Agriculture land suitability of tidal swammy area at Palingkau Irrigation Area in Central Kalimantan Province for national food estate program

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Abstract. Agriculture plays an important role in Indonesia development. Between the years 2020 - 2024, the government targets food security on sustainable development goals. Food estates have been made in several areas. However, there are constraints such as peatland and low elevation. Various irrigation systems developed by inhabitants and government called Handil, the traditional water management system applied to irrigate rice fields using tidal river system. One of the Handil in Central Kalimantan is called Handil Rakyat Palingkau in Kapuas which can control irrigation area for around 1397ha. Agricultural land suitability analysis is needed to ensure land suitability based on land quality in requirements and planning. In this study, land analysis was determined using FAO parameters which were analyzed based on temperature, soil type, soil nutrient retention, hydro-topography, safe from flooding, and water quality. The results showed that the relevant aspects for rice were salinity, peat thickness, inundation, TDS, pyrite depth, and hydro topography. However, some aspects are unsuitable for rice that need more attention, such as pH, temperature, and soil nutrient retention.

Keywords: Land suitability, agriculture, water quality, tidal river system

1. Introduction
The Indonesian government has programmed to build an irrigation network covering an area of 500 thousand hectares and rehabilitate an irrigation area of 2.5 million hectares to support national food security. One of the programs is the national food estate by building an integrated area in Central Kalimantan Province with 165 thousand hectares. One of the areas included in the food estate is the Handil Rakyat Palingkau Irrigation Area, with an area of 1397 Ha. Administratively, the area of Handil Rakyat Palingkau Irrigation Area is located in Kapuas Regency, Central Kalimantan Province which consists of traditional Handil canals namely Handil Mampai, Lumbah, Jaharap, Mangkatip, Madang, Bangkinang and Putat. In some of these channels, people still use it as water transportation, such as traditional boats. Handil is a traditional water management system applied to irrigate rice fields using a tidal river system based on the construction history. Canals wide within 25 meters and about 2 kilometers
long are made to serve farmland’s irrigation. During high tides, freshwater enters the canals from Kapuas Murung River, whereas dirty water drains and flow back to the river during low tides. Considering that the area is an area that has characteristics of peat swampland, an analysis of the land suitability of the area is needed for agricultural activities. Land suitability is an essential description of the suitability level of a land plot for a particular use [1]. In agriculture, the land requirement is the suitability of a plot of land as a medium for crop growth. This suitability will later be classified based on the quality of land with the desired land use requirements. In this study, the land will be analyzed based on the designation plan as agricultural land by analyzing the aspects of temperature, soil nutrient retention, hydro topography, safe from flooding, even water and soil quality such as pH, salinity, and Total Dissolved Solid (TDS) levels. This land suitability analysis will be useful as a reference in planning construction and agricultural activities.

![Figure 1. Location of the study area in the Central Kalimantan Province, Indonesia](image)

2. Material and Method

2.1. Agricultural suitability system

Land suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvements. The process of land suitability classification is the appraisal and grouping of specific areas of land in terms of their suitability for defined use (FAO, 1976). In this study, the classification structure of land suitability also is arranged based on FAO land suitability classification consisting of four categories are recognized as Orders, Classes, Subclasses, and Units. Land suitability Orders reflecting kinds of suitability, land suitability Classes reflecting degrees of suitability within Orders, land suitability Subclasses reflecting kinds of limitation or main kinds of improvement measures required within Classes, and land suitability Units reflecting minor differences in required management within Subclasses. Land suitability Orders indicate land assessment as suitable (S) or unsuitable (N) for the user under consideration. Land suitability Classes reflect degrees of suitability. Three Classes are recognized within the Order Suitable, as can often be recommended, the following names and definitions may be appropriate in a qualitative classification as Class S1 (Highly Suitable), Class S2 (Moderately Suitable), and Class S3 (Marginally suitable) [2-7]. Land suitability classification for rice crops in the tidal area can be derived based on land characteristics (Table 1) [8,9] and another requirement for the crop (Table 2) [10].
Table 1. Land suitability for rice crop in the tidal area (Oryza Sativa)

| Land characteristics          | S1     | S2        | S3        | N     |
|-------------------------------|--------|-----------|-----------|-------|
| Temperature (ºC)              | 25 – 28| > 28 - 30 | > 30 - 33 | > 33  |
| Peat thickness (cm)           | < 50   | 50 - 100  | 100 - 150 | > 150 |
| pH                            | 5.50 – 7.00 | 5.00 - 5.50 | < 5.00    | -     |
| Clay CEC (cmol/kg)            | > 16   | 5 - 16    | < 5       | -     |
| Base Saturation (%)           | > 35   | 20 - 35   | < 20      | -     |
| Organic C (%)                 | > 1.20 | 0.80 - 1.20 | < 0.80   | -     |
| Toxicity (‰)                 | < 4    | 4 - 6     | 6 - 8     | > 8   |
| Flood hazard (fh)             | < 25   | 25 - 50   | 50 - 100  | > 100 |

Table 2. Another requirement for rice crops in the tidal area

| Land characteristics          | Suitability value |
|-------------------------------|-------------------|
| TDS (mg/L)                    | < 2000            |
| Pyrite Depth (cm)             | < 50              |
| Hydro-topography Category A & B|                   |
| Soil Nutrient                 |                   |
| K (cmol/kg)                   | 0.40 – 0.50       |
| Na (cmol/kg)                  | 0.40 – 0.70       |
| Ca (cmol/kg)                  | 6.00 – 10.00      |
| Mg (cmol/kg)                  | 1.10 – 2.00       |

2.2. Digital Image Processing
This study uses QGIS to create a map layout and overlay the map from the boundaries to each parameter. QGIS is a free and open-source cross platform desktop geographic information system (GIS) application that supports viewing, editing, and analyzing geospatial data [11]. pH, which is taken in several points of the area. Inverse Distance Weighted (IDW) is used as a method of interpolation that estimates cell values by averaging the values of sample data points in the neighbourhood of each processing cell. The closer the point is to the center of the cell being estimated, the more influence, or weight, it has in the averaging process. This method assumes that the variable being mapped decreases in effect with distance from its sample location.

3. Result and Discussion
In this study, there are hydro topography maps and peat thickness maps to analyze the suitability. Some aspects were tested during high tide conditions in the channel section, in the rice fields for water quality and soil. Parameters for water quality and soil quality requirements analyzed included Pyrite depth, pH, temperature, salinity, inundation, nutrient retention of soil, and TDS.
3.1. Land suitability evaluation for agriculture based on hydro-topography categories
The identification of hydro-topography categories is the first step in delineating water management zones. Hydro-topography can be defined as the field elevation related to a high river or canal water level at the nearest open water or intake point and is expressed by the number of tidal irrigation during the wet and dry seasons [8].

Figure 2. Hydro topography map

The following hydro topography categories are identified into four categories. A Category is tidal irrigated areas in both wet and dry seasons. B Categories are tidal irrigated areas only in the wet season. C Categories are areas above < 0.50 m the average high water level in the wet season. D Categories are high areas that are water levels independent from the tidal effect. Based on the Hydro topography of Handil Rakyat Palingkau Irrigation Area, it shows that most of the areas are in Category B, where the area is suitable for rice crops.

3.2. Land suitability evaluation for agriculturally based on peat thickness
The peat thickness from the surface in swampy areas is also important in determining agricultural development suitability. Based on the peat thickness map above, it can be seen that Handil Rakyat Palingkau Irrigation Area has four thickness categories. Most areas are classified as Highly Suitable (S1) because the peat thickness is under 50cm.
3.3. Land suitability evaluation for agriculture based on Pyrite depth

Pyrite (FeS$_2$) is a mineral that is often found in swamp areas, especially tidal swamps. Pyrite that is behind a layer of peat or mineral soil that is waterlogged is safe for plants. However, if pyrite is exposed and then oxidised with air (O$_2$) it becomes very dangerous because it causes severe soil acidity so that plants such as rice will be difficult to survive. In the field, pyrite can be detected accurately using hydrogen peroxide (H$_2$O$_2$) solution. The soil suspected to contain pyrite was dripped with peroxide. Soils contain pyrite when froth or explosive foam comes out. The more foam formed, the higher the pyrite content in the soil. The land is said to be potential if the depth of pyrite is more than 50 cm from the soil surface, and the possibility of production constraints is estimated to be small [12]. Based on the test result, the areas are suitable for rice crops.
### Table 3. Pyrite Depth

| Handil Channel | Pyrite Depth (cm) | Handil Channel | Pyrite Depth (cm) |
|----------------|-------------------|----------------|-------------------|
| Mampai Muara   |                   |                |                   |
| a              | 110.00            | a              | 110.00            |
| b              | 110.00            | b              | 135.00            |
|                 | 85.00             | c              | 135.00            |
|                 | 95.00             | d              | 140.00            |
| Mampai Kiri    |                   |                |                   |
| a              | 110.00            | a              | 115.00            |
| b              | 110.00            | b              | 135.00            |
| c              | 120.00            | c              | 125.00            |
| d              | 165.00            | d              | 110.00            |
| Mampai Kanan   |                   |                |                   |
| a              | 110.00            | a              | 105.00            |
| b              | 110.00            | b              | 105.00            |
|                 | 110.00            | c              | 165.00            |
|                 | 125.00            | d              | 130.00            |
| Lumbah Muara   |                   |                |                   |
| a              | 110.00            |                |                   |
| b              | 110.00            |                |                   |
|                 | 115.00            |                |                   |
|                 | 100.00            |                |                   |
|                 | 95.00             |                |                   |
| Lumbah Kiri    |                   |                |                   |
| a              | 110.00            |                |                   |
| b              | 120.00            |                |                   |
| c              | 95.00             |                |                   |
| d              | 130.00            |                |                   |
| Lumbah Kanan   |                   |                |                   |
| a              |                   |                |                   |
|                 | 110.00            |                |                   |
|                 | 120.00            |                |                   |
|                 | 95.00             |                |                   |

3.4. Land suitability based on flood hazard

The inundation in rice cultivation makes the plants grow better and gives a high yield. However, excessive inundation will affect the plant yield, if the inundation is more than 25 cm. Depend on a survey, the inundation of Handil Rakyat Palingkau Irrigation Area is safe from flood hazards; therefore it is classified as Highly Suitable (S1) for rice crops.

### Table 4. Inundation water on rice field

| Handil Channel | Inundation (cm) | Handil Channel | Inundation (cm) |
|----------------|-----------------|----------------|-----------------|
| Mampai Muara   |                 |                |                 |
| a              | 20.00           | a              | 25.00           |
| b              | 20.00           | b              | 20.00           |
| Mampai Kiri    |                 |                |                 |
| a              | 20.00           | c              | 2.00            |
| b              | 15.00           | d              | 5.00            |
| c              | 5.00            | a              | 25.00           |
| d              | 15.00           | b              | 10.00           |
| Mampai Kanan   |                 |                |                 |
| a              | 20.00           | c              | 20.00           |
| b              | 2.00            | d              | 15.00           |
| Lumbah Muara   |                 |                |                 |
| a              | 25.00           | a              | 10.00           |
| b              | 25.00           | b              | 25.00           |
| Lumbah Kiri    |                 |                |                 |
| a              | 5.00            |                |                 |
| b              | 5.00            |                |                 |
| a              | 25.00           |                |                 |
| Lumbah Kanan   |                 |                |                 |
| a              | 7.00            |                |                 |
| b              | 7.00            |                |                 |
| c              | 10.00           |                |                 |
| d              | 5.00            |                |                 |

Max: 165.00
Min: 85.00
Average: 115.19
3.5. *Land suitability evaluation for agriculture based on the acidity (pH)*

The potential of hydrogen (pH) is a scale to specify the acidity of the solution. Plants usually grow at pH 5.5 for peat soil and pH 6.5 for mineral soil. Based on the survey and pH test obtained, Handil Rakyat Palingkau Irrigation Area is classified as Not Suitable (N) because the average pH is under 5.
Table 5. Acidity (pH) in each test location (Handil channel, rice field and soil)

| Handil Channel | pH     | Handil | Rice field | Soil |
|----------------|--------|--------|------------|------|
| Mampai Muara   | a      | 4.47   | 4.50       | 4.40 |
|                | b      | 4.68   | 4.50       | 4.88 |
|                | a      | 4.63   | 4.90       | 5.00 |
|                | b      | 3.12   | 3.70       | 4.40 |
|                | c      | 3.16   | 4.40       | 4.48 |
|                | d      | 3.56   | 4.78       | 4.96 |
| Mampai Kiri    | a      | 3.15   | 4.40       | 5.00 |
|                | b      | 3.43   | 3.66       | 4.08 |
|                | c      | 3.30   | 4.64       | 3.73 |
|                | d      | 3.30   | 4.64       | 3.73 |
| Mampai Kanan   | a      | 5.25   | 4.34       | 4.23 |
|                | b      | 4.96   | 5.00       | 5.26 |
|                | a      | 4.25   | 4.11       | 5.09 |
|                | b      | 3.57   | 4.17       | 3.62 |
|                | a      | 4.56   | 4.11       | 4.90 |
| Lumbah Muara   | a      | 4.67   | 4.15       | 3.23 |
|                | b      | 5.27   | 5.30       | 4.93 |
|                | a      | 5.05   | 5.22       | 5.50 |
|                | b      | 4.81   | 4.62       | 4.64 |
| Lumbah Kiri    | a      | 4.71   | 4.41       | 5.50 |
|                | b      | 4.53   | 4.62       | 5.50 |
|                | a      | 4.65   | 5.03       | 5.31 |
|                | b      | 4.65   | 4.75       | 5.05 |
|                | c      | 5.04   | 7.18       | 5.04 |
|                | d      | 5.05   | 4.40       | 5.24 |
| Lumbah Kanan   | a      | 5.02   | 5.78       | 5.92 |
|                | b      | 4.05   | 5.17       |     |
| Jawarap        | a      | 5.27   | 6.18       | 5.92 |
|                | b      | 3.12   | 3.66       | 3.62 |
|                | c      | 4.73   |            |     |
|                | d      | 4.56   |            |     |
| Mangkatip      | a      | 4.65   | 5.03       | 5.31 |
|                | b      | 4.65   | 4.75       | 5.05 |
|                | c      | 5.04   | 6.18       | 5.04 |
|                | d      | 5.05   | 4.40       | 5.24 |
| Madang         | a      | 5.02   | 5.78       | 5.92 |
|                | b      | 4.05   | 5.17       |     |

Max  5.27  6.18  5.92
Min  3.12  3.66  3.62
Average  4.42  4.73  4.75

3.6. Land suitability evaluation for agriculture based on temperature
Temperature is related to solar radiation, and temperature availability on the earth’s surface determines the types of plants that can be grown in that place. Temperature is suitable for rice in a swampy tidal field if the temperature is between 21°C to 33°C. From the test result also from temperatures maps, it could be seen that there are three to four categories for temperature suitability. Based on the temperature average, the mean temperature of Handil Rakyat Palingkau Irrigation Area is classified as Marginally Suitable (S3) for rice crops.
Table 6. The temperature in each test location (Handil channel, rice field, and soil)

| Handil Channel | Temperature (°C) | Handil | Rice Field | Soil |
|----------------|------------------|--------|------------|------|
| Mampai Muara a | 30.50            | 32.70  | 30.50      |
| Mampai Muara b | 32.00            | 30.40  | 32.70      |
| Mampai Kiri a  | 31.00            | 30.90  | 29.90      |
| Mampai Kiri b  | 30.00            | 29.90  | 29.90      |
| Mampai Kiri c  | 29.40            | 31.60  | 31.60      |
| Mampai Kiri d  | 29.20            | 32.00  | 32.80      |
| Mampai Kanan a | 28.80            | 29.70  | 32.30      |
| Mampai Kanan b | 29.60            | 31.00  | 31.00      |
| Lumbah Muara a | 32.80            | 30.80  | 32.80      |
| Lumbah Muara b | 30.50            | 31.20  | 33.40      |
| Lumbah Kiri a  | 30.00            | 34.10  | 33.20      |
| Lumbah Kiri b  | 31.80            | 34.60  | 31.50      |
| Lumbah Kiri c  | 31.20            | 31.20  | 31.60      |
| Lumbah Kanan b | 29.60            | 28.30  | 30.40      |
| Lumbah Kanan c | 28.80            | 28.30  | 30.30      |
| Lumbah Kanan d | 28.40            | 27.60  | 27.50      |
| Jaharap a      | 30.00            | 33.20  | 30.00      |
| Jaharap b      | 29.90            | 29.90  | 32.40      |
| Jaharap c      | 30.50            | 29.10  | 33.80      |
| Jaharap d      | 29.40            | 31.60  | 33.00      |
| Mangkatip a    | 29.50            | 27.40  | 29.20      |
| Mangkatip b    | 31.00            | 27.40  | 29.10      |
| Mangkatip c    | 30.50            | 29.40  | 29.40      |
| Mangkatip d    | 27.20            | 26.90  | 27.90      |
| Madang a       | 27.50            | 28.40  | 29.60      |
| Madang b       | 27.40            | 31.80  | 31.03      |

Figure 7. Temperature maps

3.7. Land suitability evaluation for agriculture based on salinity

Salinity is the concentration of dissolved mineral salt in water or soils on a unit volume or weight basis (dS/m). A high salinity concentration will inhibit the uptake of water and nutrients by plants and increase osmotic pressure. In particular, a high salt concentration will poison plants, mainly by Na+ and Cl- ions. The critical amount of salinity for rice plants is 4 dS/m or 2560 mg/L. Based on the salinity test result, Handil Rakyat Palingkau Irrigation Area is classified as Highly Suitable (S1) because there is no number above 2560 mg/L.
Table 7. Salinity in each test location (Handil channel, rice field, and soil)

| Handil Channel | Salinity (mg/L) | Handil | Rice Field | Soil |
|----------------|-----------------|--------|------------|------|
| Mampai Muara   | a 32.40         | 25.60  | 51.50      |
|                | b 38.20         | 30.60  | 30.50      |
|                | a 38.50         | 22.80  | 45.80      |
| Mampai Kiri    | b 182.00        | 425.00 | 119.00     |
|                | c 157.00        | 53.00  | 48.40      |
|                | d 57.60         | 34.00  | 65.90      |
| Mampai Kanan   | a 113.00        | 92.10  | 124.00     |
|                | b 162.00        | 170.00 | 256.00     |
| Lumbah Muara   | a 27.40         | 46.00  | 27.40      |
|                | b 40.50         | 17.40  | 69.70      |
| Lumbah Kiri    | a 56.90         | 43.80  | 37.60      |
|                | b 97.60         | 92.20  | 132.00     |
|                | a 48.60         | 19.80  | 46.00      |
| Lumbah Kanan   | b 29.20         | 35.80  | 30.70      |
|                | c 43.80         | 30.20  | 32.40      |
|                | d 43.60         | 40.10  | 445.00     |
| Jaharap        | a 29.70         | 30.30  | 29.70      |
|                | b 30.30         | 32.50  | 27.60      |
|                | c 32.90         | 47.70  | 22.90      |
|                | d 60.50         | 33.20  | 22.90      |
| Mangkatip      | a 40.10         | 20.10  | 58.10      |
|                | b 40.70         | 23.10  | 55.50      |
| Madang         | c 34.40         | 131.00 | 62.70      |
|                | d 57.00         | 33.40  | 72.10      |
|                | a 22.00         | 21.90  | 109.00     |
|                | b 21.00         | 19.10  |            |
| Max            | 182.00          | 425.00 | 445.00     |
| Min            | 21.00           | 17.40  | 22.90      |
| Average        | 59.11           | 60.41  | 80.90      |

Figure 8. Salinity maps

3.8. Land suitability evaluation for agricultural based on Total Dissolved Solid (TDS)

Total Dissolved Solids (TDS) are the amount of dissolved solid in water. TDS contains the number of organic and inorganic particles reported in parts per million (mg/L). The rice plant can tolerate a high concentration of TDL but if it too much, it can increase turbidity and inhibit sunlight's penetration and affect the process of photosynthesis inside the water (Effendi, 2003). Two thousand mg/L is the maximum amount of TDS which allows for the plant to grow optimally. Based on the TDS test result, Handil Rakyat Palingkau Irrigation Area is classified as Suitable because there is no above 2000 mg/L.
### Table 8. TDS in each test location (Handil channel, rice field, and soil)

| Handil Channel | TDS (mg/L) | |
|----------------|------------|--|
|                | Channel    | Rice Field | Soil |
| Mampai         | a           | 38.30      | 25.20 | 68.90 |
|                | b           | 46.40      | 33.80 | 35.60 |
|                | a           | 48.10      | 22.00 | 614.00|
| Mampai         | b           | 267.00     | 612.00| 170.00|
| Kiri           | c           | 230.00     | 70.60 | 14.10 |
|                | d           | 95.20      | 39.70 | 92.20 |
| Mampai         | a           | 164.00     | 131.00| 187.00|
| Kanan          | b           | 236.00     | 246.00| 172.00|
| Lumbah         | a           | 52.70      | 59.20 | 27.80 |
| Muara          | b           | 48.60      | 10.70 | 92.40 |
| Lumbah         | a           | 36.80      | 55.40 | 44.90 |
| Kiri           | b           | 141.00     | 132.00| 192.00|
|                | a           | 55.70      | 15.00 | 61.70 |
| Lumbah         | b           | 48.60      | 44.20 | 36.60 |
| Kanan          | c           | 56.90      | 34.30 | 37.30 |
|                | d           | 56.50      | 50.00 | 59.40 |
|                | a           | 33.20      | 33.80 | 60.50 |
| Jaharap        | b           | 34.20      | 36.20 | 20.50 |
|                | c           | 38.40      | 60.50 | 19.70 |
|                | d           | 83.30      | 39.10 | 19.70 |
|                | a           | 53.60      | 16.80 | 83.00 |
|                | b           | 42.50      | 22.70 | 76.90 |
| Mangkatip      | c           | 41.70      | 143.00| 86.20 |
|                | d           | 78.10      | 10.50 | 102.00|
| Madang         | a           | 20.80      | 28.10 | 150.00|
|                | b           | 20.00      | 13.20 | 14.10 |
| Max            |             | 267.00     | 612.00| 614.00|
| Min            |             | 20.00      | 10.50 | 14.10 |
| Average        |             | 79.52      | 76.35 | 100.98|

### Figure 9. TDS maps

3.9. **Land suitability evaluation for agriculturally based on Soil Nutrient**

In addition to field data and maps, laboratory tests were also carried out to determine nutrient retention in the soil for the suitability of rice plants in swamp areas. Test sampling is carried out at two depth points. Table 9 and 10 show that for C-organic, clay CEC, and base saturation are classified as suitable and for chemical content in the form of K, Ca, and Mg it still does not meet the requirements.
Table 9. Nutrient Retention Suitability

| No | Location      | Depth (cm) | C-Organic (%) | Clay CEC (cmol / kg) | Base Saturation (%) |
|----|---------------|------------|---------------|----------------------|---------------------|
| 1  | Mampai Kiri   | 0 - 20     | 4.85          | 16.38                | 52.93               |
| 2  | Mampai Kiri   | 20 - 40    | 4.16          | 44.50                | 14.79               |
| 3  | Mampai Kanan  | 0 - 20     | 4.85          | 43.27                | 19.57               |
| 4  | Mampai Kanan  | 20 - 40    | 2.70          | 30.71                | 29.08               |
| 5  | Lumbah Kiri   | 0 - 20     | 5.23          | 41.11                | 44.71               |
| 6  | Lumbah Kiri   | 20 - 40    | 2.14          | 26.98                | 58.41               |
| 7  | Lumbah Kanan  | 0 - 20     | 6.07          | 53.48                | 25.37               |
| 8  | Lumbah Kanan  | 20 - 40    | 1.06          | 26.93                | 42.67               |
| 9  | Jaharap       | 0 - 20     | 2.41          | 33.94                | 21.48               |
| 10 | Jaharap       | 20 - 40    | 1.26          | 34.88                | 17.78               |
| 11 | Mangkatip     | 0 - 20     | 2.75          | 29.85                | 27.4                |
| 12 | Mangkatip     | 20 - 40    | 1.32          | 24.79                | 36.87               |

Average: 3.23, 33.90, 32.59
Suitability: S1 S1 S2

Table 10. Nutrient Retention based on soil research criteria by Indonesian Soil Research Institute (2009)

| No | Location      | Depth (cm) | K (cmol / kg) | Na (cmol / kg) | Ca (cmol / kg) | Mg (cmol / kg) |
|----|---------------|------------|---------------|----------------|----------------|----------------|
| 1  | Mampai Kiri   | 0 - 20     | 0.16          | 0.64           | 0.76           | 7.11           |
| 2  | Mampai Kiri   | 20 - 40    | 0.06          | 0.49           | 0.57           | 5.46           |
| 3  | Mampai Kanan  | 0 - 20     | 0.11          | 0.58           | 1.09           | 6.69           |
| 4  | Mampai Kanan  | 20 - 40    | 0.13          | 0.41           | 1.05           | 7.34           |
| 5  | Lumbah Kiri   | 0 - 20     | 0.16          | 0.40           | 2.33           | 15.49          |
| 6  | Lumbah Kiri   | 20 - 40    | 0.16          | 0.37           | 1.26           | 13.97          |
| 7  | Lumbah Kanan  | 0 - 20     | 0.16          | 0.70           | 1.82           | 10.89          |
| 8  | Lumbah Kanan  | 20 - 40    | 0.04          | 0.40           | 0.76           | 10.29          |
| 9  | Jaharap       | 0 - 20     | 0.16          | 0.42           | 0.78           | 5.93           |
| 10 | Jaharap       | 20 - 40    | 0.13          | 0.49           | 0.52           | 5.06           |
| 11 | Mangkatip     | 0 - 20     | 0.10          | 0.73           | 0.63           | 6.72           |
| 12 | Mangkatip     | 20 - 40    | 0.06          | 0.82           | 0.60           | 7.66           |

Average: 0.12, 0.54, 1.01, 8.55
Description: Low Sufficient Very Low High

4. Conclusion
Based on the analysis result, it can be concluded that several aspects are suitable for the rice crop. These aspects are salinity, peat thickness, inundation, TDS, Pyrite depth and hydro topography. Two aspects need more attention: pH and temperature, which are not suitable for rice crops. The temperature is too hot for the rice crop (average is more than 30 °C), and pH is too acid (average is under 5). There are also improvements in plant nutrients such as K, Ca, and Mg elements by fertilizer application. A local
rice variety can grow in this condition, but such a local rice crop can only be harvested once per year. This land suitability study will be useful in planning an agricultural area so that there are no problems during the construction of water systems or agricultural cultivation activities.

Reference
[1] Mehrjardi, R.T., Nabiollahi, K., Rasoli, L., Kerry, R., Scholten, T 2020 Land Suitability Assessment and Agricultural Production Sustainability Using Machine Learning Models MDPI
[2] FAO 1976 A framework for land evaluation Food and Agriculture Organization of the United Nations, Soils Bulletin 32. Rome: FAO
[3] FAO 1985 Guidelines: Land evaluation for irrigated agriculture Soils bulletin 55. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.
[4] FAO 1993 Guidelines for land use planning Development Series 1. Food and Agriculture Organization of the United Nations, Rome.
[5] FAO 1983 Guidelines: land evaluation for rainfed agriculture Food and Agriculture Organization of the United Nations, Soils Bulletin 52. Italy: Rome
[6] FAO 2007 Land evaluation towards a revised framework Food and Agriculture Organization of the United Nations. Italy; Rome.
[7] FAO 1983 Guidelines: land evaluation for rainfed agriculture Soils Bulletin 52. Food and Agriculture Organization of the United Nations. Italy; Rome.
[8] Suryadi, F.X 1996 Soil and Water Management Strategies for Tidal Lowlands in Indonesia. Proefschrift Technische Universiteit Delft.
[9] Ritung, Sofyan 2007 Land Suitability Evaluation with Case Map of Aceh Barat District. Indonesian Soil Research Institute and World Agroforestry Centre. Bogor, Indonesia
[10] Indonesian Soil Research Institute 2009 Analisis Kimia Tanah, Tanaman, Air dan Pupuk. (in Bahasa). Balai Penelitian Tanah.
[11] Al-Taani, A., Al-husban, Y., Farhan, I 2020 Land suitability evaluation for agricultural use using GIS and remote sensing techniques: The case study of Ma’an Governorate, Jordan.
[12] Suastika, I.W., Hartatik, W., Subiksa, I.G.M 2014 Karakteristik dan Teknologi Pengelolaan Lahan Sulfat Masam Mendukung Pertanian Ramah Lingkungan. (in Bahasa). Balai Penelitian Tanah.