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HYDROGEOMORPHOLOGY OF CHEVELLA BASIN, RANGA REDDY DISTRICT, TELANGANA STATE

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ABSTRACT

Chevella basin of Ranga Reddy district in Andhra Pradesh is one of the drought prone basins. The methods and materials used for the survey are topographic maps, Survey of India (SoI) in 1: 25,000 scale geomorphology map, groundwater prospectus map, cadastral map, Global Positioning System (GPS) and Geographic Information System (GIS). Prominent geological formations in the basin are Deccan traps, laterites and peninsular gneissic complex. Slope of the basin is towards north east and is nearly horizontal. There is a 5th order stream in the basin and has moderate erosion characteristics. Sub dendritic to sub parallel drainage pattern is observed in the basin. Major and minor fracture and lineament structures originated at 3rd, 4th and 5th order streams. The major geomorphic units in the area are moderately dissected plateau, shallow weathered plateau, shallow valley fill, slightly dissected plateau, pediment and inselberg. Most of the land forms are suitable for creation of recharge pits and check dams for the development of ground water

Keywords- *Hydrogeomorphology, landforms, groundwater, water harvesting structures.*

I. INTRODUCTION

Hydrogeomorphology has been defined as "an interdisciplinary science that focuses on the interaction and linkage of hydrologic processes with landforms or earth materials and the interaction of geomorphic processes with surface and subsurface water in temporal and spatial dimensions."[1] The term 'hydro-geomorphology' designates the study of landforms caused by the action of water.[2]

From the groundwater point of view integration of geological, structural and hydrological data with hydro-geomorphologic data is very much useful in finding out the groundwater potential zones with fruitful results[3] Nagaraju, et al. [4] utilized the GIS for delineating hydrogeomorphology and found useful.

Chevella basin of Ranga Reddy district in Andhra Pradesh is one of the drought prone basins. It is falling in Ranga Reddy, Telangana State, India. The basin is located at central part of the district that is about 42 km from Hyderabad, lying on Hyderabad to Tanduru state highway number 4.

The Chevella basin is under semi-arid condition as well as come under Southern Telangana Zone agro-climatic zone (Agriculture Action Plan 2015-16, Department of Agriculture). Annual rainfall varies in between 700 mm to 900 mm. Minimum and maximum temperatures of the area are 13°c and 42°c respectively. The basin occupied with black soil mixed with calcareous and gravel. It has a loamy texture. The main crops grown in the basin are maize, sunflower, grape, vegetables, Jowar, cotton, Bengal gram, Paddy, Red gram and other millets. Groundwater is the source of water for crops.

II. METHODOLOGY

Longitude, latitude and elevation from the mean sea level of the structures measured. These locations are transferred to Geographic Information System (GIS). Village wise maps are prepared for all structures on cadastral map at the corresponding survey number. As well as basin maps are prepared on Survey of India (SOI) topo sheets. The materials used during survey are topography maps Survey of India (SoI) in 1: 25,000 scales as the base map, geomorphology map, groundwater prospectus map, cadastral map, Global Positioning System (GPS), Geographic Information System (GIS).

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III. GEOLOGY

The prominent geological formations in the basin are Deccan traps, laterites and peninsular gneissic complex (Fig.1). Moderately hard porous laterites of Pleistocene era are the youngest formations formed above the basalts Pleistocene era. Basalts are formed as parallel layered with steep slopes. These trap rocks were in the form of layers of different texture and thickness. Weathered basalts have medium permeability and vesicular basalts have relatively high permeability. Laterites are found capping the weathered basalts course. Alluvium is of limited to Musi River. Peninsular gneissic complex is the oldest formation in the basin. Geology of the Chevella basin is shown in the figure 1.

Geological succesion of the of the Chevella basin

Lithology	Formation	Era	Nature and characteristics
Laterite		Pleistocene	Moderately hard and porous
Basalt, Intertrappeans	Deccan trap	Cretaceous to Paleocene	Parallel layered, steep topography
Predominantly granite and alkali feldspar granite	Peninsular gneissic complex	Archean	Hard, Compact

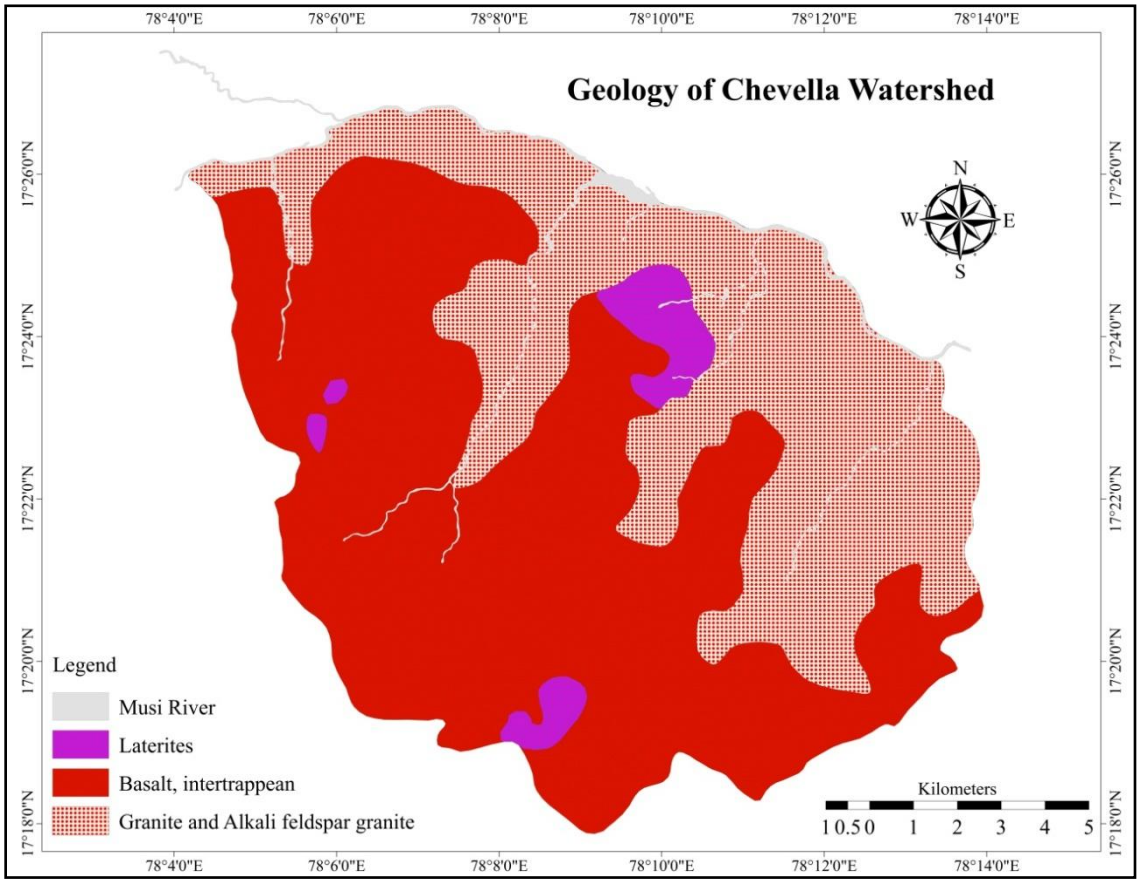

Fig 1: Geology of the Chevella basin

Granites distributed in the southern and western portions of the basin. It is grey to pink, medium to coarse grained porphyritic or massive. It occupies elevated areas forming denudation hills. Basalts and intertrapeans are also present in the south. They are recorded in the south east, along Musi River. Isolated laterite formations are found at three different locations of the basin.

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IV. GEOMORPHOLOGY

Geomorphology is the study of forms and process of landforms, which are the products of various exogenesis and ontogenetic forces. Landforms play a significant role in land resource mapping, watershed studies, terrain evaluation and soil classification in addition to ground water studies. In identification of suitable locations for water harvesting structures geomorphological units have been played vital role.

The major geomorphic units in the area are moderately dissected plateau, shallow weathered plateau, shallow valley fill, slightly dissected plateau, pediment and inselberg (Fig.2). Andhra Pradesh State Remote Sensing Application Centres (APSRAC) groundwater prospect map is taken as base map in preparing geomorphology of Chevella basin. Hydro-geomorphological units like plateau moderately dissected (PLM-21) formed by laterite has characterized poor recharge conditions. Recharge pits are suitable in this type of landform. Water accumulated in these pits can be utilized as a mix for agriculture use and irrigation for critical stage of crop. These landforms are located at south and North west part of the basin as isolated patches.

In the basin three types of plateau weathered shallow (PLWS) hydro geomorphic units are identified in massive basalts of Deccan traps. These are classified based on the depth to water level and yield of wells. PLWS-352 and PLWS - 353 are located at south tip; whereas, PLWS – 354 are occupied major part among other similar land forms, at extreme east and north of the basin. Two types of Plateau slightly dissected (PLS) land forms are found at different parts of the basin. PLS-353 are found in the entire basin and PLS-354 are located at north surrounded by PLWS-354. Recharge pits and check dams are suitable for these areas. Weathered zone over basalts act as recharge zone and the underlying fractures useful act as aquifer in the PLS land forms.

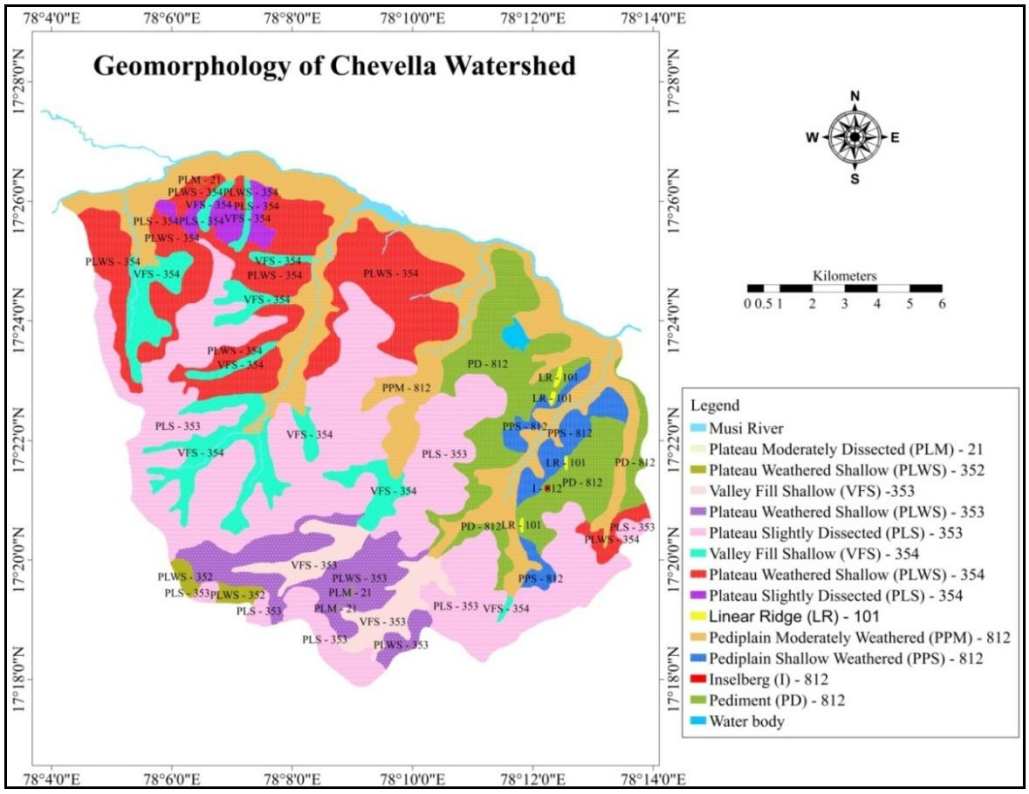

Fig 2 : Geomorphology of the Chevella basin

Quartz veins formed as Linear Ridge (LR) found as isolated hills in the west. These veins act as run off zone and act as barrier for groundwater. Valley fills (VFS) are formed along drainage course of first and second order drainage. Valley fills are filled with loose material act as a good recharge zone. The underlying fractured rock is being act as an aquifer. Check dam are the most suitable structures in this zone. Pediplain moderately weathered (PPM-812) and

pedipalin shallow weathered (PPS - 812) is occupied along streams of the basin. These are formed in granite area. PPM-812 is moderately good for recharge and is located along the weathered and fractured zone. Check dams and recharge pits are suitable for this area. PPS-812 have characterized with limited yield, present along weathered zone and fractured zone. Pediment zone is occupied around the streams. It has limited yields along fracture zone. This zone yields little quantity of water only

V. TOPOGRAPHY OF THE BASIN

Highest elevation in the basin is 672.1 meters above mean sea level (MSL) located at north and the lowest 540 meters above MSL (Fig. 3) location. Slope of the basin is towards north east. Slope is less than 1 meter (0.7%), which indicates that the basin is nearly horizontal and has moderate erosion characteristics. There are four parallel ridges trending towards north east in the basin in between four major streams formed by fluvial erosion and joining into Musi river.

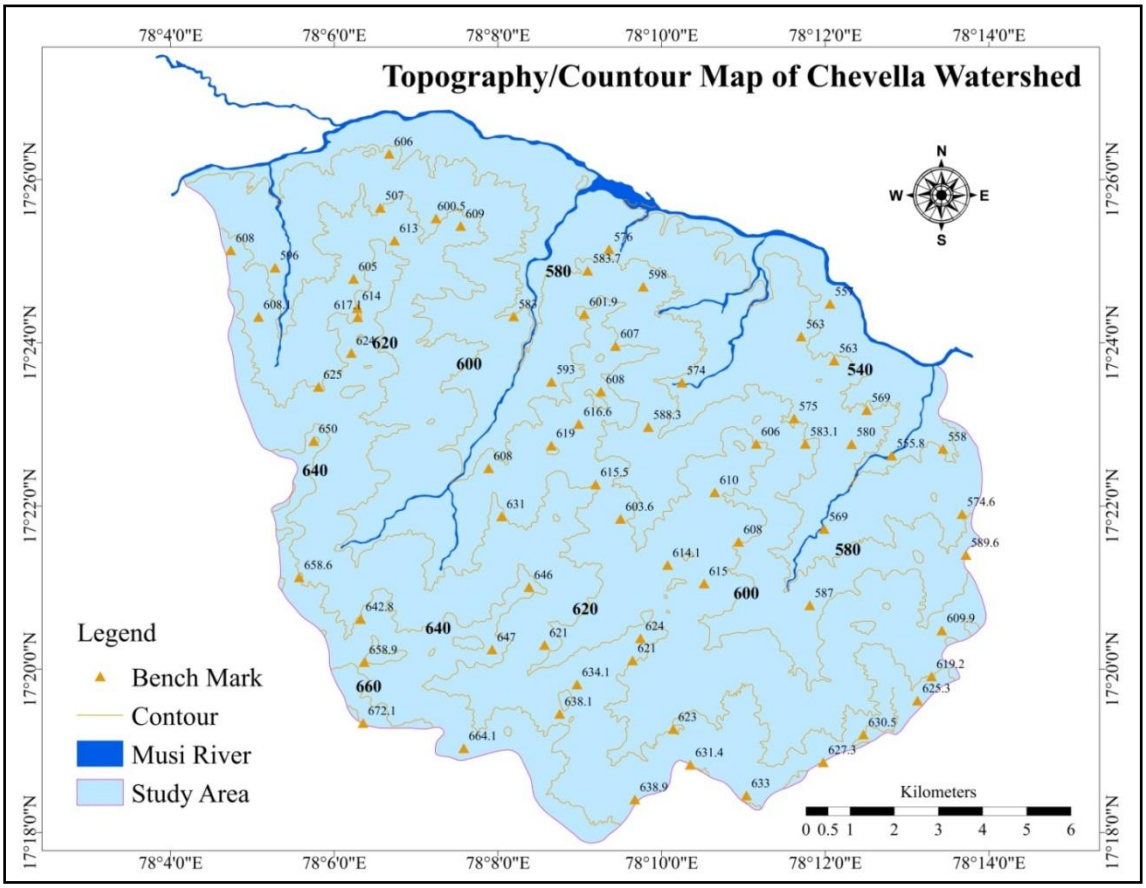

Fig 3: Topography of the Chevella basin

VI. DRAINAGE SYSTEM

Sub dendritic to sub parallel drainage pattern is observed in the basin (Fig.4) Heavy down pour occurring in concentrated periods causes most of the water going down as peak run off creating severe soil erosion. Due to heavy runoff it is observed that deep gullies are formed to depth of 4-6 meters. The basin is drained by Musi River located along northern boundary of the basin.

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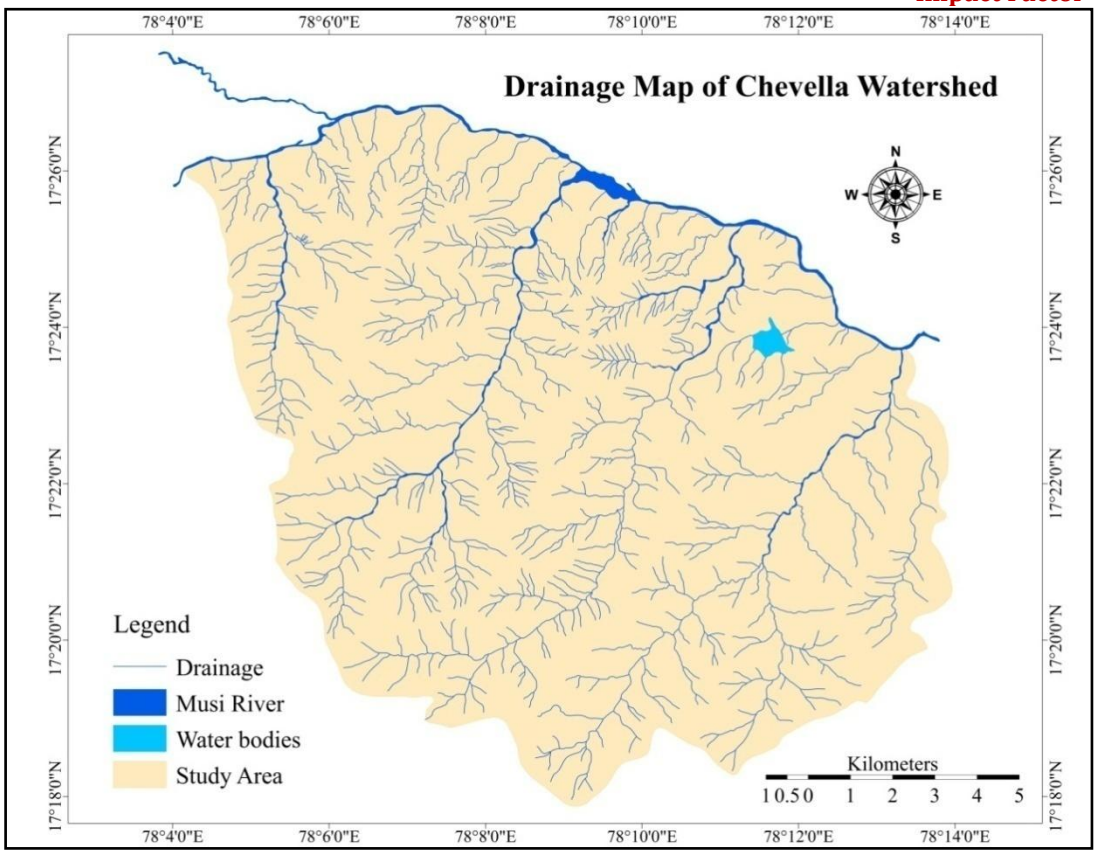

Fig 4: Drainage system of the Chevella basin

In the basin there is a 5th order stream. Total length of the five orders is 629.44 km. (length of the 1st order: 329.14 km, 2nd order: 118.50 km, 3rd order: 63.40 km, 4th order: 14.50 km and 5th order: 3.90 kms.)

VII. GEOLOGICAL STRUCTURES

In the basin major structural features are fractures and lineaments (Fig.5). These structures cause for secondary porosity and promote good groundwater potential zone. These are developed along the all drainage course of the basin. Major and minor fracture and lineament structures originated at 3rd, 4th and 5th order streams. Inferred major and minor fracture and lineaments developed at 1st and 2nd order streams. Linear ridges made up of quartzite vein act as an obstacle for the groundwater movement. A longitudinal fracture had been developed along the Musi River.

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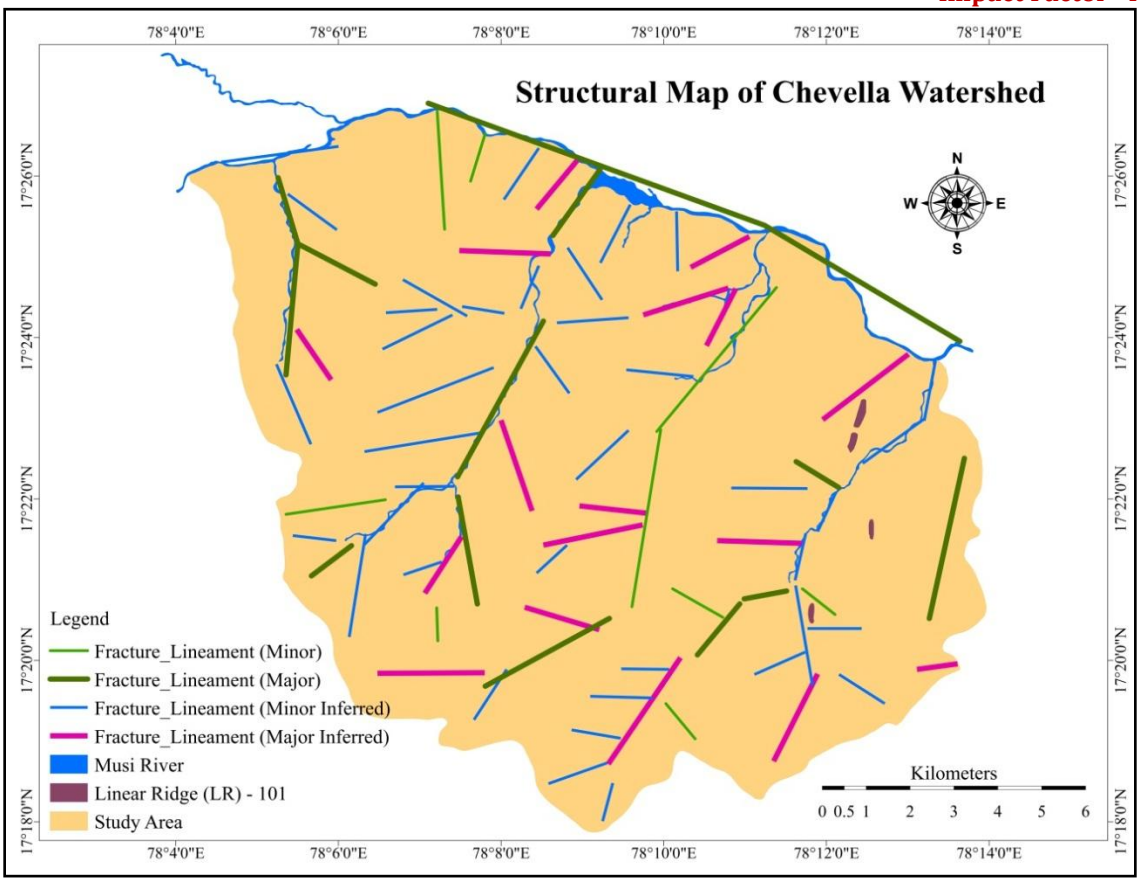

Fig 5: Structural map of Chevella basin

VIII. CONCLUSION

Chevella is a draught prone basin. Hence, development and management of groundwater shall be the prime requirement in the basin. The main crops grown in the basin are maize, sunflower, grape, vegetables, Jowar, cotton, Bengal gram, Paddy, Red gram and other millets. Groundwater is the source of water for crops. For the effective development, there is a need for exploration of aquifers. Delineation of Hydrogeomorphology is useful for locating the aquifers. Weathered Zone located over Basalts is acting as a recharge area. Other zones PLWS, PLS, and PLM landforms need construction of water harvesting structures like recharge pits and check dams for augmenting the water resource.

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