

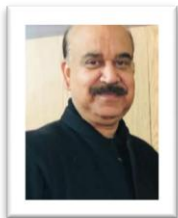
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Livability Concerns due to Ground Water Quality in the Amanishah Nala Environ of Jaipur City

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Abstract

The concept of livability has been evolved to gather the information of the quality of life of the dwelling area and to provide the dwellers the best living practices. Therefore, the ultimate goal of the study of the livability of the living environment and its subsequent application is to improve the quality of people's life to enjoy a meaningful life. The research paper attempts to assess the livability due to the groundwater quality around the Amanishah Nala that used to be known as River Dravyavati in ancient time. The river used to quench the thirst and was the lifeline of Jaipur city. The main objective of the study is to reveal the status of quality, causes of depletion and degradation of the aquifer and its socio-economic and ecological implications in terms of the livability of the environment. The city of Jaipur is situated at the confluence zone of the river with Dhund river. The research has been vividly carried out taking the help of field schedule in the form of household survey adjacent to the Amanishah area. The secondary data input has been taken from Central Pollution Control Board (CPCB), Central Ground Water Board (CGWB), Jaipur Development Authority (JDA), Jaipur Municipal Corporation (JMC) etc. The groundwater quality was observed and compared with the standards of BIS and ICMR.

Keywords: Groundwater, Aquifer, Nala, Dravyavati River, BIS, JDA.

Introduction

Indian cities are rapidly transforming and there is a new politically driven agenda for urban renewal in India. The government bodies and ministry of urban development of the state of Rajasthan have identified several water bodies in the state for rejuvenation and redevelopment projects which focuses on transforming these urban water bodies and cities in terms of planning, solid waste management, water management, sustainable energy provisions, governance and housing. Urban Planning, urban governance in the cities are focus of transformations and will be used to develop these cities into urban centers with improved public amenities, transport systems etc. Portable water has remained a prime objective in the achievement of urban sustainability. 'The comprehensive water distribution is the need of hour WHO 2017.' For Dravyavati river rejuvenation project, Amanishah Nalla which flows through the city of Jaipur and contributes to the ecology of the city vastly, was identified along with other water bodies in the state of Rajasthan by former CM Ms. Vasundhara Raje and is based on the theme of Sabarmati river front development project in Ahmedabad. The project has been tendered to TATA projects which have carried out several waterfront projects across India. This paper aims to research and study the livability scenario in the Amanishah area in Jaipur taking into account the physico-chemical nature of water primarily. 'As the heavy concentration of metals were explored in the concerned environment Sabal, D., and Khan, T. I. 2008'.

The groundwater being an invisible resource and it is widely distributed in a range of water-producing geological structures (aquifers) and since it is much less dependent on recent precipitation than surface sources, it can provide a uniquely reliable source of high-quality water for human uses. As per the United Nations 'the drinking water along with the amenity of sanitation falls under the purview of human rights (Zaheerul. 2010).

Former Amanishah Nala is known as 'Dravyavati River'. AmanishahNala is about 45 km long Starting from Vishvakarma industrial

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area. Now it has been transformed into main sewer line of Jaipur which is getting polluted due direct disposal of water from household and industries. Dye industries directly disposed waste matter directly into the Amamnishah Nala, major culprit is the Sanganer town. Also in such areas around Amanishah Nala for agricultural purposes its water is used which is injurious to human health and cancerous. The urban development has occurred incessantly. Besides the river has been an all season source of water at disposal to the city of Jaipur. Due to irregular seasonal rainfall, it was realized that growing demand of water supply could not be fulfilled by the river. Later on, due to industrialization, with all the industries started to locate near the river; it became the medium to carry waste outside the city (Kathleen et al., 2009). In addition to this 'the encroachment in the fringe areas of Nalla led to the disposal of domestic wastes in the river. CGWB 2012'. Though the interaction of people near to the area of water body is a common thing to observe but the due care is the sole responsibility of state authority. 'As it is a natural phenomenon that water-fronts are characterized as a place, integrating land with water and having a natural attraction to people (Zang 2014)'. Hence the 'pollution

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level aggravated in and around the Amanishah Nalla region (Bhatnagar A. 2015)'. Rajput R.S., Pandey S. and Bhadauria S. (2016) further discussed that domestic, sewerage and industrial pollutants are the key discharged content in the concerned river.

Development has, however, occurred without an adequate understanding of the complex and vulnerable nature of groundwater systems. The un-regularised outgrowth of the environment has given rise to many vulnerable issues pertaining to the urban environmental sustainability of the research area. Moreover, due to the worsening of the situation the living conditions of urban communities, living conditions and quality of life in the adjoining rural environments suffered and found to be below par to the standards of contemporary human life. The day to day pattern of living of the dwellers of the study region has been acknowledged in terms of livability component of the dwelling area concerned. 'Moreover the definition of livability differ spatially' Khorasani, 2018). 'Even the peri urban areas of any city the life threatening prospective have been discussed by the phenomemon of livability Khorasani and Rezvani et.al,2013) The livability hierarchy pyramid of human needs from Maslow's viewpoint).



Spirituality, Ethics, Creativity, Problem Solving Skill, Good will, Acceptance of Reality Stage-5)

Self Esteem, Self Confidence, Success and Respect (Stage-4)

Acceptance by Society, Friendship, Liking Others, Marriage (Stage-3)

Physical Health, Moral, Family, Occupational and Financial Safety (Stage-2)

Physiological Needs Including Water, Food, Sleep and So on (Stage-1)

(As per Maslow's view point)

Livability concept is a multi dimension aspect. 'Livability borrows the principles and criteria of planning-relevant theories, such as favourable

sustainable development and, in some places, is overlapping with these theories and sometimes contradicts them (South worth, 2011).'

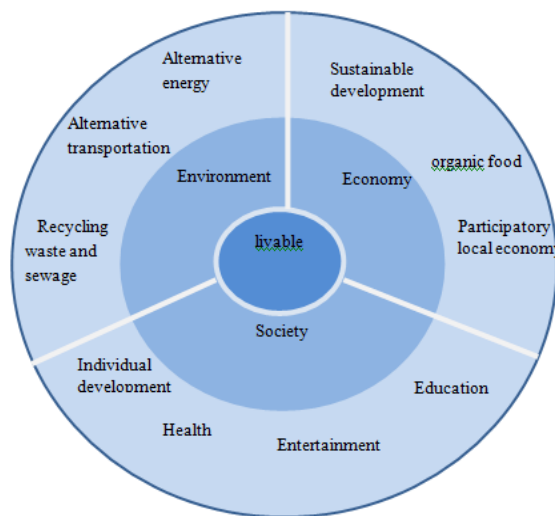


Figure 2: The Cycle of the Principles of Livability

(Source Khorasani, 2012, p. 86)

The idea of livability connects many concepts and refers to special places that interact

together and guarantees citizens' satisfaction by meeting the cultural, economic, social needs and

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improving health and happiness, conservation of natural resources and ecosystem functioning from local to global levels (Kavita Batheja et al. 2007)

Review of Literature

Kavita Batheja et al. (2007) In the Journal *Asian journal Experimental Sciences*, It was observed that 'The groundwater quality of Jaipur city experienced degradation due to rapid urbanization and industrialization'. In addition to this the impact of high concentration of TDS in groundwater used for drinking purpose with respect to medical norms was analysed.

Sabal, D, and Khan, T. I. (2008). In their journal *Environment Biology* have made attempt to find out concentration of heavy metals in the soil of agricultural fields in Amanishah Nalla in Sanganer town, and the heavy metal concentration in *Lycopersicon esculentum*. The vegetables here are grown in untreated water from municipal sewerage and effluents from textile industries.

Kathleen et al, (2009). In their acclaimed work of '*water scarcity in Rajasthan*' observed Dravyawati River was a perennial source of water to the planned walled city of Jaipur. Due to irregular seasonal rainfall, it was realized that growing demand of water supply could not be fulfilled by the river. Later on, due to industrialization, with all the industries started to locate near the river; it became the medium to carry waste outside the city

Zaheerul, Hassan, (2010) in the Journal "*Way forward to South Asian Water Crisis*." recognize access to drinking water and sanitation both as human rights and as prerequisites for the fulfillment of several other human rights.

South Worth, (2011). Ponted out in the '*Journal of urban planning and development*,' Livability borrows the principles and criteria of planning-relevant theories, such as favourable sustainable development and, in some places, are overlapping with these theories and sometimes contradict them.

Gol, Ministry of Water Resources: CGWB, (2012) a pragmatic approach regarding Dravyawati river was put forth that 'Vacant lands around these distant demarcated areas of Nalla were encroached by these populations leading to informal development, further adding to disposal of domestic waste into the river.' Hence, Dravyawati River over the years has transformed into a waste disposing nala (drain) reasons being rapid urbanization, urban sprawl and sporadic industrial activity along the river.

Khorasani and Rezvani et.al,(2013). Firmly observed in their epic work 'Surveying and assessment of livability in peri urban villages' that the concept of livability has been developed because of the importance of existing factors that threaten the quality of life. Factors such as rapid growth, the lack of farmland and open spaces, housing shortages, the growth of social inequality, the growing weakness of local and spatial identity and social life, are serious threats to livability and community

Zhang L (2014). In an unpublished thesis remarked about the natural behaviour of people to

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cluster around the water bodies. Such phenomenon was thoroughly observed around Amanishah Nalla environ.

Bhatnagar A. (2015). In his journal '*Rasayan Journal of Chemistry*' tries to assess the 'physic chemical properties of polluted water and stated that 'The most common forms of pollution are municipal sewage, agricultural runoff of nitrate fertilizers, pesticides, insect herbicides, and industrial discharges of hot water, solvents, petroleum compounds, and other chemicals'

Rajput R.S., Pandey S. and Bhadauria S. (2016) asserted in the *Reviews on Environmental Health* that 'Dravyawati River is overwhelmed by the burden of domestic, municipal and industrial discharges it is responsible for carrying

WHO (2017) In the report of United Nations Organisation's WHO 'Water supplies must be physically accessible, sufficient in quantity, safe in terms of quality, available when needed, acceptable from the organoleptic standpoint, and affordable for everyone. While this ideal has been implemented in many industrialized countries, universal water access is yet to be achieved in many parts of the world, with rural areas significantly lagging behind. This is often due to the absence of economic resources, technology and trained technicians, and generally represents a greater challenge in rural areas'.

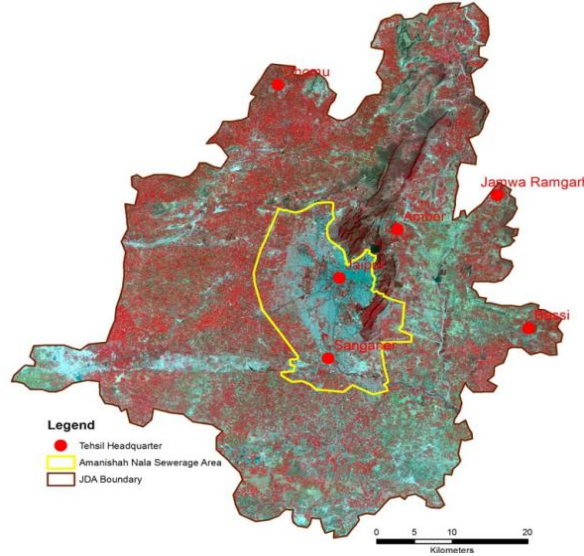
Khorasani, (2018) In 'Analyzing the impacts of spatial factors on livability of peri-urban villages' remarked that the definition of livability varies across societies, social planning aims to provide definitions and criteria for assessing indigenous livability. Livability is often used to define different dimensions of the community and common experiences that shape it and focuses on the human experience of the place and considers it in a given time and place

(No relevant research in Amanishah Nala taken place after 2018)

Study Area

Jaipur district has geographical area of 11,061.44 sq. km forms east-central part of the Rajasthan State. Jaipur is the capital of the state known as Pink city. It is undergoing rapid urbanization and industrialization during last two decades. Such areas include Vishwakarma, Sudershanpura, BaisGodown, Jhotwara, Malviya, Sanganer, Sitapura industrial areas, etc., which play a major role in polluting different water resources. Study area of the project is Amanishah Nala former known as "Dravyawati River" which is of about 45 km length, starts from Vishwakarma Industrial area. Amanishah Nala is crosses Jaipur city thus rapidly polluted by disposing domestic and industrial waste. The sewage sample collected from 10 different sites as sample Collection Sites are Vishkrama Industrial Area, Vidhyadhar Nagar - Swarn Jayanti Park, Sodala - VivekVihar, Mansarovar-Maharani Farm, Sanganer - Near Sanganer over Bridge, Kumbha Marg, Pratap Nagar, PGI, Sitapura, Goner, Ralawata, Beriand Barala etc.

The Satellite Image of Study Area



Dhund River and *Amanishah Nala* (*Dravyavati River*) form a fork like drainage pattern in the convergence zone of which the major part of Jaipur city is situated. The Amanishah nala (*Dravyavati River*), which originates from the western

slopes of Jaigarh hills, flows northwards in the upper reaches, turns south and south-west in its middle course and flows towards east with a broad semi-circle. Finally it joins river *Dhund* further downstream.

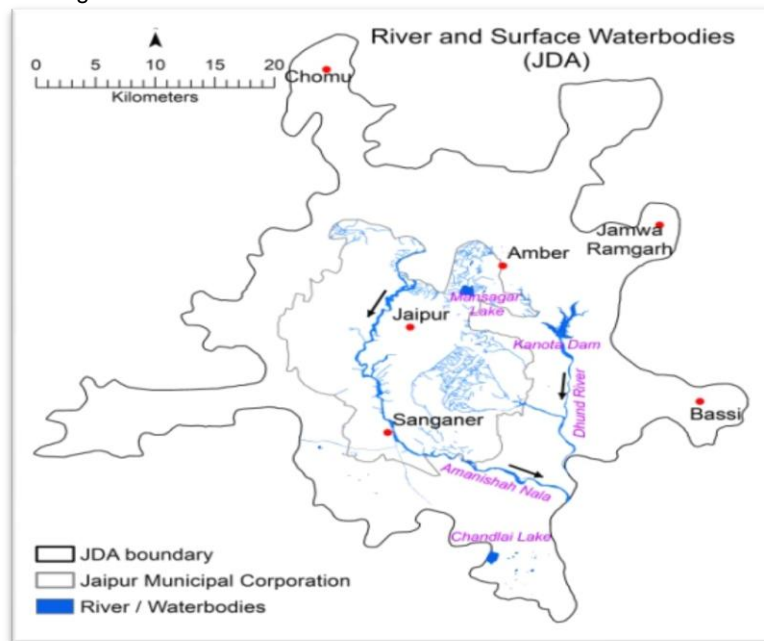


Figure: 2 The Drainage area (Source: Scholar)

Aim of the study

To assess the livability and the groundwater quality of the study area.

Data Base and Methodology

Table: 1

Primary Informatio / data	Field Schedule
Secondary Information / data	Source
	Uses
1	Published data of Govt. of India & Govt. of Rajasthan.
	The Statistical Abstract (GOI & GOR)1981-2011
	Spatial distribution of sites

2	Rajasthan Govt. Survey Report(GOI),2001,2011,2018	Govt. of Rajasthan	For geochemical and water depth analysis.
3.	Data records of the destinations. (Amanishah catchment)	Official Ward Centres.	For quantification of grim situation to humans, livestock etc and Significance.
	Structured no probability sampling method applied.		

A well structured survey in which no probability sampling method was incorporated Moreover was incorporated that involves the sample being drawn from the part of the population that is close to hand, and willing to cooperate the cause of research. The covid -19 pandemic has been taken care of in the collection of information. The study was carried out in the selected area of Amanishah region.

Moreover for primary data convenient sampling method will be used for data collection. It is a type of no probability sampling which involves the sample being drawn from the part of the population that is close to hand, and willing to cooperate. The response rate obtained was more than 90 %. This response rate is considered satisfactory because the focus of the survey is only to gain insight into the residents' preferences on inclination of stakeholders towards livability around the Amanishah Nalla and is not to generalise the findings for a larger population .The following reasons are the cause for unsuccessful interviews with the selected samples.

1. Refusal (3%)
2. Respondents not at home (4%)

3. Unaware about the subject matter (3%)

Moreover the Secondary Data were procured from the following Sources

1. The CGWB data of Govt. of India & Govt. of Rajasthan.(SGWB)
2. Data records of the destinations. (Amanishah catchment)
3. Rajasthan Govt. Survey Report (GOI), 2001, 2011, 2018.

Respondents' Background

The respondents consisted of three main groups, i.e Senior citizens, Graduate and Women. The respondents' educational background varied greatly with the majority having attained secondary school education

The Groundwater Potential

The below mentioned figure(3) explores the depth of ground water in the studied area and further analyses the potentiality of water in the aquifers of different areas of Amanishah area. The table 2 shows the eight major locations where the trend of lowering of ground water exists.

Water Contour (Aquifer)

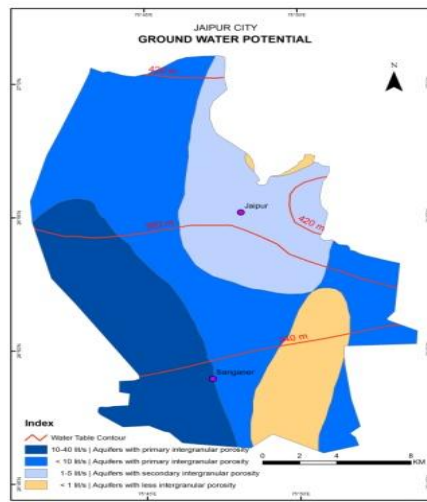


Figure: 3 Ground water Potential: (Source: Scholar)

During premonsoon period (May, 2015), depth to water levels varied from 7.08 mbgl at Dawach in Sambhar block to 84.00 mbgl at Chomu in Govindgarh block (Figure3). Deeper water levels of more than 40 mbgl were recorded in the central part of district covering most parts of Govindgarh, Shahpura Amer, Jothwara and Sanganer blocks. Shallow water level less than 10 mbgl has been recorded in the southwestern part of the district mostly

in the blocks of Dudu and Phagi. During postmonsoon period (November, 2015), depth to water level varied from 4.15 mbgl at Rasala, Jamwa Ramgarh block to 82.8 mbgl at Chiomu, Govindgarh block. Water levels more than 40 mbgl were observed in the central parts of the district covering blocks of Govindgarh, Amer, Jotwara, Sanagner and Bassi. Shallow water level less than 5 mbgl were registered in the south-western parts of the district in Dudu and Phagi blocks.

Table: 2

S.no	Location	Depth of water level		Rate of WL decline (m/year)
		2005	2015	
1	Durgapura	24.11	35.48	2.27
2	Jhotwara	45.90	55.62	1.94
3	MES	38.+77	55.22	3.29
4	Mansarovar	25.25	38.01	2.55
5	Sirsi	42.98	55.51	2.51
6	Surya Nagar	17.46	21.72	0.85
7	Sukhpuria	23.02	27.10	0.82
8	Watika	24.08	36.58	2.52

Source: Central Ground Water Board (2018), District Groundwater Brochure, Jaipur District (Rajasthan)

Urban Impact on Water Resource and Livability Index

Degradation in Water Quality

The quality of surface water has impeded the livability of Jaipur city. The main culprit of this issue is the industrial processes working without the administrative consent. The foul smelling of Amanishah nala in addition to its insightfulness has been ascribed to the untreated industrial discharge of waste water into it. The ever increasing mosquito breeding around the area is held responsible for making the dwellers vulnerable to health risks. The spillage of waste water in consequent upon the

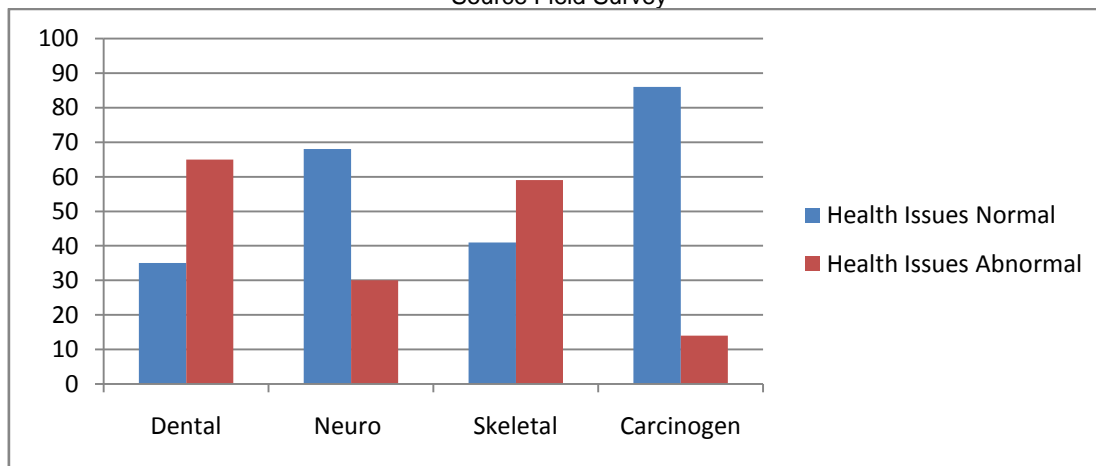
blocked drains continuously increase the cost of repairing of surface roads, hence aggravates the burden on exchequer. The health situation further gets confounded owing to the domestic uses of wastewater and into agriculture. The hotel industry has further aggravated the problem as waste water is let out in a drain connecting to the sewerage network.

Taking the help of the field schedule a survey was conducted in the vicinity of the Amanishah Area. The respondents were handpicked on the basis of their age group being more than thirty years. A sample of 50 household was selected on random basis from the wards lying close to the research area.

Table 1: Health Issues (In%)

Livability Count (Health)	Normal	Abnormal	Total
Dental	35	65	100
Neuro	68	32	100
Skeletal	41	59	100
Carcinogen	86	14	100

Source Field Survey

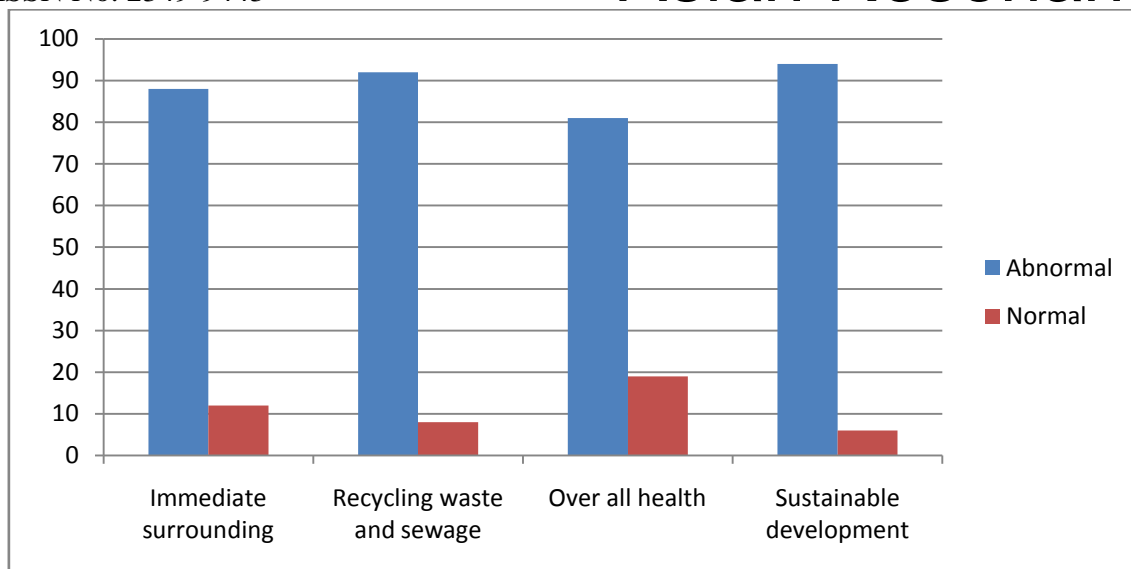


Graph 1

Table 2: Over all Livability Count (In%)

Livability Count (Over all)	Dissatisfied	Satisfied	Total
Immediate surrounding	88	12	100
Recycling waste and sewage	92	8	100
Over all health	81	19	100
Sustainable development	94	6	100

Source Field Survey



Graph 2

Results

The pH and conductivity values along with other parameters present in the ground water of

metropolitan city of Jaipur are mostly confined within the following range. (Pre and Post monsoon season)

Table:3

S.no	Parameters	Pre Monsoon (2015)	Post Monsoon (2015)
1	pH	5.7 to 8.0	6.9 to 8.0
2	Conductivity	486 to 2300 μ S/cm	430 to 2110 μ S/cm
3	Calcium	from 21 to 222	19 to 222 mg/L
4	Sulphate	1 to 155 mg/L	1 to 125 mg/L
5	Fluoride	0.45 to 3.20 mg/L	0.10 to 2.80 mg/L
6	TDS	311 to 1472 mg/L	275 to 1350 mg/L
8	alkalinity	235 to 618 mg/L	208 to 590 mg/L
9	total hardness	105 to 890 mg/L	103 to 783 mg/L

Source State ground water board Rajasthan

Table 4: The Metals Present in the Water and their Concentration are as follows

S.no	Matals	Concentration	Permissible limit
1	Lead	6mg/l	0.1mg/l
2	Zinc	8mg/l	5.0mg/l
3	Chromium	7.5mg/l	0.05mg/l
4	Cadmium	8.5mg/l	0.05mg/l
5	Copper	7.5mg/l	1.0mg/l

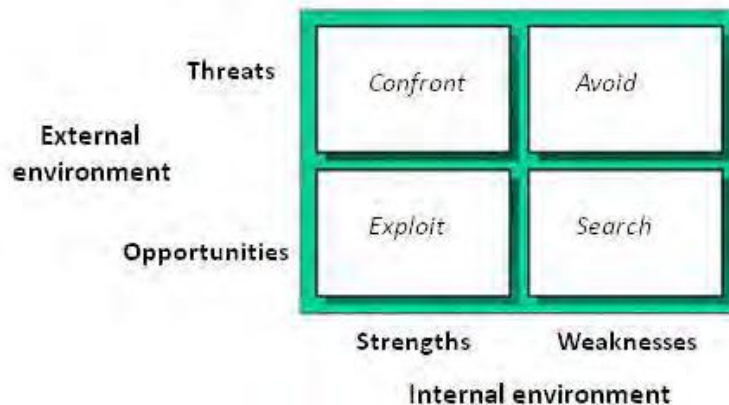
Source State ground water board Rajasthan

The above tables automatically suggest the gravity and the intensity of the problem related to the day to day water efficacy in the Amanishah Nalla environ.

Amanishah Nallah Environ SWOT ANALYSIS

SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is a useful tool for sustainable development and decision making about environmental planning and water resources management. This analysis was applied in order to evaluate the water resources of the wider area of Amanishah Nallah.

Strengths and weaknesses are factors of the system (internal issues), while opportunities and threats are factors of the external environment (external issues). In other words, a SWOT analysis helps to find the best match between environmental trends (opportunities and threats) and internal capabilities and facilitate a strategic approach to administration (Richards 2001). Concerning the application of SWOT analysis, it is necessary to minimize or avoid both weaknesses and threats. Weaknesses should be converted into strengths (Danca 2000). Likewise, threats should be converted into opportunities.



SWOT Analysis Diagram

The Strengths of the Basin are

1. The capacity of river Amanishah whose runoff crosses the whole basin, is significant
2. The availability of the surface water deposits during the wet and dry period.
3. The existence of recent hydrogeological studies is an advantage for the rational water resource management, as it can provide new data and contribute to the planning of better strategies in order to achieve water sustainability.
4. The existence of many environmentally protected areas
5. Water quality in the upper part of Amanishah, is generally good. The water recharge is moderate in quantity and of significant level, thus improving and renewing, in a sufficient rate, the deteriorated water caused by human activities

The Weaknesses of the Basin are

1. Increased water demands, mainly during summer period
2. The overexploitation of the area's water recourses for irrigative purposes.
3. The lack of adequate monitoring data (groundwater levels, quality data, torrents, etc.).
4. There is no kind of monitoring for quality or discharge.
5. The extended use of fertilizers, causing nitrate pollution.
6. Quality deterioration of the area's water resources, due to urbanization (urban wastes).
7. In most of the villages there are septic sinks, which cause problems to water quality. The
8. Lack of a proper sewage system in the area must be mentioned.
9. Water deterioration caused by industrial wastes.
10. Urbanization, construction of public transportation network infrastructure.

The Opportunities of the Basin are

1. There are many STPs and other I treatment units in the area, which doesn't work at this time. The operation of them will help to the proper management of the waste waters.
2. The existence of river side aestheticism. This is a significant factor for the touristic development of the area and the financial regeneration.

3. The involvement of TCS. This Directive provides new legislation and opportunities for the sustainable management of water resources.
4. The directive requires the establishment of monitoring programs covering groundwater quantitative and qualitative status.

The Threats of the Basin are

1. The improper waste treatment, which is a complex problem
2. The extensive pumping could cause possible subsidence
3. Shrinkage of natural biodiversity in the area
4. The climate changes in correlation with the overexploitation of the surface and groundwater resources.

Suggestive Measures

1. Removal of total Encroachment to develop the Amanishah Nala.
2. Complete ban on disposal of untreated waste in the river.
3. Green belt of plantation all along the river.
4. Controlled agricultural activity (vegetables /cash crops and flowers) may also be allowed.
5. Shifting of tie and die industry from Sanganer to other appropriate sites.
6. Water harvesting to revive and rejuvenate the river system.
7. Frequent desiltation of nala be carried out for natural unobstructed flow of drainage water.
8. It must be declared 'No Construction Zone' after demarcating its actual width Public places be developed on the nearby spare land.
9. Cycle track and Walk-way use policy should be there.

These measures would ensure free flow of clean water in the river with increase green cover and it will also add to scenic beauty, provide fresh air to its citizens and will augment ground water recharge in the region. It is also likely to act as added tourist attraction and vibrant lifeline for Jaipur Region.

Conclusion

Amanishah Nala is main sewer line of Jaipur and it is getting polluted continuously. Water contamination is a very big problem in Jaipur because of the less concern about the health and environment. During our study we analyzed various parameters

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such as pH, turbidity, temperature, total dissolved solids, dissolved oxygen, biochemical oxygen demand, conductivity, etc. These study results will be helpful in designing of new treatment plant. The results will be helpful in maintaining human health & safe environment. Some parameters such as Total Solid, Total Suspended Solid, and Total Dissolved Solid are present above 1000 ppm. pH of sample is b/w 6.6 – 7.4. COD is greater than BOD by 2.5 times which shows the presence of inorganic matter in the sewage. Oxygen of the sewage sample is less than 4 ppm which is necessary for aquatic life. Thus water of Amanishah Nala requires treatment before getting disposed off since its water is also used for agricultural purposes. Water used for the agricultural purposes is not safe for human health. Physiochemical properties of the sewage water is found to be more than the standards set by Rajasthan Pollution Control Board, Jaipur for the disposal of waste water into any stream line. Hence the quality of surface water and groundwater of the study area (Amanishah nala and its vicinity) is not safe for drinking as well as irrigation purposes. Moreover, water table has gone down due to overexploitation and the city has been demarcated as dark zone. There are other problems like encroachment, illegal construction, illegal settlements, growing agricultural crops and vegetables with untreated water are great cause of concerns and need special attention. Though the government has taken decision of development and beautification of the nala, but the political will is the urgent need in the concerned subject.

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