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Interpretation of Groundwater Flow Using Fault and Fracture Density (FFD) Method in West Bandung District

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A B S T R A C T

Utilization source sustainable groundwater resources is urgently needed in Lots case, with consider dynamics groundwater flow in the area the ground water is seeping water to in land from room between particle land and join form layers aquifer is one type ground The Fault and Fracture Density (FFD) approach was used in study this Method mapping geology used For know type and distribution rock as well as existence appearance geology in the area research Research results state that there is Trough and back Hill become target withdrawal alignment Density Fault and Fracture (FFD). There are 2 structures geology form fault valleys and faults Cibeleng results FFD analysis and geology in the area research Flow path land move from east -west, then changed direction being northwest -southeast following the red zone on the FFD map of the study area When the red zone is the density zone alignment high morphography there is Lots working crackas a flow medium groundwater groundwater flowstarting in layers lava rock which is akifug but in the lava layer is a zone of high structural density so become area catchment sectionfrom later surface watersenter through formed fractureBecause density structure high geology

INTRODUCTION

Groundwater is an important and valuable water resource in many developing countries, especially in cities where there is pressure on the public water supply due to insufficient infrastructure (West et al., 2017). In many area groundwater can used with easy and cheap and usually own good quality for health people and needs industry. Growth population industry and economy often significant with consequence enhancement groundwater exploitation For fulfil request (Taufiq et al., 2018). With thus utilization source sustainable groundwater resources is urgently neededin Lots case with consider dynamics groundwater flow in the area That's seeping water to land from gap between particle land and join For form layer called as ground water aquifer is type ground (W. Al-Muqdadi & J. Merkel, 2012). Layer permeable is that easy passed by water, like sand or pebbles meanwhile layer waterproof is a tough one passed like land clay and soil clay (Ismawan et al., 2018). Aquifer is possible layercatch and release water. Most important source of groundwater is from rock base broken carbon limestone hard which, of research in Ireland and England have very low primary porosity (1 % approx less), with porosity effectiveness and flow especially depending on faults fractures and). BecauseThat is the groundwater system This equivalent with aquifer system fissures in limestone and reservoirs fracture experience opposite type 1 with system petroleum (Delinom, 2009). Both of them characterized by porosity and permeability dominated by fractures and fractureskarstification (ie dissolution - enhanced). From analysis more from 120 locations outcrops quarries mines and caves dominant insideorder flakes airborne carboniferous_but also in more non limestones young and over old (Kurnianto, 2019). Report this explain in a manner short system fracture youngest to influence groundwater flow that is fault Cenozoic and more recently This Fault and Fracture Density analysis aims For identify structure surface area study based on density straightness Structure surface analyzed through lineament density on the surface with FFD method.

Soengkono pioneered the Fault and Fracture Density (FFD) approach, which uses detailed digital topography data (using a 25 m grid) to identify topographical lines created by faults and muscles in mokai areas for geothermal applications (Mansour et al., 2018). He found the structural trends prevalent in the area using this data. He then created a fault and fracture density map (FFD), which is defined as the length of each line in a unit area. About or exceptionally considered to be associated with fractures or faults in the region studied, which is usually covered by the surface, making identification difficult. The FFD, also known as a weak field, is a path of fluid movement that may indicate the location of a permeable area or reservoir. (Hendrasto et al., 2018). Fluid flow centers are most likely to be found in structures with the highest structural density. As a result of the FFD analysis results, a structural density zone map as a reference to which area will be the point of fluid flow in the fracture media is created. (Sunan et al., 2021).

The Bandar Utara area is a protected area or conservation area in North Bandung which is located at an altitude of more than 750 meters above sea level. North Bandung is separated into four administrative regions: part of Bandung Regency, part of West Bandar Regency, part of Bandar City, and part of Cimahi City. The Bandar Utara area has a significant purpose and plays an important role in maintaining the viability and environmental balance of the Bandung Basin. The Bandung Basin is a plateau surrounded by mountains and hills. The geography of the area is elliptical, extending up to 60 kilometers from northwest to southeast. Because the North Bandung area is a conservation area with high water absorption, it naturally becomes an area that supplies around 60% of the groundwater demands in the area. West Bandung is located at 1070 22' East Longitude 1080 05' East Longitude and 60 41' South Latitude to 70 19' South Latitude. West Bandung Regency is a fertile area with beautiful scenery and hilly geology. Bandung Regency is a fertile area with beautiful scenery and hilly geology. In the existence of the North Bandung area, the West Bandung Regency area has a very important water catchment area, where this water catchment area is to protect water resources and create a balance of environmental water resources. The following is a map of the districts in the province of Bandung.

Uncontrolled use of space in the North Bandung area, especially in the Lembang and Parongpong areas due to the development of hotel resorts and tourist attractions, can endanger the function of the conservation area as a water catchment area and create various natural disasters. Lembang and Parongpong Districts are two water catchment basins

in the North Bandung area which are part of a protected forest area and must be preserved. Space utilization in the North Bandung area, particularly in the Lembang and Parongpong areas, is out of control as a result of resort development. Based on the written explanation, this study will investigate the interpretation of groundwater flow using the FFD method in West Bandung Regency, especially for several villages in West Bandung, namely Gunungmasigit Cipatat Village, West Bandung Regency.

METHODS

Study This use Fault and Fracture Density (FFD) method. Method mapping geological used For determine type and distribution rocks in the studied area as well exists appearance geological The Fault and Fracture Density (FFD) approach was used For assess the density zone management morphography in the study area with interesting study area use map imaging satellite and then share whole long procedure with that area. Areas used is 1km2. Density zone morphography which describes feature geology in the zone is generated with share amount long with breadth.

RESULTS AND DISCUSSION

In Bandung groundwater supply to sector industry reach nearly 60% of the total water demand increases to 66% p the impact to groundwater withdrawal because groundwater is used by industry decrease to 57%, then increase to 58% in 2000. According to the latest data the amount of clean water that the Regional Drinking Water Company (PDAM) supplies to sector industry only around 3.5 million m3 in 2003 which is only 1% of the volume required by industry Groundwater usefound Keep going increase until 2004 reachednearly 70% of the total clean water needed by the sector industry in the Bandung Basin It means almost all the water needed by the sector industry originate of groundwater and causesfrom circumstances the is lack of infrastructure water supply in the Bandung Basin (Al-Muqdadi et al., 2012) When This Not yet there is accurate data about rate groundwater withdrawalFor necessity House stairs in the Bandung metropolitan area. Different with mechanism industrial use of groundwater use of groundwaterFor necessity House ladder No imposed limitation depth to 50 m drilling also not imposed limit of 100 m3 per month Projection water requirement for sector agriculture For to irrigate the fields is of 982.94 million m 3 However so because the more converted Lots become land land agriculturebuilding then water requirement for agriculture Actually only 955.66 million m 3 Request domestic tend increase from year to year Because pressure resident

FFD method was used For determine density zone morphography indicated straightnessexists activity structure geology of the zone Alignment withdrawal done on the map image Digital Elevation Model (DEM) satellite with corner illumination 0o, 45o, 90o and 135o. Trough and back Hill become target withdrawal alignment Density Fault and Fracture (FFD). There are 2 structures geology form fault in the area study is

1. Fault Lembang

The Lembang Fault is located in the study area between low and high Bouguer anomaly values (-2 mgal - 52 mgal), with a high anomaly in the southern area of the study and a low anomaly in the northern area of the study. Sloping Fault is a normal type of fault with a decreasing trend in the northern part of the study area, according to the results of calculations using the second vertical gradient method. (Endyana et al., 2018). The Bouguer anomaly data supports this finding. The study area which describes the northern part of this study has a low anomaly value when compared to the anomaly value in the southern region of the study. Low numbers indicate a decrease in density as a result of subsidence of the surface layer.

2. Fault Cibeleng

Gekbrong Fault and is located on the east side of the Gekbrong Fault. Look at the direction of the fault, maybe its normal sinistral moving components such as the Gekbrong Fault. There is a relatively simple branch of the Cibeleng Fault with a north-south orientation (Iskandar et al., 2018). These fault branches are identified as display defects, which are quite common in horizontal faults. This fault branch is only visible on the surface. Terban is formed by the Cibeleng Fault and the Gekbrong Fault.

Influence Structure Geology To Genre Groundwater.

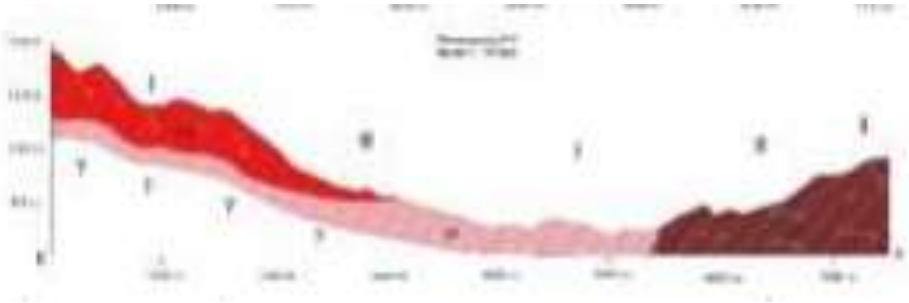

Figure 1. AB Cross Sectional Drawing

Aquifers are rock strata that allow groundwater to flow through them. An aquifer is a layer of rock or soil that can receive and transmit water (Zhou et al., 2023). One is There are two types of media that make up aquifers: pore media and fracture media. Media fracture refers to secondary porosity in rocks caused by geological structural processes. The influence of the geological structure will be seen at this time if there is activity that causes the appearance of fractures in the rock. Groundwater elevation data will be used to construct a map of groundwater flow patterns by combining the results of FFD and geology analysis in the study area. The soil flow path moves from east-west, then, following the red zone on the FFD map of the research area, shifts to the northwest-souvenir. There are several cracks that serve as groundwater flow media when the red zone is a zone of high morphographic density. Groundwater flow begins in the lava rock layer, which is an aquifer, but there is a zone of high structural density in the lava layer, thus becoming a catchment area for the water portion of the surface water, which then enters through the developed cracks. for high density of geological structure. The water then flows into the lower topography, which has two types of layers: tuff layers and volcanic breccias.

Tuff and water flow in the two forming media deep flowing aquifer_ pores between rock and break Because is the density zone structure high and medium Section AB, on the other hand is not own spring this interpreted as consequence structure geology like affecting faultarea research Fault important causedirection groundwater flowchanged from east to west- northwest -souvenir, force water supply passes layer rocks in cross section AB that are not Enough for surface water discharge containing aquifers and density zones towering structure high however the flow caused by influence structure geology form faults and is supported by map data Density from straightness show direction main from Line Ament Northwest-Southeast. Because of ground water No flow to direction sector AB, land in part AB owns very limited water supply Because No There is surface spring.

CONCLUSION

Based on the results of the research that has been done, there are troughs and ridges that are the target of alignment withdrawals. Fault and Fault Density (FFD). There are 2 geological structures in the form of the Lembang Fault and the Cibeleng Fault. FFD and geological analysis results in the study area. The soil flow path moves from east-west, then changes direction to northwest-southeast, following the red zone on the FFD map of the study area. When the red zone is a zone of high morphographic alignment density, there are many fractures that function as groundwater flow media. Groundwater flow begins in the lava rock layer which is an aquifer, but in the lava layer is a zone of high structural density, so that it becomes a catchment area for part of the surface water which then enters through faults formed due to the high density of geological structures.

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