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RESEARCH ARTICLE

The Intersection of Drainage Canal with Irrigation Canal Causes Drainage Water to Mix Irrigation Water in the Kurri-Kurri Kasambi Irrigation Area, Masamba Sub-District, North Luwu District

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ABSTRACT

This research aims to formulate an alternative model for drainage channels that intersect with irrigation channels, especially those in the Kurri-kurri Kasambi Irrigation Area. The data used in this research consists of two sources, namely primary data and secondary data. Data collection techniques in this study consisted of a combination of observation techniques and literature studies. This research is descriptive qualitative research, namely: a study that aims to describe or provide an overview of: the condition of irrigation channels and drainage channels, and what factors cause the intersection of irrigation channels with drainage channels. The results showed that at each point of intersection between the drainage channel and the irrigation channel there is a spindle channel with the condition of paying attention to the existing irrigation boundary where some settlements violate the irrigation boundary especially in the primary channel and secondary channel Kurri-Kurri. For gutter buildings made at a certain point, with the condition of paying attention to the difference in elevation of the drainage channel against the irrigation channel. (Section 01 and 02) is possible due to a difference of 0.65 - 0.70 meters, where the height of the irrigation channel is 1.0 - 1.18 meters. For infiltration well buildings can be made in (section 03) and section (06), because the condition of the drainage dimensions is rather small and also the land allows. Drainage channels that have been partially built in the old bone permanent housing (huntap), the direction of the discharge must be in line with the secondary drainage channel that intersects with the secondary irrigation channel jalajja.

INTRODUCTION

Irrigation is the business of providing, regulating, and disposing of irrigation water to support agriculture which types include surface irrigation, swamp, underground water, pumps and ponds. Irrigation Area is a unit of land that gets water from one irrigation network. Irrigation networks are channels, buildings, and their appurtenant buildings which are a single unit required for the provision, distribution, delivery, use, and disposal of irrigation water. Primary irrigation network is part of the irrigation network consisting of the main banmgunan, main / primary channel, sewer, building for, building for tapping, and its complementary buildings. Secondary irrigation network is part of the irrigation network consisting of secondary channels, sewers, divider buildings, tapping buildings, tapping buildings, and their appurtenant buildings (Government Regulation No. 20 of 2006 on Irrigation, 2006).

Irrigation areas stipulated in this Ministerial Regulation are irrigation areas that have been built by the central government, provincial government, district / city government which types include:

surface irrigation, swamp irrigation, underground water irrigation, pump irrigation and pond irrigation. Criteria for the division of authority include: irrigation areas with an area of more than 3,000 ha are the authority of the central government, irrigation areas with an area of 1,000 - 3,000 ha are the authority of the provincial government, while irrigation areas with an area of less than 1,000 ha are the authority of the district / city government (Regulation of the Minister of Public Works and Housing no. 14/PRT/M/2015 on criteria and determination of irrigation area status, 2015).

The acceleration of water use improvement program, hereinafter referred to as P3-TGAI, is a program of rehabilitation, improvement, or construction of irrigation networks based on the participation of farmer communities which is carried out by water user farmer associations (P3A), combined water user farmer associations (GP3A), or parent water user farmer associations (IP3A) in a self-managed manner (Regulation of the Minister of Public Works and Public Housing no. 4 of 2021 concerning guidelines for the implementation of the acceleration program for improving irrigation water use, 2021).

The irrigation network border line is a safety limit for irrigation channels and / or buildings with a certain distance along the channel and around the building. The irrigation network border space is the space between the right border line and the left border line of the irrigation network. The irrigation network border is the left and right space of the irrigation network, between the border line and the irrigation network boundary line. The border lines of irrigation networks of more than 1,000 ha in one district/city are determined by the regent/mayor. The boundary lines of irrigation networks in cross-district irrigation areas, irrigation areas with an area of 1,000 ha - 3,000 ha are determined by the governor by taking into account the recommendations of the regent/mayor. The boundary lines of irrigation networks across the State, across provinces, national strategic, and irrigation areas with an area of more than 3,000 ha are determined by the minister of public works in coordination with the relevant governor by taking into account the recommendations of the regent/mayor. Determination of irrigation boundary lines is reviewed every 5 (five) years (Regulation of the Minister of Public Works and Public Housing no. 08/PRT/M/2015 concerning Determination of irrigation network boundary lines, 2015).

In the field of civil engineering, drainage can generally be defined as a technical measure to reduce excess water, whether it comes from rainwater, seepage or excess water from an area/land the function of the area/land is not disturbed. The current drainage system uses a more conventional drainage system, which only drains water as quickly and as much as possible (Dwiati et al., 2010).

Drainage is an infrastructure that is as important as any other infrastructure. In accordance with its function, drainage plays an important role in regulating rain runoff water that has the potential to become puddles. Drainage is a network of discharges used to drain parts of the city's administrative area from standing water, both from local rainfall and rivers that pass through the city. Drainage can also be interpreted as an effort to control groundwater kuaitlas and its relation to salinity, where drainage is one way of disposing of excess water that is not wanted in an area, as well as ways of handling the consequences caused by excess water. From another point of view, drainage is one element of the public infrastructure needed by the city community in order to lead a comfortable, clean and healthy city life (Rachmayani, 2015).

Along with population growth, the expansion and increase in land use, both for housing and settlements, has resulted in an increase in the development of other supporting facilities. After the Masamba river flash flood in 2020, in the city of Masamba, precisely in the old bone village, 120 units of permanent housing (huntap) and commercial housing were built, which are equipped with public facilities and facilities (PSU) such as roads and drainage, which also lead to primary irrigation channels and secondary irrigation channels.

Facilities and infrastructure are buildings that are needed to support human life together in a limited space so that they can live comfortably. Masamba is a capital city with a fairly developed residential area, with the existence of various housing areas and the expansion of settlements showing that this area is an option for the development of housing and residential areas. Housing and settlement development needs to be directed so that there is a unified view between the government and the community, in a balanced manner according to their respective positions and roles. The government

is in a position to be able to provide facilities and mediation in providing and improving housing and settlements to make them healthier and more comfortable, while the community must be encouraged to have concern and responsibility in meeting the need for housing independently but still fulfill the applicable provisions and regulations (Lestari & Djumiko, 2017).

The difference between drainage channels and irrigation channels lies in their function, where drainage channels are built as a means of disposing of water from a source while irrigation channels are built as access to water supply or distribution facilities. Although irrigation and drainage have different roles, both are equally important in maintaining the water balance of an environment. Irrigation is done to provide water to plants so that they can grow well, while drainage is done to reduce humidity in certain areas (Anugerah, 2023).

There are 2 (two) Irrigation Areas (D.I) located in the Masamba city area including the Kurri-kurri Kasambi Irrigation Area (D.I) in the old bone village and the Kappuna Lebannu Irrigation Area (D.I) in the kappuna village, one of which is a regency authority and one is a provincial authority whose channel network crosses the city area, where the drainage channel intersects with the primary and secondary irrigation channels resulting in mixing of drainage water with irrigation water, where this condition seriously disrupts the irrigation system and wastewater control. The Kurri-kurri Kasambi Irrigation Area (D.I) crosses several areas including Baloli Village, Bone Tua Village, Baliase Village and Pombakka Village with a primary channel length of ± 3730 meters, Kurri-kurri secondary channel ± 2502 meters, Jalajja secondary channel ± 2562 meters, Kasambi secondary channel ± 4325 meters, Tanete secondary channel ± 1959 meters with an area of 2000 ha. The problem is because the drainage channel is made to dump into the irrigation channel so that during floods the irrigation floodgates are forcibly opened so that the rice fields are flooded. Kurri-kurri Kasambi Irrigation Area is a provincial authority which is the research locus located in Bone Tua Village, Masamba Subdistrict.

The purpose of this study is to formulate an alternative model for drainage channels that intersect with irrigation channels, especially those in the Kurri-kurri Kasambi Irrigation Area. In general, the results of this study are also used as input to the North Luwu Regency Government in planning drainage channels and irrigation channels in the future, because in North Luwu there are still many cases similar to this.

RESEARCH METHODS

Research location

This research was conducted in Bone Tua Village, Masamba Subdistrict the selection of this location was carried out with the consideration that the drainage channel intersects with the Irrigation channel in the Kurri-kurri Kasambi Irrigation Area (D.I), where household wastewater from drainage pollutes irrigation water, the object of research is shown in Figure 1.

Figure 1: Map of the research location

Point of intersection

In this study there are 8 (eight) points reviewed, namely in sections 01, 03, 05, 06, 08 is the intersection of drainage channels with primary irrigation channels, sections 02, 04 intersection of drainage channels with secondary irrigation channels kurri-kurri, section 07 intersection of drainage channels with secondary irrigation channels jalajja. Sections 04 and 05 are located on the Trans Sulawesi road and can be seen from figures 2,3,4,5,6,7,8,9,10,11,12 for each section.

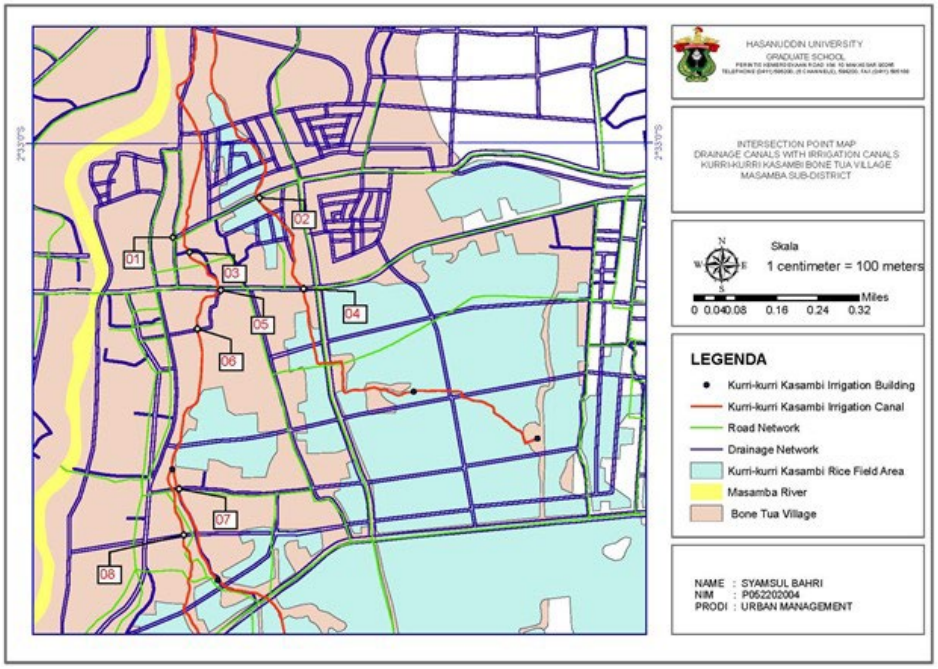

Figure 2: Intersection of drainage channel with irrigation channel

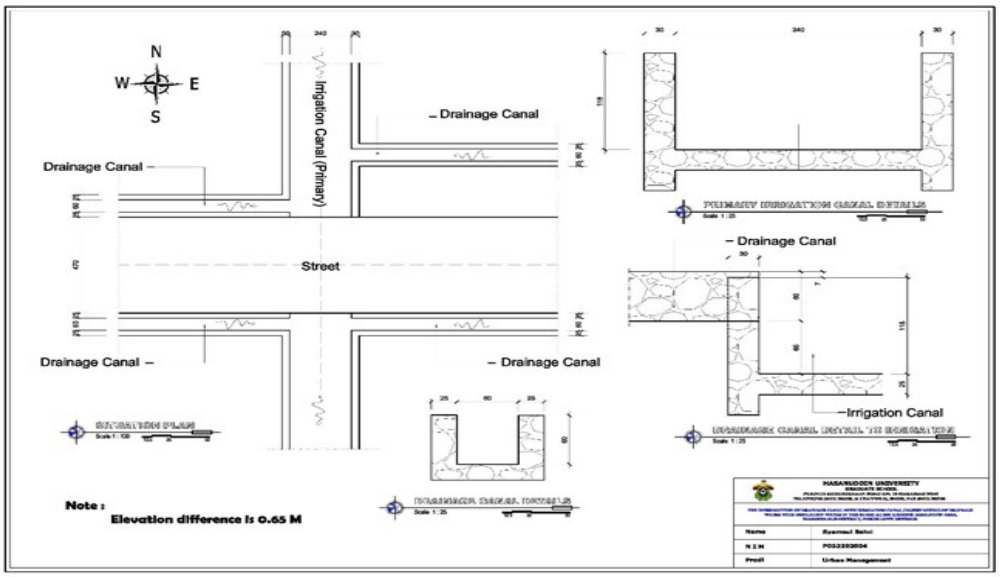

Figure 3: Drainage intersection with primary irrigation channel (section 01)

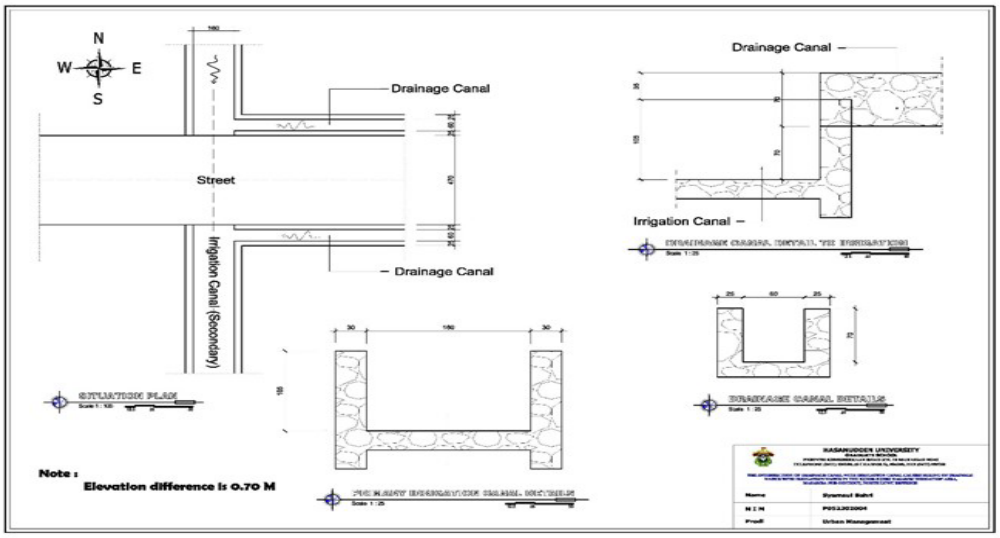

Figure 4: Drainage intersection with Kurri-kurri secondary irrigation canal (section 02)

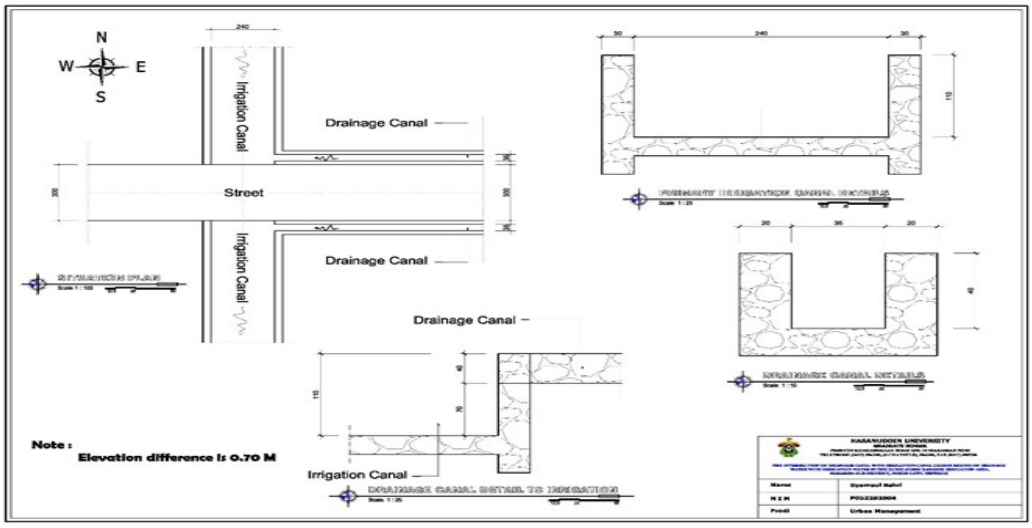

Figure 5: Drainage intersection with primary irrigation channel (section 03)

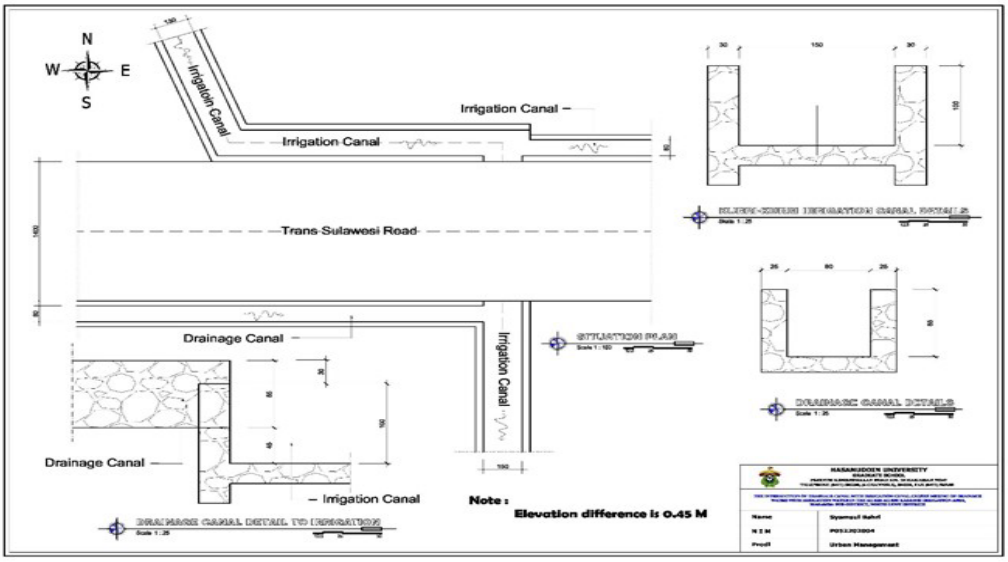

Figure 6: Drainage intersection with Kurri-Kurri secondary irrigation channel (section 04)

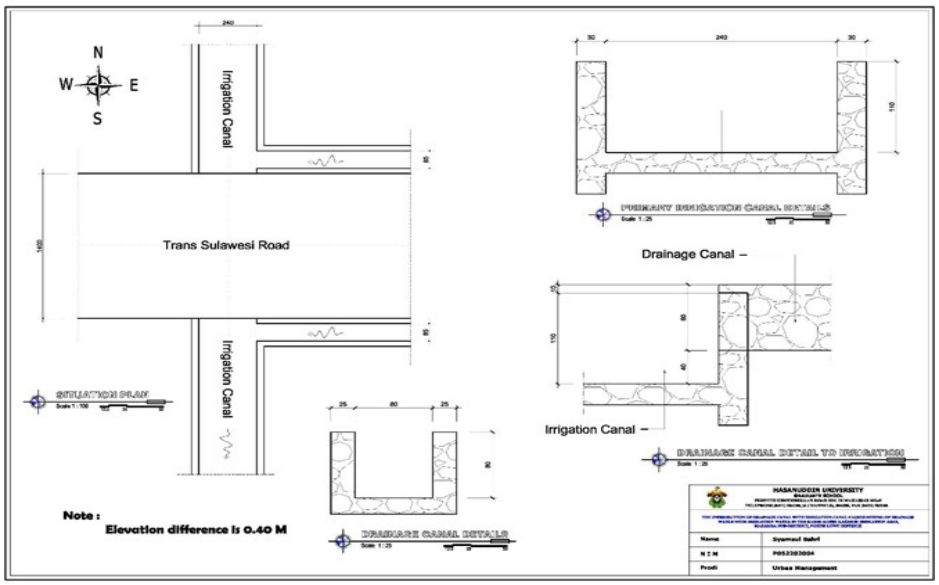

Figure 7: Drainage intersection with irrigation channel (section 05)

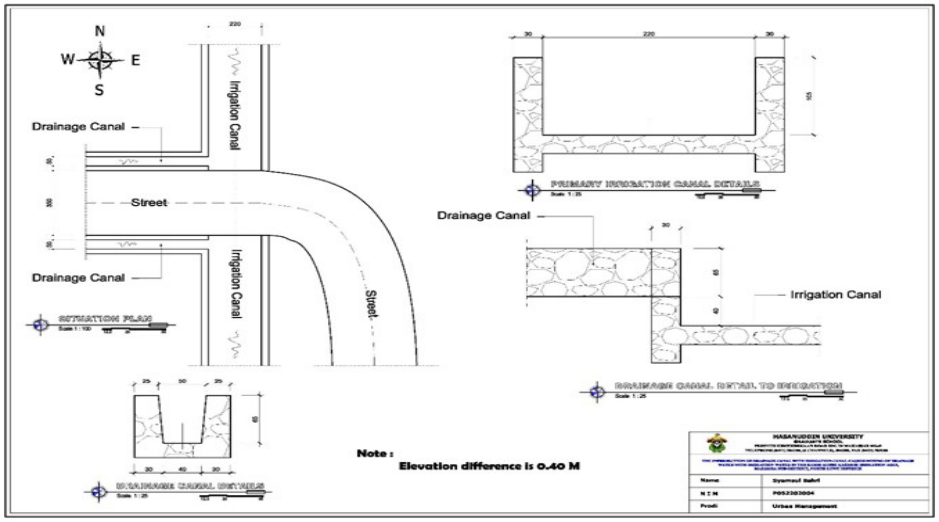

Figure 8: Drainage intersection with primary irrigation channel (section 06)

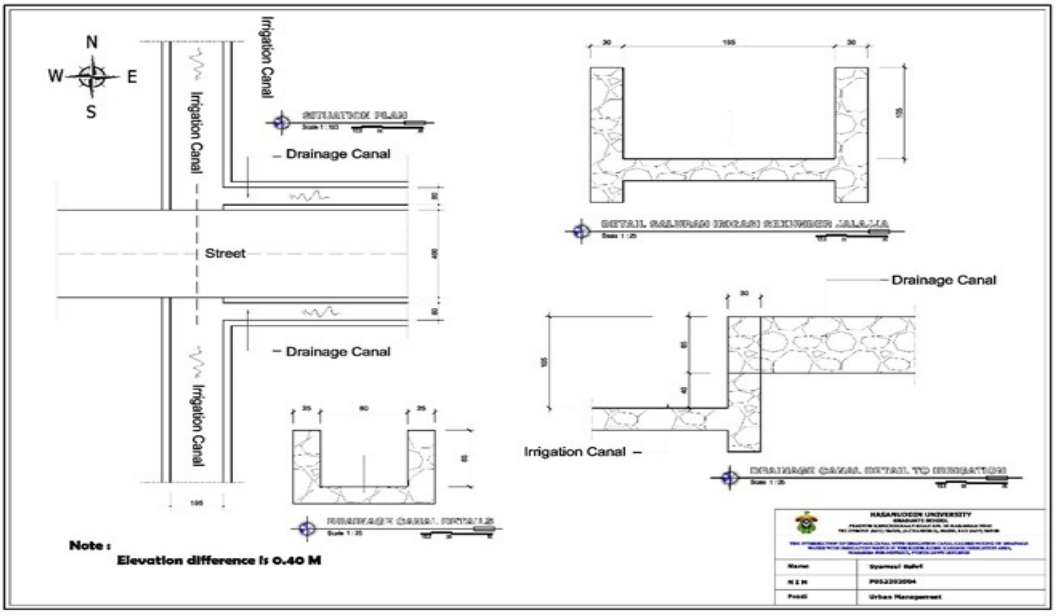

Figure 9: Drainage Intersection with Jalajja secondary irrigation channel (section 07)

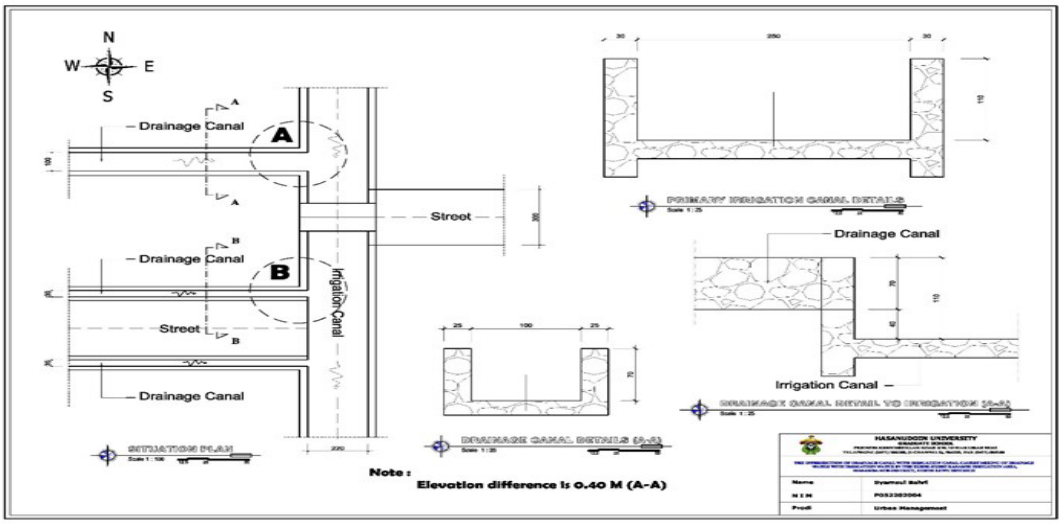

Figure 10: Drainage intersection with primary irrigation channel (section 08 A-A)

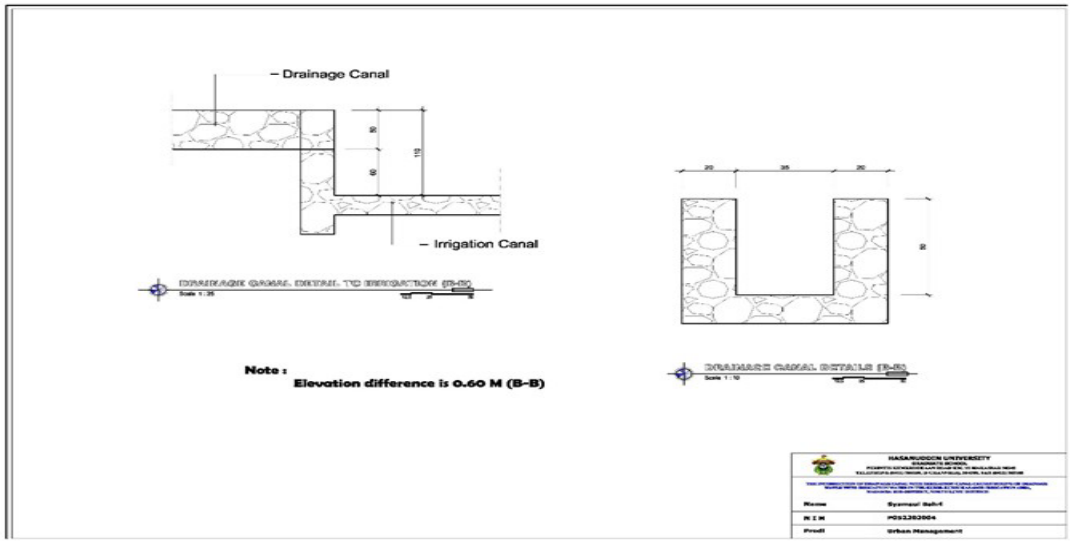

Figure 11: Drainage intersection with primary irrigation channel (continued section 08 B-B)

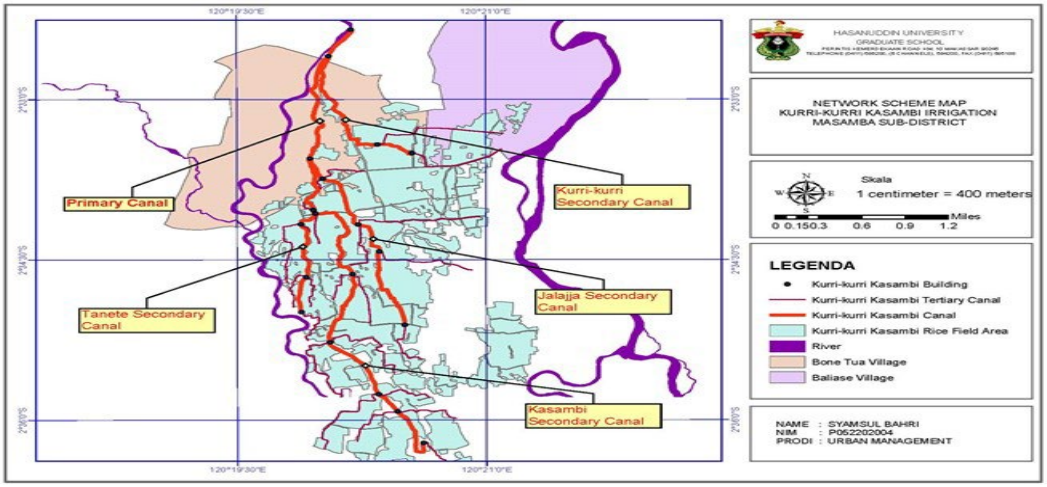

Figure 12: Network map of irrigation area (D.I) Kurri-kurri Kasambi

Data type and source

The data used in this research consists of two sources, namely primary data and secondary data. Primary data is data obtained from direct observation at the research location. Primary data consists of: length and width of irrigation channels and drainage channels. While secondary data is data

obtained from documents, literature data, related agencies/institutions and literature that is considered relevant to the problem under study. Secondary data consists of: data on the general condition of the research area in the form of administrative boundaries, the amount of irrigation area, geographical conditions and conditions of the research area.

Data collection

The data collection technique in this research consists of a combination of observation and literature study techniques. Observation technique is a process of observing and recording systematically, logically, objectively and rationally. The literature study or literature study is done to find data or research information through reading scientific journals, reference books and publication materials and other sources.

Data analysis

This research is descriptive qualitative research, namely: a study that aims to describe or provide an overview of: the condition of irrigation channels and drainage channels, and what factors cause the intersection of irrigation channels with drainage channels.

RESULT

Cross section data collection

This cross section data collection aims to find the difference in floor height between the drainage channel and the irrigation channel, which is then used to determine the cross section difference between the two channels.

From the results of the field survey at the location can be known:

1. In Section 01
   Irrigation Canal Height : 1.18 + 0.07 = 1.25 m
   Drainage Canal Height : 0.60 m

2. In Section 02
   Irrigation Canal Height : 1.05 + 0.35 = 1.40 m
   Drainage Canal Height : 0.70 m

3. In Section 03
   Irrigation Canal Heigh : 1.10 m
   Drainage Canal Height : 0.40 m

4. In Section 04
   Irrigation Canal Heigh : 1.00 + 0.3 = 1.30 m
   Drainage Canal Height : 0.85 m

5. In Section 05
   Irrigation Canal Heigh : 1.10 + 0.10 = 1.20 m
   Drainage Canal Height : 0.88 m

6. In Section 06
   Irrigation Canal Heigh : 1.05 m
   Drainage Canal Height : 0.65 m

7. In Section 07
   Irrigation Canal Heigh : 1.05 m
   Drainage Canal Height : 0.65 m

8. In Section 08 (A-A)
   Irrigation Canal Heigh : 1.10 m
   Drainage Canal Height : 0.70 m

9. In Section 08 (B-B)
   Irrigation Canal Heigh : 1.10 m
   Drainage Canal Height : 0.50 m

Rainfall data collection

The rainfall data used in the analysis is rainfall data for 6 years from 2018 - 2023. The rainfall data obtained is the daily maximum rainfall data from the nearest station, which is located around the research location. Examples of rainfall data taken are the largest rainfall data in each year of observation and the data can be seen in table 1.

Table 1: Rainfall data

Year	Month											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
2018	268	201	421	295	275	367	130	95	235	101	251	500
2019	202	397	356	482	227	542	162	194	241	344	54	69
2020	197	345	442	565	454	576	427	238	501	392	248	321
2021	628	214	379	375	462	211	245	598	515	222	326	479
2022	234	395	488	411	398	434	470	534	265	283	473	324
2023	278	167	370	459	427	265	144	197	157	72	326	240
Average 30 years	337	312	404	462	402	422	282	264	225	227	273	354

Source: BMKG Class III Andi Jemma North Luwu

Rainfall data processing

From the rainfall data obtained, then look for the average daily maximum rainfall in each year. Example of calculation analysis in 2022: Average daily maximum rain = (234+395+488+411+398+434+470+534+265+283+473+324)/12 = 392.42 mm

Table 2: Results of rainfall data calculation analysis

Year	Month												Maximum Average Rainfall
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	
2018	268	201	421	295	275	367	130	95	235	101	251	500	262.58
2019	202	397	356	482	227	542	162	194	241	344	54	69	272.50
2020	197	345	442	565	454	576	427	238	501	392	248	321	392.17
2021	628	214	379	375	462	211	245	598	515	222	326	479	387.83
2022	234	395	488	411	398	434	470	534	265	283	473	324	392.42
2023	278	167	370	459	427	265	144	197	157	72	326	240	258.50
Average 30 years	337	312	404	462	402	422	282	264	225	227	273	354	

Source: Data processed (2024)

Cross section data processing

1. In Section 01
   Irrigation Canal Height : 1.18 + 0.07 = 1.25 m
   Drainage Canal Height : 0.60 m
   Elevation Slope : 0.65 m

2. In Section 02
   Irrigation Canal Height : 1.05 + 0.35 = 1.40 m
   Drainage Canal Height : 0.70 m
   Elevation Slope : 0.70 m

3. In Section 03
   Irrigation Canal Height : 1.10 m
   Drainage Canal Height : 0.40 m
   Elevation Slope : 0.70 m

4. In Section 04
   Irrigation Canal Height : 1.00 + 0.3 = 1.30 m
   Drainage Canal Height : 0.85 m
   Elevation Slope : 0.45 m

5. In Section 05
   Irrigation Canal Height : 1.10 + 0.10 = 1.20 m
   Drainage Canal Height : 0.88 m
   Elevation Slope : 0.40 m

6. In Section 06
   Irrigation Canal Height : 1.05 m
   Drainage Canal Height : 0.65 m
   Elevation Slope : 0.40 m

7. In Section 07
   Irrigation Canal Height : 1.05 m
   Drainage Canal Height : 0.65 m
   Elevation Slope : 0.40 m

8. In Section 08 (A-A)
   Irrigation Canal Height : 1.10 m
   Drainage Canal Height : 0.70 m
   Elevation Slope : 0.40 m

9. In Section 08 (B-B)
   Irrigation Canal Height : 1.10 m
   Drainage Canal Height : 0.50 m
   Elevation Slope : 0.60 m

DISCUSSION

In general, the people of Masamba sub-district, especially in the old bone village, have a livelihood as farmers. This is reflected in the morphological condition of the area which is dominated by agricultural land, especially rice fields, where the old bone village has a rice field area, namely the Kurri-kurri Kasambi Irrigation Area (D.I) with a land area of 2,000 ha. Where the condition of existing irrigation channels in primary and secondary channels intersects with urban drainage channels which causes mixing of water from both channels. To anticipate this problem, further treatment is needed.

The existence of drainage from community settlements causes the mixing of drainage water into primary and secondary irrigation channels in the Kurri-kurri Kasambi Irrigation Area, so that irrigation water is polluted. As garbage from drainage channels causes garbage to be carried down into irrigation channels, so that at the gates for irrigation channels there are often blockages due to garbage. If plastic waste that is carried by the flow of water in irrigation channels accumulates, then this is what inhibits the flow of water in irrigation channels leading to rice fields. With the inhibition of water flow due to the accumulation of garbage, it is not uncommon for rice fields to experience water shortages. Plastic waste that pollutes irrigation canals can reach more than 50%, other types of waste also pollute irrigation such as baby diapers, animal carcasses, metal, glass and chemical waste (Putrawan et al., 2021).

Classic cases also occur in big cities in Indonesia, as revealed by Sartono on the website www.tembi.net with the title "consciously not aware of the drainage function". In writing about the development of drainage, sanitation and irrigation systems in areas around the city of Yogyakarta, he hopes that water originating from upstream can be managed properly from upstream to downstream, including drainage, sanitation and irrigation systems. Ideally, the three systems related to water can be separated, drainage is not equated with sanitation or irrigation systems. If it is not possible to separate them, the three systems are able to guarantee the feasibility or fulfillment of the need for health and environmental sustainability (Widjaya, 2013).

In many cases, the three systems merge into one function, one of the things that can be observed is the existence of drainage systems in both cities and districts that are multi-functional. The drainage system is also used as a garbage dump or an elongated waste disposal site while also functioning as irrigation. As a result, puddles are full of various kinds of solid and liquid wastes that spread to all corners or corners through which they pass. In addition to these cases, drainage is also often combined with irrigation systems. In some cases, drainage channels and irrigation channels often become one and are often (almost always) used to dispose of garbage. As a result, many rice fields are filled with solid waste, especially plastics (Widjaya, 2013).

The existing conditions in the field can be seen as follows: In section 01 the drainage channel intersects with the primary irrigation channel, the left and right sides of the irrigation channel there are community settlements that tend to partially violate the irrigation boundaries and household wastewater is discharged directly into the irrigation channel. In section 02 the drainage channel intersects with the Kurri-Kurri secondary irrigation channel, the left side of the irrigation channel has community settlements and on the right side of the irrigation channel are some rice fields and community settlements, household wastewater is discharged directly into the irrigation channel.

In section 03 the drainage channel intersects with the primary irrigation channel, the left side of the irrigation channel there are community settlements and some food stalls where household wastewater is discharged directly into the irrigation channel. In section 04 the drainage channel is on the Trans Sulawesi road which intersects with the Kurri-Kurri secondary irrigation channel, on the left side of the irrigation channel there are community settlements while on the right side of the irrigation channel is a mosque, some community settlements.

In section 05 the drainage channel is on the trans sulawesi road which intersects with the primary irrigation channel, on the left side there is a hospital, community settlements and food stalls, while on the right side there are food stalls, community settlements that tend to violate irrigation boundaries, household wastewater directly into irrigation channels. In section 06, the drainage channel intersects with the primary irrigation channel, on the left and right sides of the irrigation channel there are community settlements, where household wastewater goes directly into the irrigation channel.

In section 07 the drainage channel intersects with the secondary jalajja irrigation channel, on the left side of the irrigation channel are rice fields and on the right side are community settlements. In section 08 the drainage channel intersects with the primary irrigation channel, on the left and right sides of the irrigation channel there are community settlements.

To avoid mixing water from drainage channels to irrigation channels, there are several alternative building models such as Gutter Buildings. According to Irrigation Planning Criteria (KP-04), gutters are artificial channels made of reinforced concrete, wood or steel or ferrocement concrete, in which water flows with a free surface, made across valleys of a certain length (generally under 100 meters), waster channels, road rivers or railways, and so on. The minimum gutter channel is supported by two or more pillars of masonry construction.

Furthermore, the Gendong Channel, according to the Irrigation Planning Criteria (KP-03), the Gendong Channel is a drainage channel that is placed parallel to the irrigation channel. This spindle channel serves to prevent surface flow (run of) outside the irrigation area (extra area) into the irrigation channel. Water from this spindle channel is channeled into the nearest natural channel or artificial drainage channel.

Sipon Building according to Irrigation Planning Criteria (KP-04), Sipon is a building that carries water through under another channel (usually a waster) or road. In the sipon water flows due to pressure. The hydraulic planning of the sipon must consider the flow velocity, loss at the entrance transition, loss due to friction, loss at the elbow of the sipon and loss at the exit transition. The minimum diameter of the sipon is 0.60 meters to allow for cleaning and inspection. Since the siphon has little flexibility in transporting more water than planned, it is not used in the waster. Although the discharge is not regulated, there is a possibility of transporting more debris, siphons are only used for irrigation channels. So that the sipon pipe does not get clogged and no people or animals enter, the pipe mouth is closed with a filter grille (trashrack).

Infiltration wells are artificial wells whose main function is to expand the water absorption area, especially rainwater, in order to conserve the soil and also the water content in the soil. The working principle of infiltration wells is to channel and collect rainwater into a hole or well so that the water can gradually seep into the ground. The working principle of infiltration wells is not complicated, namely a hole that has been dug to a certain depth, then given a wall structure using materials that are still able to pass water, the purpose of infiltration wells is so that water flowing on the surface of the soil can enter the well, so that water has sufficient storage time before finally seeping into the ground (Prakoso, 2013).

CONCLUSIONS

Based on the results and discussion of the research conducted by juxtaposing previous research, the following conclusions are drawn based on the objectives of the research:

1. At each point of intersection between the drainage channel and the irrigation channel there is a spindle channel with the condition of paying attention to the existing irrigation boundary where some settlements violate the irrigation boundary, especially in the primary channel and secondary channel Kurri-Kurri.
2. For gutter buildings made at a certain point, with the condition of paying attention to the difference in elevation of the drainage channel against the irrigation channel. (Section 01 and 02) is possible due to a difference of 0.65 - 0.70 meters, where the height of the irrigation channel is 1.0 - 1.18 meters.
3. For infiltration well buildings can be made in (section 03) and section (06), due to the condition of the drainage dimensions are rather small and also the land allows.
4. Household waste that discharges directly into the irrigation channel will later switch to the drainage spindle channel, especially settlements along the primary irrigation channel and secondary irrigation channel Kurri-Kurri.
5. Drainage channels that have been partially built in the old bone permanent housing (huntap), the direction of the discharge must be in the direction of the secondary drainage channel that intersects with the secondary irrigation channel jalajja.

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