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Ground Water Content Measurement of Total Dissolved Solid in the Area Around Sumberwaru Village, Situbondo Regency, East Java

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Abstract The geographical location owned by Situbondo Regency has a coastal area, which could have the potential for seawater contamination of many particle of solids for example Calcium, Sulfur etc.. Therefore, this study aims to explore water resources, namely groundwater in a coastal area of Situbondo Regency - Banyuwangi Regency, which can be used to determine the feasibility of life, especially for humans and animals. In the distribution of Total Dissolved Solid, it was found that there was the highest TDS value in the northwest and east directions of the study site, with values ranging from 235 to 696 mg/L. From groundwater depth measurements, it was found that the further south the research location is, the deeper the depth will be. while for the pH value, it was found that the value ranged from 7.2 to 7.84, with an average of 7.54. For future improvements, it is necessary to carry out further research along the road from Situbondo District - Banyuwangi Regency to obtain a wider picture.

Keywords Groundwater, TDS (Total Dissolved Solid), pH (power of Hydrogen)

1. Introduction

Situbondo is a regency located on the north coast of Java Island, in the horseshoe area. this area is surrounded by tobacco, sugar cane plantations, Baluran protected forest, and fishing business locations. Situbondo has an area of 1,693 km^2 with geographic conditions bordering the sea and also surrounded by mountains. This regency is located at an altitude of 0 to 1,250 masl.

The need for water resources is very important, because humans will not be separated from the need for water energy to sustain even animals.

From the preliminary survey conducted by previous research, from the results of observations of researchers and also dialogue with the coastal community of Situbondo, the use of local groundwater is very much needed for life both by local communities or animals and also agriculture. Therefore, this study aims to explore air resources, namely groundwater in a coastal area of the Situbondo Regency - Banyuwangi Regency, which can be used to see the feasibility of life, especially for humans and animals.

TDS content of ground water can be in the form of particles of Calcium, Sulfide and others depending on the geological conditions of the research area and the more that is contained because there are large particles of TDS, the more dissolved Calcium is not always the other [1].

Based on research on groundwater modeling on the coast of Laizhou Bay, China, it was found that over time, groundwater chlorinity fluctuated slightly at monitoring points away from the coast, but there was an increasing trend. Groundwater chlorinity fluctuates significantly at the nearshore monitoring point and shows an increasing trend. Drought caused by a sudden drop in mean monthly rainfall in February and March 2015 resulted in insufficient groundwater supply, damaged hydrodynamic balance, and severe intrusion of seawater; As a result, groundwater chlorinity increases rapidly. Groundwater chlorinity decreases with increasing distance from the coast. Except for irregular fluctuations due to the long drought in 2015, groundwater chlorinity fell to freshwater levels when the distance from the coast was 2000 m. Over time, the seawater intrusion area gradually approached the land, and the cross-distribution of the intrusion area was uneven. In this study, the degree of seawater intrusion was observed by monitoring the chlorinity of groundwater along the coast of Laizhou Bay and analyzed the causes of seawater intrusion which is a reference for prevention and control of disasters of seawater intrusion [2].

Based on this background and the absence of research conducted in the area around the Situbondo Regency, especially those related to the effect of seawater on

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groundwater. So, this research was carried out by taking samples of groundwater or well water using parameters, namely TDS and pH of groundwater (well water).

2. Research Method

2.1. Research Location

Sampling was carried out in the morning to evening during working hours. For measurement of groundwater, content is carried out in the laboratory and to avoid errors given labeling each bottle of the water sample obtained. This research was conducted in the dry season, namely in July to August 2021.

Selection of sampling points in the area around the coast, to the area away from it, namely the area south of the sampling point. The sampling points are shown in Figure 1 and Figure 3.

Figure 1. Research Location

From the research location as shown in the Figure 2, it is a rice field. And the discussion from several people also said that it is suitable for rice to be planted here.

Figure 2. Research location adjacent to Rice Field

2.2. Research Design

This research is a quantitative and qualitative experimental study, where water samples are obtained directly from the residents around the Pesisir, Situbondo Regency, then measured their quality by its TDS and pH. Then for making contour maps we use the Surfer application with 3 main colors that distinguish the level of value [3].

2.3. Tools and Materials

The tools and materials used in this research are as follows:

1. 600ml sample bottle
2. Measuring rope
3. TDS meter
4. pH meter
5. Surfer® [3]

2.4. Research Variable

The variables in this study are parameters including TDS value and pH value. The data in this study are primary data obtained from direct sampling around the coast of the Situbondo Regency.

Then for the coordinates of the water sampling point can be seen at Table 1.

Table 1. Groundwater sampling coordinates

Sampling point	Longitude (W)	Latitude (S)
1	114.2956667	-7.7916
2	114.3059667	-7.75855
3 Sumber waru	114.3054667	-7.7793333
4	114.29525	-7.7917222
5	114.3118	-7.769
6	114.2912833	-7.76705
7	114.31405	-7.7582667
8	114.28705	-7.7907667
9	114.294	-7.7598833

3. Result and Discussion

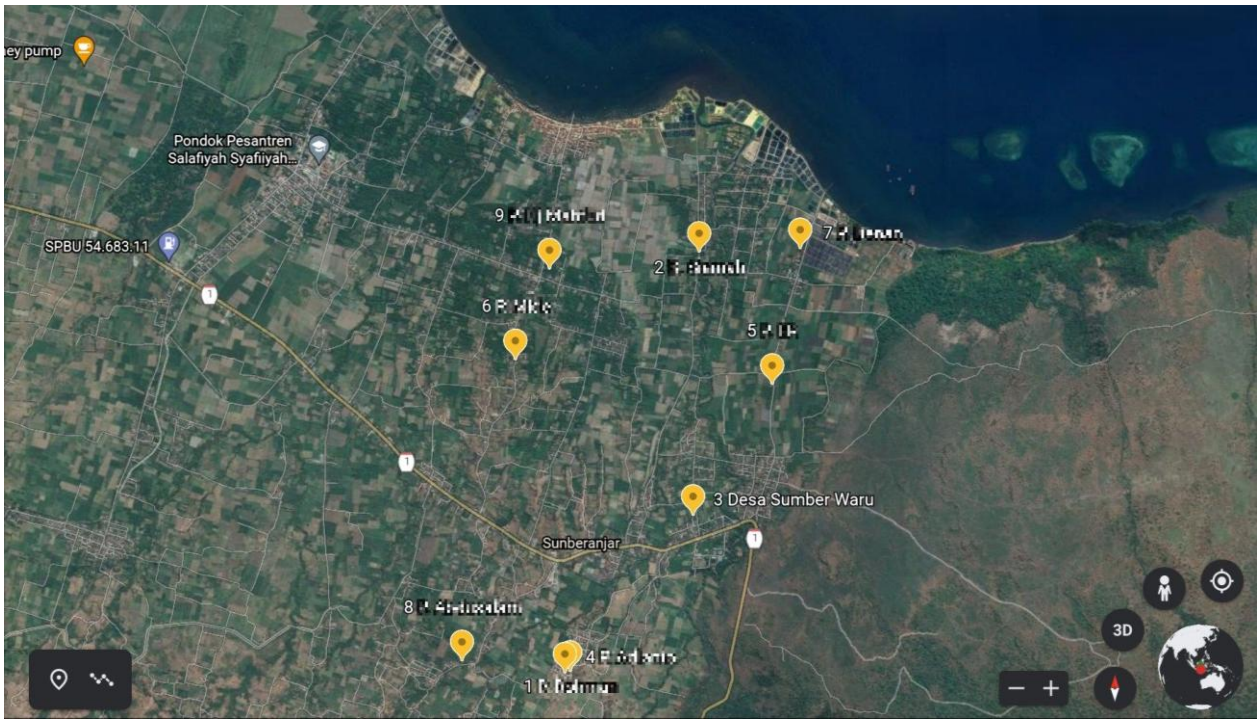

Figure 3. Location of water sampling points

Table 2. The value of the well depth from the research site

Sampling Point	Wells Depth
1	12.5
2	12.5
3 Sumber waru	12.5
4	12.5
5	10
6	7
7	2.5
8	12.5
9	7

Based on the Table 2 above, it can be seen that the difference in well water belonging to the residents varies with an average depth value of 9.88. meters below the water surface. And for the standard deviation value of 3.42 meters, which means the measurement variation is ±11.7 meters.

Then, to further clarify the understanding of the distribution of groundwater depth values in the research location, the following is a picture of the groundwater depth values affixed to the research location shown in Figure 4.

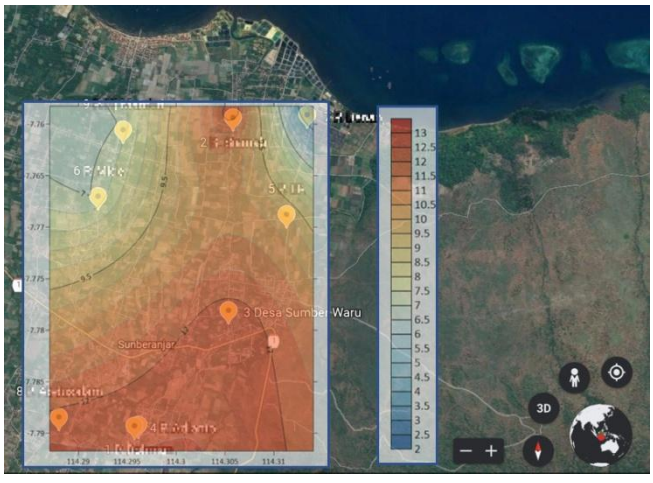

Figure 4. Contour Map of the well water depth on research location

From the data in the image above, it can be ignored that the shallowest depth of land is in the north-west and north-east cardinal directions. While the deepest depths are in the south and central north wind direction in the study area.

3.1. TDS

In this parameter, measurements are taken in the laboratory of Geophysics University Brawijaya using a TDS Meter to measure the TDS value in groundwater, which is shown in Table 3.

Table 3. Groundwater TDS value from the coastal area of Situbondo

Sampling Point	TDS (mg/L)
1	448
2	246
3 Sumber waru	267
4	422
5	235
6	657
7	327
8	347
9	696

Based on Table 3, it was found that values ranging from 235 to 696 mg/L For the results of well water owned by residents, it still meets the standard threshold value for drinking water, which is 1,000 mg/L [4] & [5].

TDS or commonly referred to as the amount of dissolved solids is an indicator of the number of particles or substances, both organic and inorganic which have a size below 1 nanometer. TDS in groundwater can be caused by minerals or substances carried by water. However, because when water enters the soil, the water will pass through the porous soil grains so that the compounds that make the dirty water will be filtered naturally. Therefore, the TDS in soil is usually small.

Then to further clarify the understanding of the distribution of TDS content, the following is a picture of the distribution of TDS content in groundwater affixed to the research location shown in Figure 5.

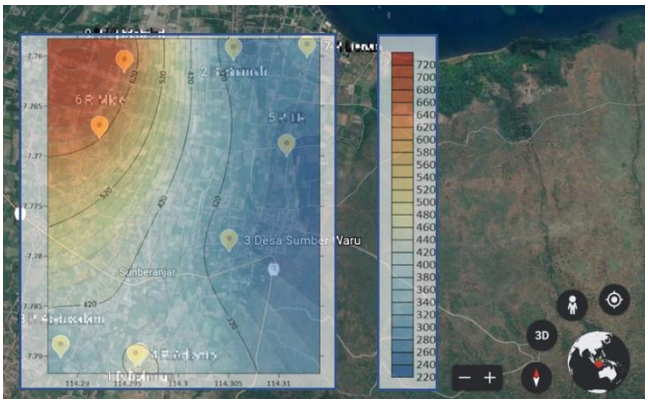

Figure 5. Contour Map of TDS on research site

In another research, the journal states that the TDS consists of an order from the largest to the smallest as follows $SO4^{-2}$ > Cl > Na^{+} > Ca^{+2} > $HCO3^{-}$ > Mg^{+2} > K^{+} > $NO3^{-}$. In that research area in Iraq, it was found that the TDS parameter ranged from an average of 3709, which indicates that the water in the area is unfit for drinking.

3.2. pH

The degree of acidity is used to determine the nature of the acid and base of a substance or solution. Changes in pH in a body of water greatly affect the process of physico-chemical and biological reactions of various organisms that live in it. The degree of acidity also affects the toxicity of pollutants and the solubility of some gases in the formation of substances in the water. The pH value of water is used to describe the acidity or concentration of hydrogen ions in water. The pH scale ranges from 1-14. The pH range of 1-7 includes acidic conditions while pH 7 is a neutral condition.

Using a pH meter to measure the pH value in groundwater, the value shown in Table 3.

Table 4. Groundwater pH value from the coastal area of Situbondo

Sampling Point	pH
1	7.8
2	7.8
3 Sumber waru	7.3
4	7.54
5	7.84
6	7.4
7	7.68
8	7.2
9	7.66

Based on the table above, it can be seen that pH value from well water owned by residents and sea water is between 7.2 to 7.84. Where this value still meets the standard threshold for drinking water, namely pH of 6.5 to 8.5 [5].

Then to further clarify the understanding of the distribution of its contents, the following is a picture of the distribution of pH value to the research location shown in Figure 6.

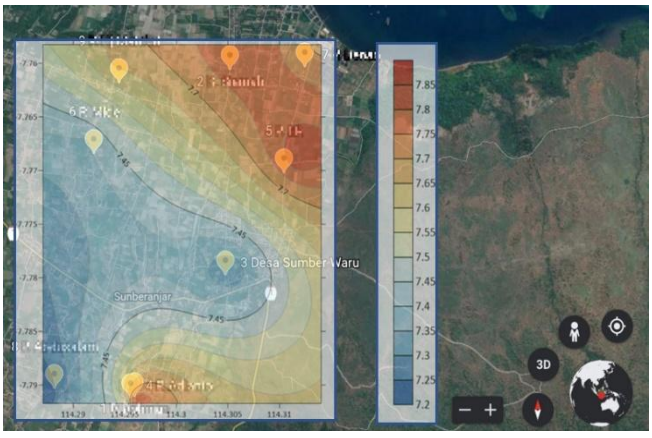

Figure 6. Contour Map of pH on research site

From the picture above, it is found that there are variations in the pH value in groundwater in the study area. The lowest pH values are in the southeast and central of the research area.

4. Conclusions

Based on the TDS parameter in Table 3, it was found that values ranging from 235 to 696 mg/L For the results of well water owned by residents, it still meets the standard threshold value for drinking water.

Then, based on the pH value parameter in Table 4, Based on the table above, it can be seen that pH value from well water owned by residents and sea water is between 7.2 to 7.84. Therefore, in general, it can be assumed that The residents's well water can still be used as drinking water.

Further research is needed to obtain more geoelectric data so that it can cover a wider area.

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