Report No.-20

जल शक्ति अभियान

संचय जल, बेहतर कल

JSA-CTR

Scientific Action Plan for Sirsa

हर बूंद संचय, हर खेत पानी

सिंचाई एवं जल संसाधन विभाग हरियाणा

Prepared By-

Haryana Space Applications Centre (HARSAC),

Citizen Resource Information Department (CRID)

Government of Haryana

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Introduction

1.1 History

Sirsa is the north western district of Haryana State with a total geographical area of 4276 sq. km and it is surrounded by Muktsar, Bathinda & Mansa districts of Punjab in the north, Ganganagar & Hanumangarh districts of Rajasthan in West and South, Sirsa and Hisar districts of Haryana in north east and south east respectively. As per 2011 census the total population of the district is 1295114. Out of total population 683242 are males and 611872 are females. In Sirsa district rural population is settled in 321 villages and the rest of population is concentrated in five towns.

It is one of the oldest places of North India and its ancient name was Sairishaka, The Sirsa district which comprised three tehsils of Sirsa, Dabwali and Fazilka was abolished in 1884 and Sirsa tehsil (consisting of 199 Villages) and 126 villages of Dabwali tehsil formed one tehsil and the same was merged in the Hisar district and the rest of the portion was transferred to the Firozpur district (Punjab). There was no change till the Independence of the country except that a village was transferred from Sirsa tahsil to the then state of Bikaner in 1906. The entire area of the district was included in the new state of Haryana on November 1, 1966. In 1968, Sirsa tehsil was bifurcated into Sirsa and Dabwali tahsils. In 1974, three villages of Dabwali tehsil were transferred to Sirsa tehsil. On September 1, 1975, Sirsa and Dabwali tehsils were constituted into a separate Sirsa district with headquarters at Sirsa.

1.2 Location

It is located between 29° 32' 11.5260" N latitudes and 75° 1' 31.8180" E longitudes (Fig 1). It is Connected to National Highway No. 64 through Dabwali and Punjab. It is surrounded by Muktsar, Bathinda & Mansa districts of Punjab in the north, Ganganagar & Hanumangarh districts of Rajasthan in West and South, Sirsa and Hisar districts of Haryana in north east and south east respectively. The district is under control of Hisar division and administratively divided into seven development blocks namely Sirsa, Dabwali, Odhan, Baragudha, Nathusari Choupta, Rania & Ellenabad. The Location map of Sirsa shown in **Fig 1**.

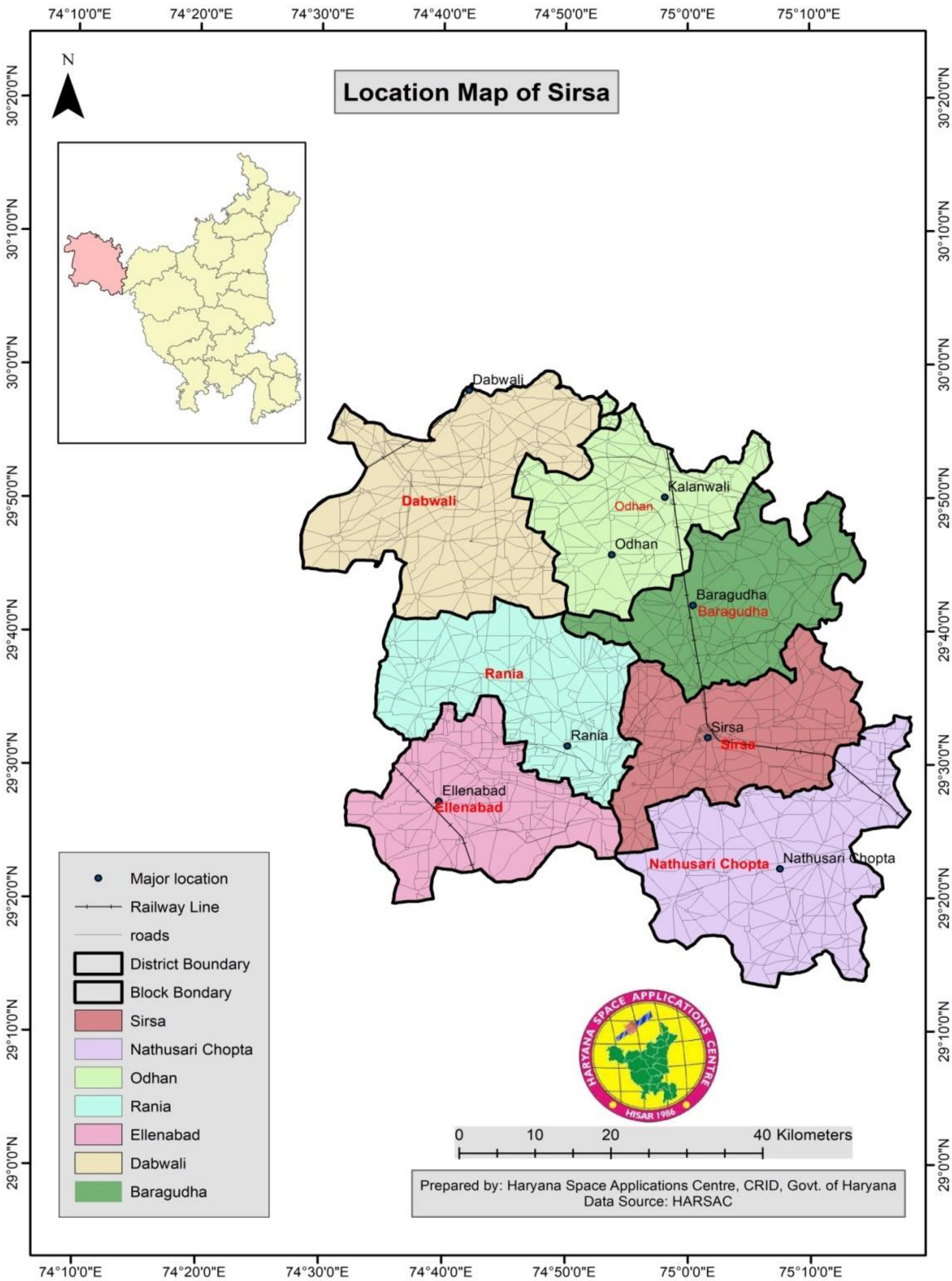


Figure 1- Location Map of Sirsa District

1.3 Administrative Setup

The administrative setup of the District of Sirsa has been described in the following table, with specific sectoral development such as water, animal husbandry, agriculture, roadways is operated under specific departments given below **Table 1.**

Table 1- Major Administrative jurisdictional set up of district

Country	India
State	Haryana
Division	Sirsa
Headquarters	Sirsa
Tehsil	1. Sirsa, 2. Nathusari Chopta, 3. Odhan, 4. Rania 5. Ellenabad 6. Dabwali 7. Baragudha
Total Area	898 Sq. Km
Total Population (2011)	182534
Density	300/km2 (780/sq. mi)
Demographics	Hinduism 72.60% Sikhism 26.17% Other 1.23%
Literacy	male literacy 86.2%, female literacy rate was 76.0%
Vidhan Sabha constituencies	Kalanwali, Dabwali, Rania, Sirsa, Ellenabad
Website	https://sirsa.gov.in
Location of Sirsa	Western part region of Haryana
Coordinates	Between 29° 32' 11.5260" N latitudes and 75° 1' 31.8180" E longitudes
Total Area	176.5 sq. mi
Elevation	200.55 m (657.97 ft)

Source: https://en.wikipedia.org/wiki/Sirsa_district

Sub Divisions (4)	Sirsa, Dabwali, Ellenabad, Kalanwali
Tehsils (7)	Sirsa, Nathusari Chopta, Odhan, Rania, Ellenabad 'Dabwali Baragudha
Blocks (7)	Sirsa, Nathusari Chopta, Odhan, Rania, Ellenabad Dabwali Baragudha
Municipal Corporation (2)	Municipal Corporation, Sirsa Municipal Corporation, Dabwali
Municipal Council (2)	Sirsa, Dabwali
Municipal Committees (3)	Ellenabad, Rania, Kalanwali
Population (Census 2011)	182534

Source: https://sirsa.gov.in/administrative-setup-of-district-sirsa/

Total Villages	330
Total Panchayats	128
Village Level	Panchayat (236)
Block Level	Panchyat Samiti (4)
District Level	Zila Parishad (10)

Source: https://Sirsa.gov.in/about-district/administrative-setup/

1.4 Climate

1.4.1 Temperature

Average weekly temperature from April to May is 32.20C, October to March 19.2 0Cand June to September 31.40C. The average number of rainy days in a year was observed about 21. The mean daily maximum temperature is about 41˚ C in the months of May and June. It may go up to 45℃ or more in June. During winter the mean daily maximum temperate in January in 21 ℃ and the minimum is about 3-4℃. May and June are the hottest months and January is the coldest month. With the advance of the Monsoon into the district, by about the end of June, there is appreciably drop in the day temperature and the weather becomes cooler during the day time, but the nights are warmer than those during the summer season. With the added moisture in the monsoon air, the nights are often uncomfortable. The decrease in temperature is rapid after October and drop in temperature after nightfall is particularly trying. According to **Table 2** January is generally the coldest month with the mean daily maximum at 20 ºC and the mean daily minimum at 7.2 ºC.

Table 2- The Table shows the average, maxim and minimum temperature of 12 months of Sirsa

Month	**Avg. Temp (°C)**	**Avg. Temp (°F)**	**Min. Temp (°C)**	**Max. Temp(°C)**
January	13.3	55.9	7.2	20
February	16.6	61.9	10	23.5
March	22.5	72.5	15.1	30
April	29.2	84.5	20.0	36.8
May	33.5	92.3	25.0	40.0
June	34.0	93.0	28.0	39.0
July	32.0	89	28.0	36.0
August	30.8	87.5	27.2	35.0
September	30	85.9	25.2	35.1
October	26.7	80.1	20.1	33.7
November	20.9	69.6	14.4	28.1
December	15.3	59.6	8.9	22.5

1.4.2 Humidity

Relative humidity in the mornings is generally high during the monsoon season and during the period December to February, it is usually 64 per cent or more, According to **Table 3** the driest part being the summer season with the relative humidity being about 30 per cent in the afternoons.

Table 3 -The Table shows humidity of 12 months of Sirsa

Month	Humidity (%)
January	64%
February	57%
March	45%
April	28%
May	27%
June	41%
July	60%
August	65%
September	57%
October	45%
November	49%
December	58%

1.4.3 Rainfall

The normal annual rainfall is 318 mm. and average monthly rainfall is 28.88 mm. The normal annual rainfall of the district is 318 mm which is unevenly distributed over the area 20 days and the normal monsoon rainfall is 253mm. The south west monsoon sets in from last week of June and withdraws in end of September, contributing about 80% of annual rainfall. July and August are the wettest months. Rest 20% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally, rainfall in the district increases from southwest to northeast.

The climate of Sirsa district is of tropical desert type arid and hot which is mainly dry hot summer and cold winter except during monsoon period season when moist air of oceanic origin penetrates into the district.

There are four seasons in a year. The hot weather season starts from mid-March to last week of the June followed by the south- west monsoon which lasts up to September. The transition period from September to October forms the post-monsoon season. The winter season starts late in November and remains up to first week of March. The following **Table 4** shows the annual rainfall seen for the District of Sirsa.

Table 4 -The Table shows the average rainfall of 12 months in Sirsa

Month	Precipitation (mm)	Rainfall (mm)	Rainy Days (d)	Av. Sun hours (Hrs.)
January	15	-0.6	2	8.2
February	23	-0.9	2	9.5
March	15	-0.6	2	10.6
April	12	-0.5	2	11.5
May	17	-0.7	3	12.2
June	46	-1.8	5	12.2
July	112	-4.4	10	10.7
August	94	-3.7	10	10.4
September	53	-2.1	5	10.3
October	11	-0.4	1	10.2
November	2	-0.1	0	9.5
December	5	-0.2	1	8.8

During the period 1901 to 1975, the highest annual rainfall as recorded was 327 per cent of the normal in 1917. The lowest annual rainfall amounting to only 34 per cent of the normal was recorded in 1920. On an average there are 20 rainy days (i.e., days with rainfall of 2.5 mm or more) in a year in the district. The heaviest rainfall in 24 hours recorded in the district was 165.4 mm on September 22, 1917. Rainfall Map of Sirsa District is given in **Figure 2**. Rainfall ranges from 353.0.46 mm to 550 mm.

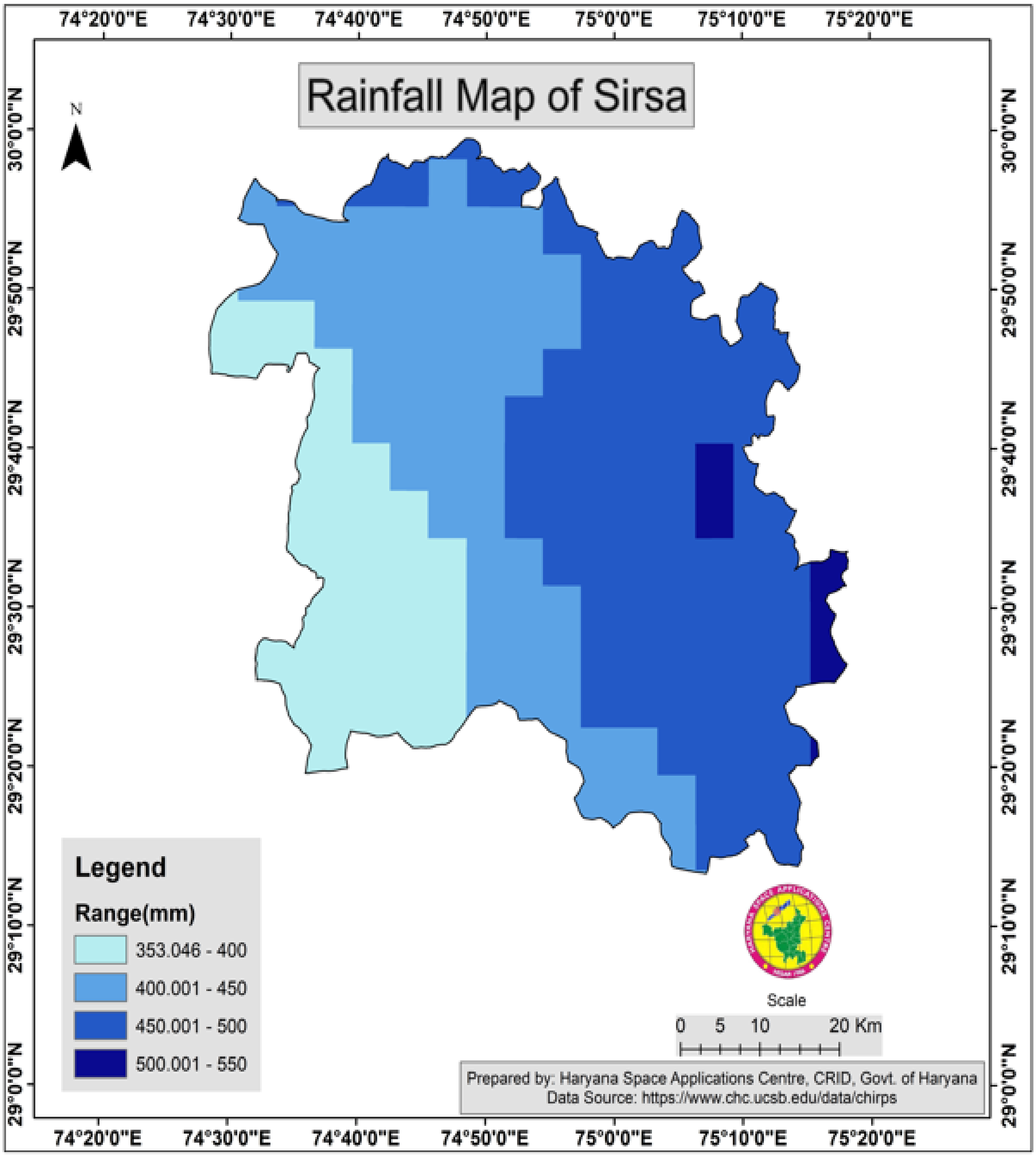


Figure 2- Rainfall Map of Sirsa District

1.5 Elevation and Topography

The terrain of Sirsa district may be broadly classified from north to south into three major types i.e., Haryana Plain, alluvial bed of Ghaggar or Nali and Sand dune tract. The characteristics of the three are briefly described below: Haryana Plain: The Haryana Plain is a vast surface of flat to rolling terrain and extends southward to the northern boundary of the alluvial bed of the Ghaggar. It covers over 65 per cent of the area of the district.

The elevation of the surface from east to west varies from 190 to 210 meters above the mean sea level. The most diagnostic feature of the Haryana Plain is the presence of palaeo channels which set the occurrence of sand dunes in this terrain unit apart from those in the dune tract. The plain is traversed by numerous dune complexes and shifting sands. alluvial bed of Ghaggar. A clayey surface of almost flat, featureless plain bordered in the north and west by the Haryana Plain and in the south along the sound dune tract, is a manifestation of the misfit nature of the present day Ghaggar.

Waterlogging is a serious problem in many parts of this flat surface of impervious clay of great thickness. At places, swamps support a high density of tall grass. Sand dune tract: Third tract covers the southernmost part of the district. The area is northward extension of the sand dunes of Hisar District and Ganga Nagar District of Rajasthan. The height above mean sea level of the district ranges from 15to 200 m **(Figure 3).**

Slope ranges from flat to >35 degree (**Figure 4**). Physiographically, the district is characterised by three distinct features i.e. Upland plain, alluvial bed (flood plain) of river Ghaggar and Sand dune clusters. The area as a whole is almost flat with a gentle slope towards south west direction. The district is mainly drained by the river Ghaggar and some artificial drains. Contours of 5 meters (**Figure 5**) interval showed similar topography as in digital elevation model.

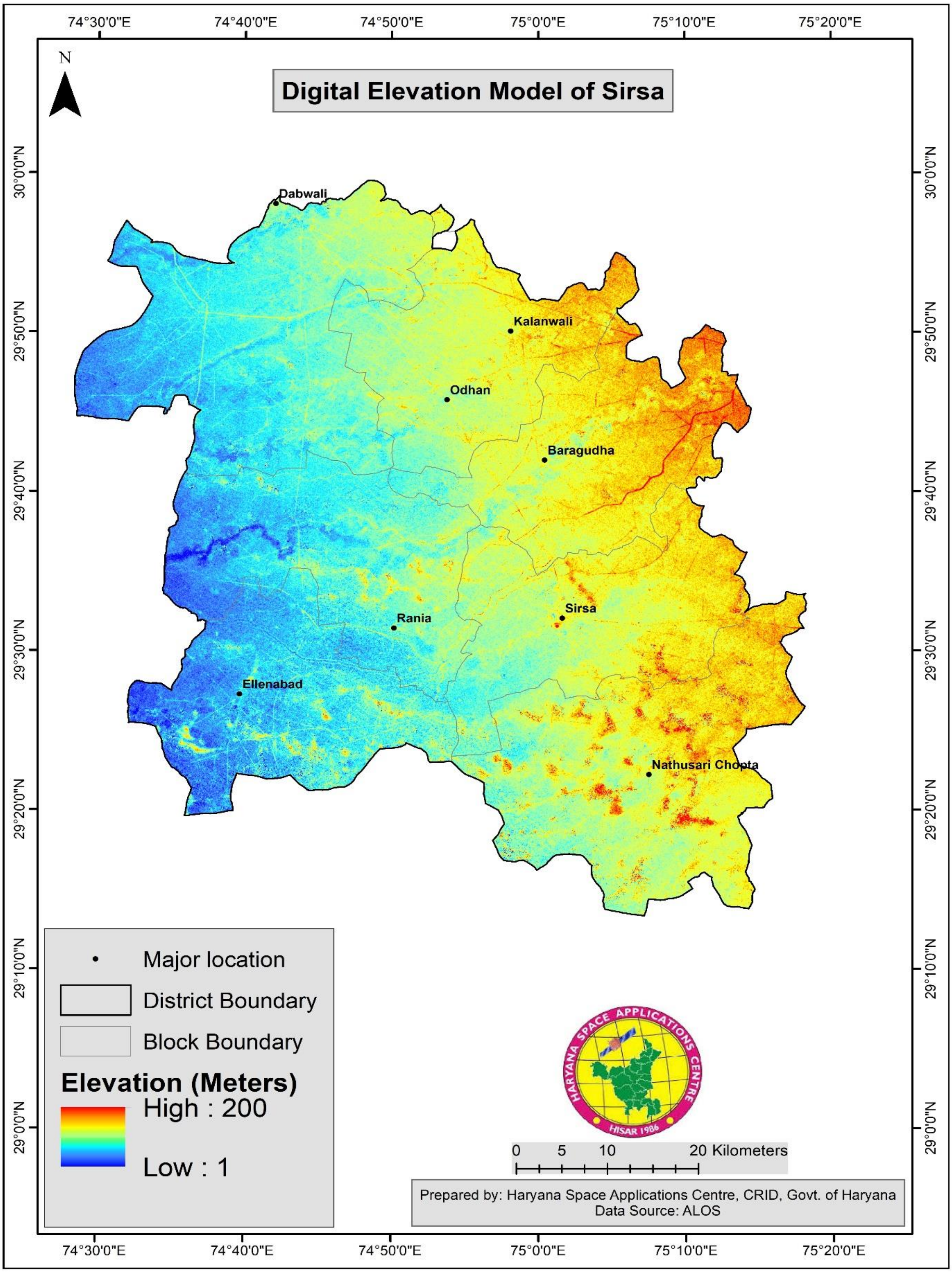


Figure 3- Digital Elevation Model of Sirsa District

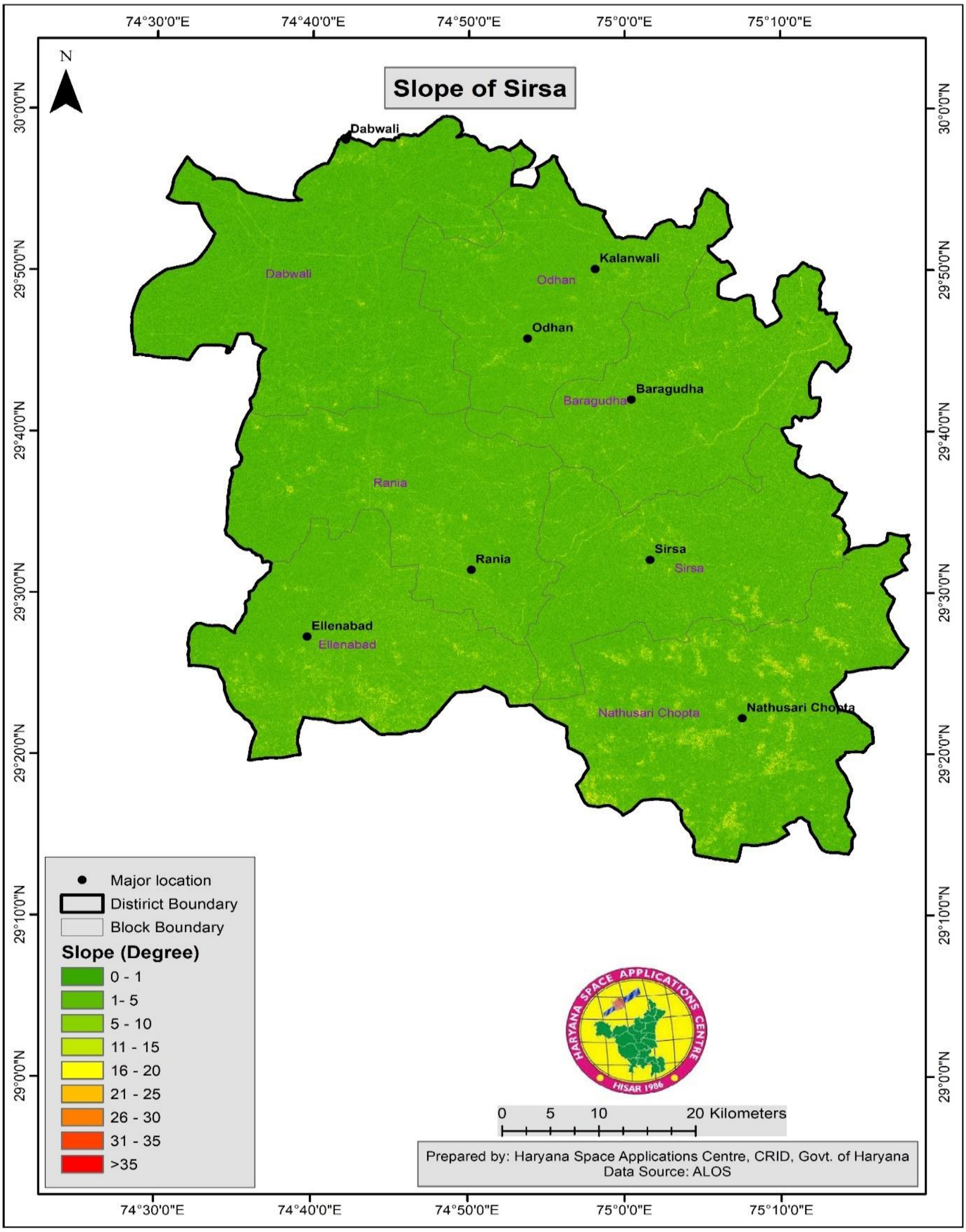


Figure 4 -Slope of Sirsa District

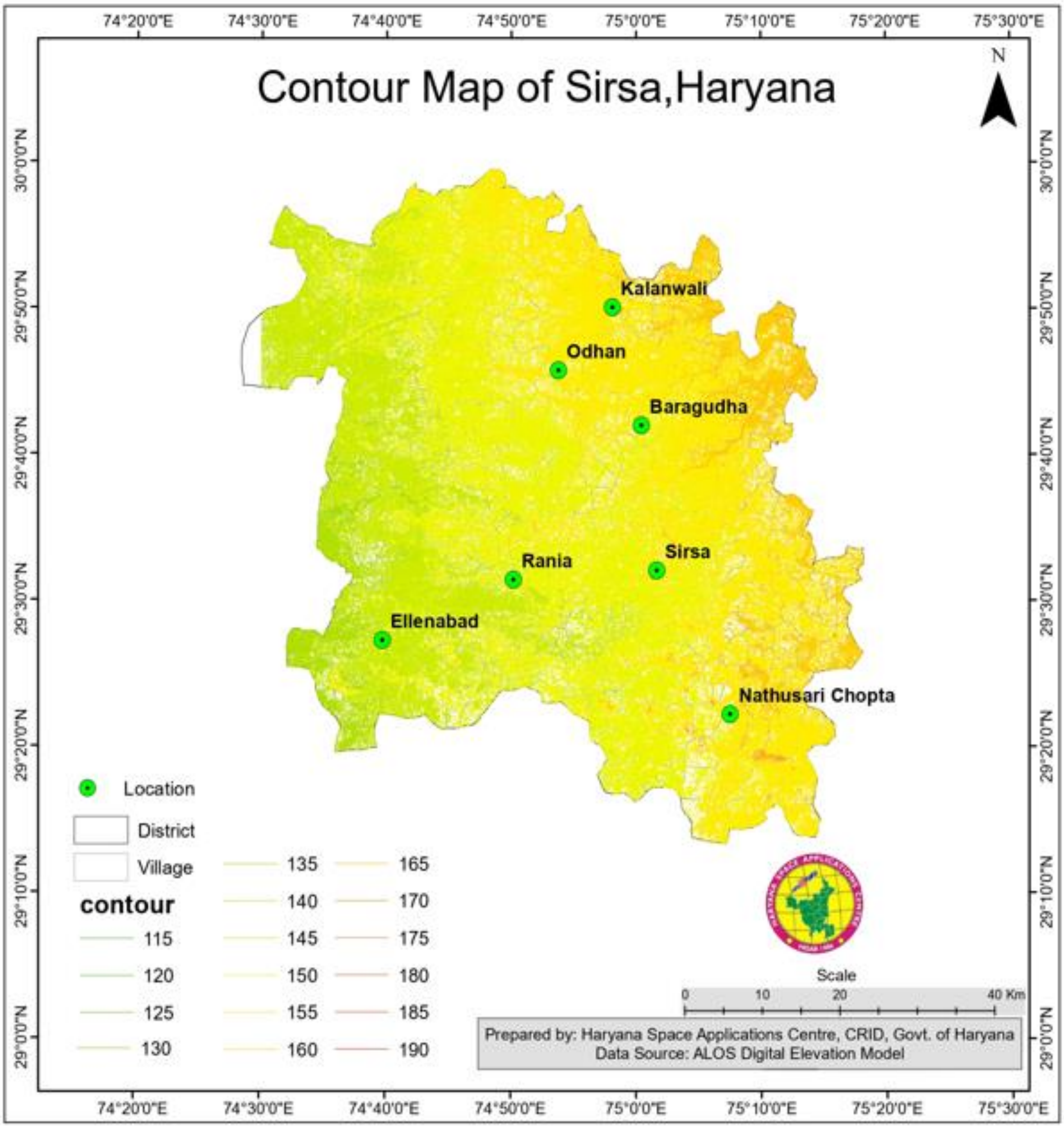


Figure 5 -Contour Map of Sirsa District

1.5.1 Geology and Lithology

The geological formations are unconsolidated alluvial deposits of Quaternary age. The alluvial deposits comprise of sand, silt, clay associated with kankar. Fine to medium grained sand horizon forms the potential aquifer in the area. The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. The area has both unconfined and confined aquifers. In general, the unconfined aquifers occur down to 60 m depth below ground level in the district. The alluvium acts as ground water reservoir and principal aquifer material comprises fine to medium sand and sand mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well-connected granular zones that have a pinching and swelling disposition and are quite extensive in nature. The ground water in unconfined condition is abstracted through hand pumps and shallow tube wells where as in deep and confined aquifer through medium and deep tube wells. The thickness of the alluvium deposit varies from 200 to 300 m. As Figure **6** shows the lithological map of Sirsa district.

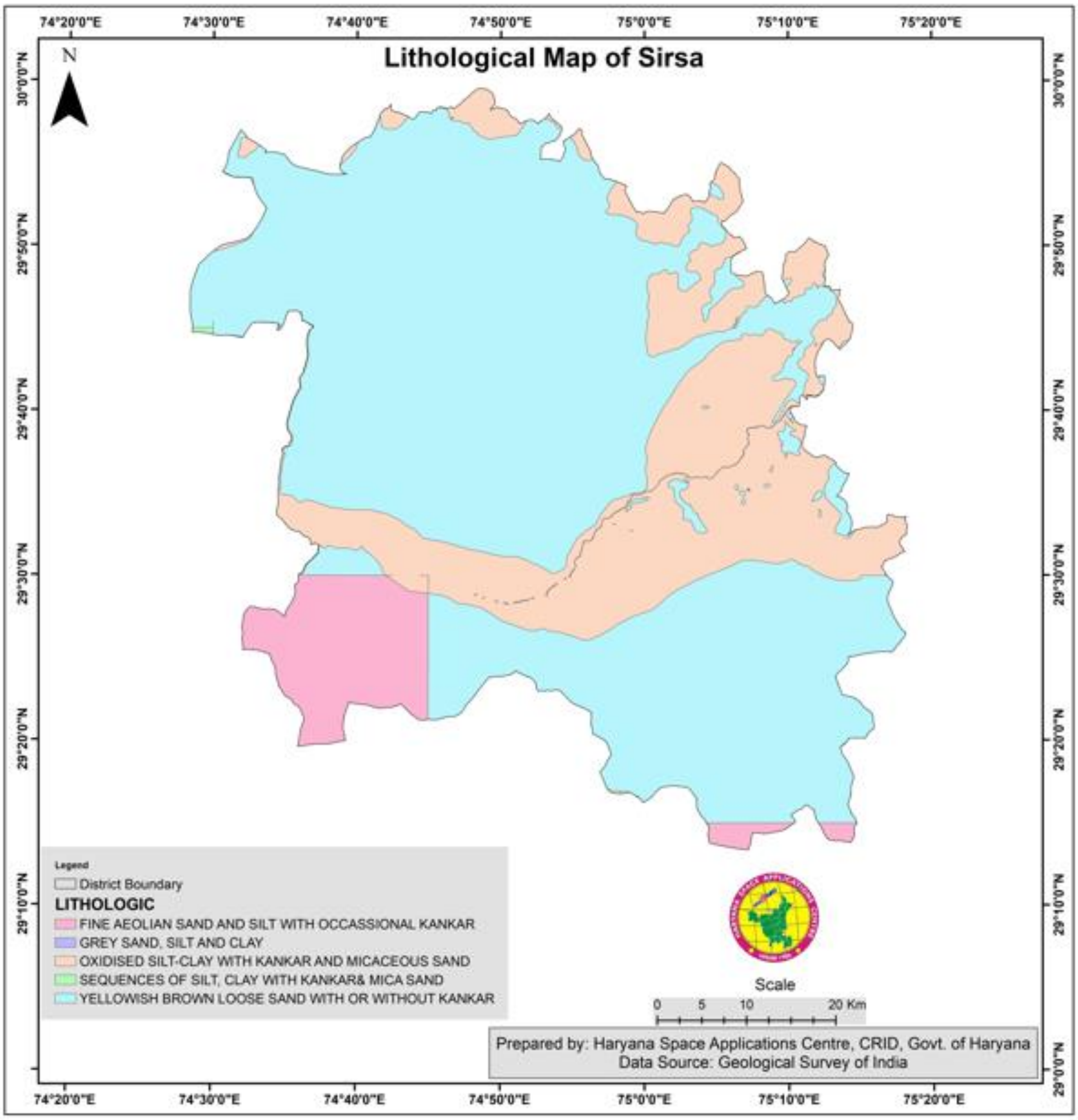


Figure 6 -Lithological Map of Sirsa District

1.5.2 Soil Erosion

According to the classifications followed by Soil Testing & Research Laboratory, Sirsa, the soils of the district are sandy to sandy loam in texture. The geological formations are unconsolidated alluvial deposits of Quaternary age. The alluvial deposits comprise of sand, silt, clay associated with kankar. There is no soil erosion is Sirsa District as per Deputy Director Agriculture Sirsa. The type of soil is an important factor for the growth of plants and crops in any area. The soil system has various criteria to classify the soils of a region such as geology, humidity, rainfall pattern, soil texture, soil salinity etc. The district has two types of soils Wise Sierozem and Desert soils. The sierozem soils are found in major parts of the district and desert soils are comparatively found in smaller part of the district especially in southern part of the district. Sierozem Soil are found in the areas where the normal annual rainfall varies from 300 to 500 mm. These soils vary from sandy loam to loamy sands in texture and are marginally fertile. Degree of salinity and alkali hazards is highly variable, though salinity is majorhazaed. These soils occur mainly in northern parts of the district i.e., Odhan, Baragudha & Sirsa blocks and parts of Dabwali, Nathusari Choupta & Rania blocks. Desert Soil are generally found in the areas where the annual rainfall is less than 300 mm. General Soil health profile of Haryana in **Figure 7**.

SOIL HEALTH-HARYANA

- Major & Secondary Nutrients:-

		L	M	H
Nitrogen	:	89.27%	7.98%	2.75%
Phosphorus	:	88.28%	9.45%	2.26%
Potash	:	10.61%	48.55%	40.84%
Sulphur	:	8.32% Deficient		

Micronutrients:-

Zinc	:	19.70% deficient
Iron	:	28.20% deficient
Manganese	:	8.90% deficient

Figure 7- General Soil health profile of Haryana

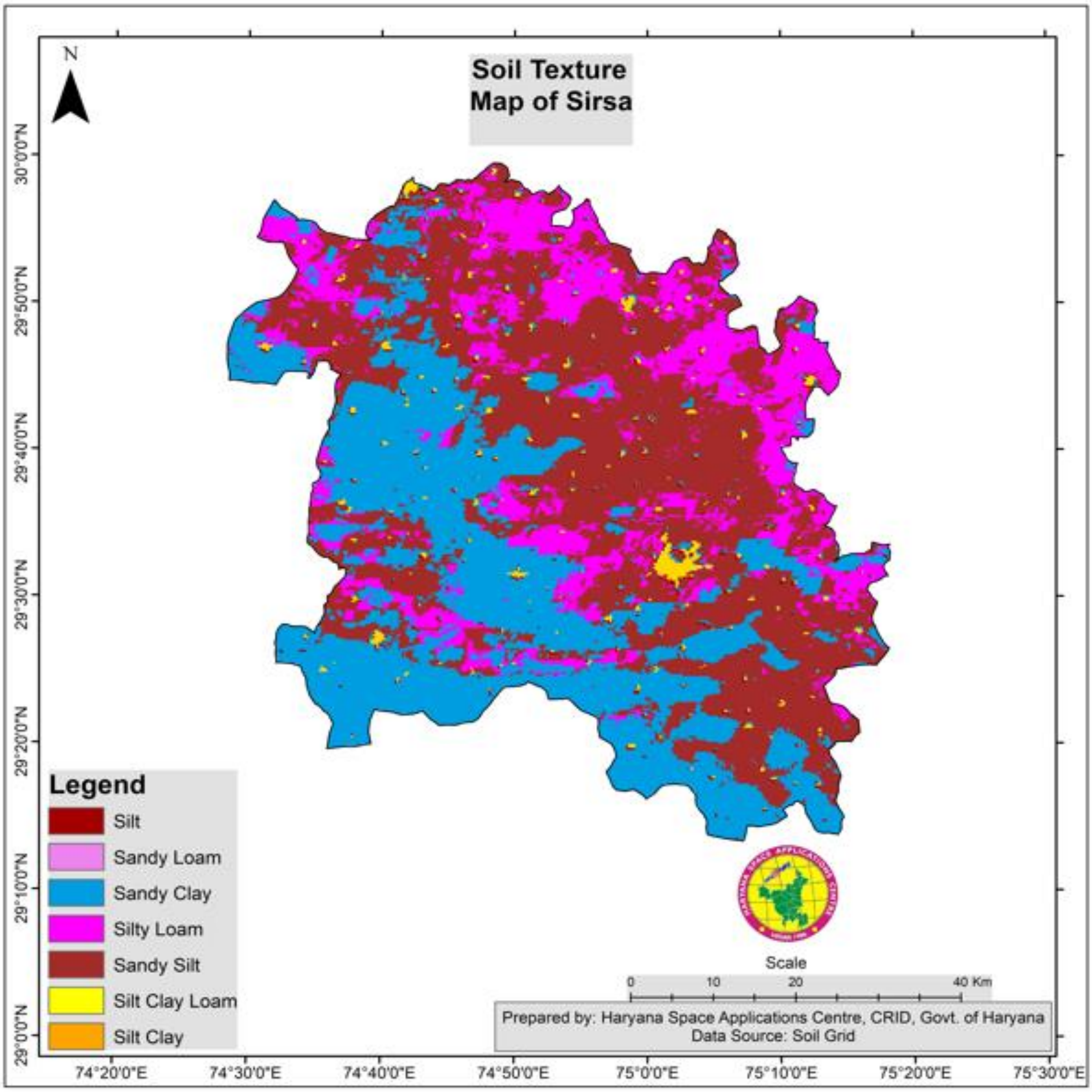


Figure 8- Soil texture map of Sirsa District

The soils are sandy and extensively cover southern parts of the district wise Ellenabad block and parts of Dabwali, Rania & Nathusari Chopta .as shown in **Figure 8**

1.6 Land use

The main classes are agriculture land, forest land, water land and surface water bodies. The agriculture land, classified in the study area is being done all along the drainage course. The major portion of Land is covered under Agriculture as shown in **Figure 9.**

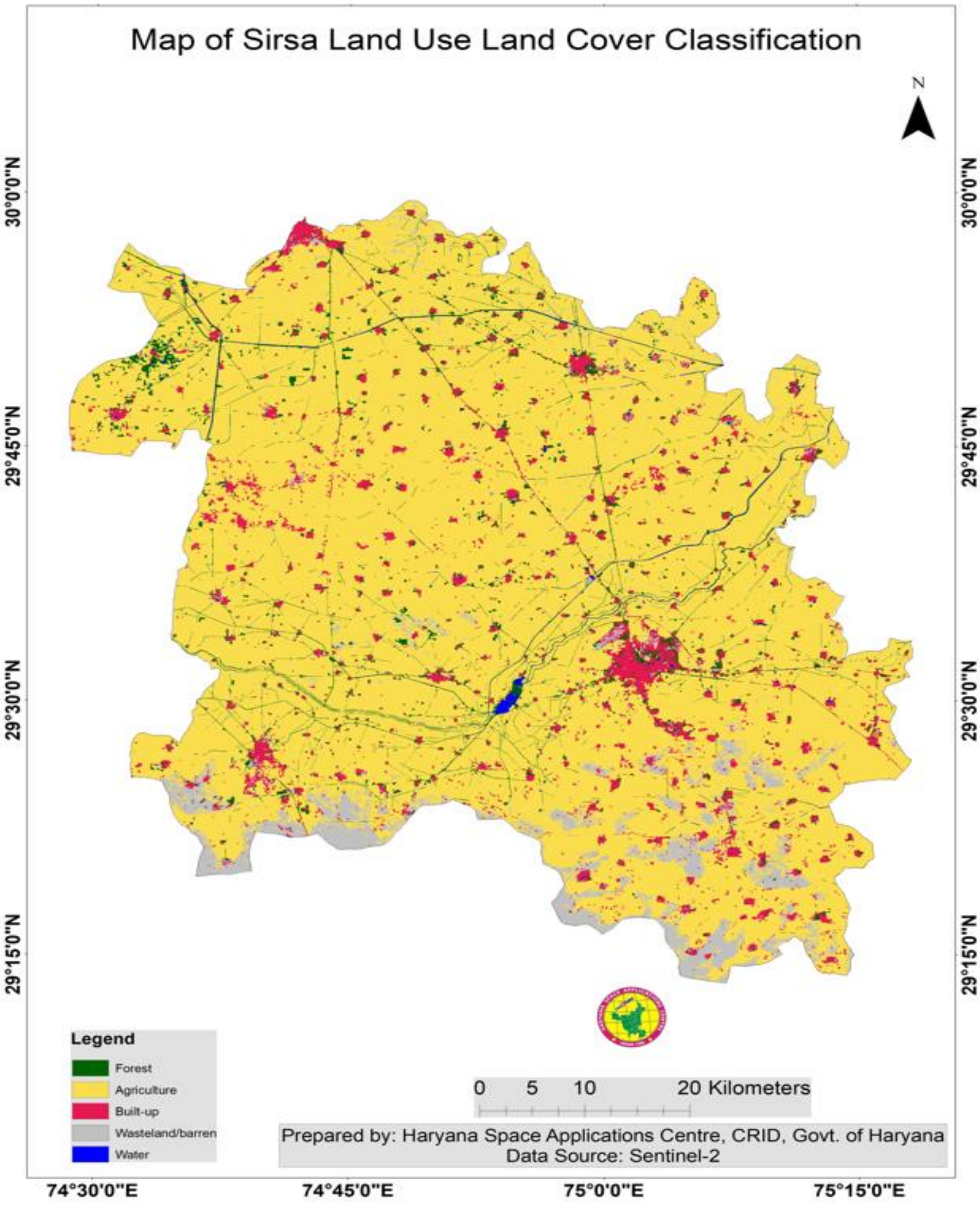


Figure 9- Land use and Landcover of Sirsa District

2 District Water Profile

2.1 Source of Water

Canal and ground water are the major sources in district Sirsa of Haryana. And other sources of water refer to (such as rivers, streams, lakes, reservoirs, springs, and groundwater) that provide water to public drinking water supplies and private wells.

2.1.1 Canals

Canals are used for navigation, crop irrigation, water supply, or drainage It can also act as inland waterways continue to fill a vital role and, in many areas, to grow substantially. many inland waterways are multipurpose, providing drainage, irrigation, water supply, and generation of hydroelectric power as well as navigation. the lay of the land (topography) and particularly changes in water levels require that many rivers be regulated to make them fully navigable. The Sirsa Branch, is the oldest canal in built in 1896[1] and originating at Indri, is a sub-branch of Sirsa branch of Western Yamuna Canal which menders through Kaithal district, Jind district, Fatehabad district and Sirsa district.

2.1.2 Ponds

A pond is a body of standing water, either natural or man-made, that is usually smaller than a lake. They may arise naturally in floodplains as part of a river system, or they may be somewhat isolated depressions (examples include vernal pools and prairie potholes). Usually, they contain shallow water with marsh and aquatic plants and animals. A wide variety of man-made bodies of water are classified as ponds. Some ponds are created specifically for habitat restoration, including water treatment. Others, like water gardens, water features and koi ponds are designed for aesthetic ornamentation as landscape or architectural features. There is total 2525 ponds in a Sirsa district. **Figure 10** features Water Bodies in Sirsa District and **Figure 11** shows monsoon Waterlogged Areas in Sirsa district.

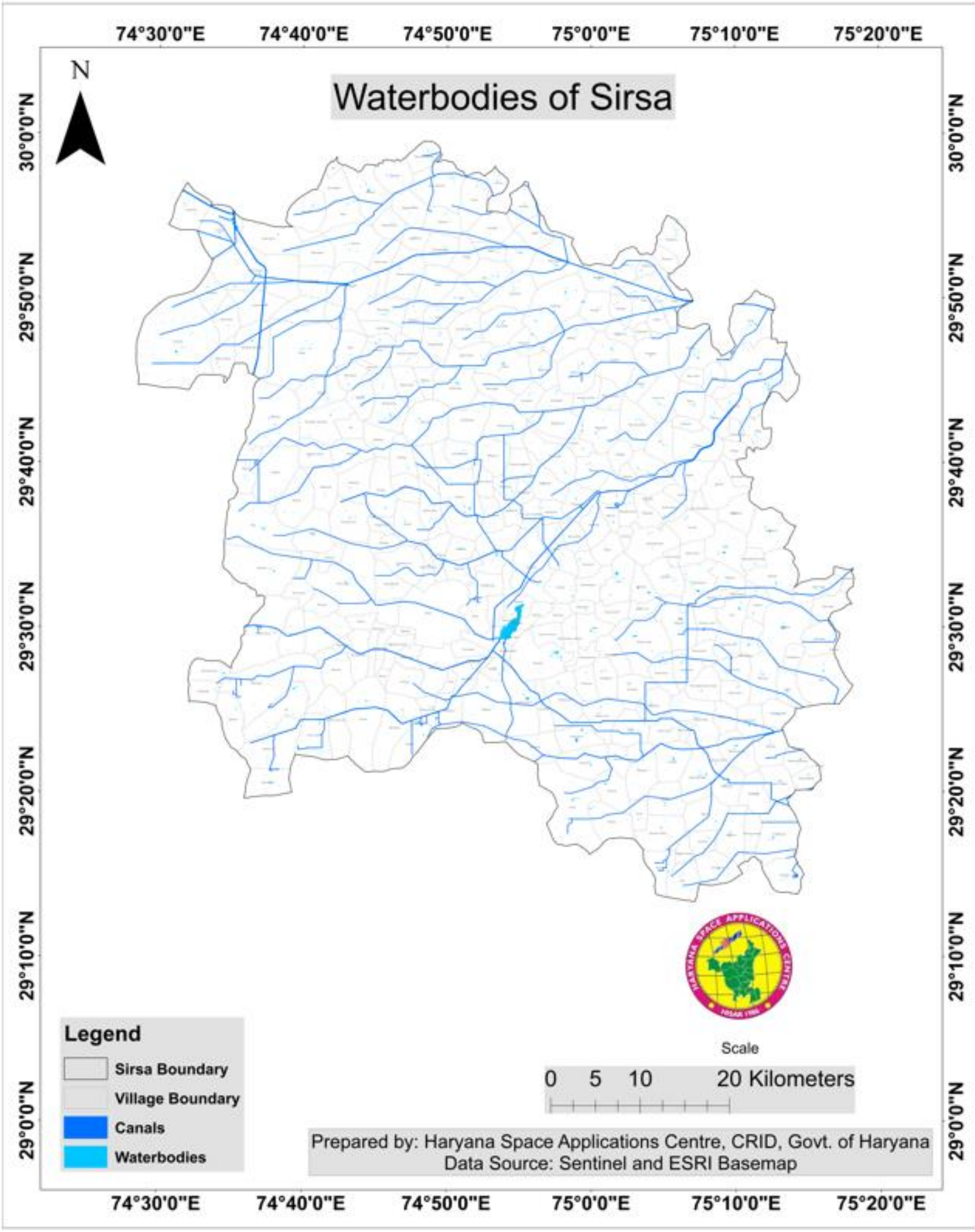


Figure 10- Water bodies of Sirsa District

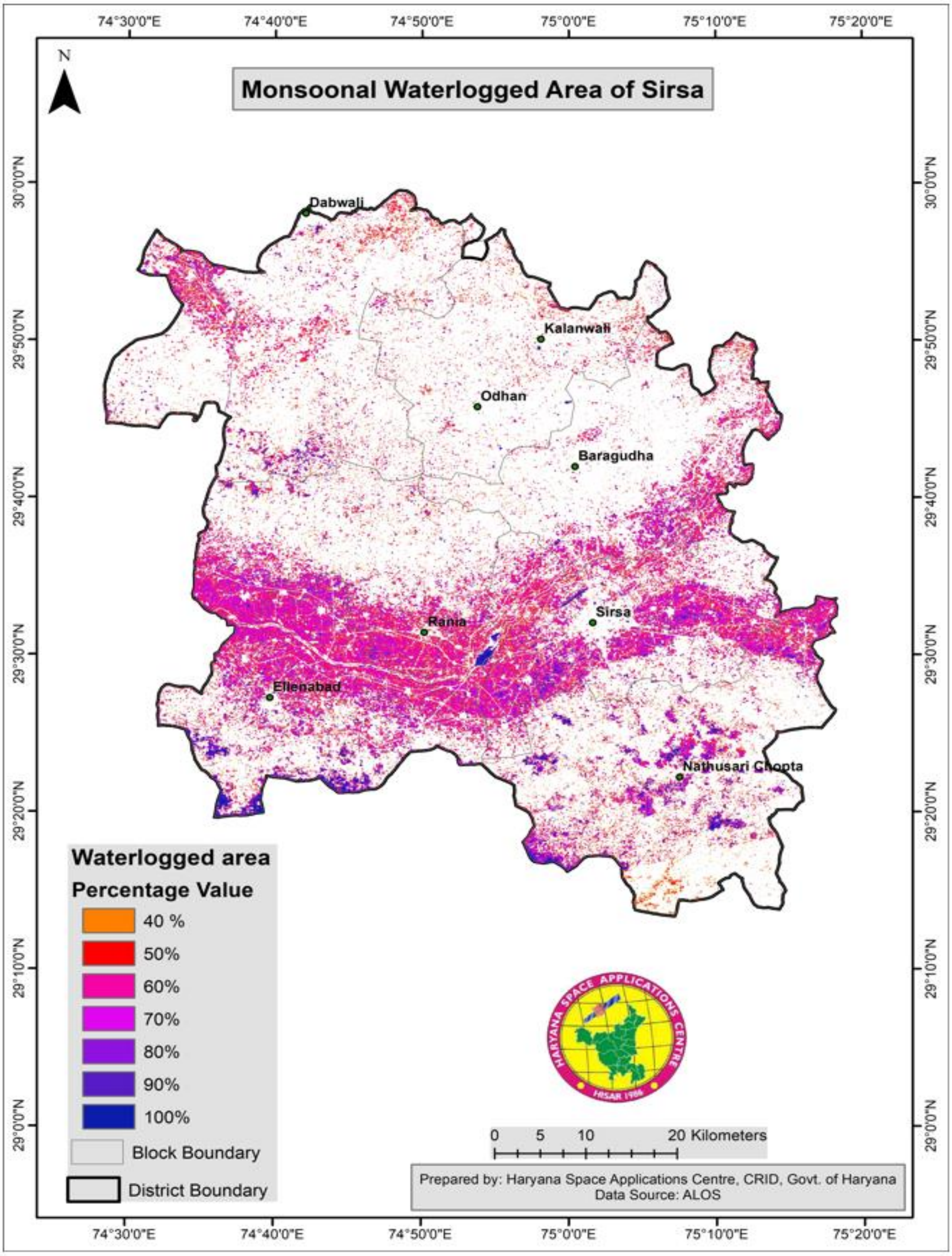


Figure 11- Monsoonal Waterlogged Area of Sirsa

2.1.3 Drain

Natural drainage means a drainage consisting of native soils such as a natural swale or topographic depression, which gathers or conveys run-off to a permanent or intermittent watercourse or water body. During rain or irrigation, the fields become wet. The water infiltrates into the soil and is stored in its pores. When all the pores are filled with water, the soil is said to be saturated and no more water can be absorbed; when rain or irrigation continues, pools may form on the soil surface. Surface drainage is the removal of excess water from the surface of the land. Shallow ditches, also called open drains, normally accomplish this. The shallow ditches discharge into larger and deeper collector drains. In order to facilitate the flow of excess water toward the drains DEM is very important. The drainage map of Sirsa District is shown in **Figure 12.** The statistics of length of drainages under each order are shown in **Table 5.**

Table 5- Stream order length in Sirsa district

Sr.No.	Stream Order	Length (metres)
1	1st	3920853.075
2	2nd	1961838.403
3	3rd	979933.955
4	4th	368515.45
5	5th	324693.600
6	6th	275.65

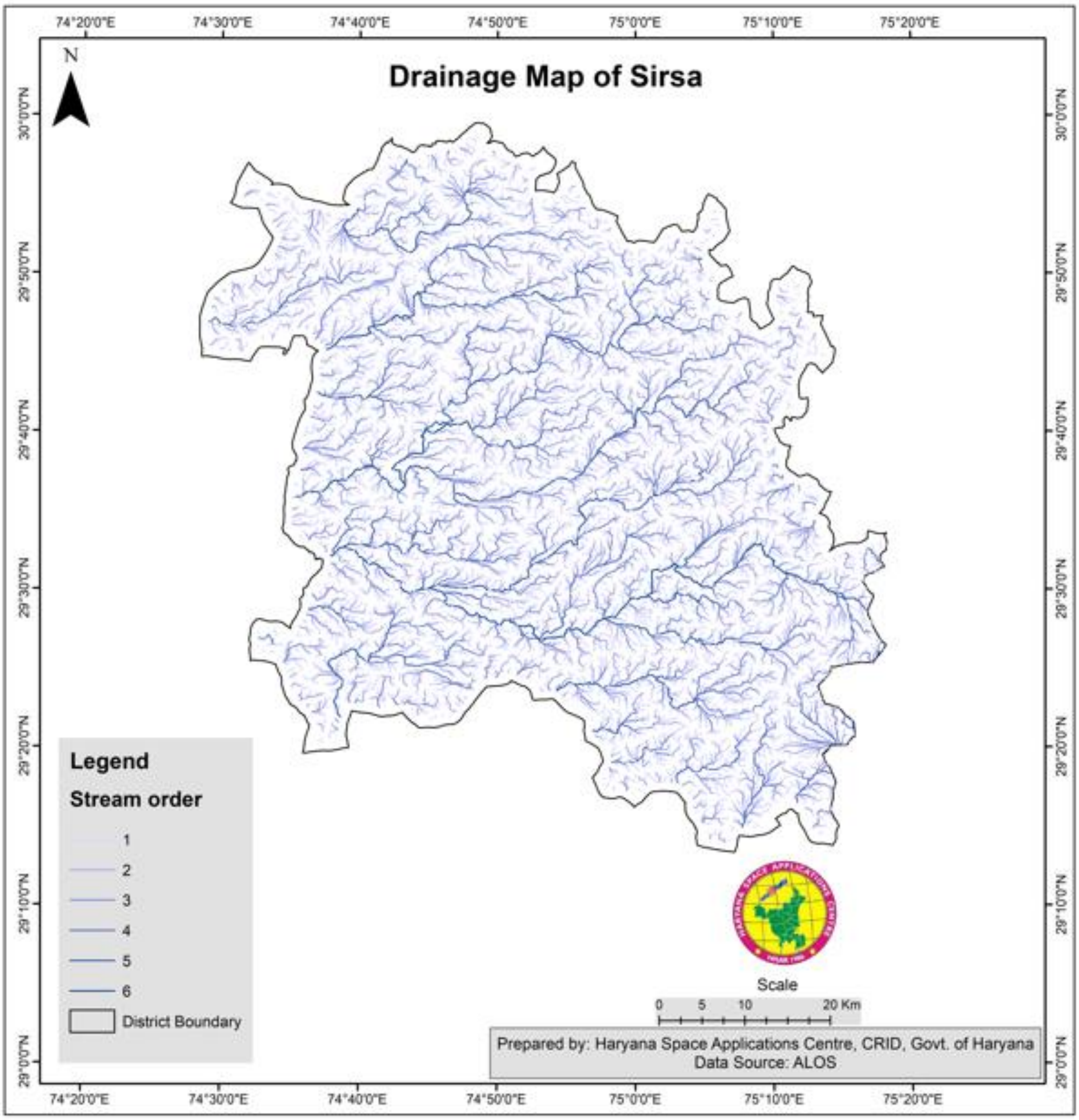


Figure 12- Drainage Map of Sirsa District

2.2 Water Harvesting System

Rainwater harvesting essentially means collecting rainwater on the roofs of building and storing it underground for later use. Not only does this recharging arrest groundwater depletion, it also raises the declining water table and can help augment water supply. Rainwater harvesting and artificial recharging are becoming very important issues. It is essential to stop the decline in groundwater levels, arrest seawater ingress, i.e., prevent seawater from moving landward, and conserve surface water run-off during the rainy season.

Advantages: - 1. Provides self-sufficiency to water supply

2. Reduces the cost for pumping of groundwater

3. Provides high quality water, soft and low in minerals

4. Improves the quality of ground water through dilution when recharged

5. Reduces soil erosion & flooding in urban areas

6. The rooftop rainwater harvesting is less expensive & easy to construct.

7. In saline or coastal areas & Islands, rainwater provides good quality water

2.2.1 Roof Top Harvesting

The roof catchments and stored in reservoirs. Technique through which rain water is captured from Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks. **Table 6** shows the Water Harvesting System in Sirsa District. In Sirsa district method like rooftop rain water harvesting is very common.

Table 6- Water Harvesting System in Sirsa District

S.NO.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam		0	
2	Pond / Tank		5	
3	Trench	10	0	

4	Rooftop Water Harvesting Structure (Public)	139	0	
5	Rooftop Water Harvesting Structure (Private)	80		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)		0	
7	Other Water Conservation Structures (Bench Terracing, Canal)		1	
Total			**6**	**283**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	929	88	
Total		**929**	**88**	**965**
Reuse and Recharge Structures				
1	Soak Pit	1519	0	
2	Stabilization Pond	2	0	
3	Other Reuse / Recharge Structure	164	0	
Total		**1685**	**0**	**2**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank		21	
3	Staggered Trenches	0	0	
4	Other Watershed Construction Activities	295	166	
Total			**187**	**1591**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	79	1	
2	Intensive Afforestation-Plantation		18	
Total			**19**	**39**
Awareness Programs by KVK				
1	Farmer’s training programs by KVKs on Water Use Efficiency and Appropriate Crops	8		

2	Distribution of one packet of vegetable seeds and saplings of five nutritious plants to farmers			
3	Awareness Programs/ Kisan Mela on the theme Valuing Water	726		
Total		**734**		
Waste Water Treatment				
1	Use of Treated Waste Water	0		
Total		**0**		

2.2.2 Water Harvesting System other than roof top

The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be a terrace, courtyard, or paved or unpaved open ground. The terrace may be a flat RCC/stone roof or sloping roof. Therefore, the catchment is the area, which actually contributes rainwater to the harvesting system. Rainwater from the rooftop should be carried through down to take water pipes or drains to the storage/harvesting system. Water pipes should be UV resistant (ISI HDPE/PVC pipes) of the required capacity. The total no of activities achieved in Sirsa District for rain water harvesting is shown in **Table 7** at rural and urban area. The map of water conservation activity in Sirsa at rural and urban level is shown in **Figure 13**.

Table 7- Water Harvesting activities in rural and urban area

In Rural Area		
Sr. No.	**Block Name**	**Total No. of Activity (no.)**
1	Baragudha	314
2	Dabwali	384
3	Ellenabad	322
4	Nathusari Chopta	373
5	Odhan	389
6	Rania	208
7	Sirsa	322
In Urban Area		
1	Sirsa	132

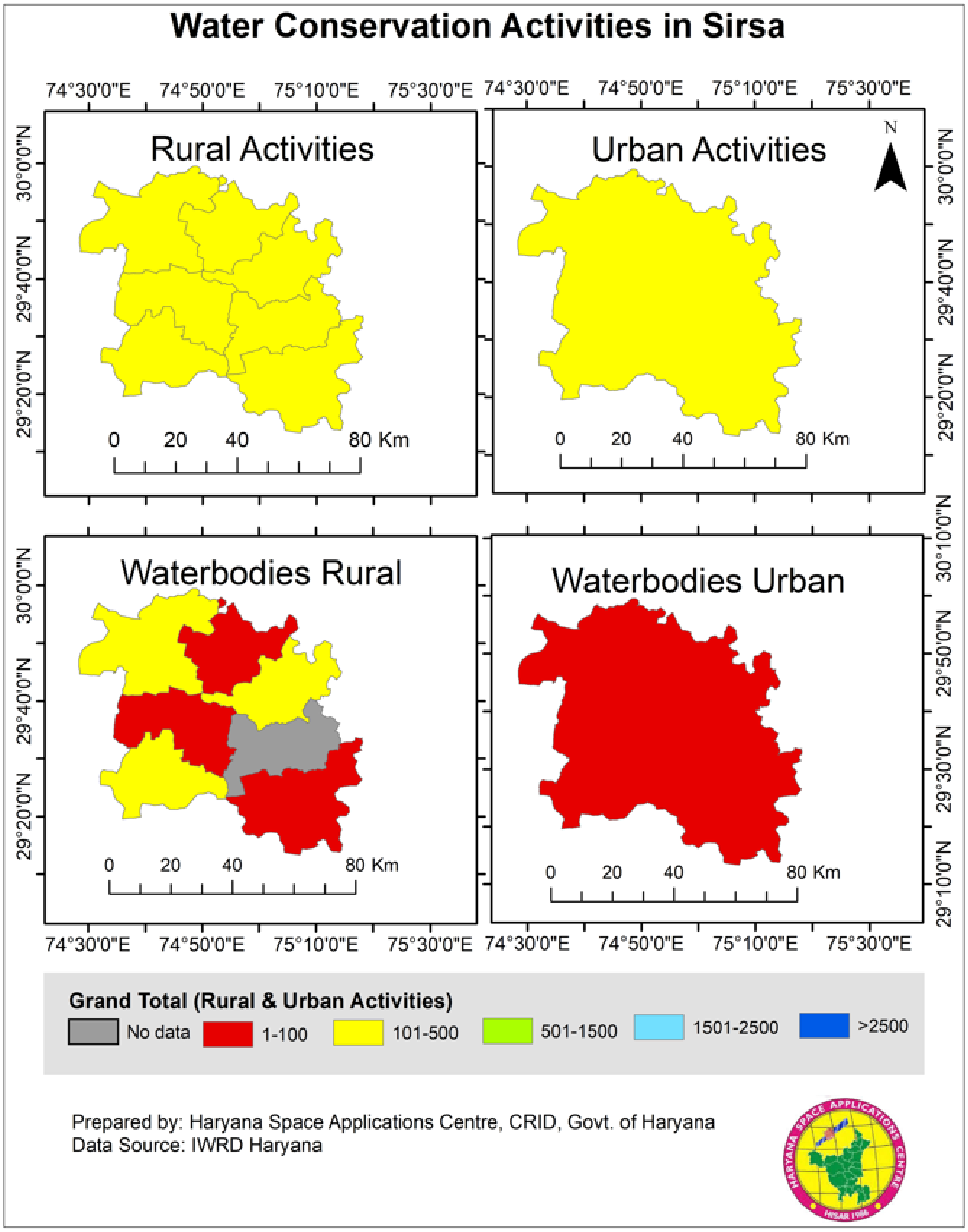


Figure 13 -Water Conservation Activity in Sirsa

2.2.4 Sewerage Treatment Plant

As sewage enters a plant for treatment, it flows through a screen, which removes large floating objects such as rags and sticks that might clog pipes or damage equipment. After sewage has been screened, it passes into a grit chamber, where cinders, sand, and small stones settle to the bottomThe sewerage treatment plant map is shown in **Figure No 14**. In Sirsa District a total of 4 treatment plant, and 2 Biomedical Waste Management sites are installed.

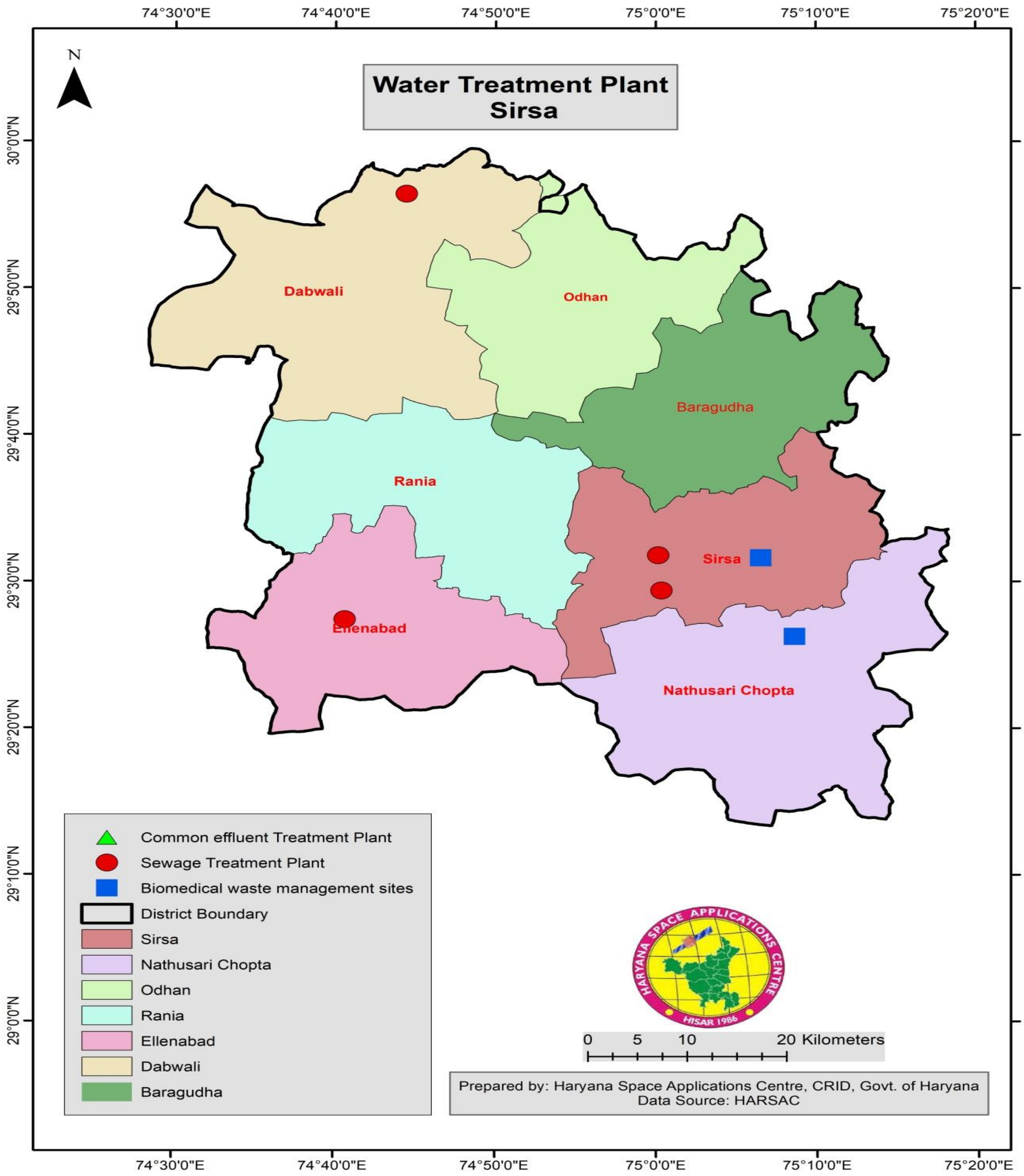


Figure 14- Water Treatment Plant of Sirsa District

3. Irrigation Profile

Total CCA 429081.8 ha in the district Sirsa. There are only two cropping seasons namely Kharif and Rabi in the district. Rabi crops have a share of 223122 ha, and Kharif crops have a share of 205959.8 ha. Paddy, Wheat and Cotton are the Major crops cultivated in kharif season. Wheat and Oil seeds including Groundnut, Til, Castor & Mustard are the Major crops cultivated in Rabi season. **Table 8** shows the Irrigation based classification in Sirsa.

Table 8 The Table shows the Irrigation based classification in Sirsa

District Sirsa				
Sr. No.	**Name of Block**	**Total CCA (In Ha)**	**Rabi**	**Kharif**
1	Baragudha	49456.68	25717.47	23739.21
2	Dabwali	76238.06	39643.79	36594.27
3	Ellenabad	72526.72	37713.89	34812.83
4	Nathusari Chopta	60783	31607.16	29175.84
5	Odhan	45058.7	23430.52	21628.18
6	Rania	60690.69	31559.16	29131.53
7	Sirsa	55904.86	29070.53	26834.33
	Total	**420658.7**	**218742.5**	**201916.2**

Existing Irrigation by canal cover in Sirsa, Gross command area is 467009 ha out of which 429081 ha is cultural command area. The total numbers of canals in the district are 137; with total length 1925.15 km. Irrigation in the district is done mainly by gravitational flow canal and irrigation system through the following canal networks.

3.1 Gravitational Irrigation

Gravity irrigation is the type of irrigation in which water is available at a higher level as to enable supply to the land by gravity flow.

Gross command area is 467009 ha out of which 429081 is cultural command area. The total numbers of canals in the district are 137; with total length 1925.15 km. Irrigation in the district is done mainly by gravitational flow canal and irrigation system through the following canal networks. **Table 9** shows the Major canals in Sirsa. And **Table 10** shows the canals falling under Bhakra System viz Bhakra Main Branch and Major canals in Sirsa.

Table 9 -The Table shows Major canals in Sirsa

Sr. No.	Name of Canal	Length (Km)	Discharge (Cs.)	GA (Ha)	CCA (Ha)	Major Crops
	B.M.B. System (Baliyala Head at RDs)					Rabi
	Bhakra Main Branch and its off take					
1		1420	3280	435363	401808	Wheat Barley Gram Oil Seed
	River Ghaggar System					Groundnut Vegetables
	SGC Unlined NGC Unlined Nimla Minor Ellenabad Dist. Kishanpura Minor Surera Minor					
1		505.15	5228	31646	27273	

Block	CCA (in Ha)	No. of Channels	Total length of Channels (In RFT)
Baragudha	49456.68	15	616985
Dabwali	76238.06	19	731996
Ellenabad	72526.72	32	872476
Nathusari Chopta	60783	18	618946
Odhan	45058.7	15	447767
Rania	60690.69	20	46000
Sirsa	55904.86	18	452386

Table 10- canals falling under Bhakra System viz Bhakra Main Branch and Major canals

4 Water Availability

4.1 Surface Water Availability

As per the data provided by Irrigation department for the year 2020-21, total annual water availability from canals was 1005.41 MCM. Dabwali block had the maximum share, followed by Nathusari Chopta block and Ellenabad block. **Table 11** shows the data provided by Irrigation department for the year 2020-21.

Table 11- data provided by Irrigation department for the year 2020-21

Sr. No.	Name of Block	Total No. of Villages	Volume of water for Agriculture		Volume of water for Public Health Tank		Volume of water for Pond filling		Volume of water for Industries/ Institutions		Volume of water for Power Plants	
			In Cusec days	In MCM	In Cusec days	In MCM	In Cusec days	In MCM	In Cusec days	In MCM	In Cusec days	In MCM
1	Baragudha	53	38954.14	95.25	3804.13	9.3	1372.5	3.36	0	0	0	0
2	Dabwali	51	76222.67	186.37	409.92	1	137.5	0.34	0	0	0	0
3	Ellenabad	45	67213.63	164.35	4377.45	10.7	463.28	1.13	0	0	0	0
4	Nathusari Chopta	63	66130	161.7	4551	11.13	733.26	1.79	0	0	0	0
5	Odhan	41	39984.61	97.77	947.6	2.32	217.5	0.53	99.36	0.24	0	0
6	Rania	48	42035.01	102.78	5045.2	12.34	1054.8	2.58	0	0	0	0
7	Sirsa	62	51134.33	125.03	5560.03	13.59	741.8	1.81	0	0	0	0
	Total	363	381674.4	933.24	24695.33	60.38	4720.64	11.54	99.36	0.24	0	0

In Addition to the above treated water from sewage treatment plants is also used for irrigation. There are six existing sewage treatment plants of capacities 10 MLD, 6.5 MLD & 10 MLD, in the towns of Odhan, Dabwali, Rania, Sirsa & Ellenabad. Therefore, annual water availability from sewage treatment plants is 9.6725 MCM. Share of surface water (Canals + STP) is 1078.11 MCM and Ground water is 74.84 MCM. **Table 12** shows the water availability of the Sirsa district.

Table 12- Table shows the Water availability of district.

Sr. No.	Block	Water Availability (MCM)				
		Canals	**Ground Water**	**Total Water**	**STP**	**Total**
1	Baragudha	107.91	12.04	119.95	0	119.95
2	Odhan	100.86	7.7	108.56	-4.2	104.36
3	Dabwali	187.71	8.08	195.79	-12.5	183.29
4	Rania	117.7	8.83	126.53	-6	120.53
5	Sirsa	140.44	13.19	153.63	-42.5	111.13
6	Nathusari Chopta	174.62	10.71	185.33	0	185.33
7	Ellenabad	176.18	14.29	190.47	-7.5	182.97
	Total	1005.41	74.84	1080.25	-72.7	1007.55

4.2 Ground Water Availability

The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. The area has both unconfined and confined aquifers. In general, the unconfined aquifers occur down to 60 m depth below ground level in the district. The alluvium acts as ground water reservoir and principal aquifer material comprises fine to medium sand and sand mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well-connected granular zones that have a pinching and swelling disposition and are quite extensive in nature. The ground water in unconfined condition is abstracted through hand pumps and shallow tube wells where as in deep and confined aquifer through medium and deep tube wells.

the thickness of the alluvium deposit varies from 200 to 300 m. The thickness of alluvial formation increases towards northwest. Perusal of the data of the exploratory tube well drilled in Ghaggar Basin indicate that tube wells tapping.

Water bearing zone with in 100 to 200 m depth yield 1500 lpm to 3000 lpm for draw down of 5 to 17 m. Aquifer parameters viz transmissivity (T), storativity (S), hydraulic conductivity (K) and yield (discharge) of the test well have been determined on the basis of Aquifer Performance Test (APT) conducted on exploratory wells. In the area, 11 exploratory boreholes down to a maximum depth of 306.71m were drilled to determine the aquifer parameters. The yield (discharge) of the test well ranges from 120 lpm to 3000 lpm with a drawdown of 3.66m to 17.47m. The transmissivity value of the aquifers ranged from 327 m^2 /day to 2600 m^2 /day. The hydraulic conductivity ranged from 5.83m to 83 m/day. The value of the storage coefficient worked out to be between 0.638 x 10-3 and 27 x 10-3. Shallow tube wells constructed in the district have discharge range between 300 and 1000 lpm with a drawdown of 1.0 to 3.5 m. Whereas, perusal of data of deeper tube well/ borewells constructed in

Ghaggar basin tapping water bearing zone in depth range 100 m to 260 m yield 1500 to 3000 lpm with 5 to 17 m of draw down. Hence it can be said that tube wells constructed in vicinity of Ghaggar river has enormous groundwater potential. The block wise ground water resource potential in the district has been assessed as per GEC-97in year 2009. Out of seven blocks five blocks namely Rania, Sirsa, Ns Chopta, Dabwali and Ellenabad are over exploited. Baragugha block is Critical and Odhan block is Semi Critical as per resource assessment year 2009.The stage of ground water development ranges between 98% (Baragudha) to 256% (Raina) in the district. The net ground water availability in the district is 754.52 MCM. The net ground water draft is 1164.10 MCM. District in **Fig 15** shows an overall 154% ground water development.

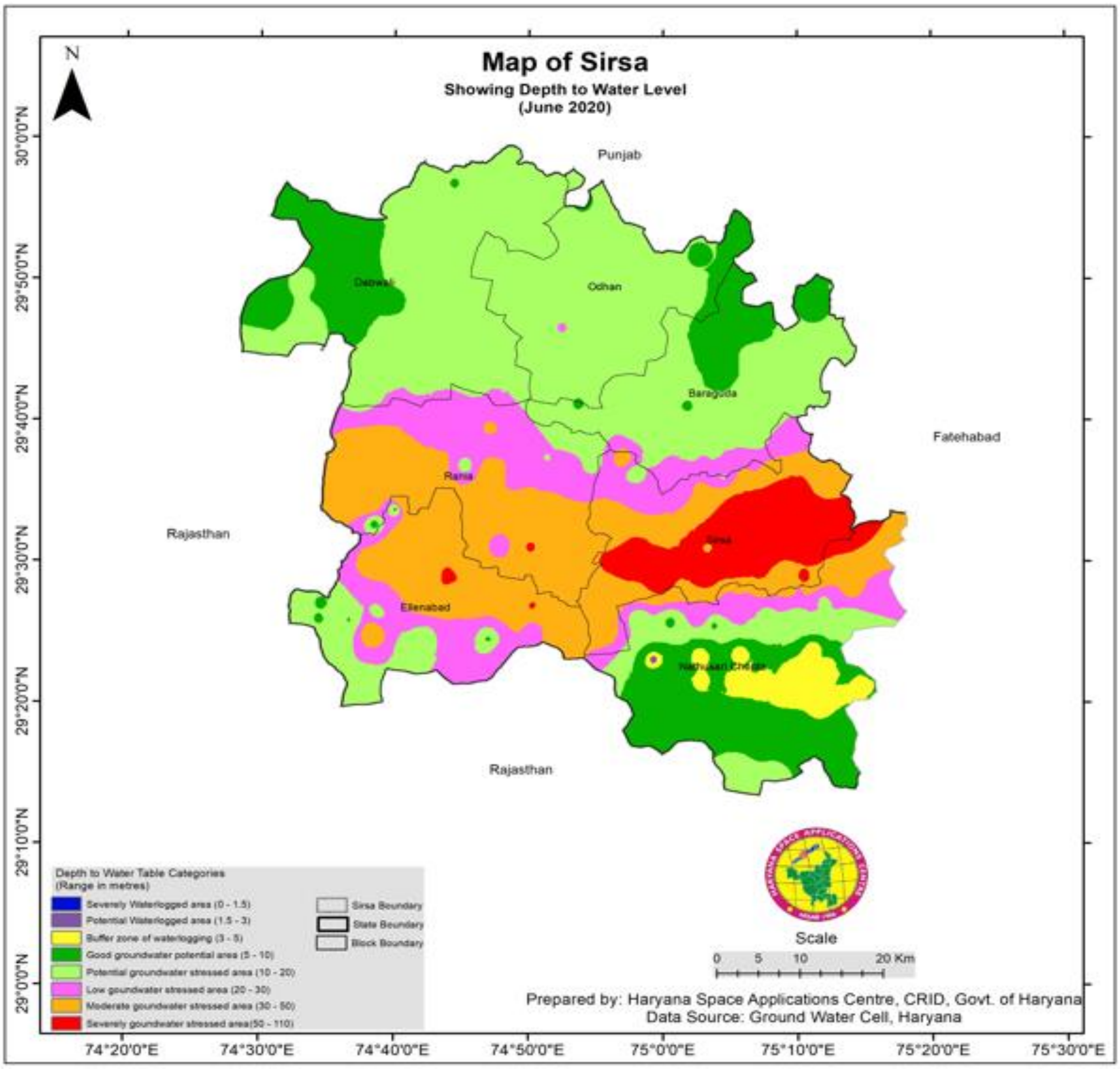


Figure 15- Ground water Availability Map of Sirsa District

According to the Central Ground Water Board the block wise ground water resource potential in the district has been given in **Table 13**. Out of seven blocks five blocks namely Rania, Sirsa, Ns Chopta, Dabwali and Ellenabad are over exploited. Baragugha block is Critical and Odhan block is Semi-Critical as per resource assessment year 2009.The stage of ground water development ranges between 98% (Baragudha) to 256% (Raina) in the district. The net ground water availability in the district is 754.52 MCM. The net ground water draft is 1164.10 MCM. District shows an overall 154% ground water development.

Table 13 -Ground water resource of Sirsa district according to Central Ground Water Board

Assessment Unit/Block	**Net Annual Ground Water Availability (Ha m)**	**Existing Gross Ground Water Draft for irrigation (Ha m)**	**Existing Gross Ground Water Draft for Domestic &Industrial water supply (Ha m)**	**Existing Gross Ground Water Draft for all uses (Ha m)**	**Allocation Domestic industrial up to next 25 years (Ha m)**	**Net GW Availability for future irrigation development (Ha m)**	**Stage of Groundwater Development**	**Category of the Block**
Baragudha	12041	11761	66	11827	79	201	98	Critical
Odhan	8088	19478	42	19520	42	-10832	225	OE
Dabwali	14285	21233	155	21388	155	-7103	150	OE
Rania	10717	11191	56	11247	56	-530	105	OE
Sirsa	7708	8145	40	8185	40	-477	106	Semi critical
Nathusari Chopta	8825	22498	137	22635	137	-13810	256	OE
Ellenabad	13188	21328	280	21608	280	-8420	164	OE
Total	**75452**	**115634**	**776**	**116410**	**789**	**-40971**	**154**	**OE**

4.2.1 Ground Water Quality

Centre Ground Water Board identified chemical quality of ground water from samples taken from hydrograph network stations in the district area. The results of chemical analysis of ground water samples in the phreatic aquifer (dug well zone) indicate that Ground water is alkaline in nature. Ground water is fresh to saline. The electrical conductivity is generally less than 1000µs/cm except at few places it ranges 94 to 6400 µs/cm at 250C. Nitrate is observed more than 45 mg/l at Mastain, Hassu, Mangian and Odhan. Iron range 1.02 to 8.91mg/l and more than permissible limits at Talwarakhurd (1.4), Madhosingham (1.02), Rupam (8.96), Gigorani (1.81) and Gosiana (8.91).

Arsenic concentration noted 0.0117 to 0.044 mg/l in groundwater. The suitability of groundwater for irrigation purpose in general ascertained by considering salinity, SAR and RSC values. Based upon the USSL classification for irrigation water it is found that groundwater of the district can be used for irrigation in well drained soils for salt tolerant crops such as wheat, maize etc. However, groundwater from Taruna and Ghuiana falls under C4S4 class of irrigation and is not fit for irrigation and its use may cause Salinity and sodium hazards. **Table 14** Shows the ground water quality period in June, 2020.

Table 14- Ground water Quality Period in June, 2020 of District Sirsa

Sr. No.	Block	Total Geo Area	Fresh	Sub Marginal	Marginal	Saline
			0-2000	**2000-4000**	**4000-6000**	**>-6000**
1	Baragudha	52091	6228	14722	5764	3602
2	Odhan	49022	5724	16879	19814	6605
3	Dabwali	83892	15627	99609	20562	18094
4	Rania	57546	13435	30228	11196	2687
5	Sirsa	57720	15891	33792	6758	1279
6	Nathusari Chopta	72394	6752	32821	13128	19693
7	Ellenabad	54935	20353	25216	5764	3602
	Total	**427600**	**84010**	**183267**	**100773**	**59550**

Water quality ranges from 0-45 is good, 45-60 is fair and >60 is very poor quality of water. So, based on that Sirsa district's water quality varies from good to poor (**Figure 16**) for the whole district. Whereas block wise water quality index value is shown in **Table 15**.

Table 15- Block wise average water quality index value in Sirsa District

Block Name	Average Water Quality Index Value
Baragudha	172.4685
Dabwali	234.6766
Ellenabad	299.4515
Nathusari Chopta	84.94363
Odhan	320.4179
Rania	135.2214
Sirsa	84.04897

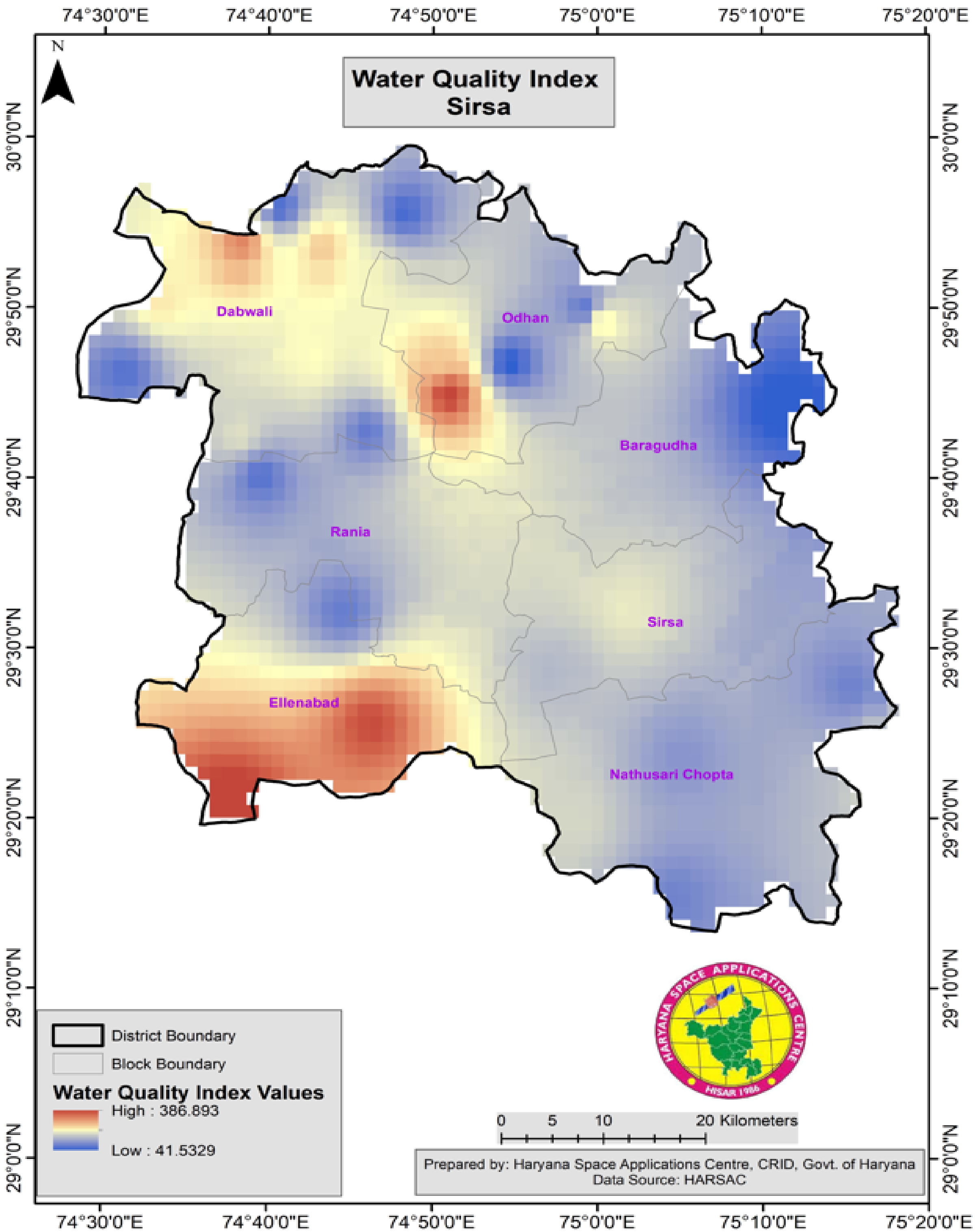


Figure 16- Water quality index of Sirsa District

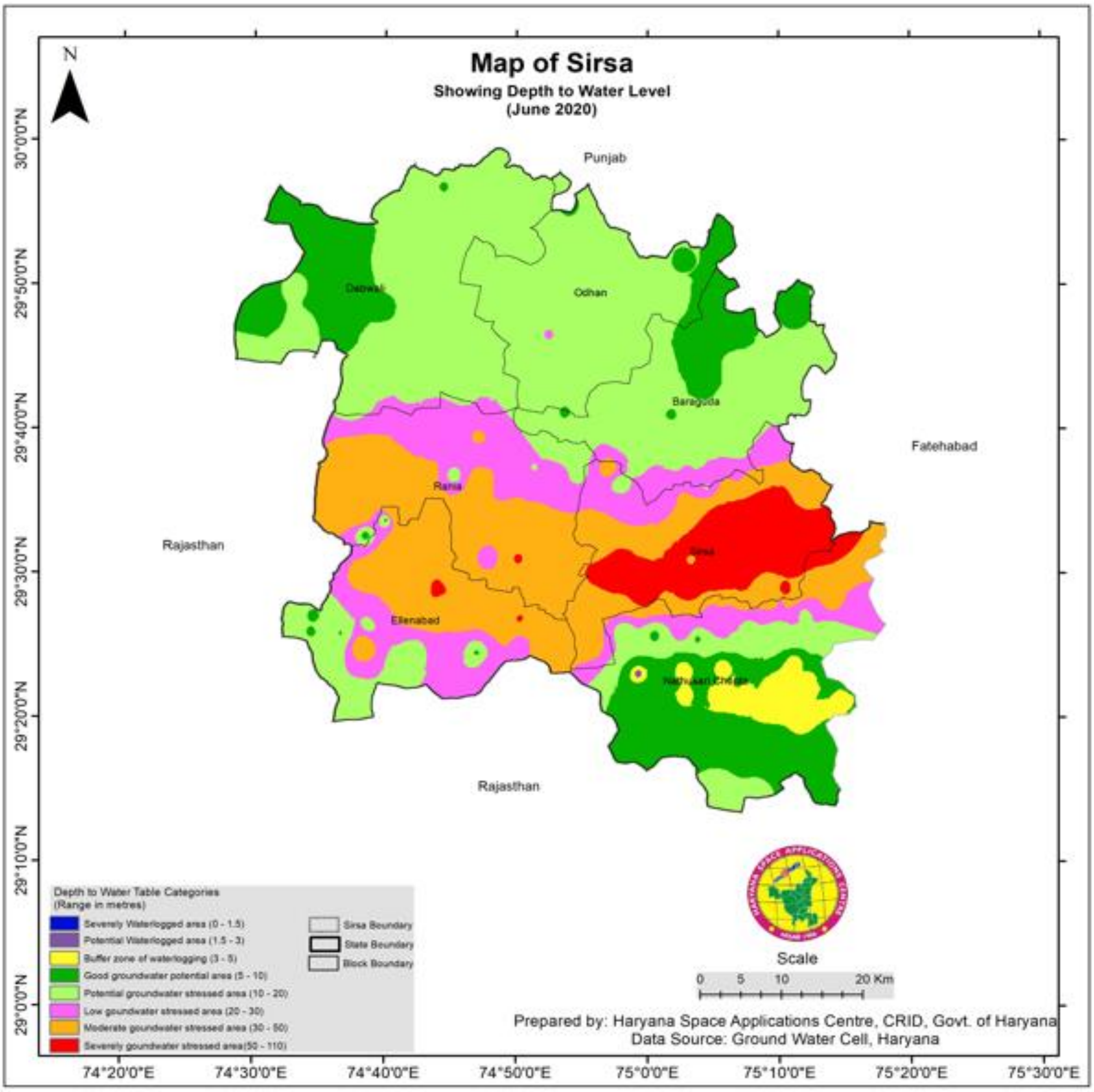


Figure 17- Ground water Availability Map of Sirsa District

According to the Central Ground Water Board the block wise ground water resource potential in the district has been assessed as per GEC-97 in year 2009. Out of seven blocks five blocks namely Rania, Sirsa, NsChopta, Dabwali and Ellenabad are over exploited. Baragugha block is Critical and Odhan block is Semi-Critical as per resource assessment year 2009.The stage of ground water development ranges between 98% (Baragudha) to 256% (Raina) in the district. The net ground water availability in **Figure 17** in the district is 754.52 MCM. The net ground water draft is 1164.10 MCM. The **Table 16** shows the district shows an overall 154% ground water development.

Table 16- Ground water resource of Sirsa district according to Central Ground Water Board

Assessment Unit/Block	Net Annual Ground Water Availability (Ha m)	Existing Gross Ground Water Draft for irrigation (Ha m)	Existing Gross Ground Water Draft for Domestic &Industrial water supply (Ha m)	Existing Gross Ground Water Draft for all uses (Ha m)	Allocation Domestic industrial up to next 25 years (Ha m)	Net GW Availability for future irrigation development (Ha m)	Stage of Groundwater Development	Category of the Block
Baragudha	12041	11761	66	11827	79	201	98	Critical
Odhan	8088	19478	42	19520	42	-10832	225	OE
Dabwali	14285	21233	155	21388	155	-7103	150	OE
Rania	10717	11191	56	11247	56	-530	105	OE
Sirsa	7708	8145	40	8185	40	-477	106	Semi critical
Nathusari Chopta	8825	22498	137	22635	137	-13810	256	OE
Ellenabad	13188	21328	280	21608	280	-8420	164	OE
Total	75452	115634	776	116410	789	-40971	154	OE

5 Aquifer System

An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt). Groundwater from aquifers can be extracted using a water well. The study of water flow in aquifers and the characterization of aquifers is called hydrogeology. An aquifer can be a confined and unconfined.

A confined aquifer is an aquifer below the land surface that is saturated with water. Layers of impermeable material are both above and below the aquifer, causing it to be under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer.

An unconfined aquifer is an aquifer whose upper water surface (water table) is at atmospheric pressure, and thus is able to rise and fall. Water-table aquifers are usually closer to the Earth's surface than confined aquifers are, and as such are impacted by drought conditions sooner than confined aquifers. **Table 17 and Table 18** below shows the block wise in storage fresh ground water resources and storage saline ground water resources in unconfined single aquifer system up to the Fresh-Saline Interface. and **Table 19** shows the block wise total available Ground water resources in Aquifer up to 300 m Depth.

Table 17 -Block Wise in storage Fresh Ground Water Resources in Unconfined Single Aquifer System up to the Fresh-Saline Interface

Name of Assessment Unit	**Type of rock formation**	**Areal extent (sq km)**		**Fresh-Saline Interface (m bgl)**	**Average Pre-monsoon Water Level (m bgl)**	**Total Thickness of formation below Pre-monsoon Water Level up to Fresh-Saline Interface (m) (5-6)**	**Thickness of the Granular Zone below Pre-monsoon WL up to Fresh Saline Interface (Fresh) (m)**	**Average Specific Yield**	**In-Storage Ground Water Resources [4*8*9] FRESH (m cm)**
Resource Estimation		**Total Geo-graphical Area**	**Fresh Water Area**						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Baraguda	Alluvium	520.91	483.82	105	7	98	57.45	0.072	2001.3
Dabwali	Alluvium	838.92	661.42	78	10.28	67.72	30.87	0.072	1470.1
Ellenabad	Alluvium	549.35	479.74	175	16.5	158.5	67	0.072	2314.3
N S Chopta	Alluvium	723.94	554.07	100	10	90	6	0.072	239.36
Odhan	Alluvium	490.22	326.18	90	10.85	79.15	33	0.072	775
Rania	Alluvium	575.46	446.53	100	18.51	81.49	46.76	0.072	1503.3
Sirsa	Alluvium	577.2	577.2	105	28	77	39	0.072	1620.8
Distt. Total		8552	3529						9924.1

Table 18 Block Wise in storage Saline Ground Water Resources in Unconfined Single Aquifer System up to the Fresh-Saline Interface

Name of Assessment t Unit	Type of rock formation	Areal extent (sq km)		Fresh-Saline Interface (m bgl)	Average Pre-monsoon Water Level	Total Thickness of formation below Pre-monsoon Water Level/Fresh-Saline Interface	Thickness of the Granular Zone below	Average Specific Yield	In-Storage Ground Water Resources [4*8*9] BRACKISH
							Pre- monsoon WL/Fresh Saline		/ SALINE
		Total Geo-graphical Area	Brackish		(m bgl)	(m) (5-6)	Interface (Saline) (m)		(mcm)
			/Saline Water						
1	2	3	4	5	6	7	8	9	10
Baraguda	Alluvium	520.91	37.09	105	7	98	57.45	0.072	153.42
Dabwali	Alluvium	838.92	177.5	78	10.28	67.72	30.87	0.072	394.52
Ellenabad	Alluvium	549.35	69.61	175	16.5	158.5	67	0.072	335.8
N S Chopta	Alluvium	723.94	169.87	100	10	90	6	0.072	73.38
Odhan	Alluvium	490.22	164.04	90	10.85	79.15	33	0.072	389.76
Rania	Alluvium	575.46	128.93	100	18.51	81.49	46.76	0.072	434.07
Sirsa	Alluvium	577.2	0	105	28	77	39	0.072	0
Distt. Total		8552	577.17						1781

Table 19- Block Wise Total Available Ground Water Resources in Aquifer up to 300m Depth

Assessment t Unit/Block	**Dynamic Ground water Resource s (2013)**	**In-storage Groundwater r Resources UPTO FRESH WATER ZONE**	**Total Groundwater Resources up to Avg. Depth of Fresh Water zone**	**Total Saline Groundwater Resources up to the depth of**	**Total Availability of Fresh and Saline Groundwater**	**Volume of**	**Unsaturated Zone (in m)**
			[(2) +(3)]	**wells available in**	**Resource s**	**Unsaturated Granular Zones**	
				each block	**[(4) +(5)]**	**(Above Water Level) for Natural Recharge (Considered below**	
						3m bgl to WL)	
1	2	3	4	5	6	7	8
Baraguda	118.1	2001.27	2119.37	1391.1	3510.47	93.76	1.5
Dabwali	94.98	1470.1	1565.08	10789.74	12354.82	302.01	3
Ellenabad	125.83	2314.27	2440.1	2590.33	5030.43	395.53	6
Ns Chopta	90.34	239.36	329.7	6484.6	6814.29	0	0
Odhan	63.06	775	838.06	2521.63	3359.69	185.3	3.15
Rania	55.87	1503.34	1559.21	3168.66	4727.87	331.46	4.8
Sirsa	88.6	1620.78	1709.38	1205.19	2914.57	865.8	12.5
							0
Total	636.78	9924.12	10560.9	28151.25	38712.1	2173.88	

6 Water Requirement/ Demand

The earlier Chapters deals with the general profile, water profile and water availability in Sirsa district. The present chapter deals with the current (2016) and projected (2022) demand for water from various sectors. The demand has been worked out on the basis of data collected from different departments which has already been presented in previous chapters. The unit for volume of water has been chosen as million cubic meters (MCM) instead of Billion cubic meters as suggested in the guidelines. **Table 20** shows the Present domestic water demand in 2020.

To assess present population (2011) and future population (2022), an annual growth rate of 1.685% is assumed, based on the decadal growth in population from census 2001 to census 2011. To assess water demand, requirement of 100 lpcd for rural and 140 lpcd for urban are assumed.

Table 20- Present Domestic Water Demand (2020)

Block	Expected Population (2022)			Present Gross Water Demand inMCM		
	Rural	Urban	Total	Rural	Urban	Total
Baragudha	133328	0	**133328**	4.86	0	**4.86**
Odhan	123630	23411	**147040**	4.51	0.85	**5.36**
Dabwali	194760	61597	**256357**	7.10	2.25	**9.35**
Rania	153969	29268	**183237**	5.62	1.07	**6.68**
Sirsa	193654	212654	**406309**	7.06	7.76	**14.82**
Nathusari Chopta	190994	0	**190994**	6.97	0	**6.97**
Ellenabad	146636	0	**146636**	5.35	0	**5.35**
Total	**1136971**	**326930**	**1463902**	**41.47**	**11.92**	**53.39**

It can be observed that total present domestic water demand is 53.39 MCM. The share of water demand from rural areas is 41.47 MCM (i.e., 77.67%), and from urban areas is 11.92 MCM (i.e., 22.33%). **Table 21** shows the projected domestic water demand in 2022.

Table 21- Projected Domestic Water Demand (2022)

Block	Expected Population (2022)			Present Gross Water Demand in MCM		
	Rural	Urban	Total	Rural	Urban	Total
Baragudha	137821	0	**137821**	5.02	0	**5.02**
Odhan	127796	24200	**151996**	4.66	0.88	**5.54**
Dabwali	201323	63673	**264996**	7.34	2.33	**10.56**
Rania	159158	30254	**189412**	5.81	1.11	**6.92**
Sirsa	200180	219820	**420001**	7.30	8.02	**15.32**

Nathusari Chopta	197430	0	**197430**	7.20	0	**22.23**
Ellenabad	151578	0	**151578**	5.53	0	**5.53**
Total	**1175287**	**337948**	**1513234**	**42.87**	**12.332**	**55.20**

6.1 Water Supply and Gap

It has been assumed that water potential required is equal to the total crop water demand of cultivated area, while the existing water potential is equal to crop water requirement of irrigated area. It can be observed that water potential to be created is to the tune of 14.72 MCM for Sirsa district. The crop water requirement includes all losses like: a) Transpiration loss through leaves (T), b) Evaporation loss through soil surface in cropped area (E) c) Amount of weather used by plants (WP) for its metabolic activities which is estimated as less than 1% of the total water absorption) Other application losses are conveyance loss, percolation loss, runoff loss, etc., (WL). e) The water required for special purposes (WSP) like puddling, operation, ploughing operation, land preparation, leaching, requirement, for the purpose of weeding, for dissolving fertilizer and chemical, etc. Hence the water requirement is symbolically represented as Water demand of different crops (agriculture + horticulture) has been worked out based on the area under different crops. Water demand of different crops (agriculture + horticulture) has been worked out based on the area under different crops. Below **Table 22** shows the Crop Water Demand in (2022). **Figure 18** shows the Block wise water under JSA and **Figure 19** shows the sector wise water demand under JSA.

Table 22 -Crop Water Demand (2022)

Sr. No.	Name of Block	Total No. of Villages	Volume of water for Agriculture (Cusec days)	
			In cusec days	In MCM
1	Baragudha	53	38954.14	95.25
2	Dabwali	51	76222.67	186.37
3	Ellenabad	45	67213.63	164.35
4	Nathusari Chopta	63	66130	161.70
5	Odhan	41	39984.61	97.77
6	Rania	48	42035.01	102.78
7	Sirsa	62	51134.33	125.03
	Total	363	381674	933.24

In Sirsa, water is required for domestic use, crop irrigation, and livestock drinking purpose, industrial use, and power generation. Total present annual water demand for district Sirsa is 1005.40 MCM. Maximum water is required for irrigation use (933.24 MCM), followed by domestic use (60.38 MCM), livestock (11.54 MCM), industry (0.24 MCM) and least for power generation. Below **Table 23** shows the total water demand for various sector.

Table 23- Total water demand for various sector

BLOCK	Sector-wise water demand					Total (MCM)
	Domestic (MCM)	Crop (MCM)	Livestock (MCM)	Industries (MCM)	Power (MCM)	
Baragudha	9.30	95.25	3.36	0	0	107.91
Dabwali	1.0	186.37	0.34	0	0	187.71
Ellenabad	10.7	164.35	1.13	0	0	176.18
Nathusari Chopta	11.13	161.70	1.79	0	0	174.62
Odhan	2.32	97.77	0.53	0. 24	0	100.86
Rania	12.34	102.78	2.58	0	0	117.70
Sirsa	13.59	125.03	1.81	0	0	140.43
TOTAL	60.38	933.24	11.54	0.244	0	1005.40

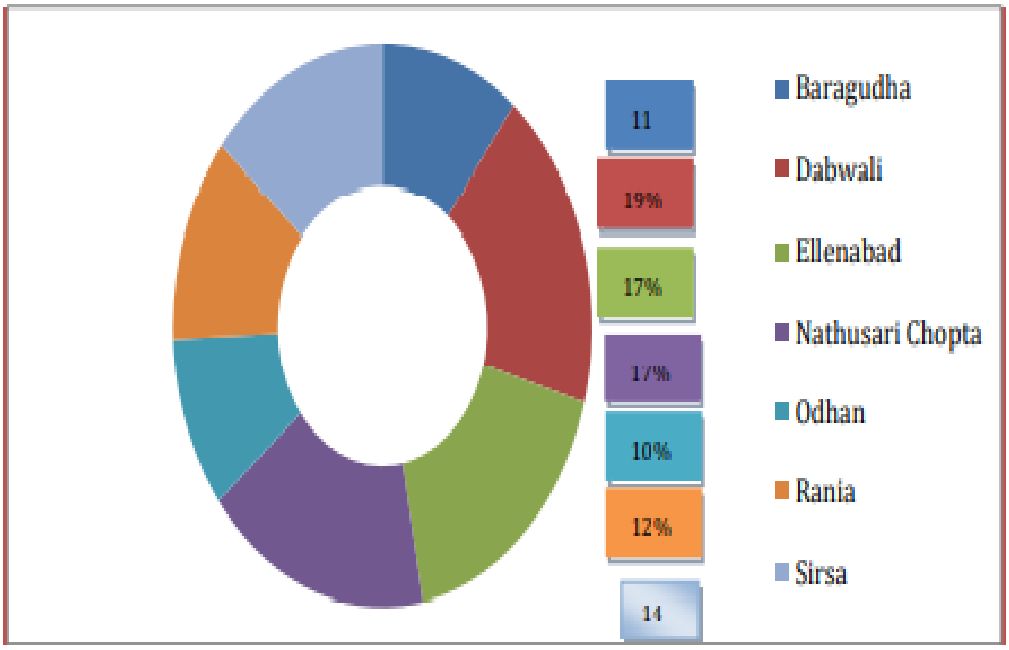


Figure 18 -block wise water under JSA

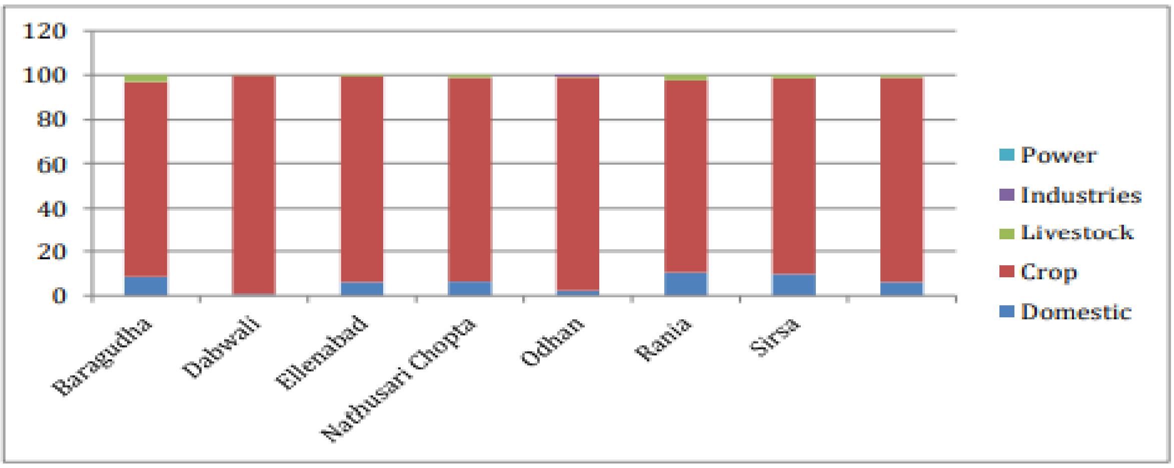


Figure 19- Sector wise water under JSA

The projected water demand in the district at the end of year 2022 will be 1024 MCM which is 18.59 MCM higher than the current water demand in the district. The major sector which forms the major part of projected water demand in the district is Agriculture where the crop water requirement is projected to be 933.24 MCM. It can be inferred that major demand of water comes from Agriculture. We need to work over shifting from water intensive crops to less water consuming crops like bajra, jowar etc. **Table 24** shows the Sector wise water demand for various sectors and **Figure 20** shows the Block wise Projected water demand for various sector.

Table 24 -Sector wise water demand for various sectors

Sector-wise water demand (2022)						
Block	**Domestic (MCM)**	**Crop (MCM)**	**Livestock (MCM)**	**Industries (MCM)**	**Power (MCM)**	**Total**
Barwala	9.47	97.00	3.42	0	0	109.79
Dabwali	1.02	189.81	0.35	0	0	191.18
Ellenabad	10.90	167.39	1.15	0	0	179.44
Nathusari Chopta	11.33	164.69	1.82	0	0	177.84
Odhan	2.36	99.58	0.54	0.25	0	102.73
Rania	12.56	104.68	2.63	0	0	119.87
Sirsa	13.84	127.34	1.84	0	0	143.02
TOTAL	**61.48**	**950.49**	**11.75**	**0.25**	**0**	**1023.97**

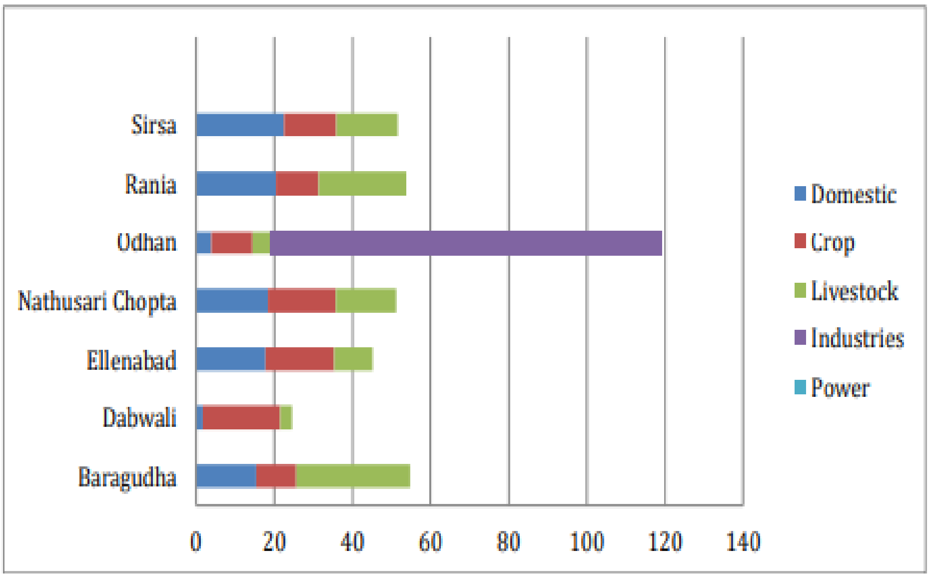


Figure 20 - Block wise Projected water demand for various sector

6.2 Water Budget

A total of 1005.40 MCM surface water and 74.84 MCM ground water is available in Sirsa district. It can be observed that based on present and projected water demand (2022), and present water availability (surface & ground), the present water gap is to the tune of 1005.4 MCM, and projected water gap (2022) is to the tune of 1024 MCM. **Table 25** shows Water Budget (Volume in MCM**).**

Table 25 -Water Budget (Volume in MCM)

Name of Block	Existing water availability/Usage (MCM)		Total (MCM)	STP	Total	Water Demand (MCM)		Water Gap (MCM)	
	Surface Water	Ground Water				Present	Projected (2022)	Present	Projected (2022)
Barwala	107.91	12.04	119.95	0.00	119.95	119.95	109.8	12.04	10.16
Dabwali	187.71	8.08	195.79	-12.50	183.29	183.29	191.2	8.08	4.61
Ellenabad	176.18	14.29	190.47	-7.5	182.97	182.97	179.4	14.29	11.03
Nathusari Chopta	174.62	10.71	185.33	0	185.33	185.33	177.8	10.71	7.49
Odhan	100.86	7.7	108.56	-4.20	104.36	104.36	102.7	7.7	5.83
Rania	117.7	8.83	126.53	-6	120.53	120.53	119.9	8.83	6.66
Sirsa	140.44	13.19	153.63	-42.5	111.13	111.13	143	13.2	10.61
TOTAL	**1005.4**	**74.84**	**1080.3**	**-72.70**	**1007.56**	**1007.6**	**1024**	**74.85**	**56.39**

7 Strategies for Water Conservation

Process of conservation may be synonymous of preservation against loss or waste. Briefly stated it means putting the water resources of the country for the best beneficial use with all the technologies at our command. Water conservation basically aims at matching demand and supply. The strategies for water conservation may be demand oriented or supply oriented and/or management oriented. The strategies may vary depending upon the field of water use, domestic, irrigation or industrial use. Here are some of the water conservation technologies for Sirsa District.

1) **Rainwater harvesting-** Rainwater harvesting essentially means collecting rainwater on the roofs of building and storing it underground for later use. Not only does this recharging arrest groundwater depletion, it also raises the declining water table and can help augment water supply. Rainwater harvesting and artificial recharging are becoming very important issues. It is essential to stop the decline in groundwater levels, arrest seawater ingress, i.e., prevent seawater from moving landward, and conserve surface water run-off during the rainy season.

2) **Better Irrigation Practices**- In Sirsa District Conservation of water in the agricultural sector is essential since water is necessary for the growth of plants and crops. A depleting water table and a rise in salinity due to over use of chemical fertilizers and pesticides has made matters serious. Various methods of water harvesting and recharging have been and are being applied all over the world to tackle the problem. In areas where rainfall is low and water is scarce, the local people have used simple techniques that are suited to their region and reduce the demand for water. For crop irrigation, optimal water efficiency means minimizing losses due to evaporation, run off or subsurface drainage. An evaporation pan can be used to determine how much water is required to irrigate the land. Flood irrigation, the oldest and most common type, is often very uneven in distribution, as parts of a field may receive excess water in order to deliver sufficient quantities to other parts. Overhead irrigation, using centre-pivot or lateral-moving sprinklers, gives a much more equal and controlled distribution pattern. Drip irrigation is the most expensive and least-used type, but offers the best results in delivering water to 48 plant roots with minimal losses. Surface water through Ghaggar River is utilized for irrigation as well as Ground Water Recharge. Moreover drip & sprinkler irrigation are being implement by MICADA, Sirsa and being promoted under Atal Bhujbal Yojana in Ellenabad and Rania Block of District Sirsa.

3) **Use of Saline Water for Irrigation-** Saline water is widely available but rarely used for agriculture because it restricts plant growth and yield. Salt resistant varieties of crops have also been developed in recent times. The barrel land in Sirsa due to rise in saline water level, have been utilized through crop diversification for some fisheries out of 785 acres of land for fisheries 400-acre area is in Sirsa through Pradhan Mantri Matsya Sampada Yojana with the assistance of Fishery Department. Further promoted to increase the outreach of the benefits to farmers.

4) **Soak pit construction-** Water run offs and water logging are combated by constructing soak pits near water points like hand pumps. This is a sanitation measure and also helps in recharge of groundwater. Under JSA target of construction of 948 Soak Pit was given to each and every block of Sirsa District but 1161 were completed.

5) **Tree plantation** in water catchments area/riverbanks and clean-up drives near water bodies are some of the other initiatives taken up to preserve our water resources. In Sirsa District 878966 trees planted against target fixed by State head quarter i.e., 869920.

6) **Desalination-** To augment the depletion of fresh water resources in coastal areas due to excessive abstraction, desalination like distillation, electro-dialysis and reverse osmosis are available. Selection and use of these processes is site specific.

7) **Long Distance Transfer of Water-** Transfer of water from surplus basins by creating storage at appropriate locations and interlinking various systems is yet another strategy for increasing the benefits considerably.

PUBLIC EDUCATION & AWARENESS: Various community meeting for better awareness under JSA and Atal Bhujal Yojana are being conducted in Gram Panchayat, School programs and Rat Yatra are also conducted for knowledge dissemination of water efficient practices.

1) There is need for public awareness regarding water conservation. Jal Shakti Abhiyan has been designed to achieve greater public participation. Local communities need to be mobilized to play a vital role in efforts being undertaken under JSA.

2) To engage greater public participation steps taken through RWAs, schools, businesses, Civil Society Organizations (CSOs), Nehru Yuva Kendras (NYKs), NSS volunteers, NCC cadets, SHGs, elected representatives to organize door to door outreach, community events, workshops, flyers, banners, wall paintings, street plays, social media, etc. for dissemination and building awareness for all four enlisted Water Conservation measures. Leading personalities in films, sports, social work or public life invited for campaigns.

3) Twitter account created to post JSA daily awareness, radio Jingle started, Radio interview with scientist and agriculturist, TARU Yatra, Nukkad Natak, PRABHAT PHERIS, PAUDHGIRI (tree plantation by children 6-12 years), wall painting etc. started. Water conservation best activates of GP/ CD Blocks/ District were celebrated at each level. Seven MARATHON has been organized for forestation and water conservation in these hundreds of persons participated.

4) Furthermore, bottom-up approach is used for future planning of Water Conservation Structure.

7.1 Artificial Recharge

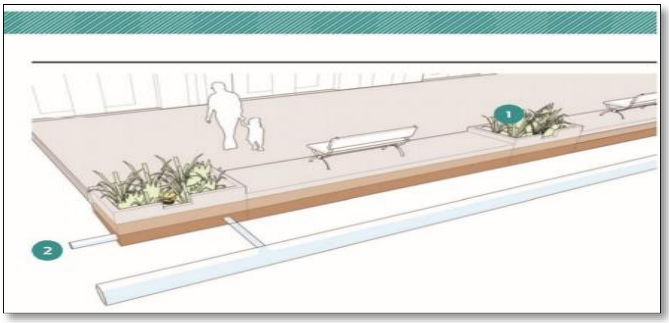
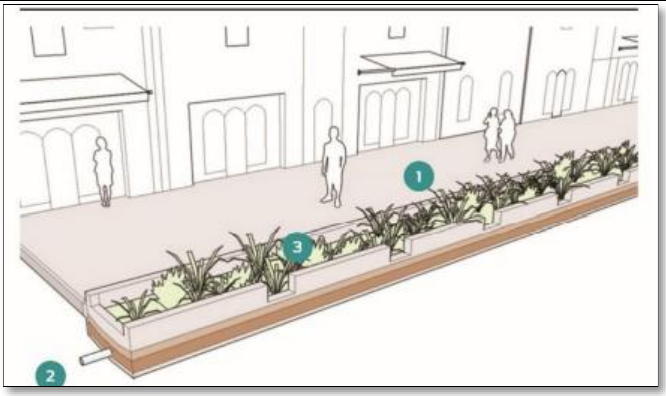
Artificial recharge to ground water is defined as the recharge that occurs when the natural pattern of recharge is deliberately modified to increase recharge. The process of recharge itself is not artificial. The same physical laws govern recharge, whether it occurs under natural or artificial conditions. What is artificial is the availability of water supply at a particular location and a particular time. In the broadest sense one can define artificial recharge as "any procedure, which introduces water in a pervious stratum". The term artificial recharge refers to transfer of surface water to the aquifer by human interference. The natural process of recharging the aquifers is accelerated through percolation of stored or flowing surface water, which otherwise does not percolate into the aquifers.

Artificial recharge is also defined as the process by which ground water is augmented at a rate exceeding that under natural condition of replenishment. Therefore, any man-made facility that adds water to an aquifer may be considered as artificial recharge**).** Artificial recharge aims at augmenting the natural replenishment of ground water storage by some method of construction, spreading of water, or by artificially changing natural conditions. It is useful for reducing overdraft, conserving surface run-off, and increasing available ground water supplies. Recharge may be incidental or deliberate, depending on whether or not it is a by-product of normal water utilization. Artificial recharge can also be defined as a process of induced replenishment of the ground water reservoir by human activities. The process of supplementing may be either planned such as storing water in pits, tanks etc. for feeding the aquifer or unplanned and incidental to human activities like applied irrigation, leakages from pipes etc**.**

7.2 Water Sensitive Urban Design

As more and more portions of the district become urbanised, it is crucial to integrate water sensitive urban design into planning of the major upcoming clusters of towns and cities that are in the satellite of the main city of Sirsa. Water Sensitive Urban Design (WSUD) is a familiar concept for engineers and architects practicing and in the face of overwhelming environmental changes brought in by climate change. A major part of WSUD also allows us as a society to grow more resilient towards more intensive changes in rainfall patterns, as they grow more intensive, however much scarce in terms of frequency. Following **Table 26** shows the methods of water table recharge strategies in urban.

Table 26 the methods of water table recharge strategies in urban

Sr. No.	Method	Image
1	**Flow Through Planters**	 
2	**Pervious Strips**	

3	**Pervious Pavement**	 
4	**Stormwater Tree**	

7.3 Plantation (wasteland map)

A major portion of WSUD that is popular within the Government Departments is plantation of various species of plants, both in public and private spaces, to encourage community participation and increase green cover. While increasing the aesthetic value of a location, plants are heavily influential to change microclimates and in fact playing a factor to rainfall patterns. Along with benefits of carbon sequestration, they contribute to increasing the local biodiversity of the region by attracting several types of fauna as well. Currently a multi-departmental approach within Sirsa is being undertaken both within and outside of government with the engagement of several active citizen stakeholders and non-governmental organisations. Geo-tagging of these plantations and survival monitoring would be undertaken actively by engagement of the mentioned stakeholders. The wasteland that could be used for plantation for conservation of water in Sirsa district is shown in **Figure 21** and **Table 27** shows the wasteland stats in Sirsa District.

Table 27 Wasteland Stats of Sirsa District

Block Name	Wasteland Area (sq feet)	Plantation at 5 feet spacing
Sirsa	8561264.7	1712253
Baragudha	15148662.4	3029732
Dabwali	17610724.63	3522145
Ellenabad	19787054.18	3957411
Nathusari Chopta	27809380.05	5561876
Odhan	9809013.87	1961803
Rania	15936222.91	3187245
Total	**114662322.7**	**22932464.55**

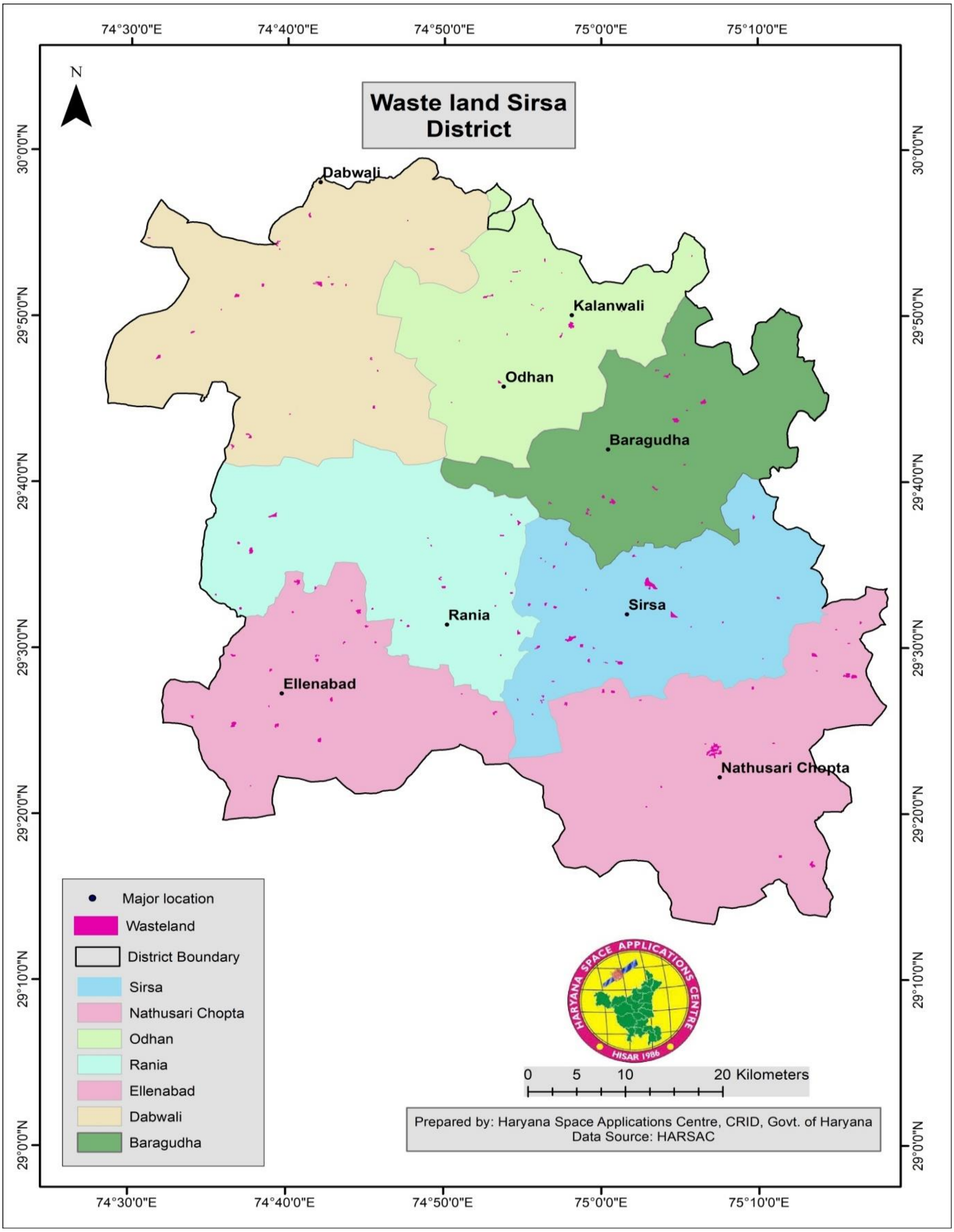


Figure 21- Wasteland Map of Sirsa District

7.4 Surface water management

7.4.1 Pond restoration and rejuvenation

The number of surface water bodies such as ponds and lakes are continuously disappearing from the landscape. However, their preservation, restoration and rejuvenation would be essential to not only survival of biodiversity, but also to maintain microclimates, and ultimately essential to preserve human civilisation.

Rejuvenation of ponds helps in recharge of Ground Water aquifers. In Sirsa District 760 ponds rejuvenated against 750 ponds target fixed by State Headquarter by Irrigation & panchayat raj Department. In future planning of rejuvenation of pond will be done next year. Rejuvenation of traditional water infrastructure- Abandoned bore well were cleaned and made functional for artificial ground water recharge. 158 completed against 130 targets fixed by State Headquarter. As such ponds demonstratively serve as an essential structure for water security. Although it serves to only hold a relatively small volume of water, the stored water becomes vital for food security and economic stability within a small community.

Ponds are also essential structures that provide water security in areas where groundwater has grown extremely saline and cannot be used for irrigation purposes. Irrigation channels have been built in such areas during the Green Revolution in these areas in order to meet irrigation demands in this region. However, in order to supply to the increasing demands of high yield production, a lot of pressure has been put on the agriculture industry, as a result of which freshwater demand has increased. The original channels are therefore not sufficient to meet the current water demands. Without accesses to enough water, structures such as ponds become of essential service to allow for agriculture to be sustained in areas of water scarcity.

These traditional water bodies are what saved drought hit villages from the brink of extinction and starvation in the great spell of droughts that the nation faced in the 1970's. Examples led by pioneers such as Anna Hazare and P R Mishra who revolutionised and reinstated the importance of having water storage and wise utilisation for increasing crop yield have served as models for reviving these traditional lifelines within the rural eco-system, while setting important benchmarks for its urban counterparts. Culturally, due to its life-sustaining properties, ponds have also been the centres or natural hubs for monthly or annual fairs to be held, and have been biodiversity hotspots that encourage the link between human and wildlife.

Therefore, ponds form a fundamental part of the hydrological cycle in the environment and has allowed a rich cultural, agricultural and societal practices to flourish in India Since ponds can be formed in a much broader range of environments and landscapes, they demonstrate a wide range of physiochemical activities that allows a wide range of flora and fauna to flourish. Currently Sirsa has a gap of 32 MLD of untreated wastewater, according the National Green Tribunal Status Report of February 2020 on Yamuna Action Plan that is being discharged directly into the Najafgarh Drain, that directly drains into the Yamuna River. However, the ground reality suggests that there are a lot of unmapped points of discharge of wastewater that pollute the local waterbodies. These localized incidents of pollution of water bodies contribute to the loss of biodiversity and pose a threat to water security. In the recent years, it has been realized that wastewater may be an essential commodity and tool that may be used to close the demand supply gap and augment freshwater supply.

In order for pond restoration and rejuvenation to be done in a scientific and methodical manner, following a 11-step procedure that is accommodative of each individual pond site requirements are given below

1. Pond Identification and Pond profiling

2. Project Feasibility Assessment

3. Administrative Approvals (Demarcation, GIS mapping, and Panchayat Resolution)

4. Detailed Project Report

5. Financial Approval

6. Community Mobilization

7. Cleaning and Levelling

8. Civil Work, Micro-STP Installation and Waste Management

9. Landscaping and Beautification

10. Sustainability Plan (O & M)

11. Monitoring and Evaluation

While the above methodology has been described in a step wise fashion, the cycle of pond rejuvenation and restoration functions on a feedback system and therefore inputs from each step can integrated into steps preceding and after as well.

7.5 Decentralize Treatment Plant

It is recognized that in the absence of 100% sewerage network connectivity just managing the grey water component would be an incomplete solution. In the rapidly urbanizing cities of developing countries, decentralized wastewater treatment systems are an attractive solution for addressing the problems of water pollution and scarcity.

Decentralized wastewater treatment consists of a variety of approaches for collection, treatment, and dispersal/reuse of wastewater for individual dwellings, industrial or institutional facilities, clusters of homes or businesses, and entire communities. An evaluation of site-specific conditions is performed to determine the appropriate type of treatment system for each location. These systems are a part of permanent infrastructure and can be managed as stand-alone facilities or be integrated with centralized sewage treatment systems. They provide a range of treatment options from simple, passive treatment with soil dispersal, commonly referred to as septic or onsite systems, to more complex and mechanized approaches such as advanced treatment units that collect and treat waste from multiple buildings and discharge to either surface waters or the soil.

Decentralized wastewater treatment systems could be a feasible alternative for areas which are not connected to sewer networks as well as ones which are newly developed, so that the construction of their infrastructure is inadequate, not ready or would be executed in the future. Therefore, for local communities in the peripheries of urban development that exist outside the city centre and rural areas where open drainage systems still exist. Over the past three decades, the city limits of Sirsa city have been continuously growing as evidenced by the satellite images of increasing urban infrastructure.

However, planning for sewage infrastructure and pipelines are a long-term investment, with the advent of exponential population increase also has been a challenge. Instead, decentralized wastewater management approach can be considered as a sustainable and cost-effective alternative as it treats discharges or reuses the effluent in the relative vicinity of its source of generation. Therefore, decentralization of wastewater treatment facilities is a feasible solution that may allow for localized treatment which may eventually be reused for secondary purposes. Like other systems, decentralised systems must be properly designed, maintained, and operated to provide optimum benefits.

The following table **(Table 28)** shows a list of generic conditions that are most often found according to the type of treatment considerations and other main constraints such as land availability and population, given that finances are a constant.

Table 28- Indicators and factors to decide the type of decentralised treatment required.

Type of Effluent Received	Land Availability	Number of people	Type of Treatment Required
Grey and Black Water Effluent	Yes	<5000 people	Natural Based Technology
Grey + Black Water Effluent	Yes	>5000 people	Hybrid Technology
Grey and Black Water Effluent	No	>5000 people	Mechanized
Black Water	Yes	<5000 people	Hybrid
Black Water	No	>5000 people	Mechanized FSTP for a cluster

Currently, the District has the following target for activities in **Table 29** related to Pond Restoration and Rejuvenation.

Table 29- The activities being undertaken by the District for Surface water management

Pond Restoration Activity	**Structure**	**Target**
Restoration and Rejuvenation of Water Bodies	Water Bodies/TANKS	21
3D Village Contour Mapping	Village Covered	320
Urban Wastewater Reuse	In Million Litres per Day	370

7.6 Information Education and Communication

Through open exchange of information, education and communication established between the community and the implementing agency, ownership of the projects and interventions is reinstated; from inception to implementation and beyond. Selected committee members that form groups such as self-help groups, youth groups are in fact chosen to carry out regular capacity building of the community at large, with special attention paid to children, women and those belonging most vulnerable groups are carried out. Knowledge exchange and capacity building are at the core of IEC activities. The following image shows the various stakeholders involved in IEC Activities. The following image shows the various stakeholders involved in IEC Activities (**Figure 22**). The numerous activities and interventions that can be carried out for IEC in **Table 30**

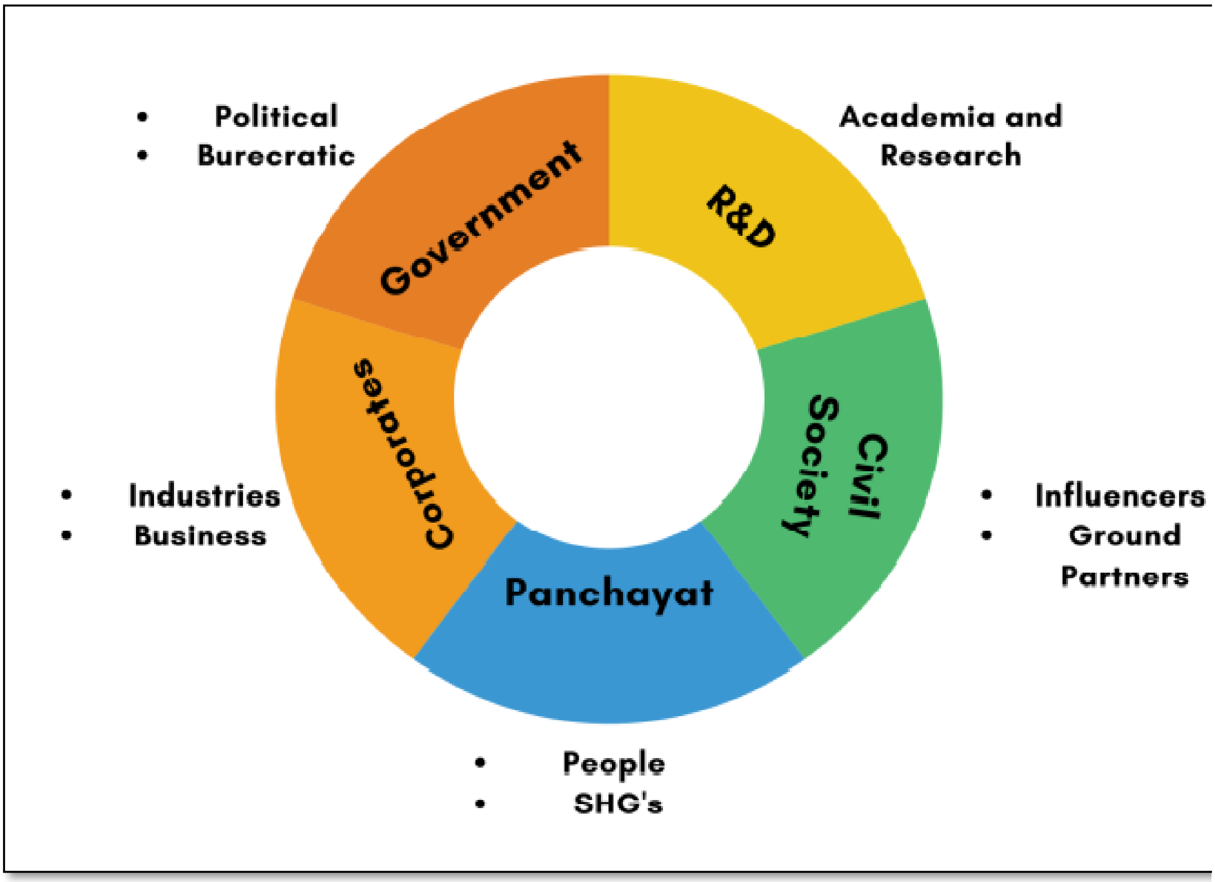


Figure 22-The above figure shows the various stakeholders of IEC Activities

.

Table 30 -The numerous activities and interventions that can be carried out for IEC

. S. No.	IEC	Intervention / Topic	Target Group	Objective	Collaterals	Outcome/ Result
1	Webinars	- Role of RWA, Schools and Citizen in Rain water harvesting - How to Harness and Harvest Rain	- RWA(through MCG) - Schools (3rd party) - Corporates(3rd Party)	- To Engage Local People in Rain water Harvesting - To make them aware of the facts and rules of RWH	Letter from which dept. Letter to Mayor and Commissioner for inviting for webinar	- Knowledge about Rain water harvesting - Respective roles and duties towards RWH
2	Capacity Building Sessions	- Technical Training sessions - Awareness Training Sessions - Workshops	- MCG Workers - MCM Workers	- Training of ground worker of MCG - Implementation Work	Presentation Retrofitting Checking list Repair and Cleaning List	1. The workers will clean and repair the RWH post training - Training on Real time Problems - Generate Employment Opportunities
3	Competitions in RWA's (Same type of Settlements)	- Water Man agent and Conservation	- RWA	-To save water - To bring the best practices through RWA	- Competition brief with parameters	- To recognise and reward the best RWA - Lead by by Example
4	Formation of Clubs	-how do we know about good vendor? - how do we identify places for RWH - How do we build RWH?	RWA	To make water representative from every RWA	Check list of water auditing for the water representative	1. do the meetings with respective water representative from every RWA. -Team building for the Society
5	Guidelines	- Guidelines for All the drops of the Society	- RWA - govt institutions - Schools - Corporates	Information Flow	- guidelines and poster	- Information and Awareness on Water

		regarding Rain water harvesting and its maintenance	- Rural Public buildings			conservation and Rules
6	Information Boards	- Water awareness (Ponds, RWH, Plantation)	- Schools - Public Institutes Open Spaces Roads -	- To change the perspective of people	Location, Capacity, Design OF RWH, information board	Awareness , mobilise citizens - Information about the RWH in Their vicinity
7	Rain Centre	- Any Problems related to water	- All the Citizens	To Resolve the issue related to RWH	FAQ (Technical)	Acts as Point of Contact for all the queries in Water Management
8	Social Media	- All the updates of the Events and posts	- All the Citizens	- Digital marketing - Awareness	FAQ TYPES Best Practices Video clips of Officers and celebrities	Awareness , mobilise citizens
9	Recognitions/Awards	- Rain water Harvesting - Best Practises - Best RWA in Water management	- RWA - In Panchayats - NGO - Schools - Corporates - Active Citizens	to recognice best practices	-Parameters list for best practices	To encourage more practices and people - Increase interest and motivation for the end users
10	Video Clips and Interviews	- Individual water Conservation steps - Best Water Management Practices	- RWA - In Panchayats - NGO - Schools - Corporates - Celebs	Digital marketing - Awareness - virtual presence	- letters for the celebs, script.	To recognise people, encourage more
11	Working Models	- Rain water Harvesting Models - GuruJal Pond Sites	- Schools	To aquire more prototypes for District Administration	- Proper Guidelines	Showcasing Children work in Administration

12	Plantation Drives	- Awareness on Plantation drives	- Urban (RWA, MCG, MC) - Rural (Pond Sites) - Schools -NGO's	-To increase the green Cover To increase the water holding Capacity	- Plant List Nursery Database - Distribution Chain Management Posters	Better environment for Future Generations
13	Collaborations	- For IEC	- NYK - District Youth Affairs and Sports -Kalagram -NGO's -Durga Shakthi -Civil Defence -Lion Club	To involve stakeholders to facilitate sessions	- Letter of Collaboration -Google form	- No Overlapping of the work or activities - More effectiveness in Catch the rain Campaign

8 Proposed Activity

8.1 Rainwater Harvesting

Rainwater harvesting is the simple process or technology used to conserve Rainwater by collecting, storing, conveying and purifying of Rainwater that runs off from rooftops, parks, roads, open grounds, etc. for later use

The rainwater harvesting system is one of the best methods practised and followed to support the conservation of water. Today, scarcity of good quality water has become a significant cause of concern. However, Rainwater, which is pure and of good quality, can be used for irrigation, washing, cleaning, bathing, cooking and also for other livestock requirements.

There are some factors that affect the rainfall water harvesting which needs to be focused for the development of suitable sites of water harvesting. These factors include rainfall, slope, soil texture, drainage, topography and land use / land cover and integration of these factors using weighted overlay analysis that results in suitable sites for rainwater harvesting. These sites are then classified into various suitability levels, namely, not suitable, less, medium, good and very good. The most suitable sites for rainfall water harvesting are shown in map (**Figure 23**). For the process of calculating suitable site a fixed weightage is needed to be applies on the below **Table 32** mentioned criteria and **Table 31** shows the Block wise calculated area under very good suitable site proposed for rain water harvesting.

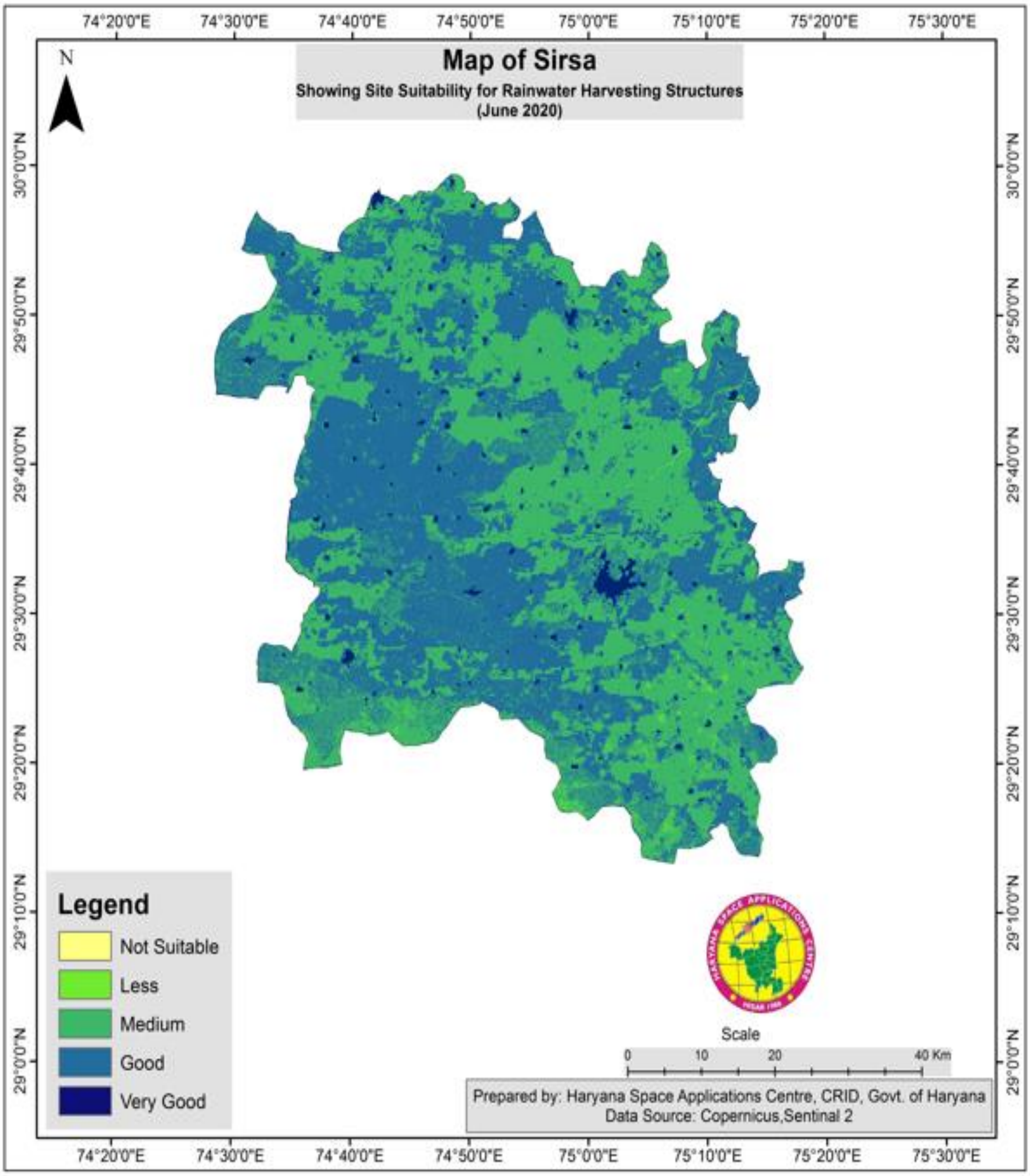


Figure 23- Site Suitability Map for Rainfall Harvesting Structure in the Year 2020

Table 31-Block wise area under very good suitable site proposed for rain water harvesting

Block Name	Area (Very Good suitability area in Sq meter)
Baragudha	533752376
Dabwali	802512445
Ellenabad	533205249
Nathusari Chopta	756920407
Odhan	515566438
Rania	584294931
Sirsa	544720258

Table 32 -Assigned Weight for layer

Parameters	Weightage
Rainfall	35
Slope	25
Drainage Density	5
Soil Texture	20
Lulc	15

8.2 Proposed Suitable Site based on Multicriteria

In this section some water harvesting structures are proposed with the suitable sites. These structures are calculated based on different criteria. These criteria are Natural drainage and water occurrence datasets that should exclude the settlement and water bodies on the same place. Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. A general idea says that in a given **Table 33** Mini percolation Tanks, on 1st order Stream, percolation Tanks, on 2nd Order Stream, pakka check Dams on 3rd Order Stream, Annicut on 4th Order, Micro Irrigation tank on 5th Order can be build. Following are the outcomes that show the type of structure on the streams. **Figure 24** shows the proposed suitable site based on multi criteria and **Table 34** shows the block wise proposed suitable sites based on multi-criteria.

Table 33- Total number of Proposed sites on Multicriteria based on different Stream order in Sirsa district

Sr.No.	Stream Order	Total no of Proposed Sites (Multicriteria)
1	1st Order mini percolation tank	17
2	2nd Order, Percolation tank	15
3	3rd Order, Pakka check Dam	5
4	4th Order, Annicut	3
5	5th Order Micro irrigation Tank	2

Table 34 Block wise proposed suitable sites based on multi-criteria

Sr. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Baragudha	13	11	2	2	0
2	Dabwali	0	0	0	0	0
3	Ellenabad	2	0	0	0	1
4	Nathusari Chopta	1	2	3	1	1
5	Odhan	1	0	0	0	0
6	Rania	0	1	0	0	0
7	Sirsa	0	1	0	0	0

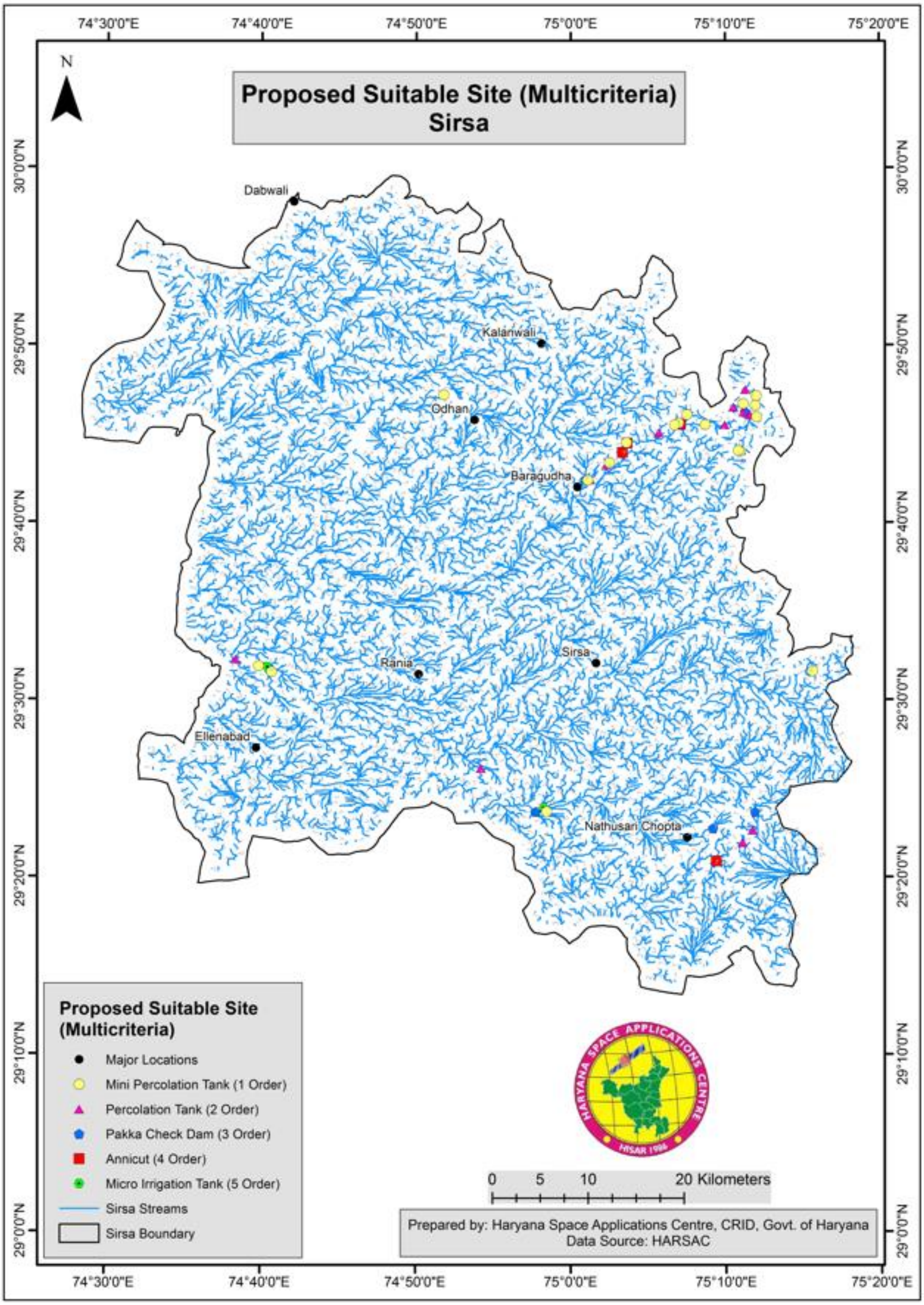


Figure 24- Proposed suitable sites based on multicriteria in Sirsa District

8.3 Proposed Suitable Site based on Based on Drainage

From satellite imagery the drainages that are created can be used as base for the water harvesting structure. Stream order system is a simple method of classifying stream segments based on the number of tributaries upstream. So, based on the order of streams we can propose the suitable sites for water harvesting structures. A general idea says that in a given **Table 35** Mini percolation Tanks, on 1st order Stream, percolation Tanks, on 2nd Order Stream, pakka check Dams on 3rd Order Stream, Annicut on 4th Order, Micro Irrigation tank on 5th Order can be build, and **Table 36** shows the Proposed harvesting structures in Sirsa based on drainage. **Figure 25** shows the proposed suitable sites based on drainage structure in Sirsa district.

Table 35- Proposed harvesting structures on Sirsa based on drainage

SR.NO	Stream Order	Harvesting Structures	Count
1	1st Order	Mini percolation tank	1072
2	2nd Order	Percolation tank	1266
3	3rd Order	Pakka check Dam	1310
4	4th Order	Annicut	445
5	5th Order	Micro irrigation Tank	569

Table 36- Block-wise proposed suitable sites based on drainage structure

Sr. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Baragudha	115	148	162	65	40
2	Dabwali	241	257	272	85	111
3	Ellenabad	123	137	135	45	77
4	Nathusari Chopta	235	210	229	85	66
5	Odhan	130	189	172	57	68
6	Rania	118	171	177	60	118
7	Sirsa	110	154	163	48	88

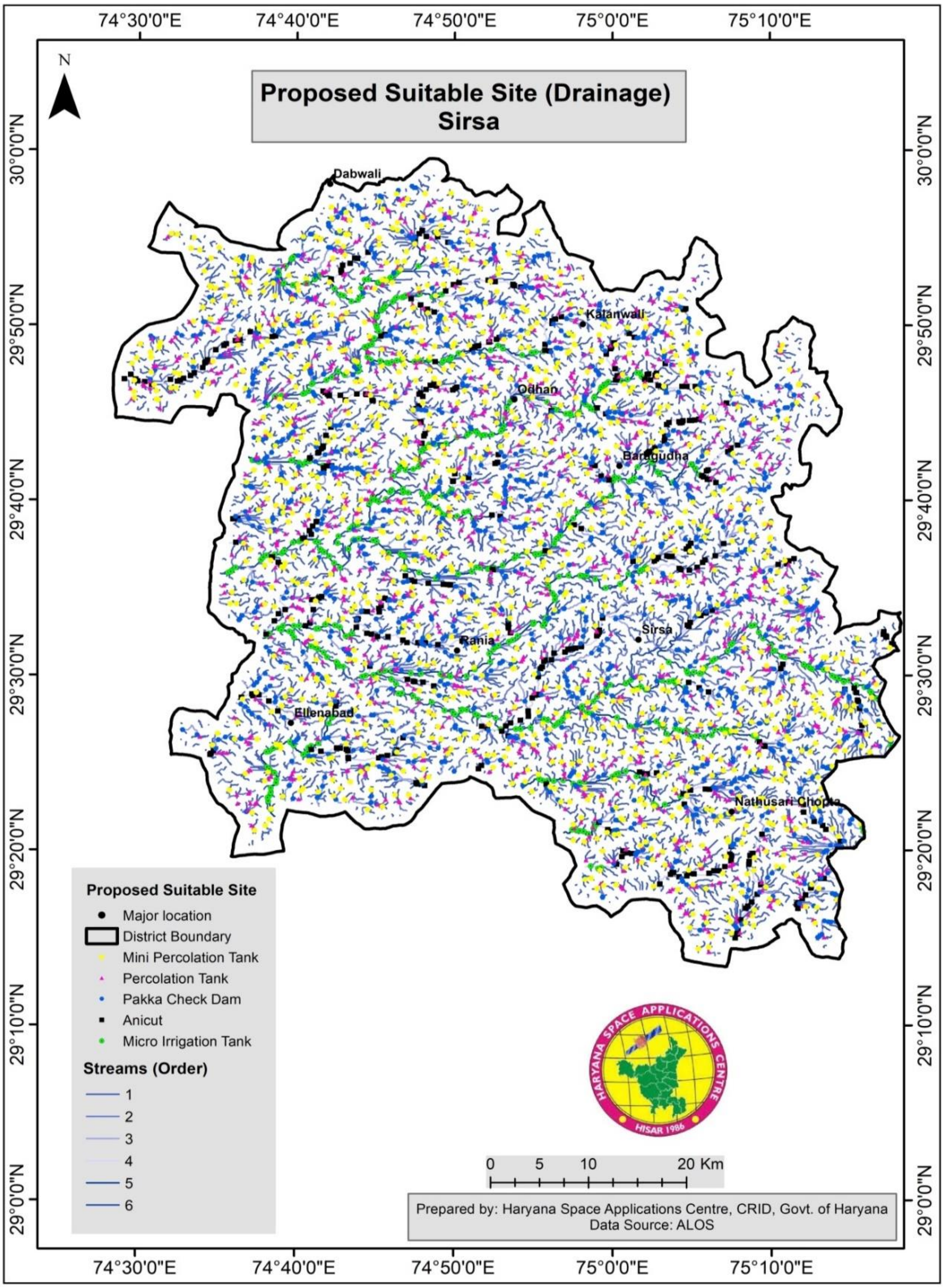


Figure 25- Proposed suitable sites based on drainage in Sirsa District

9 Conclusion

Due to rapid urbanization, Sirsa has seen problems related to water resources. There is water scarcity in lean season and waterlogging in monsoon season. Water logging over roads due to insufficient/unmanaged drains is the major problem. Current scientific report includes required information for the water harvesting where it is excess especially during monsoon/rainy season. The current water infrastructure information related to ponds/waterbodies, canals, natural drains, and drains based on slope is helpful in taking decisions on the construction of new structures for water harvesting. Block-wise estimates are given in the report while village level information is available at https://onemapggm.gmda.gov.in/portal/apps/webappviewer/index.html?id=dba1be50c558408cb6b06c27d337bdb4.

Water being an ongoing reliable source around the world, it will not be available forever. When top energy consumers include the United States and China, along with environmental factors affecting these two regions, there is no doubt that this valuable resource will be limited on Earth. Water scarcity is no joke and shouldn't be taken lightly for it has great effects on food production, our farm lands, our health, and our economies. Droughts are common factors of this scarcity of water by drying up land and all the life contained in it. The land for crops is shrinking and are in need of more and more water everyday causing limited amounts of fruits and vegetables to be produced according to the research found by Daryanto and Gilis. When there is low food production, there come high demands which affect the economy.

Environmental concerns are not situated in one side of the world. Water is a broad source extending to different countries along with different advanced technologies. Irrigation has become widespread to improve farming and food production as well. Risks are taken into account because there may be cases in which misuse of conservation technology can affect our health and other resources other than water. Menses illustrates this situation well in his research regarding wastewater in the dairy industry. Through extended research, it is found that these happenings don't just occur once and in one place. The solution to prevent these occurrences exists in such initiatives of the government such as the JAL SHAKTI ABHIYAN. This is where collaboration is important among states and regions. To better and preserve our natural resources, actions and attitudes towards sustainability must stay at a high level throughout nation who is willing to work together towards the same goal.

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"Jal Shakti Abhiyan: Catch The Rain"

WATER CONSERVATION AND RAIN WATER HARVESTING

RENOVATION OF TRADITIONAL WATER BODIES

REUSE AND RECHARGE STRUCTURES

WATERSHED DEVELOPMENT

INTENSIVE AFFORESTATION

ENUMERATION OF WATER BODIES

TRAINING / AWARENESS PROGRAMS BY KVK

Catch The Rain

Where it falls, When it falls