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# Stability of Soil Strata of Latur City for Underground Watershed Management

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**Abstract -** *Watershed management is used to describe the process of implementing land-use practices and water management practices to conserve and enhance the quality of the water and other natural resources within a watershed by managing the use of those land and water resources in an extensive manner.*

*The main objective of this study is to accumulate information on the soil strata of Latur district and to correlate with control of underground runoff & degradation and thereby conservation of soil and water. The goal is to protect, conserve, and improve the sub-surface conditions of watersheds for more efficient and sustained production of agriculture and domestic purposes.*

***Key Words*: Watershed management, Lineament, Runoff, Degradation, Groundwater.**

## 1. INTRODUCTION

Latur is a city in the Marathwada region of Maharashtra state in India. It is the administrative headquarters of Latur district and taluka. Latur lies in the Deccan region of Maharashtra. Water is one of the most important resources on Earth hence it is necessary to save and recycle it for a sustainable future. It can be done by understanding the soil stratification and annual precipitation of Latur City.

## 2. NEED OF STUDY

### 2.1 To manage underground runoff in Latur Region

The Latur region is one of the most undeveloped parts of the state. The area is away from the urbanization and due to the Sahyadri range, the monsoon doesn't hit the region properly which results in quite less rainfall than average. From this restricted amount of rainwater received by the region, most water runs away as underground runoff. To control it, the study of subsoil layers becomes important.

### 2.2 Unfavourable Topography of Latur region

The Sahyadri range does not allow the western wind to pass through the Deccan region due to the significant amount of difference in altitude between both, which results in consequential rainfall in the area, and whatever precipitation occurs in the hilly region, runs away from storage due to slope. Due to this, the area repeatedly faces drought.

### 2.3 To analyse subsurface strata

It is necessary to analyse and study subsurface strata of Latur so as to understand the problem clearly and to use given resources to present profound solutions to water scarcity in the area under consideration.

## 3. OBJECTIVE

To collect data on the bedrock of the region, the difference between altitudes of sub-regions, type of soil and its stratification, and analyse the soil strata of the region to identify the stratigraphy.

## 4. AREA UNDER CONSIDERATION

The area considered for this research is Latur which is the Marathwada region of Maharashtra. It is geographically located between 17°52′ North to 18°50′ North and 76°18′ East to 79°12′ East in the Deccan plateau. It has an average elevation of 631 meters (2,070 ft) above mean sea level. The entire district is on the Balaghat plateau, 540 to 638 meters from the mean sea level.

The climate of the study region classified semi-arid, is usually hot, potential evaporation of which is far excess of the precipitation. In general, hot and dry summers and moderately cold winters characterize the climate of the region. The region has a tropical monsoonal type of climate. About 894 mm / 35.2 inches of precipitation falls annually.


**Fig 1:** Map of Latur District

## 5. DATA COLLECTION

Various types of data are needed to collect regarding bedrock of region, a difference of altitudes amongst various sub-regions, type of soil and its stratification, etc. The sources of data are the National Remote Sensing Centre (NRSC), Bhuvan application, and the online portal of Maharashtra Government (mahaagri.gov.in).

### 5.1 Soil classification

Class 1-Very Good cultivable land
Class 2-Good cultivable land
Class 3-Moderately good cultivable land
Class 4-Fairly good/Occasional cultivable land
Class 5-Not suitable for cultivation because of stoniness
Class 6-Steep (Erosion with shallow soil)

For our proposed plan we will be mostly focusing on class 5 and 6 types of soil.

**Table -1:** Area of type 6 soil in talukas

| Sr No. | Taluka | Area(ha) |
|---|---|---|
| 1. | Renapur | 65 |
| 2. | Chakur | 580 |
| 3. | Ahmedpur | 1279 |
| 4. | Latur city | 2549 |

### 5.2 Altitude Difference of Region

According to NRSC, the relief map is the altitude difference of the region with reference to contour lines of the hilly and the valley area.

The study of this map helps us to separate various plains from plateau determining its altitude above the mean sea level. With reference to map the Latur is located southeast of Maharashtra where the MSL ranges between 600 to 900 m, whereas the natural wind flow and the cloud formation takes place basically in the west side of the state.

The average MSL varies from 900 to 1350 m on the west side, this causes jamming of cloud formation and stopping of wind flow towards the east side of the state, resulting in lesser rainfall compared to Sahyadri ranges.

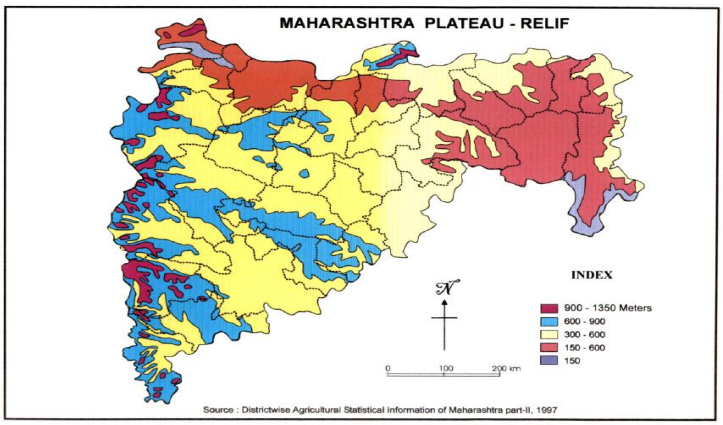


**Fig 2:** Relief Map of Maharashtra

The Sahyadri with an average height of 1200 meter runs southwards along the western edge of the Deccan Plateau from the Tapti mouth and extends much further beyond the southern limits of the state. In contrast to its steep western face, the range slopes gently east and along the Maharashtra Plateau.

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Whereas the Deccan plateau region occupies nearly 9/10th of the total state area with its local variations in relief. The average height of the plateau however varies from 300 meters in the east and 600 meters in the west. The slope of eastward is gentle compared to the Sahyadri range. Due to significant differences in MSL of the east and west area of the state, the amount of stipulated rainfall varies in huge

amounts, which causes water level differences across the state.

### 5.3 Arrangement of Latur Bedrock

Deccan Traps emerge as Basaltic lava flows, which are normally horizontally disposed over a wide stretch and surge to tableland type of topography, on weathering also known as a plateau. These flows occur in a layered sequence ranging in thickness from few meters to 50 m. Flows are defined by massive portions at the bottom and vesicular portions at the top and are detached from each other by a marker bed known as bole bed.

Groundwater in Deccan Trap Basalt appears under phreatic conditions at shallow depths up to 15 to 20 m. At deeper levels, the groundwater occurs below semi-confined to confined conditions. The weathered and fractured trap occurring in topographic lows compose the main aquifer in the district. The lava flow of the vesicular portion varies in thickness from 15 to 25 m and forms the potential zones. Almost the entire district is underlain by the Basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvial formation of recent age also occurs as a narrow stretch along the banks of major rivers flowing in the area but it does not form a potential aquifer. The soil strata below are hard BC soil is less than 2 m.

### 5.4 Geomorphology of Latur Region

According to NRSC, the region of Latur comprises mixtures of plateau terrain and plains spread across the district.

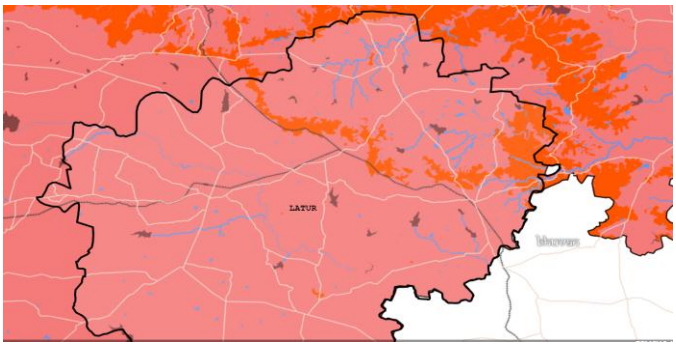


**Fig 3:** Geomorphology Map of Latur District (Scale: 0-20 Kms)

The study of this map signifies the origin of the layers to the depth of the bedrock, whether it is a hard, uncultivable surface or fertile agricultural land.

The area in light pink covers the denudational origin of pediment plains and the area shaded in the north to west of the region shows the structural origin of the upper plateau. Resulting in water bodies coming from north to south of the region being stopped by this hard layer of the plateau that causes excessive infiltration of rainwater.

The given map shows that the whole Latur district consists of pediment plains but some parts also cover hard upper plateau.

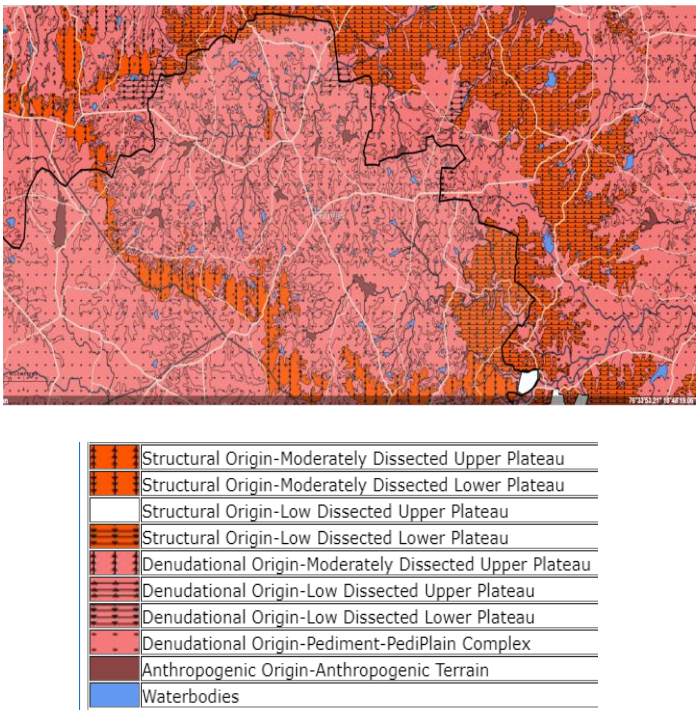


**Fig 4**: Geomorphology Map of Latur District (Scale: 0-8 Kms)

The further scaled map allows us to look deep into the subsurface of the district that not only the plateau in upper dissected and also the plateau is lower dissected and moderately dissected due to weather and also human interaction thus altering the nature of the strata.

This alteration didn't cause any huge difference to the underlying bedrocks but it did cause a change in infiltration rate.
Due to the difference between altitudes the stream cutoff was not possible that caused infiltration value from high to medium.
This reduced the water drains up to certain amounts, but not very significant that it would help to recharge the underground water table.

### 5.5 Lineament of Latur Region

A lineament is a linear feature in a landscape that is an expression of an underlying geological structure such as a fault, fracture, or joint. Lineaments are generally referred to in the analysis of fractures or structures.

According to NRSC, the region of Latur contains a huge amount of fractures and joints in plateaus and subsurface rock layers. The study of this map helps in the identification of the main fractures in the region that drains the surface runoff unnaturally.

The pink straight line shows the major joints and fractures that have deep openings so as to allow the whole stream to runoff inside the plateau, resulting in unwanted infiltration of water at unwanted places during the time of the water cycle.

The following map also shows the drainage pattern of the rivers depicted by the Dark Green straight line, caused by steep slopes with some relief. Because of the steep slopes, the streams are swift and straight, with very few tributaries, and all flow in the same direction. This helps us in clearing the doubt of having an underground water table but due to steep slopes at certain places, the water is unable to recharge the table, which causes underground water runoff.

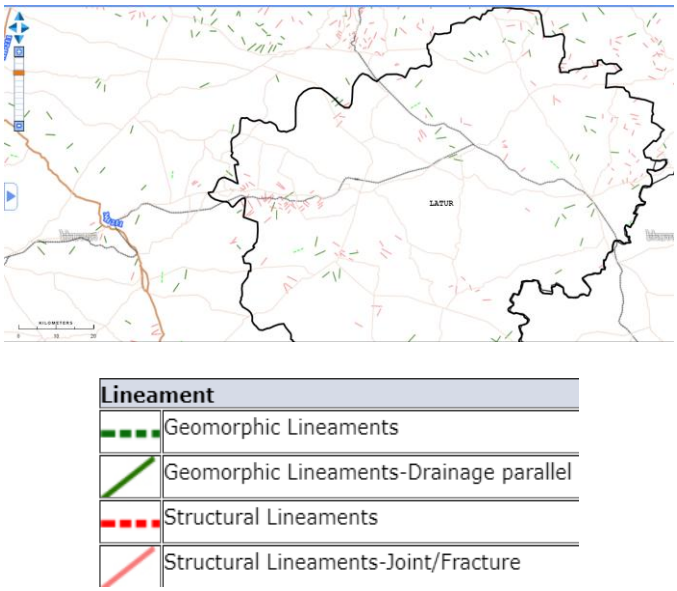


**Fig 5**: Lineament Map of Latur District

### 5.6 Groundwater Runoff Challenge

After analyzing these maps, we understood that even after sufficient rainfall in the Latur region, the sustainability of water is not possible due to geomorphology, lineament, stratigraphy, and topography of the region. After a detailed study, we noticed that the strata lying below the surface of the region i.e. the impervious bed is in a downward slope (due to its geographical factor it has heavy infiltration value) and because of which the infiltrated water fails to recharge the groundwater and flow down as runoff water. The underground runoff is an unavoidable natural phenomenon thus, the natural aquifer system fails to commute in the region of Marathwada. As the local people have underground water as the main water source for livelihood, due to the inability of natural recharge of water, excessive use of it causes water deficiency in the groundwater table.

### 6. CONCLUSIONS

After analyzing the data, we can conclude that even after having sufficient rainfall, the inability of natural aquifers to hold and transmit the water to recharge the groundwater table limits the availability of the water across the region. A possible solution to overcome this problem is to provide artificial aquifer which helps to recharge the underground water table artificially to fulfill the drawback of the natural aquifer.

The studies on artificial recharging techniques are mostly site-specific and descriptive in nature, which gives little insight into the potential success of implementing it in other locations. The underground layers are strong enough to withstand the total load of the storage aquifer without any difficulty thus, reducing the risk of failure. These structures would be made on the outskirts of the city so that no agricultural land would go waste. These aquifers would connect the entire city with pipelines, which could be used for agriculture or other household activities as well. And thus, serve the entire city and fulfill its water demands.

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