PLANNING FOR REJUVENATION OF TRADITIONAL WATER SYSTEM OF JODHPUR CITY

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Planning for rejuvenation of Traditional Water System (TWS) of Jodhpur City

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***Abstract*— Jodhpur is one of the historic cities of Rajasthan which is situated in the arid region of the state close to Thar desert. Thus water is one of the crucial resources for the region which was duly considered by the founders of Jodhpur as they saw the water potential for the city and used the important physical feature of the region i.e. Chonka-Dijar Plateau as catchment area for various water bodies. Gradually, the rulers of Jodhpur developed a systematic network of water bodies which were interconnected and conserved each and every drop of rainwater. Till centuries this traditional water system consisted of various elements - Surface water bodies, ground water bodies, canal network and the catchment area served the population of the city and city dwellers considered these water structures as sacred and having medicinal properties. But after the onset of perennial water from the rivers of Punjab through Indira Gandhi Canal, the water bodies of the city became obsolete, mining was permitted at catchment area and due to growth and development of the city the canals were either turned into drains or were demolished, this ultimately led to deterioration of the traditional water city of the city. This study focuses on the understanding of the traditional water system of Jodhpur and brings to light its historic, cultural, religious and environmental significance. In order to understand the water quality of traditional water bodies, a water quality test for 23 selected water bodies was done at the PHED lab of Jodhpur which helps in understanding that many BIS parameters of the samples fall within the acceptable limits. In addition to this, the Urban Water Diagnostic Tool was used to understand the level of deterioration the traditional water bodies of cities are facing as per which a priority matrix has been prepared for 18 selected water bodies for the concerned department to take steps for their rejuvenation. Proposal for rejuvenation of Mahila Bagh ka Jhalra has been provided as the water body has the least UWD scores.**

***Keywords*— Traditional water system (TWS), Urban Water Diagnostic tool (UWD), Corporate Social Responsibility fund (CSR), Behaviour Change Communication (BCC), Information Education Communication (IEC)**

I. INTRODUCTION

Water bodies provide numerous ecological services, including flood control and groundwater recharge, which are essential for environmental stability. They also support local communities by promoting agriculture, fishing, and livelihoods. Additionally, these bodies contribute to biodiversity and enhance the aesthetic and recreational value of the landscape. (Babu, Seth, & Arafat).

In the present context, there are several critical issues associated with the water bodies. The neglected water bodies become breeding grounds for disease-carrying insects like mosquitoes. Additionally, reduced land capacity for water retention exacerbates water scarcity issues, and nutrient pollution from agricultural runoff and sewage has led to widespread eutrophication, disrupting ecological balance. In addition increased water levels during monsoon often result in flooding, posing substantial public safety threats. Addressing these issues requires urgent attention and effective mitigation strategies to ensure public health and environmental sustainability. (EPA, 2023)

Figure 1. Flash flood at Jodhpur due to degeneration of traditional water system (Source: ABP news, 2022)

The rejuvenation of water bodies holds profound importance, as it exerts a significant impact on ecology,

aquatic life, and the surrounding community. It contributes to the maintenance of the vital water cycle, ensuring a sustainable supply of clean water for various purposes. Furthermore, rejuvenation efforts improve air quality and enhance the aesthetic appeal of the area, making it more attractive to tourists and thereby generating economic opportunities for the local community.

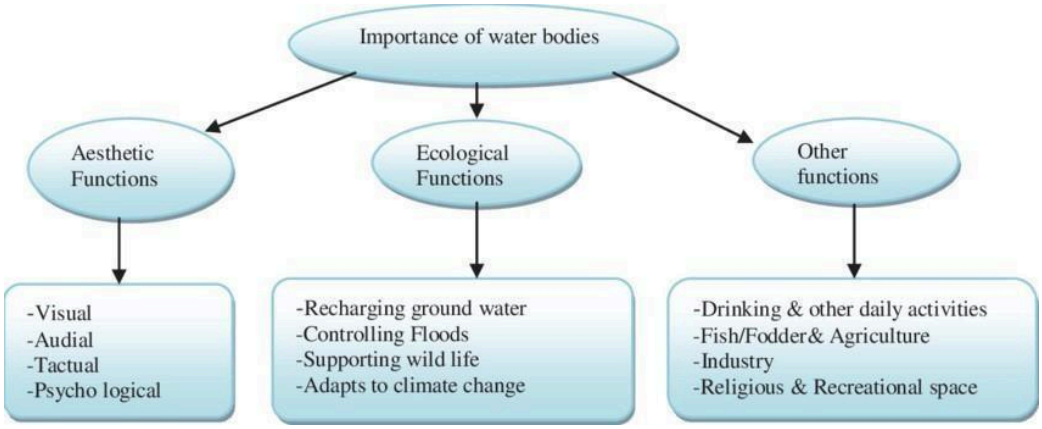

Figure 2. Importance of water bodies (Source: Bindu & Abdul, 2016)

II. STUDY AREA.

Jodhpur city is the second largest city in the state of Rajasthan and is located to the south- west of the Rajasthan's capital Jaipur. This city is a popular tourist attraction in the state and throughout India because of its princely palaces, majestic forts, and age-old temples. Jodhpur, located in the stark scenery of the Thar Desert. One of the city's unique features is that all of the residences surrounding the Mehrangarh fort are painted blue, earning the city the nickname "Blue City." (Jodhpur Development Authority).

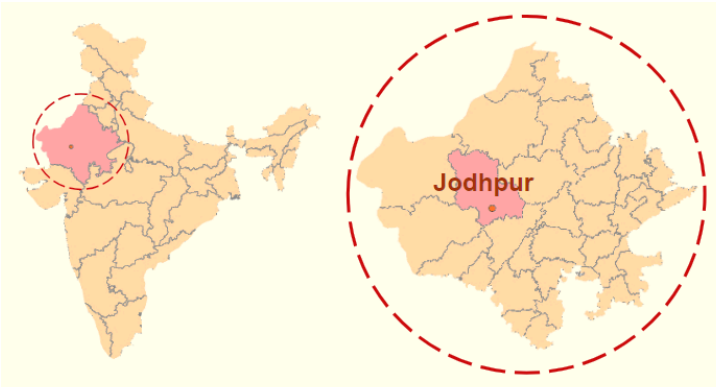

Figure 3. Location of Jodhpur (Source: Author)

Looking at the topography of the city, there are scattered hills in the west, north-west and south-west parts of Jodhpur and flat plain towards the east, north-east and south- east. The climate of Jodhpur is hot and semi-arid. In summer, hot air flows here, which is called “Loo”. Due to Jodhpur being situated in the desert area, it experiences severe cold in winter. The average annual rainfall in Jodhpur is 36 centimeters, with an average of 18 days of rainfall in a year.

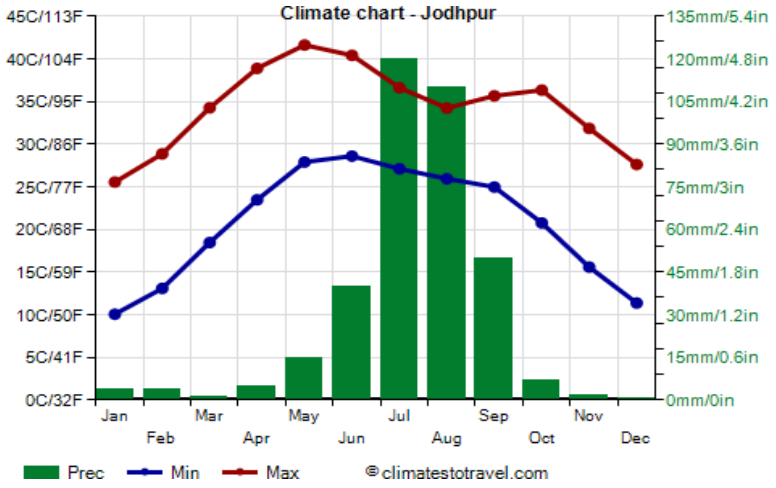

Figure 4. Climate of Jodhpur (Source: Climatestotravel.com)

The city is renowned for its sandstone, often referred to as Chittar stone, and limestone, both of which hold great importance as minerals in the area.However, the extensive mining of these valuable mineral resources has not been without consequences. It has had an impact on the water bodies within the city, potentially leading to water quality issues and environmental concerns.

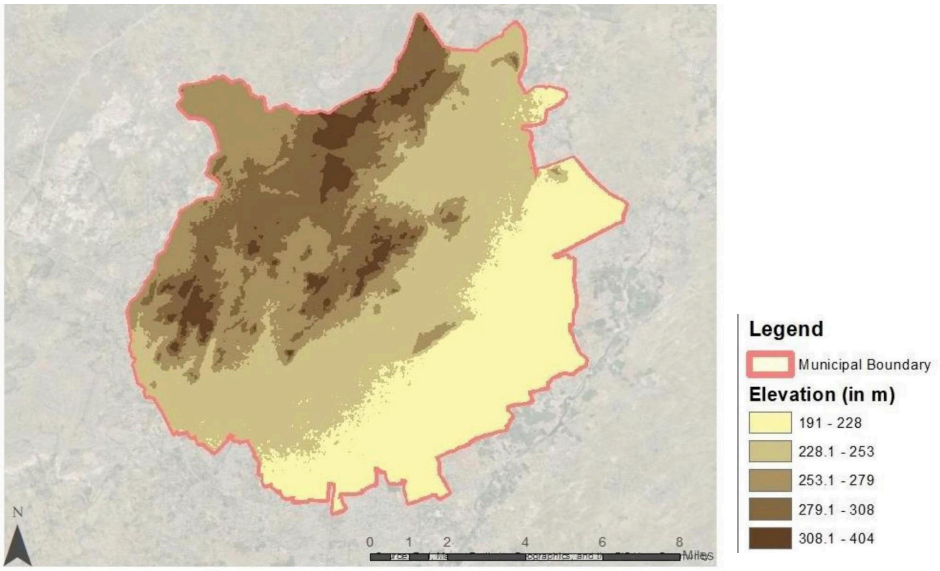

Figure 5. Topography map of Jodhpur city (Source: Author)

III. WATER BODIES LISTED BY JODHPUR NAGAR NIGAM

The municipal corporation of Jodhpur has undertaken a significant initiative to identify and list the water bodies within the city limits . Most of the identified water bodies are concentrated in the old city area, which is known for its ancient architecture, narrow lanes, and historical significance. The municipal corporation has identified around 61 bawdis, 4 jhalras, 1 lake, 4 nadis, and 10 Talabs.

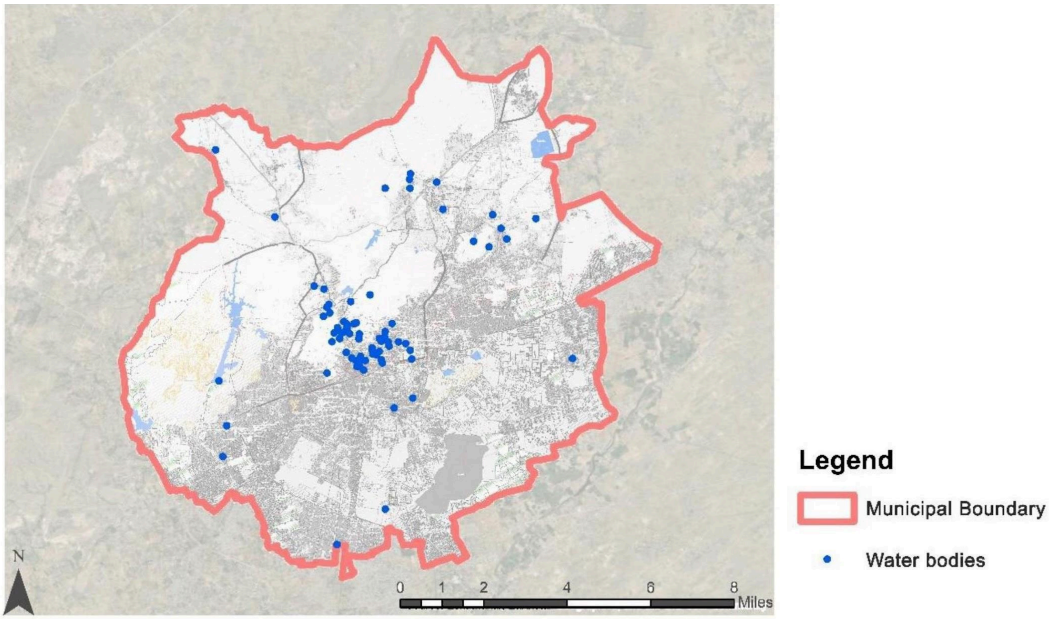

Figure 6. Map of water bodies listed byNagar Nigam Jodhpur (Source: Author, Reference - list of water bodies by Jodhpur Nagar Nigam)

The Nagar Nigam of Jodhpur City has also taken the initiative to geotag various water bodies of the city. Many of the water bodies of the city are facing social and community disconnect because of which the water bodies are either turning in barren arid land or dumping ground for e neighborhood. The following are the water bodies, which have been documented by the Nagar Nigam Jodhpur. Punjla Nadi, Anna sagar nadi, Juni Basti Nadi, Dhaysagar etc. are types of surface water bodies of the city which have geotagged by nagar nigam, which show the extent to which these water bodies have lost their identity.

Dhay sagar is now used as a dumping ground by the local community.It acts as a breeding ground of mosquitoes during monsoon months.Just like Dhay sagar, Gol nadi is also one of the surface water bodies of the city which has lost its identity as a water body. It is now used as a playground by the neighboring community and does not even hold water during monsoon months.

A.

B.

C.

D.

E.

Figure 7. Water bodies of Jodhpur which have lost their identity - A.Punjla Nadi, | B.Anna sagar nadi, | C.Juni basti nadi, | D. Dhay sagar, | E.Gol Nadi (Source: Jodhpur Nagar Nigam)

IV. TRADITIONAL WATER SYSTEM OF JODHPUR

Jodhpur was established in 1495. The founders of the city gave consideration to the city's water potential while choosing its location.The Chonka-Daijar plateau, a significant physical feature of this region, serves as a water catchment for 50 functional surface water bodies such as nadis (village ponds), talabs (ponds), tanks, canals, and lakes, as well as indirectly for approximately 154 groundwater bodies such as wells, baoris, and jhalaras.

Unfortunately, the construction and development of water bodies came to a standstill around 1897-98, when for the first time public water system was implemented. The majority of the bodies of water are now severely harmed and irreversibly damaged. A survey done in 1989 by the School of Desert Sciences (SDS) in Jodhpur was successful in discovering 229 different water bodies, 75 of which were surface and 154 groundwater bodies.

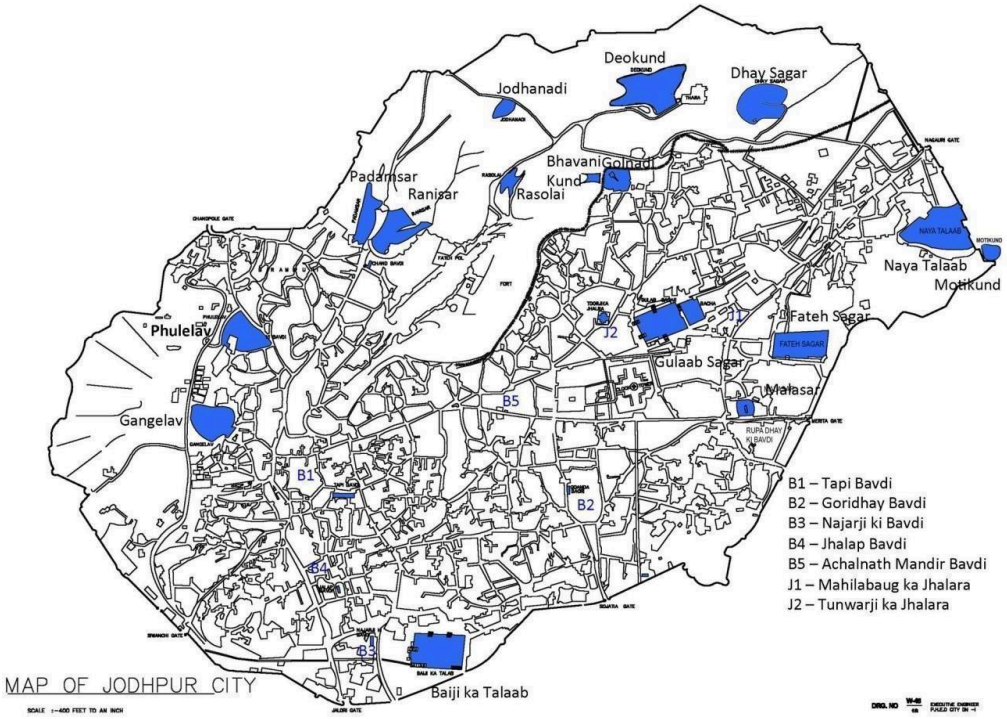

Figure 8. Map of Jodhpur showing prominent water bodies (Source: Mehrangarh fort)

V. MULTIPLE STAKE HOLDERS OF TRADITIONAL WATER SYSTEM OF JODHPUR.

The traditional water system (TWS) of Jodhpur is a multifaceted network involving various stakeholders, each responsible for different components of the system. The three primary elements of the TWS—Catchment Area, Canals, and Water Bodies—are closely interconnected, making the health of one component vital to the others.

Catchment Area: This is where water is collected and directed towards the canals and water bodies. The health and integrity of the catchment area are influenced by activities such as agriculture, urban development, and land use practices. The stakeholders involved in managing the catchment area may include local communities, agricultural departments, and environmental agencies.

Canals: Managed by multiple departments like Jodhpur Development Authority (JDA), Forest Department, Irrigation Department, and Mining Department, canals serve as the main conduits for transporting water. Each department has its role in ensuring the canals' maintenance, water flow regulation, and sustainability.

Water Bodies: These include lakes, reservoirs, and ponds that store and distribute water. Various entities, including the community, Public Health Engineering Department (PHED), Groundwater Board, Municipal Corporation, and local authorities, oversee the management, conservation, and utilization of these water bodies.

Despite the interconnected nature of the TWS components, there appears to be a lack of coordinated efforts among all stakeholders. Entities like the Archaeological Survey of India and State Archaeological Department are notably absent from the collaborative loop, potentially leading to oversight in managing historical and culturally significant water structures.

Thus, the sustainable management of Jodhpur's traditional water system requires cohesive planning, shared responsibility, and active participation from all stakeholders to ensure the resilience and longevity of this vital resource network.

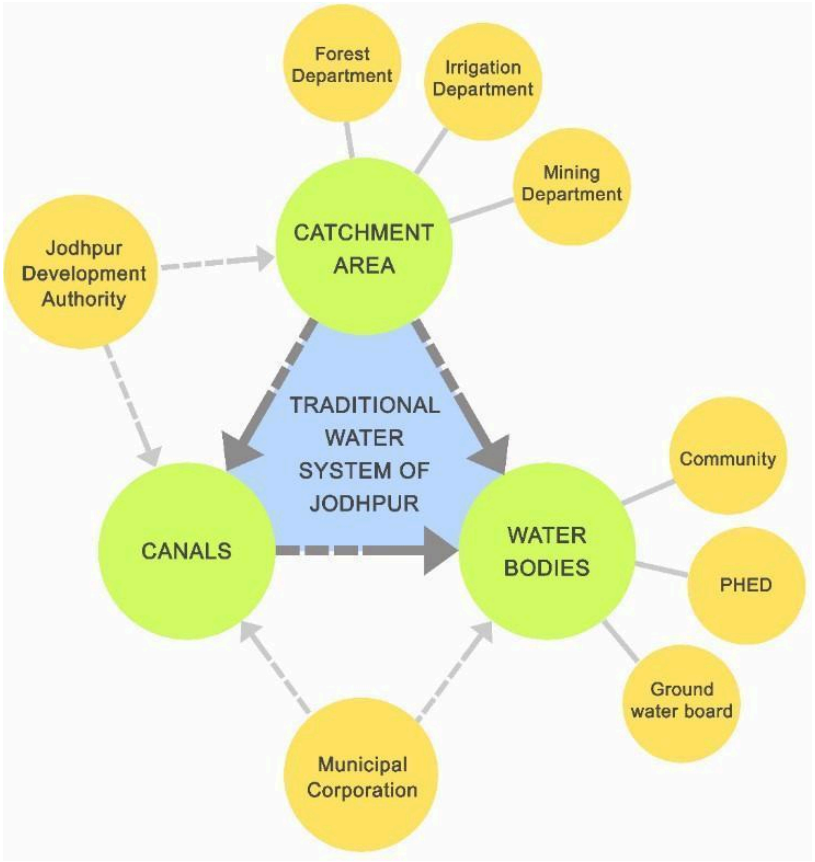

Figure 9. Multiple stakeholders of traditional water system of Jodhpur (Source: Author)

VI. WATER QUALITY OF VARIOUS WATER BODIES

In order to understand the current state of the water bodies of Jodhpur, 23 water bodies of different typology were selected to understand their quality parameters like pH, pH value, Electrical conductivity (EC), Total Dissolved Solids (TDS), Alkalinity, Total Hardness, Calcium Hardness, Magnesium Hardness, Chloride, Fluoride, Nitrate. The testing of water bodies was done at the Public Health and Engineering Department (PHED) lab. Refer to following table.

Table 1 - Water Quality of 23 selected water bodies of Jodhpur (Source: Author | Testing done at PHED lab)

Name of Water bodies	pH value	Electrical conductivity (EC)	Total Dissolved Solids (TDS) = EC x 0.7	Alkalinity	Total Hardness	Chloride	Fluoride	Nitrate
Acceptable limit →	6.5-8.5		500 (AL) 2000 (PL)	200 (AL) 600 (PL)	200 (AL) 600 (PL)	250 (AL) 1000 (PL)	1 (AL) 1.5 (PL)	45 (AL)
				(f - i) x c	(f - i) x c	(f - i) x c		
Ranisar talab	7.7	509	356.3	180	200	50	0.3	2.7
Padamsar talab	7.5	698	488.6	190	220	70	0.3	1.4
Chand bawadi	7.25	532	372.4	210	190	50	0.1	1.6
Jeta bera	7.2	706	494.2	220	240	70	0.1	12
Navchowkiya bera	7.35	894	625.8	260	280	70	0.1	40.26

Kumaria kua	7.2	1058	740.6	290	350	80	0.1	33.21
Neembla bera	7.2	893	625.1	290	300	70	0.1	23.44
Tapi bawadi	7.45	1072	750.4	340	300	70	0.1	53.42
Najar ji ki bawadi	7.2	1256	879.2	330	320	100	0.1	76.86
Baiji ka talab	8.04	2060	1442	210	400	200	0.1	131.8
Kharbuja bawadi	7.2	1522	1065.4	420	450	130	0.2	59.6
Barli pond	7.7	402	281.4	110	140	50	0.2	6.114
Umaid sagar lake	7.8	468	327.6	140	150	50	0.1	7

Raghunath ji ki bawadi	7.3	1116	781.2	350	380	100	0.2	15.2
Fateh sagar	7.5	1389	972.3	460	310	150	0.2	7.2
Gulab sagar	7.9	1343	940.1	380	310	120	0.4	8.14
Mahila bagh jhalara	7.5	1463	1024.1	430	340	150	0.4	5.3
Toorji ka jhalra	7.4	1215	850.5	320	340	90	0.4	88.12
Ganga ki bawdi	7.5	1882	1317.4	310	450	140	0.3	235.4
Navlakha bawadi	7.4	6790	4753	560	880	1060	0.8	398.8
Kaylana lake	7.9	-	220	98	102	24	0.2	4
Takhatsagar lake	8.0	-	214	96	98	28	0.2	4
Surpura	8.0	-	220	98	104	28	0.2	4

From the above table we can see that the all the water of all 20 water bodies lies within the acceptable range for pH level but varies in terms of other parameters the most concerning is the excess Nitrates levels of water bodies like Tapi bawadi, Najar ji ki bawadi , Baiji ka talab, Kharbuja bawadi, Toorji ka jhalra, Ganga ki bawdi, Navlakha bawadi. Out of these water from Tapi bawadi, Najar ji ki bawadi and Ganga ki bawdi is used for drinking purpose, which would have impact on the health of the citizens living in the locality.

VII. UWD TOOL FOR WATER BODIES OF JODHPUR.

The UWD values for different water bodies of Jodhpur would help the administrators and even corporate sector in identifying water bodies of the city which require immediate attention. The UWD tool has been used for the 19 water bodies of Jodhpur out of the selected 23 water bodies as the remaining 4 water bodies are community well, which are – Jeta bera, Navchokiya ka bera, Kumaria kua and Neembla bera, for which various indicators of the UWD tool are not applicable.

Out of selected water bodies of the city 3 fall under very poor, 5 fall under poor category, 8 water bodies are of Average category and 2 water bodies falls under good category. Thus with the help of the UWD value a priority matrix can be prepared which can be considered by the city administrator, as show in table.

Note – As Kaylana lake and Takhat sagar lake are to interconnected lake which are adjacent to each other thus for evaluation the UWD value they have been considered as one single water bodies.

Table 2 - Priority Matrix of selected water bodies of Jodhpur city (Source: Author)

PRIORITY OF WATER BODIES	UWD SCORE
Mahila bagh jhalra	1.26
Kharbuja bawadi	1.35
Fateh sagar	1.43
Chand bawadi	1.66
Gulab sagar	1.93
Umaid sagar lake	1.99
Navlakha bawadi	2.01
Barli pond	2.13
Najar ji ki bawadi	2.63
Raghunath ji ki bawadi	2.64
Padamsar talab	2.65
Baiji ka talab	2.89
Tapi bawadi	3.11
Ganga ki bawdi	3.19
Kaylana lake and Takhat sagar lake	3.25
Toorji ka jhalra	3.27
Ranisar talab	3.75
Surpura	3.95

Thus from the above priority matrix it can be inferred that 8 water bodies out of the selected water bodies are in poor and very poor state and need immediate action for their revival. Out of which the Mahila bagh jhalra is facing extreme negligence and thus suitable proposals for rejuvenating the water body are provided in a later chapter. Annexure 4 includes the inventory form of water bodies which was used to identify their respective parameters.

VIII. CONCLUSION

Jodhpur city possesses an extraordinary traditional water system (TWS) characterized by interconnected water structures that have efficiently conserved rainwater for centuries. These water bodies continue to play a crucial role in the community, providing essential resources for drinking and other daily uses. The city has witnessed a consistent rise in groundwater levels, with water being pumped daily from 89 sources. However, despite this abundance, there exists a significant mismatch between the water demand and supply, which presents a critical challenge for sustainable water management in the city.

Currently, Jodhpur's water bodies face social and administrative neglect, which has led to their degradation. Many of these once vital resources have become dumping grounds and sources of nuisance due to a lack of proper oversight and maintenance. This disconnect has not only diminished their utility but also tarnished their potential to contribute effectively to the city's water supply. Despite these challenges, many of these water bodies still contain high-quality water that could significantly augment the city's supply and reduce its dependence on the Indira Gandhi Canal (IGC), a critical but finite resource.