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Watershed Development for Water Budgeting

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Abstract*:** ***Watershed management is the process of developing and putting into effect strategies, programmers, and projects to maintain and improve the functions of the drainage that have an collision on the populations of plants, animals, and people inside the watershed border. Recent innovations in technology, such as remote sensing and geographic information systems (GIS), enable us to analyze a variety of applications accurately and quickly at a low cost. Additionally, it offers a superior viewpoint for comprehending the issues, which aids planners in coming up with a better solution for sustainable growth. The dependability and speed criteria are both met by satellite-based RS technology, which makes it the perfect tool for producing spatial information demands. However, using RS technology involves managing a significant amount of geographical data and calls for an effective method to do so. In order to manage vast and complicated databases effectively, Geographical Information Systems (GIS) technology offers acceptable choices. As a result, combining remote sensing and GIS technology has proven to be a useful tool that has been successfully employed by numerous researchers for projects involving the development and management of water resources as well as the classification and prioritising of watersheds.
Keywords: *Watershed management, the Remote sensing (RS), Geographical Information System (GIS)*

I. INTRODUCTION

Watershed management is an integration of technology within the natural boundaries of a drainage area for optimum development of land, hydrological, biotic, vegetative resources to meet the basic minimum needs of population in a sustainable state. Every watershed in this world is unique and shall be dealt as per its environment, natural capital as well as requirement. There are no hard and fast guidelines common in all for development. Watershed management is unique approach for development of rain-fed area on sustainable basis. In India 35% of irrigated land produces 55%, of total production while 65% of rained lands produce 45% food produce. Therefore it is clear indication that the rain-fed area shall be emphasized for development by watershed development management.

The watershed already exists naturally, but human agricultural involvement has affected the ecology and management methods, which have an impact on the well-balanced ecologies. If watersheds are not adequately maintained, natural resources degrade quickly and eventually cannot be utilized for human improvement. Soil water and vegetation are the most important natural resources for the survival of human beings and animals. Poor in the rural areas, who are struggling for survival, cannot be expected to pay, adapt to conservation strategies, unless their daily needs of food, fiber and fuel are met. A still more urgent need is for assured work and full employment for all. Integration of many scattered program of soil conservation, a forestation, minor irrigation, and other development activities into well prepared micro watershed projects based on a study of climate, land, water and plant resources on the land and human and aninla1 resources, otters scope for bringing about sustained natural resources development.

1.1 Basic Data Needs For Watershed Management

- ✓ Physical data such as location, physiographic, drainage, soil, vegetation, geology, and climate, hydrologic and other relevant site characteristics
- ✓ Watershed is a basic unit of management, a proper framework of delineation of watershed at macro and micro level.
- ✓ Present land use, nature and extent
- ✓ Socio-economic, cultural and traditional system
- ✓ Land tenure systems, legislation, by-laws, land facets anti its problems (arable, non-arable and drainage line etc.
- ✓ Existing stage of development and infrastructure
- ✓ Economics of development, activities, rates of return, willingness and acceptance of program by local people, any impediments 'to implementation operational conveniences and difficulties etc.

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- ✓ Technology available on conservation and production and its application
- ✓ The above information ought to be composed for identified watershed area by undertaking various kinds of land resources and socioeconomic surveys.

1.2 Research Methodology

Review the past literature to note the gap among the existing methods for project management .Firstly, determine the water balance components of watersheds such as rain, runoff, water yield and evapotranspiration and preparation of dissimilar thematic maps (resource maps) by using RS data and/or by conventional sources. Secondly the critical analysis of thematic maps derived from satellite data interpretation and other surety information leads to identification of troubles and potentials of all of thematic information as regards of its availability, sensitivity, severity and criticality of the resources for the optimal use of the resources. With combining these thematic layers below GIS environment using a set of reasonable circumstances, integrated development map of water resource for every watershed generated; recognizing appropriate areas for groundwater development and recharge location sites reliant on the terrain. On the base of RS info and conventional data, the effort of watershed was more subdivided into a No. of micro watersheds of area of 500– 1,000 hectare relies on specific properties of drainage for recognizing suitable conservation also management measures and suggestion for optimal exploitation of water resources. Finally develop the precision with the aid of 3D-modeling of GIS and RS to investigate and develop watersheds and GWT.

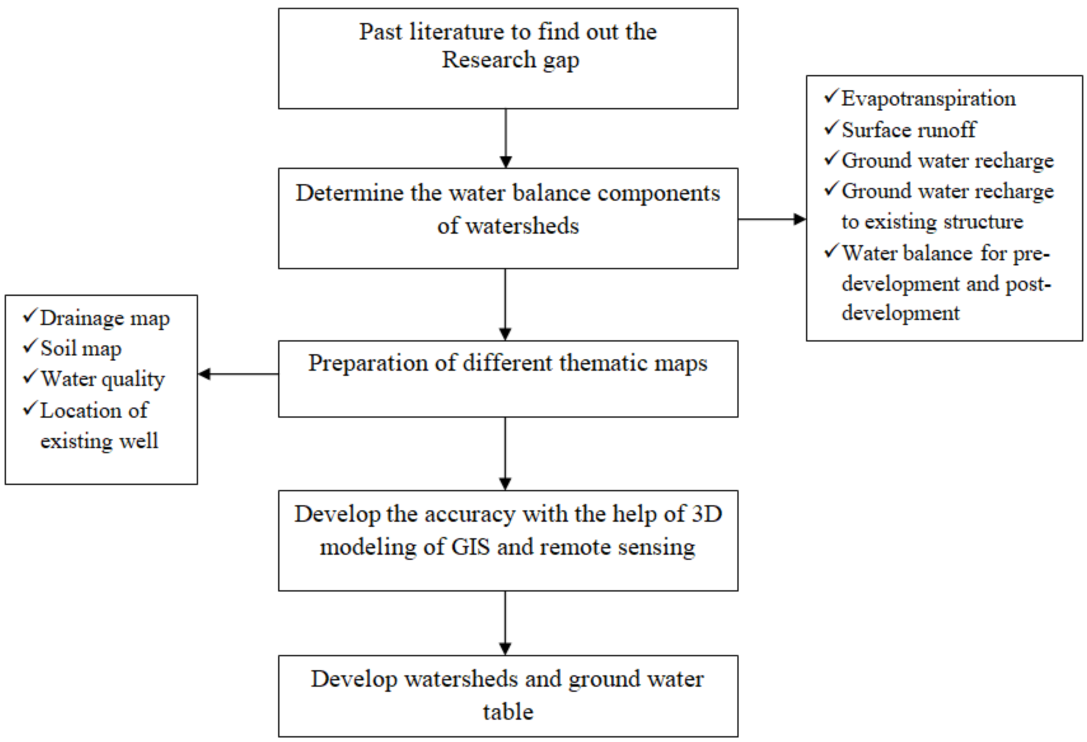

Figure No.1: Research Methodology

II. LITERATURE REVIEW

2.1 P. D. Aher, J. Adinarayana, S. D. Gorantiwar and S. A. Sawant, 2014 Being a skillful approach, a WSM is reduction of the gap among water supply with command and other NR, particularly in delicate arid & semiarid tropics. Being a composite phenomenology, there is a requirement for a dependable information system/decision support system (DSS). Watershed Management Information System is a practical and generic set of tools for the integrated planning of watershed and the management of their natural resources by using several technologies like GIS, RS, Global Positioning System (GPS), hydrological modeling and soft computation tools. This system is challenge was made to meaningfully integrate the dimensions in the agriculture-water-land-climate continuum for workable water management and land resources. The WATMIS application can be useable for different stakeholders such as farmers, rural extension communities and (WR) water resource managers to make better decisions.

2.2 J. Dujardin, O. Batelaan, F. Canters, S. Boel, C. Anibas, J. Bronders, 2011 The evaluation of surface & subsurface interactions of water is composite and highly flexible in space& time. More complexity when it has to be assessed in city areas, for reason of this pattern of the land cover in urban areas. This manuscript is about development of a modeling approach with integrated remote sensing analysis for assessing water fluctuations in urban areas. The urbanized methodology having purpose to simulate fluxes of pollutants from contaminated sites. Pollution of groundwater in those environments is connected to patterns of use of land so, it is vital to describe detailed the land cover information. Object-oriented classification approach useful on high-resolution satellite data has been assumed. To allocate the objects in the picture to one of the land covers, a multi-layer perceptron approach (kappa of 0.86) was chosen.

2.3 Mohamed A. Bastawesy, Fikry I. Khalaf, Sayed M. Arafat, 2008 The investigation also showed that throughout the course of those four years, the levels of the ponds' tops has decreased by about 10 m. Both infiltration and evaporating are responsible for this substantial pace and amount of water loss. The majority of the water in Tushka lakes is lost by condensation, with just a very small quantity percolating to the ground water, according to a comparison between the average annual evaporation rate at Tushka lakes and the estimated water loss. If the Nile doesn't overflow again, these lakes will start to diminish in 2012 and disappear entirely by 2020, having a huge negative impact on the environment.

III. STUDY AREA

1. Study Area Pimpalgaon Ujjaini in Ahmednagar District of Maharashtra

The total geographical area of village is 1582.36 hectares. Pimpalgaon Ujjaini has a total population of 3,031 peoples. The village of Pimpalgaon Ujjaini has roughly 560 homes. Pimpalgaon Ujjaini village's government is handled by a sarpanch, a representative chosen by the villagers in local elections. According to 2019 statistics, the villages of Pimpalgaon Ujjaini are part of the Rahuri assembly and Ahmednagar parliamentary constituencies. The closest town to Pimpalgaon Ujjaini, which is located around 16 kilometres distant, is Ahmadnagar.

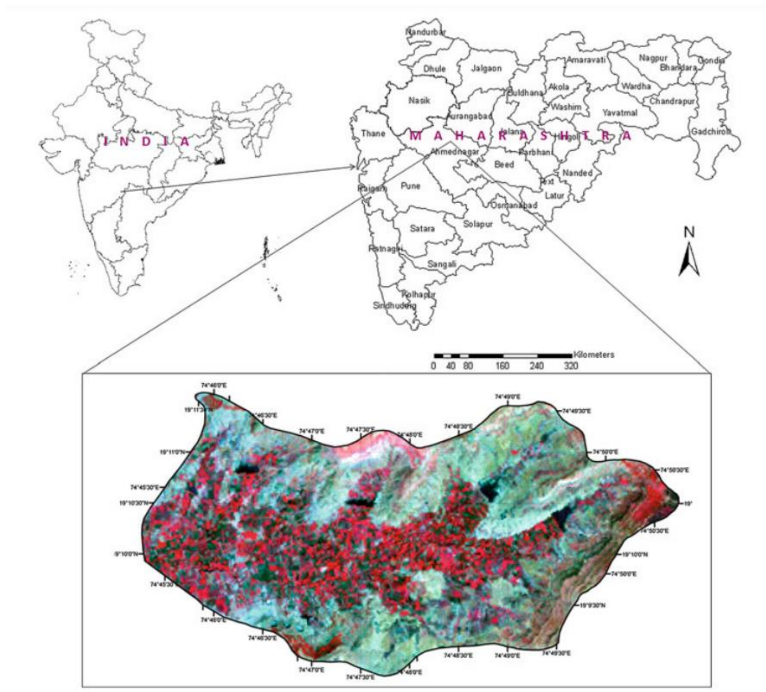

Figure No.2: Ahmadnagar Is Nearest Town To Pimpalgaon Ujjaini For All Major Economic Activities

- **Topography:** The topography of the present watershed study area is gently undulating. And two major soil types are establish in the region viz; silt clay and sandy clay. The soil depths found in the study are ranged from 30 to130.
- **Crops:** Since these lands are shallow/poor having low moisture retention capacity, with scanty rains, mostly poor type of vegetation is observed. Agriculture lands too became unproductive, as results of edaphic factors and biotic-interference, resulting into continuous process of erosion.
  Kharif crops - Maize, Jawar, bajara, and seasame Black gram and green gram
  Rabi Crop - Wheat, chickpea, mustard and Safflower

2. Data base

Data Used various spatial, non-spatial, temporal, attribute, and thematic datasets were used in WATMIS. Satellite Data of Landsat 7 Enhanced Thematic Matter (ETM/ETM+), particularly in the growing phases of crops (September–December), were used for obtaining land use distributions as well as irrigation water necessitate. The meteorological (Julian day of year, mean relative humidity, solar radiation, open pan evaporation, wind speed, and daily minimum and maximum air temperature), cropping system, soil (field capacity, soil type, permanent wilting point) and watershed datasets were used for dynamic hydrological modeling to obtain maximum crop yield through optimal allocation of watershed resources.

3.2.2.1 Ancillary Data

Survey oi India (SO[) toposheets 55 G/5, 45 016 and 54 HI8 of 1:5O,OOO to prepare base map, settlemrnt Inat>, drainage layer and also tor field work and groi111d truth vcritication.

3.2.2.2 System and Software

- Pentium 4 PC
- Window NT operating system
- ERDAS IMAGINE 8.7 & Arcllnfo 8.0 software
- MS office with word, Excel and power point
- Deskjet printer and other required material

3.2.2.3 Generation of Digital Data Base

Data input is the operation of encoding the data and writing them to the database. The creation of a clean digital database is the most important at the complex task upon which the usefulness of CIS depends. Two aspects of the data need to be considered separately for the CIS, these are first the positional or geographical data necessary to define where the graphic or cartographic features occur and second, the associated attributes that records what the cartographic features represents Data input to a GIS can be best described under three categories.

- Entering the spatial data (digitizing)
- Entering the nun-spatial, associated attributes and
- Linking the spatial to non-spatial data

At each stage there should be necessary and proper data verification and checking procedure to make certain that the resulting folder is as complimentary as probable from mistake

The spatially registered set of data constitutes a spatial database in addition; each spatial object has an associated attribute. This might be a name, a number, a range of values, etc., for example, contour has a number, and a road has a name. Such attributes also form a part of database. Further, there may be other data sets connected with the demographic data.

Geographical data deals primarily with 2 types of data:

Spatial data- The descriptive information about the objects or features present on the surface of the earth pertaining to space i.e., location as well as physical properties of the objects.

Non-spatial data - The descriptive information about the objects or feahlres present on the surface ot the earth not pertaining to the space is known as nonspatial data

3. Preparation of Tematic Maps

A thematic map contains only identical features throughout the map ignoring all the other features, thus reducing the confusion prevailing because of other features. Thematic maps are prepared for specific purpose.

❖ Preparation of Base Map

Figure No.3: Base Map Ahnednager District in Nagar Taluka

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❖ Preparation of Drainage Map

A drainage map shows the many streams and rivers that flow through the region. Drainage systems or patterns serve as indicators for determining geological and geomorphologic processes and are crucial terrain recognition features.

The tectonic history of a region is revealed by the watersheds, which accurately represents the area's buried structural properties. The six most typical drainage patterns are represented by different landforms and bedrock. Drainage patterns are commonly categorized as

- Dendritic
- Rectangular
- Trellis
- Parallel
- Sub parallel
- Radial Centripetal and Deranged
- Stream order

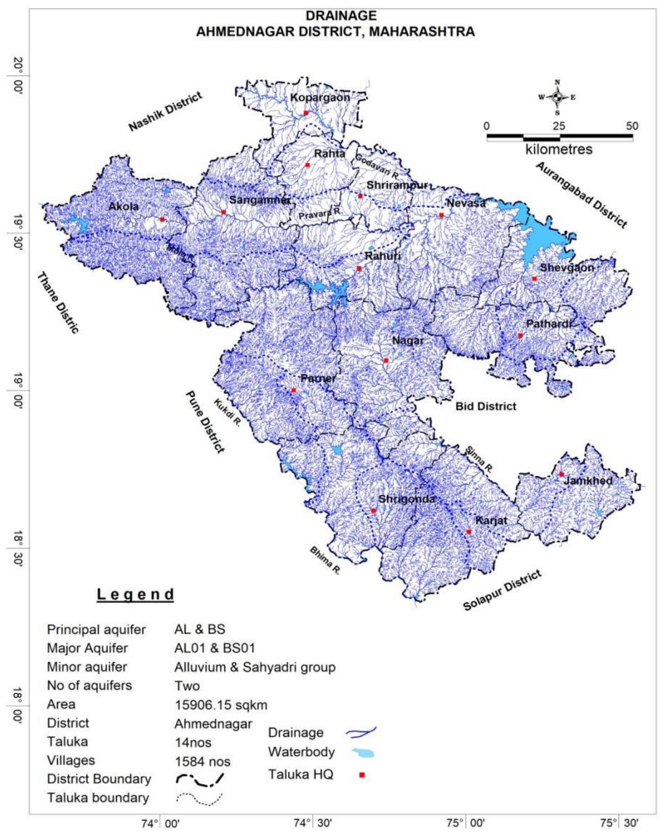

Figure No.4: Drainage Network map

❖ Preparation Of Land use & Land Cover Map

Satellite remote sensing practice are of immense value for preparing accurate land use / land cover map and monitoring changes at regular provided intervals of time.

Digital interpretation: Image classification is the process of categorizing (all pixels in an image into land cover classes or themes) the remotely sensed data into land cover classes or information. Normally, multi-spectral data are used to perform the classification i.e., different feature types manifest different combinations of (DN values) Digital Numbers based on their inherent spectral reflectance and remittance properties. Spectral pattern identification refers to the family of sorting methods that use this pixel-by-pixel spectral info that forms the basis for automatic land cover sorting.

4.4.3.1 Supervised Classification

In this categorization, the picture predictor "supervises" the pixel category method by giving the processer algorithm representative samples of the fourth renowned coverage types, known as preparation regions. These samples are used by the processer algorithm to assemble a "interpretation key" based on phantom attributes for each feature type of interest. The interpretation key also labels the category name to which each pixel in the data set is "most comparable" in a numerical comparison.

4.4.3.2 Basic Steps Involved In Supervised Classification

The predictor divides representative training regions into different categories and develops a numerical description of the spectral characteristics of each land cover type that is of relevance in the phases. Each pixel is given the land cover class that it most closely resembles in the imagery. The term "unknown" is typically used when a pixel does not adequately resemble the training data set. Because the result is digital in nature, it might be used in a different way. The output products are thematic maps; full scene or partial scene tables are statistics for various LC classes and digital data files suitable for inclusion in GIS. In the latter case, the "Output" classification becomes a GIS input.

The Training Phase: The total training required for supervised classification is both an art and a science. It requires close interaction in the image analyst and the picture data. It also requires extensive baseline data and knowledge of the geographic area to which the data applies. More importantly, the quality of the training processes determines the classification success phase and therefore the information generated is significant from the overall classification effort. The overall area of the training procedure is to compile a statisticsets that define the spectral response pattern for every land over type to be recognized in an image.

4.4.3.3 Unsupervised classification

A training phase is followed by either a classification step in supervised classification, which is the key distinction between these two methodologies. The unsupervised approach classifies the visual data by first aggregating it into the scene's natural spectral groupings or clusters. The image analyst then compares the categorised data to ground reference data to ascertain the identify of the land cover for each of these spectral groups.

Table No.4.1: Land Use Land Cover Classification System

Level I	Level II	Level III
Built-up land	Town/cities	
	Villages	
Agricultural land	Crop land	Khrif
		Rabi
		Khrif+rabi (double crop)
	Fallow land	
	Plantations	
Forest	Evergrwn/kmi-evergreen	Dense
		Open
	Deciduous (moist and dry)	Dense
		open
	Scrub forest	
	Forest blank	
	Forest plantations	
	mangrove	
Waste land	Salt affected land	
	Waterlogged area	
	Marshy/swampy land	
	Gullied/ravious land	
	Land with scrub	
	Land without scrub	
	Sandy area	
	Mining /industrial waste land	

	Barren rocks/stone waste/sheet rock area	
Water bodies	River/stream	
	Canals	
	Lake/reservoirs/tanks	

Classification of watershed: classification of watershed unto level -111 ot land use/Iand cover classification system was carried out based on key elements and tonal variations of various features ot the imagery. The comparative landuse/ landcover map of pimpalgaon watershed for the shown in fig

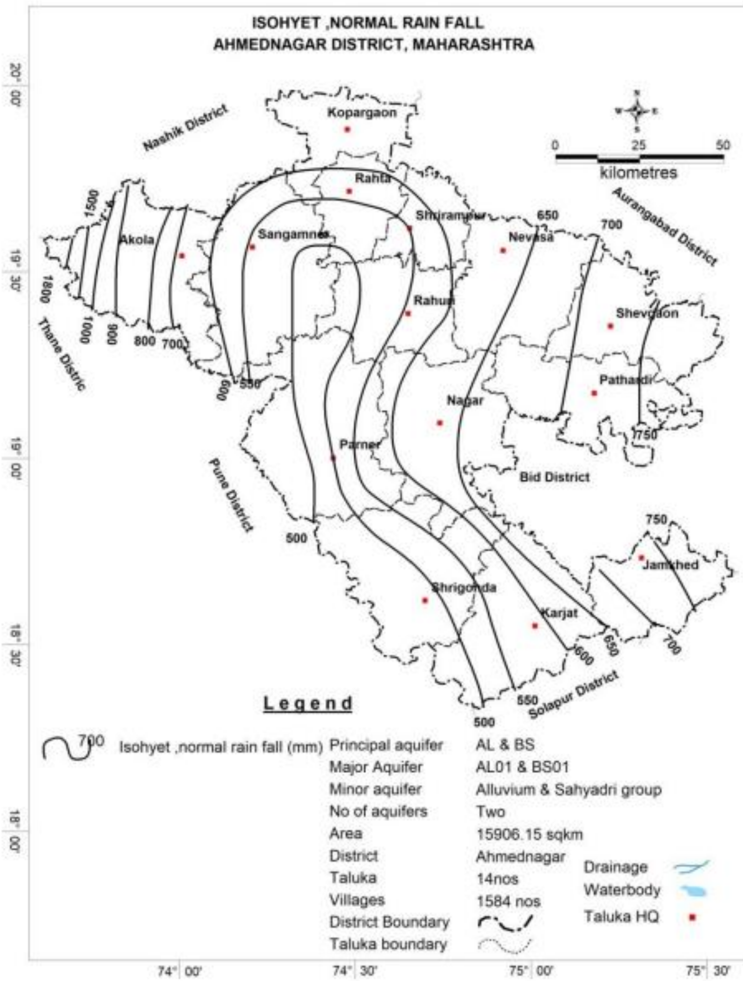

Figure No.5: Isohyetal Map Of Ahmednagar District

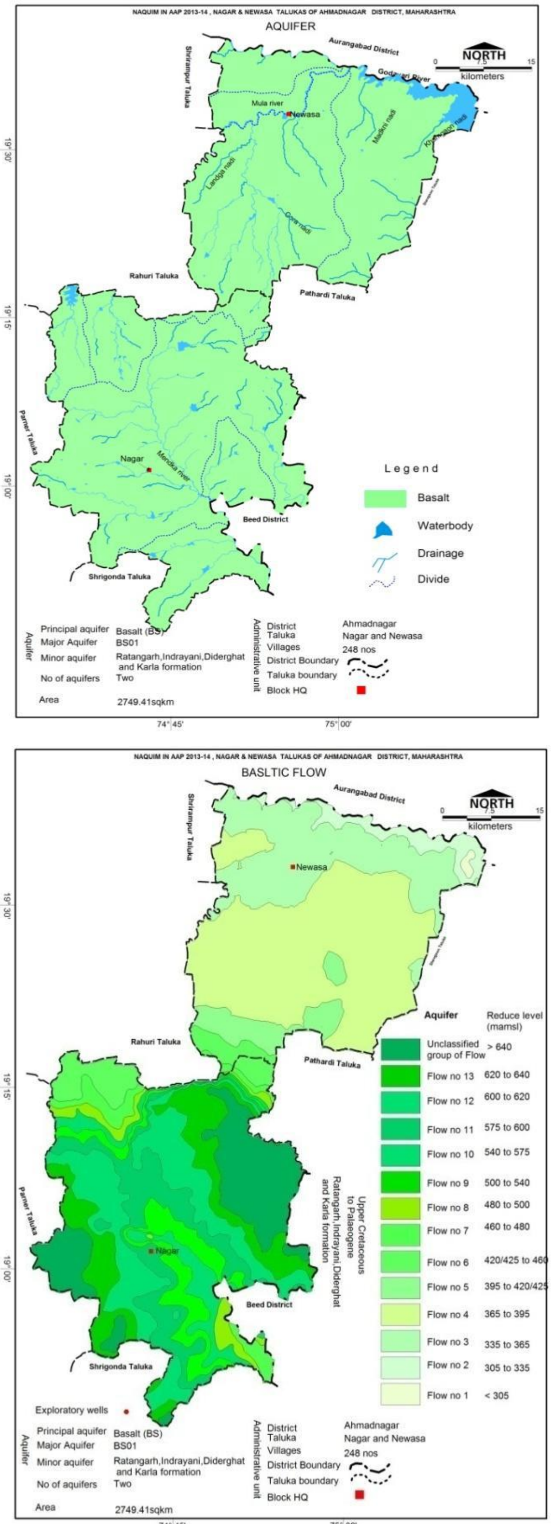

Figure No.6: Land Use Land Cover Map

❖ **Generation of NDVI Map**

The developments of vegetation cover and agricultural land use, crop output, etc., are indicators of the significant changes that have occurred in the catchments as a result of the execution of the drainage development programme. The difference between visible red (R) and near infrared (NIR) reflectance values, normalized over total reflectance, is the Normalized Difference Vegetation Index (NDVI). On a silica graphic workstation, the following data were generated: IRS lC/lD LlSS 111 and IRS 1'6 LlSS IV.

$$\mathrm{NDVI} = \frac{\mathrm{IR} - \mathrm{RED}}{\mathrm{IR} + \mathrm{REB}}$$

the equation produces NDVl values in the range of -1.0 to 1.0, where negative values generally represents clouds, snow, water and other non-vegetated surfaces, and positive values represent vegetative surfaces. The NDVI relates to photosynthetic activity of living plants. The higher the NDVl values, the more "green" the cover type. It implies that the NDVl increases as the green biomass increases.

❖ **Temporal Changes In The Groundwater Level In The Watershed And Water Quality**

Water is an essential resource for all living things. Rainwater is the primary source for water resource. Rainfall is not uniformly distributed in different months of the year in India. During monsoon period main part of rainwater goes as runoff. Some quantity of water goes as recharge in to the ground wherever favorably aquifer conditions are available. The study of historic groundwater level data is important in the assessment, growth and management of groundwater. These data are used to charge the change in groundwater storage and its response to rainfall, evaporation, plumage, surface irrigation etc. Historic water levels are necessary for forecasting future trends or water levels in answer to the adoption of modern concept sin groundwater reservoir operation.

✓ **Water Table Fluctuation Data**

Water table fluctuation data is geared up on the foundation of monthly water levels measured from the existing observation wells averaged over five years. These hydrographs not only show the monthly water level fluctuation in the shallow aquifer but also give the long term trend of the water levels to infer the groundwater balance in the area.

✓ **Depth Of Water Level**

Depth to water level data will give an idea about the level of water table in different landforms and in different rainfall regions.

✓ **Groundwater Quality**

In the groundwater assessment studies, evaluation of tllc quality of the groundwater available is as important as quantity. The usability of available groundwater is determined by its chemical, physical and biological properties. Detailed chemical analysis is done in the laboratory for six parameters.

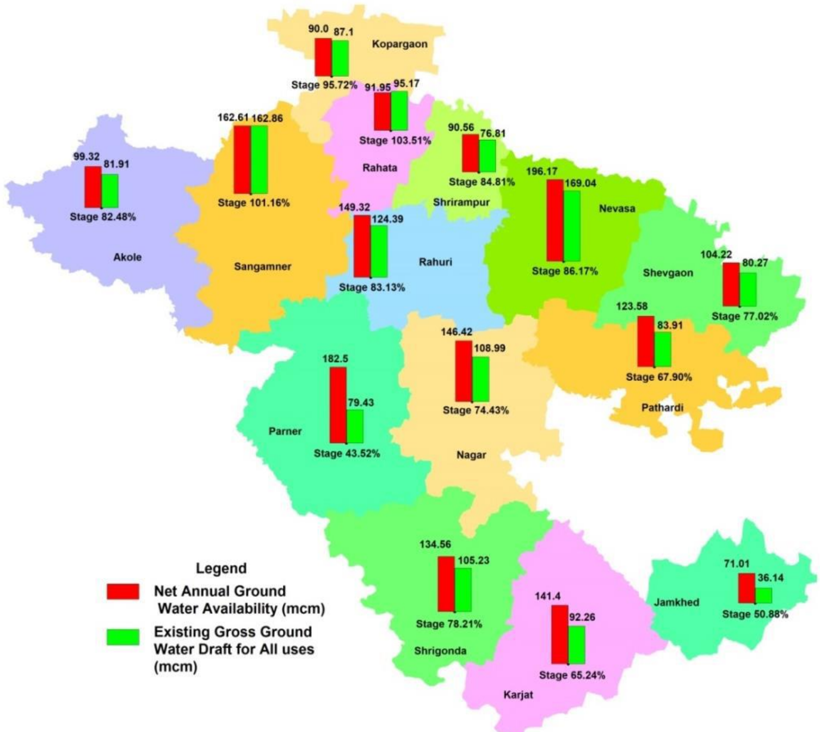

Figure No.7: Ground Water Resources

4. Water Balance Equation

The Water Budgeting is broadly done using basic water balance equation given below

$$W_{nt} = R - GWR - ET_a - S_w \text{..............................(1)}$$

Where,

Wn t is net change in water resources of watershed at time t,

R is input from Rainfall,

Sw is surface runoff calculated with SCS curve number method,

GWR is recharge to the ground water, which is estimated based on procedure given in Ground Water Potential Evapotranspiration (ETo) is calculated from Hargreaves-Samani method. ET o is further related to vegetation coefficient to account for actual land use/land cover, and from this actual Evapotranspiration (ETa) is calculated. Based on this, available net water balance is calculated on monthly and annual basis. The above calculations are repeated for predevelopment and projected post-development scenarios.

5. Surface Runoff Computation

The SCS CN model is as follows:

$$Q = \frac{(P-I_a)^2}{(P-I_a+S)} \text{..............................(2)}$$

Where,

Q = runoffvalue in mm;

P = Precipitation in mm;

Ia = Initial abstraction in mm;

S = potential maximum retention and is given as

$$S = \frac{254000-254}{CN} \text{..............................(3)}$$

and I a = 0.3XS forAMC- I

la = 0.1X S forAMC-I I and AMC-IIl

The Runoff curve number CN is a function of land use, treatment and condition; infiltration characteristics of the soils; and antecedent moisture condition (AMC). Curve number for AMC condition III and I were calculated from the following formulae:

$$CNI = {}^{4.2XCNII}/_{(10-0.058XCNII)}$$

$$CNIII = {}^{23XCNII}/_{(10+0.13XCNII)} \ldots\ldots\ldots\ldots(4)$$

6. Ground Water Recharge Estimation

Calculating SR is to be defined in manner of the net liquid water supplied to channels on timescales comparable to storm duration, after evapotranspiration, interception, surface retention, infiltration, and seepage into underlying aquifers. Because infiltration is the primary factor affecting the quantity of water available for runoff, the Curve Number (CN) model developed by the USDA 0968 SCS was useful to estimate runoff in a watershed. The SCS curve number (CN) method was useful to count the hydrological response of the basin to LU change. Many of the parameters affecting runoff are aquifer recharge or water infiltration and percolation into the aquifer predictable using the guidelines provided in the GWREC report. The groundwater recharge component consists of recharge from precipitation, waterbodies and water catchment structures. Static groundwater was not estimated as it is part of the deep aquifer system and does not influence the dynamic WB of the basin.

1. Recharge from Rainfall

The cost of rainfall recharge charges become are used as consistent with suggestions given withinside the GWREC Report (1997). Geomorphology and lithology information become useful for determining exclusive rainfall recharge charges as consistent with given norms.

2. Recharge from Water Harvesting Structures

The main proposed water harvesting structures for the check dam recharge, check dam storage, percolation tanks. As per guidelines from the GWREC, the value of recharge from these structures is taken for this study. Recharge rate From Various Water Harvesting Structures Is Given In Table

Table No 1: Recharge For The Water Harvesting Structures.

Existing water structure	No
Percolation tank	94.00
Check dam recharge	263.00
Check dam storage	263.00

7. Evapotranspiration Estimation

Evapotranspiration is calculated in two parts, first potential or reference ET is calculated and then actual ET is calculated using different crop coefficients for different land use/land cover classes.

$$ET_a = ET_p x K_c \ldots\ldots\ldots\ldots(5)$$

Where,

ETp, reference potential evapotranspiration, which is calculated using Hargreaves-Samani equation and Kc is the coefficient related to actual land use/land cover.

Hargreaves-Samani Method

$$ET_p = 0.00135x(T_{mean} + 17.8).R_s \ldots\ldots\ldots\ldots(6)$$

$$R_s = k_{RS}X\left[\sqrt{(T_{max} - T_{Min})}\right]xR_a \ldots\ldots\ldots\ldots(7)$$

Where,

ETp is reference evapotranspiration in mm/ day,

Tmean is the mean temperature,

Tmax is the maximum temperature,

Tmm is the minimum temperature,

kRs is a adjustment coefficient, $k = 0.17(^{0}C^{-0.5})$

Ra is extraterrestrial solar radiation in MJ m2day

- **Climate and Rainfall**

The climate of this district is characterized by hot tropical Climate with extreme summer, Mild winter season and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. As per Agro-climatic Zones of the Agriculture Department, Ahmednagar district falls under 'Moderate Rainfall Zone'. Long term rainfall analysis and annual rainfall data of last 20 years is given in Table

Table No 2: Rainfall Data

Year	Sw Monsoon Rainfall (mm)		Annual Rainfall (mm)	
	Rainfall	% Departure	Rainfall	% Departure
2000	798.1	-10%	1035.4	-13%
2001	818.8	-8%	1100.7	-7%
2002	700.5	-21%	935.9	-21%
2003	902.9	2%	1187.3	0%
2004	807.1	-9%	1106.5	-7%
2005	874.3	-1%	1208.3	2%
2006	889.3	0%	1161.6	-2%
2007	943	6%	1179.3	-1%
2008	877.8	-1%	1118	-6%
2009	698.3	-21%	95.7	-20%
2010	911.1	3%	1215.5	2%
2011	901.3	2%	1116.3	-6%
2012	823.9	-7%	1054.7	-11%
2013	937.4	6%	1242.6	5%
2014	781.7	-12%	1044.7	-12%
2015	765.8	-14%	1085	-9%
2016	864.4	-3%	1083.2	-9%
2017	845.6	-5%	1127.1	-5%
2018	804.1	-9%	1020.8	-14%
2019	971	10%	1288.8	10%
2020	961.4	9%	1289.6	10%

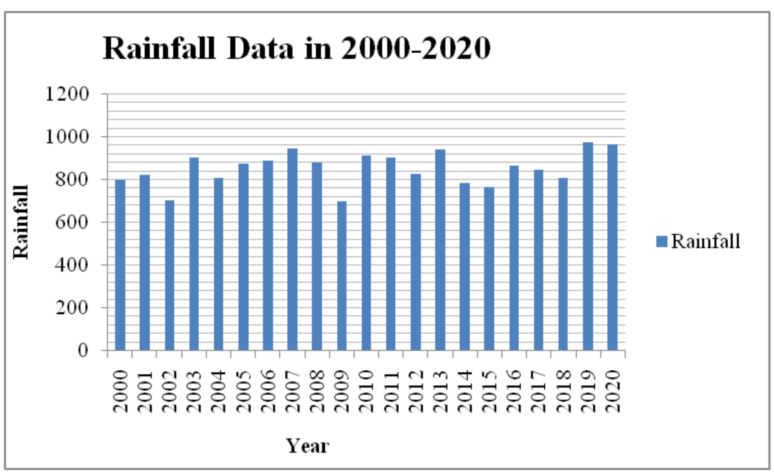

Figure No.8: Rainfall Analysis in Ahmednager District

1 **Hydrogeology**

Ahmednager District are 2 types of aquifer systems exist in the area namely Alluvium and Basalt. The map showing major aquifer systems

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- **Alluvium**

Alluvium occurs in small areas along banks and flood plains of major rivers like Godavari, Pravara, Mula rivers and their tributaries. Coarse grained detrital material like sand and gravel usually occurring as lenses forms good aquifer. The ground water occurs under water table conditions in flood plain deposits near the river banks. Confined conditions are also found wherever the thick clay deposits confine the ground water below it. Ground water exploration in Godavari-Pravara Alluvium reveals that the thickness of alluvium is less than 40 m and the aquifer thickness are ranges between 5-8 m. The yield of the dugwells ranges from 6 to 100 m3 /day.

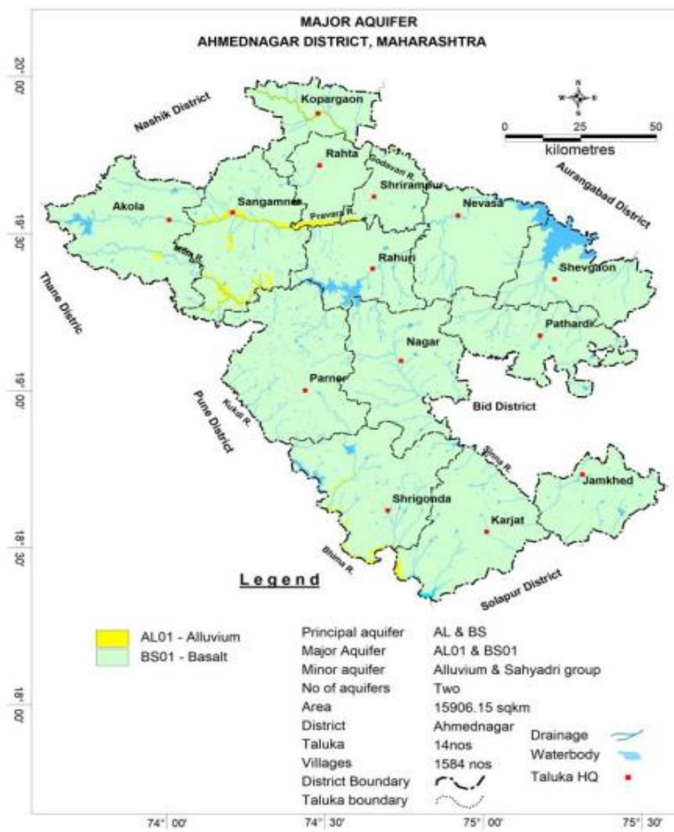

Figure No.9: Major Aquifers

Table No 3: Aquifer Characteristic of Ahmednagar district

Major Aquifer	Basalt (Deccan traps)		Alluvium
Type of Aquifer	Aquifer I	Aquifer II	Aquifer I
Formation	Weathered/Fractured Basalt	Jointed/Fractured Basalt	Alluvium-Sand/silt &Clay
Depth of Occurrence (mbgl)	9-35	3-182	10-40
SWL (mbgl)	3.9-32	12-75	5.1-34
Granular/Weathered /Fractured rocks thickness (m)	5-24	0.5-14	5-8
Fractures/granular zone encountered (mbgl)	Uptoo35	Upto 182	Upto 40
Yield	10-1000 m3 /day	2.5lps	60-100 m3 /day
Sustainability	1-3 hrs	0.5 -3 hrs	1 -5 hrs
Transmissivity (m2/day)	30 to 80 m2/day	25 to 389 m2/day	30 to 120 m2/day
Specific Yield/ Storativity (Sy/S)	0.019-0.028	2.0 x10-5 To 5.2 X 10-6	0.06-0.1
Suitability for drinking/ irrigation	Suitable for both	Suitable for both, except high EC	Suitable for both

IV. CONCLUSION

Following conclusion can be listed below:
Thematic layers, including hydro-geomorphology, land use/cover, and lineament characteristics, were created from RS data and merged with drainage, soil, and slope maps in a GIS context to create an integrated water resource development plan. It is possible to identify and outline a variety of ground features, such as geological structures and geomorphic features that serve as direct or indirect indicators of groundwater, by interpreting remote sensing data in conjunction with data sources but instead sufficient ground truth information. As a result, an integrated RS and GIS can offer the right platform for the convergent analysis of a significant amount of data from several disciplines and for choice in the creation of an integrated water resource development plan.

❖ **Future Scope**

By building a watershed at the recommended area, the socioeconomic standing of nearby farmers will be enhanced. A building for soil and water conservation that benefits the neighborhood farmer was also recommended at the appropriate location. The ground water level in diverse micro-watersheds can rise with proper management and the development of various water and soil conservation structures. In the indicated area, the use of GIS and remote sensing improves precision in order to understand the differential recharge condition in the watershed.

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