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GEO-Morphological Classification of Dhulia District: A Case Study

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ABSTRACT

Terrain, topography, climate, geology, and geomorphology are crucial in assessing the potential of water resources. To gain accurate insights into the availability of these resources, it is essential to examine the effects of these factors. The region under investigation features distinct physiography, geology, and climatic conditions. A significant portion of the area is dominated by Deccan basalt, while alluvial deposits occupy the central region. The characteristics of the aquifers are influenced by weathering processes, fractures, faults, and lineaments. Both surface and subsurface hydrological elements, including geological formations, lineaments, types of rock, drainage density, existing water bodies, and the thickness of the weathered overburden, significantly impact groundwater availability across various geological formations or aquifers. The drainage patterns of the watershed also attract the attention of hydrologists and geomorphologists. Several geomorphic factors are taken into account to evaluate water resources within the district.

Keywords: Terrain, Geomorphology, Basalt, Hydrological Element, Weathering

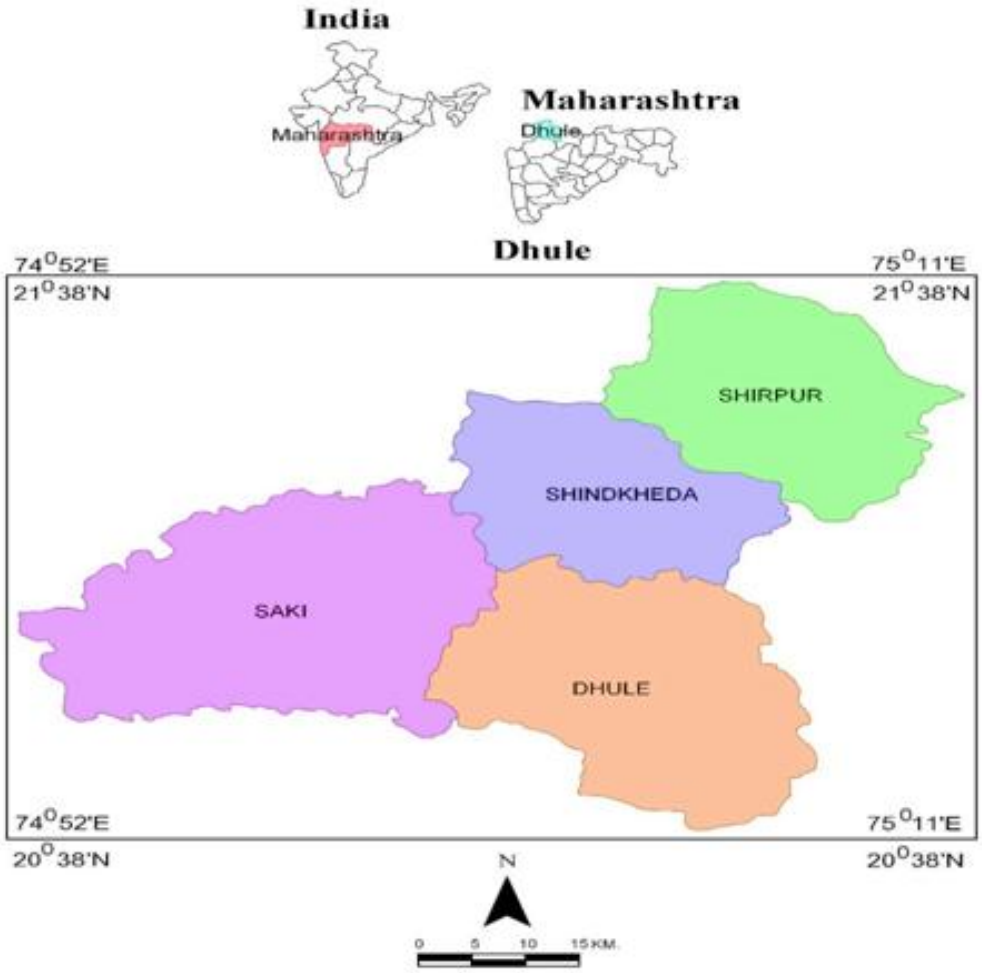
INTRODUCTION

Morphology of the region is most dominant factor which are responsible for ground water development. This morphology is also varies from region to region and time to time too. The morphology is also result of environmental factor situated around the region. An every place has a specific morphology controlled by geographical factors i.e. climate, air, slope, geology, hydrological factors etc.

LOCATION AND EXTENT

Dhule district is situated in the north-western part of Maharashtra State. It spans from 20°38' to 21°38' North latitude and from 74°52' to 75°11' East longitude. Covering an area of 8,063.11 square kilometers, Dhule represents 2.62% of Maharashtra's total geographical extent. The district measures 108 kilometers from west to east and 112 kilometers from south to north. Its territory is depicted in Survey of India degree sheets No. 46K, 46L, 46O, 46G, and 46H at a scale of 1:250,000. The district is bordered to the north by Barwani district in Madhya Pradesh, to the east by Jalgaon district, to the south by Nasik district, and to the west by Nandurbar district, with Dang district in Gujarat touching its southwestern edge.

LOCATION MAP

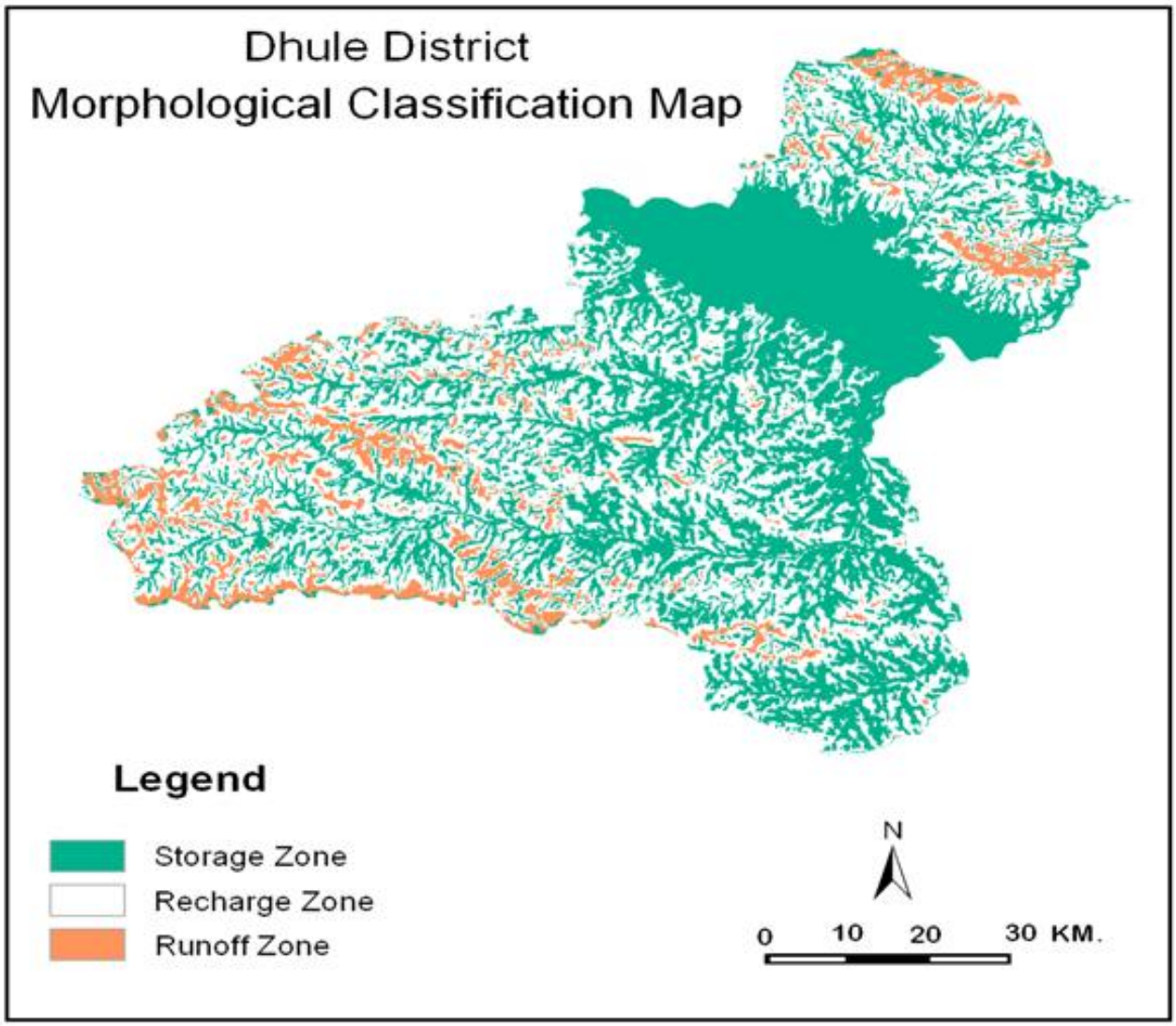


TOPOGRAPHY

The area under study is situated within the Deccan Plateau and lies at the center of the Tapi basin. This region showcases distinct topographical characteristics and landforms. Notable features include a chain of mountains, hill ranges, valleys, dykes, lineaments, a strip of fertile alluvial soil, pediment plains, and eroded riverbanks. The highest elevations in the district reach 1291 meters above mean sea level (20° 50’ 45” N latitude and 74° 4’ 7” E longitude) to the west of the MangiTungi peaks, with another peak at 1290 meters above mean sea level (20° 50’ 22” N latitude, 73° 56’ 31” E longitude) located south of the village of Shenvad in Sakri tehsil. Conversely, the lowest point is at an elevation of 129 meters above mean sea level (21° 25’ 26” N latitude, 74° 31’ 51” E longitude) near the Tapi River, close to the village of Takarkheda in Shindkheda tehsil.

GEOLOGY

The majority of the district is covered by the 'Deccan Basalt/Traps' from the Late Cretaceous to Early Eocene period. In 1833, W. H. Sykes coined the term 'Deccan Traps' (where 'Trappa' means stair in Swedish) to describe the step-like landscape of the volcanic terrain in the Deccan Region (Kale and Gupta, 2002). The word 'Deccan,' derived from the Sanskrit 'Dakshin,' means south. This geological formation is a result of extensive lava flows that spread over large areas. The basaltic lava flows are classified into two types: 'Pahoehoe' and 'aa.' The Pahoehoe type features a vesicular section with pipe-like amygdaloidal structures, a solid middle portion, and a vesicular top with rounded vesicles. In contrast, the 'aa' flow is characterized by a thick, fragmented surface and a less consistent clinkery base. The basaltic lava flows in the area are classified into the Sahyadri Group to the south and the Satpura Group to the north of the Tapi River. The Sahyadri Group encompasses the Salher, Lower Ratangarh, and Upper Ratangarh formations. The Salher formation can be found exposed near Sakri and Pimpalner along the Panzara River, covering a distance of 50 kilometers. Within the district, the Satpura Group contains between 18 and 21 lava flows, with thicknesses ranging from 15 to 40 meters.

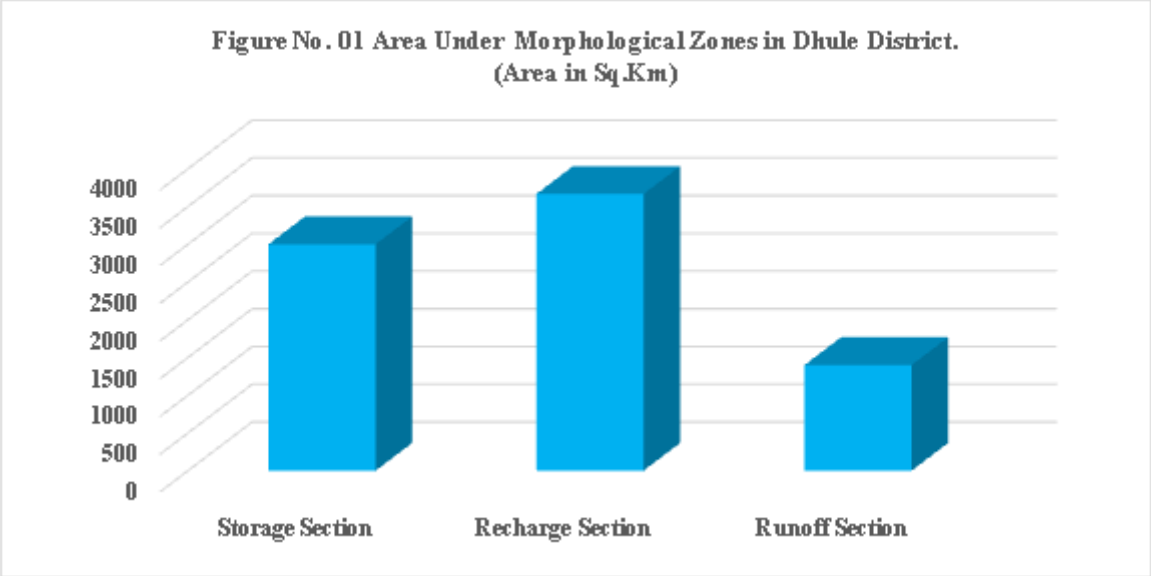


MORPHOLOGICAL CLASSIFICATION

Morphology significantly impacts the hydrological conditions and behavior of groundwater reservoirs. Based on their locations within river basins and the physiographic characteristics of the terrain, watersheds are classified into three categories (Maggirwar, 1990). These are as follows;

i) Runoff Section: -
Runoff occurs in the upland regions near the water divide, characterized by highly fragmented morphological features, steep slopes, and varying topography. This zone features barren hills, rocky outcrops, a poorly developed weathered layer, and a lack of vegetation. As a result, it experiences limited infiltration and rapid runoff during rainfall. The hydrological conditions in this region suggest either poor or nonexistent aquifers. Groundwater in the runoff area is found only in limited and perched water table conditions (Maggirwar, 1990). In the current research area, the Satpura hills, Dhanora-Galna Hills, and the Western Ghat section are identified as runoff zones. 1397.91 sq. km. area which is 17.34% of the study area. Dykes can be also including in this zone.

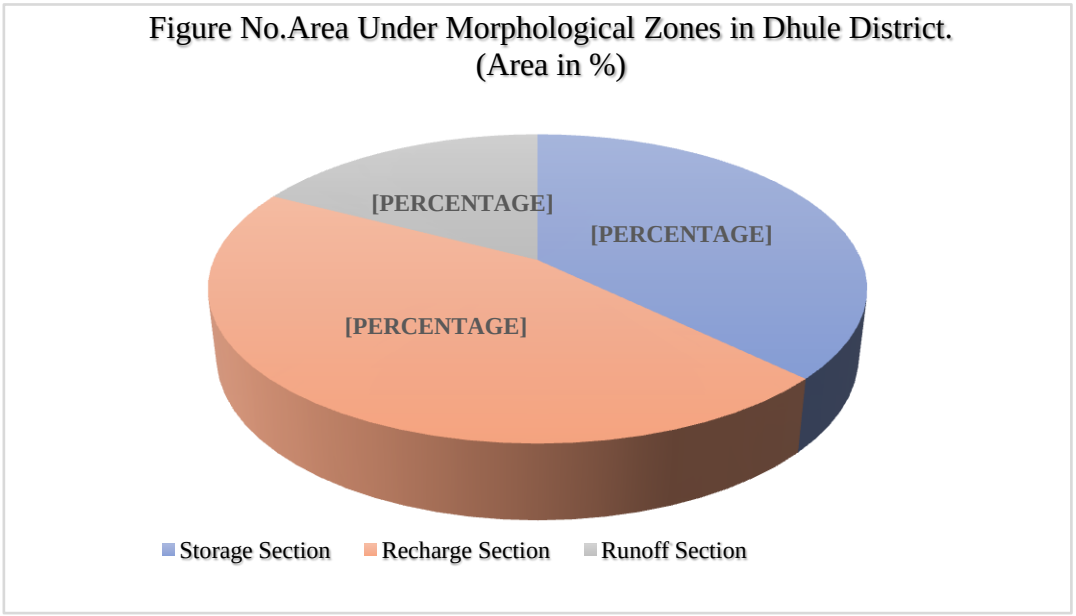
ii) Recharge Section: -
Recharge zone lies in the central part of the basin. The area's topography is moderately dissected and features streams of a higher order. It has moderate elevation and a shallow layer of soil. These characteristics create ideal conditions for average groundwater infiltration and recharge. Therefore, the region is endowed with groundwater and is suited for its development. This zone also experiences active weathering. The recharge zone includes landforms such as piedmont plains and moderately dissected plateaus. The groundwater yield in this area is seasonal, supporting only kharif and rabi crops. Covering an area of 3,665.62 square kilometers, the recharge zone accounts for 45.46% of the total study area. It is present throughout the study area, excluding the alluvial plain of the Tapi River.



Computed by Researcher

iii) **Storage Zone: -**

Low-lying regions and the lower segments of river basins belong to this category. These areas are marked by inadequate drainage. The thick soil cover in the storage zone comes from either extensive weathering or alluvial deposits. Due to the considerable thickness of the weathered layer and its porosity, this zone can retain a large amount of water. Additionally, it benefits from favorable recharge conditions, receiving groundwater inflow from higher land areas after the rainy season. Groundwater in this zone exists under water table conditions. From a hydrological perspective, the storage zone is very suitable for groundwater exploration. This zone is found in the alluvial plains and eroded lands of the Tapi valley, as well as in the valley fills of its tributaries and streams. The storage zone spans an area of 2,999.58 square kilometers in the studied region. Both dug and tube wells in this area have a high yield, ranging between 100 to 150 cubic meters per day, thus providing support for crops throughout the year. Storage zones are also very fertile and productive, leading to bountiful yields.



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CONCLUSION

The Satpura ranges to the north and the Dhanora and Galna hills to the south enclose the Dhule or Dhulia district. The district's center is traversed by the Tapi River. Four separate physiographic divisions can be found within the Dhule district's territory: the Deccan plateau, the Satpura mountains, the Dhanora and Galna hills, and the Tapi River's Alluvial Plain. Basaltic topography, which is enormous and unyielding, covers around 85% of the district. Thus, there is little chance of replenishing the groundwater. The Tapi River flows through a rift valley from the district's center.

Thick alluvium and silt deposits abound in it. Known as the state's greatest aquifers, these alluvial deposits come from healthy aquifers.The district is known for two geological formations: Recent Alluvium and Deccan Trap. Along the river valleys, alluvium covers the Deccan traps. Alluvium ranges in thickness from a few centimeters to 308 meters. To the north of the Tapi River, the alluvium is thicker. The southern portion of the study region contains a few isolated pockets of deeply worn basalt. In Sangavi, Palasaner, Nimzari, Kudashi, Sakri, and Shindkheda tehsils, layers of red and green bole with thicknesses ranging from a few centimeters to 1.5 meters are visible.

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