International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province

Murni Sulastri[1], M Tobibi Pohan[2], Nana Sulaksana[2], Pradnya Paramarta Raditya Rendra[2]
[1]Mining Engineering, Universitas Islam Negeri syarif Hidayahtullah, South Tangerang, Banten, Indonesia-15412
[2]Geological Engineering, Universitas Padjadjaran, Jatinangor, West Java, Indonesia-45363
Email address: murni.sulastri@uinjkt.ac.id

Abstract— *The research area is located on Cipeundeuy, Cipatat District, West Bandung Regency, West Java Province. Geographically it is located at 107° 17' 26.6712" E - 107° 20' 9.708" E and 6° 49' 10.9812' S - 6° 46' 29.1" S. Most of the research area is hill which is dominated by volcanic and sedimentary rocks. Based on the physiographic aspect, the research area is in the West Bandung Zone. This study aims to determine the role of geomorphology in land use in the Cipeundeuy area and its surroundings using field survey and and studio analysis. The geomorphology aspects that used are morphometry, morphography, and morphogenetics which overlap with land use aspect of the research area. The results show that the research area consists of steep slope high volcanic hill, steep slope volcanic hill, gentle slope volcanic hill, and volcanic valley. Changes in land use into fields, plantations, and rice fields which is quite massive shows that the condition of land use is not good. The condition of land use change has the potential to cause landslides.*

Keywords— *Geomorphology, morphography, morphometry, morphogenetics, river flow patterns.*

I. INTRODUCTION

The research area is Cipeundeuy District, West Bandung Regency, West Java Province. Geographically, it is located at 107° 17' 26.6712" E - 107° 20' 9.708" E and 6° 49' 10.9812" S - 6° 46' 29.1" S (Figure 1). The Cipeundeuy area and its surroundings in Cipeundeuy District, Bandung Regency, are hills located in the Bandung Physiographic Zone (Van Bemmelen, 1949). This zone stretches from Pelabuhan Ratu Bay through the Cianjur Highlands, Bandung, to the Citanduy river valley and ends at Segara Anakan, Central Java. Structurally the area is the upper part of the Java anticline, which experienced a tectonic period in the Late Tertiary. Quaternary volcanic deposits generally cover this zone, but Tertiary deposits are found in several places in the western part of the Bandung Basin.

The history of sedimentation and tectonic position is quite interesting in this area, so research is carried out to determine the processes in it and the influence of its tectonic position from its geomorphology, namely morphometry, morphography, and morphogenetics to determine knowledge of lithological content and properties of the surface shape. A geomorphological analysis is also needed to determine the suitability of the landform with the function of the land used by residents.

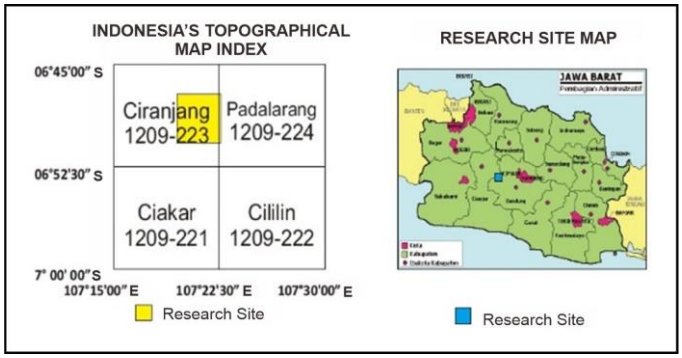

Figure 1. The location of the research area based on the Indonesian topographic map index

This research is geomorphological such as a description of shape (morphography), quantitative assessment of shape (morphometry), the origin of shape (morphogenetic), and constituent materials. A term very commonly used in Europe, namely geomorphology, studies things related to the earth's shape (including geodesy, structure, and dynamic geology) (Bermana, 2006). The landforms formed are influenced by two forces acting on the earth, namely endogenous and exogenous forces, as well as the character of the rock from which the area is composed, which will produce different features of the earth's surface. The shape of the earth's surface includes mountains, hills, plains, and valleys so that it can affect land use in the research area. A geomorphological map is produced, including the fundamental aspects surface to identify aspects of the most relevant geomorphology (Cooke and Doornkamp, 1990). It relates to geotechnical characteristics in the form of parameters that are made to find similarities morphology and lithological differences in an area (Hutchinson, 1989).

Land *use planning* is the regulation of land use. Land use is not only about the use of the earth's surface but also about the use of the earth's surface at sea (Jayadinata, 2009) . Land use, according to the Basic Agrarian Law, is the structure and pattern of land use, whether planned or not, which includes land supply, land use.

Factors for regional development and determination of land use and geological hazard control include morphological conditions, geological structure conditions, hydrogeology, and land use conditions (Sulaksana *et al.*, 2015; Rifai *et al.*, 2018)

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.

using satellite imagery because various approaches can determine the condition and presence of vegetation in urban areas, one of which is the use of remote sensing by looking at the value vegetation index (Yunhao *et al*., 2005); (Nowak *et al*., 2000). Utilization of satellite imagery with a very high spatial resolution is needed in urban areas with a heterogeneous level of land cover diversity (Liang *et al*., 2007). Chand (1998) also sees the need for activity.

II. Research and Methodology

This study uses the studio analysis method using a map of the Indonesian Earth, No. 1209-223 Ciranjang, and DEM (*Digital Elevation Map*) from ASTER GDEM v2. In this study, using the geological mapping method, the return of field data is in the form of geomorphology by observing the geomorphology in detail (plains, hills and valleys) of rock outcrops found in the field of as many as 63 observation points (Figure 2). Geomorphological analysis, namely by analyzing morphometry, morphogenetic, and morphology of the research area, including contour patterns, elevation, hill shape, slope angle, and river flow patterns, as well as interpretation of land use at the research location.

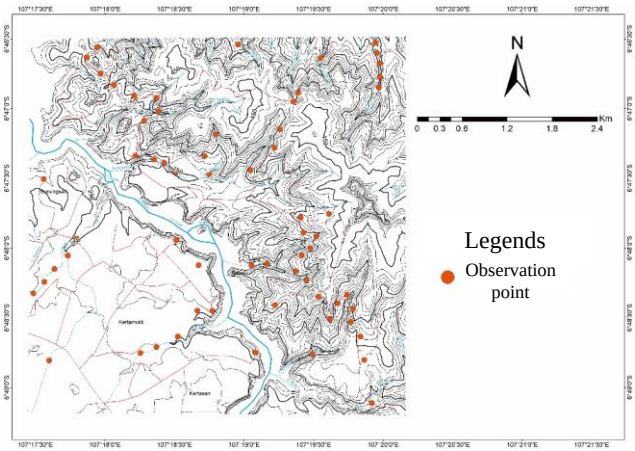

Figure 2. Location of observation points in the research area

III. Data Analysis

1) *Research Area Morphography*

Based on the analysis conducted by the author using topography and DEM (*Digital Elevation Model*), the research area consists of hilly landscapes to high hills, which are dominated by hilly landscapes (Figure 2). These landscapes are classified using their absolute height according to Van Zuidam in 1985 and based on their landforms from a geomorphological classification for geological mapping. The morphology of this area can be classified into valleys, hills, and high hills. The hilly morphography spans almost the entire study area and the high hilly morphography is only visible in the eastern part of a small part.

2) *Flow Pattern of Research Area*

The flow pattern analysis is more emphasized on the descriptive aspect according to its appearance on the drainage pattern map (Figure 3), which is then named according to the classification of the drainage pattern model according to Howard (1967) in Van Zuidam's (1985) book. Based on the flow pattern map in the picture above, which has been divided into types of drainage patterns, three types of drainage patterns developed in this research area, namely:

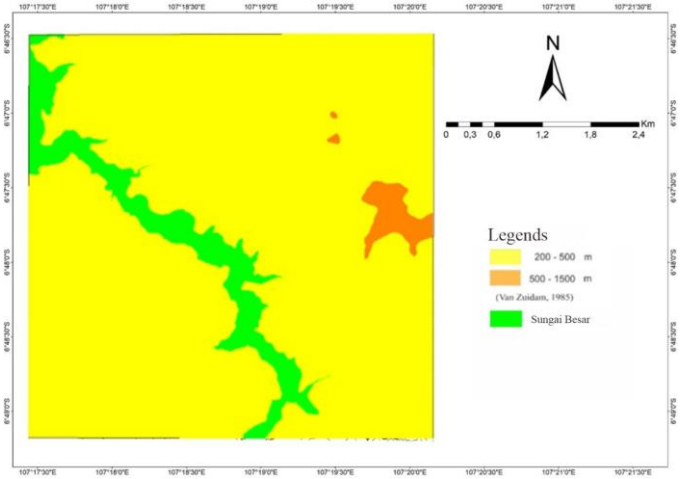

Figure 3. Morphography of the Cipeundeuy area and its surroundings, West Bandung Regency

1. This radial flow pattern develops in the study area's eastern part to the southeast. This drainage pattern develops in 29% of the total research area, the river density is moderate, and the shape of the subwatershed is steeped around the mountain peak pattern. This pattern develops in the rivers around Mount Cabe. This pattern is found in volcanic areas. This radial pattern has a centrifugal system (spread outward), indicating that this area forms a cone or dome. In addition, it has volcanic rock conditions with relatively homogeneous hardness and a steep slope. River valleys generally form the letter V, where vertical erosion still plays a dominant role.
2. This sub-parallel flow pattern is found in the northern part of the study area. This drainage pattern develops in the range of 31% of the total area of the study area. The rivers that make up this drainage pattern include the Cisadang, Citangkil, and other rivers located in the northern part of Margaluyu village. This drainage pattern develops relatively steep to steep topographic relief in these areas. River valleys mostly form the letter V, where the vertical erosion process still plays a dominant role.
3. Sub-dendritic drainage pattern occupies the central, southern, and western parts of the study, covering about 40% of the total area of the study. This river flow pattern is modified (Howard, 1967). has a general characteristic of relatively irregular shape, this drainage pattern develops in areas with relatively gentle slopes and develops in an environment with rocks that tend to be homogeneous and generally structural, but the deflection in the study area is caused by man-made irrigation of rice fields. This river flow pattern is formed by the Cibodas, Cipeuyeum, and Citarum rivers and is composed of volcanic lithology.

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.

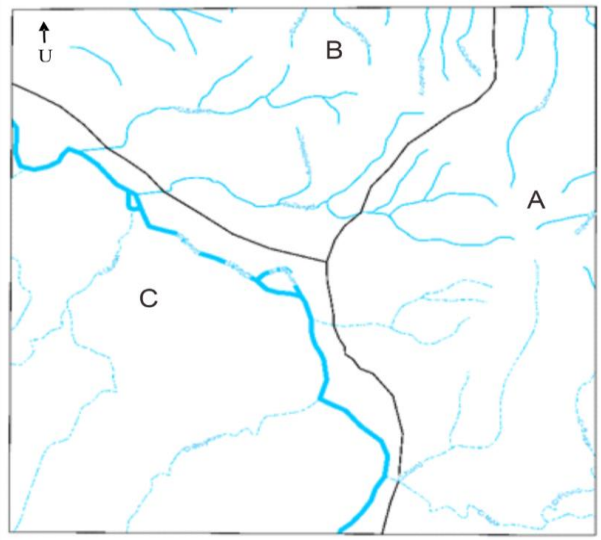

Figure 4. Flow Pattern of Research Area; A. Radial, B. Sub-Parallel, C. Sub-Dendritic

3) Research Area Morphometry

Morphometry is a quantitative assessment of a landform and is one of the most important geomorphological elements for its morphography and morphogenetics. Quantitative assessments of landforms provide a sharpening of landform nomenclature and will greatly help land analysis for specific purposes, such as erosion rates and determining the value of the slope. In this analysis, data collection and calculation of the height or elevation and slope of the slope are carried out.

Based on the analysis results in morphometric calculations carried out to classify areas based on the determination of the slope, three classifications of the dominating slopes were obtained: very gentle slopes, rather steep slopes, and steep slopes (Figure 4).

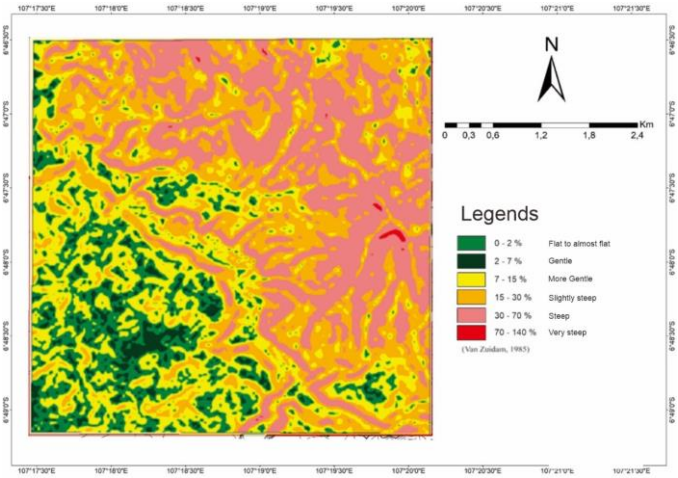

Figure 5. Morphometry of the Cipeundeuy area and its surroundings, West Bandung Regency

4) Morphogenetic Research Area

Morphogenetics are factors that influence the formation of the morphology of an area. The author observes the endogenous and exogenous processes that develop in the research area through field data that has been collected. Today's diverse landforms, of course, can be formed due to the influence of this process and are also influenced by the types of rocks affected by the process to form the land that now exists in the research area.

The morphology of the study area is dominated by endogenous volcanic forces, and there are endogenous structural forces in the northeastern part of the study area. The material that fills the study area is dominated by volcanic material, namely volcanic breccia, tuff scattered throughout the study area, and andesite lava which spreads from northeast to west of the study area.

5) Land Use

Land use in the Cipeundeuy sub-district is dominated by plantations, around 46%, around 22%, rice fields at 18%, and settlements at 4%. Plantations are developing in the North, Northwest, Northeast, East, and Southeast parts and developing Fields in the Southwest, West and Central parts of the Research Area. Rice fields are spread out in the research area's Southwest, West and Central parts, while settlements are evenly distributed in the study area's Northwest, West, Southwest and South of the study area, and settlements are in the fields and rice fields (Figure 5).

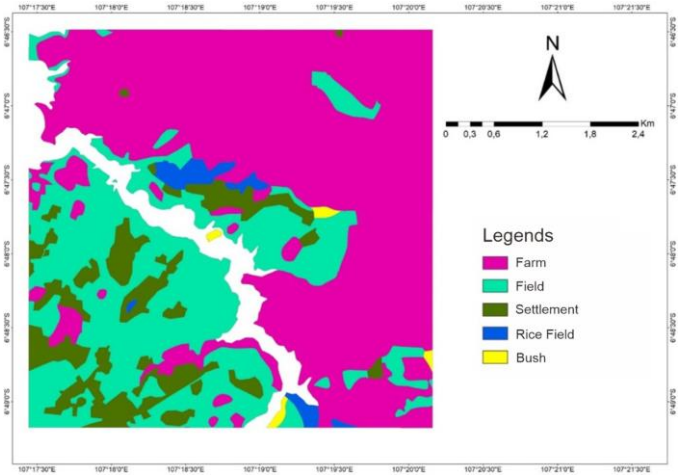

Figure 6. Map of land use in Cipeundeuy Region, West Bandung Regency (Indonesian Earth Map, No. 1209-223 Ciranjang)

IV. Discussion

Based on the analysis that has been carried out by taking into account the geomorphological aspects, including the morphographic, morphometric, and morphogenetic aspects, the geomorphological unit of the research area is divided into three units (Figure 10), namely:

1) Steep Slope Volcanic Height Evidence Unit

This unit is located in a relatively higher area in the study area, occupying an area of approximately 10% of the research area. This unit has a hilly terrain forming a V valley. The drainage pattern that develops is radial with a slope of about 20-50 ^{o} and an altitude ranging from 500-550 mdpl. The endogenous energy that develops in this area is volcanic, which is composed of volcanic breccia and tuffaceous materials (Figure 6).

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.

Figure 7. The geomorphological appearance is in the form of high volcanic hills, steep slopes that develop in it, endogenous volcanic forces, and are composed of volcanic breccia and tuff material.

2) Steep Slope Volcanic Hill Unit

This geomorphological unit occupies an area that has a high elevation in the study area. This unit is exposed in the northern to the eastern part of the study area, occupying an area of approximately 30% of the research area. This unit has a hilly terrain with a V valley. The drainage patterns that develop in this unit are radial and sub-parallel. Has a tight contour with a slope of 10 º to 35 º. This unit is located at an elevation of 250 - 500 masl. The endogenous forces that develop in this area are volcanic and structural forces, composed of volcanic breccia, tuff, and andesite lava (Figure 7).

Figure 8. The geomorphological appearance is volcanic hills with steep slopes that develop in which endogenous volcanic and structural forces are formed and are composed of volcanic breccias, tuff, and andesite lava.

3) Volcanic Basin Unit

This geomorphological unit is located in an area that has a relatively lower area in the study area. This unit is located along the northwest that extends to the southeast, occupying approximately 15% of the research area. This unit has a low hilly landform with a U-shaped valley. The drainage patterns that develop include sub-dendritic drainage patterns with a slope of about 0 º - 2 º and an altitude ranging from 212.5-250 mdpl. The endogenous energy that develops in this area is endogenous energy, namely volcanic, which is composed of volcanic breccia material, and tuff (Figure 8).

Figure 9. The geomorphological appearance is a volcanic valley that develops in its volcanic energy, which is composed of volcanic breccia, and tuff.

4) Sloping Slope Volcanic Hill Unit

This geomorphological unit is located in an area that has a relatively high area in the study area. This unit is located along the northwest that extends to the southeast, occupying approximately 45% of the research area. This unit has hilly terrain to low hills with V and U valley shapes. The drainage patterns that develop include sub-dendritic, radial, and sub-parallel drainage patterns with slopes of around 0 º - 10 º and altitudes ranging from 250 - 275 masl. The endogenous energy that develops in this area is endogenous energy, namely volcanic, which is composed of volcanic breccia material, tuff, and andesite lava.

Figure 10. The geomorphological appearance is in the form of volcanic hills with gentle slopes that develop in endogenous volcanic forces and are composed of volcanic breccias, tuff, and andesite lava.

5) Geomorphology of Cipeundeuy Land use

The geomorphology that develops in the Cipeundeuy area is very diverse, starting from units of high volcanic hills with steep slopes, units of volcanic hills with steep slopes, units of volcanic hills with gentle slopes, and units of volcanic valleys. This affects the land use that develops in the Cipeundeuy area.

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.

The land use that develops in the Cipeundeuy area is very diverse, ranging from shrubs, settlements, plantations, fields, and rice fields (Figure 11 and Table 1).

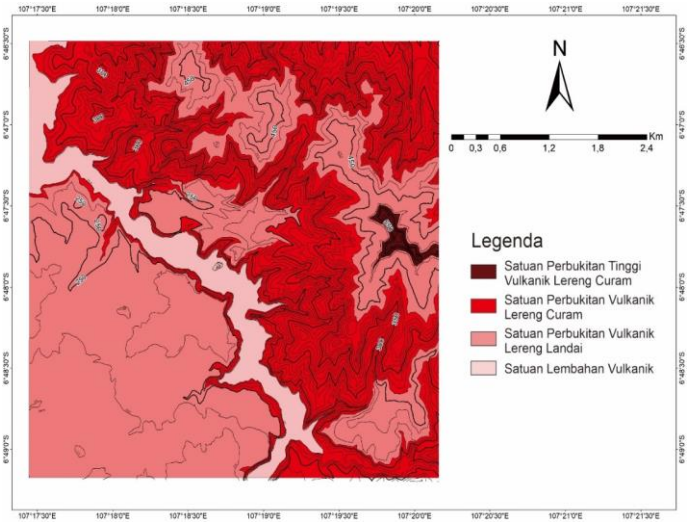

Figure 11. Distribution of geomorphological units in the study area

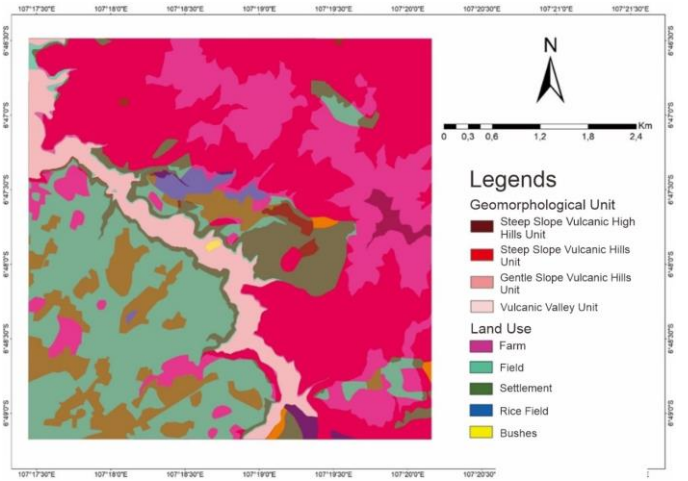

Figure 12. Distribution of geomorphological units and land use in the study area

TABLE 1. Geomorphological characteristics and land use of the study area

Geomorphological Unit	Area (km ^{2})	Land use									
		Shrubs		Settlement		Plantation		Field		Ricefield	
		%	Area (km ^{2})	%	Area (km ^{2})	%	Area (km ^{2})	%	Area (km ^{2})	%	Area (km ^{2})
Volcanic High Hills Steep Slope	0.12	0	0	0	0	100	0.12	0	0	0	0
Steep Slope Volcanic Hills	13.05	0.79	0.10	1.55	0.20	81.23	10.60	16.95	2.21	1.12	0.14
Sloping Slope Volcanic Hills	13.30	0	0	18,40	2.44	38.27	5.09	44.36	5.90	2.41	0.32
Volcanic Valley	2.20	0.95	0.02	0	0	4.86	0.10	8,241	0.18	0.02	0.00

Geomorphology of high volcanic hills with steep slopes occupies an area of 0.12 km^2. The land use development in the area is in the form of plantations located in the eastern part of the research location. Geomorphology of steep slope volcanic hills occupies an area of about 13.05 km^2. Developed land uses include; plantations have an area of 81.23% or about 10.60 km^2, fields area of 16.79% or about 2.21 km^2, settlements area of 1.55% or about 0.20 km^2, rice fields area of 1 .12%, or about 0.14 km ^{2}, and shrubs covering an area of 0.79% or about 0.10 km ^{2}. Spread in the North, Northeast, East, and Southeast. It has volcanic breccia and tuff lithology and volcanic breccia, tuff, and andesite lava lithology.

Geomorphology of gently sloping hills occupies an area of approximately 12.30 km ^{2}. Developed land uses include; Fields have an area of 44.36% or about 5.90 km ^{2}, plantations have an area of 38.27% or about 5.09 km ^{2}, residential areas have an area of 18.40% or about 2.44 km ^{2,} and rice fields have an area of 2.41% or about 0.32 km ^{2}. Distributed in the West, Southwest, North, and East has a lithology of volcanic breccia, tuff, and andesite lava. The geomorphology of the volcanic valley occupies an area of approximately 2.20 km ^{2}. Developed land uses include; Fields have an area of 8.241% or about 0.18 km ^{2}, plantations have an area of 4.86 % or about 0.10 km ^{2}, shrubs have an area of 0.95 % or about 0.02 km ^{2,} and rice fields have an area of 0 0.02 % or about 0 km ^{2}. Spread in the northwest to the Landmark following the flow of the Citarum tributary, it has a lithology of volcanic breccia, tuff, and andesite lava.

Land use in the Cipeundeuy area is not good because the Steep Slope Volcanic High Hills morphology has changed its function to fields, and the geomorphology of steep slopes of volcanic hills, sloping hills, and volcanic valleys is dominated by plantation land use, fields, and land use. Rice fields should still be forest and shrubs. The land use that changes its function can cause landslides because the lithology in the area is in the form of volcanic breccias and tuff that has soft hardness until loose. Even so, the nature of volcanic breccias and tuffs, which generally have high levels of porosity and permeability, and are located in high areas, make this area very good to be used as a water catchment area for settlements below it therefore, the use of this land is not as a settlement or area of activity. The dense population is a good thing.

V. CONCLUSION

Based on the research description of the research area, it can be concluded that the geomorphology of the Cipeundeuy area, Cipeundeuy sub-district, West Bandung Regency, West Java Province has geomorphological geomorphology: (a) Unit of High Volcanic Hills Steep Slope, which is composed of volcanic breccia and tuff lithology (b). Steep Slope Volcanic Hills Unit comprises volcanic breccia lithology, tuff, and andesitic lava. (c). Sloping Slope Volcanic Hills Unit, with volcanic breccia lithology, tuff, and andesite lava (d). Volcanic Basin Unit, with volcanic breccia lithology and tuff.

Geomorphology of high volcanic hills with steep slopes occupies an area of 0.12 km^2. Geomorphology of steep slopes volcanic hills occupies an area of approximately 13.05 km ^{2}. Developed land uses include; plantations have an area of 81.23% or about 10.60 km ^{2}, fields area of 16.79% or about 2.21 km^2, settlements area of 1.55% or about 0.20 km^2, rice fields area of 1 .12%, or about 0.14 km^2, and shrubs covering an area of 0.79% or about 0.10 km^2. Geomorphology of gently sloping hills occupies an area of approximately 12.30 km^2. Developed land uses include; Fields have an area of 44.36% or about 5.90 km^2, plantations have an area of 38.27% or about 5.09 km^2, residential areas have an area of 18.40% or

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.

about 2.44 km^2, and rice fields have an area of 2.41% or about 0.32 km^2. The geomorphology of the volcanic valley occupies an area of approximately 2.20 km^2. Developed land uses include; Fields have an area of 8.241% or about 0.18 km^2, plantations have an area of 4.86 % or about 0.10 km ^{2}, shrubs have an area of 0.95 % or about 0.02 km ^{2,} and rice fields have an area of 0 0.02 % or about 0 km ^{2}.

This land use change function can cause landslides because it is dominated by volcanic breccia and tuff material. Even so, the use of this land is not as a settlement or a densely populated area of activity, which is a good thing because it does not hinder the water absorption process in this area.

REFERENCES

[1] Bandono, and Brahmantyo, B. "Peta Geomorfologi, Masalah dan Penggunaannya dalam Pembangunan Berwawasan Lingkungan di Indonesia", Yogyakarta, Indonesia:Pros. PIT IAGI XXI, pp 777-783, 1992.

[2] Bermana, I, "Klasifikasi Geomorfologi untuk Pemetaan Geologi yang telah dibakukan". Bulletin of Scientific Contribution, pp. 161–173, 2006.

[3] Brahmantyo, B., and Bandono, "Geomorphologic Information in Spatial Planning of Indonesian Region" in Proc. Of Indonesian Assoc. of Geologist, the 28th Ann.Conv, Jakarta., pp. 255-259, 1999

[4] Bronto, Sutikno. "Stratigrafi Gunung Api Daerah Selatan, Jawa Barat". Pusat Survei Geologi., Indonesia, 2006.

[5] Chand, F. Environmental Geology in Urban Development. Proc. Geosea '98, in Bull. Geol. Soc. Malaysia, Dec. 1999, Spec. Publ., No. 43, 329-335

[6] Hutchison, C. S., Geological Evolution of South-East Asia. Oxford Monograph on Geology and Geophysics, 1989 No 13, hal 368.

[7] Howard, A.D, "Drainage Analysis in Geologic Interpretatiton". AAPG Bulletin, Volume 51, No.11, 1967.

[8] Liang, S., T. Zheng, D. Wang, K. Wang, R. Liu, S. Tsay, S. Running, and J. Townshend. Mapping high-resolutian incident photosynthetically active radiation over land from polar-orbiting and geostationary satellite data. Photogrammetric Engineering & Remote Sensing. 2007. 1085-1089

[9] Nowak, D. J., K. L. Civerolo, S. T. Rao, G. Sistla, C. J. Luley, and D. E. Crane. 2000. A modelling study of the impact of urban trees on ozone. Atmospheric Environment, 34. 2010.

[10] Rifai, A., Sulaksana, N., Iskandarsyah, T.Y.W.M., Sulastri, M., Raditya, P. P., and Mulyani, S., "Development of Urban Areas in Potential Areas of Natural Disasters in South Bandung, Indonesia," in IOP Conference Series: Earth and Environmental Science, 2018, pp. 1–11.

[11] Sudrajat, Adjat, "Jawa barat Selatan Sebagai Potensi Yang Terpendam". Direktorat Jendral Geologi Dan Sumberdaya Mineral., Departemen Pertambangan dan Energi., Indonesia, 1992

[12] Sudjatmiko, "Peta Geologi Lembar Cianjur, Jawa". Pusat Penelitian dan Pengembangan Geologi., Indonesia, 1972

[13] Sukamto, RAB, "Peta Geologi Lembar Jampang, Jawa". Pusat Penelitian dan Pengembangan Geologi., Indonesia, 1975

[14] Sulaksana, N., Sjafrudin, A., Sukiyah, E., Raditya, P.P., Abdulah,F., Setiyanto, P. Peran Tata Guna Lahan terhadap Distribusi Tingkat Kerawanan Erosi di Kawasan Ciletuh Jawa Barat, Bulletin of Scientific Contribution, Vol. 13, No. 2, 2015: 160-167.

[15] T. Johara Jayadinata, Tata Guna Tanah dalam Perencanaan Pedesaan Perkotaan dan Wilayah. Institut Teknologi Bandung, Bandung. 2009.

[16] Van Bemmelen, R.W, "The Geology of Indonesia" Volume 1A., The hauge Martinus Nijhoff., Netherland, pp 732, 1949

[17] Van Zuidam, R.A, "Aerial Photo-Interpretation in Terrain Analysis and Geomorphologic Mapping". Smith Publisher., The Hague., ITC, pp 442, 1985.

[18] Yunhao, C., S. Peijun, L. Xiaobing, C. Jin, and L. Jing. 2006. A combine approach for estimating vegetation cover in urban/suburban environment fromremotely sensed data. Computers & Geoscience, 32, 1299-1309.doi:10.1016/j.cageo.2005.1

[19] Zui dam, R. A. Van,1985. Aerial Photo-Interpretation in Terrain Analysis and Geomorphologic Mapping. ITC, Smits Publ., Enschede, The Hague.

Murni Sulastri, M Tobibi Pohan, Nana Sulaksana, and Pradnya Paramarta Raditya Rendra, "The Role of Geomorphology in Cipendeuy Regional Land Use, Cipendeuy District, West Bandung Regency, West Java Province," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 5, Issue 4, pp. 122-127, 2022.