CHAPTER 3 STUDY AREA AND DATA COLLECTION

3.1 General

The study area for the research is an alluvial region between Mahi and Narmada rivers, which are following through the central part of Gujarat state (Fig 3.1). The area coverage is six blocks of Vadodara, three blocks of Panchmahal and three blocks of Bharuch district above Narmada River. Total area of the alluvial region is 2750.15 km^2, located between 72.51° to 73.64° Eastern longitude and 21.78° to 22.83° Northern latitude on a geographical basis.

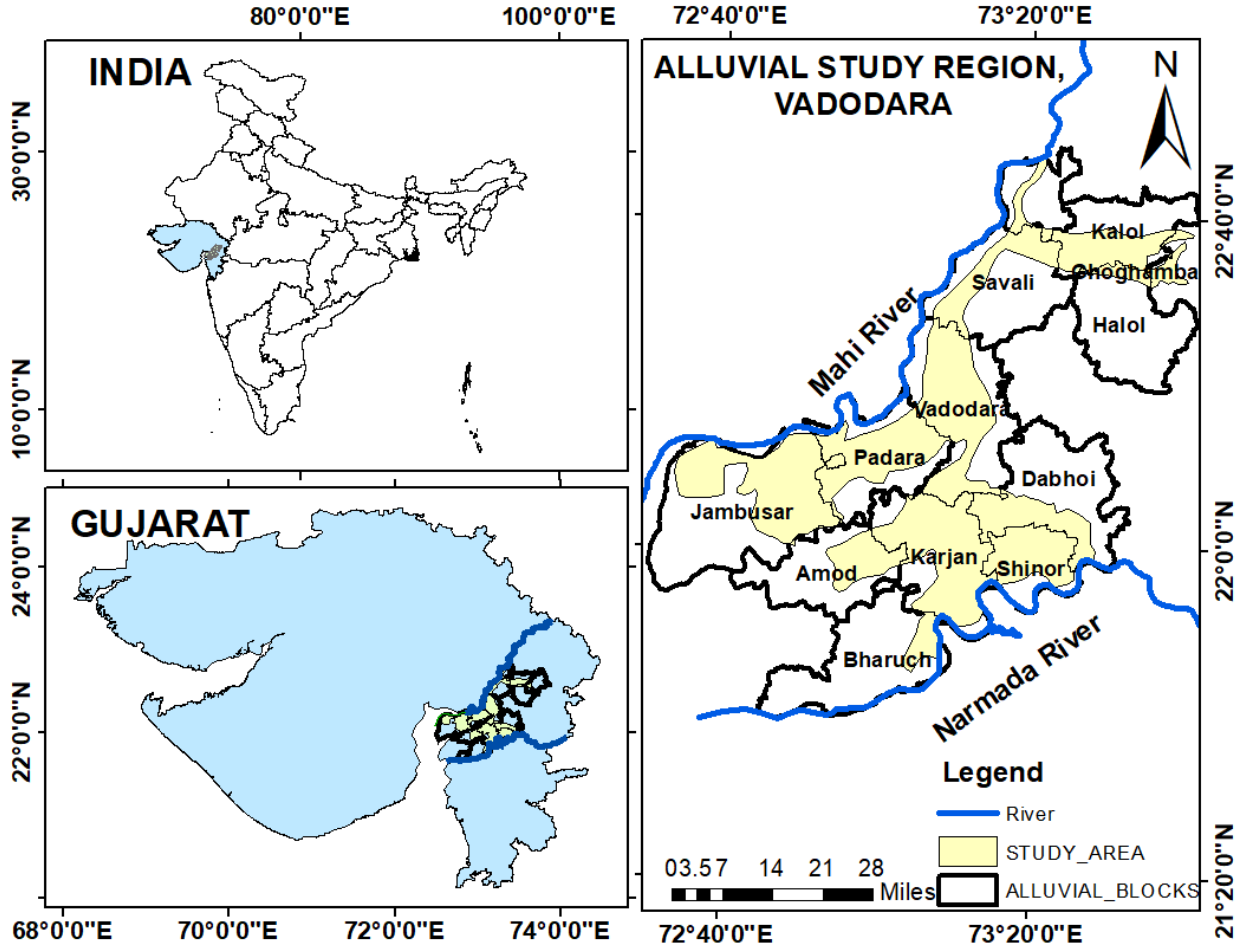


Fig 3.1 Alluvial study region, Gujarat, India

The Vadodara district, sits on the banks of the Vishwamitri River, lies between 21º49’19” and 22º48’37” North latitude and 72º51’05” and 74º16’55” East longitude, with total area of 7550 km^2. The overall elevation ranges from 610 m in east to 20 m msl in South-West. The Vadodara is divided into 8 talukas namely Vadodara City, Vadodara Rural, Dabhoi, Karjan, Padra, Savli, Sinor and Waghodiya. Vadodara district is sharing border with Alirajpur and

Chhota Udaipur District to the East, Anand – Panchmahal and Kheda District to the North, Bharuch and Narmada District to the South.

The Bharuch District, sits on the banks of Narmada River, lies between 21º24' to 22º17' North latitude and 72º22' and 73º31' East longitude. Total area of Bharuch is 6527 km^2, divided into 7 talukas namely Jambusar, Amod, Vagra, Jhagadia, Anklesvar, Hansot and Valia and consist 21 towns and 663 villages. Bharuch District is sharing border with Anand and Vadodara districts to the North, Surat district to the South, Narmada district to the East.

The Panchmahal district, sits on the banks of Mahisagar River, situated between 22º30' and 23º30' Latitudes and 73º15' and 74º30' Longitudes. With total area of 5210 km^2, comprises 11 talukas at present namely Godhra, Halol, Kalol, Lunawada, Santrampur, Kadana, Jambughoda, Shahera, Morva-Hadaf, Khanpur and Ghoghamba. Panchmahal district is sharing border with Aravalli district to the North, Kheda district to the west, Dahod district to the east and Vadodara and Chhota Udaipur district to the south. Panchmahal district is one of the important tribal districts of Gujarat State.

3.2 Hydro-meteorology of Study area

The Vadodara district is located in transition zone of heavy rainfall areas of South Gujarat and arid areas of North Gujarat plains, having sub-tropical climate with moderate humidity. Roughly, 850 millimeters or 33 inches of rain that the city receives annually is due to the area's high potential evapotranspiration very close to being classified as a hot semi-arid climate. There are three main seasons: summer, monsoon and winter and aside from the monsoon season, the climate is arid. The weather is hot during March to July, when the average maximum is 39 °C or 102.2 °F and the average minimum is 24 °C or 75.2 °F. From November to February, the average maximum temperature is 30 °C or 86 °F, the average minimum is 15 °C or 59 °F and the climate is extremely dry. Cold northerly winds are responsible for mildly chilly days in January. The southwest monsoon brings a humid climate from mid-June to mid-September. Average humidity is 55%. The average wind speed is 90.92 km/day. The average sunshine available in 24 hours are 8.45 hours, whereas the average evapotranspiration is 4.46 mm/day.

The Panchmahal district comes under heavy rainfall areas of Gujarat, having sub-tropical climate with moderately low humidity. Roughly, 950 millimeters or 38 inches of rain that the

city receives annually. The maximum daily temperature during the year ranges from 27.7 °C in January to 39.7 °C in May while minimum temperature ranges from 11.9 °C in January to 25.6°C in May. Maximum humidity ranges from 98.2 % to 79.6 % while minimum range is from 28 to 83.5 %. The wind speed ranges from 105.2 to 479.6 km/day, whereas evapotranspiration ranges from 3.4 to 11.1 mm/day. The average sunshine available in 24 hours are 8.60 hours whereas the average evapotranspiration is 5.90 mm/day.

The Bharuch district is having sub-tropical climate with moderately low humidity. Roughly, 925 millimeters or 36 inches of rain that the city receives annually. The average maximum temperature during the year is 34.7 °C, while average minimum temperature is 20.7 °C. Average humidity is 59.7%. The average wind speed is 155.4 km/day. The average sunshine available in 24 hours are 8.00 hours whereas the average evapotranspiration is 5 mm/day.

3.3 Surface Water Sources

The Sardar Sarovar Project's Vadodara branch canal, which runs along the North and East boundaries, is a perennial canal and a more recent addition to the hydraulic system. The hydraulic network has included about 30 water bodies. Some of them, such as Sursagar in the center of the city, have brick walls. The numbers of lakes have influenced the city's growth until now and are a crucial component of Vadodara's hydraulic system. All lakes have water that is not fit for human consumption. Other than a few rare examples, there is no aquatic life.

The river Vishwamitri was a free-flowing river. Neither it nor its tributaries were protected by a storage dam. With the city's expansion, there was a lot of development, which includes,

- Reservoirs at Ajwa, Pratappura, Dhanora, Haripura and Warda on the tributaries of Vishwamitri
- National Highway, Express Highway and Ring Road
- Narmada Main Canal of Sardar Sarovar Project
- Vadodara Branch Canal (VBC) of Sardar Sarovar project with the development of the city.

Flooding started to pose a threat in the river's low-lying sections. The worst flood came in 2005, when there were widespread reports of damages, loss of human life and severe damage to the slums. Almost one third of the city suffered significantly. The Vishwamitri River used to meander, but there have been efforts to straighten the river channel close to some of the meanders. But even while this reduced erosion, it only slightly improved Vishwamitri's capacity.

On the West side of the city, Bhukhi rivulet flooded some areas. Investigations to redirect a portion of the flow to the river Mahi through the river Mini had been ordered by VMC.

3.3.1 Narmada river

The Narmada River is also known as the Reva and was once called Narbada or Nerbudda. India's two states Madhya Pradesh and Gujarat are crossed by this river. Due to its significant and varied contributions to the states of Madhya Pradesh and Gujarat, it is also known as "Life Line of Madhya Pradesh and Gujarat." Amarkantak Plateau in Madhya Pradesh's Anuppur district is where the Narmada River rises. It runs Westward for a distance of 1,312 km (815.2 mi), serving as the ancient border between North and South India. It drains into the Arabian Sea through the Gulf of Khambhat 30 km (18.6 mi) to the west of the Gujarat city of Bharuch.

It is one of only two major rivers in peninsular India that run from East to West (longest west flowing river), along with the Tapti River. A major portion of it flows through Madhya Pradesh (1,000 km) and Maharashtra (74 km) and along the border between Madhya Pradesh and Maharashtra (39 km) and then on to Gujarat (161 km).

3.3.2 Mahisagar river

Mahi River flows through Western India. It rises in Madhya Pradesh, flows through the Vagad region of Rajasthan, then enters Gujarat and flows into the Arabian Sea. Aside from the endorheic Luni River, the Sabarmati and Tapi rivers, it is among the relatively few west-flowing rivers in India. There are several peninsular rivers in India that drain eastward into the Bay of Bengal or northward into the Ganges.

The Mehwasis, traveling highlanders frequently mentioned in Arabian chronicles and the Mahi Kantha agency of Bombay also preserve its name. The exact location of the Mahi River's origin is Minda Village in Madhya Pradesh's Dhar district.

Numerous temples and other sites of worship are found along the coast of the River Mahi, which is revered by countless people. As a result of the river's size, it is frequently referred to as Mahisagar. This holy river serves as the inspiration for the name of Gujarat's recently developed Mahisagar district. The Tropic of Cancer is crossed twice by this river.

3.3.3 Narmada canal Details between Mahisagar and Narmada area

The Narmada Main Canal is a contour canal. It is the world's largest lined irrigation canal. From the start to the Rajasthan border, it is around 458 km length. At Kevadia, where it originates, it has a flow capacity of 1133 cumecs (40000 cusecs), which reduces to 71 cumecs (2500 cusecs) at the Gujarat-Rajasthan boundary. As shown in figure 3.2, along the Narmada Main Canal, there are 598 structures. This includes 236 cross-drainage structures, which include 5 Aqueducts, 15 canal syphons, 182 drainage syphons, 33 canal crossings and 1 super passage. There are 89 regulatory structures total, including 1 Main HR, 44 Branch HR, 32 Cross Regulators and 12 Escapes. There are 274 different types of road bridges, including state and national highways, as well as MDRB, ODRB, VRB and UVRB. The Narmada Main Canal is now 458 kilometers from completion.

Fig 3.2 Sardar Sarovar (Narmada) Project (Source: SWDC)

The Phase-I Chief Engineer Vadodara's Office covers the 4,46,609 hector culturable command area between the Narmada and Mahi rivers. There are 52 blocks in this area, five of which are in the Bara Tract (area contiguous to Gulf of Khambhat). The C.C.A. 4,46,609 ha of 52 blocks includes 3 Talukas (Naswadi, Sankheda and Bodeli) in Chhota Udaipur District and two Talukas (Garudeshwar & Tilakwada) in the Narmada District. In the Vadodara District, there are eight talukas (Vadodara, Savli, Desar, Waghodia, Dabhoi, Karjan, Sinor & Padra), in

the Bharuch District, four talukas (Jambusar, Vagra, Amod and Bharuch) and in the Panchmahal District, there are three talukas (Halol, Kalol & Jambughoda) that constitute the command area for Phase-I. Between chainage 0 and 144.5 km, the Command Area is served by 14 branch canals and one direct distributary offtake from Narmada Main Canal.

3.4 Geohydrology of study area

The study of groundwater and its chemical and physical interactions with the surrounding environment is known as geo-hydrology. This study primarily addressed the geologic concepts that determine the occurrence, flow and nature of groundwater, with a focus on those concepts that are essential to environmental professionals.

3.4.1 Geohydrology of Vadodara District

Groundwater can be found in both confined and unconfined circumstances in the Vadodara district area. Unconfined aquifers are produced by saturated zones of unconsolidated shallow alluvium and weathered zones, as well as by shallow depth jointed and fractured rocks, whereas semi-confined to confined conditions are produced by multilayered aquifers beneath impervious clay horizons in alluvium formation and by interflow zones of basalts, inter-trappean beds, deep seated fracture zones and shear zones in basalts, granites and gneisses.

The water table often follows topographic structure. While on shallow terrain and valley portions, the levels are extremely close to the surface, the depth of the water is greater in upland places. Spring zones can be found in stream river sections as well as along the Mahi, Narmada and Orsang rivers in the district's steep eastern, north-east and south-east portions. The piezometric surface also follows a mild gradient that corresponds to the subsurface layout of deep aquifer zones, primarily in alluvium portions of the district's western half.

In The majority of the district is made up of hard rocks, including granite, gneiss, basalt, phyllite and schist, while other sediments, such as sandstone and limestone, form aquifers. The remaining central, south-central and western half of the district is made up of multilayered alluvium deposits, which form aquifer systems. In areas near rivers and on vast undulating plains adjacent to hilly terrain, weathered basalt, granite, gneiss, covered with soil / muram and valley fill & piedmont deposits form potential aquifers, but their regional continuity and extent are limited due to heterogeneous deposits with limited thickness and as such rarely exceed a few square kilometers in size (CGWB Vadodara report 2014).

3.4.2 Geohydrology of Bharuch District

The northern part of the district, which is mainly covered by unconsolidated alluvial sand, gravel and stones, is traversed by the river Narmada, which flows almost east-west through it. Basaltic rocks from the Cretaceous period make up the majority of the district. Only a small portion of the Mesozoic formations are exposed, especially in Tilakwada Taluka.

In all of the rock formations under the majority of the district's area, groundwater exists in unconfined conditions. In sections of the Deccan Trap, the weathered zone below the water table serves as a reliable storage location for groundwater. In addition to the presence of water in the spaces between sand grains in the Infratrapean rocks (Bagh beds- sandstone, marls and limestone), the main joints, fissures and other planes of structural weakness play a significant role in the movement of groundwater. In the alluvium regions, groundwater enters the spaces between sand, gravel and boulder fragments (CGWB Bharuch report, 2014).

3.5 Population census data

According to figures from the 2011 Census, the total population of the Vadodara district is 41,65,626. The district has a population density of 551 people per square kilometer (1,430 people per square mile) and its population growth rate from 2001 to 2011 was 14.16%. Vadodara has 934 females for every 1000 males in terms of gender ratio and its 2011 literacy rate was 81.21%. The district's residents were 81.97% Gujarati language, 9.64 % Hindi language, 4.51% Marathi language and 1.11% Sindhi language.

According to the 2011 census, there are 15,51,019 people living in the Bharuch district, which has a population density of 238 people per square kilometer (620/sq mi). Between 2001 and 2011, the district's population grew by 13.14%. In 2011, the literacy rate in the Bharuch district was 83.03 percent. Bharuch district has a sex ratio of 924 females for every 1000 males. The first language of 90.02 percent of people in the district was Gujarati, followed by Hindi (6.30 percent) and Marathi (1.13%).

According to the 2011 census, there are 23,90,776 people living in the Panchmahal district, which has a population density of 458 people per square kilometer (1190/sq mi). Between 2001 and 2011, the district's population increased by 17.92%. Panchmahal district has a sex ratio of 945 females for every 1000 males. The first language of 95.44 percent of people in the district was Gujarati, followed by 2.28% Urdu and 1.48% Hindi.

3.5.1 Geohydrology of Panchmahal District

Panchmahal district groundwater exists under both confined and unconfined conditions. Unconfined aquifers occur in regions of unconsolidated shallow alluvium, weathered, jointed and fractured rock, whereas confined ones occur in zones of interflow basalts, intertrappean beds, buried fractures and shear zones.

Water level typically follows topographic structure. The hot springs at Tuwa are connected to various pegmatite intrusive and deeply seated shear zones in the granitic rock. Phyllites, quartzites, schists, basalts, sandstones and limestones are producing aquifers as part of the hard rock. In the area of rivers and the piedmont zone, alluvium and valley fill materials form potential aquifers, but their distribution is irregular and their extension is limited, rarely expanding over a few square kilometers (CGWB Panchmahal report, 2014).

3.6 Area Specific Anthropogenic Activities

Anthropogenic activities and natural processes damage soil and aquatic ecosystems with a high concentration of organic pollutants or chemicals such as pesticides, solvents, halogenated compounds, petroleum hydrocarbons and phthalate esters. The utilization of conventional or traditional technologies, such as physical and chemical methods, for the cleanup of these organic contaminants is an expensive process. Anthropogenic activities have impacted agricultural productivity significantly. While exposed to heavy metal toxicity, most plant species demonstrate basal metal tolerance. Based on the area, anthropogenic activities details have been given for the Bharuch, Vadodara and Panchmahal districts:

3.6.1 Anthropogenic Activities in Bharuch district

The infrastructure in the Bharuch area is suitable for the possibility and expansion of industries. Specifically, GIDC is developing a major industrial estate of 1700 hectares in Jhagadia. The area has been designed for chemical and pharmaceutical enterprises and infrastructure such as power, water and effluent disposal has been constructed. As a result, demand-driven sectors such as medicines, chemicals and engineering to provide vessels for chemical industries and equipment parts have a bright future in this sector. Dahej is a port in South Gujarat that is well connected by road and rail. A chemical port terminal with a capacity of 4 million tons of various containers has been built. IPCL has completed the construction of a 4.5-million-ton petrochemical complex. GIDC is developing sufficient land for the chemical and

downstream petrochemical businesses. Infrastructure for power, water, and effluent disposal is being built.

3.6.2 Anthropogenic Activities in Vadodara district

In the Vadodara district, large-scale industries including as petrochemicals, pharmaceuticals, chemical fertilizers, plastics and engineering units manufacture a variety of products. As a result, there is tremendous opportunity for the formation and growth of ancillary units to fulfil the needs of such large-scale facilities. Furthermore, there is still huge potential for the development of chemical industry by adopting pollution control measures in a real essence and proper manner. From the report of District Industrial Potentiality Report Survey of Vadodara district (2016-17), large scale industrial units are situated into Vadodara district such as 20 Micron Ltd., ABB Ltd, Cadila Health Care Ltd, Indian Oil Corporation Ltd. and Jyoti Ltd. Etc. Fluconazole bulk, Ammonia, Pharmaceuticals, Chemicals, Tyers for Automotive vehicles and tractors, Automotive Radiators and Fertilizers & Pesticides are the major exportable items manufactured by the medium & small-scale enterprises in the district.

3.6.3 Anthropogenic Activities in Panchmahal district

Since the district's economy is mostly dependent on agriculture, the development of the non - agricultural sector in the district has grown in importance. The district's industrial center is located in the blocks of Godhra, Kalol and Halol. Textile industries, Machinery and parts except electrical, Tobacco industries, Food Products, Chemical & chemical Products, Wood Products, Rubber & Plastic Products, Glass, Clay & Cement Industries, Non-Ferrous Industries, Ferrous Industries, Paper Products & Printing, Electrical Machinery and Apparatus, Transport equipment and parts, as well as primarily covered by Panchmahal districts. According to MSME data, the transport of equipment and parts industry has 148 units in this district (2016-17). It was discovered that a lack of natural resources in the district is the primary obstacle to rapid industrial development. Despite the fact that the pattern of industrial development over the last 20 years indicates that the government is providing appropriate infrastructural facilities to promote local entrepreneurs in the region.

The MSME (Ministry of Micro, Small, and Medium Enterprises) report for the 2016-2017 financial year was used to compile industrial data for Bharuch, Vadodara and Panchmahal districts. According to reports, these three districts have the potential to develop into industrial zones, especially the Panchmahal area.

3.7 DATA COLLECTION

The data requirement and their collection for the purpose of this research is described in table-1. To achieve the objective of groundwater contaminant source identification, groundwater sample data of 50 openwells and shallow tubewells falling in the alluvial region were collected from MOJS-DDWAS (Ministry of Jal Shakti, Department of Drinking Water and Sanitation) portal for 2018-2020 time period of both pre and post monsoon seasons. The multivariate statistical analysis (Z-score, PCA, HCA and FSA) was applied on these data to obtain pockets of anthropogenic sources with the help of IDW (Inverse Distance Weighted) interpolation method in GIS environment.

The objective of groundwater vulnerability assessment was achieved using various data such as groundwater depth collected from 50 observation wells of CGWB from India-WRIS portal for the time period 2018 (Pre and Post monsoon). Groundwater recharge was estimated as per (GEC-2015) for which the data related to rainfall was collected from SWDC, Gandhinagar for the time period 2000-2016. Other sources of groundwater recharge such as canals, tanks, ponds and water conservation structures were digitized in google earth pro and imported in GIS environment. The estimated recharge was also checked against block-wise referenced values provided by CGWB-WCR, Ahmedabad.

Aquifer media (A), Soil media (S), Impact of vadose zone (I) and hydraulic Conductivity (C) parameters of DRASTIC model were assigned the ratings based on 76 lithologs of the alluvial region for which the data was collected from GWRDC, Gandhinagar. Topography (T) parameter was obtained by collecting DEM (Digital Elevation Map) for the alluvial region from USGS Earth Explorer. The factor score (FS) parameter was estimated from above mentioned multivariate statistical analysis (PCA and FSA) applied on 50 openwells and shallow tubewells of MOJS-DDWAS portal for 2018 pre and post monsoon time periods. The External Influence (EI) parameter was evaluated from the industrial location, Sewage Treatment Plants (STPs) and rural sanitation details obtained from MSME reports and census reports respectively.

The objective of public health risk assessment against groundwater Nitrate was achieved considering data from 50 openwells and shallow tubewells of MOJS-DDWAS portal for 2018 pre and post monsoon time periods which also showed water use scenario, average water demand and population distribution at each sample location. The United States Environmental Protection Agency guidelines **(USEPA 1992, USEPA 1999)** on chronic daily intake (CDI) and

reference dose (RD) were also used to obtain hazard quotient (HQ) for children and adults. To minimize the health risk against groundwater Nitrate, various groundwater management strategies were recommended based on area specific characteristics.

Table 3.1 Data requirement and collection

Sr.	Source	Description of collected data
Obj. 1: To identify various sources of ground water contamination in study area		
1	MOJS-DDWAS	Groundwater quality data (50 Wells) (2018 Pre and Post monsoon)
Obj. 2&3: To develop suitable model to assess the ground water vulnerability (DRASTIC Index)		
1	India WRIS	**For 'D':** Groundwater depth / Water level data (54 Wells) (2018 – Pre and Post monsoon) (Fig. 3.11)
2	SWDC, Ahmedabad	**For 'R':** Average Annual Rainfall (2000-2016) (Fig. 3.12) Canals, Tanks and Ponds, WCS polygons from google earth (Fig. 3.13) (Fig. 3.14)
3	CGWB-WCR, Ahmedabad	**For 'R':** Reference block wise Groundwater Recharge and Extraction (For recharge calculation), Hydraulic conductivity reference
4	GWRDC, Gandhinagar	**For 'A, S, I, C':** Lithology – Aquifer, Soil, Vadose zone, Hydraulic Conductivity (Fig. 3.16)
5	USGS Earth explorer	**For 'T':** SRTM Digital Elevation Map, Landsat 8 images, Land Use Land Cover (Fig. 3.15) (Fig. 3.17)
6	MOJS-DDWAS	**For 'FS':** Groundwater quality data (50 Wells) (2018 – Pre and Post monsoon) (Fig. 3.4 - 3.9) **For 'Model Validation':** (2018, 2019, 2020 – Pre and Post monsoon)
7	DIPS Reports (MSME)	**For 'EI':** Location and Type of Industries and STP Locations (Fig. 3.3)
8	Socioeconomic Data and Applications Center (SEDAC)	**For 'EI':** Villages Location and Population (Fig. 3.10)
Obj. 4: To develop the relationship between vulnerability parameter with ground water quality		
1	MOJS-DDWAS	Groundwater quality data (50 Wells) (2018 – Pre and Post monsoon)
Obj. 5: To suggest the management strategy to minimize the risk on public health		
1	USEPA guidelines	Groundwater Nitrate daily consumption for adults and children
2	Primary data	Groundwater quality samples (2021 Pre) (Fig. 3.18)
3	MOJS-DDWAS	Groundwater quality data (OS-50) (2018, 2019, 2020 – Pre & Post monsoon) Water use scenario, Population distribution

Table 3.2 MOJS-DDWAS Groundwater quality data (2018-Pre monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Amod	Vedcha	Shallow Tubewell	22.015626	72.943070	7.66	382	30	0.21	36	6	22	37	216	256
2	Bharuch	Jambusar	Jafarpara	Open well	22.061978	72.875670	7.96	1008	14	0.19	292	46	120	28	420	296
3	Bharuch	Jambusar	Kavi	Open well	22.195323	72.636001	6.89	996	7	1.38	104	64	16	43	220	668
4	Bharuch	Jambusar	Nondhana	Open well	22.133854	72.781111	8.08	588	9	0.07	80	23	37	35	240	380
5	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.646063	73.618754	7.92	942	44	0.80	168	24	119	72	596	432
6	Panch Mahals	Kalol	Alali	Shallow Tubewell	22.635123	73.538779	7.80	1354	129	1.46	224	35	166	99	828	568
7	Panch Mahals	Kalol	Alva	Shallow Tubewell	22.602179	73.511642	7.96	856	35	1.30	132	25	114	69	572	480
8	Panch Mahals	Kalol	Bakrol	Shallow Tubewell	22.566359	73.415924	7.66	1809	104	0.78	232	112	239	144	1196	428
9	Panch Mahals	Kalol	Bedhiya	Shallow Tubewell	22.603151	73.408605	7.88	1144	132	0.62	76	41	166	99	832	628
10	Panch Mahals	Kalol	Devpura	Shallow Tubewell	22.611365	73.557365	7.87	1287	96	0.30	450	23	93	56	468	412
11	Panch Mahals	Kalol	Jetpur	Shallow Tubewell	22.598398	73.478261	7.90	616	42	0.42	64	21	86	52	432	491
12	Panch Mahals	Kalol	Medapur	Open well	22.587207	73.517653	7.74	736	42	0.45	60	27	110	66	552	490
13	Panch Mahals	Kalol	Shaktipura	Shallow Tubewell	22.641422	73.504198	7.70	786	137	0.92	212	10	57	35	284	296
14	Panch Mahals	Halol	Arad	Open well	22.561229	73.568108	7.70	584	38	0.60	84	18	75	45	376	320
15	Panch Mahals	Halol	Govindpuri	Shallow Tubewell	22.573575	73.631665	7.90	1478	28	1.30	448	31	144	86	720	444
16	Panch Mahals	Halol	Navaria	Open well	22.564894	73.476012	7.78	740	23	0.80	84	22	109	66	544	412
17	Panch Mahals	Ghoghamba	Dhaneshwar	Shallow Tubewell	22.543069	73.631231	7.89	798	42	0.54	192	16	86	52	428	408
18	Panch Mahals	Ghoghamba	Jitpura	Shallow Tubewell	22.541712	73.598965	7.89	1312	31	0.80	540	17	86	52	428	372
19	Panch Mahals	Ghoghamba	Kanbipalli	Shallow Tubewell	22.577437	73.640175	7.80	662	44	0.94	80	14	70	42	352	456
20	Panch Mahals	Ghoghamba	Kumbhar Palli	Shallow Tubewell	22.577848	73.642155	7.80	518	41	0.80	92	10	61	36	304	276
21	Panch Mahals	Ghoghamba	Ranipura (dam)	Shallow Tubewell	22.571486	73.638536	7.78	1778	29	0.72	508	41	184	110	920	556
22	Panch Mahals	Ghoghamba	Rayan Muvada	Shallow Tubewell	22.571230	73.642055	7.72	1052	44	0.68	296	20	103	62	516	328
23	Panch Mahals	Ghoghamba	Savapura	Shallow Tubewell	22.545865	73.657977	7.82	1102	83	0.70	128	32	154	92	768	228
24	Vadodara	Savli	Dhantej	Shallow Tubewell	22.595273	73.360274	7.00	4120	284	0.54	848	473	24	424	1810	602
25	Vadodara	Savli	Kalupura	Shallow Tubewell	22.614267	73.250771	7.99	822	104	0.88	108	37	19	46	236	464

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Vadodara	Savli	Dipapura	Shallow Tubewell	22.635083	73.338365	8.01	1020	34	2.15	112	45	14	24	136	704
27	Vadodara	Savli	Rasawadi	Shallow Tubewell	22.608294	73.239200	7.94	734	86	0.35	104	33	72	56	412	276
28	Vadodara	Savli	Wankaner	Shallow Tubewell	22.543114	73.182610	7.30	1310	168	0.34	135	40	100	140	828	487
29	Vadodara	Karjan	Vadava	Shallow Tubewell	21.871356	73.146472	7.90	772	2	0.29	156	30	48	41	292	436
30	Vadodara	Karjan	Delvada	Shallow Tubewell	21.870076	73.143891	8.04	582	3	0.52	104	14	22	27	168	360
31	Vadodara	Karjan	Somaj	Shallow Tubewell	21.872436	73.144918	7.74	578	10	0.42	72	26	41	43	284	384
32	Vadodara	Karjan	Fatepur	Shallow Tubewell	21.911216	73.217983	7.84	820	4	0.74	84	22	35	38	248	596
33	Vadodara	Karjan	Pura	Shallow Tubewell	21.846364	73.177747	7.58	1418	2	0.82	428	57	91	88	596	464
34	Vadodara	Karjan	Sandarna	Shallow Tubewell	22.007471	73.166414	8.04	1556	45	0.79	476	60	91	88	596	360
35	Vadodara	Karjan	Saniyad	Shallow Tubewell	21.919963	73.166132	7.86	410	3	1.32	48	21	34	36	236	280
36	Vadodara	Padra	Bhoj	Shallow Tubewell	22.221413	73.005110	8.04	1056	2	1.12	308	42	67	65	440	460
37	Vadodara	Padra	Brahmanvasi	Shallow Tubewell	22.150838	72.875035	8.11	898	7	0.86	148	22	35	41	260	596
38	Vadodara	Padra	Chokari	Shallow Tubewell	22.273760	73.072250	7.95	940	10	0.72	232	11	17	21	132	488
39	Vadodara	Padra	Dabhasa	Shallow Tubewell	22.243011	73.051750	7.98	886	45	1.98	176	38	61	60	404	446
40	Vadodara	Padra	Goriyad	Shallow Tubewell	22.195859	73.087332	7.88	674	4	1.04	192	26	41	42	280	296
41	Vadodara	Padra	Pipli	Shallow Tubewell	22.201581	73.051033	7.74	1102	31	0.88	172	12	16	15	104	700
42	Vadodara	Padra	Sadra	Shallow Tubewell	22.136073	72.981860	8.02	1403	23	1.18	272	13	20	24	152	825
43	Vadodara	Padra	Shihor	Shallow Tubewell	22.182023	73.114620	8.41	1618	9	0.82	568	36	57	57	380	772
44	Vadodara	Padra	Vishrampura	Shallow Tubewell	22.194093	72.967710	7.98	2236	102	1.36	440	114	182	169	1160	828
45	Vadodara	Shinor	Simli	Shallow Tubewell	21.990325	73.365538	7.72	1018	17	0.33	236	44	73	72	484	468
46	Vadodara	Shinor	Tinglod	Openwell	21.993000	73.249902	7.88	1270	44	0.34	296	58	94	88	600	368
47	Vadodara	Dabhoi	Bhimpura	Shallow Tubewell	21.982612	73.441960	7.76	480	5	0.36	76	21	60	36	304	240
48	Vadodara	Vadodara	Karchiya	Openwell	22.377866	73.103213	7.49	900	23	0.49	147	70	49	71	415	550
49	Vadodara	Vadodara	Sankarda	Shallow Tubewell	22.433878	73.123409	7.59	1260	92	0.47	360	31	25	112	523	525
50	Vadodara	Vadodara	Sisva	Openwell	22.400058	73.182021	7.31	2494	95	0.38	832	210	109	131	812	404

Table 3.3 MOJS-DDWAS Groundwater quality data (2018-Post monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Jambusar	Amanpor Mota	Openwell	22.12588	72.75626	7.58	428	4	0.38	116	9	21	20	136	204
2	Bharuch	Jambusar	Bojadra	Openwell	22.05637	72.90022	7.9	512	1	0.13	84	16	40	46	292	328
3	Bharuch	Jambusar	Jafarpara	Openwell	22.06198	72.87567	8	1280	11	0.19	448	9	62	80	488	332
4	Bharuch	Jambusar	Nahar	Openwell	22.17589	72.68945	8.09	1370	166	0.37	236	14	58	56	380	740
5	Bharuch	Jambusar	Nondhana	Openwell	22.13385	72.78111	7.73	400	4	0.26	112	10	22	21	144	184
6	Bharuch	Jambusar	Salehpor Sang	Openwell	22.12304	72.60688	7.9	406	6	0.22	44	13	34	31	216	284
7	Panch Mahals	Ghoghamba	Damanpura	Shallow Tubewell	22.63941	73.64751	7.78	838	145	3.2	128	18	91	55	456	308
8	Panch Mahals	Ghoghamba	Gorada	Shallow Tubewell	22.54306	73.60124	7.9	1514	218	2.72	380	28	134	81	672	300
9	Panch Mahals	Ghoghamba	Goya Sundal	Shallow Tubewell	22.54171	73.59897	7.74	852	112	2.29	148	18	94	57	472	252
10	Panch Mahals	Ghoghamba	Kanbipalli	Shallow Tubewell	22.57785	73.64216	7.79	702	127	1.1	84	15	82	49	408	220
11	Panch Mahals	Ghoghamba	Kharkhadi	Shallow Tubewell	22.54182	73.59953	7.72	1068	208	0.95	52	28	146	87	728	372
12	Panch Mahals	Ghoghamba	Poyali	Shallow Tubewell	22.54327	73.66751	7.69	866	113	0.54	152	19	96	58	480	264
13	Panch Mahals	Ghoghamba	Tadkundla	Shallow Tubewell	22.57744	73.64017	7.8	968	124	3.85	156	22	112	67	560	364
14	Panch Mahals	Halol	Arad	Shallow Tubewell	22.56123	73.56811	7.72	3882	247	1.48	1224	78	339	203	1696	500
15	Panch Mahals	Halol	Govindpuri	Shallow Tubewell	22.57358	73.63166	7.76	566	41	1.46	76	14	67	40	336	372
16	Panch Mahals	Halol	Maruva	Shallow Tubewell	22.57424	73.51546	7.82	2348	123	1.36	752	48	205	123	1024	432
17	Panch Mahals	Halol	Maswad	Shallow Tubewell	22.55885	73.50957	7.74	2412	217	0.91	636	54	232	139	1160	376
18	Panch Mahals	Halol	Varasada (govi	Shallow Tubewell	22.56323	73.54115	7.86	2452	225	1.01	676	52	227	136	1136	372
19	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.64516	73.61621	7.79	2154	255	0.07	424	102	227	136	1136	420
20	Panch Mahals	Kalol	Alva	Shallow Tubewell	22.57915	73.54104	7.78	1398	152	0.67	348	24	118	71	588	676
21	Panch Mahals	Kalol	Barola	Shallow Tubewell	22.58831	73.44071	7.7	866	84	0.36	172	19	96	58	480	432
22	Panch Mahals	Kalol	Bhukhi	Shallow Tubewell	22.62606	73.60734	7.72	716	180	0.05	76	12	77	46	384	372
23	Panch Mahals	Kalol	Ghoda	Shallow Tubewell	22.61099	73.48147	7.88	2242	205	3.23	968	21	107	64	536	460
24	Panch Mahals	Kalol	Khadki	Shallow Tubewell	22.60709	73.46171	7.8	2168	171	1.22	932	24	110	66	548	536
25	Panch Mahals	Kalol	Khandeval	Shallow Tubewell	22.63356	73.48387	7.58	854	90	1.48	160	18	96	58	480	376

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Panch Mahals	Kalol	Medapur	Shallow Tubewell	22.58836	73.50263	7.64	892	42	0.81	136	23	119	72	119	596
27	Panch Mahals	Kalol	Nevariya	Shallow Tubewell	22.56609	73.4957	7.72	1708	111	1.08	440	38	174	105	872	596
28	Panch Mahals	Kalol	Utarediya	Shallow Tubewell	22.62276	73.53953	7.72	1604	248	1.46	496	22	114	67	564	532
29	Vadodara	Dabhoi	Bhimpura	Shallow Tubewell	21.98261	73.44196	7.74	618	32	0.21	104	27	50	57	360	320
30	Vadodara	Dabhoi	Kajapur	Shallow Tubewell	22.07573	73.39972	8.18	2542	27	1.22	1012	114	18	100	576	740
31	Vadodara	Dabhoi	Vayadpur	Shallow Tubewell	22.36463	73.14272	7.98	1410	79	0.87	348	64	42	137	668	500
32	Vadodara	Karjan	Delvada	Shallow Tubewell	21.87008	73.14389	8.48	512	2	0.47	96	18	22	25	160	308
33	Vadodara	Karjan	Somaj	Shallow Tubewell	21.87244	73.14492	7.6	564	12	0.4	48	34	53	52	352	396
34	Vadodara	Padra	Gavasad	Openwell	22.16039	72.94403	7.82	1362	99	0.36	440	39	62	61	408	464
35	Vadodara	Savli	Dhantej	Shallow Tubewell	22.55811	73.23216	8.36	2262	276	0.52	495	102	152	158	1030	737
36	Vadodara	Savli	Dipapura	Shallow Tubewell	22.63508	73.33836	8.34	1144	44	1.47	172	51	56	24	238	717
37	Vadodara	Savli	Gutardi	Shallow Tubewell	22.64148	73.33159	7.73	1702	172	0.7	414	77	80	132	742	747
38	Vadodara	Savli	Khokhar	Shallow Tubewell	22.61427	73.25077	7.82	910	17	1.87	152	41	24	89	426	566
39	Vadodara	Savli	Parthampura (	Shallow Tubewell	22.60829	73.2392	7.51	1062	65	0.53	263	47	68	76	485	384
40	Vadodara	Savli	Vemer	Shallow Tubewell	21.87244	73.14492	7.6	1242	27	1.81	333	56	16	41	208	586
41	Vadodara	Vadodara	Ankhol	Openwell	22.2975	73.2436	6.8	3822	56	0.39	850	1036	141	207	1205	287
42	Vadodara	Vadodara	Bajva	Openwell	22.36463	73.14272	7.97	1750	79	0.32	200	691	55	112	598	470
43	Vadodara	Vadodara	Dhanora	Shallow Tubewell	22.25409	73.2486	8.07	458	3	1.3	69	13	16	31	167	303
44	Vadodara	Vadodara	Hansapura	Shallow Tubewell	22.40006	73.18202	8.04	1596	39	1.56	424	72	16	28	157	768
45	Vadodara	Vadodara	Kajapur	Shallow Tubewell	22.16616	73.19726	8.27	1254	20	1.23	202	64	35	36	235	792
46	Vadodara	Vadodara	Ratanpur	Shallow Tubewell	22.43388	73.12341	7.65	1288	50	0.47	290	51	19	154	680	414
47	Vadodara	Vadodara	Salad	Shallow Tubewell	22.13364	73.23847	7.66	1912	123	0.28	525	159	82	134	755	586
48	Vadodara	Vadodara	Sankarda	Shallow Tubewell	22.30983	73.09747	7.62	1236	95	0.38	340	19	39	105	529	540
49	Vadodara	Vadodara	Sisva	Openwell	22.40006	73.18202	7.75	2798	92	0.29	820	395	122	150	921	376
50	Vadodara	Vadodara	Tatarpura	Shallow Tubewell	22.26891	73.2535	7.92	1168	6	1.38	260	76	13	24	130	624

Table 3.4 MOJS-DDWAS Groundwater quality data (2019-Pre monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Jambusar	Amanpor Mota	Openwell	22.12588	72.75626	6.99	930	1	0.32	304	5	60	60	396	468
2	Bharuch	Jambusar	Bojadra	Openwell	22.05637	72.90022	6.8	1292	9	0.37	628	24	50	49	316	378
3	Bharuch	Jambusar	Jafarpara	Openwell	22.06198	72.87567	7.1	528	7	0.28	124	23	48	46	312	120
4	Bharuch	Jambusar	Nahar	Openwell	22.17589	72.68945	7.38	634	68	1.04	124	47	70	70	464	460
5	Bharuch	Jambusar	Nondhana	Openwell	22.13385	72.78111	7.07	920	2	0.57	472	3	32	30	208	104
6	Panch Mahals	Ghoghamba	Bhilod	Shallow Tubewell	22.6182	73.6136	7.77	684	40	1.02	104	10	62	37	312	452
7	Panch Mahals	Ghoghamba	Chatha	Shallow Tubewell	22.54217	73.63486	7.77	844	24	1.48	236	16	85	51	424	384
8	Panch Mahals	Ghoghamba	Devlikuwa	Shallow Tubewell	22.59073	73.64257	7.78	646	41	0.94	116	10	62	37	308	396
9	Panch Mahals	Ghoghamba	Jitpura	Shallow Tubewell	22.54171	73.59897	7.71	612	16	0.58	92	13	74	44	368	420
10	Panch Mahals	Ghoghamba	Kanpur	Shallow Tubewell	22.58358	73.63049	7.78	758	193	0.71	76	14	78	47	392	412
11	Panch Mahals	Ghoghamba	Kharkhadi	Shallow Tubewell	22.54246	73.60186	7.72	894	94	0.55	164	20	102	60	508	476
12	Panch Mahals	Ghoghamba	Paroli	Shallow Tubewell	22.57798	73.61572	7.74	698	32	1.24	184	12	70	42	352	332
13	Panch Mahals	Ghoghamba	Ranipura (dam	Shallow Tubewell	22.57084	73.63855	7.72	804	197	3.18	2446	16	86	52	432	1000
14	Panch Mahals	Halol	Arad	Openwell	22.55104	73.56236	7.67	534	25	1.23	76	9	58	35	288	360
15	Panch Mahals	Halol	Govindpuri	Shallow Tubewell	22.57358	73.63166	7.72	894	80	0.7	132	18	93	56	464	572
16	Panch Mahals	Halol	Maruva	Shallow Tubewell	22.5723	73.51743	7.82	3289	254	0.42	952	70	302	192	1512	424
17	Panch Mahals	Halol	Maswad	Shallow Tubewell	22.55885	73.50957	7.8	4078	256	0.72	1264	85	363	218	1816	588
18	Panch Mahals	Halol	Navaria	Openwell	22.56545	73.47564	7.58	402	21	0.36	56	8	53	32	264	164
19	Panch Mahals	Halol	Varasada (govi	Shallow Tubewell	22.56507	73.55046	7.56	252	6	0.28	28	2	35	21	176	160
20	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.64606	73.61875	7.72	842	25	0.74	120	15	83	50	416	596
21	Panch Mahals	Kalol	Alva	Shallow Tubewell	22.59846	73.52426	7.76	788	43	1.29	68	25	118	71	592	540
22	Panch Mahals	Kalol	Bakrol	Shallow Tubewell	22.60315	73.4086	7.79	2746	258	0.49	912	47	210	126	1048	264
23	Panch Mahals	Kalol	Barola	Openwell	22.58831	73.44071	7.7	1198	95	0.63	308	24	118	71	592	560
24	Panch Mahals	Kalol	Derol	Shallow Tubewell	22.63237	73.46027	7.74	1022	131	0.55	164	24	119	72	596	200
25	Panch Mahals	Kalol	Eral	Shallow Tubewell	22.60825	73.60027	7.76	684	108	1.04	80	10	62	37	312	420

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Panch Mahals	Kalol	Khadki	Shallow Tubewell	22.63885	73.51063	7.84	1852	175	2.01	468	40	182	109	908	808
27	Panch Mahals	Kalol	Madhavas	Shallow Tubewell	22.57978	73.43654	7.78	3236	255	0.39	1096	57	251	151	1256	312
28	Panch Mahals	Kalol	Nevariya	Shallow Tubewell	22.56609	73.4957	7.82	1854	145	0.7	472	41	187	112	936	440
29	Panch Mahals	Kalol	Saliyav	Shallow Tubewell	22.58584	73.57422	7.68	716	44	1.11	100	17	91	55	456	480
30	Panch Mahals	Kalol	Shaktipura	Shallow Tubewell	22.34989	73.18347	7.76	1322	127	0.57	376	24	117	70	580	496
31	Vadodara	Karjan	Karan	Shallow Tubewell	21.90297	73.15903	8.05	1360	2	0.72	304	70	112	104	712	560
32	Vadodara	Karjan	Pura	Shallow Tubewell	21.84548	73.17682	7.82	1376	2	0.18	412	62	91	88	596	600
33	Vadodara	Karjan	Sarupur Timbi	Shallow Tubewell	21.92789	73.14401	7.92	1116	20	1.07	336	44	70	69	464	372
34	Vadodara	Padra	Bhoj	Shallow Tubewell	22.22141	73.00511	7.77	996	2	0.32	280	42	33	86	440	428
35	Vadodara	Padra	Brahmanvasi	Shallow Tubewell	22.15103	72.87352	8.03	828	16	2.49	120	12	19	24	148	556
36	Vadodara	Padra	Dudhwada	Shallow Tubewell	22.19749	72.88378	8.08	2552	3	1.62	992	76	121	114	780	492
37	Vadodara	Padra	Goriyad	Shallow Tubewell	22.19586	73.08733	7.99	1286	34	0.98	344	32	42	46	300	600
38	Vadodara	Padra	Karkhadi	Shallow Tubewell	22.20791	72.90492	7.64	3548	2	0.48	896	184	278	255	1760	536
39	Vadodara	Padra	Kotna	Shallow Tubewell	22.1377	72.9813	7.86	2616	70	0.44	964	94	131	112	800	348
40	Vadodara	Padra	Latipura	Shallow Tubewell	22.22408	73.05846	8.45	952	73	0.91	132	44	70	68	460	556
41	Vadodara	Padra	Ranu	Shallow Tubewell	22.20925	73.02487	8.4	1246	33	2.78	280	22	35	36	240	668
42	Vadodara	Padra	Shihor	Shallow Tubewell	22.18202	73.11462	8.08	1538	22	0.81	500	58	910	87	592	6000
43	Vadodara	Savli	Dhantej	Shallow Tubewell	22.59527	73.36027	8.13	2770	270	0.64	500	371	140	185	1110	660
44	Vadodara	Shinor	Simli	Shallow Tubewell	21.99032	73.36554	7.12	668	15	0.39	116	34	48	48	320	400
45	Vadodara	Vadodara	Chikhodara	Shallow Tubewell	22.2363	73.23161	8.03	1666	18	0.51	604	52	24	34	200	608
46	Vadodara	Vadodara	Fajalpur (san	Shallow Tubewell	22.43445	73.12439	7.78	1104	64	0.29	164	12	21	142	712	376
47	Vadodara	Vadodara	Karodiya	Shallow Tubewell	22.35815	73.15121	7.8	936	53	0.4	204	63	21	72	416	456
48	Vadodara	Vadodara	Maretha	Shallow Tubewell	22.22586	73.17047	7.88	738	65	1.3	129	130	33	42	257	299
49	Vadodara	Vadodara	Sankarda	Shallow Tubewell	22.43147	73.12263	7.66	1480	80	0.38	440	19	21	120	643	560
50	Vadodara	Vadodara	Sisva	Openwell	22.40006	73.18202	7.4	3052	95	0.3	870	422	21	172	1050	430

Table 3.5 MOJS-DDWAS Groundwater quality data (2019-Post monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Amod	Malkinpura Al	Shallow Tubewell	21.97199	72.95801	7.31	1106	1	0.48	332	76	94	86	596	452
2	Bharuch	Amod	Manjola	Shallow Tubewell	22.029	72.963	7.1	624	0	0.54	176	20	54	61	388	296
3	Bharuch	Bharuch	Mangleshwar	Shallow Tubewell	21.781	73.131	7.68	1518	5	0.12	480	87	122	89	677	184
4	Bharuch	Bharuch	Shahpura	Shallow Tubewell	21.86422	73.10998	8.29	962	20	0.41	233	34	24	70	352	460
5	Bharuch	Bharuch	Shuklatirth	Shallow Tubewell	21.78	73.098	7.6	1144	16	0.16	248	95	74	79	515	512
6	Bharuch	Bharuch	Uparali	Shallow Tubewell	21.841	73.092	7.52	3452	2	0.28	1016	244	513	76	1600	780
7	Bharuch	Jambusar	Nadiad	Openwell	22.051	72.732	6.93	694	2	0.41	92	34	19	26	156	336
8	Bharuch	Jambusar	Nahar	Openwell	22.17589	72.68945	8.09	1370	166	0.37	236	14	58	56	380	740
9	Bharuch	Jambusar	Nondhana	Openwell	22.13385	72.78111	7.73	400	4	0.26	112	10	22	21	144	184
10	Bharuch	Jambusar	Salehpor Sang	Openwell	22.12304	72.60688	7.9	406	6	0.22	44	13	34	31	216	284
11	Bharuch	Jambusar	Tankari	Openwell	22.05175	72.79662	7.21	1566	29	0.52	516	24	104	100	676	452
12	Bharuch	Jambusar	Uber	Openwell	22.12594	72.80363	7.1	2772	2	0.38	1008	43	101	101	676	808
13	Panch Mahals	Ghoghamba	Jitpura	Shallow Tubewell	22.54306	73.60124	7.36	304	3	2.04	24	6	26	40	232	220
14	Panch Mahals	Ghoghamba	Kanbipalli	Shallow Tubewell	22.582	73.638	7.58	532	43	1.04	88	11	26	61	320	224
15	Panch Mahals	Ghoghamba	Paroli	Shallow Tubewell	22.57798	73.61572	7.39	1422	93	1.33	384	29	134	86	696	380
16	Panch Mahals	Ghoghamba	Rinchhiya	Openwell	22.543	73.629	7.51	892	159	0.41	156	17	42	84	456	180
17	Panch Mahals	Ghoghamba	Valinath	Shallow Tubewell	22.56641	73.58607	7.39	904	93	0.87	172	20	122	48	504	508
18	Panch Mahals	Ghoghamba	Virapura	Openwell	22.551	73.654	7.38	858	3	1.21	176	22	19	96	544	420
19	Panch Mahals	Halol	Arad	Shallow Tubewell	22.5649	73.56403	7.41	514	43	0.68	96	9	22	54	280	292
20	Panch Mahals	Halol	Govindpuri	Shallow Tubewell	22.565	73.496	7.49	1032	21	2.34	296	21	22	96	520	420
21	Panch Mahals	Halol	Maghasar	Shallow Tubewell	22.563	73.444	7.11	4229	86	0.55	1360	94	516	169	1984	476
22	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.64516	73.61621	7.61	1911	245	0.3	492	57	152	85	736	488
23	Panch Mahals	Kalol	Alva	Openwell	22.59973	73.52379	7.64	1223	98	0.73	282	25	85	94	602	654
24	Panch Mahals	Kalol	Bhukhi	Shallow Tubewell	22.62606	73.60734	7.41	699	112	0.77	76	10	58	44	328	430
25	Panch Mahals	Kalol	Ghoda	Openwell	22.6073	73.48582	7.75	1838	163	2.1	658	26	78	106	636	528

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Panch Mahals	Kalol	Khandeval	Shallow Tubewell	22.63715	73.48144	7.65	1151	114	1.21	230	26	95	95	632	588
27	Panch Mahals	Kalol	Medapur	Shallow Tubewell	22.5855	73.50212	7.67	1398	139	0.71	298	28	138	100	520	568
28	Panch Mahals	Kalol	Shaktipura	Shallow Tubewell	22.64142	73.5042	7.68	1724	43	0.47	520	8	26	48	264	868
29	Vadodara	Dabhoi	Bhimpura	Shallow Tubewell	21.98261	73.44196	7.74	618	32	0.21	104	27	50	57	360	320
30	Vadodara	Karjan	Kanthariya	Shallow Tubewell	21.95036	73.19096	7.86	714	13	0.4	172	36	37	56	324	340
31	Vadodara	Karjan	Karan	Shallow Tubewell	21.90297	73.15903	7.69	2168	1	0.38	560	95	140	168	1056	536
32	Vadodara	Karjan	Mangrol	Shallow Tubewell	22.00996	73.03827	7.65	1998	177	0.2	400	88	131	157	948	360
33	Vadodara	Karjan	Moti Koral	Shallow Tubewell	21.849	73.204	8.05	788	1	0.23	108	35	70	84	528	400
34	Vadodara	Karjan	Pura	Shallow Tubewell	21.84636	73.17775	7.81	1258	44	0.37	304	55	80	96	600	440
35	Vadodara	Karjan	Saniyad	Shallow Tubewell	21.91996	73.16613	7.85	822	8	0.38	140	38	68	81	512	452
36	Vadodara	Karjan	Somaj	Shallow Tubewell	21.87244	73.14492	8.31	1198	146	0.42	192	52	80	96	600	612
37	Vadodara	Karjan	Surwada	Shallow Tubewell	22.105	73.064	7.97	664	44	0.34	76	29	53	61	400	424
38	Vadodara	Karjan	Umaj	Shallow Tubewell	22.041	72.997	8.08	778	1	0.81	272	34	36	42	268	272
39	Vadodara	Padra	Brahmanvasi	Shallow Tubewell	22.15103	72.87352	7.91	898	26	1.25	116	39	16	19	120	584
40	Vadodara	Padra	Vishrampura	Shallow Tubewell	22.19409	72.96771	7.92	1422	73	0.69	308	62	56	67	420	704
41	Vadodara	Savli	Bhadarva	Shallow Tubewell	22.507	73.14	7.7	370	7	0.89	40	16	32	39	240	256
42	Vadodara	Savli	Dhantej	Shallow Tubewell	22.55811	73.23216	8.36	2262	276	0.52	495	102	152	158	1030	737
43	Vadodara	Savli	Samlaya	Openwell	22.518	73.208	7.38	998	59	0.93	260	66	92	90	416	456
44	Vadodara	Shinor	Simli	Shallow Tubewell	21.98759	73.36576	7.68	864	44	0.32	200	43	62	62	416	300
45	Vadodara	Vadodara	Dhanora	Shallow Tubewell	22.384	73.104	8.44	480	2	1.49	64	14	35	24	188	332
46	Vadodara	Vadodara	Jobantekri	Shallow Tubewell	22.273	73.252	7.99	2264	18	1.02	1080	95	40	45	284	420
47	Vadodara	Vadodara	Sankarda	Shallow Tubewell	22.43147	73.12263	7.3	1320	23	0.82	256	114	49	123	792	652
48	Vadodara	Vadodara	Sindhrot	Shallow Tubewell	22.31	73.097	7.26	1630	43	0.33	464	92	170	72	720	344
49	Vadodara	Vadodara	Sisva	Openwell	22.40006	73.18202	8.31	2304	63	0.37	692	289	134	119	828	352
50	Vadodara	Vadodara	Vadadla	Shallow Tubewell	22.24674	73.23839	7.73	3836	27	0.85	1824	103	54	86	492	720

Table 3.6 MOJS-DDWAS Groundwater quality data (2020-Pre monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Amod	Ghamnad	Shallow Tubewell	21.94556	72.94634	6.88	1406	4.01	0.59	688	71	86	84	568	492
2	Bharuch	Amod	Malkinpura Al	Shallow Tubewell	21.97295	72.96044	7.18	1028	1	0.27	328	46	96	83	584	360
3	Bharuch	Amod	Pursa	Openwell	22.007	72.82	6.89	860	27.92	0.39	188	72	42	45	292	104
4	Bharuch	Amod	Vedcha	Shallow Tubewell	22.01558	72.943	7.93	608	11.52	0.34	160	14	78	77	516	112
5	Bharuch	Bharuch	Shuklatirth	Shallow Tubewell	21.72699	73.07998	7.48	2280	113.97	0.51	780	91	24	177	790	560
6	Bharuch	Jambusar	Degam	Openwell	22.18441	72.58979	7.36	912	55.68	0.48	228	58	96	91	620	700
7	Bharuch	Jambusar	Runad	Openwell	22.15101	72.64095	7.43	2588	133.62	0.87	908	98	156	151	1104	904
8	Bharuch	Jambusar	Zamdi	Shallow Tubewell	22.11093	72.58356	7.56	1846	3.55	0.54	804	95	112	117	768	604
9	Panch Mahals	Ghoghamba	Dhaneshwar	Shallow Tubewell	22.542	73.633	7.39	646	43.18	0.38	140	11	117	7	320	356
10	Panch Mahals	Ghoghamba	Jitpura	Shallow Tubewell	22.54306	73.60124	7.68	824	16.15	1.28	172	17	112	40	448	508
11	Panch Mahals	Ghoghamba	Kanbipalli	Shallow Tubewell	22.57744	73.64018	7.66	622	24.3	0.6	116	14	29	75	384	368
12	Panch Mahals	Ghoghamba	Kanpur	Shallow Tubewell	22.58428	73.6296	7.38	516	7.48	1.43	24	10	51	44	312	436
13	Panch Mahals	Ghoghamba	Kharkhadi	Shallow Tubewell	22.54246	73.60186	7.14	1222	89.72	0.81	248	30	157	75	704	528
14	Panch Mahals	Ghoghamba	Paroli	Shallow Tubewell	22.57798	73.61573	7.4	816	122.7	1.17	496	25	179	89	816	472
15	Panch Mahals	Ghoghamba	Ranipura (dam	Shallow Tubewell	22.57149	73.63854	7.63	1708	10.74	2.02	672	24	160	47	596	640
16	Panch Mahals	Ghoghamba	Rayan Muvada	Shallow Tubewell	22.57123	73.64206	7.22	1712	37.94	0.83	520	36	208	75	832	528
17	Panch Mahals	Halol	Arad	Shallow Tubewell	22.55235	73.56363	7.41	628	11.81	1.01	96	11	60	41	324	436
18	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.64516	73.61621	7.67	1954	222.5	0.99	532	35	160	113	872	436
19	Panch Mahals	Kalol	Alva	Shallow Tubewell	22.59973	73.52379	7.63	1594	163.36	0.54	524	24	93	87	596	380
20	Panch Mahals	Kalol	Athamana	Shallow Tubewell	22.641	73.599	7.7	812	130.47	0.24	164	14	74	48	384	396
21	Panch Mahals	Kalol	Bakrol	Shallow Tubewell	22.60315	73.40861	7.62	1058	96.43	0.44	212	24	99	84	596	408
22	Panch Mahals	Kalol	Baletia	Shallow Tubewell	22.641	73.443	7.72	1004	184.15	0.45	172	12	74	40	352	524
23	Panch Mahals	Kalol	Barola	Openwell	22.58831	73.44071	7.7	1382	92.94	0.36	380	28	134	79	664	468
24	Panch Mahals	Kalol	Bhadroli Khurd	Shallow Tubewell	22.60989	73.40696	7.74	2083	246.7	0.48	668	33	131	96	776	344
25	Panch Mahals	Kalol	Derol	Openwell	22.61127	73.46246	7.66	1342	98.4	0.71	260	34	163	92	792	596

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Panch Mahals	Kalol	Jeli	Shallow Tubewell	22.642	73.458	7.72	1182	81.72	1.02	192	14	83	44	392	772
27	Panch Mahals	Kalol	Kandach (inam	Openwell	22.62384	73.51192	7.48	1068	105.11	0.8	180	27	106	90	640	588
28	Panch Mahals	Kalol	Khadki	Shallow Tubewell	22.63885	73.51063	7.51	2802	101.57	0.63	1120	42	237	86	952	568
29	Panch Mahals	Kalol	Khandeval	Shallow Tubewell	22.63206	73.48454	7.64	1054	113.02	0.42	84	21	109	61	528	768
30	Panch Mahals	Kalol	Navagam	Shallow Tubewell	22.58283	73.63082	7.54	752	113.56	0.52	140	13	54	56	368	388
31	Panch Mahals	Kalol	Nesda	Shallow Tubewell	22.648	73.486	7.7	582	218.5	0.8	28	9	67	29	288	152
32	Panch Mahals	Kalol	Nevariya	Shallow Tubewell	22.56609	73.4957	7.68	814	44.14	0.77	152	16	83	55	436	500
33	Panch Mahals	Kalol	Saliyav	Shallow Tubewell	22.59831	73.58748	7.7	574	6.5	0.82	52	15	102	38	416	448
34	Panch Mahals	Kalol	Vyasada	Openwell	22.633	73.569	7.7	872	90.41	0.55	96	17	99	48	448	596
35	Panch Mahals	Kalol	Zardaka	Openwell	22.62114	73.39158	7.36	846	43.93	1.25	108	17	109	42	448	596
36	Vadodara	Dabhoi	Bhimpura	Shallow Tubewell	21.98261	73.44196	7.7	446	11.29	0.55	52	41	54	35	280	237
37	Vadodara	Dabhoi	Nada	Shallow Tubewell	22.095	73.356	7.35	3046	44.88	0.75	940	395	176	140	1016	500
38	Vadodara	Padra	Brahmanvasi	Shallow Tubewell	22.15084	72.87504	7.76	1056	8.06	0.84	208	46	37	44	208	564
39	Vadodara	Padra	Dhobikuwa	Shallow Tubewell	22.22188	73.00569	7.94	768	1.21	0.9	212	34	45	53	336	360
40	Vadodara	Padra	Goriyad	Openwell	22.19586	73.08733	7.8	390	9.21	0.37	60	18	30	36	228	285
41	Vadodara	Padra	Latipura	Shallow Tubewell	22.22408	73.05846	7.68	968	44	0.69	144	43	80	96	600	520
42	Vadodara	Padra	Pavda	Shallow Tubewell	22.247	72.93	7.52	4860	7.44	0.68	1676	212	102	122	768	1716
43	Vadodara	Padra	Vishrampura	Shallow Tubewell	22.19409	72.96771	7.96	2194	104	1.32	448	118	185	156	1108	816
44	Vadodara	Savli	Adalwada	Shallow Tubewell	22.482	73.181	8.48	582	5.68	1.72	60	11	14	15	100	435
45	Vadodara	Savli	Alindra	Openwell	22.445	73.188	7.71	2062	83.45	0.55	680	151	142	92	736	364
46	Vadodara	Savli	Amarapura	Shallow Tubewell	22.614	73.249	7.68	1008	94.37	0.65	152	63	58	100	556	492
47	Vadodara	Savli	Dhantej	Shallow Tubewell	22.6177	73.36476	7.45	1606	93.56	1.49	408	79	43	127	0	740
48	Vadodara	Savli	Dungrapura	Shallow Tubewell	22.60555	73.31591	7.24	2423	152.38	0.39	0	154	200	142	1084	488
49	Vadodara	Savli	Rasulpur	Shallow Tubewell	22.603	73.234	7.79	740	86.52	0.74	77	51	33	86	436	416
50	Vadodara	Savli	Rupankui	Openwell	22.589	73.223	7.39	886	88.51	0.51	80	65	61	98	556	424

Table 3.7 MOJS-DDWAS Groundwater quality data (2020-Post monsoon)

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Amod	Malkinpura Al	Shallow Tubewell	21.97199	72.95801	7.31	1106	0.88	0.48	332	76	94	86	596	452
2	Bharuch	Amod	Manjola	Shallow Tubewell	22.029	72.963	7.1	624	0.35	0.54	176	20	54	61	388	296
3	Bharuch	Amod	Vasna	Shallow Tubewell	22.033	72.976	7.7	911	18.31	0.33	348	42	56	61	396	232
4	Bharuch	Bharuch	Samlod	Shallow Tubewell	21.82433	73.09674	7.81	2642	27.05	0.42	988	62	88	202	1052	552
5	Bharuch	Jambusar	Amanpor Mota	Openwell	22.13763	72.7587	7.26	1712	0.31	0.77	476	81	50	61	380	396
6	Bharuch	Jambusar	Bojadra	Openwell	22.0566	72.8982	6.98	568	1.24	0.9	88	22	38	43	276	328
7	Bharuch	Jambusar	Kangam	Openwell	22.14704	72.65219	6.94	372	0.1	0.28	96	13	34	42	260	256
8	Bharuch	Jambusar	Karmad	Openwell	22.07157	72.75257	7.16	1326	0.21	0.53	396	62	90	89	596	336
9	Bharuch	Jambusar	Kavi	Openwell	22.19532	72.636	7.41	2034	49.35	0.28	604	67	78	98	604	620
10	Bharuch	Jambusar	Nadiad	Openwell	22.051	72.732	6.93	694	1.65	0.41	92	34	19	26	156	336
11	Bharuch	Jambusar	Nahar	Openwell	22.17079	72.67118	6.93	858	3.84	0.47	228	39	45	53	336	352
12	Bharuch	Jambusar	Rampore	Openwell	22.08234	72.74017	6.88	578	0.14	0.36	128	25	37	38	252	256
13	Bharuch	Jambusar	Runad	Openwell	22.13363	72.63772	7.19	1090	2.14	0.5	248	50	53	58	376	380
14	Bharuch	Jambusar	Shambha	Openwell	22.108	72.666	7.21	1052	1.11	0.51	388	52	58	59	392	296
15	Bharuch	Jambusar	Tankari	Shallow Tubewell	22.05089	72.79476	7.17	946	2.41	0.56	252	22	43	8	92	448
16	Bharuch	Jambusar	Uber	Openwell	22.12594	72.80363	7.1	2772	1.78	0.38	1008	43	101	101	676	808
17	Panch Mahals	Halol	Arad	Shallow Tubewell	22.56389	73.5669	7.63	1506	88.98	0.73	388	33	99	127	776	448
18	Panch Mahals	Halol	Govindpuri	Shallow Tubewell	22.57358	73.63166	7.62	1046	40.82	0.9	240	24	85	91	592	596
19	Panch Mahals	Halol	Madar	Shallow Tubewell	22.57584	73.43443	7.63	1422	103.47	0.57	368	29	70	129	712	524
20	Panch Mahals	Halol	Navaria	Shallow Tubewell	22.579	73.49121	7.42	1092	18.73	1.3	296	7	29	44	256	596
21	Panch Mahals	Halol	Rasulpur	Shallow Tubewell	22.59585	73.23083	7.7	1874	83.25	1.3	672	30	115	97	728	588
22	Panch Mahals	Halol	Sathrota	Shallow Tubewell	22.5657	73.47395	7.5	894	40.22	0.76	148	14	29	77	392	592
23	Panch Mahals	Halol	Tarkhanda	Shallow Tubewell	22.551	73.528	7.66	2734	175.44	0.59	992	45	106	177	1000	420
24	Panch Mahals	Halol	Varasada (govi	Shallow Tubewell	22.56323	73.54115	7.52	544	23.35	0.33	88	12	54	52	352	304
25	Panch Mahals	Kalol	Adadara	Shallow Tubewell	22.64516	73.61621	7.42	1668	235.34	0.53	560	11	77	34	336	556

SR	District	Block	Village	Source	Latitude	Longitude	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
26	Panch Mahals	Kalol	Alva	Openwell	22.59973	73.52379	7.49	1048	43.51	0.78	216	25	51	117	616	632
27	Panch Mahals	Kalol	Bhadroli Khurd	Shallow Tubewell	22.60989	73.40696	7.7	642	35.05	2.19	64	15	51	67	408	468
28	Panch Mahals	Kalol	Bhukhi	Shallow Tubewell	22.62606	73.60734	7.1	682	44.39	1.48	76	8	38	42	272	488
29	Panch Mahals	Kalol	Devpura	Shallow Tubewell	22.61136	73.55737	7.74	3472	246.98	0.34	988	70	560	60	1648	412
30	Panch Mahals	Kalol	Eral	Shallow Tubewell	22.602	73.601	7.7	1534	164.21	0.73	332	32	141	111	816	424
31	Panch Mahals	Kalol	Fansi	Openwell	22.644	73.607	7.14	1744	241.41	0.38	348	36	195	98	920	452
32	Panch Mahals	Kalol	Ghoda	Openwell	22.6073	73.48582	7.62	1434	121.15	0.97	348	30	48	148	736	596
33	Panch Mahals	Kalol	Jeli	Shallow Tubewell	22.642	73.458	7.67	1862	151.15	1.06	536	10	42	48	304	872
34	Panch Mahals	Kalol	Jetpur	Shallow Tubewell	22.59952	73.47815	7.62	1724	153.46	0.87	468	35	146	98	808	692
35	Panch Mahals	Kalol	Kandach (inam	Openwell	22.62384	73.51192	7.48	1318	163.03	0.43	236	32	102	117	744	524
36	Panch Mahals	Kalol	Khandeval	Shallow Tubewell	22.63715	73.48144	7.72	1448	138.53	0.93	300	34	93	132	784	800
37	Panch Mahals	Kalol	Malav	Shallow Tubewell	22.59719	73.55262	7.69	1648	191.86	0.9	332	38	115	146	896	568
38	Panch Mahals	Kalol	Medapur	Shallow Tubewell	22.5855	73.50212	7.7	1904	236.71	0.6	460	32	157	127	920	540
39	Panch Mahals	Kalol	Navagam	Openwell	22.58358	73.63049	7.7	1154	112.15	0.99	264	24	160	47	596	400
40	Panch Mahals	Kalol	Nesda	Shallow Tubewell	22.648	73.486	7.67	2014	232.07	1.02	784	30	74	129	720	628
41	Panch Mahals	Kalol	Saliyav	Shallow Tubewell	22.58362	73.56662	7.62	1252	92.57	0.98	228	32	67	142	760	592
42	Vadodara	Karjan	Karan	Shallow Tubewell	21.90297	73.15903	7.94	1594	0.45	0.41	436	70	100	120	748	344
43	Vadodara	Padra	Brahmanvasi	Shallow Tubewell	22.15103	72.87352	7.91	898	25.99	1.25	116	39	16	19	120	584
44	Vadodara	Padra	Chokari	Shallow Tubewell	22.225	72.929	7.68	1452	44.1	0.66	268	63	128	120	820	512
45	Vadodara	Padra	Goriyad	Shallow Tubewell	22.19586	73.08733	7.88	408	7.09	1.41	84	18	29	35	220	232
46	Vadodara	Padra	Luna	Shallow Tubewell	22.263	73.05	8.2	1384	63.23	1.14	368	61	74	89	560	596
47	Vadodara	Padra	Mahuvad	Shallow Tubewell	22.24	73.007	8.14	2918	59.7	0.44	744	127	182	219	1372	492
48	Vadodara	Padra	Narsipura	Shallow Tubewell	22.229	72.966	7.92	3096	32.35	0.39	1068	136	144	172	1080	436
49	Vadodara	Padra	Vishrampura	Shallow Tubewell	22.19409	72.96771	7.92	1422	72.59	0.69	308	62	56	67	420	704
50	Vadodara	Vadodara	Dena	Shallow Tubewell	22.348	73.212	7.43	798	27.5	0.5	136	69	70	66	448	364

Table 3.8 Location and type of Industries and Sewage Treatment Plants (STP) can be read from ANNEXURE-III

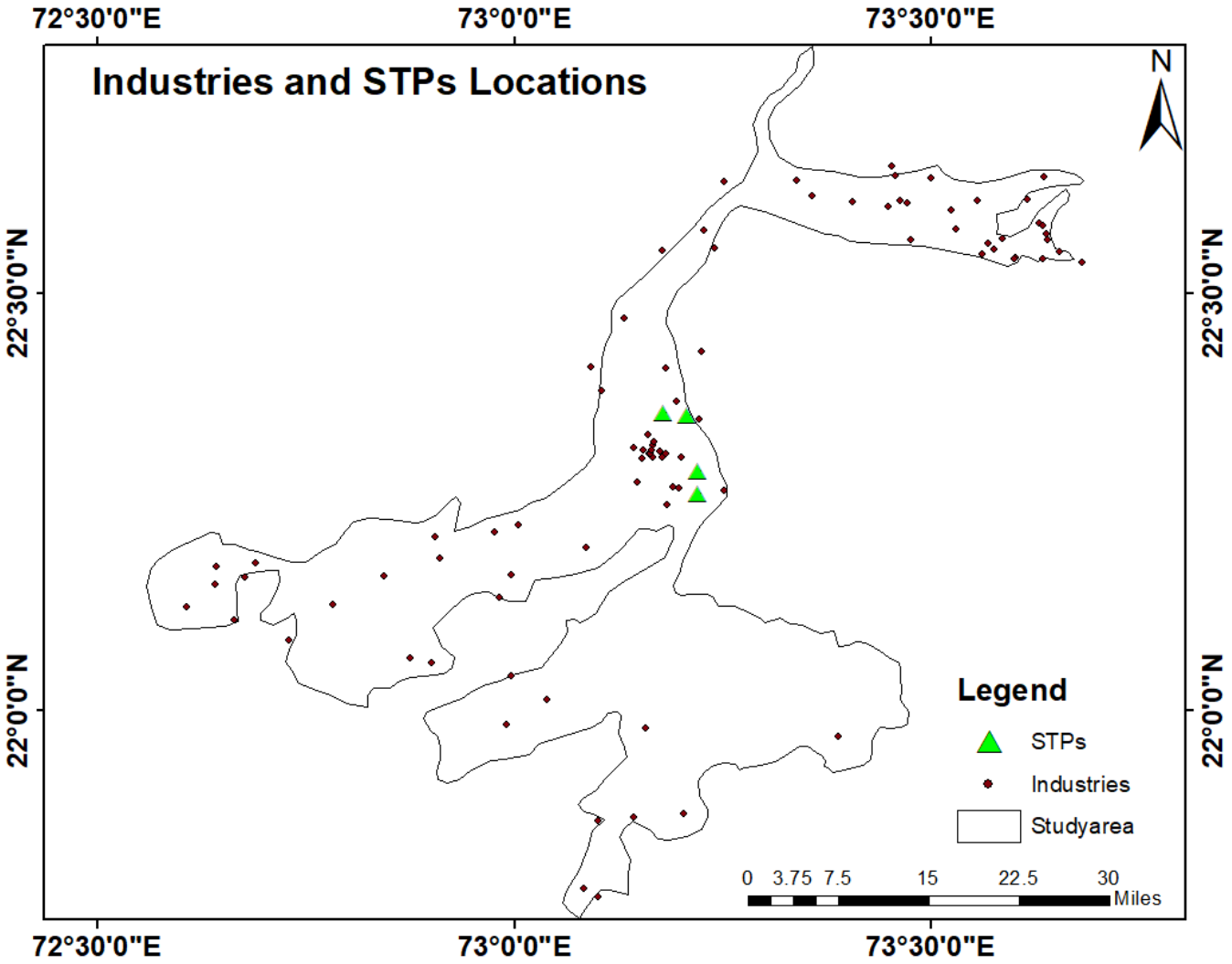


Fig 3.3 Industries and STP Location

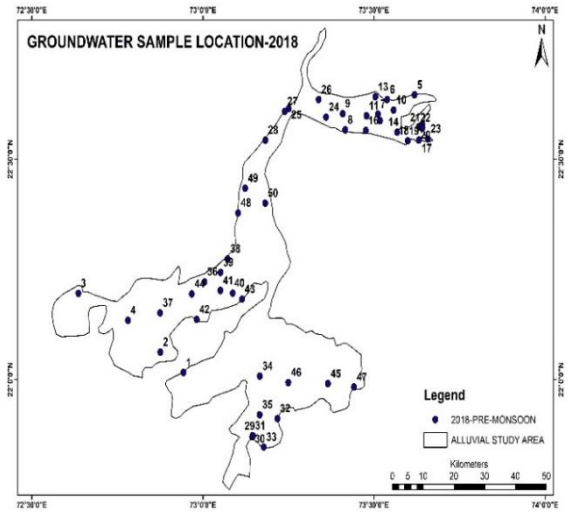


Fig 3.4 2018-Pre Monsoon Samples Location

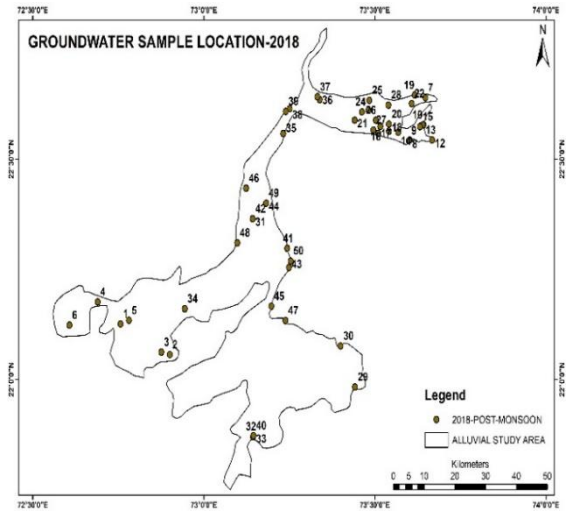


Fig 3.5 2018-Post Monsoon Samples Location

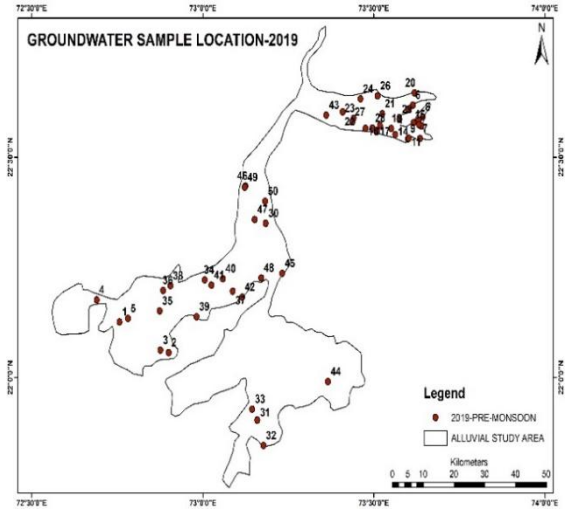


Fig 3.6 2019-Pre Monsoon Samples Location

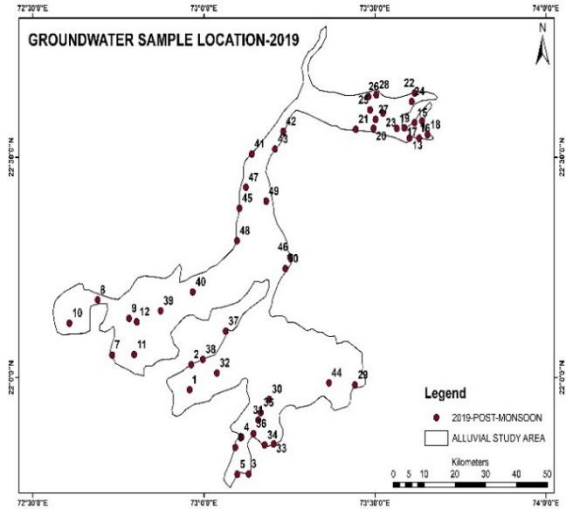


Fig 3.7 2019-Post Monsoon Samples Location

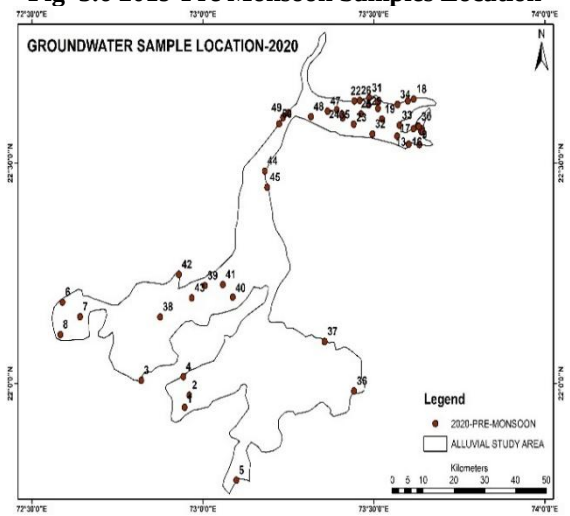


Fig 3.8 2020-Pre Monsoon Samples Location

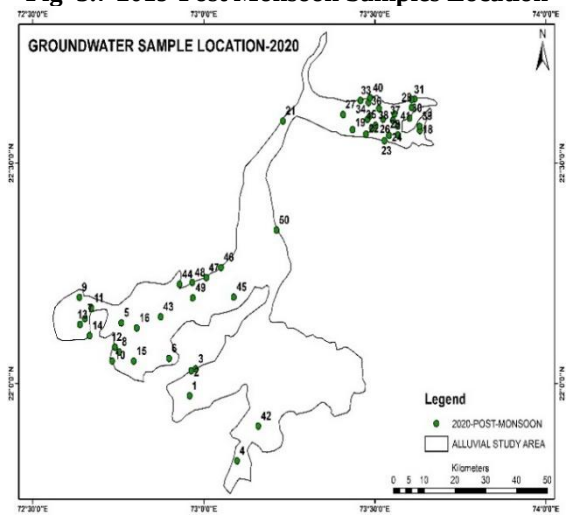


Fig 3.9 2020-Post Monsoon Samples Location

Table 3.9 Study Area Villages and Population can be read from ANNEXURE-IV

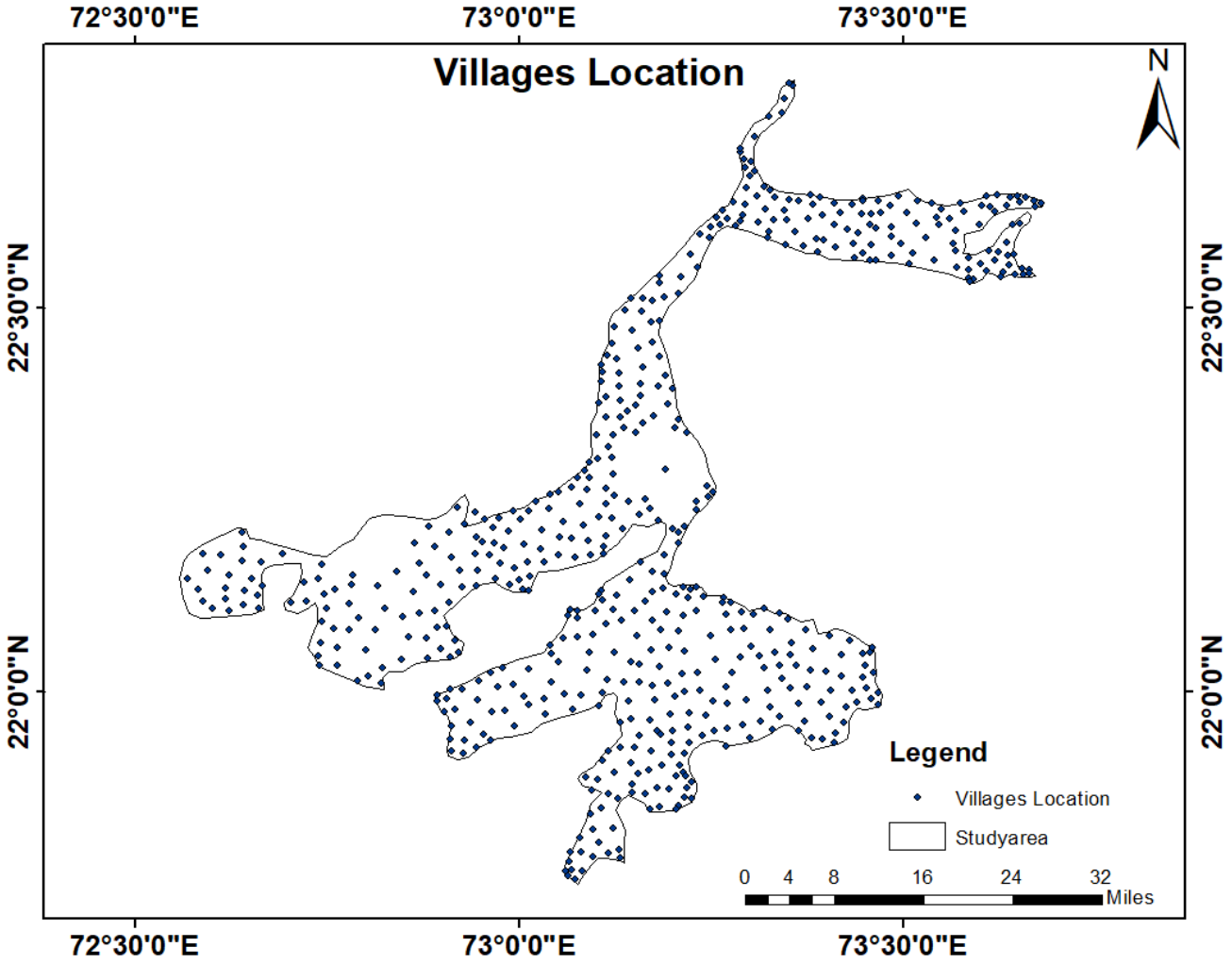


Fig 3.10 Villages Locations

Table 3.8 IWRIS-CGWB Groundwater Depth data (2018 Pre and Post monsoon)

Sr.	District	Station	Latitude	Longitude	May-18 (mbgl)	Oct-18 (mbgl)	May-18 (ft)	Oct-18 (ft)
1	Bharuch	Bhadkodra	22.058300	72.591700	5.50	5.50	18.04	18.04
2	Bharuch	Bharuch	21.700000	73.004200	13.35	4.09	43.79	13.42
3	Bharuch	Bharuch I	21.708300	73.000000	6.92	2.90	22.70	9.51
4	Bharuch	Bharuch Ii	21.708300	73.000000	8.18	8.18	26.83	26.83
5	Bharuch	Chhindra	22.126700	72.669700	9.98	5.87	32.73	19.25
6	Bharuch	Dahegam	22.184700	72.597200	10.71	1.25	35.13	4.10
7	Bharuch	Jambusar	22.052800	72.805600	6.25	6.25	20.50	20.50
8	Bharuch	Jambusar2	22.050000	72.800000	8.20	8.20	26.90	26.90
9	Bharuch	Juna borbhata	21.675000	72.975000	8.50	5.10	27.88	16.73
10	Bharuch	Kalak1	22.018600	72.763100	7.30	6.06	23.94	19.88
11	Bharuch	Kaswa	21.683300	72.816700	8.80	2.30	28.86	7.54
12	Bharuch	Kavi	22.193600	72.639400	7.97	6.05	26.14	19.84
13	Bharuch	Mahegam1	21.683300	72.758300	0.90	0.51	2.95	1.67
14	Bharuch	Navetha	21.707800	72.830600	7.16	0.20	23.48	0.66
15	Bharuch	Roja tankaria	21.916700	72.791700	8.27	6.77	27.13	22.21
16	Bharuch	Sarod	22.158300	72.758300	10.74	7.29	35.23	23.91
17	Bharuch	Sindhav	22.026900	72.636100	7.85	6.10	25.75	20.01
18	Bharuch	Tankari	21.991700	72.675000	5.24	3.66	17.19	12.00
19	Panchmahals	Kalol_UR1	22.600300	73.443300	18.40	9.90	60.35	32.47
20	Panchmahals	Kalol_UR2	22.589700	73.451400	14.04	14.04	46.05	46.05
21	Panchmahals	Khadki_Vadiya	22.662200	73.500300	17.70	11.40	58.06	37.39
22	Panchmahals	Palla Rajgarh Pz	22.522800	73.700800	23.30	8.50	76.42	27.88
23	Panchmahals	Pavagadh	22.487500	73.555600	9.86	3.36	32.34	11.02
24	Panchmahals	Ranipura	22.725000	73.758300	9.43	3.63	30.93	11.91
25	Panchmahals	Shivrajpur	22.425000	73.591700	12.50	9.00	41.00	29.52
26	Panchmahals	Tarkanda	22.545800	73.529200	13.30	0.35	43.62	1.15
27	Panchmahals	Tarvada	22.605600	73.522200	15.20	15.20	49.86	49.86
28	Panchmahals	Timbi2	22.508300	73.508300	3.10	3.10	10.17	10.17
29	Panchmahals	Vejalpur	22.695800	73.558300	8.70	3.10	28.54	10.17
30	Vadodara	Amreshwar	22.227800	73.483300	3.35	3.35	10.99	10.99
31	Vadodara	Chhaliyar	22.666700	73.316700	23.90	23.90	78.39	78.39
32	Vadodara	Chitral PZ_II	22.181900	72.945800	24.96	24.96	81.87	81.87
33	Vadodara	Chitral Pz-I	22.181900	72.945800	24.48	27.63	80.29	90.63
34	Vadodara	Ghayaj ii	22.233300	73.054200	21.30	19.48	69.86	63.89
35	Vadodara	Handod1	22.073600	73.045800	29.80	29.80	97.74	97.74
36	Vadodara	Handod2	22.073600	73.045800	28.07	28.07	92.07	92.07
37	Vadodara	Juna samalya	22.504200	73.283300	16.65	2.65	54.61	8.69
38	Vadodara	Masor	22.141700	72.908300	12.95	12.95	42.48	42.48
39	Vadodara	Rasulpur	22.600000	73.233300	5.00	5.00	16.40	16.40
40	Vadodara	Raypura i	22.281900	73.090300	17.40	17.40	57.07	57.07
41	Vadodara	Sankarda	22.438900	73.122200	32.04	33.88	105.09	111.13
42	Vadodara	Sankarda1	22.438900	73.122200	29.16	29.16	95.64	95.64
43	Vadodara	Sankheda	22.538900	73.175000	32.17	32.17	105.52	105.52
44	Vadodara	Segwa chouki ii	22.008300	73.383300	37.70	37.70	123.66	123.66
45	Vadodara	Segwa chowki I	22.008300	73.383300	29.05	28.76	95.28	94.33
46	Vadodara	Sinor	21.912500	73.341700	26.05	26.05	85.44	85.44
47	Vadodara	Tundav	22.483300	73.202800	10.90	8.70	35.75	28.54
48	Vadodara	Vadodara I	22.304700	73.271700	13.74	19.89	45.07	65.24
49	Vadodara	Vadodara Ii	22.304700	73.271700	7.50	13.76	24.60	45.13
50	Vadodara	Kevada Bag	22.293300	73.198300	8.98	8.98	29.45	29.45
51	Vadodara	Vadodara_ONGC	22.269200	73.212800	16.14	16.14	52.94	52.94
52	Vadodara	Vadodara_Sama	22.342500	73.200600	3.57	0.60	11.71	1.97
53	Vadodara	Vadshala Pzi	22.163100	73.169400	23.90	28.30	78.39	92.82
54	Vadodara	Vega	22.159400	73.412500	7.28	7.28	23.88	23.88

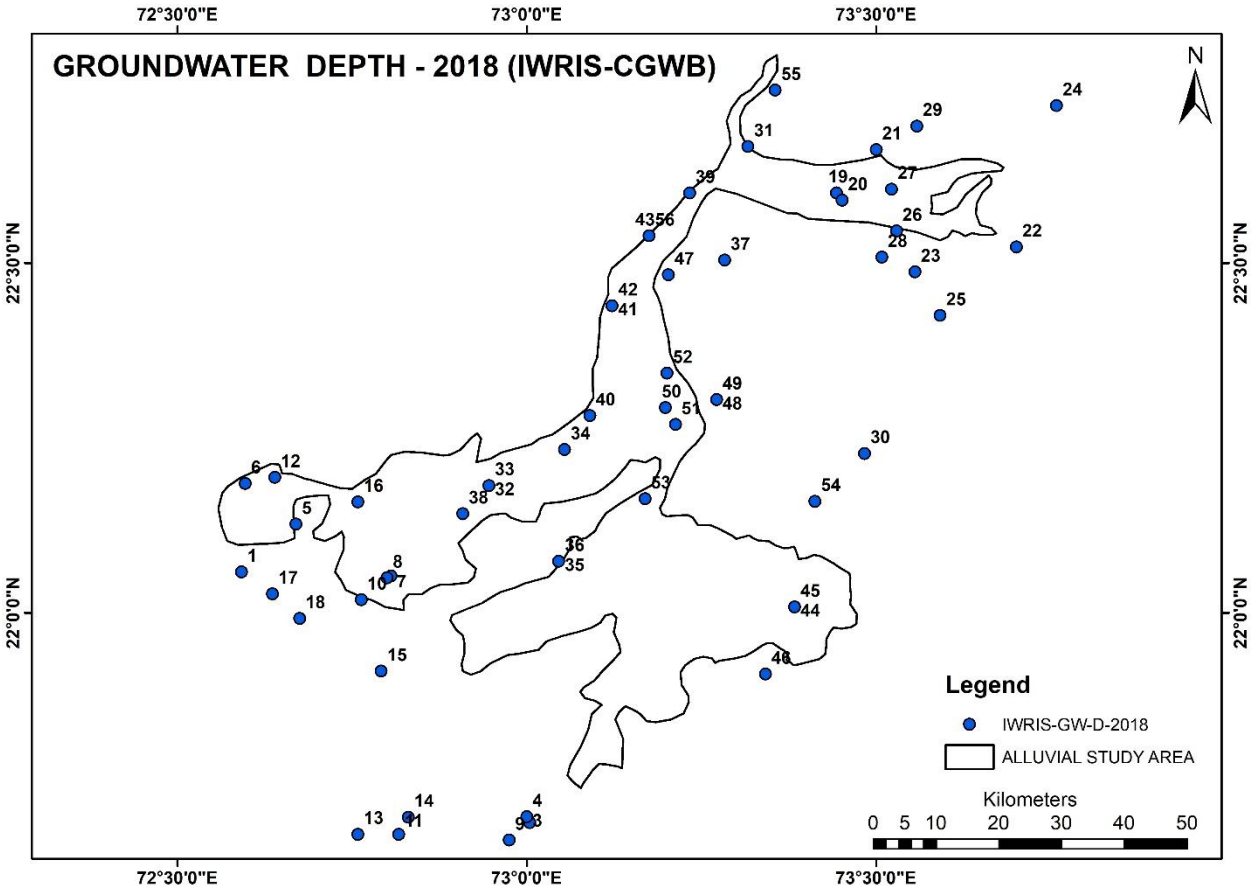


Fig 3.11 Groundwater Depth data for 2018 Pre and Post monsoon (Source: IWRIS-CGWB)

Table 3.9 Annual Rainfall from SWDC (2006-2015)

Sr.	Station	District	Block	Latitude	Longitude	Avg. Annual Rainfall (mm)	Avg. Annual Rainfall (Inch)
1	Rajpardi	Bharuch	Jhaghadia	21.763611	73.228056	959.27	37.77
2	Muler	Bharuch	Vaghra	21.874722	72.697778	1292.17	50.87
3	Veganpur	Panchmahal	Ghodra	22.779167	73.550000	778.60	30.65
4	Shivrajpur	Panchmahal	Halol	22.428889	73.596111	866.90	34.13
5	Sansoli	Panchmahal	Kalol	22.701667	73.420278	677.34	26.67
6	Rampura	Vadodara	Dabhoi	22.097222	73.550278	1013.53	39.90
7	Karvan	Vadodara	Karjan	22.081389	73.218333	571.68	22.51
8	Pilol	Vadodara	Savli	22.410833	73.223056	854.75	33.65
9	Savli	Vadodara	Savli	22.548889	73.220556	855.29	33.67
10	Sinor	Vadodara	Sinor	21.901944	73.331389	715.13	28.15

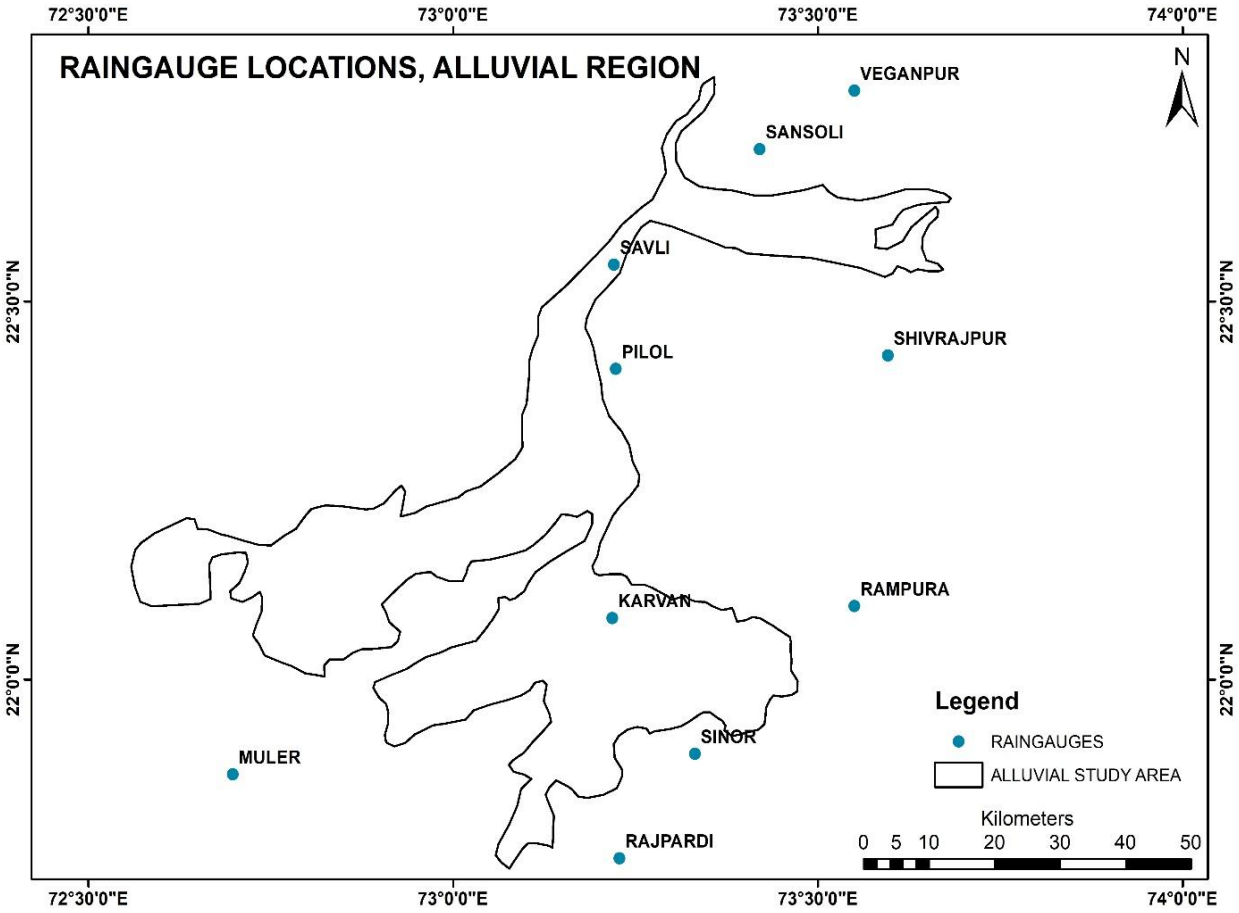


Fig 3.12 Alluvial Rain Gauges (Source: SWDC)

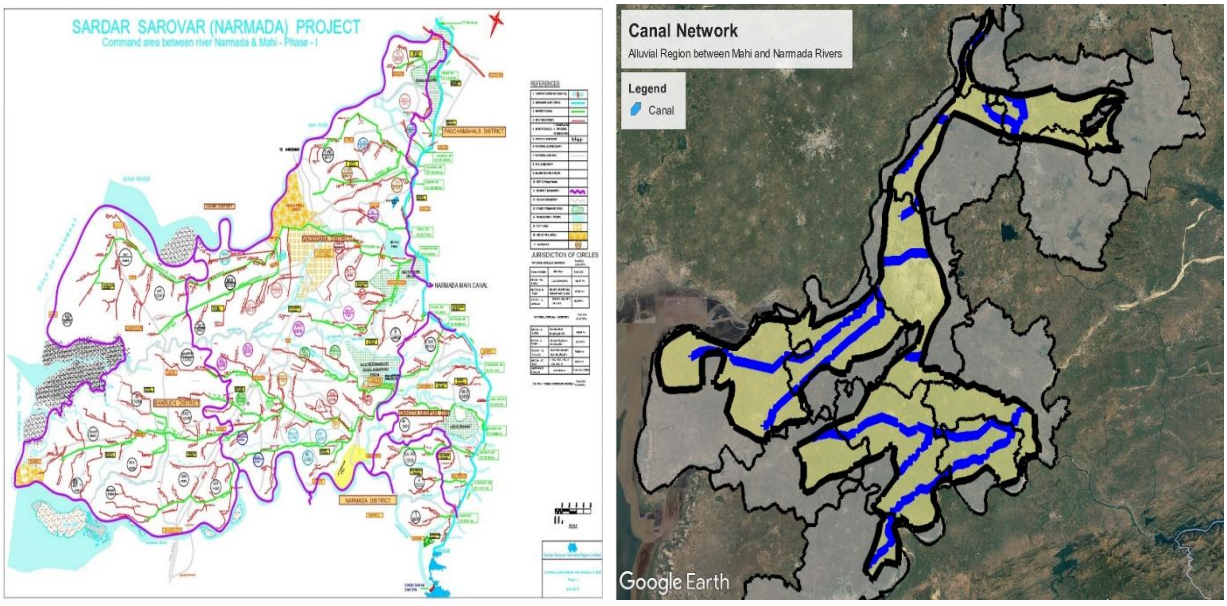


Fig 3.13 Canal network Details between Mahi and Narmada rivers (Source: SWDC)

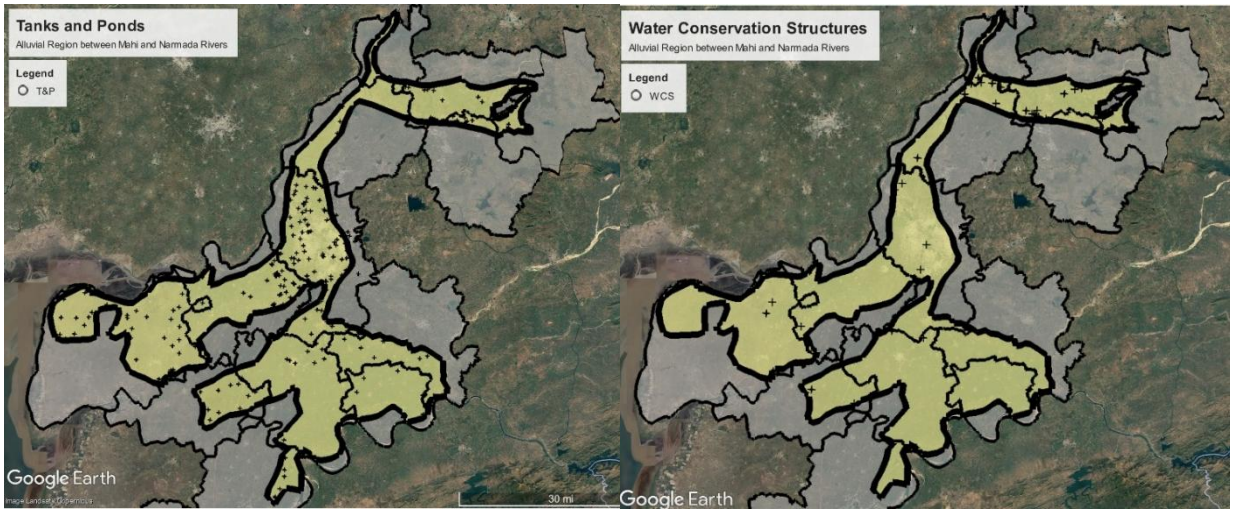


Fig 3.14 Tanks, Ponds and WCS in alluvial region

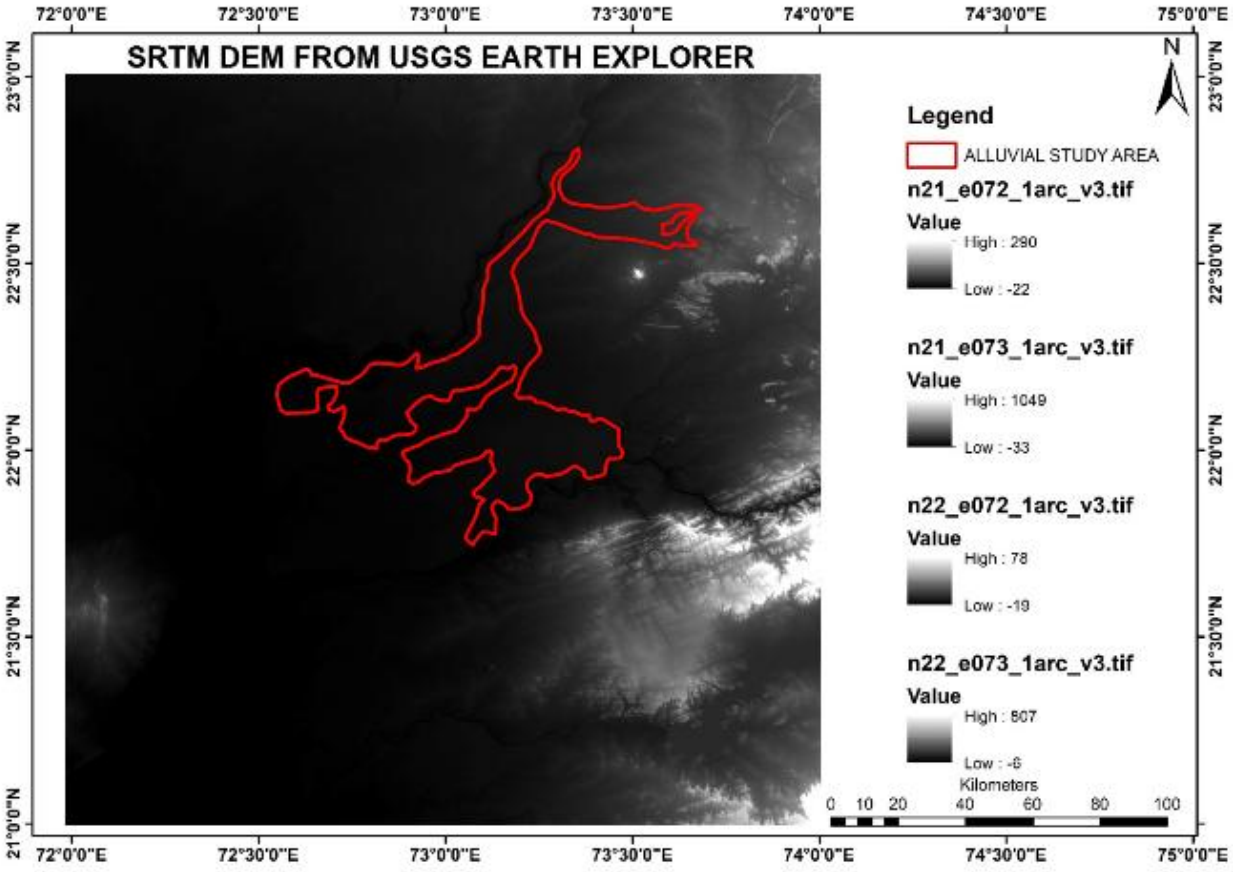


Fig 3.15 SRTM-Digital Elevation Model tiles for alluvial region (Source: USGS-EE)

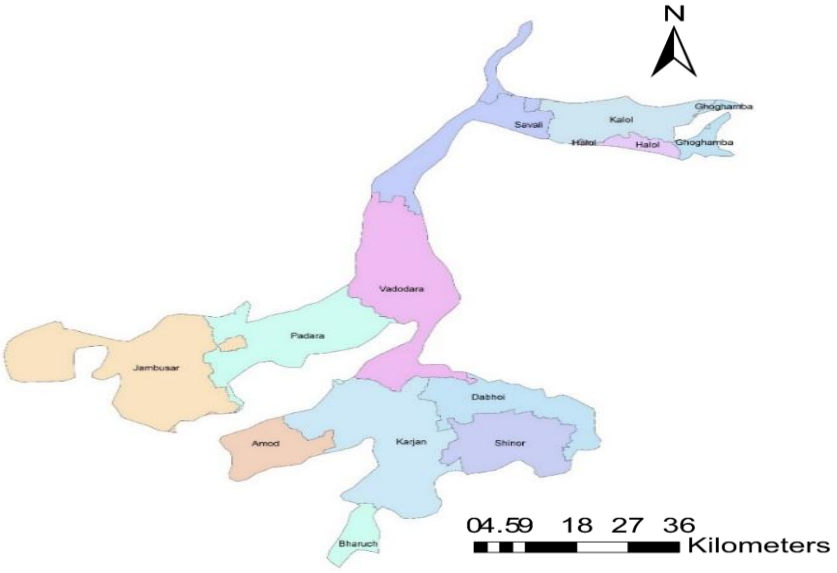
Table 3.10 Reference Block wise Ground Water Recharge and Extraction (CGWB, 2017)

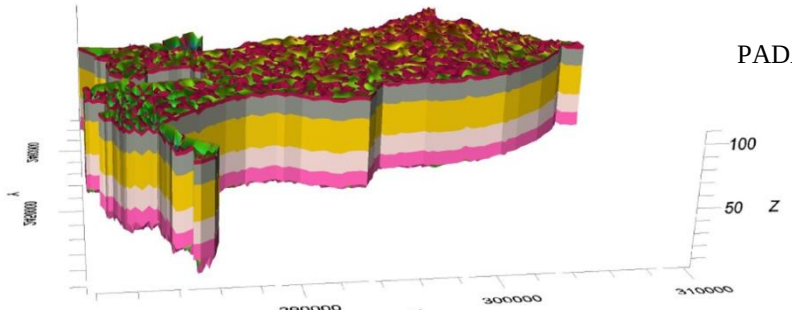
Sr.	District	Block	Ground Water Recharge (Ham)				Annual GW Recharge (Ham)	Total Natural Discharges (Ham)	Annual Extractable Recharge (Ham)	Annual Ground Water Extraction (Ham)			
			Monsoon Season		Non-monsoon season					Irrigation Use	Industrial Use	Domestic Use	Total Extraction
			Rainfall	Other Sources	Rainfall	Other Sources							
1	Bharuch	Amod	4687.21	257.03	0.00	1159.06	6103.30	305.17	5798.14	2941.00	22.99	130.26	3094.25
2	Bharuch	Bharuch	6343.75	382.78	0.00	1281.22	8007.75	400.39	7607.36	2761.50	83.00	471.00	3315.50
3	Bharuch	Jambusar	795.82	61.42	0.00	1368.13	2225.37	111.27	2114.11	166.30	5.00	27.30	198.60
Bharuch			**11826.78**	**701.23**	**0.00**	**3808.41**	**16336.43**	**816.82**	**15519.61**	**5868.80**	**110.99**	**628.56**	**6608.35**
4	Panchmahal	Ghoghamba	2802.61	2176.74	0.00	1059.64	6038.99	301.95	5737.04	2132.40	55.00	310.00	2497.40
5	Panchmahal	Halol	5282.88	994.29	0.00	1087.82	7364.98	368.25	6996.73	2428.20	60.00	338.00	2826.20
6	Panchmahal	Kalol	3005.70	1091.81	0.00	1620.22	5717.73	285.89	5431.84	1961.00	54.00	307.00	2322.00
Panchmahal			**11091.19**	**4262.84**	**0.00**	**3767.68**	**19121.70**	**956.08**	**18165.61**	**6521.60**	**169.00**	**955.00**	**7645.60**
7	Vadodara	Dabhoi	12022.39	1953.30	0.00	4758.62	18734.32	936.72	17797.60	11103.00	44.46	251.92	11399.38
8	Vadodara	Karjan	12154.22	757.83	0.00	1821.23	14733.27	736.66	13996.61	8750.50	41.27	233.87	9025.64
9	Vadodara	Padra	13499.72	1339.32	0.00	1386.28	16225.32	811.27	15414.05	8434.00	65.49	371.08	8870.57
10	Vadodara	Savli	3555.21	2571.97	0.00	3943.22	10070.40	503.52	9566.88	4876.50	62.80	355.88	5295.18
11	Vadodara	Sinor	7854.97	1148.09	0.00	815.07	9818.13	490.91	9327.22	5386.00	16.12	91.33	5493.44
12	Vadodara	Vadodara	13640.53	1462.79	0.00	1250.74	16354.06	817.70	15536.36	10582.00	233.00	1321.00	12136.00
Vadodara			**62727.04**	**9233.30**	**0.00**	**13975.16**	**85935.50**	**4296.77**	**81638.72**	**49132.00**	**463.13**	**2625.08**	**52220.21**

Table 3.11 Lithologs in Alluvial region (Source: GWRDC)

Sr.	District	Taluka	Village	Latitude	Longitude	Depth To	Lithology	Colour	Texture
1	Bharuch	Amod	Amod	21.996344	72.870430	3.05	Topsoil	Brown	Fine
2	Bharuch	Amod	Ikhar-I	21.956460	73.032936	1.52	Topsoil	Black	Fine to Medium
3	Bharuch	Amod	Ikhar-II	21.954446	73.038575	3.04	Topsoil	Black	Fine
4	Bharuch	Amod	Ikhar-III	21.957147	73.039037	1.52	Topsoil	Black	Medium
5	Bharuch	Amod	Matar	22.007076	72.992799	3.05	Topsoil	Black	Fine Grained
6	Bharuch	Amod	Valipor	21.945918	72.751204	3.04	Topsoil	Yellow	Fine
7	Bharuch	Amod	Vantasara	21.899095	72.986182	3.1	Topsoil	Black	Hard
8	Bharuch	Bharuch	Sankhwad	21.726228	72.814254	2.5	Topsoil	Brown	Fine
9	Bharuch	Bharuch	Tralsa	21.803394	72.962800	3.05	Topsoil	Black	Fine Grained
10	Bharuch	Bharuch	Varediya	21.867866	73.056608	3.04	Topsoil	Brown	Fine
11	Bharuch	Jambusar	Bhadkodra	21.606567	73.008010	2.44	Topsoil	Black	Fine
12	Bharuch	Jambusar	Bhankhetar	22.067334	72.806975	3.05	Topsoil	Yellow	Fine
13	Bharuch	Jambusar	Khanpur Deh	21.986811	72.774641	3.05	Topsoil	Black	Fine
14	Bharuch	Jambusar	Piludara	22.172683	72.885747	3.05	Topsoil	Yellow	Fine
15	Bharuch	Jambusar	Sarod	22.170418	72.748182	2.4	Topsoil	Brown	Fine
16	Bharuch	Jambusar	Sigam	22.144406	72.585105	1.52	Topsoil	Brown	Fine
17	Bharuch	Jambusar	Tankari	21.990555	72.668156	2.1	Topsoil	Brown	Fine
18	Bharuch	Jambusar	Tundej	22.105258	72.723080	3.05	Topsoil	Black	Fine
19	Bharuch	Jambusar	Uber	22.128160	72.803250	3.05	Topsoil	Yellow	Fine
20	Panchmahals	Ghoghamba	Kantu	22.615772	73.800005	0.5	Topsoil	Dull Brown	Fine
21	Panchmahals	Ghoghamba	Kothayadi	22.655238	73.644259	2	Topsoil	Dull Brown	Fine
22	Panchmahals	Ghoghamba	Richhvani	22.699232	73.779261	1	Topsoil	Dull Brown	Fine
23	Panchmahals	Ghoghamba	Simaliya	22.638179	73.510873	0.76	Topsoil	Yellowish Grey	Fine
24	Panchmahals	Ghoghamba	Undava	22.565550	73.748019	0.5	Topsoil	Dull Brown	Fine
25	Panchmahals	Ghoghamba	Vanskot	22.569887	73.648663	1.52	Topsoil	Yellowish Brown	Fine
26	Panchmahals	Halol	Arad	22.564902	73.564034	2.5	Topsoil	Brown	Fine
27	Panchmahals	Halol	Baliadev	22.380642	73.515332	1.5	Topsoil	Black	Fine
28	Panchmahals	Halol	Jambudi	22.481900	73.486950	1.82	Topsoil	Brown	Fine
29	Panchmahals	Halol	Shivrajpur	22.421484	73.609381	1.5	Topsoil	Dull Brown	Fine
30	Panchmahals	Halol	Sultanpur	22.497491	73.492687	1.5	Topsoil	Black	Fine
31	Panchmahals	Kalol	Bedhiya	22.658232	73.523256	2	Topsoil	Grey	Fine
32	Panchmahals	Kalol	Bhadroli khurd	22.700956	73.499998	1.5	Topsoil	Black	Fine
33	Panchmahals	Kalol	Bhukhi	22.625839	73.609858	1.5	Topsoil	Grey	Fine
34	Panchmahals	Kalol	Kalol	22.608713	73.458830	4.57	Alluvium	Brown	Fine
35	Panchmahals	Kalol	Kanod	22.702692	73.468501	1	Topsoil	Black	Fine
36	Panchmahals	Kalol	Vejalpur	22.697015	73.564659	1.2	Topsoil	Grey	Fine
37	Panchmahals	Kalol	Zaradaka	22.624284	73.386485	2	Topsoil	Yellow	Fine
38	Vadodara	Dabhoi	Chanwada	22.056505	73.462456	1.52	Topsoil	Brown	Fine
39	Vadodara	Dabhoi	Chhatral	22.114458	73.295661	3.05	Topsoil	Greyish Black	Fine
40	Vadodara	Dabhoi	Dabhoi	22.135786	73.422004	3	Topsoil	Brown	Fine

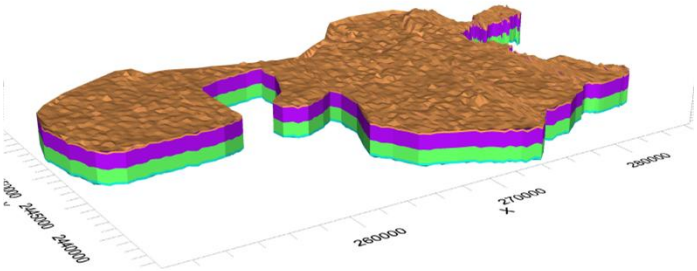
Sr.	District	Taluka	Village	Latitude	Longitude	Depth To	Lithology	Colour	Texture
41	Vadodara	Dabhoi	Dharampuri	22.100657	73.442679	3.05	Topsoil	Greyish Black	Fine
42	Vadodara	Dabhoi	Lunadra	22.203647	73.494754	3.05	Topsoil	Brown	Fine Grained
43	Vadodara	Dabhoi	Palaswada	22.209016	73.294689	1.52	Topsoil	Brown	Fine
44	Vadodara	Dabhoi	Sathod	22.088554	73.382442	3.05	Topsoil	Greyish Black	Fine
45	Vadodara	Desar	Jesar	22.711406	73.373364	3.04	Topsoil	Yellow	Fine
46	Vadodara	Desar	Tulsigam	22.788208	73.393701	2.05	Topsoil	Grey	Fine
47	Vadodara	Karjan	Bamangam	22.103152	73.191872	3.28	Topsoil	Black	Medium
48	Vadodara	Karjan	Chorbhuj	22.061900	72.998999	3.05	Topsoil	Black	Fine Grained
49	Vadodara	Karjan	Karjan	22.049157	73.123946	3.05	Topsoil	Black	Fine
50	Vadodara	Karjan	Sayar	21.860963	73.228233	3.05	Topsoil	Black	Fine
51	Vadodara	Karjan	Urad	21.941563	73.150289	3.05	Topsoil	Black	Fine
52	Vadodara	Padra	Chansad	22.209037	73.131915	3.05	Topsoil	Grey	Fine
53	Vadodara	Padra	Mahuvad-I	22.241406	73.005583	1.52	Topsoil	Brown	Fine
54	Vadodara	Padra	Masar Road	22.108689	72.887406	3.05	Topsoil	Grey	Fine
55	Vadodara	Padra	Sarswani	22.173074	73.094011	3.05	Topsoil	Brown	Fine Grained
56	Vadodara	Savli	Bhadarva	22.510054	73.120122	8	Topsoil	Brown	Fine
57	Vadodara	Savli	Manjusar	22.445154	73.199729	3.05	Topsoil	Grey	Fine
58	Vadodara	Savli	Mundhela	22.503677	73.396497	1	Topsoil	Brown	Fine
59	Vadodara	Savli	Savli	22.562959	73.223519	3.05	Topsoil	Grey	Fine
60	Vadodara	Savli	Tundav	22.481479	73.197718	3.05	Topsoil	Grey	Fine
61	Vadodara	Sinor	Chhanbhoi	22.015681	73.339409	3.05	Topsoil	Black	Fine
62	Vadodara	Sinor	Mota Fofaliya	21.955729	73.371916	3.05	Topsoil	Yellow Sticky	Fine Grained
63	Vadodara	Sinor	Sinor	21.914016	73.338916	3.05	Topsoil	Grey	Fine
64	Vadodara	Sinor	Surasamal	21.932414	73.291926	3.05	Topsoil	Black	Fine
65	Vadodara	Vadodara	Anagadh	22.389406	73.079389	3.05	Topsoil	Brown	Fine
66	Vadodara	Vadodara	Ankodiya	22.338205	73.115163	3	Topsoil	Brown	Fine
67	Vadodara	Vadodara	Bajwa	22.341952	73.152410	3.04	Topsoil	Brown	Fine
68	Vadodara	Vadodara	Bapod	22.304914	73.236912	3.05	Topsoil	Grey	Fine
69	Vadodara	Vadodara	Bhayli	22.284668	73.125904	3.05	Topsoil	Brown	Fine
70	Vadodara	Vadodara	Dashrath	22.385543	73.155502	3.05	Topsoil	Grey	Fine
71	Vadodara	Vadodara	Kalali	22.255715	73.171924	3.5	Topsoil	Brown	Fine
72	Vadodara	Vadodara	Nandesari	22.414129	73.095178	3.05	Topsoil	Brown	Fine
73	Vadodara	Vadodara	Ranoli	22.400158	73.124535	3.5	Topsoil	Brown	Fine
74	Vadodara	Vadodara	Shankarpura	22.279172	73.265871	1.52	Topsoil	Black	Fine to Medium
75	Vadodara	Vadodara	Sokhda	22.422503	73.166103	3.05	Topsoil	Grey	Fine
76	Vadodara	Vadodara	Virod	22.389640	73.221952	3.05	Topsoil	Brown	Fine





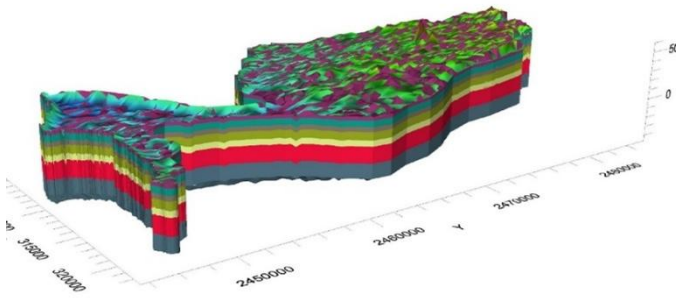
PADARA

Colour	Lithology	Depth To
	Topsoil	3.05
	Clay	18
	Sand	45
	Clay	62
	Sand	74



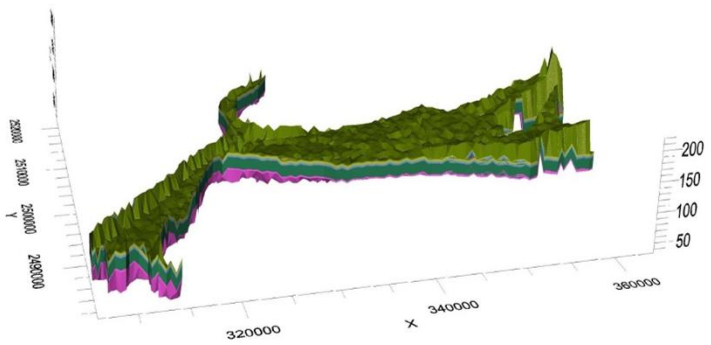
JAMBUSAR

Colour	Lithology	Depth To
	Topsoil	3.05
	Clay	28.96
	Sand	50.3
	Clay	53.35



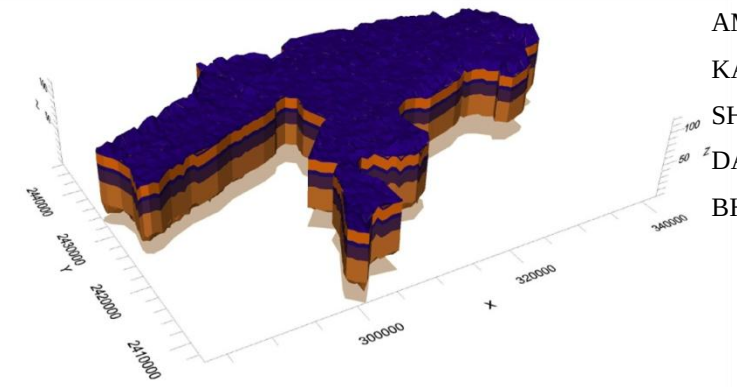
VADODARA

Colour	Lithology	Depth To
	Topsoil	3.5
	Clay	10
	Sand	14.8
	Sand	23
	Clay	29
	Clay	45.8
	Sand	61.2



SAVALI,
KALOL,
HALOL,
GHOGHAMBA

Colour	Lithology	Depth To
	Topsoil	1.82
	Basalt Highly Weathered	6.1
	Basalt Weathered	9.14
	Basalt Fractured	27.43
	Basalt Hard	30



AMOD,
KARJAN,
SHINOR,
DABHOI,
BHARUCH

Colour	Lithology	Depth To
	Topsoil	3.05
	Clay	18.29
	Kankar	24.39
	Sand	42.68
	Sand	74.7

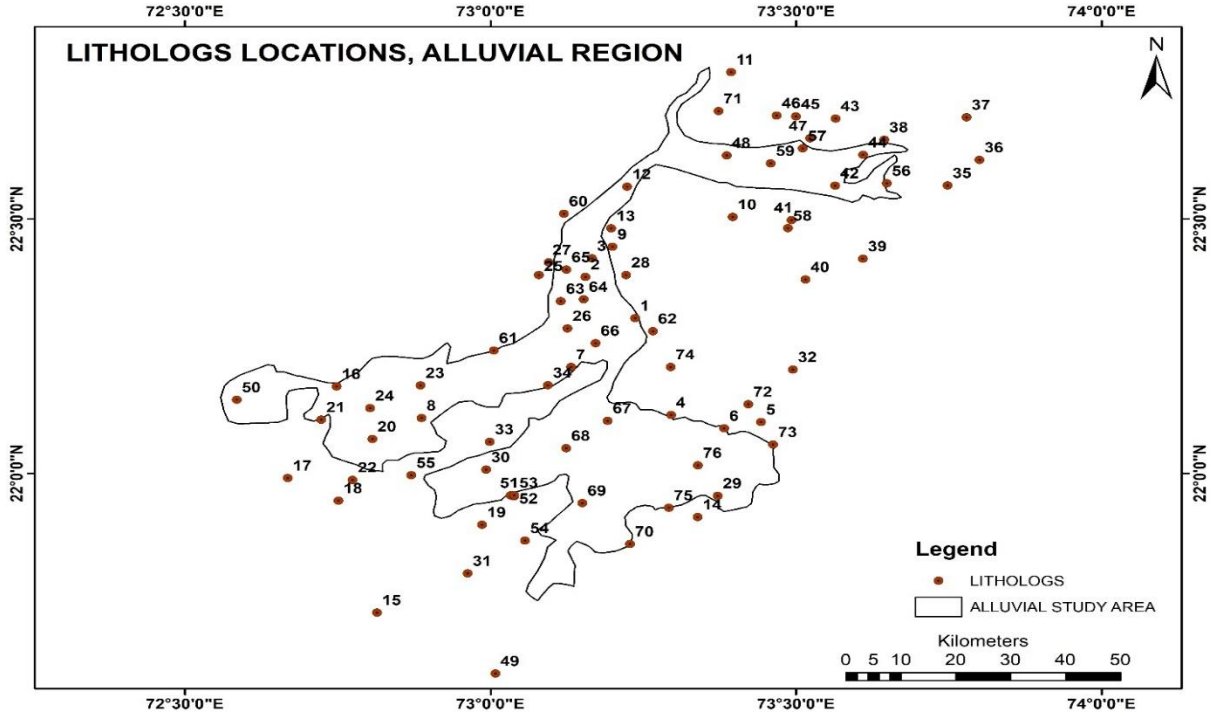


Fig 3.16 Visual representations of lithologs and Lithologs locations in alluvial region (Source: GWRDC)

Table 3.12 LULC Map of alluvial region from Sentinel (10m)

Sr.	Class	Description	Examples
1	Water bodies	Location present with mostly water at surface	Rivers, ponds, lakes, Sea
2	Vegetation	Zone of vegetation intermixed with water	Flooded mangroves
3	Agriculture Land	Artificially planted crops, grass and trees	Cotton, maize, wheat, sugarcane
4	Built-up Area	Man-made residential, commercial and industrial structures; major road and rail networks	Office buildings, malls, houses, urban and sub-urban settlements
5	Barren Land	Ground surface containing rock, soil mixed with very less vegetation, large deserted lands	Exposed rock or soil, desert and sand dunes, dried lake beds

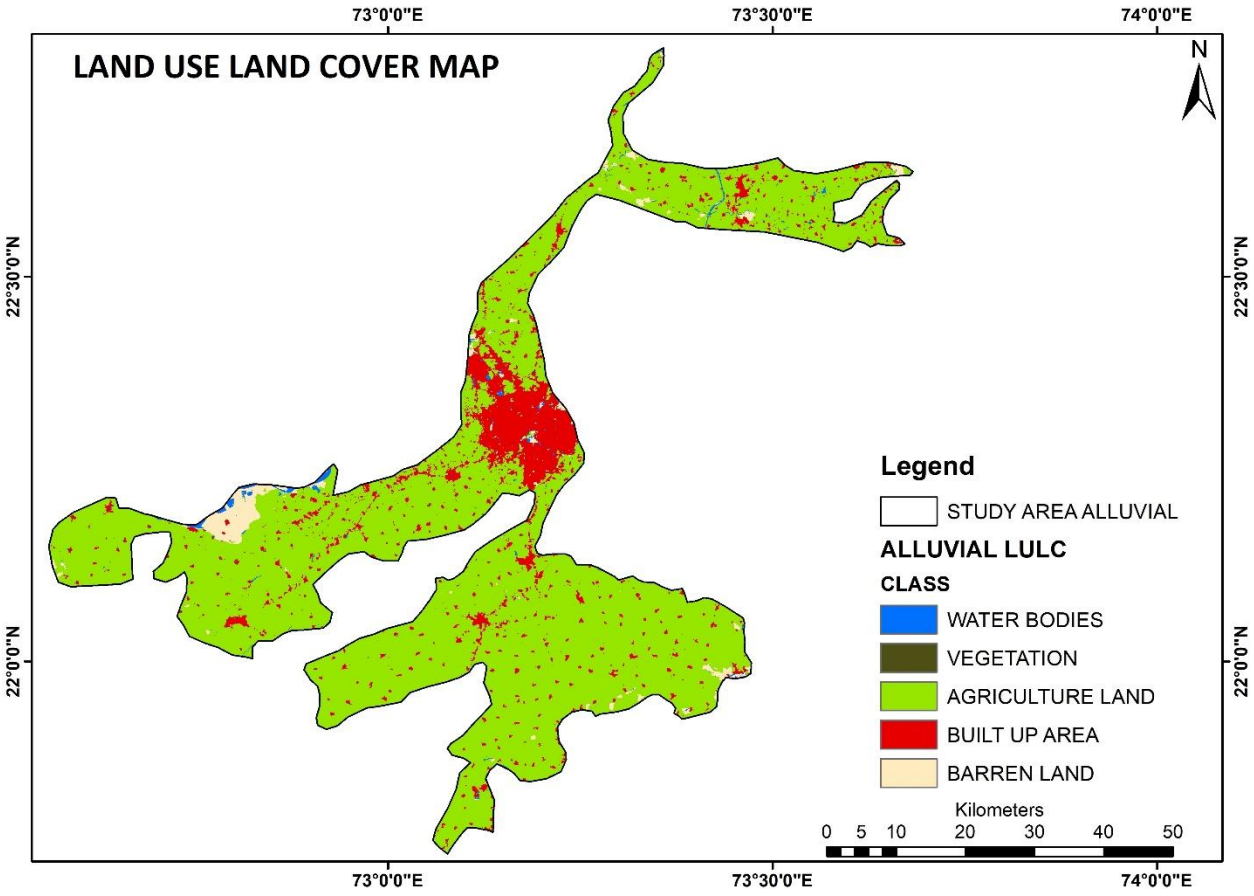


Fig 3.17 LULC Map of alluvial region from Sentinel 2018 (10m)

Selection of Water Quality Parameters:

The criteria for selection of water quality parameters such as pH, TDS, NO_3^-, F^-, Cl^-, SO_4^{2-}, Ca^{2+}, Mg^{2+}, TH, and ALK for groundwater quality assessment is driven by their significance in understanding the overall health of the groundwater system and its potential impacts. These parameter data is collected as given in following table 3.13.

- These parameters are crucial for public health, as excessive concentrations of Nitrate and fluoride can lead to serious health issues, while pH and TDS are general indicators of water quality, affecting taste, corrosivity, and chemical stability.
- Geochemical characteristics, like Ca^{2+}, Mg^{2+}, TH and ALK levels, help to determine water hardness and its interaction with domestic uses.
- Additionally, parameters like NO_3^-, F^-, Cl^- and SO_4^{2-}, are important for evaluating environmental impacts and agricultural suitability, as they can influence soil salinity and plant health.

Finally, these parameters align with regulatory standards to ensure water safety and compliance with national and international guidelines.

Table 3.13 Primary Data Collection (2021-Pre-Monsoon)

Sr.	District	Taluka	Village	Latitude	Longitude	Type of well	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
1	Bharuch	Amod	Sarbhan	21.990944	72.946917	Hand pump	7.01	5645	260	0.47	2084	174	330	302	2084	792
2	Bharuch	Amod	Suthodara	21.988917	73.005528	Hand pump	7.28	1379	109	0.98	256	5	136	98	880	376
3	Bharuch	Jambusar	Hamdpor	22.159389	72.633333	Open well	8.32	3102	148	0.72	1204	139	36	178	832	748
4	Bharuch	Jambusar	Kavi	22.199250	72.638389	Open well	7.41	2034	49	0.28	604	67	78	98	604	620
5	Bharuch	Jambusar	Limaj	22.057306	72.758278	Open well	7.01	998	64	0.41	352	31	102	99	668	392
6	Bharuch	Jambusar	Nahar	22.174972	72.689528	Open well	7.38	634	68	1.04	124	47	70.4	70	464	460
7	Bharuch	Jambusar	Sarod	22.168417	72.741583	Open well	7.12	2876	107	0.34	1152	109	122	115	788	768
8	Bharuch	Jambusar	Vedach	22.137556	72.844028	Hand pump	7.48	7000	151	4.19	3159	328	56	223	1060	1460
9	Panchmahal	Ghoghamba	Raveri	22.610694	73.635000	Open well	7.72	1044	1	2.02	232	93	61	53	372	576
10	Panchmahal	Halol	Dharampuri	22.517250	73.512917	Open well	7.84	4022	244	1.46	1408	72	514	308	1568	524
11	Panchmahal	Halol	Muladhari	22.555528	73.551917	Open well	7.68	1342	44	0.59	440	24	118	70	588	332
12	Panchmahal	Kalol	Delol	22.623694	73.495167	Open well	7.55	972	41	0.89	204	20	29	99	504	580
13	Panchmahal	Kalol	Derol	22.630278	73.446944	Open well	7.66	1342	98	0.71	260	34	163	92	792	596
14	Panchmahal	Kalol	Kalol city	22.607972	73.453333	Open well	7.92	942	44	0.8	168	24	119	72	596	432
15	Panchmahal	Kalol	Madhvas	22.569694	73.449083	Open well	7.67	1956	170	0.58	460	46	128	169	1024	508
16	Vadodara	Dabhoi	Mandala	22.088583	73.332861	Tube well	7.86	920	28	0.29	216	56	19	71	343	432
17	Vadodara	Dabhoi	Mota habipura	22.099167	73.362556	Tube well	7.97	1408	4	1.61	272	63	24	64	328	856
18	Vadodara	Dabhoi	Parikha	22.084556	73.290139	Tube well	7.71	992	114	0.2	176	44	19	60	296	504
19	Vadodara	Karjan	Bamangam	22.101389	73.191556	Tube well	7.88	1388	24	0.29	396	60	91	88	596	480
20	Vadodara	Karjan	Manglage	22.090833	73.171861	Open well	7.88	2076	120	0.38	604	82	126	119	812	376
21	Vadodara	Padra	Chansad-1	22.208611	73.131111	Open well	7.94	1902	8	1.81	700	90	51	42	304	600

Sr.	District	Taluka	Village	Latitude	Longitude	Type of well	pH	TDS	NO_3	F	Cl	SO_4	Ca	Mg	TH	ALK
22	Vadodara	Padra	Chansad-2	22.207778	73.131639	Open well	8.04	1198	12	2.4	228	14	18	20	132	732
23	Vadodara	Padra	Darapura	22.224056	73.105639	Tube well	7.86	1420	100	0.61	300	64	97	117	732	468
24	Vadodara	Padra	Kanzat	22.110361	72.893417	Open well	8.42	2484	43	1.46	904	50	80	11	536	832
25	Vadodara	Padra	Patod	22.219250	73.119667	Hand pump	7.71	502	27	0.48	80	22	40	48	300	300
26	Vadodara	Padra	Sareja	22.208222	73.113250	Open well	7.72	600	80	0.61	232	50	96	86	600	416
27	Vadodara	Savli	Mevli	22.622528	73.314389	Open well	7.43	2252	300	0.66	400	181	139	173	1060	524
28	Vadodara	Savli	Prathampura	22.618694	73.262667	Open well	7.94	984	102	0.5	200	47	16	90	470	280
29	Vadodara	Savli	Rasulpur	22.593472	73.233333	Open well	6.91	2382	279	0.26	504	267	61	196	960	404
30	Vadodara	Savli	Tulsipura	22.567472	73.371667	Open well	7.66	1514	110	1.57	328	109	64	100	576	668
31	Vadodara	Savli	Tulsipura	22.567472	73.371667	Hand pump	7.64	2722	284	0.36	490	534	16	212	1019	500
32	Vadodara	Vadodara	Bill	22.256444	73.133222	Hand pump	7.78	1034	142	0.65	260	34	54	52	352	380
33	Vadodara	Vadodara	Danteswar-1	22.275250	73.211778	Open well	7.31	2494	95	0.38	832	210	109	131	812	404
34	Vadodara	Vadodara	Danteswar-2	22.275333	73.211472	Tube well	7.75	1282	110	0.55	228	104	9	151	645	388
35	Vadodara	Vadodara	Itola	22.144556	73.147306	Open well	6.77	2524	118	0.85	808	162	85	167	900	792
36	Vadodara	Vadodara	Kevdabaug	22.292778	73.201667	Hand pump	7.93	930	63	0.32	214	73	52	65	396	408
37	Vadodara	Vadodara	Maretha	22.225850	73.171328	Open well	7.51	2138	193	0.58	608	197	105	115	736	520
38	Vadodara	Vadodara	Panigate	22.301694	73.217806	Open well	7.52	1138	99	0.26	228	151	60	79	475	332
39	Vadodara	Vadodara	Por	22.136778	73.187833	Tube well	8.26	1288	9	3.2	184	59	16	16	107	836
40	Vadodara	Vadodara	Tarsali-1	22.255194	73.217250	Tube well	7.79	1322	105	0.53	196	111	56	145	740	612
41	Vadodara	Vadodara	Tarsali-2	22.252583	73.216083	Open well	7.92	836	2	1.12	124	20	32	24	184	560
42	Vadodara	Vadodara	Yakutpura	22.302667	73.219861	Open well	7.84	1146	40	0.1	234	116	52	106	568	380

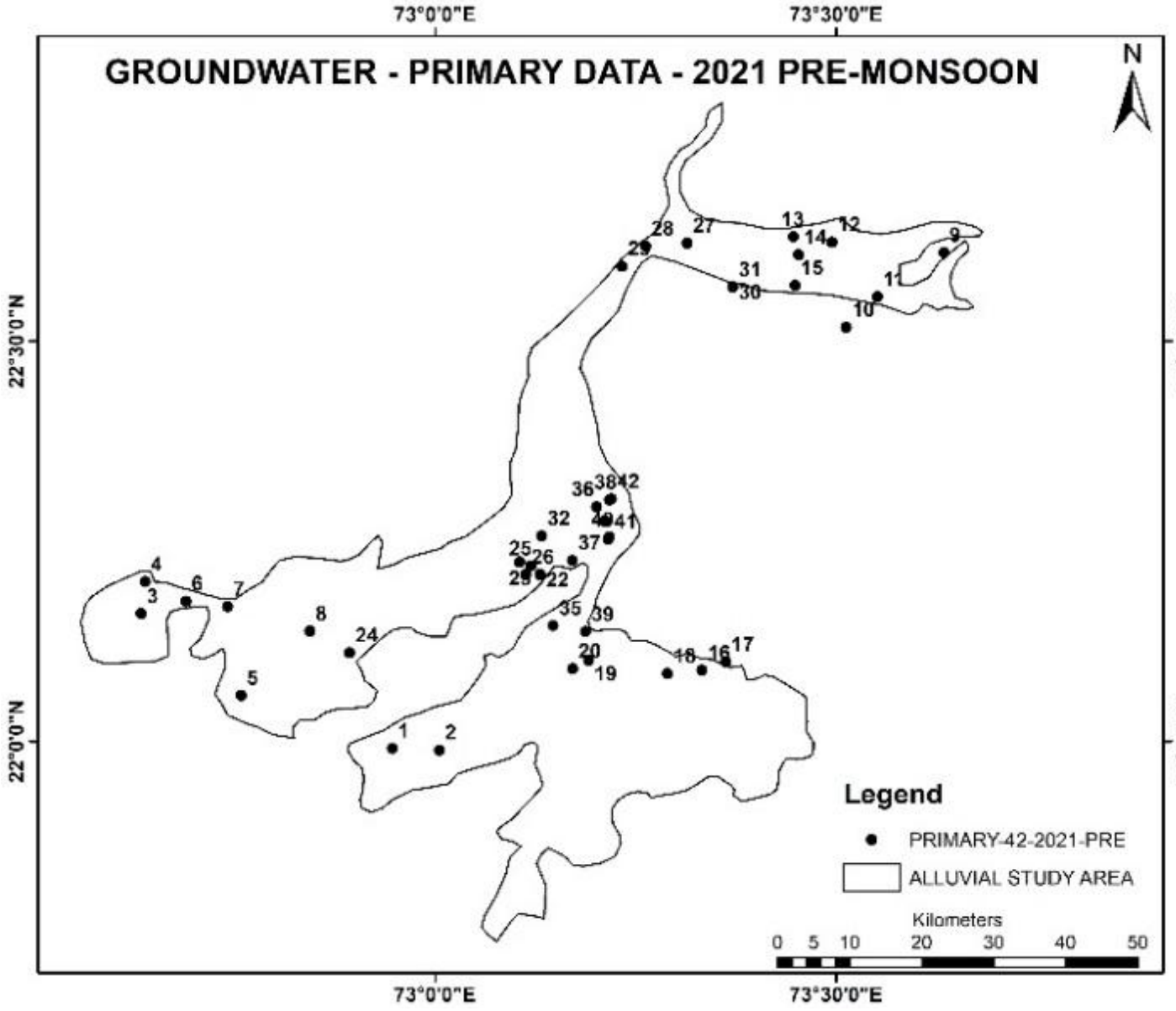


Fig 3.18 Groundwater sample location of primary data, 2021-pre monsoon

Table 3.14 Aquifer Characterization and Disposition – Vadodara District (Source: CGWB)

Stratigraphy	Formation	Aquifer Nomenclature	Depth of Occurrence (mbgl)	Thickness (m)	Water Level (mbgl)	Quality (TDS) mg/l	Discharge lps	Transmissivity m^2/day	Nature of Aquifer
Quaternary	Alluvium	Unconfined	0 to 60	35 to 60	3 to 38	470 to 2890	2 to 50	1.67 to 1067	Phreatic
		Confined I	70 to 100	10 to 30	5 to 50	360 to 5370	1.2 to 60	38 to 2665	Confined
		Confined II	110 to 130	10 to 20	18 to 37		4 to 20	602 to 2616	Confined
Tertiary	Alluvium	Confined III	150 to 200	25 to 50	24 to 37		6 to 34	2616 to 4622	Confined
Upper Cretaceous to Lower Eocene	Basalt	Weathered Basalt	0 to 25	0 to 25	3 to 17	337 to 1980	0.5 to 5		Weathered
		Fractured Basalt	35 to 100		9 to 14	1000 to 2120	0.2 to 7		Fractured

Table 3.15 Aquifer Characterization and Disposition – Panchmahal District (Source: CGWB)

Stratigraphy	Formation	Aquifer Nomenclature	Depth of occurrence (mbgl)	Thickness (m)	Water Level (mbgl)	Quality (TDS) mg/l	Discharge (lps)	Transmissivity (m^2/day)	Nature of Aquifer
Holocene	Sand, Kankar and Clay	Alluvium	0 to 21	0 to 21	14 to 16	500 to 600			Phreatic
Cretaceous	Basalts & Rhyolite	Weathered Basalt	0 to 24	12 to 24	5 to 10	500 to 600			Phreatic
	Basalts & Rhyolite	Fractured Basalt	40 to 54		2 to 16	300 to 2000	1 to 4	0.19 to 1000	Fractured
Upper Proterozoic	Granite & Granodiorite	Weathered Granite	0 to 24	16 to 24	5 to 13	400 to 1500			Phreatic
	Granite & Granodiorite	Fractured Granite	55 to 75		3 to 18	250 to 1200	0.5 to 5	239 to 1600	Fractured
Lower Proterozoic	Phyllite, mica schist, quartzite	Weathered Meta Sediments	0 to 20	15 to 20	5 to 14	400 to 1500			Phreatic
	Phyllite, mica schist, quartzite	Fractured Meta sediments	70 to 100		3 to 21	300 to 1700	0.1 to 6.3	322 to 1300	Fractured