



MOVING BHUJ TOWARDS WATER SECURITY

Executive Summary



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*“ The rain on your roof, stays in your home;
the rain on your field, stays in your field;
rain on your village, stays in your village,
‘If you quench the thirst of Mother Earth, she will quench yours ...”*

-Pandurang Shastri Athawale

Introduction

In recent years, with increasing urbanization water scarcity has become a major concern for cities. History teaches us that many civilizations were wiped out due to water scarcity. With climate change and resultant uncertain weather patterns, cities have become more susceptible to water scarcity. This study of Bhuj, a city located in the arid region of Kachchh in India, demonstrates how a city that had withstood water scarcity for centuries in the past, has revived its traditional wisdom to work towards becoming water secure again. Its survival in the past was made possible due to the strategic water reserves created through a water management system of linking lakes and wells. The journey of Bhuj from evolution of its traditional water supply system to its complete decline, where the city's transition to a modern centralised water system led to higher dependence on distant sources and complete neglect and misuse of its own groundwater sources. The report also highlights the role of participatory ground water management and efforts of local resident groups and in particular the role of Arid Communities and Technologies (ACT), a local NGO, in reviving the traditional water conservation practices. Over the past decade ACT has worked relentlessly in creating awareness and adopting a participatory approach for water security, backed by technical studies of water resources systems. The study and documentation of these processes serve as a background for developing urban PGWM guidelines that can be used in other cities and pave the way for them to become water secure.

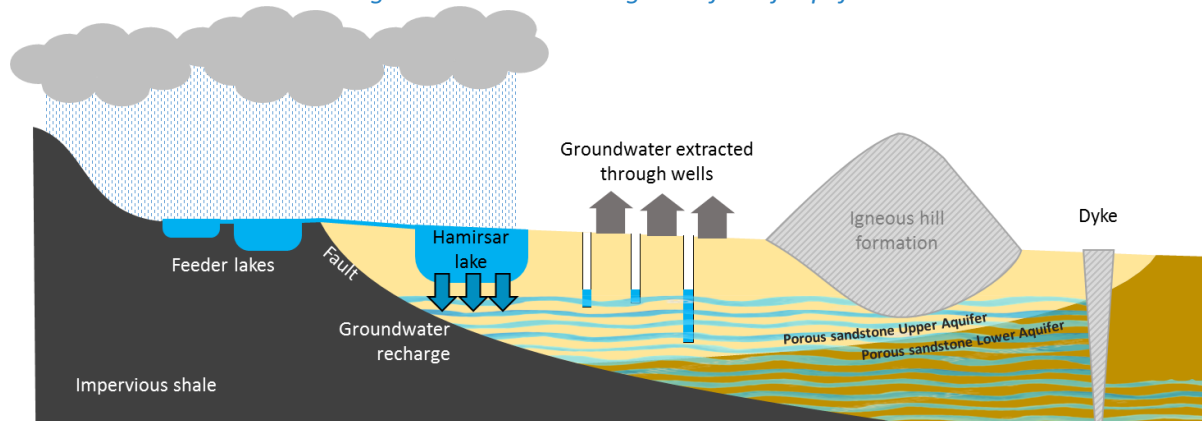
Evolution of water supply system in Bhuj

Bhuj is located in the arid region of Kachchh in India. As per data from Indian Meteorological department, it receives an average annual rainfall of 430 mm while there are only 15 rainy days in a year.

Within the Kachchh region, the settlement of Bhuj has unique geo-hydrology and aquifer system. The city resides on a large porous sandstone aquifer. This cretaceous sandstone belt has enormous capacity to hold water for year-round municipal and agricultural use. Fault lines and dykes on south, east and west, geographically confine the aquifer. The Hamirsar lake system is located over this and together they act as a spongy layer for recharging water. The Hamirsar lake system consists of

receiver lakes that recharge the aquifer and are located on permeable sandstone. The feeder lakes are located on impervious shale in upper catchments, preventing percolation until water can be moved into the urban area where it is most needed. When the aquifer is full, healthy and potable water can be easily accessed through wells.

Figure 1: Schematic diagram of Bhuj Aquifer



The history of Bhuj water resource management dates back to more than 500 years. Bhuj was established by Rao Hamirji in the year 1510 and later declared the capital of Kachchh. During 1510 to 1549, from the inception of Bhuj to its declaration as a capital, the Hamirsar lake system was developed to harness water from its catchments. With an exhaustive understanding of the hydrology of region, local rulers linked adjoining watersheds with a series of dams and canals to feed the artificial lake that eventually earned the name ‘Hamirsar lake.’

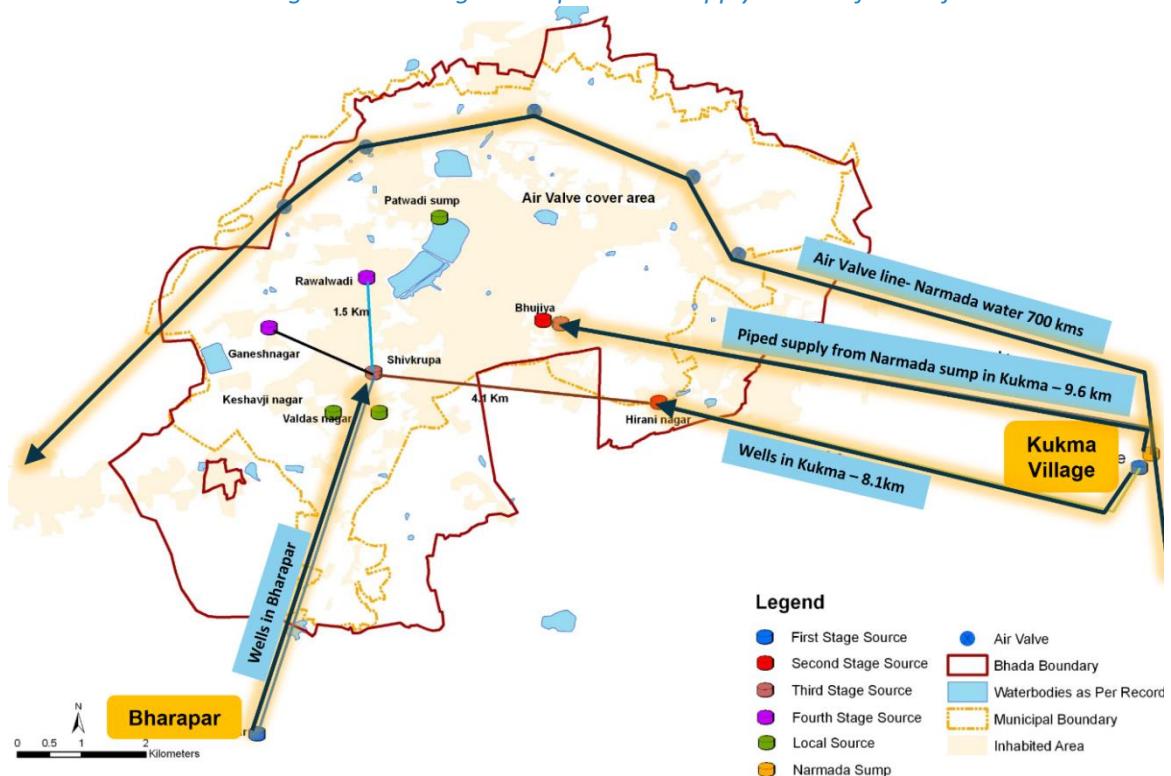
The major function of Hamirsar lake was to recharge the groundwater and make water accessible to the people of Bhuj through a system of wells. The entire catchment system was well-managed and activities such as de-silting, cleaning of lakes and cleaning of channels in catchment areas were done regularly to ensure its efficient operation. Thus, nearly 450 years of careful catchment management and development kept the aquifer healthy and continuously recharged throughout the year. Historical evidence indicates that not only the arid Bhuj town met its water requirement efficiently during drought but also planned water harvesting for the future.

Piped water at Doorsteps

With the annexation of Kachchh by the British in India, water supply systems came under the direct purview of British rule. The British introduced a more centralized system of management staffed by civil engineers, who were largely not familiar with the local water resource management systems. The twin effect of lowered fiscal resources and an unaware administration led to the neglect of the traditional management system. Despite this, the traditional water system was sufficient to cater to the water requirement till the 1960s. However, with the growing population, rapid expansion of the city and resultant demand for water, centralised piped water system was introduced in Bhuj.

Over the years, Bhuj became dependent on water being brought from a large distance. The traditional sources were further neglected due to the piped water system. As a consequence, the common people lost touch with the traditional systems with water available at their doorstep. Neglect of the catchment led to drying up of many lakes, which then were taken over for urban uses by realtors in the city. Also with a centralized piped system, average household consumption started to rise significantly. Water demand exceeded the available supply, resulting in the haphazard digging of wells which interfered with spring discharge and resulted in excessive withdrawal from aquifers. In addition, contamination of aquifer through improper discharge of waste water constituted major health hazards. These ultimately resulted in the deterioration of groundwater quantity and quality.

Figure 2: Existing Municipal water supply sources for Bhuj



Challenges and opportunities for water security

Over the past fifty years since the piped water supply system was introduced in Bhuj in 1968-69, there have been significant changes in sources of water supply for the Bhuj municipal area. In exploring potential sources of water, the municipality went 11 km east of Bhuj boundary in Kukma village. Nearly 26 borewells in Kukma and 4 bore wells within the city supplied water upto 2 Million Litres per Day (MLD) to Bhuj city in 1970. Currently, the same sources provide nearly 12 MLD of water. In addition to this, Bhuj Municipality has started receiving water from the Narmada canal since 2004. Compared to a smaller quantity of 4 MLD in the beginning, water from this source has increased to an estimated 20 MLD in 2015. Today, Bhuj city receives a total of 32.5 MLD of water

from different sources. However, there are large variations in end-user access in different areas. A few areas receive water every alternate day while some areas receive water once in three or even four days. Despite supplying water through municipal system, large numbers of households and institutions also depend on alternate sources like private wells or tanker supply to meet their water demand. In addition, groundwater is also extracted for industrial and agriculture uses. This has resulted in rapid depletion of groundwater in the aquifer. Lowering of groundwater levels has a compounding negative effect on its quality as it increases water salinity ingress. The water level in the aquifer has dropped causing not just lack of access to water but declining potability of local groundwater.

Water Balance

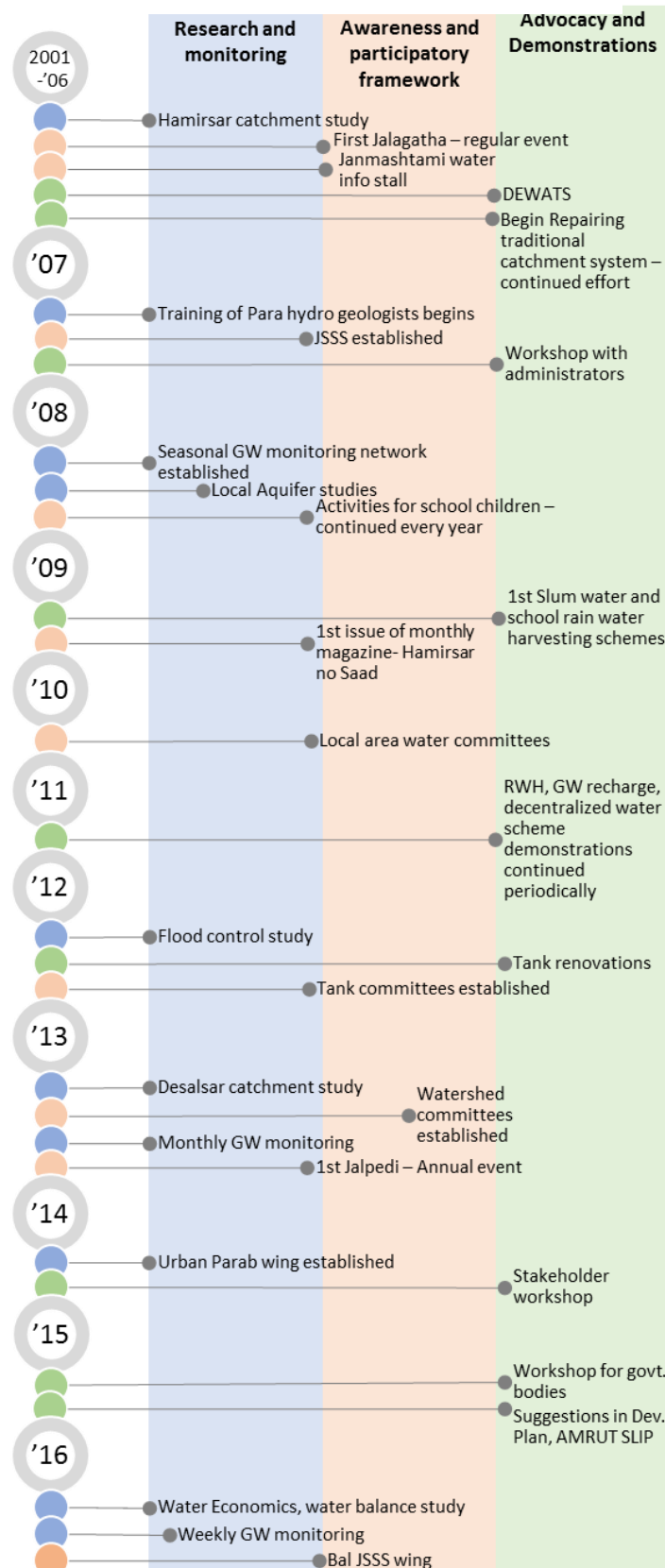
Supply of water in Bhuj is a big challenge with growing demand, rapid population growth, depletion of groundwater in the aquifer and deteriorating water quality. Moreover, haphazard change in landuse due to rapid urbanization has triggered a flood risk in city. Besides this, there is also a lack of proper institutional structure as multifarious organisations are involved in management of water resources and supply system. Reservoirs are overseen by various government entities with different priorities. There is a lack of management and maintenance of lakes and flood control systems. There is also lack of political will to remove encroachments and restore canals and lakes to their historic (and necessary) size. Looking at these challenges, it was decided to assess the potential of natural water resources in Bhuj. For this, a detailed water balance study was carried out. Three major watersheds viz. Hamirsar, Umasar and Desalsar watershed were taken to study the water balance of Bhuj city. The results show that in reality the balance tips towards a positive scenario where water is surplus for Bhuj, with more inflow than outflow (10.69 MCM). It clearly indicates that, Bhuj has enough reserves of water and hence it is possible, with better management, to tap its own resources carefully and eventually reduce its dependence on external and distant sources. Approaches for water management based on water balance study suggest more recharge or infiltration activities which will improve groundwater quality, prevent surplus runoff from flowing out of city by building adequate infrastructure for storage (ponds/lakes), reduce abstraction of groundwater for domestic and other usages and reduce distribution losses.

Approach for water security in Bhuj should essentially include revival of lakes and watershed system, integrated water resource planning, proposing rainwater harvesting and recycling wastewater.

Pathways to water security: ACT's efforts in Bhuj

Realising the deteriorating situation of water resources and inspired by rural initiatives, Arid Communities and Technologies (ACT), Sahjeevan and partners, initiated activities for a revival of

Figure 3: Timeline of ACT's PWGM activities in Bhuj



traditional water system, creating awareness among communities and other stakeholders. This was backed by an initial set of studies to understand the geo-hydrology and historical evolution of water resource management in Bhuj. ACT, through its work and studies, believes that Bhuj has an immense potential to be water secure and be self-sufficient. They argue that a paradigm shift is needed to improve water security in the region. Drawing inspiration from the “Pani thiye Panjo”, translated as “Let’s make this water ours again”, an initiative undertaken in the rural areas in the year 2006 by Water and Sanitation Management Organisation (WASMO), ACT decided to adopt this framework in urban setting of Bhuj.

The main aim of ACT was to demonstrate self-reliance of the city for its own water requirement through participatory planning. This involved understanding the extent and complexities of the problem, mapping stakeholders and establishing their willingness and ability to motivate community. Initially, their journey was not simple due to large scale of urban areas and the diverse community as compared to small close knit

communities in rural areas. Also acceptance of change by communities was more difficult in urban areas. Overtime, ACT realised that the people of Bhuj have a great affinity for the Hamirsar Lake. Thus, the Lake emerged as a common interest point and the awareness programmes were organized around the idea of the Lake as a unifying element for the communities. These activities led to increased awareness among residents of Bhuj towards the water problems. Involvement of people in various activities to revitalise the traditional lake system has inculcated a sense of ownership among people. People now recognise that the crisis of water security in Bhuj is real. They realise that it is not the responsibility of the government alone but a collective responsibility of all residents of Bhuj to mitigate the crisis.

Under ACT's initiative, a Citizen Committee forum called 'Jalstrot Sneh Samvardhan Samiti' (JSSS) was formed to carry out various activities related to watershed management. In the initial stages, the citizen committee was technically supported by ACT for detailed studies, research, data collection, capacity building, planning and monitoring related activities. Citizen committee with its effort has managed to create awareness among people of Bhuj about traditional water management system and efforts to restore it. Today the committee is also well known by the local government and other stakeholders.

Overtime it was also realised that only awareness creation was not enough for the JSSS. An in-depth technical knowledge of local geo-hydrology and water resources is essential to influence local government and advocate in its decision making process. Hence for the dissemination of technical knowledge, the concept of 'Parabs' was developed. The term 'Parabs' is given to para workers who work with JSSS to help them demystify groundwater management and develop technical plans. 'Parabs' are drawn from local communities, of few not having basic education. They are given extensive technical training before they are sent to the field. With the intensive training and on-field experience, the 'Parabs' have now become para-professionals for Participatory Ground Water Management in Bhuj. Based on the results of studies and research, demonstrations of different technology options were carried out with the aim of encouraging citizens to adopt them. Demonstration activities like revival of the Hamirsar system, groundwater recharge, rain water harvesting and decentralized drinking water supply systems were met with great success among citizens. Collaboration, strong advocacy and participatory approaches as witnessed in the participatory ground water management (PGWM) have been the key to success so far.

An important lesson from ACT experience is that people's participation can be meaningful when informed discussions take place during consultations. Such consultations require experts to explain

technical details to lay persons. Thus, ACT conducts regular workshops with decision makers to sensitize them with water management practices and issues in context of Bhuj.

The impact of collective efforts of all, revival of traditional water system and restoration of natural water resources has resulted in improving groundwater levels and its quality in Bhuj.

Moving from the vicious cycle of water scarcity to a Virtuous cycle of water security

In summary, Bhuj study shows how urbanization and a shift from the traditional to piped water supply system led to a water crisis. Inadequate municipal supply led to exploitation of groundwater. Poor pricing policy for municipal water supply has led to significant wastage. Absence of regulation for ground water abstraction has led to over exploitation. This has resulted in decline in the use of

Figure 4: Vicious cycle of threat to water security



local water resources and a neglect of the traditional water management systems.

On other hand, city population has been rising and there is an increased demand for land for housing and commercial activities. The dry lakes were taken over for construction work thus disturbing the natural path of flowing rainwater and causing flooding in parts of city. Apart from this,

failure in water governance due to multiple authorities and lack of regulations led to total neglect of local water resources. Thus, the vicious cycle of neglect of local water resources poses a major threat to water security of Bhuj. How to move from this vicious cycle to virtuous cycle?

The most important challenge is to ensure secure water resources for Bhuj in next decades. This could be achieved by moving towards integrated approach of urban water management supported by all stakeholders. Degradation of water resources and water scarcity make it imperative to rethink conventional urban planning practices wherein each component of urban water cycle (water supply, storm water, sanitation and land-use) is planned in isolation. The innovative approaches of Integrated Urban Water Management (IUWM), Participatory Ground water management (PGWM) and Water Sensitive Urban Design (WSUD) have to be linked with the urban planning processes and

backed by awareness and capacity building programme for efficient water management. It would help accelerate the activities related to revival of traditional watershed system through lake restorations and increasing recharge activities. This process should be backed by effective governance system to ensure sustainable water management. ACT and its

Figure 5: Virtuous cycle of moving towards water security

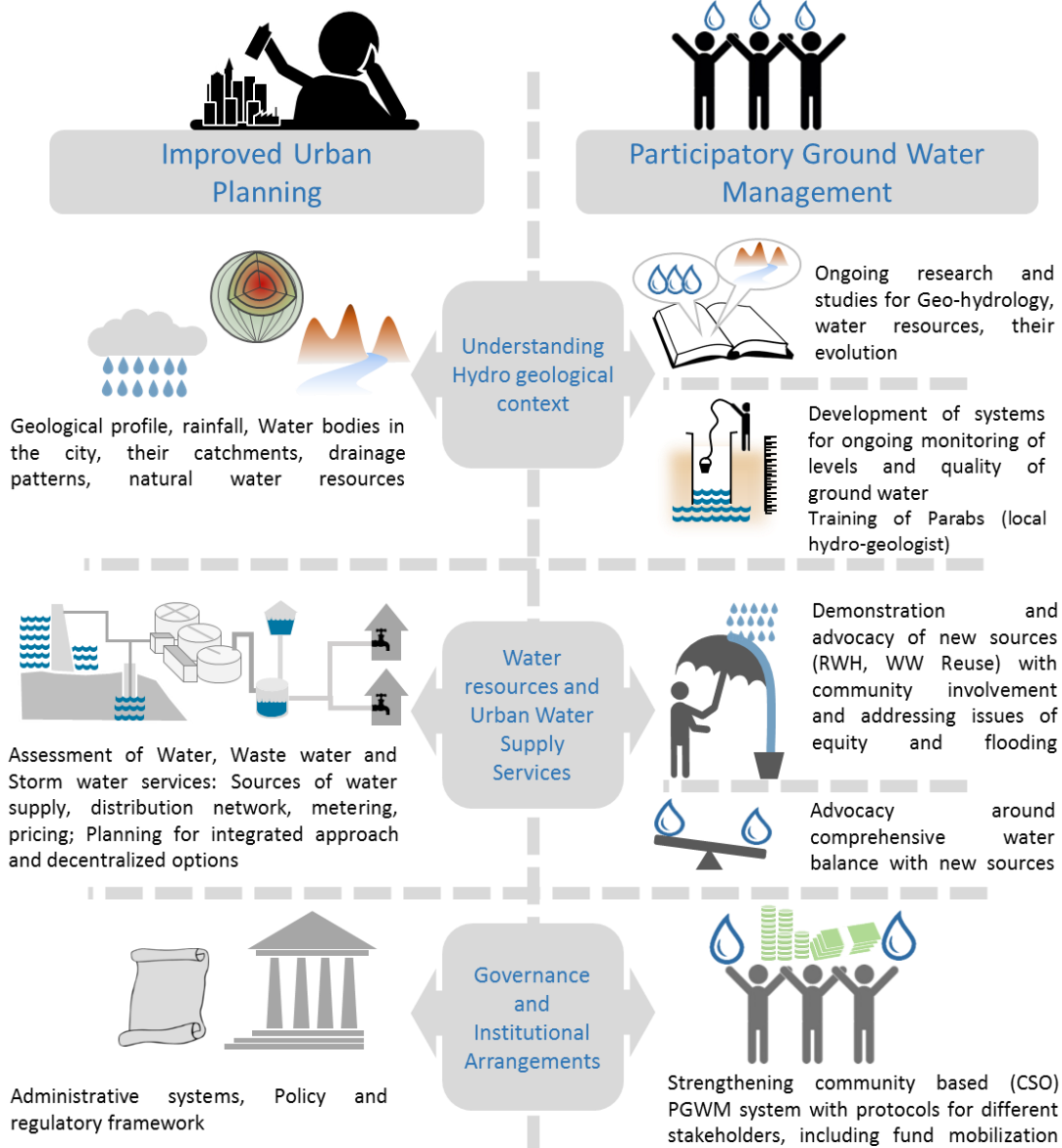


partners have already initiated efforts and demonstrated various pilot schemes through PGWM approach, which are helping Bhuj to move towards a virtuous cycle of water security.


Evolving Guidelines and protocols

A framework for Participatory Ground Water Management (PGWM) built around the creation and dissemination of a strong technical knowledge base with an equally strong Citizens’ Forum is the key strength of Bhuj participatory efforts. This approach can serve as a background for developing urban PGWM guidelines and initiating similar efforts in other cities. Guidelines and protocols for Participatory Groundwater Management (PGWM) should be considered around two broad areas : urban planners for improving the conventional planning approach to include water sensitive planning and another for PGWM that is aimed at strengthen civil society institutions for undertaking detailed field assessment of hydro-geological and water resource conditions, as well as demonstration activities.

Figure 6: Framework for Participatory Ground Water Management (PGWM)



The guidelines and protocols to be developed on the basis of Bhuj experience will pave way for other cities to become water secure.



Knowledge Management and Advocacy Partnership for Participatory Ground Water Management in Bhuj

CEPT University is the Knowledge Partner to Arid Communities and Technologies (ACT) for ground water management activities in the city of Bhuj, Gujarat.

CEPT supports ACT in documentation of processes related to Participatory Ground Water Management (PGWM) in Bhuj. Based on this study, CEPT plans to develop guidelines to promote Participatory Ground Water Management in Indian cities.

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