



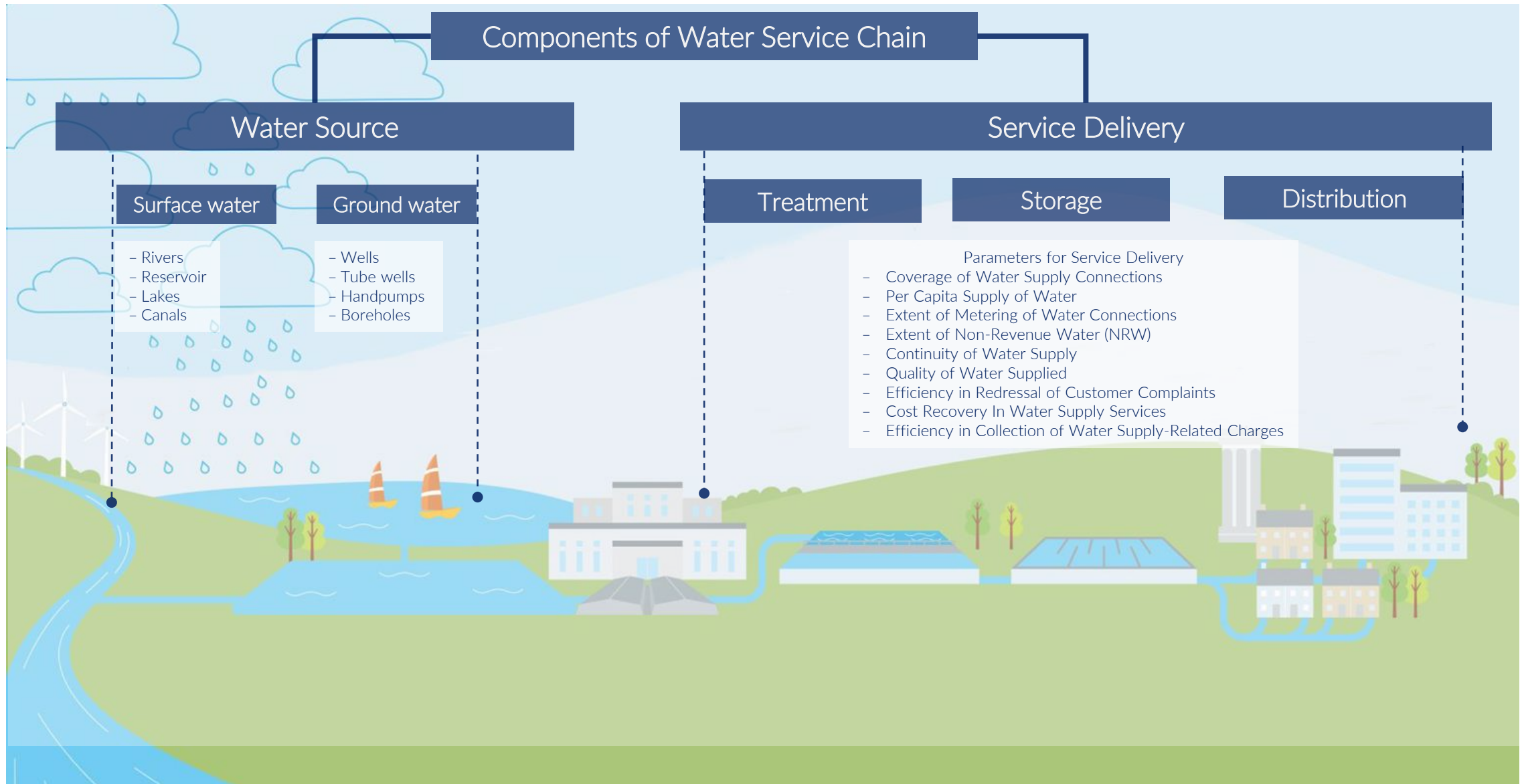
Assessment of water situation across the water service chain in Kachchh region- A Case study of Anjar and Gandhidham City

GUIDE: AASIM MANSURI
CO-GUIDE: PRIYADARSHNI CHOUDHARY

STUDY BY
RUTVIK BHATT | PUI21295

DRP SPRING SEMESTER 2023
MASTER OF INFRASTRUCTURE PLANNING
FACULTY OF PLANNING
CEPT UNIVERSITY

Water Service Chain comprises of Water source and Service delivery...



Sustainable Water Chain is an interface between Source, Service delivery and Management



Sustainable Source



Efficient Service Delivery



Water Management



Source water sustainability refers to the **long-term** ability to maintain a **reliable supply** of **high-quality drinking water** while **protecting the natural systems that provide** this water

WHAT?



Sustainable water system is a system which provides **adequate water quality and appropriate water quantity** for a **given need/time** without compromising the future demand

Efficient Water Management can help survive day zero situation

Most of Cape Town relies on surface source (dams) to supply the city with water. Three years of inadequate rainfall caused dam levels to fall to 21%



Below average Rainfall pattern



Warm Mediterranean climate



Climate Change Impacts



Population Growth



Supply Side Mismanagement

ULB Measures to overcome Day Zero



Demand incentives



Intensive supply management



Behavioral change

How Day Zero can be avoided



Water Conservation



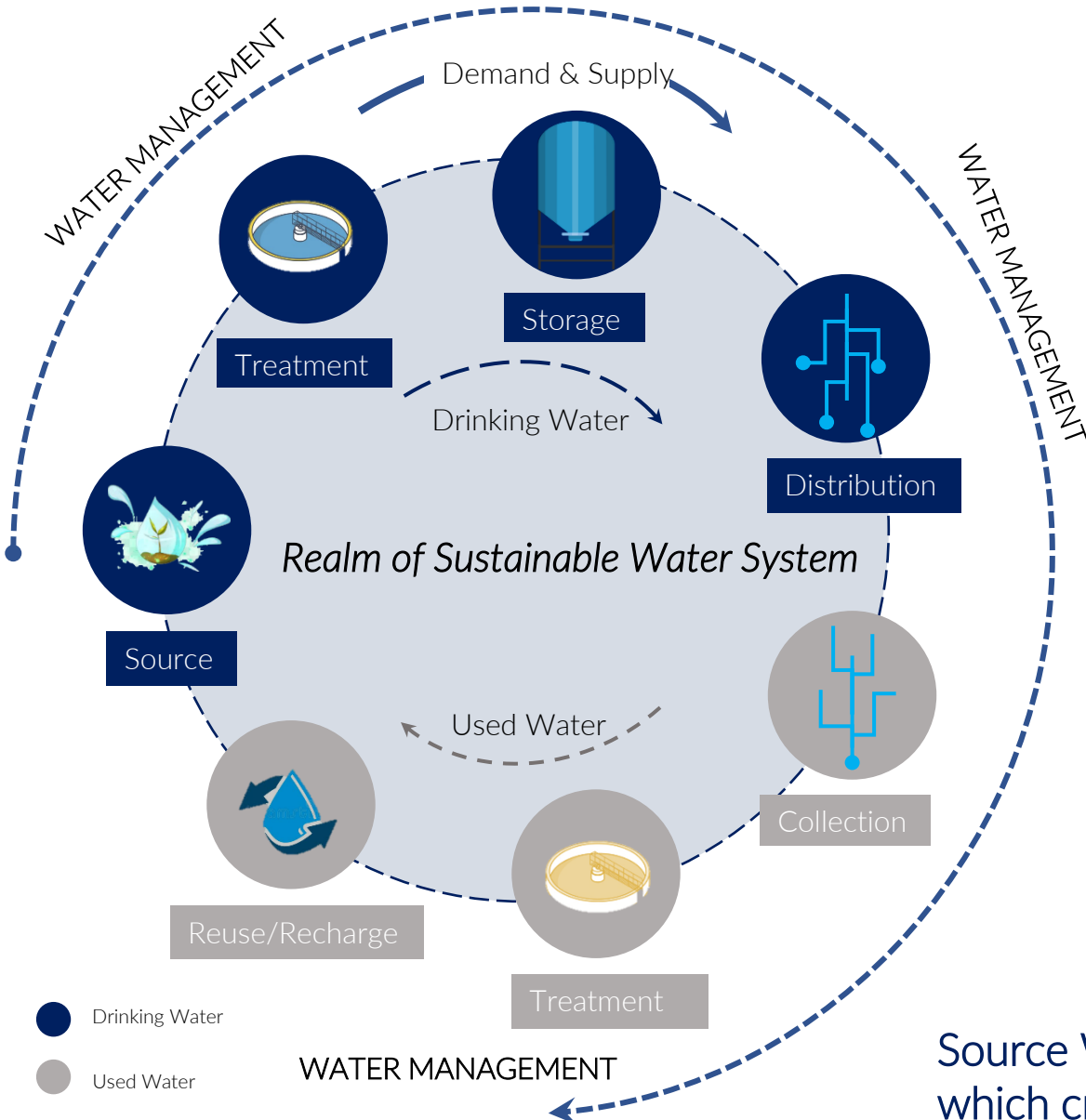
Investment in water infrastructure



Diversify water sources

Source: CAPE TOWN: TOWARDS A SUSTAINABLE WATER FUTURE: Urban Water Atlas

Balancing the realm of sustainable water system....



- Sustainability of **source** not only relies on **upstream side** where the source is located but also on **downstream side** where it is **distributed** i.e., service side
- Sustainability of whole system not only depends on how water is used but also includes alternate technology which alleviates water consumptions, considers usage of reuse water and stormwater
- The whole system will be sustainable only when there is efficiency in supply and demand side of service delivery

On the supply side, it is fundamental to enhance

- Operation and maintenance capabilities of water utilities,
- Reducing non-revenue water (NRW), leakages,
- Energy use
- Capacity of the workforce
- Cost Recovery through tariff

On the Demand side, it is fundamental to enhance

- Adoption of water efficient technology
- Less water intensive industrial processes

Source Water Sustainability and efficient service delivery are correlated which creates sustainable Water System and goes hand in hand

Aim & Objectives

“The aim of the study is to assess the water situation across the water service chain in Kachchh region” – A case of Anjar and Gandhidham”

- To understand the existing water situation from source and service delivery perspective in Anjar and Gandhidham.
- To analyze the advances/lacunae of the existing water situation in both the cities.
- To explore alternative urban water management practices to strengthen existing water source and service delivery.

Research Design

- The approach for the assessment would be based on Qualitative and Quantitative data Sets based on literature review, Field visits and stakeholder consultation

Scope & Limitation

- To understand and achieve the sustainable approaches, the study is conducted on two cities of Kutch District: Anjar and Gandhidham Municipal Limits
- The study excludes assessment of slum pockets as separate units
- The study's assessment is done on the components of water supply chain for which primary survey and PAS-SLB parameters has been considered (Quantity, Quality, Service delivery- Supply days, Hours , Complaint redressal)

Methodology

Objectives

To understand the existing water situation from source and service delivery perspective in Anjar and Gandhidham

To analyze the advances/lacunae of the existing water situation in both the cities

To explore urban water management practices to strengthen existing water source and service delivery

Tasks

• *To understand the water service chain*

• *To identify parameters which will help assessing the situation on Water Service Chain*

• *FGDs with different stakeholders*

• *To conduct on field surveys to understand the existing water situation from citizen*

• *To strengthen the scope for RWH by Community Participation and Policy level intervention*

Tools

• Literature Review – On Water service chain, Existing situation, regional water supply setting in the region

• Designing a questionnaire to know about before and current scenario of water through the citizens perspective. (Primary Survey)

• Analyzing Primary and Secondary data

• Literature Review– Focusing on water conservation practices and technological initiatives

Outcomes

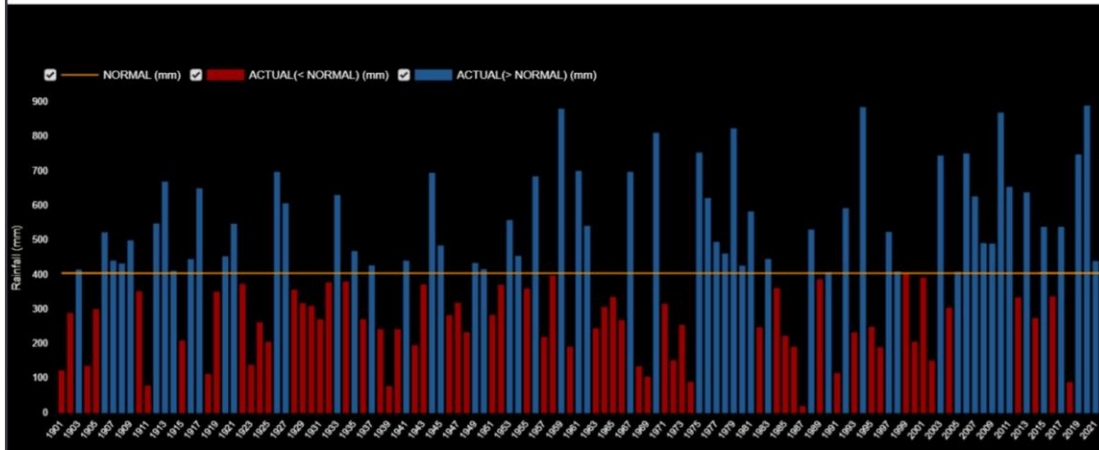
• Will receive clear understanding of water situation and impacts due to the Narmada projects

• Compendium of best practices which can be easily adopted for Kachchh region

The region is historically water stressed due erratic rainfall and chronic drought scenario...

About the Region

Yearly Rainfall trends for Kachchh from 01-Jan-1901 to 31-Dec-2022

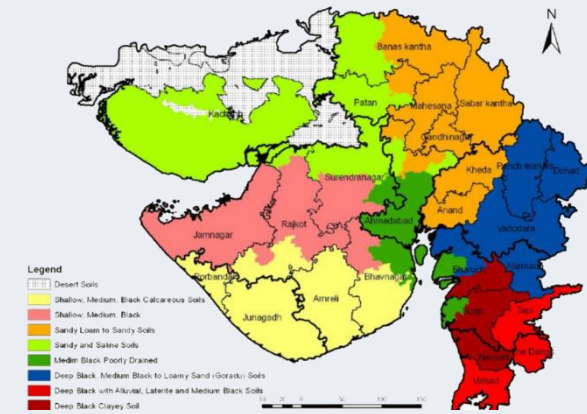
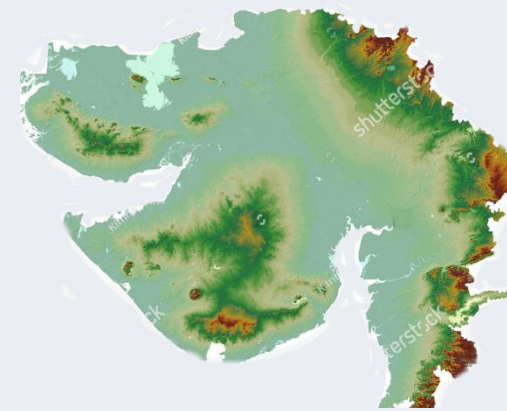


Rainfall

- The region has erratic rain fall and prone to drought
- Drought happens **once in 2.5-3 years**
- However, we can see there is an increase in the annual average rainfall in recent years

Topography

- The region have 97 streams & rivers but are non perennial and have high run-off rate due to higher slope topography
- Region has sandy to saline soil typology which has very low water holding Capacity



Groundwater

5-10 m
Pre monsoon
water levels

20 m
Post monsoon
water levels

Fresh to saline
Quality of Ground water

378.2 mm
Average Rainfall

45.60°
Max
Temperature

11.50°
Min
Temperature

National Initiatives addresses the realm of sustainable service chain

Jawaharlal Nehru National Urban Renewal Mission

The mission aimed to create **productive, efficient, equitable, and responsive** cities,

- with one of a focus on water-related areas such as **water supply** (including desalination plants) and **preservation of water bodies**



2011

2005

Aims to **conserve water**, minimize waste, and ensure **equitable distribution**. Its five goals include

- creating a comprehensive water database,
- promoting conservation efforts, focusing on vulnerable areas,
- increasing water use efficiency by 20%,
- promoting **integrated management** at the basin level.



National Water Mission

Swachh Bharat Mission

SBM grant is released based on a Performance Matrix and one of the evaluation parameters is suggest **prevention of pollution of water sources**



2014

Aims to enable effective water management in Indian states in the face of this growing crisis. The index provides useful information for the states and concerned Central ministries and departments enabling them to formulate and implement suitable strategies for better **management of water resources**



Composite Water Management Index

Atal Bhujal Yojana (Atal Jal)

The goal is to demonstrate community-led sustainable **ground water management** which can be taken to scale. The objective of the Scheme is to improve

- **management of groundwater resources** in select water stressed areas in identified states viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh



2021

2019

Aim of making the cities 'water secure' and providing functional water tap connections to all households.

- By effecting **water source conservation**,
- **rejuvenation of water bodies and wells**, recycle/ reuse of treated used water, and rainwater harvesting by involving community at large

Atal Mission for Rejuvenation and Urban Transformation 2.0



Source water sustainability



Sustainable water resource management



Service Delivery

However, the state initiatives are limited to source augmentation...

Participatory Irrigation Management

Aim is to ensure that **irrigation water is distributed efficiently and equitably** in the command area and that it be used efficiently through Participatory Irrigation Management (PIM)

2002

Sujalam Suflam Yojana

Aim: to **raise ground-water levels across the state** by deepening water bodies and building check-dams to trap run-off water. For **Kachchh region**, 50 bandharas are constructed for utilization of 1 MAFT **excess flood water of Narmada** under SSY and to prevent Salinity Ingress in the region

2004

Swarnim Gujarat Saurashtra-Kutch Water Grid Project.

The aim is to provide a reliable and safe water supply to the **water-scarce regions of Saurashtra and Kutch** in the state of Gujarat, India. The project involves **interlinking various rivers and reservoirs in the region and constructing pipelines and canals to transport water to areas where it is needed**. By ensuring a sustainable water supply, the project aims to promote the economic and social development of the region while also improving the overall quality of life for its residents.

(Saradar Sarovar Narmada Nigam
(Narmada Water Supply))

2011

Salinity Ingress Prevention Scheme

The Salinity Ingress Prevention Scheme of Gujarat **aims to prevent the ingress of salinity (saltwater) into freshwater sources** in order to maintain and improve the quality of the state's water resources. This is done through the construction of **check dams, recharge wells, and other infrastructure to capture rainwater and recharge aquifers**, as well as by promoting better water management practices

2012

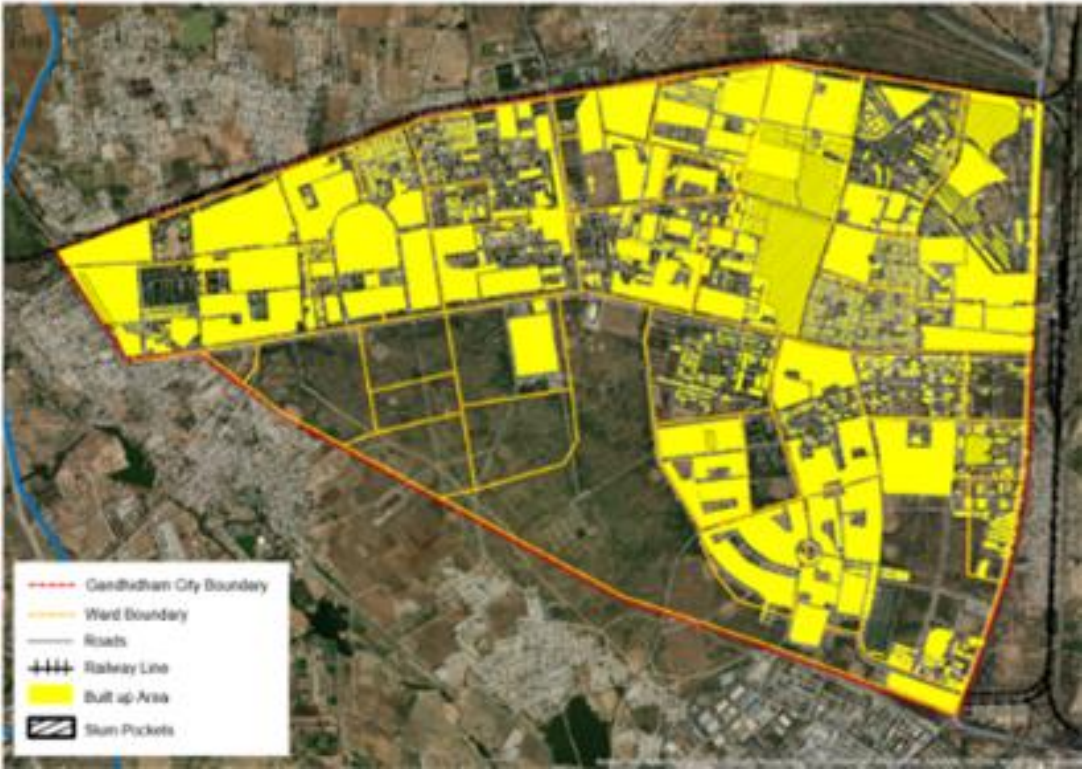
SAUNI Yojana

objective of **filling 115 major dams by diverting flood water of Narmada allocated to Saurashtra Region**. The excess overflowing flood water of Narmada districts of Saurashtra through total 112 will be distributed to 115 reservoirs of eleven 6 km long four link pipelines benefiting 10,22,589-acre land.

2016

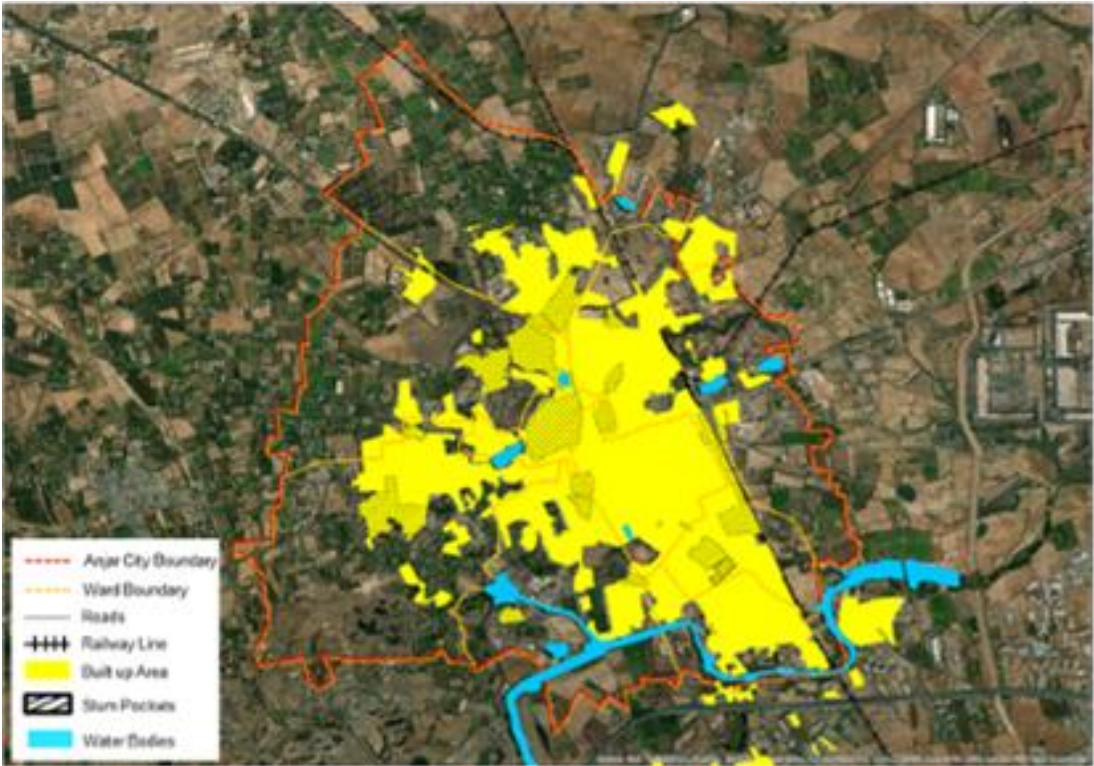
Gandhidham and Anjar can be called twin cities located 10-12 Km apart ...

GANDHIDHAM



30	14	A	17.92mm
Area (sq.Km.)	Total Wards	Class	Annual Rainfall
400,000	85,120	69,880	13,950
City Population	Total Households	Slum Population	Slum HH

ANJAR



18	12	B	15.37mm
Area (sq.Km.)	Total Wards	Class	Annual Rainfall
109,283	26,036	29,214	9,738
City Population	Total Households	Slum Population	Slum HH

Source: Anjar Area Development Authority, Pas/Know your city, Gandhidham Area Development Authority, Pas/Know your city

Existing water situation in the two cities

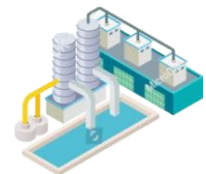
GANDHIDHAM

52 MLD Demand

“Major source for water supply has been surface water”


Surface water

Ground water



Varshamedi Narmada Water

40_{MLD}



30 GWSSB Tubewells

12_{MLD}



40_{MLD}



89_{LPCD}



15-120_{min}

Water Treatment Plant

Per Capita water supply

Duration of water supply



10_{Days/month}
(Once in 3-4 days)

Frequency of water supply

96%

City Water supply system coverage

Unserved areas will be covered under Nal Se jal Project

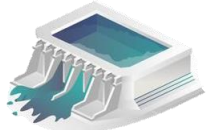
ANJAR

19 MLD Demand

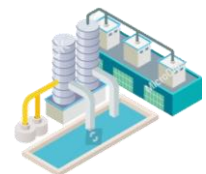
“Equal dependency on both the sources for water supply”

Surface water

Ground water




Tappar Dam



Varshamedi Narmada Water

9_{MLD}



29 Tubewells

10_{MLD}



9_{MLD}



91_{LPCD}



45-165_{min}

Water Treatment Plant

Per Capita water supply

Duration of water supply



15_{Days/month}
(Alternate days)

Frequency of water supply

95%

City Water supply system coverage

Unserved areas will be covered under Nal Se jal Project

Source: (Data from primary field visits, CWAS-CEPT University)

Methodology

Objectives

To understand the existing water situation from source and service delivery perspective in Anjar and Gandhidham

To analyze the advances/lacunae of the existing water situation in both the cities

To explore urban water management practices to strengthen existing water source and service delivery

Tasks

• *To understand the water service chain*

• *To identify parameters which will help assessing the situation on Water Service Chain*

• *FGDs with different stakeholders*

• *To conduct on field surveys to understand the existing water situation from citizen*

• *To strengthen the scope for RWH by Community Participation and Policy level intervention*

Tools

• Literature Review – On Water service chain, Existing situation, regional water supply setting of the region

• Designing a questionnaire to know about before and current scenario of water through the citizens perspective. (Primary Survey)

• Analyzing Primary and Secondary data

• Literature Review– Focusing on water conservation practices and technological initiatives

Outcomes

• Will receive clear understanding of water situation and impacts due to the Narmada projects

• Compendium of best practices which can be easily adopted for Kachchh region

Survey Methodology

- The type of survey is based on stratified random sampling in which people above the age of 35 is consider for survey to understand the scenario before Narmada water Supply
- The medium for conducting surveys were done on site as well as online link was circulated amongst the several citizens of the both cities
- Taking into linguistic considerations, the questionnaire was design in Gujarati as well to get maximum responses

Water Situation Survey

(આ ગ્રામીણામ અને અંજલ શહેર માટે ઉચ્ચ વિકસાવવા માટે CEPT યુનિવર્સિટીની પહેલ છે જે તમામ નાગરિકોની જરૂરિયાતોને વધુ સારી રીતે પૂરી કરવા માટે પાણી શેરે જાહેર ઈન્ફ્રાસ્ટ્રક્ચરમાં સુધારો કરે છે. આ સર્વેક્ષણ દ્વારા, અમે તમારી રોજિંદા જરૂરિયાતોને સમજવા માંગીએ છીએ. તમારા પ્રતિભાવો મહત્વપૂર્ણ છે અને અમને શહેરને સારી રીતે સમજાવવામાં મદદ કરશે. અમે તમને ખાતરી આપીએ છીએ કે તમારા પ્રતિભાવો સંપૂર્ણપણે અનમી છે. તમારા સમય માટે આભાર.)

(This is an initiative of CEPT University to develop solutions for the city of Gandhidham and Anjar that improve public Infrastructure in the Water Sector to serve the needs of all citizens better.

Through this survey, we'd like to understand your day-to-day needs. Your responses are important and will help us understand the city well. We assure you that your responses are completely anonymous. Thank you for your time.)

* Required

1. 1. વોર્ડ નંબર? (Ward No)

2. ઉંમર/Age

3. તમે ગ્રામીણામ અથવા અંજલમાં કેટલા સમયથી રહો છો? *

4. 2. લોકેશન (Location/Area name)

5. 3. ઘર કેવું છે?/Housing Typology

Mark only one oval.

- એપાર્ટમેન્ટ (Apartments)
 ટેનન્ટિંગ (Twin Sharing)
 બંગ્લો (Bungalow)
 રો હાઉસ (Row House)
 Other: _____

6. 4. ઘર માં કેટલા લોકો છે (Family Size?)

Water Supply Service

7. 5. તમારા ઘરે પાણી ક્યાંથી આવે છે? (From where do you get water?)

Mark only one oval.

- a. મ્યુનિસિપલ કોર્પોરેશન (Municipal Corporation)
 b. બોરવેલ (Bore well)
 c. હેન્ડ પંપ (Hand Pump)
 d. કોર્પોરેશન ટેન્કર (Corporation Tanker)
 e. પ્રાઇવેટ ટેન્કર (Private Tanker)

20. 17. જો ના તો, ક્યાંથી પાણી લાવો છો? (If no, how do you solve the issue of water supply during summers?)

Mark only one oval.

- a. પ્રાઇવેટ સપ્લાયર (Private Supplier)
 b. નજીકની બોરવેલ (Nearby borewell)

21. 18. તમારા ઘરે બોરવેલ છે? (Do you have bore well connection?)

Mark only one oval.

- Yes Skip to question 22
 No

Untitled Section

22. 19. બોરવેલ નું પાણી પીવા જેવું છે? (Is the borewell water drinkable?)

Mark only one oval.

- Yes
 No

23. 20. તમારા ઘરે વરસાદી પાણી સ્ટોર કરો છો? (Any practice of rainwater harvesting like groundwater recharge?)

14. 12. શું તમારી પાસે પીવાના પાણી માટે RO છે? (Do you have RO for drinking water?) *

Mark only one oval.

- Yes
 No Skip to question 15

RO Treatment

15. જો નહીં, તો પછી તમે પીવા માટે તમારા ઘરમાં પાણી કેવી રીતે ટ્રીટ કરશો (If no, then how do you treat water in your house for drinking)

16. 13. તમે પાણી કેવી રીતે સ્ટોર કરો છો? (How do you store your water?)

Mark only one oval.

- a. જમીનની નીચેની ટાંકી (Under ground water tank)
 b. ટેરેસ પટની ટાંકી (Upper head water tank)
 c. પોપ્કુ (Barrel)
 d. ડોલ (buckets)

Water Supply Services

17. 14. પાણી સ્ટોર કેટલું કરો છો? (what is the capacity of storage?)

18. 15. જરૂરિયાત અનુસાર પાણી મડી રહે છે? (Is the water enough for the day?)

19. 16. ઉનાળા માં પૂરું પાણી મડી રહે છે? (Is there a sufficient water supply during summers?)

Approach

Primary Survey

- Household survey HIG and MIG households with a specific age group
- Site observations
- Visit to WTP and ESR
- Understanding the cities water supply services through people's perception (FGD's)

Stakeholder Meeting

- Chief Engineers
- GWIL, GWSSB engineers (Roles and function of the organization, Current responsibilities)
- Pump Men

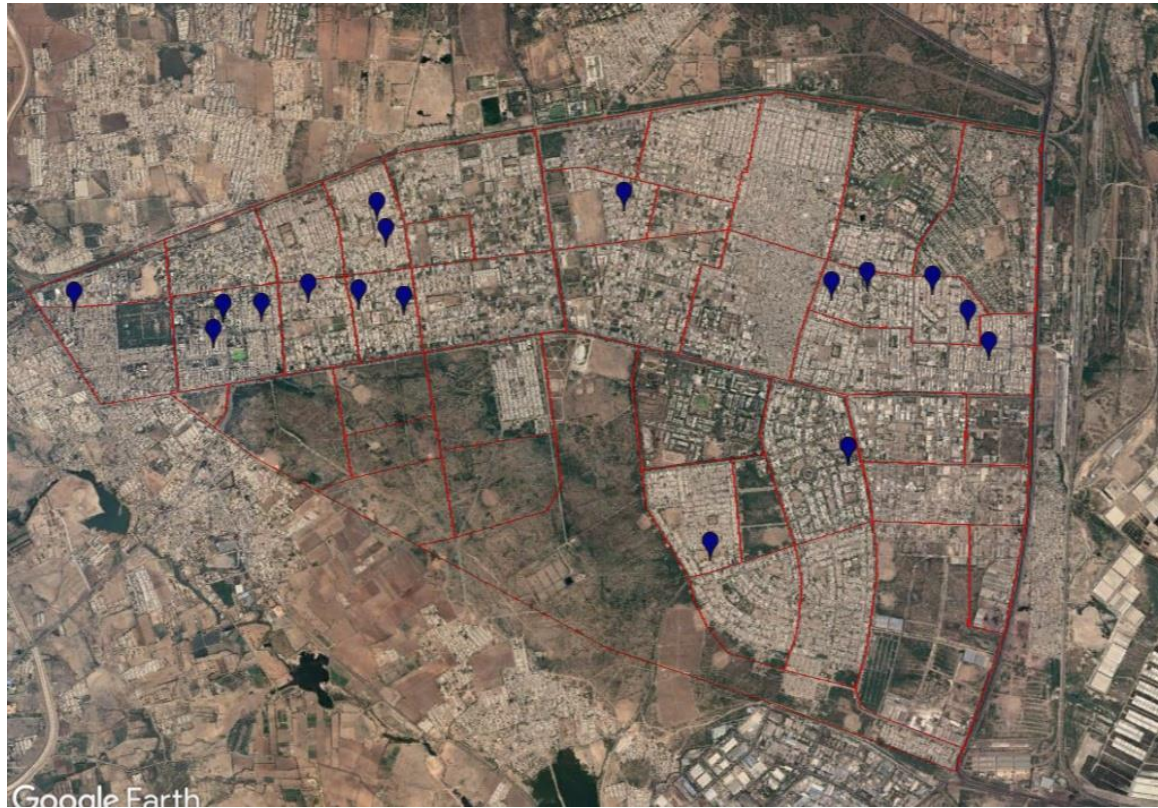
Secondary Survey

- Desktop literature review
 - (Literature on water situation dating from 1980's to present scenario)
- News articles, Research papers on previous assessment on Narmada project



Survey Points

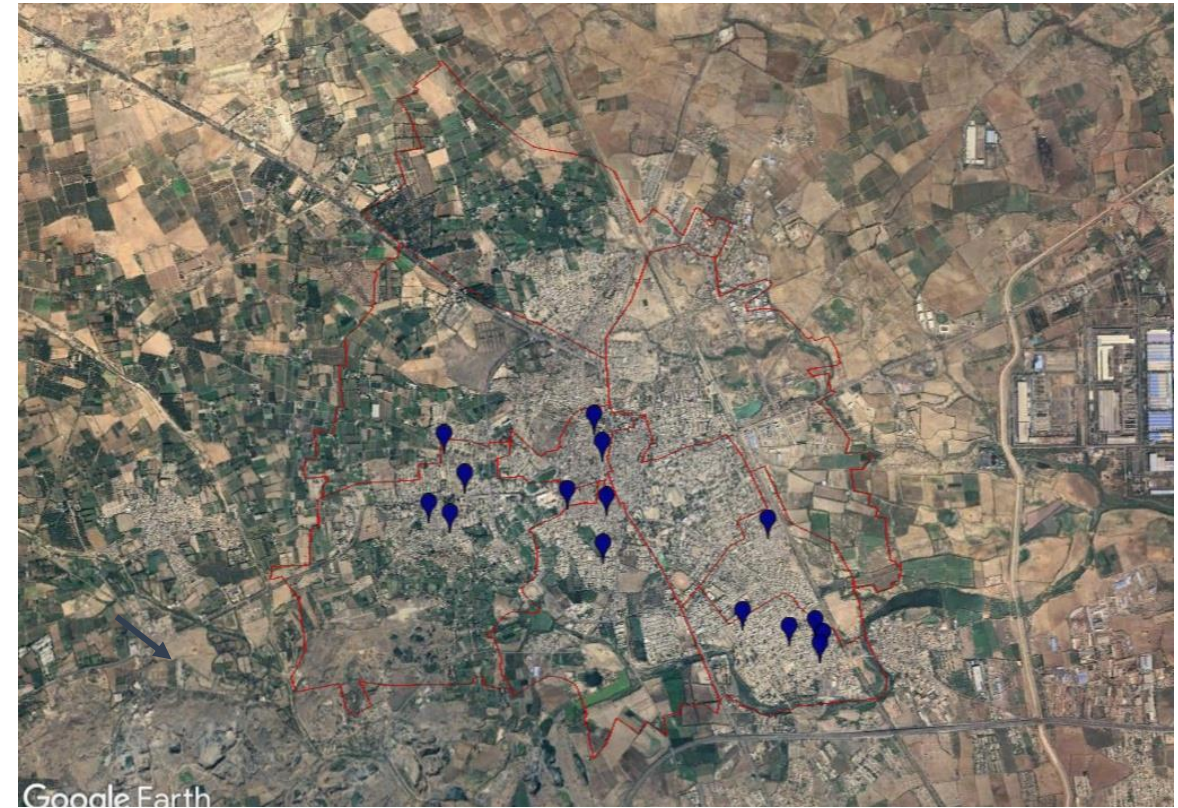
GANDHIDHAM



Google Earth

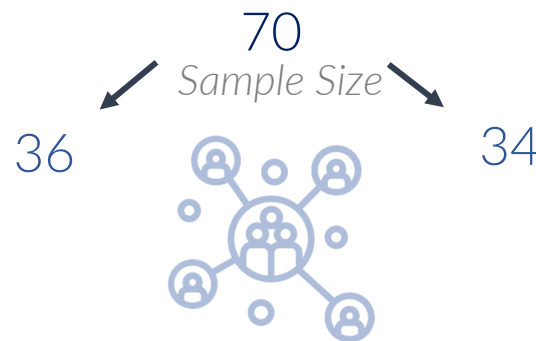
Population	400,000
Wards	13
Slum Population	69,880

ANJAR



Google Earth

Population	109,283
Wards	9
Slum Population	29,214

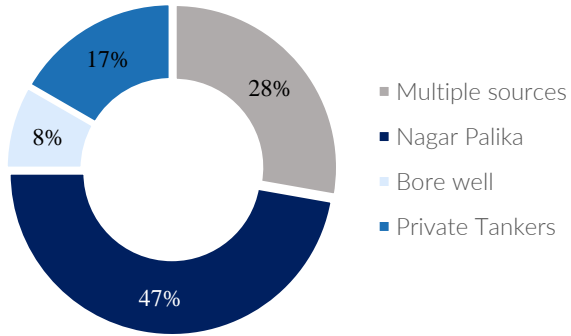




Survey Analysis (Source)

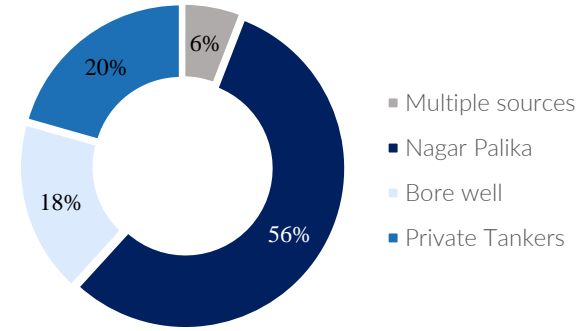
Majority of the respondent from both cities depends on multiple sources of water supply, apart from Municipal Supply...

GANDHIDHAM Primary Survey



53% responded procure water from **other sources** apart from Nagar Palika supply

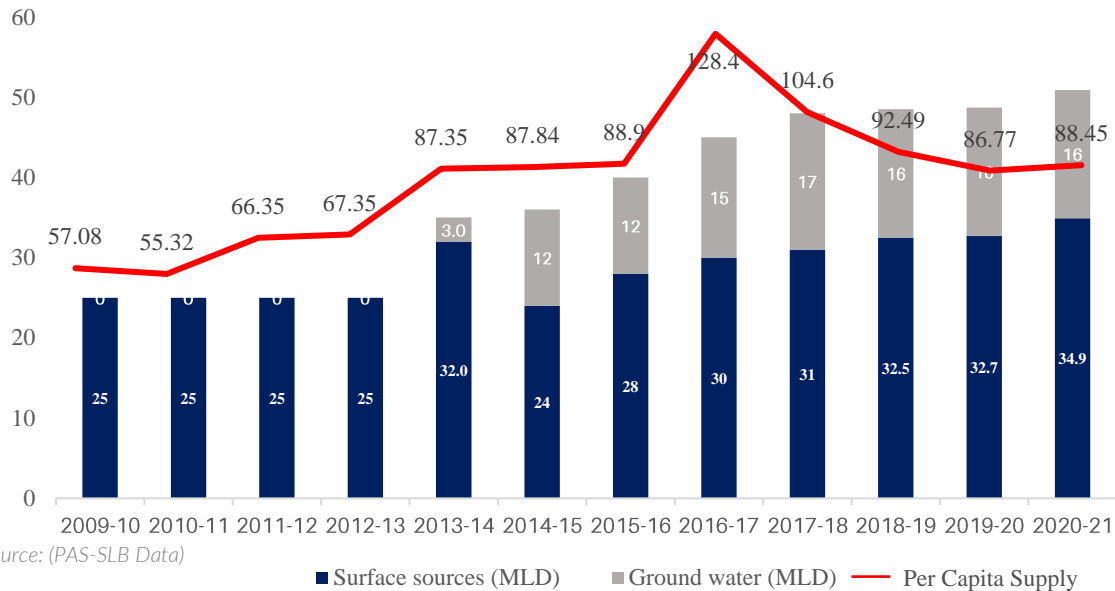
ANJAR



44% responded procure water from **other sources** apart from Nagar Palika supply

Source: (PAS-SLB Data) Secondary Survey

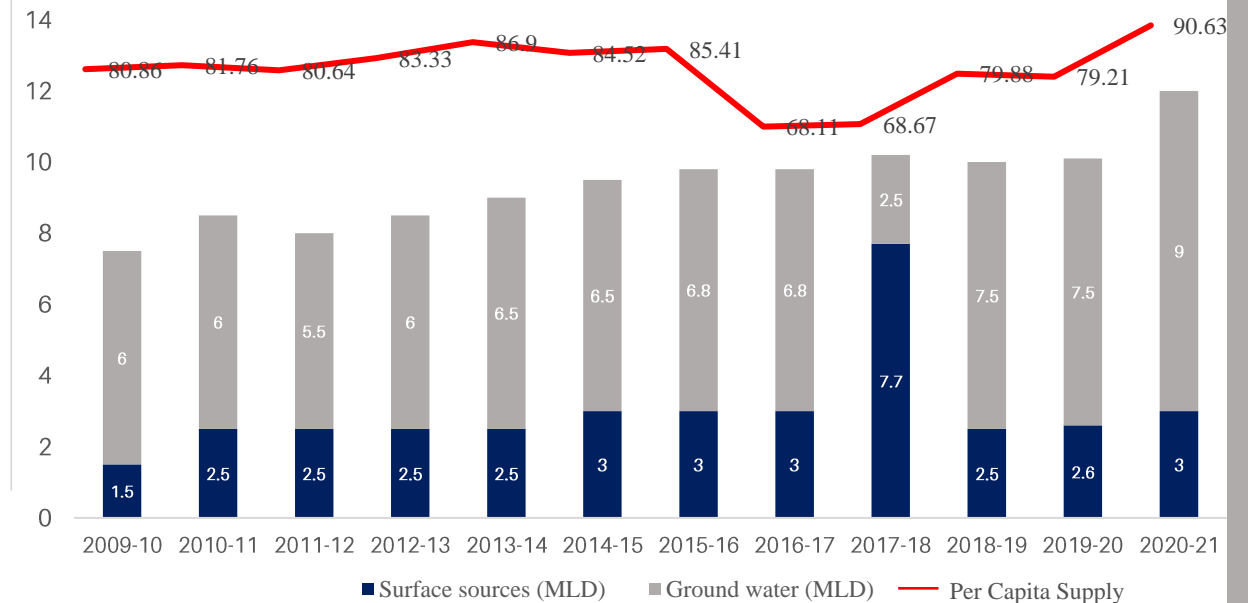
Source Dependency Gandhidham



Source: (PAS-SLB Data)

As there is increase in population, city has also augmented the water source, but **per capita supply is decreasing**

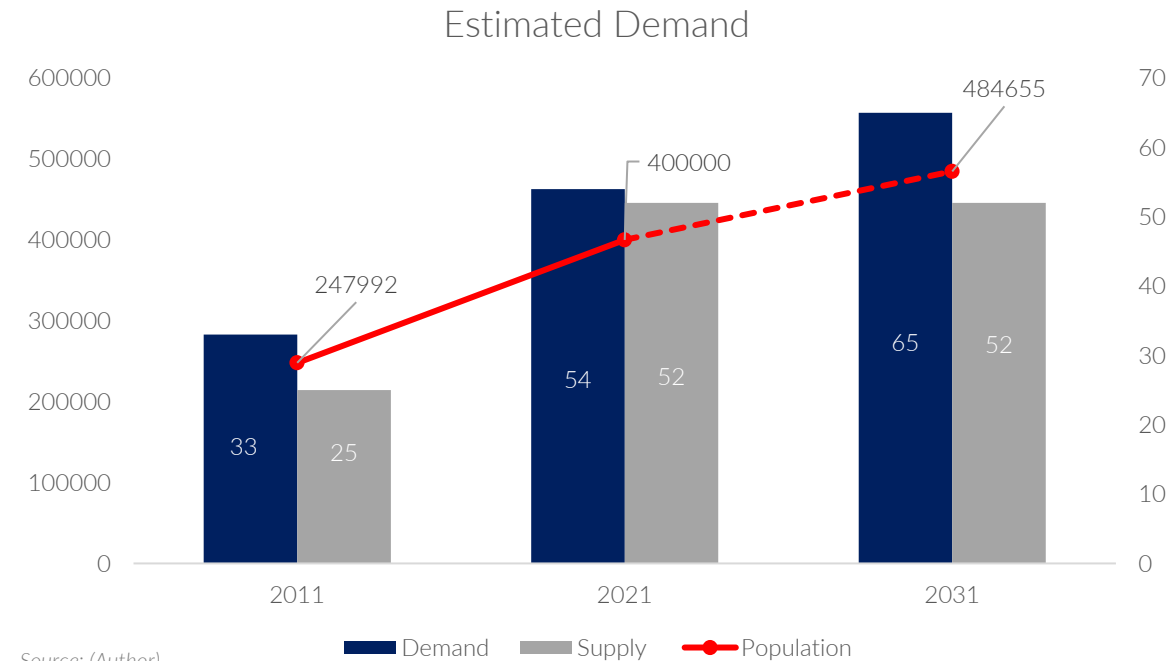
Source Dependency Anjar



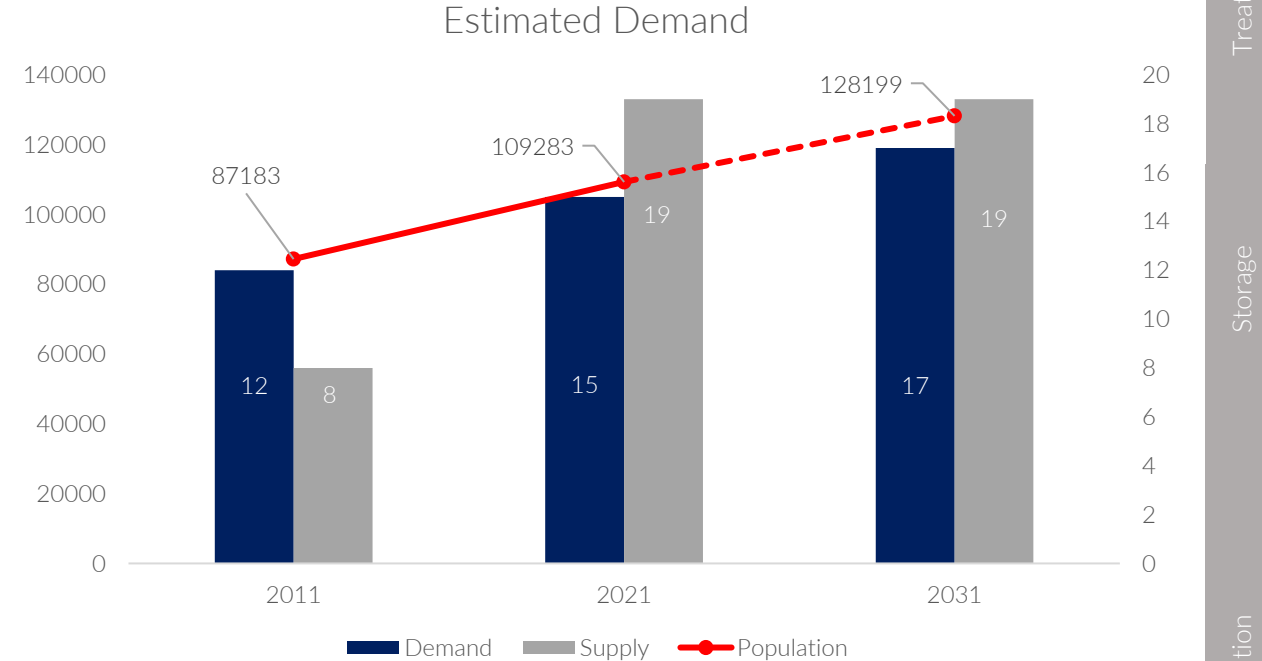
As there is increase in population, city has also augmented the water source, and there is **increase in per capita water supply**

Currently the supply can meet the demand in both the cities, however future scenarios indicate huge gaps...

GANDHIDHAM



ANJAR



Cities need to take initiatives to augment their own water sources



Survey Analysis (Services)

Install treatment capacities are sufficient, however WTP of Gandhidham is non-functional since more than a year...

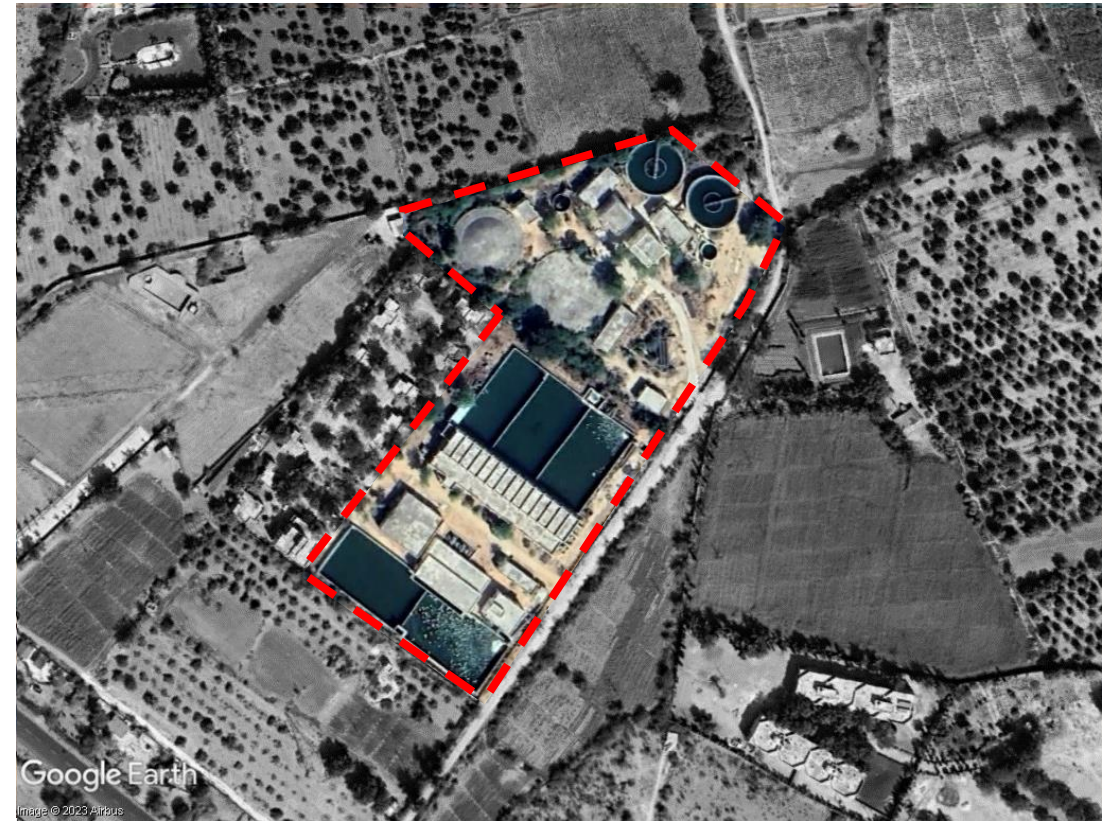
GANDHIDHAM



- The Rambaugh facility has been non-functional for certain years now, with only chlorination processes taking place.
- A design capacity of 40 MLD

Source: (Primary Site visits & CWAS-CEPT University)

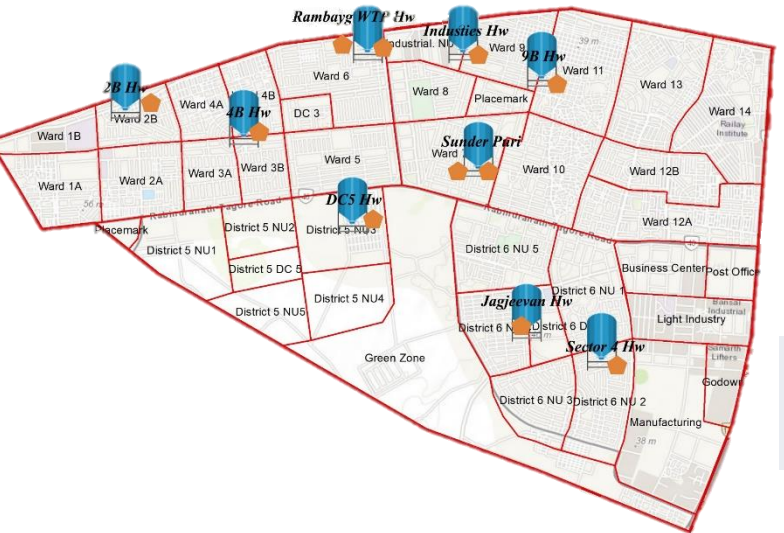
ANJAR



- The WTP system is functioning well however periodic checking is required, by doing so, it will assure quality water supply
- A design capacity of 9 MLD

Both the cities have sufficient capacity for storage infrastructure to adopt 24X7 water supply system

GANDHIDHAM



For 24X7 water supply the storage capacity should be 1/3 of the estimated demand.

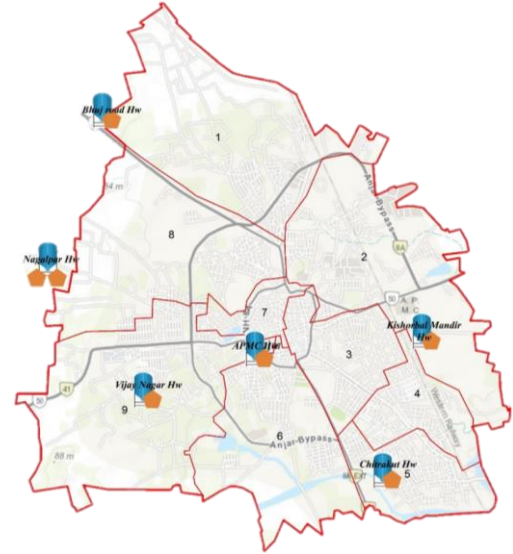
$$(400000 * 135 * 1/3 = 18000000)$$

32.8 ML Total Capacity and required capacity is of 18 ML

Name of Headworks (Gandhidham)	Storage	
	Capacity of ESR (MLD)	Capacity of Sumps (MLD)
6 Industries	01	02
9B	01	02
Sundar Puri	1.6	3.2
2B	01	01
4B	01	02
DC 5	01	01
Jagjeevan	01	01
Rambaugh WTP	2.5	7.5
Sector 4	01	02
Total	11.1	21.7

- The ULB states that in order to increase the amount of water available and address problems linked to water pressure, particularly those that are present in periphery regions, the storage capacity at all HWs has to be increased. However, there are 7 proposed ESRs under the "Nal Se Jal" program, which will assist the city in providing a better supply system.

ANJAR



For 24X7 water supply the storage capacity should be 1/3 of the estimated demand.

$$(109283 * 135 * 1/3 = 18000000)$$

14.4 ML Total Capacity and required capacity is of 5 ML

Name of Headworks (Anjar)	Storage	
	Capacity of ESR (MLD)	Capacity of Sumps (MLD)
Bhuj Road	01	02
Nagalpur	01	3.2
Vijay Nagar	01	2
Kishorbal Mandir	0.30	0.35
APMC	0.30	0.80
Chitrakut	01	1.50
Total	4.6	9.85

- The Nal Se Jal project will augment the city WSS from intermittent to daily supply system (15 mld WTP at Nagalpur and ESRs and UG Sumps at Kadash Circle, APMC and Chitrakut)

Source: (Guidelines for Planning, Design and implementation of 24x7 water supply System, MoHUA)

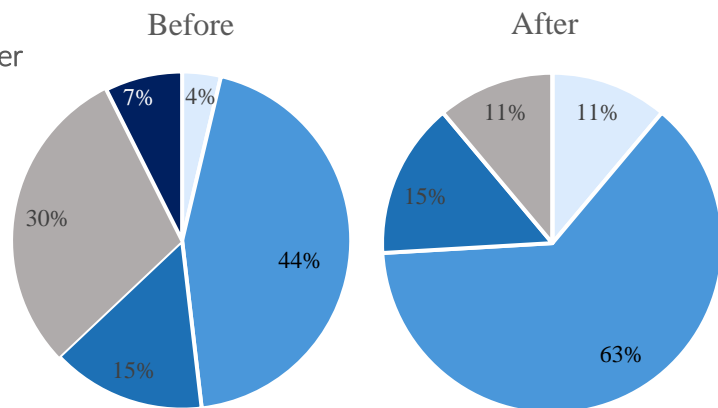
A Shift towards equitable distribution system can be observed post implementation of Narmada sardar Sarovar project

GANDHIDHAM

Primary Survey

Frequency of water supply

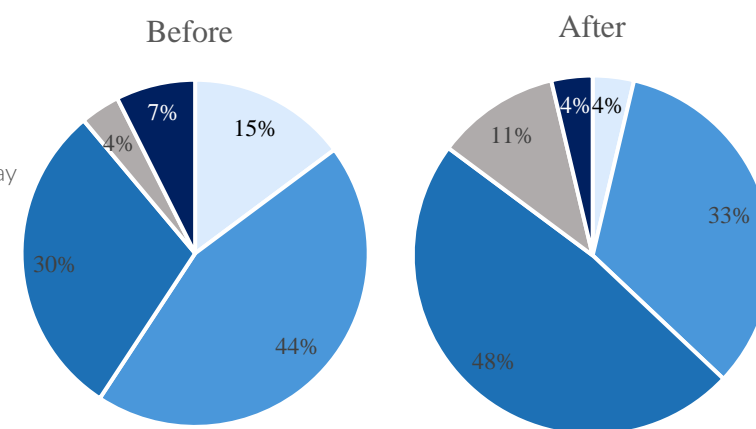
- (Once a week)
- Once in 3 Days
- Once in 2 Days
- (Alternate Days)
- Daily



Source: (PAS-SLB Data)

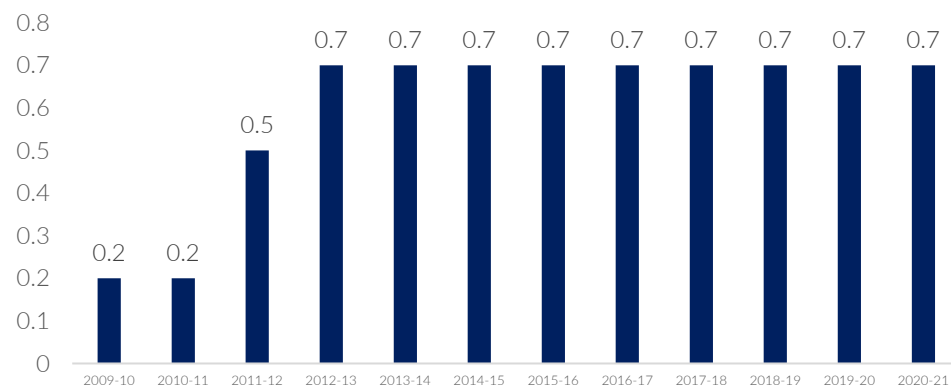
Duration of water supply

- < than 30 mins a day
- 30 mins-1 hrs/day
- 1-2 hrs/day
- 2-3 hrs/day
- > than 3 hrs a day



Secondary Survey

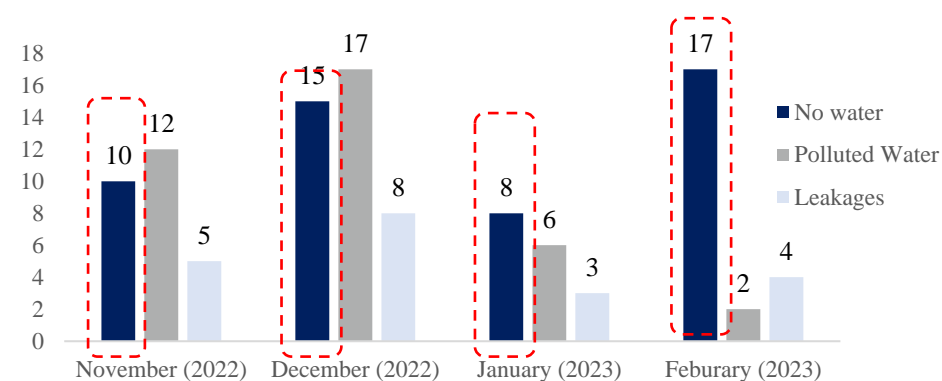
Continuity of Water Supply (Hrs)



Source: (PAS-SLB Data)

After 2011-12 year, there is increase and consistency in continuity of water supply that is of **42 mins (At frequency once in 3 days)**

Type of Complaint



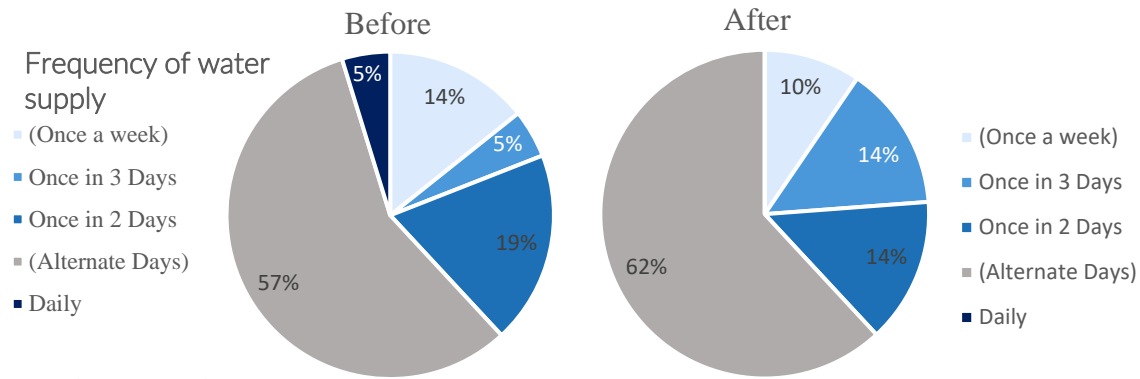
Source: (As received by ULBs, Adopted from CWAS- CEPT University)

Water supply inconsistency has resulted in a dire situation where there is no water available. This happens when there is a skipped day in the supply cycle, causing an inability to provide water or supplied on a weekly basis.

According to Anjar's response, there has been no alteration in the frequency or duration of water supply since the arrival of Narmada sardar Sarovar project

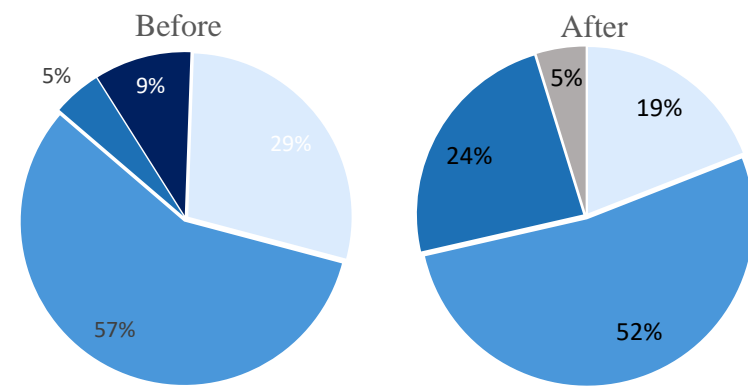
ANJAR

Primary Survey



Duration of water supply

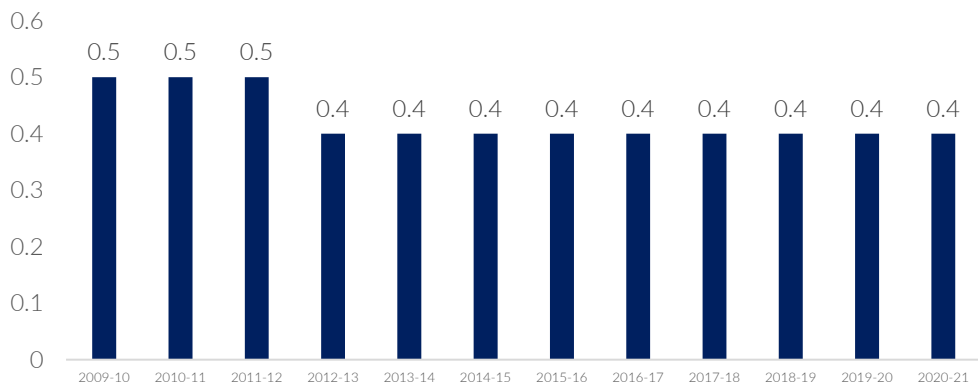
- < than 30 mins a day
- 30 mins-1 hrs/day
- 1-2 hrs/day
- 2-3 hrs/day
- > than 3 hrs a day



Source: (PAS-SLB Data)

Secondary Survey

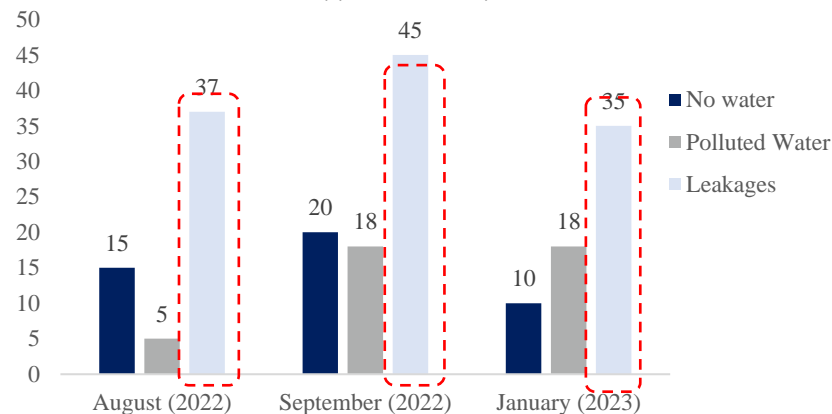
Continuity of Water Supply (Hrs)



Source: (PAS-SLB Data)

After 2011-12 year, there is decrease and consistency in continuity of water supply that is of **24 mins (At frequency of Alternate Days)**

Type of Complaint



Source: (As received by ULBs, Adopted from CWAS- CEPT University)

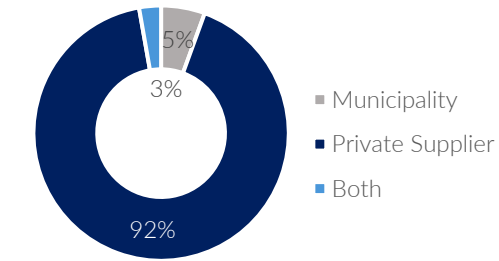
So far from the registered complaints received by the ULB, the uncommon complaint was of water supply which is due to anomaly in the system

92% of the Gandhidham respondent's preferer filter bottled water over municipal for drinking

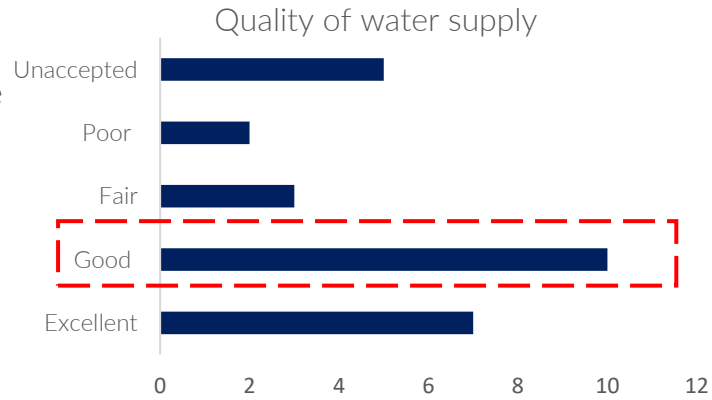
GANDHIDHAM

Primary Survey

Preference for Drinking Water Source



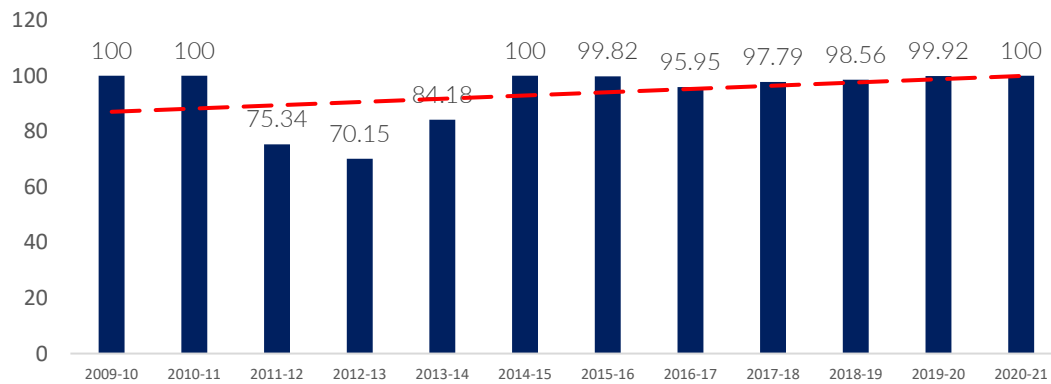
Source: (PAS-SLB Data)



Although majority of the respondent believed to have a GOOD quality of water supply, but half of them still rely on Bottled Drinking water.

Secondary Survey

Quality of Water Supplied (%)



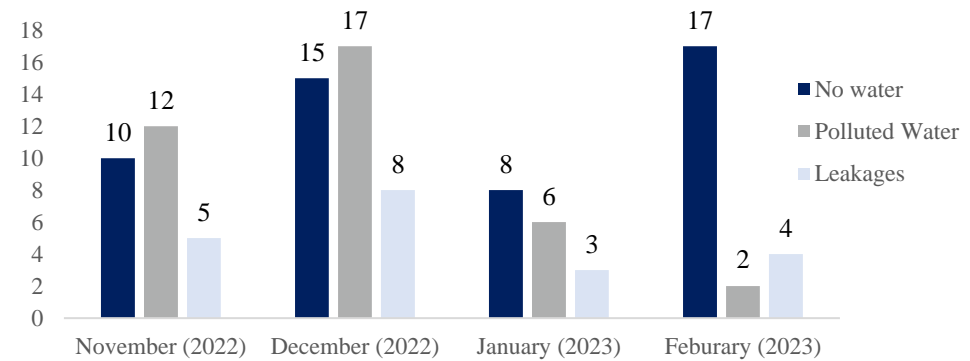
Source: (PAS-SLB Data)

As per secondary Data the quality has been remained consistent and up-to the standards but during the visit to WTP, it has been found dysfunctional since more than a year

Water Quality Testing Report of Gandhidham and Anjar								
Report Generation Date:		16-09-2022						
Sample Received Date:		02-09-2022						
Sr.No.	Sample Location	pH	Turbidity, NTU	Total Dissolved Solids (TDS), mg/l	Chloride, mg/l	Alkalinity, mg/l	Hardness, mg/l	E. Coli
	Drinking Water Standards (IS 10500 : 2012)	6.5 - 8.5	1	500	250	200	200	Shall not be Detectable in 100 ml sample
1	Khodiyar Nagar Borewell, G.DM - GMC	7.5	0.1	1650	660	30	1030	Not Detectable
2	A. V. Joshi Slum (Municipal Supply), Sector 10, GIDC	7.8	0.6	378	175	15	545	Detectable
3	Sector 10, Gandhidham Municipal Corporation (GMC)	7.8	0.4	335	157	15	330	Detectable
4	Municipal Supply, Sector - 10, GIDC, Gandhidham	7.7	0.2	401	167	10	625	Not Detectable
5	Municipal Water Supply of Gandhidham School, GIDC, Sector 10	8.0	0.1	378	170	10	195	Not Detectable
6	Ward No.5 Borewell, Gandhidham	6.9	0.1	2941	1859	55	995	Not Detectable
7	GM, Sector - 10	7.7	0.4	351	172	25	530	Detectable
8	Municipal Water Supply, A. V. Joshi GIDC, Sector - 10	8.0	0.7	396	182	10	290	Not Detectable
9	Anjar Ward No. 9, Vijaynagar	8.0	0.5	510	207	15	470	Not Detectable
10	Anjar Ward No. 2, APMC	7.6	0	571	222	25	1095	Not Detectable
11	Anjar Ward No. 6, Mahadevnagar	7.4	1.3	531	217	20	330	Not Detectable

Source: (CWAS- CEPT University)

Type of Complaint



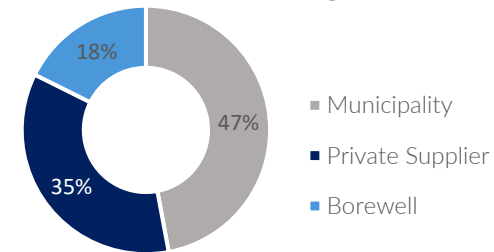
Source: (As received by ULBs, Adopted from CWAS- CEPT University)

After unreliability, quality related complaints are register in the city which justifies the drinking preferences, leading to the dependency on private supplier

Over half of the responded in Anjar prefers filter bottled water over municipal for drinking

ANJAR Primary Survey

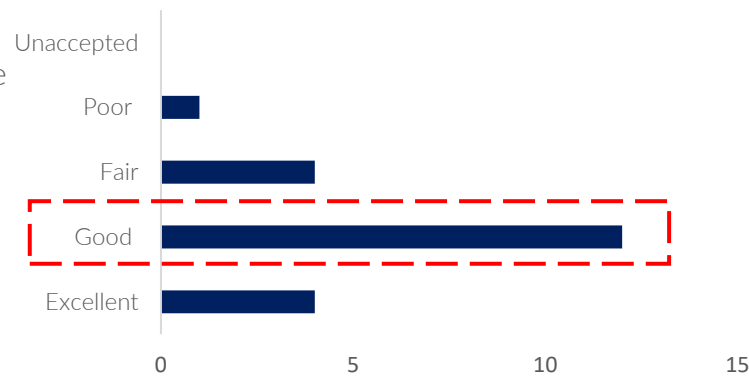
Preference for Drinking Water Source



Source: (PAS-SLB Data)

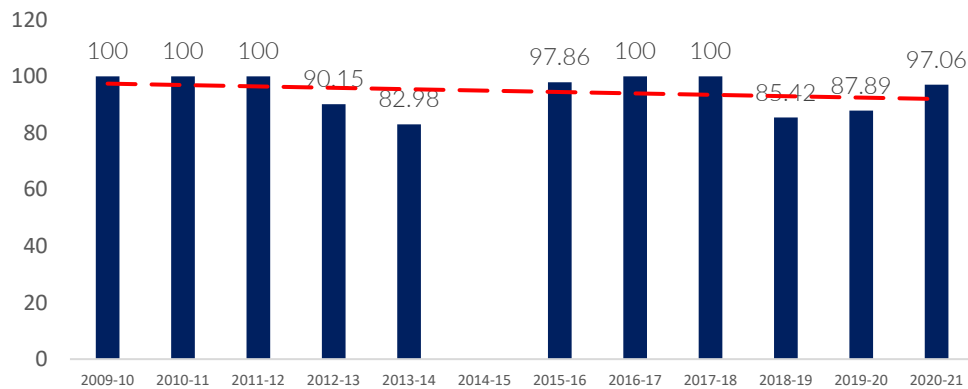
Almost 1/3rd of the respondent still prefer Private supplier over Nagar Palika for drinking purpose. And rest of respondent which rely on Nagar palika water, 58.3% have RO system.

Quality of water supply



Secondary Survey

Quality of Water Supplied (%)



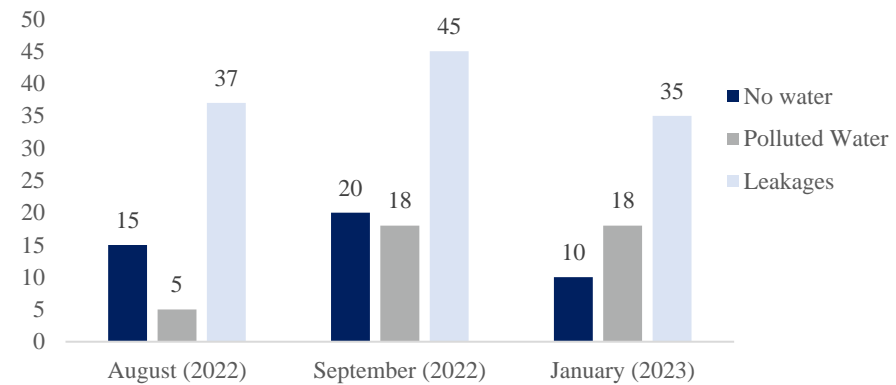
Source: (PAS-SLB Data)

As Data showcase the quality has been remained consistent

Water Quality Testing Report of Gandhidham and Anjar								
Report Generation Date:		16-09-2022						
Sample Received Date:		02-09-2022						
Sr.No.	Sample Location	pH	Turbidity, NTU	Total Dissolved Solids (TDS), mg/l	Chloride, mg/l	Alkalinity, mg/l	Hardness, mg/l	E. Coli
	Drinking Water Standards (IS 10500 : 2012)	6.5 - 8.5	1	500	250	200	200	Shall not be Detectable in 100 ml sample
1	Khodiyar Nagar Borewell, G.DM - GMC	7.5	0.1	1650	660	30	1030	Not Detectable
2	A. V. Joshi Slum (Municipal Supply), Sector 10, GIDC	7.8	0.6	378	175	15	545	Detectable
3	Sector 10, Gandhidham Municipal Corporation (GMC)	7.8	0.4	335	157	15	330	Detectable
4	Municipal Supply, Sector - 10, GIDC, Gandhidham	7.7	0.2	401	167	10	625	Not Detectable
5	Municipal Water Supply of Gandhidham School, GIDC, Sector 10	8.0	0.1	378	170	10	195	Not Detectable
6	Ward No.5 Borewell, Gandhidham	6.9	0.1	2941	1859	55	995	Not Detectable
7	GM, Sector - 10	7.7	0.4	351	172	25	530	Detectable
8	Municipal Water Supply, A. V. Joshi GIDC, Sector - 10	8.0	0.7	396	182	10	290	Not Detectable
9	Anjar Ward No. 9, Vijaynagar	8.0	0.5	510	207	15	470	Not Detectable
10	Anjar Ward No. 2, APMC	7.6	0	571	222	25	1095	Not Detectable
11	Anjar Ward No. 6, Mahadevnagar	7.4	1.3	531	217	20	330	Not Detectable

Source: (CWAS- CEPT University)

Type of Complaint

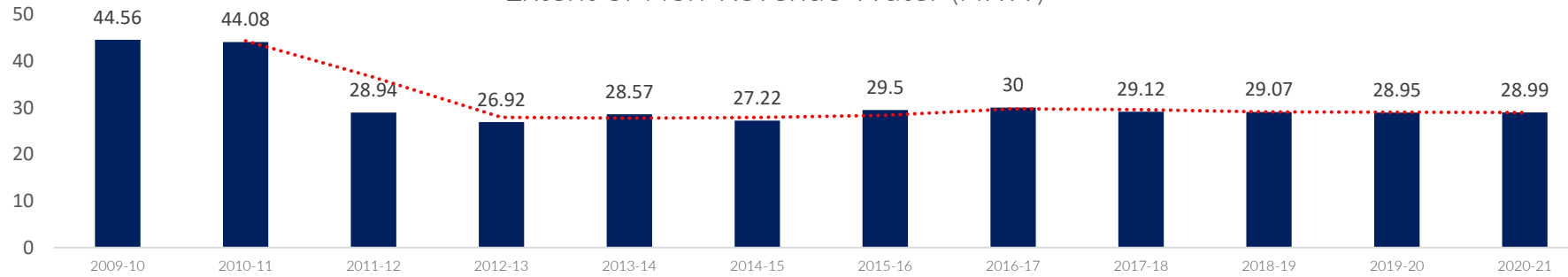


Source: (As received by ULBs, Adopted from CWAS- CEPT University)

Post monsoon the quality of water has affected probably because of leakages in the system

Water Balance calculation shows higher NRW then the set SLB benchmark of 20%, city need to address the situation of water loss

Extent of Non-Revenue Water (NRW)

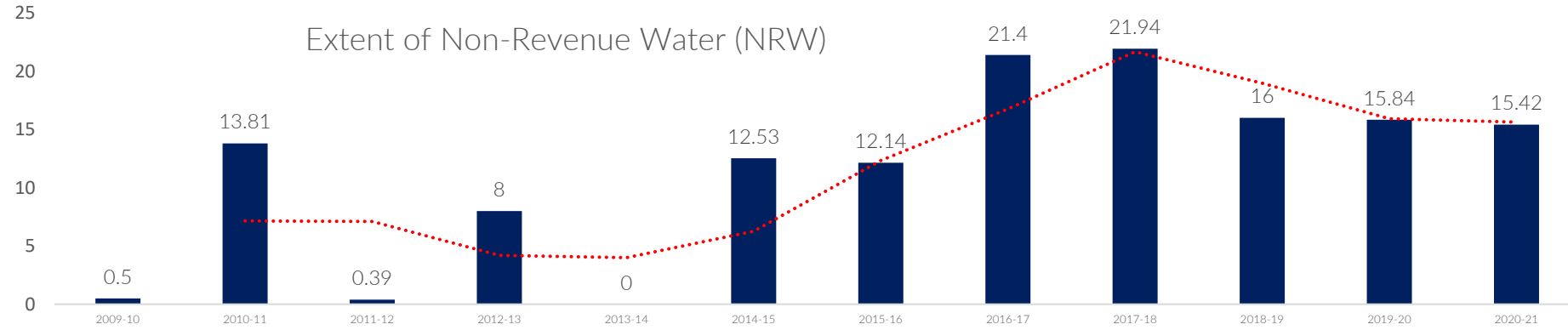


Source: (PAS-SLB Data)

System Input Volume (52 MLD)	Authorized Consumption (36.9 MLD) 70 %	Billed Authorized Consumption (36.0 MLD) 70 %	Billed Metered Consumption (NA)	Revenue Water (36.0 MLD) 70 %
			Billed Unmetered Consumption (36.0 MLD) 70 %	
		Water Losses (15.1 MLD) 30 %	Unbilled Authorized Consumption (0.9 MLD) 1.73 %	Unbilled Metered Consumption (NA)
			Unbilled Unmetered Consumption (0.9 MLD) 1.73 %	
	Apparent Losses 0 %		Unauthorized-Consumption 0 %	
	Real Losses (15.1 MLD) 30 %		Metering Inaccuracies (NA)	
		Leakage on Transmission and/or Distribution mains (15.1 MLD) 30 %		

Water Balance calculation shows higher NRW then the set SLB benchmark of 20%, city need to address the situation of water loss

Extent of Non-Revenue Water (NRW)



Source: (PAS-SLB Data)

System Input Volume (19 MLD)	Authorized Consumption (11.95 MLD) 62.89 %	Billed Authorized Consumption (10.15 MLD) 53.42 %	Billed Metered Consumption (NA)	Revenue Water (10.15 MLD) 53.42 %	
			Billed Unmetered Consumption (10.15 MLD) 53.42 %		
		Water Losses (7.05 MLD) 37.10 %	Unbilled Authorized Consumption (1.80 MLD) 9.47 %	Unbilled Metered Consumption (NA)	Non-Revenue Water (7.05MLD) 37.10 %
				Unbilled Unmetered Consumption (1.80 MLD) 9.47 %	
		Apparent Losses 0 %	Unauthorized-Consumption 0%		
		Metering Inaccuracies (NA)			
		Real Losses (7.05 MLD) 37.10 %	Leakage on Transmission and/or Distribution mains (7.05 MLD) 37.10 %		

Key Findings

		Gandhidham	Anjar	Remarks		
Source	Water Availability	54 MLD vs 51 MLD Demand Supply Gap	15 MLD vs 12 MLD Demand Supply Gap	Gandhidham	89 LPCD which is on decreasing trend (supplied days)	
				Anjar	91LPCD which is on increasing trend	
Distribution	Treatment	Rambaugh WTP is not functional	Anjar WTP is functional but lacks on periodic check	Gandhidham	Chlorination takes place with no other treatment process	
				Anjar	Treatment taking place as per the defined standards	
	Storage	Total storage available 32.8 ML	Total storage available 14.4 ML	Gandhidham	For 24X7 supply required storage is 18 ML	
				Anjar	For 24X7 supply required storage is 5 ML	
	Continuity of Water Supplied	Supplied hrs: 1-2 (Primary Survey) & Frequency of once in 3 days	Supplied hrs: 0.5-1 (Primary Survey) & Frequency of Alternate days	Gandhidham	Inconsistency in water supply sometimes leading to no availability of water	
				Anjar	Reliable water supply in terms of frequency as stated by the ULB	
Quality of water Supplied	Heavy reliance on private suppliers for drinking water	Equivalent reliance on both private and municipal supply for drinking	Gandhidham	Lack of Quality assurance and supply availability leading people using bottled water		
			Anjar	High level of water contamination due to leakages and mixing of sewage making loose confidence in municipal water supply		
NRW	Water losses higher than SLB benchmark	Water Losses are under the SLB benchmark	Gandhidham	NRW is 30 % more than the set benchmark of 20 % by SLB		
			Anjar	NRW is 15 % fulfilling the set benchmark of 20 % by SLB but the complaints suggest high leakages and the need for water audit persists		

Methodology

Objectives

To understand the existing water situation from source and service delivery perspective in Anjar and Gandhidham

To analyze the advances/lacunae of the existing water situation in both the cities

To explore urban water management practices to strengthen existing water source and service delivery

Tasks

• *To understand the water service chain*

• *To identify parameters which will help assessing the situation on Water Service Chain*

• *FGDs with different stakeholders*

• *To conduct on field surveys to understand the existing water situation from citizen*

• *To strengthen the scope for RWH by Community Participation and Policy level intervention*

Tools

- Literature Review – On Water service chain, Existing situation, regional water supply setting of the region
- Designing a questionnaire to know about before and current scenario of water through the citizens perspective. (Primary Survey)
- Analyzing Primary and Secondary data

- Literature Review– Focusing on water conservation practices and technological initiatives

Outcomes

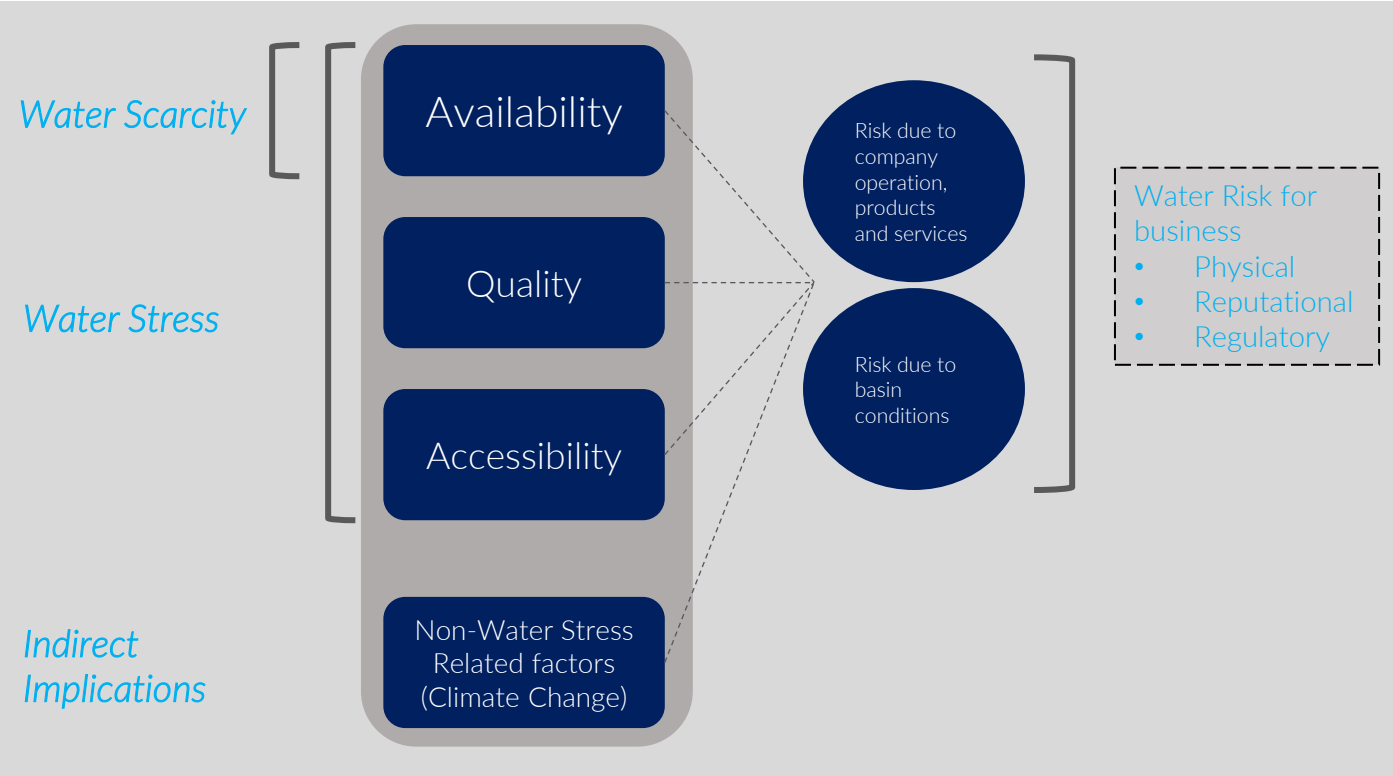
- Will receive clear understanding of water situation and impacts due to the Narmada projects

- Compendium of best practices which can be easily adopted for Kachchh region



Good Practices

Good Practices- Categorization and Selection



Cities	Chennai	Surat	Malkapur	Puri
Issues faced by the cities	Insufficient Water Source	Higher Amount of Water Leakages	Unable to provide access and quality water	Unable to provide access and quality water
Water Service chain's Component related issue	Source	Distribution issue impacting low quality and quantity of water	Distribution issue leading to discontinuous and low quantity of water supply	Distribution issue in terms of coverage and poor quality of water supply
Indicator defining water Status	Availability	Availability, Quality	Availability, Quality, Accessibility	Quality, Accessibility
Status on Water Situation	Water Scarcity	Water Stress	Water Stress	Water Stress

“Water Stress comprises of water availability, Quality and accessibility”

“Water Scarcity is an indicator of a problem with water availability”

On the basis of this defined terminology and concept, related good practices are identified/categorized by the issues exacerbating to water stress/scarcity and the initiatives to overcome it.

As per the key findings, Gandhidham and Anjar city are facing issues broadly related to Quality, Availability and accessibility making both the cities water stress. The selected case studies are similar with the situation and addresses each component and the issues with the initiatives to tackle it.

Source: Adapted from CEO Water Mandated, Water-Related Terminology

Good Practices-Source

Augmenting the Own Sources - Case of Chennai City

Issues the city was facing



shortage of fresh water sources



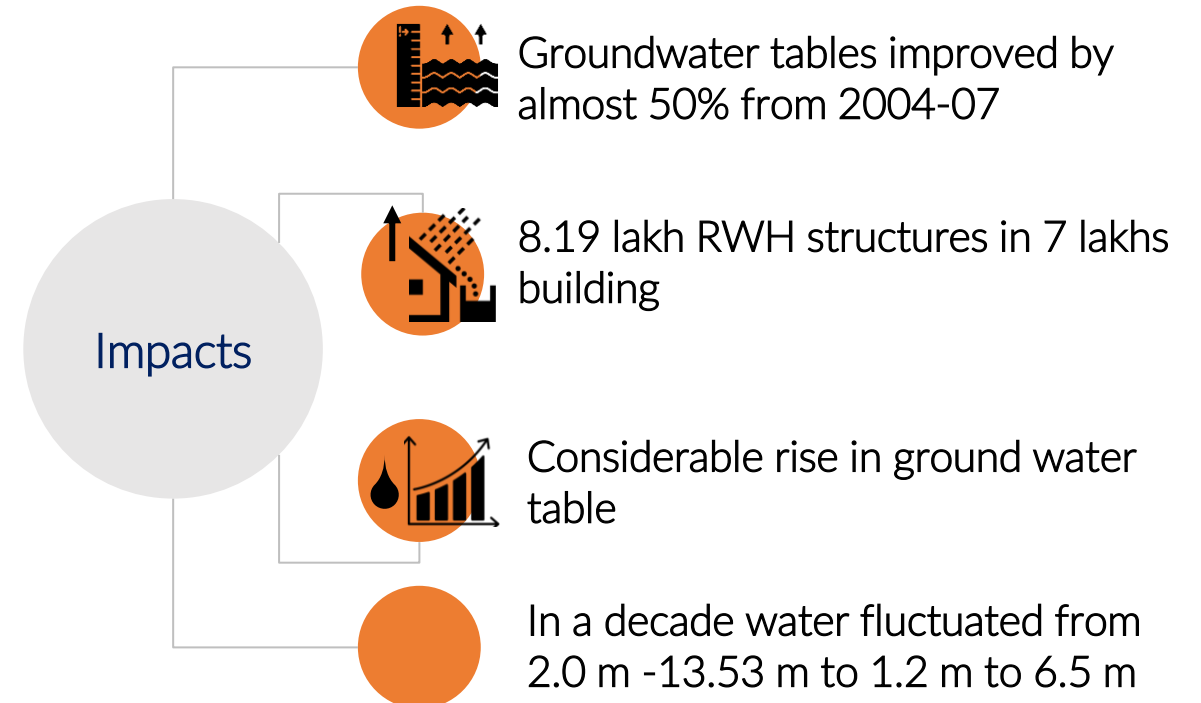
Higher dependency on Ground water



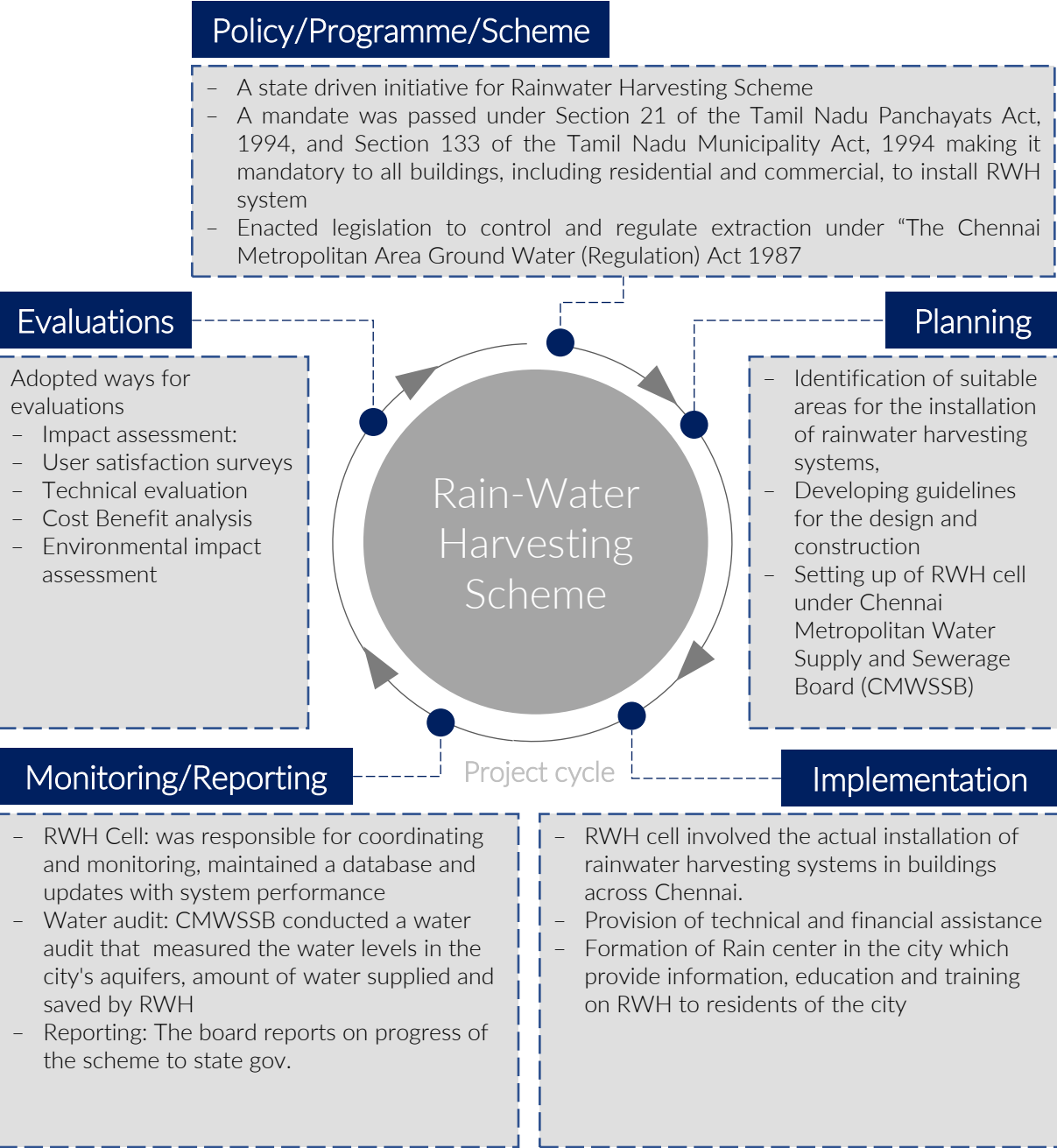
further ingress of saline water into fresh groundwater sources

Initiatives to tackle the issues

- Formulation of a regulation in Groundwater Act, 1987 which obligates obtaining permission for extraction and transportation of the water
- Camping on rainwater harvesting by CMWSSB
- Setting up RWH Cell
- Free technical assistance to all citizens for setting up RWH
- RWH as prerequisite for getting new water and sewerage connections
- Enacted legislation to control and regulate extraction under "The Chennai Metropolitan Area Ground Water (Regulation) Act 1987"



(Augmenting the Own Sources - Case of Chennai City)



How will it work for Gandhidham & Anjar ?

Provision for Rainwater Harvesting through legislative backing. The Gujarat Municipalities Act. 1963, under section 275, the law gives power to make a bye-law

- Identify the potential sites/location for implementation RWH
- Development of rainwater guidelines for design and construction as per the city's need. The current guideline as per GDA & AADA, mandates compulsory setting up of RWH that have building coverage from 80 sqm to 4000 sqm
- Setting up RWH cell as a nodal agency under GWSSB which will be act a state representator

The RWH cell would help to assist the installation of RWH structure through technical assistance like awareness campaigns, training and educating the citizens. It would provide grants and subsidies to support the needy

The responsibility for monitoring will be of the RWH cell which will coordinate with building approval department for giving building approval after setting up RWH structure. Other responsibility would be to conduct water audit

Several Study related to impact assessments, cost benefit: analysis looking cost of installing and maintaining RWH systems and compared it to the savings generated through reduced water usage. And user satisfaction survey can help evaluation of the whole scheme

Good Practices-Services

Tracing the NRW: case of Surat, formation of a NRW cell

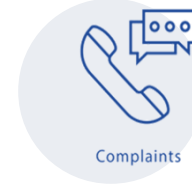
Issues the city was facing



20.4%
NRW



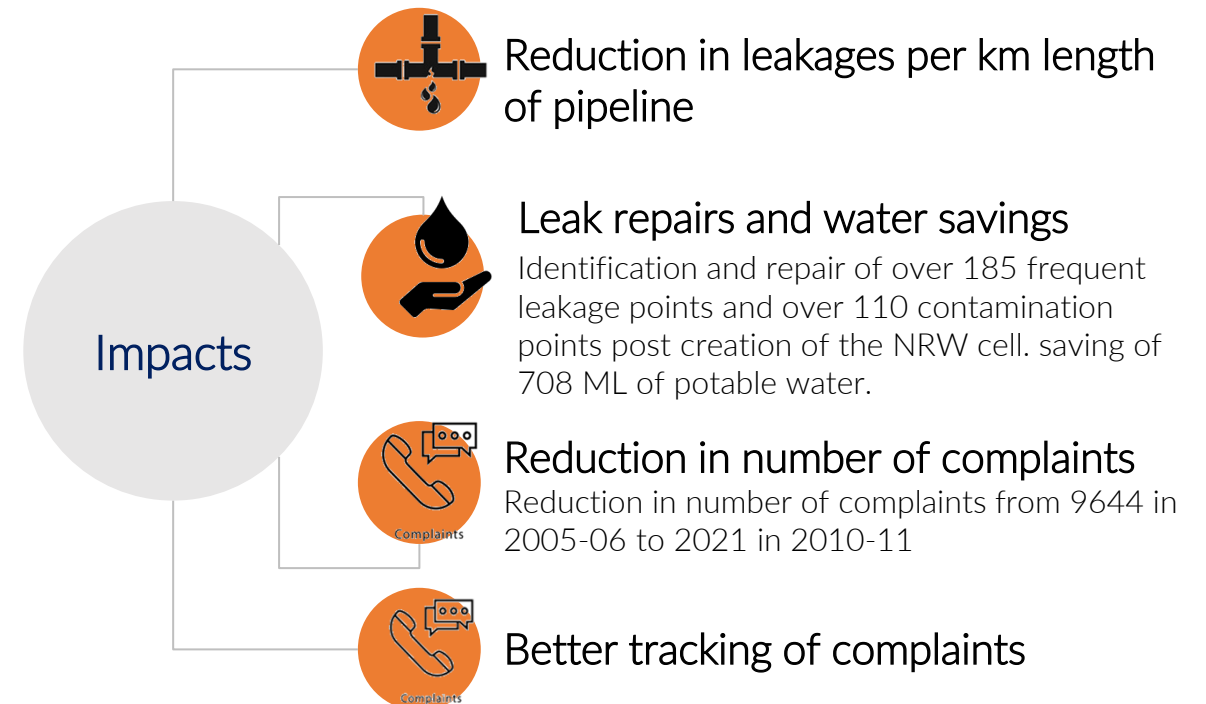
Absence of volumetric metering at consumer level
SMC's reported NRW scores a 'D' with respect to reliability levels under the SLB framework



2006 and 2007, complaints received (9,644 complaints in 2006 and 9,903 complaints in 2007) from various zones about pressure, leakages and breakages in the system.

Initiatives to tackle the issues

- **Leak detection and mapping** based on current and historical complaints from citizens/areas, then addressed by respective departmental or zonal leak detection team.
- Ground level assessment by SMC's Hydraulic department
- Leakage repairs done
- Installation of SCADA system at WTPs
- GIS mapping of water networks
- Conducting periodic water audits (Every 3 years)
- SMC constituted an NRW Cell with the mandate to plan, develop, implement and monitor an action plan for reduction of NRW



Tracing the NRW: case of Surat, formation of a NRW cell

Policy/Programme/Scheme

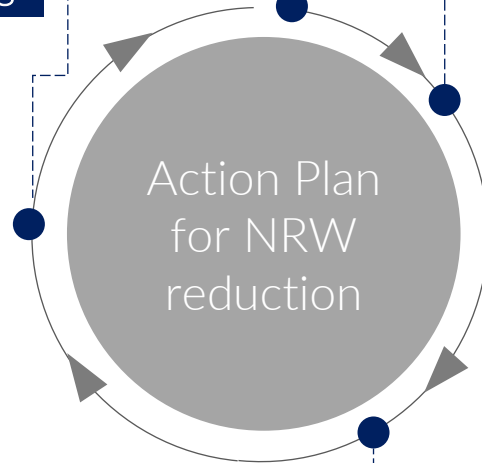
- A mandate to plan action plan for reduction of NRW by constituting a NRW cell
- Plan, develop, implement and monitor reduction of NRW under SMC

Monitoring/Reporting

- Installation of SCADA system for water distribution network and provide real time data
- Metering helped in flow of water and detects leaks
- Pressure monitoring
- Water quality testing, identified contaminated points

Planning

- Phase 1- Leakage Mapping
- Phase 2- Comprehensive Water Audit and metering



Project cycle

Implementation

- Approx 50 DMA comprising 1500 to 2500 consumers each
- For Water audit : Installation of bulk meters Flow meters, valves and related accessories.

How will it work for Gandhidham & Anjar ?

- Both the cities should formulate a dedicated NRW

- Both city should make GIS based water network maps which is absent as of now
- Leakage Complains are mapped online
- For water audit Identification pf DMA areas

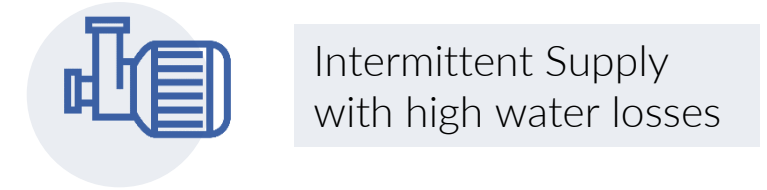
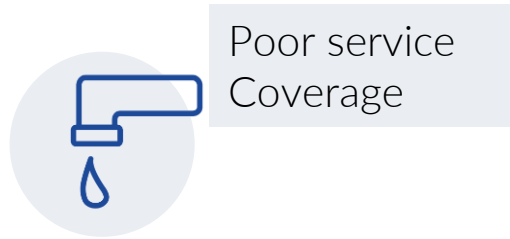
- Installation of bulk meters, flow meter valves and related accessories
- It will help to collect data for apparent losses

- For monitoring cities should use SCADA system install in the main water distribution system

Good Practices-Services

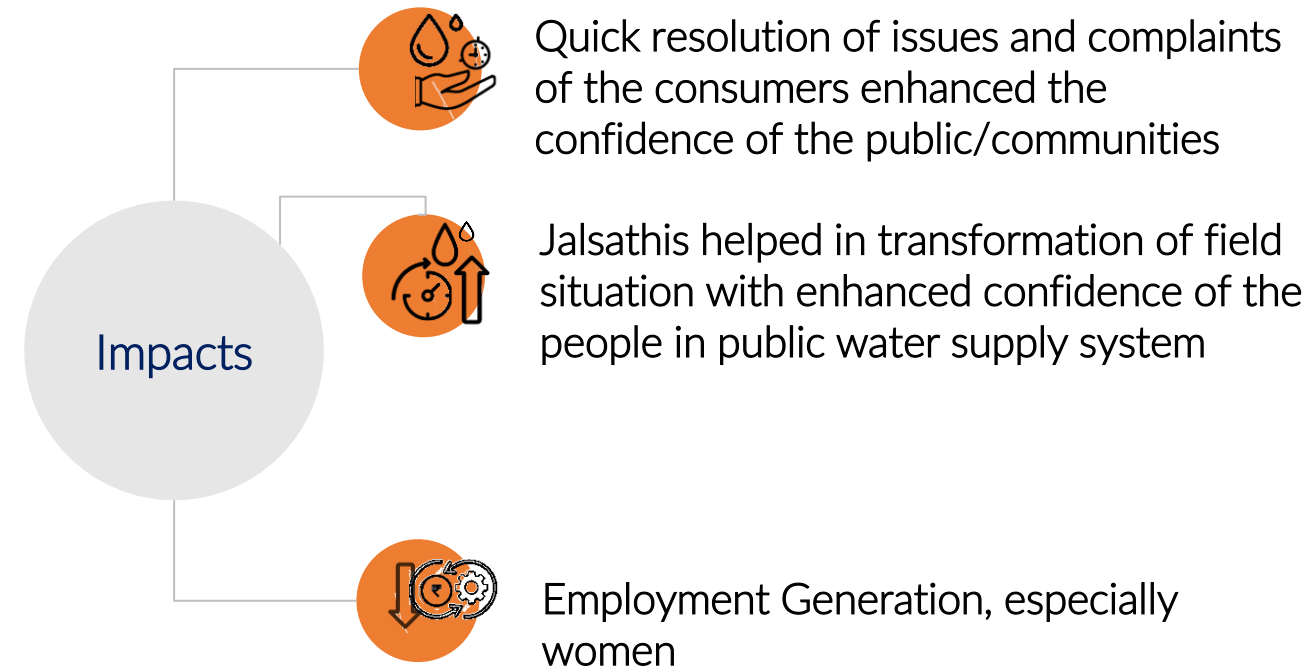
Water Quality Assurance: Case of Puri City

Issues the city was facing



Initiatives to tackle the issues

- **Ensure regular water quality testing:** By established a Water Testing Laboratory to conduct and setting up Jalsakhis
- **Invest in treatment facilities:** The modern treatment plant uses a combination of technologies such as coagulation, flocculation, sedimentation, filtration, and disinfection to treat the water
- **Maintain proper infrastructure:** The GIS provides real-time information about the location of pipelines, pumping stations, and reservoirs addressing issues related to maintenance.
- **Educate the public:** The city has established a Community Water Center, which conducts outreach activities such as workshops, awareness campaigns
- **Promote conservation:** The city has established a Rainwater Harvesting Cell to promote the collection and storage of rainwater.
- **Ensure transparency:** The city has established a Water Information Management System, which provides real-time information on the quality of water supplied, water consumption, and billing.



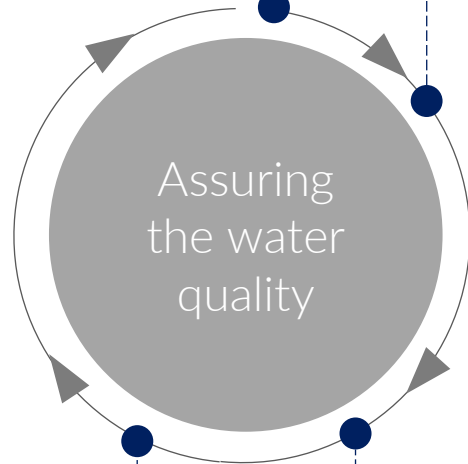
Water Quality Assurance: Case of Puri City

Policy/Programme/Scheme

- Women volunteers will ensure the supply of clean drinking water through piped water systems.
- Formation of Jalsakhi mandals (SHG)

Planning

- The GoO mission drink from Tap planned for 24x7 water supply.
- In one of the planning stage for 24x7 water supply was to supply quality water and assure the quality of water supplied is drinkable
- For that purpose, communication strategy was formed which was delivered by Jalsakhi



Monitoring/Reporting

- The monthly meetings and the quarterly meetings at the ward level need to have feedback on communications as part of the agenda,
- To capture the progress and suggestions for changes/additions

Implementation

- The implementation of the strategy responsibility is of WATCO and through its field officer and the trained Jal Sathis
- The communication strategy involved topics
 - Water quality
 - Quality of material and maintaining
 - Safe water, Contamination through tanks
 - Metering and Tariffs
 - Customer contacts and complaints mechanism

How will it work for Gandhidham & Anjar ?

Formulation of (SHGs) can be happen with collaboration of ULB's with The women & child development department (WCD), Government of Gujarat

The implementation of this strategy would be done through ULBs

- The SHG group will help Collecting samples for quality checking that would help to provide water supplied information in real time
- Will address the complains and issues related water supply
- Awareness Campaign

- A check list/ survey form should be capturing perception of water quality in the city to monitor the impacts of communication strategy

Conclusion

		Gandhidham	Anjar	Remarks		Learnings from the case studies / Improvements
Source	Water Availability	54 MLD vs 51 MLD Demand Supply Gap	15 MLD vs 12 MLD Demand Supply Gap	Gandhidham	89 LPCD which is on decreasing trend (supplied days)	For both the cities augmenting the own sources through RWH would help catering the future estimated demand
				Anjar	91LPCD which is on increasing trend	
Distribution	Treatment	Rambaugh WTP is not functional	Anjar WTP is functional but lacks on periodic check	Gandhidham	Chlorination takes place with no other treatment process	The problem of minimum water requirement at WTP to run it, would be solved once the augmentation through own source happens
				Anjar	Treatment taking place as per the defined standards	
	Storage	Total storage available 32.8 ML	Total storage available 14.4 ML	Gandhidham	For 24X7 supply required storage is 18 ML	
				Anjar	For 24X7 supply required storage is 5 ML	
	Continuity of Water Supplied	Supplied hrs: 1-2 (Primary Survey) & Frequency of once in 3 days	Supplied hrs: 0.5-1 (Primary Survey) & Frequency of Alternate days	Gandhidham	Inconsistency in water supply sometimes leading to no availability of water	The 24x7 water supply approach will help resolve the problems related to continuity and Quality of water supplied and provisions can be adopted from the case of Puri city
				Anjar	Reliable water supply in terms of frequency as stated by the ULB	
Quality of water Supplied	Heavy reliance on private suppliers for drinking water	Equivalent reliance on both private and municipal supply for drinking	Gandhidham	Lack of Quality assurance and supply availability leading people using bottled water		
			Anjar	High level of water contamination due to leakages and mixing of sewage making loose confidence in municipal water supply		
NRW	Water losses higher than SLB benchmark	Water Losses are under the SLB benchmark	Gandhidham	NRW is 30 % more than the set benchmark of 20 % by SLB	Setting up NRW and timely water auditing will help reduction in NRW, this will help making the service efficient	
			Anjar	NRW is 15 % fulfilling the set benchmark of 20 % by SLB but the complaints suggest high leakages and the need for water audit persists		

Thank You !

STUDY BY
RUTVIK BHATT | PUI21295

DRP SPRING SEMESTER 2023
MASTER OF INFRASTRUCTURE PLANNING
FACULTY OF PLANNING
CEPT UNIVERSITY