International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 8 Issue 9 ǁ 2020 ǁ PP. 22-29

Governance of water in urban areas

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Abstract
India is a developing nation with a population of 1.2 billion (according to 2011 census). Growing population and increase in urbanization are resulting in climate change and depletion of natural resources.Exponential rise in pollution level, extreme cases of droughts, drastic runoffs in monsoons are the indicators of urban infrastructure mismanagement. The need of the hour is toconserve and utilize the existing available water resources in a sustainable way. This paper mainly sheds light on requirement of Water Sensitive Urban Planning for Indian metropolitan cities (taking Hyderabad as a case study), and by following a comprehensive approach to urban water services, taking water supply, waste water and storm water as components of an integrated physical system. This research is an attempt to understand existing policies and management strategies on water, at global and local scale. Finally, giving the policies under few identified categories. The categories were 1. Protect water bodies from pollution and extinction, 2. Conserve the storm water, 3. Reuse the grey water, 4. Replenish the groundwater, 5. Adopting modern technical methods.

Keywords: *Water management, urban areas, conservation, scarcity, Hyderabad.*

Date of Submission: 25-09-2020 Date of acceptance: 07-10-2020

I. INTRODUCTION

Although water is a renewable source, it still is a finite resource. It's a known fact that only 3% of world's water is fresh and only 2/3rd of it is accessible. Population explosion, Urbanization, increasing food demand, have been pushing the water demands to its extremities. As a result of rising standard of living, industrialization and increasing food demands; urban areas are experiencing water consumption, over extraction, exploitation, pollution of surface water and scarce ground water.

In the recent years, people has come up with up with the realization of climate change, water scarcity, extinction of resources and many more is not just some hoax and it is for real. It still remain as a subject of ignorance for those living in underdeveloped parts of the nation."In a world of unprecedented wealth, almost 2 million children die each year for want of a glass of clean water and adequate sanitation. Millions of women and young girls are forced to spend hours collecting and carrying water, restricting their opportunities and their choices. And water-borne infectious diseases are holding back poverty reduction and economic growth in some of the world's poorest countries" (Human Development Report 2006). Water pollution and scarcity has augmented in industrialized cities.

According to 2001 census, 77.9% of India's population was accessed to safe drinking water. A survey conducted by Tata institute of Social Science (TISS) showed 50lakh households in Mumbai, Delhi, Kolkatta, Hyderabad, Kanpur &Madhurai are water deficient (Chand 2019).

II. GLOBAL SCENARIO

Water has always been as the top fundamental for sustaining human life. As a result of urbanization, rural to urban migration, growth of cities and many other factors are contributing to the stress on water infrastructure particularly in urban areas. As of the records, cities account for almost 60% of water apportioned for domestic human use. It is documented that only half of the water is accounted and the remaining half is either illegal water connections or leakages while transportation costing an average amount of US $14 billion every year (in USA). "Currently, 2.8 billion people, or 44 percent of the world's population, live in areas of high water stress.22 Present trends suggest that this will rise to almost 4 billion by 2030. Globally, water shortages are estimated to cause an annual loss to economic growth of about 3.6 per cent.24 In California, the cost of water issues is already 2 percent of the state budget" (IBM 2009).

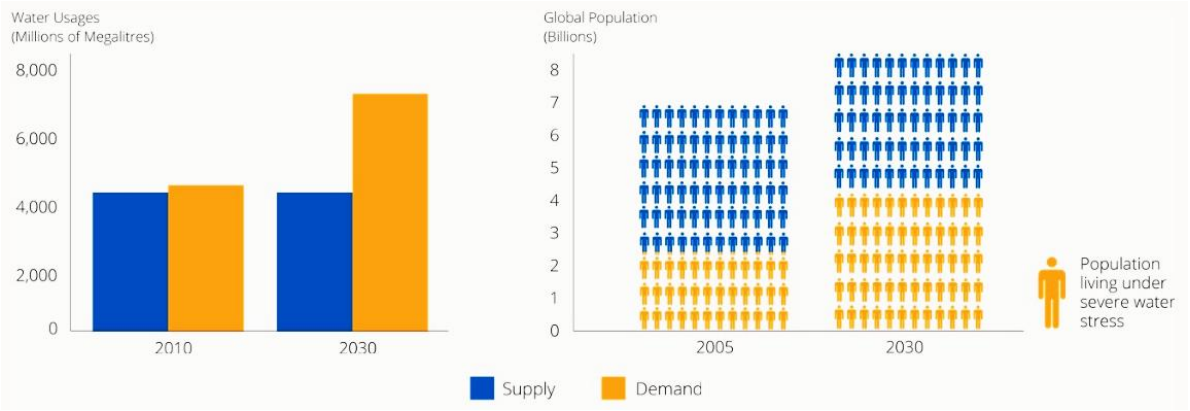

Figure 1: Water Demand and Supply Vs population projection. Source: (Rainmaker 2020)

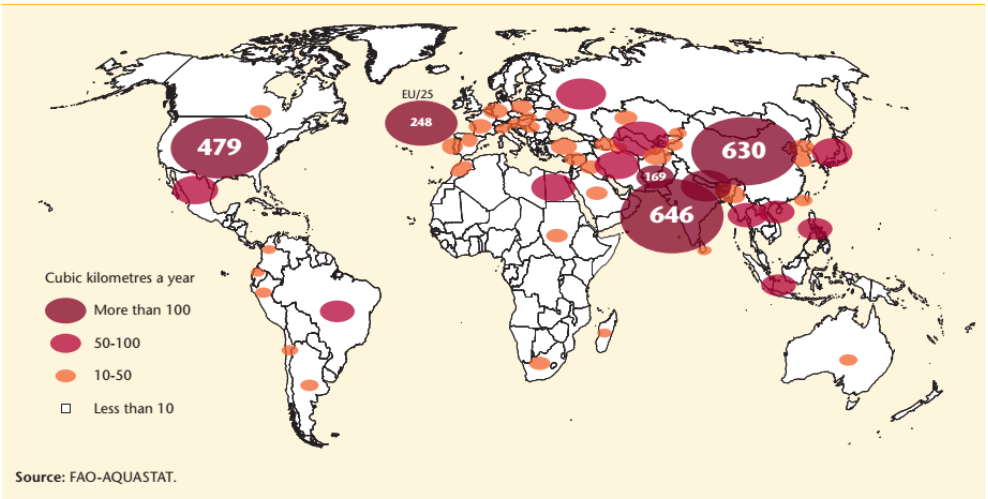

Figure 2 : Water withdrawals across (UNESCO 2009)

III. INDIAN SCENARIO

"Every minute during the next twenty years, 30% Indians will leave rural India for urban areas. India will need some 500 new cities. If there were ever a time to focus on the smart growth of our urban areas, that time is now"(Development 2011).

In Conventional Urban Water Management, water supply, wastewater and storm water are considered as separate entities. Currently, the system that Indian cities follow, requires importing huge quantities of water from remote catchments and groundwater sources, delivering potable water to all urban uses and subsequently collection of generated wastewater. Cities should sustain with the available resources, without depending on any other external source. Indian cities are fortunate to learn from its past on how to conserve water and maintain the balance. Cities need strong policies for the conservation of existing resources and teach future generations with lessons of being sustainable (IRAP 2010).

It is observed that the central part of the India is more water deficient than the northern or southern parts of the nation. Nearly 40% of water demand in urban India is met by ground water, and ground water levels have been falling at an alarming rate of 2-3m per year. Studies shows that a population of more than 1.5billion will be at risk of flooding and many cities will be affected with drought.Both In-migration and Out-migration are taking place in all the Indian cities. The gap between Water demand and supply has increased continuously. Many areas do not have access to piped water supply lines. The sewage generated is not treated completely, leading to pollution of water bodies. The city does not have sufficient storm water drains. And last but not the least, the water bodies have remained polluted, thanks to the sewage effluents and pollution caused by citizens.

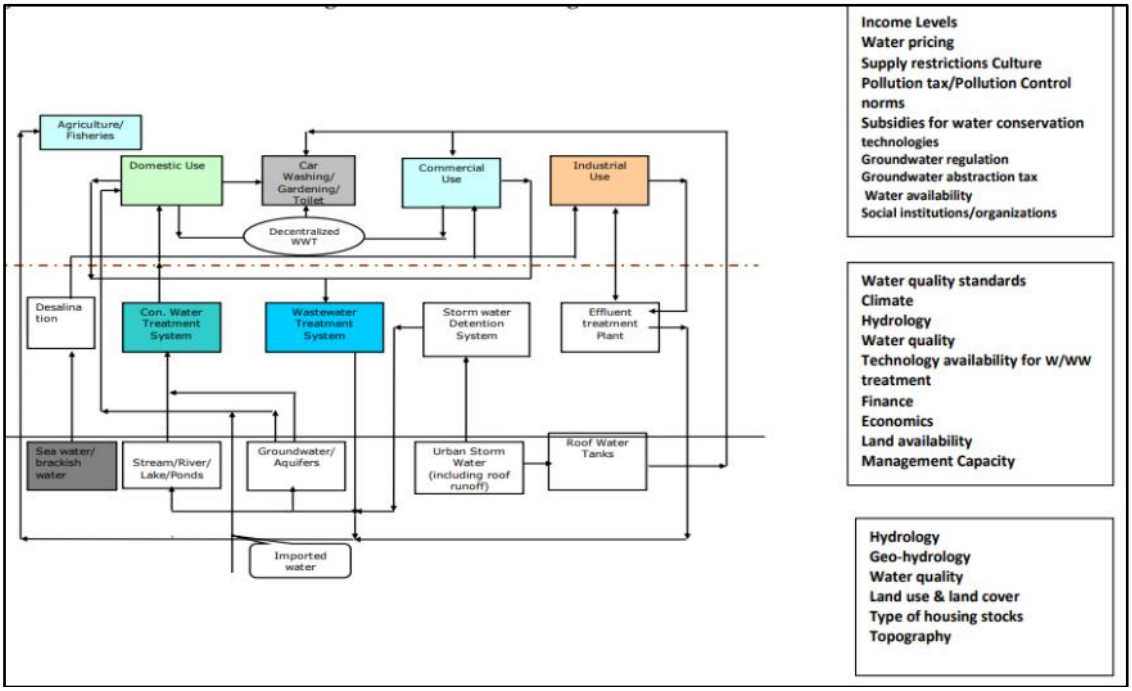

Figure 3: Generic Framework for Integrated Urban Water Management. Source: (IRAP 2010)

Findings From Global And Indian Scenarios

- Within the next 20 years, the 60% population will be urban. 95% of the urban growth will be in the developing countries. The cities will need to think about sustainable water sources for the coming years.
- The demand for freshwater is increasing by about 64 billion m3 a year. The percentage of the world population affected by water-scarcity could raise from 8% to 47% in the coming three decades. Countries have been over exploiting their water aquifers leading to fall in water table in many parts of the world.
- Lack of proper storm water management systems is a big concern.
- Outdated infrastructure, poor operations and maintenance policy, including ineffective record-keeping systems, Inadequate technical skills and technology, unsuitable tariff structure and/or revenue collection policy, political, cultural, and social influences, a higher incidence of commercial losses, particularly illegal connections etc. are issues that can't be neglected.
- Urbanizing India, currently being water stressed, with per capita water availability as 1544 m3/year in 2011, 1340 m3/year in 2025 (estimated) and 1140 m3/year in 2050 (estimated), is moving gradually on its way to reach water scarcity status.

IV. SCENARIO OF HYDERABAD

Hyderabad Metropolitan Development Authority (HMDA), is spread over an area of 7257km^2. Being a state capital and a metropolitan city, Hyderabad has always prone to flooding in monsoons and water shortages in summers. The city has the board called Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) to supply portable water including planning, design, construction, maintenance, operation & management of water supply system for the urban region.

4.1 Source of water supply

From the formation of Andhra Pradesh State in 1956, several schemes has been taken up to enhance water supply to the city of Hyderabad to meet growing demand. City being without any perennial river of its own, is continuously dependent on the lakes and tanks for drinking water purposes.

Hyderabad is one of the metropolitan cites of India with a population of approximately 10 million (census 2011). Urban Hyderabad receives approximately 2068 MLD from its 5 major sources, i.e., Osmansagar, Himayatsagar, Singur, Krishna, Godavari and Manjira. City of Hyderabad requires an average of 320 to 340 MGD and is drawn from 6 sources. According to Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB), forecasts water supply and demand rates for the city as follows.

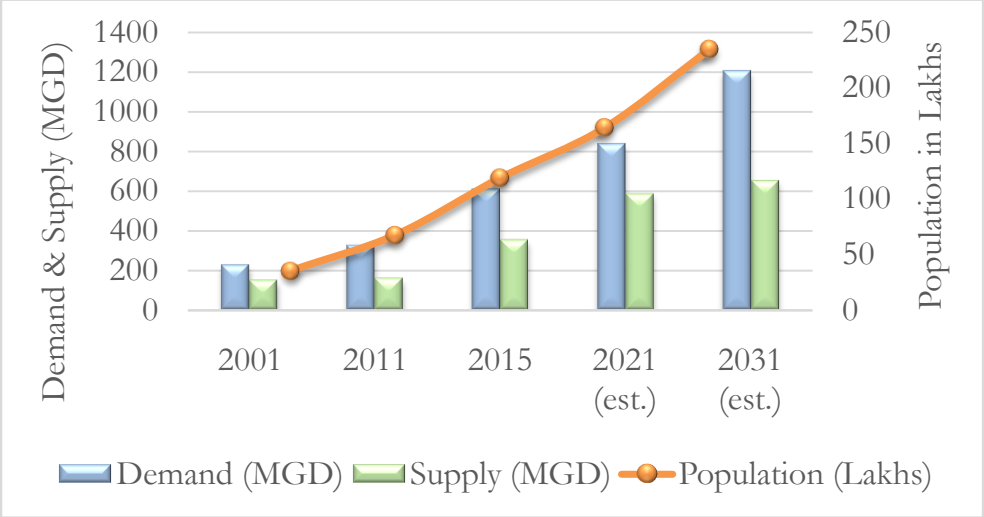

Figure 4: Water demand and supply vs population projections for the city of Hyderabad. Source: (USAID)

Table 1: Water sources and withdrawals for the city of Hyderabad

S. No.	Year of Initiation	Source	Distance from Hyderabad (km)	Daily Supply (MLD)	System mode
1	1920	Osman Sagar (Gandipet) Lake - Musi River	15	40-68	Gravity
2	1927	Himayathsagar Lake – Esi River	9.6	40-50	Gravity
3	1965 (Phase 1) 1981 (Phase 2)	Manjira Barrage-Manjira River	58 59	68 135	Gravity/pumping
4	1991 (Phase 3) 1994 (Phase 4)	Singur Dam – Manjira river	80 80	171 176	Gravity/pumping
5	2004 (Phase 1) 2008 (Phase 2)	Nagarjuna Sagar Dam (principal supplier to city) - Krishna River	116	261	3 stage pumping
6	2015 (Phase 3) 2015 (Phase 1)	Krishna project Godavari project	Srisailam (152); Joorala (186); Nagarjunasagar(131) SriramSagar (200); Yellampally (170); Inchampally (270) Kanthalapally(270)	409 386	Gravity/pumping

Source: edited from(USAID 2016)

4.2 Service Level Benchmarking Index

Table 2 : Service level benchmarks for Hyderabad

Proposed SLB Indicators	**MoUD Benchmark**	**Hyderabad Score**
Coverage of water supply connections	100%	90%
Per capita supply of water	135 LPCD	162 LPCD
Extent of metering of water connections	100%	20 - 30 %
Extent of Non-Revenue Water (NRW)	20%	--
Continuity of water supply	24 hours	Intermittent
Efficiency in redressal of consumer complaints	80%	87%
Quality of water supplied	100%	94%
Cost recovery in water supply services	100%	66%
Efficiency in collection of water supply-related charges	90%	68%

Source: (USAID)

4.3 Billing and water charges

Cost recovery for the water infrastructurehas always been one of the critical issues for all municipalities of India, and is equally applicable to Hyderabad. Though the city's tariff structure is realistic but there are high technical losses, with a 25 percent meter default rate. A predefined tariff rates for people with metered connections and they have to pay according to the designated slab rates. The HMWS&SB developed a system of online billing and collection for greater efficiency in billing cycle and revenue collection. This system, functional since 2009, involves 630 meter readers issuing bills and collecting payments directly from consumers and enabling real-time update of billing and collection information. Bills are raised on a bimonthly basis for domestic users, and on a monthly basis for institutional, commercial, and industrial users. Payments are accepted at 42 e-seva-centers across the city, at designated cash collection counters of the HMWS&SB. Payments can also be done online.Recently introduced online payment is giving promising results. It not only increased consumer convenience but also improved revenue collection from INR 24 crores (USD 3.6million) to INR 30crores (USD 4.5million)in 2009(USAID).

V. NEED OF MANAGEMENT SYSTEM

A metropolitan city's growth is bound to have a major influence on the urban water environment. With increasing urbanization, the impact on the water resources in very much observed with ease. Already water environment degradation is becoming a major concern among the policymakers. The city is growing both laterally as well as population wise. There exists a water supply demand gap. There is a significant water loss through the supply lines. Most of the rain water flows through the streets and goes waste. The city lacks storm water drains. The water bodies are polluted. The city which is going to be one of India's 100 Smart cities, needs to look for a proper water sensitive oriented strategy for the coming future. The integrated urban water management based strategy for Hyderabad will be a multidimensional approach including all aspects of the water cycle, wastewater, storm water, and drinking water and water bodies to optimize operation and management solutions.

What needs to be done for achieving the integrated urban water management?

After studying the existing scenarios, issues, case studies and household surveys and citizen's responses, by adopting the following ways, we can make city water sensitive.

1. Provision 100% storm water drains, and connecting them to the local water bodies.
2. Controlling/ reducing the imperviousness by 10% in every planning year. Encouraging vertical Developments.
3. Decrease the runoff volume by implementing rain water harvesting practices in the new as well existing houses/buildings and adopt artificial recharge techniques like SUDS, recharge shafts in gardens and open spaces.
4. Adopt decentralized waste water recycling systems in / gray water recycling in households, commercial, public places, government offices and industries to reduce raw water demands.
5. Protect and conserve the existing surface water bodies from getting encroached, polluted and degraded and Regulate the activities near to surface water bodies to protect the surface water bodies and prevent surface and ground water pollution (as seen in Singapore and Melbourne)
6. Keep the shoulders of the roads pervious, thus helping the ground water recharge. Promote porous pavements. (as seen in Singapore and Melbourne)
7. Carryout awareness programs in the city for water conservation.

VI. BROAD POLICIES FOR CONSERVING WATER

Cities should sustain with the available resources, without depending on any other external source. Indian cities are fortunate to learn from its past on how to conserve water and maintain the balance. Design should be in integration with nature. Following design ideas can be adapted to any place and also serves the purpose of growing population.

1. Protect water bodies from pollution and extinction
2. Conserve the stormwater
3. Reuse the grey water
4. Replenish the groundwater
5. Adopting modern technical methods

1. Protect water bodies from pollution and extinction

- Urban Local bodies should take care of all water bodies within their jurisdiction. For example, the government of Telangana has been rejuvenating lakes and water bodies in the name of "**MISSION KAKATIYA**".

- Existing water bodies should be cleaned and maintained. Controlling weed growth (in case of still lakes), and deposition of silt (in case of flowing rivers) should be inspected regularly.
- Buffer has to be maintained along the water bodies and developments must be restricted. Plantations should be planned to control soil erosion.
- Pollutants should be restricted from entering into, existing drainage lines should be diverted to a wastewater treatment plant.
- Wastewater treatments plants should be planned as per the requirement.

2. Conserve the stormwater

- To avoid any cases of flooding, stormwater should be managed and the water can be used for the rest of the year.
- Integration of Green Infrastructure (GI), SuDS (Sustainable Drainage System) should be considered. The following figure explains how a city can be modified with simple alterations of physical infrastructure to Green Infrastructure. This also provides a link from the local scale to the regional scale.
- A dedicated stormwater network has to been provided which can collect rainwater in the entire catchment and depending on the feasibility, appropriate methods should be adopted.
  - All the stormwater can be diverted to wetlands (periphery of the area).
  - Construction of step wells should be given a chance again at possible locations.
  - Step wells should be developed as an integral part of parks, so their maintenance is taken care of by the park authorities. It also adds up significance to the place.

Figure 5 : Integration of Green Infrastructure which includes hubs and linkages. Source: (Scottish Govemment 2011)

3. Reuse the grey water

At household level:

- People should be educated over the importance of the collection of stormwater and reuse of grey water.
- With minimal treatment, grey water can be used directly for gardening and landscaping.

At the ULB level:

- Treated water from wastewater treatment can be diverted to agricultural use.
- The concentration of stormwater can be diverted to outskirts or step wells, to cease the cases of flooding within the city.

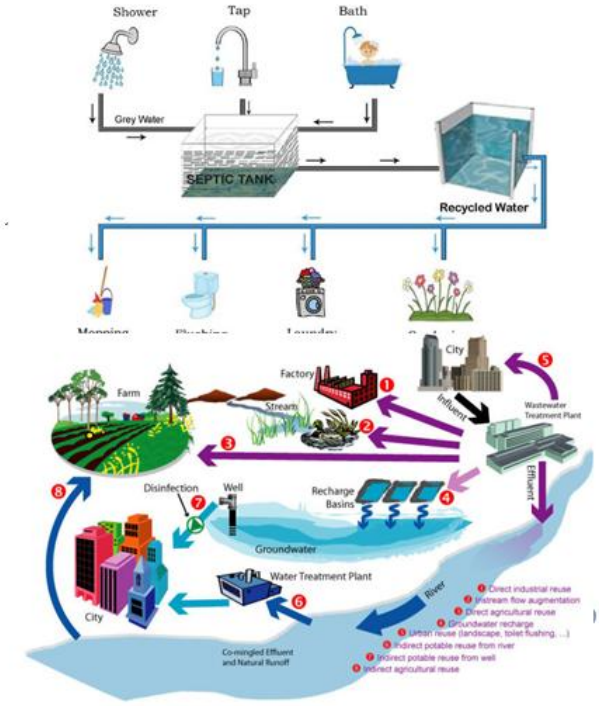

Figure 7: Water Reuse. Source: (Gulch 2018)

4. Replenish the groundwater

- Intermediate Step wells will contribute to groundwater recharge.
- Wetlands on the outskirts will recharge groundwaterlevels and contributes to maintaining the groundwater table.
- Household stormwater harvesting can be diverted to unattended bore wells, which can replenish groundwater at the household level.

5. Adopting modern technical methods

- Water should be charged. Metered water connection will make people limit unwanted usage.
- Encourage organic farming, thereby limiting the use of fertilizers.
- Green roofs, low energy consumption buildings should be planned.
- Low water consuming irrigation techniques.

This way, cities can sustain its resources and also accommodate population growth.

VII. CONCLUSION AND SUMMARY:

Water is the basic requirement for life on earth. Water is needed for the developments on earth. But this water is a limited resource.

The research focusprimarily on a strategy making for achieving water sensitivity for Indian cities. Hyderabad is on its way to tackle water scarcity in the coming years with increasing supply networks. Protection and conservation of water bodies and other sources of water will lead the city to achieve Waterways community. Adopting to water conservation methods at home, at community level, at public level, at everywhere will lead the city to become Water cycle community. Finally, the situation when the city becomes totally self-dependent for water requirements with no need for new water resources, the city will become Water Sensitive City.

The idea of in house water efficient appliances, rainwater harvesting, grey water recycling etc. is significant for the point of water saving, conservation and demand reduction. Provided the complete grey water gets recycled, the city will not require any new water resource, and truly it will be called sustainable and water sensitive.

But, howsoever new technologies are proposed, it is very necessary to create awareness for any purpose which will help in fulfilling the strategy.

Bibliography

[1]. Chand, Smriti. 2019. Water Scarcity in India. http://www.yourarticlelibrary.com/essay/essay-on-water-scarcity-in-india-1113-words/20871.

[2]. Development, Ministry of Urban. 2011. "Report on Indian Urban Infrastructure and Services." New Delhi.

[3]. 2017. Grey Water Recycling. http://www.zandxmechanicalinstallations.com/greywater-recycling/.

[4]. Gulch, Coyote. 2018. "Reuse into building design." Urban designers are incorporating. https://coyotegulch.blog/2018/01/02/ca-urban-designers-are-incorporating-reuse-into-building-design/.

[5]. Human Development Report. 2006. Human Developemnt Report. United Nations: United Nations Development Programme.

[6]. IBM. 2009. A vision for smarter cities. New York: IBM Global services.

[7]. IRAP, Institute for Resource Analysis and Policy. 2010. "Tool kit for Integrated Urban Water Management." Hyderabad.

[8]. Migration TablesD1,D1(Appendix), D2 and D3 tables. 2001. Data Highlights. New Delhi: Census of India, Govt. of India.

[9]. 2019. "India's Demography at 2040." In Economic Survey 2018 - 2019, by Department of Economic Affairs Ministry of Finance, 128-147. New Delhi: Govt. of India.

[10]. Ministry of Urban Development, Government of India and The World Bank,. 2015. "City Development Plan for Nagpur- Revised Draft Report- 2041." Nagpur.

[11]. Rainmaker. 2020. Rainmaker. Aug. http://rainmakerww.com/about-global-water-crisis/.

[12]. Scottish Government. 2011. Green infrastructure: design and placemaking. November. Accessed July 2020. https://www.gov.scot/publications/green-infrastructure-design-placemaking/pages/3/.

[13]. UNESCO. 2009. Water in a changing World : The United Nations World Water Development Report 3. Paris, London.

[14]. USAID. 2016. Drinking water supply for urban poor: city of Hyderabad. Assessment Report, Hyderabad: Safe Water Network. https://www.hyderabadwater.gov.in/en/index.php/about/source.