

# WATERSHED DELINEATION USING OPEN SOURCE GIS SOFTWARE – A CASE STUDY OF ANAND DISTRICT

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**Abstract :** The watershed delineation and Extraction of drainage network is important in management of water resources and Protection of drainage of the area from haphazard development. This study has been under taken as a part of final year project. In present study Using Shuttle Radar Topographic Mission (SRTM) data Watersheds and Drainage Networks are delineated. The open source software Map Window 4.6 is utilized for analysis purpose and for presentation purpose Arc MAP 10.6 is used.

**IndexTerms –** Watershed Delineation, Open Source GIS Platform, SRTM

## I. INTRODUCTION

Water is one of the most important resources for development and propagation of human civilization. If we see historically all major civilization started near water source. In current time due to higher population growth, urbanization and industrialization has resulted in higher demand for the water. Also as we know the potable water resource available for the human consumption is very small. To sustain current development and to achieve growth in future the watershed management is one of the key tools. We can employ Geographical Information System (GIS) and Remote Sensing (RS) technique for analysis and planning and management of the watershed at regional level. Here the attempt is made towards delineation of watershed and drainage network.

## II. STUDY AREA PROFILE

Anand District, with 8 Taluka as regions, is situated between 22.07E to 22.57 E and 72.15N to 73.28N in Gujarat State. Figure 1 shows location map of the study area. Anand is famous for the Co-operative Movement, particularly AMUL DAIRY and National Dairy Development Board (NDDB) and Institute of Rural Management (IRMA) Campus. The District of Anand has experienced rapid stride in population growth in the last three decades, with highest population density in Gujarat State. It also part of the Charotar and Bhal region which are the fertile lands and considered as food bowl of Gujarat.

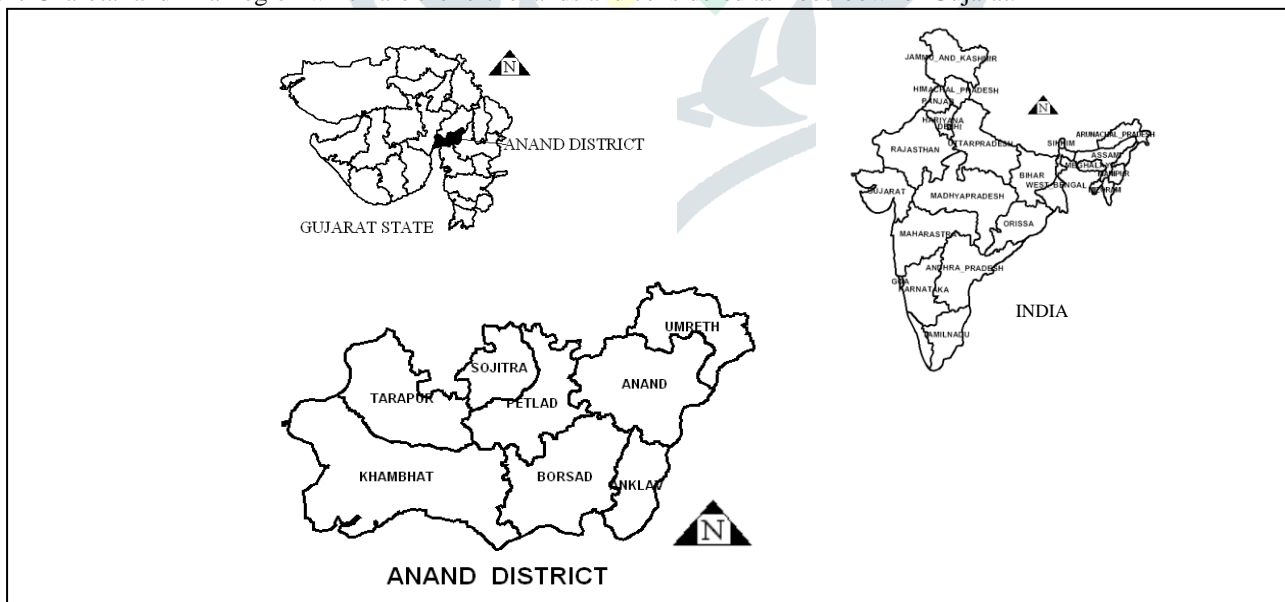


Figure 1 Location of Anand District

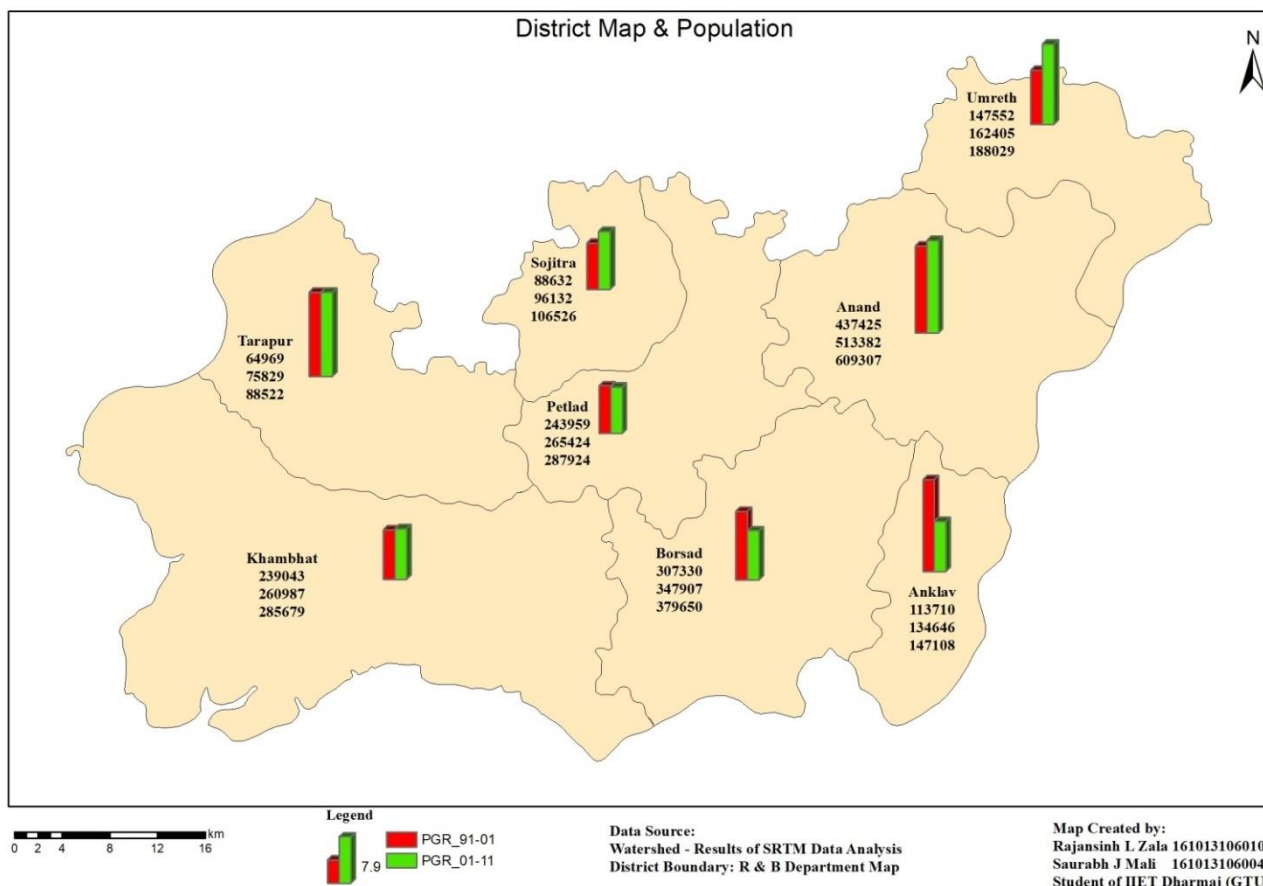


Figure 2 Taluka wise Population Growth

The Elevation varies from approximately 87m to -5m. The slope is from north-east to south west direction. The slope direction is in confirmation with the river and natural drainage system. The Mahi River is there on one boundary of the district. The figure 3 below shows the contours of the study area generated from SRTM Digital Elevation Model (DEM).

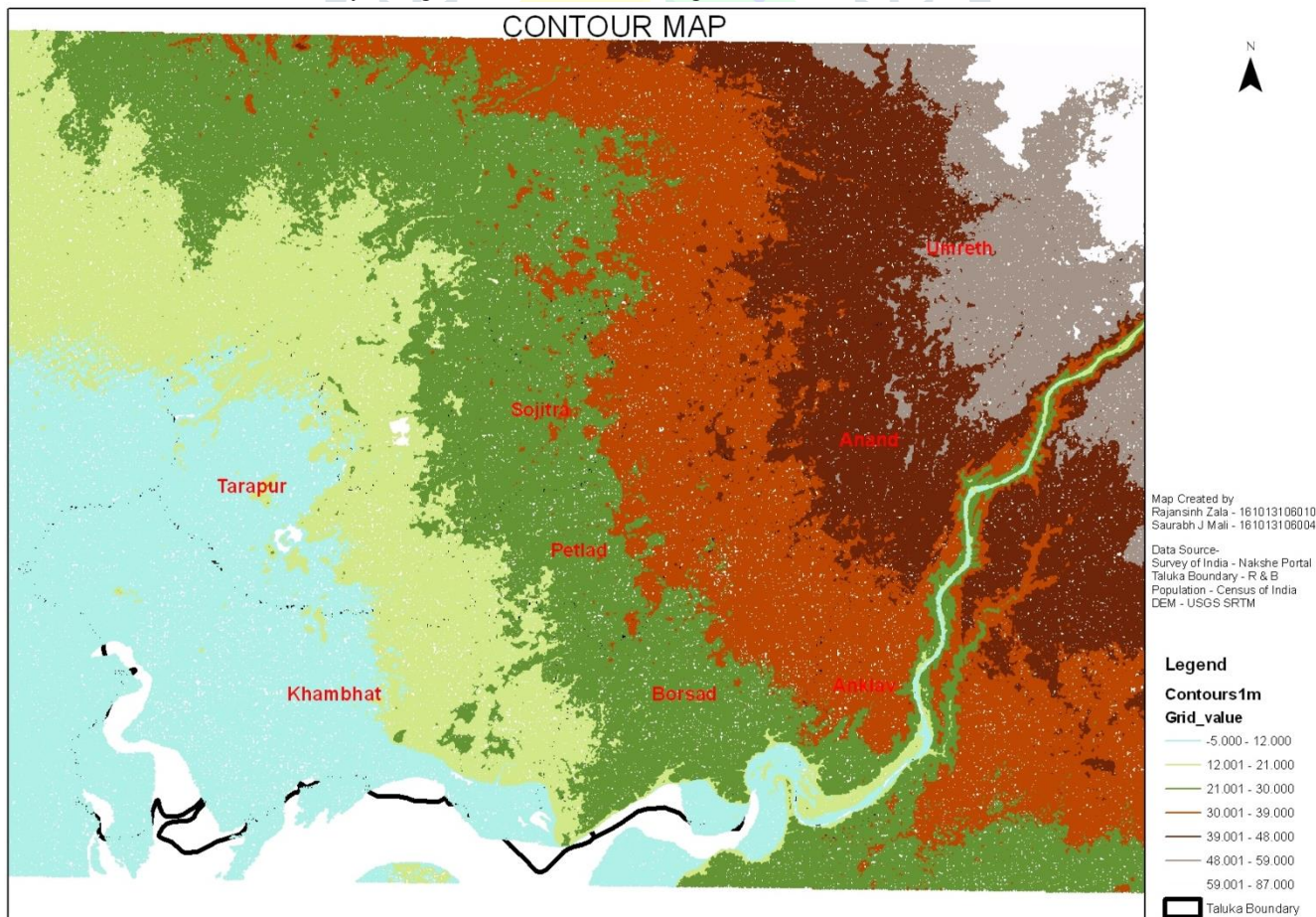


Figure 3 Contour Map of Study Area

**III. METHODOLOGY**

The study is based on secondary data analysis. For the study following data was collected – prepared and analyzed. For base map the district map of Anand was collected from Road and Building Department. The map in scanned form was provided. The map was further geo referenced in geographical coordinate system and used as a base map. The further map was re-projected for overlaying purpose. The boundaries of taluka and road network was digitized in GIS environment. The Survey of India Open Series Map tiles pertaining to Anand District was downloaded from Nakshe portal and same was Georeferenced to use as base map in further analysis. The Digital Elevation Data from United State Geological Survey’s SRTM data was downloaded for further analysis. The raw data was clipped and then analyzed for study region using Map Window GIS Software. The Output then composed using ESRI’S Arc Map as the free ware Map Window GIS is unstable and do not provide good output. The following flow chart shows how the data collection and analysis process has been carried out for present study.

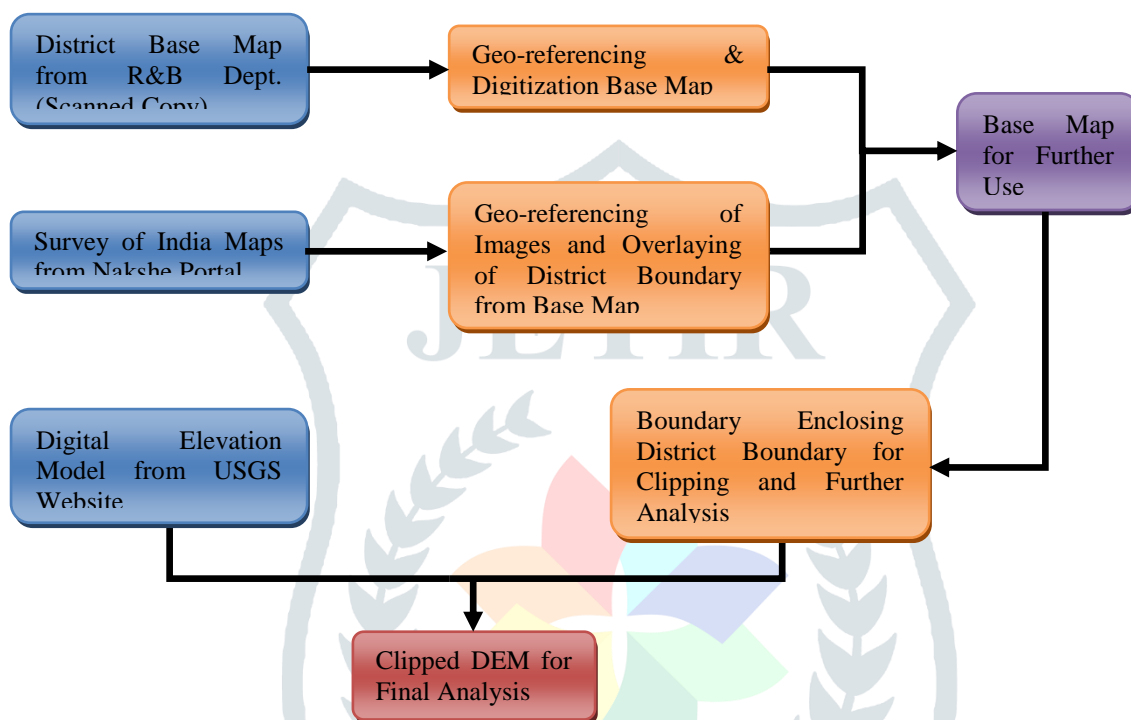


Figure 4 Process Flow Diagram

For the Watershed Delineation from Clipped DEM of Study area Process Shown in Figure 5 is followed.

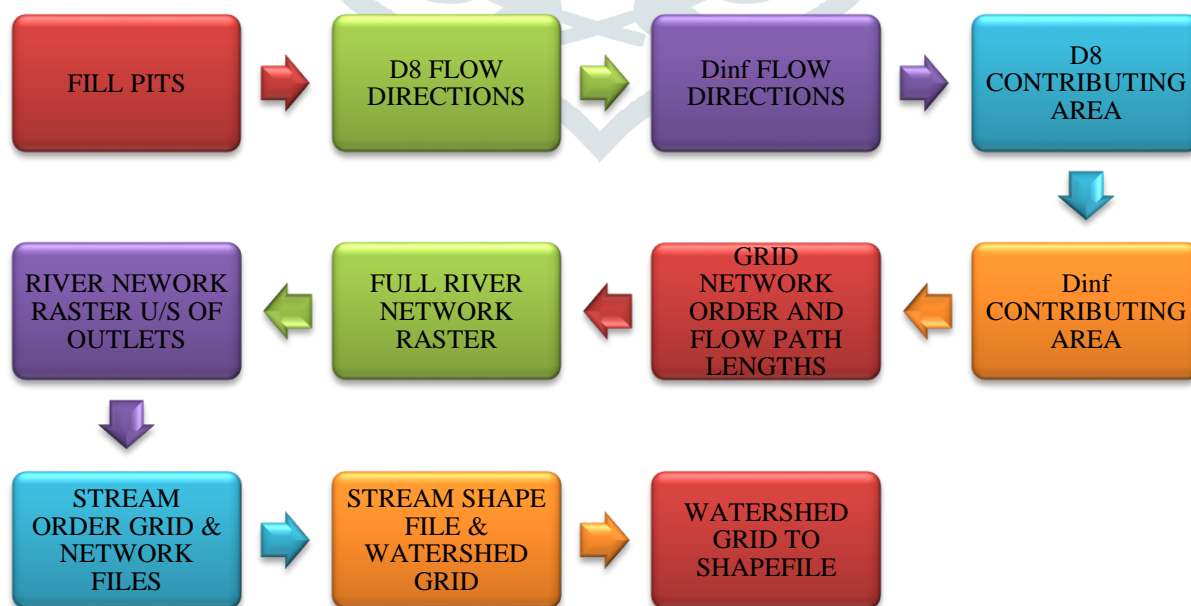


Figure 5 Watershed Delineation Process

IV. RESULTS AND DISCUSSION

Each above process resulted in one or more raster image as a result. Figure 6 shows the raw DEM used for Analysis. Figure 7 shows the pit filled DEM, where all the pits (missing data) were filled and DEM is smoothed for further analysis. The pit filled DEM then processed to delineate watershed shape file and drainage network shape file which is shown in Figure 8.

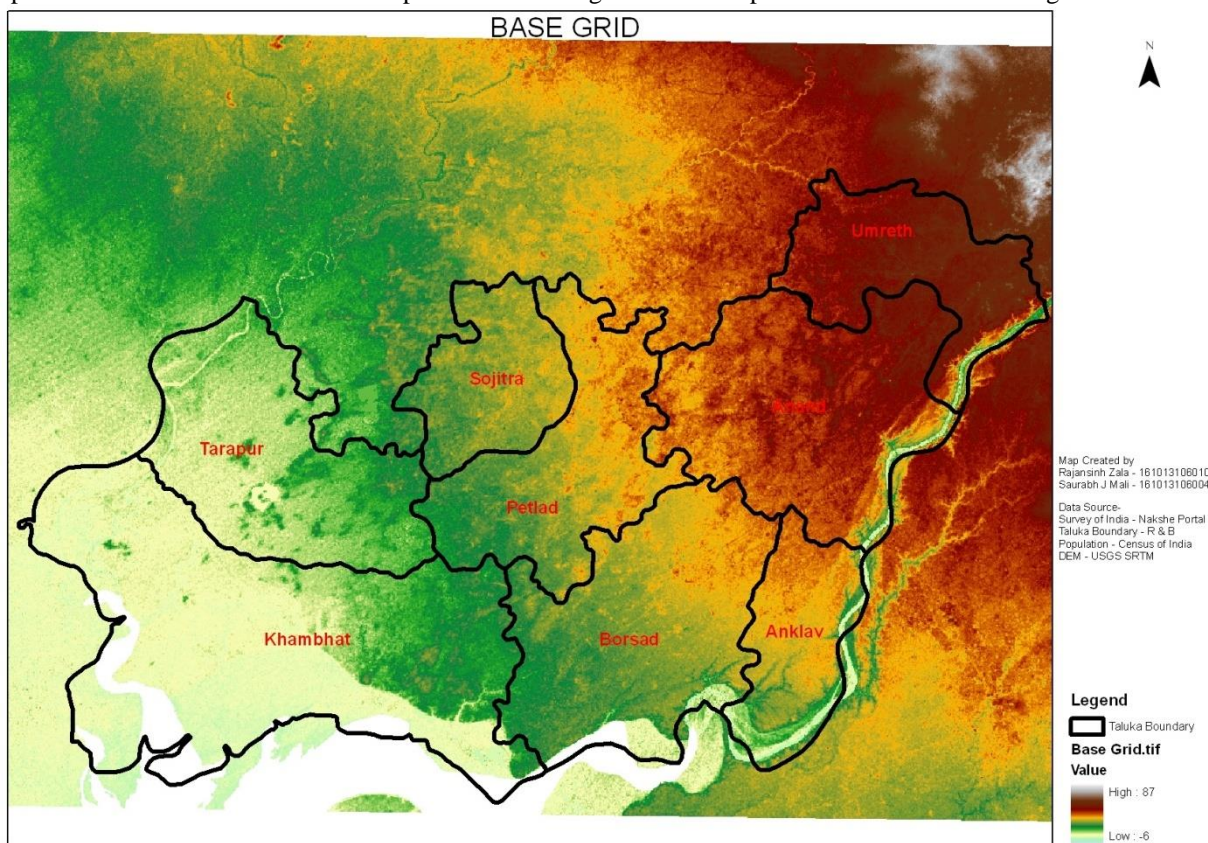


Figure 6 Raw SRTM DEM

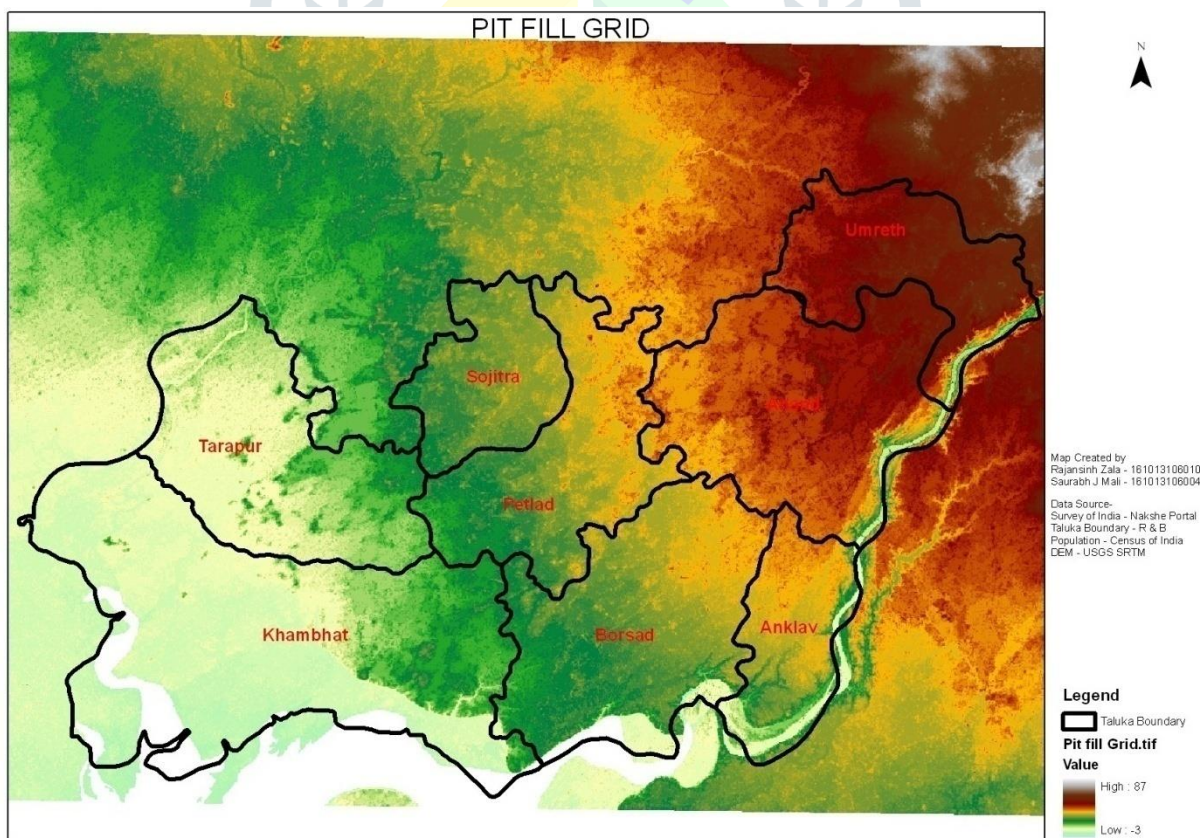


Figure 7 Pit Filled DEM

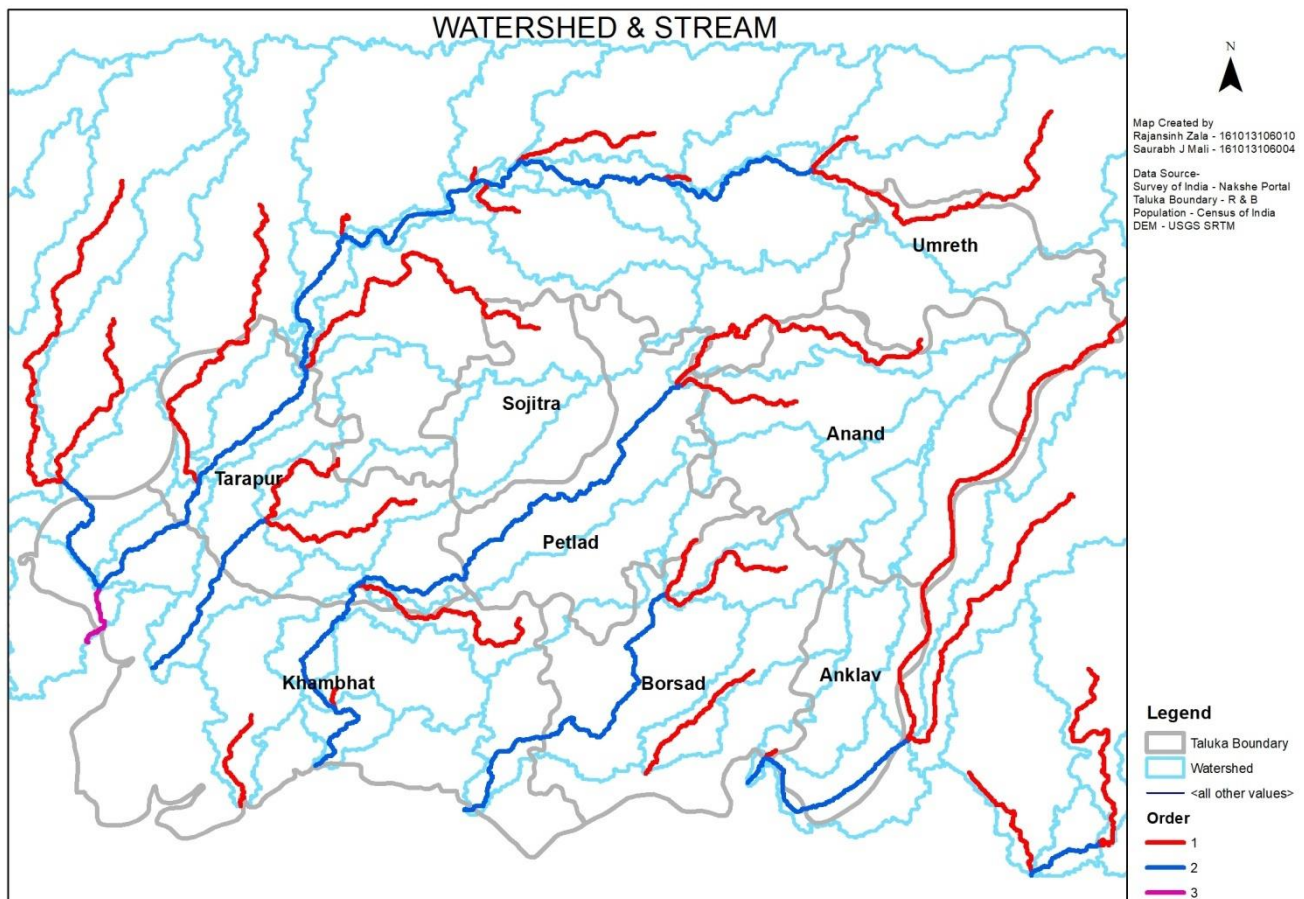


Figure 8 Watershed & Streams with order

The Streams delineated gives attributes namely Link No, Down Stream Link No, Order, Length, Slope, Associated Watershed No, Maximum and Minimum Elevation, Mean Width, Mean Depth and Upstream and Down Stream Area. This results can be further used for determination of capacity of the drain. Using Open Channel Hydraulic analysis along with rain fall / storm data we can identify drains that requires capacity augmentation. Also with use of stream order we can further prioritize drain development schedule.

#### Acknowledgment

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