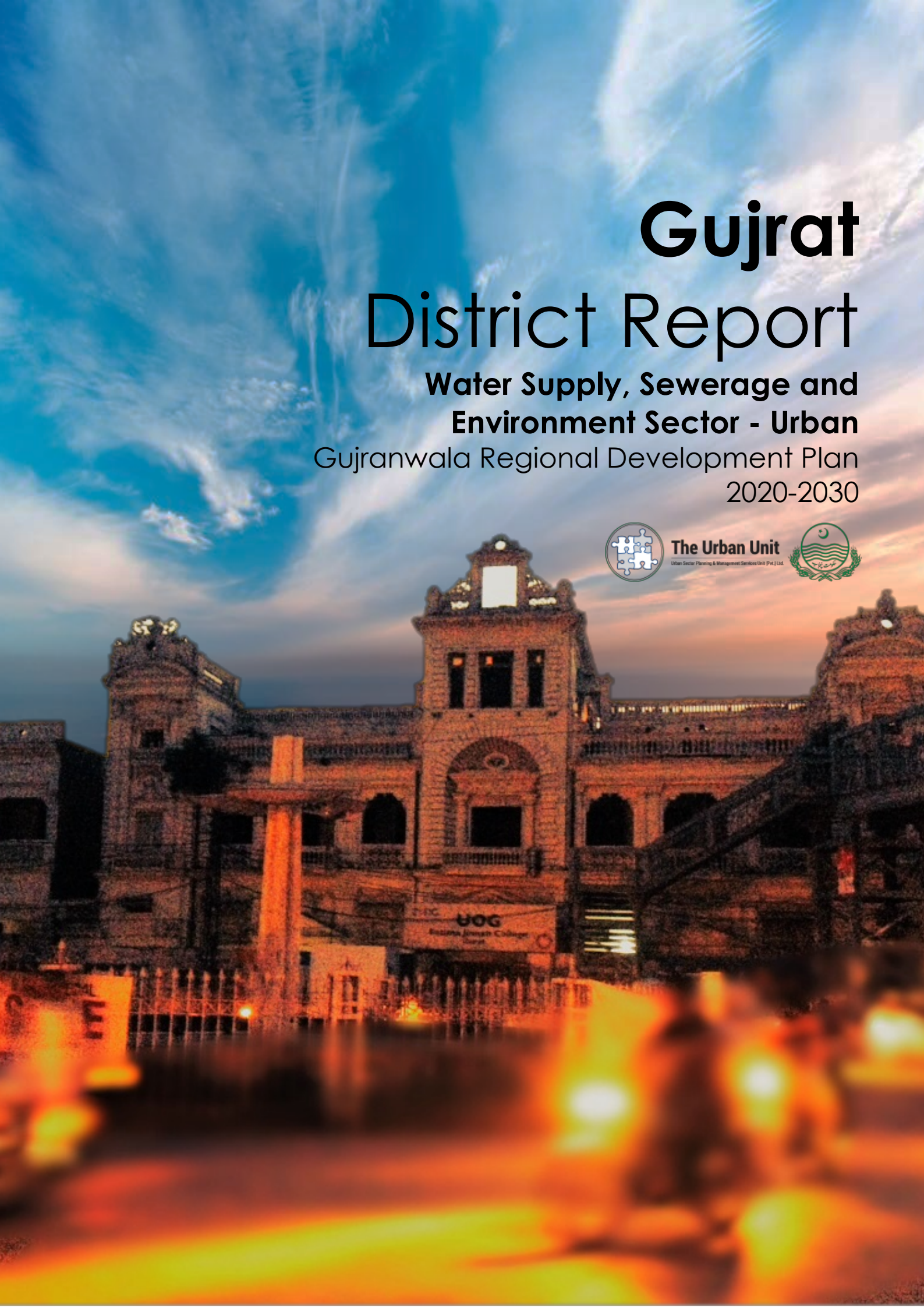
Gujrat
District Report
Water Supply, Sewerage and Environment Sector - Urban
Gujranwala Regional Development Plan
2020-2030

The Urban Unit



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Acronyms

GIS	Geographic Information System
GSTs	Ground Storage Tank
MGD	Million Gallons Per Day
MC	Municipal Corporation
OHRs	Overhead Reservoirs
PHED	Public Health Engineering Department
PVC	PolyVinyl Chloride
SCADA	Supervisory Control and Data Acquisition
TDS	Total Dissolved Solids
TMA	Tehsil Municipal Administration
UC	Union Council
UGWTs	Underground water tanks
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Gujrat District Report is developed using participatory approach combined with the field visits of Gujranwala division and primary & secondary data analysis at local, regional and national level. The planning exercise involved all relevant key stakeholders (including local community) for identification of key projects, their timelines i.e., short-medium-long term investment plan at district and regional level. Number of projects and program executed in the previous years for the improvement of municipal service delivery and environmental conditions were also assessed. Existing legal landscape, administrative and institution set-up, China Pakistan Economic Corridor (CPEC) and other initiatives as well as similar projects executed internationally were also considered in the study.

The current report is comprised of six sections. Gujrat district profile, current state of water supply and proposed projects for WS are discussed in sections I, II and III. District Gujrat is bounded on the northeast by Mirpur, on the northwest by the River Jhelum, which separates it from Jhelum District, on the east and southeast by the Chenab River, separating it from the districts of Gujranwala and Sialkot, and on the west by Mandi Bahauddin. With regard to water coverage, it is estimated that the water supply network covers 75% of the town and serves 70% of the total population. Presently, the water distribution system is only working on an intermittent pumping method without any storage facility. This is potentially due to the lack of coordination and planning when extending the distribution system beyond its hydraulic capacity to provide a 24-hour service. Currently, the water supply runs for approximately 16 hours on average.

Considering the existing disparity in demand and supply and with the aim to improve service delivery, a number of interventions are proposed on short-medium-long term basis for Gujrat district in order to make the existing network efficient and enhance the water supply coverage. Likewise, 3 DNI zones are proposed in this regard for safe and reliable supply of water in the district. Schemes in long projects will serve the population settlements which are beyond the ambit of MC Gujrat. The total estimated cost of the proposed projects is 1619.1 M rupees.

Likewise, the coverage of the sewerage system is approximately 50% of the population and 60% of the area. The sewer capacity is not adequate to handle the quantities of sullage water generated and the sewers frequently overflow. This has also been due partly to a number of illegal connections, which urgently need to be legalized to close off. Discharge into open channels has led to seepage drains. Recommendations with regard to rehabilitation and extension of the current sewerage system have been prioritized for Short, Medium and Long term in the recommendation section. Safe disposal of wastewater through centralized wastewater treatment plant has also been suggested as a long-term intervention. The total estimated cost of the proposed projects is 1290.5 M rupees.

Section 4 of the report provides current state of environment and public parks. The degradation of environment in Gujrat is a major environmental concern these days. Air pollution levels in the urban centers have either crossed safe limits given in the PEQS or have reached the

threshold values whereas lack of green spaces is another serious issue. In order to improve the existing situation, recommendations are forwarded.

Section 5 of the report addresses the key challenges and Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis with reference WSS service delivery and environmental management while complimentary details to some of the proposed projects are enlisted in Section 6.

SECTION 1: DISTRICT PROFILE

1.1. LOCATION

Gujrat lies in "Chaj Doab" i.e. between Jhelum River on the North West separating it from district Jhelum, and Chenab on the South separating it from District Gujranwala and Sialkot. It includes historic villages and towns such as Kathala chenab, Barnali, Jalalpur Jattan, Chak dina, Karnana, Kunjah, Sehna, Kharian and Lalamusa. Gujrat city is a historical settlement which has been of significant importance in the past times.
The map of MC Gujrat is shown in Figure 1 that depicts different features in the region.

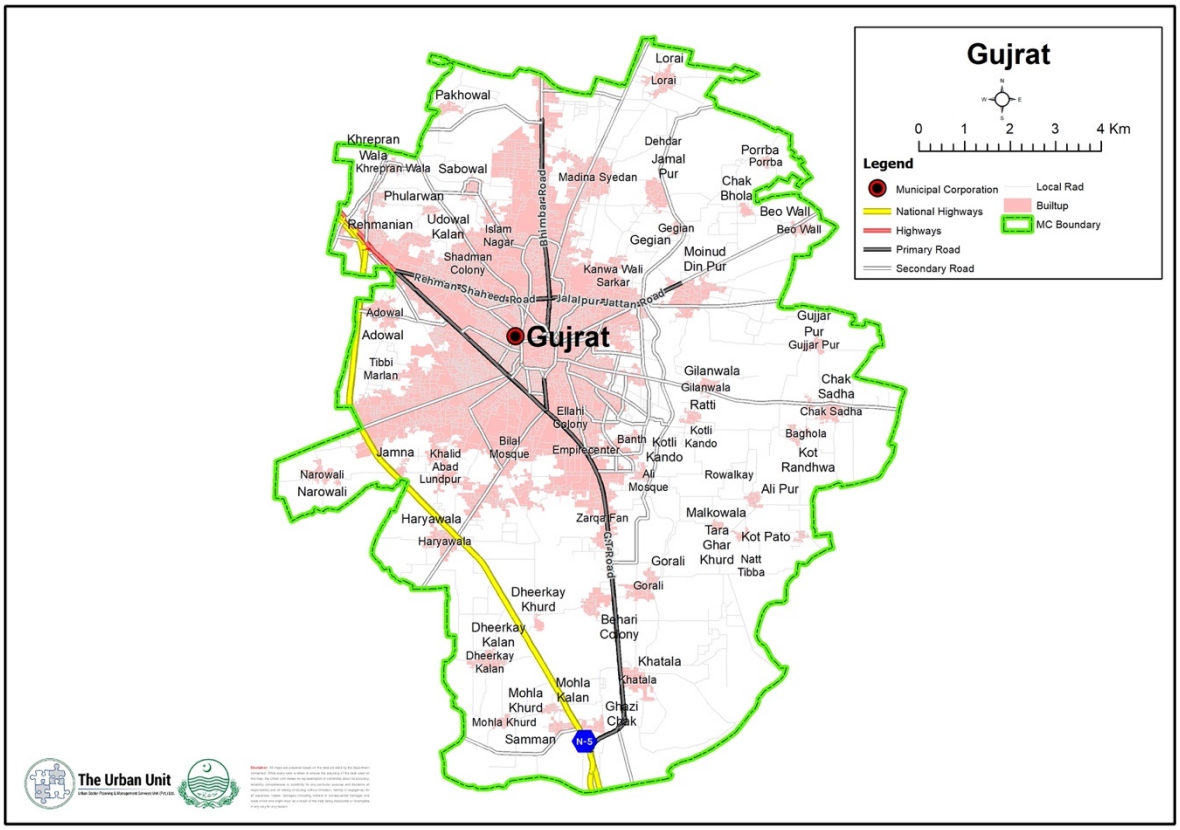


Figure 1: Gujrat at a glance

1.2. BOUNDARY

District Gujrat is bounded on the northeast by Mirpur, on the northwest by the River Jhelum, which separates it from Jhelum District, on the east and southeast by the Chenab River, separating it from the districts of Gujranwala and Sialkot, and on the west by Mandi Bahauddin.

1.3. ADMINISTRATIVE STRUCTURE

Gujrat District is divided into three tehsils for administrative services i.e.

- Gujrat
- Kharian
- Sarai Alamgir, amongst which Gujrat is the biggest one.

For a general perspective, there are 119 Union Councils in the District, along with a cantonment area in Tehsil Kharian.

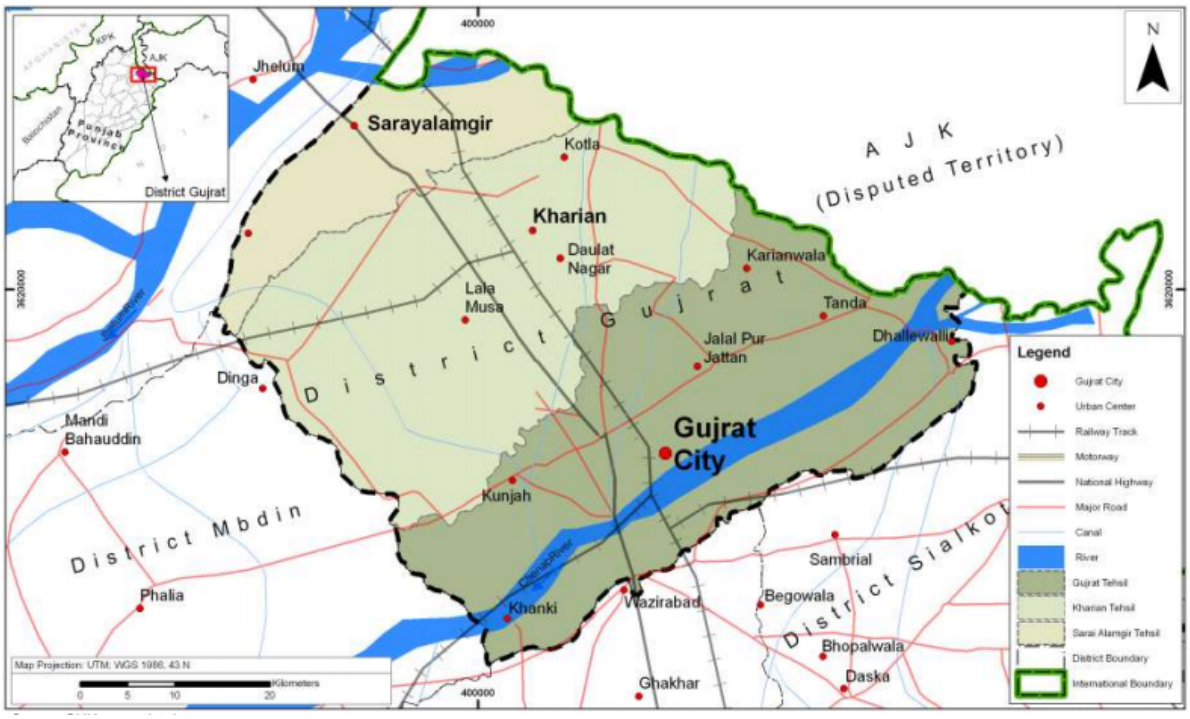


Figure 2: Location Map of Gujrat City

Salient features that contribute to the land use in city include residential, commercial, religious, educational, health and industrial facilities, which are spatially depicted in the map (Figure 3) below.

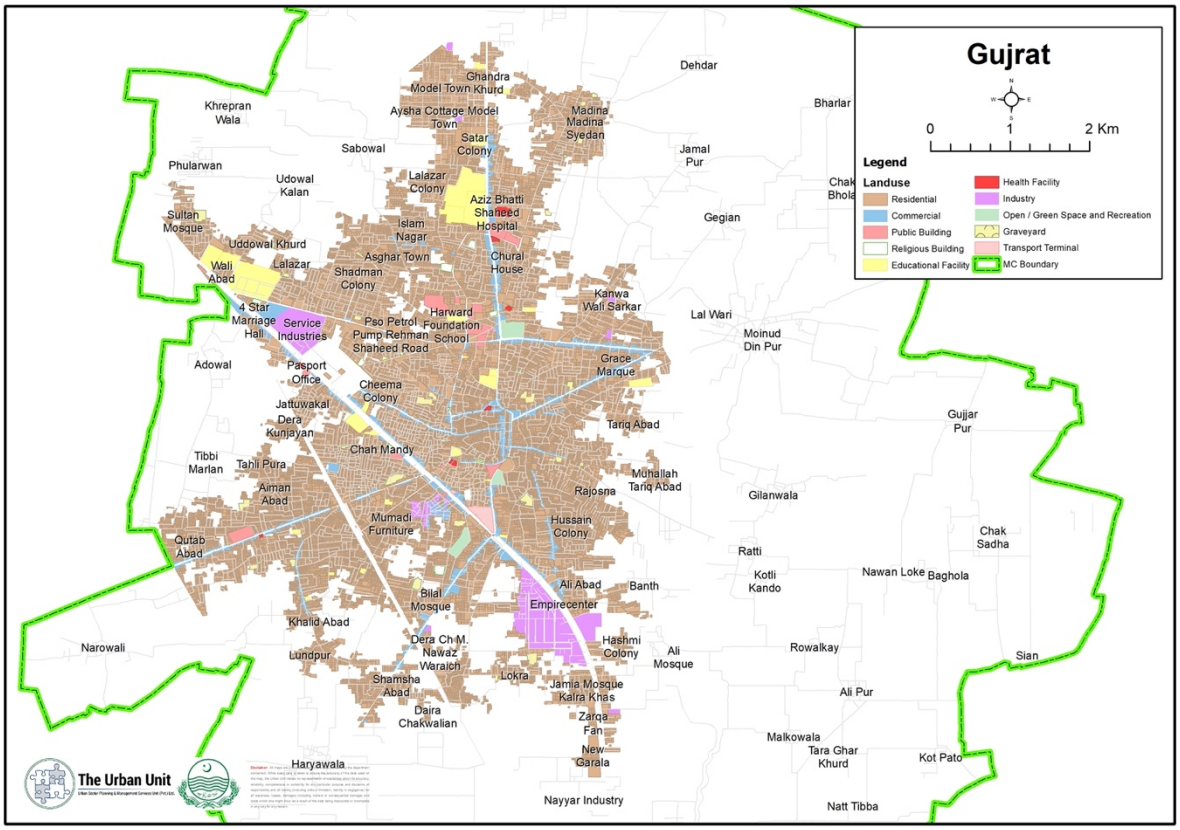


Figure 3: Land-use Map of Gujrat City

1.4. DEMOGRAPHY AND SOCIOECONOMIC TRENDS

Gujrat has a cluster of furniture, fan and pottery industries that not only meet the domestic needs but also contribute to foreign exchange through significant exports. It has a unique location between river Chenab and Jhelum, dwelling more than 2.7 million people in Tehsil Gujrat, Kharian and Sarai Alamgir. Gujrat's decent literacy rate is worthy of notice and therefore the addition of new universities and medical colleges has been welcomed. In total, there are 1395 schools, 17 colleges, one University and one medical college in Gujrat District. Likewise, there are 1905 health facilities in the District including one Teaching Hospital.

District Gujrat is spread over an area of 3,192 square kilometres. According to the census of 2017, the population of the district was 2,756,110 persons, while the average Annual Growth Rate (1998-2017) was 1.57%.

Other salient Features of the District (as per 2017 Census) are enlisted below.

Table 2- Population Characteristics of District Gujrat[1]

Population Characteristics		
Sr.no	**Feature**	**Quantity**
1	Households	442,399

[1] District Census Report of Gujrat (2017)

2	Urban population	30.1 %
3	Rural population	69.9 %
4	Male population	48.5%
5	Female population	51.5%

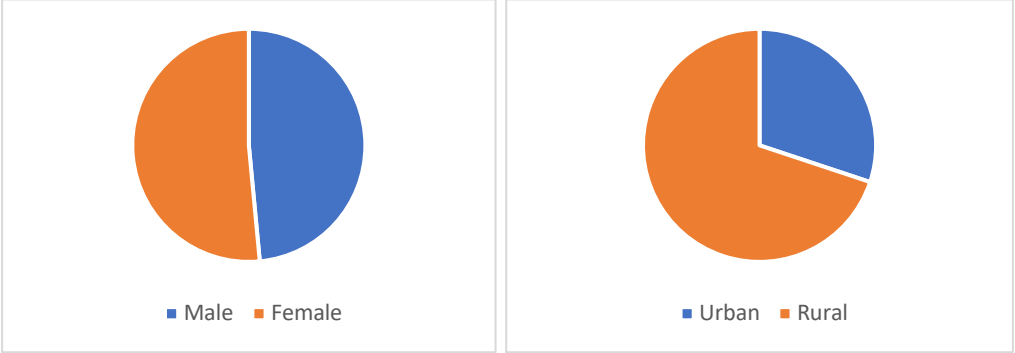


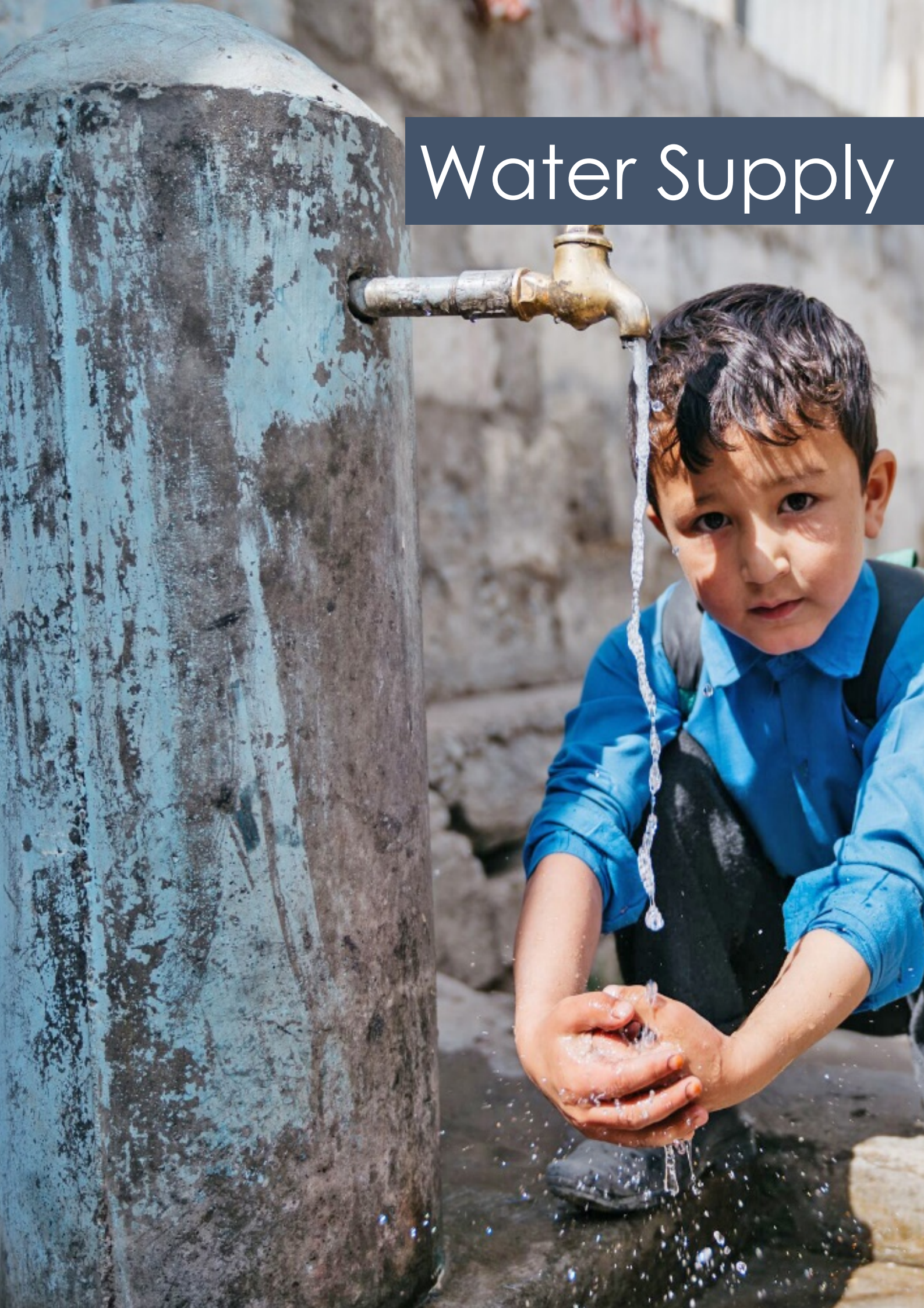
Figure 4: Demographic Distribution in Gujrat District

In the same manner, the following table summarizes the demographic profile of Gujrat city. Other than TMA, there are different departments involved in Municipal Services which include Public Health Engineering Department, Provincial Highway, District Housing Department (PHATA), District Environment Department, Traffic Police, District Transport Department, and District Road Department.

Table 3: Profile of Gujrat City

Item	Value
Creation of Tehsil	Year 1856
Creation of City	522 B.C
Number of Union Councils	15
Total Area of the City	31.52 Sqkm
Total Population of the City	0.4 Million
Literacy rate of the City	72.2%
Average Household Size	7.0

Water Supply



SECTION 2: WATER SUPPLY

2.1. VISION

"A region, and communities within, having safe, equitable and sustainable water and sanitation"

2.2. CURRENT STATE

2.2.1. Water Demand

Based on the current and projected populations for the Municipal Corporation and as per design criteria of Public Health Engineering Department, the proposed water demand of 50 gallons per capita per day, current water demand and future (2020, 2025 and 2030) water demands are shown in Table below, for the existing and potential future service areas.

For the purpose of projections, Industrial water demand is assumed to be only 15% of the total water consumption as it is assumed that larger industrial establishments have private water supply source. Commercial and institutional demands have been assumed to be 15% and 10% of the total water consumption respectively. A growth rate value of 1.57% was considered, which was the average annual growth rate from 1998-2017 with a base population of 393,094 as reported for 2017.

At present, the water losses are assumed to be around 30%. However, the eventual target would be to reduce these losses to around 10% in the year 2030.

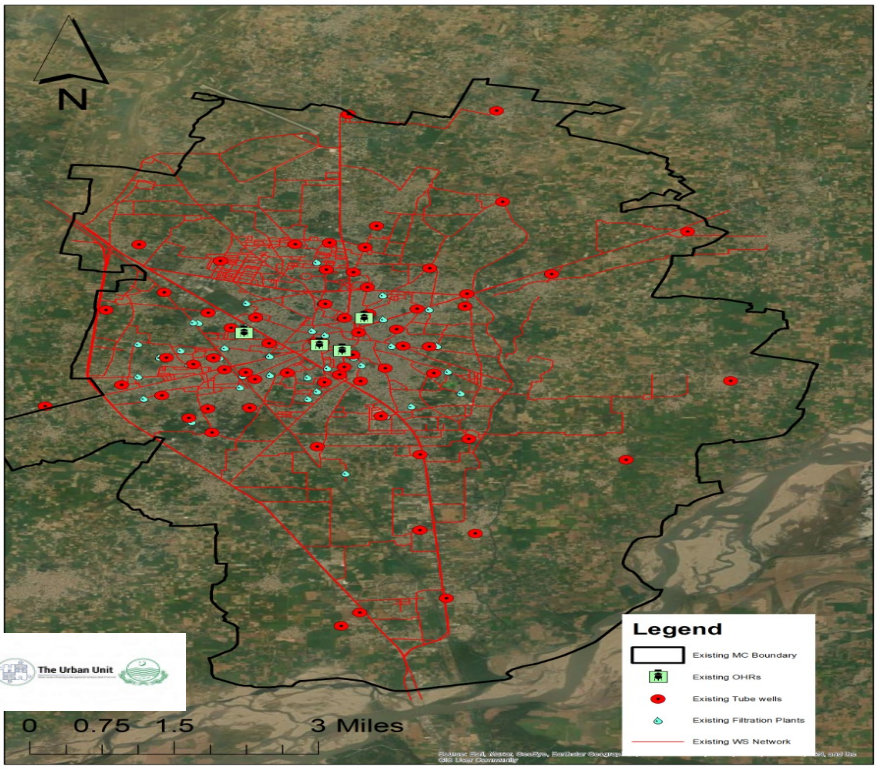


Figure 5: Existing Water Supply Network in MC Gujrat

The following table summarizes the existing and projected water demand in Gujrat, owing to growing population and increased needs

Table 4: Projected Water demand in Gujrat

	2020	2025	2030
	Existing Urban Boundary	Existing Urban Boundary	Existing Urban Boundary
Population	411,901	445,267	481,335
Domestic (GD)	20,595,046	22,263,326	24,066,742
Commercial (GD)	3,089,257	3,339,499	3,610,011
Institutional (GD)	2,059,505	2,226,333	2,406,674
Industrial (GD)	2,059,505	2,226,333	2,406,674
Losses (GD)	8,340,994	9,016,647	9,747,030
Total (Gallons Per Day)	36,144,307	39,072,137	42,237,132
Total (MGD)	36.1	39.1	42.2

2.2.2. Water Coverage

It is estimated that the water supply network covers 75% of the town and serves 70% of the total population. Presently, the water distribution system is only working on an intermittent pumping method without any storage facility. This is potentially due to the lack of coordination and planning when extending the distribution system beyond its hydraulic capacity to provide a 24-hour service. Currently, the water supply runs for approximately 16 hours on average. The following table provides an overview of the current water supply system.

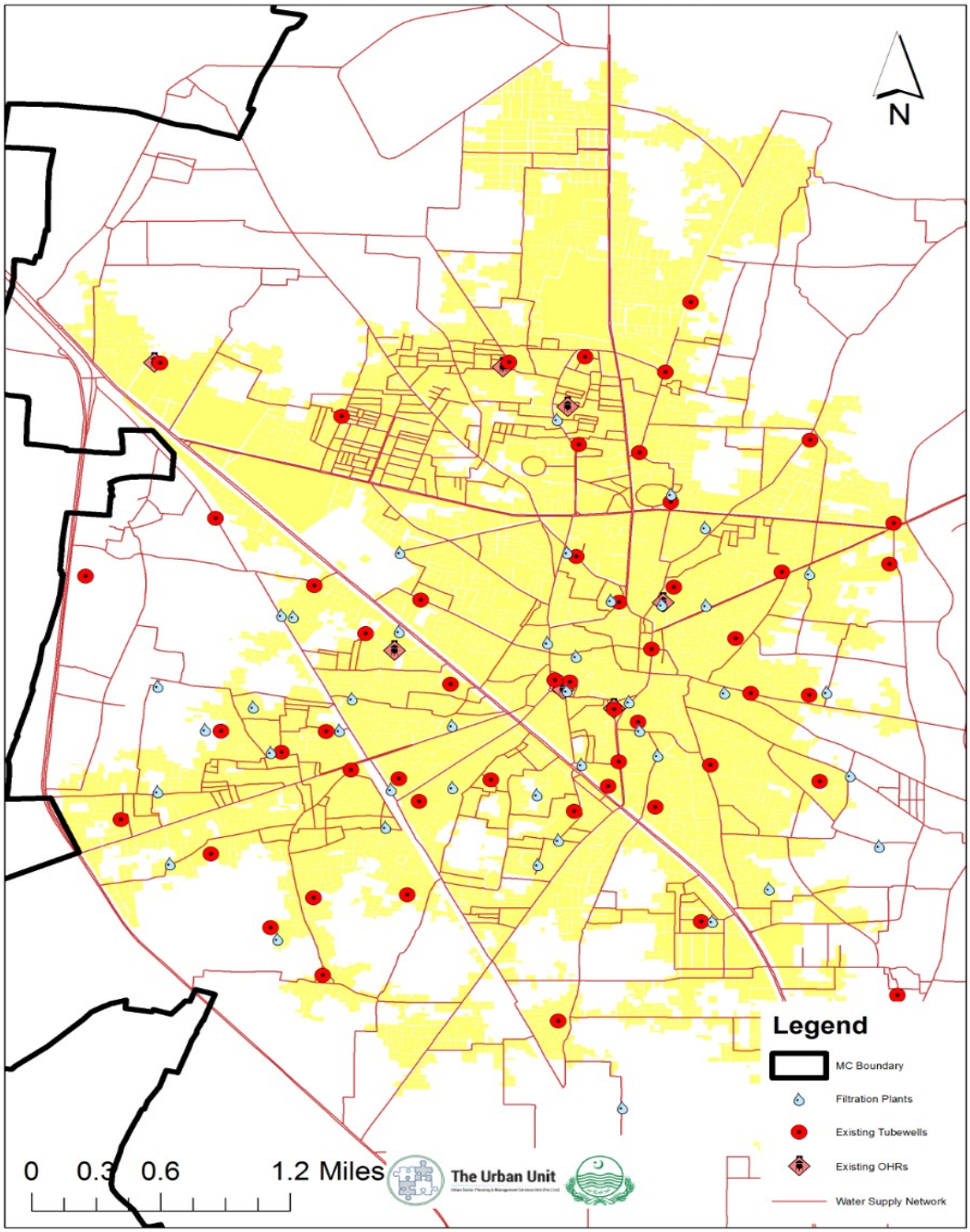


Figure 6: Existing Water Supply Network in MC Gujrat

2.2.3. Water Connections

The following table enlists salient features of the water supply system in MC Gujrat along with a summary of water rate connections. As envisaged through this report, proactive planning would be needed presently to ensure sound balance of demand and supply of water in a safe, sustainable and equitable manner.

Table 5: Summary of Gujrat's water supply system

Sr.No.	Item	Value
1	**Coverage**	
	Water supply coverage area	75%
	Population	70%
2	**Source**	
	Ground Water (tube wells based)	Yes
	No of Tube Wells	55
	Functional Tube Wells	55
	Capacity of Functional Tube Wells	53.5 cusec
	Total Supply	19.26 MGD
	Duration (Supply Hours)	16
3	**Total Connections**	34382
	Domestic Connection	33984
	Commercial	259
	Industrial	139
4	**Water Consumption**	
	Per Capita water Consumption	50g/d
	Total Water Consumption	18MGD
	Overhead Reservoirs	6Nos
	Capacity of OHT's	0.278Million Gallon
	Ground Water Storage Tank	0
	Capacity of Ground Water storage tank	Not applicable
5	**Water Distribution Network**	
	Type of Distribution pipe network	3inch to 24inch AC/ PVC
	Approximate pipe length	200Km
6	**Staff**	
	Total Staff for W/S Management	130
	Technical	12
	Non-technical	118
	Maintenance Teams	10
	Staff/1000 Population for Water Connections	3.24

Table 6: Summary of Water Rate Connections

Type of Connection	No. of Bills	Water +Sanitation Fee		Total Yearly Demand (in Billion PKR)
		Monthly	Yearly	
Domestic Connections	33,984	175	2,100	71.4
Commercial Connections	259	400	4,800	1.24
Industrial Connections	139	650	7,800	1.1
Total	34,382		14,700	73.7

2.2.4. Existing Water Supply Facilities

2.2.4.1. Tube wells

Gujrat city falls in sweet water zone. A total of 65 tubewells fall under the domain of MC Gujrat and a detailed table is attached as Annex, along with their current status. Tubewells not operational currently are proposed to be rehabilitated as a short-term intervention in recommendations section. Previously, 17 Nos tube well, each having discharge of 2 cusecs were installed by PHE Department under the project. *"CONSTRUCTION OF WATER SUPPLY SYSTEM GUJRAT CITY*". All tube wells are functioning satisfactorily, and residents are being benefitted with clean drinking water. In this project rising main/distribution system having lengths 784712 Rft in Gujrat city with 12600 Nos of house connections was done. The project is being maintained by Municipal Corporation Gujrat.

2.2.4.2. Filtration Plants

A total of 53 filtration plants come under the domain of MC Gujrat and a detailed table is attached as Annex, along with the current status. Essentially, all of these plants are operational currently with good water quality, as reported by authorities and public during the site visits. However, some plants/network requiring minor repair/maintenance are being proposed as short-term interventions in the recommendations section.

A project is under process in Punjab Municipal Services Programme namely "Repair and renovation of all filtration plants Municipal Corporation Gujrat", which has significantly contributed to improved situation.

2.3. DESIGN CRITERIA

Design Criteria for water supply system has been based on "Technical and Service Delivery Standards for Water Supply and Sanitation Sectors" by PDSSP and PHED Design Criteria 2008.

2.3.1. Population Projections

As per PHED design criteria 2008, the population projections are to be calculated according to the following expression:

$$P_n = Po\ (1+r)^n$$

Where:

Pn = Projected population by the end of nth year
Po = Population of base year, year of known population
r = Population growth rate per year to be taken from related District Census Reports.
n = No. of years, counted from base year i.e. design period

2.3.2. Design Period

Component	Criteria
Tube Well	The former standard for design period of tube wells and treatment work in case of urban and rural water supply schemes was 10 years. However, PHED notes that majority of drinking water tube wells installed in the province, about 15 to 20 years back, are still in satisfactory working condition. For optimal utilization of resources, PHED advises to adopt a design period of 15 years as far as tube wells are concerned. Furthermore, the design of tube wells should be based on maximum day demand.
Slow Sand Filter Plants	According to the guidelines, the design life of slow sand filter plant may be considered around 20 years
Rapid Sand Filter Plants	According to the guidelines, the design life of slow sand filter plant may be considered around 25 years
Tube Well Pump Houses	The design period of tube well pump house is suggested as 25 years
Pumping Machinery	PHED recommends that it is not possible for pumping machinery to work for 10 years without proper maintenance and repair and replacement of the pumping unit is necessary after every 10 years of its operation.
Distribution System	The existing standard for the design period of distribution system is 20 years. It is added that the water distribution network capacities should be based on peak hour demands
Rising Mains	The existing standard for the design period of distribution system is 25 years. Furthermore, the size of rising mains should be based on maximum day demands

2.3.3. Water Consumption

Component	Criteria
Domestic Water Consumption	In the previous Design Criteria of PHED a figure of 50 gpcd was recommended for all cities having population more than 100,000 persons. However, in the revised criteria, the standards are listed in the table below:

Design Population (Thousands)	Per Capita Consumption Per Day (Inclusive of unaccounted water)
100,000 – 200,000	50 gallons
200,000 – 300,000	55 gallons
300,000 – 400,000	60 gallons

Institutional Water Consumption	For institutions such as hospitals, hostels, schools etc. an allowance @ 10 gallons per boarder and @ 5 gallons per day scholar is to be made
Maximum Day Demand	Maximum day demand is to be taken as 1.5 times the average day demand
Peak Hour Demand	Peak hour demand to be taken as 1.5 times the maximum day demand

2.3.4. Tube Well Design

Component	Criteria
Terminal Pressure	Keeping in view the trends of multistory building construction, PHED recommends to adopt at least 12 meters minimum terminal pressure
Flow Velocity in Pipes	**Distribution Mains** (0.5 to 2 m/s) **Rising Mains** (0.3 to 1.5 m/s)
Minimum Pipe Size	For plain areas the 3 inches (80 mm) standard of minimum pipe size is recommended
Earth Cover on Pipes	An earth cover of 3 feet (about one meter) should be provided over laid water supply pipe lines of all sizes except in hilly areas. Road cuts are to be backfilled with pit/river sand.
Sluice Valves	Sluice valves will be located at main control points for balancing and regulating the flows. These valves are recommended for pipes up to 250mm
Butterfly Valves	For pipes having diameter 300mm and above, butterfly valve shall be used at main control points
Non Return Valve	It is recommended to use Non Return Valves outside delivery main of the tube well and in the rising main after 2000m
Air Valves and Washouts	Air Valves are to be provided at the summits and after 2000m intervals in straight to facilitate escape of trapped air. Washouts are recommended to be used at lowest points to wash out all kinds of debris
Chlorination	0.1 PPM residual at the farthest end of the distribution system should be provided as per PHED design criteria. Hypo-chlorination may be provided where chlorine gas is not easily available

2.3.5. Overhead Reservoirs

According to PHED, overhead reservoir should be provided in all urban and rural water schemes except in cases of hilly/semi hilly areas. Capacity of overhead reservoirs in case of communities having population more than 10,000 persons should be based on around 1/10th of average day demand. Furthermore, minimum capacity of overhead reservoir should be 10,000 gallons.

2.3.6. Water Filtration Plant

<table>
<tr><th>Component</th><th>Criteria</th></tr>
<tr><td>Rate of Filtration</td><td>PHED standard for rate of filtration is 30 gallons per Sq. ft of sand area per day</td></tr>
<tr><td>Filter Sand</td><td>Depth = 30 – 36 inches</td></tr>
<tr><td>Effective Size of Sand (d_{10})</td><td>From top of Gravel to 1 feet =0.30 – 0.35 mm
1 to 2 feet = 0.25 – 0.30 mm
Top Layer 9 inches = 0.18 – 0.22 mm</td></tr>
<tr><td>Uniformity Co-efficient of Sand</td><td>It must not be greater than 2.5 of Sand = (d_{60}/d_{10})</td></tr>
<tr><td>Depth of Water Over Sand</td><td>3 – 4 feet</td></tr>
<tr><td>Velocity of Water</td><td>0.75 ft/sec in drainage system</td></tr>
<tr><td>Sedimentation Tank</td><td>Minimum number of sedimentation cum storage tanks in case of slow sand filtration plant should be two</td></tr>
<tr><td>Filter Gravel</td><td><table><tr><th>Size Range</th><th>Depth</th></tr><tr><td>3 to 1 inches</td><td>6 inches</td></tr><tr><td>1 to 3/8 inches</td><td>3 inches</td></tr><tr><td>3/8 to 3/16 inches</td><td>3 inches</td></tr></table></td></tr>
<tr><td>Outlet System</td><td>The outlet system will be provided with telescopic arrangement of pipes to adjust required flow of filtered water according to varying resistance in filter media. The difference in inlet and outlet will be kept 24 – 30 inches</td></tr>
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2.4. CHALLENGES FOR SERVICE DELIVERY

Some of the major challenges that were noted as part of the stakeholder consultations and field visits include:

- Poor maintenance of the supply network, including the wear & tear of machinery, impacting the overall efficiency of system
- Properly defined service area zones and DNI zones are absent for improved service delivery
- Institutional framework for water governance is weak
- Human resources, including the technical capacity of TMAs and PHED staff is limited

- Resource allocation is not done based on sound planning, need assessment, criteria and/or data
- Evidence based decision making is not taken into consideration
- Low budget allocation for extension or rehabilitation of existing water supply schemes, where actually needed
- MCs have no legal powers to recover user charges from defaulters
- Recovery does not meet the Operational expenditure

2.5. ASSET CONDITION ASSESSMENT – WATER SUPPLY

The team performed condition assessment of the infrastructure by physically visiting each facility. Ten tube wells, five filtration plants and three OHRs were examined in this regard on the basis of criteria mentioned in **Table 7.**

Table 7: Criteria for Asset Condition Assessment

Rating Chart		
Excellent	A	No noticeable defects. Some aging or wear may be visible.
Good	B	Only minor deterioration or defects are evident.
Fair	C	Some deterioration or defects are evident, but function is not significantly affected.
Poor	D	Serious deterioration in at least some portion of the structure. Function is inadequate.
Failed	F	No longer functional. General failure or complete failure of a major structural component.

Observations:

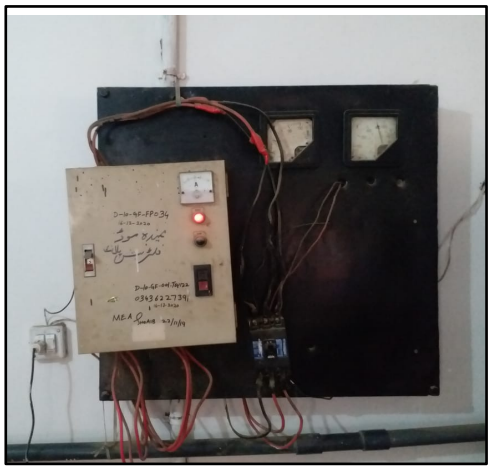
Tube Wells
- Non-functional chlorinators and unavailability of bulk meters
- Improper layout of electric cables on control panels
- Motor fan covers are not present
- Non-existent pump houses

Filtration Plants
- Condition of civil structure is acceptable but work is required in the interior
- Water taps have expired their life
- Inadequate cleanliness inside water filling area

OHRS
- Earth wiring mechanism and hazard light for air traffic is not present
- Overall condition of civil structure is satisfactory
- Pipes and valves are leak proof

Tubewell - TMA

Tubewell - Mehmada



Tubewell - Rest House

Tubewell - Veterinary Hospital

OHR - UOG Campus

OHR - TMA

Figure 7: Glimpses of Asset Condition at Tubewells and OHRs of Gujrat

2.6. RECOMMENDATIONS – WATER SUPPLY

During the Stakeholder Consultation with Deputy Commissioner and officers Municipal Committees, Town Committees, Public Health Engineer Department A0 size maps were used to define areas where water supply pipelines are in poor conditions, which areas are unserved at the moment, conditional assessment of infrastructure, future DNI zones, proposed location of infrastructure etc. Site visits were conducted building on the same exercise. This helped in not only understanding the current state but also envisioning the future state of the respective areas. Some recommendations, in terms of short, medium- and long-term priority are being forwarded.

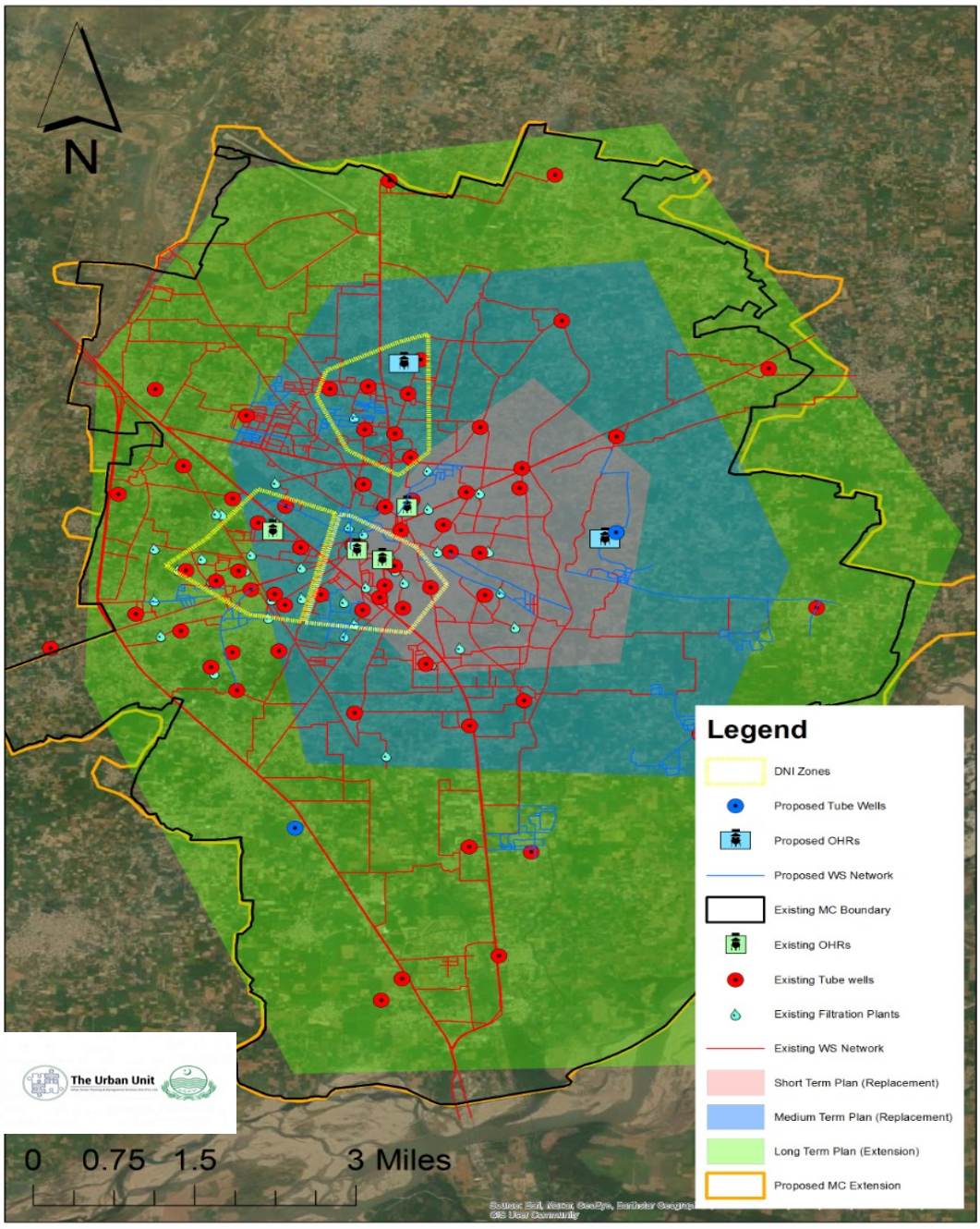


Figure 8: Gujrat Water Network and Infrastructure – Proposed

2.6.1. Interventions

2.6.1.1. Short Term (0-5 Years)

S.#	Project	Estimated Cost (Million PKR)
1	Rehabilitation of existing tube well in Moh. Tibbi Goriyaan and construction of new filtration plant	9.50
2	Relocation of tube well and installation of new machinery (2 cusec each) with pump house in Moh. Ucha Dara and Moh. Shah Hussain	24.00
3	Construction of pump house relocate tube well in Moh. Shadmaan Colony along with rehabilitation of existing filtration plant	13.251
4	Rehabilitation schemes in UCs 1-12	170.252
5	Provision of chlorinators with automatic dosing pumps to existing tube wells (65 Nos)	3.945
6	Rehabilitation of 7 OHRs in Model town, Zamidar College, Marghzar Colony, Science College, TMA office, Muslimabad, State Area	103.2503
7	Rehabilitation of tubewell at AliPura chowk and Mehmda Chowk	10.256
8	Installation of Water Filtration Plants in UCs Of Gujrat	5.30
9	Digitization through SCADA system for effective M&E	20.00
	Total Cost:	**359.75**

2.6.1.2. Medium Term (5-10 Years)

S.#	Project	Estimated Cost (Million PKR)
1	Capacity enhancement 5 tubewells from 0.5 cusec 2 cusecs in Rehmatpura. Kashmirpura, Chahkol Sultanabad Jattuwakal	283.753
2	Capacity enhancement of 46 tubewells from 1 cusec to 2 cusecs and 3 tubewells of 0.5 cusec to 2 cusecs	338.221
3	Extension of water supply system in extended U (Narowaali, Samamula, Ghazi Chak, Beowali)	84.12
4	Development of 3 DNI zones for safe and reliable supply of water	320.27

5	Installation of 6 tubewells in areas of Shadman colony, Shah Hussain, Purani Jail, Mehtab Colony Chah Kholay, Sada Chak Gillawala, Ibbi Gorian	39.00
	Total Cost:	**1065.36**

2.6.1.3. Long Term (>10 Years)

S.#	Project	Estimated Cost (Million PKR)
1	Installation of 2 tubewells with filtration plants in areas near Harrya wala and Kashmir Pura	28.00
2	Installation of 2 OHRs (50000 gallon) in areas near Harrya wala and Kashmir Pura	46.00
6	Door to Door Water Bottle service from 20 Filtration Plants	120.00
	Total Cost:	**194**

Sewerage

SECTION 3 - SEWERAGE AND DRAINAGE

3.1. VISION

"A region, and communities within, having safe, equitable and sustainable water and sanitation"

3.2. CURRENT STATE

Recently, the MC Gujrat conducted a survey to improve the drainage and sewerage system, with a special focus on immediate drainage of rainwater during monsoon season. However, a formal sanitation plan has still not been developed. Existing sewerage system of the city is depicted in the figure below. The drainage system is mainly composed of nullahs/drains in streets and sewers in main areas.

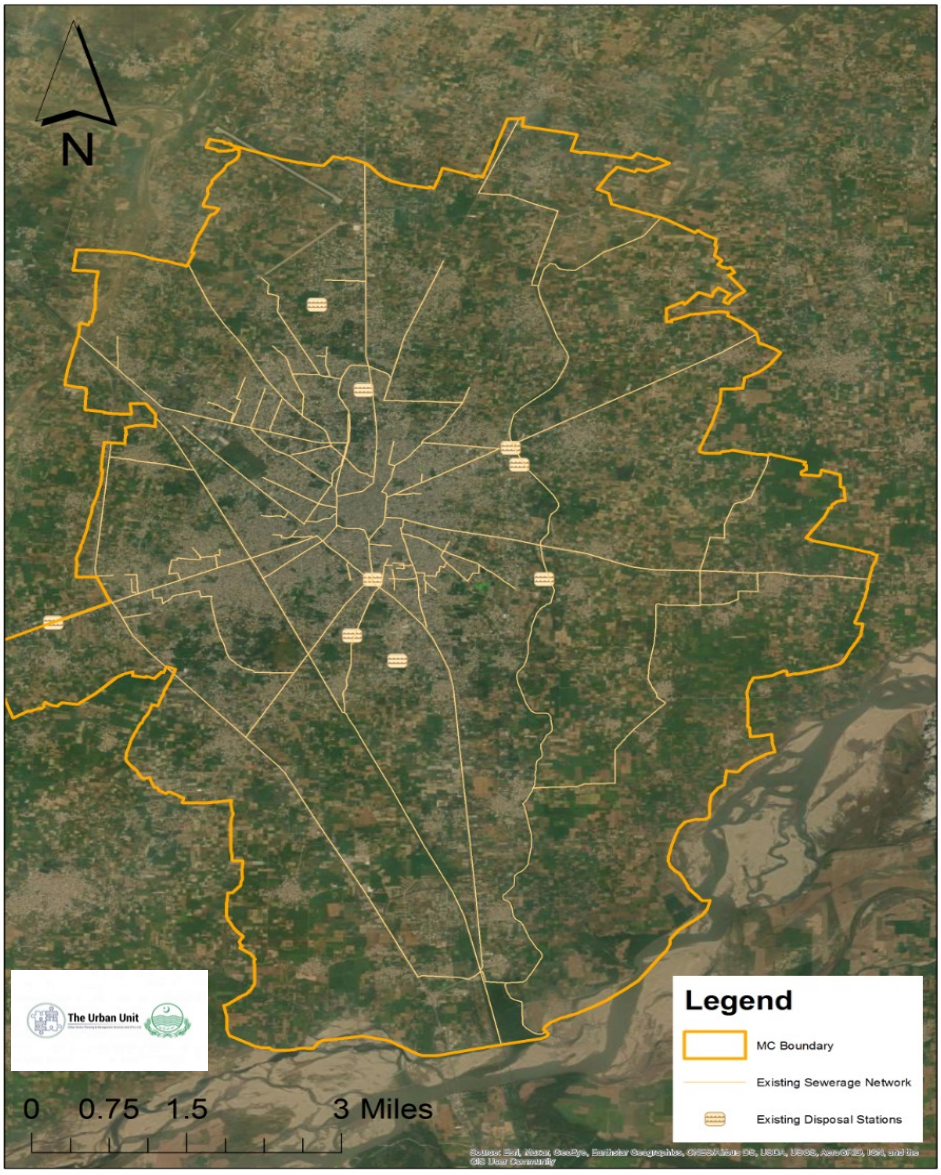


Figure 9: Overview of Gujrat's Sewerage system

The following table summarizes salient features of the existing sewerage in Gujrat.

Table 7: Summary of Gujrat's sewerage system

Feature	Quantity	Capacity/ Specification	Remarks
Length of Total sewers	75 Km		Dia Range= 9 inch -54inch
Approximate open sewage drains (main and small)	60 Km		
Covered sewage drains	15 Km		
Effluent/Discharge	N/A	100 Cusec	
Pumping Arrangements	Nil	Total Pumping Capacity = 150 Cusec	No of Pumping Stations = 08 No of Pumps = 31
Treatment Arrangements	Nil		
Sewerage connections	32599		Domestic= 32178 Commercial/Industrial = 421
Ultimate Discharge Points			Halsi nallah Jalalpur Jattan road, Bhimber Nallah, Kalra Irrigation open drain, River Chenab

It must be noted that this system is run by around 50 management persons only, amongst which the staff with technical expertise are only 20 persons while the remaining 30 belong to non-technical domain. In short, only 30 persons are involved with the maintenance work and this simply translates into 8.42/1000 persons for sewerage connections, which is extremely low and alarming from the management perspective. Around 250 complaints per month are reported, while on average, almost 1 pipe break is also noted each month.

3.2.1. Wastewater Production

The following table summarizes the projected wastewater production rate till 2030 based on the population of 2017 and average annual population growth rate of 1.57% as reported from 1998-2017.

Table 8: Projected Wastewater production in Gujrat

Year	2020	2025	2030
Population	411,901	445,267	481,335
Average Dry Weather Flow (GD)	10,915,375	11,799,563	12,755,373
Non Domestic Flow (GD)	1,091,537	1,179,956	1,275,537

Peak Dry Weather Flow (GD)	36,020,736	38,938,557	42,092,732
Infiltration (GD)	1,801,037	1,946,928	2,104,637
Storm Water (GD)	10,806,221	11,681,567	12,627,819
Total (GD)	48,627,994	52,567,051	56,825,188
Total (MGD)	48.6	52.6	56.8

3.2.2. Coverage

The coverage of the sewerage facility is approximately 50% of the population and 60% of the area. The sewer capacity is not adequate to handle the quantities of sullage water generated and the sewers frequently overflow. This has also been due partly to a number of illegal connections, which urgently need to be legalized to close off. Discharge into open channels has led to seepage drains.

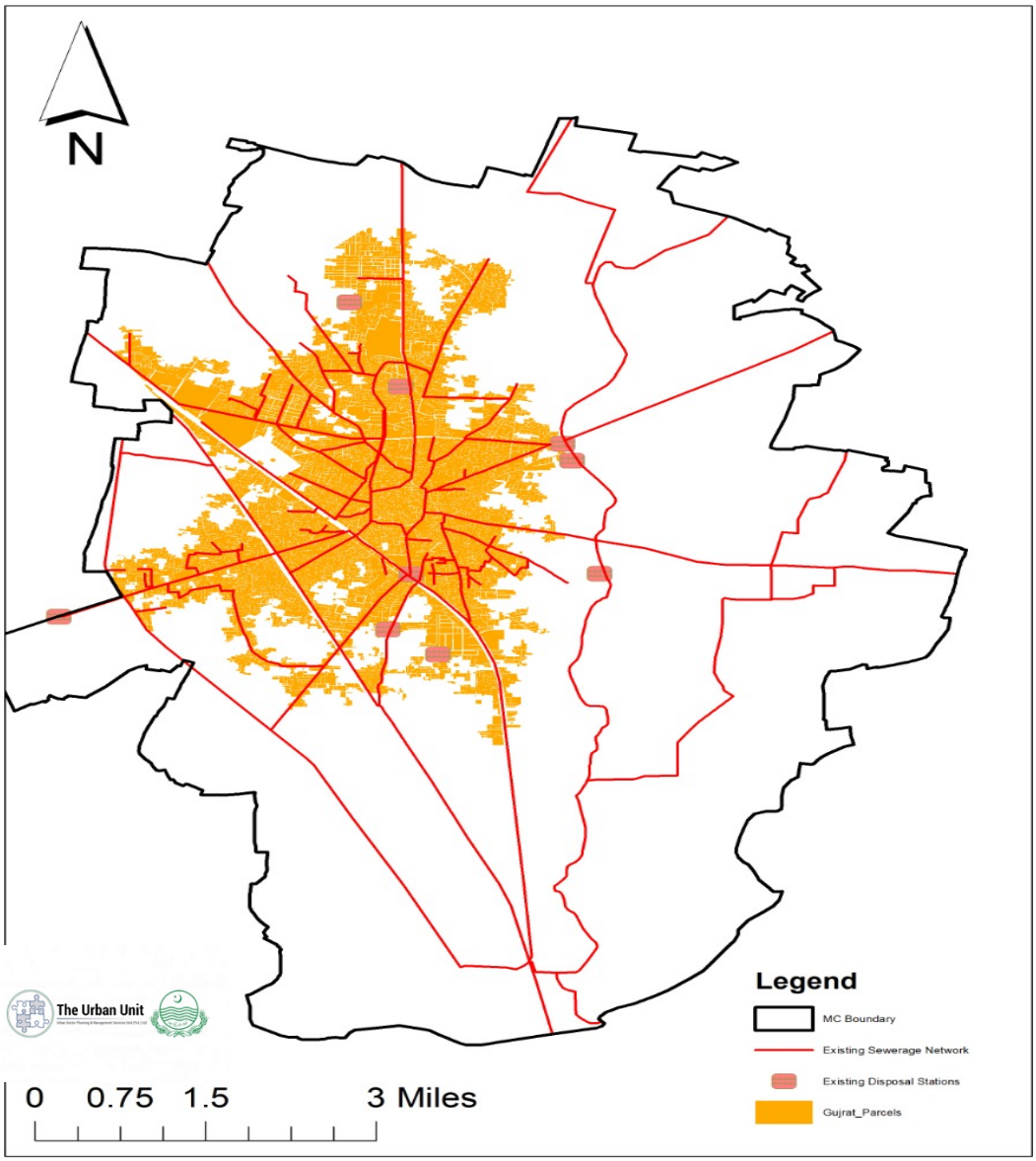


Figure 10: Overview of the Gujrat's Sewerage Network

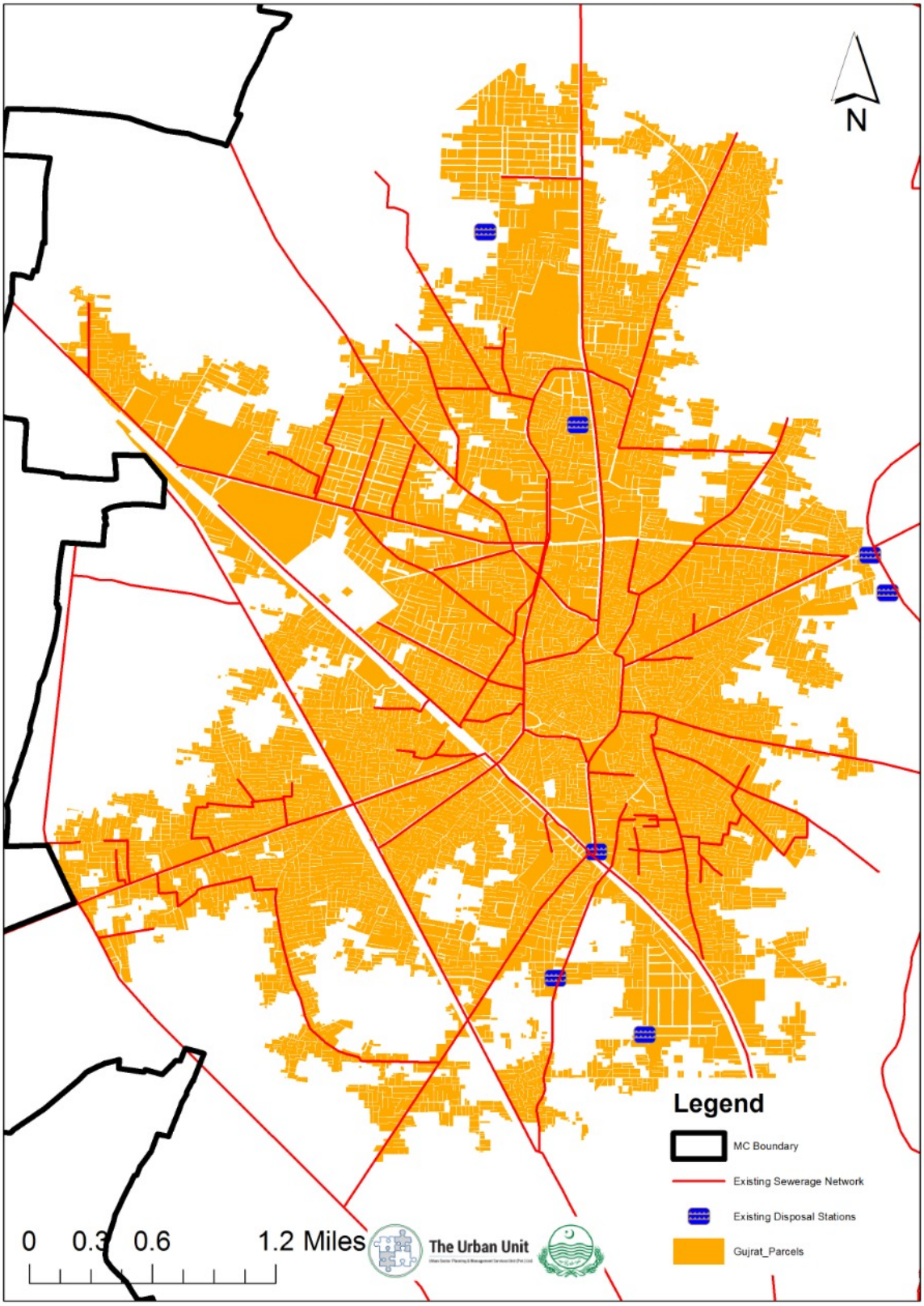


Figure 11: Overview of the Gujrat's Sewerage Network (Zoomed)

3.2.3. Disposal Stations

Existing Sewerage/Drainage system of Gujrat is composed of surface drains, sullage carries and sewer network, ultimately disposing into Malsi (Bhimber) and Halsi Nullahs passing around the city on eastern and western side of the city through 4 major disposal stations. Details of these disposal stations are as under: -

3.2.3.1. Kalra Disposal

It is located at Kalra village behind Old fruit mandi and takes the sewage water of the area composing of main city Muslim Bazar, Circular road, Fawara chowk, Jinnah road and area of old G.T. Road Gujrat. Trunk sewer of diameters 18", 21", 24", 27", 36", 42" and 48" is connected to the disposal work and is ultimately being disposed off into Kalra Drain.
This disposal work is comprised of: -

i) Collecting Tank = 1
ii) Screening chamber = 1
iii) Pumping chamber = 1
iv) Pumping Machinery = 4 Set

Current Status

PHED installed 3 Nos of pump on submersible pump is working at this station newer machinery still awaits installation by PHED.

3.2.3.2. Narowali Disposal

It is located at along Sargodha road near Narowali village and takes the sewage water of the area composing of main along Sargodha road, Mohallah Faroza abad, Rehman Pura, Niamat Pura, Sardar Pura, Khalida abad, Qutab abad road, Railway Station road, Zafar Colony, Hayat Pura, Qudartabad, Rehmad abad, and area of around Shaheen Chowk Sargodha road Gujrat. Trunk sewer of diameters 18", 21", 24" ,27", 36" ,42" and 48" is connected to the disposal work and sewage water is ultimately being disposed off into Malsi (Bhimber) Nullah.
The disposal work is comprised of: -

i) Collecting Tank = 1
ii) Screening chamber = 1
iii) Pumping chamber = 1
iv) Pumping Machinery = 4 Set

Current Status

In this disposal station only one submersible pump is working, and all the other machinery is out of order due to new installation. The new machinery is awaited to be installed by the PHED.

3.2.3.3. Ratti Disposal

It is located at along Bund road near Ratti Village and takes the sewage water of the area Ghari Shah Doudla, Ghari Ahmed Ahmed, Chah Bariwala, Maqbool abad, Rehmatabad, Kalu Pura, Hussain Colony, Banth road, Qadoosabad, and area around Shahdoula Choki and Shahdoula road Gujrat City. Trunk sewer of 12", 15", 18", 24", 27", 30" and 36" i/d is connected to the disposal work and sewage water is ultimately being disposed off into Halsi Nullah.
This disposal work is comprised of: -

i) Collecting Tank = 1
ii) Screening chamber = 1
iii) Pumping chamber = 1
iv) Pumping Machinery = 4 Set

Current Status

In this disposal station 4 Nos of pumping machinary.one motor is out of order & one motor is shutting when work.other two motors are working well.

3.2.3.4. Bolay Disposal

It is located at along Jalal Pur Jattan road near Bolay Village. It covers the sewage water of the area Model Town, Aziz Bhatti Hospital, Bhimber road, Madina Sayedan, Mehmada Sharqi and Gharbi, Sain Kawanwali Sarkar along Awan Sharif road, Mehmada Chowk, Jail Road, Shadman Colony, Rehmad Shaheed road, Jail Chowk, Katchari Chowk, Shah Jahangir road, and area around Jalal Pur Jattan Road Gujrat City. Trunk sewer of diameters 12", 15", 18", 24", 27", 30", 36", 42", 48", & 54" is connected to the disposal work and sewage water is ultimately disposed of into Halsi Nullah.
This disposal work is comprised of: -

i) Collecting Tank = 1
ii) Screening chamber = 1
iii) Discharge sump = 1
iv) Pumping chamber = 1
v) Pumping Machinery = 4 Set

Current Status

One submersible motor is working PHED installed one motor Municipal Corporation installed two motors one is working at this station.

3.2.3.5. Intermediate Pumping Station

In Gujrat city, existing intermediate pumping stations are working at different locations like Shadman mini pumping station, Ali Pura mini pumping station, Eid ghah mini pumping station, GTS chowk disposal station, industrial area mini disposal station, Model town disposal station and Ramtalai chowk disposal station.

These pumping stations facilitate sewage of areas Shadman colony, Mughal colony, Lalazar colony, Ali pura, Ahmad town, Mohallah Faizabad, Mohallah Sultan pura, Model Town, Chah Tarhing, Old city, Railway road, Estate industrial area etc.

3.2.3.6. Ongoing Projects

Some of the ongoing projects being carried out by MC Gujrat and PHED for rehabilitation of sewerage system in Gujrat are listed below:

1. Desilting of sewer line from Service more to Jail chowk
2. Desilting of sewer line from Jail chowk to Bolay disposal station
3. Construction of Nullah from Bagdad colony to service more (GT road)
4. Rehabilitation of Disposal Stations: PHE Gujrat called 3 Nos of Tenders to enhance the capacity of different disposal stations under Community Development Program of Punjab Government. Now the work is in process by the Executive Engineer PHE Gujrat. Following 3 disposal stations are being rehabilitated and replaced with new machinery: -
   i) Narowali Disposal Station
   ii) Kalra Disposal station
   iii) Bolay Disposal station

3.3. DESIGN CRITERIA

3.3.1. Components of Sewerage System

1. **Conveyance Network**
   Lateral (smaller) sewer pipes are used to collect the sewage directly from the interception points and convey sewage up to sub-main or main/trunk sewers. As the sewage is conveyed under gravity flow, therefore pipes are sloped towards final disposal point. To raise hydraulic grade line, the sewage is pumped through a disposal/pumping station.

2. **Manholes**
   Manholes are generally provided in the sewer pipes at suitable distances for connection of lateral lines and inspection and maintenance purposes. For closed drains, inspection chambers are provided for removal of sludge and maintenance works.

3. **Pumping/Disposal Stations**
   In plain areas, the trunk sewer lines usually go well beneath the natural surface level (NSL) at the end and sewage is pumped through a pumping/disposal station to dispose of into Sewage Treatment Plant. A disposal/pumping station is generally composed of a collection well and pumps with suction and delivery pipe lines.

4. **Sewage Treatment Plant (STP)**
   Sewage from the Hafizabad city will be collected at disposal stations at different locations as per the master plan. This sewage contains hazardous chemicals and pollutants, so they cannot be disposed of directly into any water body as per provisions

of the Pakistan Environmental Protection Laws. This acts as the driving force behind construction of the sewage treatment plants that are to be located after disposal stations and/or sullage carriers. These treatment plants will treat the sewage according to the prescribed standards given in Punjab Environmental Quality Standards (PEQS) and the treated product will be afterwards disposed into the water body.

3.3.2. Design Flows

Flow calculations will be based on the following list of parameters.

5. **Average Domestic Sewage Flow**
   Sewage production is based on the water consumption. The sewage production will be taken as 85% (for population more than 100,000) of the water consumption according to PHED criteria. Water consumption per capita per day for Hafizabad city will be adopted as 55 gallons (PHED).
6. **Peak Flow**
   Peak flow will be estimated by multiplying the average daily flow by the Peak factor to calculate the peak flow. Peak Factor depends upon the population as it decreases with increase in population. PHED criteria provides different peak factors according to population as shown in **Table 9**.

Table 9: Peak flow according to population

Population	Peak Factor
5000	4.5
5000-10,000	4
10,000-25,000	3.5
25,000-50,000	3
50,000-100,000	2.5
More than 100,000	2

7. **Non-domestic Sewage Allowance**
   The non-domestic sewage allowance will be taken as 5% of average sewage flow that will cover institutional, commercial and small industrial discharges.

8. **Storm Water Allowance**
   An allowance of storm water flow will be considered in the partially combined sewerage system which shall be equivalent to the 33% of peak sewage flow as per PHED design criteria.

9. **Infiltration Allowance**
   As per the given PHED criteria, an allowance for infiltration rate equals to 5% of average flow will be used.

10. **Design Calculations**
    Total sewage flow shall be the sum of all the above flows and sewers/conduits shall be designed on this total sewage flow.

    Total flow = *Average domestic sewage flow + Peak flow + Infiltration rate + Non-domestic flow + Storm water flow*

3.3.3. Conveyance Network

Components of sewerage system mentioned previously will be designed considering above design flows and on the criteria listed as follows.

1. **Pipe Materials**
   Selection of a viable pipe material is based on the capital cost to be incurred on the installation of collection network, design life and operation and maintenance expenditure. In this regard, following are the pipe materials which can be considered:

   - RCC Sewer Pipes
   - RCC Drains/conduits
   - High Density Polyethylene (HDPE) Pipes
   - Corrugated High Density Polyethylene (HDPE) Pipes

RCC sewer pipes are most commonly used successfully for local sewerage schemes. HDPE pipes are relatively less common for gravity sewers in Pakistan due to higher capital cost and non-availability of larger diameters in local market. However, HDPE pipes are being used for gravity sewerage system in developed countries.

The **Table 10 below** shows the comparison of above-mentioned types used for sewage conveyance.

Sr. No	Evaluation Criteria	RCC Sewer Pipes	RCC Drains/Conduits	HDPE Pipes
1	Available unit Length	2.4 m	Precast conduits up to 1.8 m length are common	6 or 12m
2	Diameters/Sizes Available	225 to 1830 mm	Can be casted in any required size	Available up to 1600 mm
3	Type of Joint	Bell & Spigot Joint, Tongue & Grove Joint	Expansion Joint with Sealant	Butt fusion welding process.
4	Weight	Heavy	Heavy	Light
5	Handling	Difficult due to heavy weight	Precast conduits are difficult to handle due to heavy weight	Easy mobility but jointing requires trained labour
6	Roughness Coefficient	0.011-0.013	0.011-0.013	0.011
7	Corrosion resistance	Subject to H_2S corrosion due to acids, highly septic sewage and	Subject to H_2S corrosion due to acids, highly septic sewage and by highly acidic sewage.	Highly Corrosion resistant

		by highly acidic sewage.		
8	Structural Life	Around 25 years	Around 25 years	More than 50 years
9	Local Availability	Easily available	Easily available	Larger diameters are manufactured on special orders or imported
10	Requirements of Special Equipment for Jointing	Not required	Not required	Equipment for Butt fusion welding is required
11	Previous Local Experience	Commonly practiced and successful under many local circumstances for urban sewerage schemes	Commonly practiced when RCC sewer dia. above 72" is required. It is successful for both urban and industrial developments. Used in industrial estates of PIEDMC.	Smaller diameters up to 27" have been successfully used in local projects. Larger diameters are not common.
12	Operational Problems	Effluent may erode and deteriorate the strength and cause crown failures.	Cleaning is relatively easy and repairing work is easier in case of drains/sullage carrier	Resistant against chemicals of industrial effluents and lesser operational problems

2. Manhole

Manholes will be provided at each junction of the sewers with varying diameter, gradient or alignments. As per PHED criteria, size & depths of manholes and spacing of manholes are tabulated within **Table 11** and **Table 12**.

Sewer Size (mm)	Spacing (m)
310	30
380	45
460	60

530 -610	75
690 -1070	90
1220 -1520	120
Above 1520	150

Size of Sewer (mm)	Sewer Depth (m)	Diameter of Manhole (m)	Remarks
225-530	1.25-2.25	1.25 dia	-Masonry 1:3 Cement Sand Mortar -Up to 2.25m depth 225mm Masonry. -From 2.25m to 4.75m Depth 350 to 225mm Masonry -From 4.75m and above 450mm to 350mm.
610-760	2.5-6.0	1.5 dia	
840-1070	2.5-6.0	2 dia	
1220-1370	2.5-6.0	2.25 dia	
1520	2.5-6.0	2.5 dia	
1680	2.5-6.0	2.5 dia	
1830	2.5-6.0	2.75 dia	

For manholes under sub soil water, RCC core-wall will be designed and floor will be designed as per actual depth of water encountered. Furthermore, it may be noted that the traffic flow is also taken into considerations when deciding manhole covers and their designs.

3. Sewer Pipes

i. The Master Plan has been prepared for primary, secondary and tertiary sewer pipes. Primary sewerage network include 72", 54", 48" and 36" diameter pipes, secondary sewer pipes are of 30", 27", 24" and 18" diameters and tertiary pipes comprise of 15", 12" and 9".
ii. Reinforced cement concrete pipes conforming to ASTM Specification C-76 shall be used.
iii. A minimum cover of 1 m over the crown of sewers has been proposed from the finished road level.
iv. Pipe roughness coefficient (n) of RCC pipes will be 0.015 and 0.013 for old and new pipes respectively.
v. Bedding materials for the design of sewers above sub-soil water level having diameter 310mm and greater will be crushing stone (6mm to 25mm). For sewers below sub-soil water level, decision to be taken as per site conditions.
vi. Minimum gradient for sewers will be recommended to attain the self-cleansing velocity (0.75 m/sec).

For sewer joints rubber ring joint in addition to jute wrapping with cement slurry is recommended.

Table 13: Design criteria for Sequencing Batch Reactors

Description	Unit	Continuously fill Intermittently decent	Intermittently fill Intermittently decent

Number of reactors	Nos	2	2
F/M Ratio		0.05- 0.08	0.05 – 0.30
Hydraulic Retention Time	Hours	18 - 24	18 - 24
Mixed Liquor Suspended Solids (MLSS)	mg/l	3000 - 4500	3000 - 4500
Dissolved Oxygen (DO)	mg/l	0 – 6.50	0 – 6.50
Sludge yield	Kg sludge produced/ kg BOD5 consumed	0.75 – 0.85	0.75 – 0.85
Cycle time	hrs	4 - 8	4 - 8
Waste activated sludge	kg sludge/day	WAS = total sludge/sludge age	WAS = total sludge/sludge age
Decant time	hrs	>1	>1
Decant volume	m^3	Max 0.5	Max 0.5
Decanting device loading rate	m3 /m/hr	≤20 for decant drawdown from TWL	≤20 for decant drawdown from TWL
Minimum number of decanter		2 nos. independent decanter per tank	2 nos. independent decanter per tank
Max decanter length	m	4	4

3.4. ASSET CONDITION ASSESSMENT – SEWERAGE NETWORK

The team performed condition assessments of the infrastructure by physically visiting each facility. 04 disposal stations and drains were examined in this regard on the basis of criteria mentioned in **Table 14.**

Table 14: Criteria for Asset Condition Assessment

Rating Chart		
Excellent	A	No noticeable defects. Some aging or wear may be visible.
Good	B	Only minor deterioration or defects are evident.
Fair	C	Some deterioration or defects are evident, but function is not significantly affected.
Poor	D	Serious deterioration in at least some portion of the structure. Function is inadequate.
Failed	F	No longer functional. General failure or complete failure of a major structural component.

Observations:

Disposal Stations

- Pumps at Kalra disposal stations are having allignment problems
- Screening Chambers are choked and solid waste accumalation issues
- Delivery pipes are getting rusty and under gauged
- Civil structure requires rehabilitation

Open Drains

- Earthen drains have expanded, require lining
- Linned drains are spalling
- Screen chambers are not present in most of the drains

Pumping Stations

- Pumping machinery require pump house and proper control panel
- Safety guards on belts (pumping machinery) are missing

Kalra Disposal

Kalra Disposal

Kalra Disposal

Pumping Station Gulshan Colony

Figure 12: Glimpses for Asset Condition Assessment in Gujrat

3.5. CHALLENGES FOR SERVICE DELIVERY

- The sewerage system has insufficient capacity for the current connected population and suffers from many breaks and overflows of raw sewage into streets. Basically, the whole system needs to be revamped in an integrated manner.
- Blockages and silting are a frequent problem in drains.
- Besides the mentioned flooding and blockages, there is a particular problem of new housing colonies coming into existence without approval of the MC.
- Open sullage carriers in housing areas with raw sewage are a serious health and environmental hazard. Also, no proper facility for treatment of the wastewater.
- At present no formal Sanitation plan has been developed as such
- There is no separate wing of sanitation staff, the sanitation staff is part of the overall MC staff body.

3.6. RECOMMENDATIONS – SEWERAGE/SANITATION

During the Stakeholder Consultation with the Deputy Commissioner and officers Municipal Committees, Town Committees, Public Health Engineer Department A0 size maps were used for quantitative and qualitative assessment of the existing infrastructure. Site visits were conducted building on the same exercise. This helped in not only understanding the current state but also envisioning the future state of the respective areas. Some recommendations, in terms of short-, medium- and long-term priority are being forwarded.

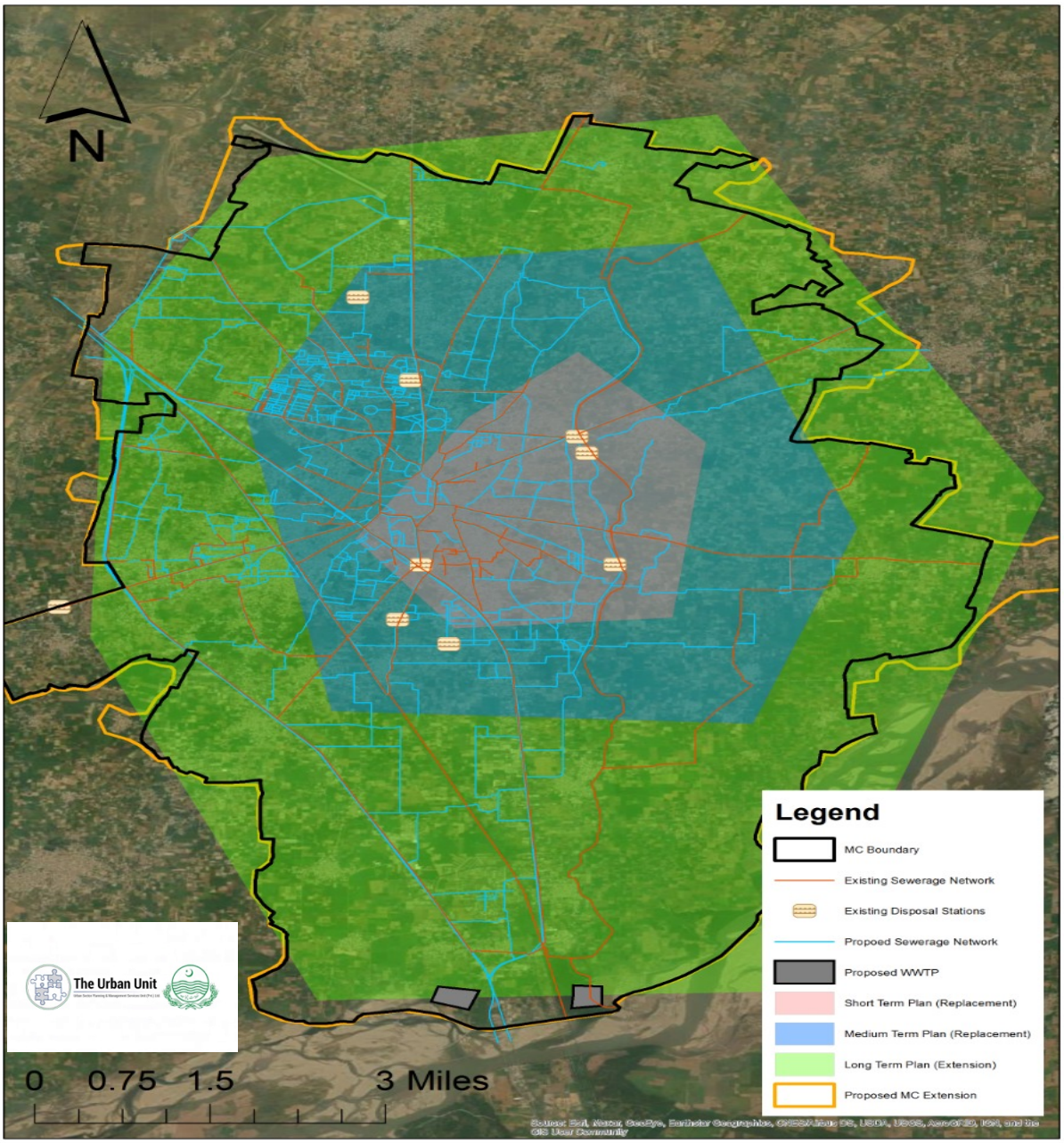


Figure 13: Gujrat's Sewerage Network - Proposed

3.6.1. Interventions

3.6.1.1. SHORT TERM (1-5 years)

S.#	Project	Estimated Cost (Million PKR)
1	Rehabilitation and lining from Shadman To Bhimber Nullah	52.02
2	Rehabilitation and lining from Madina To Jamalpur, Halsi Nullah	53.00
3	Desilting of Sewer Lines including fixing of Galli Gratings, screening chambers and lining at 4 disposal stations	67.152
4	Construction of Sewerage/Drainage, Nullah, Tuff Tiles and Extension of Water Supply Scheme In PP-31 Gujrat	43.256
5	Upgradation of Sludge Carrier around Circular Road, AliPura Road, Jalalpur ring road	50.00
6	Rehabilitation Of Sullage Carrier From Old G.T.Road To Kalra Khasa Gujrat	30.00
7	Repair of Nullahs at both side of Rehman Shahee road	24.00
8	Replacement with 12" drainpipes around Gulbe Colony, Allah Loke colony and Gharibpura	39.00
Total Cost		**358.43**

3.6.1.2. MEDIUM TERM (5-10 years)

S.#	Project	Estimated Cost (Million PKR)
1	Construction of Storm Water Drain from Dec Mandi To Bhimber Nullah	56.900
2	Construction Of RCC Drain From Shaheen Chowk To Kalra Drain along by Pass G.T.Road Eastern Side	64.203
3	Construction of Sullage Carrier from new Fruit/Vegetable Market to Bhimber Nullah	50.00
4	Extension of sewerage network in Qutubab Narowali and Elahi Colony	43.00

5	Construction of intermediate pumping station and Chah Taraing mini disposal station near Chah taring Graveyard	162.367
6	Restructuring and Capacity building of MCs	-
	Total Cost	**376.5**

3.6.1.3. LONG TERM (>10 years)

S.#	Project	Cost (Million PKR)
1	Establishment of Wastewater Treatment Plants – East/ West near Ghazi Chak on Chenab	357.444
2	Establishment of Wastewater Treatment Plant	198.23
	Total Cost	**555.6**

Environmental Consideration and Green Spaces

SECTION 4: ENVIRONMENTAL CONSIDERATIONS & GREEN SPACES

4.1. CLIMATE AND ENVIRONMENT TRENDS

The climate of Gujrat is extreme hot during summer and cold during the winter. The months of March, April, September, October and November are pleasant. December and January are coldest months, when minimum temperature falls down to 4 degree centigrade. Whereas in the summer season the highest temperature goes up to the 44-degree centigrade in the months of June and July, but the hot spells are comparatively shorter due to proximity of Azad Kashmir Mountains. The average rainfall on the Kashmir border is over 100 cm, at Kharian it is 75 cm, at Gujrat 67 cm and at Dinga 50 cm.

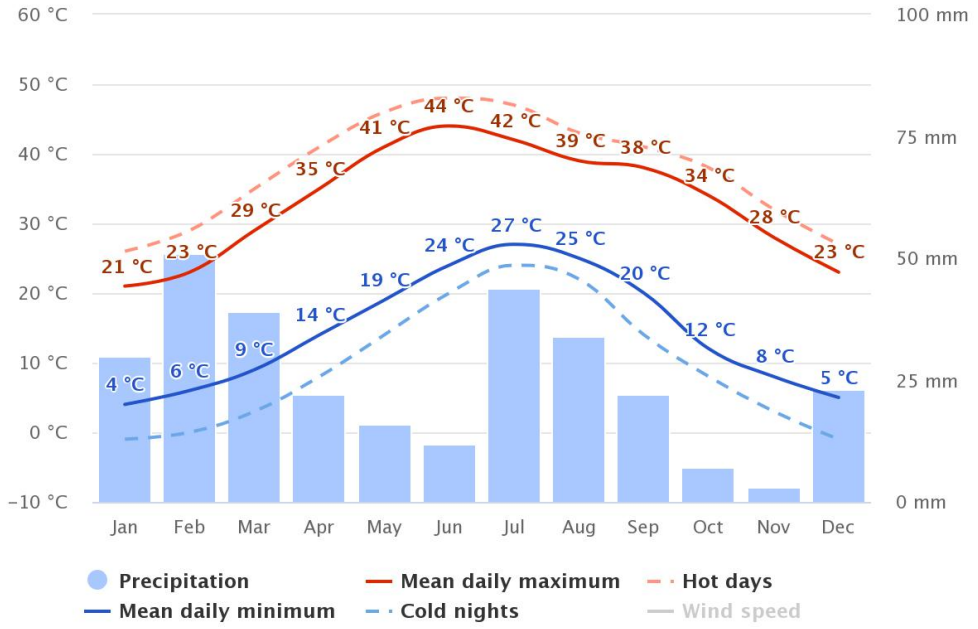


Figure -14: Climatic Conditions of Gujrat

Wind speed in most of the days is within the range of 5 km/hr to 12 km/hour, whereas wind directions are mostly towards North North East and North as shown in **Figure 15**.

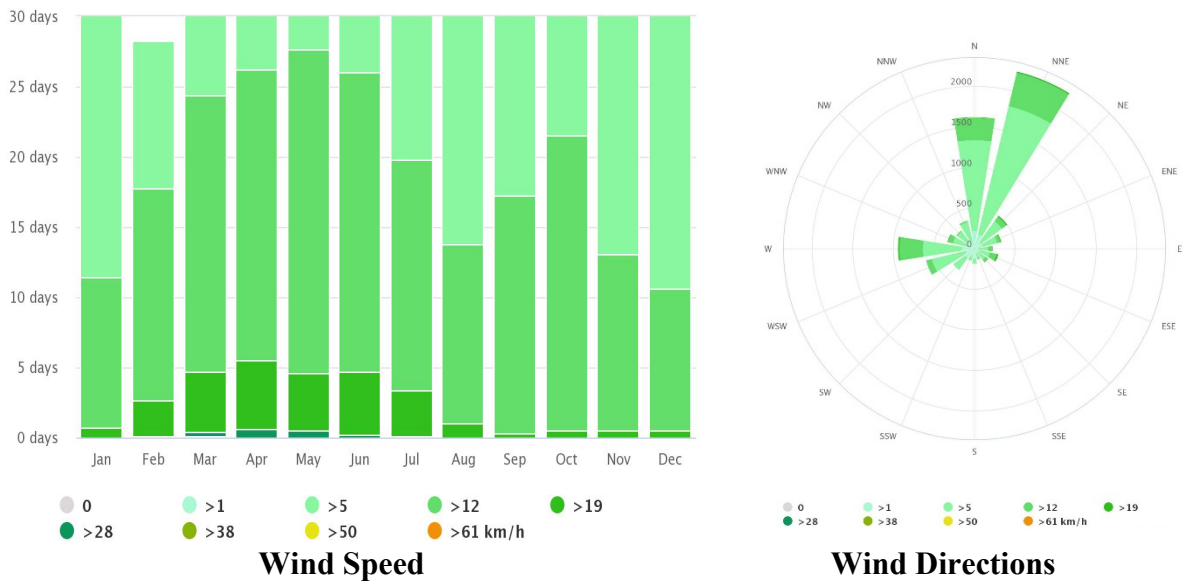


Figure 15: Wind Speed and Directions in Gujrat

4.2. AIR QUALITY

Gujrat, like other cities of Pakistan has faced air pollution issues due to rapid increase in vehicular emissions and industries. There are almost all categories of vehicles in Gujrat i.e. two wheelers, three wheelers and four wheelers, from which two and three wheelers contribute significantly more to air pollution. Rickshaws are another source of air pollution. Large burden of different vehicles on roads and industries with the use of fossil fuels is increasing countless diseases and destroying the city's ecosystem. Major impacts of air pollution are in the form of respiratory diseases, eye irritation; reduce visibility, loss of vegetation and harmful effects on plants' growth etc.

4.3. WATER QUALITY

According to PCRWR's report on Gujrat District's Water Quality, majority of the contamination in the District was due to bacteriological quality. Table 15 summarizing results from this report is shown below:

Table 15: Status of Water Quality in Gujrat

Parameter	% samples exceeding Permissible limits	Comments
Physical and Aesthetic (Color, Electrical Conductivity, Odour, pH, Taste, Turbidity)	22%	22% samples exceeded the permissible limit of 5 NTU for Turbidity
Chemical and Inorganic Constituent (Alkalinity, Hardness, TDS, K+, Na+, SO4, NO3, PO4 etc)	Nil	All samples were under the respective permissible limits

Trace and Ultra Trace elements (Fe, F, As, Pb)	11%	Iron (Fe) samples were found to be non-compliant
Bacteriological Quality (Total Colifoms, E.Coli)	56%	

The situation is not different in Gujrat City where an analysis by PCRWR[2] revealed that major contamination in the city was microbiological in nature.

Water Quality Parameter	**Total samples analyzed**	**Number of Contaminated samples**	**% of contaminated samples**
Coliforms (MPN/100 mL)	9	3	33
E.coli (MPN/100 mL)	9	2	22

However, it must be noted that the overall situation of drinking water in Gujrat city has improved over the years.

Figure 16 shows the improvement in Gujrat's water quality over the years.[3]

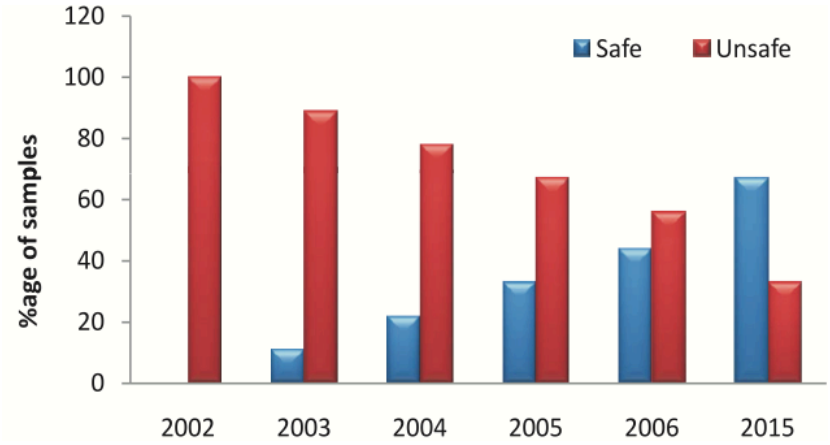


Figure 16: Gujrat's Water Quality over the years

4.4. PARKS AND HORTICULTURE

A lot of work has been done for beautification of Gujrat and its surrounding areas. A number of new public parks have also been developed including a state-of-the-art Park namely "Shahbaz Sharif Park" on an area of 405 Kanals costing Rs. 2.3 billion near River Chenab which is catering the recreational needs of the people of all ages and walks of life of the district Gujrat and adjacent districts of Sialkot and Gujranwala.

Furthermore, in order to maintain the existing beautification works, parks and green belts, and expansion of parks and horticulture in the district, establishment of Parks and Horticulture Authority (PHA) is essentially required at the earliest to develop Gujrat as clean and green district.

[2] *Water Quality Status of major cities of Pakistan (2015-16)*, PCRWR
[3] *Water Quality Status of major cities of Pakistan (2015-16)*, PCRWR

The major roads with green belts and parks in Gujrat are detailed.

Table 16: Major Roads with Green Belts in Gujrat City

Sr. No	Name of Road	Location	Length
1	Old G.T. Road	Kathala to Service More	15 KM
2	Rehman Shaheen Road	Jail Chowk to Service More	5 KM
3	Bhimber road	Kutchery Chowk to Aziz Bhatti Hospital	4 KM
4	Jalalpur Jattan road	Kutchery Chowk to Jalalpur Jattan	13 KM
5	Airport Road	Airport Chowk to G.T. road	6 KM
6	Gulzar-e-Madina Road	Ramtalai Chowk to Children Park	1 KM
7	Kutchery Road	Hassan Chowk to Kutchery Chowk	1 KM
8	Shah Jahangir Road	Zahoor Elahi Palace to Bolay	3 KM

The following table shows major parks in Gujrat district and 3 of these come under the domain of MC Gujrat.

Table 17: Major Parks in Gujrat District

Sr. No	Name of Park	Location	Maintained By	Area
1	Nawaz Sharif Park	City Gujrat	Municipal Corporation, Gujrat	72 Kanals 15 Marlas
2	Ladies & Children Park	City Gujrat	Municipal Corporation, Gujrat	33 Kanals 16 Marlas
3	Inayat Park	City Gujrat	Municipal Corporation, Gujrat	06 Kanals 5 Marlas
4	Shahbaz Sharif Park	City Gujrat	Tehsil Council, Gujrat	405 Kanals
5	Zahoor Elahi Park Jalalpur Jattan	Jalalpur Jattan	Municipal Committee Jalalpur Jattan	14 Kanals
6	Ladies and Children Park Kharian	Kharian	Municipal Committee Kharian	11 Kanals
7	Haji Asghar Park Lalamusa	Lalalmusa	Municipal Committee Lalamusa	31 Kanals
8	Children & Ladies Park Lalamusa	Lalamusa	Municipal Committee Lalamusa	8 Kanals
9	Fatima Jinnah Park Dinga	Dinga	Municipal Committee Dinga	4 Kanals
10	Banazir Park Dinga	Dinga	Municipal Committee Dinga	1 Kanal 1 Marla
11	Canal View Park Sara-i- Alamgir	S.A. Gir	Municipal Committee S.A. Gir	5 Kanals

12	Pabbi Forest Park S.A. Gir	S.A. Gir	Forest Department	80 Kanals

4.5. SOIL CONDITION

Multiple studies on the district have revealed that the texture of the soil is clay loam throughout the district. The pH value is around 8.3-5, ECe averages to 2.3 dS m-1 and field capacity ranges from 60-75%. The amount of organic matter is generally high at Lala Musa (~5.5-5.9 *mgg*-1 dry soil) while it is low (~3.5-3.9 *mgg*-1 dry soil) at Gujrat. The amount of nitrogen appears to be normal in almost all sites of this district ranging from 0.17-0.21 *mgg*-1 dry soil and the amount of K ranges from 0.05 -0.08 *mgg*-1 dry soil. The amount of Phosphorus is above 15.25 *mgg*-1 dry soil in the soils of Bhimber road site, Lala Musa and Gujrat site.

4.6. WILDLIFE AND PROTECTED AREA

Gujrat has one protected area which is Rabbi Forest (scrub forest) situated in Sarai Alamgir. In addition to this, there are few other small patched of scrub forest in the district. The fauna and flora of the area include: Kikar, Dhreak, Toot, Shisham and Poplar trees, and wild animals are rarely found in this area. However, jackal, wolf and fox are found in some part of the area.

4.7. RECOMMENDATIONS

- In order to maintain the existing beautification works, parks and green belts, and expansion of parks and horticulture, establishment of Parks and Horticulture Authority (PHA) is essentially required at the earliest to develop Gujrat as clean and green district. The Government may establish Parks and Horticulture Authority under sub-section 2 of section 3 of Parks and Horticulture Authority Act 2012 for any area to which the Act is extended. A business model for this authority has been already developed by District Administration Gujrat. The proposed budget, business plan and HR of PHA Gujrat will be as following:

Table 18: Budget Estimates of PHA Gujrat

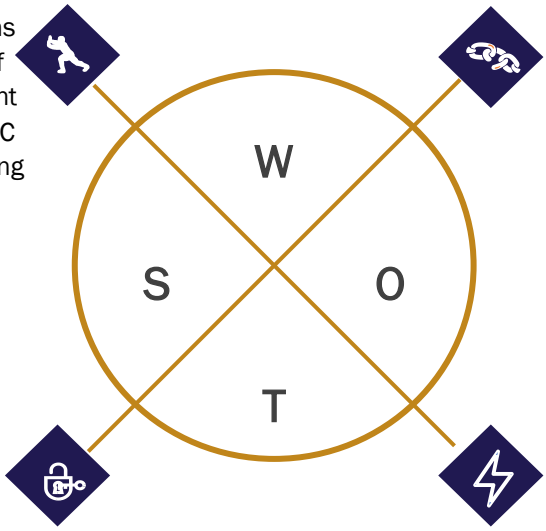
Sr. No	Description	Estimated Budget (PKR Million)
1	Establishment Charges	50
2	Machinery & Equipment	30
3	Purchase of Vehicle	9
4	Construction of office Building	30
5	Office Equipment	5
6	Operating Expenditure / Contingencies	13
	TOTAL	**137**

- Likewise, it was noticed that the Environmental Protection Department's staff had overlapping roles and responsibilities for multiple regions at a time e.g. Gujrat, Sialkot, Gujranwala. In order to get improved environmental governance regime in Gujrat, it is recommended that the vacant positions be filled on immediate basis and that the active staff is not overloaded with tasks beyond their capacity.
- Efforts must be given to rehabilitating and improving the existing green spaces for improved environment and public health in the region

SECTION 5: SWOT ANALYSIS

Based on the current scenario, analysis and field visits, a SWOT Analysis summarizing strength, weakness, opportunities and threats of the Gujrat district with respect to its Water and Sewerage situation is given below.

- Noticeably better socioeconomic conditions
- Generally good history of utilization of development expenditure and filled MC staff positions – indicating a responsive local authority
- Better road connectivity



- The various upgrades for water supply, sewerage, and solid waste that are already underway are likely to improve the coverage and quality of service delivery. With improved services, more accurate billing through private sector participation could be much more profitable
- The ring road project will open new doors for socioeconomic development of region

- Lack of training and development for MC staff and in particular no "in-house" planning and development control capacity
- Low own source revenue generation

- Declining growth of National economy can hamper regional development
- Limited internal/external funding

SECTION 6: PROJECT DIGEST

This section details information on some of the projects that have been proposed as recommendations in the above sections.

METERED CONNECTION

Metered connection is also proposed as one of the recommendations. Advantages of the metered connection would include:

1- Conveyance losses will be less.
2- Water theft/ illegal connections will be minimized.
3- All the connections will be monitored smoothly by Municipal Corporation Gujrat
4- Local community will be served efficiently.
5- The own source revenues of MC Gujrat will be enhanced.

SMART WATER MANAGEMENT WITH INTEGRATION OF SCADA

A smart city is a sustainable and efficient urban center that provides a high quality of life to its inhabitants through optimal management of its resources. Energy and water management are one of the most demanding issues within such urban centers owing to the complexity of the energy and water management system.

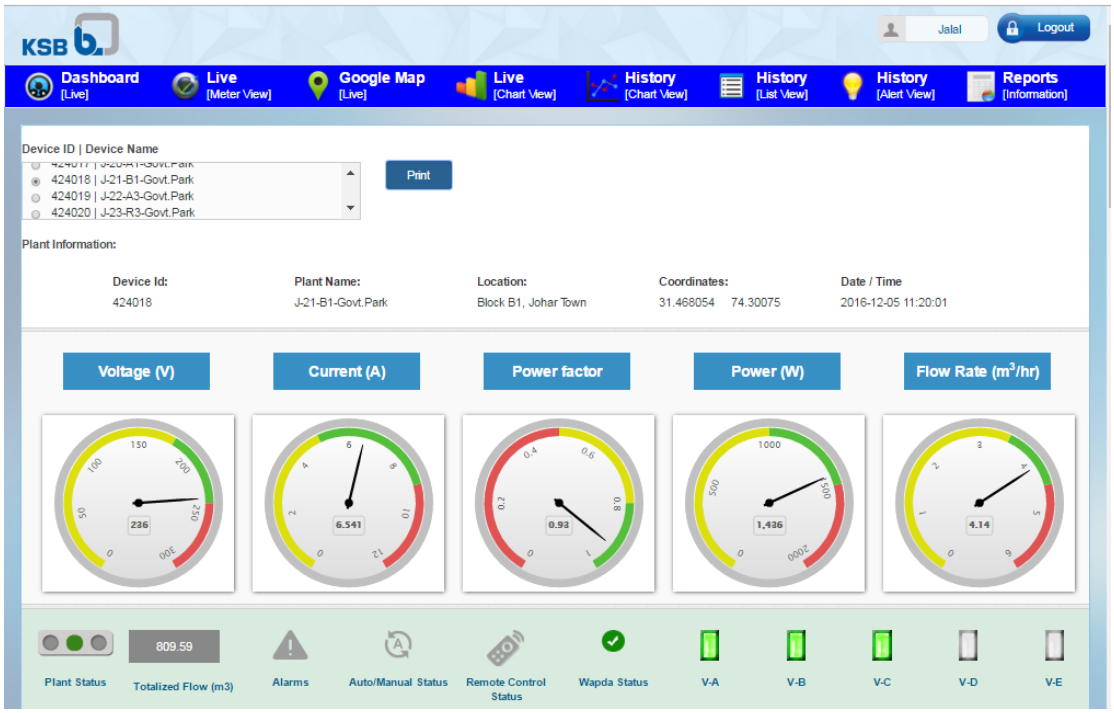


Figure 17: Graphical interface of Water Management System

Water resource management is the activity of planning, developing, distributing and managing the optimum use of water resources.
One of the biggest concerns for our water-based resources in the future is the sustainability of the current and future water resource allocation. As water becomes scarce, the importance of how it is managed grows immensely. Finding a balance between what is needed by humans and what is needed in the environment is an important step in the sustainability of water resources management.

The Water infrastructure installed in Pakistan is several decades old and this results in significant water losses due to leakage or other reasons. Moreover, a reasonable amount of electricity is being wasted due to traditional management, inaccuracies in metering, aging of equipment used in distribution system and wrong practices. This situation arises a need to monitor water usage data and based upon the data recorded the water supply agency should manage their resources.

Primarily there is need to implement a check and balance system for water supply provider which will monitor real time data logging for tube wells and underground reservoirs and can be remotely accessed from a web-based server. Secondly the efficiency of water distribution of water distribution needs to be improved via load management.

Implementation of SCADA system on Tube wells

Water supply represents a vital problem for people of Gujrat, and this imposes the need to know the information regarding consumptions, resources and production. This implies a continuous supervision of the water supply process in order to allow any problem that could appear to be solved, and in the same time, to maintain normal functioning parameters. Proper solutions imply automation and monitoring architectures which contain: a supervision and control system for the real time installation, programmable logic controllers with basic functions (communication, adjusting, measuring, etc.) libraries, communication systems, standard interfaces or dedicated ones with sensors, electrical drive elements, measuring devices, etc. The informatics systems present the possibility of preventing some phenomenon, by analysing and processing the data, leading to an optimum functioning and to important financial economies. A SCADA system for the monitoring and control of Tube wells within the limits of MC Gujrat, which will allow the optimum functioning of the pumping system, safety, obtaining efficient energy usage and optimum administration of the drinkable water.

When it comes to water security and reduction of NRW (Non-Revenue Water) cities face a big challenge which is water metering. Water management can only be achieved once all water connections are metered. With the deployment of bulk flow meters at sources consumption can be remotely monitored by a central computer.

The SCADA system proposed here has sufficient capability to record all electrical parameters of the water resource management and can be logged on to a cloud server. The data can be later analysed for optimum resource management of water system. Specialized energy metering system has also been included to measure energy parameters along with power factor of water system. The main objective is to improve overall water coverage and energy efficiency based on the parameters measured and indicate all deficiencies.

Components of a basic SCADA System

A typical SCADA system consists of

- SCADA Master
- Remote Terminal Unit (RTU)
- Sensors
- Valves
- Control Relays

The main functions are:

- Data acquisition

- Data Communication
- Data Presentation
- Control

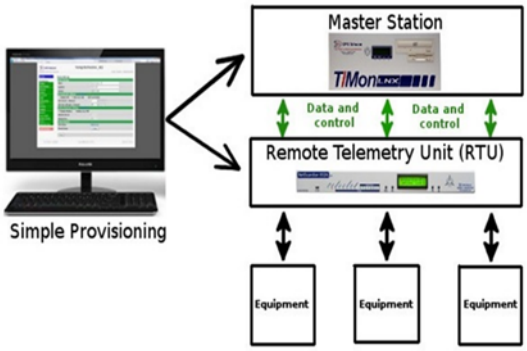


Figure 18: SCADA Architecture

Data acquisition:
It is the process of acquiring real time continuous data from all remote units installed, feeding it to each RTU for processing, transmission and presentation. Sensors monitor inputs and outputs.
Types of Input:

- Discrete Inputs
- Analogue Inputs

Data Communication:
It focuses on the communication channel between RTU and the Master SCADA. SCADA networks communicated over radio, modem or dedicated serial lines. These days the trend is to put SCADA data on Ethernet, Microwave and Optical fiber.

Data Presentation:
SCADA systems report to human operators over a centralized master station. It continuously monitors all sensors and alerts the operator when there is an alarm. It also has the capability to shut down the system in case of a critical failure.

Control:
In a SCADA system the control is with the Master SCADA which serves as the brain of this system. Master SCADA HMI commands the respective RTU to perform a specific action.

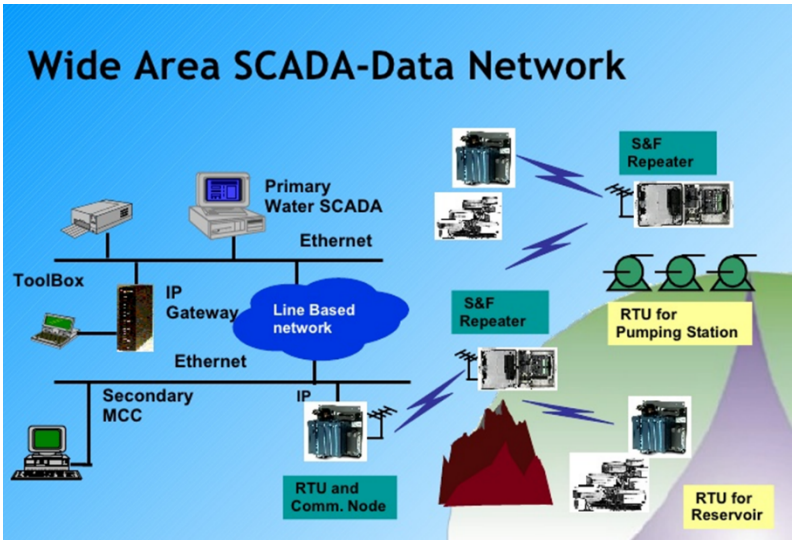


Figure 19: SCADA Network

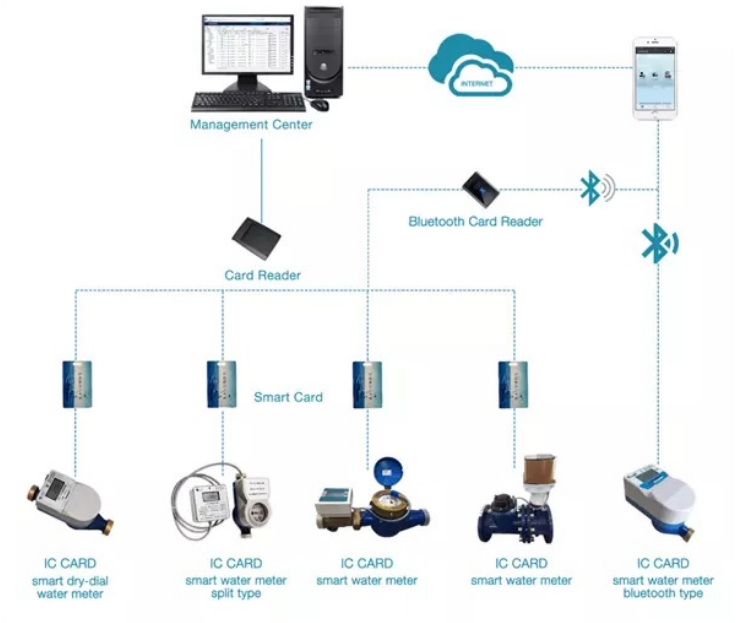


Figure 20: Smart Water Metering Management System

WASTEWATER TREATMENT

Majority of households in Punjab have water-borne sanitation and produce wastewater that had to be disposed of beyond the property boundary. Some toilets, mainly in larger towns and cities, are connected to sewers but most households in peri-urban areas, smaller towns and villages discharge wastewater to open drains, with WC wastes routed via fairly crude individual household septic tanks. Because toilets are connected to drains and sewers, wastewater characteristics are essentially those of sewage rather than sullage. A significant proportion of this wastewater is used to irrigate crops, either directly or after being pumped out of the agricultural drains to which it is discharged. The remainder is ultimately discharged to the rivers that traverse the province.

Very little wastewater is treated at present. Islamabad has four diffused-air activated sludge plants while around 20% of Faisalabad's wastewater is treated in a waste stabilisation pond

system. Some of the tannery waste from Kasur is also treated. Otherwise, there are currently no operational municipal wastewater treatment plants in Punjab. There are proposals to provide new waste stabilisation ponds to treat Rawalpindi's waste water under the ADB-funded Rawalpindi Environmental Improvement Project (REIP). Several smaller towns will be provided with treatment facilities under the ADB-funded Southern Punjab Basic Urban Services Project and the World Bank-funded Punjab Municipal Services Improvement Project. Wastewater treatment may be designed to remove suspended solids and organic material, which would otherwise harm the environment, remove pathogens, which might otherwise infect people who come into contact with wastewater, or both. Most 'conventional' sewage treatment systems are concerned with the first and are less successful in removing pathogens. As a general rule, wastewater treatment technologies with a long retention time, in particular waste stabilisation ponds and constructed wetlands, achieve the best pathogen removal results.

When wastewater is treated, it may provide useful resources. For instance, digested sewage sludge may be used as a soil conditioner while treated wastewater may be used to irrigate crops. This may provide a financial incentive for treatment. However, a fairly high degree of treatment is required to reduce pathogen counts to levels that can 'officially' be considered safe.

Waste Water Treatment Plant

The process design of the sewage treatment plants (STPs) shall be carried out at average sewage flows, whereas the hydraulic design of all the wastewater conveyance and transfer components shall be carried out at peak flows. Urban waste water is categorized in terms of its physical, biological and chemical constituents. The most common parameters used for measuring the sewage, entering or leaving the treatment plant are as follows:

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Suspended Solids (TSS)
- pH

Waste Water Treatment Plant (WWTP) shall be designed primarily to bring the BOD, COD, pH and TSS values of sewage/wastewater within the National Environmental Quality Standards (NEQS) limits.The process designs of component facilities are primarily based upon the design guidelines and methods as laid down by the Environment Protection Agency.[4] The same has been displayed in the following layout.

11. **Pre-treatment Process**

    Pre-treatment process will be comprised of primary screens, inlet chambers, grit and grease removal system and balancing tanks. The criterion to be considered for the selection and the design of these components is as follows:

    - **Primary Screens**

      Upon reaching the sewage treatment plant, sewage flows through the primary screening facility which is the first stage of treatment. The screens shall be provided upstream of all inlet pump stations and shall be designed to protect downstream processes and equipment. The purpose of primary screens is to protect equipment from rags, wood and other debris.
      Design parameters for the primary screens are summarised in the **Table 16**.

[4]www.epa.ie/pubs/advice/water/wastewater/EPA_water_%20treatment_manual_primary_secondary_tertiary1.pdf

Table 19: Design parameters for primary screens

Description	Unit	Design Criteria	
		Manually Raked	Mechanically Raked
Maximum clear spacing	mm	25	25
Slope to the vertical		30° - 45°	30° - 45°
Max approach velocity at feed channel	m/s	1	1
Max velocity at screen face	m/s	1	1
Min freeboard	mm	150	150
Screen skipping storage facility	day	7	7
Min channel width	mm	500	500
Min channel depth	mm	500	500
RC staircase with riser details	unit	Anti-skid and non-corrosive	Anti-skid and non-corrosive

- **Inlet Chambers**

  Provision for inlet chamber before the primary screen channel is necessary for proper operation and maintenance of the plant. A penstock shall be installed upstream to isolate the pump station in the event of flooding in relation to the bypass and emergency overflow. Design criterion for inlet chambers and secondary screens has been summarised in **Table 17** and **Table 18**.

Table 20: Design criteria for inlet chambers

Description	Unit	Design Criteria	
		PE≤50,000	PE>50,000
No. of pumps	Nos	4 (2sets)	6 (3 sets)
Pump design flow		Each at Q_{peak}	Each at Q_{peak}
Min retention time at Q_{ave}	min	30	30
Min pass through openings	mm	75	75
Min suction and discharge openings	Mm	100	100
Pumping cycle	min	6	6-15

Lifting device*	mm	Mechanical and block	Mechanical

*Motorized hoists shall be provided when the lifting weight exceeds 100 kg.

Table 21: Design criteria for secondary screens

Description	Unit	Design Criteria	
		Manually Raked	Mechanically Raked
Maximum clear spacing	mm	12	12
Slope to the vertical		30° - 45°	15° - 45°
Max approach velocity at feed channel	m/s	1	1
Max velocity at screen face	m/s	1	1
Min freeboard	mm	150	150
Screen skipping storage facility	day	7	7
Min channel width	mm	500	500
Min channel depth	mm	500	500
RC staircase with riser details	unit	Anti-skid and non-corrosive	Anti-skid and non-corrosive

- **Grit and Grease Removal**

In grit removal system, grit or discrete particles that have subsiding velocities or specific gravities substantially greater than those of organic putrescible solids, e.g. eggshells, sands, gravel are removed by gravitate settlement or centrifugal separation. This same principle applies to oil and grease removal system, where free oils and grease globules lighter than water rise through the liquid and are later skimmed from the top surface.

Table 22: Design criteria for grease and grit

Description	Unit	Design Criteria
		>PE 50,000
Grease removal		Mechanical
Chamber type		Aerated type
Min detention time (Q_{peak})	min	3
Max gravity flow through velocity	m/s	0.20
Max centrifugal flow through velocity	m/s	<1

Aeration requirement	l/s/length of tank	10
Chamber dimension: (Depth x width) (Length x width)	-	Manufacturer specification
Estimated grit quantity	$m^3/10^3$ m^3 of sewage	0.03
Washing and dewatering of grit	-	Yes

- **Biological Treatment Process**

Biological treatment is the heart of the sewage treatment process. It is inclusive of different processes whereby the dissolved and non- settle-able organic materials that continue to remain in the sewage are finally removed by living organisms. For reasons of long term whole life economics, ease of operation and maintenance, consistent effluent standards and standardization, the following types of biological treatment processes are recommended:

- Activated Sludge System
- Extended Aeration (EA)/Oxidation Ditch (OD) System
- Sequencing Batch Reactor

- **Activated Sludge System**

The design parameters to be considered while designing sewage wastewater treatment plant based on conventional activated sludge system are as follows in **Table 20**

Table 23: Design criteria for Activated Sludge System

Description	Unit	Design Criteria
Organic Loading Low rate Intermediate rate High rate	Kg BOD_5/day/m^3	 0.08 – 0.15 0.15 – 0.5 0.5 - 2
Acceptable Media		HDPE, PVC, stone, slag, coke
Hydraulic Loading Low rate Intermediate rate High rate	m^3/day/m^2	 1 – 4 4 – 10 10 – 40
Sludge Yields Low-rate filters Intermediate filters High-rate filters	Kg sludge	 0.5 0.6 – 0.8 1
Minimum depth of media	m	1.5

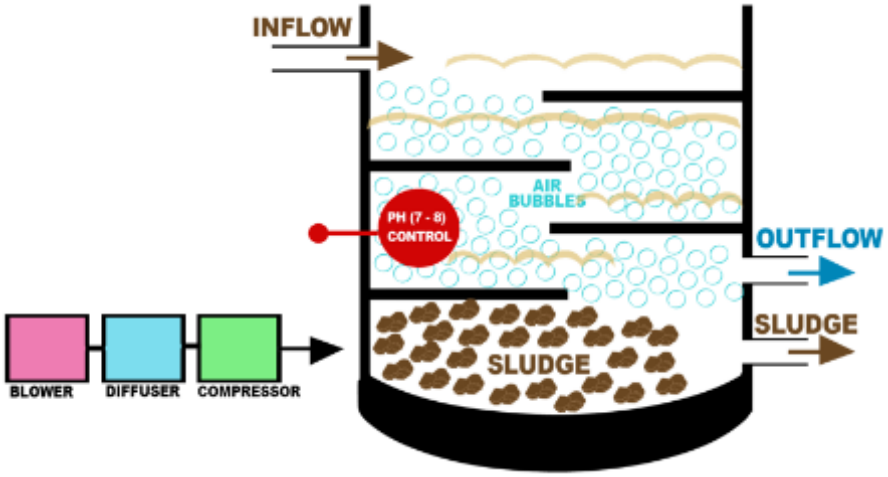


Figure 21: Schematic Diagram of Activated Sludge System

- **Extended Aeration (EA) / Oxidation Ditches (OD)**
  The Extended Aeration process is similar to the Conventional Activated sludge process except that it operates in the endogenous respiration phase of the growth curve, which requires a low organic loading and long aeration time. EA plants shall be designed as either plug flow or completely mixed. Anoxic zone at the head of the reactor must be provided for de-nitrification. The anoxic zone is free from dissolved oxygen.
  For Oxidation Ditches, the minimum velocity within the channel shall be sufficient to keep the activated sludge in suspension. The minimum velocity within the channel shall not be less than 0.3 m/s.

Table 24: Design criteria for Extended Aeration

Description	Unit	Design Criteria
Minimum number of aeration tanks	Nos	2
F/M Ratio		0.05 – 0.1
Hydraulic Retention Time	Hours	18 - 24
Oxygen requirement	KgO/Kg	2
Mixed Liquor Suspended Solids (MLSS)	mg/l	2500 - 5000
Dissolved Oxygen (DO)	mg/l	2
Sludge yield	Kg sludge produced/ kg BOD5 consumed	0.4 (at 24 hrs HRT) 0.6 (at 18 hrs HRT)
Sludge age	day	>20
Waste activated sludge, Q_{WAS}	m^3/day	Refer to equation
Return activated sludge flow, QRAS	m^3/day	(MLSS /$C \cup MLSS) x Qav$
RAS pump rating	Hrs/day	24
Recirculationratio, Q_{RAS}/I_{nflow}		0.5 - 1
MLSS recycle ratio		4-5 times of Q_{avg}
Volumetric loading	kg BOD5 /m3.d	0.1– 0.4
Minimum mixing requirement	W/ m3	20

Table 25: Design criteria for Extended Aeration

Description	Unit	Design Criteria
Organic Loading Low rate Intermediate rate	Kg BOD_5/day/m^3	 0.08 – 0.15 0.15 – 0.5

High rate		0.5 - 2
Recirculation of flow to head of plant		>1
Acceptable Media		HDPE, PVC, stone, slag, coke
Hydraulic Loading Low rate Intermediate rate High rate	$m^3/day/m^2$	 1 – 4 4 – 10 10 – 40
Sludge Yields Low-rate filters Intermediate filters High-rate filters	Kg sludge	 0.5 0.6 – 0.8 1
Minimum depth of media	m	1.5

- **Sequencing Batch Reactor**

  Sequencing Batch Reactors system is suspended activated sludge system. In this system, the sewage flows into one or more reactors where biological oxidation and its clarification take place within the same reactors sequentially on cyclical mode. Detailed design parameters are shown in **Table 23**.

WASTEWATER TREATMENT METHODS

Methods of treatment in which the application of the physical forces predominate are known as "Unit Operations". Methods of treatment in which the removal of the pollutants is brought about the chemical or biological reactions are known as "Unit Processes". Currently, unit operations and processes are grouped together to provide various levels of treatment known as preliminary, primary, advanced primary, secondary(with or without nutrient removal systems) and advanced /tertiary treatment approaches as described follows :

- In ***preliminary treatment***, large and floating particles such as rags and grit are removed that might damage the subsequent equipment especially the screens (if employed). In preliminary treatment, a physical operation usually sedimentation, is used to remove the floating and settle-able materials found in the sewage.
- In ***advanced primary treatment*** chemicals are added to enhance the removal efficiency for floating and settle-able solids and dissolved solids (limited).

  It reduces the Total Suspended Solids (TSS) in the water by about 40 to 60% and reduces the Biochemical Oxygen Demand (BOD) by about 25 to 35%.Some organic nitrogen, organic phosphorous and heavy metal associated with solids are also removed during primary sedimentation but colloidal and dissolved constituents are not affected.

- In ***secondary treatment***, biological and chemical processes are used to remove most of the organic matter.
- In ***advanced treatment***, additional combination of unit operations and processes are added into the treatment line to further remove residual suspended solids, toxic compounds and any refractory and persistent to degrade pollutants through conventional secondary treatment technologies/approaches. Tertiary treatment/ advanced treatment is done only in case when it is desired to use the resultant treated sewage for recycling/ reuse purposes such as irrigation and groundwater recharge.

A list of unit operations and processes used for the removal of major constituents found in wastewaters given in the Table 26

Table 26: Unit operations & processes in wastewater treatment (General)

Sewage Constituent	Sub-Constituent	Unit Operation/Processes
Suspended Solids	--	Screening
		Grit removal
		Sedimentation
		High rate clarification
		Flotation
		Chemical precipitation
		Depth filtration
		Surface filtration
Biodegradable Organic	---	Aerobic suspended growth variation
		Aerobic attached growth variation
		Anaerobic suspended growth variation
		Anaerobic attached growth variation
		Lagoon variation
		Physical-chemical systems
		Chemical oxidation
		Advanced oxidation
		Membrane filtration
Nutrients	Nitrogen(N)	Chemical Oxidation
		Suspended growth nitrification & denitrification variation
		Air stripping
		Ion exchange
	Phosphorus (P)	Chemical treatment
		Biological Phosphorus removal variation
	N& P	Biological Nutrients removal variation
Pathogens	---	Chlorine compounds
		Chlorine dioxide
		Ozone
		UV Irradiation
	---	Membranes

Sewage Constituent	Sub-Constituent	Unit Operation/Processes
Colloidal and Dissolved Matter		Chemical treatment
		Activated Carbon
		Ion exchange
Volatile Organic Compounds	---	Air Stripping
		Activated Carbon
		Advanced Oxidation
Odors	---	Wet scrubbers
		Activated Carbon
		Bio filters
		Compost filters

OVERHEAD RESERVOIRS

Overhead reservoirs have been proposed as one of the recommendations. A few of their primary functions entail to absorbing the hourly variations in demand, maintaining the constant pressure in the distribution mains and that of storing water for emergencies. With ever increasing demand through urbanization of population growth, these reservoirs can help in smooth supply of water to the population, especially in DNI zones.

ANNEXURE 1

Table 27: Tube Wells Being Operated By Municipal Corporation Gujrat

Sr. No.	Name Scheme	Motor Horse power	Transformer KVA	Discharge Capacity	Functional	Non-Functional	Board Installed
1	AliPura chowk	40 HP	50	1 Cusec		Temporary Not working	Yes
2	Faisalpura	40 HP	50	1 Cusec	Yes		Yes
3	Awan colony	50 HP	50	1 Cusec	Yes		Yes
4	Aminabad	40 HP	50	1 Cusec	Yes		Yes
5	Taalipura	40 HP	50	1 Cusec	Yes		Yes
6	Usmanpura	40 HP	50	1 Cusec	Yes		Yes
7	Railway station	40 HP	50	1 Cusec	Yes		Yes
8	Umarabad	40 HP	50	1 Cusec	Yes		Yes
9	Hayatpura	40 HP	50	1 Cusec	Yes		Yes
10	Ferozabad	50 HP	50	1 Cusec	Yes		Yes
11	Qutababad	40 HP	50	1 Cusec	Yes		Yes
12	Estate Area	40 HP	50	1 Cusec	Yes		Yes
13	Bolay	40 HP	50	1 Cusec	Yes		Yes
14	Kashmirpura	30 HP	50	1/2 Cusec	Yes		Yes
15	Madina Sayeedan	40 HP	50	1 Cusec	Yes		Yes
16	CHah tarhang	40 HP	50	1 Cusec	Yes		Yes
17	Garhi ahmad	40 HP	50	1 Cusec	Yes		Yes
18	Children park	40 HP	50	1 Cusec	Yes		Yes
19	Office MC Gujrat	40 HP	50	1 Cusec	Yes		Yes
20	Noorpaday	40 HP	50	1 Cusec	Yes		Yes
21	Katra Bazar	40 HP	50	1 Cusec	Yes		Yes
22	Rehmatpura	25 HP	25	1/2 Cusec	Yes		Yes
23	Baghbawa	40 HP	50	1 Cusec	Yes		Yes
24	Muslimabad	40 HP	50	1 Cusec	Yes		Yes
25	Zahoor Elahi stadium	40 HP	50	1 Cusec	Yes		Yes
26	Mehmda CHowk	40 HP	50	1 Cusec		Non functional	
27	Margzar Colony	40 HP	50	1 Cusec		Temporary Not working	Yes
28	District Katcheri	40 HP	50	1 Cusec	Yes		Yes
29	ALipura road	40 HP	50	1 Cusec		Temporary Not working	Yes
30	Laari Adda Bakhshupura	40 HP	50	1 Cusec	Yes		Yes

31	Old Jail	40 HP	50	1 Cusec	Yes		Yes
32	Gareebpura	40 HP	50	1 Cusec		Temporary Not working	Yes
33	Hassanpura	40 HP	50	1 Cusec	Yes		Yes
34	Inayat Park	40 HP	50	1 Cusec	Yes		Yes
35	Qilla dhaki	40 HP	50	1 Cusec	Yes		Yes
36	Jattuwakal	40 HP	50	1 Cusec	Yes		Yes
37	Islamnagar	40 HP	50	1 Cusec			Yes
38	Tibbi gorian	40 HP	50	1 Cusec	Yes		Yes
39	SHadman colony	40 HP	50	1 Cusec	Yes		Yes
40	Bismillah CHowk	40 HP	50	1 Cusec	Yes		Yes
41	Amin colony	40 HP	50	1 Cusec	Yes		Yes
42	Model town	40 HP	50	1 Cusec	Yes		Yes
43	Nawaz sharif park	40 HP	50	1 Cusec	Yes		Yes
44	Moladad colony	40 HP	50	1 Cusec	Yes		Yes
45	Darbar naangay shah	80 HP	100	2 Cusec	Yes		Yes
46	Fiazbad	40 HP	50	1 Cusec	Yes		Yes
47	Science college	80 HP	100	2 Cusec	Yes		Yes
48	Maaki masjid	80 HP	100	2 Cusec	Yes		Yes
49	Zamindar college	80 HP	100	2 Cusec	Yes		Yes
50	Darbar Pir walayat shah	80 HP	100	2 Cusec	Yes		Yes
51	Chah kholay railway station	20 HP	25	1/2 Cusec	Yes		Yes
52	Sultanabad	20 HP	25	1/2 Cusec	Yes		Yes
53	Mission high school	80 HP	100	2 Cusec	Yes		Yes
54	Margzar park	80 HP	100	2 Cusec	Yes		Yes
55	Kalra kalan	40 HP	50	1 Cusec	Yes		Yes
56	Jattuwakal naae abadi	15 HP	25	1/2 Cusec	Yes		Yes
57	Veternary hosp gareebpura	80 HP	100	2 Cusec	Yes		Yes
58	Aziz bhatti hospital	80 HP	100	2 Cusec	Yes		Yes
59	Ghazi khokhar	80 HP	100	2 Cusec	Yes		Yes
60	Darbar shahjahangir	80 HP	100	2 Cusec	Yes		Yes
61	Banth	80 HP	100	2 Cusec	Yes		Yes
62	District Jail	80 HP	100	2 Cusec	Yes		Yes
63	Niyamat pura	80 HP	100	2 Cusec	Yes		Yes

64	Jamya school	80 HP	100	2 Cusec	Yes		Yes
65	Tibbi marlan	80 HP	100	2 Cusec	Yes		Yes

Table 28: List of Water Filtration Plants of MC Gujrat

Sr. No	Location	Date of installation of water filtration plant	No. of consumers of scheme	Status
1	Mehmda More	Installed by PHED in 2009	8000	Functional
2	Mehmda Chowk	" " " " " " " " " "	14000	Functional
3	Madina Syedan Shahid Shah	" " " " " " " " " "	3000	Functional
4	Madina Syedan	" " " " " " " " " "	3000	Functional
5	Bolay	" " " " " " " " " "	3200	Functional
6	Kashmir Pura	" " " " " " " " " "	2500	Functional
7	Kalra Punwan	" " " " " " " " " "	2000	Functional
8	District Bar	" " " " " " " " " "	1000	Functional
9	Bismillah Chowk	" " " " " " " " " "	2500	Functional
10	Shadman Colony	" " " " " " " " " "	2200	Functional
11	Municipal Model School	" " " " " " " " " "	3000	Functional
12	Police Line	" " " " " " " " " "	500	Functional
13	District Jail	" " " " " " " " " "	500	Functional
14	Islam Nagar	" " " " " " " " " "	2500	Functional
15	Commerce College	" " " " " " " " " "	10000	Functional
16	Dhakki Qila	" " " " " " " " " "	2500	Functional
17	Ali Pura Chowk	" " " " " " " " " "	2000	Functional
18	Baghdad Colony	" " " " " " " " " "	1000	Functional
19	Municipal Corporation Office	" " " " " " " " " "	3000	Functional
20	Shah Hussain	" " " " " " " " " "	3500	Functional

21	Hayat Un Nabi	Installed by PHED in 2010	1800	Functional
22	Hassan Pura	" " " " " " " " " "		Functional
23	Zahoor Ellahi Stadium	" " " " " " " " " "	700	Functional
24	Tibbi Marlan	" " " " " " " " " "	500	Functional
25	Kiran Cinema	" " " " " " " " " "	1200	Functional
26	Khalid Abad	" " " " " " " " " "	2500	Functional
27	Feroz Abad	" " " " " " " " "		Functional
28	Madina Bazar	" " " " " " " " " "	6000	Functional
29	Amin Abad	" " " " " " " " " "	2000	Functional
30	Dera Mughlan	" " " " " " " " " "	1200	Functional
31	Jattuwakkal 1	" " " " " " " " " "	2500	Functional
32	Jattuwakkal 2	" " " " " " " " " "	2000	Functional
33	Sultan Pura	" " " " " " " " " "	3000	Functional
34	Faiz Abad	" " " " " " " " " "	7000	Functional
35	Noorpur Padday	" " " " " " " " " "	3500	Functional
36	Railway Station	" " " " " " " " " "	7000	Functional
37	Kalra Line Wala	" " " " " " " " " "	5000	Functional
38	Estate Area	" " " " " " " " " "	8000	Functional
39	G.T. Road Near Makka Colony	" " " " " " " " " "	4000	Functional
40	Children Park	" " " " " " " " " "	8500	Functional
41	Maqbool Abad	" " " " " " " " " "	4500	Functional
42	Islamia School	" " " " " " " " " "	4200	Functional
43	Shah Jehangir Road	" " " " " " " " " "	5500	Functional
44	Sanat Zar College	" " " " " " " " " "	500	Functional

45	Gharib Pura	“ “ “ “ “ “ “ “ “	16000	Functional
46	Dera Pagganwala	“ “ “ “ “ “ “ “ “	2500	Functional
47	Session Court	“ “ “ “ “ “ “ “ “	1000	Functional
48	Old Jail	“ “ “ “ “ “ “ “ “	5000	Functional
49	Katra Bazar	“ “ “ “ “ “ “ “ “	7000	Functional
50	Rest House	“ “ “ “ “ “ “ “ “	12000	Functional
51	Model Town	“ “ “ “ “ “ “ “ “	3000	Functional
52	Zila Kutchery	“ “ “ “ “ “ “ “ “	3200	Functional
53	Nawaz Sharif Park	“ “ “ “ “ “ “ “ “	3500	Functional