Quest Journals
Journal of Education, Arts, Law and Multidisplinary
Volume 1 ~ Issue 1 (2011) pp: 01-12
ISSN(Online):2347-2895
www.questjournals.org

Research Paper

Availability of Potable Water (A Case Study of Chittorgarh City)

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Abstract:
Despite good rains and several ongoing projects to protect the city's beauty infinite, Chittorgarh, Rajasthan, with a population of about 50.000 in the Mewar region, suffers from a general scarcity of water and a lack of potable water in particular. However, the availability of portable water (water that can be taken from one site to another, such as river water) does not solve the problem of potable water (water that can be stored and utilised for drinking purposes), because potable water must meet particular standards with permitted limits. Because of the good rains, the portable water supply in Chittorgarh is adequate, but the problem is a lack of drinkable water in comparison to the population.
This is raising alarm among planners. Based on primary and secondary data, this article illustrates the disparity between the demand and availability of potable water in Chittorgarh city in connection to increasing population, urbanisation, and industrialization. Data is displayed by graphs and maps made with Arc GIS 09, Coral, T.N.T. Lite, and Adobe Arcade.

Key Words
mld - Million Litres Per Day
lpcd - Litres Per Capital Per Day
llpd - Lakh Litre Per Day
bcum - Billion Cubic Metre
mbgl - Metres Below Ground Level

I. INTRODUCTION

Water covers three-quarters of the earth's surface. Only 2% of accessible water is fresh water. There is 68.7% of it in the form of glaciers and snow, 30.1% in the form of subsurface water, and 0.9% in the form of surface water.

Many nations, including India, have been dealing with a "water crisis" in recent years. Rain and snow are the two main sources of fresh water in India. In India, the average annual rainfall is 4,000 billion cubic metres, which is distributed erratically both geographically and temporally. During the monsoon season, from June through September, the majority of the rain falls. There has been a "water crisis" in recent years, with precipitation varying from 100 millimetres per year in Western Rajasthan to more than 9,000 millimetres per year in North Eastern Meghalaya.

Rajasthan has a particular geographical position, topographic structure, constant high temperatures, low humidity, drier desertic conditions, environmental, ecological structure, and water-related difficulties. Rajasthan, unfortunately, lacks a single permanent river. Water is a scarce resource, but it is essential. Rajasthan is India's biggest state in terms of land area and tenth in terms of population. Rajasthan, on the other hand, has less than 1% of India's available water.

WATER:

Nearly 97.25% of all water is in oceans, and around 2.05% is covered by ice, leaving just 0.70% available for direct usage, with 0.60% as ground water and 0.10% as vapour in the atmosphere above the available water. The intensive use of accessible water resources, as well as ground water, has resulted in a reduction in water availability. During a period of crisis, many sections of the world experienced water scarcity.

Even highly industrialised nations of temperate latitudes, which may be classified as "water surplus zones," suffer from scarcity due to greater levels of drinking water consumption and the extremely high rate of its usage in three primary industrial purposes: cooling, processing, and steam production. The majority of third-world nations, mostly in the Tropics and Subtropics, suffer from water shortage due to natural forces, while their ever-growing human population and its affects have just lately added to this problem.

As a consequence of the activities of over fertilization, excessive application of berbicides and pesticides, under the intense pressure of green revolution, changing ideas of hygienic living, increasing rate of industrialization and urbanization, changing cropping pattern from food grains to commercial items for economic gains, greater water demand has accounted not only to the ever increasing scarcity of water for drinking and problems of salinity, alkalinity and drainage in canal irrigated areas but the more serious concern is the steepened rate of underground water table of which Chittorgarh is no exception.

In India the major source of water is rain and snow. India receives an average annual rainfall equivalent of about 4.000 billion cubic metres (bcm). This sence of water is unevenly distributed both spatially as well as temporally. Most of the raintail if con of the rainfall if confined to the monsoon season from June to September and levels of precipitation vary from 100 mm a year in Western Rajasthan to over 9,000 mm a year in North Eastern Meghalaya.

With 3,000 bcm of rainfall concentrated over the four monsoon months and the other one thousand bcm spread over the remaining eight months. India's rivers carry 90% of water during June to November and only 10% of the river flow is available during the other 6 months. It is estimated that around 700 billion cubic metre of water soaks into the ground, 1150 billion cubic metre flows as surface run off

Spatially, the utilizable resource availability in the country varies from 18.417 cubic metres in the Brahmaputra valley to as low as 180 cubic metres in the Sabarmati basin, Rajasthan, with 8.5% of the country's population has only 1% of the country's water resources.

The fresh water demand for agriculture. Industry and fast growing urban centes is expected to double by 2025 .In the rural areas, where the majority of India's population lives ground water resources account for 80% of domestic water supply 50% of the urban & industrial water demand is met by ground water and 50% of all irrigated area is fed by this source. Moreover, in drought ground water is the prime one of water for irrigation Rain water by itself has been found to be inadequate to meet the domestic needs. Even areas with heavy rainfall Cherrapunji, for example face water scarcity. Owing to deforestation, soil erosion -, the rain water does not percolate in the ground to feed the spring

India will be a "Water stressed nation by 2017. This signifies that it will face acute water shortages for prolonged periods. There is also the risk of water pollution in cities as they generate approximately 2,000 crore litres of sewage per day and treat only 10% of it, the rest flows out to merge with ground water or even surface water which results in drastic increase in water borne diseases and deaths. The Central Ground Water Authority says that in various districts of the differ states of India the water level has fallen more than 4 m since 1982. The situation is serious regarding the quality and quantity of fresh water in states

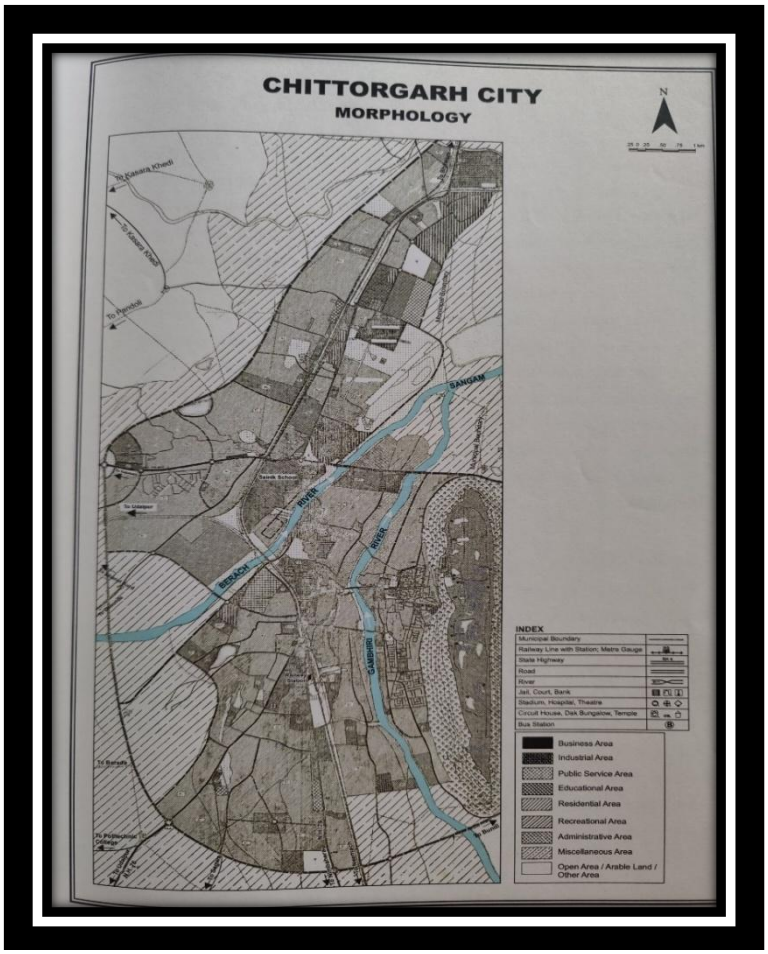
IMPORTANCE OF THE PROPOSED PROBLEM

The surface water available in the Chittorgarh region whole and sole depends on the amount of rainfall humidity conditions and temperature. In the Chittorgarh region the trend of rainfall has been decreasing since 1990 when it was 111.60 cm and in 2001 it was 77.23 cm.The Urban town is facing severe potable water problems. Our impressive gains in technological capabilities to find transport and conserve fresh water may not be able to meet ever increasing demand of it.

The water available for agriculture and non-agricultural purposes is not only surface water but even the underground water is exploited to such a great extent that the water table is going deep down, having an adverse impact directly on the quality and quantity of water and indirectly on human health. The availability of water and specially drinking water is becoming a major issue of discussion in the region because neither the qualitative nor the quantitative distribution of it is sufficient enough along with the time of supplying it.

The present paper deals with the problem of conservation and management of the available water in the Chittorgarh region of Chittaurgarhdistrict . In the present context keeping its historical background in view and giving planning strategies of the problem to make study helpful to the planners, the departments of water management and above all the people of Chittorgarh who at present are facing a severe potable water problem for which they have to wait for very long time and then also they have to compromise with quality of the water available to them. Keeping in view concept of sustainable development, which is defined as a strategy that

meets the needs of the present without compromising the ability of future generation to achieve their own requirement.



OBJECTIVES

- To study the Hydrology and the Hydrograph and the status of potable water in the Chittorgarh
- To study quality of the water and its distribution pattern in city of Chittorgarh.
- To say the conservation and management of potable water in the city of Chittorgarh.

HYPOTHESIS

With the increase in population the demand of potable water increases but water being a natural resource is limited. Hence future seems to be bleak.

AVAILABILITY OF WATER :

Of the 13 tehsils in Chittorgarh,Chittorgarh district had 20.60% of urban population with 192 persons per sq kms, followed by 83.96% of rural population in 2395 villages and 16.04% of urban population with a density of 166 persons per sq km The district of Mewar observed the decennial growth rate from 1991 to 2001 to be 21.5%.

In relation to the urban and rural density of population, Chittorgarh had 141 persons per sq km at rural and 2155 density of persons at urban level. Chittorgarh city population touched 96,219with a growth rate of +34.44 in 2001 in comparison to the population of 1991 which was 71,569

The population of Chittorgarh has been declining from 9254 in 1891 to 7573 in 1901 and 7332 in 1911 but exceeding the 1891 figure in 1941 being 9300 and then reaching the figure of 44,990 in 1981. thus attaining a high growth rate of 73.59% between 1971 and 1981 and 34.44 growth rate from 1991 to 2001.There is assured power supply, nuclear and hydroelectric, the Rana Pratap Sagar power house being located at Rawatbhata at a distance of about 160 km. Water is also more abundantly available. Of its working population, some 89% are engaged in non agricultural activities, indicating there by a higher degree of urban development.

Taking Chittorgarh city rainfall from 1950 to 2007 its average annual rainfall came out to be 789.89 km, nearly 29 years experienced rainfall below average The average number of rainy days calculated was 35 from which 32 years experienced rainy days less than the average. Chittorgarh city had maximum rainfall in 1973 when it was 1330.2 mm and minimum rainfall of 286.7 mm in 1951. In last decade Chittorgarh received maximum of 1072.2 mm of rainfall in 2006 and minimum of 470.7 mm rainfall in 2002 with 23 minimum number of rainy days

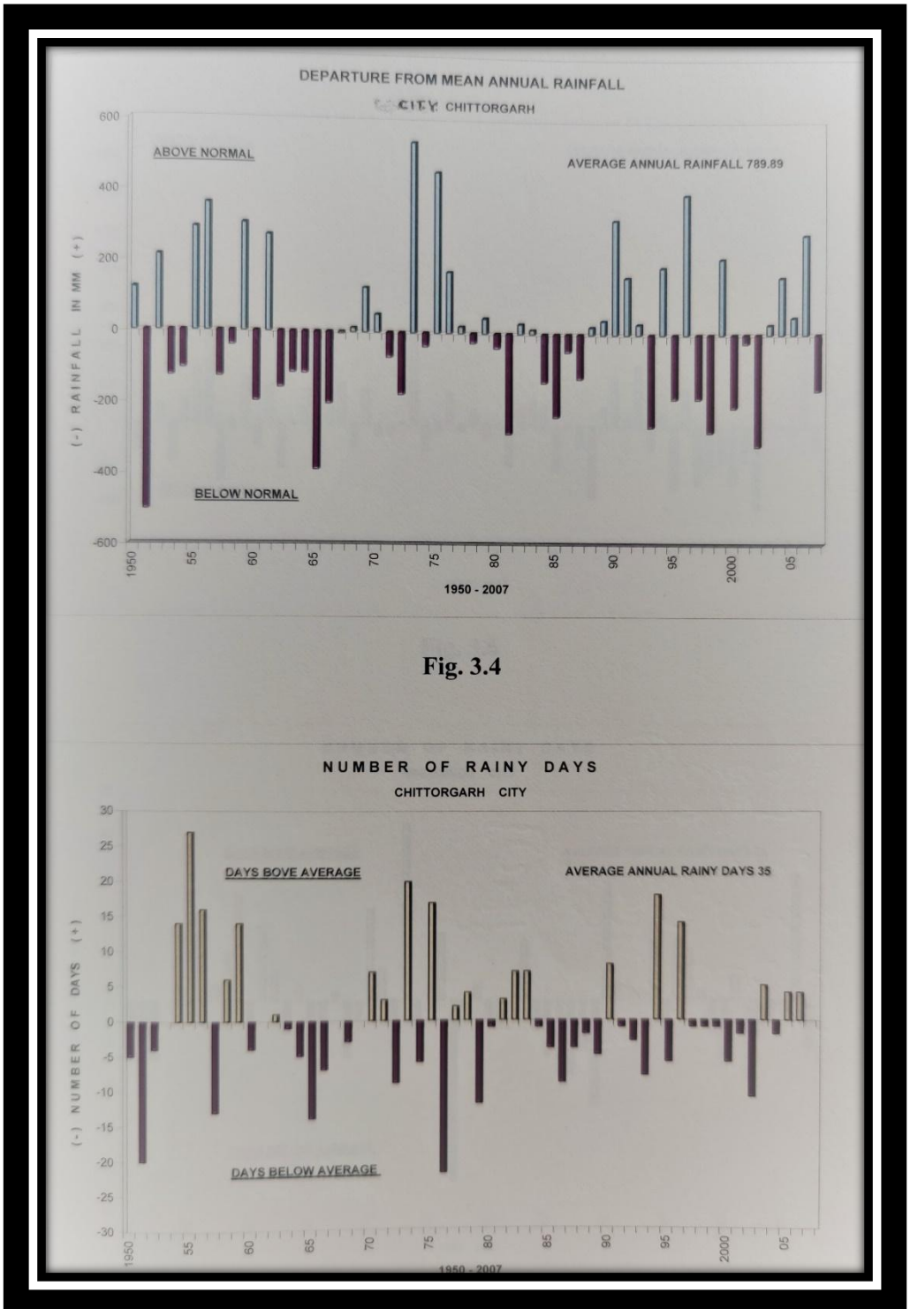


Fig. 3.4

WATER RESERVOIRS

Water remained reserved in nature in various forms called water reservoirs. Rivers, lakes, tanks, anicuts, open wells, tube wells, baovries etc. are various types of water reservoirs of the region. They can be broadly classified into surface sources and underground sources.

The presence of fresh water in any area depends upon the amount of transpiration, evaporation, run off in the streams, and porosity of the soil. Precipitation that occurs in these urban areas of Mewar region flows of in the form of rivers. Most of the water is either lost in evaporation or by seepage in the soil. Due to wide fluctuation in precipitation, the pronounced low water periods tends to promote water storage and irrigation through reservoir construction. The major sources of surface water in Chittorgarh are lakes, talabs, kunds, rivers and dams .

Rivers of the district are Banas, Berach, Bamini, Bagali, Bagan, Orrai, Gambhiri, Seebana, and Jakham& Mahi

Taking study area Gambhiri rivers is the main sources of surface water for Chittorgarh city. Berach River passes through West to Northern part of Chittorgarh city and Gambhiri River flowing from South to North. It flows from the Western part of old town, irrigation colony, Gora Badal stadium.

Berach the main tributary of river Banas originates from the Girwa ranges of Aravali situated to the North of Udaipur city. It is called river Ahar from its fountainhead through Bedla up to Udaisagar lake, in which it falls.It is the principal river of Udaipur Basin.BeyondUdaisagaruptoDabok village the river passes through a distance of about 75.5 km and is named as Udaisagar ka nala. Afterwards known as Berach it runs for another 70 km towards North-East and finally merges into river Banas, near Bigod in the Bhilwara district, which is a tributary of Chambal river, Chambal again is a tributary of river Yamuna and Yamuna is the principal tributary of the holy river Ganga. Near the town of Chittorgarh it receives the water of Gambhiri River, then it turns North-East and after flowing for about 190 km it joins river Banas at the place acclaimed as Triveni Sangam near the village Bigod.

Gambhiri is a tributary of Berach River and mainly flows in Chittorgarh district. The water drainage area of Gambhiri valley is 4,865 km from which 263 million m of water is received. Chittorgarh town is also well drained by the river as it flows from South to North of it.

STORAGE CAPACITY OF VARIOUS DAMS OF CHITTORGARH DISTRICT

S.NO	NAME OF THE DAM	TOTAL STORAGE CAPACITY	
		GAUGE/RL FEET	Mcft
1	GAMBHIRI DAM	23.0	2300
2	BASSI DAM	36.00	715
3	VAGON DAM	16.40	1327
4	ORAI DAM	31.00	1158
5	BADGAON	25.00	1056
6	BHOPAL SAGAR	18.00	650
7	BANAKIA	13.00	327
8	DORAI	27.93	292
9	MURLIA	9.50	299
10	SOMIYANA	12.00	200

BHOPALSAGAR (Chittorgarh)

Bhopalsagar is in Chittorgarh. It has full tank gauge 18.00 ft, live storage capacity 650.00 meft, dead storage capacity 5.00 mcft, 13 mcft water was reserved for the PHED during 1998-99. Its capacity forms 60 to 650 mcft depending upon the yearly rainfall.

BHERDA MINES (Chittorgarh)

Bherda Mines Are of Birla cement works in Chittorgarh is an example which has benefitted towards the regular water supply of factory as well as partly to the people of Chittorgarh town in critical time since last decade.

Baovries

The hundereds of traditional baovries and kunds in Chittorgarh city. A couple of five baovries in Chittorgarh city are Kukreshwar Kund, Ratneshwar Tal, Mataji Ka Kund, Bhital Kund, FattaSarowar, Suraj Kund.

TABLE :SURFACE SOURCES OF WATER CONSERVATION IN CHITTORGARH DISTRICT

SOURCES	ANICUT	TANKS	NADI	TALAB	OTHERS	REJUVENATION OF TRADITIONAL METHODS OF RESERVOIRS
NUMBER	88	41	169	72	65	55

SOURCE:RAJASTHAN SUJAS 2008

Underground Water

The underground water development work started in 1950 with the establishment of "Underground Water Board". In 1971 it was renamed as "Ground Water Department". A systematic and scientific based study started in 1965. It was from 1984 that a continuous watch was kept on the water level of the wells. It's head office is in Jodhpur. Its subdivisional offices are at Jaipur. Jodhpur, Udaipur and Bikaner.

Data is collected after monitoring the water level at pre monsoon and post monsoon which helps in comparative analysis and annual recharge is found. On the basis of under ground water level all the blocks, districts are divided into 3 zones-safe, semi critical and critical.

Safe zones are those areas where water exploitation is less than 70% than water recharge. The Semi critical zones have 70% to 90% and 90% to 100% are critical zones. 100% exploited zones are called over exploited. In East of Rajasthan deth of water is in between 10 m to 25 m, Western Rajasthan has water level in between 20 m to 80 m. The fluctuation is in between 2 m to 5 m. Eastern Rajasthan has fluctuation in hard rocks, it is in between 1 m to 10 m.

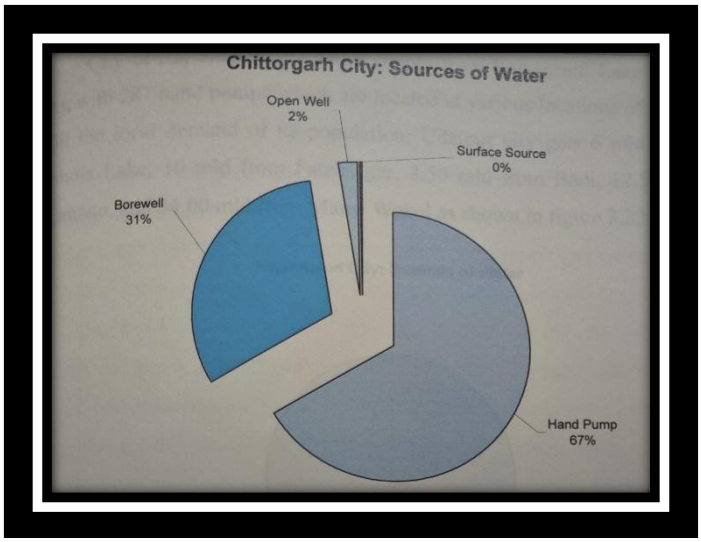
Chittorgarh district area is 10856 sq km. Potential zone area is 8278, potable water area 8195 comes under semi critical zone.

It is obvious that the yield of water from aquifers is dependent upon the nature of the underground rocks. It has been noticed that slope conditions directly affect the level of water in the. The fluctuations in the levels of ground water are varied and are grossly decipherable. The level of water rises in the period of heavy rainfall while conversely in the years of drought it sinks low. The various sources of ground water are dug wells, tube-wells, step wells and hand pumps. Most of wells have been dug mainly in the areas of phyllite and schist rock formations, tube-wells in gneisses area and hand pumps in both of these rock formation areas, distributed throughout the region. Out of the total area 75% dependence is on the surface water available as 592 million cubic metre from the big, small lakes and dams near about 1684 in number having a total storage capacity of 842 million cubic metre. The ground water of the region can be divided into 35 potential areas. The groundwater development rate is more than 90% therefore it is kept in sensitive and extremely exploited rank. The groundwater development rate of the region has been assumed as 116% which comes under extremely exploited rank. The annual availability of total groundwater in the region is 390 million cubic metre.

Groundwater is water which occurs beneath the earth's surface. Open wells, baovriestubewells, panghatpariyojana and handpumps are the main underground sources of water in the area. Before the commencement of piped supply, in Chittorgarh during the medieval period, the fort and the walled town had world of its own with water supply system from the traditional sources of water namely kunds, baovries, wells, tals etc.

Dealing with the geological structure of the Chittorgarh district including the city of Chittorgarh and Chittorgarh has a prominent mining industry .The ground water is over exploited in the district at 2095 mcft. People are actually mining ground water resource which is disastrous to the health and efficiency of the aquifers and ground water structures and sustainability. The ground water levels in the district of open wells vary from 5 m to 20 m in May 1989 and 10 m to 25 m or dry in May 2003. The conjunctive use of surface and ground water is called for safe yields and utilization of water resources. In the year 2004 due to rainfall infiltration and recharge through streams, river anicuts and tanks in monsoon there has been exceptional rise in ground water levels in wells and boreholes, at places in the vicinity of anicuts.

(Wells are the principal source of irrigation. They irrigate 1916.90 sq km of the total irrigated area of Chittorgarh district including Chittorgarh and Chittorgarh Chittorgarh city is a zone of limestone formation. The pre monsoon conditions of underground water in the year 2001, 2005 and 2007 were dry, 14.50 mbgl and 6.10 mbgl respectively whereas post monsoon depth to water was 5.42 mbgl, 6.25 mbgl and 6.15 mbgl in the year 2001, 2005 and 2007 respectively as shown in figure 3.18. This throws light on the fact that underground water consumption is increasing and the recharging of underground water is not sufficient.) Asunderground water plays an important role in meeting the demand Chittorgarh has 123 handpumps, 103 borewells and 7 open wells.



The seasonality of rainfall has increased the dependence on ground water resources. In the absence of wide network of surface storage system, ground Water is the only source of supply of water especially during summers. Though long-term use of water is not favourable but due to exigency the dependency on ground water has increased since independence and has seriously increased since last decade.

Thus, it becomes very clear that in Chittorgarh the underground water contributes as a major source of supply of potable water.

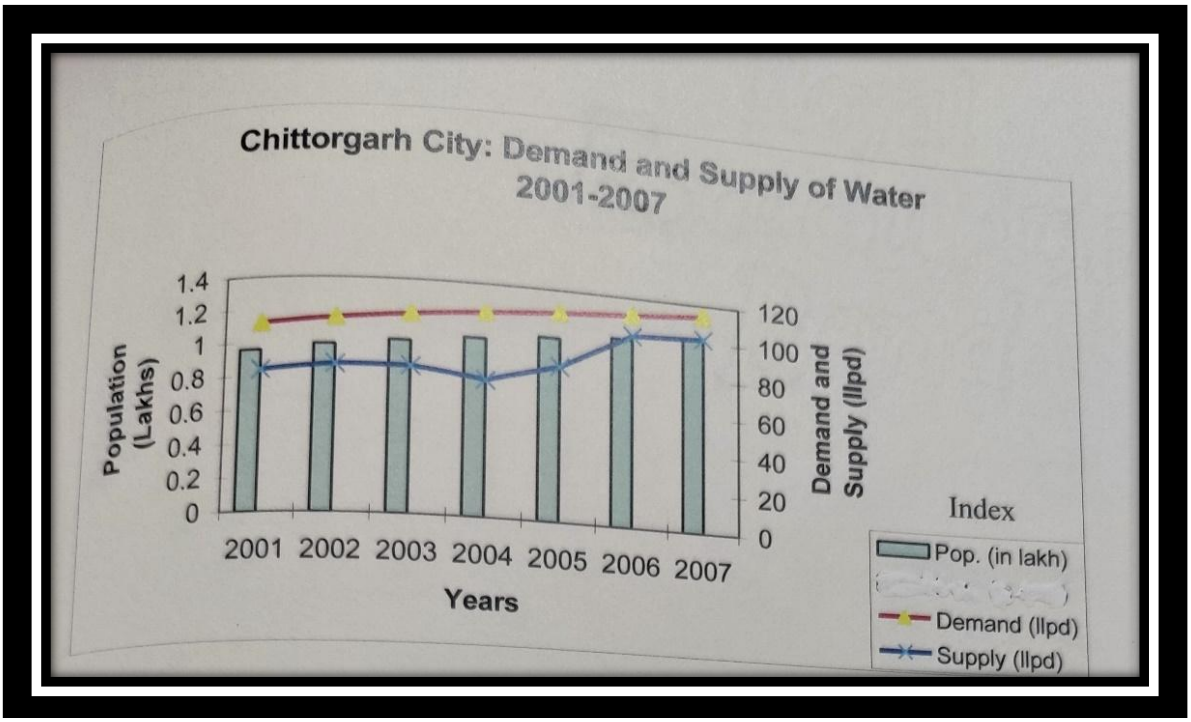
Chloride in drinking water is relatively harmless. In waste water the chloride content is higher than natural water. High chloride content in water bodies harms agricultural crops and metallic pipes. It is soluble in water. The important source of chloride in water is the discharge from sewage. Some industries are also sources of chlorides in water. Animal excreta have high quantity of chlorides along with nitrogenous waste. Chlorides contents above 250

The hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca2 and Mg. If hardness is caused by carbonates and bicarbonates than this is called temporary hardness, temporary hardness can be removed by boiling the water. Sulphates and chlorides of calcium and magnesium are called permanent hardness. It cannot be removed by boiling the waters. Hardness is the property of water which prevents lather formation with soap and increase the boiling point of water, therefore hard water is not suitable for domestic use as washing and bathing. The main sources of magnesium in natural water are rocks. Sewage and industrial waste are the other sources of magnesium. (Bherda mines of Chittorgarh had hardness in water upto 210. It is 40 mg/l at Meja dam and 120 mg/l at KankroliGhati. Total hardness at Meja dam is 110 mg/l and total hardness at KankroliGhati is 260 mg/l.Total dissolve solid at Meja dam is 290 mg/l and at KankroliGhati it is 170 mg/l. It is 280 mg/l at Berada Mines of Chittorgarh.

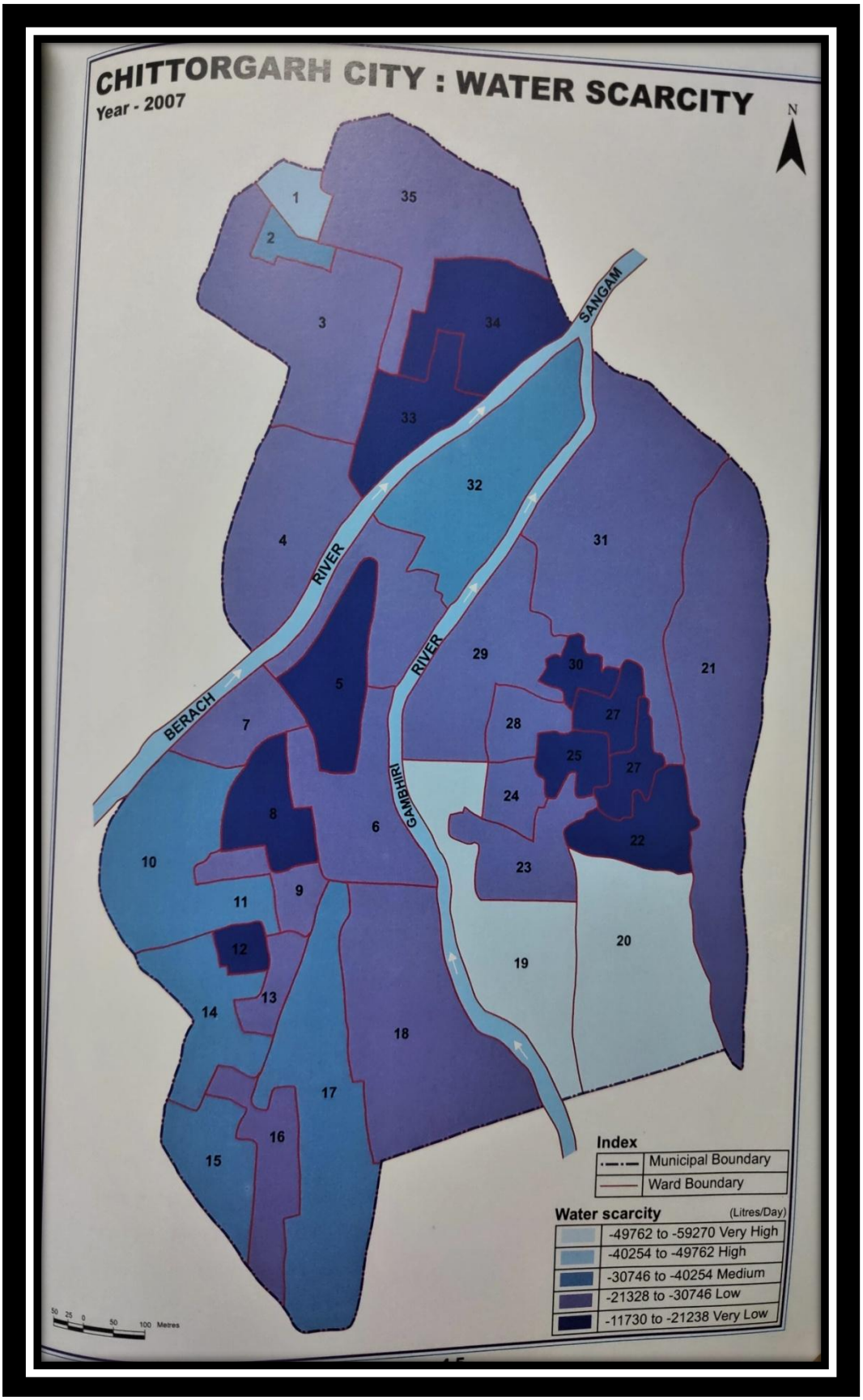
Chittorgarh district in all had 4032 potable sources out of which 55.90 percent were potable sources. Chittorgarh 338 sources had fluoride and minimum level of total dissolved salts are in Chittorgarh. Water sources having multiple water problem were 289 in Chittorgarh district.

Taking cities under study TDS is more in 'sector-1 zone of Chittorgarh. It is 280 mg in Bherda mines.

The Chittorgarh city of Mewar with population above 50,000 are facing numerous problems related to water, since last few years. Chittorgarh famous for quarrying and mining faced water crisis during last few years. The figure below throws light on the demand and supply of water in Chittorgarh city from 2001-2007.The demand in continuously increasing .so is the supply of water. The gap between the demand and supply is reducing from 2001-2007.



Ward 5, 6, 11, 12, 13, 24, 26, 36, 39, 40, 41, 42, 43, 44, 45 have demand more than 10 llpd and the supply of the six wards, ward no. 6, 13, 23, 36, 39, 42 is a little more than 5 lakh litres per day. Therefore showing scarcity of nearly 50% in most of the wards but more than 50% in most of the wards but more than 50% in the wards discussed above. Whereas in 2007 very high scarcity was found in ward no. 12, 23, 39 and 42 .



Above figure shows per day ward wise demand and supply in Chittorgarh city and from the figure it becomes clear that ward no. 19 has demand more than 10 lakh litres per day, along with ward no. 11 having demand more

than 8 lakh litres per day. These two wards have supply of about fifty percent. Ward no. 10, 14, 15, 17, 32 have demand of more the 6 lakh litres per day rest all other wards have demand less the 6 lakh litres per day. The overall scarcity is 24.6 per person per day. Whereas in 2007 ward nso. 19, 20 had very high scarcity and ward no. 1 had high scarcity as shown in figure.

Figure shows that ward no. 4, 6, 7, 8, 10, 22 have demand more the 2 lakh litres per day, ward no. 7 had more than 5 lakh litres per day and ward no. 8 had demand of more than 4 lakh litres per day. Rest all, other wards had demand of less than 2 lakh litres per day and the supply was more than 2 lakh litres per day in ward no. 7 and in between 1 and 2 lakh litres in wards discussed above wards 27 and 29. The per person scarcity came out to be more the 30 litres per person per day and in 2007. Ward no. 1 had very high scarcity and ward no. 7 had high scarcity. The scarcity remain continuously high in these two wards as shown in figure.

From the above study we may conclude that the potable water which is the prime need of the people has been a major problem. It has been observed that, as it is a general principal, that availability of water is not uniformly available and distributed in all the five cities. Though geographically the Region almost falling under the similar physical conditions and the population also increasing with the similar trend but the rapid expansion of Urbanised areas has in general aggrevated the problem and hence the demand and supply of water is badly affected by this fact. This fact has resulted a different graph of man water ratio which also depends on the demand and supply of water in the entire region. Thus the present trend of demand and supply and man water ratio showing the general water in all the units.

The figure shows clearly that surface sources of water conservation by 169 nada in Chittorgarh

Low and erratic rainfall force the mankind to make the maximum use of water available either on the surface or below it. Now a days in urban areas most of the potable water demand is met by ground water sources in the form of borings, hand pumps, open wells, tubewells etc.

TABLE :UNDERGROUND SOURCES OF WATER CONSERVATION IN CHITTORGARH DISTRICT

SOURCES	HANDPUMPS	TUBEWELLS/BOREWELLS	OPENWELLS
NUMBER	123	103BW	7

SOURCE:RAJASTHAN SUJAS 2008

Table above shows the number of handpumps, tubewells, wells in the five urban areas of research which contribute in fulfilling the demand of potable water in the urban areas of Chittorgarh.

Quality of Water:

When the quality of 4032 sources of potable water tested ,2254 sources water was found potable.289 depicted multiple problems in the available water which is clear from the table given below .overall 55.90% sources water was found potable in Chittogarh city.

Table : Water Sources Tested

Sources tested	Potable	Number of sources						Potable %
		Only f	Only TDS	Only no.3	Only iron	Multiple Problem	Total	
4032	2254	338	65	1086	0	289	1178	55.90

Source :Conservation and Management Of Water ,BCW Report,Chittorgarh

Chittorgarh city needs 96 Lakh litres drinking water daily. To meet this demand the wells are being dug in the river BagliaDeh in Gabhri River basin more than 110 tube wells in the urban areas. During summers some amount of water is being taken from the Gosunda dam besides it the demand of water is also met by Bherda Mines of Birla Cement. But during summers all these supply of water as per the need is done through tankers from nearby villages.

Taking Chittorgarh water supply structured and service levels of the town in 2001. The supply of water to the town was I day. Water supply considerably decreases with the beginning of summer season in all the cities under study. It is at interval of 1 to 3 days. The drinking water sources include surface as well underground water sources. Chittorgarh had 1 surface sources, 103 bore well, 7 open well and 220 working hand pumps in 2004

Table : Chittorgarh per person Demand and Supply

Year	2001	2002	203	2004	2005	2006	2007
Population	.96028	.99500	1.03000	1.06700	1.10400	1.14200	1.18000
Per Person Demand(lpcd)	100	99.5	99.0	98.13	98.18	97.4	95
Per Person Supply (lpcd)	75.4	75.37	72.81	65.42	72.73	87.6	85

Source: Computed from available Census Data.

Table above shows the growth of demand in proportion to the growth of population but the supply had been somewhat similar in 2001 02, 03, 05 but year 2006 and 2007 experienced full supply as per the demand.Whereas the actual demand was 96.62 Lakh litres per day, in the year2004 the requirement of water for the domestic use by the people of Chittorgarh was 103 lpcd for a population of requirement of potable water for the domestic.In Chittorgarh city water supply is at alternate day except for ward no. 14 of Nagar Palika Colony which receives continuous supply of water throughout the day. Ward no. 18, 19 gets water during everning where as other 33 wards get water supply during morning which is clear from fig.
The water supply is for hour in summers for 1%½ hour during winter no. 28 Kalika Transport, ward no 8 Pawadhar Colony, ward no. 24 Sitapane

The pipeline width for supply of water in the cities vary from 80 mm to 400 mm which is used for supply of water in the city of Bhilwara. The pipeline of Chittorgarh city is 40 mm to 250 mm of cast iron and asbestos cement.)

II. CONCLUSION

The city of Nimbahera has been facing potable water scarcity due to the following reasons:

- Unplanned residential growth in cities;
- Unplanned residential growth in cities;
- Surface and subsurface water sources are accessible.
- Rapid population growth.
- Rising water demand.
- More demand, decreased supply.
- A lack of departmental cooperation (e.g., Cigation, PHED, Nape Palika, UIT, RUIDP, and so on.)
- Lack of a water supply management system; • Overexploitation of subterranean water.

III. SUGGESTIONS

Due to the erratic nature of the rainfall, it is suggested that the wastage of water should be checked through rain water harvesting techniques which will check

- There should be a standard procedure for boring wells.
- • Rooftop and rainwater harvesting should be strictly required for new building.
- • People's daily habits, such as bathing, require a modification.

- • Such water-saving strategies in everyday activities should be used, and water from other surface sources should not be fully exploited (talab, baovries etc.)

- • Pollutants such as litter, solid waste, hotel effluent, and uncontrolled boating should be avoided in the water bodies.
- • A contaminated (dirty) water treatment facility should be developed.
- • A decrease in ground water levels.
- • Old pipelines should be replaced, and leaks in pipes should be repaired as soon as possible to avoid water waste.
- • Water bodies should be conserved in order to ensure an appropriate supply of water. • Lake water should be used sparingly.

If the various measures suggested in this work are practised generously, the doomsday forecasters for mankind will be proven incorrect, and man will continue to enjoy the use of good quality potable water for a long time to

come, and the doomsday fears will have to eat their words as they will be proven incorrect. The final remarks made are not the end in themselves, but rather guidelines for future development.

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