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# Robust Strategies of GIS and Geospatial Data mining techniques for drinking ground water quality management, challenges and issues of Drought Case study Jalna (Maharashtra-India)

Mohammed Waseem Ashfaque[1], Sayyada Sara Banu[2], Quadri N.Naveed[3], Quadri S. Ali Ahmed[3],

[1]Department of Computer Science & IT, College of Management and Computer Technology, Aurangabad, India
[2]College of computer science and information system, J azan university, Saudi Arabia
[3]Department of Computer Science & IT, King Khalid University, Abha, Saudi Arabia
[4]Department of Computer Science & IT, College of Management and Computer Technology, Aurangabad, India

**Abstract**

Dependency factors of drought in Maharashtra state of drinking water are groundwater resources, for rural, Urban and Agriculture commercial zone .this situation exploits the development and progress of groundwater management study. No doubt the climate has a vital role in it. So Researcher and decision maker have a new topic of study and research with increasing product of Geospatial data and different temporal of characteristics, geometrics, and Geospatial information systems. And it has been capabilities to control and handle a case like diverse range of geospatial data with varieties of skills. One of the major aspect and issues in geospatial data management is to explore the ratio and future trends of the data and which is smoothly possible with the GIS and Geospatial Data mining techniques and that is being brought into our consideration to discussed and to write this paper on this issue and for this we introduced geospatial data mining applications in drinking ground water quality Management, At last about the abundance of industrial Zones in state of Maharashtra, of India and their effects on water quality in this region, correlation between industrial pollutions and water quality indicators through geospatial data mining has been modeled as a case study at Jalna District Maharashtra.

**Keywords**-Geospatial data mining; GIS; water quality management.

## I. INTRODUCTION

### *1.1 "Marathwada" Region at a glance*

Marathwada region is just coming out of the worst drought in 40 years. Our research in Jalna District has provided an opportunity to explore the impacts of climate change and extreme weather on water and agricultural resources and the responses at community and district levels. While a drought of the magnitude observed in 2012 will always bring hardship to local people, it also exposes systemic and institutional strengths and weaknesses, and thus offers opportunities to think afresh and initiate change. The recent launch of the Adaptation Fund in Maharashtra within the framework of the government's new climate change policy makes the lessons on community level adaptation approaches, Based on local interviews and perceptions from field work in Jalna, we find that in response to the 2012 drought, the district and state government initiated a set of appropriate emergency and more long-term measures to provide drinking water, fodder camps, crop-loss compensation, watershed development, and local employment. However, the scope and outreach of the relief was not adequate to meet local demands given the magnitude of impacts. The measures pursued were sometimes unevenly distributed. The emergency programs also carried heavy costs on the part of the government. Our research suggests that improved community resilience and transformation towards sustainable rural development require continuous efforts by the government and non-government actors[1,2,3].

### *1.2 Hydro geological issue of Maharashtra*

Most of the land surface of Maharashtra State is underlain by the Deccan Traps Basalt including the entire highly drought-prone central area with an average rainfall of less than 750 (and locally 500) mm/a. This formation gives rise to a complex low storage weathered hard-rock aquifer system – and in the very extensive rural areas outside the command of (the few) major irrigation canals it is vital to human survival and livelihoods. But the total available storage of groundwater in hard rock aquifers (such as this) is strictly limited by their weathering characteristics and water-bearing properties. There is one part of Maharashtra State which possesses a major alluvial aquifer – this is the Tapi Gurnia 'tectonic graben' which runs approximately west-east in the northwestern part of the State passing under the town of Jalna the development and management of the groundwater resources of this economically-important aquifer require a different approach and are also considered here[4,5].

### *1.3 Groundwater Resource Situation*

Widespread and progressive depletion of ground water tables in Maharashtra has become a cause of major concern over the past 10 years – in many locations this has occurred more-or-less year-on-year, except for a partial (but temporary) recovery following years of exceptionally heavy monsoon rainfall. The developmental sequence for groundwater observed since the mid-1980s [6,7,8]

● drying-up of most dug wells ever earlier in the dry (rabi) season – initially those at the margins of the main groundwater bodies (where the weathering depth was less) but subsequently stretching much more widely

● deepening of dug wells as dug-cum-bore wells, but also with subsequent yield reductions

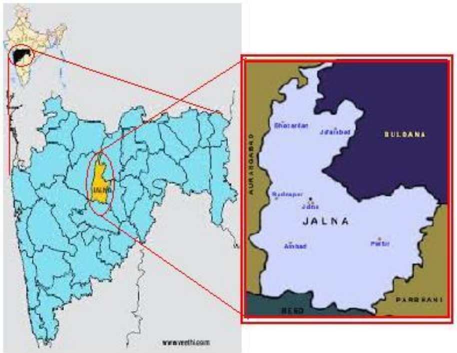
● drilling of progressively deeper bore wells, almost regardless of whether there was evidence of the existence of groundwater flow at greater depth[8].

### *1.4 Jalna At A Glance*

Jalna district became 27th district of Maharashta from 1st May 1981. Jalna town is situated at the confluence of the Kundalika and the Sina rivers and was known as "Hirawali" till 1300 AD. The last ruler in the area was "Jalarai" and the present name of the district is after him. The district head quarters is located at Jalna and it comprises of 8 talukas viz; Jalna, Bhokardan, Jafrabad, Badnapur, Ambad, Ghansawangi, Partur, Mantha. The district forms the eastern part of Marathwada region of Maharashtra and is bordered by Aurangabad district in the west, Jalgaon district in the north, Buldhana and Parbhani districts in the east and Beed district in the south. It is bounded by north latitude 19° 16 and 20° 32' and ea st longitude 75°42'00" and 76°30'45". It falls in parts of Survey of India Top osheet No. 46P, 47 M, 55 D and 56 A. The district has a geographical area of 7718 sq.km., out of which forest area is 64.60 sq.km., whereas cultivable area was 5744.74 sq.km., and net area shown was 5152.30 sq.km as per 2000-01 data. Central Ground Water Board has taken up several studies in the district [9]

### *1.5 Ground water exploration in Jalna*

Ground water exploration has not been taken up in the district. However 30 bore wells have been constructed by outsourcing in hard rock areas occupied by Deccan Trap Basalt in 2003-04 and the salient features are given in Table-2. The depth of these bore wells ranged from 145.65 to 200.2 metres below ground level (m bgl). The discharge from these wells varied from 0.14 to 1.37 litres per second (lps). Static water levels ranged from 17.95 to 50.00 m bgl [10,11]




(A)


(B)

Fig:1 Jalna District Map(A),(B)

Table:1 Jalna District Ground water exploration

| Sr. No | Taluka | BW's Drilled | Depth (m bgi) | SWL (m bgi) | Discharge (lps) |
|---|---|---|---|---|---|
| 1 | Jalna | 7 | 200.20-200.85 | 35.40-50.00 | 1.37 |
| 2 | Bhokardan | 5 | 200.20 | 50.00 | 0.38 |
| 3 | Jafrabad | 4 | 195.65-200.20 | 50.00 | 0.14 |
| 4 | Badnapur | 2 | 200.20 | 17.95 | 0.78 |
| 5 | Ambad | 2 | 200.20 | --- | --- |
| 6 | Ghansaungi | 3 | 200.20 | 50 | 0.85 |
| 7 | Partur | 4 | 145.60-200.20 | 50 | 1.37 |
| 8 | Mantha | 3 | 195.65-200.20 | 50 | 0.38 |
| 9 | Total | 30 | 145.65-200.20 | 17.95-50.00 | 0.14-1.37 |

### *1.6 Rainfall status*

The district has dry and tropical climate with very hot summer and mild winter with humid SW monsoon season of moderate rainfall. The climate can be divided into three main seasons

a) Hot to warm humid monsoon season from June to September [12].
b) Cool dry winter season from October to February and
c) Hot dry summer season from March to June. Temperature during rainy season ranges from 21°C to 30°C. In winter season temperature fall appreciably and range from 10°C to 25°C. In nights temperature range is 20°C to 25°C with privilege of cool breeze. The air is generally dry over the district except during the southwest monsoon when the relative humidity is high. The summer months are the driest when the relative humidity is generally between 20°C and 25% in the afternoon. Winds are generally light to moderate with increase in speed during the later half of the hot season and in monsoon season. The winds blow predominantly from directions between west and north during the hot season. They are mostly from directions between southwest and northwest during the southwest monsoon season. The rainfall record shows that the district has two regions on the rainfall pattern. The first comprises Bhokardan, Jafrabad and Jalna talukas with rainfall of about 700 mm favorable for Khariff cropping. The second region comprises Ambad and Partur talukas with rainfall of about 800 mm or more favorable for rabi cropping. Rainfall is not uniform in all parts of the district as assured rainfall area are Jalna and Ambad talukas and the area of moderate rainfall of 625 to 700 mm is Bhokardan and Jafrabad talukas. The average annual rainfall in the area is 725.80mm. About 83% of the rainfall occurs during June to September and July is the rainiest month. The rainfall for the period 1998-2007 is given in Table-3. The average annual rainfall in the district ranges from about 664 mm (Bokardhan) to about 837 mm (Mantha) [13].

Table:2 Jalna District Annual rainfall Status

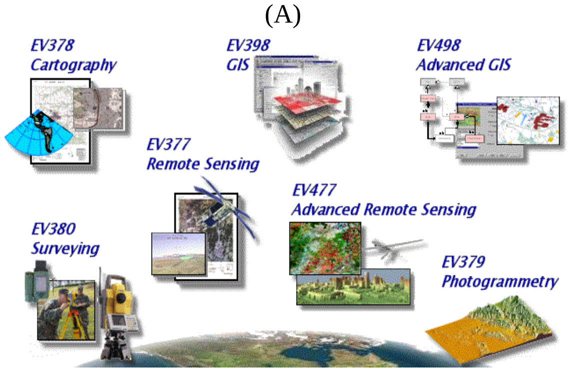
| **Villages** | **Annual Avg.** | **2012** | **2013** | **2014** |
|---|---|---|---|---|
| Jalna | 700.9 | 348.4 | 823.7 | 438.5 |
| Badnapur | 700.1 | 345.4 | 617.4 | 316.6 |
| Bhokardan | 662.9 | 292.5 | 785.1 | 490.4 |
| Jafrabad | 640.4 | 324.2 | 959.4 | 360.0 |
| Partur | 743.9 | 429.9 | 968.2 | 476.0 |
| Mantha | 707.4 | 314.2 | 860.2 | 317.2 |
| Ambad | 651.7 | 315.6 | 757.3 | 363.3 |
| Ghansavangi | 699.2 | 229.6 | 538.6 | 269.7 |
| Average | **688.3** | **324.98** | **788.6** | **377.4** |

## II. LITERATURE REVIEW

### *2.1 Geospatial Information technology*

Parallel to ever increasing uses of geospatial information technology (GIT), its computing environment, scope, coverage and volume of geospatial data are growing fast. A number of agencies in public and private companies involve in acquisition, processing and display of geospatial data. In addition, spatial data acquisition systems are evolving from speed and accuracy point of view. For example, remote sensing systems and global positioning systems (GPS) are used to capture huge amount of geospatial data. Increasing spatial data sharing and interoperability throughout the world have resulted availability of large amount of data to be used in development of spatial data infrastructures (SDI) in a rapid and unprecedented pace. In spite of production of such a huge amount of spatial and thematic data, It has been clear that conventional approaches of statistical analyses of geospatial data in analogue form and in small amount cannot further be efficiently implemented for digital data and in large volume, which are being produced nowadays. Therefore, conventional analysis approaches cannot be implemented to explore the hidden relationship between and among spatial data and their future trends, which are quite important functionalities in optimum geospatial data management. Such functionalities can be efficiently employed using geospatial data mining and knowledge discovery. One of the important applications of GIS is environmental data management. GIS can be used to provide scientists and managers with a range of scenarios for spatial distribution of the data and predict future trends of the data to avoid possible environmental crisis. Geospatial data mining can be used to assess hidden relationships of the crisis and environmental pollutions, sources, causes and amount of pollutions to take necessary measures for environmental protection [14].

(A)

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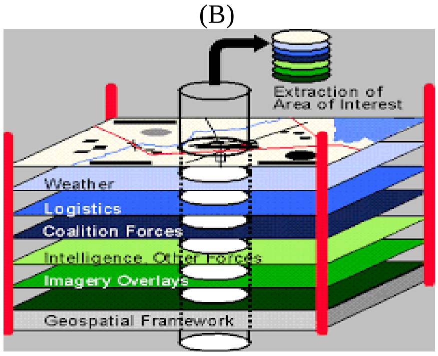


Fig:2 Geospatial Technology Approach(A),(B)

***2.2 Ground water status in Jalna***

*2.2.1 Hydrogeology*

Groundwater occurrence and movement in the area is influenced by its rock formations. Groundwater potentially depends upon porosity and permeability (both primary and secondary) of rock formations. Jalna district is underlain by basaltic lava flows and alluvium only. Water bearing properties of these rocks are described below and the map depicting hydro geological features is shown as in fig 2

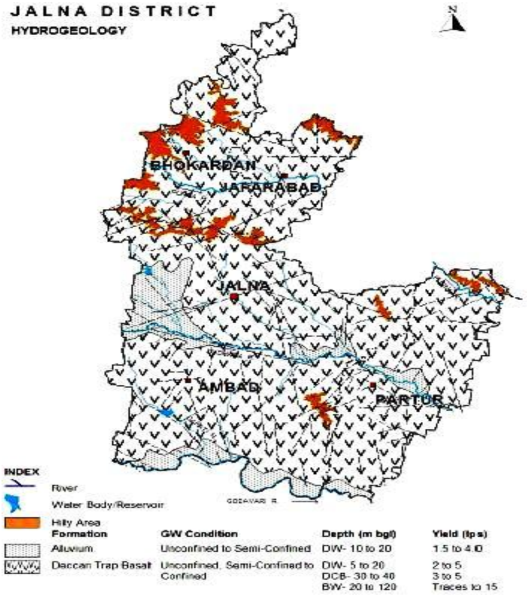


Fig:3 Jalna District Hydrology

*2.2.2 Hard Rock Areas*

*2.2.2.1 Deccan Trap Basalt*

The basaltic lava flows belonging to the Deccan Traps occupy about 98% of the area of the district. The formation is very thick and comprises scores of lava flows of 5 to 25 meters individual thickness. Each flow comprises a lower zone of 40 to 70% hard, massive basalt which is devoid of primary porosity and permeability. The upper zone of 30 to 60% is vesicular basalt which has limited primary porosity. However, the formation generally has secondary porosity and permeability acquired due to weathering, jointing, shearing, fracturing etc. When the thickness of these zones are appreciable (30 to 60% of a flow), the flow forms an aquifer of moderate potential. The structural and composite characteristics described above are repeated in all the lava flows of an area and they thus form a multiple aquifer system which generally extends to depths of 150 to 250 meters. Apart from the inherent properties of lava flows cited above, topography also plays an important role in groundwater potential of basaltic area. Hills and higher grounds stood out as their rocks were hard, compact and resistant to weathering. The steep gradient causes rain water to run off rapidly without much infiltration. In contrast, the valleys depressions and areas of lower elevations were carried out as the rocks were weaker, prone to weathering due to joints, fractures etc. In addition, rain water runoff is less. And infiltration is more. Ground water in Deccan Traps Basalt occurs under water table condition in weathered, jointed, fractured and vesicular zones of the flow exposed at the surface. Ground water occurs under confined conditions in Jointed, brecciate or fractured and vesicular zones of lower flows. The vesicular and zeolitic basalts are highly susceptible to weathering as interconnected vesicles form conduits from weathering agents. It is generally seen that "Pahoehoe" flows containing uniformly distributed vesicles have good porosity and permeability and constitute potentials aquifers [15,16].

Fig:4 Hard rock's areas

*2.2.3 Soft Rock Areas*

*1.6.3.1 Alluvium*

It occurs as small patches along banks, flood plains and meanders of main rivers. These have individual extent from 1 to 20 Km2 and 5 to 30m thickness. It comprises beds and lenses of sands, gravels and boulders in a matrix of clays. These granular zones form aquifers in which groundwater occurs under prelatic and semi confined conditions. The porosity of these granular zones ranges from 10 to 15 %[16].

***2.3 Ground Water Quality***

Central Ground Water Board monitors the ground water quality of the district through its National Hydrograph Network Stations (NHNS), which mainly consist of the dugwells representing shallow aquifer. The objective behind the monitoring is to develop an overall picture of the ground water quality in the district. During the year 2007, CGWB carried out the ground water quality monitoring of 16 NHNS [17]. The chemical analysis results show that the ground 13 water in the district is alkaline in nature, while the EC and TDS values show that the ground water in the area is mineralised to medium

extent. anions, the concentration of chloride ion is highest followed by bicarbonate and sulphate ions. The results also show that the concentration of nitrate ions in the ground is significant and appearing as major ion. In the district, 16 samples were collected all representing Deccan Trap Basalt. The epm percentage of alkaline earths (Ca+Mg), alkali metals (Na+K), weak acids (CO3+HCO3) and strong acids (Cl+SO4+NO3) in the ground water samples were calculated and samples were
broadly classified into four classes as given in Table-3 [18].

Table:3 Ground Water Quality

| S. No. | Classification | Type | No. of Sample | % of Sample |
|---|---|---|---|---|
| 1 | Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and weak acids ($CO_3$+$HCO_3$ > 50%) exceeds strong acids. | Ca-$HCO_3$ | 4 | 25 |
| 2 | Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and strong acids (Cl+$SO_4$+$NO_3$ > 50%) exceeds weak acids. | Ca-Cl | 9 | 56 |
| 3 | Alkali metal (Na+K > 50%) exceeds alkaline earths and strong acids (Cl+$SO_4$+$NO_3$ > 50%) exceeds weak acids. | Na-Cl | 3 | 19 |
| | Total | | 16 | 100 |

### *2.4 Suitability of Ground Water for Drinking Purpose*

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TDS, TH, Ca, Mg, Cl, SO4 and NO3 prescribed in the standards and is given in Table-6 [19].

Table:4 Sustainability of drinking Ground Water

| Parameters | DL | MPL | Samples with conc. < DL | Samples with conc. in DL-MPL | Samples with conc. >MPL |
|---|---|---|---|---|---|
| TDS (mg/L) | 500 | 2000 | 4 | 11 | 1 |
| TH (mg/L) | 300 | 600 | 4 | 9 | 3 |
| Ca(mg/L) | 75 | 200 | 6 | 8 | 2 |
| Mg(mg/L) | 30 | 100 | 2 | 13 | 1 |
| Cl (mg/L) | 250 | 1000 | 11 | 4 | 1 |
| $SO_4$ (mg/L) | 200 | 400 | 11 | 2 | 3 |
| $NO_3$ (mg/L) | 45 | No relaxation | 4 | - | 12 |
| F (mg/L) | 1.0 | 1.5 | 14 | 1 | 1 |

### *2.5 Geographical Land Area and Use*

The most significant part of the Jalna district is that about 85 % of the geographical area is under agricultural use. Out of the total 7,61,200 Hectares of the geographical area, 6,51,553 Hectare of land is under agricultural use.The details of the land use in Jalna district are given in below tables 5[19].

Table:5 Geographical Land Area and Use

| Land use / cover Category | Area in Hect. | % of Geographical area |
|---|---|---|
| Built up land | 2,381 | 0.28 % |
| Agriculture land | 6,51,553 | 85.56 % |
| Forest land | 12,600 | 1.65 % |
| Waste land | 80,035 | 10.51 % |
| Water bodies & River | 6,371 | 0.85 % |
| Others | 8,260 | 1.15 % |
| Total | 7,61,200 | 100 % |

### *2.6 Data Mining*

Every organization collects its required data to solve some specific problems. Indeed, these data are collected for specific purposes. When the existing data are hoarded (so called data warehouse), some extra information can be extracted form this huge amount of data. This process is known as data mining. In this section, fundamental aspects of data mining, its requirements, processes and analysis approaches are elaborated.

#### *2.6.1 Data Mining Concepts*

Data mining is an approach for information extraction from huge amount of data stored in a database [20] The concept of data mining is illustrated in Figure 5.Recent trends in information technology (IT) and its growing application areas in addition to increase of available databases, along with the data mining are being used to extract and interpret information available in the databases, and explore the necessary information and their relationships to produce useful information/knowledge for decision making It has to be pointed out that data mining analyses are valid while having huge amount of data [21].

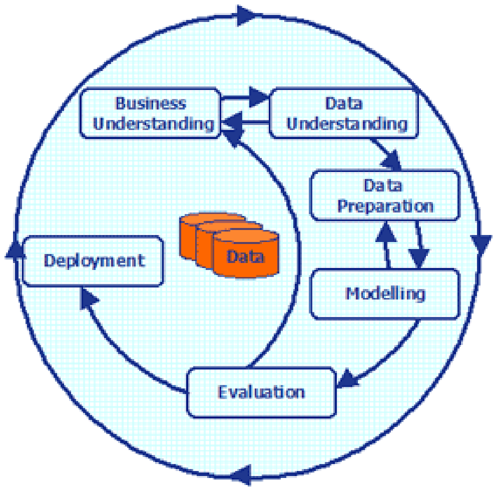


Fig:5 Data Mining concept and methodology

*2.6.2 Data Mining Stages*

Data mining analyses follow several stages including data cleaning, data selection, data reduction, information extraction, interpretation and reporting [22] Since most data are provided through observations and measurements, they must be checked against errors and distortions. Data cleaning covers cleaning of data in addition to removing noises and duplications. Data selection refers to selection of some fields and records in a database in order to be used in the analysis operations as well as maintaining the data integrity to provide the proper results[22].

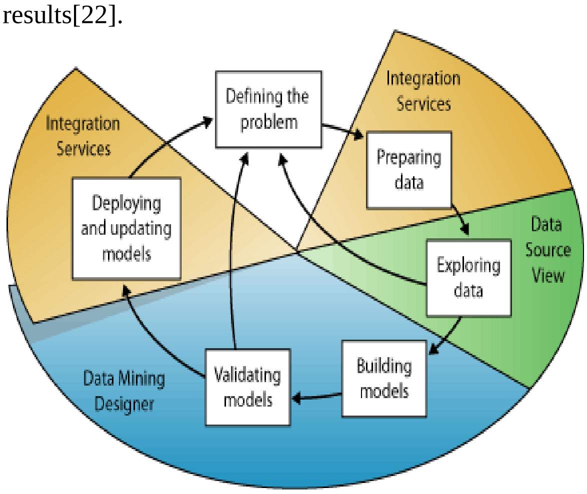


Fig:6 Data Mining stages

*2.6.3 Analyses Used in Data Mining*

There are several analyses used in data mining which are mainly classified as clustering, classification, dependency analysis and trend prediction. They are elaborated as follows [22].

*2.6.4 Clustering*

Clustering means specifying some implicit classes in which the selected data are classified. In this case, the number of classes is not known beforehand and existing data in terms of specific characteristics are divided to some classes having similar characteristics. Some statistical approaches exist for clustering. These approaches recursively divide the data to some classes with less variances form a certain tolerance. In addition, the average of the elements of each class must be far from that of others regarding a predefined tolerance. However, statistical approaches for clustering face some computational problems while having huge amount of data. This problem can be solved using Artificial Neural Networks (ANNs) that have ability to cluster huge amount of data efficiently [22].

***2.7 Geospatial Data Mining***

Geospatial data are data with some important positional components. Data in a non-spatial database are not associated to a certain position. However, in a spatial database there is a reference framework where geospatial data are associated with it through their coordinates. Experiences show that about eighty percent of existing data have some geospatial components. Therefore, extension of the data mining concept to geospatial data seems quite essential. This section reviews data mining form a GIS perspective to determine the specific characteristics of geospatial data mining.

*2.7.1 Geospatial Data Mining Characteristics*

There are a number of characteristics to distinguish geospatial data from others. The specific characteristics of geospatial data necessitate more complicated analyses to be implemented in geospatial data mining. The mentioned characteristics of spatial data are geospatial measurement framework, spatial dependency and complex objects [22]They are described below.

*2.7.2 Geospatial Measurement Framework*

Data used in data mining processes, are usually multi-dimensional which are mainly independent. However, spatial data in addition to multi-dimensionality, are interrelated in three spatial and may be one temporal dimensions which form a framework for other dimensions.

*2.7.3 Analyses Used in Geospatial Data Mining*

Although the analyses used in geospatial data mining seem similar in nature to those of data mining, they can be much more complex from conceptual and implementation point of view. These analyses include spatial clustering, spatial classification, spatial dependency and spatial trend prediction [22] In these analyses at least one locational component has to be incorporated as a main parameter. Spatial dependency analysis as an example of spatial data mining is implemented in this research. Spatial dependency analysis involves determination of some rules to estimate the value of one or more data using the value of other data while one or some of their main components are spatial data. Such a relationship can be between a spatial and an attribute component or between two spatial components. In the reminder of the paper, importance of water quality management and some past efforts in this area using GIS are investigated. In addition, a case study in GIS data mining applied on water quality management is introduced.


Fig:7 GIS Data mining Environment

***2.8 The Importance of Water Resource Management***

Water is one of the most important requirements in daily life which contains a major parts of the earth's hydrosphere. Scientific investigations regarding lack of enough water resources, increase of pollution in water resources in major parts of the world and increase of man's destructive activities affecting water resources are going to make a disaster in the near future. Implementation of proper and practical policies to evaluate the water resources through integrated exploitation, management and planning is vital. This is to ensure the availability of enough qualified water for the whole planet in addition to maintain the hydrologic, biologic and chemical ecosystem in a proper way. Considering the vital role of water resources in national, regional and global ecosystems and a number of socioeconomic disputes currently exist especially in the Middle East which seems to be intensified in the near future, assessment of existing situation and evaluation of the potentials of available water resources are vital steps for proper water resource management. Water crisis in international domain has been considered especially in effects such as increasing the earth temperature has changed the spatio-temporal distribution of rain. This will lead to desertification, flooding, etc. [23] The relationship between development and environment, population increase and the importance of maintaining food security are among the important challenges in water demand and supply management. Therefore, water supply and quality protection have been considered in Agenda 21 in Rio Conference in 1992 (www.un.org). The importance of water quality management forced a number of countries to investigate ways for pollution control. In this direction, GISs are among the most useful approaches. Recently, many efforts have been undertaken to use GISs for water quality assessment and management in different scales such as streams, rivers, lakes, seas and oceans. For example "The Alabama Watershed Demonstration" project links land use patterns and water quality through GIS (Flynn, 1999). Also some successful efforts about satellite and GIS tools to assess lake quality have been reported in University of Minnesota [24].

## III. METHODOLOGY

***3.1 Case Study***

In this research, of geospatial data mining for drinking water quality management case study is taken of Jalna district and its around taluka places ,Maharashtra. Due to the following reasons if we look at one glance on it .

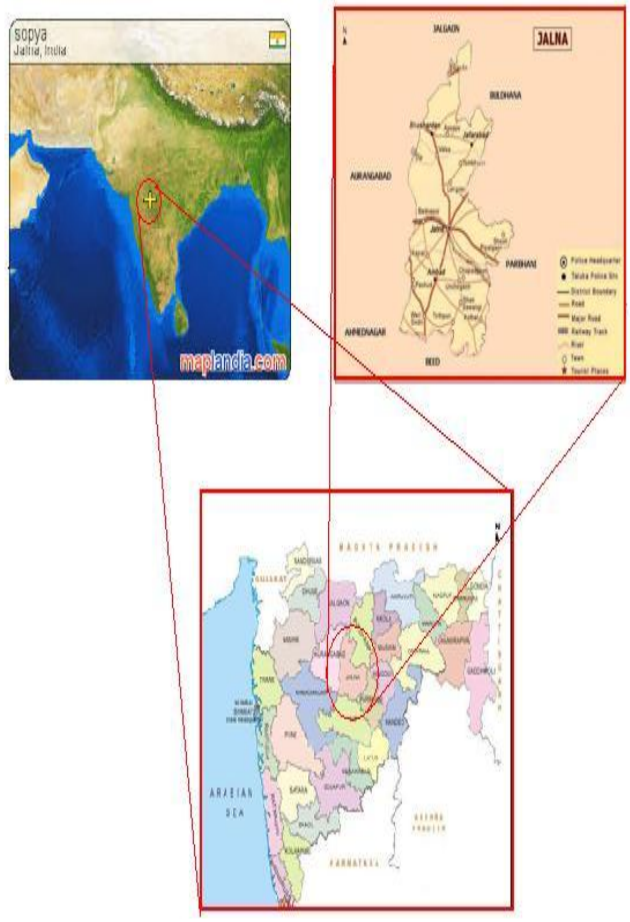


Fig:8 Geographical view of Jalna

***3.2 General Information***

Geographical Area: 7718 sq. km. Administrative Divisions: Taluka-8; Jalna, Bhokardan, Jafrabad, Badnapur, Ambad, Ghansawangi, Partur, Mantha

Villages : 971
Population (2001) : 1612980
Normal Annual Rainfall : 625 to 800 mm

*3.2.1 Geomorphology*

Major Physiographic unit: Part of Western Ghats, Satmala hill range, Ajanta hill range and Godawari plain Major Drainage : One; Godawari

*3.2.2 Land Use (2000-01)*

Forest Area : 64.60 sq. km.
Net Area Sown : 5152.30 sq. km.
Cultivable Area : 5744.74 sq. km.

*3.2.3 GROUND WATER MONITORING WELLS*

(As on 31/05/2007)
Dugwells : 24
Piezo meters : 7

*3.2.4 Geology*

Recent : Al
uvium
Upper Cretaceous-Lower
Eocene
: Basalt (Deccan Traps)

*3.2.5 Hydrogeology*

Water Bearing Formation : Basalt (Deccan Traps) weathered,
vesicular fractured, jointed. Under phreatic
and confined conditions.
Pre monsoon Depth to
Water Level (May-2007)
: 2.35 to 23.39 m bgl
Post monsoon Depth to
Water Level (Nov.-2007)
: 1.90 to 11.45 m bgl
: Rise: 0.01 Premonsoon Water Level to 0.21 m/year
Trend (1998-2007) Fall: 0.05 to 0.52 m/year
Pos tmonsoon Water Level Rise: 0.13 m/year
Trend (1998-2007)
:Fall: 0.01 to 0.78 m/year

*3.2.6 Ground Water Exploration (Outsourcing)*

(As on 31/03/07)
Wells Drilled : 30
Depth Range : 145.65 to 200.20 m bgl
SWL : 17.95 to 50.00 m bgl
Discharge : 0.14 to 1.37 lps

*3.2.7 Ground Water Quality*

The quality of ground water is generally alkaline and suitable for irrigation
purpose. The potability is mainly affected by nitrate contamination.
Type of Water : Ca-Cl and Ca-HCO3

*3.2.8 Dynamic Ground Water Resources*

Net Annual Ground Water
Availability : 917.28 MCM
Annual Ground Water
Draft (Irrigation+Domestic) : 392.27 MCM
Allocation for Domestic and Industrial requirement up to next 25 years : 13.88
Stage of Ground Water Development : 42.76 %

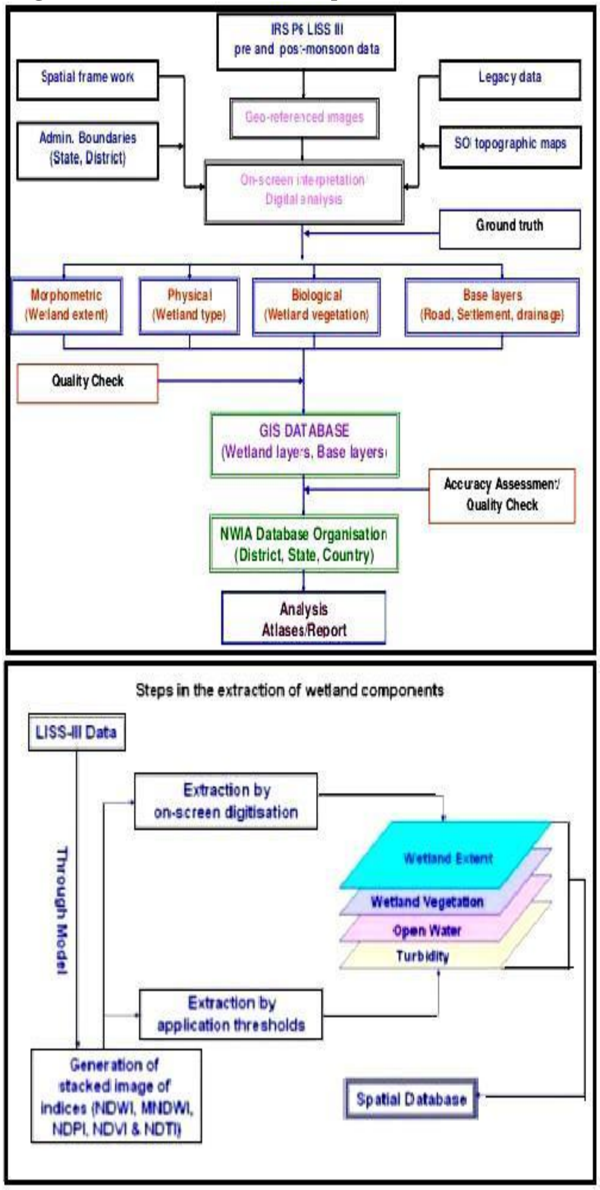


Fig:9 flow chart and methodology of geospatial techniques

***3.3 Major ground water problems and issues***

Major parts of the district are showing falling ground water level trends in northern, southern and eastern parts comprising almost entire Bhokardhan, Jafrabad, Ambad, and Partur talukas and major parts of Jalna taluka in central part of the district. Thus, the future water conservation and artificial recharge structures needs to be prioritized in these areas. on these areas. Ground water quality is adversely affected at many places due to high concentration of some parameters specially nitrate. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.

### *3.4 Approach towards finding the results*

The spatial data related to some rivers in the study region have been collected from 1:100 maps the Major rivers of the study area that have stations for measurement of water quality parameters have been extracted. In addition, the data related to some cities, industrial centers including food, chemical and leather industries and mines have been acquired using 1:100 topographic maps In addition to major data available on quality parameters of industrial waste water, few data were simulated from neighboring and similar industries where the actual data were unavailable. Since the volume of waste water and kind of industry has a relatively direct relation, the simulated data can be considered as adequate approximations and they have not distorted the results. The above procedure is described bellow for one of the mentioned cases To check the existence of dependency between popular. To check the existence of dependency between population concentration and *do* (Dissolve Oxygen) first to third degree polynomials and an exponential curve have been fitted to population concentration in the selected buffer (30 km from quality parameter measurement stations) and their respected *do*. The calculated *do*. (d,o ) regarding these fitted curves for each case and each river have been calculated. The calculated and observed value for *do* of each river and sum of the squares of the residuals (*R*) has been calculated for each case .

$$R=\sum_{i-1}^{n}(do_i-\hat{do}_i)^2$$

These parameters can be used for goodness of fitness test The best fitted curve is selected where *R* is minimum. On the other hand, it can be proved that *R* has a Chi-square distribution with *n-p* degrees of freedom where *n* and *p* are number of observations and unknowns,

$$R<\chi^2_{\alpha,n-p}$$

where $x^2_{\alpha,n-p}$ is the value of the Chi-square distribution atsignificance level *α* and *n-p* degree of freedom (*df*).Finally the second degree polynomial
( $do = 2\times10{-}13\, p - 10{-}6\, p + 5.2792$ )
where the calculated *R* is minimum (*R* =5.424) and the $R_{min} <_{x0.5,25}$ = 10.520

has been selected for the best fit This process has been done for each case and the results for all of the checked dependencies

| Population Con. | DO | First Degree Polynomial | | Second Degree Polynomial | | Third Degree Polynomial | | Exponential | |
|---|---|---|---|---|---|---|---|---|---|
| | | $\hat{DO}$ | $(DO-\hat{DO})^2$ | $\hat{DO}$ | $(DO-\hat{DO})^2$ | $\hat{DO}$ | $(DO-\hat{DO})^2$ | $\hat{DO}$ | $(DO-\hat{DO})^2$ |
| 205000 | 4.5 | 5.000 | 0.250 | 5.083 | 0.339 | 4.974 | 0.224 | 4.961 | 0.213 |
| 900000 | 4.6 | 4.722 | 0.015 | 4.541 | 0.003 | 4.209 | 0.153 | 4.628 | 0.001 |
| 150000 | 4.7 | 5.022 | 0.104 | 5.134 | 0.188 | 5.101 | 0.161 | 4.988 | 0.083 |
| 190000 | 4.7 | 5.006 | 0.094 | 5.096 | 0.157 | 5.007 | 0.094 | 4.968 | 0.072 |
| 0 | 6.3 | 5.082 | 1.483 | 5.279 | 1.042 | 5.507 | 0.629 | 5.064 | 1.528 |
| 110000 | 5.9 | 5.038 | 0.743 | 5.172 | 0.531 | 5.201 | 0.489 | 5.008 | 0.795 |
| 600000 | 4.4 | 4.842 | 0.196 | 4.751 | 0.123 | 4.362 | 0.001 | 4.769 | 0.136 |
| 400000 | 4.6 | 4.922 | 0.104 | 4.911 | 0.097 | 4.608 | 0.000 | 4.865 | 0.070 |
| 40000 | 4.8 | 5.066 | 0.071 | 5.240 | 0.193 | 5.390 | 0.349 | 5.044 | 0.059 |
| 50000 | 6.1 | 5.062 | 1.077 | 5.230 | 0.757 | 5.362 | 0.544 | 5.039 | 1.127 |
| 250000 | 4.9 | 4.982 | 0.007 | 5.042 | 0.020 | 4.878 | 0.001 | 4.939 | 0.002 |
| 250000 | 5.2 | 4.982 | 0.047 | 5.042 | 0.025 | 4.878 | 0.104 | 4.939 | 0.068 |
| 240000 | 5 | 4.986 | 0.000 | 5.051 | 0.003 | 4.898 | 0.010 | 4.944 | 0.003 |
| 200000 | 4.7 | 5.002 | 0.091 | 5.087 | 0.150 | 4.985 | 0.081 | 4.964 | 0.069 |
| 300000 | 4.8 | 4.962 | 0.026 | 4.997 | 0.039 | 4.779 | 0.000 | 4.914 | 0.013 |
| 3400000 | 3.8 | 3.722 | 0.006 | 4.191 | 0.153 | 6.636 | 8.043 | 3.604 | 0.038 |
| 350000 | 4.5 | 4.942 | 0.196 | 4.954 | 0.206 | 4.689 | 0.036 | 4.890 | 0.152 |
| 215000 | 4.6 | 4.996 | 0.157 | 5.073 | 0.224 | 4.952 | 0.124 | 4.956 | 0.127 |
| 300000 | 4.8 | 4.962 | 0.026 | 4.997 | 0.039 | 4.779 | 0.000 | 4.914 | 0.013 |
| 1350000 | 4.5 | 4.542 | 0.002 | 4.294 | 0.043 | 4.364 | 0.018 | 4.424 | 0.006 |
| 700000 | 4.7 | 4.802 | 0.010 | 4.677 | 0.001 | 4.284 | 0.173 | 4.721 | 0.000 |
| J | | 6.046 | | 5.424 | | 15.616 | | 5.887 | |
| $\chi^2_{\alpha,df}$ | | 11.160 | | 10.520 | | 9.88 | | 11.160 | |
| df | | 26 | | 25 | | 24 | | 26 | |

## IV. CONCLUSION

In the preparation of this paper a detail review and analysis on geospatial techniques and geospatial data mining is being covered and the, Robust Strategies against the Challenges and issues of Drought under the case study of Jalna district in Maharashtra and around also being discussed . And some of techniques and methodology of data mining also being test out in direction of drinking ground water quality management to improve its quality. It has being brought into our consideration that the importance of water quality and its managements and the use of geospatial data mining and geographic information system for extraction of information is quit necessarily. Hence the result is being achieved in respect to the spatial distribution of water quality parameters can be utilized Regarding geospatial data mining and various statistical analyses the existence and saturation towards more quality oriented and complete data sets to deal with better quality oriented and accuracy based results

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