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# Utilization of Telemetry Monitoring System on The Dynamics of Water Quantity and Quality in The Dadahup Swamp Irrigation Area †

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**Abstract:** One of the technological developments in supporting irrigation modernization is the installation of telemetry monitoring systems that are built based on three main elements of sensors, internet connections, and data centers. Dadahup Swamp Irrigation Area is one of the development areas that has been supported by the installation of telemetry monitoring system at three points located on the upstream and middle stream sides of the irrigation area. The water management system of Dadahup Swamp Irrigation Area has not been running optimally in regulating the water level which results in irrigated land not getting good water quality for rice plant growth. The research objective is to describe the condition of the water quantity and quality profile based on telemetry monitoring system. The research method was carried out by observing water level elevation, rainfall, and pH, during the rainy and dry seasons in the upstream, middle, and downstream parts. The results showed that the dynamics of water quantity greatly affect water quality in both the rainy and dry seasons.

**Keywords:** telemetry monitoring system; water quantity; water quality; Dadahup

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## 1. Introduction

The food estate development program is one of the Government's efforts to anticipate a food crisis due to the significant increase in population in recent years [1]. One of the efforts to develop food land into agricultural cultivation is the rehabilitation and improvement of the Dadahup Swamp Irrigation Area network with a potential area of ±21,226 thousand ha in Kapuas Regency, Central Kalimantan Province [2].

Due to extreme seasonal changes, the Dadahup Swamp Irrigation Area is often flooded, resulting in crop failure [3]. The condition of the channel network system and irrigation buildings that are not functioning optimally along with the broken and collapsed embankments around the irrigation area has resulted in the conversion of the area into shrub land [4].

The development of technology that supports the polder water system is the installation of the internet of things (IOT) which consists of sensors, internet connections, and data centers [5]. The installation of a telemetry monitoring system in the Dadahup Swamp Irrigation Area aims to observe changes in water quantity and quality in the upstream and middle of the main primary channel in order to optimize the operation and maintenance of irrigation networks and buildings [6].

## 2. Material and Methods

### *2.1. Study Area*

The research site is located in the Dadahup Swamp Irrigation Area of Kapuas Regency, Central Kalimantan Province, which is traversed by the Barito, Kapuas Murungand Mengkatip Rivers. The tertiary blocks of the Dadahup Swamp Irrigation Area are divided into seventeen tertiary blocks dominated by shrubs, shown in Figure 1.

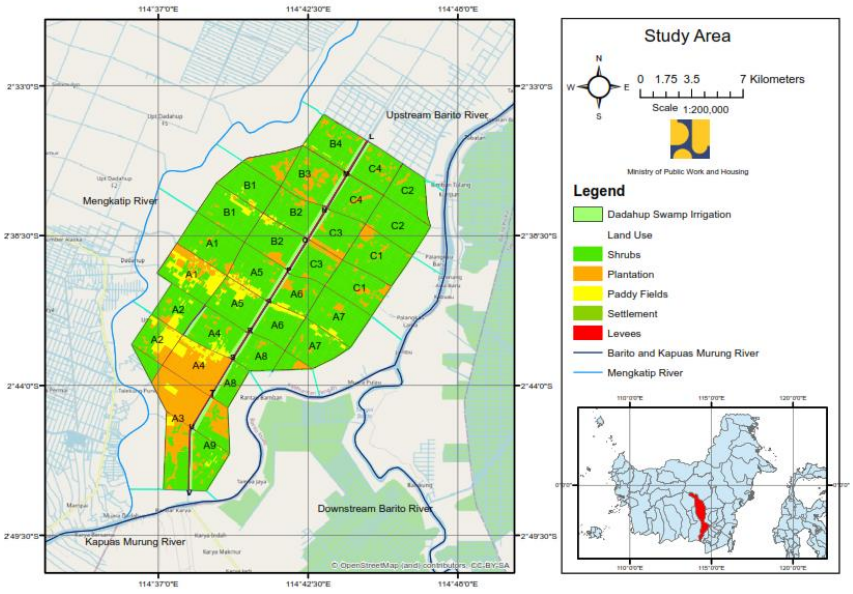


**Figure 1.** Study Area.

### *2.2. Methods*

The research was conducted at point locations L and Q by collecting data on water level, rainfall, and pH, which were obtained by direct observation through the telemetry monitoring system shown in Figure 2.

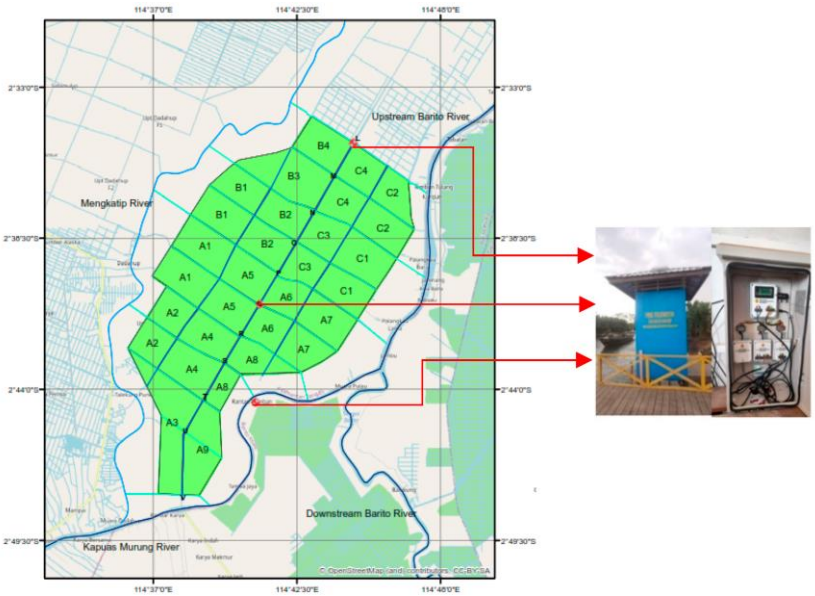


**Figure 2.** Monitoring Telemetry System Dadahup Swamp Irrigation.

### *2.3. Characteristics of Dadahup Swamp Irrigation Area*

Hydro-topography is the relationship between water table elevation and land elevation which is a factor in determining the type classification of swamp irrigation areas is shown in Figure 3 [7]. The Dadahup Swamp Irrigation Area falls into categories C and D where the tidal water level never inundated the land elevation so that the main source of water is rainfall which is included in the non-tidal swamp category shown in Figure 4. [8]. The characteristics of the soil which is dominated by pyrite peat soil can reduce water quality and have a negative impact on rice growth [9]. The polder water system is one of the solutions for the development of the Dadahup Swamp irrigation area by utilizing rainfall as a water source by isolating the land which is regulated through the operation of gate buildings in the north, east, west, and south [10].

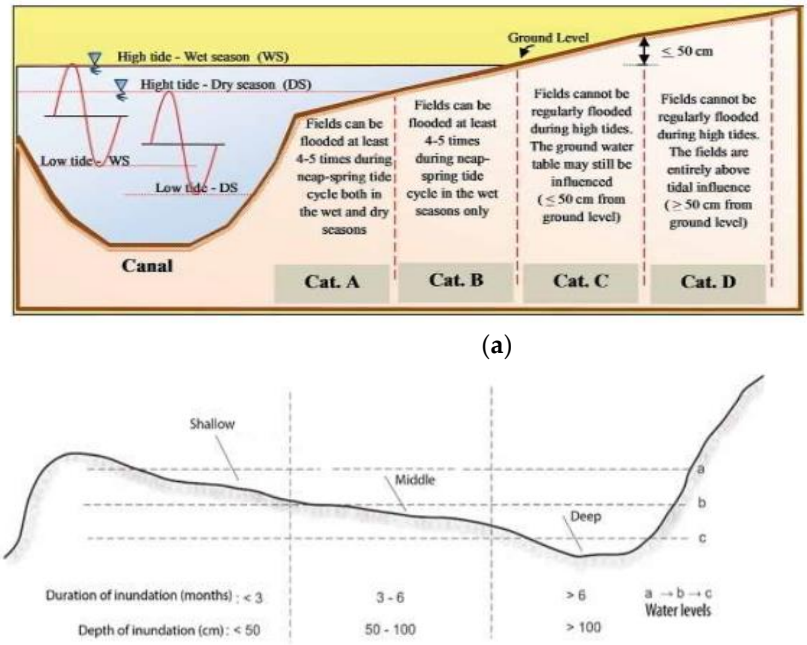


**Figure 3.** (**a**) Tidal Swamp Hydro-topography dan (**b**) Non-Tidal swamp Hydro-topography.

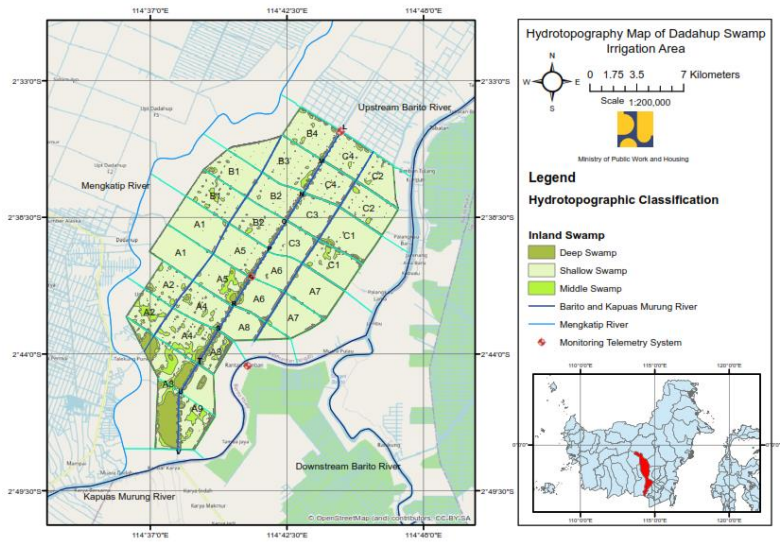


**Figure 4.** Hydro-topography Map of Dadahup Swamp Irrigation Area.

### *2.4. Water Quantity and Quality*

The tidal influence of the estuary and the upstream discharge of the Barito River can affect the water level at the intake channel of the Dadahup Swamp Irrigation Area with a distance of up to 158 km to the upstream of the river [11]. Dadahup Irrigation Area is included in the wet category of climate types B and E where the rainy season occurs from May to October and the dry season occurs from November to April. Swamp soil characteristics are influenced by the presence of pyrite formed from marine deposits containing organic matter and sulfate-reducing bacteria. Oxidation of pyrite can cause high acidity which produces sulfuric acid and jarosite minerals that reduce pH concentration and interfere with plant growth [12].

## 3. Result and Discussion

### *3.1. Water Quantity Dynamics Profile*

The dynamics of water quantity will illustrate the profile of the relationship between rainfall and water level during the dry and wet seasons at point L and point Q in the main primary channel shown in Figures 5 and 6.

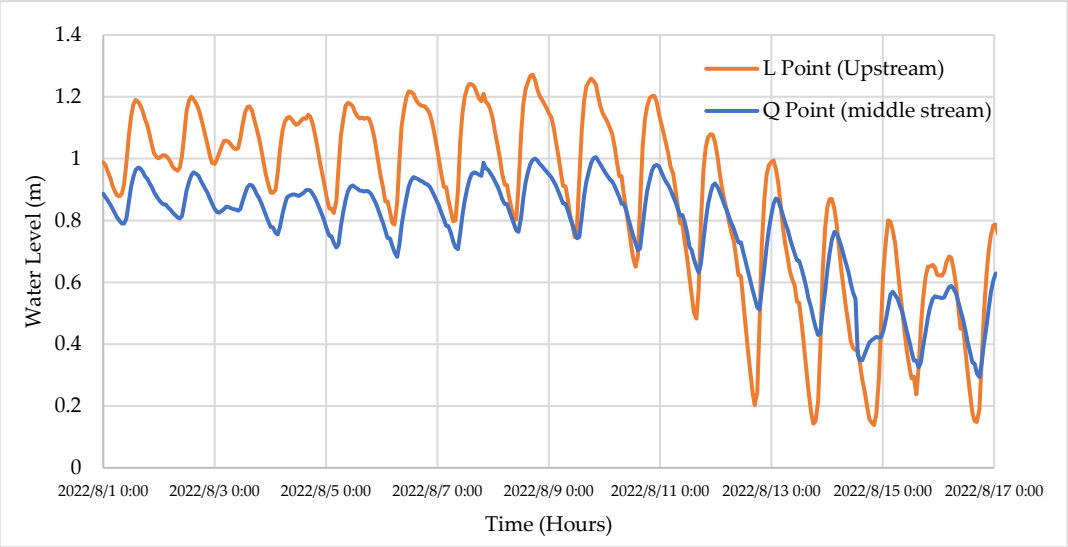


**Figure 5.** Water Level Dynamics Profile in the Dry Season in the Upper and Middle Sections of the Dadahup Swamp Irrigation Area.

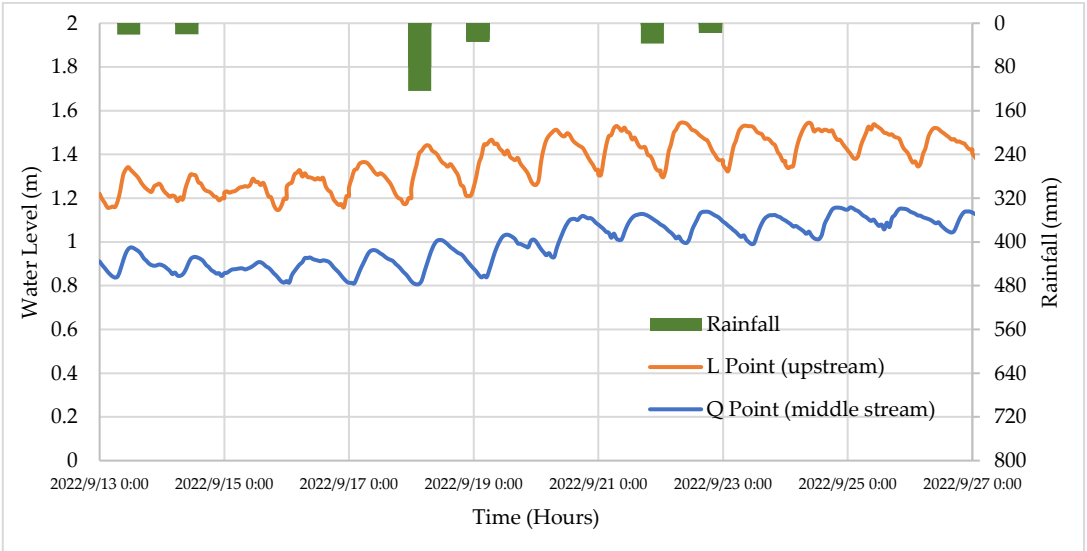

**Figure 6.** Water Level Dynamics Profile in the Rainy Season in the Upper and Middle Sections of the Dadahup Swamp Irrigation Area.

Based on the results of the description of the dynamic profile of the water level at points L and Q for the dry season and the rainy season, it shows that there was a change in the water level elevation influenced by rainfall with an average increase of 0.3 m which is shown in Table 1.

**Table 1.** Changes in Water Level during Dry and Rainy Season at Points L and Q.

| No | Point | Season | Water Level (m) |
|---|---|---|---|
| 1 | L | Dry | 1.2 |
| 2 | Q | | 0.9 |
| 3 | L | Rain | 1.5 |
| 4 | Q | | 1.2 |

*3.2. Water Quality Dynamics Profile*

The water quality dynamics will illustrate the relationship profile of pH during the dry and wet seasons. The results of the water quality dynamics profile at point L upstream and point Q in the middle of the Dadahup Swamp Irrigation Area during the dry and wet seasons are shown in Figures 7 and 8.

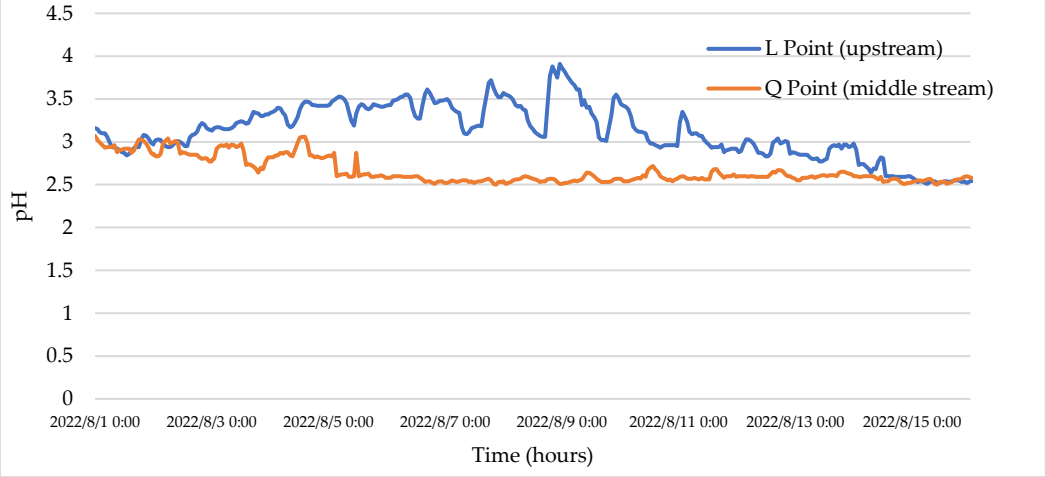


**Figure 7.** Water Quality Dynamics Profile in the Dry Season in the Upper and Middle Sections of the Dadahup Swamp Irrigation Area.

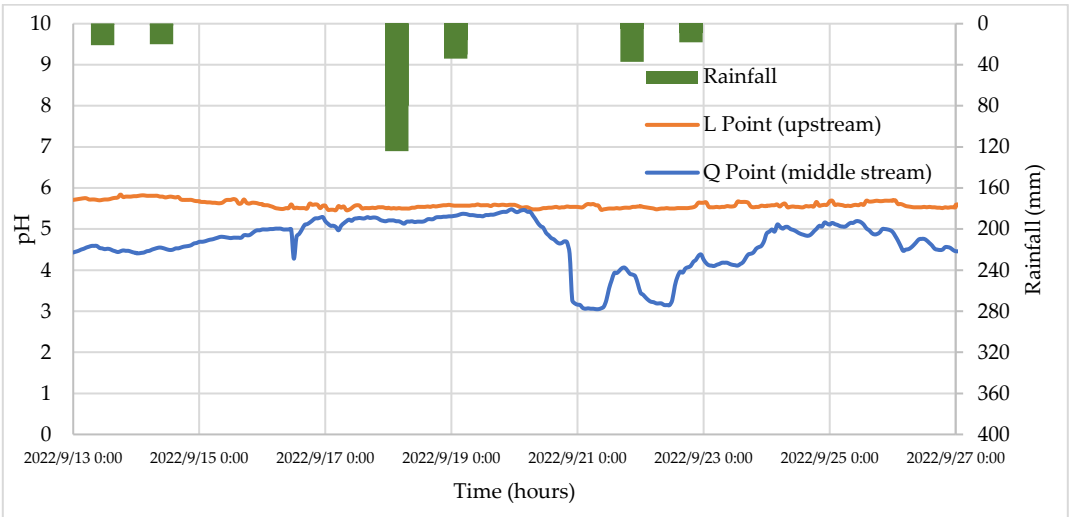

**Figure 8.** Water Quality Dynamics Profile in the Rainy Season in the Upper and Middle Sections of the Dadahup Swamp Irrigation Area.

Based on the results of the description of the dynamic profile of water quality, there was a change in pH value influenced by rainfall with an average increase reaching level 3 which is shown in Table 2.

**Table 2.** Changes in pH Values during Dry and Rainy Seasons in the Upper and Middle Sections of Dadahup Irrigation Area.

| No | Point | Season | pH |
|---|---|---|---|
| 1 | L | Dry | 3.91 |
| 2 | Q | | 3.07 |
| 3 | L | Rain | 5.84 |
| 4 | Q | | 5.48 |

## 4. Conclusions

The results explained that the pH value and water level elevation increased as a result of being influenced by rainfall and became the basis for optimizing the operation and maintenance of the Dadahup Irrigation network by utilizing a telemetry monitoring system.

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## References

1. Santosa, E. Percepatan Pengembangan Food Estate Untuk Meningkatkan Ketahanan Dan Kemandirian Pangan Nasional. *Risal. Kebijak. Pertan. DAN Lingkung. Rumusan Kaji. Strateg. Bid. Pertan. dan Lingkung.* **2015**, *1*, 80. https://doi.org/10.20957/jkebijakan.v1i2.10290.
2. Arif, M.I.; Legono, D.; Luknanto, D. Study on the Performance of the Hydraulics System Planning of Swampy Irrigation Area of Dadahup, Kapuas District, Central Kalimantan Province. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *930*, 1–10. https://doi.org/10.1088/1755-1315/930/1/012049.
3. Arif, M.I.; Legono, D.; Luknanto, D.; Wignyosukarto, B.; Marpaung, M.F. Behavior of Flow of Channel Network of Dadahup Swampy Irrigation Area. In *IOP Conference Series: Earth and Environmental Science*; IOP Publishing: Bristol, UK, 2022; Volume 1091, p. 012035. https://doi.org/10.1088/1755-1315/1091/1/012035.
4. Karya, V. Laporan Akhir SID Rehabilitasi dan Peningkatan Jaringan Irigasi Rawa Blok A. 2020.
5. Setiadi, D.; Muhaemin, M.N.A. Penerapan Internet of Things (IoT) Pada Sistem Monitoring Irigasi (SMART IRIGASI). *J. Infotronik* **2018**, *2*, 95–98.
6. Zevri, A.; Rahardjo, A.P.; Legono, D. Swamp Water Parameter Dynamics Induced by Rainfall and Tides in Dadahup Irrigation Area , Kalimantan. In *IOP Conference Series: Earth and Environmental Science*; IOP Publishing: Bristol, UK, 2022; pp. 1–10. https://doi.org/10.1088/1755-1315/1105/1/012013.
7. Istianto, H.; Bernard, R.; Suryadi, F.X. Improving the performance of tidal irrigation through the water management, (study case gandus Palembang, South Sumatra). In *Proceedings–International Association for Hydro-Environment Engineering and Research (IAHR)-Asia Pacific Division (APD) Congress: Multi-Perspective Water for Sustainable Development, IAHR-APD 2018*; 2018; Volume 1, pp. 677–685.
8. Wignyosukarto, B.S. Konsep Pengembangan Pola Tata Air Lahan Gambut. *Forum Tek.* **2000**, *24*, 342–357.
9. Purboseno, S.; Suparyanto, T.; Hidayat, A.A.; Pardamean, B. A Hydrodynamic Analysis of Water System in Dadahup Swamp Irrigation Area. In Proceedings of the *2021 1st International Conference on Computer Science and Artificial Intelligence (ICCSAI)*, Jakarta, Indonesia, 28 October 2021; pp. 400–406. https://doi.org/10.1109/iccsai53272.2021.9609729.
10. Noor, M.; Anwar, K.; Kartiwa, B. Sistem Polder untuk Pengembangan Pertanian Berkelanjutan di Lahan Rawa Lebak. 2017, 22–38.
11. Suriadikarta, D.A. Teknologi Pengelolaan Lahan Rawa Berkelanjutan: Studi Kasus Kawasan Ex PLG Kalimantan Tengah. *J. Sumberd. Lahan* **2012**, *6*, 45–54. https://doi.org/6301.
12. Blunden, B.; Indraratna, B. Pyrite Oxidation Model for Assessing Ground-Water Management Strategies in Acid Sulfate Soils. *J. Geotech. Geoenvironmental Eng.* **2001**, *127*, 146–157. https://doi.org/10.1061/(asce)1090-0241(2001)127:2(146).