Report No.-22

JSA-CTR

Scientific Action Plan for Yamunanagar

Prepared By-

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1 Introduction

1.1 History

Yamunanagar was earlier known as 'Abdulahpur'. Pre-independence, it was a small village with population concentrated around its Railway Station. After partition of India, many refugees from Punjab in Pakistan choose to make Yamunanagar their new home, and in the process adding to the culture of the town. The area where land was allocated to the refugees later. Yamuna Nagar district is bounded by the state of Himachal Pradesh in the north, by the state of Uttar Pradesh in the east and south east by the districts of Yamuna Nagar and Kurukshetra in the south west and by Ambala district in the west. The district has a sub-tropical continental monsoon climate where we find seasonal rhythm, hot summer, cool winter, unreliable rainfall and great variation in temperature. In winters, frost sometimes occurs during December and January. The district also gets occasional winter rains from cyclones. The rain fall is mostly restricted to rainy season. The district has Shivalik hills and foot hill rolling plain in the north and north- east, and flood – plain along the Yamuna River in the east and south- east. The important rivers/ streams of the district are Yamuna, Sarasvati, Chautang, Rakshi, Somb, Boli, etc. Yamuna River after rising from the snow-clad peaks of the middle Himalayas at yamnotri, enters the district from its northeastern corner through a narrow corridor in the Siwaliks. It is a perennial river. Bolinadi joins the sombnadi near dadupur and then the combined somb and bolinadis join the Yamuna River at meharmajra. The rakshi stream takes its birth in the rolling foot hill plain while the Chautang and Sarasvati rivers originate in the lower hills. Generally, the slope of the district is from north-east to south-west, in which direction most of rivers/nadis/ rainfed torrents flow down.

1.2 Location

Yamuna Nagar district of Haryana located in north-eastern part of Haryana State and lies between 29º 55': 30 º 31' north latitudes and 77 º 00': 77 º 35' east longitudes. The district is bounded, in north by Himachal Pradesh, in the east by Uttar Pradesh, in west by Ambala district, in south by Karnal and Kurukshetra districts. Total geographical area of the district is 1756 sq.km and comprises 4% of total area of State. Yamuna Nagar district is divided into one sub-division and six development blocks viz. Bilaspur, Chhachhrauli, Jagadhri, Saraswati Nagar, Radaur and Sadhaura. Yamuna Nagar is thickly populated district. The local inhabitants mainly depend on agriculture, others are workers. Yamunanagar is well known for its industries. It has emerged as an important industrial destination in the state. This has been despite its relatively isolated location from rest of the state. Due to expanding industries, the city kept on extending geographically. This is primarily due to an increasing number of immigrants. This led

to an intermixing of diverse culture. It also has to do with the rural ambiance which is reported to have undergone a lot of change. With increasing population, the trading aspects became brighter and the city went on becoming the second highest revenue generator of Haryana, immediately after Faridabad that owes its position largely to its prime location. The city produces sugar machinery, paper machinery along with highly efficient equipment's for Petro-chemical plants, which are shipped to various refineries across the country. The city is also known for its Plywood productions, which is attributed to the easy accessibility of primary raw material – poplar tree. It has also one of India's largest railway carriage and wagon repair workshops. Recently, Reliance Industries has also installed a thermal power plant in the town. HSVP has done major development work in the land-stretch linking the city with Jagadhri, the other part of twin city. The Location Map of Yamunanagar district is shown in **Figure 1**.

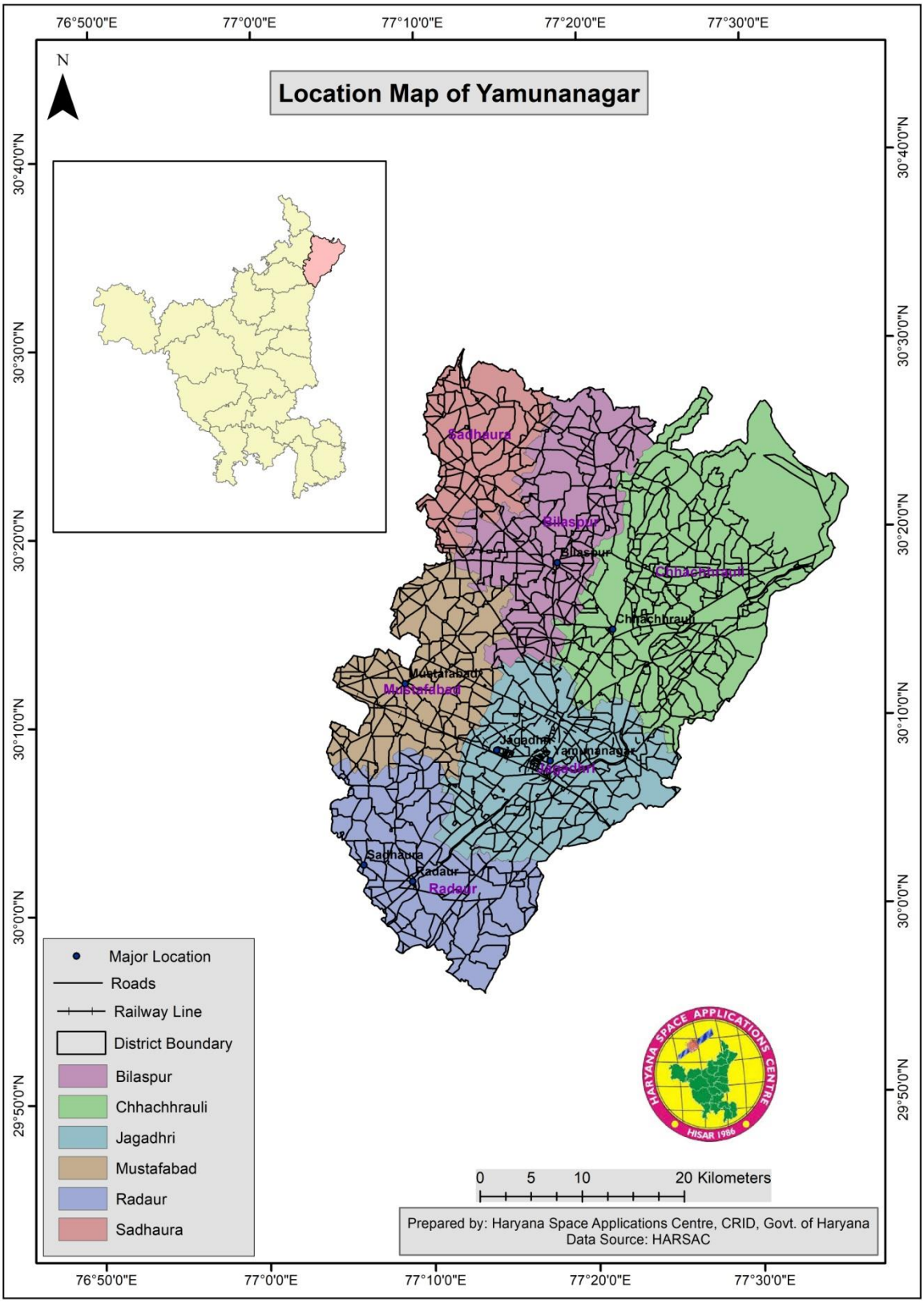


Figure 1- Location Map of Yamunanagar District

1.3 Administrative Setup

The administrative setup of the District of Yamunanagar has been described below, with specific sectoral development. The detailed administrative setup is shown in **Table 1**.

Table 1- Major Administrative Jurisdictional Setup of Yamunanagar District

Country	India
State	Haryana
Division	Yamunanagar
Headquarters	Yamunanagar
Tehsil	Jagadhri, Radaur, Bilaspur, Chhachhrauli
Total Area	1,756 km2
Total Population (2011)	1,304,420
Density	690
Lok Sabha constituency	Ambala (Lok Sabha constituency)
Vidhan Sabha constituencies	07-Sadhaura, 08-Jagadhri, 09-YamunaNagar, 10-Radaur
Website	https://yamunanagar.nic.in/
Location of Gurugram	Northern most region of Haryana
Coordinates	30.1290° N, 77.2674° E
Elevation	255 m above the sea level
Sub Divisions (3)	Jagadhri, Radaur, Bilaspur
Tehsils (4)	Jagadhri, Radaur, Bilaspur, Chhachhrauli
Sub-Tehsils (3)	Saraswati Nagar, Sadhaura Partapnagar
Blocks (6)	Jagadhri, Radaur, Bilaspur, Chhachhrauli, Sadhaura, Saraswati Nagar,
Municipal Corporation (1)	Municipal Corporation of Yamuna Nagar Jagadhri
Municipal Committees (1)	Radaur

Population (Census 2011)	12,14,162
Total Villages	655
Village Level	Panchayat
Block Level	Panchayat Samiti
District Level	Zila Parishad (1)

1.4 Climate

Located at an elevation of None meters (0 feet) above sea level, Yamunanagar has a Humid subtropical, dry winter climate (Classification: Cwa). The district's yearly temperature is 28.02ºC (82.44ºF) and it is 2.05% higher than India's averages. Yamunanagar typically receives about 26.68 millimeters (1.05 inches) of precipitation and has 28.53 rainy days (7.82% of the time) annually.

1.4.1 Temperature

During monsoon season, relative humidity is high (between 70 and 85 percent). Atmosphere is generally dry for the rest of year. The driest part of the year is the summer season when relative humidity is the lowest, about 27 percent. Cloudiness is moderate to heavy during monsoon season. The skies are mainly clear or lightly clouded during the remaining part of the year. Light winds generally blow in the district. In the post-monsoon and cold season winds are predominantly from north-west. In the beginning of summer season easterly or south-easterly winds blow on some days. May to September easterlies or south-easterly winds predominate.

1.4.2 Rainfall

The district has a sub-tropical continental monsoon climate where we find seasonal rhythm, hot summers, cool winter, unreliable rainfall and great variation in temperature. In winters dense fog occurs during December and January. The district also gets occasional winter rains from cyclones. Rainfall is concentrated in the monsoon months of July and August. Rainfall recorded for district Yamunanagar – average annual rainfall of 973.8 mm. About 81 percent of the annual normal rainfall is received during June to September and about 8 percent during winter months of December to February. The rainfall in the district generally increases from south-west to north-east. The variation in the annual rainfall in the district from year to year is appreciable. The average number of rainy days for the district is 42. Rainfall map of Yamunanagar is shown in **Figure 2**.

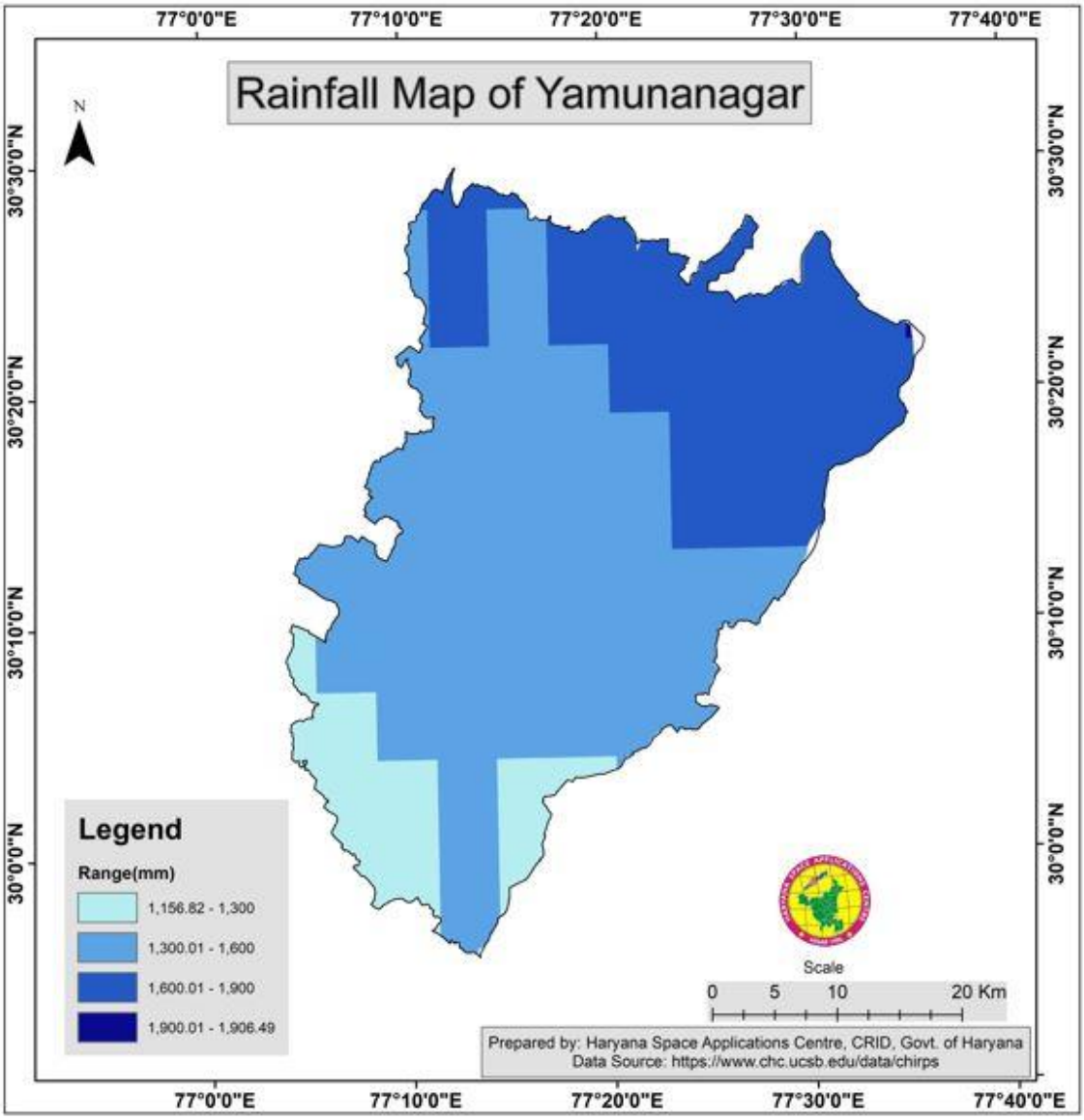


Figure 2- Rainfall Map of Yamunanagar District

1.5 Elevation and Topography

The district has elevation 0f 255 meter and is divided into five Physiographic units.

- Siwaliks
- Dissected Rolling Plains
- Interfluvial Plains
- Active And Recent Flood Plains
- Relict Plains

Siwaliks hills –

Siwalik hill ranges occupy the northern fringe of Yamuna Nagar district and attain the height up to 950m AMSL. The hills are about 500m high with respect to the adjacent alluvial plains. These are characterized by the broad tableland topography that has been carved into quite sharp slopes by numerous ephemeral streams come down to the outer slopes of the Siwaliks and spread much of gravels boulders, pebbles in the beds of these streams.

Kandi Belt –

A dissected rolling plain in the northern parts of district is a transitional tract between Siwaliks hills and alluvial plains. It is about 25 km wide and elevation varies between 250 and 375m AMSL.

Interfluvial plains –

This tract is part of higher ground between Ghaggar and Chautang and includes high mounds and valleys. In general, the slope is from northeast to southwest.

Active and recent flood plains –

This plain is narrow tract along river Yamuna in the district.

Relict wedge plain –

This is almost in alignment to the surface water divide between the westward flowing Ghaggar and eastward flowing Yamuna River. Barring northern part of the district i.e., Parts of Partapnagar, Chhachhrauli, Bilaspur and Sadhaura blocks slope is within 8%. Major part of the district is having slope 0-3%. In the northern part of the district slope is more than 25%. Digital Elevation Model, slope and contour maps of the district are shown in **Figure 3, 4 and 5** respectively.

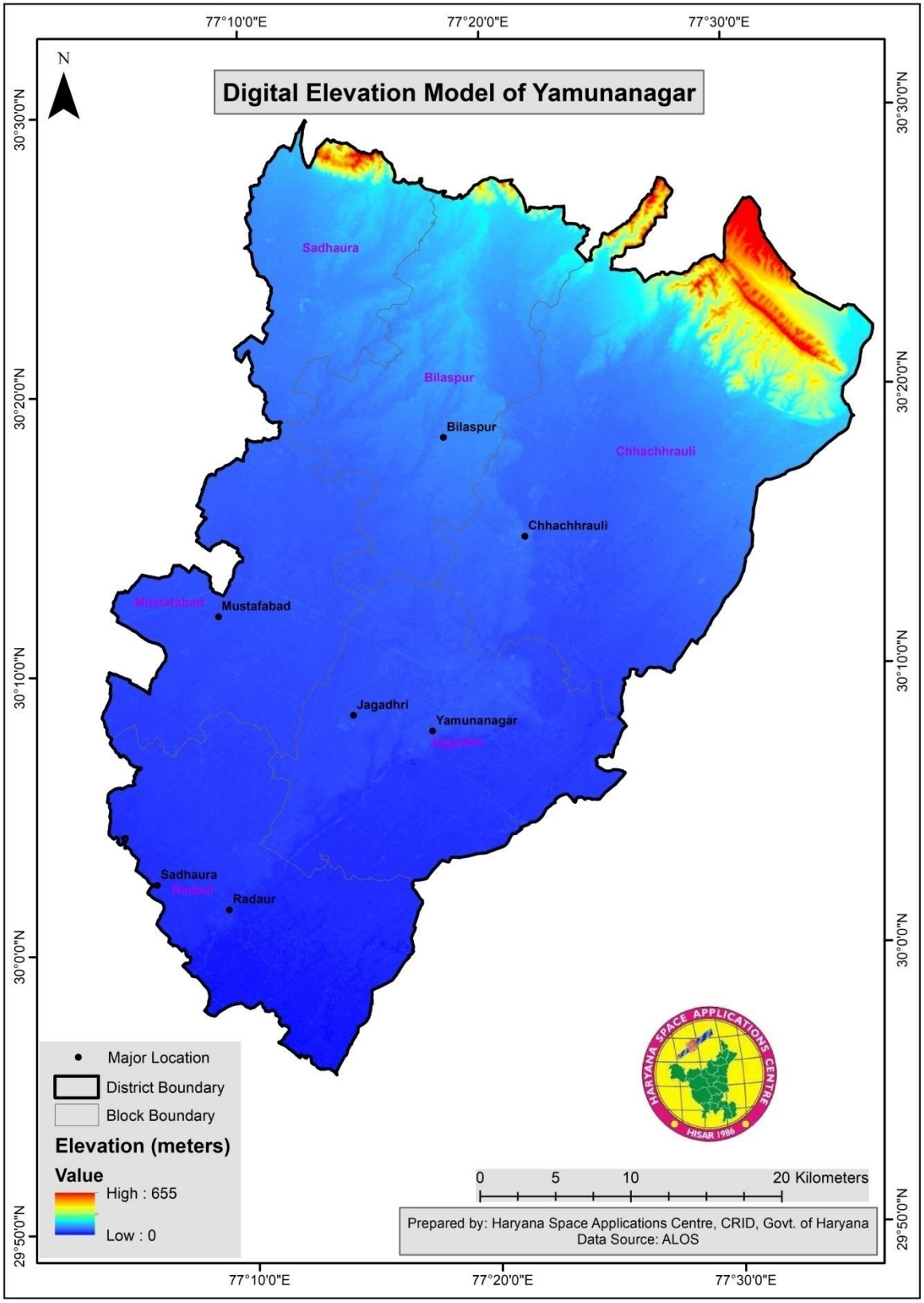


Figure 3- DEM of Yamunanagar District

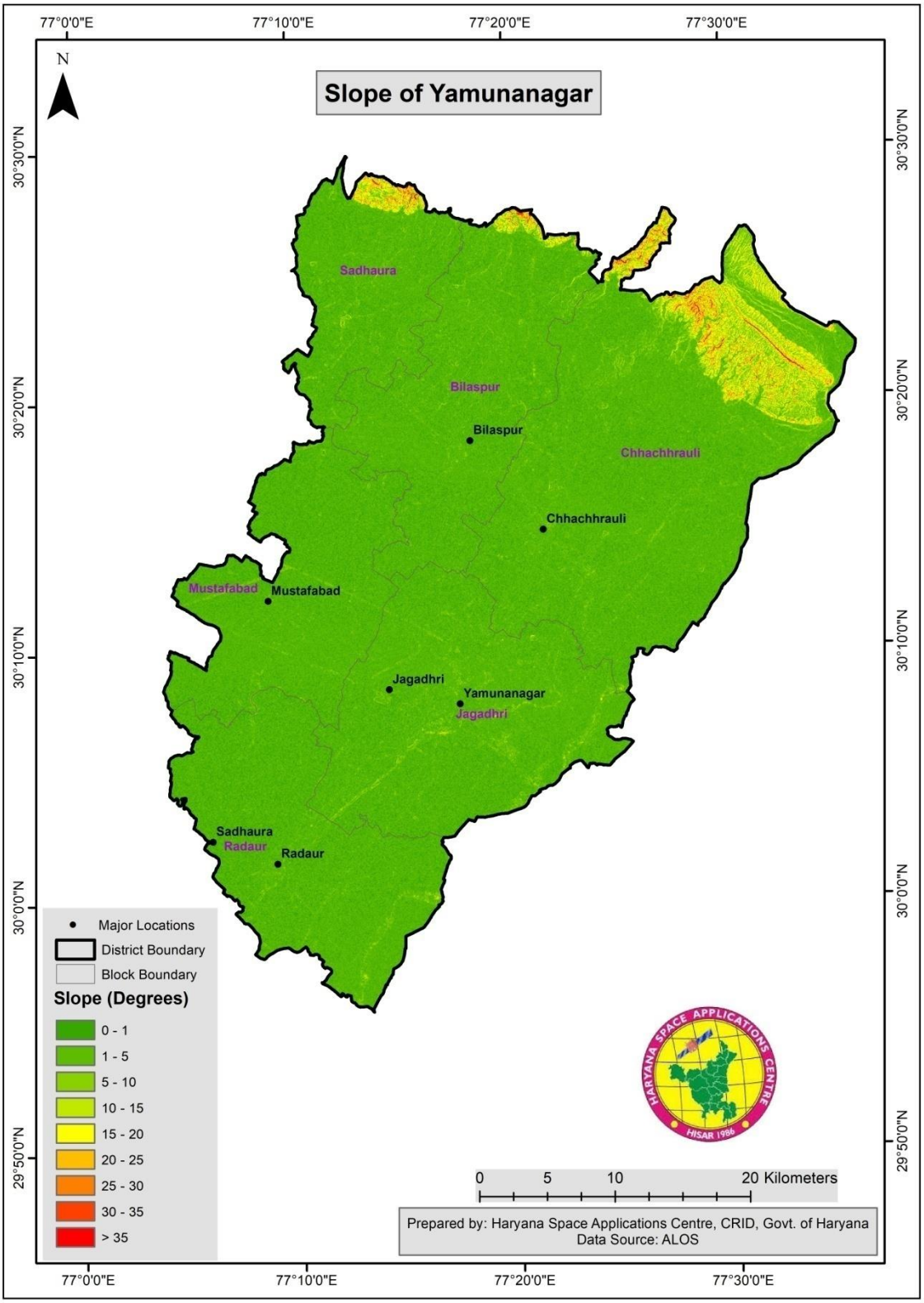


Figure 4- Slope map of Yamunanagar District

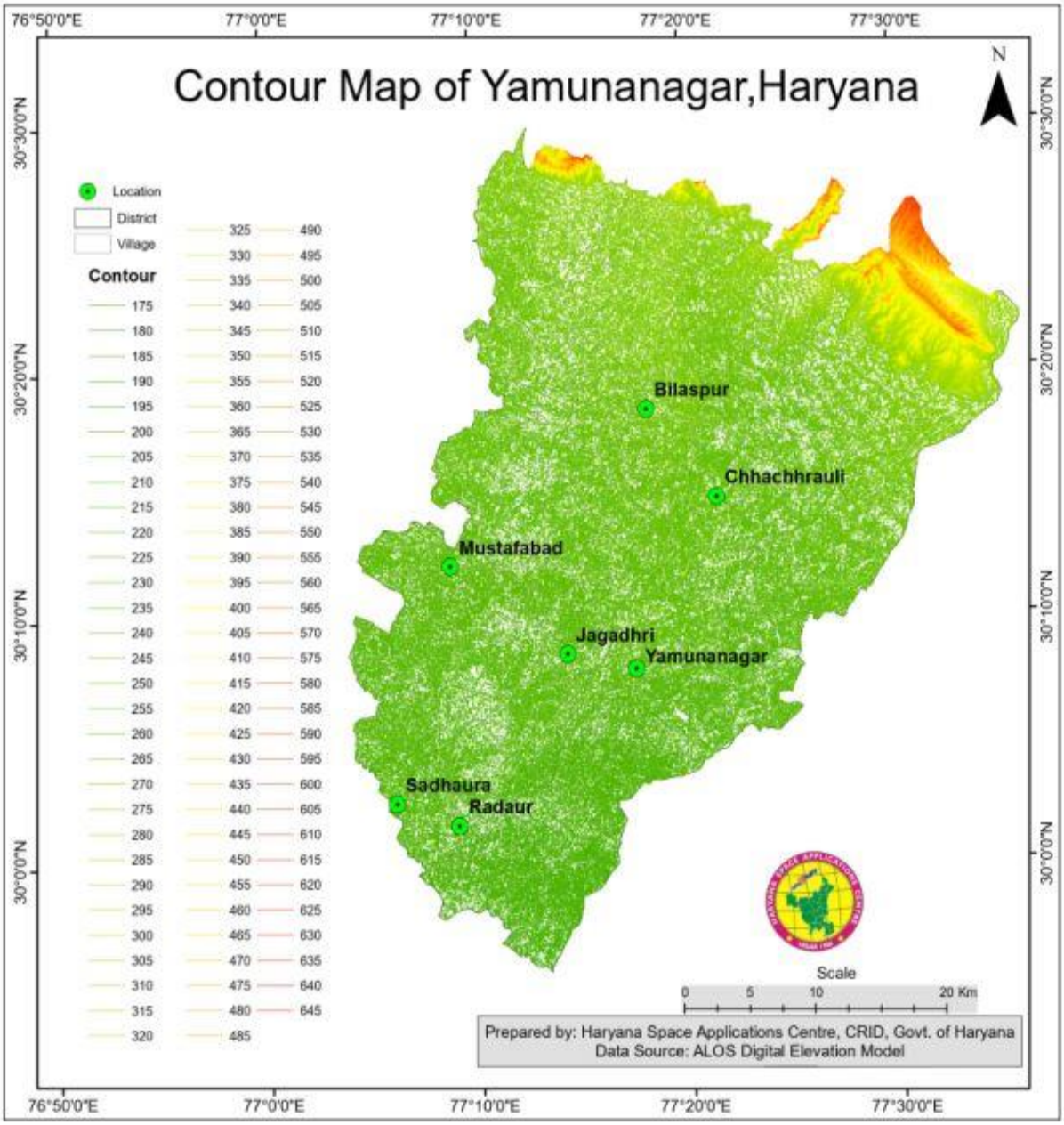


Figure 5- Contour map of Yamuna Nagar

1.5.1 Geology and Lithology

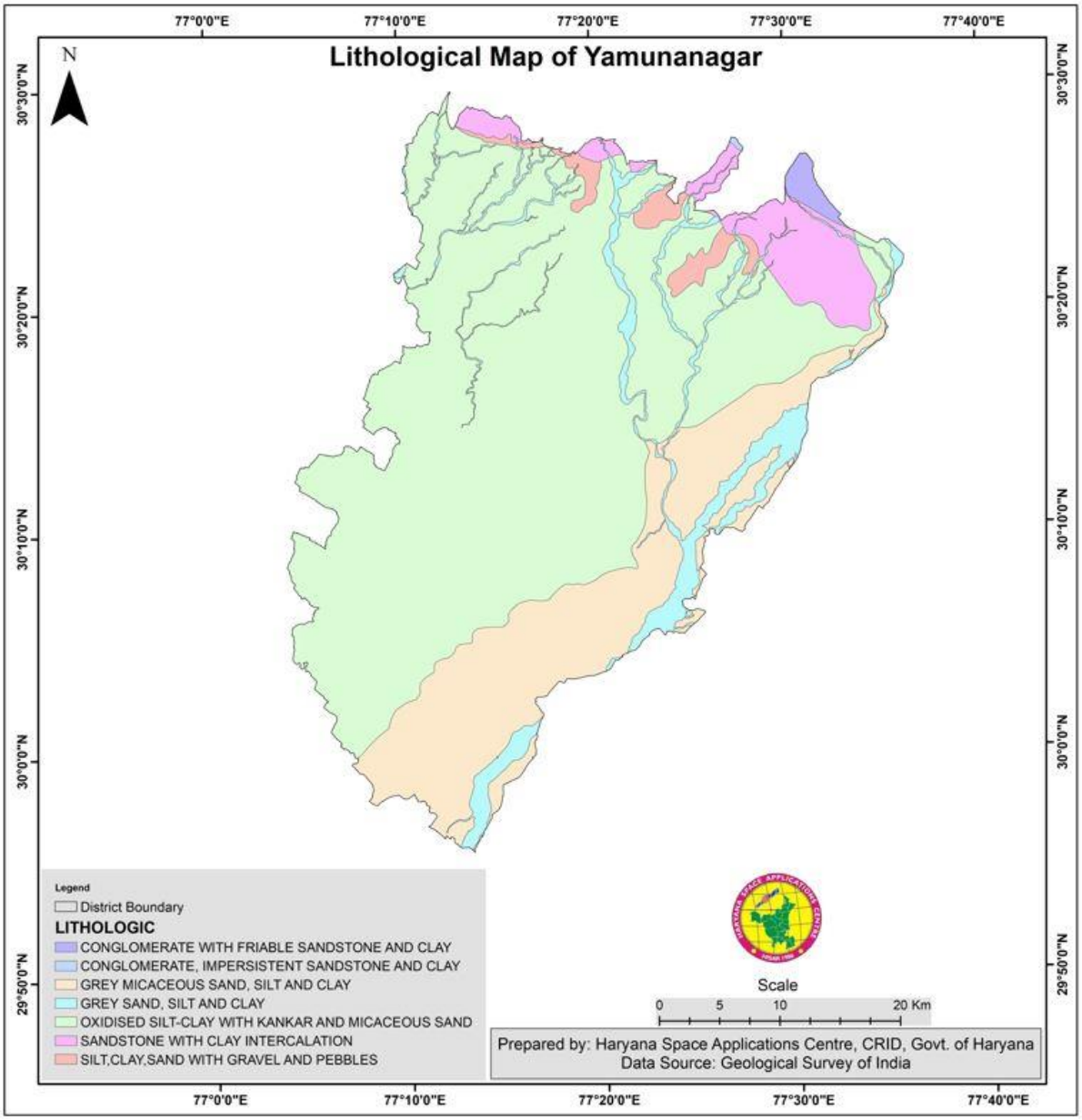


Figure 6 -Lithological Map of Yamunanagar District

1.5.2 Soil Profile

Major part of the district is inundated by the seasonal rivers/rivulets. Silty loam and coarse loam are found in the region. The soils in the district are mainly silty loam (khaddar), loam (Bhangar &Nardak), piedmont (Ghar & Kandi), silty clay (Naili & Chhachhra Dakar) and light loam (Seoti). The soils as classified by the National Bureau of Soil survey and Land Use Planning (ICAR), Nagpur, consist mainly of Udalfs, Aquents-fluvents and Ochrepts– Orthentstypes.The crops grown in the district are divided into two main categories viz. Kharif and Rabi, locally called as Sawani and Hadhi. The former is the summer

season harvest and the later the winter season harvest. Any crop which does not strictly fall within these two harvests is known as a Zaid crop and its harvest is called the Zaid kharif or Zaid Rabi.

Eurtrochrepts/ Udorthents - These are shallow and loamy sands to fine sandy loams, except in depressions, well-drained, non-saline, non-alkali, noncalcareous, mostly base saturated and are classified as loamy skeletal typic, lithyhic, eurtrochrepts/ udorthents. These soils are found in the Siwalik range.

Udipsamments/ udorthents - These are loamy sand to sandy loam deep, excessively or well-drained, non-saline, non-alkali. These are placed under the associations of transitional tract between Siwaliks hills and alluvial plains.

Psammaquents and Haplaquepts - These soils are found in Yamuna Plains.

Haplaquept - These soils are non-saline, alkalinity hazards are classified as typicustochrepts but water-logged soils with loam to clay loam texture showing the effect of glazing, are classified as aeric/ typicHaplaquepts. Areas as aeridic soil moisture, moisture have soils classified as camborthics and torropsamments. Soil texture map of Yamunanagar is shown in **Figure 7**.

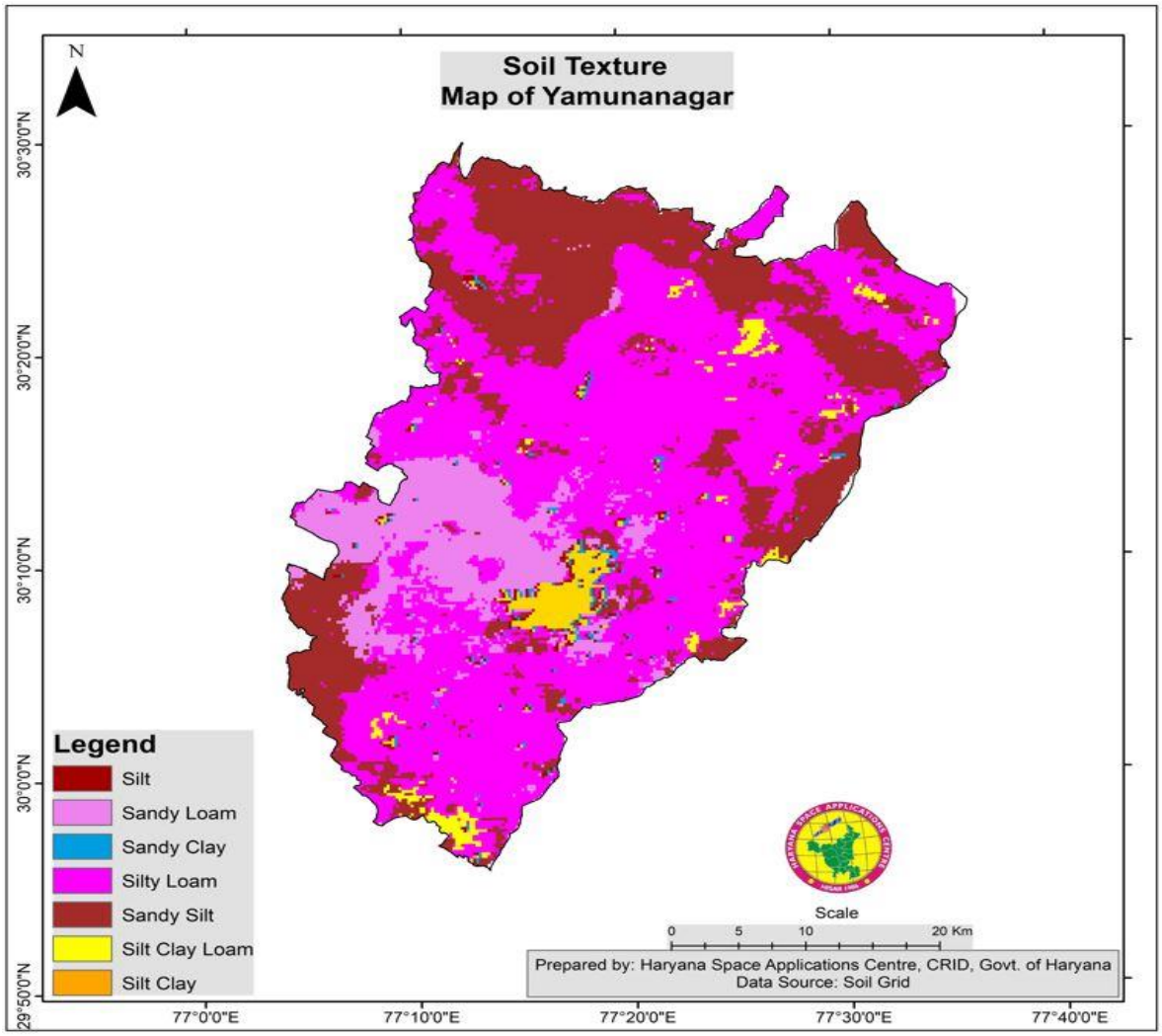


Figure 7 - Soil texture map of Yamunanagar District

1.6 Land use

The total geographical area (TGA) of Yamunanagar is 1, 74,931 hectares. The largest block of the district is Bilaspur which is comprises TGA of 30,847 hectares i.e., about 20% of the TGA of the district. The Gross Cropped Area of the district is 1,74,931 hectares out of which 30,847 hectares i.e., 20% of the area falls in Bilaspur Block. Area under agriculture is shown in **Table 2**.

Table 2- Area under agriculture (Area in ha)

Block	TGA	Area Under Agriculture	
		GCA	NSA
Bilaspur	30847.00	22726	21741
Chhachhrauli	20832.30	17725	16847
Jagadhri	29159.00	23310	22094
Saraswati Nagar	27014.8	18621	17936
Radaur	14279.80	22456	21798
Sadhaura	27286.00	11144	10725
Partapnagar	25109.00	12512	12132
Total	**174931**	**191603**	**120803**

TGA- Total Geographical Area, GCA- Gross Cropped Area, NSA- Net Sown Area

Source: Agriculture department Yamunanagar

The map shown in **Figure 8** depicts the land use/ land cover area of Yamunanagar district in the year 2017.

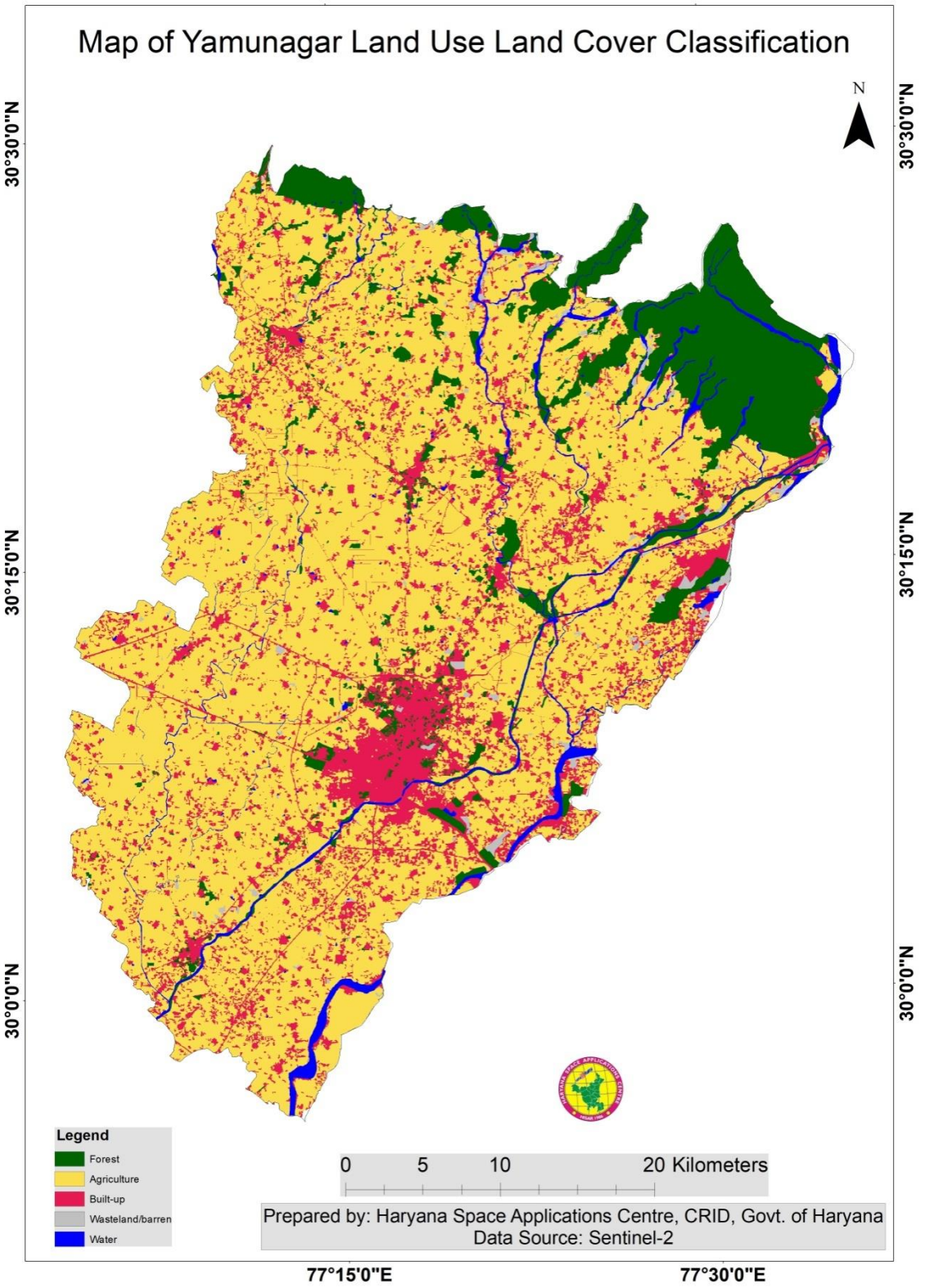


Figure 8- Landuse and Landcover of Yamuna Nagar District

2. District Water Profile

Agriculture and horticulture play an important role in rural economy of Yamunanagar. Out of 1,76,105 main workers in the rural area of the district, 33.3% i.e., 84,943 persons are engaged in agriculture and allied activities to sustain their life. The major crop grown in the district are field crops, vegetables, fruits and flowers.

2.1 Sources of Water

The district is mainly drained by the rivers Yamuna, Markanda and its tributaries. Markanda is tributary of river Ghaggar and drains major part of the district. The high land between Markanda River and small rivulets of River Yamuna acts as basin boundary between west flowing rivers of Indus system and east flowing rivers of Ganga basin. River Yamuna drains eastern part of the district and acts as boundary between Haryana and Uttar Pradesh State.

2.1.1 Canals

Yamuna Nagar district is bestowed with rich water resources, both surface as well as ground water resources. The ground water is major sources of irrigation in the district. Nearly 40% of area is irrigated by canal water. Distributaries in the district are 21.45 Km long. Two major canals passing through the district are Western Yamuna Canal and augmentation canal. Length of unlined WJC is 63.64km whereas augmentation canal is 22.54 km long.

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. In Yamunanagar district total 1703 ponds/waterbodies found on satellite image. The map of total ponds/waterbodies that include ponds, canals are shown in **Figure 9**and monsoonal waterlogging of the district is shown in **Figure 10.**

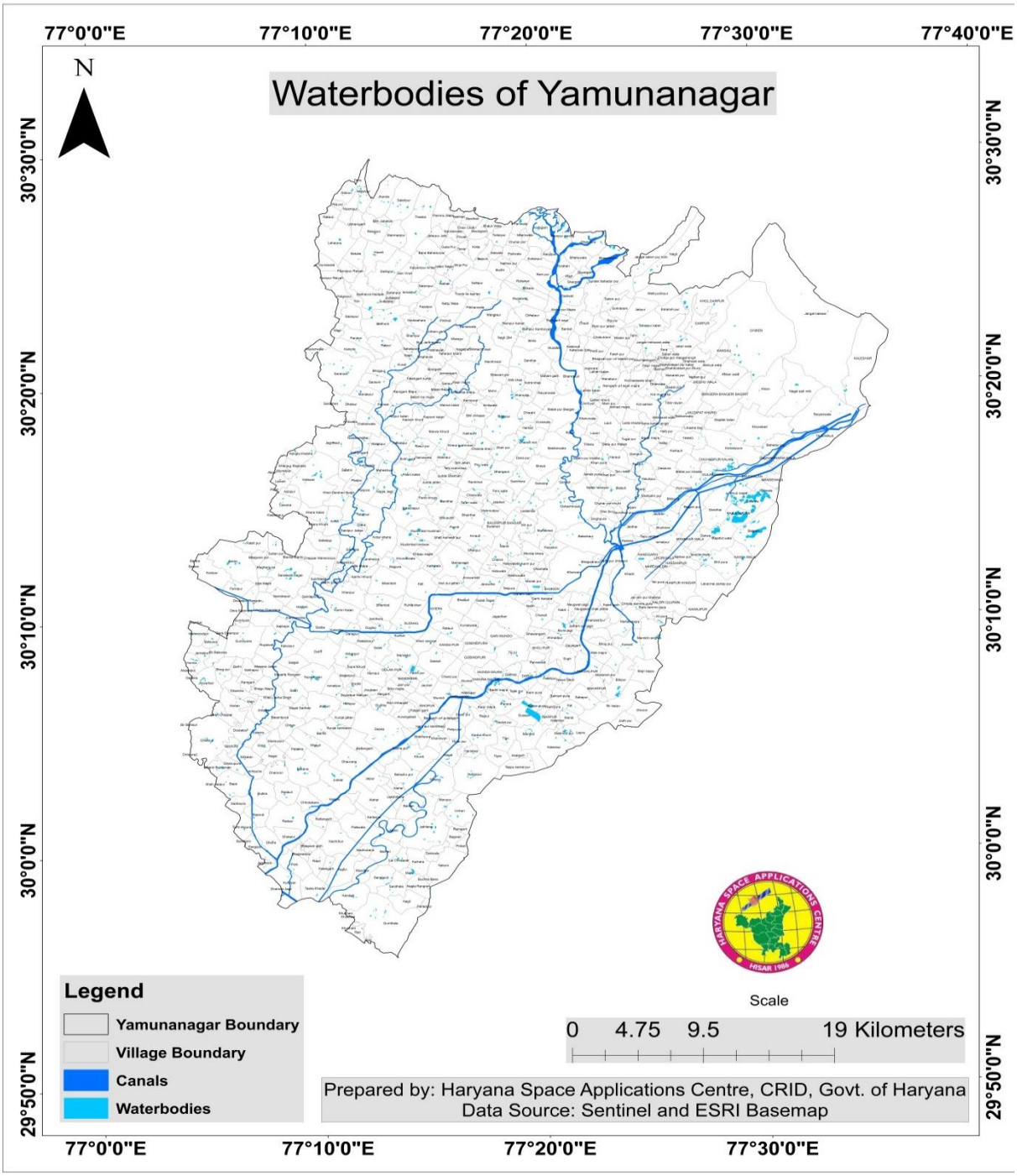


Figure 9-Waterbodies map of Yamuna Nagar

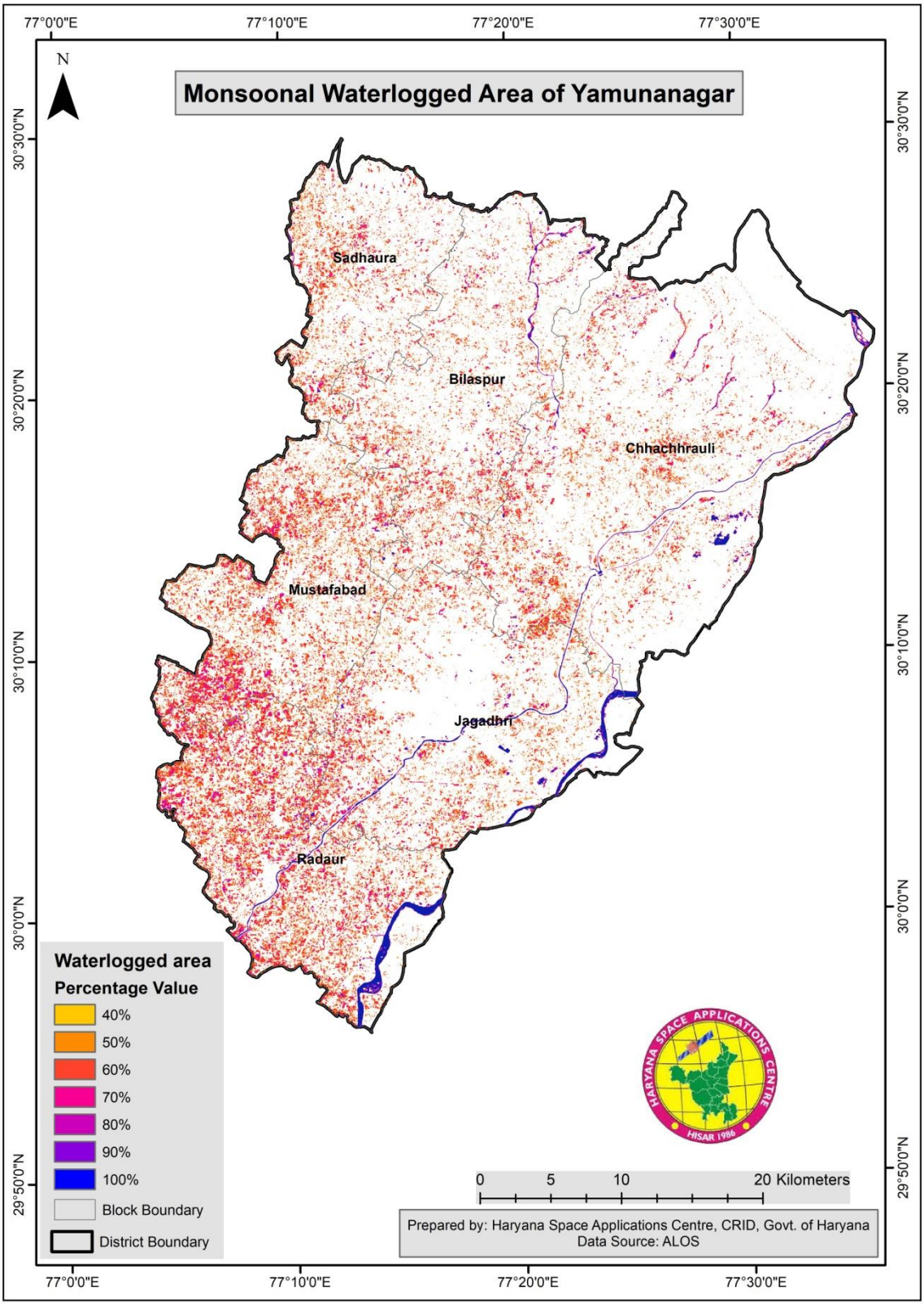


Figure 10- Monsoonal waterlogged area of Yamunanagar

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 waterbody. 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 Yamunanagar District is shown in **Figure 11.** The statistics of length of drainages under each order are shown in **Table 3**.

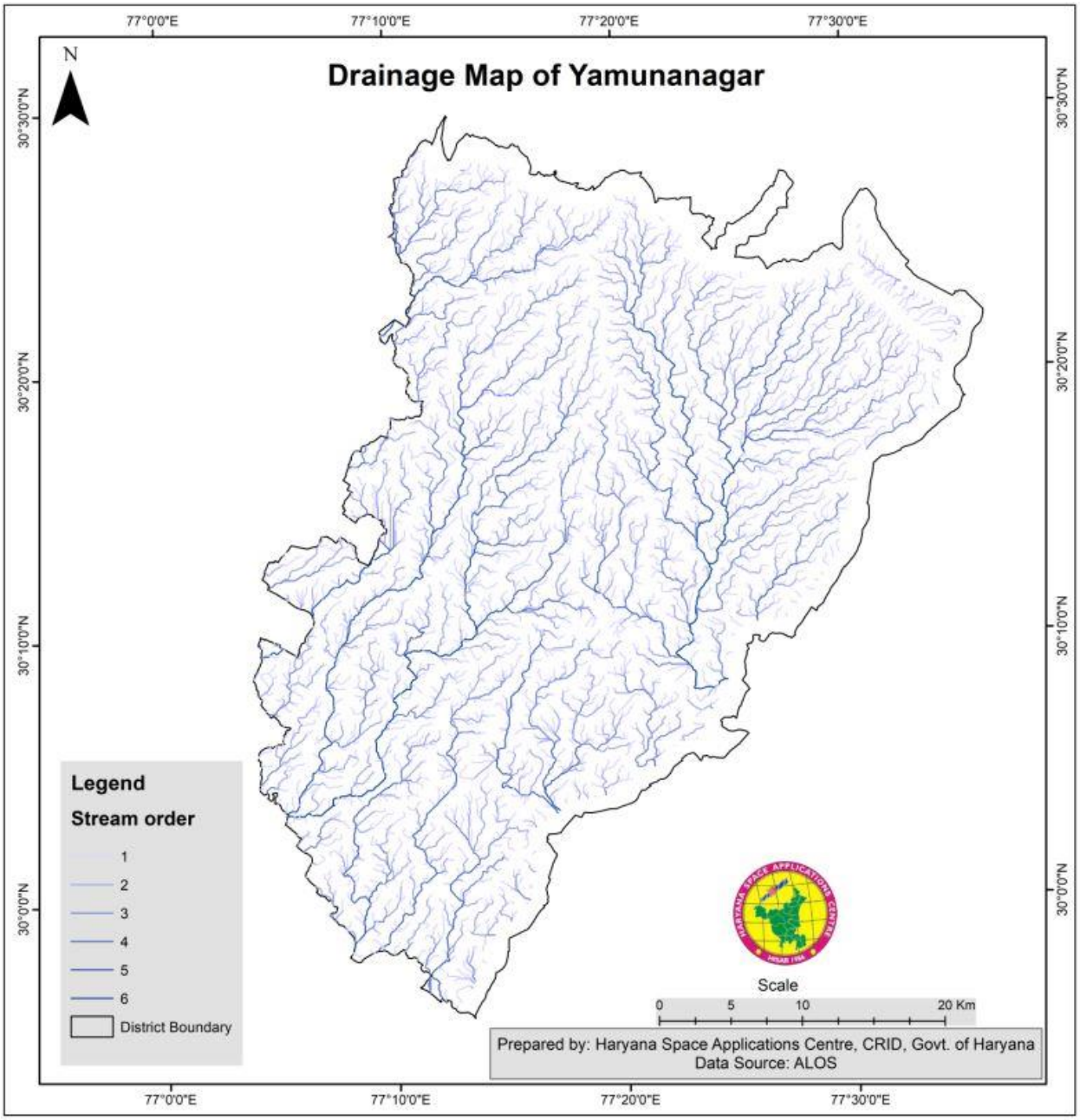


Figure 11 Drainage Map of Yamunanagar District

Table 3- Drainage order and total length of the drains in Yamunanagar district

Sr. No.	Order of Drainage	Total Length (in meter)
1	1st Order	1510497.382
2	2nd Order	777658.1564
3	3rd Order	419279.7189
4	4th Order	211868.2315
5	5th Order	105192.4572
6	6th Order	48723.87853

2.2Water Harvesting System

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge. Water harvesting profile of Yamunanagar district is shown as follows:

2.2.1 Roof Top Harvesting

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. 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. The Main Objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dryland, hilly, urban and coastal areas.

There are a number of different ways to harvest rain water. But the one most essential thing that is common in all of the available water conservation techniques is to utilize natural rainwater to supplement the daily life's water consumption. People in the city are becoming all the more conscious day by day in implementing the best possible water conservation techniques. The major benefits of harvesting natural

rainfall that the water can be harvested on a small-scale basis, such as on a bungalow or in housing societies, and it can also be done on a large-scale basis, such as at industrial level.

Many commercial premises have incorporated rainwater harvesting system in their building. And slowly, a lot of housing societies are also incorporating this technique. Harvesting rainwater involves the installation of a very simple technology that can be used by both commercial as well as residential places to make a tiny difference for a good cause.

In general, there are three main types of rainwater harvesting systems, which include direct pump, indirect pump and indirect gravity. Mentioned below (**Table 4**) is some of the most popular rain water harvesting techniques:

Table 4- Water Harvesting System in Yamuna Nagar District

Sr.No.	Activity Name	Works Completed	Works Ongoing	Expenditure (in Lakhs)
Water Conservation and Rain Water Harvesting				
1	Check Dam		0	
2	Pond / Tank		4	
3	Trench	6	0	
4	Rooftop Water Harvesting Structure (Public)	1258	0	
5	Rooftop Water Harvesting Structure (Private)	168		
6	Other Rainwater Recharge Structures (Open Well Recharge, Sand Filter for open well recharge)		0	
7	Other Water Conservation Structures (Bench Terracing, Canal)		4	
	Total		**8**	**139**
Renovation of Traditional and other Water Bodies / Tanks				
1	Traditional Water Bodies Restored	97	23	
	Total	**97**	**23**	**118**
Reuse and Recharge Structures				

1	Soak Pit	1194	8	
2	Stabilization Pond	2	0	
3	Other Reuse / Recharge Structure	153	1	
	Total	**1349**	**9**	**0**
Watershed Development				
1	Gully Plug	0	0	
2	Percolation Tank		0	
3	Staggered Trenches	0	0	
4	Other Watershed Construction Activities	226	34	
	Total		**34**	**721**
Intensive Afforestation				
1	Intensive Afforestation-Nurseries	8	8	
2	Intensive Afforestation- Plantation		15	
	Total		**23**	**72**
Awareness Programs by KVK				
1	Farmer's training programs by KVKs on Water Use Efficiency and Appropriate Crops	1709		
2	Distribution of one packet of vegetable seeds and saplings of five nutritious plants to farmers			
3	Awareness Programs/ KisanMela on the theme Valuing Water	1197		
	Total	**2906**		
Waste Water Treatment				
1	Use of Treated Waste Water	13835		
	Total	**13835**		

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 Yamunanagar District for rain water harvesting is shown in **Table 5** in rural and urban area. The map of water conservation activity Yamunanagar is shown in **Figure 12**.

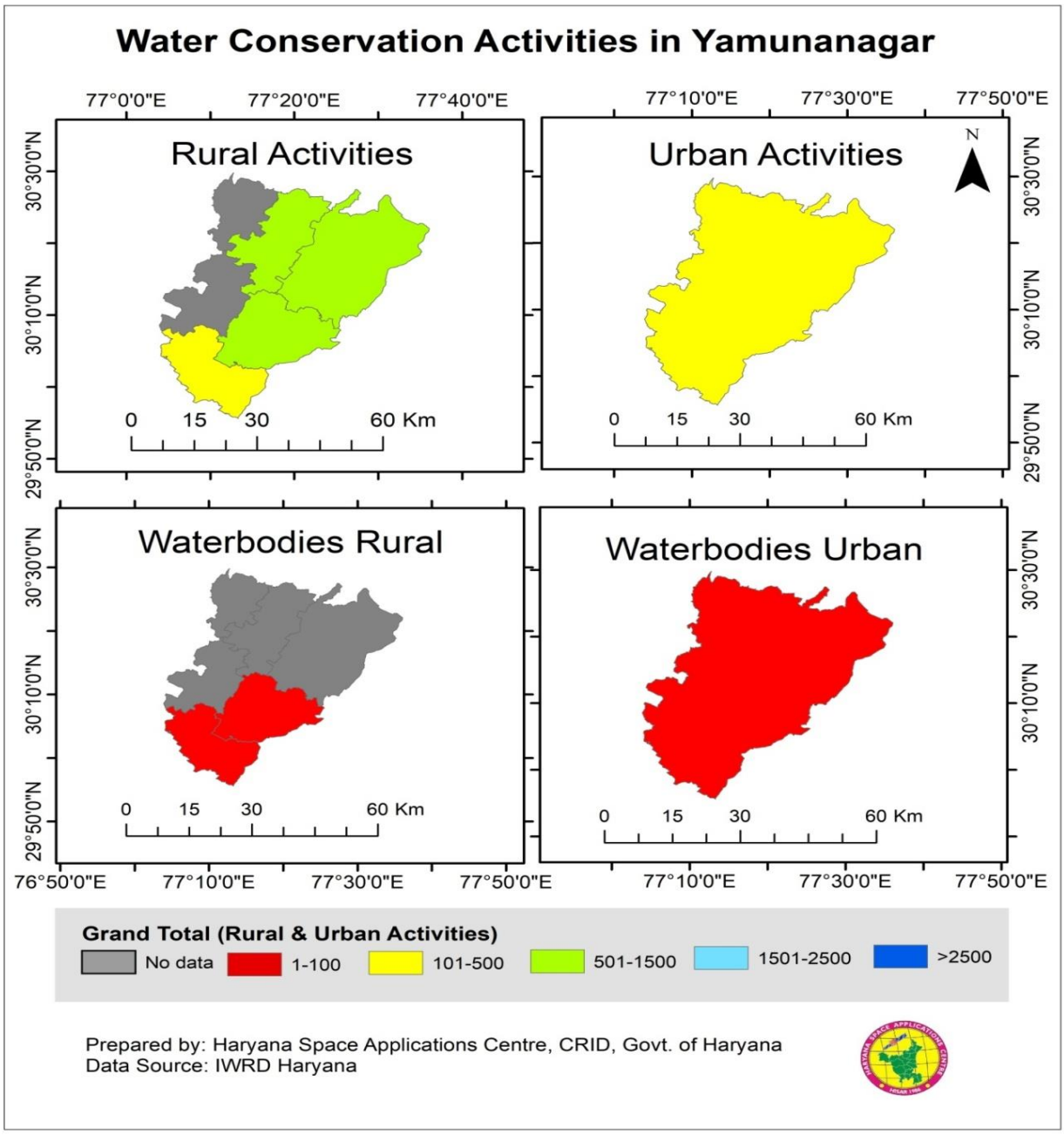


Figure 12- Water Conservation Activity in Yamunanagar District

Table 5- Water Harvesting activities in Rural area and Urban Area

In Rural Area		
Sr. No	**Block Name**	**Total No of Activity (no.)**

1	Bilaspur	506
2	Chhachhrauli	581
3	Jagadhri	507
4	Mustafabad	0
5	Radaur	430
6	Sadhaura	461
In Urban Area		
1	Yamunanagar	139

2.2.3 Sewerage Treatment Plants

Sewage from every residential colony, hotel, or corporate office collected in the sewage collection system. The purpose of a sewage treatment plants (STPs) is to thoroughly treat wastewater. The sewerage treatment plant map is shown in **Figure No. 13**. In Yamunanagar District a total of 6 treatment plant are installed having total capacity of approx. 40-60 MLD.

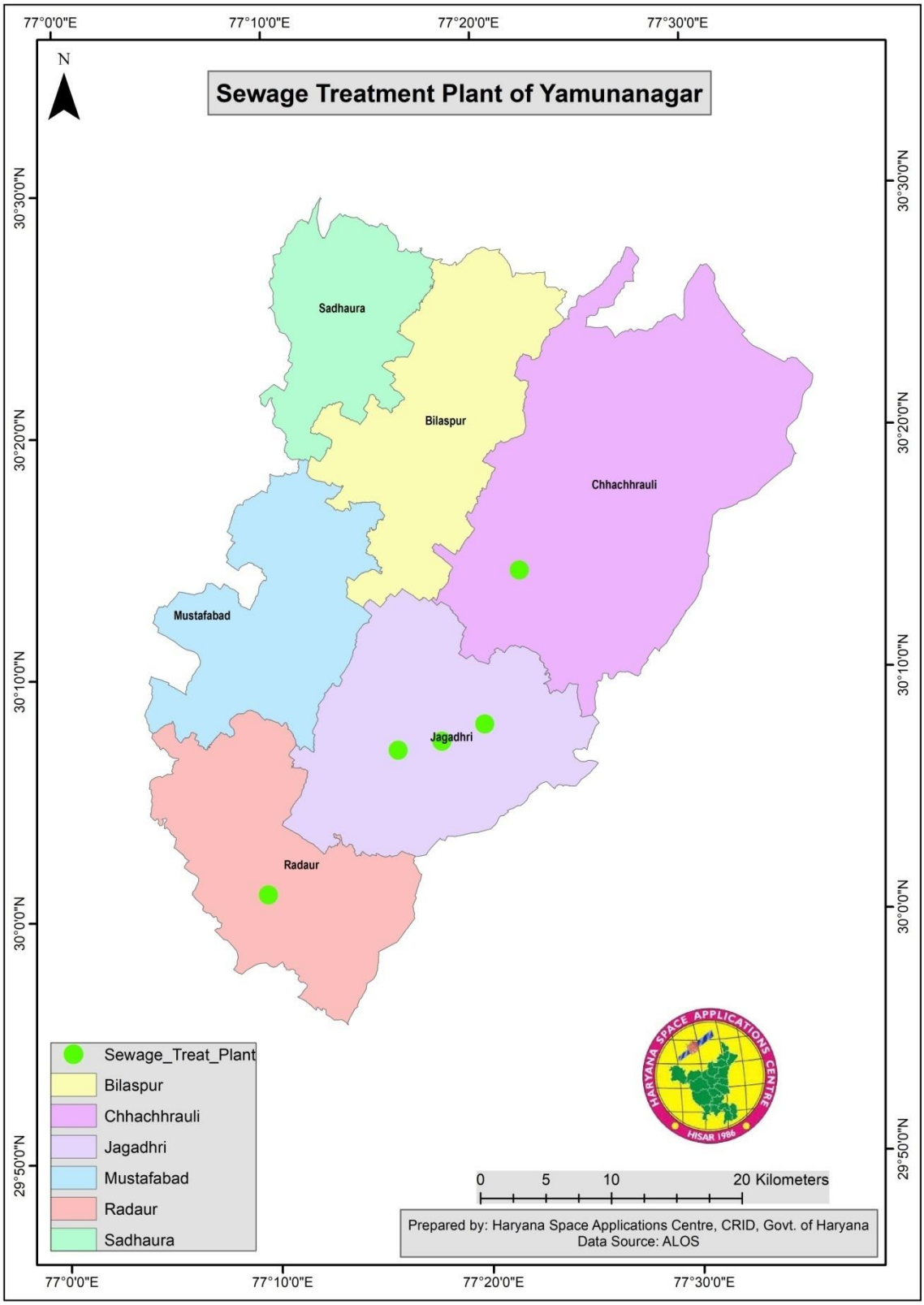


Figure 13- Water Treatment Plant Map of Yamunanagar District

3. Irrigation Profile

The gross irrigated area in the district is 2, 48,570 hectare which is around 130% of the 1, 91,603 hectares of gross cropped area. The extent of irrigated land in gross cropped area in Kharif is 32% while the same in Rabi is 38%. The gross cropped area in Rabi is 0.01% more than the gross cropped area in Kharif. In Kharif, the gross cropped area is 1, 27,035 hectares while during Rabi, the gross cropped area is 1, 27,048 hectares. In case of Horticultural and Plantation crops, the irrigated area is to the extent of 100% of the total area covered under this category of crops.

It is apparent from the table that 23% of the total agricultural area of Yamunanagar district falls in Chhachhrauli Block. The total irrigated area under agriculture in Chhachhrauli during Kharif is 28,188 hectare which is 23% of the total irrigated land in the district during Kharif season. In case of Rabi season, the total irrigated land in Chhachhrauli is 21.85% of the gross cropped area in the block. Chhachhrauli block also holds record for maximum extent of irrigated land in comparison to total cropped area. Sadhaura is the block in Yamunanagar district where the extent of irrigation is comparatively less than other blocks of the district. In this block, the extent of irrigation is only 47.52% during Kharif and 57.78 % during Rabi season. Area wise irrigation status of district is shown in **Table 6**.

Table 6- Area Wise irrigation Status

BLOCK	**IRRIGATED AREA IN HECTARE**
17127	17127
14531	14531
22573	22573
17590	17590
21798	21798
9213	9213
10128	10128
112960	**112960**

Source: Department of Agriculture, Yamunanagar (2020-21)

3.1 Irrigation Based Classification

The Gross Irrigated Area of Yamunanagar is 1,82,158 hectare and net irrigated area is 112844 hectares. The gross irrigated area is maximum in Jagadhri and minimum in Sadhaura. The net irrigated area is maximum in Jagadhri and minimum in Sadhaura. Irrigation based classification is shown in **Table 7** and extent of irrigation in blocks is shown in **Figure 14**.

Table 7 - Irrigation based classification

Block	Gross Irrigated Area	Net Irrigated Area	Partially Irrigated
Bilaspur	34288	17127	0
Chhachhrauli	21552	14531	0
Jagadhri	35029	22573	0
Saraswati Nagar	33639	17590	0
Radaur	32031	21798	0
Sadhaura	11120	9213	0
Partap Nagar	14499	10012	0
Total	182158	112844	0

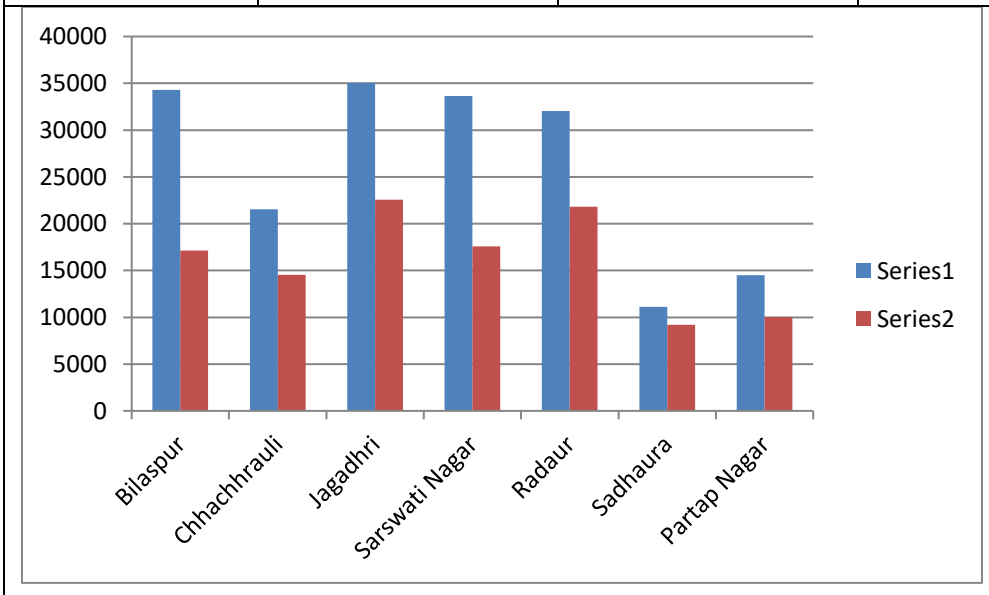


Figure 14- Extent of irrigation in the blocks of Yamunanagar

4. Water Availability

4.1 Surface Water Availability

The district is mainly drained by the rivers Yamuna, Markanda and its tributaries. Markanda is tributary of river Ghaggar and drains major part of the district. The high land between Markanda River and small rivulets of River Yamuna acts as basin boundary between west flowing rivers of Indus system and east flowing rivers of Ganga basin. River Yamuna drains eastern part of the district and acts as boundary between Haryana and Uttar Pradesh State.

Yamuna Nagar district is bestowed with rich water resources, both surface as well as ground water resources. The ground water is major sources of irrigation in the district. Nearly 40% of area is irrigated by canal water. Distributaries in the district are 21.45 Km long. Two major canals passing through the district are Western Yamuna Canal and augmentation canal.

4.2 Ground Water Availability

Rainfall is the major source of recharge to the groundwater body, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas. The block wise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 97% (block-Bilaspur) to 181% (block-Jagadhri). The total replenish able ground water resource in the district is 481.99 mcm, of which the total existing ground water draft by all means is 652.92 mcm. Ground water resources and irrigation potential for Nalagarh valley area of the district have been computed as per the GEC-97 methodology and the resources for the year 2011 are presented below in **Table 8**.

Table 8- Status of ground water availability

Sl.	Ground Water Resources (Yamunanagar) March 2011	
i.	Assessment Unit (Yamunanagar)	23849 ha m
ii.	Existing gross ground water draft for all uses	65292 ha m
iii.	Total Annual Ground Water Recharge	48199 ha m
iv.	Natural Discharge during Non-Monsoon season	5380 ha m
v.	Allocation for domestic and industrial requirement supply up to next 25 years	10471 ha m
vi.	Net ground water availability for future irrigation development	55077 ha m
vii.	Stage of ground water development	135%
viii.	Category of the assessment unit	Critical

Source: - CGWB Report Yamunanagar 2011

This suggests, that further ground water development is difficult as the blocks are categories as overexploited only Sadhuara block comes under critical category and rest all are categories as over exploited.

The following map (**Figure 15**) depicts the ground water depth in Yamunanagar district.

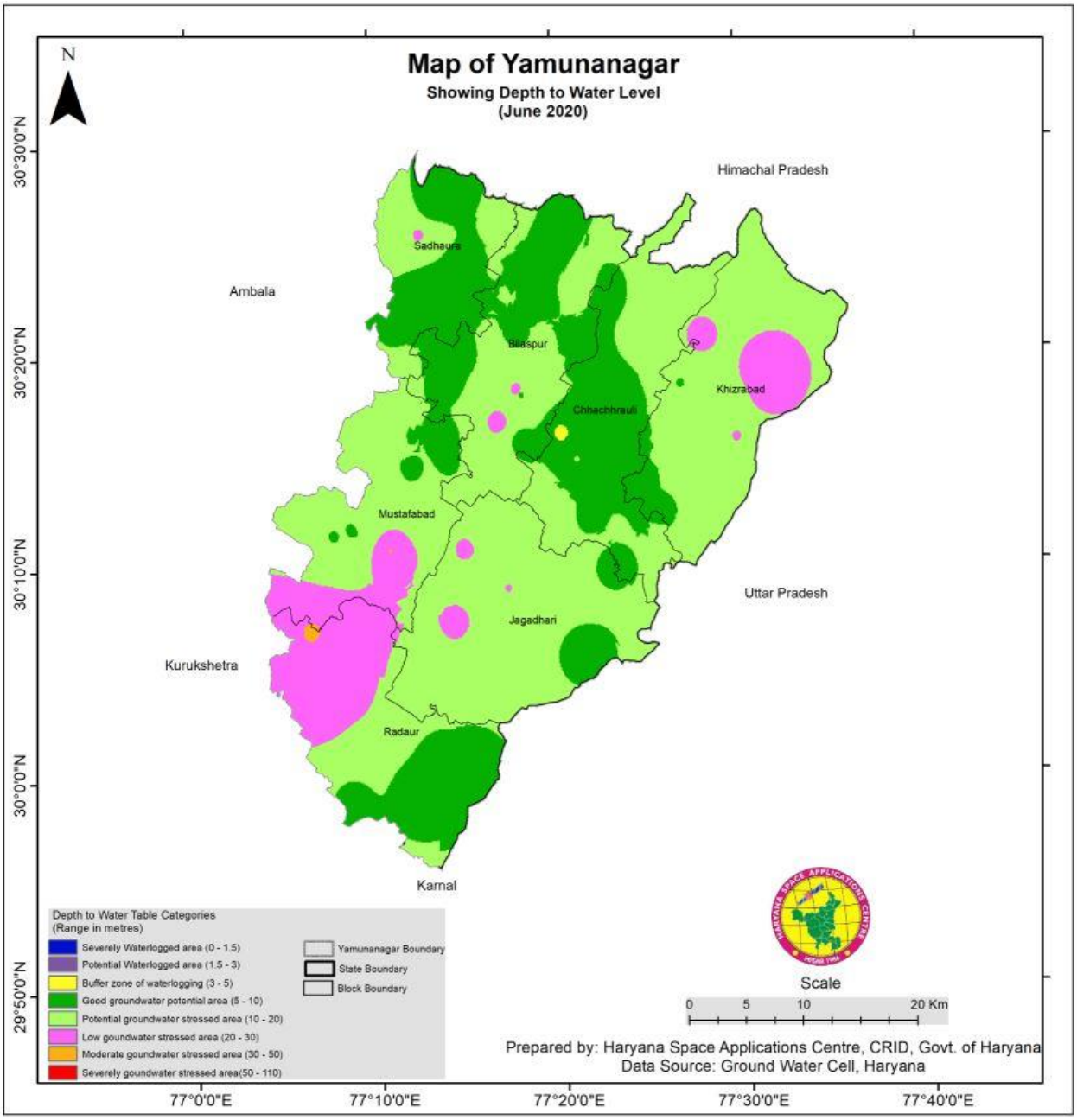


Figure 15- Ground water depth in Yamunanagar district

4.2.1 Ground Water Quality

Chemical quality of ground water from shallow as well as deep aquifers in the district indicates that ground water is generally alkaline and it is of low to medium salinity in nature and suitable for both domestic and irrigation use. All the parameters analyzed are well within the permissible limits of safe drinking water, as per Bureau of Indian Standard (BIS). Quality of ground water in shallow aquifer is good for domestic and irrigation purpose in the district. Except nitrate at Bilaspur and Mustafabad where

its values are 60 mg/l and 89 mg/l respectively, iron at Sabri (2.74mg/l) and Rasulpur (8.47mg/l) and arsenic at Shadipur (0.0152 mg/l). Block wise average water quality index value of Yamunanagar District is shown in **Table 9** and Water Quality Index od district is shown in **Figure 16**.

Table 9- Block wise average water quality index value in Yamunanagar District

Block Name	**Average Water Quality Index Value**
Bilaspur	57.489892
Chhachhrauli	58.075335
Jagadhri	49.254237
Mustafabad	57.271859
Radaur	44.630751
Sadhaura	63.826131

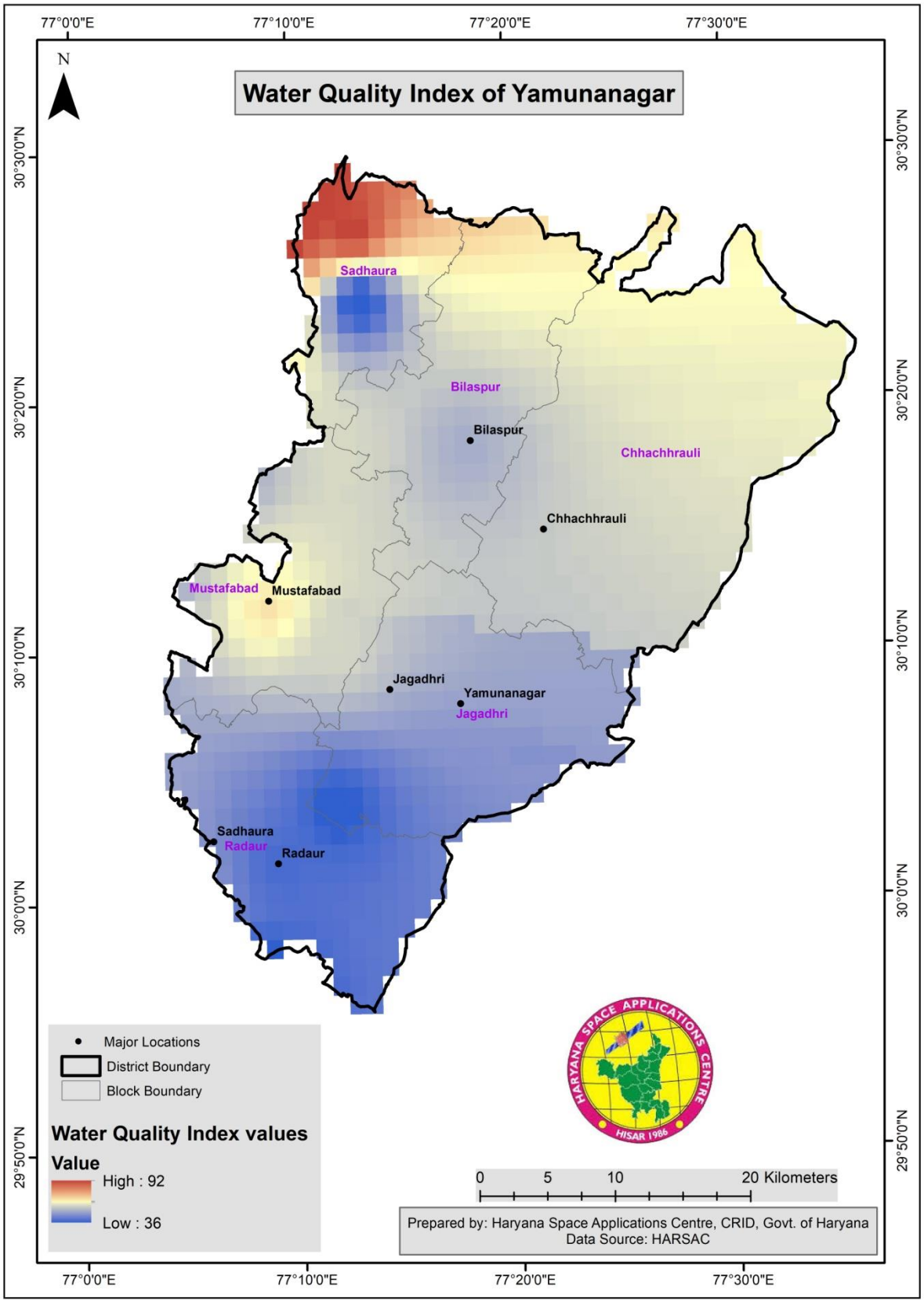


Figure 16- Water quality index of Yamunanagar District

5. Water Requirement/ Demand

This section deals with the current (2021) and projected (2026) demand of water for various sectors. The demand for water has been assessed on the basis of data obtained from different departments.

5.1 Water Supply and Gap

5.1.1 Domestic Water Demand

Data of Census 2011 and 2001 has been considered to arrive at the growth rate of population of the district. As per Census 2011, Percent growth for every village has been derived and cumulative estimated population of villages in a block are taken as population of the block.

It has been assumed that per capita daily water requirement of people residing in urban areas having sewerage utility of the district is 135 liters and for population in rural areas, the daily per capita daily water requirement is 55 liters. Using the same norms, block-wise Population has been worked out and is given in **table 10** below-

Table 10- Projected Population

Block	Population (2011)	Estimated Population (2021)	Estimated Domestic Water Demand (In ha m)
Bilaspur	126791	115440	294.57
Jagadhri	582069	724894	274.5
Saraswati Nagar	108668	118116	2631.98
Chhachrauli	119600	136655	177.8846
Sadhaura	68484	63949	263.75
Radaur	116464	131152	156.75
Partap Nagar	88610	100126	265.8
Total	**1210686**	**1390332**	**4065.3**

5.1.2 Crop Water Requirement

Crop water requirement for the district have been calculated based upon the cropping pattern followed in district. Cropping pattern under irrigated and rainfed system is different in the district. Under irrigated

conditions, in almost all the blocks vegetable based cropping system is followed. However, under irrigated system, paddy-wheat, maize-wheat based cropping systems are also being followed. Cereal crops occupy major portion in all the blocks and in district as a whole. Among grain crops, maize, wheat and paddy are the most commonly cultivated crops. In some blocks of the district, Barley is also being cultivated.

Since most of the area in the district is under flood irrigation so the losses are high and efficiency of irrigation is about 50%. So, if we consider total water demand for kharif crop to be 1.2 m and for Rabi crop to be 0.45m we arrive at the total water demand to be 1.65 m for the entire year. Now considering about 0.4m of irrigation demand to be fulfilled by the rains and remaining 1.25 by irrigation. So, taking 50% of 1.25 we arrive at a value of 0.6125 m. But as we observe actual evaporation is 0.6335 m for the district per year. So, water consumed is taken as irrigated area multiplied by actual evapotranspiration. **Table 11** shows Crop Water Requirement of blocks of Yamunanagar.

Table 11- Crop Water Requirement in Million Cubic Meter

Sr. NO.	**Block**	**Area under irrigation (in Hectares)**	**Water Depth required in meters (= Evapotranspiration)**	**Estimated Water Requirement (in MCM)**
1	Bilaspur	16018.43	0.6335	101.47
2	Jagadhri	17755.76		91.62
3	Saraswati Nagar	9961.32		112.48
4	Chhachhrauli	14463.89		63.48
5	Sadhaura	8309.42		134.90
6	Radaur	21295.27		55.60
7	Partap Nagar	10020.93		63.93

It can be concluded from the table that in all the 7 blocks, a total present water requirement in Yamunanagar district is 623.5 MCM. As per data received from agriculture and horticulture department water use efficiency has to be increased almost all area under irrigation. To reduce the use of water for irrigation it is done by changing the irrigation method means from flood irrigation to either drip or sprinkler. As the efficiency for flood irrigation is 50-60% while for drip it is around 90%. More and more area should be covered under drip and sprinkler irrigation in the district to increase the water use efficiency for crop cultivation.

5.1.3 Livestock Water Demand

The requirement of water for livestock of the district has been derived from the data provided by Animal Husbandry Department, Yamunanagar. **Table 12** below represents the total water requirement of the district for livestock block wise.

Table 12-Blockwise Livestock Water Demand

Sr. No.	Block	Water Required in MCM
1	Bilaspur	1.4
2	Jagadhri	1.19
3	Saraswati Nagar	1.19
4	Chhachhrauli	1.35
5	Sadhaura	0.75
6	Radaur	1.62
7	Partap Nagar	0.85
	Total	**8.35**

5.1.4 Industrial Water Requirement

Yamunanagar is well known for its industries. It has emerged as an important industrial destination in the state. This has been despite its relatively isolated location from rest of the state. Due to expanding industries, the city kept on extending geographically. This is primarily due to an increasing number of immigrants. This led to an intermixing of diverse culture. It also has to do with the rural ambiance which is reported to have undergone a lot of change. With increasing population, the trading aspects became brighter and the city went on becoming the second highest revenue generator of Haryana, immediately after Faridabad that owes its position largely to its prime location.

The city produces sugar machinery, paper machinery along with highly efficient equipment's for Petro-chemical plants, which are shipped to various refineries across the country. The city is also known for its Plywood productions, which is attributed to the easy accessibility of primary raw material – poplar tree. It has also one of India's largest railway carriage and wagon repair workshops. Recently, Reliance Industries

has also installed a thermal power plant in the town. HSVP has done major development work in the land-stretch linking the city with Jagadhri, the other part of twin city. Major industrial products requiring water in the state is as follows mentioned in **Table 13**.

Table 13- Industrial Water Demand in MCM

Block	Current Water Demand	Water Demand in 2026	Existing Water Potential	Water Potential to be created
Bilaspur	0.11	14.92	NA	14.83
Chhachhrauli	1.6	11.3	NA	9.7
Jagadhri	24.69	23.99	NA	-0.07
Mustafabad	0.01	8.65	NA	8.64
Radaur	1.59	9.45	NA	7.86
Sadhaura	0.44	6.68	NA	6.24
Total	**28.44**	**50.94**	**NA**	**22.5**

5.1.5 Water Demand for Power Generation

In the Yamunanagar District the Deenbandu Chhotu Ram thermal power plant (DCRTPP) is under working condition with total power generation capacity is 600 MW (2 x 300 MW). The current water demand (year 2016) for the power plant is 25 cusecs. And in future expansion of plant is planned. The new proposed plant is having capacity of 660/800 MW (1 x 660/800 MW). The future water demand for the plant is 25 cusecs. So, the total water demand for thermal power plant up to 2022 is 50 cusec means 44.66 MCM annually. **Table 14** shows DCRTPP power plant water demand.

Table 14- DCRTPP power plant water demand.

Yamunanagar	Power Requirement	Water Demand	Water Demand in 2022	Water Requirement in MCM
Deenbandu Chhotu Ram Thermal Power Plant (DCRTPP) Yamunanagar	2x300 MW	25 cusecs	25cusec	22.33
Deenbandu Chhotu Ram Thermal Power Plant (DCRTPP) Yamunanagar (Expansion)	1x660/800 MW 3rd Unit		25 cusecs	22.33
Total water demand in MCM				**44.66**

Present water demand is met from the water being provided through Western Yamuna Canal future demand will also be met from the same.

5.1.6 Total Water Demand of the district for various sectors

This section presents the total water demand of the district and has been calculated by summing up all major sectors consuming water. The current water demand and the projected water demand have been depicted in **Table 15 and 16**.

Table 15- Total water Demand (in MCM)

Sector	Water Demand (2021)
Domestic	40.65
Agriculture	623.5
Livestock	8.36
Industry	28.44
Power	22.33
Total	**723.28**

Table 16- Total Water Demand Block wise

Block	Domestic Water Demand	Irrigation Water Demand	Livestock Water Demand	Total
Bilaspur	294.57	10147.68	139.6894	**10581.94**
Chhachrauli	274.5	9162.26	135.5	**9572.26**
Jagadhri	2631.98	11248.24	119.4221	**13999.64**
P. Nagar	177.8846	6348.262	85.29397	**6611.441**
Radaur	263.75	13490.55	162.2087	**13916.51**
Sadhaura	156.75	5560.6192	75.21701	**5792.586**
S. Nagar	265.8	6392.559	118.94764	**6777.307**
Total	**4065.235**	**62350.17**	**836.2788**	**67251.68**

5.2 Water Budget

A water budget is a hydrological tool used to quantify the flow of water in and out of a system. In other words, it is an accounting of all water stored and exchanged on the land surface (rivers, lakes), subsurface (aquifer, groundwater), and atmosphere (precipitation, evaporation). Total Water inflow through rain is shown in **Table 17**.

While assessing the water being used from Surface sources and through Ground Water extraction, following assumption has been considered.

- Since the total water available (consumed) by different sector had to be bifurcated based on their source of origin (Surface/ Ground), proportion of number of ground water and surface water sources have been taken as the basis for bifurcation of total volume of water.
- Runoff coefficient is taken as 0.2 for inhabited areas and as 0.8 for habited areas.

Table 17- Total Water inflow through rain

Sr. No.	Block	Area (in ha)	Total Rainwater (in ha m)
1	Jagadhri	25347.13	11807
2	Saraswatinagar	19714.96	8152.7
3	Bilaspur	28988.71	11505
4	Chhachrauli	27302.92	11781
5	Sadhaura	15065.85	5234.5
6	Radaur	23739.42	8695.3
7	Partap Nagar	20199.44	7504.1

Total water input as Rainfall (after deducting evapotranspiration) = 71689.69 = 716.9 MCM

Total Water Deficit in 2021 = 6.38 MCM

6 Strategies for Water Conservation

Water conservation plan of district revolve around “Each drop of water is precious”. District administration is committed to giving high priority to water security. It will complete the long pending water conservation structures as well as irrigation project on priority and launch the “Jal Shakti Abhiyan Phase 2” with the motto of ‘Catch the rain, where it falls, when its falls’. There is a need for seriously considering all options of conserving water for ensuring optimal use of our water resource to prevent the recurrence of floods and droughts.

The goals of plan can be enumerated as:

- Improving the effectiveness of water in district
- Reducing the loss of water
- Recycle/Reuse of water
- Recharge of ground water by rain water harvesting methods and Afforestation
- Reviving the traditional infrastructure for water recharge
- Convergence of existing and new schemes for water conservation with local bodies funds under 14th finance commission
- Effective monitoring and sustainability of various structures built under this abhiyan.

The district water conservation plan is developed by compilation of different department conservation plans, which is essentially the compilation of water conservation plan of respective rural and urban areas of district. This is essentially a strategy to conserve, recharge and improve water use efficiency. Overall emphasis is laid on to build efficient system in every sector like treatment and reuse of wastewater, water saving practices, drinking water supply system meeting design standards etc. **Table 18** shows Water Conservation and Rainwater Harvesting techniques used in Yamunanagar.

Table 18- Water Conservation and Rainwater Harvesting

Sr. No.	**Sub Categories**	**Department**	**Planned Target Year 2021 (April-November)**		
			Number	**Estimated Cost (In Lacs)**	**Volume of Water Likely To be saved (In cum)**
A.					
1.	Roof Top/Rain Water harvesting on public Buildings	Irrigation	9	43.37	3375
		Rural Development and Panchayats	77	119	5433
		Agriculture/ASCO	3	5	137
		PWD (B&R)	17	70.55	14807.5
		PHED	10	-	82.5

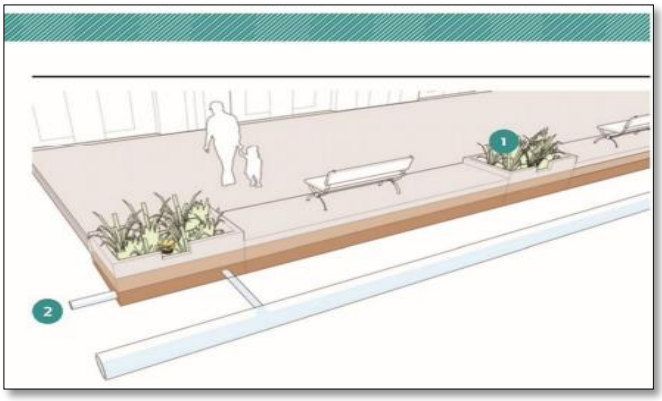
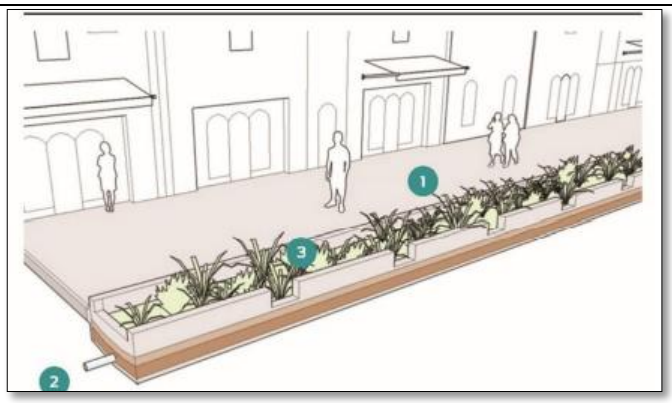
		Urban Local Bodies	4	9	400
		HSVP	100	-	
		Forest	10	5	3293.84
		Jan Panchayati Raj	51	67.42	867
		Education	629	1258	31450
		HSIIDC	20		2800
		Women & Child Development	475	95	27000
2.	Soak Pits	Rural Development and Panchayats	1450	62.31	102805
		Urban Local Bodies	50	2.15	3500
B.	**Renovation of Traditional and other Water Bodies**				
1	Desilting of channels and internal clearance of Drains	Irrigation	21	176.11 (MGNREGA)	520
2.	Restoration of traditional Water Bodies	Agriculture	08	48	72000
3.	Desilting, Deepening & Renovation of Ponds	Rural Development and Panchayats	51	160	303284
4.	Desilting of Ponds	Jan Panchayati Raj	27	160	125250
5.		Urban Local Bodies	5	28	23194
C.	**Reuse, Borewell Recharge Structures (in Nos.)**				
1.	Borewell Recharge	Agriculture	10		36797
D.	**Watershed Development**				

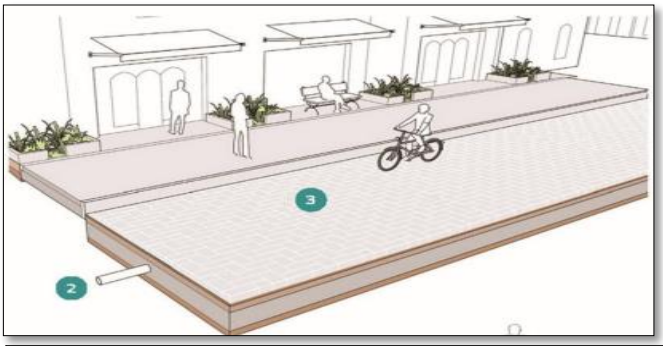
1.		Agriculture	59	107	708000
2.	Trenches	Irrigation	5	1.5	254.88
E.	**Intensive Afforestation**				
1.	Afforestation	Forest	1000000	173.27	
F.	**Krishi Vigyan Kendra Melas**				
1.	KrishiVigyan Kendra Melas	Agriculture	3010		-
2.	KisanMela	Agriculture	2	4	-
G.	**Crop Shifting Area**				
1.	Crop Shifting Area	Agriculture	2000 Hac.		5000000

6.1 Water Sensitive Urban Design

As more and more portions of the district become urbanized, 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 Gurugram. Water Sensitive Urban Design (WSUD) is a familiar concept for engineers and architects practicing and designing 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. The methods of water table recharge strategies in urban area are shown in **Table no 19.**

Table 19- The methods of water table recharge strategies in urban area

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

3	Pervious Pavement	 
4	**Stormwater Tree**	

6.2 Plantation

Plantation plays a significant role in absorption of storm and rainwater for maintenance of ground water table, prevention of soil erosion and run-off and encourage growth of natural habitat for flora and fauna. The Forest Department performs an important Role in intensive afforestation near Water Bodies, Public spaces, parks, road side and forest land to improve green cover and water cycle. The large amount of land is in wasteland form that could be used for plantation. The wasteland that could be used for plantation for conservation of water in Yamunanagar district is shown in **Figure 17** and **Table 20** shows the proposed no of plantation targets in Yamunanagar District.

Table 20-The proposed targets for plantation in Yamunanagar District

Block Name	Wasteland Area (acre)	Plantation at 5 feet spacing
Bilaspur	3168.4	27603100
Chhachhrauli	21244.2	185079470
Jagadhri	703.3	6127149
Mustafabad	66.8	581961
Radaur	183.3	1596909
Sadhaura	3336.1	29064103

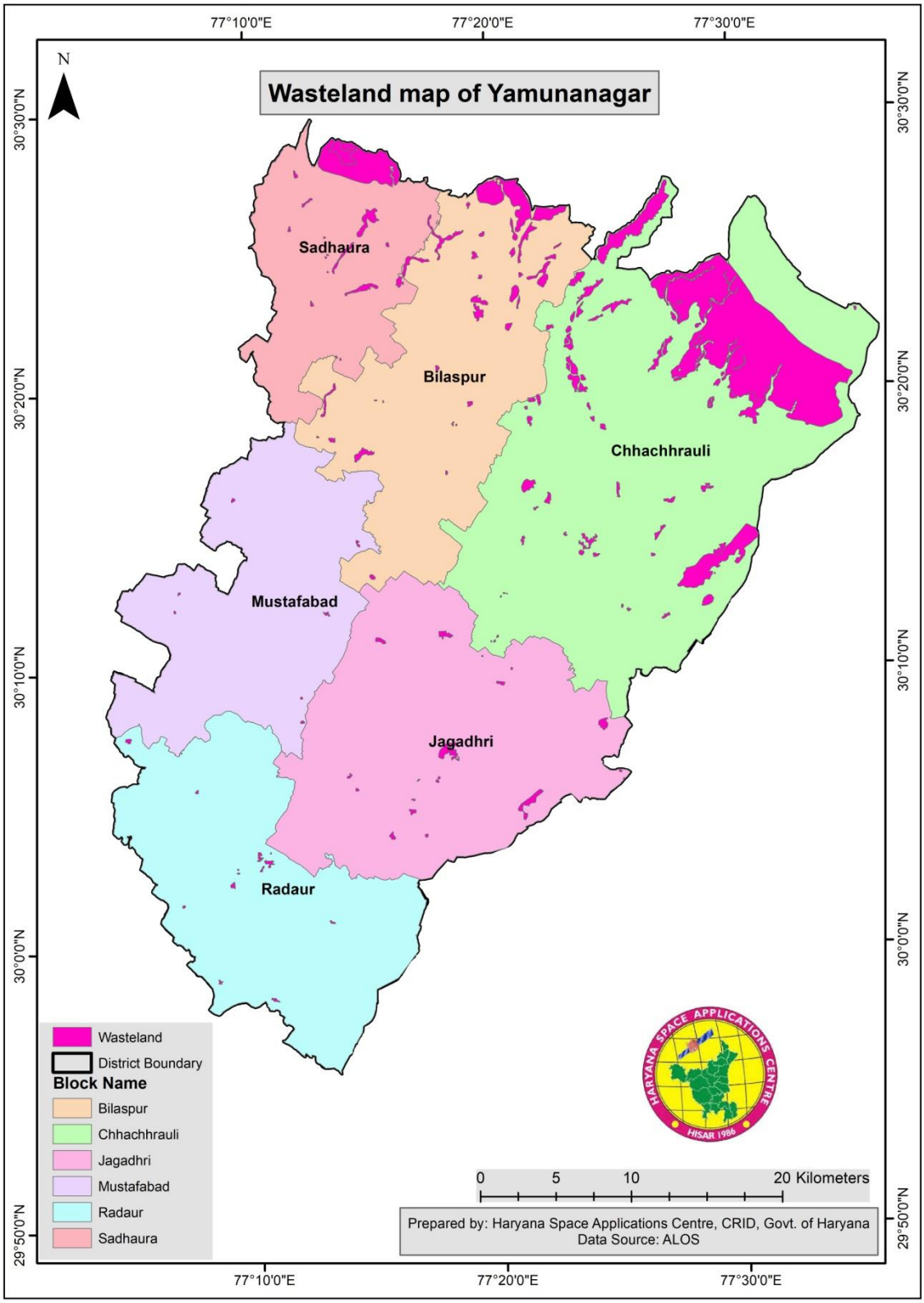


Figure 17- Wasteland Map of Yamunanagar District

6.3 Surface water management

6.3.1 Pond restoration and rejuvenation

Urban water bodies such as lakes, ponds, step-wells, and baolis have traditionally served the function of meeting water requirements of drinking, washing, agriculture, fishing and religious/cultural purposes. Surface water bodies and traditional water harvesting structures in several cities have either dried up, or disappeared due to encroachment, dumping of garbage, and entry of untreated sewage.

Research also shows that that storage of water within a single pond structure contributed to a range of 26,000 to 62,000 m3 to groundwater recharge over a year, that was equivalent to 1.3 to 3.6% of the total water recharge volumes in the study carried out in Ramganga Basin, India, which would serve to irrigate lands of 8 to 18 hectares of land cropped in the rabi season. 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 revolutionized and reinstated the importance of having water storage and wise utilization 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 centers 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 Gurugram 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 11 step procedures that is accommodative of each individual pond site requirements is 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 proceeding and after as well.

6.3.2 Decentralize Treatment Plant

It is recognized that in the absence of 100% sewerage network connectivity just managing the gray 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 center and rural areas where open drainage systems still exit. Over the past three decades, the city limits of Gurugram 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, decentralized systems must be properly designed, maintained, and operated to provide optimum benefits.

6.4 Information Education and Communication

There is need for public awareness regarding water conservation. Jal Shakti Abhiyan has been designed to achieve greater public participation in the efforts being undertaken by Centre/States/UTs/ULBs in this regard. Local communities need to be mobilized to play a vital role in efforts being undertaken under

JSA-2. Nehru Yuva Kendra should undertake measures to encourage collective ownership in management of water available locally.

NYK Yamunanagar launched the “Catch the Rain, where it falls, when it falls” Campaign on 31.12.2020 under the worthy Chairmanship of DC Yamunanagar & District level launching, promotion and distribution of IEC materials and Water Pledge taking Ceremony for effective management & conservation of water at District, block and village level taken place.

In a nutshell NYK Yamunanagar has made all possible efforts in making the Catch the Rain Campaign a People’s Campaign (Jan Andolan) and ensured their active participation. The effective collaboration with District Administration was indispensable part of all the IEC activities. **Table 21** shows Intervention activities in Yamunanagar district.

Table 21- Intervention activities.

Serial	Intervention Name	Number of Activity Planned
1	State and District Twitter Account to post daily under #jalshaktiabhiyan	15
2	Radio Jingles	5
3	Radio Interviews with scientist/agriculturist	1
4	Nukkad Nataks	10
5	Newspaper Advertisements	15
6	Films/Documentaries	1
7	Taru yatras (Sapling yatras by people)	5
8	Prabhat pheris	20
9	Paudhagiri (tree plantation by children of 6-12 years)	15
10	Special Projects such as human chain,crop diversification,micro irrigation etc	1
11	Wall Paintings	30
12	Brand Ambassdor and youth Icon	5
13	Fortnightly success story dissemination throw print and social media	5
14	Celebration of GP/Block/District with most water conservation activities	5
15	Marathon for afforestation and water conservation	3

7 Proposed Activity

7.1 Rainwater harvesting

Rain water harvesting primarily consists of the collection and storage of rainwater for subsequent use as source of water. The harvested water can be used for both potable and non-potable applications. There are many examples of rainwater harvesting systems which provide water for domestic, commercial, institutional and industrial purposes as well as agriculture, livestock, groundwater recharge, flood control, process water and as an emergency supply for firefighting. There are different criteria and techniques to select suitable sites for harvesting rainwater. In recent years, the analytical hierarchy process (AHP) and multi-influencing factors (MIF) are most widely used model for identification of rainwater harvesting sites. The AHP technique determines the weights of thematic layers and their rank to process identify the zones of rainwater harvesting sites. MIF analysis is an effective tool for water management because it is comparatively simple and reliable.

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 18**). The block wise area proposed for rainwater harvesting under most suitable sites is shown in **Table 22.** For the process of calculating suitable site a fixed weightage is needed to be applies on the above-mentioned criteria (**Table 23).**

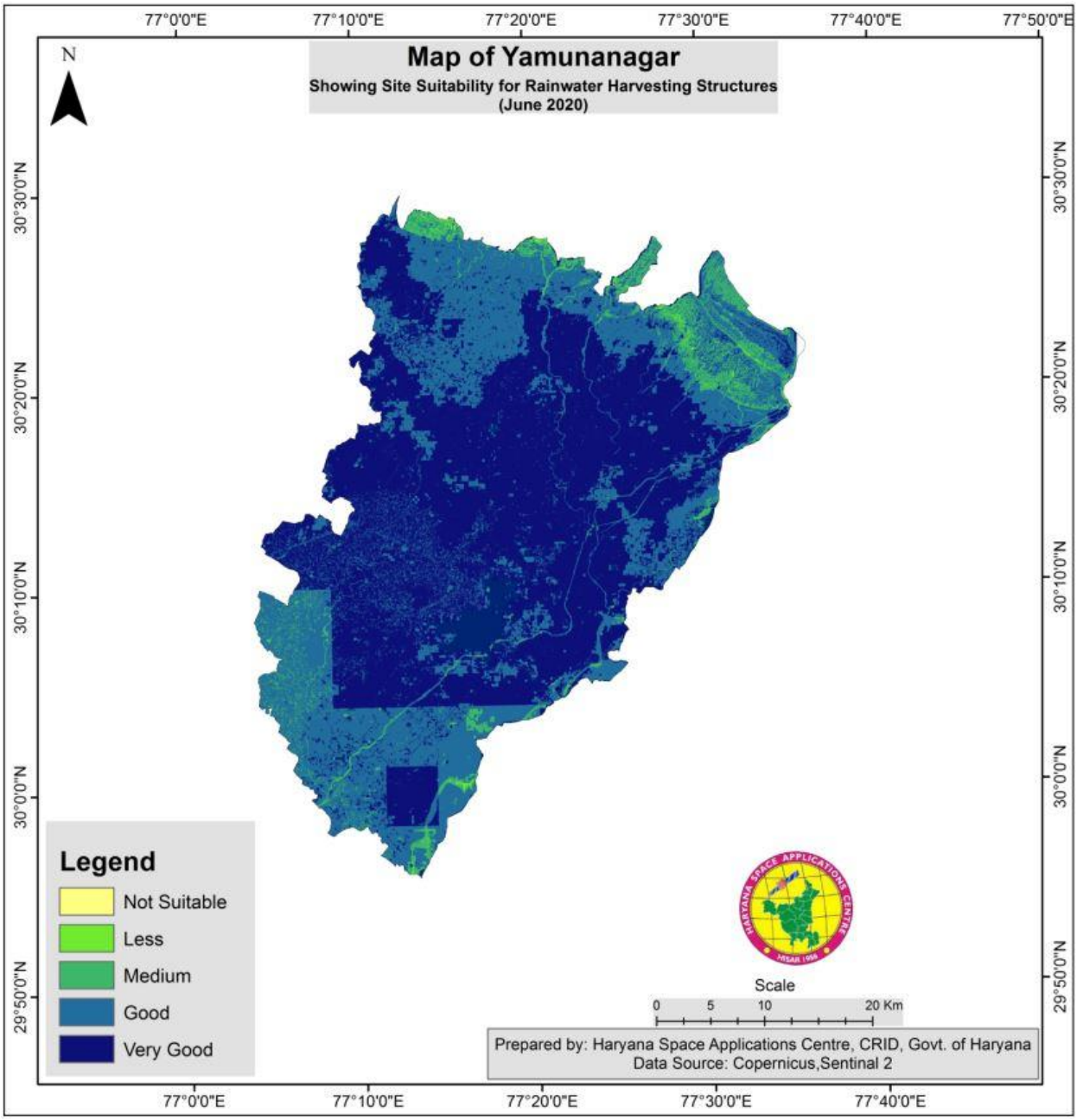


Figure 18 -Proposed Site Suitable Map for rain water harvesting

Table 22- Block wise area under very good suitable site proposed for rain water harvesting

Block Name	Area (Sq. meter)
Bilaspur	252373187
Chhachhrauli	475543197.2
Jagadhri	296817867
Mustafabad	215661499.3
Radaur	227900058.6
Sadhaura	142720311.1

Table 23 -Assigned Weight for Criteria Parameters

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

7.2 Proposed Suitable Site based on multi-criteria

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. Following are the outcomes that show the type of structure on the streams. **Figure 19** shows the proposed suitable site based on multi criteria. Block wise proposed suitable sites based on multi-criteria is shown in **Table 24**.

Table 24- 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	Bilaspur	2		1		
2	Chhachhrauli	5	1	2		
3	Jagadhri					1
4	Mustafabad					
5	Radaur					
6	Sadhaura	2				

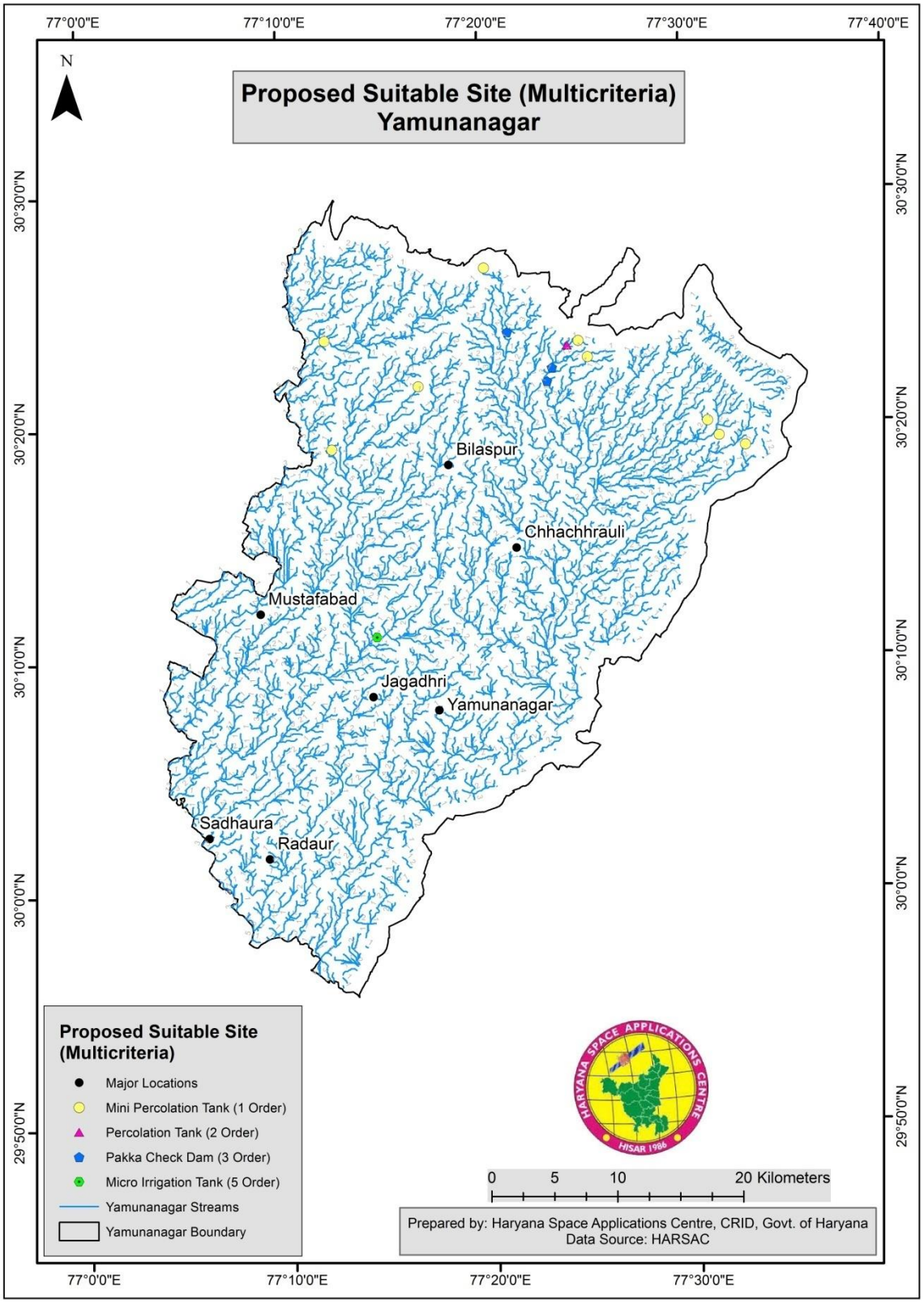


Figure 19- Proposed suitable sites based on multicriteria in Yamunanagar District

7.3 Proposed Suitable Site based on Drainage

The drainages that are created from satellite imagery 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 Mini percolation Tanks on 1st order Stream, percolation Tanks on 2nd Order Stream, Pakka check Dams 3rd Order Stream, Annicut on 4th order, Micro Irrigation tanks 5th Order can be built. **Figure 20** shows the proposed suitable sites based on drainage structure in Gurugram district. Proposed harvesting structures in Gurugram based on drainage **Table 25.**

Table 25 Proposed harvesting structures in Yamunanagar based on drainage

Sr. No.	Block Name	Mini percolation Tank	Percolation Tank	Pakka Check Dam	Annicut	Micro Irrigation Tank
1	Bilaspur	18	21	45	15	9
2	Chhachhrauli	35	33	76	43	30
3	Jagadhri	9	15	21	22	17
4	Mustafabad	19	21	37	15	45
5	Radaur	17	11	46	17	24
6	Sadhaura	11	8	36	11	4

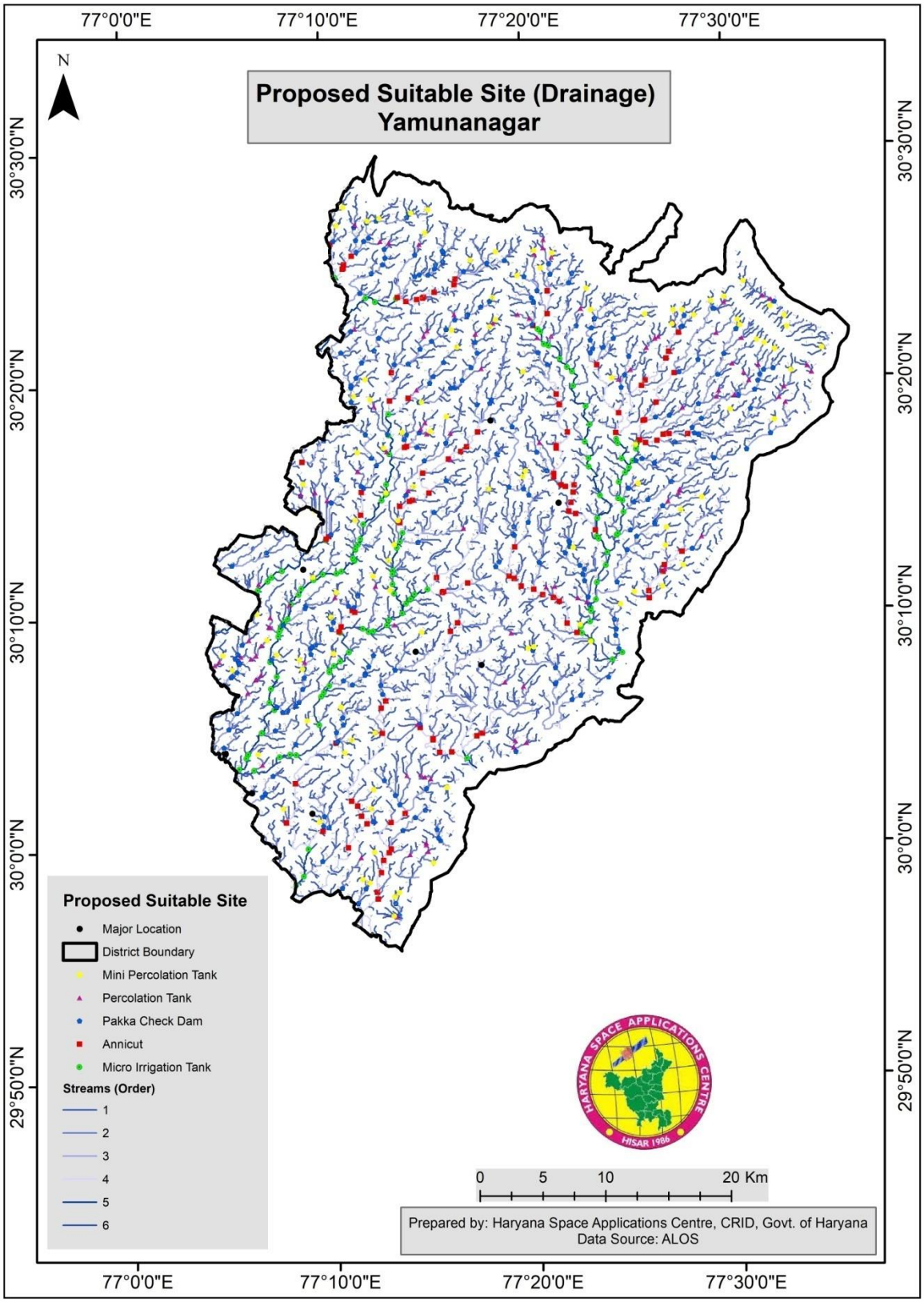


Figure 20 -Proposed suitable sites based on drainage in Yamunanagar District

8. Conclusion

Due to rapid urbanization, the Yamunanagar 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.

……..END……

“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

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