Peat water quality in Block C Pulang Pisau Regency, Central Kalimantan

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Abstract. The increasing need for agricultural land has led to a shift in the cultivation of vegetation on peatland especially food crops. Agricultural activities on peatland require careful planning, appropriate technology application, and proper management due to the marginal and the fragile peatland ecosystem. Research and development are needed to evaluate the carrying capacity of environmental impacts on peatland use. This study aimed to obtain information on the water quality of peat domes, primary canals, and secondary canals of Block C, Pulang Pisau Regency. The study area is now mostly used for agricultural activities. The analysis was carried out in a descriptive qualitative manner based on water parameter testing results to assess the water quality of peat domes, primary canals, and secondary canals of each type of peatland use in Buntoi, Garung, and Kanamit Barat Village. The results indicated that five chemical parameters exceeded the water quality criteria for Class II PP No. 22/2021 namely BOD, COD, free chlorine, zinc, and lead in Buntoi. Further, in Garung, six chemical parameters exceeded the water quality criteria: DO, BOD, COD, free chlorine, lead, and copper. Meanwhile, in Kanamit Barat Village, seven chemical parameters exceeded the criteria: DO, BOD, COD, free chlorine, zinc, lead, and copper. Based on this research, therefore, agricultural activities on this peatland area should consider the natural characteristics of peat water and the selection of suitable plants.

1. Introduction

Indonesia has the largest tropical peatlands in the ASEAN region and globally with total peatland area of about 15 million hectares [1]. In Indonesia, the largest peatlands are found at Sumatera Island, followed by Kalimantan Island and Papua Island [2]. Peatland has some crucial function including production function, water storage, protective function, and economic function [2].

The growing population in Indonesia is directly proportional to the increasing need for agricultural land to meet food needs. Fulfillment of agricultural land needs can be done on mineral soils or peat soils. The potential of peatland in Indonesia to be used as agricultural land is to reach 6 million hectares [3]. The use of peatland as agricultural land has been carried out for a long time, although it is not optimal but can contribute to the provision of food for the surrounding community [4]. Agricultural development on peatlands requires careful planning, application of appropriate technology, and proper management due to its marginal and fragile ecosystem [3].
One way to develop peatland for agriculture was done through the development project of one million hectare peatland (PLG) in Central Kalimantan which based on Presidential Decree No. 82 Year 1995 [5]. The PLG project as a matter of fact was considered a failure and gave rise to various problems and negative impacts, especially in climate change and environmental damage. Peatland restoration and rehabilitation efforts have been implemented since 2016 following Government Regulation PP No. 57 Year 2016, namely the restoration of peatland ecosystems based on the peat hydrological unit (KHG). KHG is a peatland ecosystem located between two rivers, between rivers and the sea and or in swamps [6], in which peat domes and peatlands can be found.

KHG restoration can be carried out by applying restoration techniques including water canal construction system, operation of hydrological system, maintenance at site level, and applying cultivation according to the local wisdom [6]. Restoration by cultivation application must be selective, such as not close to the peat domes and upstream rivers. Water management system is done appropriately and carefully in accordance with the dynamics of the groundwater surface and carrying capacity of given peatland. Research and development activities are needed to evaluate the carrying capacity of cultivated peatland in particular KHG. This study aimed to obtain data and information on the water quality of peat domes, primary canals, and secondary canals of Block C, Pulang Pisau Regency.

2. Method

2.1. Time and research location

This research was held in September – November 2020 in three villages in Pulang Pisau Regency, Central Kalimantan Province. The three villages were Buntoi Village, Kahayan Hilir District (2°49’43” SL and 114°9’24” EL), Garung Village, Jabiren Raya District (2°37’21” SL and 114°7’1” EL), and Kanamit Barat Village, Maliku District (2°52’9”SL and 114°3’59” EL) (Figure 1). The average rainfall observed from the nearest climatological station (Palangkaraya) at 2018-2020 was 2482 mm/year, with an average number of rainy days of 200 days/year [7][8][9]. Sampling in each village was carried out in peat domes, primary canals, and secondary canals with three replications at each point. The total number of sampling points was 27 points. Water quality analysis was done at the South Kalimantan Provincial Health Laboratory in Banjarmasin.

Figure 1. Map of sampling location in Block C, Pulang Pisau Regency.
2.2. Materials
The tools used in the field sampling were cooler boxes, glass bottles, polyethylene bottles, and field measuring instruments, i.e., pH meter, conductometer, GPS. The materials used were sample preservatives, including sulfuric acid ($\text{H}_2\text{SO}_4$), nitric acid ($\text{HNO}_3$), cooler pack gel, manganese solution, alkaline solution, and aluminum foil.

2.3. Procedure
2.3.1. Water sampling. Water sampling was done by following the method according to SNI 6989.57:2008 in which surface water was sampled using the grab sampling method. Water quality parameters observed include physical and chemical parameters covering organic and metal substances.

2.3.2. Water sample preservation. The water samples were put into a glass bottle and polyethylene bottle, then preservatives were added according to the parameters to be analyzed. The water samples for COD and ammonia analysis were preserved with $\text{H}_2\text{SO}_4$. Water samples for metal analysis were preserved with $\text{HNO}_3$ and water samples for DO analysis were preserved with alkaline and manganese solution.

2.3.3. Water quality analysis. Chemical characteristics of water were analyzed at the South Kalimantan Health Laboratory (Labkesda Kal-Sel), which has been accredited. A total of 25 parameters were chosen to describe the quality of peat water at the three locations. Analysis methods carried out in the laboratory is shown in Table 1.

| No. | Parameter                  | Method                                      |
|-----|----------------------------|---------------------------------------------|
| 1   | Temperature                | SNI 06-6989.23-2005                        |
| 2   | Colour                     | SNI 06-6989.24-2005                        |
| 3   | Electric conductivity      | SNI 06-6989.1-2004                        |
| 4   | TSS                        | SNI 06-6989.3-2019                        |
| 5   | TDS                        | SNI 06-6989.27-2019                       |
| 6   | pH                         | SNI 06-6989.11-2019                       |
| 7   | Mercury (Hg)               | SNI 06-6992.2 – 2004                      |
| 8   | Fluoride (F)               | SNI 06-6989.29-2005                       |
| 9   | Hardness (CaCO$_3$)        | SNI 06-6989.12-2004                      |
| 10  | Nitrate (NO$_3$-N)         | SNI 06-2480-1991                         |
| 11  | Nitrite (NO$_2$-N)         | SNI 06-6989.9-2004                       |
| 12  | Sulphate (SO$_4$)          | SNI 6989.20:2009                         |
| 13  | Dissolved oxygen (DO)      | SNI 06-6989.14-2004                      |
| 14  | BOD                        | SNI 6989.72 :2019                        |
| 15  | COD                        | SNI 6989.2 :2019                         |
| 16  | Ammonia (NH$_3$-N)         | SNI 06-6989.30-2005                      |
| 17  | Organic matter (KMnO$_4$)  | SNI 06-6989.22-2004                      |
| 18  | Free chlorine (Cl$_2$ free) | DPD-Spectrophotometry                  |
| 19  | Iron (Fe)                  | APHA 3030 F..3120 B 22ed 2012 (ICP)      |
| 20  | Cadmium (Cd)               | APHA 3030 F..3120 B 22ed 2012 (ICP)      |
| 21  | Manganese (Mn)             | APHA 3030 F..3120 B 22ed 2012 (ICP)      |
Table 2. Peat water quality in Buntoi Village.

| Parameter               | Unit   | Peat dome | Primary canal | Secondary canal | Quality Criteria Class II |
|-------------------------|--------|-----------|---------------|-----------------|--------------------------|
| **Physics**             |        |           |               |                 |                          |
| Temperature             | °C     | 27.83     | 27.67         | 27.17           | Deviation ± 3            |
| Color                   | Pt-Co  | 187.33    | 194.67        | 191.67          | 50 (does not apply to peat water) |
| Electrical conductivity | µs/cm  | 53.30     | 66.27         | 108.87          | -                        |
| TSS                     | mg/L   | 5.67      | 3.33          | 3.33            | 50                       |
| TDS                     | mg/L   | 28.27     | 33.10         | 54.47           | 1000                     |
| **Chemical**            |        |           |               |                 |                          |
| pH                      |        | 3.66      | 3.66          | 3.40            | 6-9 (does not apply to peat water) |
| Mercury (Hg)            | mg/L   | < 0.0008  | < 0.0008      | < 0.0008        | 0.002                     |
| Parameter                  | Unit     | Peat dome | Primary canal | Secondary canal | Quality Criteria Class |
|----------------------------|----------|-----------|---------------|----------------|-----------------------|
| Fluoride (F)               | mg/L     | < 0.002   | < 0.002       | < 0.002        | 1.5                   |
| Hardness (CaCO₃)           | mg/L     | 19.30     | 29.83         | 33.33          | -                     |
| Nitrate (NO₃-N)            | mg/L     | 0.67      | 0.45          | 0.67           | 10                    |
| Nitrite (NO₂-N)            | mg/L     | < 0.0013  | < 0.0013      | < 0.0013       | 0.06                  |
| Sulfate (SO₄)              | mg/L     | 47.47     | 10.85         | 111.49         | 300                   |
| Dissolved oxygen (DO)      | mg/L     | 4.26      | 4.44          | 4.81           | 4 (minimum)           |
| BOD                        | mg/L     | 90.97     | 71.27         | 73.73          | 3                     |
| COD                        | mg/L     | 189.33    | 156.23        | 159.93         | 25                    |
| Ammonia (NH₄-N)            | mg/L     | 0.37      | 0.41          | < 0.003 - 0.171| -                     |
| Organic matter (K MnO₄)    | mg/L     | 301.11    | 287.24        | 279.53         | -                     |
| Free chlorine (Cl₂ free)   | mg/L     | < 0.002 - 0.318 | 0.16     | 0.22          | 0.03                  |
| Iron (Fe)                  | mg/L     | 0.27      | 0.59          | 0.97           | -                     |
| Cadmium (Cd)               | mg/L     | < 0.0015 - 0.0091 | < 0.0015 - 0.045 | 0.02 | 0.01           |
| Manganese (Mn)             | mg/L     | 0.01      | 0.01          | 0.03           | -                     |
| Zinc (Zn)                  | mg/L     | 0.02      | 0.05          | 0.12           | 0.05                  |
| Lead (Pb)                  | mg/L     | 0.22      | 0.29          | 0.21           | 0.03                  |
| Copper (Cu)                | mg/L     | 0.02      | 0.02          | 0.03           | 0.02                  |
| Total Nitrogen (N)         | mg/L     | 1.72      | 1.62          | 1.10           | 15                    |

**Graphs:**

A) BOD levels with maximum limit line.

B) COD levels with maximum limit line.
Figure 2. Level of BOD, COD, free chlorine, zinc, and lead in peat water in Buntoi Village. A) BOD, B) COD, C) free chlorine, D) zinc, E) lead.

3.2. Peat water quality in Garung Village
Water sampling in Garung Village was carried out in around the CIMTROP peatland management model area. The water flow starts from the peat dome in the model area, flows into primary canals, and then to secondary canals. The peat water quality in Garung Village is shown on Table 3. The result indicates that five chemical parameters exceeded the water quality criteria of Class II PP No. 22 Year 2021, namely BOD, COD, free chlorine, lead, and copper, but one parameter was less than the class II water quality criteria, namely DO (Figure 3).
### Table 3. Peat water quality in Garung Village.

| Parameter                      | Unit       | Peat dome | Primary canal | Secondary canal | Quality Criteria Class II                  |
|-------------------------------|------------|-----------|---------------|-----------------|------------------------------------------|
| **Physics**                   |            |           |               |                 |                                          |
| Temperature                   | °C         | 28.00     | 28.00         | 27.36           | Deviation ± 3                            |
| Color                         | Pt-Co Unit | 329.00    | 174.67        | 173.00          | 50 (does not apply to peat water)        |
| Electrical conductivity       | µs/cm      | 56.74     | 52.07         | 47.40           | -                                        |
| TSS                           | mg/L       | 130.33    | 13.00         | 11.67           | 50                                       |
| TDS                           | mg/L       | 28.27     | 29.37         | 23.70           | 1000                                     |
| **Chemical**                  |            |           |               |                 |                                          |
| pH                            |            | 3.67      | 3.36          | 3.84            | 6-9 (does not apply to peat water)       |
| Mercury (Hg)                  | mg/L       | < 0.0008  | < 0.0008      | < 0.0008        | 0.0002                                   |
| Fluoride (F)                  | mg/L       | < 0.002   | < 0.002       | < 0.002         | 1.5                                      |
| Hardness (CaCO₃)              | mg/L       | 33.33     | 29.83         | 33.33           | -                                        |
| Nitrate (NO₃⁻)                | mg/L       | 2.29      | 0.26          | 0.68            | 10                                       |
| Nitrite (NO₂⁻)                | mg/L       | < 0.0013  | < 0.0013      | < 0.0013        | 0.06                                     |
| Sulfate (SO₄²⁻)               | mg/L       | 8.76      | 7.12          | 9.02            | 300                                      |
| Dissolved oxygen (DO)         | mg/L       | 3.89      | 3.79          | 3.95            | 4 (minimum)                              |
| BOD                           | mg/L       | 185.30    | 62.77         | 69.10           | 3                                        |
| COD                           | mg/L       | 405.73    | 137.70        | 151.40          | 25                                       |
| Ammonia (NH₃-N)               | mg/L       | 0.10      | < 0.003       | < 0.003 - 0.553 | -                                        |
| Organic matter (KMnO₄)        | mg/L       | 574.48    | 263.60        | 282.62          | -                                        |
| Free chlorine (Cl₂ free)      | mg/L       | 0.27      | 0.35          | 0.13            | 0.03                                     |
| Iron (Fe)                     | mg/L       | 0.18      | 0.44          | 0.40            | -                                        |
| Cadmium (Cd)                  | mg/L       | 0.01      | < 0.0015 - 0.0042 | < 0.0015 - 0.0037 | 0.01                                    |
| Manganese (Mn)                | mg/L       | 0.01      | 0.02          | 0.01            | -                                        |
| Zinc (Zn)                     | mg/L       | 0.03      | 0.05          | 0.04            | 0.05                                     |
| Lead (Pb)                     | mg/L       | 0.23      | 0.34          | 0.15            | 0.03                                     |
| Copper (Cu)                   | mg/L       | 0.03      | 0.05          | 0.05            | 0.02                                     |
| Total Nitrogen (N)            | mg/L       | 2.59      | 0.78          | 1.60            | 15                                       |
Figure 3. Level of BOD, COD, free chlorine, lead, copper and DO in peat water in Garung Village. A) BOD, B) COD, C) DO, D) free chlorine, E) lead, F) copper.

3.3. Peat water quality in Kanamit Barat Village

Water sampling in Kanamit Barat Village was conducted in the village forest area adjacent to the oil palm plantation. The water flow starts from the peat dome, then flows into primary canals and then to secondary canals. The peat water quality in Kanamit Barat Village is described on Table 4. Six chemical parameters exceeded the water quality criteria of class II PP No. 22 Year 2021, namely BOD, COD, free chlorine, zinc, lead, and copper, but one parameter is less than the water quality criteria for class II, namely DO (Figure 4).
Table 4. Peat water quality in Kanamit Barat Village.

| Parameter            | Unit       | Peat dome | Primary canal | Secondary canal | Quality Criteria Class II |
|----------------------|------------|-----------|---------------|-----------------|---------------------------|
| **Physics**          |            |           |               |                 |                           |
| Temperature          | °C         | 27.30     | 27.00         | 27.00           | Deviation ± 3             |
| Color                | Pt-Co Unit | 162.0     | 236.0         | 202.3           | 50 (does not apply to peat water) |
| Electrical conductivity | µS/cm     | 75.6      | 92.7          | 74.4            | -                         |
| TSS                  | mg/L       | 34.5      | 4.0           | 8.7             | 50                        |
| TDS                  | mg/L       | 37.8      | 46.4          | 37.2            | 1000                      |
| **Chemical**         |            |           |               |                 |                           |
| pH                   | -          | 3.56      | 3.5           | 3.6             | 6-9 (does not apply to peat water) |
| Mercury (Hg)         | mg/L       | < 0.0008  | < 0.0008      | < 0.0008        | 0.002                     |
| Fluoride (F)         | mg/L       | < 0.002   | < 0.002       | < 0.002         | 1.5                       |
| Hardness (CaCO₃)     | mg/L       | 31.58     | 33.3          | 33.3            | -                         |
| Nitrate (NO₃-N)      | mg/L       | 2.85      | 2.5           | 2.3             | 10                        |
| Nitrite (NO₂-N)      | mg/L       | < 0.0013  | < 0.0013      | < 0.0013        | 0.06                      |
| Sulfate (SO₄)        | mg/L       | 13.16     | 15.4          | 14.3            | 300                       |
| Dissolved oxygen (DO)| mg/L       | 3.82      | 3.8           | 4.1             | 4 (minimum)               |
| BOD                  | mg/L       | 122.05    | 174.1         | 103.8           | 3                         |
| COD                  | mg/L       | 267.65    | 381.9         | 227.6           | 25                        |
| Ammonia (NH₃-N)      | mg/L       | 0.23      | 0.2           | 0.2             | -                         |
| Organic matter (KMnO₄)| mg/L   | 570.37    | 583.7         | 526.2           | -                         |
| Free chlorine (Cl₂ free) | mg/L      | 0.68      | 0.4           | 0.3             | 0.03                      |
| Iron (Fe)            | mg/L       | 0.55      | 0.6           | 0.6             | -                         |
| Cadmium (Cd)         | mg/L       | 0.01      | < 0.0015      | 0.04            | 0.01                      |
| Manganese (Mn)       | mg/L       | 0.02      | 0.02          | 0.02            | -                         |
| Zinc (Zn)            | mg/L       | 0.07      | 0.03          | 0.06            | 0.05                      |
| Lead (Pb)            | mg/L       | 0.23      | 0.11          | 0.15            | 0.03                      |
| Copper (Cu)          | mg/L       | 0.04      | 0.02          | 0.03            | 0.02                      |
| Total Nitrogen (N)   | mg/L       | 3.52      | 3.16          | 3.03            | 15                        |
Figure 4. Level of BOD, COD, free chlorine, zinc, lead, copper and DO in peat water in Kanamit Barat Village. A) BOD, B) COD, C) free chlorine, D) zinc, E) lead, F) copper, G) DO.
The color of the peat water in this study was brownish, ranging from 162 – 329 Pt-co units. Based on the literature, peat water has a dark brown to black color caused by dissolved plant organic material in the form of humus and its derivatives [11]. The characteristics of peat water are quite unique, there may be a relationship among the color, pH, DO, COD, and BOD.

The study indicates that peat water in three villages in Block C, Pulang Pisau Regency did not meet the water quality standard for class II PP No. 22 Year 2021. In most cases, the main parameters of water quality not fulfilled the standard are DO, BOD, and COD. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are two critical parameters related to the oxygen demand of aquatic microorganisms to break down or oxidize organic material into a stable inorganic form [12][13]. Measurement of BOD and COD is one way to determine the level of water pollution. In our study, the level of both parameters is very high and distinctively above the maximum limit. This value indicates that peat water in this study contains high organic material. High levels of BOD and COD are caused by decomposed biomass. BOD levels will continue to increase due to the natural process of plant debris decay, fertilizers use, and other [14]. Another study reported that due to fragility of peatland ecosystem, drainage in peatland can accelerate the rate of decomposition [15]. High levels of BOD and COD can cause a decrease in dissolved oxygen (DO) content in the water, leading to the death of the aquatic organism [16]. In this study, DO content in the peat water of Garung, and Kanamit Barat Village was under the minimum limit (Figure 3F and 4G).

Analysis of water quality in Perawang Riau showed that BOD and COD levels reached 50.6 mg/L and 168 mg/L, respectively [17]. In addition, in the Beriah district, the concentration of COD reached 33.3 mg/L [18]. Several filtration techniques have been reported to reduce the BOD and COD levels in the water. Application of combinations of natural adsorbents such as activated charcoal, zeolite, silica sand, ferro lite, and anthracite as a filtration medium significantly reduced the BOD and COD levels by 50% in laundry wastewater [19]. Furthermore, filtration experiments using cattail (Typha angustifolia) in constructed wetland concluded that this technique could reduce the BOD and COD levels as high as 78% on day 20 [20]. However, the effectiveness of this method has not been reported on large-scale peatlands.

In this study, two important chemical parameters namely BOD and COD are picked up to see if there are significant differences among the corresponding parameters across peat dome, primary canals, and secondary canals for each village. Based on Kruskal Wallis test, BOD and COD parameters across all sampling points for each village are summarized in Table 5, 6, 7, 8, 9 and 10.

**Table 5.** Kruskal Wallis test of BOD content at Buntoi Village.

| BOD Location          | N  | Mean rank | df | Asymp.sig |
|-----------------------|----|-----------|----|-----------|
| Buntoi peat dome      | 3  | 6.17      | 2  | 0.472     |
| Buntoi primary canal  | 3  | 3.50      |    |           |
| Buntoi secondary canal| 3  | 5.33      |    |           |
| Total                 | 9  |           |    |           |

**Table 6.** Kruskal Wallis analysis of BOD content at Garung Village.

| BOD Location          | N  | Mean Rank | df | Asymp.sig |
|-----------------------|----|-----------|----|-----------|
| Garung peat dome      | 3  | 6.33      | 2  | 0.288     |
| Garung primary canal  | 3  | 3.00      |    |           |
| Garung secondary canal| 3  | 5.67      |    |           |
| Total                 | 9  |           |    |           |
Table 7. Kruskal Wallis analysis of BOD content at Kanamit Barat Village.

| BOD   | Location                      | N  | Mean Rank | df | Asymp.sig |
|-------|-------------------------------|----|-----------|----|-----------|
|       | Kanamit Barat peat dome       | 2  | 5.50      | 2  | 0.077     |
|       | Kanamit Barat primary canal   | 3  | 6.33      |    |           |
|       | Kanamit Barat secondary canal | 3  | 2.00      |    |           |
|       | Total                         | 8  |           |    |           |

Table 8. Kruskal Wallis test of COD content at Buntoi Villages.

| COD   | Location                | N  | Mean rank | df | Asymp.sig |
|-------|-------------------------|----|-----------|----|-----------|
|       | Buntoi peat dome        | 3  | 4.50      | 2  | 0.578     |
|       | Buntoi primary canal    | 3  | 4.17      |    |           |
|       | Buntoi secondary canal  | 3  | 6.33      |    |           |
|       | Total                   | 9  |           |    |           |

Table 9. Kruskal Wallis test of COD content at Garung Villages.

| COD   | Location                 | N  | Mean rank | df | Asymp.sig |
|-------|--------------------------|----|-----------|----|-----------|
|       | Garung peat dome         | 3  | 6.33      | 2  | 0.288     |
|       | Garung primary canal     | 3  | 3.00      |    |           |
|       | Garung secondary canal   | 3  | 5.67      |    |           |
|       | Total                    | 9  |           |    |           |

Table 10. Kruskal Wallis test of COD content at Kanamit Barat Villages.

| COD   | Location                           | N  | Mean rank | df | Asymp.sig |
|-------|------------------------------------|----|-----------|----|-----------|
|       | Kanamit Barat peat dome            | 2  | 5.50      | 2  | 0.077     |
|       | Kanamit Barat primary canal        | 3  | 6.33      |    |           |
|       | Kanamit Barat secondary canal      | 3  | 2.00      |    |           |
|       | Total                              | 8  |           |    |           |

Based on Kruskal Wallis test, this study indicates that there is no significant difference of BOD level as affected by position of sampling covering peat domes, primary canals, and secondary canals, however, the level of this characteristic is considered as high. This phenomenon is understandable due to the fact that the water brings about high organic matter content as maybe affected by dissolved plant debris.

Likewise, the statistical analysis regarding COD level across all position of sampling points indicates that there are no significant differences of COD level for all villages. This indicates that in every village, the water flowing down from peat dome to lower level of the peatland landscape are already having high COD level.

Peat domes are a protected peatland forest, functioning as source of water that flows into primary canals and secondary canals passing through the lower landscape before ending in the river. The peat dome in Buntoi Village is the forest with large tree vegetation in the past, then underwent burning many times, leaving shrubs. Meanwhile, the peat dome of Garung Village is ex rubber plantation that was also suffered from burning and turning out to be the guava tree and geronggang. Peat dome in Kanamit Barat Village is a former forest that was accidentally burned and has been rehabilitated using belangeran (*Shorea belangeran*).

The analysis of peat water quality in three villages in Block C, Pulang Pisau Regency, provides data and information for use in regard to formulate peatland restoration or rehabilitation strategy to be applied in the area. The paludiculture system may be applied by putting into account those well adaptive plant species that are resistant to high BOD and COD concentration and low pH. Several studies have shown that there are five important paludiculture commodities in Central Kalimantan and
South Kalimantan, namely Purun, Rumbia (Metroxylon sago), Galam (Melaleuca cajuputi), Geronggang (Cratoxylum glaucum), and Belangeran (Shorea balangeran) [21]. Another study reported that the selection of local plant commodities should be based on economic benefit, namely food producers, fiber producers, bioenergy, medicinal sources, and latex producers [15].

4. Conclusions
Peat water in Buntoi, Garung, and Kanamit Barat Villages, Block C, Pulang Pisau Regency bearing characteristics of high BOD, COD, free chlorine, zinc, lead, and copper. Those parameters are exceeding the quality criteria II PP No. 22 Year 2021. Peat water quality resulted from this research can be used as input factor as a basis for policy making process in terms of peatland restoration and rehabilitation activities.

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