

A Study of Map of Water Bodies of Gwalior

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Abstract

Water is one of the major ingredients of human life. To survive and to make our self-healthy it is necessary to save the water resource. The prime objective of present research is to identify the fresh water resources in Gwalior city and locate their position on map.

To fulfill the prime object of this empirical research Global Positioning System (GPS) is used to locate the exact position of the water bodies. AutoCAD designing software is used to draw the map of all water bodies. The water bodies surveyed in this study needs immediate attention at the government as well as public level. These water bodies must be conserved properly by clearing their premises, plantation in their banks and motivating the general public for sustainable use of the water resources.

This paper is first of its kind which focused on identification of living water resource inside the Gwalior city and generation of AutoCAD map through the GPS data.

Keywords: - AutoCAD, Water bodies, Global positioning system, Gwalior, India.

INTRODUCTION

Water is a chemical substance with the chemical formula H₂O. A water molecule contains one oxygen and two hydrogen

atoms connected by covalent bonds. Water is a liquid at ambient conditions, but it often co-exists on Earth with its solid state, ice, and gaseous state (water vapor or

steam). Water also exists in a liquid crystal state near hydrophilic surfaces.

Water covers 70.9% of the Earth's surface and is vital for all known forms of life. On Earth, 96.5% of the planet's water is found in oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Only 2.5% of the Earth's water is freshwater, and 98.8% of that water is in ice and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products.

Water on earth continually through the hydrological of evaporation and transpiration, condensation precipitation on and run off usually reaching the sea. Evaporation and Transpiration contribute to the precipitation over land.

Water cycle

The water cycle (known scientifically as the hydrologic cycle) refers to the continuous exchange of water within the hydrosphere, between the atmosphere, soil

water, surface water, ground water and plants.

Water moves perpetually through each of these regions in the water cycle consisting of following transfer processes: evaporation from oceans and other water bodies into the air and transpiration from land plants and animals into air. Precipitation, from water vapor condensing from the air and falling to earth or ocean runoff from the land usually reaching the sea.

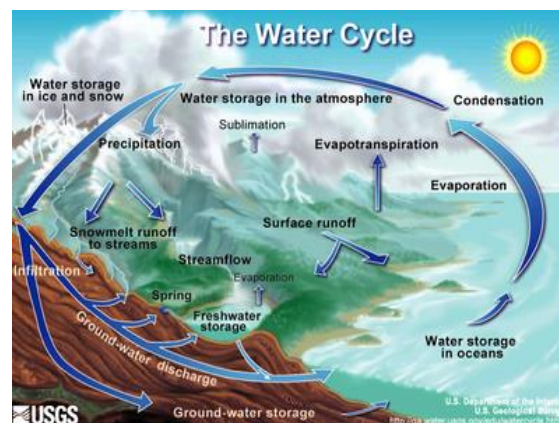


Fig 1: Water cycle of our Environment.

Uses of water

Agriculture: The most important use of water in agriculture is for irrigation, which is a key component to produce enough food.

Irrigation takes up to 90% of water withdrawn in some developing countries

Drinking water: The human body contains from 55% to 78% water, depending on body size. To function properly, the body requires between one and seven liters of water per day to avoid dehydration; the precise amount depends on the level of activity, temperature, humidity, and other factors

Washing: The propensity of water to form solutions and emulsions is use-full in various washing processes. Many industrial processes rely on reactions using chemicals dissolved in water, suspension of solids in water slurries or using water to dissolve and extract substances. Washing is also an important component of several aspects of personal body hygiene.

Transportation: The use of water for transportation of materials through rivers and canals as well as the international shipping lanes is an important part of the world economy.

Chemical uses: Water is widely used in chemical reactions as a solvent or reactant and less commonly as a solute or catalyst. In inorganic reactions, water is a common solvent, dissolving many ionic compounds.

Heat exchange: Water and steam are used as heat transfer fluids in diverse heat exchange systems, due to its availability and high heat capacity, both as a coolant and for heating. Cool water may even be naturally available from a lake or the sea.

Fire extinction: Water has a high heat of vaporization and is relatively inert, which makes it a good fire extinguishing fluid. The evaporation of water carries heat away from the fire. It is dangerous to use water on fires involving oils and organic solvents

Recreation: Humans use water for many recreational purposes, as well as for exercising and for sports. Some of these include swimming, waterskiing, boating, surfing.

Water industry: The water industry provides drinking water and wastewater services (including sewage treatment) to households and industry. Water supply facilities include water wells cisterns for rainwater harvesting, water supply network, water purification facilities, water tanks, water towers, water pipes including old aqueducts. Atmospheric water generators are in development.

Industrial applications: Water is used in power generation. Hydroelectricity is

electricity obtained from hydropower. Hydroelectric power comes from water driving a water turbine connected to a generator. Hydroelectricity is a low-cost, non-polluting, renewable energy source. The energy is supplied by the motion of water.

Food Processing: Water plays many critical roles within the field of food science. It is important for a food scientist to understand the roles that water plays within food processing to ensure the success of their products.

Anthropogenic Pressure on water resources

Water Pollution: Water pollution is the contamination of water bodies. (e.g. lakes, rivers, oceans, aquifers and groundwater). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities.

Overexploitation: Overexploitation, also called overharvesting, refers to harvesting a renewable resource to the point of diminishing returns. Sustained overexploitation can lead to the destruction of the resource. The term applies to natural resources such as: wild medicinal plants, grazing pastures, fish stocks, forests, and water aquifers.

Groundwater Contamination:

Groundwater Contamination - the detrimental alteration of the naturally occurring physical, thermal, chemical or biological quality of groundwater. Further, groundwater contamination, for purposes of inclusion of cases in the public files and the joint groundwater monitoring and contamination report, shall be limited to contamination reasonably suspected of having been caused by activities of entities under the jurisdiction of the agencies identified in the Texas Water Code §26.406, TGPC rules, and subsequent legislative amendments. Groundwater contamination may result from many sources, including current and past oil and gas production and related practices, agricultural activities, industrial and manufacturing processes, commercial and business endeavors, domestic activities, and natural sources that may be influenced.

Salinity of water: Water salinity of fresh, brackish and sea water, salinity is the saltiness or dissolved salt content of a body of water.

Need of managing water resources

Urbanization: Water is an essential component of life and is required for almost all the vital activities of living beings like drinking, bathing, washing, irrigation and industrial operations. Rapid increase in population, industrialization and urbanization has made water increasingly scarce commodity both in terms of quantity as well as quality. The rapid process of urbanization leads to a number of environmental problems.

The improper land use changes without due consideration of the drainage pattern of the cities have affected the hydrological cycle and consequently the quantity and quality of the water resources.

Scarcity of water: Water scarcity already affects every continent. Around 1.2 billion people, or almost one-fifth of the world's population, live in areas of physical scarcity, and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world's population, face economic water shortage (where countries lack the

necessary infrastructure to take water from rivers and aquifers).

Water scarcity is among the main problems to be faced by many societies and the World in the XXIst century. Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water.

Watershed management: Watershed management is the study of the relevant characteristics of a watershed aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary. Features of a watershed that agencies seek to manage include water supply, water quality, drainage, storm water runoff, water rights, and the overall planning and utilization of watersheds. Landowners, land use agencies, storm water management experts, environmental specialists, water use purveyors and communities all play an integral part in the management of a watershed.

Scenario in India and Madhya Pradesh:

The water resources in India are under immense pressure and as a result many of them have either lost their identity while others are in very bad shape. The water urban bodies in the state of Madhya Pradesh are in similar condition.

Scenario of Gwalior

In Gwalior city population will be increased in comparison this rain fall ratio will be decreased day by day. Many water resources in the form of small watersheds, ponds, lakes and rivers are present in and around the city. But, due to scarcity of water and improper management activities, these water bodies are on the verge of drying up.

Objectives

- Rapid assessment of current situation of the urban catchment pertaining to availability of water' sectoral demand identification of major point and non-point sources of pollution, waste generation,
- Study of drainage pattern, flow gauging and develop a GIS map based run of model.
- GPS of water bodies

- Develop city specific strategies at improving the water quality.

LITERATURE REVIEW

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day.

LORAN and the Decca Navigator developed in the early 1940s, and used during World War II in 1956, Fried ward Winter berg proposed a test of general relativity (for time slowing in a strong gravitational field) using accurate atomic clocks placed in orbit inside artificial satellites. (To achieve accuracy requirements, GPS uses principles of general relativity to correct the satellites' atomic clocks. Additional The design of GPS is based partly on similar ground-based radio-navigation systems, such inspiration for GPS came when the Soviet Union launched the first man-made satellite, Sputnik in 1957. Two American physicists, William Guier and George Weiffen bach, at Johns Hopkins's Applied

Physics Laboratory (APL), decided on their own to monitor Sputnik's radio transmissions.[5] Within hours they realized that, because of the Doppler effect, they could pinpoint where the satellite was along its orbit from the Doppler shift. The Director of the APL gave them access to their UNIVAC to do the heavy calculations required. When they released the orbit of Sputnik to the media, the Russians were dumbfounded to learn how powerful American computers had become, as they would not have been able to calculate the orbit themselves. The following spring, Frank McClure, the deputy director of the APL, asked Guier and Weiffenbach to look at the inverse problem where you know the location of the satellite and you want to find your own location. (The Navy was developing the submarine-launched Polaris missile, which required them to know the submarine's location.) This led them and APL to develop the Transit system. The first satellite navigation system, Transit (satellite), used by the United States Navy, was first successfully tested in 1960. It used a constellation of five satellites and could provide a navigational fix approximately once per hour. In 1967, the U.S. Navy developed the Timation satellite that proved the ability to place accurate clocks in space, a technology required by

GPS. In the 1970s, the ground-based Omega Navigation System, based on phase comparison of signal transmission from pairs of stations, became the first worldwide radio navigation system. Limitations of these systems drove the need for a more universal navigation solution with greater accuracy.

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as

speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Garmin's 12 parallel channel receivers are quick to lock onto satellites when first turned on and they maintain strong locks, even in sources of error can affect the accuracy of GPS receivers. Garmin® GPS receivers are accurate to within 15 meters on average.

The GPS satellite system

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 7,000 miles an hour. GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path. Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS

The first GPS satellite was launched in 1978. A full constellation of 24 satellites was achieved in 1994. Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit. A GPS satellite weighs approximately 2,000 pounds and is about 17 feet across with the solar panels extended. Transmitter power is only 50 watts or less.

GPS satellites transmit two low power radio signals, designated L1 and L2. Civilian GPS uses the L1 frequency of 1575.42 MHz in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects such as buildings and mountains.

A GPS signal contains three different bits of information - a pseudorandom code, ephemeris data and almanac data. The pseudorandom code is simply an I.D. code that identifies which satellite is transmitting information. You can view this number on your Garmin GPS unit's satellite page, as it identifies which satellites it's receiving. Ephemeris data, which is constantly transmitted by each satellite, contains important information about the status of the satellite (healthy or unhealthy), current date and time. This part of the signal is essential for

determining a position. The almanac data tells the GPS receiver where each GPS satellite should be at any time throughout the day. Each satellite transmits almanac data showing the orbital information for that satellite and for every other satellite in the system.

Sources of GPS signal errors

Factors that can degrade the GPS signal and thus affect accuracy include the following:

- **Ionosphere and troposphere delays:** The satellite signal slows as it passes through the atmosphere. The GPS system uses a built-in model that calculates an average amount of delay to partially correct for this type of error.
- **Signal multipath:** This occurs when the GPS signal is reflected off objects such as tall buildings or large rock surfaces before it reaches the receiver. This increases the travel time of the signal, thereby causing errors.
- **Receiver clock errors:** A receiver's built-in clock is not as accurate as the atomic clocks onboard the GPS satellites. Therefore, it may have very slight timing errors.
- **Orbital errors:** Also known as ephemeris errors, these are inaccuracies of the satellite's reported location.
- **Number of satellites visible:** The more satellites a GPS receiver can "see," the better the accuracy. Buildings, terrain, electronic interference, or sometimes even dense foliage can block signal reception, causing position errors or possibly no position reading at all. GPS units typically will not work indoors, underwater or underground.
- **Satellite geometry/shading:** This refers to the relative position of the satellites at any given time. Ideal satellite geometry exists when the satellites are located at wide angles relative to each other. Poor geometry results when the satellites are located in a line or in a tight grouping.
- **Intentional degradation of the satellite signal:** Selective Availability (SA) is an intentional degradation of the signal once imposed by the U.S. Department of Defense. SA was intended to prevent military adversaries from using the highly accurate GPS signals. The government turned off SA in May 2000, which

significantly improved the accuracy of civilian GPS receivers.

AutoCAD Software

AutoCAD is a software application for computer-aided design (CAD) and drafting. The software supports both 2D and 3D formats. The software is developed and sold by Autodesk, Inc., first released in December 1982 by Autodesk in the year following the purchase of the first form of the software by Autodesk founder, John Walker. AutoCAD is Autodesk's flagship product and by March 1986 had become the most ubiquitous microcomputer design program in the world, utilizing functions such as “polylines” and “curve fitting”. Prior to the introduction of AutoCAD, most other CAD programs ran on mainframe or minicomputers, with each user's unit connected to a graphics.

According to its own company information, Autodesk states that the AutoCAD software is now used in a range of industries, employed by architects, project managers and engineers, amongst other professions, and as of 1994 there had been 750 training centers established across the world to educate users about the company's primary products

AutoCAD was derived from a program called Interact, which was written in a proprietary language (SPL) by inventor Michael Riddle. This early version ran on the Marin chip Systems 9900 computer (Marin chip Systems was owned by Autodesk co-founders John Walker and Dan Drake). Walker paid Riddle US\$10 million for the CAD technology.

When Marin chip Software Partners (later known as Autodesk) formed, the co-founders decided to re-code Interact in C and PL/1. They chose C because it seemed to be the biggest upcoming language. In the end, the PL/1 version was unsuccessful. The C version was, at the time, one of the most complex programs in that language. Autodesk had to work with a compiler developer, Lattice, to update C, enabling AutoCAD to run. Early releases of AutoCAD used primitive entities — lines, polylines, circles, arcs, and text — to construct more complex objects. Since the mid-1990s, AutoCAD supported custom objects through its C++ Application Programming Interface (API).

The modern AutoCAD includes a full set of basic solid modeling and 3D tools. The release of AutoCAD 2007 included the improved 3D modeling that provided better navigation when working in 3D.

Moreover, it became easier to edit 3D models. The mental ray engine was included in rendering and therefore it is possible to do quality renderings. AutoCAD 2010 introduced parametric functionality and mesh modeling. The latest AutoCAD releases are AutoCAD 2013 and AutoCAD 2013 for Mac. The release marked the 27th major release for the AutoCAD for Windows and the third consecutive year for AutoCAD for Mac.

Autodesk has also developed a few vertical programs for discipline-specific enhancements. For example, AutoCAD Architecture (formerly Architectural Desktop) permits architectural designers to draw 3D objects, such as walls, doors and windows, with more intelligent data associated with them rather than simple objects, such as lines and circles. The data can be programmed to represent specific architectural products sold in the construction industry, or extracted into a data file for pricing, materials estimation, and other values related to the objects represented. Additional tools generate standard 2D drawings, such as elevations and sections, from a 3D architectural model. Similarly, Civil Design, Civil Design 3D, and Civil Design Professional support data-specific objects, facilitating easy standard civil engineering

calculations and representations. It was skillfully designed by Autodesk.

While the latest release of AutoCAD did not come with a major overhaul, the 2012 version did receive minor improvements. Several small changes were made to improve the 3D capabilities, and some new features were added to enhance the productivity of the program. These changes and features included: increased canvas control, associated arrays, improved 3D model manipulation, and other less noticeable additions. After the release of AutoCAD 2011 for Mac, the Windows version lacked several features found in the Mac version. Several of the Mac version canvas controls have now been added to the 2012 release. To accomplish the goal for better 3D model manipulation, Autodesk did away with the old saved history method and introduced a new plug-in that will automatically be installed, Autodesk Inventor Fusion. This plug-in allows users to directly open and edit 3D models without having to save and export their work manually. When the user is finished editing the plug-in automatically opens the updated version back in AutoCAD. Autodesk also replaced the older array feature with new associated arrays features. This now allows users to duplicate things using three different

commands: polar arrays, rectangular arrays, and placing objects along a predetermined path. The new redesigned array feature will also work with both 2D and 3D objects.[Autodesk has also chosen to allow users to purchase companion applications directly within the AutoCAD 2012 program. The newest release of AutoCAD also came with new system requirements and recommendations in order to run AutoCAD 2012.

MATERIALS & METHODS

Study Area

Gwalior city: Gwalior is situated in the north of state of madhya pradesh at 26°12' N latitude and 76°18'E on indo gangetic plains. Gwalior city is a district head quarter of chambal division, madhya pradesh. It is a historical place blessed with classical music maestro Tansen. The Gwalior city was ruled by Tomars, Marwahas and Marathas. The old city is covered with white sandstone mosque ,places ,rock temples and statues of archaeological and architectural interest .the city was the capital of the princely state of Gwalior until 1948 to 1956/. Fort is the chief attraction of Gwalior .Gwalior's history is traced back to 8th century .the city was named after a hermi-saint Gwalipa when a chieftan known as Surajsen was struck by a deadly disease

and cured by a hermit- saint Gwalipa. As a gratitude for that incidence, he founded this city by his name .the new city of gwalior came into existence over the centuries .the cradle of great dynasties Scindias ruled the gwalior city .the city is also the setting for the memorial of freedom fighters such as Tatyta Tope and the indomitable Rani of Jhansi . To facilitate adminstrate the city is divided into 20 Zones and is further sub divided in to 60 wards.

Climate: Summers in gwalior remain very hot and dry. The season of summer starts from April and last until june while bringing about steep rise in temperature. The maximum temperature during summer may ascend to 46°C and the minimum temperature is recorded at only 23.9°C. The summer hails experienced during june/july.

Winters in Gwalior are very cold and damp .the season lasts for four months – november, december, january and february. Winters in Gwalior starts in late october, and it generally very mild with daily temperature averaging in the 14-16°C, and mostly dry and sunny conditions.

January is the coldest month with average lows in the 5-7°C .and during extreme

conditions temperatures dips to freezing .during winters, the maximum temperature rises to 20.50 C however might be a sudden drop in the temperature levels during the night's .sometimes, cold days are accompanied with heavy fog and winter sleets.

Gwalior has average annual rain fall of 970mm(39in) of rain ,most of which is concentrated in the monsoon months from late june to early october .july and august is the wettest month with about 380mm(15mm) of rain .wind pattern for Lashkar in the southwest are determined by its bowl-enclosure between the dry hills ,resulting in extreme hot winds during pre-monsoon period .in comparison .the more green flat area of morar to the east with its considerable vegetative cover present a more comfortable microclimate during the hot season .winds in Gwalior are predominantly from south-west dirctions.

URBAN BASIC SERVICES

Water Resources: The city is located on plains sloping from south-west to north and north- east.the plains extend from Chambal river in the extreme north .where it joins a number of rivers flowing from the south west to finally join the gangetic river system .the natural drainage of the Gwalior urban area is dominated by

Swarnrekha and Morar river ,Swarnrekha is flowing south to north through the urban area for about 13.65 km .storm water and a considerable amount of untreated sewage drains naturally through this stream .besides Swarnrekha and Morar river there are mainly two water tanks : Janak tal and Sagar tal with in the municipal limits and are used mainly for recreation .The Kaketo and Tighra reservoirs situated in the outskirts of the city .Detail of the important water bodies in the Gwalior city is given in the Table 1.

Water Supply: The water supply of Gwalior urban area mainly depends on Tighra –Kaketo reservoir and groundwater .it is the main source of Domestic water supply for the coty and is also used for irrigation and pisiculture. This was constructed on the river Sank in the year 1914.The average storage capacity of the reservoir is 2,237 mcft and the total catchment area of the reservoir is 260 sq.mt. It is linked with two reservoirs named Kaketo and pesari on the upstram by a 55 km. long fedder canal .The total water availabe from Tighra and Kaketo system is 190 mld . Water is taken into (old&new) water reatment plants located in Moti jheel . the old water treatment plant is having the installed capacity.of 68.19 MLD .the ground water is also used

as a supplementary source and supplies about 27MLD through tube wells.

Water demand and supply

The daily total water demand of gwalior for various sectors is estimated to be 155.52 MLD, while the total daily water supply is 130 MLD (54 MLD from motijheel old WTP, 54 MLD from The daily total water demand of gwalior for various sectors is new Motijheel WTP and 22.5 MLD from ground water) there is a gap between demand and supply of water in Gwalior city.

Study sites

The drainage of the city can be divided into four major catchments .for the purpose of the development of catchment management strategy, five additional catchments of monitoring points have been identified .Two of these catchments lie within the MORAR River catchment while three in the Swarnarekha River catchment .The land cover of each catchment has been studied using IRS P6 satellite imagery dated 8th May 2009 at a scale of 1:12500. The land cover has been classified as agriculture, built up with dense vegetation, built up with moderate vegetation, build up with sparse vegetation, and land with scrub, open ground, rocky land and water body.

Table 1: Water bodies in the Gwalior city

S.No	Name of Water Body	Water Bodies Area (sq.km)	Present Use
1.	Janak Tal/Lake	0.04	Recreation ,Religious activities
2.	Sagar Tal/Lake	0.04	Recreation ,Religious activities
3.	Tighra Reservoir	48.05	Drinking, Pisciculture, irrigation
4.	Swarna Rekha Reservoir	-	Disposal of waste water ,Surface runoff and for out flow of Hanuman Dam.
5.	Morar River	-	Disposal of waste water ,Surface runoff.
6.	Laxman talaiya	-	Recreation.
7.	Moti jheel	-	Recreation.
8.	Jararua Dam	-	Disposal of waste water ,Surface runoff.

Gps location: N 26⁰13'26.34" E 78⁰8'53.84"

Place: Gwalior

Features: Janaktal is located in a western part of the city . Tal is a spot of recreational activities of the town and also has religious due to the presence of Hanuman temple and other temples which are situated on a bank of this lake. The major problems of the waterbodies are solid waste dumping ,washing,bathing activities inflow of households untreated waste water, cattle wallowing and grazing.



Fig 2: Water body Janaktal of Gwalior

SAGARTAL

GPS Location: N 26⁰14'30.59" E 78⁰9'33.59"

Place: Gwalior

Features: It is located in the western part of the city it is a historical lake was constructed in early 18 centuries, ruling

period of royal family of the Gwalior City. sagartal also has religious importance due to presence of temples which are situated in the bank of the lake this water body is under control of municipal authority, lake is partially covered with aquatic weeds. lack of proper solid waste management system in the fringe area of the lake reduces water storage capacity of the lake and also add contaminants. Water spread at FTL is 4 hectares. Rain water is the source of the water. Its depth is 5 meter. Its structure is earthen dam. It has urban type of catchment. Water availability is Annual. Present use of water body is Recreation, Nester, (Domestic Secondary Use)



Fig 3: Water body Sagartal of Gwalior

TIGHRA DAM

GPS Location: N 26⁰ 13'0.39" E 78⁰0'21.85"

Place: Gwalior

Features: Tigra Dam (also spelled as “Tighara Dam”) creates a freshwater reservoir on the Bank River, about 23 km from Gwalior, Madhya Pradesh, India it plays a crucial role in supplying water to the city. The dam is 24 meters high at its crest, and 1341 m long. The reservoir has a capacity of 4.8 million cubic meters and the spillway structure can pass up to 1274 cubic meters per second. A dam constructed on this site in 1916 failed on the afternoon of August 4, 1917, due to infiltration into its sandstone foundations. About 1000 people were killed downstream.



Fig 4:Water body TigraDam of Gwalior

MORAR NADI

GPS Location: N 26°13’0.79”
E78°13’1.80”

Features: The morar river starts from a distance of about 15 Km upstream of Ramaua Dam in Gwalior District and approximately 2 km with in Gwalior city

area then finally joins Vaisali river on the boundary of Gwalior district. Vaisali river on the boundary of Gwalior district. Vaisali river ultimately joins Sindh river near village Bilao in Bhind district .Morar river water is being used for agriculture irrigation purpose by farmers in the down stream by constructing temporary earthen barrier .This water contains rich nutrients such as Nitrogen and Phosphorous because it carries the sewage water from the city. It,s catchment area is 389.19. Rain water,waste water of the city ,Ramua Dam are the source of the water. It,s Depth is 1.5 meter. It,s catchment are urban(Residential and commercial) rural and forest area. Water availability is annual. Present use of water body is Disposal of waste water, outfall of Ramua dam and surface run off.



Fig 5: Water body Morar Nadi of Gwalior

Table 2: Drains of Morar river waterbody

S.No	Gwalior Drains	Origin Point	Area Covered	End Point	GPS Location
1.	Nadika rapta bridge	Nadika rapta	Riverview colony	Morar River	N26 ⁰ 13.349' E78 ⁰ 13.220'
2.	Harnampura Drainage	Harnampura	Shiv Nagar	Morar ariver	N26 ⁰ 12.627' E78 ⁰ 12.727'
3.	Gandhi nager Drainage	Gandhi Nagar	Batham mohalla	Morar River	N26 ⁰ 12.627' E78 ⁰ 11.573'
4.	Near SVM School	Ganesh colony	SuryaBihar Colony	Morar River	N26 ⁰ 14.879' E78 ⁰ 13.038'

LAXMAN TALAIYA

GPS Location: N26⁰12'44.74"
E78⁰09'44.93"

Features: Laxman talaiya is a historical palace of Maharaja Man Singh & state time in Gwalior. This place is developed by saint laxmandas then after some time this palace name on baba Laxmandas. Laxman talaiya is a something 1*1 km residential area. its area is very developed at this time. Laxman talaiya is south area of Gwalior fort base.



Fig 6: Water body Laxman Talaiya of Gwalior

MOTIJHEEL

GPS Location: N 26⁰15'1.72"
E78⁰8'.23.94"

Features: Moti jheel has also a water treatment plant .Railway station is situated near the water body and it is situated near the city.No environment problem are found there. Immence growth of aqatic plans was observed in the lake. Input of sewage water in the source of organic pullution as two drains were found discharging effluent in the lake.



Fig 7: The Water body Motijheel of Gwalior

BAIJATAAL

GPS Location: N 26⁰12'31.79"
E78⁰10'18.30"

Features: It is situated near Chetak puri and it has a stage in water .this is very famous stage for functions in Gwalior. No environment problem are found there.previously it was filled with waterr but now the Tal is dry due to unavailability of fresh water.



Fig 8: The Water body Baijataal in Gwalior

SURAJKUND (FORT)

GPS Location: N 26⁰13'22.69"
E78⁰10'1.41"

Features: Situated in the majestic Gwalior fort, Suraj Kund is believed to be the same place where the Sage Gwalipa healed Suraj Sen, the Rajput chieftain. The history of Suraj Kund complex dates back to the 15th century. The myth behind this

legendary pond is very fascinating. It says that the chronic illness of Suraj Sen was cured after he had tasted the water of the pond. The king as a token of his gratitude towards the saint, who had cured his disease, built a tank and the mighty fort and named the city after the sage. The pond that can be seen in the fort draws the attention of the people because of its great historical value and sumptuousness.



Fig 9: The Water body Surajkund in Fort of Gwalior

SWARNAREKHA RIVER

GPS Location: N 26⁰13'4.30" E
78⁰08'9.24"

Features: The Swarnarekha river is a sub tributary of River Chambal .it originates from 3.5 kms upstream of virpur village .The river after passing through 7 No's old tanks and enters in the Gwalior city at Hanuman Bandh. The total distance from its origin to Hanuman Bandh is 20 kms

and from there it follows from the heart of Gwalior town for 13.65 kms and ultimately it meets into river sank. Tributary of Chambal on up stream of pullowa dam .the length of Swarnarekha river from its origin to confluence point is 70.65 kms .the total catchment area of the

Swarnarekha river is 109.9 kms sq,km. the salient features of the river is given in drains (Table 3).

Material required: GPS (Global position system), Autocad software , Computer etc.

Table 3: Drains of Swarnarekha river waterbody and their GPS locations.

S.no	Name of Drain	Origin point	Area covered	End Point	GPS location
1.	Bajrang gadh drain	Sindhi colony	Tilak Nagar	Swarnarekha river	N26 ⁰ 11.311 E78 ⁰ 08.116
2.	Jinsi Drain	Lakadkhana	Sindhi colony jinsi road no.3	Swarnarekha river	N26 ⁰ 12.330 E78 ⁰ 09.819
3.	Light house Drain	Jai roy hospital	Bazare.mahal gate bridge slaughter house,behind Hanuman takies.	Swarnarekha river	N26 ⁰ 12.335 E78 ⁰ 09.828
4.	Naugoja	Nirdhan	Naugoja road,Shindey chawniarea,bijasen mohalla slum area medical college .	Swarnarekha river	N26 ⁰ 12.327 E78 ⁰ 09.833
5.	Kalasair nala	Bajaria Gospura	Harijan basti Mahavir chowk,fish market ,Subhas nagar.	Swarnarekha river	N26 ⁰ 11.987 E78 ⁰ 08.528
6	Dholi bua pool na			Swarnarekha river	N26 ⁰ 11.987 E78 ⁰ 08.528
7.	Gandhi Nagar Nala	Gandhi Nagar		Swarnarekha river	N26 ⁰ 12.989 E78 ⁰ 10.532
8.	Dhanmeel Nala			Swarnarekha river	N26 ⁰ 11.311 E78 ⁰ 08.117
9.	Hanuman bandh			Swarnarekha river	N26 ⁰ 11.266 E78 ⁰ 08.022

METHOD

The survey has been carried out during April, May and June, 2012. The data were collected every two days in a week from 10:00 am to 5:00 pm. GPS (global position system) is used in the survey of water bodies in Gwalior city and the longitude and latitude values of the water bodies were identified. The map of water bodies was also made with the help of AutoCAD.

Operation of GPS (GARMIN 60): The hand held GPS was taken to the study sites and the device was started. When the device showed 3D location the Latitude and longitude of the location was taken and copied in the register. The same process was repeated for all the locations.

Mapping through Autocad: In first step open the Autocad in computer. In Autocad we can go to the insert option and in insert we can go to Raster image and open the JPEG image in Cad. Trace the image and use the command on Poly lines and offset then trace it. Then separate the parts of image and insert the text to the image and print the image.

RESULT & DISCUSSION

GPS locations were taken and the maps are prepared with the help of Autocad

software. all the water bodies and their roots are represent in the Map Figures

- **Tighra dam-** depictedand in Map1. Tighra Dam (also spelled "Tighara Dam") creates a freshwater reservoir on the Bank River, about 23 km from Gwalior, Madhya Pradesh, India It plays a crucial role in supplying water to the city. It has full facility to provide peoples for amusement purpose such as Boating, Fishing and all types of food items are available.
- **Katora taal-** No water is found there. All water bodies are representing in point view on Map 2. Swarna Rekha River is depictedand in Map 2. This river is much polluted .because Total 88 drains (11 large, 20 medium, and 57 small drains) flowing through the city area join the river.
- **Swarnarekha river** .The discharge of waste water in these drainage of waste water (sewage) in these drain as overflow from septic tanks or leakages from broken sewerage lines and dumping of solid waste in their catchment cause organic pollution due to anthropogenic activities and directly influencing the water quality of river. Small scale industries along the river

add to toxic chemical pollution in it. Solid waste dumping in the open area in the catchment affects the water quality.

- **Morar River** is depicted and in Map 2. The Morar river while flowing through the city areas receives the discharge of waste water (sewage) through no of drains as over flows from septic tanks and leakages from broken sewage lines and dumping of solid waste in their catchments cause organic pollution which directly have adverse impact on the water quality of river. Discharge of hospitals and nursing homes into the river into Toxic pollution.

Inflow of Agriculture runoff into the river carrying Fertilizer and Pesticides residues causes nutrient enrichment and pollution. Solid waste dumping in the open area in the catchment affects the water quality. Nutrient enrichment is causing Growth of Aquatic weeds.

- **Motijheel** is depicted and in Map 3 Motijheel is situated near the railway station and has also also a motijheel treatment plant near the lake .now a days , Motijheel is very polluted due to domestic sources such as washing

,clothing etc and industrial effluents such as harmful chemicals many algal blooms are found in jheel so, excessive algal blooms carry eutrophication process takes place .so the human intervention, water contaminated by pathogens cause disease like chloral Typhoid etc. hence the water becomes unfit for drinking use.

- **Janaktal** is located in a western part of the city. The map of Janak tall is depicted in Map 3. The Tal is a spot of recreational activities of the town and also has religious due to the presence of Hanuman temple and other temples which are situated on a bank of this lake. The major problems of the water bodies are solid waste dumping, washing, bathing activities inflow of household's untreated waste water, cattle wallowing and grazing.
- **Jararua dam** is depicted in Map 4. while flowing through the city areas receives the discharge of waste water (sewage) through no of drains as over flows from septic tanks and leakages from broken sewage lines and dumping of solid waste in their catchments cause organic pollution which directly have adverse impact on the water quality of river. Discharge of hospitals

and nursing homes into the river into Toxic pollution.

- **Suraj Kund** is depicted in Map 5. It is situated in Gwalior fort. The condition of this waterbody is very bad. The major problems of the waterbodies are solid waste dumping, washing; bathing activities inflow of household's untreated waste water, as harmful chemicals many algal blooms are found.
- **Laxman Talab** is depicted in Map 5. there are 100 meters on the fort hill. but here are many facilities provide by municipal corporation Gwalior, Madhya Pradesh vidhyut mandal. The water is not more polluted and it is covered by boundary. The major problems of the water bodies are like solid waste dumping, washing, bathing activities inflow of household's untreated waste water, are not found there.
- **Baijatal Talab** is depicted in Map 5. It is situated near Chetak puri and it has a stage in water. This is very famous stage for functions in Gwalior. No environment problem is found there. Previously it was filled with water but

now the Tal is dry due to unavailability of fresh water.

- **Sagar Talab** is depicted in Map 6 sagartal also has religious importance due to presence of temples which are situated in the bank of the lake this waterbody is under control of municipal authority. Lake is partially covered with aquatic weeds. Lack of proper solid waste management system in the fringe area of the lake reduces water storage capacity of the lake and also adds contaminants.

CONCLUSION

Water pollution is the cause of our undisciplined actions and irresponsibility. We, humans are only creating problems that consequently we will also carry the burden of these problems. We all know that water pollution can affect our health badly and seriously. It can cause such sicknesses and diseases that will badly affect our health.

The water bodies I have surveyed needs immediate attention at the government as well as public level as we say that water is life then these water bodies are the role of the region in maintaining its water table and fulfills vast needs of the people. So these water bodies must be taken in

firsthand by clearing their premises make it strict vigil on their cleanliness plantation in their banks more people aware their importance as this is very much important

factor until the local people did not cooperate it is very difficult to manage this.

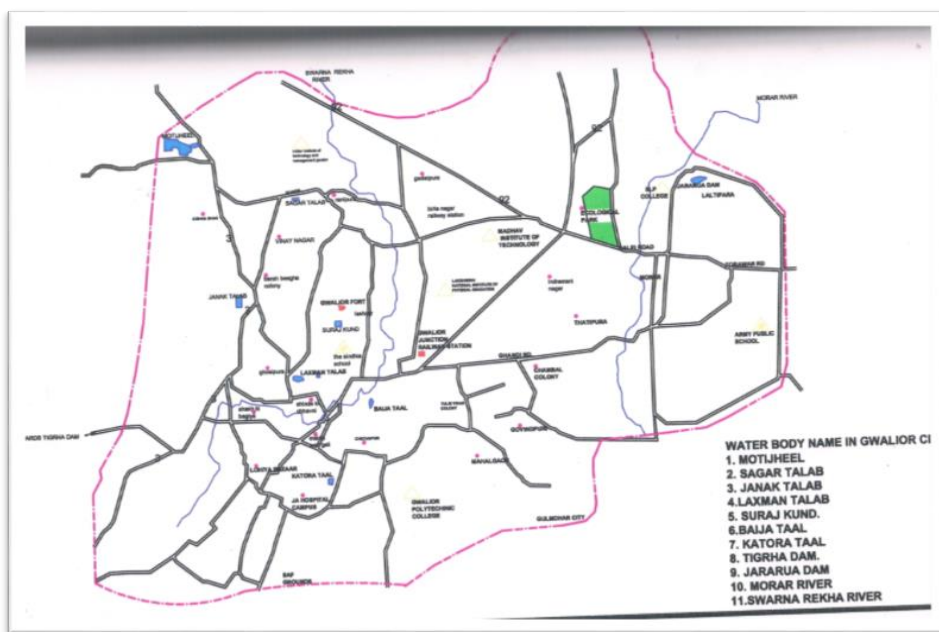


Fig 10: Autocad Map of Waterbodies of Gwalior city.

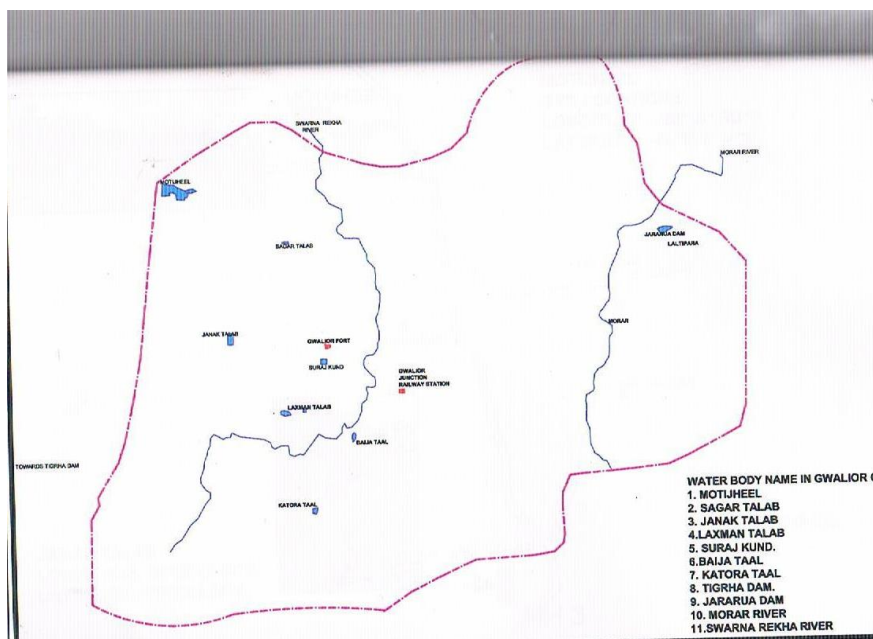


Fig 11: Autocad Point Map of Water Bodies of Gwalior City.

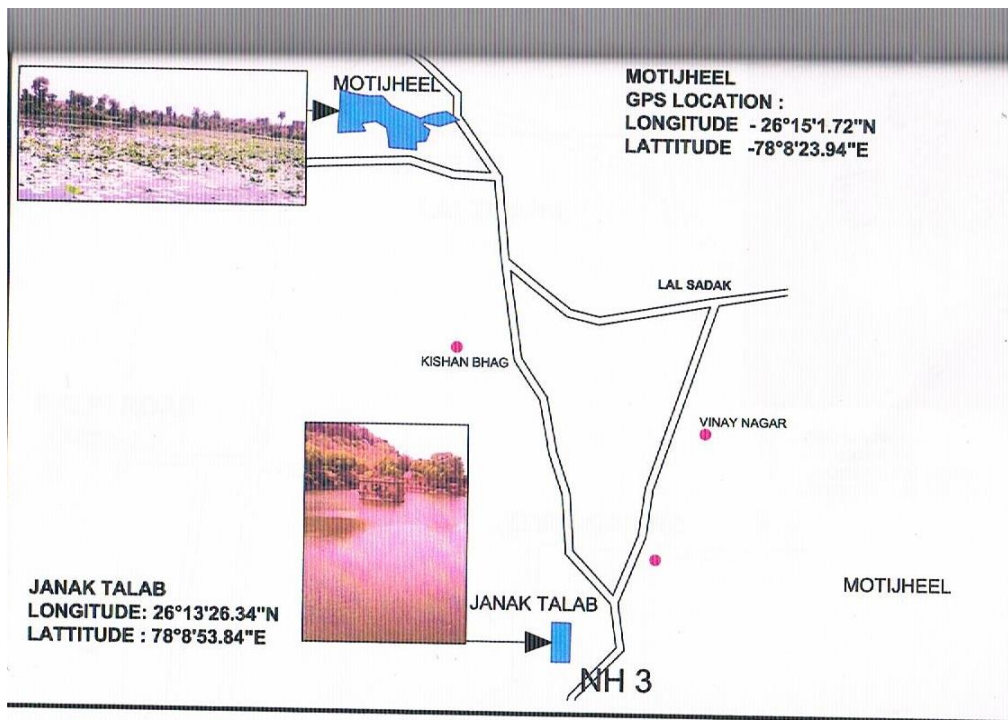


Fig 12: Map shows the Gps location and picture of Motijheel and Janak Talab

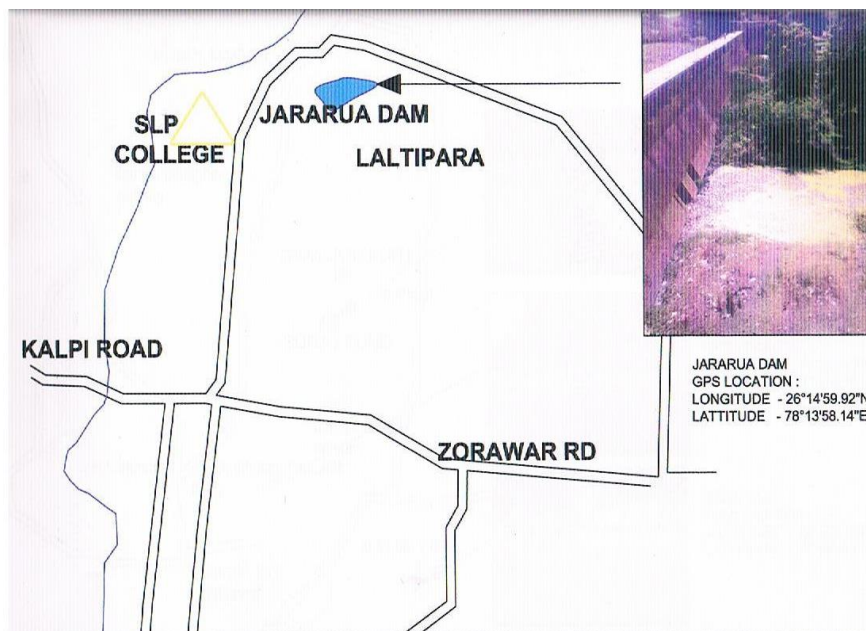


Fig 13: Map shows the Gps location and picture of Jararua Dam.



Fig 14: Map shows the Gps location and picture of Surajkund, Laxman Talab and Baijatal.

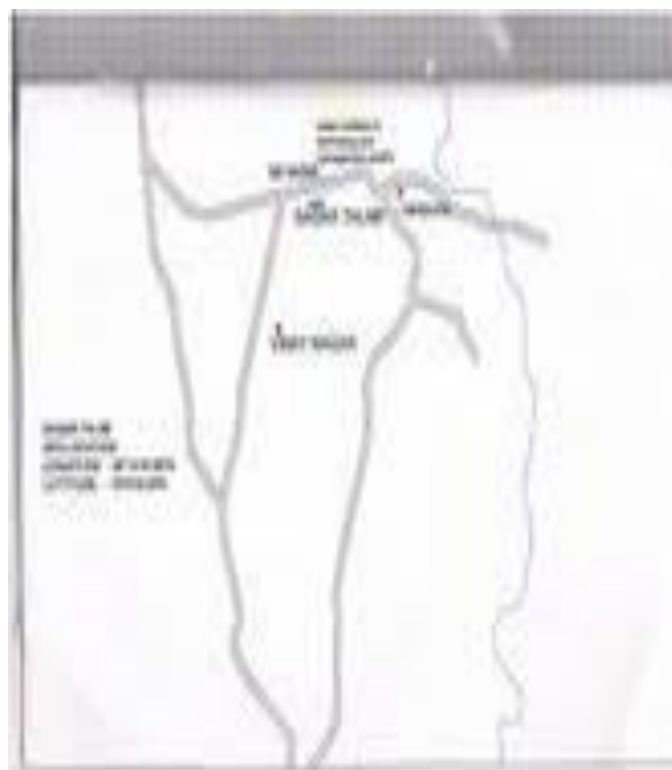


Fig 15: Map shows the Gps location of Sagartaal.

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