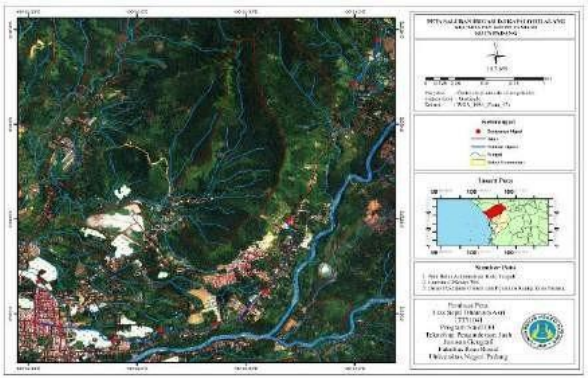

Figure 1. Map of the Kapalo Hilalang Irrigation Channel

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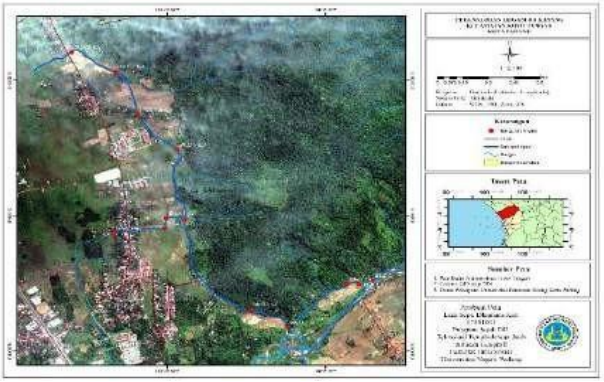

Figure 2. Map of the Kasang Irrigation Channel

The object characteristics in the image used to identify the image are referred to as image In the book Encyclopedia of Geography of Remote Sensing (2018) by Nur Fitriana Sari, nine elements are explained image that is:

a. Hue and Color

Based on the images in Figures 10 and 11, it can be seen that the color of the irrigation canals in the city of Padang is dark in color, this is due to the fact that irrigation canals are a wet element, due to the natural of water which absorbs electromagnetic waves.

b. Form

Based on the images in Figures 10 and 11, it can be seen that the shape of the irrigation image in the city of Padang is elongated, this is influenced by the topography of the area around the river basin which consists of community rice fields.

c. Pattern

Based on the images in Figures 10 and 11, it can be seen that the pattern shown in the image of the irrigation canal in the city of Padang has an irregular pattern, this shows the flow of the river from the upstream to the downstream area of the river.

d. Texture

Based on the images in Figures 10 and 11, it can be seen that the texture shown in the image of the irrigation canal in the city of Padang has a smooth texture.

e. Site

Based on the images in Figures 10 and 11, it can be seen that the site shown in the image of the irrigation canal in the city of Padang is adjacent to the community's rice fields in the Koto Tangah District.

f. Association

Based on the images in Figures 10 and 11, it can be seen that the Kasang and Kapalo Hilalang irrigation areas in Koto Tangah Padang District, West Sumatra, are directly associated with community-owned rice fields in Koto Tangah District.

Table 2. Coordinate data and building conditions in Kasang II:

Data data obtained from field surveys The field data collection was carried out using a survey method on the areas and irrigation networks of Padang City including the following:

1. The position of the area and the primary and secondary irrigation network is determined by GPS data recording (marking).
2. Data collection for each condition of buildings and irrigation networks.Table 2. Data collection

No	DI name		Channel Length	Channel Dimensions	Coordinate	Network conditions
1	Kasang II					
	-	Weir	97m	160cm	S0 49.238 E100 21.149	Good
	-	BKD 1	592m	160cm	S0 49.254 E100 21.107	Good
	-	BKD 2	277m	160cm	S0 49.252 E100 21.069	Good
	-	BKD 3	796 m	130cm	S0 49411 E100 20882	Good
	-	BKD 4	538m	130cm	S0 49.016 E100 20.555	Good
	-	BKD 5	239m	130cm	S0 48.756 E100 20.531	Good
	-	BKD 6	307 m	100cm	S0 48.628 E100 20.407	Moderate damage

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-	BKD 7 322 m	100cm	S0 48.469 E100 20.336	Moderate Damage
BKD 4 (BAA)				
-	BAAs 1 120m	90cm	S0 49.009 E100 20.498	Moderate Damage
-	BAAs 2 74 m	90cm	S0 49.047 E100 20.492	Moderate Damage
-	BAAs 3 329m	90cm	S0 49.066 E100 20.330	Moderate Damage

Information :
BKD : Building for Kasang IIBAA : Building part of BKD 4

From the above data it is known that the Kasang II dam has a channel length of 97 m, with a channel dimension of 160 cm, the network conditions are in a good category. Furthermore, BKD 1 has a channel length of 592 m and a channel dimension of 160 cm with good network conditions. BKD 2 has a channel length of 277 m and a channel dimension of 160 cm, and the network condition is good.
BKD 3 has a channel length of 796 m and a channel dimension of 130 cm in good condition. BKD 4 has a channel length of 538 m and a channel dimension of 130 cm in good condition. BKD 5 has a channel length of 239 m, and a channel dimension of 130 cm in good condition.
BKD 6 has a channel length of 307 m with a channel dimension of 100 cm with moderate damage. BKD 7 has a channel length of 322 m, and a channel dimension of 100 cm with moderate damage. Meanwhile, the building part of BKD 4, namely BAA 1, has a length of 120 m, and a channel dimension of 90 cm with moderate damage. BAA 2 has a length of 74 m, the dimensions of the canal are 90 cm in moderately damaged condition and BAA 3 has a length of 329 m with dimensions of 90 cm in moderately damaged condition.

Table 3. Coordinate data and conditions in Kapalo Hilalang

No	DI name	Channel Length	Channel Width	Coordinate	Network conditions
2	Kapalo				
	Gone	0	0	S0 48.555 E100 24.108	Damaged
	Weir				Heavy
		1998m	80cm	S0 49504 E100 23699	
	- BKH				Damaged
	1	767 m	80cm	S0 49,881 E100 23,590	Currently
	- BKH 2	567 m	80cm	S0 50.053 E100 23.365	Moderate Damage
	- BKH 3	515m	80cm	S0 50.088 E100 23.106	Damaged
	- BKH 4	447 m	100cm	S0 50.141 E100 22.893	Currently
	- BKH 5	520m	100cm	S0 50.072 E100 22.647	Moderate Damage
	- BKH 6	224 m	100cm	S0 50.046 E100 22.529	Damaged
	- BKH 7	405m	100cm	S0 49830 E100 22545	Currently
	- BKH 8				Moderate Damage
					Good
					Good

Information: BKH: Building for Hilalang Ship

From data in the table above it can be seen that BKH 0 was heavily damaged so the irrigation flow could not flow smoothly. BKH 1 has a length of 1,998 m, dimensions of 80 cm with a moderately damaged building condition. BKH 2 has a length of 767 m, and dimensions of 80 cm in moderately damaged condition. BKH 3 has a length of 567 m with dimensions of 80 cm in moderately damaged canal conditions. BKH 4 has a length of 51 m, and dimensions of 80 cm with moderate damage. BKH 5 has a length of 447 m, and canal dimensions of 100 cm with moderate damage. BKH 6 has a channel length of 520 m with dimensions of 100 and the condition of the building is moderately damaged. BKH 7 has a length of 224 m, the dimensions of the canal are 100 cm with good canal conditions and BKH 8 has a length of 405 m with dimensions of 100 cm, the condition of the building is good.

Currently, the main use of Bandar Laweh's water resources is for agricultural irrigation, which reaches Nagari Tabek. With the non-functioning canal from Kenagarian Tabek to Lurah Kapecong, the supply of irrigation water for the Bukit Tandang area to Solok is only sourced from tributaries in Kapecong Lurah. The malfunction

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of the left primary canal and some of the right primary canal is the result of damage along the canal, ranging from minor to severe damage such as landslides. Water supply in the dry season is also very limited,
Currently, the main use of water resources in Koto Tangah is for agricultural irrigation. With the irrigation canals not functioning, the water supply for the Koto Tangah sub-district is only sourced from tributaries.
Irrigation canal failure occurs due to damage to irrigation canals, ranging from minor damage to severe damage such as landslides which result in damage to the intake structure and the body of the weir.
The Kapalo Hilalang irrigation network suffered heavy category damage from the weir building to the building for 1 Kapalo Hilalang which resulted in the breaking of irrigation channels along ± 1km. The rupture of the Kapalo Hilalang irrigation canal was caused by the 2009 earthquake which caused a cliff slide in the canal weir. In order to restore the damaged irrigation canals, the Kapalo Hilalang canal had to be rebuilt from scratch. As shown by figure 7 and the map below

Figure 3. Damaged Kapalo Hilalang canal.

The following is a map of the Kapalo Hilalang irrigation canal which was cut off 1 KM.

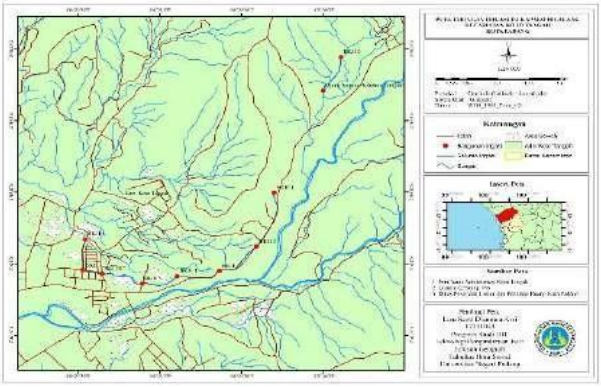

Figure 4. The shape of the damaged Kapalo Hilalang irrigation canal

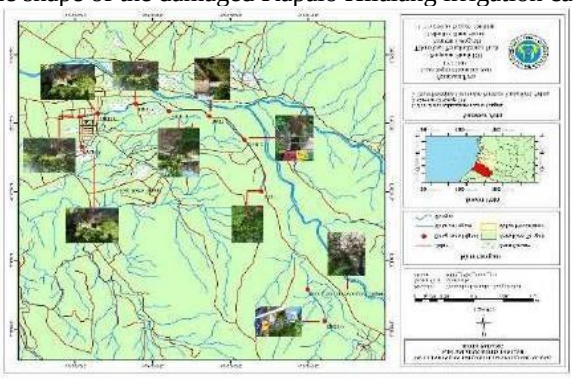

Figure 5. Shape of the Kapalo Hilalang Irrigation Canal

From the picture above it can be seen some of the field survey documentation in Kapalo Hilalang, along with the attachments in the table below.

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Table 10. Field Survey Documentation in Kapalo Hilalang

Build name	Documentation
BCH 0	
End of Channel Before Landslide	
BKH 8	
BKH 4	

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BKH 5

BKH 6

BKH 7

The irrigation canal in Kasang II was only slightly damaged with thick sediment conditions and a slight shift in irrigation structures. Casting channels are classified as moderately damaged so they only need repair/rehabilitation of the channels. As shown in Figure 8 and the map below.

Figure 15. Kasang II Dam covered by sediment

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The following shows the map of the Kasang 2 P dam irrigation canal

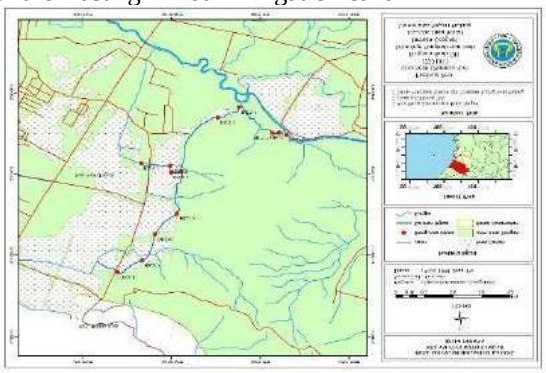

Figure 16. The shape of the Kasang II canal

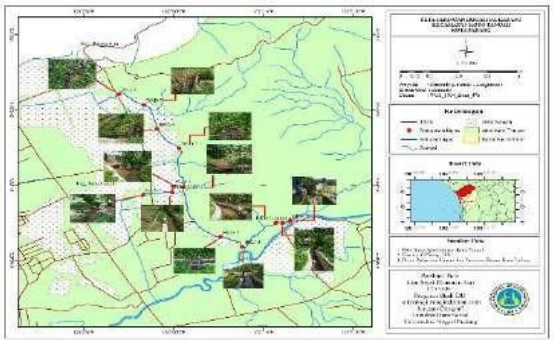

Figure 6. The Kasang II canal

4. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

The results of identifying irrigation canals using high-resolution imagery produce sufficient data according to field conditions. This is evidenced by the length of damage to irrigation canals on the map which is almost the same as the results of field conditions. The specific benefits of image interpretation of irrigation canals can be used for spatial analysis in the field of regional planning and development or development. Based on field surveys, the condition of network damage for Hilalang Ship, starting from the weir building to BKH 1, was heavily damaged, and BKH 2 to BKH 6 was moderately damaged. Starting from BKH 7 to BKH 8, they are still in good condition. Meanwhile, the condition of the Kasang II irrigation canal, starting from the weir to BKD 5, is still in good condition. BKD 6 to BKD 7 experienced moderate damage. In contrast, BKD 4 is in good condition, while parts of BAA 1 to 3 are in moderately damaged condition. The damage was caused by a natural disaster in the form of a landslide which was preceded by an earthquake in 2009. For the application of image interpretation elements used to see the condition of damage to irrigation networks in Kasang II and Kapalo Hilalang it can be seen by the flow of the tributaries having hues and colors in the irrigation image in the city of Padang is dark because irrigation canals are a wet element, due to the nature of water which absorbs electromagnetic waves. The shape of the irrigation image in the city of Padang is tortuous, this is influenced by the topography of the area around the river basin which consists of community rice fields. The pattern shown in the image of irrigation canals in the city of Padang is elongated, this shows the flow of the river from the upstream to the downstream area of the river. The texture shown in the image of the irrigation canal in the city of Padang has a smooth texture.

2. Suggestion

1. Various kinds of things were found as a result of research, so the authors suggest:

To deal with greater damage to irrigation canals, the government must take appropriate precautions by carrying out a site plan for heavily damaged canals and rehabilitation for moderately and lightly damaged canals.

2. The local government should pay more attention to the condition of irrigation canals and make irrigation canal maps a consideration in terms of development or planning.

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