Climate Resilient Cities in Context of Urban Water and Sanitation

CWAS CENTER FOR WATER AND SANITATION | CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION | CEPT UNIVERSITY

Darak Sakshi Omprakash | PUI20299

Masters in Urban Infrastructure

Faculty of Planning

Batch of 2020-22

Guided by

Upasana Yadav and Dhwani Sheth

Climate Resilient Cities in Context of Urban Water and Sanitation

Darak Sakshi Omprakash
Roll №: PUI20299

Upasana Yadav
Dhwani Sheth

Faculty of Planning

CEPT UNIVERSITY

2022

Ahmedabad, India

Intellectual Property Rights (IPR) and Publications:

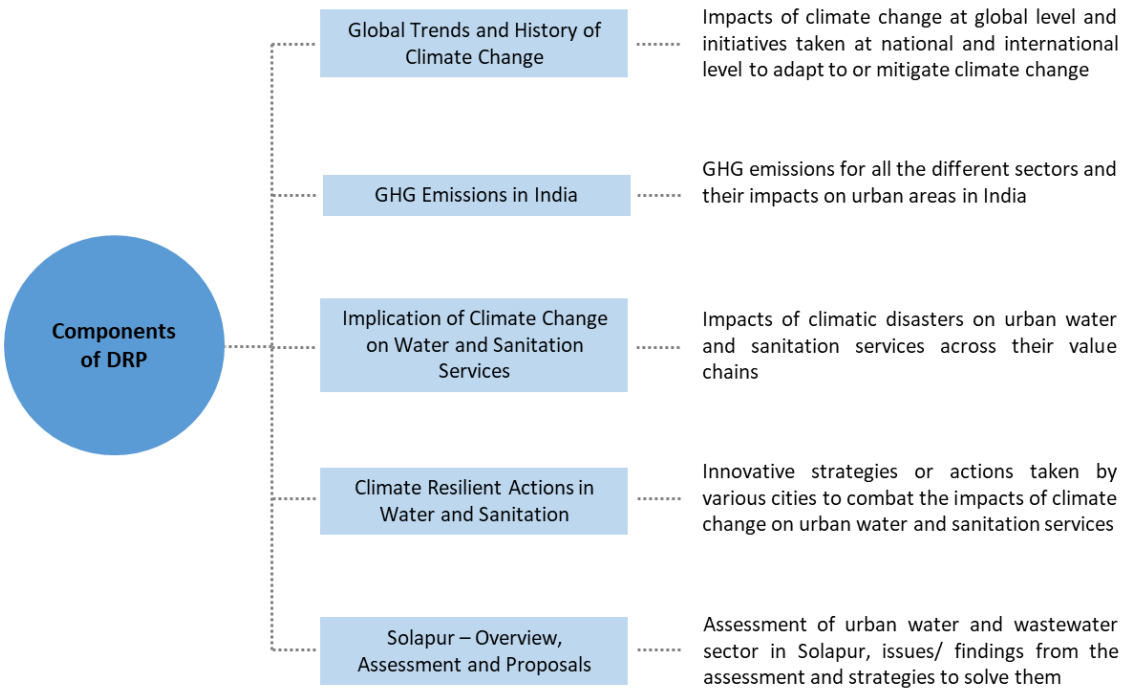
The copyright for this report shall remain equally with the Centre for Water and Sanitation (CWAS), CEPT Research and Development Foundation (CRDF) and CEPT University. All publications arising from this research/thesis project will acknowledge the concerned members of the both organizations.

Centre for Water and Sanitation (CWAS), CEPT Research and Development Foundation (CRDF) and CEPT University reserve the right to use the outputs of the research/thesis project for dissemination and publicity ensuring proper acknowledgment to the Student and Supervisor/s.

Executive Summary

Climate change is long term shifts in weather patterns and temperatures due to natural internal processes or external effects because of human induces i.e., anthropogenic changes in land use or in the composition of the atmosphere (Barros et al., 2012). Human effect on the climate system is obvious, and current anthropogenic emissions of Greenhouse Gases (GHG) are the highest in history (IPCC et al., 2015). Climate change is frequently described in terms of greenhouse gas emissions or carbon emissions. But people largely experience its impacts through water. Rising temperatures leads to floods, droughts and various other extreme weather events which disrupt the water supply and sanitation services in the urban areas. These disruptions larger impact the lives of communities and makes them more vulnerable. Hence, it becomes important to study the impacts of climate change on urban water and sanitation.

This Directed Research project (DRP) on 'Climate Resilient Cities in Context of Urban Water and Sanitation' aims at finding the identifying the implications of climate change and preparation of climate action plan from urban water and wastewater perspective for an Indian case city of Solapur. Key components of this DRP are summarised in the chart below.



Global Trends and History of Climate Change

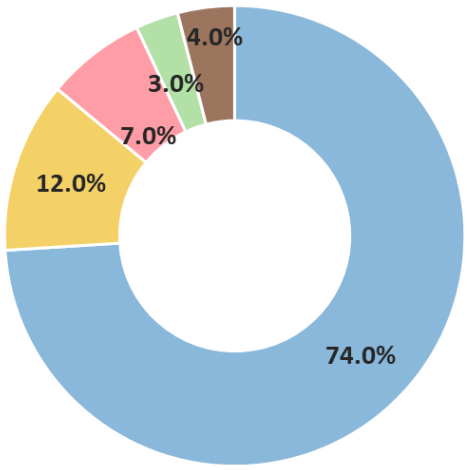
In this section, global impacts of climate change are studied and history of climate change i.e., conferences, meetings, discussions, agreements, policies and missions at national and international level, are mapped.

Sub-Saharan Africa and south and southeast Asia are most vulnerable to climate change: Cities in these regions are facing the sever impacts of climate change like increase in precipitation, increased frequency of extreme weather events, rising sea levels, increase in mean temperature, longer dry periods and reduction in river flows.

National and International actions have not led to expected impacts: In order to reduce the predicted impacts of climate change, numerous conferences, meetings and discussions have happened, steps and actions are taken, agreements and treaties are signed, policies and missions are launched at both, national and global level. Despite all these initiatives, the impacts of these actions are very low because of no strict, unavailability of climate finance, absence of monitoring authority/ mechanism, very less or no involvement of Urban Local Bodies (ULB) and no awareness about of climate change in citizens and local level government officials.

GHG Emissions in India

This section mentions the GHG emissions from all the sectors in India (energy, agriculture, industries, land use change and waste) and spatially maps the climatic disasters in India because of these emissions.



Contribution of waste sector to GHG emissions is only 4% but the impacts faced by it are large: Highest GHG emissions are from the energy sector followed by agriculture and industries. These emissions have led to numerous climatic disaster events in India, which have affected 25 out of 36 states and UTs. Rising temperatures because of GHG emissions cause huge damage to water supplies and sanitation services.

Implications of Climate Change on Water and Sanitation Services

In this section, implications of these atmospheric changes on water supply and sanitation services across their value chains, and the greater implications on the society as a whole are mapped.

Climate Change has larger implications on all the components of urban water and sanitation value chain: Climatic disasters because of climate change like rising sea levels, urban flooding, cyclones, droughts and heatwaves have huge implications on water supply and sanitation services across their value chains. These impacts are summarized in the figures below.

Impacts of Climate Change on Water Supply Services

	Water Source	Water Treatment	Water Distribution	User End
Rising sea levels	Saltwater intrusion affects the quality of water at source	Infrastructure corrosion Consumption halted		
Urban Flooding and Cyclone	Flooded latrine pits lead to pollution of surface and groundwater. Higher volumes of untreated wastewater discharge. Poor infiltration of rainfall during intense rainfall events.	Facilities are weakened, which makes them either less efficient or damaged Water reservoirs are weakened		Service interruptions Inaccessible Water points Drop in the quality of water distributed
Droughts and Heatwaves	Lack of surface water and groundwater Higher concentrations of various pollutants Algae blooms and increased salinity	Increase in water needs and in volumes withdrawn for all uses leading to over-use of facilities		Interrupted or temporarily reduced water supply services Drop in the quality of water distributed

Impacts of Climate Change on Sanitation Services

	User Interface	Collected and Storage	Transportation	Treatment	Disposal/ Reuse
Rising Sea level, Urban Flooding and Cyclone	Collapse of latrines	People no longer have working sanitation facilities available Increase in waterborne diseases	Pit emptying services are disrupted Breakdowns of pumps and electrical systems.	Treatment processes fail to function correctly due to hydraulic overload.	Increase in untreated wastewater discharged into the environment
Droughts and Heatwaves	Problems with usage of flush latrines because of unavailability of sufficient water Choking of sewer systems	Olfactory pollution Hydrogen sulphide (H_2S) production is exacerbated by the heat increasing the risk to staff of poisoning through H_2S inhalation, especially sewer workers.		Biological treatment processes fail to function. Condition of treatment infrastructure and facilities deteriorate	The wastewater discharged is not properly treated resulting in a drop in water resource quality and Disruptions to ecosystems and biodiversity

Climate Resilient Actions in Water and Sanitation – National and International Case Studies

Smaller, cost effective and easily implementable solutions can create larger impacts in adaptation/ mitigation to climate change: Cities across the globe have used various innovative actions/ strategies to adapt to or mitigate the effects of climate change on urban water and sanitation sector. All these case studies reviewed imply that smaller, cost effective and easily implementable solutions related to renewable energy sources and tapping local water resources can make the water and wastewater sector in urban areas more capable to adapt to climate change. Though numerous cities have undertaken innovative initiatives to combat climate change, but a lot more needs to be done in water and wastewater sector, since water is the key ingredient in helping communities to adapt to climate change.

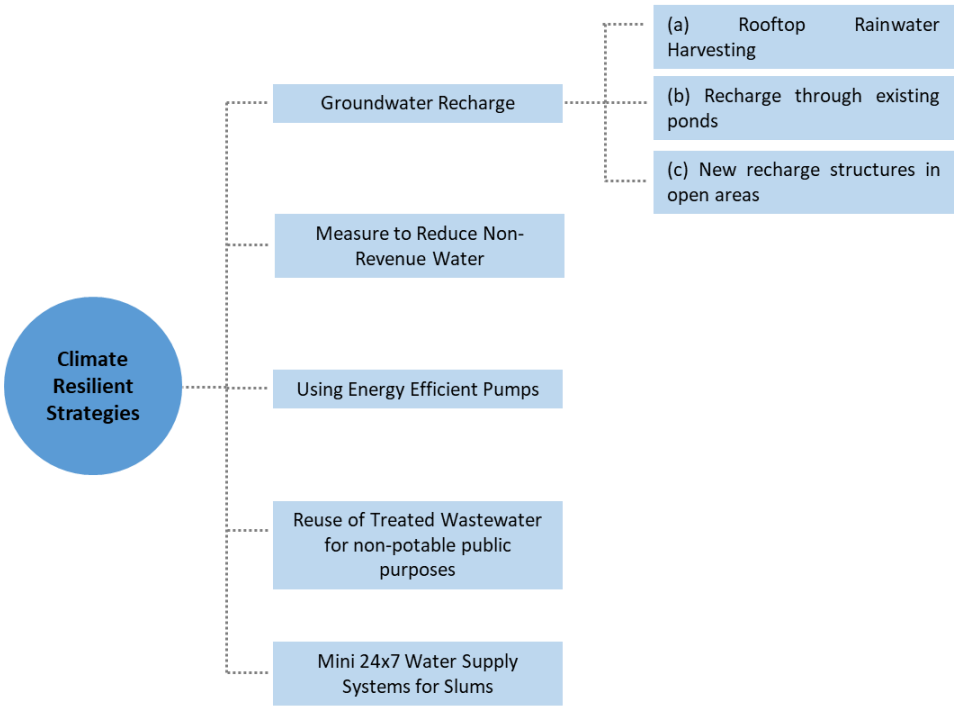
Solapur – Overview, Assessment and Proposals

Solapur has a population of 9.5 lakh (as per census 2011) and an area of 178.6 sq. km. under the jurisdiction of the Municipal Corporation. In this section, the overview of Solapur city is mentioned, its water and wastewater system are assessed across the value chain, issues are found out and proposals for these issues are mentioned.

Drought condition in Solapur has intensified because of climate change and the city is facing water scarcity: Solapur lies in the drought prone region of Maharashtra since past 30 years. Increase in temperature of the city and decrease in rainfall and green cover over years proves that climate change has affected Solapur. Most significant impact of this climate change is intensification of the drought condition which is leading to increased water scarcity.

Major problem that Solapur has is water scarcity: Increased water scarcity is leading to high dependency on only one own source of water i.e., groundwater and this over dependency is depleting their levels. Despite numerous water scarcity events and depleting groundwater resources, Solapur has large (45%) extent of Non-Revenue Water (NRW). Moreover, there is no reuse of treated wastewater even in such disastrous situation. Other smaller issues with this sector are presence of older pumps in treatment and distribution system leading to high energy consumption and the problem of over flooding in Slums.

Focus is on developing alternative sources of water: Focus of the proposals in on developing an alternative source of water either by capturing rainwater or by reusing treated wastewater.



All the solutions/ strategies are short term solutions which will solve immediate problem. For wider, faster and better implementation of these climate resilient strategies and for implementation of larger ideas in longer term, some softer supportive aspects like policy backing and stakeholder participation are necessary.

Conclusion

All these interventions lead to three main outcomes: (a) Groundwater recharge and (b) treated wastewater reuse and (c) reduced GHG emissions from water and wastewater sector. Rainwater captured using these groundwater recharge techniques equals to 22% of the total water supplied by Solapur Municipal Corporation (SMC) annually. Whereas use of energy efficient pumps leads to 10% reduction in the GHG emission from water and wastewater sector.

Implementing these strategies in Solapur would make the city more self-sufficient in case of intense drought events and longer dry period. Capturing rainwater would make intense rainfall events fruitful for the city and also reduce the risk of flooding. In longer run, these strategies would take Solapur one step closer to achieving water security.