DRAFT FINAL REPORT

PREPARATION OF SUB-REGIONAL PLAN FOR HARYANA SUB-REGION OF NCR

Department of Town and Country Planning, Haryana

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Chapter 1 : INTRODUCTION

1.1 *Background*

The unprecedented growth of metropolitan cities in the country has become a source of serious concern to Government, on the one hand, and metro-city corporators, planners, demographers and social scientists, on the other. The Census 2001 reveals that the number of million-plus cities has almost tripled over the last three decades, jumping from a mere 12 in 1981 to 23 in 1991 and 35 in 2001. Interestingly, the aggregate population of these metro cities accounts for more than a third (37.81%) of the country's total urban population, which is spread over more than 5,000 towns. It, therefore, goes without saying that these 35 metro (or million-plus) cities should be the focus of a sustained, country-wide effort to regulate and contain runaway urban growth by channelising fhe flow and direction of economic growth (on which the urban phenomenon feeds) along more balanced and spatially-oriented paths. This is essentially what the National Capital Region (NCR) Planning Board is attempting to do with respect to the National Capital City.

The vast hinterland of the NCR, which lies mostly outside the Delhi Metropolitan Area (DMA) [now Central National Capital Region (CNCR)], continues to experience a very slow rate of economic development even while the core Sub-region of NCT-Delhi is witnessing a phenomenal surge of physical and economic growth. When we see the population trend of Delhi we find there is very high growth during last several decades. The decennial growth rate has been as high as 90% during 1941-51 and over 50% till 1981-91.

Below table 1.1 shows the population trend of Delhi since 1901.

Table 1-1 : Population trend of Delhi since 1901

Year	Total Delhi Population	Percentage increase	Urban Population	Percentage increase	Rural Population	Percentage increase
1901	405819	_	214115	_	191704	_
1911	413851	2.0	237944	11.13	175907	-8.24

1921	488452	18.03	304420	27.94	184032	4.62
1931	636246	30.26	447442	46.98	188804	2.59
1941	917939	44.27	695686	55.48	222253	17.72
1951	1744072	90.00	1437134	106.58	306938	38.10
1961	2658612	52.44	2359408	64.17	299204	-2.52
1971	4065698	52.93	3647023	54.57	418675	39.93
1981	6220406	53.00	5768200	58.16	452206	8.01
1991	9420644	51.45	8471625	46.87	949019	109.86
2001	13850507	47.02	12905780	52.34	944727	-0.45

Source : Census of India 2001

1.2 *Need of NCR Planning Board*

The explosive rate of growth in its population has been a cause of serious concern to the government and all concerned city authorities. Efforts were made, in the past, through planned development and controls to contain the population of Delhi Metropolis. However, due to heavy influx of migration to Delhi from surrounding areas these efforts did not yield encouraging results. This population increase has heavily strained the infrastructural facilities and its resources. Therefore, it was felt necessary to invest in selected settlements outside the metropolis at appropriate distance and also, in impulse sectors to relieve Delhi of these pressure within a reasonable time frame. In order to prevent new pressures being generated and relieve Delhi from its present avoidable pressures it was felt that the planned growth of Delhi should be conceived only in a regional context. The need for Regional approach was felt as early as in 1959 when the draft Master Plan for Delhi was prepared. Thereafter the Master Plan of 1962 recommended that a statutory National Capital Region Planning Board should be set up for ensuring balanced and

harmonized development of the region. Thereafter a statutory organization called "National Capital Region Planning Board" was set up in March 1985 under the National capital region planning board act -1985, to plan and promote the balanced and harmonized development of the Region comprising of Union territory of Delhi ; Meerut, Bulandshahar and Ghaziabad Districts of Uttar Pradesh ; Faridabad, Gurgaon, Rohtak and Sonipat districts and Rewari tehsil of Mahendragarh district and Panipat tehsil of Karnal district of Haryana ; and Alwar, Ramgarh, Behror, Mandawar, Kishengarh and Tijara tehsils of Alwar District in Rajasthan. The board in its 26th meeting held on 16.01.2004 approved the inclusion of additional areas comprising the remaining tehsils of Alwar district to NCR . Thus , the total area of NCR increased to 33578 SqKm in 2004 against area of NCR 30242 SqKm in 1986.

This NCR planning board had been formed keeping following objectives in mind:

1. Relieving the capital city from additional pressures.

2. Avoid adding new pressures on the capital and

3. Development of settlements in NCR to play their assigned role.

To achieve these objectives Regional plan 2021 was prepared under section 10 of NCR Planning Board Act, 1985. The Regional Plan-2021, has suggested strategies and programmes to achieve the objectives of balanced development of the region. In order to implement these programmes and policies, it is necessary to prepare the Sub-regional Plan, Action Plans and Functional Plans for each sub-region.

1.3 *Provisions for Sub-Regional plans*

Under the provision of Section 17 of the NCRPB Act,1985 there is detailing of preparation of Sub-Regional plan. Section 19 of Act provides the directions for the submission of Sub-Regional plan to the Board for the approval and Section 20 of Act provides for the implementation of Sub-Regional plans by each participating States.

1.4 *Section 17 of NCRPB Act, 1985*

Under this section there are following provisions:

1. Each participating State shall prepare a Sub-Regional Plan for the sub-region within that State and the Union Territory shall prepare a Sub-Regional Plan for the sub-region within the Union Territory.

2. Each Sub-Regional Plan shall be a written statement and shall be accompanied by such maps, diagrams, illustrations and descriptive matters as the participating State or the Union territory may deem appropriate for the purpose of explaining or illustrating the proposals contained in such Sub-Regional Plan and every such map, document, illustration and descriptive matter shall be deemed to be a part of the Sub-Regional Plan.

3. A Sub-Regional Plan may indicate the following elements to elaborate the Regional Plan at the sub-regional level namely :-

    a) reservation of areas for specific land-uses which are of the regional or sub-regional importance ;

    b) future urban and major rural settlements indicating their area, projected population, predominant economic functions, approximate site and location ;

    c) road net-work to the district roads and roads connecting major rural settlements ;

    d) proposals for the co-ordination of traffic and transportation, including terminal facilities ;

    e) priority areas at sub-regional level for which immediate plans are necessary ;

    f) proposals for the supply of drinking water and for drainage ; and

    g) any other matter which is necessary for the proper development of the sub-region.

1.5 *Section 19 of NCRPB Act, 1985*

Under this section following provisions are there :

(1) Before publishing any Sub-Regional Plan, each participating State or, as the case may be, the Union territory, shall, refer such Plan to the Board to enable the Board to ensure that such Plan is in conformity with the Regional Plan.

(2) The Board shall, after examining a Sub-Regional Plan, communicate, within sixty days from the date of receipt of such Plan, its observations with regard to the Sub-Regional Plan to the participating State or the Union territory by which such Plan was referred to it.

(3) The participating State, or, as the case may be, the Union territory, shall, after due consideration of the observations made by the Board, finalize the Sub-Regional Plan after ensuring that it is in conformity with the Regional Plan.

1.6 *Section 20 of NCRPB Act, 1985*

Under this section it is given that each participating State, or, as the case may be, the Union territory shall be responsible for the implementation of the Sub-Regional Plan, as finalized by it under subsection (3) of section 19, and Project Plans prepared by it.

Under the above provision of NCR Planning Board Act,1985, the draft Sub-Regional plan is being prepared for the Haryana Sub-Region of NCR.

Chapter 2 : THE REGION

2.1 *National Capital Region (NCR) Delhi*

2.2 *Constituent area of NCR*

National capital region (NCR) constitutes of National Capital Territory Delhi and various parts of three states namely UP, Haryana and Rajasthan. The detailed description is shown in table (2.1):

Table 2-1 : NCR Constituent descriptions

Sub-Region	Population (2001)	Growth rate (%)	Population Density (Persons/Sq Km)	Area (Sq Km)	Area share to NCR (%)	Population share to NCR (%)
NCT Delhi	13850507	47.02	9340	1483	4.41	37.33
Haryana	8687050	30.76	648	13413	39.95	23.42
Rajasthan	2992592	30.31	382	7829	23.32	8.06
UP	11570117	28.53	1066	10853	32.32	31.19
NCR	**37100266**	**35.59**	**1105**	**33578**	**100.00**	**100.00**

Source : Census of India 2001

2.2.1 General Profile

The NCR lies between 27^0 03' and 29^0 29' North latitude and 76^0 07' and 78^0 29' East longitude. The physiography of the region is characterized by the presence of the Ganga skirting it as its eastern boundary, the Yamuna traversing north-south forming the boundary between UP and Haryana, and the sand dunes and barren low hills of the Aravalli chain and its outcrops in the west, flat topped prominent & precipitous hills of the Aravalli range enclosing fertile valley and high table lands in the south-west, and the rolling plains dominated by rain fed torrents in the south. The rest of the region is plain with a gentle slope of north-east to south and south west.

The rock type exposed in the area belongs to Delhi Super-group of Lower Proterozoic age consists of Quartzite of the Alwar group, Phyllite and Slate of the Ajabgarh group.

Figure (2.1) below shows the current administrative division in the NCR.

Figure 2-1 : Administrative division of NCR

Source : Regional plan 2021, NCR

Topographically, the NCR has two major sub-units. The alluvial plains whose monotony is intercepted by isolated hillock or fairly continuous ridges of hard rock and sand dunes.

The major rivers in NCR are the Ganga, the Yamuna, Hindon and Kali, which flows from north to south and a small part of Sahibi, which flows in the south western part. Most of the NCR is also predominantly irrigated through well developed canal network except Alwar and Gurgaon districts, which are irrigated by ground water.

Open wells, shallow tube wells, gravity wells and deep tub wells are abundant in the area covered by the alluvium. Their discharge vary anywhere from 18 to 25 cubic metres per hour for about 2 to 3 meters drawn down in the open wells to about 162 per cubic metres per hour for about 8-12 metres draw down in the deep tub wells.

As far as ground water quality is concerned , there are few fresh water pockets in the north east and south east corners of NCR, otherwise in these area the total dissolved solids (TDS) are more than desirable limits and other quality parameters as within the desirable range. The TDS (nitrate and fluoride) are more than desirable limits in the NCT Delhi area and most part of the north-west and south west part of NCR.

The NCR area lacks in vegetation cover (forest) and mineral resource on the whole. The major mineral deposits of the region are china clay, quartz, silica sand and fire clay.

2.2.2 Policy zones and Land use zones

For the regulated and controlled development of the NCR there are four policy zones and four land use zones has been recommended, as discussed below;

A. **Policy zones :**

i) NCT Delhi

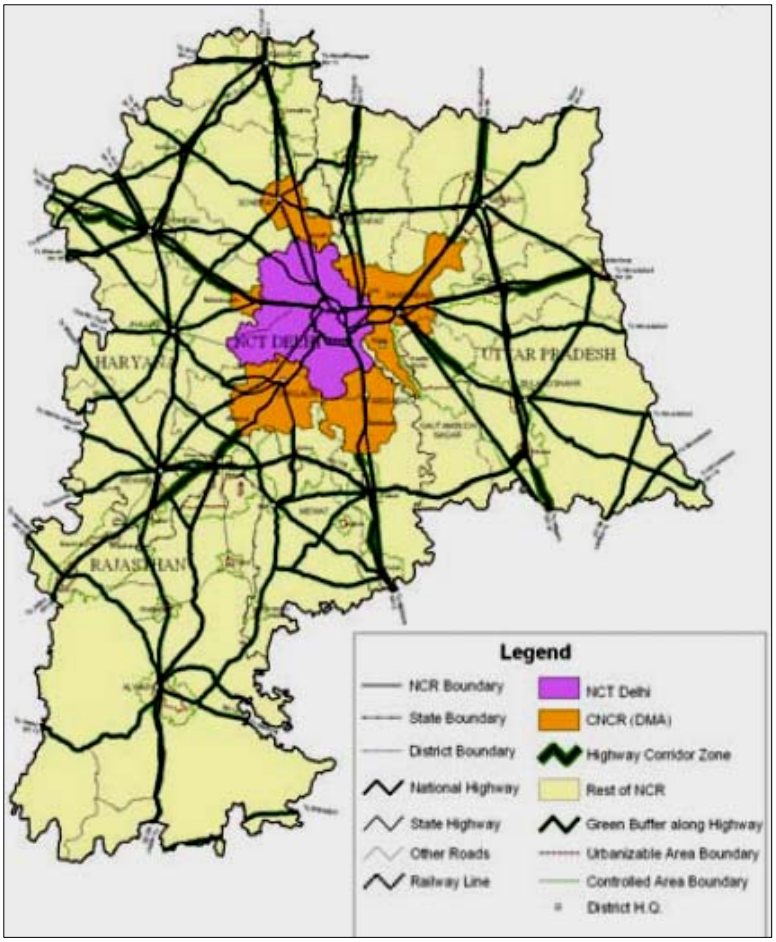
ii) Central National Capital Region (CNCR) : The notified controlled areas of the adjoining towns of Ghaziabad-Loni, Noida, Gurgaon-Manesar, Faridabad-Ballabgarh, Bahadurgarh, and Sonepat-Kundli.

iii) Highway Corridor Zone : The controlled area comprising a minimum width of 500 meters, inclusive of green buffer, on either side of the right of way along the National Highway Nos. 1, 2, 8, 10, 24, 58 and 91 converging to Delhi.

iv) Rest of NCR: The area of the NCR outside the designated CNCR and Highway Corridor Zone, comprising both urban and rural areas.

The figure (2.2) below shows policy zones of NCR.

Figure 2-2 : Policy zones of NCR



Source : Regional plan 2021, NCR

B. Land use zones :

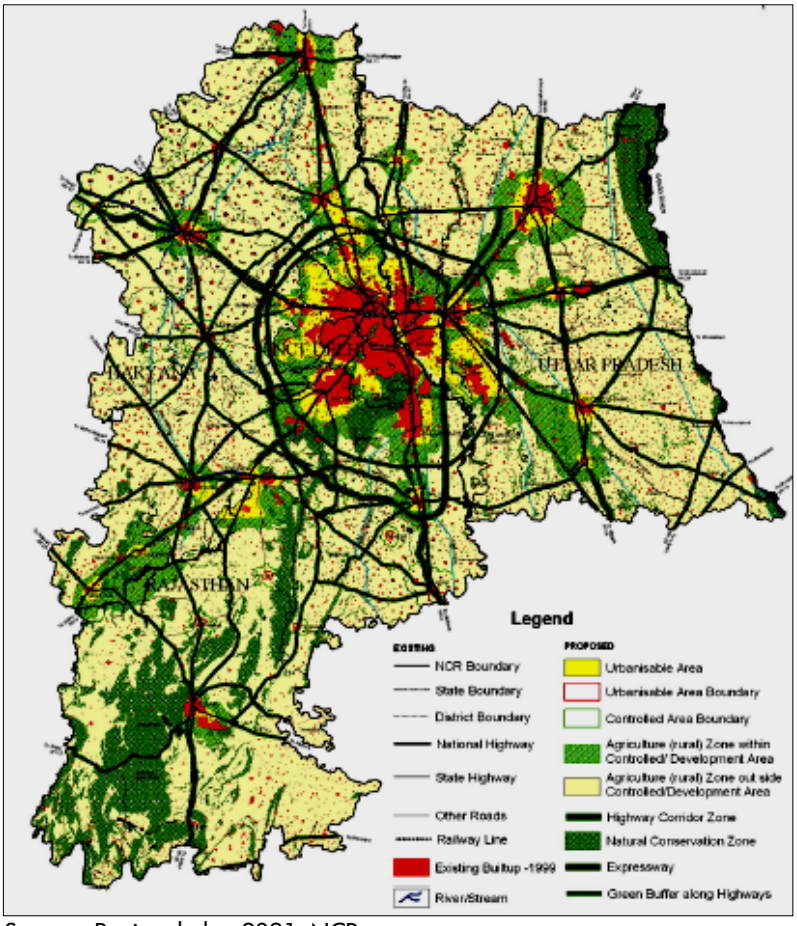
(i) Controlled / development / regulated zone

(ii) Highway corridor zone

(iii) Natural conservation zone

(iv) Agricultural (rural) zone outside controlled area / development / regulated zone

Figure 2-3 : NCR Land use zones



Source : Regional plan 2021, NCR

i) Controlled / Development / Regulated Zone : The controlled area zone demarcated in proposed landuse plan is under intense pressure of development. The activities within this zone will have to be effectively controlled and monitored. For this purpose while all a controlled areas declared by the respective State governments from time to time within the preview of their own acts will be deemed as controlled areas/ regulated zone. Within controlled areas/ regulated zones there will be three sub-zones, whose precise delineation will be undertaken by respective master plan for controlled development.

- ❖ Urbanisable Areas (including existing built up/urban areas)
- ❖ Agriculture (Rural) Zone within controlled/development regulated areas
- ❖ Green buffers

ii) Highway Corridor zone: In order to control the large scale urban development along the important highways in the region, outside the controlled / development / regulated zone, a regulatory zone is provided within which necessary planned development can be undertaken. It includes all major roads and highways within the Haryana sub region: such as;

NH-1: Delhi to Amritsar

NH-10: Delhi to Rohtak

NH- 71: Rohtak to Jind

NH-8: Delhi to Gurgaon and beyond

NH-2: Delhi to Calcutta

Controlled area of 500 meters from the ROW (right of way) is mandatory. All major roads and state highways such as state highway 10, state highway 20, state highway 22, state highway 24, and state highway 25 have been in restriction of 500 meters of controlled zone. The actual boundaries of the highway corridor zone will be delineated based on the revenue village boundaries by the respective state governments in sub regional plan.

iii) Natural area Conservation Zone : Major natural features identified as environmentally sensitive areas, are the extension of Aravalli ridge in Rajasthan. In NCR, these areas have been demarcated as Natural area conservation zone in the regional plan 2021. Similarly, ground water recharging areas such as water bodies, ox bow lakes, and paleo channels have also been identified. Therefore all the Aravallis within the Haryana state, in addition to the local agricultural zone have to be further detailed out in sub regional plan.

The extension of Aravalli ridge, sanctuaries and other ecologically sensitive areas needs to be conserved with utmost care and afforested with suitable species. The development in this area is to be in accordance with the Environment Act, 1986 from time to time. In view of the very low existing forest cover (4.02%), it is imperative to

bring more areas under forest so as to maintain the ecological balance in this region. Accordingly, all wastelands identified in the existing landuse plan and proposed land use plan 2021, ROW of irrigation canals, drains, roads and railway lines are proposed to be brought under forest cover which is proposed to be 10% of the total area of the region.

The areas under water bodies and ground water rechargeable areas will be kept free from any encroachment/ development to allow free flow of water, construction activities for human habitation or for other ancillary purpose thereto not be permitted. Suitable measures are to be taken to maintain the water bodies with the minimum flow or water level. In the flood prone areas / river banks, no construction or habitation activities are to be permitted. Flood protection plan be prepared by the concerned state government / agency.

Detailed conservation plan be prepared for the areas shown in Natural conservation zone in the Landuse Plan 2021 given at the end of discussion. The monuments / man made heritage sites and conservation areas be identified in the master plan / zonal plan of each town and detailed conservation.

iv) Agricultural zone outside controlled / development / regulated areas: Agricultural (Rural) area of NCR has to be regulated by village and block plans to be drawn under district planning process. At the regional level, agricultural zone be designed for primary sector production and as open areas comprising of farmlands, orchards, and pastures etc.

The new employment opportunities in non agriculture sector and consequent concentration of population, the urban expansion would have to be largely made from the agricultural land and other non urban uses. In view of this, following policies have been proposed;

- existing cultivated land be conserved for agricultural use as far as possible
- efforts be made to increase the production through intensive cultivation by providing irrigation facilities and other necessary infrastructure

- measures to be initiated for protection of prime agricultural land and ensure its needless conversion into non agricultural use
- Utilization of less and least valuable land for urban expansion / new urban centers / development purposes.

2.3 *Haryana Sub-Region of NCR*

2.3.1 Constituent area of Haryana Sub-Region

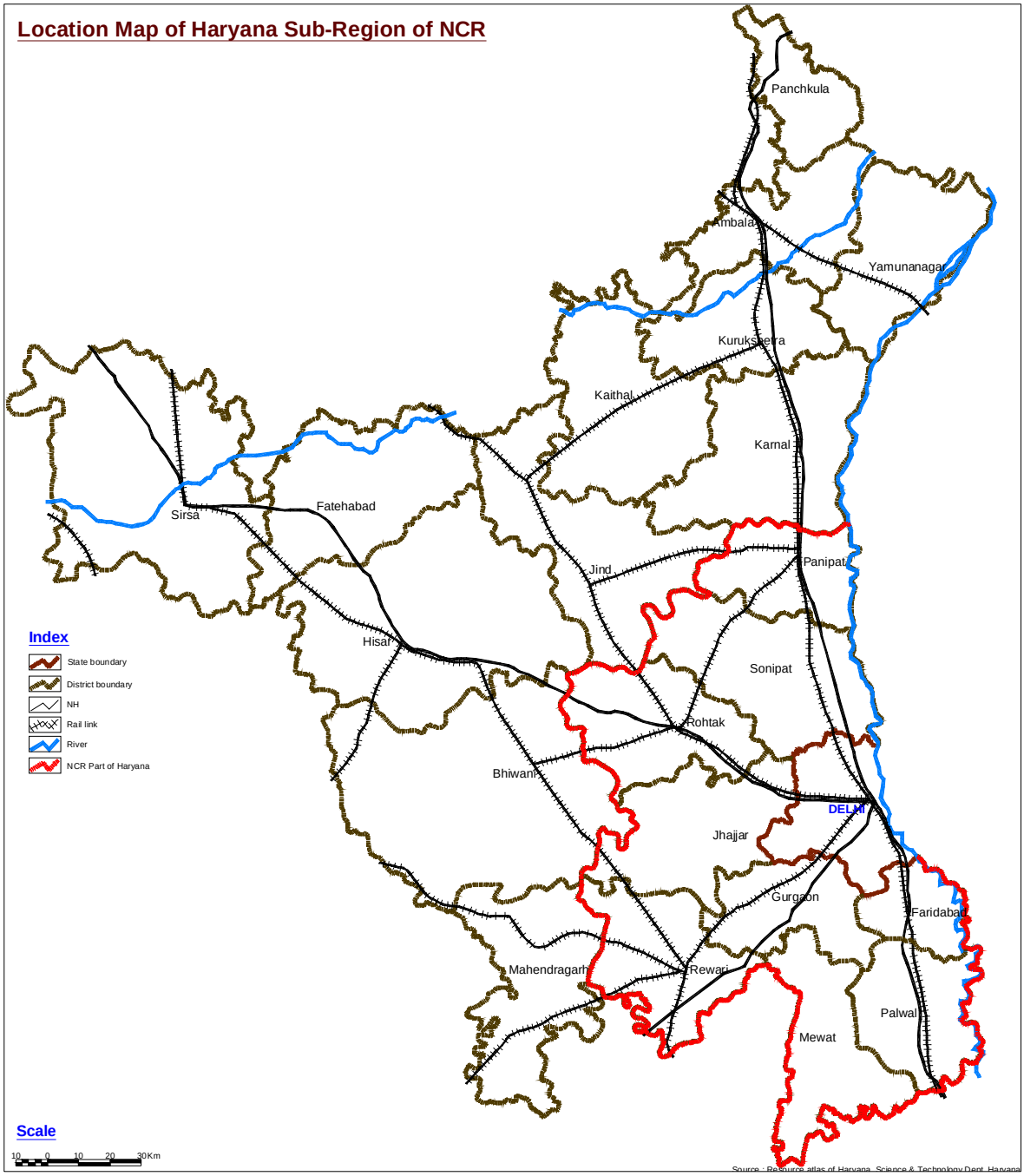
Haryana Sub-region is part of National Capital Region around Delhi. The constraints of space and high costs associated with development within NCT Delhi, are causing spill over of economic activities from Delhi which could be absorbed by neighboring states like Haryana, Uttar Pradesh and Rajasthan, in case they are ready to receive them with appropriate physical and social infrastructure support, matching the investors' perception.

The Harayana sub region comprises of the following nine districts, situated on the periphery of Delhi, forming the NCR Sub Region:

Table 2-2 : Haryana Sub-Region profile

Districts	Area (Sq KM)	Population	Population density (person/Sq Km)
Panipat	1268	967449	763
Sonipat	2122	1279175	603
Rohtak	1745	940128	539
Jhajjar	1834	880072	480
Rewari	1594	765351	480
Gurgaon	1254	870539	694
Mewat	1859	993617	534
Faridabad	743	1365465	1838
Palwal	1368	829121	606

Figure 2-4: Haryana Sub-Region Political map



2.3.2 Physiography of the Haryana Sub-Region

Physiography of Haryana Sub-Region is almost plain made up of alluvium of Yamuna river with some pediments of Aravalli. All most all districts of sub-region is having same physiography except those area which are more dominated by Aravalli.

Panipat district is a part of alluvial plain of Yamuna river. It slopes from west to east and water of the area flows towards Yamuna. There are two major physiographic units in the area. The flood

plain which is within one mile of the Yamuna river, has light soils and the water table is very near to the surface. This flood plain of the river Yamuna is suitable for rice and sugarcane cultivation. The other unit i.e. older alluvial plain spreading in the western part of the district is inclined towards the south and south-west area. This area is irrigated by tube wells and canals and is a prosperous agricultural area. The district has a perennial river Yamuna, which forms the eastern boundary of the district.

Sonipat district has almost a plain topography. Physiographically, it may roughly be divided into two units. The Khadar, which lies along the Yamuna in a narrow flood plain ranging from two miles in width, has medium to fine textured soils. The upland plain, which is spread in the west of the Khadar. It is about 20 to 30 feet higher than the Khadar and is 735 feet above mean sea level. It is covered with old alluvium.

Rohtak district is comprised of the vast Indo-Gangetic alluvial plains called older alluvial plain. This older alluvial plain is further divided into sand dunes, plan and depressions. The sediment derived in the old alluvial plain are mostly from the Himalayan rivers having a heterogeneous composition. This landform is formed predominantly by medium to fine textured soils. Since the soils are fertile with good irrigation facilities (canal and tube wells), these have been put into maximum use over a long time. This landform has been further divided into the following subunits:

- ***Dunal ridges/Plains***: Dunal ridges, interdunal plains and plains with sandy Aeolian cover dominate the western and south-western part of Rohtak district.

- ***Plains:*** These occupy mainly the northern, north-eastern and north central parts of the study area, which are characterized by slight to moderate erosion, moderately distinct parceling and mixed tones due to variable moisture conditions. The soils are mainly free from salt problems except in few small patches.

- ***Depressions:*** The post-Pleistocene age sediments, which filled the depression areas are mostly derived from the Himalayan rivers from the north. The sediments itself is very deep and fine textured. The majority of the surface drainage is seasonal passing through linear depression areas. This unit occupies the north-eastern and north-central part of Rohtak district.

Jhajjar district is comprised of the vast Indo-Gangetic alluvial plains. The main physiographical units of the district are as under:

1. ***The upland plain*** spreads in the north-eastern part of the district. It slopes towards south. This plain is covered with old alluvium o high productivity. The sandy region is spread in the southern and south-western parts of the district. It comprises of permanent sand dunes, most of them now have been leveled. Sahibi is the only seasonal stream which enters the district from the south-eastern part and flows from the south.

2. ***Alluvial Plains:*** The sediment derived in the alluvial plain are mostly from the Himalayan rivers having a heterogeneous composition. This landform is formed predominantly by medium to fine textured soils. Since the soils are fertile with good irrigation facilities (canal and tube-wells), these have been put into maximum use over a long time. The alluvial plain again has been subdivided as follows:

    - **Plains:** These occupy mainly the northern, north-eastern and north central parts of the district, which are characterized by slight to moderate erosion, distinct parceling and mixed tones due to variable moisture conditions.

    - **Depressions:** The post-Pleistocene age sediments, which filled the depression areas, are mostly derived from the Himalayan rivers from the north. The sediment itself is very deep and fine textured. The majority of the surface drainage is seasonal passing through linear depression areas. This unit occupies the north-eastern and north-central part of the district.

    - **Sand dunes/ Plains:** Dunal ridges, interdunal plains and plains with sandy Aeolian cover dominate the southern and south-western part of the district.

Rewari district can be divided into four terrain classes viz. Barren rocky/stony waste/sheet rocky, Sandy plain with sand dunes, Old flood plains and occasional hillocks and Undulating uplands with or without scrub. Generally physical condition of terrain and its evolution is the result of poly-cyclic activities and also affected by the change of climate. The Aravalli consist of organic and volcanic action and presently it is undergoing weathering and denudation. The hills traverse through western part of district roughly in south west to north east direction.

Gurgaon district comprise of hills on the one hand and depression on the other, forming irregular and diverse nature of topography. Two ridges (i) the Ferozpur-Jhirka Delhi ridge forms the western boundary and (ii) the Delhi ridge forms the eastern boundary of the district. These hills are the northern continuation of the Aravallis. The north-western part of the district is covered with shifting sand dunes lying in the direction of westerly and south-westerly winds.

Mewat district has distinct topographic features with flat alluvial plains over most of the region, long and narrow pediments and local undulations caused by wind blown sands at eh foot hill zones and over much of the plains. The piedmont zone with eroded remnants and weathered rocks separate Rajasthan State and western part of the district from Punnhana and Ferozepur Jhirka on the east.

Faridabad and Plwal district has monotonous physiography and has alluvium deposits. The alluvial plains have been divided into two units. Khadar that is the low lying flood plain of newer alluvium and Banger, an upland plain made of older alluvial and is spread towards west. The general slope in the district is towards east. The leveled surface, fertile alluvial soil and facilities for irrigation make the district beast suited for intensive cultivation. The district enjoys with perennial river Yamuna, bordering it on the east. The river forms narrow but consistent flood plains There are also few artificial lakes namely Suraj kund, Badhkal, Peacock and Dhauj Lake etc.

2.3.3 Geology of Haryana Sub-Region

Geology is defined as the study of rocks and minerals of the earth with respect to their origin, composition and mode of occurrence. The Haryana State comprises a good assemblage of rocks belonging to age from Pre-cambrian to Quaternary. The state can be divided in three different geological domains:

1) Pre-Cambrian rocks of Aravalli Mountains,

2) Tertiary rocks of Himalayas and

3) Quaternary deposits of Indo-Gangetic Plains.

Out of above mentioned three geological division Haryana sub-region is dominated by Quaternary deposits of Indo-Gangatic plains and Pre-Cambrian rocks of Aravalli mountains.

Panipat : The district has not much geological diversity. It is entirely covered by old and new alluvium deposits of quaternary to recent age, which consist of clay and sand. Consolidated and un-consolidated sands are also found at places in the district.

Sonipat: The districts is almost entirely covered by alluvial deposited of clay, loam, silt and sand brought douwn by river Yamuna. High grade silica sand left behind by the change in course of the Yamuna river is found in the district.

Rohtak : The geological structure of the district consists of alluvium (recent), loam (Bhangar and Nadrak), coarse loam (daher and chaeknote). Infect, the district is a part of indo Gangetic alluvial plain ranging from Pleistocene to recent age. Aeolian deposits of sub recent age cap the plains. The sediments comprise of clay, sand and kankar mixed in different proportions. No exposure of hard rocks forming the basement are seen in the area which one as deep as three hundred metres. Geological succession of the area is as under: -

Age	System	Formation
Pleistocene to recent	Recent to sub recent	Alluvial Aeolian sand

Jhajjar : The area forms a part of in Dugan ethic plain ranging from Pleistocene to recent in age Aeolian deposits of Sub- recent age cap the plains. The sediments comprise of clay, sand and Kankar mixed in different proportions. No exposure of hard rock farming the basement is seen in the area.

Rewari : The purona rocks in Rewari district belongs to Ajabgarh series of Delhi system. The hills have been denuded since ages and hence are with a height ranging from 300m to 425m above mean sea level. The hills are mostly steep, bare and rocky. The hillocks and discontinuous ranges are locally called khols, which are known for mineral bearing rocks. Sandy plains are notable landscape feature in Rewari district which are present in the east of Aravalli hills and are having a scattered pattern of stabilized to partially stabilized sand dunes due to sand deposition from south westerly winds coming from adjacent Rajasthan desert. The previously existing old flood

plains have been superimposed by Aeolian plains and sand dunes. These plains are impregnated with sand dunes 1 to 3 meter high above ground and which are mostly stabilized.

Gurgaon : The large part of the district is occupied (i) by scattered isolated strike ridges of old rocks, the relicts of a former Aravalli mountain chain of Pre-Cambrian and (ii) alluvium, sand of recent to sub-recent origin.

Mewat : The large part of the district is occupied (i) by scattered isolated strike ridges of old rocks, the relicts of a former Aravalli mountain chain of Pre-Cambrian and (ii) alluvium, sand of recent to sub-recent origin.

Faridabad and Palwal : The major part of the district is occupied by vase alluvial plains of recent to sub-recent age, which include older (Banger) and newer (Khadar) alluvial and kankar. The kankar occurs mainly in the northern part and is poor in calcareous matter.

2.3.4Natural resources

2.3.4.i Water Bodies

Haryana State is a part of two major river basins namely, the Ganga and the Indus. The Ganga river basin occupies the eastern part covering an area of about 30,000 square kilometers whereas the western parts fall under the Indus river basin.

Yamuna is the only perennial river in the Sub-Region, which originates in Tehri district of Uttaranchal. It forms the boundary between Haryana and Uttar Pradesh. The Yamuna sub-basin covers parts of the districts of Panipat, Sonepat, Rohtak, Gurgaon and Faridabad.

The river basin area between Yamuna and Ghaggar drainage basin, which are flat and have no drainage outfall in either of the rivers, forms the Inland drainage basin. The inland drainage basin covers the districts of Rewari, Rohtak and parts of Gurgaon. The Aravalli hill ranges occupying the southern margins of Haryana Sub-Region bring a number of small rainy streams from Rajasthan side into Gurgaon, Jhajjar and Rewari. Among these streams the Sahibi, Krishnawati and Dohan are the major ones. Artificial drains have been constructed in the inland drainage basin to drain the excessive rainwater to the main rivers. In the Sub-Region a number of

small ponds or *jhil* exist of which Najafgarh jhil, Jahajgarh Jhil, Barkhal Jhil, Surajkund Jhil and Sohna Jhil are the most important.

Canals are the most popular and important source of irrigation in Haryana Sub-Region due to easy supply and regular flow of water to the agriculture fields. In the Inland drainage basin the drains excavated are made to outflow in canals through lift pumps. The canals network is dense in most of the districts except in the districts of Rewari and Gurgaon where there is a general absence of canals. There are four irrigation systems in the State namely Western Yamuna Canal, Bhakra Canal, Agra Canal and Ghaggar Canal. The Bhakra and Western Yamuna Canal system are interlinked and it is difficult separate their command areas. All the districts except Gurgaon and Faridabad fall under their commands. The Bhakra Irrigation System (which receives water from Gobind Sagar Reservoir) and the Western Yamuna Canal system irrigate the major parts of the State. Western Yamuna Canal depends of the water availability in Yamuna river because no dam has been made on the river in the recharge area to tap the water for canal feeding. To cater to the needs of each other both the canal systems have been jointed. Lift irrigation scheme has been developed for the purpose of irrigation with the help of these canals. The districts of Faridabad and Gurgaon fall under Agra canal commands. The topography of the State is such that district of Mahendragarh, Rewari, Bhiwani and part of Jhajjar and Rohatk cannot be brought under gravity canal commands.

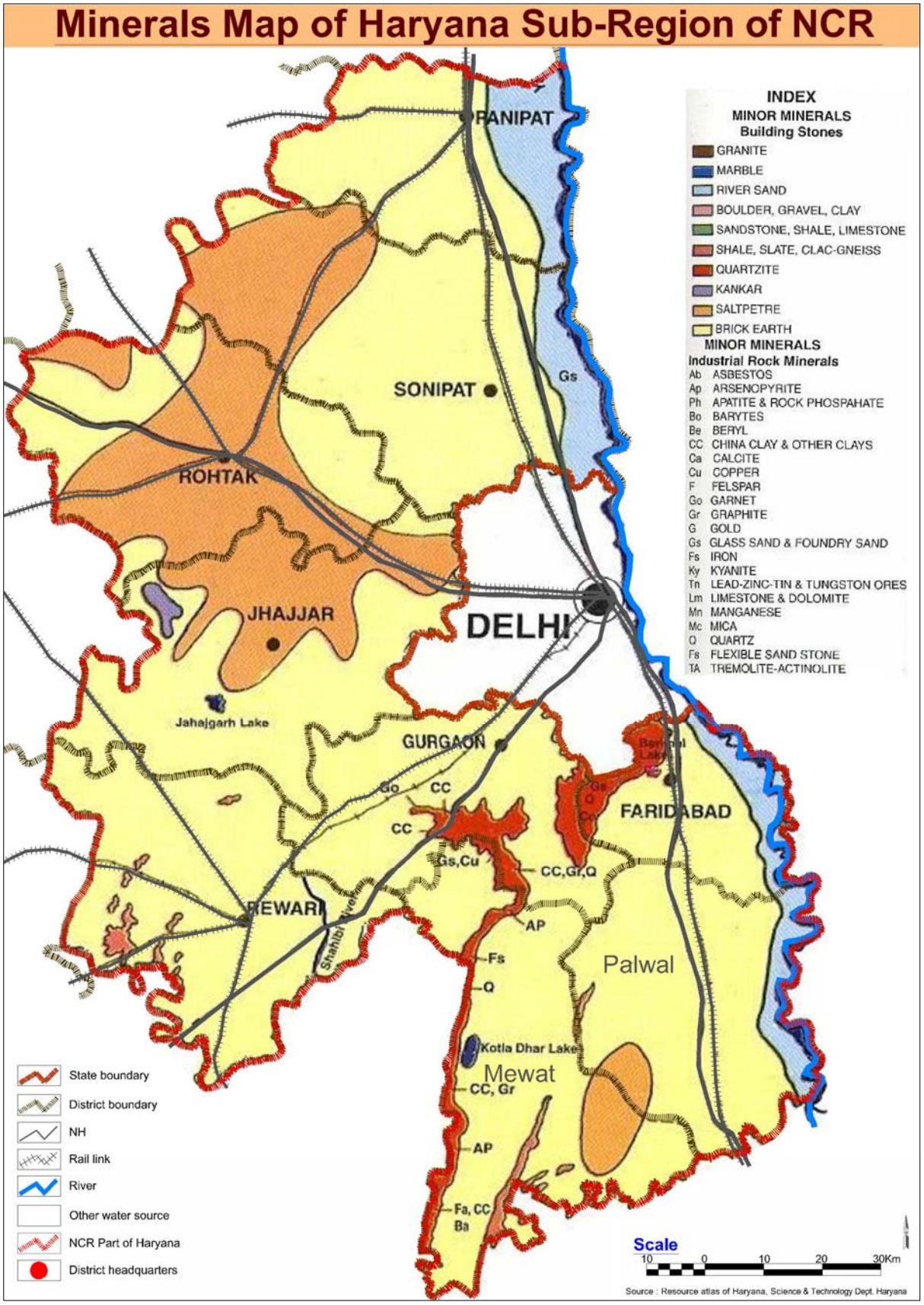
2.3.4.ii Minerals

Minerals play an important role in the development of the State's economy. The various rocks and minerals found in the State according to definitions contained in the Mines & Minerals Act, 1957 under section 3(E), are classified as 'minor minerals' and remaining as minerals commonly known as 'major minerals'. Minor minerals include building stones, gravel, ordinary clay, ordinary sand, boulder, chalcedony pebble, kankar and limestone (used for lime burning), murrum, brick earth, fuller's earth, bentonite, road metal, rehmatti and shale (used for building materials), salt petre and granite. Minor minerals are the major sources of income because maximum amount of revenue is derived from the auctioning of these minerals. Almost all the industrial rocks and minerals are grouped under major minerals.

Haryana sub-region has very little mineral wealth. The region is having mainly brick earth, saltpeter and quartzite. Excellent quality slate is found in the Rewari and Gurgaon districts. Badar sand also called bazri is found in huge quantities in the hilly terrain of Aravallis in Faridabad and Gurgaon district. Siliceous kankar and lime kankar and lime kankar occur in huge quantities in parts of Jhajjar district. Brick earth / ordinary clay suitable for manufacturing of bricks is available in plenty in almost every part of the Salt Petre occurs as thin white incrustations on the surface. Its major occurrences are in Rohtak, Practically inexhaustible deposits of quartzite are found in the state in the Aravalli ranges in the districts of Faridabad, Gurgaon, Rewari Low-grade haematitie and jasperiod haematite occur in Ferozpur-Jhirka area of Gurgaon district.

A number of major minerals, though in minor quantities, are also found in the state. These include aresenopyrite (Alwar quartzites in Gurgaon dist.) china clay (in the feldspathic pegmatite veins in Alwar quartzites in Faridabad and Gurgaon district), felspars (in pegmatites intruding quartzites in Gurgaon dist.), garnet (in garnetiferous mica schist associated with Alwar quartzited in Gurgaon Dist.), graphite (in graphite mica schist occurring in Gurgaon dist.), foundary sand (in abandoned course of Yamuna river in Sonepat dist.), quartz (as intrusive veins with pegmatites in Gurgaon & Faridabad dist.).

Figure 2-5 : Mineral map of Haryana Sub- Region



Source : Resource atlas of Haryana, Science & Tech. Dpt., Haryana, 2004

2.3.4.iiiSoil of Haryana Sub-Region

Soil constitutes the most precious natural resource of the State. A variety of soils are found in Haryana due to the marked variation in the physiographic and climatic conditions. Soil of the Haryana Sub-Region have been classified and described under the following major soil types:

- Typic Ustochrepts : Soil of old alluvial plains
- Typic Ustipsamments : Soil of Aravalli plains
- Typic Ustifluvents : Soil of recent alluvial plains and flood plains
- Typic Torripsamments : Soil of Aeofluvial plains
- Rock Outcrops : Aravalli rocky hills

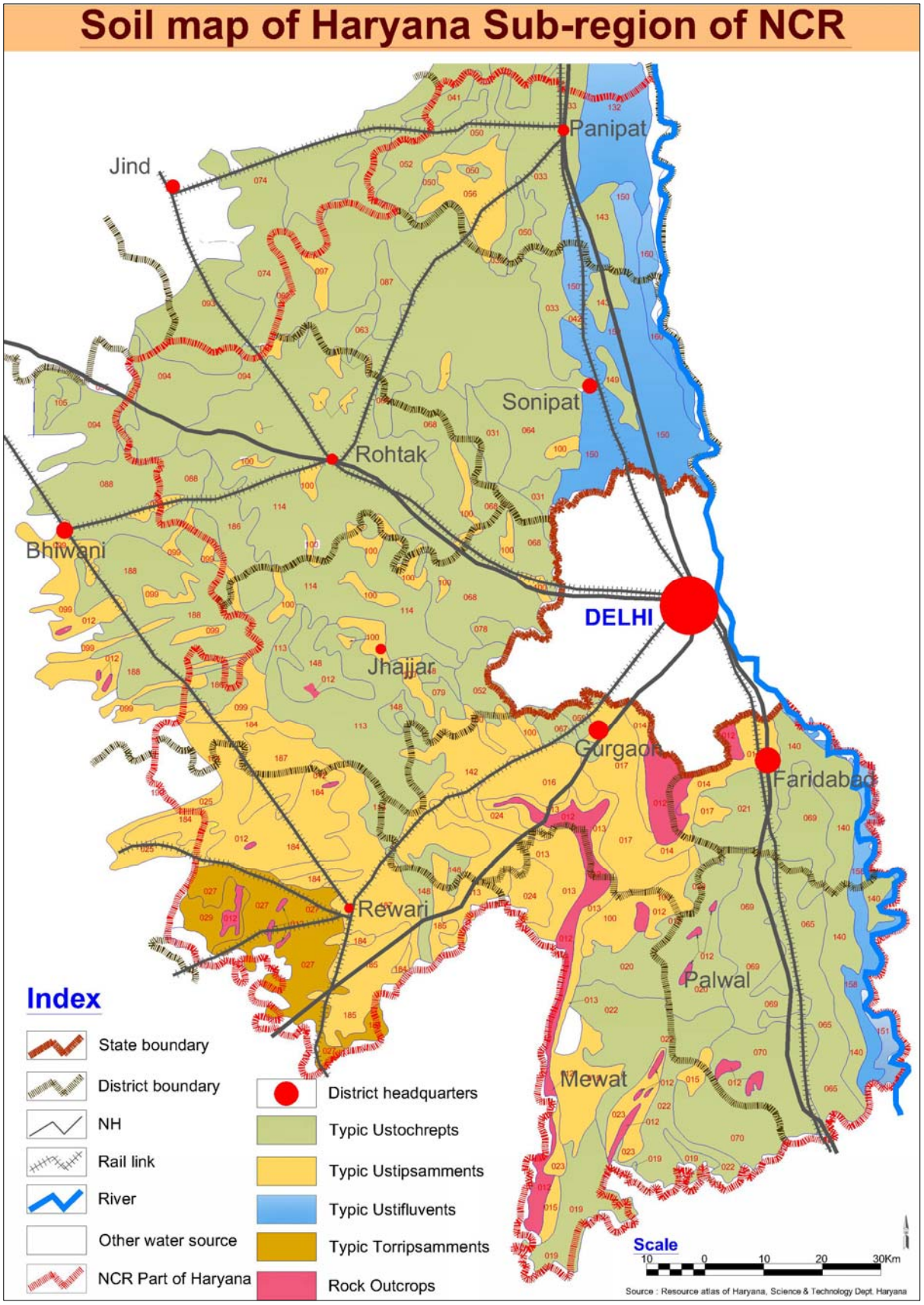
Now district wise details of soil and their characteristics are described below:

Panipat : The soils are well drained, Sandy loam to clay loam/silty clay loam in plains and loam to clay loam/ silty/ loose clay loam in relic channels/depressions/basins.

Sonipat : The districts comprises of recent flood plains, young meander plains, old meander plains and old alluvial plains. Recent flood plains occur a few Kms. Along the Yamuna river and clearly show fluvial features. The young meander plains show meandering features left by river Yamuna like Palaeochannels, natural levees, point bar complexes, meander cut off and sand bars. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface. Old meander plains are almost flat with loamy sand to silty clay loam soils. Oldest among all the land forms are old alluvial plains, which cover the major area in the district. These soils are sand to loamy sand/sandy loam (surface) to silt loam/silty clay loam (sub-surface).

Rohtak : The districts mainly comprises of old alluvial plains. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface. Old meander plains are almost flat with loamy sand to silty clay loam soils. Oldest among all the land forms are old alluvial plains, which cover the major area in the district. These soils are sand to loamy sand/sandy loam (surface) to silt loam/silty clay loam (sub-surface).

Figure 2-6 : Soil map of Haryana Sub-Region of NCR



Source : Resource atlas of Haryana, Science & Tech. Dpt., Haryana, 2004

Jhajjar : The districts mainly comprises of old alluvial plains and some part of the district comprised of soil of Aravalli plains.

Rewari : The soils of the district fall under Entisols and Inceptisols orders. The surface soil texture varies from sand to fine loamy sand. These are excessively drained with slight to moderate soil erosion having high percolation rate. In fluvial low lands the soils are heavier in texture that varies from sandy loam to loam. These soils are well to moderately well drained with slight erosion.

Gurgaon : The district comprises of sand dunes, sandy plains, alluvial plains, salt affecter areas, low lands, lakes, hills and pediments. The soil varies from sand to loamy sand in sand dunes and sandy plain areas, sandy loan to clay loan / silty clay loan is alluvial plains, calcareous, loamy sand to loam in salt affected plains, silty load to loam in low lands and calcareous, loamy sand to loam in hills.

Mewat : The soils of the area are generally sandy loam to loam. In parts of the low-lying areas, they are clayey and saline. The soils are light and derived from the older and new alluvial layers; the older alluvium is dark-coloured and is generally rich in concretions and nodules of impure calcium carbonate known as "Kankar". The new alluvium is light coloured and poor in calcareous matter. The soils are generally shallow and low in organic matter.

Faridabad : The district comprises of recent Yamuna flood plains, low lying plains, depressions, sand dunes and hills. The texture of the soil is sand to loamy sand in recent Yamuna flood plains, sandy loam in plains, sandy load to clay loam in alluvial plains, sandy loam to loam (surface), clay loam/silty clay (sub-surface) in low lying plains/depressions

Soil types with their agricultural productivity are:

1. Soils of Aravalli Plains

Location: In vicinity of the aravalli hills and in the parts of Gurgaon, mewat, Faridabad and Rewari in the sub region.

Characteristics: They are frequently distributed by aeolian activity. The soils of this unit are described under two moisture regimes;

Soil Type: the dominated soils of the aridic zone occur on the sand dunes of the shifting nature. They are sandy, single grain and are alkaline. They are classified as typic torripsamments. The associated sub dominant soils are coarse-loamy typic camborethids. They belong to interdunal areas and are deep, well drained, neutral to slightly alkaline, poor in organic carbon content and fertility.

Cultivation: They are cultivated to Bajara, Gram, Oilseed and Pulses.

Constraints:

- Moderate to severe wind and water erosion
- Poor soil structure
- Poor fertility (Low O.C., low CEC)
- Low water holding capacity

2. Soils of old Alluvial Plains

Location: Soils of this region are spread over parts of Panipat, Sonipat, Rohtak, Jhajjar, Faridabad and Palwal districts.

Characteristics: The dominant and sub dominantsoils have been classified as typic ustochrepts and in some areas as udic ustochrepts.

Soil Type: The sub dominated soils are deep, well drained, with or without salinity and /or sodicity problem. Other sub dominated soils are imperfectly drained, fine loamy, calcareous, sodic with high pH and exchangeablesodium percentage. They are classified as nitric ustochrepts and poorly drained fine loamy fluventic ustochrepts.

Cultivation: These soils respond ery well to the applicationof fertilizers and irrigation. Wheat, paddy and sugarcane are the major crops. Excessive use of irrigation water especially of poor quality has created many problems.

Constraints:

- Salinity
- Sodicity
- Poor drainage
- High ground water table

3. Soils of old Alluvial Plains with sand dunes

Location: Soils of this unit are spread over parts of Rohtak, Jhajjar, Gurgaon and Mewat districts. Aeolian sands are deposited by the south western winds from the Rajasthan. Sand dunes at many places have been reclaimed and stabilized.

Characteristics: soils of this unit are described under two moisture regims: Ustic and Aridic. Majority of the soils ustic moisture regime occur in Rohtak and Jhajjar districts .

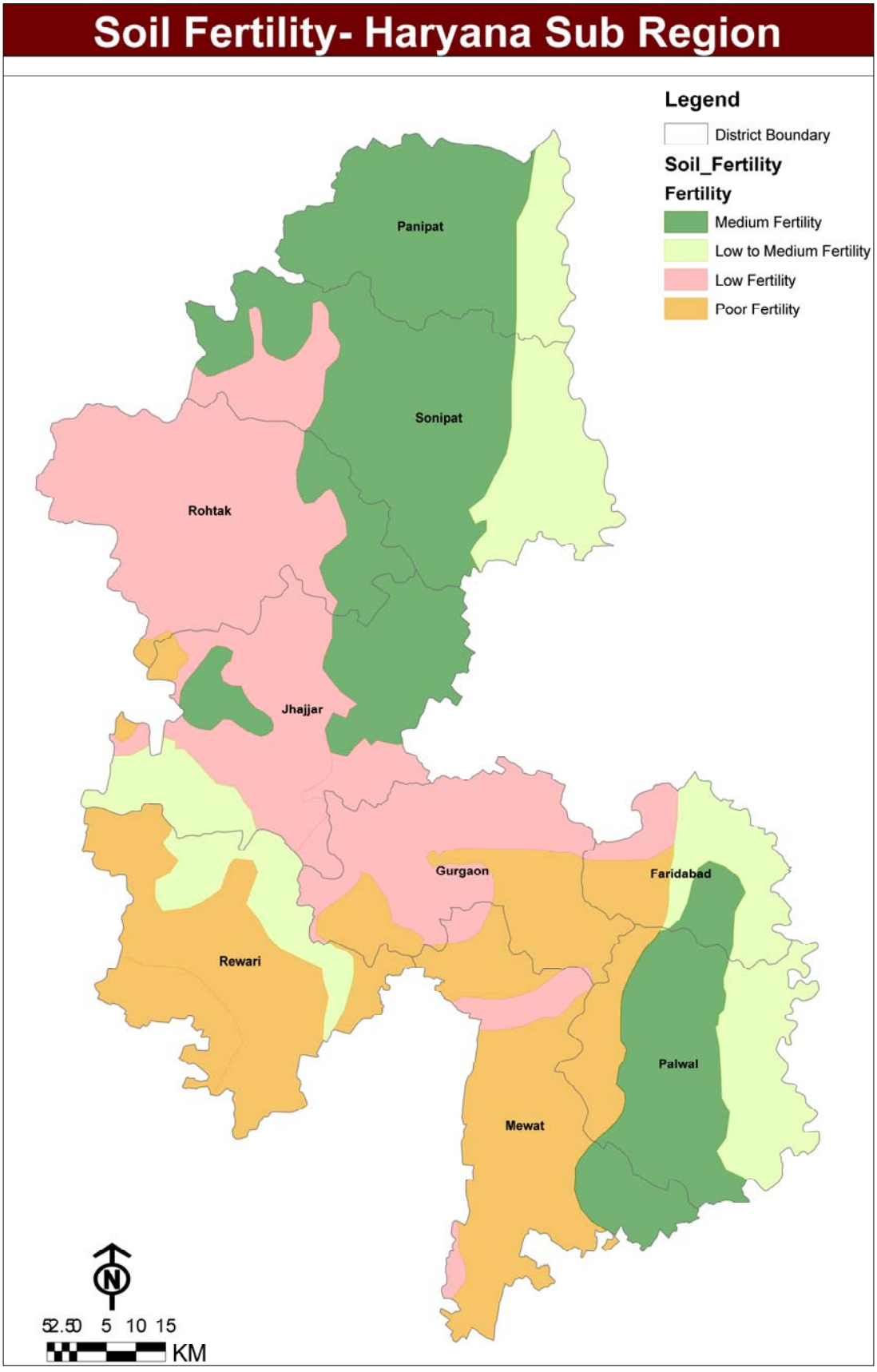
Soil Type: Dominated soils of Ustic moisture regime are very deep, somewhat excessive drained, severely to moderately eroded and sandy in texture, classified as typic Ustipsamments.

Cultivation: With adequate soil and water conservation measures they have very good yield potentials for rainfed crops. Adequate application of FYM and fertilizers insplit doses will enhance the productivity of these soils.

Constraints:

- Low Fertility
- Salinity
- Moderate to severe erosine
- Poor retention of moisture in the root zone.

Figure 2-7 : Soil fertility map of Haryana sub-region



Source : NBSS & LUP in Cooperation with Department of Agriculture, Haryana

4. Soils of recent Alluvial Plains

Location: Soils of this unit are developed from the alluvial deposits along the bank of the Yamuna and its tributaries in parts of Panipat, Sonipat, Faridabad and some part of Rewari. They are occasionally subject to moderate flooding during heavy rains.

Characteristics: The dominating soil in recent flood plains of the Yamuna is coarse-loamy and sandy. They are classified as coarse-loamy, calcareous as well as non-calcareous typic Ustifluvents and coarse-loamy and fine-loamy, fluventic Ustochrepts.

Soil Type: sub-soil water of good quality facilities intensive farming. Conservation measures and application of recommended doses of FYM and fertilizers are some of the suggestive measures.

Cultivation: They are cultivated for wheat and paddy in the low lying areas while bajra and gram are cultivated on levees.

Constraints:

- Moderate seasonal flooding
- Shallow groundwater table
- Slight to moderate erosion
- Low to medium fertility

5. Soils of Fluvio-aeolian Plains

Location: Soils of this unit are located in Rewari and western part of Rohtak District. They are occasionally subject to moderate flooding during heavy rains.

Characteristics: The soils of this unit are of Aeolian nature modified by fluvial activity of river Sahibi. The annual rainfall ranges between 300-500 mm. The soil of this unit under two moisture regimes:

Soil Type: Domestic soils are very deep, excessive drained, slightly alkaline, sandy and calcareous, occurring on gentle sloping plains. These soils are the Ustic moisture regime as typic Torripsamments. Subdominant soils in Ustic moisture regime are well drained, coarse-loamy, calcareous, typic Ustifluvents and fine loamy typicUstochrepts.

Constraints:

- Poor soil structure
- Poor Fertility
- Moderate wind erosion
- Low water holding capacity

2.3.4.iv Ground water

Ground water is an important resource for meeting the water requirements for irrigation, domestic and industrial uses. Ground water is annually replenishable resource but its availability is non-uniform in space and time. In Haryana sub-region ground water occurs in alluvium as well as in hard rocks. In alluvium, sand, silt, kankar and gravel beds constitute potential water bearing zones whereas in hard rocks weathered/fracture quartzites and cavernous limestones constitute potential aquifers. Ground water at shallow depths occurs under unconfined conditions, whereas at deeper levels confined/conditions prevail.

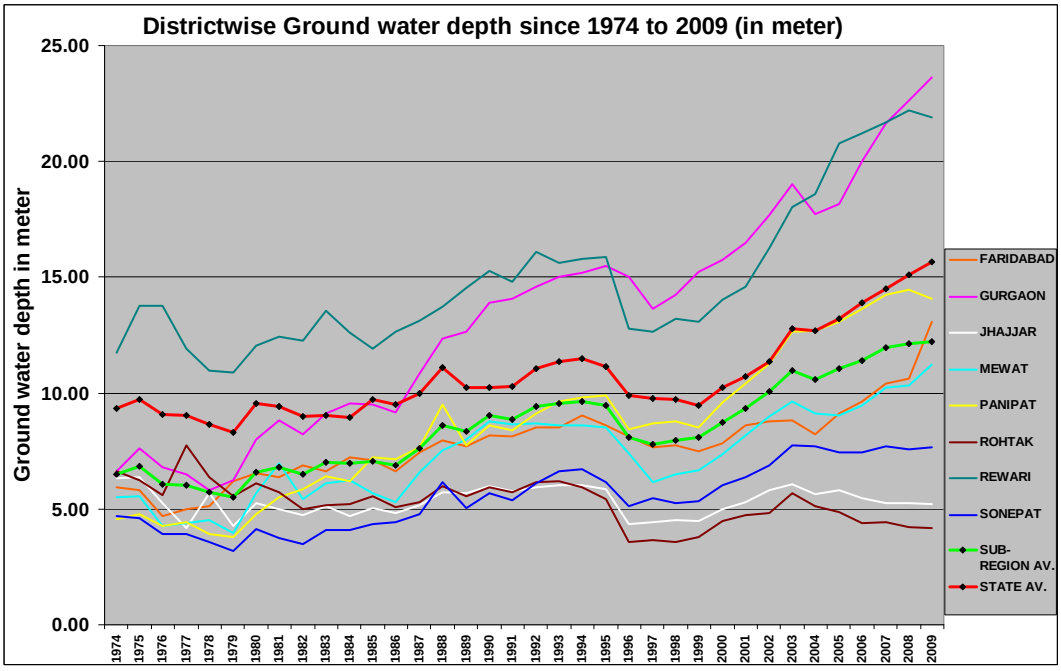
a) Ground water status

In the Sub-Region the ground water is extensively used for irrigation and domestic purpose. Due to tremendous increase in the requirement of ground water for agriculture, industries and by newly developed urban areas, the water levels have shown a continuous declining trend in a number of districts. On the contrary, the excessive use of canal water for agricultural purpose coupled with unfavorable geological conditions, lack of natural surface drainage and poor quality of ground water, the less utilized ground water have risen towards the ground causing water logging conditions in some districts. The quality of ground water in Haryana Sub-Region

has changed significantly during past decades due to industrialization, urbanization and agricultural growth.

If we see the ground water depth in various district of the Sub-Region since 1974 to 2009, we find that there is drastic fall in ground water level mainly in the district of Gurgaon, Rewari and Panipat. In the Sub-Region since 1974 to 1995 there was minor decrease in ground water level and between1995 to 1997 water level has increased but after that till 2009 there is continuous decline in the ground water level. So, mainly since 1997 the water depth of the Sub-Region has increased tremendously. It can be easily understood through following, figure 2.8 and table.2.3.

Figure 2-8 : District wise Ground water depth



Source : Haryana Hydrological cell under Agriculture department.

Table 2-3 : Ground water depth since 1974 to 2009

YEAR	Month	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
FARIDABAD	JUNE	5.94	5.82	4.7	4.99	5.12	6.2	6.53	6.37	6.87	6.63	7.24	7.11	6.62	7.45	7.94	7.71	8.16	8.14
	OCT.	4.77	3.93	3.71	4.19	3.92	4.97	5.71	5.47	6.86	6.11	6.25	5.67	6.58	7.63	6.14	7.46	7.82	7.66
GURGAON	JUNE	6.64	7.62	6.8	6.51	5.82	6.24	8.01	8.8	8.21	9.14	9.56	9.51	9.18	10.85	12.37	12.66	13.9	14.08

	OCT.	6.33	5.58	5.5	4.52	4.59	6.18	7.81	8.04	8.31	8.05	7.74	8.28	9.73	11.05	11.14	12.9	13.05	14.29
JHAJJAR	JUNE	6.32	6.36	5.27	4.16	5.67	4.24	5.23	4.98	4.73	5.12	4.69	5.04	4.82	5.16	5.74	5.66	5.99	5.77
	OCT.	5.77	4.5	3.98	2.88	3.4	4.86	4.81	4.47	4.69	3.53	4.05	3.56	4.54	5.3	4.73	5.64	5.11	5.24
MEWAT	JUNE	5.5	5.54	4.28	4.41	4.53	3.97	5.7	6.99	5.41	6.12	6.26	5.66	5.28	6.57	7.55	8.02	8.79	8.67
	OCT.	4.14	3.49	3.17	2.64	2.84	3.96	5.59	5.13	4.95	4.37	4.45	4	5.53	6.82	6.62	8.1	7.37	7.68
PANIPAT	JUNE	4.56	4.78	4.26	4.44	3.93	3.79	4.78	5.49	5.84	6.39	6.19	7.24	7.13	7.68	9.49	7.75	8.6	8.41
	OCT.	4.18	3.51	3.76	3.22	2.5	3.92	3.93	5.33	5.51	5.25	4.99	5.92	6.58	8.04	6.87	7.87	7.78	8.75
ROHTAK	JUNE	6.64	6.24	5.61	7.74	6.36	5.54	6.09	5.71	5	5.18	5.19	5.56	5.06	5.29	5.98	5.53	5.94	5.72
	OCT.	5.83	4.6	4.66	4.98	5.41	6.04	5.08	4.92	4.75	4.03	4.23	4.4	4.57	5.7	4.94	5.6	5.46	5.26
REWARI	JUNE	11.75	13.75	13.75	11.91	10.96	10.9	12.05	12.42	12.27	13.54	12.6	11.92	12.64	13.11	13.73	14.56	15.27	14.82
	OCT.	11.61	13.37	12.43	10.65	10.11	10.88	11.41	11.2	12.62	12.17	12.11	11.76	12.8	13.34	13.32	14.75	14.34	15.24
SONEPAT	JUNE	4.68	4.6	3.9	3.92	3.56	3.19	4.11	3.76	3.49	4.07	4.09	4.34	4.43	4.77	6.15	5.05	5.69	5.36
	OCT.	3.89	3.4	2.85	2.53	2.52	3.55	2.79	3.24	3.04	2.5	3.15	3.65	4.19	5.28	3.93	5.21	4.73	5.07
SUB-REGION	**JUNE**	**6.504**	**6.839**	**6.071**	**6.01**	**5.744**	**5.509**	**6.563**	**6.815**	**6.478**	**7.024**	**6.978**	**7.048**	**6.895**	**7.61**	**8.619**	**8.368**	**9.043**	**8.871**
	OCT.	**5.815**	**5.298**	**5.008**	**4.451**	**4.411**	**5.545**	**5.891**	**5.975**	**6.341**	**5.751**	**5.871**	**5.905**	**6.815**	**7.895**	**7.211**	**8.441**	**8.208**	**8.649**
STATE AVERAGE	**JUNE**	**9.35**	**9.73**	**9.08**	**9.05**	**8.64**	**8.3**	**9.55**	**9.44**	**8.98**	**9.02**	**8.94**	**9.73**	**9.52**	**9.99**	**11.12**	**10.26**	**10.26**	**10.27**
	OCT.	**8.93**	**8.33**	**8.09**	**7.86**	**7.31**	**8.25**	**8.8**	**8.87**	**8.78**	**8.45**	**8.24**	**8.74**	**9.18**	**10.37**	**9.23**	**10.07**	**9.7**	**10.29**

YEAR	Month	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
FARIDABAD	JUNE	8.52	8.53	9.04	8.62	8.12	7.68	7.73	7.47	7.83	8.59	8.77	8.84	8.2	9.12	9.65	10.41	10.61	13.1
	OCT.	6.99	7.04	7.98	6.56	6.89	6.39	6.07	6.78	7.13	7.94	8.36	6.41	7.65	8.32	8.71	9.88	9.57	
GURGAON	JUNE	14.59	15.01	15.21	15.49	15.02	13.62	14.25	15.22	15.74	16.47	17.68	19.02	17.71	18.16	19.99	21.66	22.62	23.61
	OCT.	14.43	13.9	14.3	13.96	13.8	13.07	13.82	15	15.57	16.48	17.77	17.02	17.41	17.97	19.54	21.76	22.67	

JHAJJAR	JUNE	5.95	6.04	6.01	5.85	4.34	4.44	4.51	4.49	4.97	5.29	5.79	6.05	5.64	5.83	5.46	5.24	5.27	5.2
	OCT.	5.28	5.09	4.93	3.57	3.3	3.94	3.83	4.38	4.49	5.06	5.51	4.96	5.19	4.53	5.11	4.86	4.35	
MEWAT	JUNE	8.69	8.62	8.59	8.5	7.39	6.15	6.5	6.67	7.34	8.19	8.99	9.63	9.12	9.05	9.45	10.25	10.31	11.23
	OCT.	7.7	7.23	7.38	6.1	5.08	5.43	5.42	6.09	7.1	7.86	8.73	7.76	8.08	8.21	9.69	9.44	9.57	
PANIPAT	JUNE	9.13	9.65	9.83	9.88	8.45	8.71	8.78	8.53	9.58	10.41	11.27	12.63	12.68	13.1	13.63	14.24	14.45	14.09
	OCT.	9.31	9.18	8.44	7.44	7.21	7.78	7.01	8.89	9.39	10.32	11.68	12.19	11.98	12.67	14.23	14.97	14.34	
PALWAL	JUNE																		8.83
	OCT.																		
ROHTAK	JUNE	6.17	6.21	5.94	5.42	3.55	3.64	3.59	3.8	4.49	4.74	4.84	5.67	5.12	4.88	4.41	4.45	4.2	4.19
	OCT.	5.5	4.9	4.94	2.46	2.43	3.08	2.64	3.7	3.83	4.39	4.86	4.18	4.38	3.46	3.99	3.91	3.15	
REWARI	JUNE	16.09	15.61	15.81	15.87	12.76	12.67	13.23	13.07	14.03	14.59	16.28	18.01	18.61	20.8	21.2	21.7	22.21	21.91
	OCT.	15.2	14.81	15.05	13.42	11.56	11.69	11.99	13.11	14.29	14.14	16.47	16.5	19.92	19.98	21.03	21.66	20.73	
SONEPAT	JUNE	6.13	6.64	6.73	6.14	5.14	5.46	5.24	5.33	6.04	6.36	6.87	7.76	7.7	7.43	7.44	7.7	7.56	7.68
	OCT.	5.58	5.16	5	3.95	3.97	4.7	4.35	5.46	5.72	6.21	6.58	7.06	6.89	6.56	7.06	6.99	7	
SUB-REGION AV.	**JUNE**	**9.409**	**9.539**	**9.645**	**9.471**	**8.096**	**7.796**	**7.979**	**8.073**	**8.753**	**9.33**	**10.06**	**10.95**	**10.6**	**11.05**	**11.4**	**11.96**	**12.15**	**12.2**
	OCT.	**8.749**	**8.414**	**8.503**	**7.183**	**6.78**	**7.01**	**6.891**	**7.926**	**8.44**	**9.05**	**9.995**	**9.51**	**10.19**	**10.21**	**11.17**	**11.68**	**11.42**	
STATE AV.	**JUNE**	**11.04**	**11.34**	**11.48**	**11.15**	**9.91**	**9.75**	**9.73**	**9.46**	**10.22**	**10.71**	**11.35**	**12.76**	**12.7**	**13.23**	**13.9**	**14.48**	**15.1**	**15.66**
	OCT.	**10.45**	**10.41**	**10.3**	**9.03**	**8.59**	**8.87**	**8.31**	**9.38**	**10.01**	**10.43**	**11.75**	**11.67**	**12.46**	**12.54**	**13.71**	**14.46**	**14.71**	

Source : Haryana Hydrological cell under Agriculture department.

In the Sub-Region, only Rohtak and Jhajjar has shown improvement in the ground water status since 1974. In Rohtak and Jhajjar district ground water table in 1974 was at the depth of 6.64

meter and 6.34 meter respectively where as it has improved to 4.19 meter and 5.2 meter respectively in 2009. There are three districts namely Gurgaon, Rewari and Panipat which has lower ground water table than the Sub-Region average and shown drastic decline in ground water table depth. In 1974, Gurgaon, Rewari and Panipat had ground water table at the depth of 6.64 m, 11.75 m and 4.56 m respectively and it has gone down to 23.61 m, 21.91 m and 14.09 m respectively in 2009. Faridabad is also showing great decline in water table since 2003. In the Sub-Region Gurgaon and Rewari is worst in terms of availability of ground water. In the above table districts marked by red color are showing drastic fall of ground water table, yellow colored districts are not in a critical stage but on the verge of decline in terms of ground water and those which are marked by green color shows increase in ground water table but the quality of ground water is very poor which is not fit for agriculture practice.So in these area plantation of those type of plant spacies should be done which helps in improvement in quality of soil; and ground water and increases the forest cover in the district.

b) Ground water quality

Industrial effluents, sewage waster, fertilizers, pesticides and insecticides cause a number of pollutants to enter into surface and ground water, thereby deteriorating water resources of the region. The Sub-Region has been divided into three quality zones based on the electrical conductivity (EC) values of ground water as: fresh water with EC value <2000 micro mhos/cm, marginal water with EC value 2000-6000 micro mhos/cm and saline water with EC value of more than 6000 micro mhos/cm for agricultureal purpose and six combination zones based on the occurrence of ground water quality zone with respect to depth.

On the basis of above criteria if we see the ground water quality of the sub region then we find that these zones are distributed in patches in all over the region.

Fresh ground water:

Fresh ground water occurrences are more in the shallow aquifers as compared to deep aquifers whereas water salinity becomes prominent with the increase in depth of water bearing zones. Fresh water zones are found in the southeastern parts of Rewari district. In these districts the presence of Aravalli hills, which acts as a ground water recharge zone and absence of canal irrigation has rendered the ground water quality as fresh.

Marginal Ground Water:

Marginal ground water is generally located around the zones of fresh water. Major zones of marginal ground water are found in majority of areas of Rewari district, western part of Gurgaon and central parts of Faridabad districts.

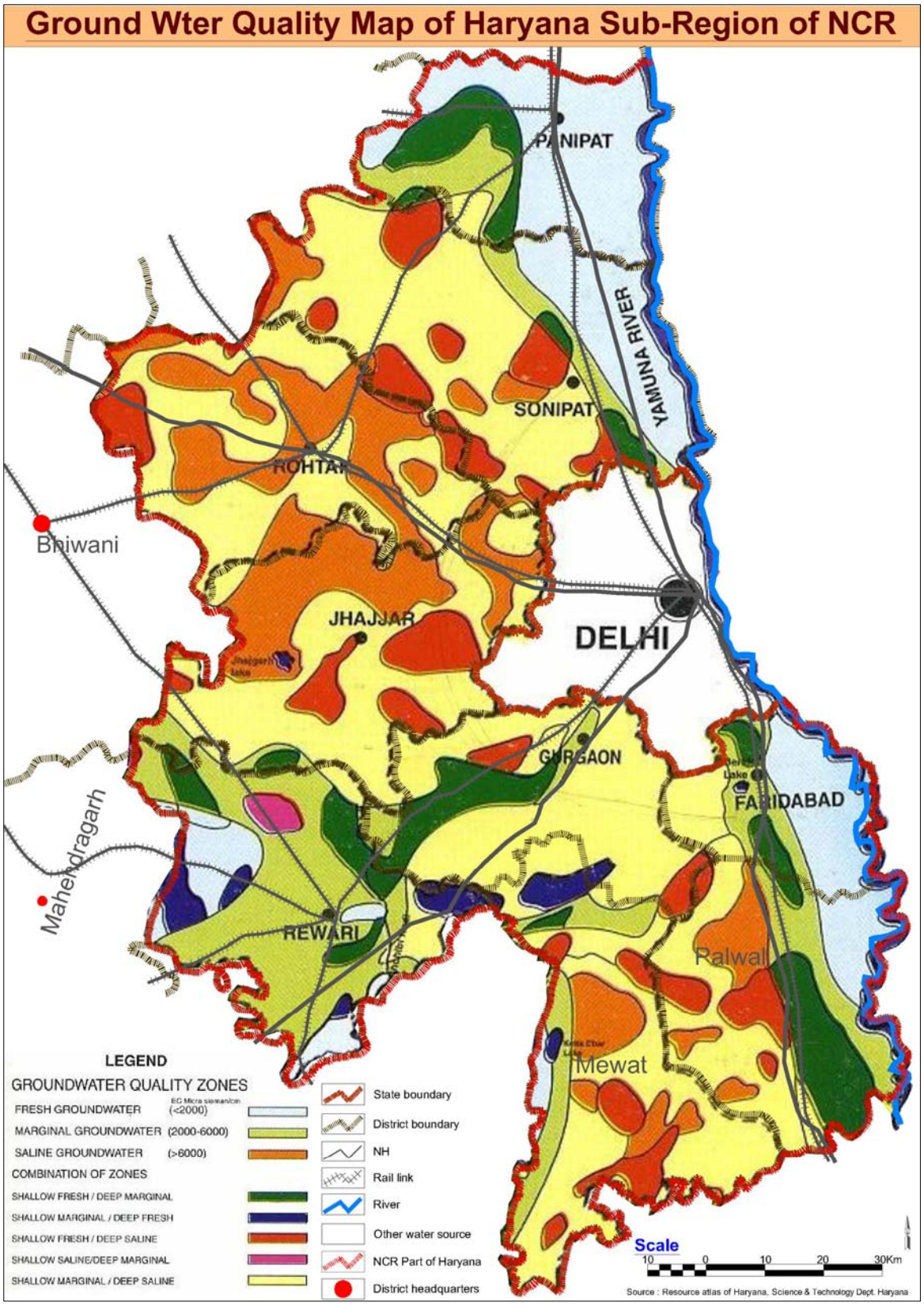
Saline Ground Water:

Saline ground water occurs mainly in the northern parts of Jhajjar district and at number of places in Rohtak. Some areas occur in central parts of Gurgaon and Faridabad districts. This is aggravated due extensive canal network adding surface water to saline ground water and non-exploitation of ground water due to its saline quality. This has resulted in rise in water table and water logging. The salinity in the south-western and south-eastern parts of the Faridabad and Gurgaon district respectively can be explained in terms of desiccation of water in these flat and semi arid plains coupled with under exploitation of ground water.

The shallow marginal-deep fresh zones are found associated with fresh water zones as seen in the districts of Rewari and Gurgaon, Deep Saline Zones are generally associated with saline zone. These zones cover majority of areas is Sonipat, Jhajjar district and southwestern and southeastern parts of Faridabad and Gurgaon districts.

Mapping of Ground Water zone as per their suitability for domestic, irrigation and industrial uses is highly desirable for proper management of ground water resources and to safeguard human being from consumption of poor quality ground water. To check further deterioration of quality of ground water in the State regular monitoring of their chemical quality is necessary.

Figure 2-9 : Ground water quality of Haryana Sub-Region



Source : Resource atlas of Haryana, Science & Tech. Dpt., Haryana,

2.3.4.v Flora and Fauna

The forests confer manifold ecological benefits on the State economy. They have great bearing on ground water occurrence, soil erosion, floods and environment. They supply a variety of raw material to many industries. Forests are source of revenue to the Government and provide employment to a large number of people. The forests in Haryana are classified under Reserved Forests, Protected forests, unclassed forests, closed U/S 38 of IFA (Indian Forest Act) and Areas closed U/S 4 & 5 of LPA (Land Preservation Act).

Considering the district wise various types of forest distribution during 2007-08, Sonipat district has highest forest cover (7359 Ha) followed by Gurgaon including Mewat (6455.42 Ha) and Faridabad including Palwal district (5851.08 Ha). Jhajjar district has least forest cover (3902.38 Ha) in the Sub-Region. In the Sonipat district maximum forest covers are protected forests i.e. forest along roads, canals, bandh and rail. There is no reserved forest or compact forest in the district of Sonipat. Sonipat district is also having maximum Un-classed forest in the Sub-Region. This indicates, the district is having maximum forest cover because of social forestry and government initiatives of aforestation.

Table 2-4 : Division/District Wise Forest Area (in Ha) for the Year 2007-2008

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Panipat	0.00	15.81	967.9	295	2734.47	89.49	4102.67	0	72	0	4174.67
Sonipat	0.00	0	1851.16	331.58	4573.02	316.84	7074.60	284.4	0	0	7359
Gurgaon	214.89	144.68	1010.26	142	200.83	90.50	1588.27	22.66	247.37	308.36	2381.55
Mewat	16.19	0.37	1203	0	821.68	136.27	2161.32	39.66	0	1856.70	4073.87
Faridabad + Palwal	314.24	37.78	925.14	0	903.48	29.59	1895.99	92.38	0	3548.47	5851.08
Rewari	514.04	0	1678.46	269.9	1471.57	117.51	3537.14	55.04	0	0	4106.22
Rohtak	0.00	41.20	1335.26	505.5	1917.99	198	3997.95	375.40	0	221	4594.35
Jhajjar	0.00	491.00	1294.16	146.57	1852.19	42.42	3826.34	45.04	31	0	3902.38
Haryana Sub-Region	**1059.36**	**730.84**	**10265.34**	**1690.55**	**14475.23**	**1020.62**	**28184.28**	**914.58**	**350.37**	**5934.53**	**36443.12**

Source : Department of Forest , Panchkula, Haryana

Table 2-5 : Division/District Wise Forest Area (in Ha) for the Year 2010

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Panipat	0	15.81	967.9	295	2734.47	89.49	4102.67	0	72	0	4174.67
Sonipat	0	0	1851.16	331.58	4573.02	316.84	7072.6	284.4	0	0	7357
Gurgaon	214.89	144.68	1010.26	142	200.83	90.5	1588.27	22.66	238.15	6824.93	8888.9
Mewat	24.43	0	1136.32	0	694.74	167.96	1999.02	40.03	0	6777.99	8841.47
Faridabad	175.63	0	321.95	0	426.32	29.59	777.86	0.12	0	5509.72	6463.33
Palwal	138.61	37.78	1010.1	0	879.47	13.04	1940.39	92.26	0	25.49	2196.75
Rewari	514.04	0	1678.46	269.9	1471.57	117.51	3537.44	55.04	0	970.42	5076.94
Rohtak	0	41.2	1335.26	505.5	1917.99	198	3997.95	375.4	0	221	4594.35
Jhajjar	0	491	1294.16	146.57	1852.19	42.42	3826.34	45.04	31	0	3902.38
Sub-Region	**1067.6**	**730.47**	**10605.57**	**1690.55**	**14750.6**	**1065.35**	**28842.54**	**914.95**	**341.15**	**20329.55**	**51495.79**

Source : Department of Forest , Panchkula, Haryana

During the year 2009-10, total forest area of the sub-regiong increased to 51495.79 Ha as compared to 35866.77 Ha in 2000-01 and 36443.12 Ha in 2007-08. This increased was mainly due to increase in the Forests u/s 4&5 of LPA 1900. Table 13.1,13.2 & 13.3 shows the status of forest area in the Sub-Region.

From the above analysis it is observed that the due to active initiatives of forest department in the way of aforestation and social forestry the forest area is increasing in the Sub-Region. But these aforasted areas are not reserved or protected, so the sustainability of the forested areas are under question. Despite of all the efforts taken by forest depart for increasing the forest cover it is much below the environmental standard.

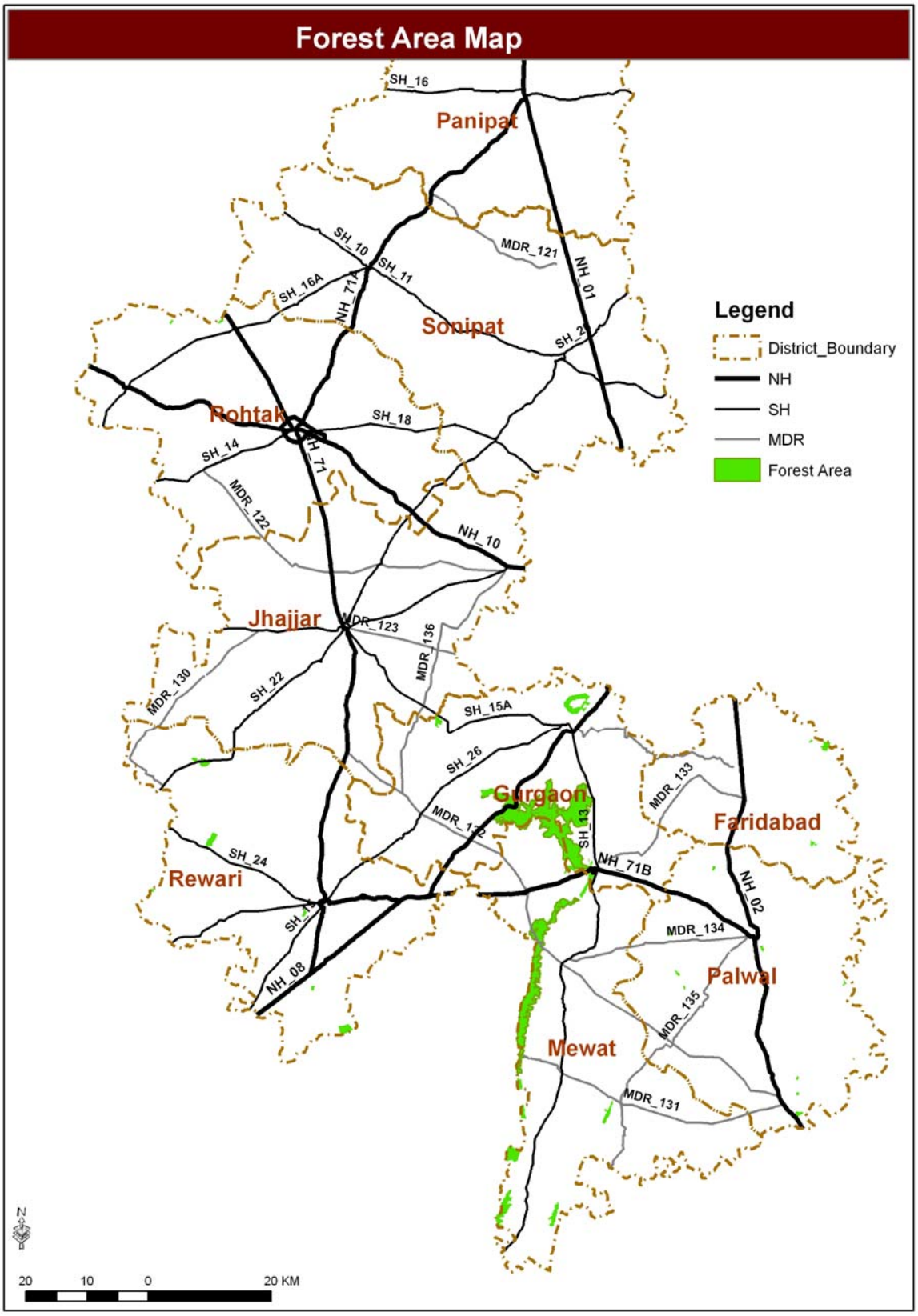
In addition to the various categories of forest in the Sub-Region, over the year extensive plantations have been raised in the Aravalli region in the various villages of the district of NCR. The district wise details of Aravalli plantation is given in below table.

Table 2-6 : Division/District Wise Aravalli plantation Area (in Ha) in the Year 2009-10

S.No.	Name of District	No. of Villages	Area in Hectare
1	Faridabad	14	3636
2	Palwal	2	131
3	Gurgaon	32	5058
4	Mewat	94	11741
5	Rewari	35	4240.5
Total		177	24806.5

Source : Department of Forest , Panchkula, Haryana

Figure 2-10 : Forest area map



Source : SOI Toposheet 1:50000 scale; Resource atlas of Haryana-2004, Satellite image 2008

Wildlife constitutes an integral part of the forests. Development of wildlife to a greater extent relies on the type of forests, their density and climate of the region. In Haryana State there are 9 wildlife sanctuaries and 2 national parks out of which there are 3 wildlife sanctuaries and 1 national park in the Haryana Sub-Region covering an area of 1742.55 acres and 359.51 acres respectively consisting of the rate species of birds, black bucks, chital, barking dears, red jungle fowls and leopards etc. The location, spatial extent and wild animals found in these parks and sanctuaries are given in table:

Table 2-7 : National parks and wild life centuary details

National Park/Wildlife Sanctuary	Tehsil/District	Important Wild Animals Found	Area (in acres)
Sultanpur National Park	Gurgaon	Water birds	359.51
Bhindawas Wildlife Sanctuary	Jhajjar	Water birds, Black buck, Blue bull	1016.94
Nahar Wildlife Sanctuary	Kosli/Rewari	Black buck, Blue bull, Black and brown partridges	522.25
Khaparwas Wildlife Sanctuary	Jhajjar	Water birds	204.36

Source : Resource atlas of Haryana, Science & Tech. Dpt., Haryana, 2004

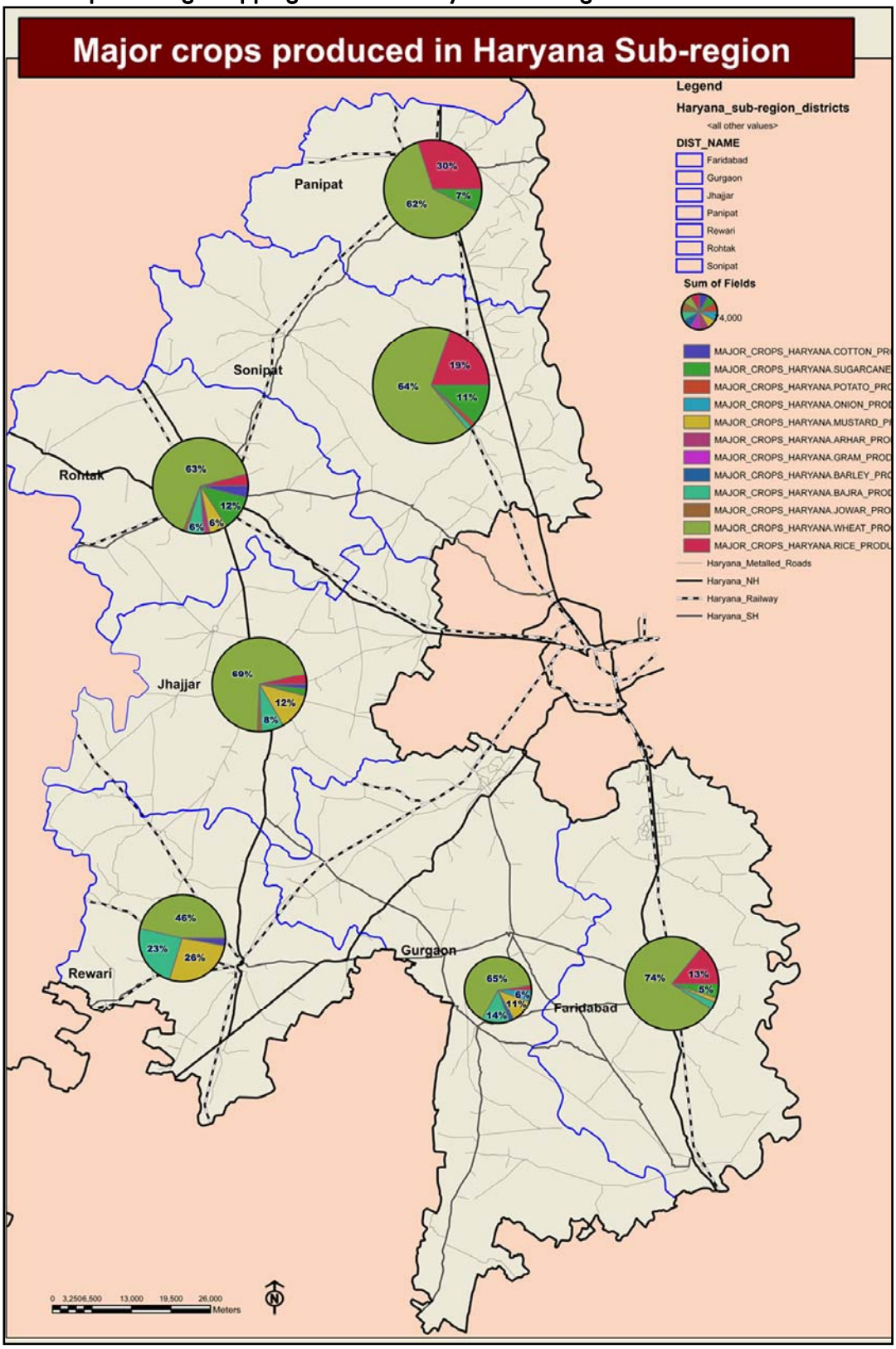
These wildlife sanctuaries are under the control of Chief Wildlife Warden of Ministry of Environment and Forest Gov. of India and National Parks are under the control of The DG Forest MOEF Gov. of India. No development within the sanctuaries and national parks can be under taken without the consent of the controlling authority. In addition, it is desirable to exercise development control so that no development which can directly or indirectly affect the sanctuaries and the national park. It is desirable to leave 5 Km buffer zone from the sanctuary and national park border. Since Sultanpur national park is in close proximity to Gurgaon urban area and proposed expansions it is necessary to exercise control to ensure environmentally compatible land use.

2.3.5 Agriculture

Haryana Sub-Region being a part of fertile Indo-Gangetic Plains, the agriculture practice forms the main landuse of the region. There are two main cropping seasons, namely Kharif and Rabi. Majority of the area is utilized for agriculture during Rabi and Kharif (double crop) season due to better irrigation facilities in the region; major kharif crops include rice, jowar, bajra, gaur, maize, cotton, sugarcane, groundnut and pulses. Rabi crops include wheat, barley, gram rapeseed/mustard and pulses. The short period available between mid-May and July is

sometimes also used for raising a third crop particularly in the areas where assured irrigation is available for watering the crop during the dry season.

Figure 2-11 : Map showing Cropping Pattern in Haryana Sub-Region



Source : Agriculture department , Haryana, 2008

Northern portion of the region is characterized by good agricultural area due to fertile alluvial soils, marginal to food quality of ground water, network of irrigation, canals, tube wells and relatively better natural drainage. On the contrary southern part like Gurgaon and Rewari, due to lack of rainfall, poor irrigation facilities, poor Ground water quality coupled with desertic terrain with and dunes, result in relatively less cultivation during Kharif season.

2.3.6 Agro-Ecological Zones of Haryana Sub-Region

Based on the soil, physiography, bioclimate and length of growing period, the State has been divided into 8 agro – ecological zones (NRDMS Centre and Science & Tech. Dept. Chandigarh, 2004). Out of those eight zones our sub region falls under zone-2, zone-3, zone-4 and zone-5.

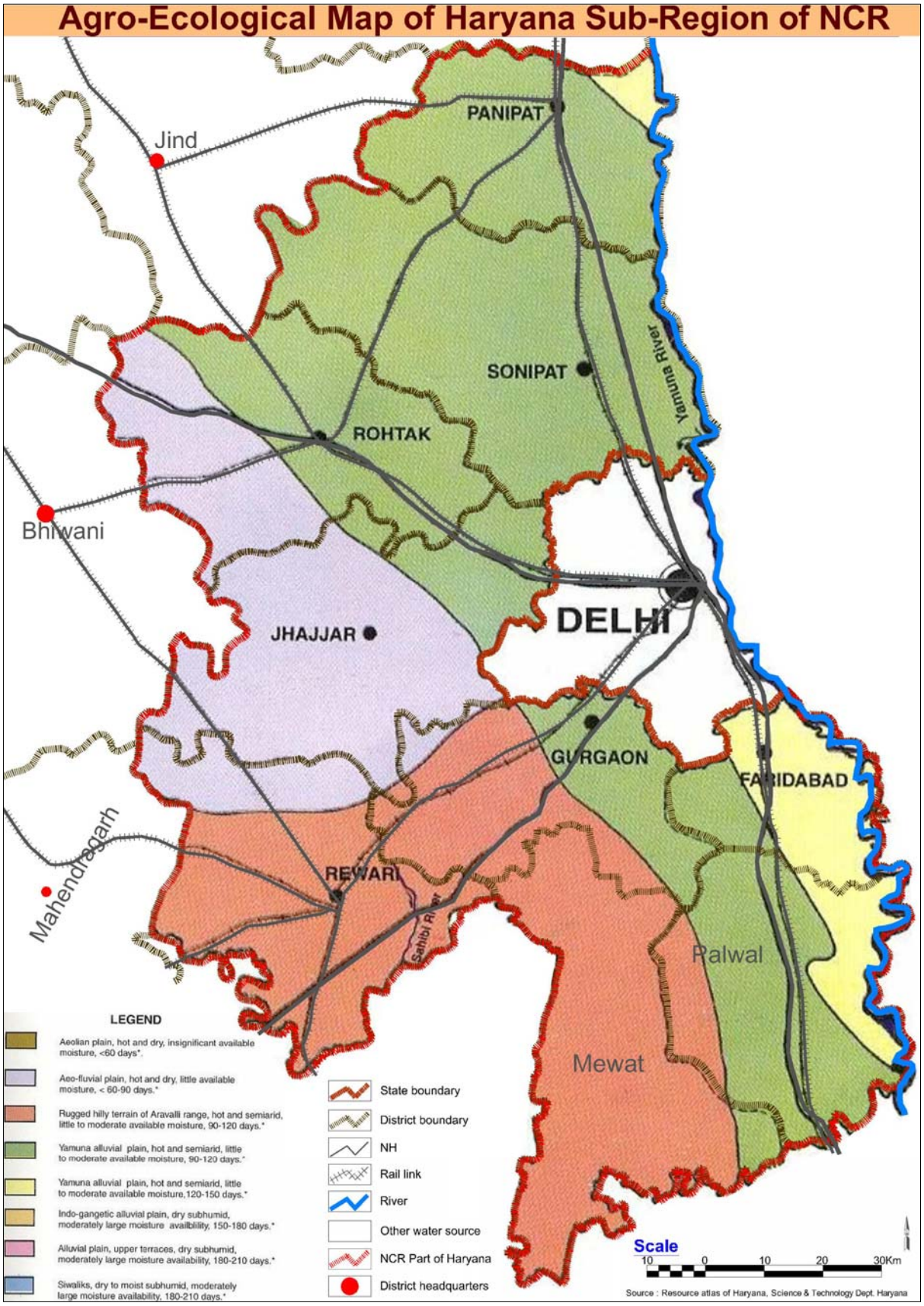
Zone 2: These zones cover maximum area of the State extending over parts of Sirsa, Fatehabad, Hisar, Bhiwani and Jhajjar districts. The geomorphology of the region comprises of aeofluvial plain, having hot and dry climate. The annual rainfall varies from 300-450mm with growing period of 60-90 days.

Zone 3: This zone covers southern parts of the State covering districts of Mahendragarh, Rewari and Gurgaon. The topography of the region is represented by rugged hilly terrain of Aravalli ranges. The climate is hot and semi-arid with annual rainfall of about 350-500mm and growing period of less than 90-120 days.

Zone 4: This zone extends over parts of central and eastern Haryana covering districts of Karnal, Kaithal, Panipat, Jind, Rohtak, Sonipat and Faridabad. Topography of the region belongs to alluvial plain with Yamuna alluvial plain covering majority of the areas along the eastern parts of the State. The climate is hot and semi-arid with annual rainfall of 450-600mm and growing period of less than 90-120 days.

Zone 5: This small zone extends in the alluvial plains covering part of districts of Kurukshetra, Karnal and Faridabad. Topography of the region belongs to Yamuna alluvial plain. The climate is hot and semi-arid with annual rainfall of 600-700 mm and growing period of less than 120-150 days.

Figure 2-12 : Agro-Ecological zones of Haryana Sub-Region



Source : Resource atlas of Haryana, Science & Tech. Dpt., Haryana,

Chapter 3 : VISION, OBJECTIVES AND DEVELOPMENT POLICY

3.1 *Vision Statement*

Vision of Haryana Sub region is based on its inherent strength in its and economy which is based on both highly productive agriculture as well as Industrial Development undertaken since the formation of the State. It has got well developed Infrastructure of Educational and health facility as well as Infrastructure of Transportation. The Haryana Sub Region Plan of the National Capital region is covering Eastern part of the State covering area of 13428 Km^2 consisting of district of Panipat, Sonipat, Rohtak, Jhajjar, Gurgaon, Rewari, Mewat, Faridabad and Palwal.

Due to its proximity to the national Capital it is poised to reap the benefit of the unprecedented growth witnessed by the National Capital during the last few Decades. Till now due to enormous attraction of Delhi the immediate hinterland suffered from under development. However the potential for economic growth cannot be accommodated within the confines of Delhi state anymore. The limitation of physical space and the need to maintain and environmentally satisfying quality of life in Delhi has necessitated evolution of the concept of decentralization of functions in areas surrounding Delhi.

The Sub region of Haryana surrounding Delhi on three sides is a potential natural beneficiary of this growth propensity unleashed by the economic upturn in the country as well as Globalization of the Economy. Globalization and Liberalization of Indian Economy has accelerated investment in the county. Government of Haryana is also in the pursuit of creating an environment for attracting substantial investment. The constrain of space and high cost associated with it are resulting in spill over of economic activities of Delhi which could be by neighboring State like Haryana. Therefore it is imperative that the sub region prepares itself to receive these opportunities with appropriate physical and social Infrastructures support responding to the investors' perceptions.

The Regional Plan 2021 for the NCR prepared by NCRPB has provided guidelines for development. In the NCR Plan certain Infrastructure Development was proposed. One of them was an orbital Expressway with a parallel orbital Railway Corridor proposal. This orbital expressway known as KMP Corridor is already under construction by the Govt of Haryana. A

Plan for developing specialized cities on this corridor has already been approved by the Govt. of Haryana. However the alignment of Orbital Railways has not yet been finalised. It is anticipated during the Plan period this railway will also come about. The advantage of the Orbital Road is that it connects all the National and State highway radiating out of Delhi. Similarly the Orbital railway connects the entire major railway corridor radiating from Delhi. Proper development of these two transport infrastructure with adequate interface with Local Transport will provide tremendous flexibility in transportation and thus facilitate the most efficient transportation system to help commuting between various urban and activity centre. In addition a Delhi- Mumbai infrastructure corridor is also envisaged part of which passes through the Southern Portion of the Sub Region Connecting Rewari, with Palwal. These two developments have unleashed enormous potential of development whose advantage needs to be taken to ensure optimization of the opportunity offered. In order to study and Plan for a Sustainable future of the Haryana Sub region keeping in view the challenges posed by the threats of Global Climate Change and the Disaster Management Act. The Development Plan of the Sub Region is being prepared keeping in mind the postulates of the NCR Plan as well as the emerging opportunity.

Analysis of existing Land use, on the basis of Remote sensed data, indicates that in the Haryana Subregion of NCR 83.77 of land is under agriculture. Major areas under forest & wasteland, coming approximately 8% are mainly located in the Aravalli area & few patches along NH2 corridor.The KMP corridor covers a portion of the Haryana Sub-region & majority of ecologically sensitive area of the sub-region fall in the corridor.

3.2 *Aim and Objectives*

3.2.1 Aim

To promote growth and balanced development of the National Capital Region.

3.2.2 Objectives

To achieve the above aim following objectives have been framed:

1. Providing suitable economic base for future growth by identification and development of regional settlements capable of absorbing the economic development impulse of NCT-Delhi.

2. To provide efficient and economic rail and road based transportation networks (including mass transport systems) well integrated with the land use patterns, to support balanced regional development in such identified settlements.

3. To minimize the adverse environmental impact that may occur in the process of development of the National Capital Region.

4. To develop selected urban settlements with infrastructural facilities such as transport, power, communication, drinking water, sewerage, drainage etc. comparable with NCT-Delhi.

5. To provide a rational land use pattern in order to protect and preserve good agricultural land and utilize unproductive land for urban uses.

6. To promote sustainable development in the region to improve quality of life.

7. To improve the efficiency of existing methods of resource mobilization and adopt innovative methods of resource mobilization and facilitate, attract and guide private investment in desired direction.

3.3 *Policy Zones in NCR Plan*

Control over the use of land is essential to protect & conserve vital environmental endowments. The area of concern is:

i) Area where development pressure is high

ii) Area which would have to be protected from built form development, much as ridge, riverbed, wild life sanctuaries, forest etc.

iii) Good quality agriculture land

iv) Areas which are potential for tourism, ecological development etc.

Accordingly four major land use zones have been identified in NCR plan:

i) Controlled/development/regulated zone

ii) Highway corridor zone

iii) Natural conservation zone

iv) Agricultural (rural) zone outside controlled / development / regulated area.

i) Controlled/development/regulated zone

Within the controlled / regulated zones there are three sub zones, whose delineation will be undertaken by the Master/Development plans for the controlled / development / regulated areas the sub zones are:

a) Urbanization areas (including existing Builtup/urban areas)

b) Agriculture (rural) zone within controlled/ development/regulated areas

c) Green belts

d) **Urbanisable area:**

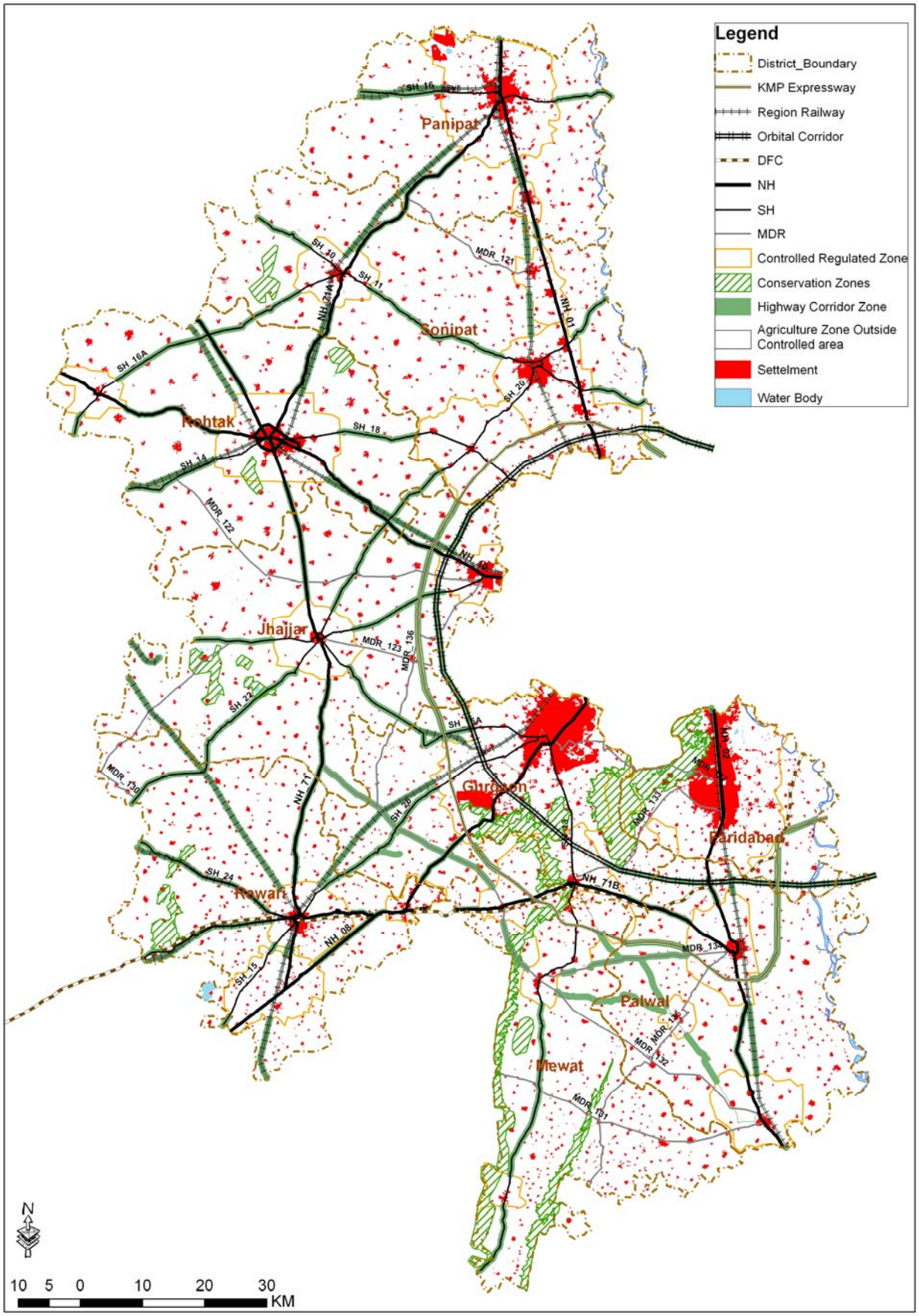
The existing & proposed built up areas have to be regulated and guided by Master/Development Plans & local areas plans including Village Development plans within the framework of Regional Plan & Sub-Regional Plans 2021. The density of population has been prescribed as the following

Table 3-1 : Density permissible in Urbanisable area

Sl No.	Urban Centres	Person Per Ha
a)	Below 50,000	60 – 80
b)	50,000 to 1,00,000	80 – 100
c)	1,00,000 to 5,00,000	100 – 125
d)	5,00,000 to 10,00,000	125 – 150

The above is the general guidelines for urban area development. In the Haryana , for the urban development government has taken population density limit between 100 to 120 pph.

Figure 3-1 : NCR Policy Zones in Haryana Sub-Region



The NCR plan stipulates that no proposal for development should be envisaged in natural conservation zones planned green areas, agriculture area, ground water recharging areas and water bodies. Land should be reserved for (a) disposal of solid waste, (b) utility services, (c) dairy farming,(d) horticulture, (e) inter & intra urban transport system etc.

a) Agriculture (Rural) zone:

Agriculture (rural) zone within the controlled/regulated need to be conserved, so that good agriculture land is not conserved unless inevitable.

b) Green buffers:

Green buffers along the expressways, National Highways, State Highways and Railway lines or around / adjacent to any other area as provided in the regulated zone along major transport corridors and other areas, would be maintained & regulated. These green buffers would be outside the controlled/regulated areas. The width of the green buffers would be based on the following:

(a) Expressway / By pass: 100 m

(b) NH: 60 m

(c) State Highways: 30 m

(d) Railway Lines: 30 m

The width of green buffers outside controlled area should be 500 meters both side.

ii) Highway corridor zone

Highway Corridor zone: In order to control the large scale urban development along the important highways in the region, outside the controlled / development / regulated zone, a regulatory zone is provided within which necessary planned development can be undertaken. It includes all major roads and highways within the Haryana sub region such as;

NH-1: Delhi to Amritsar

NH-10: Delhi to Rohtak

NH- 71: Rohtak to Jind

NH-8: Delhi to Gurgaon and beyond

NH-2: Delhi to Calcutta

Controlled area of 500 meters from the ROW (right of way) is mandatory.

iii) Natural conservation zone

a) Nature Conservation zone :

Following area have been identified as naturally sensitive areas:

Extension of Aravalli ridge in Haryana, forest areas, rivers and tributaries of Yamuna and Sahibi, Sanctuaries, major lakes and water bodies, such as Bhadkar lake, Sultanpur etc. Development needs to be restricted to project the ecology of these areas.

Following areas have to be covered:

(a) Extension of Aravalli ridge, sanctions & other ecologically sensitive areas. The development of this area is to be in accordance with the guidelines of MOEF

(b) Forest area is to be conserved & more areas brought under forests through afforestation by bringing all water lands review of irrigation canals, drains, roads, railway lines and village common lands.

(c) Area under water bodies, ox-bow lakes & Paleo channels and their surrounding areas all areas, which we ground water rechargeable areas are to be kept face from any construction.

(d) Detailed construction plans are to be prepared for areas shown as Nature conservation in the land use plan 2021.

(e) The monuments / man-made heritage sites are to be identified is the development plan of each town.

b) Natural Conservation Zone:

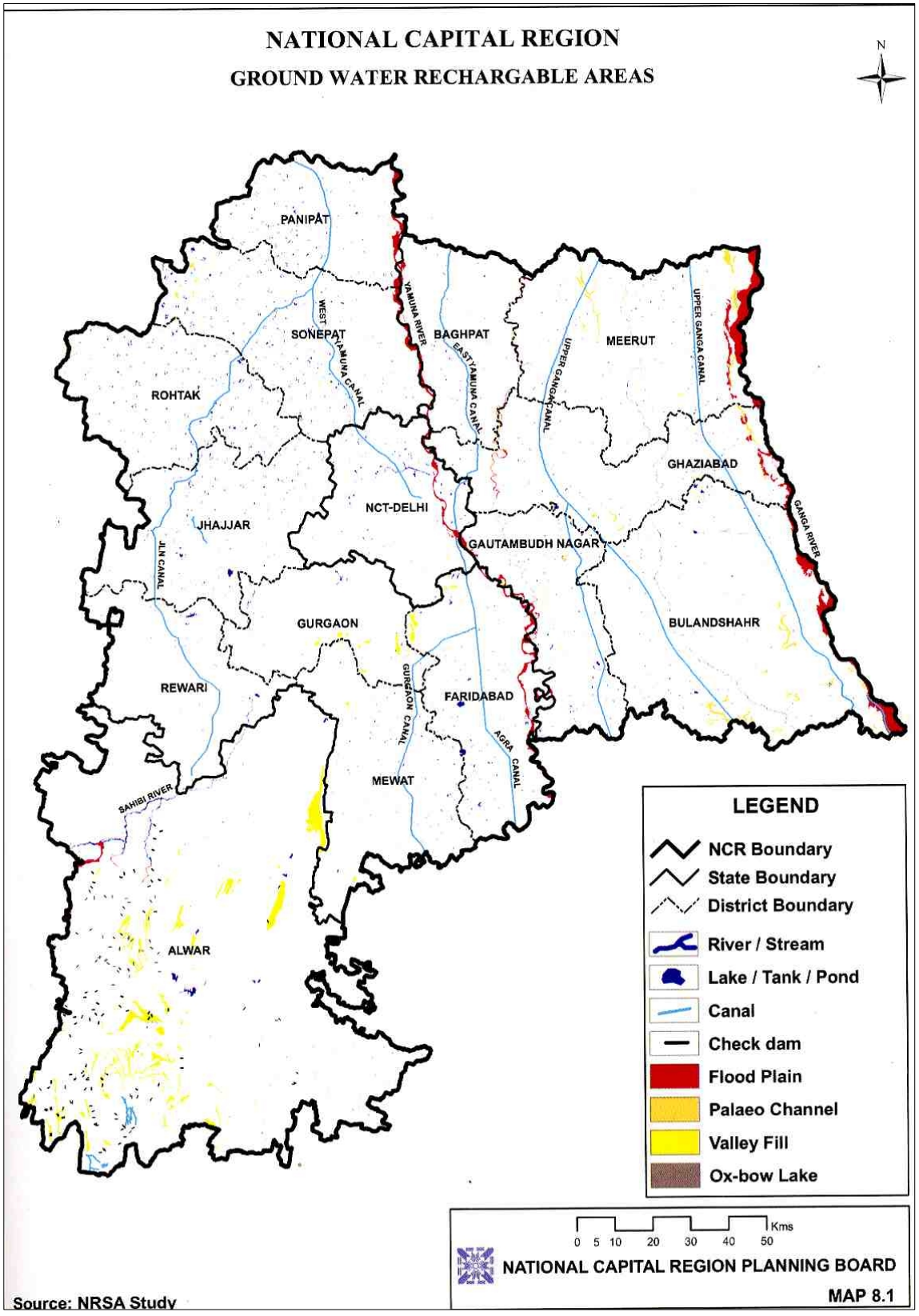
The major natural features, identified as environmentally sensitive areas, are the extension of Aravalli ride in Rajasthan, Haryana and NCT-Delhi, forest areas, the rivers are tributaries of Yamuna, Ganga, Kali, Hindon and Sahibi, sanctuaries, major lakes and water bodies such as Badkal lake, Suraj Kund and Damdama in Haryana Sub-region and Siliserh lake in Rajasthan etc. These areas have been demarcated as Natural Area Conservation Zone in the Regional Plan – 2021. Similarly, ground water recharging areas area such as water bodies, ox-bow lakes and paleo-channels has also been identified.

These areas be further detailed out in the Sub-regional Plans and master/Development Plans and the broad policies for these zones which are as under be incorporated appropriately in them and be further elaborated and implemented.

(i) The extension of the Aravalli ridge, sanctuaries and other ecologically sensitive areas be conserved with utmost care and afforested with suitable species. The development in this area be in accordance with the notifications issued for such areas by the Ministry of Environment and Forests under the Environment (Protection) Act, 1986 from time to time.

(ii) In view of the very low existing forest cover (4.02%), it is imperative to bring more areas under forest so as to maintain the ecological balance in this region. Accordingly, all wastelands identified in the existing Land Use 1999 and proposed Land Use Plan 2021, ROW of irrigation canals, drains, roads, railway lines and village common lands are proposed to be brought under forest cover. The total forest cover proposed to be 10% of the total area of the region.

Figure 3-2 : Ground water rechargeable areas in NCR



(iii) The areas under water bodies, ox-bow lakes and paleo-channels and their surrounding areas as shown in the Ground Water Rechargeable Areas of NCR Plan

2021in Figure No.3.1 /Land Use Plan 2021 in Figure No. 2.3 are kept free from any encroachment/development to allow free flow of water.

Construction activities for human habitation or for any other ancillary purpose thereto not are permitted. Suitable measures be taken to maintain the water bodies with the minimal flow/water level.

(iv) In the flood prone areas/river beds/banks, no construction or habitation activities are permitted. Flood Protection Plan is prepared by the concerned State Governments/agencies. Policies proposed in the Disaster management chapter at para 15.3 are further elaborated in the Sub-regional Plans, Master/Development Plans and Flood Protection Plans.

(v) Detailed Conservation Plans be prepared for the areas shown as Natural Area Conservation Zone in the Land Use Plan 2021.

(vi) The monuments / man-made heritage sites and conservation heritage areas be identified in the Master/Zonal Plans of each town and detailed conservation plans be prepared for their protection and conservation.

iv) Agricultural (Rural) Zone outside Controlled/Development/Regulated Areas

Agricultural (Rural) Area of NCR has to be regulated and guided by Village a Block Plans to be drowning under the district planning process. At the regional level, agriculture (rural) zone be designated for primary sector production and as open areas comprising of farmlands, orchards and pastures etc.

The new employment opportunities in non-agriculture sector and consequent concentration of population, the urban expansions would have to be largely made from the agricultural land and other non-urban uses. Therefore, there would be a major impact on land requirements of agriculture sector. In view of this, following policies have been proposed:

(i) Existing cultivated land be conserved for agriculture use as for as possible. Efforts are made to increase the production through intensive cultivation by providing irrigation facilities and other necessary infrastructure.

(ii) Measures be initiated for protection of prime agricultural land and ensure its needless conversion into non-agricultural / urban use.

(iii) Utilization of less and least valuable land for urban expansion/new urban centres/development purpose.

3.4 *Policy for Future Development in Sub-Region*

The sub-region development plan will attempt to achieve the objectives enumerated earlier. The sub region may be divided into four policy zones.

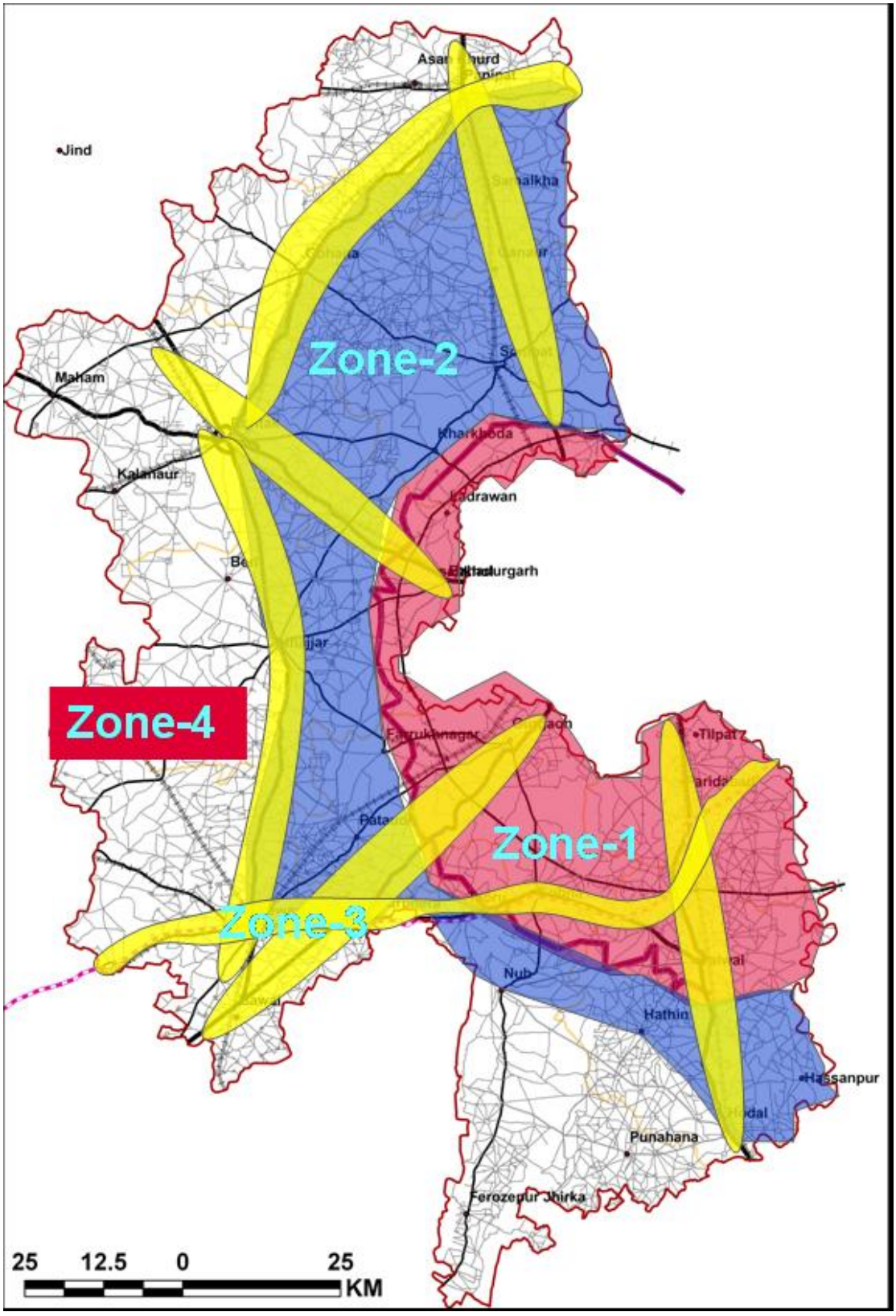
1. The area abutting Delhi up to the KMP corridor (Zone-1)
2. Area between KMP and an arc covering the area from Panipat, Rohtak, Rewari, Hathin & Hodal (Zone-2)
3. Corridor zones (Zone-3)
4. Rest of the Sub-Region area (Zone-4)

Considering that Hissar has been identified as a counter magnate for NCR the corridor connecting Delhi, Bahadurgarh, Rohtak and Hissar would need to be emphasized.

The existing corridors viz, Gurgaon-Manesar, Faridabad- Palwal would need to be carefully planned within the parameters of NCR plan. The new corridors viz, KMP, the Western-Dedicated Freight Corridor (DFC) connecting Rewari to Palwal would need to be carefully planned to take advantage of the growth potential. Rewari -Rohtak corridor would similarly require extensive planning for exploiting the development potential. The Delhi Mumbai Industrial Corridor (DMIC) being planned along the DFC where specific Investment regions and Industrial areas are being planned by the Govt. of India and the respective State govt. needs to be incorporated in the Sub regional plan. The Manesar – Bawal Investment region, Rewari - Hissar Investment region, Kundli-Sonipat Industrial Area lie in the Haryana sub region. The upcoming Multi-product SEZ

promoted by Reliance Industries at Jhajjar also lies in the sub-region. Numerous smaller SEZ and Industrial estates are also being planned.

Figure 3-3 Policy Zones of Haryana Sub-Region

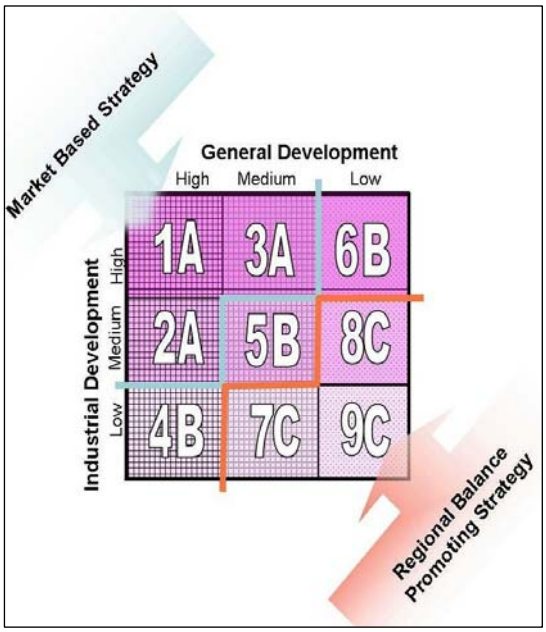


Areas for conservation, which have been identified in the NCR plan and which are revealed in detailed analysis of land use identifying water resources such as streams, canals, water bodies would be protected against intrusive development and conserved.

Highly productive agricultural land would similarly need protected and conserved. All forest areas in the sub region would be protected and no development would be permitted within one kilometer from the perimeter of the forest. Wasteland reclamation through afforestation would be one of the major concerns of development. Industrial locations would be chosen considering their potential to pollute the environment and industrial zoning atlas as recommended by CPCB would be adopted for choice of location suitability.

3.5 *Policy Sub-Zones for Future Development in Sub-Region*

After overlapping NCR Landuse zones and Policy zones and analysis of development potentials each policy zones will have following policy sub-zones:



Sub-Zone A : This zone will have either high industrial and high general development status or medium industrial and high general development or high industrial and medium general development. It includes major urban complexes/towns. This zone is most developed zone. Therefore this zone will be treated by market based development strategy.

Sub-Zone B : This zone will have either high and low development combination or both medium status. It generally includes smaller towns and surrounding villages around most developed urban ares or along developed corridors. It can be called as unutilized potential zones which need mixed approach of development. It does not need more care for development.

Sub-Zone C : This zone will have either low industrialisation and low general development or low industrialisation with medium development or low development with medium industrialization. It

is the most backward area of the region which creates regional imbalance in the region. Threfore this sub-zone need regional balance promoting strategy.

Sub-Zone D : This zone will have all the environmentally sensitive area which need to be conserved and treated as per the standard environmental laws and controlled/regulated development zones under which development will be done in controlled way as per the norms and standards . In these areas there will be restricted development. In this zone maximum area is under no development zones and rest are in restricted development.

3.6 *Policy for Policy Zones and Sub-Zones in the Sub-Region*

Sub-Zone A Policy

Focus on market driven, rapid economic development and seek to ensure that the economic forecasts are met primarily by focusing on the established industrial areas and the potential problems that might arise from over-development. Policy will main oriented to solving increasing congestion, higher labour, land and housing costs and deteriorating environmental conditions and facilitating infrastructure.

Sub-Zone C Policy

Focus specifically on encouraging and facilitating those areas which will make the most positive contribution to inclusive growth. This strategy will seek to intervene in the predicted outcome from the economic forecasts, encouraging more extensive and rapid development in the areas which area in need of development. These area need high socio-economic development initiatives to remove regional imbalance and inequality.

Sub-Zone B Policy

This area needs mixed approach of Zone A and Zone C. In this zone only providing necessary infrastructure facilities will induce socio-economic development

Sub-Zone D Policy

This zone is either environmentally sensitive or comes under controlled/regulatory zone . So in this zone various strict regulations have to be adopted. Areas for conservation, which have been

identified in the NCR plan and which are revealed in detailed analysis of land use identifying water resources such as streams, canals, water bodies would be protected against intrusive development and conserved. Highly productive agricultural land would similarly need protection and conservation.

3.7 *Zoning Regulations:*

Keeping in view rapid urbanization, environmental degradation and to ensure orderly development in the region, a legislative tool in the form of Zoning Regulation is required. In view of this, four broad zones have been identified for application of strict land use control and development and enabling preparation for detailed Plans such as Sub-regional/Master/Local Area Plans and Master/Development Plans by the respective State Governments. Four broad zones and major activities/uses permitted in these zones are given below:

1. **Controlled / Development/regulate Zone:**

(a) Urbanisable Areas (including existing built-up/urban areas)

Within the Urbanisable are proposed in the Master/Development Plan of the respective towns, the functions and uses designated as under be continued:

(i) Residential

(ii) Commercial

(iii) Industrial

(iv) Government offices, public and semi-public

(v) Recreational

(vi) Utility services

(vii) Transport and communications

(viii) Open spaces, parks and playgrounds

(ix) Graveyards/cemeteries and cremation ghats

(x) Man-made heritage areas

(xi) Natural heritage areas/eco-sensitive areas/conservation areas

The local authority according to the prescribed uses in the Master/Development Plans will govern detailed land uses within the Urbanisable area. The Master/Development Plans of all the towns will be prepared within the framework of the Regional Plan – 2021 and Sub-regional Plans. In case any amendment is required in the acts to implement the policies of Regional Plan – 2021 that be done by the respective State Governments appropriately.

(b) Agriculture (Rural) Zone within Controlled/Development / Regulated Areas

1) Agricultural, horticultural crops and cash crops

2) Dairy and poultry farming including milk chilling station and pasteurization plants

3) Social forestry / plantations including afforestation

4) Non-polluting industries registered as RSI/SSI units subject to one of the following conditions:

(i) Located within half kilometer belt encircling the existing village *abadi* and approachable from a public road/*rasta* other than scheduled road, national highways and state highways

(ii) On public road/*rasta* not less than 30 feet wide other than schedules roads national highways and state highways outside the half kilometer zone referred to in above up to a depth of 10 meters along the approach road.

5) Non-polluting agro-based industries on public roads/revenue rasta not less than 30 feet wide other than scheduled roads, National Highway and State Highway.

6) The site should not fall within 900 meters restricted belt around defence installations.

7) Land drainage and irrigation by hydro-electric works and tube well for irrigation

8) Sanitary landfill, compost processing plant and other such activity sites with adequate protected belt as prescribed in the CPHEEO Manual of the Ministry of Urban Development and Poverty Alleviation and the notifications issued by the Ministry of Environment and Forests from time to time.

9) Mining and extraction operations including lime and brick kilns, stone quarries and crushing subject to the rules and approved site.

10) Bus queue shelter and railway station.

11) Airports with necessary buildings

12) Wireless Station

13) Grain godowns, storage spaces at site approved by competent authority

14) Weather station

15) Telephone and electric transmission lines and poles

16) Cremation and burial grounds

17) Fuel filling station, Service stations and repair workshops

18) Power plant/sub-station/water works/treatment plants and other utility services

19) Storage godowns for inflammable petroleum products such as LPG, petrol, diesel, kerosene, aviation turbine fuel, light diesel o8il and other petroleum products and lubricants with the approval of the competent authority

20) Village houses within abadi-deh

21) Farm houses outside abadi-deh, and

22) Expansion of existing village contiguous to abadi-deh including social institutions like schools, dispensaries, veterinary centres and police posts strictly for the requirements

of the village and located within 500 meters of the abadi-deh, if undertaken as a project approved or sponsored by the Central Government or State Governments.

23) Recreational/tourist facilities not more than 4.5 meters height, FAR not exceeding 5% of the plot areas.

(c) Green buffers

i) Approach / service roads

ii) Agriculture and horticulture

iii) Social forestry/plantations including afforestation

iv) Fuel filling stations with amenities like toilets, STD booths small repair shop, small tea / soft drink and snack bar (with no cooking facility)

v) Toll Plaza, bus queue shelters, police boot, first aid centers and telephone booth

2. Highway Corridor Zone

The Highway Corridor Zone will have to be notified controlled /development /regulated area and master/Development Plans will have to be prepared by the respective State Governments. In the Highway Corridor Zone (excluding green buffers along highways, activities permitted in 'Urbanisable area', 'agriculture zone within development/controlled/regulated areas' and the 'green buffers' prescribed in paras 17.5.1(a), 1(b) and 1(c) of Zoning Regulations will be permitted through Master/Development Plans. The competent authority will regulate access to the expressways and highways.

3. Natural Conservation Zone:

In this zone the following uses activities may be permitted:

i) Agriculture and horticulture

ii) Pisiculture

iii) Social forestry/plantations including afforestation

iv) Regional recreational activities with no construction exceeding 0.5% of the area with the permission of the competent authority.

4. Agriculture (Rural) Zone outside Controlled / Development / Regulated Areas

In the agriculture (rural) area zone outside controlled/development/regulated areas the following activities / uses may be permitted in addition to the activities / uses permitted in the "agriculture zone within controlled / development / regulated area' as indicated:

i) Intensive agriculture and allied activates such as dairying and poultry farming

ii) Afforestation especially on the wastelands and barren lands

iii) Regional recreational uses such as, regional parks, wildlife sanctuary etc.

iv) Cemeteries, schools, hospitals, etc

v) Quarrying

vi) Brick kilns

vii) Existing village Mandis / agricultural markets

viii) Rural industries

Chapter 4 : DEMOGRAPHIC PROFILE AND SETTLEMENT PATTERN

4.1 *Demography*

4.1.1 Population distribution & density

The Haryana Sub Region comprises of an area of 13428 sq. km. with a total population of 8.7 million. This amounts to 30.4% area & 41.14% Population of Haryana State. The average density of the region (647 person per sq.km.) is more than the state average of 478. The more dense areas with in the region are- Faridabad , Panipat & Gurgaon . The lowest density in the region is that of Mewat followed by Rohtak.

Table 4-1 : District wise demographic details of Haryana Sub-Region befor creation of Palwal

Districts	Area (Sq KM)	Total Population	Population density (Persons/Sq Km)	Urbanization (%)	Household size
Panipat	1268	967449	763	40.5	5.5
Sonipat	2122	1279175	603	25.1	5.7
Rohtak	1745	940128	539	35.1	5.6
Jhajjar	1834	880072	480	22.2	5.6
Rewari	1594	765351	480	17.8	5.6
Gurgaon	1254	870539	694	35.6	6.1
Faridabad	1752	1990719	1136	60.8	5.6
Mewat	1859	993617	534	7.5	7.5

Source: Census 2001, Statistical abstract haryana 2006-07

Now after the division of Mewat from Gurgaon and Palwal from Faridabad we get the following demographic scenario :

Table 4-2 : Demographic details of Gurgaon district

Tehsil	Area (Sq.Km)	Population					Literates		
		Total	Male	Female	Rural	Urban	Total	Male	Female
Gurgaon	738.82	629508	342527	286981	380541	248967	433150	258969	174181
Pataudi	177.39	100957	53193	47764	67791	33166	63399	38367	25032
Sohna	336.86	140074	74784	65290	112504	27570	80726	50735	29991
Total	**1253.07**	**870539**	**470504**	**400035**	**560836**	**309703**	**577275**	**348071**	**229204**

Source :- Census of India 2001, Statistical abstract haryana 2006-07

Table 4-3 : Demographic details of Mewat district

Tehsil	Area (Sq.Km.)	Population					Literates		
		Total	Male	Female	Rural	Urban	Total	Male	Female
Taoru	225.19	126169	67072	59097	108841	17328	55833	37777	18056
Nuh	463.70	212855	112553	100302	201816	11039	71591	52830	18761
F.P.Jhirka	521.50	243868	128055	115813	226113	17755	72567	55350	17217
Punhana	290.15	206858	108267	98591	193679	13179	57427	44480	12947
Total	**1500.54**	**789750**	**415947**	**373803**	**730449**	**59301**	**257418**	**190437**	**66981**

Source :- Census of India 2001 , Statistical abstract haryana 2006-07

Table 4-4 : Demographic profile of Faridabad district

Tehsil	Area (Sq Km)	Population					Sex Ratio	Literacy Rate (%)
		Total	Male	Female	Rural	Urban		
Faridabad	422.25	1178007	646425	531582	115700	1062307	822	78
Ballabgarh	320.65	187458	101248	86210	187458	0	851	65
Total	**742.90**	**1365465**	**747673**	**617792**	**303158**	**1062307**	**826**	

Source :- Census of India 2001 , Statistical abstract haryana 2006-07

Table 4-5 : Demographic profile of Palwal district

Tehsil	Area (Sq Km)	Population					Sex Ratio	Literacy Rate (%)
		Total	Male	Female	Rural	Urban		
Palwal	631.94	404136	217233	186903	303414	100722	860	65
Hathin	359.34	203867	108925	94942	192951	10916	872	46
Hodal	376.75	221118	119232	101886	173719	47399	855	60
Total	**1368.03**	**829121**	**445390**	**383731**	**670084**	**159037**	**862**	

Source :- Census of India 2001 , Statistical abstract haryana 2006-07

Therefore after the re-division of Faridabad and Mewat into Faridabad, Mewat and Palwal district, now Haryana sub-region is comprised of nine districts whose demographic profile is described in below table.

Table 4-6 : Population details of all districts of Haryana Sub-Region

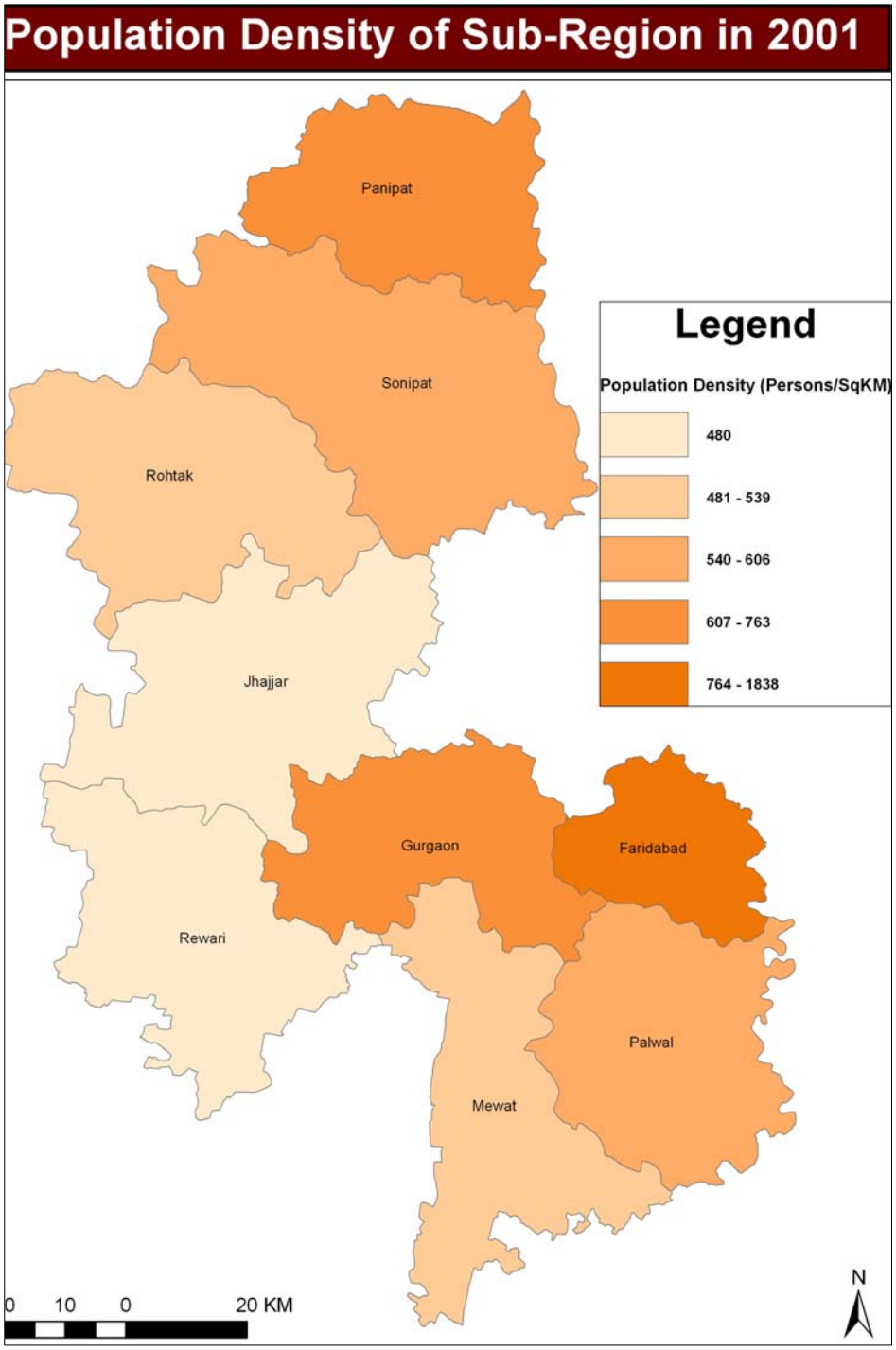
Districts	Area (Sq km)	Population					Sex Ratio	Population Density
		Total	Male	Female	Rural	Urban		
Panipat	1268	967449	528860	438589	575369	392080	829	763
Sonipat	2122	1279175	695723	583452	957800	321375	839	603
Rohtak	1745	940128	509038	431090	610524	329604	847	539
Jhajjar	1834	880072	476475	403597	684975	195097	847	480
Rewari	1594	765351	403034	362317	629177	136174	899	480
Gurgaon	1253	870539	470504	400035	560836	309703	873	695
Mewat	1501	789750	415947	373803	730449	59301	893	526
Faridabad	743	1365465	747673	617792	303158	1062307	826	1838
Palwal	1368	829121	445390	383731	670084	159037	862	606
Total	**13428**	**8687050**	**4692644**	**3994406**	**5722372**	**2964678**	**851**	**647**

Source :- Census of India 2001 , Statistical abstract haryana 2006-07, Palwal NIC

Population density is defined as number of persons per square kilometer. It is a generalized and easy to understand method knowing the pressure of population on land resources. In 2001, density of population in Haryana was 477persons/km^2. This has increased from 372persons/km^2 in 1991. In other words, 105persons/km^2 has been added in Haryana during 1991-2001. It is immigration from other States to Haryana has contributed towards increase in population pressure on land resources in the State. There are wide inter-district variations in population density. Against the State average of 477persons/km^2, it ranged from a high of 1838 persons/km^2 in Faridabad district to a low of 260persons/km^2 in Sirsa district.

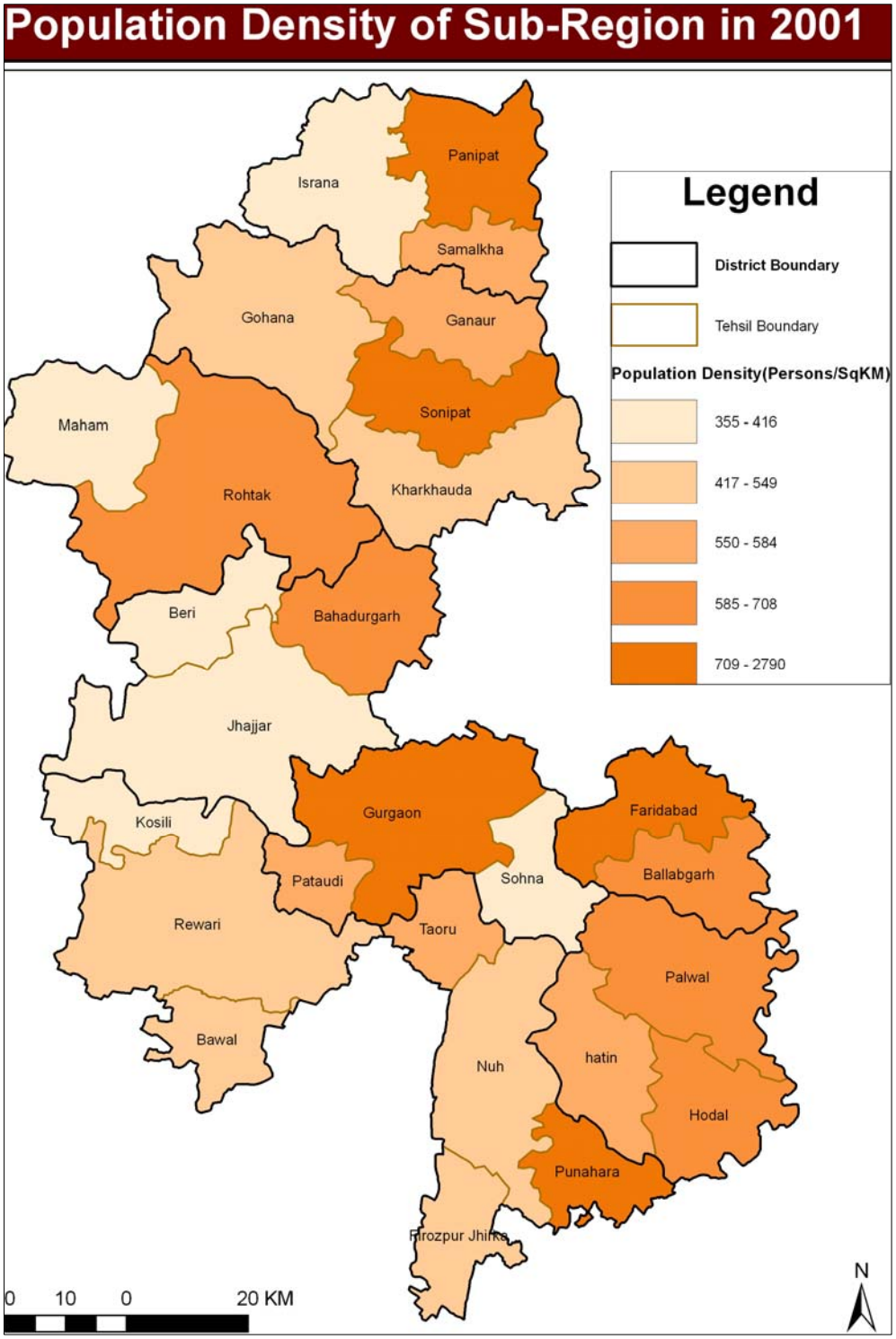
Now in the NCR part of Haryana Sub-Region average population density is very high i.e 647 persons/km^2 which is much more above than state average population density. Located in the close proximity to national capital New Delhi, Faridabad is a highly urbanized and industrialized district in the State. Presence of big industries in the district attracts job seekers to settle in towns. The density of population in Faridabad district is not only very high but also growing fast over the period. In the Sub-Region Faridabad is followed by Panipat and Gurgaon in population density. Jhajjar and Rewari are the least dense district in the Sub-Region.

Figure 4-1 District wise Population Density of Haryana Sub-Region



If we see the intra district variation in population density then we find only in Faridabad population distribution is relatively homogeneous in each tehsils otherwise in other districts population distribution is not homogeneous. Although the population density of Gurgaon district is very high but Sohna tehsil comes under the lowest range of population density among the tehsils in the Sub-Region, simmilarly Israna tehsil in the Panipat district.

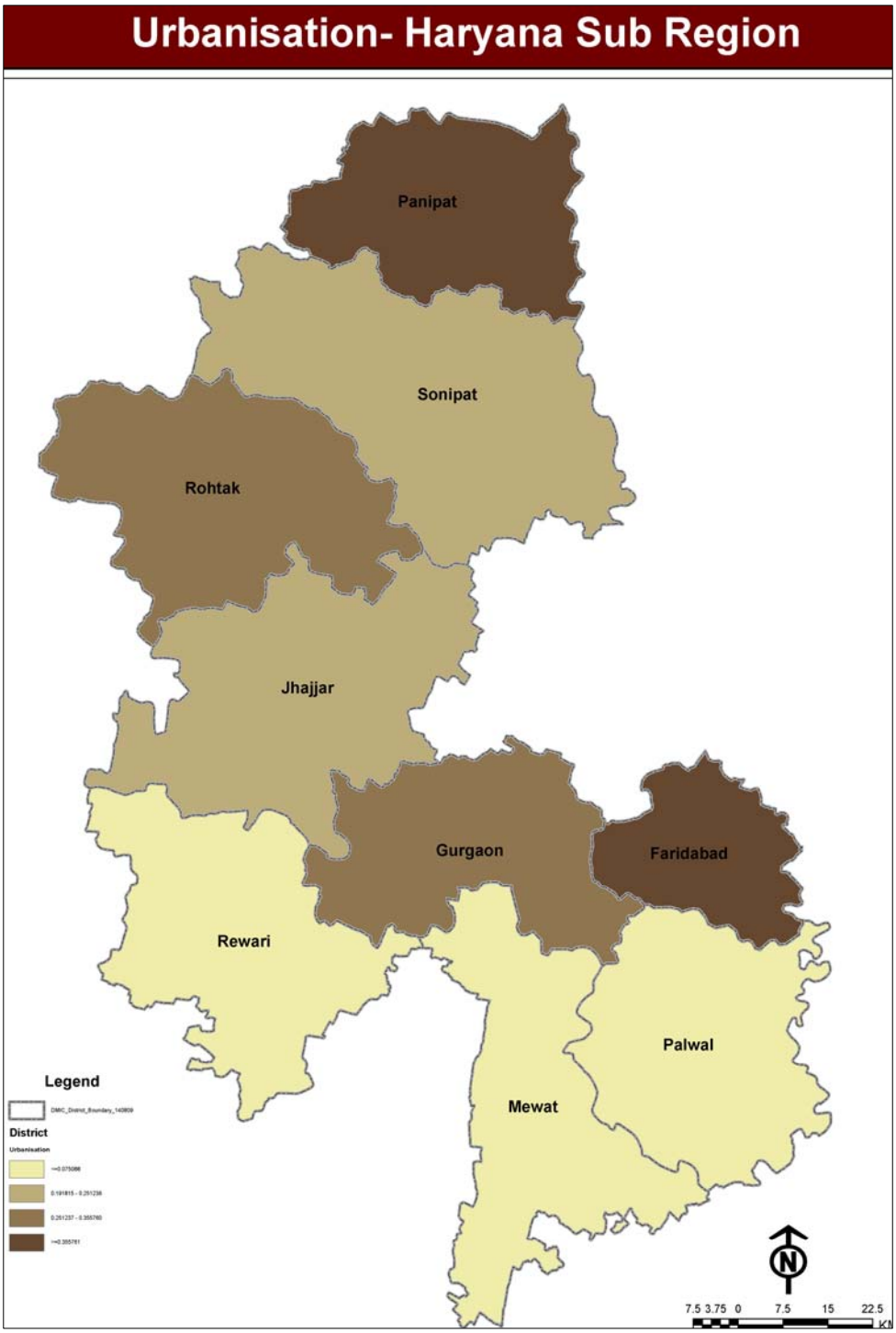
Figure 4-2 : Tehsil wise Population Density of Haryana Sub-Region



4.1.2 Urbanization level and Integration of Development Plans

Haryana is the most urbanized state among the sates surrounding the NCT Delhi having 28.9% average population living in urban area. In the state maximum urban population are concentrated more within the NCR Region of Haryana. The average percentage of people living in the urban areas in the Haryana sub-region is 34% which higher than the staes average. The more urbanized districts within the sub-region are Gurgaon, Faridabad and Panipat.

Figure 4-3 : District wise Level of Urbanisation in Haryana Sub-Region



The average percentage of people living in Urban areas in the region is 34% against the state's average of 28.9%, which probably means that the region comprises of more urbanized portion of state. The most urbanized districts within the region is Faridabad followed by Panipat & Gurgaon. The lowest Urbanization within the region is observed in Mewat followed by Rewari and Palwal.

The power conferred by the " *Punjab Scheduled Roads and Controlled areas Restriction of Unregulated Development Act, 1963*" and "*The Haryana Development and Regulation of Urban Areas Act, 1975"* results to formulation of various master plans for the urban areas for their proper and controlled development. In the Haryana Sub-Region master plans are not made only for the urban areas but also for those urban area complex whose surrounding areas are not classified by the census as town but their growth and urbanization potential is very high and form an urban complex with their mother town, like Gurgaon-Manesar Complex, Faridabad-Ballabgarh Complex, Rewari-Dharuhera-Bawel Complex and Sonipat-Kundli Complex.

Figure 4-4 : The population scenario of various urban areas/complex is shown in Master plans is in below table:

Districts	Town_name	Class	C_status	Area	pop_1991	pop_2001	pop_2011	pop_2021
Panipat	Panipat*	I	M Cl	24.29	191,212	362,047	506,866	709,612
	Samalkha	III	MC	4.48	22,931	29,856	44,800	67,200
	Asan Khurd	V	CT	4.92	-	8,066	included in panipat	included in panipat
Sonipat	Sonipat*	I	M Cl	47.75	143,922	225,074	357,990	1,000,000
	Gohana	III	MC	6.57	32,467	48,518	82,480	150,000
	Ganaur	III	MC	9.06	20,952	29,005	55,109	175,000
	Kharkhoda	IV	MC	1.63	13,151	18,763	46,907	125,000
Rohtak	Rohtak	I	M Cl	29.58	216,096	294,577	534,644	748,501
	Maham	IV	MC	3.35	15,083	18,174	29,065	51,000
	Kalanaur	IV	MC	5.7	14,524	16,853	22,752	32,990
Jhajjar	Bahadurgarh	I	M Cl	28.81	57,235	132,000	198,000	300,000
	Jhajjar	III	MC	6	27,693	39,002	74,034	133,261
	Beri	IV	MC	2.59	15,205	17,625	23,000	32,500
	Ladrawan	V	CT	8.73	-	8,008	10,209	13,016
	Sankhol	V	CT	0.84	-	5,179	included in bahadurgarh	included in bahadurgarh
Rewari	Rewari	I	M Cl	11.78	75,342	127,230	250,000	450,000
	Dharuhera	IV	CT	11.49	10,848	46,853	93,706	200,000
	Bawal	IV	MC	0.36	9,010	12,144	57,500	100,000
Gurgaon	Gurgaon*	I	M Cl	29.30	135,884	228,820	920,127	3,700,000

	Sohna	III	MC	9.7	16,348	27,570	76,230	167,706
	Pataudi	IV	MC	13.51	24,541	33,166	59,699	107,458
	Haileymandi	IV	MC	16.27	13,263	17,081	included in pataudi	included in pataudi
	Dundahera	IV	MC	5.75	6,767	10,626	Included in gurgaon	Included in gurgaon
	Farrukhnagar	V	MC	3.28	8,046	9,521	11,266	13,332
Mewat	Taoru	IV	MC	4.52	12,534	17,328	27,725	45,000
	Ferozepur Jhirka	IV	MC	8.86	12,413	17,755	28,408	46,000
	Punahana	IV	MC	3.5	8,679	13,179	20,012	30,388
	Nuh	IV	MC	0.3	7,492	11,038	17,661	28,258
Faridabad	Faridabad*	I	M. Corp.	198.75	617,717	1,055,938	1,750,000	2,900,275
Palwal	Palwal	I	M Cl	8.3	75,127	100,722	200,721	400,000
	Hodal	III	MC	2.25	25,635	38,309	57,249	85,553
	Hathin	IV	MC	1.99	7,863	10,916	20,407	38,000
	Hassanpur	V	MC	0.93	7,130	9,090	11,589	14,774
Total Urban population					**1,845,110**	**3,040,033**	**5,588,157**	**11,864,825**
Avg Urban GR						**65**	**84**	**112**

Source : Master plans of various Urban area for 2021

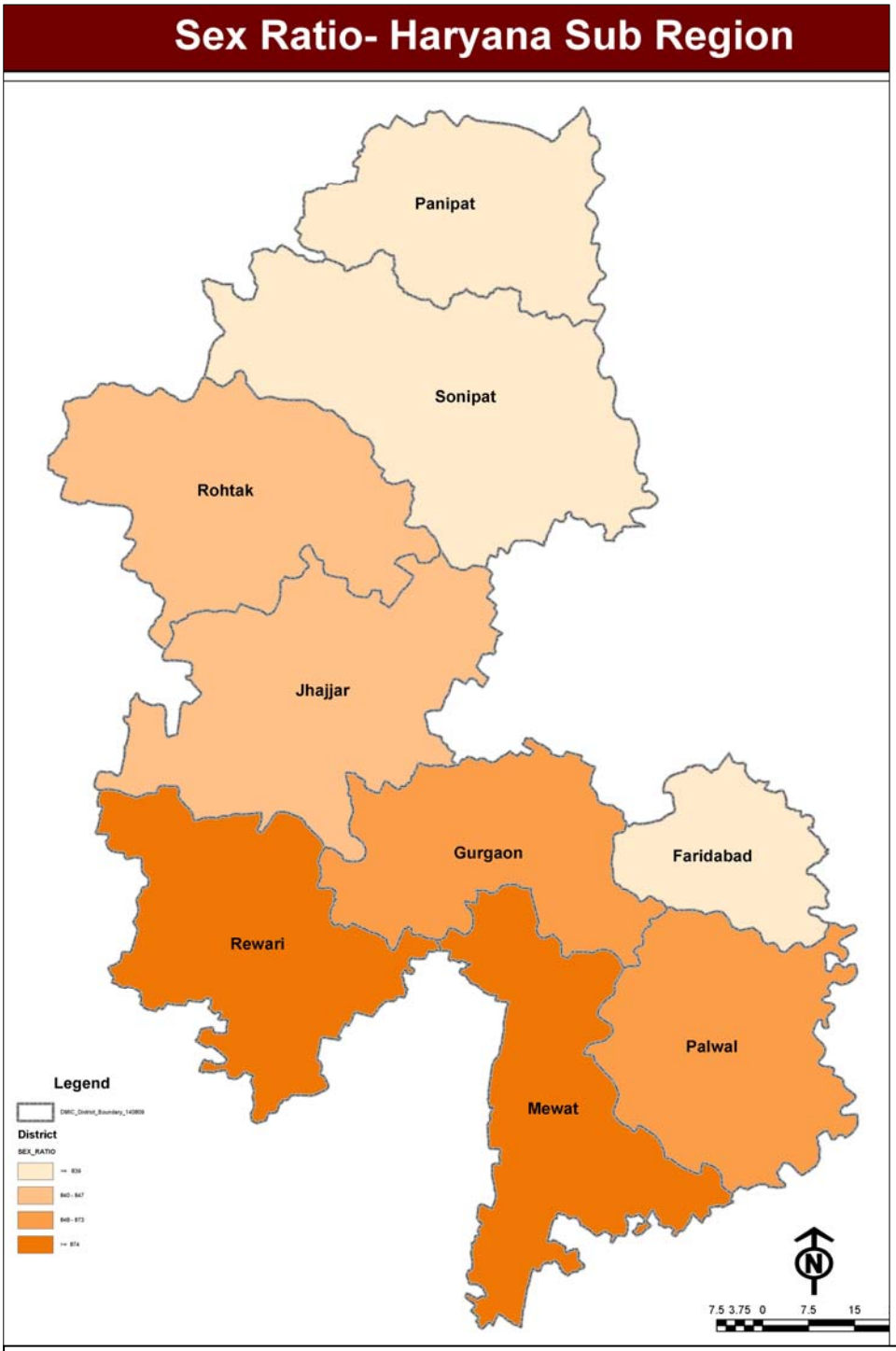
From the above table it is clearly seen that urban population growth rate is shown very high. It has increase from 65% in 2001 to 112% in 2021. In the case of Gurgaon - Manesar Urban complex, it is very high . It is increasing from 68% in 2001 to 302% in 2011 and 2021 at a CAGR OF 14.93% which is a very high in comparison to any other Urban area of the Sub-Region.

In the case of controlled area boundary demarcation, Gurgaon has covered approximately all the area of Gurgaon Tehsil and Faridabad has covered all most all the district area. In the case of Jhajjar, Nuh and Taoru the controlled area is much more than the present land use development.

4.1.3 Gender ratio and Literacy

The Gender ratio within the region varies from 826 to 899, which is quite poor as compared to national average of 933. In the Sub-Region it is observed that the region which has high high literacy rate and high urbanization is having low gender ratio which is very peculiar and just reverse to the general pattern, like Faridabad has highest urbanization and literacy rate but have

Figure 4-5 : District wise Gender ratio situation in Haryana Sub-Region



Source :- Census of India 2001 , Statistical abstract haryana 2006-07, Regional plan2021-NCR

lowest gender ratio, whereas Mewat and Rewari has least urbanization but have higheswt sex ratio.

The average literacy in the region varies from 62.9% to 75.2%, which is quite comparable to the national average of 65%. The female literacy is quite poor in Gurgaon, which needs to be addressed, in order to achieve gender equity.

4.1.4 Population Growth Rate

When we see the population growth trend of the districts of Haryana Sub-Region then we find that since 1981-91 Faridabad district including Palwal district has highest growth rate in the Sub-Region followed by Gurgaon (including Mewat) and Panipat . But in the case of change of growth rate Gurgaon (including Mewat) has shown highest growth rate change from 32.66% in 1981-91 to 44.87% in 1991-2001 in the region, where as Faridabad (including Palwal) and Sonipat has shown declining trend of growth rate.

Table 4-7 : Population growth rate of districts of Haryana Sub-Region

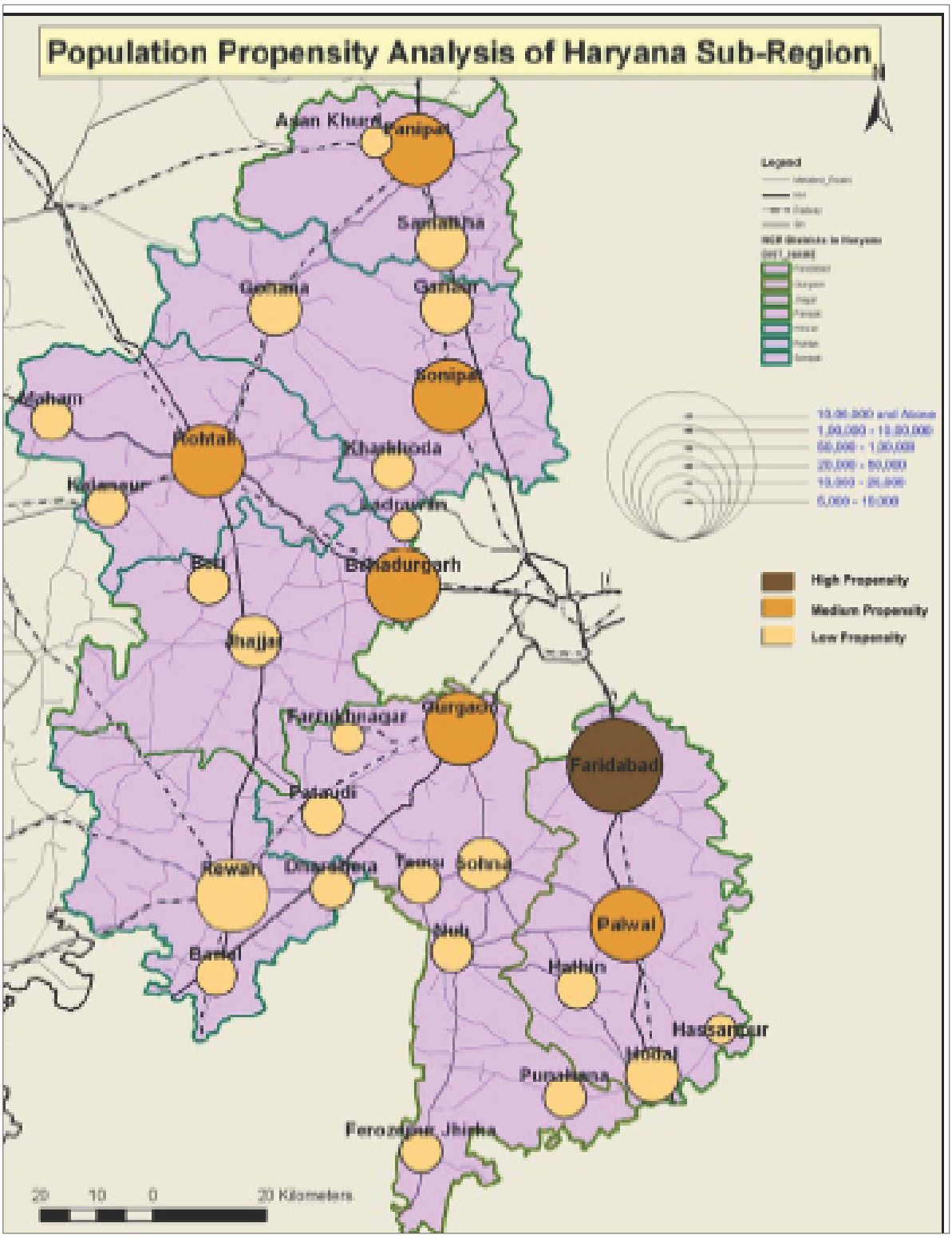
Districts	Population			Growth rate	
	1981	1991	2001	1981-91	1991-2001
Panipat	522963	698103	967449	33.49	38.58
Sonipat	821965	1045129	1279161	27.15	22.39
Rohtak	651380	776966	940128	19.28	21.00
Jhajjar	*	715136	880072	*	23.06
Rewari	486737	610611	793312	25.45	29.92
Gurgaon & Mewat	863930	1146090	1660289	32.66	44.87
Faridabad & Palwal	996795	1493199	2194586	49.8	46.97

Source :- Census of India 2001 , Statistical abstract haryana 2006-07

Note : Population has been taken as per the district boundary as on 1-1-2000

Propensity of growth has been assessed on the basis of correlation between rate of population growth and size of population in different urban centers of the sub-region. When we see the population growth scenario of urban area in the sub-region we the below situation :

Figure 4-6 Population Propensity of Towns of Haryana Sub-Region



Source :- Census of India 2001 , Statistical abstract haryana 2007-08, Regional plan2021-NCR

The size of the present population has a positive correlation with population growth except in the Rewari. Whether this trend will continue will depend on various endogenous and exogenous factors.

4.2 *Population Projections*

Keeping the natural growth and increasing population pressure in NCT Delhi because of migration from near by states in mind the NCRPB has done population projection for the year 2011 and 2021 in the NCR Plan 2021 for the NCR. Similarly Haryana government has also done population projection for Haryana for 2011 and in various master plans made by the local urban authorities has also done population projection for the year of 2011 and 2021 for their respective urban centers. So, if we see the population projections done by various government agencies for the Haryana Sub-Region then we find that the population projection done in various master plans are quite high i.e one and half time more than the projection done by NCRPB.

Table 4-8 : Population projections done by various government organizations

Haryana Sub-region projection	Pop_2001			Pop_2011			Pop_2021		
	Urban	Rural	**Total**	Urban	Rural	**Total**	Urban	Rural	**Total**
As per GOH (Statistical Handbook)	2,964,678	5,722,372	**8,687,050**	-	-	**10,609,000**	-	-	-
As per NCR Planning board	2,964,678	5,722,372	**8,687,050**	4,556,435	7,198,565	**11,755,000**	7,002,819	9,013,181	**16,016,000**
As per Master Plans for urban and Census for rural	3,040,033	5,659,180	**8,699,213**	5,588,157	6,995,734	**12,583,891**	11,864,825	8,742,962	**20,607,787**

Source :- Census of India 2001 , Statistical abstract haryana 2007-08, Regional plan2021-NCR, Master plans of towns of Haryana sub-region for 2021.

In the case of population growth rate we see that for the year of 2011 done in the master plans is quite comparable to growth rate projection done in NCR plan but for the year of 2021 growth rate projection done in master plans is very high.

Table 4-9 : Population growth rate projections done by various government organizations

Haryana Sub-region projection	GR_2001			GR_2011			GR_2021		
	Urban	Rural	**Total**	Urban	Rural	**Total**	Urban	Rural	**Total**
As per GOH (Statistical Handbook)	63.73	22.83	**34.28**	-	-	**22.12**	-	-	-
As per NCR Planning board	61.54	19.01	**30.76**	53.69	25.80	**35.32**	53.69	25.21	**36.25**
As per Master Plans for urban and Census for rural	64.76	22.38	**34.47**	83.82	23.62	**44.66**	112.32	24.98	**63.76**

Source :- Census of India 2001 , Statistical abstract haryana 2006-07, Regional plan2021-NCR, Master plans of towns of Haryana sub-region.

In the population projection shown in the above table (4.8) as per master plans, we have taken master plans projections for all the towns whose master plans are available and for the other towns we have applied constant growth rate and similarly for the rural population projection constant growth rate has been adopted. The details of urban population projections and detailed district wise population projection are shown in below tables (4.10 & 4.11).

Table 4-10 : Details of population projections done in master plans

Districts	Town_name	Class	C_status	Area	pop_1991	pop_2001	pop_2011	pop_2021
Panipat	Panipat	I	M Cl	24.29	191,212	362,047	506,866	709,612
	Samalkha	III	MC	4.48	22,931	29,856	44,800	67,200
	Asan Khurd	V	CT	4.92	-	8,066	included in panipat	included in panipat
Sonipat	Sonipat	I	M Cl	47.75	143,922	225,074	357,990	1,000,000
	Gohana	III	MC	6.57	32,467	48,518	82,480	150,000
	Ganaur	III	MC	9.06	20,952	29,005	55,109	175,000
	Kharkhoda	IV	MC	1.63	13,151	18,763	46,907	125,000
Rohtak	Rohtak	I	M Cl	29.58	216,096	294,577	534,644	748,501
	Maham	IV	MC	3.35	15,083	18,174	29,065	51,000
	Kalanaur	IV	MC	5.7	14,524	16,853	22,752	32,990
Jhajjar	Bahadurgarh	I	M Cl	28.81	57,235	132,000	198,000	300,000
	Jhajjar	III	MC	6	27,693	39,002	74,034	133,261
	Beri	IV	MC	2.59	15,205	17,625	23,000	32,500
	Ladrawan*	V	CT	8.73	-	8,008	10,209	13,016
	Sankhol	V	CT	0.84	-	5,179	included in bahadurgarh	included in bahadurgarh
Rewari	Rewari	I	M Cl	11.78	75,342	127,230	250,000	450,000
	Dharuhera	IV	CT	11.49	10,848	46,853	93,706	200,000
	Bawal	IV	MC	0.36	9,010	12,144	57,500	100,000
Gurgaon	Gurgaon	I	M Cl	29.30	135,884	228,820	920,127	3,700,000
	Sohna	III	MC	9.7	16,348	27,570	76,230	167,706
	Pataudi	IV	MC	13.51	24,541	33,166	59,699	107,458
	Haileymandi	IV	MC	16.27	13,263	17,081	included in pataudi	included in pataudi
	Dundahera	IV	MC	5.75	6,767	10,626	Included in gurgaon	Included in gurgaon
	Farrukhnagar*	V	MC	3.28	8,046	9,521	11,266	13,332
Mewat	Taoru	IV	MC	4.52	12,534	17,328	27,725	45,000
	Ferozepur Jhirka	IV	MC	8.86	12,413	17,755	28,408	46,000
	Punahana*	IV	MC	3.5	8,679	13,179	20,012	30,388
	Nuh	IV	MC	0.3	7,492	11,038	17,661	28,258

Faridabad	Faridabad	I	M. Corp.	198.75	617,717	1,055,938	1,750,000	2,900,275
Palwal	Palwal	I	M Cl	8.3	75,127	100,722	200,721	400,000
	Hodal*	III	MC	2.25	25,635	38,309	57,249	85,553
	Hathin	IV	MC	1.99	7,863	10,916	20,407	38,000
	Hassanpur*	V	MC	0.93	7,130	9,090	11,589	14,774
Total Urban population					**1,845,110**	**3,040,033**	**5,588,157**	**11,864,825**
Avg Urban GR						**65**	**84**	**112**

Source :-, Master plans of Urban centres, 2021

Note : Master plan not available for stared (*) towns, so population taken from census of India 2001 and projection done for those towns are at constant growth rate of present growth rate.

Population projection for the rural area is done on the basis of linear population projection method and we find that rural population of Gurgaon district is increasing at highest growth rate in the Sub-Region and least in the Jhajjar district. For the Faridabad and Palwal as well as for Gurgaon and Mewat the rural population growth rate has been taken as it was in before division into separate district. Growth of rural population in the Sub-Region is because of the migrating population serving the urban area and staying in rural area for cheaper accommodation. In the Sub-Region it is observed that urban and rural growth rates are synonyms to each other except in Rewari. Following table (4.11) describes the rural projection:

Table 4-11 : Population projection for the rural area of Haryana Sub-Region

District	Pop_1991	Pop_2001	Pop_2011	POP_2021	GR 91_01	GR 01_11	GR 11_21
Faridabad	759727	303158	391231	504891	28.94	29.05	29.05
Palwal	-	670084	864756	1115983	-	29.05	29.05
Rohtak	531263	610524	701614	860009	14.92	14.92	22.58
Panipat	488507	567470	702694	870141	16.16	23.83	23.83
Sonipat	834637	957814	1154641	1391915	14.76	20.55	20.55
Gurgaon	913386	560836	760717	1031836	41.37	35.64	35.64
Mewat	-	730449	990780	1343893	-	35.64	35.64
Jhajjar	615700	679721	750412	828455	10.40	10.40	10.40
Rewari	515411	579124	678889	795841	12.36	17.23	17.23
Total rural population for Sub-Region	**4658631**	**5659180**	**6995734**	**8742962**	**21.48**	**23.62**	**24.98**

Source :- Census of India 2001 , Statistical abstract haryana 2007-08

Therefore final district wise population projection of the Sub-Region after taking urban population projection from master plans and rural population projection from census of India we get the following situation:

Table 4-12 : District wise population projection of Haryana Sub-Region as per the master plans for urban areas and census for rural areas

District wise Population Projection of Haryana Sub-Region					
District	**Type**	**pop_1991**	**pop_2001**	**pop_2011**	**pop_2021**
Faridabad	Rural	743,768	303,158	391,231	504,891
	Urban	733,472	1,055,938	1,750,000	2,900,275
	Total	**1,477,240**	**1,359,096**	**2,141,231**	**3,405,166**
Palwal	Rural	Included in Faridabad	670,084	864,756	1,115,983
	Urban	Included in Faridabad	159,037	289,966	538,328
	Total	Included in Faridabad	**829,121**	**1,154,721**	**1,654,310**
Rohtak	Rural	531,263	610,524	701,614	860,009
	Urban	245,703	329,604	586,461	832,491
	Total	**776,966**	**940,128**	**1,288,075**	**1,692,500**
Panipat	Rural	483,960	567,470	702,694	870,141
	Urban	214,143	399,969	551,666	776,812
	Total	**698,103**	**967,439**	**1,254,360**	**1,646,953**
Sonipat	Rural	834,666	957,814	1,154,641	1,391,915
	Urban	210,492	321,360	542,486	1,450,000
	Total	**1,045,158**	**1,279,174**	**1,697,127**	**2,841,915**
Gurgaon	Rural	900,123	560,836	760,717	1,031,836
	Urban	245,967	326,784	1,067,322	3,988,496
	Total	**1,146,090**	**887,620**	**1,828,040**	**5,020,331**
Mewat	Rural	Included in Gurgaon	730,449	990,780	1,343,893
	Urban	Included in Gurgaon	59,300	93,806	149,646
	Total	Included in Gurgaon	**789,749**	**1,084,586**	**1,493,539**
Jhajjar	Rural	615,003	679,721	750,412	828,455
	Urban	100,133	201,814	305,243	478,777
	Total	**715,136**	**881,535**	**1,055,655**	**1,307,232**
Rewari	Rural	515,411	579,124	678,889	795,841
	Urban	95,200	186,227	401,206	750,000
	Total	**610,611**	**765,351**	**1,080,095**	**1,545,841**
Subregion population	Rural	4,624,194	5,659,180	6,995,734	8,742,962
	Urban	1,845,110	3,040,033	5,588,157	11,864,825
	Total	**6,469,304**	**8,699,213**	**12,583,891**	**20,607,787**
GR			**34.47**	**44.66**	**63.76**

Source :- Census of India 2001 , Statistical abstract haryana 2007-08, Master plans 2021

From the above table it is observed that rate of growth of population from 2011 to 2021 is very high i.e. 63.76% .

If we see the comparative situation of population projections done for various urban centers in NCR Plan and Master plans for the year of 2021 then we find that for the urban centers/complex of Faridabad, Rohtak, Gurgaon-Manesr and Rewari-Dharuhera-Bawal master plan has overestimated the population than NCR plan. Below table (4.12) gives the comparative picture of towns.

Table 4-13 : Differences in Population projection of towns for 2021 done in Master plans and NCR Plan

Districts	Town Names	Master plan Population 2021	NCR Plan Population 2021
Faridabad	Faridabad	2,900,275	2,500,000
Rohtak	Rohtak	748,501	600,000
Gurgaon	Gurgaon	3,700,000	1,650,000
Rewari	Rewari	450,000	400,000
	Dharuhera	200,000	
	Bawal	100,000	

Source :- Regional plan2021-NCR, Master plans 2021 of towns of Haryana sub-region.

Now Population projection done for the districts of Haryana Sub-Region for the year 2011 and 2021 on the basis of various scientific methods we find that the population projections are nearer to population projection done in NCR plan.

Table 4-14 : Population projection of the Sub-Region on the basis of various scientific method

	Existing Population			Linear Method				
Districts	1981	1991	2001	r1	r2	Average GR	2011	2021
Panipat	522963	698103	967449	175140	269346	222243	1189692	1411935
Sonipat	821965	1045158	1279175	223193	234017	228605	1507780	1736385
Rohtak	651380	776966	940128	125586	163162	144374	1084502	1228876
Jhajjar	-	715136	880072	-	164936	164936	1045008	1209944
Rewari	486737	610611	765351	123874	154740	139307	904658	1043965
Gurgaon + Mewat	863930	1146090	1660289	282160	514199	398180	2058469	2456648
Faridabad + Palwal	996795	1477240	2194586	480445	717346	598896	2793482	3392377
Total population	4345751	6469304	8687050				10583590	12480130

Source: - Census of India 2001, Statistical abstract haryana 2007-08.

Note : r1 = growth rate 1981-91 , r2 = growth rate 1991-2001

After doing population projections through various methods we find that population of Gurgaon district including population of Mewat district is coming less than the population projection done in master plan of Gurgaon –Manesar urban complex.

We also understand that the controlled area of masterplans of urban areas for 2021 has expended in area and included the rural areas of surroundings so assuming 10% rural population by 2011 and 25% rural population by 2021 has been converted into urban population and already taken care in Masterplans. Therefore most acceptable and ralistic population projection would be considering the respective masterplan's population projection for

	Geometric Method					Exponential Method				
Districts	r1	r2	Average GR	2011	2021	r1	r2	Average GR	2011	2021
Panipat	0.335	0.386	0.360	1316081	1790348	0.289	0.326	0.308	1315851	1789720
Sonipat	0.272	0.224	0.248	1596053	1991429	0.240	0.202	0.221	1595763	1990704
Rohtak	0.193	0.210	0.201	1129469	1356944	0.176	0.191	0.183	1129440	1356874
Jhajjar	-	0.231	0.231	1083048	1332838	-	0.208	0.208	1083048	1332838
Rewari	0.254	0.253	0.254	959718	1203447	0.227	0.226	0.226	959718	1203447
Gurgaon + Mewat	0.327	0.449	0.388	2303863	3196904	0.283	0.371	0.327	2301634	3190721
Faridabad + Plawal	0.482	0.486	0.484	3256314	4831700	0.393	0.396	0.395	3256312	4831693
Total population				**11644548**	**15703610**				**11641766**	**15695997**

the urban area and reducing rural population by 10% for the year of 2011 and 25% for the year of 2021 from the rural population projection done on the constant growth rate for the villages on the basis of census data. Hence final population projection for the Haryana Sub-Region would be :

Figure 4-7 : Final Population Projection for the Haryana Sub-Region

District	Type	Pop-1991	Pop-2001	Pop-2011	Pop-2021
Faridabad	Rural	743,768	303,158	352,108	378,668
	Urban	733,472	1,055,938	1,750,000	2,900,275
	Total	**1,477,240**	**1,359,096**	**2,102,108**	**3,278,943**
Palwal	Rural	In Faridabad	670,084	778,280	836,987
	Urban	In Faridabad	159,037	289,966	538,328
	Total	In Faridabad	**829,121**	**1,068,246**	**1,375,315**
Rohtak	Rural	531,263	610,524	631,453	645,007
	Urban	245,703	329,604	586,461	832,491
	Total	**776,966**	**940,128**	**1,217,914**	**1,477,498**
Panipat	Rural	483,960	567,470	632,425	652,606
	Urban	214,143	399,969	551,666	776,812
	Total	**698,103**	**967,439**	**1,184,091**	**1,429,418**
Sonipat	Rural	834,666	957,814	1,039,177	1,043,937
	Urban	210,492	321,360	542,486	1,450,000
	Total	**1,045,158**	**1,279,174**	**1,581,663**	**2,493,937**
Gurgaon	Rural	900,123	560,836	684,645	773,877
	Urban	245,967	326,784	1,067,322	3,988,496
	Total	**1,146,090**	**887,620**	**1,751,968**	**4,762,373**
Mewat	Rural	In Gurgaon	730,449	891,702	1,007,919
	Urban	In Gurgaon	59,300	93,806	149,646
	Total	In Gurgaon	**789,749**	**985,508**	**1,157,566**
Jhajjar	Rural	615,003	679,721	675,371	621,341
	Urban	100,133	201,814	305,243	478,777
	Total	**715,136**	**881,535**	**980,614**	**1,100,118**
Rewari	Rural	515,411	579,124	611,000	596,880
	Urban	95,200	186,227	401,206	750,000
	Total	**610,611**	**765,351**	**1,012,206**	**1,346,880**
Subregion population	Rural	4,624,194	5,659,180	6,296,161	6,557,222
	Urban	1,845,110	3,040,033	5,588,157	11,864,825
	Total	**6,469,304**	**8,699,213**	**11,884,317**	**18,422,046**

Source: - Census of India 2001, Statistical abstract haryana 2007-08, Master plan 2021.

4.3 *Settlement Hierarchy and Pattern*

4.3.1 Existing Scenario of Settlement pattern

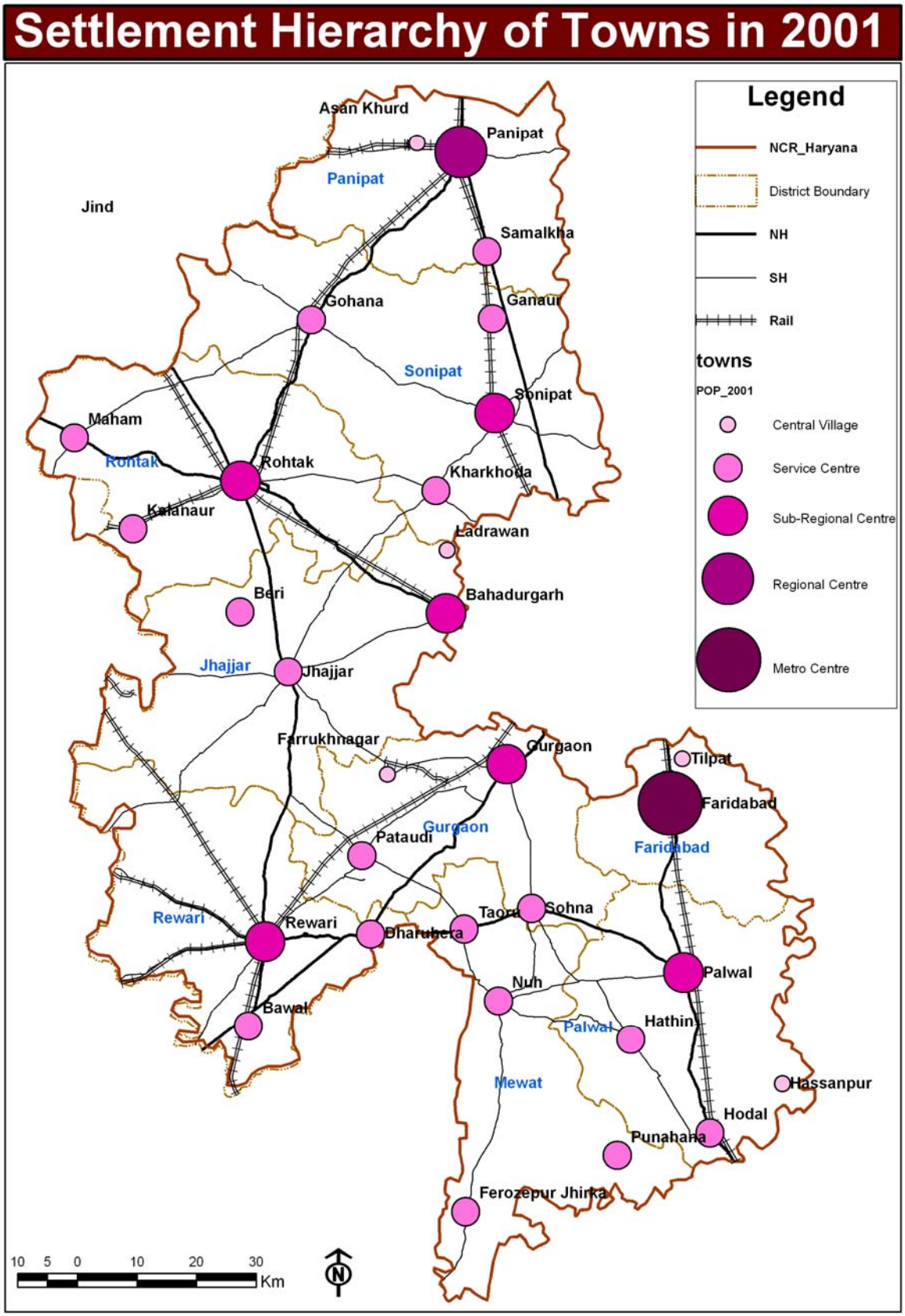
The urban spatial expansion of Delhi, which is the main core of the NCR, has spread into surrounding areas of Haryana and other states. Due to overspill of Delhi's population, the adjoining areas have also gained tremendous momentum. Then the policy was formulated for restricting the growth of Delhi and allowing only moderate growth in DMA (Delhi Metropolitan Area) towns and inducing development in regional centres around Delhi. But the review of Regional Plan 2001 as well as the results of census 2001 has shown that there had not been any perceptible change in the earlier trends. Then in Regional plan 2021, strategies for development of settlement system has been adopted to harness the growth impulse of Delhi and to integrate the urban and rural functions in the region.

In the Regional Plan 2021 six tier hierarchy of settlement is proposed. These are follows :

1. Metro Centre : Population more than equals to10 lakhs
2. Regional Centre : Population 3 lakhs to 10 lakhs
3. Sub-Regional Centre : Population 0.5 lakhs to 3 lakhs
4. Service Centre : Population 10000 to 50000
5. Central Village : Population 5000 to 10000
6. Basic Village : Population below 5000

Following the above settlement hierarchy as per census 2001 in the Haryana Sub-region, there are one Metro Centre (Faridabad town), one Regional centre (Panipat), six Sub-Regional centres (Palwal, Rewari, Bahadurgarh, Sonipat, Gurgaon and Rohtak), fifty eight Service Centres (38 villages and 20 Towns), two twenty seven Central villages (221 villages and 6 towns) and 2154 Basic Villages. District wise details of the six tier settlement hierarchy is described in below tables (4.9):

Figure 4-8 : Settlement pattern of Haryana Sub-Region in 2001



Considering the six tier hierarchy of settlement we see that only in Faridabad district Metro exists and in Panipat district there is one Regional centre. Except Panipat, Mewat and Palwal all six districts has one Sub-Regional centre. There are 38 villages and 20 towns which full fill the criteria of Service centres. Gurgaon has the maximum service centres in the Sub-Region. Similarly, Panipat has maximum central villages in the Sub-Region. So, in over all Rewari has least number of upper hierarchies of settlement.

Table 4-15 : District wise details of Settlements

Existing Number of Towns and Villages in 2001 under six tier hierarchy								
Districts	Metro	Regional centre	Sub-Regional centre	Service centre		Central villages		Basic villages
				Villages	Towns	Villages	Towns	
Panipat	0	1	0	4	1	32	1	144
Sonipat	0	0	1	4	3	39	0	280
Rohtak	0	0	1	7	2	42	0	97
Jhajjar	0	0	1	5	2	22	2	220
Rewari	0	0	1	0	2	8	0	391
Gurgaon	0	0	1	7	4	11	1	253
Mewat	0	0	0	4	4	18	0	401
Faridabad	1	0	1	1	0	11	1	132
Palwal	0	0	0	6	2	28	1	236
Sub-Region Total	**1**	**1**	**6**	**38**	**20**	**221**	**6**	**2154**

Source: - Census of India 2001

Table 4-16 : Six tier hierarchy of settlement of towns

Six tier Hierarchy of Settlement of Towns in 2001 of Haryana Sub-Region		
Hierarchy of Settlement	Criteria	Towns
Metro	> 10 Lakhs	Faridabad
Regional Centre	3 - 10 Lakhs	Panipat
Sub- Regional Centre	0.5 - 3 Lakhs	Palwal, Rewari, Bahadurgarh, Sonipat, Gurgaon, Rohtak
Service Centre	10,000 - 50,000	Dundahera, Hathin, Nuh, Bawal, Punahana,Pataudi,Beri, Kalanaur,Haileymandi,Taoru, Ferozepur Jhirka, Maham, Kharkhoda, Dharuhera, Sohna, Ganaur, Samalkha, Hodal, Jhajjar, Gohana
Central Village	5,000 - 10,000	Sankhol, Tilpat, Ladrawan, Asan Khurd, Hassanpur, Farrukhnagar
Basic Villages	< 5000	All 2154 villages

Source: - Census of India 2001

4.3.2 Future Scenario of Settlement pattern

After the projection of population for all the villages and towns mentioned in census 2001 for the year of 2021 we find that few of the urban centres as well as towns which were at lower hierarchy in 2001 has come at higher hierarchy in 2021. Details are described in below tables :

Table 4-17 : District wise details of proposed number of Towns and Villages in 2021 under six tier hierarchy

Proposed Number of Towns and Villages in the 2021 under six tier hierarchy								
Districts	Metro	Regional centre	Sub-Regional centre	Service centre		Central villages		Basic villages
				Villages	Towns	Villages	Towns	
Panipat	0	1	1	21	0	57	0	101
Sonipat	1	0	3	15	0	92	0	216
Rohtak	0	1	1	17	1	49	0	80
Jhajjar	0	1	1	8	2	39	0	200
Rewari	0	1	2	3	0	28	0	366
Gurgaon	1	0	2	16	1	38	0	217
Mewat	0	0	0	19	4	51	0	353
Faridabad	1	0	0	6	0	18	0	119
Palwal	0	1	1	26	2	40	0	204
Sub-Region Total	**3**	**5**	**11**	**131**	**10**	**412**	**0**	**1856**

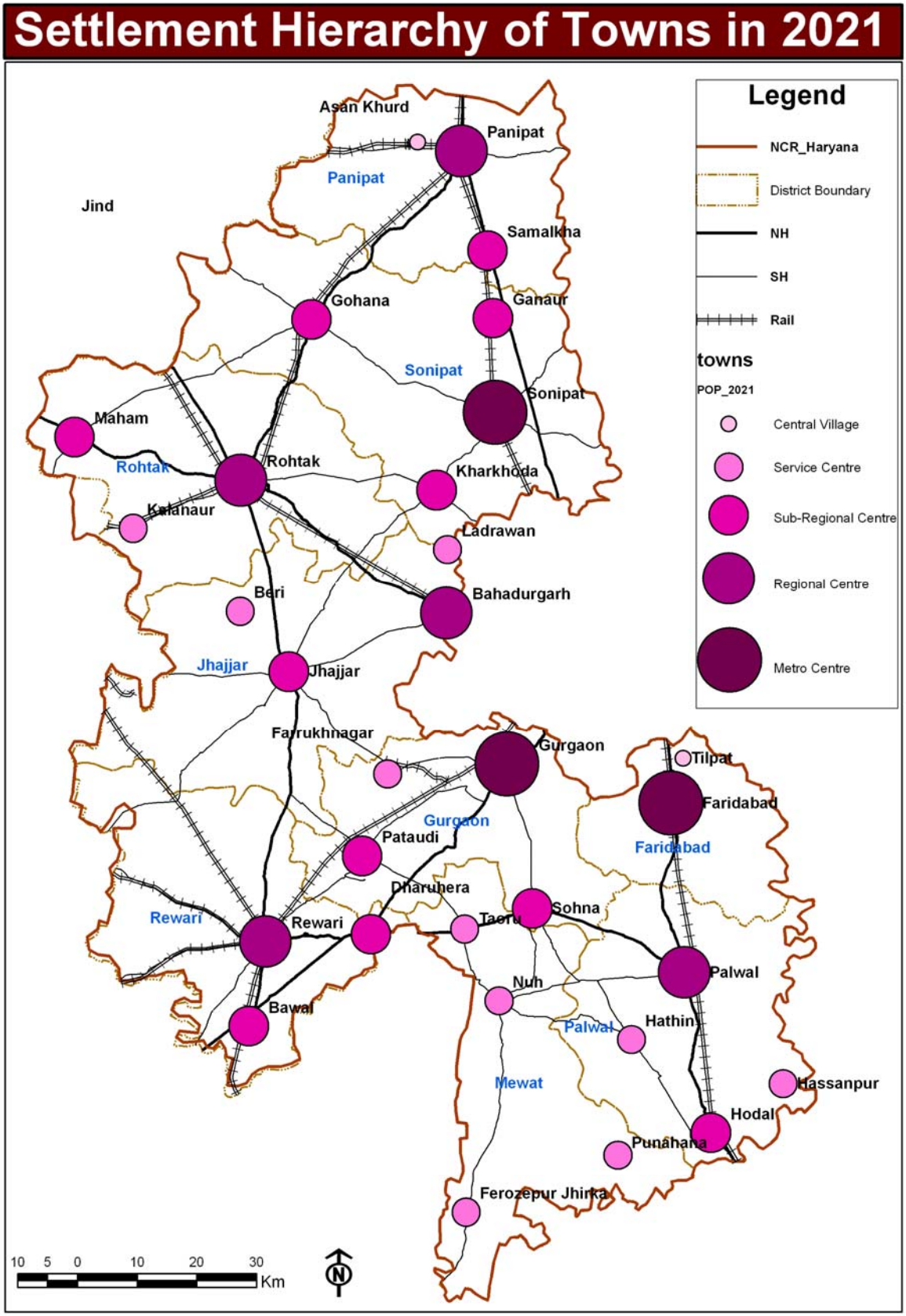
Source: - Census of India 2001, projection done for the year of 2021

Table 4-18 : Six tier Hierarchy of Settlement of Towns in 2021 in Haryana Sub-Region

Six tier Hierarchy of Settlement of Towns in the year of 2021 of Haryana Sub-Region		
Hierarchy of Settlement	Criteria	Towns
Metro	> 10 Lakhs	Gurgaon, Faridabad, Sonipat
Regional Centre	3 - 10 Lakhs	Rohtak, Panipat, , Palwal, Rewari, Bahadurgarh
Sub- Regional Centre	0.5 - 3 Lakhs	Hodal, Gohna, Ganaur, Sohna, Jhajjar, Dharuhera, Maham, Kharkhoda, Samalkha, Bawal, Pataudi
Service Centre	10,000 - 50,000	Hathin, Hassanpur, Nuh, Punahana, Beri, Kalanaur, Taoru, Ferozepur Jhirka, Farrukhnagar , Ladrawan
Central Village	5,000 - 10,000	412 Villages
Basic Villages	< 5000	All 1856 villages

From the above analysis it is observed that during the year of 2021 maximum upgradation in hierarchy of settlement of villages and towns will be in the districts of Sonipat, Panipat, Rohtak, Mewat and Palwa which indicate the future potentiality in terms of urbanization and other development. Below figure shows the settlement hierarchy in 2021.

Figure 4-9 : Settelement Pattern of urban centres of Hayana Sub-Region in 2021



Source:Population projection done for the year of 2021

Chapter 5 : ECONOMIC PROFILE

5.1 *Economic base*

The State economy continued to record an excellent growth during 2007-08 as well. According to Quick Estimates, the Gross State Domestic Product (GSDP) of Haryana at constant (1999-2000) prices has been estimated at Rs. 104188.51 crore in 2007-08 as against Rs. 95282.92 crore in 2006-07 recording a growth of 9.3 percent during 2007-08. The economy has been witnessing a growth of more than 9 percent during the last three years. At current prices, the Gross State Domestic Product has been estimated at Rs. 153087.03 crore in 2007-08 as against Rs. 130032.79 crore in 2006-07 recording a growth of 17.7 percent.

The State economy has recorded the excellent growth of 9.3 percent in real terms during 2007-08 in spite of the low performance in Agriculture sector. The excellent growth during the year is mainly attributed to the encouraging growth rates recorded in Trade, Communication, Construction, Transport, Real Estate, Ownership of Dwellings, Legal & Business Services, Manufacturing and Electricity, Gas & Water Supply sectors. During this period, Trade sector has recorded an increase of 16.1 percent, Communication sector 15.9 percent, Construction and Transport sectors each 11.2 percent, Real Estate, Ownership of Dwellings, Legal & Business Services sector 10.7 percent, Manufacturing sector 9.6 percent and Electricity, Gas & Water Supply sector 9.3 percent. In case of Agriculture Sector, the production of some crops mainly rice, wheat, bajra and cotton recorded increase of 7.2 percent, 1.8 percent, 13.7 percent and 4.4 percent respectively during the year 2007-08 over the previous year. But the production of oilseeds, sugarcane (Gur) and gram decreased by 23.2 percent, 8.2 percent and 40.0 percent respectively during the year. As a consequence of decreased production of oilseeds, sugarcane(Gur) and gram, the Agriculture Sector recorded the growth rate of 0.9 percent only during the year 2007-08.

The structural composition of State economy has witnessed significant changes since the formation of Haryana State. Agriculture Sector still continues to occupy a significant position in State economy, although, the share of this sector in the Gross State Domestic Product is continuously declining. The predominance of Agriculture Sector is also responsible for instability in the growth rate of economy due to fluctuations in agricultural production. Natural calamities

and fluctuation in rainfall often cause substantial loss in crop production which eventually results in fluctuation and instability in growth rate of State economy. Moreover, rapidly increasing share of Services Sector is also responsible for decline in the share of Agriculture Sector. The composition of Gross State Domestic Product at constant (1999-2000) prices reveals that the share of Primary Sector which includes Agriculture and Allied Sectors has declined from 32.0 percent during 1999-2000 to 20.5 percent during 2007 -08.

The State has proposed an outlay of Rs. 10000.00 crore for the Annual Plan 2009-10 to the Planning Commission, Government of India. This outlay is 50.38 % higher than the Approved Outlay of Rs. 6650.00 crore for the Annual Plan 2008-09. While distributing this outlay among various sectors, Development of infrastructure of Irrigation, Power, Road & Road Transport has been given highest priority. The State's usual plan strategy of growth with social justice will be continued during 2009-10. Accordingly, the second highest priority has been accorded to the Social Services sector.

5.2 *Work Force Participation:*

Total worker force to total population of the region is 39.3% which is almost same as that of state average (39.62%) and national average (39.1%). The high value districts are that of Jhajjar, Rewari and Sonpat.

The primary sector workers in the region are 52.5% as against 58.27% of state average. This is even lower than the national average of 60.4%. This shows that employment structure within this region is more towards non primary activities as compared to national average. The districts of Panipat & Faridabad have lower primary sector workers proportion than the regional average.

The secondary sector employment in the region is around 22% as against 18.04% of state average, which is even quite higher than the national average of 16.8%. This shows employment structure is more oriented towards manufacturing in the region as compared to state or national average. The districts of Panipat & Faridabad have high percentage of secondary sector workers than the regional average.

The tertiary sector employment in the region is around 25.5% as against 23.69% of state average and 22.8% of national average. Faridabad, Gurgaon & Rohtak have a higher amount of tertiary sector workers than the regional average.

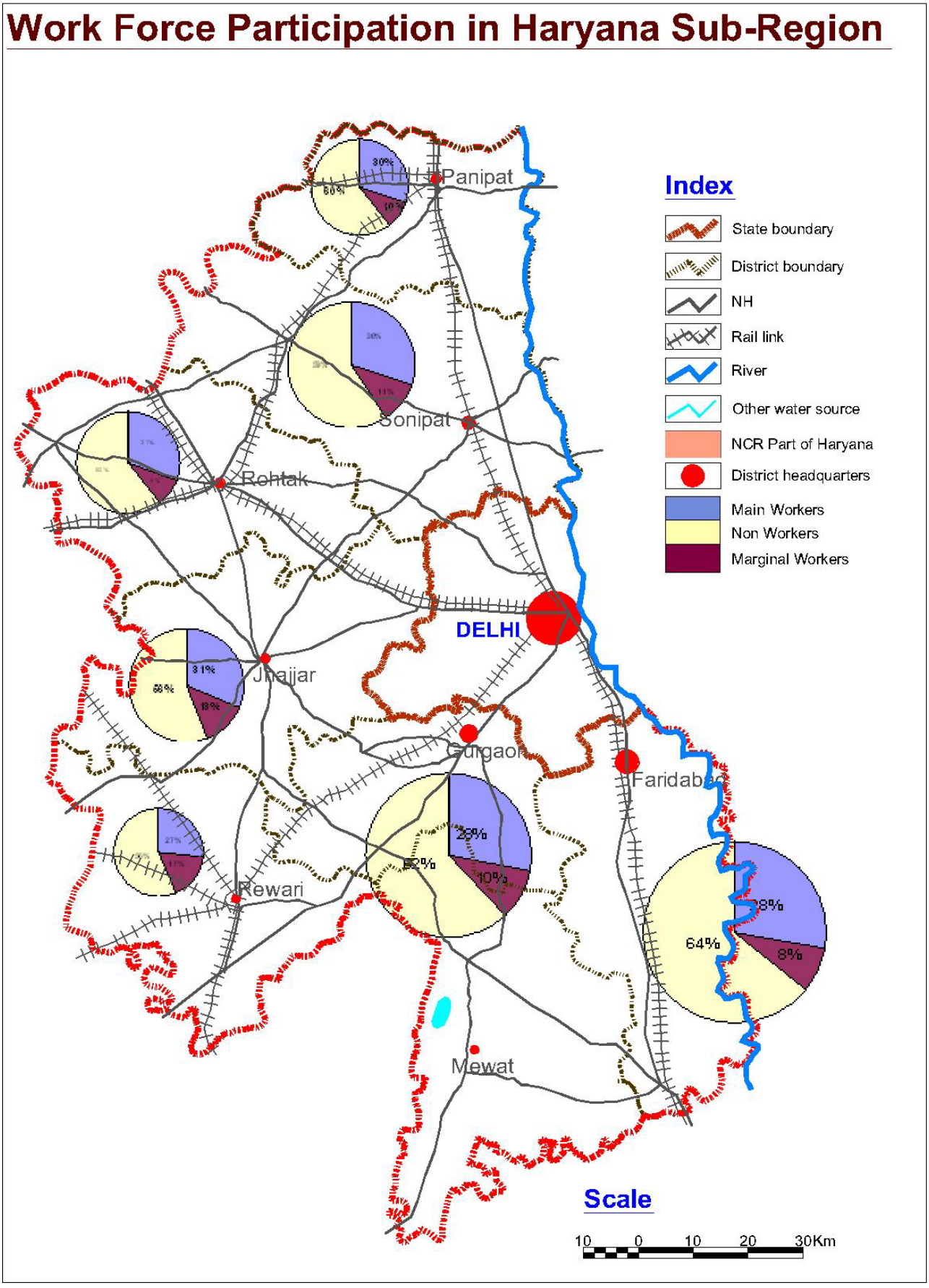
Table 5-1 : District wise work force participation details in 2001

NAME	MAIN WORKER	MARG WORKER	NON_ WORKER	%_ P_ workers	%_S_ workers	%_T_ workers	WFPR	Dependency ratio
Panipat	289013	93788	584648	43.14	33.70	23.16	39.6	76.8
Sonipat	383449	139582	756144	59.13	17.90	22.98	40.9	77.2
Rohtak	288225	82848	569055	55.41	17.13	27.46	39.5	73.6
Jhajjar	276208	112507	491357	62.21	18.70	19.10	44.2	74.8
Rewari	204855	128767	431729	65.51	15.23	19.26	43.6	75.6
Gurgaon+Mewat	464644	165014	1030631	52.97	20.03	27.00	37.9	93.5
Faridabad+Palwal	609663	176099	1408824	40.42	27.76	31.82	35.8	79.6

Source : Census of India 2001

Since this data is only available from the census of India so for the Mewat and Palwal district separate data is not available. Hence Gurgaon and Mewat as well as Faridabad and Palwal has been combinedely presented in this case.

Figure 5-1 : Work force participation in the Sub-Region



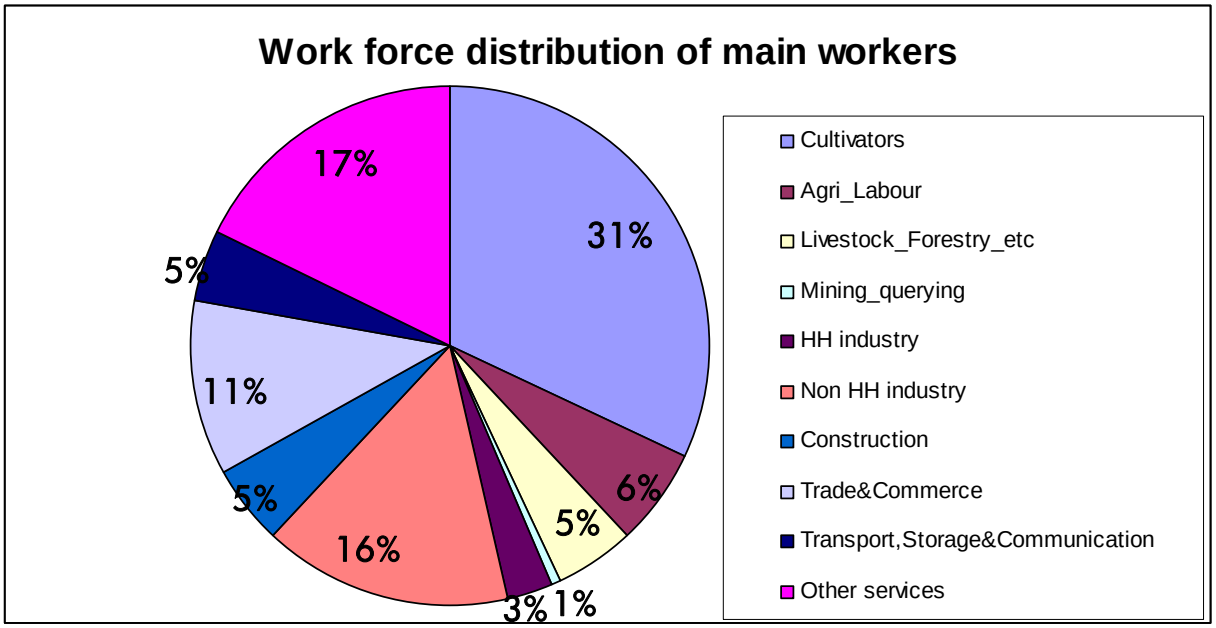
Considering the sectoral classification of main workers in the Sub-Region we find that apart from cultivators the sub-region is dominated by other service workers, non house hold industrial workers and workers in trade & commerce. Below table describes the district wise detail of main workers in the sub-region.

Table 5-2 : District wise sectoral details of main workers in the Sub-Region for the year 2006-07

Districts	Cultivators	Agri_ Labour	Livestock_ Forestry_ etc	Mining_ querying	HH industry	Non HH industry	Construction	Trade& Commerce	Transport, Storage,etc	Other services
Panipat	69,440	23,197	9,662	569	11,468	74,737	12,015	35389	10,664	40851
Sonipat	138,613	36,993	20,456	687	9,204	42,658	14,180	34452	16,418	65752
Rohtak	111,172	21,394	9,098	287	7,597	24,567	11,876	30583	12,756	53064
Jhajjar	123,944	16,142	9,806	202	4,001	39,351	9,463	18065	11,227	40036
Rewari	83,040	9,148	11,504	758	5,263	22,205	9,064	18975	7,443	32996
Gurgaon	140,722	16,370	37,961	8,952	11,867	59,456	30,391	49018	25,498	86975
Faridabad	129,886	30,416	25,824	3,891	16,787	126,465	35,517	83608	30,548	122289
Sub-Region Total	**796,817**	**153,660**	**124,311**	**15,346**	**66,187**	**389,439**	**122,506**	**270,090**	**114,554**	**441,963**

Source : Statistical Abstrct of Haryana 2006-07

Figure 5-2 : Work force details of main workers in the Sub-Region



5.3 *Industrial Scenario*

In terms of industrial activity, Haryana has been providing constant impetus to manufacturing activity across the past few years, with the objective of developing the state as major manufacturing/export hub of Northern India. With regard to the above, the state government has been promoting industry specific infrastructure developments such as Export Promotion Parks, Food Parks, Apparel Parks, Auto Clusters, Engineering Clusters, etc. to provide manufacturers a level platform to successfully compete with both domestic and international counterparts. These initiatives have led to enhanced investments across sectors such as automobile and auto components, food processing, wearing apparel, basic metals, light engineering, textiles, machinery, construction material and scientific instruments.

In addition to the above, the state government has also introduced specific policies such as the "Total Industrial Support" policy to augment investment across specific sectors. The objective of this policy is to provide a gamut of services such as industry specific Infrastructural Development, Project Promotion and Financial Services, thereby facilitating ease of establishment of industrial units. Further, Haryana's key strength of abundance of agricultural products coupled with proactive development of industry specific infrastructure is also expected to raise the potential of Agro-processing sector in the state.

With the inception of the SEZ Act in 2005, Haryana has also witnessed a surge in the development plans Special Economic Zones (SEZs) being proposed in the state. There are about 87 SEZs in the pipeline, with 25 already notified, 45 having received formal approval and 17 having just received in principle approval1. Successful implementation of these projects in the medium to long term is expected to also make available significant amount of industrial activity across various sectors.

Implementation of DMIC (Delhi Mumbai Industrial Corridor) and DFC (Dedicated Freight Corridor) in Haryana is a major infrastructure development with both the projects expected to act as catalysts to enhance industrial/manufacturing activity. Inherent strengths such as large agricultural resources (which provide upstream raw materials for the food and agro-processing sector), synergies of strategic location with respect to major markets, superior transport linkages, state of the art industrial infrastructure, established industrial investments and proactive government initiatives are expected to develop the state as a major industrial hub in the DMIC region.

5.3.1 District wise Existing Industrial analysis

Economy of Haryana Sub-Region, though traditionally dominated by the primary sector, has witnessed a gradual transition towards secondary & tertiary sectors over the years. Today, the sub-region boasts of being one of the largest trade and consumption centers in the country. Availability of skilled manpower, proximity to strong consumption markets in North India etc. has provided additional impetus to all sectors of the state economy. Further, as exhibited, certain sectors such as motorcycles, bicycles (other transport equipment), motor vehicles, base metals, machinery, textiles & apparel etc., which have traditionally been focus industries have exhibited sustained growth and account for approximately 73% of the total industrial output in the Sub-Region.

Over the years, Haryana Sub-Region has also emerged as an established IT/ITeS hub. Gurgaon today, is one of the prominent IT/ITeS centers in India. Further, availability of a large talent pool, established industry clusters, well developed physical infrastructure, development of dedicated

[1] Ministry of Commerce & Industry, Government of India

industrial clusters and investor focused approach in administration processes etc. continue to attract investments across the secondary & tertiary sectors.

In line with the above analysis, the primary industries of the Sub-Region have been highlighted in the box below.

- FOOD PRODUCTS & BEVERAGES
- MACHINERY & EQUIPMENT
- FABRICATED METAL PRODUCTS
- TEXTILES
- RUBBER & PLASTICS
- APPAREL
- AUTOMOBILES & AUTO COMPONENTS
- BASIC METALS
- COKE, REFINED PETROLEUM PRODUCTS
- CHEMICALS AND CHEMICAL PRODUCTS

Thus in line with prioritization of industries at a India, State, DMIC and Sub-Region level the following industries have been identified (not listed in order of priority) as common growth/thrust industries:

- Automobiles and Auto Components
- Textiles and Apparel
- Light & Heavy Engineering: Basic Metals, Fabricated Metal Products, Machinery & Equipment, Electrical Machinery & Apparatus
- Chemicals: Petrochemicals, Plastic, Pharmaceuticals, Pharmaceutical R&D, Clinical Research, Contract Manufacturing, Biotechnology
- Food Products and Beverages
- IT/ITeS (including Knowledge Services)

District wise details of number of major industries in the Sub-Region in the year 2007 is described below (table 5.3):

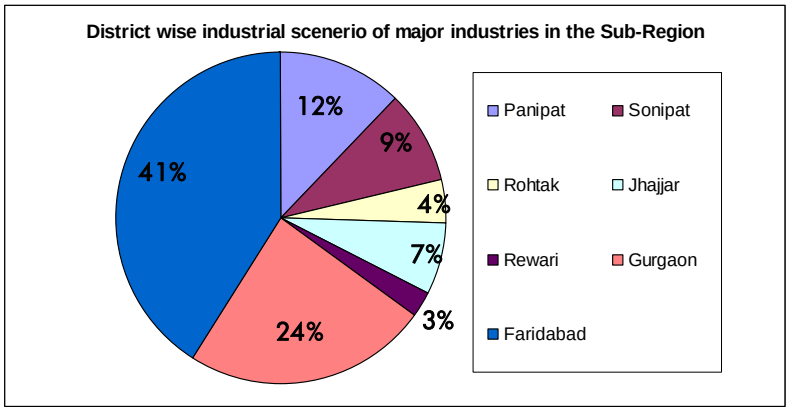
Table 5-3 : District wise Industrial scenario : Number of major industries in the Sub-Region in 2007

Major Industries	Industry NIC Code	Panipat	Sonipat	Rohtak	Jhajjar	Rewari	Gurgaon	Faridabad	Haryan aSub-Region
Manufacture of Food Products and Beverages	15	53	33	31	20	15	51	79	**282**
Manufacture of Tobacco Products	16	6	3	1	-	1	4	2	**17**
Manufacture of Textiles	17	413	63	11	22	12	83	190	**794**
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	18	5	13	2	19	3	444	110	**596**
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear	19	2	13	8	6	2	9	41	**81**
Manufacture of Wood and of Products of Wood and Cork, except Furniture; Manufacture of Articles of Straw and Plaiting Material	20	63	100	59	29	22	46	212	**531**
Manufacture of Paper and Paper Products	21	11	15	10	19	3	12	50	**120**
Publishing, Printing and Reproduction of Recorded Media	22	2	8	8	20	3	11	28	**80**
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	23	6	12	3	5	6	10	23	**65**
Manufacture of Chemical and Chemical Products	24	17	61	11	32	18	72	140	**351**
Manufacture of Rubber and Plastic Products	25	7	56	17	37	4	68	203	**392**
Manufacture of Other Non-Metallic Mineral Products	26	15	40	14	67	6	118	278	**538**
Manufacture of Basic Metals	27	43	44	27	43	12	51	289	**509**
Manufacture of Fabricated Metal Products except Machinery and	28	42	47	26	58	14	85	273	**545**

Equipments									
Manufacture of Machinery and Equipment, N.E.C.	29	47	18	17	22	13	56	287	**460**
Manufacture of Office, Accounting and Computing Machinery	30	2	-	-	9	1	7	10	**29**
Manufacture of Electrical Machinery and Apparatus N.E.C.	31	9	18	11	4	8	93	153	**296**
Manufacture of Radio, Television and Communication Equipment and Apparatus	32	2	2	-	-	-	50	21	**75**
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	33	2	4	3	2	2	39	21	**73**
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	34	1	7	5	2	4	110	85	**214**
Manufacture of Other Transport Equipment	35	3	12	6	1	8	65	46	**141**
Manufacture of Furniture; Manufacturing N.E.C.	36	3	5	2	2	2	10	22	**46**
Total		**754**	**574**	**272**	**419**	**159**	**1,494**	**2,563**	**6,235**

Source : Department of Industrial Policy & Promotion Annual Report 2007-08, Annual Servey of Industries 2008-09, Economic Survey of Haryana 2007-08 & FICCI

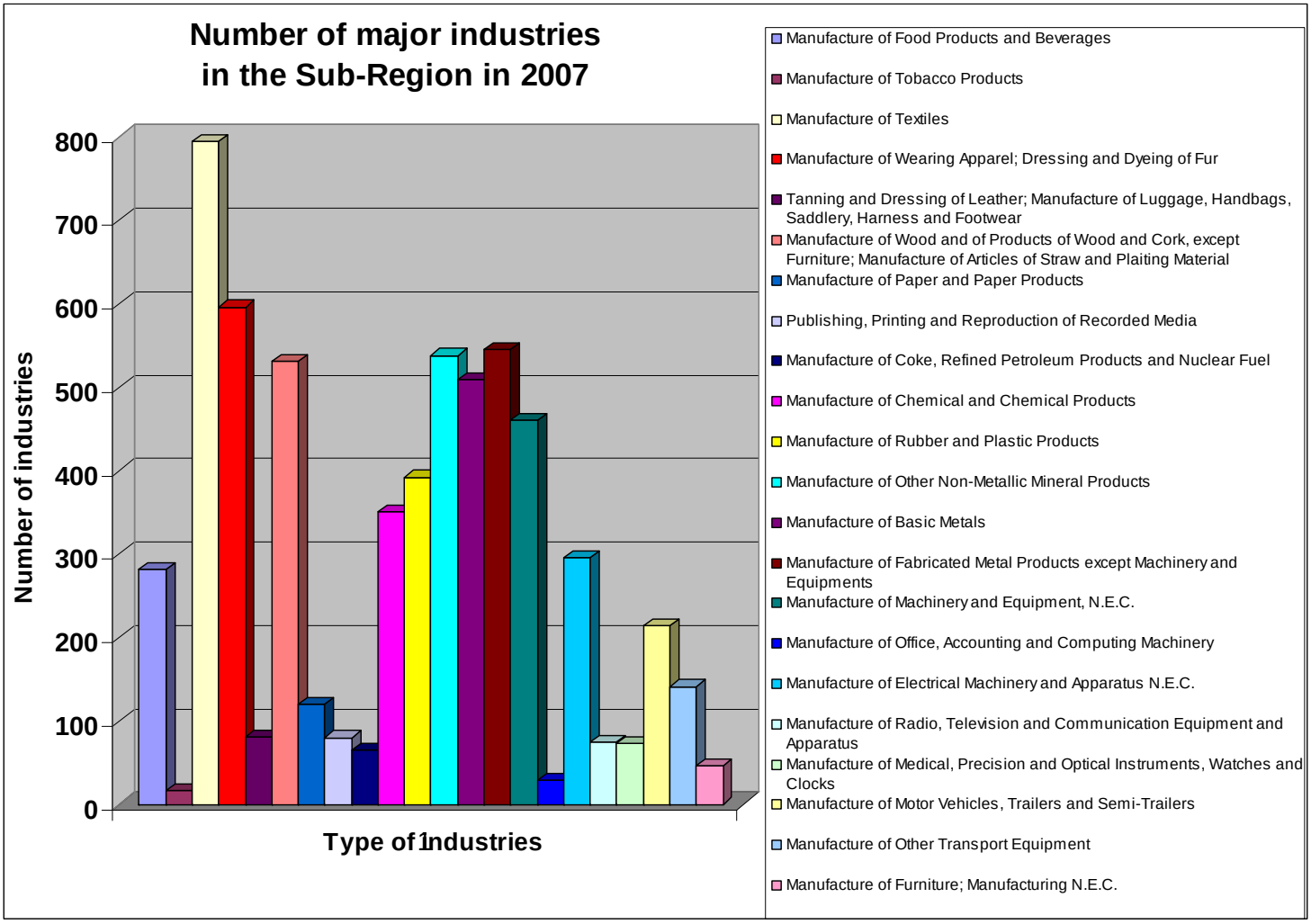
Figure 5-3 : District wise percentage share of major industries in 2007



From the above figure(5.3) it is quite clear that of the total major industries in the Haryana Sub-Region only Faridabad (41%) and Gurgaon (24%) occupies 65% of the major industries of the Sub-Region . It

indicates that Faridabad and Gurgaon are the most industrialized districts in Haryana Sub-Region, next progressing districts are Panipat (12%) and Sonipat (9%) and Rewari (3%) is the least industrialized district.

Figure 5-4 : Number of major industries in the Sub-Region in 2007



Similarly, if we see the scenario of various industries in the Sub-Region we find that Manufacture of Textile industry is the leading industry followed by Manufacture of wearing apparel, dressing and dyeing of fur ; Manufacture of fabricated metal products except machinery and equipments ; etc. and Manufacture of Tobacco products and Manufacturing of office, accounting and computing machinery are the least growing industries in the Sub-Region. Sector wise details are shown in above figure (5.4) and table (5.3).

Now considering the value of out put in various major industries across Sub-Region we find that although Faridabad has highest percentage share in number of industries in the Sub-Region yet in percentage sharing in out put values it is far behind the Gurgaon. Gurgaon has the highest share in out put value of industries i.e. 47% of the Haryana Sub-Region. Gurgaon and Faridabad collectively share 80% out put value of Haryana sub-region, which indicates the maximum potentiality of industrialization in the sub-region. The detailed analysis could be understood through following tables and figures.

Table 5-4 : District wise details of various major industries out put values (in INR Million) in 2007

Major Industries	Panipat	Sonipat	Rohtak	Jhajjar	Rewari	Gurgaon	Faridabad	Sub-Region Total
Manufacture of Food Products and Beverages	8,344	2,070	3,541	3,736	1,155	3,883	14,758	**37,488**
Manufacture of Tobacco Products	85	222	28	-	28	98	71	**533**
Manufacture of Textiles	15,574	12,353	830	1,915	905	5,399	17,912	**54,887**
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	1,356	1,557	171	1,647	422	92,616	8,683	**106,452**
Tanning and Dressing of Leather; Manufacture of	92	834	391	313	43	1,184	6,777	**9,633**

Luggage, Handbags, Saddlery, Harness and Footwear								
Manufacture of Wood and of Products of Wood and Cork, except Furniture; Manufacture of Articles of Straw and Plaiting Material	322	1,206	413	325	384	946	6,529	**10,126**
Manufacture of Paper and Paper Products	428	770	378	1,363	314	1,176	2,406	**6,836**
Publishing, Printing and Reproduction of Recorded Media	159	692	424	593	335	951	2,617	**5,771**
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	245	490	86	144	173	464	670	**2,272**

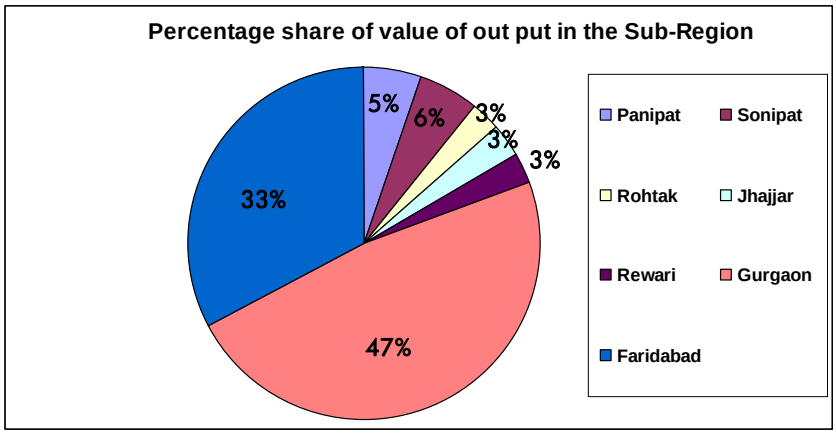
Manufacture of Chemical and Chemical Products	2,115	7,885	1,881	2,738	3,067	15,101	23,309	**56,097**
Manufacture of Rubber and Plastic Products	745	3,866	1,737	3,113	673	8,073	18,569	**36,775**
Manufacture of Other Non-Metallic Mineral Products	334	800	410	1,117	142	2,897	4,360	**10,060**
Manufacture of Basic Metals	13,884	10,121	9,644	5,753	3,670	23,315	115,393	**181,781**
Manufacture of Fabricated Metal Products except Machinery and Equipments	2,718	2,927	1,213	3,133	756	4,591	15,453	**30,791**
Manufacture of Machinery and Equipment, N.E.C.	8,730	2,032	2,443	1,747	4,733	7,090	41,923	**68,699**
Manufacture of Office, Accounting and Computing	395	-	-	2,221	165	1,390	1,974	**6,145**

Machinery								
Manufacture of Electrical Machinery and Apparatus N.E.C.	1,324	2,616	1,614	797	1,276	12,962	12,556	**33,145**
Manufacture of Radio, Television and Communication Equipment and Apparatus	240	213	-	-	-	20,441	1,964	**22,858**
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	290	580	435	290	290	5,684	3,047	**10,617**
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	961	5,045	2,883	1,345	3,139	110,733	26,042	**150,149**
Manufacture of Other Transport Equipment	3,872	7,495	3,623	2,082	11,659	239,054	54,504	**322,289**

Manufacture of Furniture; Manufacturing N.E.C.	389	649	260	260	260	1,298	2,855	**5,969**
Total Industrial out-put value	**62,603**	**64,424**	**32,404**	**34,633**	**33,590**	**559,348**	**382,372**	**1,169,373**

Source : Department of Industrial Policy & Promotion Annual Report 2007-08, Annual Servey of Industries 2008-09, Economic Survey of Haryana 2007-08 & FICCI

Figure 5-5 : Percentage share of values of out put in the sub-region in 2007



Gurgaon has 47% share in out put values of industries in Haryana sub-region but has only 24% share in number of industries in the Sub-Region where as Faridabad has only 33% share in out put value and has 41% share in number of industries in the Sub-Region. It indicates Gurgaon is more industrially potential district than any other districts in the Sub-Region followed by Faridabad, Sonipat, Panipat, Rewari, Rohtak and Jhajjar.

5.3.2 District wise Industrial projection

In the past decade there has been a major transformation in the structure and composition of the economy in Haryana. Though, all the three sectors have contributed in the overall growth of the economy, progress has been predominantly across the secondary and tertiary sectors. The primary sector has witnessed a decline in its share to 23.3% in 2005-06 from 31.9% in 1999-00.2 This trend is contrary to the phenomenal growth of secondary sector. Its contribution to the

[2] Source: Economic Survey of Haryana 2006-07 & FICCI

GSDP has increased from 30% in 1999-00 to an estimated 32.4% in 2005-06 attaining a CAGR of 8.1%.3

This growth can be attributed to the fast expanding manufacturing sector that has experienced a spurt of activities across sectors like Automobile, Auto Components, Food & Agro Processing, Light Engineering and Textiles. The state currently produces two-thirds of passenger cars, 50% of tractors, 60% of motor cycles, 50% of refrigerators and 25% of sanitary-ware manufactured in the country.

The tertiary sector's contribution was the most in the year 2005-06 with 44.3% in the GSDP as compared to 38.10% in 1999-20004. Growth has been primarily driven by the IT/ITeS sector with Gurgaon emerging as an industry hub of North India.

The above interrelated tasks undertaken have been considered as key inputs for undertaking a comprehensive 'Industrial Demand Assessment' exercise for the entire Haryana Sub-region, with the objective of mapping the region's future industrial potential in terms of key industrial parameters and outlined objectives.

The primary objective of this section is to present the preliminary findings of the comprehensive 'Industrial Demand Assessment' with regard to the Haryana Sub-region. In view of the same, the subsequent sections of this report would highlight the following:

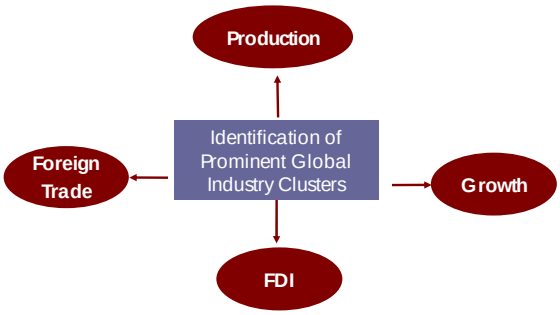
- Overview of the Approach and Methodology used to undertake the 'Industrial Demand Assessment' exercise, including the key tasks undertaken
- Preliminary findings with respect to the 'Industrial Demand Assessment' exercise undertaken by for the Haryana Sub-region.

5.3.2.i Approach and Methodology

The exhibit below highlights the various steps involved in undertaking the 'Industrial Demand Assessment' exercise for the Haryana Sub-region. Subsequent to the exhibit, necessary details with regard to each of the steps have been explained.

[3] Source: Economic Survey of Haryana 2007-08 & FICCI
[4] Source: Economic Survey of Haryana 2007-08 & FICCI

Step 1: Prioritizing Global , India and State Level Growth Industries



As an initial step to identify prominent emerging and established industry groups/clusters, industries have been prioritized at a Global , India and State level on the basis of parameters such as Production (Value of Output generated); Growth trends across various industry clusters; Opportunity to attract foreign investments (Foreign Direct Investment) and Foreign Trade (Import & Export).

This analysis was undertaken to primarily identify those industry sectors which would be given further growth impetus in the Haryana Sub-region due to their importance from both an Indian and Global standpoint. The adjacent exhibit lists the industry groups which have been thus prioritized based on this dynamic analysis.

Prioritized Industry Groups	
Motor Vehicles, Auto Components & Other Transport Equipment	Rubber & Plastics
Pharmaceuticals, R&D, Clinical Research, Contract Manufacturing	Coke, Refined Petroleum Products
IT/ ITeS (incl. Knowledge Services)	Basic Metals
Bio-technology	Non-metallic Minerals
Food Products and Beverages	Fabricated Metal Products
Textiles and Apparel	Machinery & Equipment, Electrical Machinery & Apparatus

Comprehensive global , Indian and State Industrial databases were acquired from prominent national and international agencies in order to undertake a robust and comprehensive analysis of the same.

Step 2 – Detailed Data Collation Exercise to Map Historical Industrial Activity across the Respective Districts of the Haryana Sub-Region

Before undertaking a comprehensive demand assessment, a detailed data gathering exercise was undertaken to collate statistical time series information on historical industrial and economic activity across district level.

The interactions with a number of government agencies has been done to obtain industrial databases across various districts of the Haryana Sub-Region and to map historical trends across the past years with regard to industrial activity. To maintain standardization in terms of historical industry trends and projections, data was collated in terms of number of operational units across

all industries pertaining to the Manufacturing sector (viz. Section D as per the National Industrial Classification - NIC Code 2004) and the IT/ITeS sector as defined by the 'Software Technology Parks of India' and put into statistically usable databases.

The following exhibit highlights the various government databases and agencies which have cooperated and kindly provided the consortium with detailed industrial and economic data for the Haryana Sub-region.

Databases	Publisher	Description
District Statistical Handbooks District Industrial Databases State Statistical Abstracts IT/ ITeS Sector Activity	Directorate of Economics and Statistics Department of Industrial Health & Safety Software Technology Parks of India	Industrial Activity Employment Trends Exports
Economic Survey of State	Statistics & Planning Department	Gross Domestic Product Economic Activity

Step 3 – Estimating Additional Growth Parameters on Forecasts Due to DMIC Induced Industrial Infrastructure

In order to account for the significant impact of the DMIC initiative on future industrial activity, additional growth parameters on account of the following factors were also taken into consideration with respect to the industrial projections undertaken.

Due to the proposed development of the DMIC region as a global investment platform, additional growth was allocated to identified prominent and emerging industries (based on findings of industry analysis undertaken in Step 1)

Additional induced growth allocated state and industry wise owing to upcoming DFC (Dedicated Freight Corridor) infrastructure

Additional growth allocated state and industry wise based on perceived impact of DMIC induced infrastructure such as upcoming IRs (Investment regions) and IAs (Industrial areas) across the region

Step 4 -Apportioning district level industry forecasts amongst the relevant Sub-Region districts

In order to understand district level opportunities across each industry, a detailed district level analysis to understand their dynamics with regard to established industrial synergies, future industry potential, State Government thrust sectors, raw material availability, DMIC induced growth initiatives, etc would be undertaken.

A 'Industry Attractiveness Model' was utilized to assess each district's potential to attract various industries and accordingly shares allocated from the district level forecasts.

Major parameters assessed to determine potential of district to attract an industry

- Historical Industry Strength (25% weight)
- Presence of Mother/Ancillary Industry (12% weight)
- Raw Material Availability (25% weight)
- Basic Infrastructure (5% weight)
- Industry Specific Infrastructure (13% weight)
- Labour Availability (4% weight)
- Social Infrastructure (4% weight)
- Land Availability (4% weight)
- Policy Level Advantage (4% weight)
- DMIC Induced Growth (4% weight)

Step 5 - Conversion of forecasted units into Value of Output

In order to convert projections of industrial units across the Haryana Sub-Region region into necessary Value of Output data, appropriate conversion ratios have been utilized. Ratios used for conversion have been calculated based on historically observed per unit value of output ratios which vary as per each state/district and industry type.

Assumptions made for undertaking the above exercise include:

a. Accounting for inflation in the per unit value of output ratios used for projections

- Appropriate inflation rates based on historically observed industry wise Wholesale Price Index (WPI) trends for the period 1997-98 to 2004-05 were utilized
- Further, the above inflation rates have been dynamically adjusted across the period 2011-2021 taking into account decreasing inflationary trends with maturing of the Indian economy

b. Historically observed per unit value of output ratios have been increased across the period 2011-2021 to account for internal capacity expansion (which would lead to increasing value of output per unit) across established units, driven by greater opportunities of industrial production in the Haryana Sub-region

- The above growth in per unit value of output has been kept higher during the ten year period of 2011-2021.

5.3.2.ii Districtwise Projected Number of Industries for the year 2011 & 2021

Adopting the above methodology for projecting the various types of industries for the year of 2011 & 2021 in the districts of Haryana Sub-Region we find the following scenario:

Table 5-5 : District wise projected number of major industries in the Sub-Region in 2011 & 2021

Major Industries	Panipat		Sonipat		Rohtak		Jhajjar		Rewari		Gurgaon		Faridabad		HaryanaSub-Region	
	2011	2021	2011	2021	2011	2021	2011	2021	2011	2021	2011	2021	2011	2021	2011	2021
Manufacture of Food Products and Beverages	59	156	40	151	34	79	22	51	15	19	57	146	86	189	313	791
Manufacture of Tobacco Products	7	10	3	4	1	2	-	-	1	2	4	5	2	2	18	25
Manufacture of Textiles	428	543	71	135	13	23	26	55	16	44	94	173	203	292	851	1265
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	15	84	24	110	2	7	24	53	8	46	464	603	131	264	668	1167
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear	2	5	15	37	10	20	6	8	2	14	11	27	43	65	89	176
Manufacture of Wood and of Products of Wood and Cork, except Furniture; Manufacture of Articles of Straw and Plaiting Material	66	86	105	133	61	81	31	41	22	25	49	77	217	243	551	686
Manufacture of Paper and Paper Products	11	21	15	25	10	13	19	33	3	5	12	22	52	66	122	185
Publishing, Printing and Reproduction of Recorded Media	2	5	8	11	8	11	23	46	3	7	11	19	33	68	88	167
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	6	8	13	14	3	3	5	5	6	6	10	14	23	32	66	82

Manufacture of Chemical and Chemical Products	21	50	65	106	13	23	35	68	22	46	78	113	147	193	381	599
Manufacture of Rubber and Plastic Products	8	14	60	84	19	29	39	49	4	9	73	96	211	244	414	525
Manufacture of Other Non-Metallic Mineral Products	17	34	44	64	16	26	71	91	6	9	124	150	284	310	562	684
Manufacture of Basic Metals	45	54	48	66	29	39	45	53	14	24	54	69	293	325	528	630
Manufacture of Fabricated Metal Products except Machinery and Equipments	50	101	57	125	30	52	64	105	20	74	99	189	289	396	609	1042
Manufacture of Machinery and Equipment, N.E.C.	57	116	18	20	17	18	26	55	13	17	62	103	301	387	494	716
Manufacture of Office, Accounting and Computing Machinery	2	4	-	2	-	-	10	12	1	11	8	18	11	24	32	71
Manufacture of Electrical Machinery and Apparatus N.E.C.	9	18	20	38	12	15	4	6	10	20	97	127	157	188	309	412
Manufacture of Radio, Television and Communication Equipment and Apparatus	2	8	4	14	-	-	-	-	-	-	54	80	25	50	85	152
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	2	3	5	9	4	5	2	3	2	3	42	75	25	53	82	151
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	1	3	10	34	6	9	3	6	7	26	125	218	98	181	250	477
Manufacture of Other Transport Equipment	3	7	18	57	8	11	1	4	16	56	79	174	60	148	185	457
Manufacture of Furniture; Manufacturing N.E.C.	3	4	5	8	2	3	2	3	2	4	12	28	24	40	50	90
Total	**816**	**1334**	**648**	**1247**	**298**	**469**	**458**	**747**	**193**	**467**	**1619**	**2526**	**2715**	**3760**	**6747**	**10550**

Figure 5-6 : District wise projected percentage share of major industries in 2011

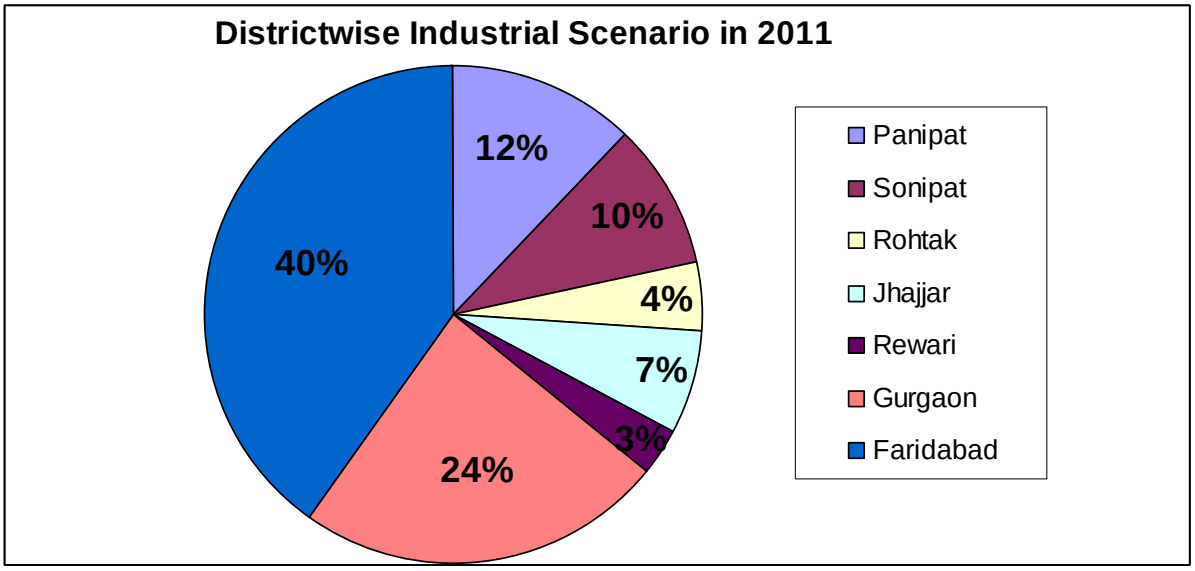


Figure 5-7 : District wise projected percentage share of major industries in 2021

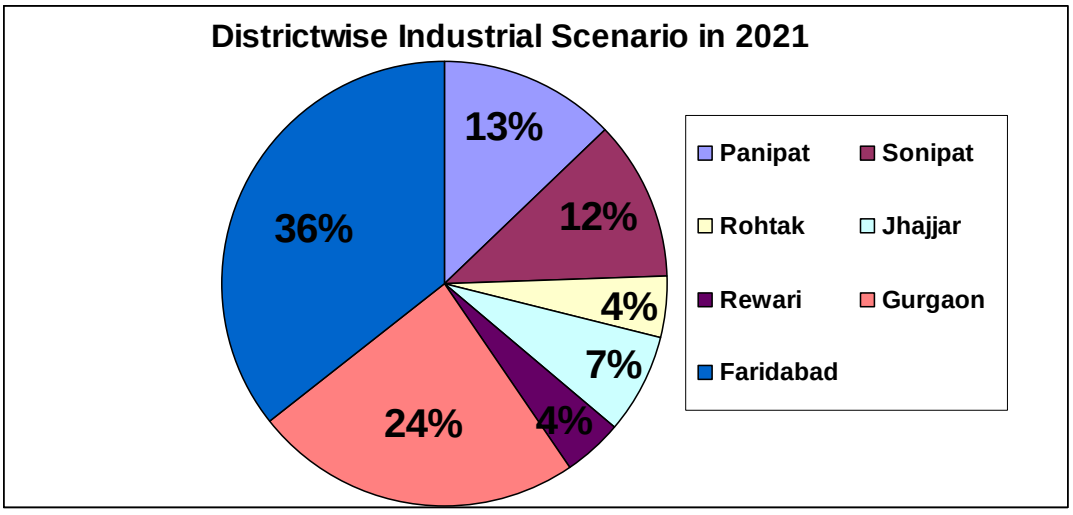


Figure 5-8 : District wise Industrial Scenario since 2007 to 2021

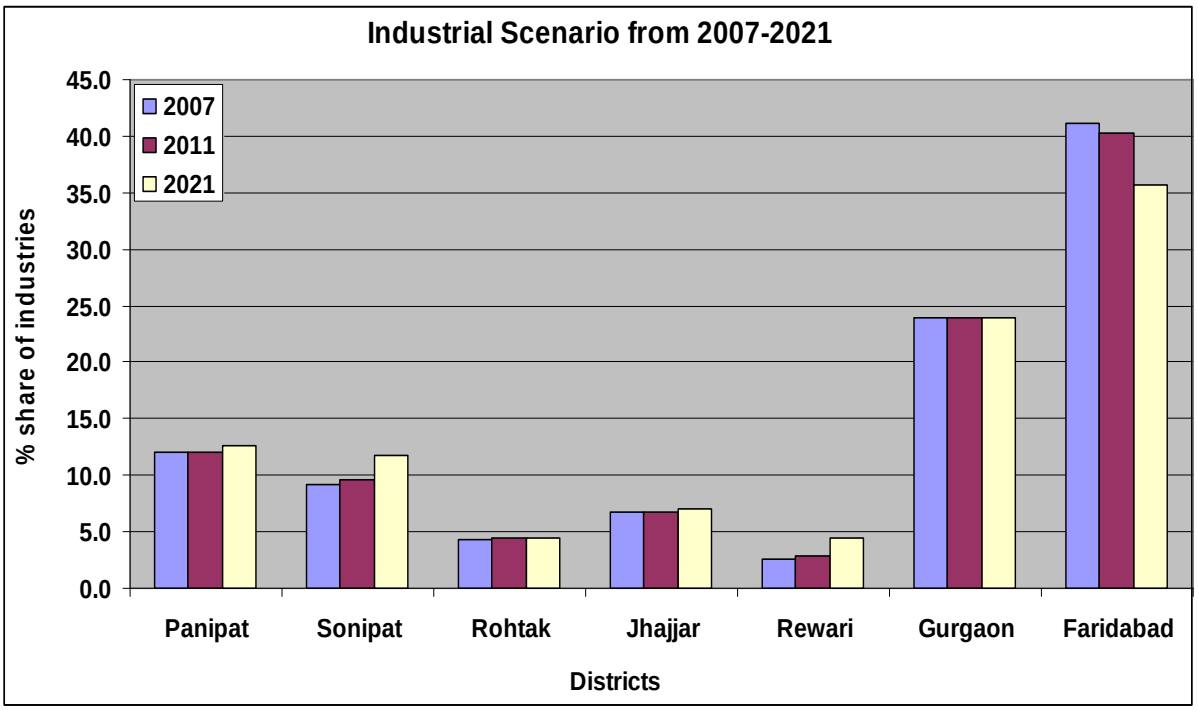
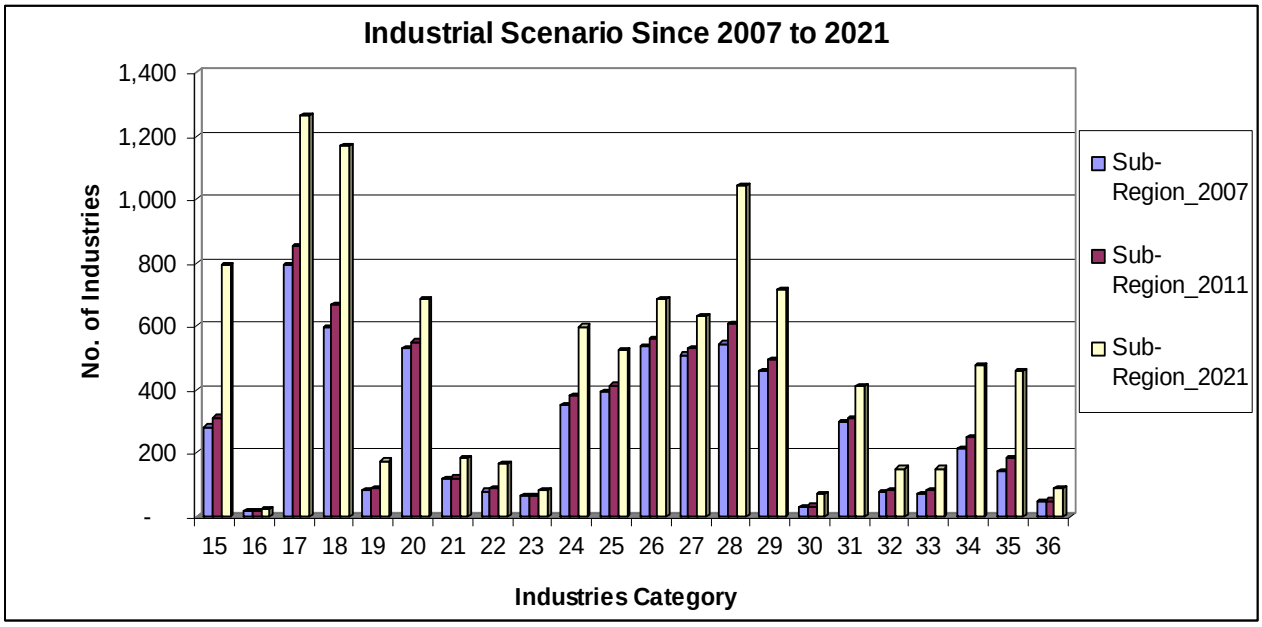


Figure 5-9 : Category wise Industrial scenario since 2007 to 2021



5.3.2.iii Districtwise Projected Industries Output values for the year 2011 & 2021

Table 5-6 : District wise projected industrial Output value (in INR Million) in the Sub-Region for 2011

Major Industries	Panipat	Sonipat	Rohtak	Jhajjar	Rewari	Gurgaon	Faridabad	Sub-RegionTotal
Manufacture of Food Products and Beverages	10,883	2,940	4,550	4,815	1,353	5,085	18,823	**48,448**
Manufacture of Tobacco Products	119	265	34	-	34	117	85	**653**
Manufacture of Textiles	17,729	15,294	1,077	2,486	1,326	6,717	21,022	**65,651**
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	4,634	3,274	195	2,370	1,282	110,254	11,779	**133,788**
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear	104	1,084	550	352	48	1,629	8,003	**11,770**
Manufacture of Wood and of Products of Wood and Cork, except Furniture; Manufacture of Articles of Straw and Plaiting Material	389	1,463	493	401	443	1,164	7,718	**12,072**
Manufacture of Paper and Paper Products	492	885	435	1,567	361	1,352	2,876	**7,967**
Publishing, Printing and Reproduction of Recorded Media	181	788	483	776	382	1,084	3,514	**7,208**
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	306	664	108	180	216	580	837	**2,892**
Manufacture of Chemical and Chemical Products	3,023	9,724	2,573	3,466	4,339	18,934	28,326	**70,385**
Manufacture of Rubber and Plastic Products	934	4,543	2,129	3,599	738	9,506	21,170	**42,618**
Manufacture of Other Non-Metallic Mineral Products	427	994	528	1,336	161	3,435	5,026	**11,907**
Manufacture of Basic Metals	17,156	13,036	12,231	7,109	5,056	29,147	138,130	**221,864**
Manufacture of Fabricated Metal Products except Machinery and Equipments	3,821	4,191	1,653	4,082	1,276	6,314	19,314	**40,650**

Manufacture of Machinery and Equipment, N.E.C.	11,700	2,245	2,699	2,282	5,230	8,674	48,586	**81,416**
Manufacture of Office, Accounting and Computing Machinery	436	-	-	2,727	182	1,756	2,400	**7,501**
Manufacture of Electrical Machinery and Apparatus N.E.C.	1,463	3,212	1,946	881	1,762	14,940	14,237	**38,441**
Manufacture of Radio, Television and Communication Equipment and Apparatus	274	486	-	-	-	25,147	2,663	**28,570**
Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	331	826	661	331	331	6,973	4,132	**13,584**
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	1,080	8,101	3,889	2,268	6,175	141,439	33,749	**196,702**
Manufacture of Other Transport Equipment	4,353	12,637	5,429	2,340	26,209	326,577	79,910	**457,454**
Manufacture of Furniture; Manufacturing N.E.C.	443	739	296	296	296	1,774	3,548	**7,391**
Industrial Total output value	**80,276**	**87,390**	**41,957**	**43,664**	**57,199**	**722,598**	**475,847**	**1,508,930**

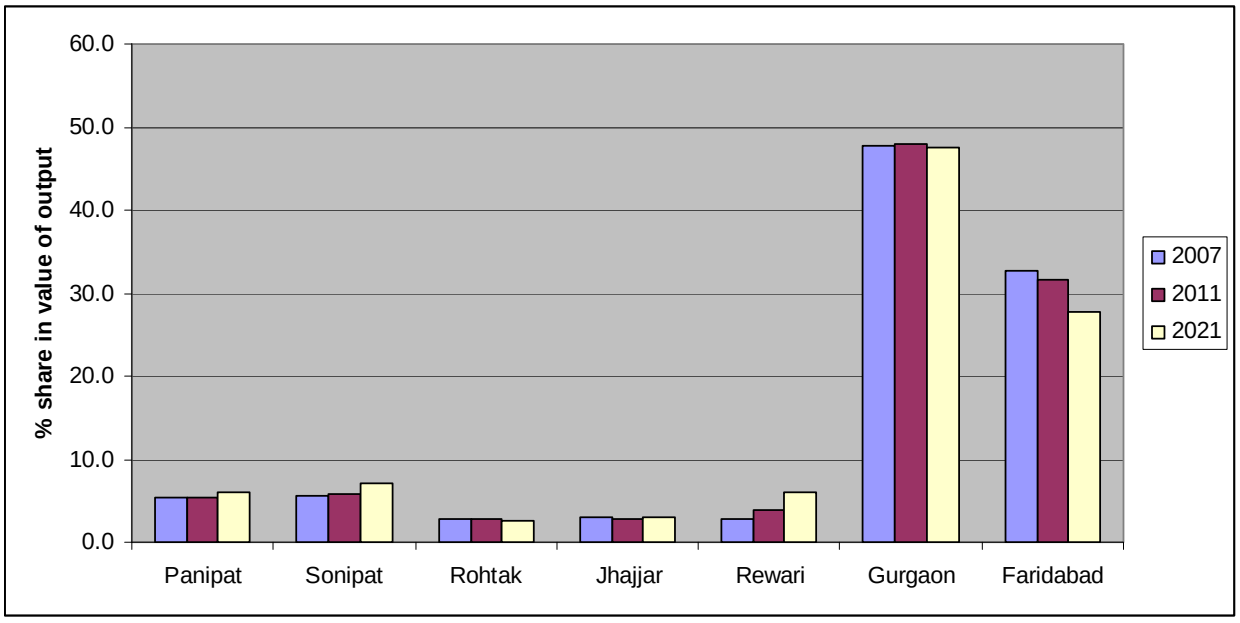
Table 5-7 : District wise projected industrial Output value (in INR Million) in the Sub-Region for 2021

Major Industries	Panipat	Sonipat	Rohtak	Jhajjar	Rewari	Gurgaon	Faridabad	Sub-Region Total
Manufacture of Food Products and Beverages	61,907	23,875	22,742	24,014	3,687	28,020	88,994	**253,240**
Manufacture of Tobacco Products	400	831	160	-	160	345	200	**2,095**
Manufacture of Textiles	35,431	45,805	3,001	8,284	5,742	19,472	47,632	**165,368**
Manufacture of Wearing Apparel; Dressing and Dyeing of Fur	48,729	28,179	1,278	9,829	13,837	269,051	44,573	**415,477**
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear	459	4,746	1,953	833	595	7,095	21,471	**37,153**

Manufacture of Wood and of Products of Wood and Cork, except Furniture; Manufacture of Articles of Straw and Plaiting Material	1,017	3,717	1,314	1,065	1,010	3,669	17,335	**29,128**
Manufacture of Paper and Paper Products	1,839	2,890	1,107	5,331	1,180	4,855	7,152	**24,355**
Publishing, Printing and Reproduction of Recorded Media	849	2,035	1,246	2,916	1,674	3,515	13,597	**25,831**
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	1,205	2,108	318	531	637	2,396	3,435	**10,629**
Manufacture of Chemical and Chemical Products	14,596	32,155	9,230	13,652	18,396	55,618	75,408	**219,055**
Manufacture of Rubber and Plastic Products	2,556	9,945	5,080	7,069	2,597	19,546	38,278	**85,071**
Manufacture of Other Non-Metallic Mineral Products	1,531	2,593	1,540	3,073	432	7,457	9,844	**26,470**
Manufacture of Basic Metals	45,982	40,035	36,738	18,701	19,359	83,187	342,221	**586,224**
Manufacture of Fabricated Metal Products except Machinery and Equipments	17,238	20,526	6,399	14,958	10,542	26,924	59,112	**155,699**
Manufacture of Machinery and Equipment, N.E.C.	38,593	4,043	4,632	7,824	11,086	23,358	101,251	**190,786**
Manufacture of Office, Accounting and Computing Machinery	1,414	708	-	5,304	3,241	6,403	8,487	**25,558**
Manufacture of Electrical Machinery and Apparatus N.E.C.	4,742	9,891	3,942	2,143	5,713	31,704	27,633	**85,768**
Manufacture of Radio, Television and Communication Equipment and Apparatus	2,054	3,196	-	-	-	69,956	10,001	**85,207**

Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	931	2,793	1,552	931	931	23,380	16,450	**46,968**
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	5,704	48,485	10,267	7,986	40,373	434,206	109,723	**656,744**
Manufacture of Other Transport Equipment	17,877	70,439	13,140	16,477	161,473	1,266,156	346,967	**1,892,530**
Manufacture of Furniture; Manufacturing N.E.C.	1,110	2,221	833	833	1,110	7,772	11,103	**24,981**
Industrial Total output value	**306,166**	**361,217**	**126,475**	**151,753**	**303,776**	**2,394,085**	**1,400,866**	**5,044,338**

Figure 5-10 : District wise Industrial Output value since 2007 to 2021



From the above all analysis it is clear that up to the year of 2021 industrial growth in Gurgaon wiould come to the saturation level i.e. percentage share in number of industry as well as in out put value in the Haryana Sub-Region would remain same . In the case of Faridabad, percentage share would decrease, where as percentage share of Sonipat, Rewari and Panipat would increase. It indicates that in the coming future industrial development would not restrict to Gurgaon or Faridabad but it would get diverted to Sonipat, Rewari and Panipat.

Now considering the works of HSIIDC in the field of industrial and infrastructure development in the sub-region we find that it is the nodal agency of Haryana Government to develop industrial and its support infrastructure in the state. In fulfillment of the mandate it is developing industrial infrastructure of different hierarchies. A Township named Ch. Devi Lal Industrial Model Township, Manesar near Gurgaon is being developed over an area measuring about 5000 acre has already become the destination of many Multi National Companies like Denso, Honda, Suzuki, Narcool, Barco, Mitsubishi, Duracell, NHK, to name a few. HSIIDC is also developing Industrial Growth Centre at Bawal over an area measuring 1200 acre which has also emerged as the destination of Multi-National Companies like YKK, TDT Copper, Exide, Becton Dickinson, Nerolac, Svedla, Ashai Glass, to name a few.

A multi functional complex is also being developed at Kundli popularly known as Rai-Kundli Multi-functional Complex. It is in this complex that Export Promotion Industrial Park, Food Park, Cold Chain Complex have been developed by HSIIDC.

The Govt. also proposed to setup a SEZ named New Gurgaon, which will be available for allotment soon.

For general industry HSIIDC has also acquired land measuring about 734 acre at Bahadurgarh to enable relocation of the industry from Delhi. HSIIDC has been pioneer in allotting land to the industrial units being shifted from non-conforming zone in Delhi. The infrastructure for relocation of such industries is readily available at Rai-Kundli Multi-functional-Complex, IMT, Manesar and Industrial Growth Centre, Bawal.

HSIIDC has also developed Industrial & Infrastructure Development Centre (IIDC) at Rai, Barhi near Gannaur, Sirsa and Manakpur in Yamunanagar District. Industrial Growth Centre and a Food Park has also been developed by HSIIDC at Saha in Ambala District together measuring 415 acre. The Industrial Growth Centre has been sanctioned by Govt. of India, Ministry of Commerce and Food Park has been sanctioned by the Ministry of Food Processing. Plots are readily available for general industry and also for food processing and packaging industry at Saha.

To relocate the Plywood Industry from congested area of Yamunanagar, HSIIDC is acquiring about 250 acre land in Yamunanagar on Yamunanagar – Radaur Highway.

HSIIDC has also acquired land at Barhi (Ph-II) over an area measuring 330 acres in continuity of IIDC. The land will be available for allotment to the Hosiery and Textiles processing, knitting units etc.

HSIIDC has also plans to develop state-of-the-art and high security zone for Gems and Jewellery Park at Gurgaon. The discussions had been held on its concept with major players in this trade both in India and abroad.

HSIIDC has also plans to set up two more Food Parks in the State at Narwana and Dabwali. Land at Narwana has already been acquired whereas land at Dabwali is at the advance stage of acquisition.

In addition, mini-industrial estates (Udyog Kunjs) at selected focal villages in the State have also been established to provide opportunities for self-employment to the unemployed rural youth. The corporations have set up Udyog Kunjs in almost all Districts of Haryana and are now being handed over to Industries deptt. of Haryana.

The available infrastructure in the industrial estates has also been refurbished for smoother functioning.

For detailed information, the corporation has brought out an 'Atlas of Industrial Estates' which is available on demand. Similarly, another publication titled 'An Investor's Guide to Haryana' has been brought out which is further available on demand.

Details regarding tentative number of plots/sheds available (as on 16-09-2010) in various estates developed/being developed by HSIIDC in Haryana Sub-Region are following:

Table 5-8 : List of the Industrial Estates/IMTs Developed by the HSIIDC (16-09-10)

Location/Town	Industrial Estate/Phase	Area (in Acre)	No. of Ind. Plots/Shed
Gurgaon	Udhyog Vihar Phase - I	625.83	278
	Udhyog Vihar Phase - II		121
	Udhyog Vihar Phase - III		134
	Udhyog Vihar Phase - IV		408

	Udhyog Vihar Phase - V		437-PLOTS 118-SHEDS
	Udhyog Vihar Phase - VI	103	362-PLOTS 92-SHEDS
Faridabad	Sector 31	12.50	14-PLOTS 144-SHEDS
	Sector 59	51.27	137-PLOTS 77-SHEDS
Kundli	Phase - I	66.87	106
	Phase - II	32.45	91
	Phase – III (EPIP)	107.92	189
	Phase - IV	413.24	617
	Phase - V	608.59	419
Rai	I.E.Rai, Sec-38, Phase-I	443.82	1131
	Food Park , Rai, Phase-I	115.68	225
Barhi	I.E. Phase-I	275.25	489
	I.E. Phase-II	330.47	248
Bawal	Phase – I & II	2243.34	871
Manesar	IMT Phase - I	1749.49	1313
	IMT Phase - II	183.4	160
	IMT Phase – III & IV	1318	632
Murthal	I.E., Sonipat	35	46-PLOTS 36-SHEDS
Bahadurgarh	Sector-16, 17	555.34	608
	Sector – 4 B	177	46
Samalkha	I.E.	26.14	81
Sonipat	I.E.	2.83	58
	Phase – II	3.82	39
Roz-Ka-Meo	I.E. , Sohna	8.42	20-SHEDS
Kultana (Rohtak)	I.E.	159	270

Source : HSIIDC, Panchkula, 2010

Table 5-9 : List of the Industrial Estates/IMTs under Development by the HSIIDC (16-09-10)

Location/Town	I.E./Phase	Tentative Area (in acre)
Manesr	Phase – IV (Transport & Logistic Hub)	465.67
Faridaba	IMT	1784
Rohtak	IMT Phase-I	859
	IMT Phase-II	1893
Rai	Phse-II (Food park and General)	352.31
Gurgaon	Sector 34 & 35	341
Barhi	Phase-III	648.71
Bawal	Phase-III	452.09
Panipat	I.E.	921.6

Source : HSIIDC, Panchkula, 2010

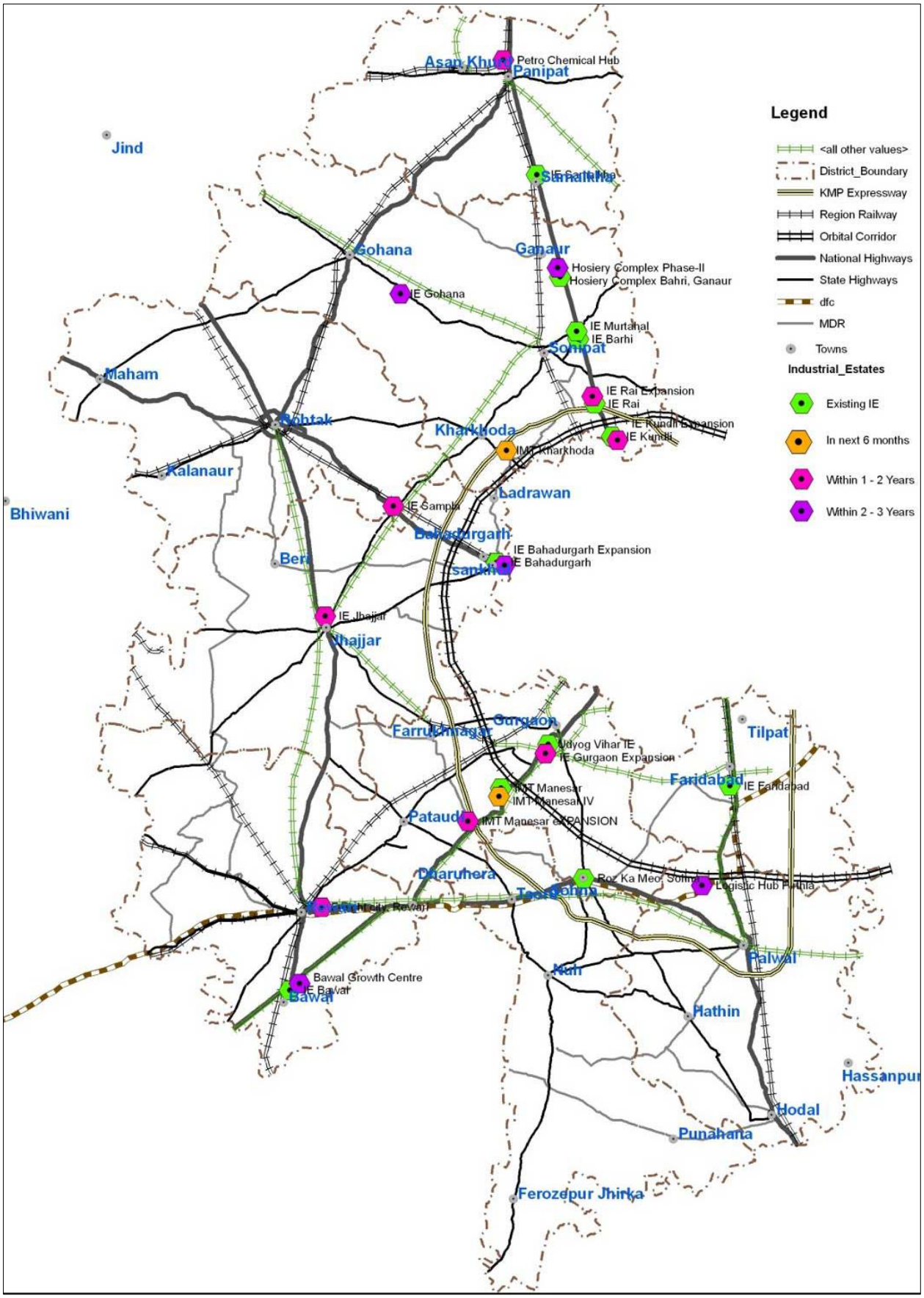
Table 5-10 : List of the Industrial Estates/IMTs proposed to be developed by the HSIIDC

Location/Town	I.E./Phase	Tentative Area (in acre)	Remarks
Bawal	Phase-IV	679	Land Acquired
Rai	Sector-39	379	Land Acquired
Dharuhera	Phase-I & II	494	Land Under Aqcuisition
Manesar	Phase – V	952.81	Land Under Aqcuisition
Rohtak	IMT Phase-III	964.3	Land to be Acquired
Kharkhauda	IMT	3364.6	Land to be Acquired
Bidhal-Lath (Gohana)	I.E.	250	Land to be Acquired
Roz-Ka-Meo	IMT	1506	Land to be Acquired

Source : HSIIDC, Panchkula, 2010

From the above data analysis it is understood that all the Existing Industrial Development by the HSIIDC is mainly along the NH-1, NH-8 and KMP corridor. Even the proposed industrial development follows the same pattern. It indicates the highway corridor development nature. Where as for the balanced regional development the western part of Rohtak & Jhajjar, Mewat and Palwal districts should also be emphasized for the industrial development which has relatively more land suitable for industrial development than other districts of Sub-Region . Below map shows it clearly.

Map 5-1: Locational map of existing and proposed I.E./IMTs by HSIIDC



Chapter 6 : TRANSPORTATION

6.1 *Road Transportation*

Since the formation of Haryana state, there has been a significant growth in the road transportation sector of Haryana. As on year 2001, around 23, 000 km of roads connect to villages and cities in Haryana state and with its neighbor states. At present more than 99.88 percentages of villages are connected by metalled roads and road density is around 63.8 km per 100 sq. km area. Length of different types of roads in Haryana State is as follows:

National Highways : 1,346 km

State Highways : 2,559 km

Major District Roads : 1,569 km

Other Distt. & village roads : 14,730 km

Other roads : 2,852 km

Source: Statistical Abstract Haryana, 2006-07

However, economic development in the state is taking place at very higher rate in comparison to other states of India. This is the reason for large density of vehicles on these available roads. As per the information available for the year 2003-2004, about 5763 motor vehicles accommodated within 100 square kilometer of area. Though, the registered number of vehicles as on 31st march 2004 were 25, 47,910, in actual about 28, 53,667 number of motor vehicles traveled on roads of Haryana sate. This shows that a significant percentage of through traffic passes through Haryana state. This large volume of traffic may cause road accidents which results in huge loss of economy and human resources, if proper transportation facilities are not provided. From the statistical information, it is found that about 10,000 vehicles were involved in road accidents in the different part of the state in the year 2006-07. Unfortunately, 4291 persons died and 8471 persons were injured due to road accidents during this period. The objective of this study is to promote and support the economic development of the region and provide connectivity

to all parts of the region, enhance safety and increase the ease of movement of both passengers and goods by decreasing delays.

6.1.1 Existing Road Network and Traffic Characteristics

The existing road network consists of National Highways, State Highways and Major District Roads and Other roads.

6.1.1.i National Highways

The study area covers 9 districts of Haryana state, cumulatively called as the Haryana Sub-region of NCR in this study. Seven national highways pass through the study area. NH-1, NH-71 and NH -71 A connect Haryana state to the northern parts of India while NH -10 connects the study area to the northern parts of Rajasthan. The National Highways NH-2, NH-8 and NH-71 B provide connectivity of the study area to central and southern parts of India. Currently National Highway NH-1 (Delhi to Ambala), NH-2 (Delhi to Palwal) and NH-8 (Delhi to Behror) have four lane divided carriageway, whereas NH-10 (Delhi to Rohtak) is partially four laned. Besides, NH-71 (Rewari to Rohtak), NH-71A (Rohtak to Panipat), NH-71B (Rewari- Sohna- Palwal) are two-laned highways. Details of these seven National Highways (NHs) are presented in the Table 6-1.

Table 6-1 : Details of National Highways in the Sub-region of Haryana

NH No.	Name of Road	Passing through Districts within Sub-region of Haryana	Length (in km) within Haryana	Current Status (No. of Lanes)	National Highway Development Program (NHDP)	Annual Average Daily Traffic (AADT) (in PCUs)
1	Delhi-Ambala Road (Sher Shah Suri Marg)	Sonipat, Panipat,	182	4	6- lanes by the year 2012	82,543
2	Delhi- Mathura Road	Faridabad, Palwal	75	4	6- lanes by the year 2015	59,329
8	Delhi- Jaipur Road	Gurgaon,	83	4	6- lanes by the	81,563

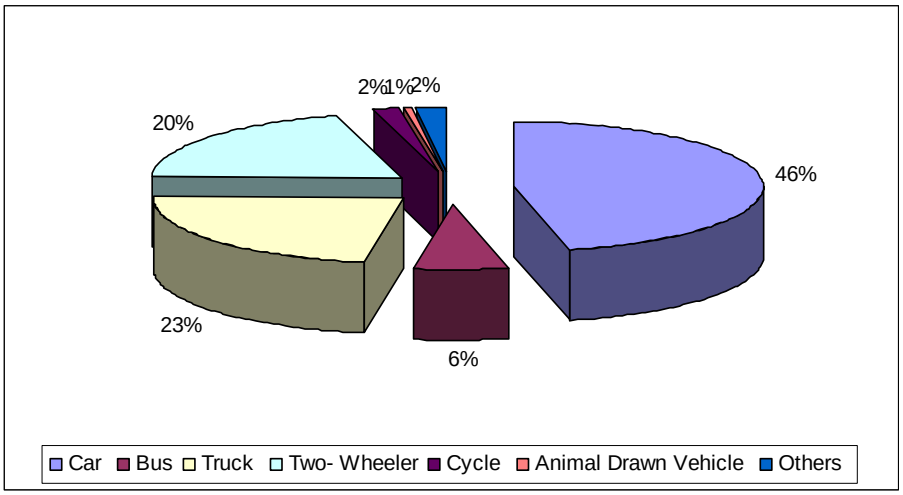
		Rewari			year 2012	
10	Delhi- Hisar-Dabwali Road	Jhajjar, Rohtak	286	2	4- lanes by the year 2013	20,329
71	Sangrur-Narwana-Rohtak-Jhajjar-Bawal Road	Rewari, Jhajjar, Rohtak	205	2	4- lanes by the year 2013	18,649
71-A	Rohtak- Gohana-Panipat Road	Rohtak, Sonipat, Panipat	72	2	4- lanes by the year 2013	36,910
71-B	Rewari- Dharuhera-Palwal	Rewari, Mewat, Sohna, Palwal	76	2	-	28,690

Source: Detail Project Reports and Traffic Reports of Pre/ Post tender services of various NH sections, Scott-Wilson India Pvt. Ltd., New-Delhi.;

www.nhai.org; www.morth.nic.in

Annual Average Daily Traffic (AADT) volume on NH-8 is found to be as high as 81,563 Passenger Car Units (PCUs) per day on Delhi- Gurgaon section of Haryana state in the current year. Similarly, it is found that large volumes of traffic are running over NH-2 and NH-1 sections within Haryana State. Various transportation development initiatives have already been taken by the National Highway Authority of India (NHAI) in the region and many are in pipeline. Some of the important Development projects which will have remarkable impact on the transportation scenario of the region (increase/ improve the influx of passengers) are: Conversion of NH- 1, 2 and 8 from four lane divided road to six lane divided road in different phases of National Highway Development Program (NHDP) by next six years, and conversion of NH-10, 71, 71-A and 71-B from two lane divided road to four lane divided road by the year 2015. Composition of vehicles on NHs is shown in the Figure 6-1. It is interesting to note from traffic compositions of NHs that about 75% of the total vehicles are passenger carrying vehicles and the remaining 25% vehicles are goods vehicles.

Figure 6-1 Traffic Composition on NHs



6.1.1.ii State Highways

State Highways (SH) are the major connectors between Sate Capital (Chandigarh) and District head quarters. Substantial percentages of traffic in the sub-region are being carried by the State Highways. There are eleven State Highways passing through the Haryana sub-region of NCR and details of these roads are presented in the Table 6-2.

Table 6-2 : Details of State Highways in the Sub-region of Haryana

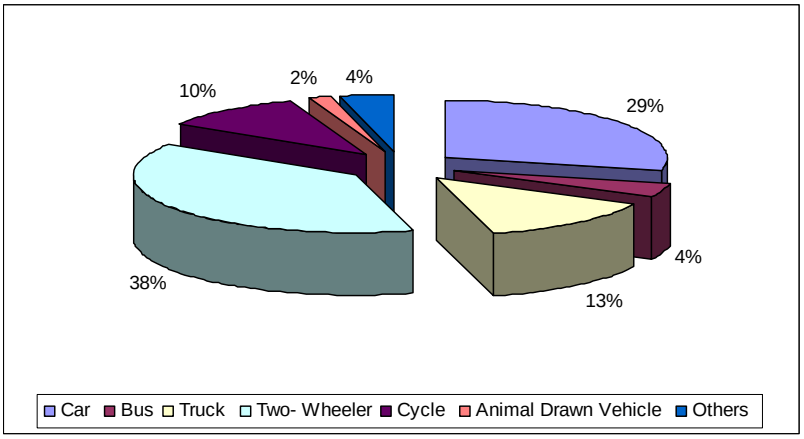
SH No.	Name of Road	Passing through Districts within Sub-region of Haryana	Length (in km) within Sub-region of Haryana	Length (in km) within Haryana	Annual Average Daily Traffic (AADT) (in PCUs)
11	Meerut-Sonepat-Gohana-Assandh-Kaithal-Patiala Road	Sonipat, Panipat	86.34	175.00	36,539
13	Gurgaon-Sohna-Nuh-Alwar Road	Gurgaon, Mewat	88.25	95.00	25,011
14	Panipat-Safidon-Jind-Bhiwani-Loharu Road	Panipat	24.00	195.00	8,879
15-A	Jhajjar-Farukhnagar-Gurgaon Road	Gurgaon, Jhajjar	40.53	45.00	16,786
16	Sanauli-Panipat-Rohtak-	Panipat	18.31	62.00	39,176

	Bhiwani Road				
16-A	Gohana-Lakhanmajra-Meham-Chang Road	Sonepat, Rohtak	52.00	68.00	11,282
18	Rohtak-Kharkhoda-Delhi Border Road	Rohtak, Sonipat	42.00	42.00	33,676
20	Murthal-Sonepat-Kharkhauda-Sampla-Jhajjar-Chhuchakwas-Jhajjar-Dadri-Loharu Road	Jhajjar, Rohtak, Sonipat	82.85	160.00	6,317
22	Bahadurgarh-Jhajjar-Kosli Road	Rewari, Jhajjar	63.72	77.00	19,172
24	Rewari-Dahina-Mahendragarh-Satnali-Loharu Road	Rewari	33.65	92.00	8,774
26	Gurgaon-Rewari-Narnaul-Singhana Road	Gurgaon, Rewari	76.64	120.00	52,180

Source: P.W.D. (Building & Road Branch), Haryana, 2009

It is observed that more than sixty percent length of these State Highways of Haryana is covered under this study area. Traffic volume on these SHs are found to be less than traffic volume on NHs in this region; however large volume of traffic are being carried by some roads like SH-11, SH-16, SH- 26 etc. The composition of vehicles on SHs is shown in the Figure 6.2.

Figure 6-2 Traffic Composition on SHs



It is interesting to note from traffic compositions of SHs and MDRs that about 80% of the total vehicles are passenger carrying vehicles and the remaining 20% vehicles are goods vehicles. Similarly, traffic compositions of MDRs shows that about 77% of the total vehicles are passenger carrying vehicles and the remaining 23% vehicles are goods vehicles. Cars have a major share among passenger vehicles followed by two wheelers. It signifies that people prefer to use their own private vehicles over public transport in the NCR. Among goods carrying vehicles, truck has a major share. The number of heavy industries which are located in the NCR is less. Hence major percentages of goods carried as freight are agricultural products and are generally being carried by LCVs and trucks.

6.1.1.iii Major District Roads

The other important roads are the Major Districts Roads (MDRs) connecting district head quarters with sub-district head quarters. These roads are important at sub regional level because they act as the main connector to the SHs and MDRs. There are twelve MDRs passing through the study area and are shown in the Table 6-3. The compositions of vehicles on MDRs are shown in the Figure 6.3. Both SHs and MDRs in the study area need substantial geometric improvements to accommodate this heavy traffic. All these road sections on which, traffic volume is high and road conditions are not good need to be widened on priority basis, to provide better level of service in the near future.

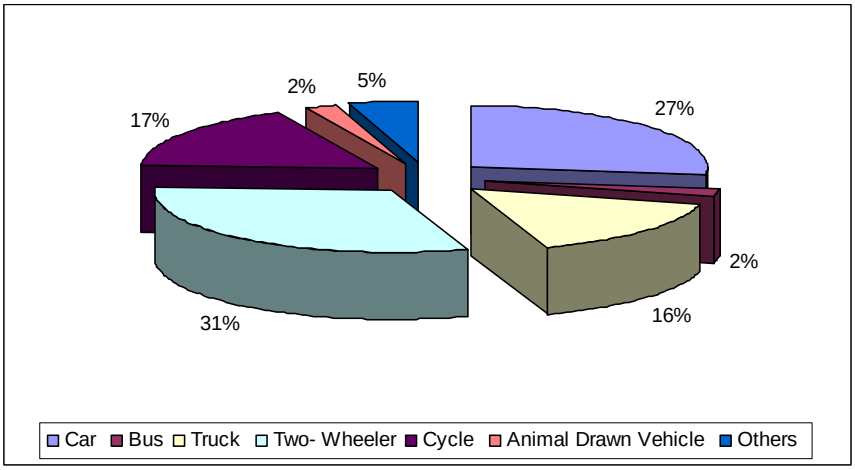
Table 6-3 : Details of Major District Roads in the Sub-region of Haryana

MDR No.	Name of Road	Passing through Districts within Sub-region of Haryana	Length (in km) within Sub-region of Haryana	Length (in km) within Haryana	Annual Average Daily Traffic (AADT) (in PCUs)
121	Ghanaur- Shahpur Road	Ponipat, Sonipat	26.00	26.00	19,796
122	Bahadurgarh-Chhara-Dhujana-Beri-Kalanaur Road	Jhajjar, Rohtak	56.00	56.00	12,268
123	Jhajjar-Badli-Delhi Border	Jhajjar	18.75	18.75	9,305

130	Chhuchakwas-Jharli-bahu-Karoli Road	Jhajjar, Rewari	36.23	36.23	-
131	Hodal-Punahana-Nagina Road	Mewat, Palwal	40.39	40.39	26,164
132	Hodal-Utwar-Nuh-Taoru-Pataudi-Patuda Road	Palwal, Mewat, Gurgaon, Jhajjar	91.50	91.50	23,484
133	Ballabgarh-Pali-Dauj-Sohna Road	Faridabad, Gurgaon	33.00	33.00	16,268
134	Palwal-Mandkaul-Nuh Road	Palwal, Mewat	32.00	32.00	17,330
135	Palwal-Hathin-Utwar-Bhadas Road	Palwal, Mewat	37.09	42.59	21,631
136	Bahadurgarh-Badli-Chandu Road	Gurgaon, Jhajjar	32.50	32.50	11,870
137	Mehraul-Gurgaon-Faridabad Road	Faridabad, Gurgaon	30.45	30.45	33,757
138	GT road-Jatheri-Akbarpur-Rathdhana-Nahra-Kundal-Sohati-Bahadurgarh Road	Jhajjar, Rewari	25.00	25.00	22,950

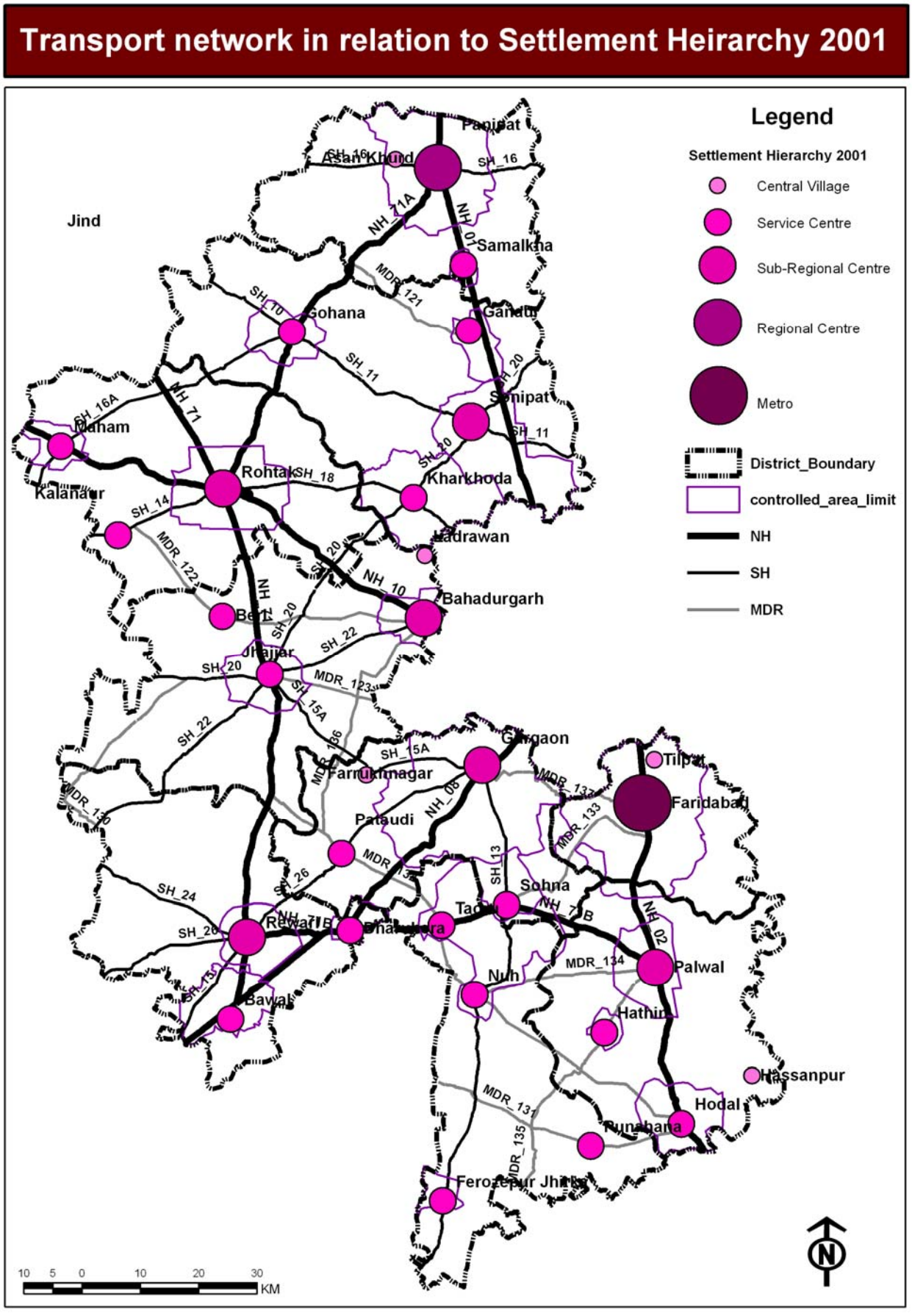
Source: P.W.D. (Building & Roads Branch), Haryana, 2009

Figure 6-3 : Traffic Composition on MDRs



Source: P.W.D. (Building & Road Branch), Haryana, 2009

Map 6-1 : Existing Major Transport Network in relation to 2001 population



6.1.1.iv Level of Service on the Existing Road Network

Level of Service is a qualitative measure describing operational conditions within a traffic stream and their perception by drivers/passengers. It generally describes these conditions in terms of factors such as speed and travel time, freedom of maneuver, traffic interruptions, comfort, convenience and safety. Six levels of service are recognized commonly, designated from A to F, with Level of Service A representing the best operating condition (free flow condition) and level of service F the worst (break down flow).

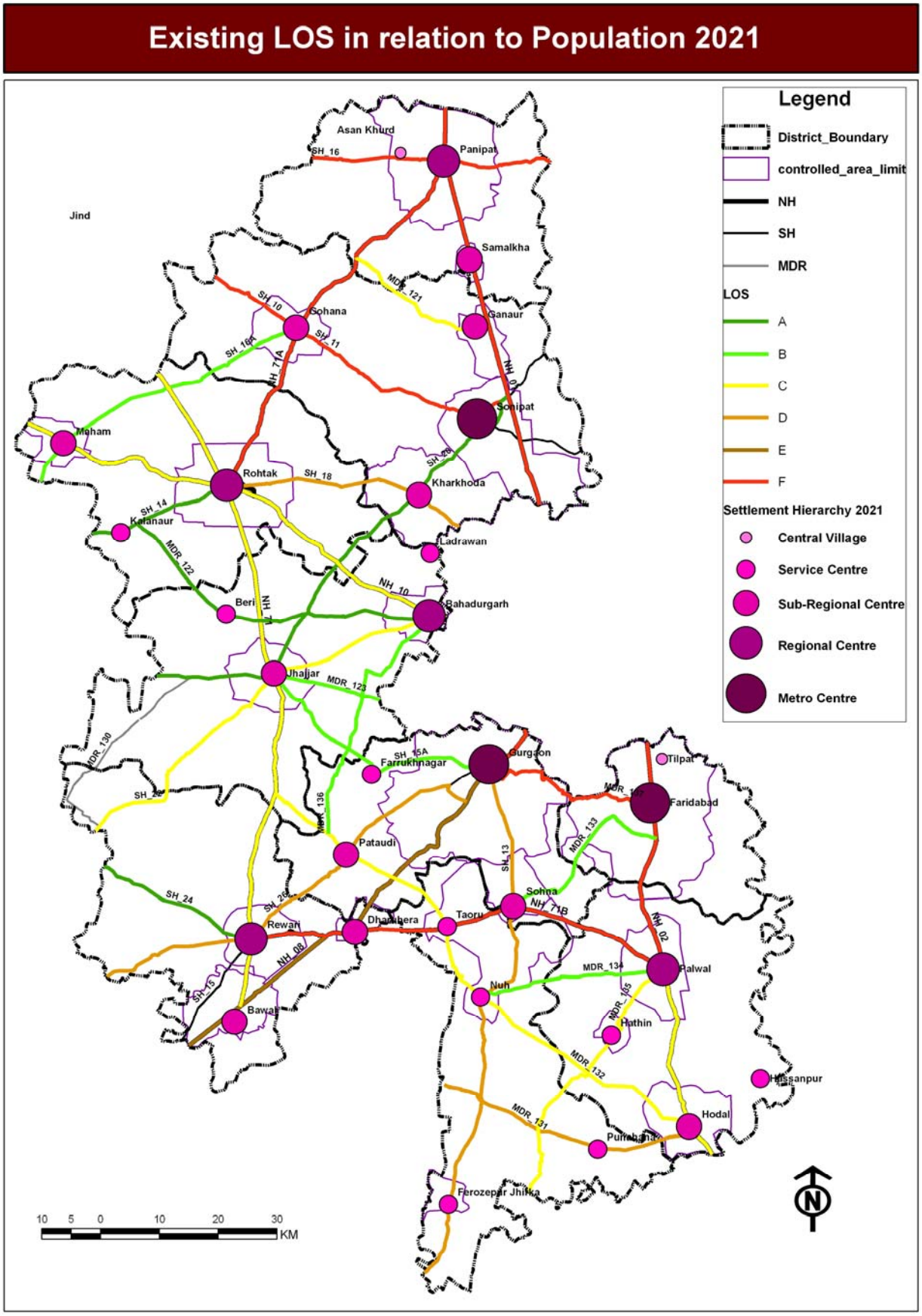
The current lane configuration of the links in the study network varies between 2 and 4 lanes. It is observed that most links of the national highway network under Haryana Sub-region are currently operating at LOS-E or LOS-F. In the near future the LOS category of certain links may upgrade to the higher level on completion of the capacity augmentation of the links as detailed in a later section. Most of the State highways in the study area network is operating at poor levels of Service and require capacity augmentations. Links Panipat-Safidon-Jind-Bhiwani-LoharuRoad (SH-14), Murthal-Sonepat-Kharkhauda-Sampla-Jhajjar-Chhuchakwas-Jhajjar-Dadri-LoharuRoad (SH-20) and Rewari-Dahina-Mahendragarh-Satnali-Loharu Road (SH-24) are operating at LOS-A. Major District Roads, Mehraul-Gurgaon-Faridabad Road (MDR-137) and Hodal-Punahana-Nagina Road (MDR-131) are operating at LOS F and LOS D respectively. Table6-4 shows the Level of Service on the existing road network.

Table 6-4 : Link wise traffic flow and Capacity

NH/SH/MDR No.	No of Lanes	Volume (PCUs/Day)	Capacity (PCUs/Day)	V/C Ratio	LOS
National Highways					
Delhi-Panipat-1	4	82543	70000	1.18	F
Delhi-Palwal-2	4	72628	70000	1.04	F
Palwal-Hodal-2	4	46031	70000	0.66	C
Delhi-Gurgaon-8	8	81563	160000	1.17	C
Gurgaon-Bawal-8	4	61426	70000	0.88	E
Delhi-Hisar-10	2	20329	30000	0.68	C
Rewari-Rohtak-71	2	18649	30000	0.62	C
Rohtak-Panipat-71A	2	36910	30000	1.23	F

Rewari-Palwal-71B	2	28690	30000	0.96	F
State Highways					
11	2	36573	30000	1.22	F
13	2	24379	30000	0.81	D
14	2	8882	30000	0.30	A
15-A	2	14878	30000	0.50	B
16	2	44577	30000	1.49	F
16-A	2	13426	30000	0.45	B
18	2	22337	30000	0.74	D
20	2	6538	30000	0.22	A
22	2	20277	30000	0.68	C
24	2	8805	30000	0.29	A
26	2	21921	30000	0.73	D
Major District Roads					
121	2	18734	30000	0.62	C
122	2	5028	30000	0.17	A
123	2	11719	30000	0.39	B
131	2	21986	30000	0.73	D
132	2	19236	30000	0.64	C
133	2	9850	30000	0.33	B
134	2	13646	30000	0.45	B
135	2	16793	30000	0.56	C
136	2	10760	30000	0.36	B
137	2	34330	30000	1.14	F
138	2	20834	30000	0.69	C

Map 6-2 : Existing Level of Service on various roads



6.1.1.v Origin- Destination Analysis

Origin Destination analysis helps in estimating the travel pattern and assessing the travel characteristics, i.e. trip length, frequency, commodity movement etc. OD results from previous studies available with the Consultant are used to assess the travel characteristics of goods as well as passenger traffic in the study area. OD data was analysed on the following roads to find the travel pattern of the vehicles in the sub-region.

Rohtak-Bawal (NH-71)

In case of passenger vehicles 9.4% of the traffic is of through nature and the remaining 90.6% of the traffic is either originated or destined within the surrounding areas of the road. Among the passenger vehicles bus has the lowest share of through traffic and this is mainly because most of the bus trips connects between different parts of three important town along the road viz., Rohtak to Jhajjar, Rohtak to Rewari, Jhajjar to Rewari and vice versa. The above analysis reveals that major share of passenger traffic is observed with trip length between 20 and 100km. The analysis of travel pattern reveals that about 55.5% of freight vehicles captured are using entire length of the corridor and can be termed as through traffic to the road. Remaining 44.5% is either originated or destined within the surrounding areas of the road. LCVs are essentially used for short haul trips whereas MAV are utilised for medium and long haul trips. Major share of LCVs trips has been observed with trip length between 20 and 100 km. whereas major share of 2 axle trucks, 3 axle trucks and MAVs trips has been observed with trip length more than 500 km. This reflects that major movement of HCV/MAV traffic is of long distance through type. It is observed that food grains are the predominant commodity share followed by Machines/parts. Food grains are mostly carried by all modes of Trucks whereas machines/parts are mostly carried by 2-Axle, 3-Axle and MAV. It is also observed that high share of empty vehicles and other miscellaneous commodities movement takes place along the corridor.

Rohtak-Panipat (NH-71A)

From the analysis of the 2 axle, 3axle and multi axle trucks OD Matrices it is found that about 50% of the trips made by 2 axle, 3axle and multi axle trucks are within 300 Km distance and about 38% trips are in greater than 800 Km distance.32% of the trips are originated from

Rajasthan, Gujarat, Madhya Pradesh, Chattisgarh, Maharashtra, Goa, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala and about 53% of these trips ends in Panipat, Chandigarh and Panchkula, and Ambala, Yamunanagar, Kurukshetra and Karnal . About 86% of the trips by LCV are within a distance of 300 Km and about 52% of the remaining trips are from Rajasthan, Gujarat, Madhya Pradesh, Chattisgarh, Maharashtra, Goa, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala and destined to Panipat, Sonipat, Rohtak, Chandigarh, Panchkula, Ambala, Yamunanagar, Kurukshetra and Karnal. This indicates that a major share of the freight traffic along NH-71A is through traffic and it uses entire length of the corridor.

Delhi-Rohtak (NH-10)

It can be seen that majority of the cars have trip lengths ranging between 50 km to 200 km (more than 70 %). Majority of the buses (more than 70%) are observed to have trip lengths between 50-500 km showing the interaction between Delhi and Rohtak, Haryana district and Punjab. Majority of the Mini buses have trip length found between 20-300 km showing interaction of Delhi with Rohtak, Hisar and Haryana districts. Building Materials & Hardware, Sand, Aggregate, Stone, Pipes and forest products (paper) have major share in the overall commodity movement by heavy commercial vehicles (2 & 3 axle trucks) on this road. Significant share (more than 30%) of empty vehicles is also observed in all modes on the road. It can be seen that majority of the 2 axle and 3 axle trucks have a trip length between 50-500 km while majority of LCV have a lead ranging between 50-200 km. The lead range of multi axle trucks is observed between 100 and 500 km.

Rohtak- Hisar (NH-10)

From the analysis of the OD data it is found that for through trip ends, Rohtak has more influence potential in case of passenger traffic. The maximum percentages of trips are made within a distance of 50 km. It has been observed that, around 19% of the trips have trip length within 150-200 km. It is observed that over 45% of trips are "Work" and "Business" oriented and are performed by two-wheelers, Auto and cars. Recreational trips are also observed to be very high and performed through all type of modes. In case of freight traffic, Hissar is the most influencing region. About 60% of goods vehicles have trip length below 200 km which indicates their local interaction. About 90% of trips are within 500 km range. This indicates the influence of

other parts of Haryana, southern Punjab and northern Rajasthan on the corridor predominantly. LCV operates quite expectedly on the local areas, mainly between Delhi-Hissar and Rohtak - Sirsa. Food grains & other daily necessities are the major commodities moved on the corridor. It has been also observed that about 29% of the goods vehicles are empty.

Gurgaon –Manoharpur (NH-08)

It can be seen that majority of the cars have trip lengths ranging between 50 km to 200 km. Buses and mini buses have a trip length between 50-300 km showing interaction between different town and district headquarters at the vicinity of the corridor. It is observed that food grains are the predominant commodity share followed by Machines/parts. Food grains are mostly carried by LCV, 2-Axle and 3-Axle Trucks whereas machines/parts are mostly carried by MAV. It can be seen that majority of the MAV and 3-Axle trucks have a trip length of more than 1000 km. It is also observed that majority of LCV and 2 axle trucks have a trip length between 50 – 500 Km ranges.

Delhi-Palwal (NH-02)

The OD analysis shows that major inter-actions are among Delhi, Faridabad, Palwal, Mathura and Agra. .The purpose wise percentage distribution of trips by car shows significant proportion of religious/recreation trips followed by business related, work, educational trips etc. It is found that average trip length for cars and buses is about 177 kms and 217 km respectively. Average occupancy of cars and buses is 3 and 43 respectively. From the analysis of goods OD matrices it is observed that about 70% goods vehicles have lead of upto 300km and nearly 30% goods vehicles have an average lead of more than 300 km.About 42% of the trips by 2, 3 and Multi axle vehicles are within a distance of 300 km. In the case of LCVs, 68% trips are within a distance of 300 km. Commodity movement pattern shows considerable movement of fruits, general merchandise, iron etc.

6.1.1.vi Condition of the roads and safety aspect

NH-10: The road, namely the Bahadurgarh - Rohtak section of NH-10, starts at Bahadurgarh and ends at Rohtak bypass in the sub-region of Haryana State. The road passes through various settlements namely Bahadurgarh, Jakhoda, Asauda, Sampla, Ismaila, Kharawar, Kheri, and

Rohtak. At present, the 63.49 km long road is of two lanes. There exists a 2-lane bypass of Sampla town in this road section. There are small and large-scale industrial establishments and some agricultural land of plain terrain along the stretch. The pavement condition of the stretch is fair. The intensity of traffic (heavy vehicles) on NH-10 has increased manifold and, therefore, it requires augmentation of capacity for safe and efficient movement of traffic. The highway, besides carrying high intensity of goods traffic is a major arterial route that serves a significant volume of passenger traffic from various places like, Haryana, Punjab, Rajasthan and Delhi.

NH-71: The road, namely the Rohtak- Bawal section of NH-71, starts at Rohtak and ends at Bawal in the sub-region of Haryana State. The road passes through various settlements like Rohtak, Jhajjar, Rewari, Bawal. At present, the road is of two lanes and average travel speed on this road is 40 km/h. Congested Rewari town and level crossings are the major bottle necks and cause of delays in this stretch of road.

NH-8: The project stretch starts from Gurgaon and ends at Bawal of Haryana state in the sub-region. This corridor section of NH-8 is one of the busiest highways in the country which links with various regions of educational, industrial and tourism hubs namely Delhi, Gurgaon, Daruhera, Bawal, etc. At present, the Delhi-Gurgaon stretch is of eight lanes and Gurgaon-bawal stretch is four lanes divided road and the whole stretch is of plain terrain only. There are small and large-scale industrial establishments and agricultural land of plain terrain along the stretch. The intensity of traffic (heavy vehicles) on NH-8 has increased manifold and, therefore, accordingly it is necessary for the augmentation of capacity of the existing road for safe and efficient movement of traffic. The highway, besides carrying high intensity of goods traffic is a major arterial route that serves a significant volume of passenger traffic from various places like Delhi, Jaipur, Mumbai etc. The condition of this road stretch is very good; however frequent accident occurs in Delhi-Gurgaon Section. The design speed of this road section is around 80 km/h.

NH-2: The portion of NH-2 from Delhi to Palwal is already having 4-lane divided carriageway configuration. The corridor has been identified as one of the fastest growing economic corridor. However, the experience of four lane stretch that have already been in use has brought into sharp focus the fact that mere improved riding quality is not enough and that value additions by way of reducing capacity constraints, additional facilities, particularly, those having a bearing

on safety aspects, are much more important. Hence from safety point of view and growing traffic requirements, a smooth uninterrupted flow of traffic through this corridor was felt necessary. Accordingly capacity augmentation of the existing 4-lane divided highway to 6-lane divided highway was conceived by National Highways Authority of India (NHAI). Data on accident for four consecutive years (2003-2006) was analyzed. Accident-prone area/hazardous locations are identified based on the study of indicator termed as Accident Severity Index (ASI). The location is termed as accident prone where the ASI for a particular stretch exceeds the threshold value of ASI. The ASI for various stretches is calculated by assigning severity weight age of 6 to fatal, 3 for serious injuries, 1 for minor injuries. Threshold value for the whole stretch was estimated and the respective ASI was compared with the threshold value to identify the accident-prone stretches. Based on analysis of accidents for the past 4 years, it can be seen that there are no critical stretches where the ASI exceeds the accident threshold value. The ASI is close to threshold value.

6.1.2 Traffic Forecast and Development Proposals

6.1.2.i Methodology

The travel demand on the road network in the study area has been estimated based on the likely industrial development in the Districts of the region and the assumed modal shift that is likely to be occurred in the horizon years from private (Car) mode of transport to the public (Bus, Train) mode of transport.

Forecasts

Traffic growth rates needed to assess the likely future traffic levels on a link (project road) are a product of the economic growth rate and the elasticity of the traffic demand vis-à-vis economic growth. This can be expressed by the following equation.

$Tg = e \times Eg$ 1

Where Tg = Traffic Growth Rate

e = Elasticity of Traffic Demand

Eg = Economic Growth Rate

The elasticity of traffic demand for the project was assumed based on the time series data on passenger/freight kilometers. The assumed mode-wise elasicities for past and future are shown in the Table 6.5.

Table 6.5 Elasticity of Traffic demand

Vehicle Type	Base Elasticity (1980-91)	1991-96	1996-2001	2001-06	2006-09	2009-14	2014-21
Buses	1.76	1.58	1.42	1.28	1.15	1.10	0.90
Cars	1.83	1.65	1.49	1.34	1.20	1.15	1.00
Trucks	2.61	2.35	2.11	1.90	1.71	1.60	1.40
LCVs	2.98	2.69	2.42	2.17	1.96	1.80	1.50

Source: IRC; SP: 45- 1996 Time series Data on Road Transport Pasenger and Freight Movement (1951-1991)

This economic growth rate indicated earlier refers to regional (influence area) income expressed as NSDP (Net State Domestic Product) and has been considered for assessing the traffic growth rates of passenger vehicles. In the case of freight vehicles the Primary/Secondary sector incomes at the state level have been considered. Net District Domestic Product (NDDP) and corresponding Primary/Secondary sector growth was assessed considering the historical relationship between industrial growth and NSDP and the relationship between NSDP and Primary/Secondary sector at the state level. These assessments were made based on the corresponding industrial forecast at the district level. The elasticity of traffic demand for the project was assumed based on the time series data on passenger/freight kilometers. Mode wise estimated traffic growth rates for select links on the study network for the period 2009-14 and 2014-21 have been derived, as given in Tables 6-6 and 6-7.

Table 6-6: Road traffic growth rate (2009-14)

NH/SH/MDR No.	Car	Bus	Truck	2-W	Cycle & Rickshaw	ADV	Others (Includes Tractor & Trailor)
NH							
Delhi-Panipat-1	14.64	14.00	11.63	12.50	4.00	4.00	5.00
Delhi-Palwal-2	10.15	9.71	8.06	9.00	2.00	2.00	2.00
Palwal-Hodal-2	10.15	9.71	8.06	5.00	2.00	2.00	5.00
Delhi-Gurgaon-8	13.25	12.68	10.53	5.00	4.00	2.00	4.00
Gurgaon-Bawal-8	16.50	15.75	13.08	10.10	2.00	1.00	2.00
Delhi-Hisar-10	11.27	10.79	8.93	5.00	5.00	5.00	5.00
Rewari-Rohtak-71	16.21	15.51	12.88	10.10	2.00	1.00	2.00
Rohtak-Panipat-71A	13.38	12.80	10.63	5.00	5.00	5.00	5.00
Rewari-Palwal-71B	16.50	15.78	13.11	5.00	5.00	5.00	5.00
SH							
11	16.21	15.50	12.87	9.50	4.00	4.00	5.00
13	13.25	12.68	10.53	9.50	4.00	4.00	5.00
14	13.07	12.50	10.38	9.50	4.00	4.00	5.00
15-A	12.38	11.93	9.90	9.50	4.00	4.00	5.00
16	13.07	12.50	10.38	9.50	4.00	4.00	5.00
16-A	13.53	12.95	10.75	9.50	4.00	4.00	5.00
18	13.53	12.95	10.75	9.50	4.00	4.00	5.00
20	12.92	12.36	10.26	9.50	4.00	4.00	5.00
22	18.89	18.07	15.00	9.50	4.00	4.00	5.00
24	26.10	24.96	20.73	9.50	4.00	4.00	5.00
26	19.68	18.82	15.63	9.50	4.00	4.00	5.00
MDR							
121	14.64	14.00	11.63	9.50	4.00	4.00	5.00
122	11.27	10.78	8.95	9.50	4.00	4.00	5.00
123	11.68	11.18	9.28	9.50	4.00	4.00	5.00
131	11.70	11.19	9.29	9.50	4.00	4.00	5.00
132	11.70	11.19	9.29	9.50	4.00	4.00	5.00

133	11.70	11.19	9.29	9.50	4.00	4.00	5.00
134	11.70	11.19	9.29	9.50	4.00	4.00	5.00
135	11.70	11.19	9.29	9.50	4.00	4.00	5.00
136	12.47	11.93	9.90	9.50	4.00	4.00	5.00
137	11.70	11.19	9.29	9.50	4.00	4.00	5.00
138	18.89	18.07	15.00	9.50	4.00	4.00	5.00

Table 6-7: Road traffic growth rate (2014-21)

NH/SH/MDR No.	Car	Bus	Truck	2-W	Cycle & Rickshaw	ADV	Others (Includes Tractor & Trailor)
NH							
Delhi-Panipat-1	11.20	10.71	8.90	12.50	4.00	4.00	5.00
Delhi-Palwal-2	8.31	9.75	6.60	9.00	2.00	2.00	2.00
Palwal-Hodal-2	8.31	9.75	6.60	5.00	2.00	2.00	5.00
Delhi-Gurgaon-8	9.72	9.30	7.72	5.00	4.00	2.00	4.00
Gurgaon-Bawal-8	10.83	10.36	8.60	10.10	2.00	1.00	2.00
Delhi-Hisar-10	8.84	8.46	7.02	5.00	5.00	5.00	5.00
Rewari-Rohtak-71	10.62	10.15	8.43	10.10	2.00	1.00	2.00
Rohtak-Panipat-71A	10.17	9.73	8.08	5.00	5.00	5.00	5.00
Rewari-Palwal-71B	10.73	10.27	8.52	5.00	5.00	5.00	5.00
SH							
11	11.66	11.15	9.26	9.50	4.00	4.00	5.00
13	9.72	9.30	7.72	9.50	4.00	4.00	5.00
14	10.74	10.27	8.53	9.50	4.00	4.00	5.00
15-A	10.15	9.23	7.66	9.50	4.00	4.00	5.00
16	10.74	10.27	8.53	9.50	4.00	4.00	5.00
16-A	9.88	9.45	7.85	9.50	4.00	4.00	5.00
18	9.88	9.45	7.85	9.50	4.00	4.00	5.00
20	9.78	9.35	7.76	9.50	4.00	4.00	5.00
22	11.87	11.35	9.43	9.50	4.00	4.00	5.00
24	14.17	13.55	11.25	9.50	4.00	4.00	5.00

26	11.95	11.43	9.49	9.50	4.00	4.00	5.00
MDR							
121	11.20	10.71	8.89	9.50	4.00	4.00	5.00
122	11.27	8.45	7.02	9.50	4.00	4.00	5.00
123	9.57	9.15	7.60	9.50	4.00	4.00	5.00
131	9.02	8.63	7.16	9.50	4.00	4.00	5.00
132	9.20	8.80	7.31	9.50	4.00	4.00	5.00
133	9.02	8.63	7.16	9.50	4.00	4.00	5.00
134	9.02	8.63	7.16	9.50	4.00	4.00	5.00
135	9.02	8.63	7.16	9.50	4.00	4.00	5.00
136	9.64	9.23	7.66	9.50	4.00	4.00	5.00
137	9.02	8.63	7.16	9.50	4.00	4.00	5.00
138	11.87	11.35	9.43	9.50	4.00	4.00	5.00

It is noticed from Table 6-6 and 6-7 that car, bus, truck and two-wheeler traffic is expected to grow at a rate of above 8 percentages per year on most of road sections. Cycle and rickshaw, Animal Drawn Vehicles (ADV) and others (including tractor and trailer) are expected to grow around 4 to 5 percentage per year during the projected period. Share and growth rate of cars, Buses and Trucks are high which will further bring down the level of service of the road network. In order to improve the quality of service on this road network the use of private vehicles (Cars) and commercial Vehicles (Truck) need to be discouraged and at the same time public mode of transportation (Bus and Train) need to be encouraged. In order to encourage the shift from private mode of transportation to public mode of transportation better quality of service on these public modes has to be provided in terms of required frequency with comfortable sitting arrangements. Good conditioned local trains/ metro system connecting Panipat, Rohtak, Rewari, Palwal and Faridabad to the National Capital (Delhi) need to be provided. Also an outer Orbital rail corridor connecting the above cities should be provided on priority basis.

Travel demand on the study network was assessed based on the traffic growth rates given in the Table 6-6 and 6-7 and base year (2009) traffic levels. Shift from road to rail is assumed based on the impact of the potential medium and long haul freight traffic volume road link and the influence of Western Dedicated Freight Corridor. It has been assumed that some capacity on the existing railway network would become available due to the shift from road to orbital rail

corridor. Considering all the above information it has been assumed that the freight traffic demand on the road network would decrease incrementally at the rate of 10% and 20% during 2009-14 and 2014-21 over the study period. Occupancy of Cars in the study area is about 3 and that of buses is about 30. Car and bus passenger forecast suggest that respective vehicle (PCUs) forecast is likely to increase about 3.7 and 3.6 times by the horizon.

Mass Transport (Bus) Impact on Travel Demand

The current share of mass transport and the base forecast of Cars and Buses suggest that greater emphasis need to be given in upgradation of the road based mass transport system. It is assumed that about 20 percent of the car passenger traffic on any link would shift to bus in every time period such that the car passenger traffic share would not be lower than 10 percent. i.e., mass transport share on any link would be a maximum of 90 percent. The impact of this phased increase of mass transport would be that the present percentage share of car passenger traffic of the total passenger traffic will be reduced from 50 percentages to 37 percentages by the horizontal year 2021.

Mass Transport (Rail) Impact on Travel Demand

Link volume of buses on an average would increase from about 500 in the base year (2009) to about 2760 by the horizon year (2021). A very high volume of buses are likely to flow on the network and would be desirable to consider other forms of mass transport that would reduce the load on road network. The other forms could be Sub-Urban Rail System (SURS) or Rapid Rail Transit System (RRTS) or any other form of rail based system. However, development of the same is time dependent and may result in gradual shift of bus passenger traffic to it. Assumed bus to rail shift rates of passenger traffic for the projection years of 2009-14 and 1014-21 is 10 % and 25 % respectively. The impact of rail based mass transport system is that the bus traffic volume on a link on an average would decrease from 2760 to 2060 by year 2021. This suggests that the potential traffic to a rail based system on a route would be about 21000 passengers by year 2021. Various PCU values adopted in this study to calculate the present and projected traffic volume are shown in the Table 6-8.

Table 6-8: PCU values adopted for Vehicle Types

Vehicle Type	PCU
Car	1.0
Bus	3.0
Truck	3.0
2- Wheeler	0.5
Cycle	0.5
ADV	4.0
Others(Tractor and Trailer)	4.5

Present traffic volume (PCUs) on NHs, SHs and MDRs in the study area is shown in the Table 6-9. Traffic forecast considering the impact of both road and rail based mass transport is given in Table-6-10 and Table 6-11. These figures serve to highlight the need for additional transport infrastructure and services.

Table 6-9: Traffic Volume (PCUs) – Year 2009

NH/SH/MDR No.	Car	Bus	Truck	2W	Cycle	ADV	Others	Total
NH								
Delhi-Panipat-1	23130	6189	35136	4398	675	640	12375	82543
Delhi-Palwal-2	24170	4443	28605	7421	1336	344	6309	72628
Palwal-Hodal-2	15110	2913	19557	2964	258	460	4770	46031
Delhi-Gurgaon-8	51230	6141	18651	2605	231	276	2430	81563
Gurgaon-Bawal-8	9010	4800	43983	2012	116	105	1400	61426
Delhi-Hisar-10	4490	1914	9564	1214	540	462	2145	20329
Rewari-Rohtak-71	2980	843	12294	1441	127	65	899	18649
Rohtak-Panipat-71A	4330	1992	24075	1683	820	671	3339	36910
Rewari-Palwal-71B	5870	1860	16941	1929	248	154	1687	28690
SH								
11	9900	1096	8039	8769	4019	1096	3654	36573
13	4000	1331	9390	1676	693	1512	5778	24379
14	2400	266	1953	2131	977	266	888	8882
15-A	3900	121	5186	1182	272	399	3818	14878
16	4400	3597	15618	1803	1860	8312	8987	44577

16-A	1200	2028	2541	440	602	3236	3380	13426
18	7700	657	5454	3081	1080	968	3398	22337
20	700	442	2210	354	324	1077	1432	6538
22	2100	804	9519	747	398	591	6119	20277
24	2400	263	1930	2106	965	263	877	8805
26	5900	658	4828	5267	2414	658	2195	21921
MDR								
121	4900	264	2418	2392	2466	3068	3227	18734
122	400	229	768	286	324	1668	1351	5028
123	1200	594	2951	674	334	1993	3974	11719
131	3600	267	8695	1599	2645	1481	3700	21986
132	3300	180	7541	1623	2280	982	3331	19236
133	2400	612	939	1219	460	242	3979	9850
134	1600	260	4439	920	2358	1839	2230	13646
135	2300	347	6148	1264	2736	1315	2684	16793
136	1400	494	3663	669	621	969	2944	10760
137	9200	501	21424	2577	28	39	561	34330
138	4100	248	4368	1881	1395	2072	6771	20834

Table 6-10 : Projected Traffic Volume (PCUs) by the Year 2014

NH/SH/MDR No.	Car	Bus	Truck	2W	Cycle	ADV	Others	Total
NH								
Delhi-Panipat-1	35920	13380	54815	7924	821	779	15794	129434
Delhi-Palwal-2	31370	8460	37932	11418	1475	380	6966	98001
Palwal-Hodal-2	19560	5490	25934	3782	284	508	6088	61646
Delhi-Gurgaon-8	75590	15390	27691	3324	281	305	2956	125537
Gurgaon-Bawal-8	15250	10080	73192	3255	128	110	1546	103561
Delhi-Hisar-10	6040	3300	13200	1550	689	590	2738	28106
Rewari-Rohtak-71	4960	1920	20277	2332	140	69	992	30690
Rohtak-Panipat-71A	5420	3270	31015	1855	904	740	3681	46886
Rewari-Palwal-71B	9020	3810	25604	2233	287	179	1953	43086
SH								
11	16500	3210	13253	13805	4890	1334	4663	57655
13	5900	2610	13942	2638	843	1839	7374	35146

14	3500	690	2881	3355	1188	324	1133	13071
15-A	5600	570	7483	1860	331	486	4873	21202
16	6500	6270	23031	2838	2263	10113	11469	62485
16-A	1800	3510	3810	693	732	3937	4313	18795
18	11500	1920	8179	4850	1313	1178	4336	33276
20	1000	780	3241	558	394	1311	1827	9111
22	3900	1980	17231	1176	484	719	7809	33299
24	5900	1170	4454	3315	1174	320	1120	17453
26	11500	2250	8982	8292	2937	801	2801	37564
MDR								
121	7700	990	3772	3766	3000	3733	4118	27078
122	500	390	1061	451	395	2030	1725	6551
123	1600	1050	4139	1061	407	2424	5072	15752
131	5000	750	12202	2517	3218	1802	4722	30210
132	4500	600	10582	2555	2774	1194	4251	26456
133	3300	1170	1317	1919	559	295	5078	13638
134	2200	570	6230	1448	2868	2237	2846	18400
135	3200	750	8627	1989	3329	1599	3425	22920
136	2000	930	5285	1053	756	1179	3757	14961
137	12800	1620	30065	4056	34	47	716	49338
138	7700	1080	7907	2961	1697	2521	8642	32506

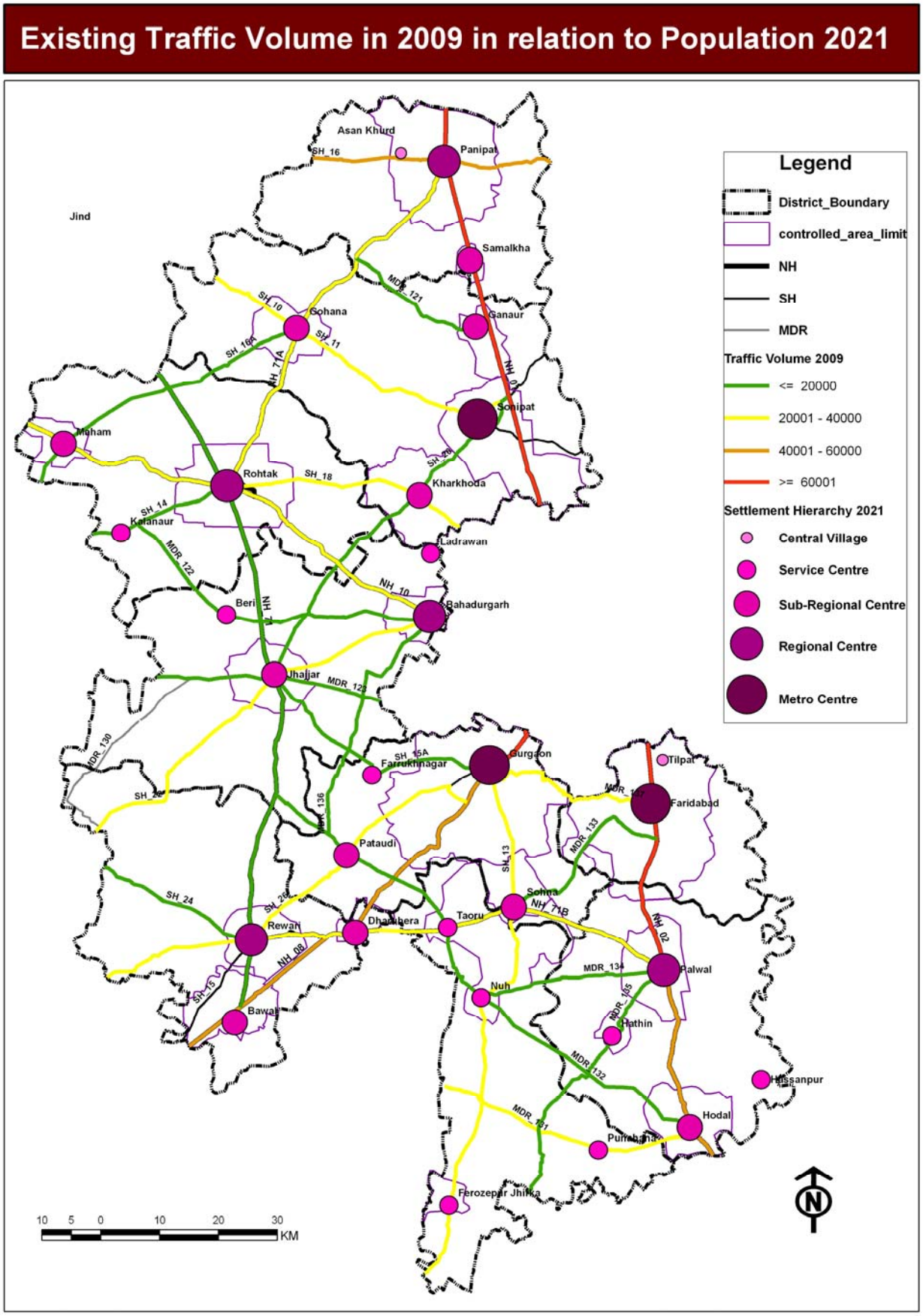
Table 6-11: Projected Traffic Volume (PCUs) by the Year 2021

NH/SH/MDR No.	Car	Bus	Truck	2W	Cycle	ADV	Others	Total
NH								
Delhi-Panipat-1	60270	26310	88500	18073	1081	1025	22224	217482
Delhi-Palwal-2	45480	15360	52742	20873	1694	436	8001	144587
Palwal-Hodal-2	28250	9930	36060	5322	327	583	8566	89038
Delhi-Gurgaon-8	115910	30600	41424	4678	369	350	3890	197221
Gurgaon-Bawal-8	24380	18360	115910	6384	147	118	1775	167075
Delhi-Hisar-10	8490	5430	18866	2181	969	830	3852	40618
Rewari-Rohtak-71	7980	3630	31759	4573	161	74	1140	49317
Rohtak-Panipat-71A	8470	5730	47496	2610	1272	1042	5180	71800
Rewari-Palwal-71B	14420	7230	40339	3143	404	251	2748	68535

SH								
11	28100	7410	21897	26058	6435	1755	6562	98217
13	8800	4620	20857	4979	1109	2420	10376	53161
14	5600	1470	4541	6332	1564	426	1595	21528
15-A	8700	1410	11151	3511	435	639	6856	32703
16	10700	10950	36309	5358	2978	13308	16138	95741
16-A	2800	5640	5748	1307	963	5181	6069	27709
18	17900	4020	12339	9155	1728	1550	6101	52793
20	1600	1320	4861	1053	519	1725	2571	13648
22	6800	3900	28781	2221	637	946	10989	54273
24	11800	3120	8350	6257	1545	421	1576	33070
26	19800	5250	15061	15651	3865	1054	3941	64623
MDR								
121	12800	2460	6086	7108	3947	4912	5794	43108
122	800	660	1517	851	520	2671	2427	9445
123	2500	1740	6143	2003	535	3190	7136	23248
131	7200	1560	17599	4750	4234	2371	6644	44359
132	6700	1290	15414	4822	3650	1572	5982	39430
133	4700	2040	1900	3622	736	388	7146	20531
134	3300	1020	8985	2733	3775	2944	4005	26762
135	4700	1380	12443	3755	4381	2105	4820	33583
136	3000	1590	7876	1988	995	1552	5286	22287
137	18600	3570	43364	7657	45	62	1007	74305
138	13500	2700	13206	5588	2233	3317	12160	52704

Design Service Volume considered for the various lane configurations of roads having paved shoulders are given in Table-6-12. As per IRC-64 -1990 section 6.2, LOS C could be adopted for roads other than major roads. Design Service Volume (DSV) of State Highways (SHs), designed for level of service C, can be taken as 40% higher than those for LOS B.

Map 6-3 : Traffic Volume in 2009



Map 6-4 : Projected Traffic Volume in 2021

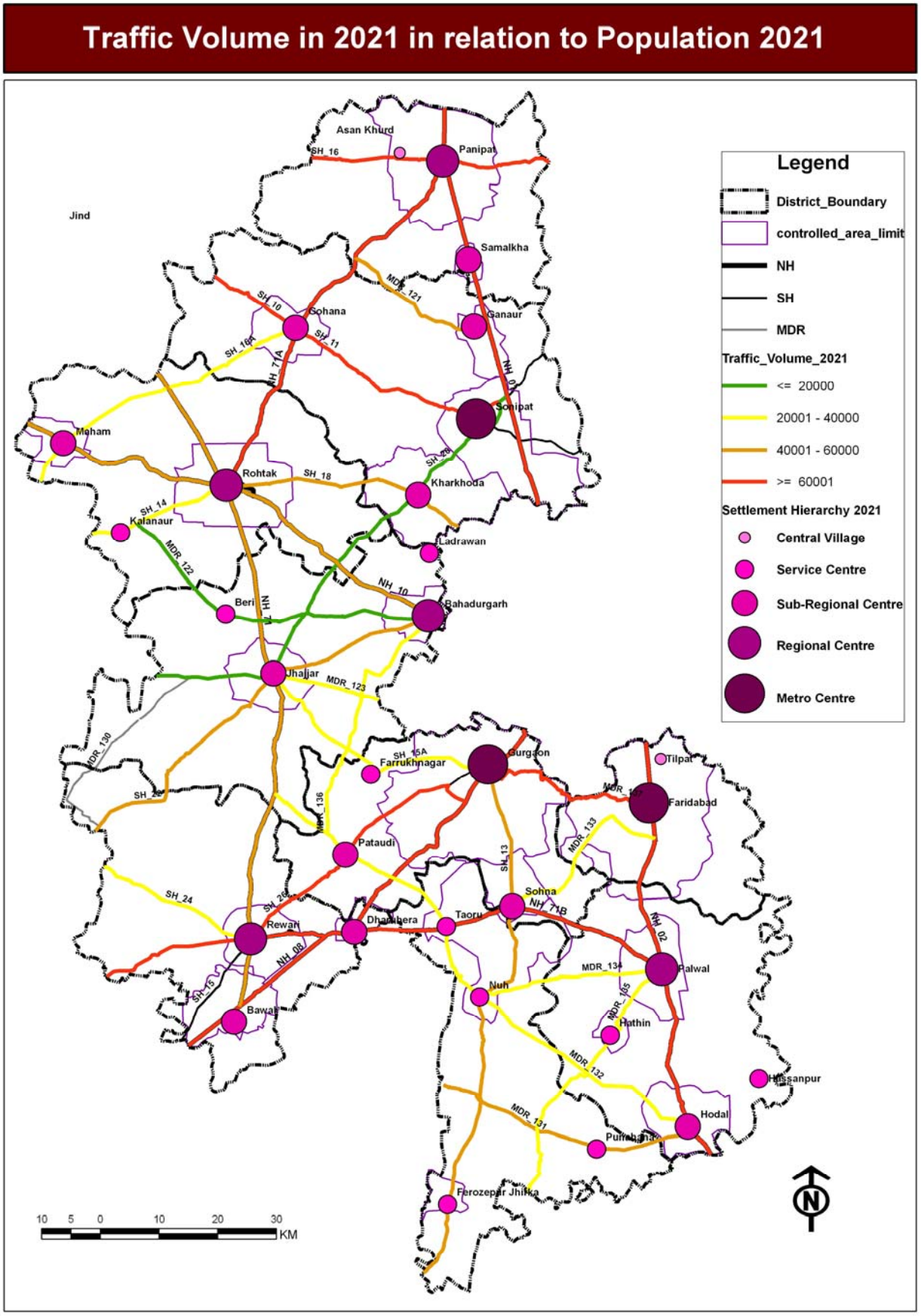


Table 6-12: Design Service Volume of Multi-lane Highways

Lane Configuration	Design Service Volume (PCUs/Day)	
	NH	SH/MDR
2-Lanes	17250	24150
4-Lanes	40000	56000
6-Lanes	60000	84000
8-Lanes	80000	112000

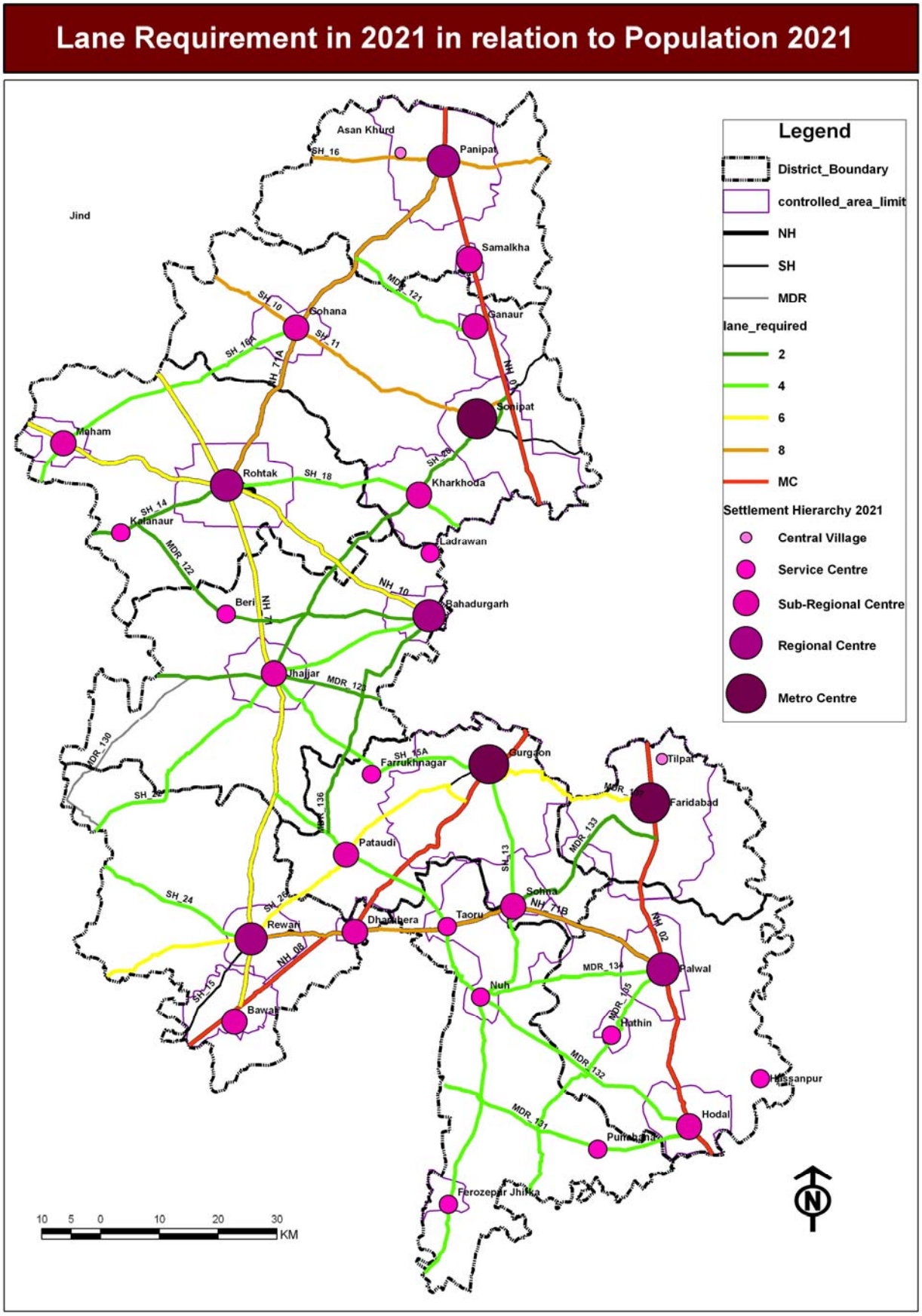
Future lane requirements were assessed based on these limits and shown in the Table 6-13. It has been assumed that the traffic demand over and above that which can be served by an 8-Lane facility would have to be met by the development of an additional road corridor thus results in the requirement of Multi-lane Corridors (MC) is proposed.

Table 6-13 : Future Traffic Lane Requirements on roadways of Haryana Sub-region

NH/SH/MDR No.	Traffic Forecast (PCU)-Expected			Lanes Required		
	2009	2009-14	2014-21	2009	2009-14	2014-21
NH						
Delhi-Panipat-1	82543	129434	217482	MC	MC	MC
Delhi-Palwal-2	72628	98001	144587	8	MC	MC
Palwal-Hodal-2	46031	61646	89038	6	8	MC
Delhi-Gurgaon-8	81563	125537	197221	MC	MC	MC
Gurgaon-Bawal-8	61426	103561	167075	8	MC	MC
Delhi-Hisar-10	20329	28106	40618	4	4	6
Rewari-Rohtak-71	18649	30690	49317	4	4	6
Rohtak-Panipat-71A	36910	46886	71800	4	6	8
Rewari-Palwal-71B	28690	43086	68535	4	6	8

SH						
11	36573	57655	98217	4	6	8
13	24379	35146	53161	2	4	4
14	8882	13071	21528	2	2	2
15-A	14878	21202	32703	2	2	4
16	44577	62485	95741	4	6	8
16-A	13426	18795	27709	2	2	4
18	22337	33276	52793	2	4	4
20	6538	9111	13648	2	2	2
22	20277	33299	54273	2	4	4
24	8805	17453	33070	2	2	4
26	21921	37564	64623	2	4	6
MDR						
121	18734	27078	43108	2	4	4
122	5028	6551	9445	2	2	2
123	11719	15752	23248	2	2	2
131	21986	30210	44359	2	4	4
132	19236	26456	39430	2	4	4
133	9850	13638	20531	2	2	2
134	13646	18400	26762	2	2	4
135	16793	22920	33583	2	2	4
136	10760	14961	22287	2	2	2
137	34330	49338	74305	4	4	6
138	20834	32506	52704	2	4	4

Map 6-5 : Future lane requirement in 2021



6.1.2.ii Implications of the Forecasts

Key Implications: - The following implications from these growth forecasts are highlighted:

- The roads in the Haryana Sub-region will become more congested, as the overall area becomes more highly urbanized.
- Avoid encouraging significant increases in car journey trip lengths as accessibility increases, as this result in simply more traffic.
- Need to improve and introduce significant amounts of public transport infrastructure and services, and introduce demand management techniques to reduce car use.
- Need to encourage shift of medium and long haul freight traffic onto the railways, and maximize their efficiency.
- Need to encourage and provide land use close to work, to minimize the need to travel.
- Changes to the ways in which tolls are currently charges may need to be considered, e.g. it may be necessary to charge different toll levels at different locations.

In the future there may be different characteristics in terms of changing PCUs factors for different vehicle types (as vehicle efficiency increases); there may be changed travel patterns (e.g. more inter-peak travel outside the peak times); freight movements will increasingly move towards Just-in-Time delivery mechanisms.

6.1.3 Road Development Program in NCR

Existing and planned Expressways in the NCR area include:

- NCR Regional Plan proposes to develop the existing Ring Road, Outer Ring Road and the five radial roads (NHs) up to the NCR towns as expressways (i.e. NH1 Delhi to Kundli, NH2 Delhi to Ballabgarh, NH8 Delhi to Gurgaon, NH10 Delhi to Bahadurgah and NH24 Delhi to Ghaziabad).

- The NCR Regional Plan also proposes that all NCR towns should be connected with each other through the Peripheral Expressway consisting of Kundli – Manesar – Palwal (KMP) Western Peripheral Expressway and the Kundli – Ghaziabad – Palwal (KGP) Eastern Peripheral Expressway (Faridabad – Noida – Ghaziabad Corridor and Ghaziabad – Kundli Corridor). These are to be implemented as a priority in the first phase.

- The NCR Regional Plan also proposes that all the Metro and Regional Centres to be connected with perimeter roads of expressway standard to act as a bypass for through traffic.

- Yamuna Expressway (Delhi – Agra): Yamuna expressway will relieve NH-2 which is already congested and runs through the heart of cities like Faridabad, Ballabgarh and Palwal. It will reduce the travel time between New Delhi and Agra and help in industrial and urban development of the region also.

Other hierarchical road systems for the regional towns were proposed to be developed to cater for the intra-urban traffic for all the priority towns.

On the basis of analysis and projections various proposals has been identified for the proper growth and development of Haryana Sub-region which is described in detail in chapter-14.

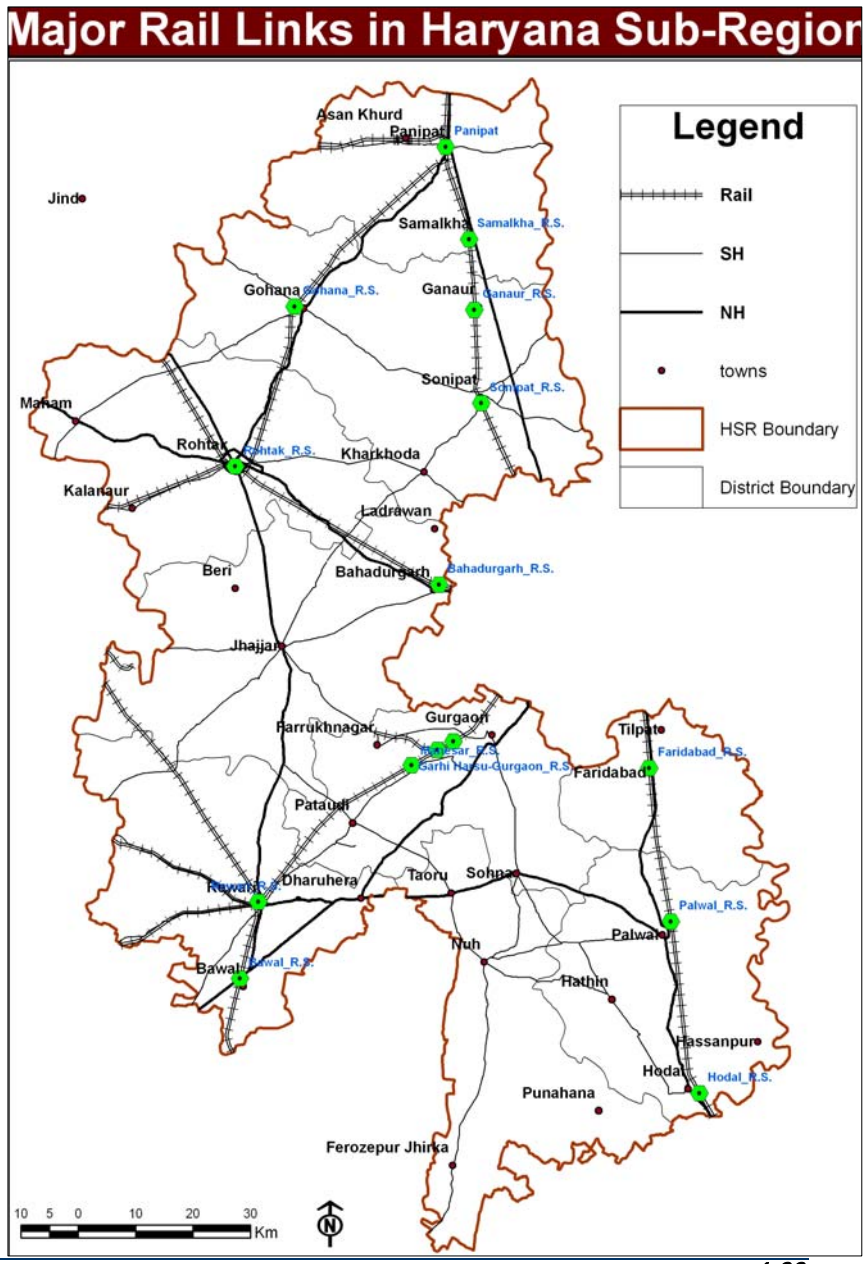
6.2 *Railways*

Indian Railways play a major role in India's industrial and economic development by catering the needs of both Freight and passenger traffic. Haryana state is currently served by about 1700 route kilometers of rail network. About 625 route kilometers, comprising about 35% of rail routes in Haryana state is serving Haryana sub-region of NCRS.

6.2.1 Current Status of Rail Network

Rail network in Haryana sub-region of NCR is administered by Northern (65%), North Western (24%) and North Central Railways (11%) of Indinan Railways. Rail network serving Haryana sub-region is shown in Fig 6-4

Figure 6-4: Rail Networks in the Sub-Region



Presently all rail lines are used by both freight and passenger trains and in movement passenger carrying trains take precedence over freight trains. The freight traffic from Haryana includes mainly food grains, oil seeds and sugar.

Rail routes serving Haryana sub-region and their capacity utilization is indicated in the table 6-16 below:

Table 6-16: Rail Routes serving Haryana Sub-Region

S.No.	Route Details	Administrative Rail Zone	Length in Haryana sub-region of NCR	Capacity utilization %
1	Delhi - Gurgaon-Rewari-Bawal-Alwar	N.R	100	80 - 150
2	Delhi-Rohtak-Jakhal - Bhatinda	N.R	60	100 -130
3	Rohtak - Panipat	N.R	143	60-75
4	Delhi - Sonepat - Ambala	N.R	75	100 - 140
5	Panipat - Jind	N.R	25	60-75
6	Rohtak - Bhiwani	N.R	30	70-80
7	Garhi Harsaru - Farukhnagar	N.R	11	40-60
8	Rewari-Dabla-Ringus-Phulera	NWR	25	75 -90
9	Rewari-Bhiwani-Hisar	NWR	50	100
10	Rewari-Sadulpur-Bikaner	NWR	35	50 – 75
11	Delhi- Faridabad-Palwal-Mathura	NCR	70	130 -160

More than 50% of rail route kilometers serving the sub-region are already over saturated and have capacity utilization of over 100%.

Important routes which carry bulk of freight and passenger traffic in nHaryana sub-region of NCR are: Delhi- Faridabad-Palwal-Mathura, Delhi - Sonepat – Ambala, Delhi-Rohtak-Jakhal – Bhatinda, Delhi - Gurgaon-Rewari and Rewari-Bhiwani-Hisar.

Delhi- Faridabad-Palwal-Mathura

This route is part of the western corridor (Delhi – Mumbai via Kota, Ratlam) of Indian Railway's Golden Quadrilateral and is highly saturated. It is dominated by passenger movements. On this section, jurisdiction of Northern Railway extends upto Palwal station (inclusive) and thereafter the section is under the control of Agra Division of North-Central Railway. This is a major artery, which carries heavy mixed traffic from Central and Western India. 65 passenger carrying trains and over 50 freight trains each way are operated daily on this vital sub section of Indian Railway with 150% line capacity utilization, introduction of any new passenger/freight train on this sub section becomes a major issue. Palwal, Faridabad, Ballabgarh, Kosi Kalan and Tuglakabad are the major contributors of commuter traffic. Freight traffic moving on the route comprises Containers, Food grains, Fertilizers, Coal, Iron & Steel and Petroleum products. This is one of Indian Railway's high density (HDN) routes. Bulk of freight traffic moving on this route is likely to get diverted to Western DFC

Delhi - Sonepat – Ambala,

The NCR limit on this rail corridor extends upto Panipat station at a distance of 89 km from Delhi. The section is an electrified double line rail corridor which is extensively utilised for running of inter-city mail / express trains, ordinary passenger carrying trains as well as freight trains to and from Haryana, Punjab, Himachal Pradesh and Jammu & Kashmir. In priority, this sub section falls at third position in NCR, after New Delhi – Aligarh Jn and New Delhi – Palwal sections. With electrified territory it moves around 70 trains each way, including 38 passenger carrying trains each way. Line capacity is saturated with 135% utilization. Panipat, Sonipat, Narela, Naya Azadpur, Ganaur, Samalkha and Sabzimandi contribute a major share in commuter/unreserved traffic.

Delhi-Rohtak-Jakhal - Bhatinda

This is a non-electrified double line section operating on diesel traction system which is utilised for running of mail / express, trains, ordinary passenger and freight trains to and from Haryana, Punjab and Rajasthan. Being a diesel section, seamless operation from and to other vital sections is a challenge for commuter operation. Rohtak, Bahadurgarh, Sampla, Nangloi and Shakurbasti are the major contributors to commuter traffic.

Delhi - Gurgaon-Rewari – Bawal - Alwar

The NCR limit on this rail corridor extends upto Alwar station at a distance of 158 km from Delhi. Gurgaon (DMA town) is situated at a distance of 32 km from Delhi. The entire section is non-electrified running on diesel traction system and catering to inter-city mail / express, trains, ordinary passenger and freight trains. The section upto Rewari (excluding) is double line and falls under the administrative control of Delhi Division of Northern Railway. Beyond that, it is single line and is under Jaipur Division of North-Western Railway.

On Rewari – Gurgaon – Delhi portion of the section 20 passenger trains and 6 freight trains are running each way. Rewari, Pataudi road, Gurgaon, Palam and Delhi Cantt. contribute a major share in unreserved passenger stream. Bulk of freight traffic moving on this route is likely to get diverted to Western DFC. Freight trains to/from Western DFC for/from the ICDs at Patli and Garhi Harsaru would would continue on the section.

Rewari-Bhiwani-Hisar

This is a non-electrified single line section (Figure 6-5). Bulk of rail freight traffic from western India, especially ports on west coast of Gujarat and Maharashtra to/from Ludhiana and Northern Punjab are routed through this section. Presently the section has capacity of 15 trains per direction per day and 15 trains per day including 9 passenger trains are being run.

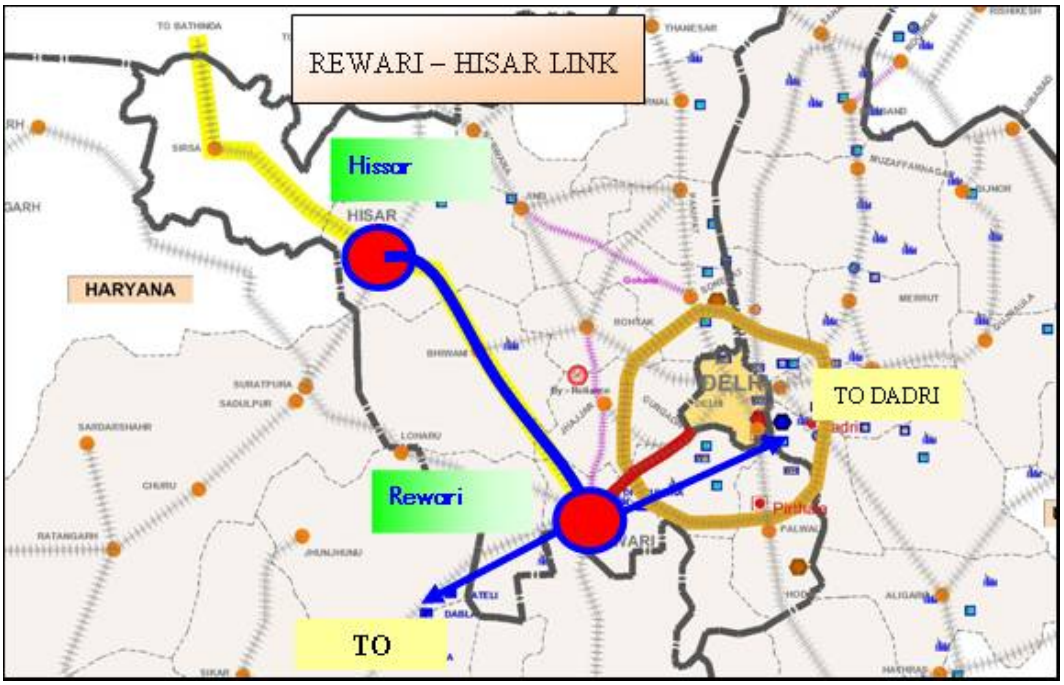


Figure 6-5: Rewari – Hissar Link

Other routes have some spare capacity available to take care of future growth.

6.2.2 Ongoing Development of Rail Infrastructure

In view of the anticipated national growth in freight traffic to over 1100 million tones in 2011-12, besides developing two dedicated freight rail corridors (DFCs) Indian Railways have prepared a blue print for augmentation of line capacity of High Density Network (HDN) routes. There are 7 such routes, which include all the 6 routes of Golden Quadrilateral and its Diagonals, high-density feeder/alternative routes associated with them.

HDN Routes which also serve Haryana sub-region of NCR are:

- Delhi- Mathura - Mumbai (via Kota-Ratlam),
- Delhi- Rewari- Ringas-Phulera-Ajmer
- Delhi – Rohtak – Jakhal – Bhatinda
- Delhi – Panipat - Ambala

In addition Western DFC is likely to be available for traffic in 2017. While substantial quantum of freight traffic on Delhi- Mathura - Mumbai (via Kota-Ratlam) and Delhi- Rewari – Alwar/Ringas – Phulera - Ajmer is likely to get diverted to this DFC, the released capacity is likely to be absorbed by growth in passenger and remaining goods traffic streams. Capacity on these routes is being augmented. Capacity on Delhi – Rohtak – Jakhal – Bhatinda and Delhi – Panipat - Ambala is also being augmented.

In appreciation of likely growth in freight and passenger traffic, Indian Railways have already undertaken capacity augmentation measures and strengthening of alternate routes. These measures can be grouped under four categories:-

I. New rail links
II. Doubling of existing freight line stretches
III. Conversion of Meter/Narrow Gauge to Broad Gauge
IV. Other Development Works

Development works which impact traffic flows in Haryana sub-region of NCR will include:

i) New rail links:

a) Rewari-Rohtak (81.26kms)-work in progress
b) Jind-Sonepat (98.9kms)

ii) Doubling

a) Provision of 4th line between Tughlakabad and Palwal (33.5km) and
b) Provision of 3rd line between Palwal and Mathura-Work in progress.
c) Rewari-Alwar-Bandkui-Jaipur (224.9Kms)

iii) Gauge Conversions (Metre Gauge to Broad Gauge):-

a) Rewari-Delhi(83.0 kms) – second line Completed in 2007-08
b) Rewari-Ringas-Phulera(294.57kms) - Completed in 2007-08

Other developmental works include creation of passenger terminals at Bijwasan on Delhi – Rewari and at Holambi kalan on Delhi – Rohtak – Bhatinda sections for augmenting the passenger train handling capacity in Delhi area, which will help running of more trains on these sections serving Haryana sub-region of NCR.

A Regional Rapid Transit system connecting Gurgaon, Manesar and Bawal is being studied as part of the development of Delhi Mumbai Industrial Corridor in the Haryana Sub region.

Industrial activity of the magnitude envisaged in Haryana sub region is bound to increase demand for a faster and reliable passenger transport system connecting various areas of activities. Rail based passenger transport system, by virtue of being space and energy efficient is preferable to road based. Therefore rail based mass rapid transit system should be provided for meeting with the increase in passenger traffic.

Proposed Orbital Rail

The NCR-RP 2021 has proposed an Orbital Rail corridor along the Western and Eastern peripheral expressways. This was intended to divert through goods trains to avoid Delhi Area. However, as intense urbanization has been proposed along these expressways, it would not be practicable to use this rail corridor for bypass movements. Hence, the rail corridor connecting Panipat-Gohana-Rohtak-Rewari-Palwal-Khurja-Hapur-Meerut-Panipat is proposed to be developed as the new Rail Orbital Corridor to enable diversion of through movements avoiding

Delhi area. This revised Orbital Rail Corridor (ORC) though primarily envisaged to enable diverting goods trains to avoid Delhi, would also serve as a regional commuter service corridor as it inter-connects regional centres.

Traffic Potential

Gurgaon has already become a metropolitan city with an estimated population of more than one million. Roads connecting it to Delhi and Faridabad are already congested. Regional centres (with population ranging between 3 lakh and ten lakh) will increase from one in 2001 to five in 2021, and sub-regional centres (with population ranging between 50.000 and three lakh) will increase from 6 to 11. Population of Haryana sub-region is estimated to grow by 166 % from 86.87 lakhs in 2001to 231.17 Lakhs in 2021.Growth of this magnitude in population will increase demand for travel manifold.

In the project report for "Integrated Transportation Plan for NCR" it has been brought out that two-third of the trips are made for work and education purposes. Further it has been concluded that a large share of people expressed their opinion in favour of commuter rail (86.6%) ranking it as their first choice followed by their preference for Metro services (57.7%) as second choice, HCBS as third choice (55.6%) and ordinary bus service as their last choice(56.7%).

Rail Projects envisaged in"Integrated Transportation Plan for NCR"

For Haryana sub-region, following rail projects has been included in the development programme.

New Rail Links

1. Rewari-Bhiwadi-Palwal
2. Rewari – Rohtak, (already under Construction)
3. Sonipat – Jhajjar,
4. Jhajjar – Gurgaon,
5. Gurgaon – Faridabad,
6. Sonipat – Jind,(already under implementation)

Projects at S.No.2 and 6 are already under implementation.

Introduction of Regional Rapid Transit/Regional Metro System

Delhi – Panipat,

Delhi – Rewari,

Delhi – Rohtak,

Gurgaon-Manesar-Rewari

Faridabad - Palwal

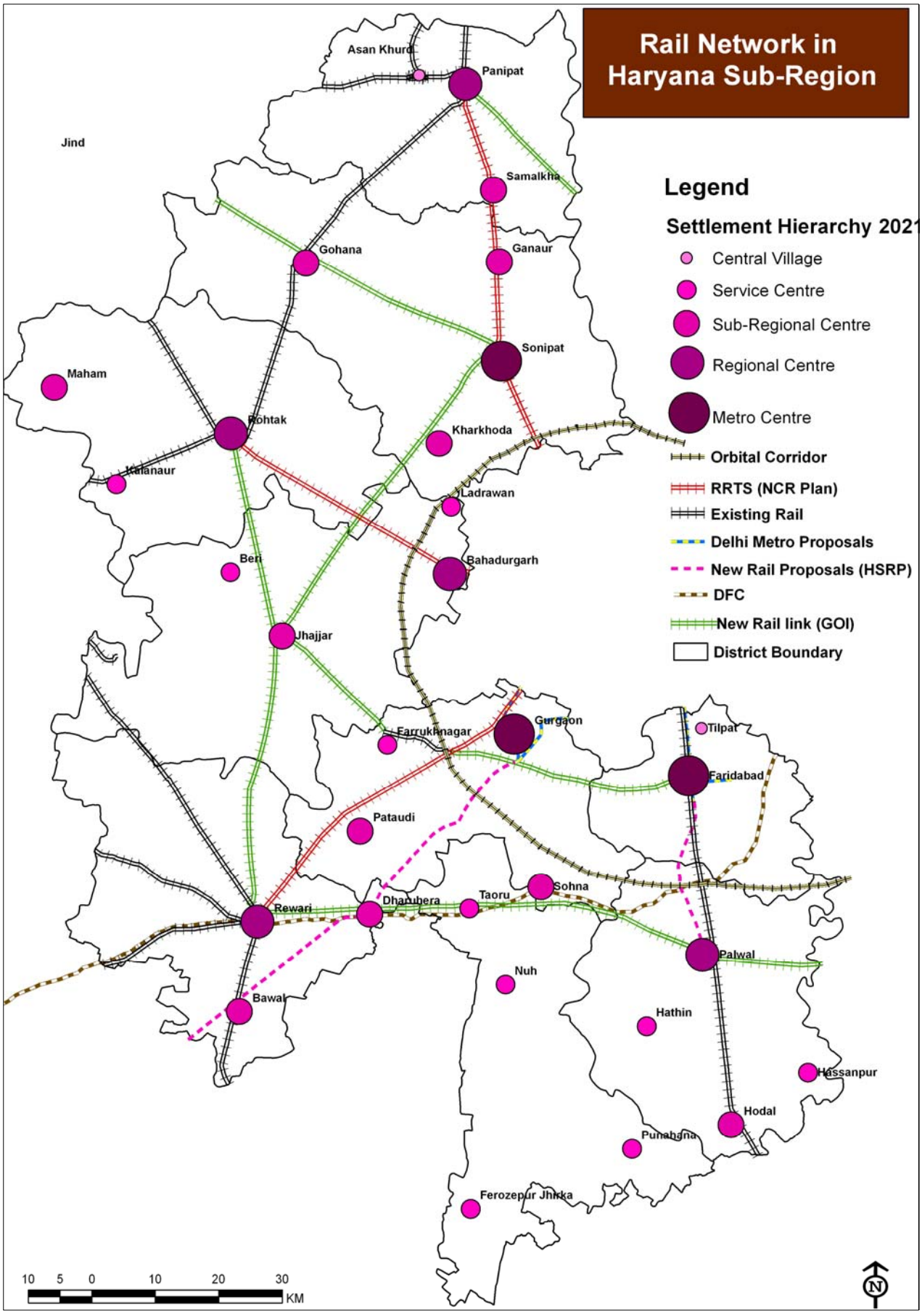
Rail Projects for Commuter Traffic

In view of above observations in the project report for" Integrated Transportation Plan for NCR in addition to development works for rail network mentioned above following projects need to be vigorously pursued at appropriate level for meeting the future demand for transport in the sub-region:

- Regional Rapid Transit rail system linking Gurgaon with Dharuhera and Bawal,
- Commuter rail linking Rewari, Dharuhera, Sohna and Faridabad,
- Commuter rail linking Gurgaon and Faridabad,
- Electrification of Rewai-Gurgaon-Delhi and introduction of EMU type trains for catering to commuter traffic,
- Electrification of Delhi – Rohtak section and introduction of EMU type commuter trains.

Below figure shows existing, proposed rail links by GOI and proposals of Sub-Regional plan.

Map 6-6 : Existing and proposed rail links by GOI



Chapter 7 : Power

7.1 POLICY GUIDELINES AND VISION STATEMENT

7.1.1 POLICY GUIDELINES

Govt. of India has issued the following broad guidelines as the National Electricity Policy:

(i) Access to electricity: Available for all house-holds by 2012,

(ii) Per capita availability of electricity to be increased to over 1000 units by 2012,

(iii) Minimum consumption of 1 unit / house hold / day as a merit good by year 2012,

(iv) Reliable RE system aiming at creation of Rural Electrification Distribution Backbone (REDB),

(v) Overcoming Energy & Peaking Shortages and adequate spinning reserves (at least 5%) by 2012,

(vi) SERCs to prepare action plan for reduction of losses with adequate investments and improvement in governance so as to bring losses in line with International practices by 2012,

(vii) Promotion of HV Distribution System for reduction of technical losses, prevention of theft, improved voltage profile and better consumer services,

(viii) Adoption of suitable load management techniques to reduce the requirement of capacity addition through Peak Load Clipping, Valley Filling, Load Shifting, etc,

(ix) Ensuring adherence to energy efficiency standards through better Demand Side Management in agriculture, industrial and general sectors,

(x) State Governments to prepare five year plan with annual milestones to bring down T&D losses.

NCR Haryana Sub-region largely meets the goals i) to iv) stated above; but added emphasis is needed for initiating actions, expediting the process and achieving rest of the goals.

7.1.2 VISION STATEMENT

Haryana has been witnessing doubling up of power demand every 5 (five) years and the development in the sub-region is even faster. The vision for Power Plan - 2021 for the sub-region is stated as the planning and development of an installed generation capacity of 3 times of that available at present so as to meet the expected rise in demand of power and energy in the sub-region by over 2.5 times of that reflected at present. And this can be done only by immediate sorting out of the key issues and prioritizing release of held up generation, transmission and distribution capacities through improvement in quality of service, drastic reduction in AT&C losses, efficient load side as well as demand side management

7.2 IDENTIFICATION OF SUB-ZONES AND FUTURE DEVELOPMENT POLICY

7.2.1 IDENTIFICATION OF SUB-ZONES

On the basis of present state of industrial and commercial development, Haryana / NCR sub-region can be classified into three sub-zones, namely;

Table 7-1 : Power Sub-Zones of Haryana Sub-Region

High development level sub-zone-I	Medium development level sub-zone-II	Low development level sub-zone-III
Faridabad, Gurgaon & Rewari	Panipat, Sonipat, & Rohtak	Palwal, Mewat & Jhajjar

7.2.2 FUTURE DEVELOPMENT POLICY

A number of infrastructure development schemes including, transport hubs & corridors, special economic zones (SEZs), new townships and model industrial areas have been planned in the Haryana sub-region. The Sub-region also surrounds the National Capital on three sides which gives it an advantage in the matter of development. The rising standards of living arising from better incomes and increased purchasing capacity of general population in this region shall certainly result in higher consumption rate of electricity and incremental load growth requiring higher investment levels than envisaged in the present planning process. The future development policy for the sub-region may have to take in to account the factors stated above and other constraints.

7.2.2.i Key Issues:

Certain key issues briefly stated here under that make adequate planning and free flow of needed investment rather difficult:

1) Inferior operational performance of power utilities leading to poor revenue cash flow,

2) Inadequate capital mobilization for sector expansion, and

3) Absence of mechanism to guarantee professional management of power sector.

7.2.2.ii Future Development Policy:

Unlike most other infrastructure sectors, development of generation capacities and the inter-state and to a good extent the intra-state transmission infrastructure are global in nature and grid specific. These can not be strictly located within the boundaries of or dedicated solely to the sub-region. The regional transmission system and the distribution networks are; however, region and area specific. Power plan - 2021 for the sub-region shall, therefore, be required to be based on the policy of an integrated development of generation and transmission capacity for Haryana and the National grids with special emphasis on locating added relevant transmission capacity and all the distribution infrastructures required to meet the demands of the sub-region within the sub-region boundaries. The power plan – 2021 for the sub-region is thus reflected in the state plan - 2021 for generation and transmission. The plan for distribution etc would be sub-region specific.

7.2.2.iii Resource Mobilization & Implementation Policy:

Haryana sub-region would largely depend for its generation requirement on Gas and Coal based Thermal Plants. Availability of added generation capacity to meet the rising demand would largely depend upon the ability of the State to harness power generation potential in the neighboring states through determined removal of road blocks in achieving collaborations and speedy implementation of share projects.

Transmission sector in the sub-region would need complete revamping by bringing in visionary and futuristic planning, selection of modern technology like GIS and optimization of lines Right-of-Way, substation automation and communication as well as qualitative improvement in the

construction process. Larger transmission projects should be developed by cultivating public private participation so as to bring in private investment and efficiencies.

Distribution companies would require sorting out the key issues through genuine re-organization; bring in private sector involvement in line with the guiding principles of the Electricity Act-2003. The success of future distribution development policy for the sub-region would depend on the ability of the utilities to cut down AT&C losses by creating empowered technical engineering design and drawing and giving a technical bias to all its new construction and improvement programs and work dedicatedly for demand side management of its system.

7.3 Analysis of Data from Secondary Sources

7.3.1 Time Phased Projection of Population and Urban & Rural to Total Ratio

Table 7-2 : Time frame population projection of Haryana and Sub-Region

Year	Population			NCR Sub-region Urban Rural Ratio	
	Haryana	Sub-region	% of total	% Urban	% Rural
1991	16463648	6469304	39.3	28.2	71.8
2001	21083000	8699213	41.2	34.95	65.05
2011	25014000	11884317	47.51	47.02	52.98
2021	30000000	18422046	61.41	64.41	35.59

The demographic data given above indicates that the rate of rise in population in the sub-region compared to that of the state as a whole as also that in urban areas compared to the rural areas within the sub-region is higher. This establishes a trend towards migration of population from outside to the Haryana sub-region and a progressive increase in urbanization, commercialization and industrialization within the sub-region.

7.3.2 DISTRICT WISE DEMOGRAPHIC PROJECTIONS:

Migration of population from outside to the Sub-region and shift from rural to urban centers within the sub-region are clearly indicated in the table given as follows:

Table 7-3 : Districtwise Population Projection

District	Type	Pop-1991	Pop-2001	Pop-2011	Pop-2021
Faridabad	Rural	743,768	303,158	352,108	378,668
	Urban	733,472	1,055,938	1,750,000	2,900,275
	Total	**1,477,240**	**1,359,096**	**2,102,108**	**3,278,943**
Palwal	Rural	In Faridabad	670,084	778,280	836,987
	Urban	In Faridabad	159,037	289,966	538,328
	Total	In Faridabad	**829,121**	**1,068,246**	**1,375,315**
Rohtak	Rural	531,263	610,524	631,453	645,007
	Urban	245,703	329,604	586,461	832,491
	Total	**776,966**	**940,128**	**1,217,914**	**1,477,498**
Panipat	Rural	483,960	567,470	632,425	652,606
	Urban	214,143	399,969	551,666	776,812
	Total	**698,103**	**967,439**	**1,184,091**	**1,429,418**
Sonipat	Rural	834,666	957,814	1,039,177	1,043,937
	Urban	210,492	321,360	542,486	1,450,000
	Total	**1,045,158**	**1,279,174**	**1,581,663**	**2,493,937**
Gurgaon	Rural	900,123	560,836	684,645	773,877
	Urban	245,967	326,784	1,067,322	3,988,496
	Total	**1,146,090**	**887,620**	**1,751,968**	**4,762,373**
Mewat	Rural	In Gurgaon	730,449	891,702	1,007,919
	Urban	In Gurgaon	59,300	93,806	149,646
	Total	In Gurgaon	**789,749**	**985,508**	**1,157,566**
Jhajjar	Rural	615,003	679,721	675,371	621,341
	Urban	100,133	201,814	305,243	478,777
	Total	**715,136**	**881,535**	**980,614**	**1,100,118**
Rewari	Rural	515,411	579,124	611,000	596,880
	Urban	95,200	186,227	401,206	750,000
	Total	**610,611**	**765,351**	**1,012,206**	**1,346,880**
Subregion population	Rural	4,624,194	5,659,180	6,296,161	6,557,222
	Urban	1,845,110	3,040,033	5,588,157	11,864,825
	Total	**6,469,304**	**8,699,213**	**11,884,317**	**18,422,046**

The table above show that the population within Haryana NCR Sub-region has been rising exponentially and the ratio of rural to urban population is reversing. This is also indicative of increasing urbanization leading to successively higher standards of living in the NCR Sub-region.

From the data in the tables above it can be assumed that the sub-region is likely to have a GDP growth @ 5 to 6% higher compared to rest of the state. Haryana plan envisages 10% GDP growth per year in the 11th Plan. Consequently, the sub region can expect 15 to 16% GDP growth per year. CEA have assumed elasticity ratio of electrical demand to GDP growth equal to 0.9. Based on the same the annual rise in demand for power in the sub-region shall be 14% at least up to 2011-12 and is likely to average out to 9% from 2012-13 to 2021-22. These assumptions are proposed to be used for assessing power demand during the study period in the sub-region.

7.4 HARYANA SUB-REGION- EXISTING SITUATION & IDENTIFICATION OF ISSUES

7.4.1 POWER REQUIREMENT / AVAILABILITY AND DEFICIT AS ON 31.03.2010

Table 7-4 : Existing Power requirement and deficit in the state and sub-region

Description	2006-07		2007-08		2008-09		2009-10	
	State	Sub-Region	State	Sub-Region	State	Sub-Region	State	Sub-Region
Requirement (MW)	4837	1976	4956	2196	5511	2534	6133	2812
Maximum Power Availability (MW)	4201	1785	4821	1981	4791	2249	5675	2466
Deficit (MW)	636	191	135	215	720	285	458	346
Percentage Deficit	13.1	9.66	2.7	9.79	13.1	11.25	7.4	12.30

The demand for power and energy is based on statistical data reflecting a situation of power roistering, restrictions and poor voltage and other quality parameters. The practice of running tube wells in two or more groups is more due to system constraint than necessitated by tariff policy. From the analysis of connected loads & maximum demand in the sub-region it is concluded that actual demand for power and energy is significantly higher than reflected in the data and indicated in the tables above primarily because of suppression of demand by factors mentioned above.

7.4.2 INSTALLED GENERATION CAPACITY AS ON 31.03.2010

Table 7-5 : Installed generation capacity in State and in the Sub-region as on 31.03.2010:

Sr. No.	Source	Installed Capacity (MW)	Haryana's Share (MW)
(A)	**Haryana's own Generating Stations**		
1*	Faridabad Thermal Power Station	55	55
2*	Panipat Thermal Power Plant.	1367.8	1367.8
3	Rajiv Gandhi TPP	600	600
4	DCRTPP Yamuna Nagar	600	600
5	WYC Hydel Project, Yamuna Nagar & Kakroi HEP	62.7	62.7
	Sub Total (A)	**2685.5**	**2685.5**
(B)	**Partnership Projects**		
1	Bhakra-Nangal Complex	1490	492
2	Dehar Power Plant	990	317
3	Pong Power Plant	396	66
	Sub Total (B)	**2876**	**875**
(C)	**Share in Central Generating Projects.**		
1	Baira-Siul Hydel Project	198	54.9
2	Salal Hydro-Elect. Project Stage-I & II	345 (690)	104

Sr. No.	Source	Installed Capacity (MW)	Haryana's Share (MW)
3	Tanakpur Hydel	94.2	6
4	Chamera Hydel	540	85
5	Chamera-II	300	17
6	Uri Hydel	480	26
7	Dhauli Ganga	280	16
8	Dhulhasti	390	21
9	Tehri Hydel	1000	43
10	Singrauli Super Thermal. Project	2000	200
11	Rihand Super Thermal Project-I	1000	65
12	Rihand Super Thermal Project-II	1000	57
13	Unchahar Super Thermal	840	34.03
14	Unchahar-III	210	12
15	Anta Gas	419.33	25.3
16	Auriya Gas	663.36	38.2
17	Dadri Gas	829.58	40.6
18*	Faridabad Gas	432	432
19	Narora Atomic	440	28.1

Sr. No.	Source	Installed Capacity (MW)	Haryana's Share (MW)
20	RAPP stage-B-4	220	48
21	Tala Hydro	1020	14.99
22	Farakha	1600	14.56
23	Kahalgaon(Bihar)	840	31.75
24	Kahalgaon-II (Bihar)	1500	47.2
25	Mejia (W.B)	250	14.7
	Sub Total (C)		**1541.33**
(D)	**Independent Private Power Projects & Purchase**		
1*	Magnum International Power, Gurgaon	25	25
	Sub Total (D)	**25**	**25**
	Total Installed Capacity available (A+B+C+D) (includes 55 MW FTPH since shut down permanently from 13.04.10)	**Haryana State = 5126.82 MW**	**Sub-region = 1879.80 MW**

* The items in red color are the projects installed within the Sub-Region

7.4.3 EXISTING TRANSMISSION & DISTRIBUTION SYSTEM AS ON 31.03.2010

7.4.3.i District wise Transformation Capacity (MVA)

Table 7-6 : Districtwise transformation capacity

District	400/220 kV	220/132 kV	220/66 kV	220/33 kV	132/33 kV	132/11 kV	66/11 kV	66/33 kV
Gurgaon & Mewat	0	0	1200	0	0	0	1221	46.5
Faridabad & Palwal	1260	0	800	-	0	0	1052	34
Rohtak	0	300	0	0	250	132	0	0
Sonepat	0	350	0	0	320	248	0	0
Panipat	900	400	0	60	276	302	0	0
Jhajjar	315	250	0	0	190	116	0	0
Rewari	0	250	0	0	138.5	188	32	20
NCR Total	**2475**	**1550**	**2000**	**60**	**1174.5**	**986**	**2305**	**100.5**

7.4.3.ii District wise Transmission Line Details

Table 7-7 : Districtwise Transmission line details

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
220 kV lines					
1	Faridabad	220 kV Samayapur-pali Ckt.-1	220kV	10	0.4 Sq inch (Zebra)
2		220 kV Samayapur-pali Ckt.-II	220kV	10	0.4 Sq inch (Zebra)
3		220kV Pali –Palla Ckt.-I	220kV	13.5	0.4 Sq inch (Zebra)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
4		220kV Pali –Palla Ckt.-II	220kV	13.5	0.4 Sq inch (Zebra)
5		220 kV Samayapur Palwal line Ckt-I	220kV	18.906	0.4 Sq inch (Zebra)
6		220 kV Samayapur Palwal line Ckt-II	220kV	18.906	0.4 Sq inch (Zebra)
7		220 kV Palla-NTPC Mujeri Ckt-I	220 kV	13.0	0.5 Sq. inch
8		220 kV Palla-NTPC Mujeri Ckt-II	220 kV	13.0	0.5 Sq. inch
9	Gurgaon, Mewat & Rewari District	220 kV D/C B/Pur-S/Pur Ckt-I	220kV	24	0.4 sq inch Zebra
10		220 kV D/C B/Pur-S/Pur Ckt-II	220 kV	24	0.4 sq inch Zebra
11		220 kV D/C B/Pur- Pali Ckt-I	220 kV	22.27	0.4 sq inch Zebra
12		220 kV D/C B/Pur- Pali Ckt-II	220 kV	22.27	0.4 sq inch Zebra
13		220 kV D/C 52 A- Pali Ckt-I	220 kV	21	0.4 sq inch Zebra
14		220 kV D/C 52 A- Pali Ckt-II	220 kV	21	0.4 sq inch Zebra
15		220 kV Badshapur- Manesar Ckt-I	220 kV	11.72	0.4 sq inch Zebra
16		220 kV Bhiwadi – B/pur Ckt-II	220 kV	22.75	
17		220kV Nunamazra- Daultabad Ckt-I	220 kV	29.89	0.4 sq inch ACSR
18		220kV Nunamazra- Daultabad Ckt-II	220 kV	29.89	0.4 sq inch ACSR
19		220 kV Daultabad –IMT MNS Ckt-I	220 kV	17.99	0.4 sq inch ACSR

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
20		220 kV Daultabad –IMT MNS Ckt-II	220 kV	17.99	0.4 sq inch ACSR
21		220 kV Dadri- Rewari S/C line	220 kV	58.896	0.4 sq inch ACSR
22		220 kV B/Pur – Rewari line	220 kV	79.0	0.4 sq inch ACSR
23		220 kV Bhiwadi – Rewari line	220 kV	23.761	0.4 sq inch ACSR
24	Rohtak	220 kV Panipat- Rohtak Ckt-I	220 kV	63	0.4 sq. inch (Zebra)
25		220 kV Panipat- Rohtak Ckt-II	220 kV	63	0.4 (Zebra)
26		220 kV bahadurgarh- Rohtak Ckt-I	220kV	46.173	0.4 (Zebra)
27		220 kV bahadurgarh- Rohtak Ckt-II	220kV	46.173	0.4 (Zebra)
28		220 KV D/C Bahdurgarh- PGCIL-Nunamajra	220 kV	3.0	
29		220 kV PTPS Panipat-Sonipat Ckt-I	220 kV	52.0	0.4 (Zebra)
30		220 kV PTPS Panipat-Sonipat Ckt-II	220 kV	52.0	0.4 (Zebra)
31		220 kV D/C Sewah-Thermal I&II	220 kV	12.0	0.4 (Zebra)
32		220 kV D/C Sewah-Thermal III&IV	220 kV	12.0	0.4 (Zebra)
		Total		**886.57**	

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
132 kV lines					
1	Faridabad	Nil			
2	Gurgaon, Mewat & Rewari District	132kV S/C Rewari – Jhajjar line	132 kV	45.0	0.2 Sq. inch
3		132kV Rewari – Kosli Ckt-I	132 kV	30.0	0.2 Sq. inch
4		132kV Rewari – Kosli Ckt-II	132 kV	30.0	0.2 Sq. inch
5		132kV S/C Rewari – Bawal line	132 kV	20.0	0.2 Sq. inch
6		132kV S/C Rewari – Baroli line	132 kV	16.8	0.2 Sq. inch
7	Rohtak, Panipat, Sonepat,& Jhajjar District	132 kV Rohtak –Rohtak Ckt-I	132 kV	1.5	0.2 Sq. inch (Panther)
8		132 kV Rohtak –Rohtak Ckt-II	132 kV	1.5	0.2 Sq. inch (Panther)
9		132 kV Rohtak –Sonepat line	132 kV	50	0.15 Sq. inch (Wolf)
10		132 kV Rohtak –MDU Ckt	132 kV	20	0.2 Sq. inch (Panther)
11		132 kV Rohtak –Meham Ckt	132 kV	29	0.2 Sq. inch (Panther)
12		132 kV Rohtak –Gohana Ckt	132 kV	26	0.2 Sq. inch (Panther)
13		132 kV MDU Rohtak –Sampla Ckt	132 kV	18	0.2 Sq. inch (Panther)
14		132 kV Nuna Majra- Bahadurgarh LILO	132 kV	3.6	0.2 Sq. inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
		Ckt			
15		132 kV Nuna majra –Jhajjar Ckt	132 kV	22	0.2 Sq. inch (Panther)
16		132 kV Rewari- Jhajjar Ckt	132 kV	46	0.2 Sq. inch (Panther)
17		132 kV Dadri- kalanaur	132 kV	41	0.2 Sq. inch (Panther)
18		132 kV Nuna majra MIE Ckt	132 kV	11.2	0.2 Sq. inch (Panther)
19		132 kV Narela- Bahadurgarh Ckt	132 kV	35	0.2 Sq. inch (Panther)
20		132 kV Sewah- Panipat Ckt.I	132 kV	8.0	0.2 Sq. inch (Panther)
21		132 kV Sewah- Panipat Ckt.II	132 kV	9.4	0.2 Sq. inch (Panther)
22		132 kV NFL- Panipat Ckt.I	132 kV	2.6	0.2 Sq. inch (Panther)
23		132 kV NFL- Panipat Ckt.II	132 kV	2.6	0.2 Sq. inch (Panther)
24		132 kV Sewah- Samalkha Ckt.	132 kV	17.5	0.2 Sq. inch (Panther)
25		132 kV PTPS-I/C Ckt.I	132 kV	0.5	0.2 Sq. inch (Panther)
26		132 kV PTPS-I/C Ckt.II	132 kV	0.5	0.2 Sq. inch (Panther)
27		132 kV PTPS-Dewana Ckt.I	132 kV	13.2	0.2 Sq. inch (Panther)
28		132 kV PTPS-Dewana Ckt.II	132 kV	13.2	0.2 Sq. inch (Panther)
29		132 kV PTPS-Chandoli Ckt.I	132 kV	15.3	0.2 Sq. inch (Panther)
30		132 kV PTPS-Chandoli Ckt.II	132 kV	15.3	0.2 Sq. inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
31		132 kV PTPS-Panipat Ckt.	132 kV	17.0	0.2 Sq. inch (Panther)
32		132 kV PTPS-Munak Ckt.	132 kV	21	0.2 Sq. inch (Panther)
33		132 kV PTPS-IOC Ckt.	132 kV	17	0.2 Sq. inch (Panther)
34		132 kV PTPS-MadlodaCkt.I	132 kV	11	0.2 Sq. inch (Panther)
35		132 kV Sewah- Ganaur Ckt.	132 kV	29.5	0.2 Sq. inch (Panther)
36		132 kV Murthal- Ganaur Ckt.	132 kV	15.17	0.2 Sq. inch (Panther)
37		132 kV Snp-F/Pur Ckt.	132 kV	0.5	0.2 Sq. inch (Panther)
38		132 kV Snp-F/Pur Ckt.-II	132 kV	0.5	0.2 Sq. inch (Panther)
39		132 kV F/Pur- Harsana line	132 kV	9.0	0.2 Sq. inch (Panther)
40		132 kV F/Pur- Murthal line	132 kV	9.75	0.2 Sq. inch (Panther)
41		132 kV Harsana – Kharkhoda line	132 kV	9.0	0.2 Sq. inch (Panther)
42		132 kV Chandoli- Chhajpur line	132 kV	10.3	0.2 Sq. inch (Panther)
43		132 kV Snp- Rai line	132 kV	14.0	0.2 Sq. inch (Panther)
44		132 kV Kundli- Narela line	132 kV	1.0	0.2 Sq. inch (Panther)
45		132 kV Kundli- Rai line	132 kV	9.0	0.2 Sq. inch (Panther)
46		132 kV Sewah- Israna Ckt.	132 kV	17.2	0.2 Sq. inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
47		132 kV Madloda- SFD line	132 kV	16	0.2 Sq. inch (Panther)
48		132 kV Khakhoda -Rohtak line	132 kV	34	0.2 Sq. inch (Panther)
		Total		**791.19**	
66 kV lines					
1	Faridabad	66 kV BBMB – A-2 Ckt-I	66kV	7.6	0.2 Sq inch (INVAR)
2		66 kV BBMB – A-2 Ckt-II	66kV	7.6	0.2 Sq inch (INVAR)
3		66 kV BBMB – A-2 Ckt-III	66kV	8.9	0.2 Sq inch (Panther)
4		66 kV BBMB – A-2 Ckt-IV	66kV	8.9	0.2 Sq inch (Panther)
5		66 kV line unit Ckt-I of FTPH to A-2 S/S	66 kV	0.547	0.2 Sq inch(Panther)
6		66kV line unit Ckt-II of FTPH to A-2 S/S	66 kV	0.547	0.2 Sq inch(Panther)
7		66kV S/C line unit-III of FTPH to A-2 S/S	66 kV	0.542	0.2 Sq inch(Panther)
8		66kV D/C Ballabgarh Rly, traction Ckt-I	66 kV	1.5	0.15 Sq inch(Wolf)
9		66kV Ballabgarh Rly, Traction Ckt-II	66 kV	1.5	0.15 Sq inch(Wolf)
10		66kV A-2 - Dabriwala (T-Off at Dabriwala to Ckt-IV)	66 kV	0.5	0.2 Sq inch(panther)
11		66kV Oswal - Hydrabad Ckt-I	66kV	3.5	0.2 Sq inch (Panther)
12		66kV Oswal - Hydrabad Ckt-II	66kV	3.5	0.2 Sq inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
13		66kV A-2 - Oswal Ckt-III	66 kV	4.5	0.2 Sq inch (Panther)
14		66kV Hydrabad - Oswal Ckt-III	66 kV	3.5	0.2 Sq inch (Panther)
15		66kV Hydrabad-BBMB Ballabgarh Ckt-I	66 kV	0.85	0.2 Sq inch (Panther)
16		66kV Hydrabad-BBMB Ballabgarh Ckt-II	66 kV	0.85	0.2 Sq inch (Panther)
17		BBMB - Hydrabad Ckt-III	66 kV	0.85	0.2 Sq inch (Panther)
18		66kV S/C line from 220KV BBMB Ballabgarh to Jharsthly.	66 kV	4	0.15 Sq inch(Wolf)
19		66kV NH-3 - Pali Ckt-I	66 kV	4.36	0.4 Sq inch (Zebra)
20		66kV NH-3 - Pali Ckt-II	66 kV	4.36	0.4 Sq inch (Zebra)
21		66kV NH-3 - FCI Ckt-I	66 kV	2	0.2 Sq inch (INVAR)
22		66kV NH-3 - FCI Ckt-II	66 kV	2	0.2 Sq inch (INVAR)
23		66kV Ringmain Line Ckt-I from FCI to A-2	66 kV	2.5	0.2 Sq inch (INVAR)
24		66kV Ringmain Line Ckt-II from FCI to A-2	66 kV	2.5	0.2 Sq inch (Panther)
25		66kV T-off line Ckt-I from TL no. 120 of ring main to Sec-46 Faridabad.	66 kV	1.3	0.2 Sq inch (Panther)
26		66kV T-off line Ckt-II from TL no. 120 of ring main to Sec-46 Faridabad.	66 kV	1.3	0.2 Sq inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
27		66kV BBMB - A-5 Ckt-I	66 kV	6.38	0.2 Sq inch (INVAR)
28		66kV BBMB - A-5 Ckt-II	66 kV	6.38	0.2 Sq inch (INVAR)
29		66kV A-5 - A-4 Ckt-I	66 kV	5.61	0.2 Sq inch (INVAR)
30		66kV A-5 - A-4 Ckt-II	66 kV	5.61	0.2 Sq inch (INVAR)
31		66kV Idgah - Northern India S/C	66 kV	1.3	0.2 Sq inch (INVAR)
32		66kV Globe Steel - Idgah S/C	66 kV	1	0.2 Sq inch (INVAR)
33		66kV A-5 - Globe Steel S/C	66 kV	2.8	0.2 Sq inch (INVAR)
34		T-Off Partap Steel S/C	66 kV	0.4	0.2 Sq inch (INVAR)
35		66kV A-2 – Northern India D/C Ckt-I	66 kV	1.5	0.2 Sq inch (Panther)
36		66kV A-2 – Northern India D/C Ckt-II	66 kV	1.5	0.2 Sq inch (Panther)
37		66kV A-4 - A-3 Ckt-I	66 kV	6.5	0.2 Sq inch (INVAR)
38		66kV A-4 - A-3 Ckt-II	66 kV	6.5	0.2 Sq inch (INVAR)
39		66kV Ford - A-4 Ckt-I	66 kV	3.6	0.15 Sq inch (Wolf)
40		66kV Ford - A-4 Ckt-II	66 kV	3.6	0.15 Sq inch (Wolf)
41		T-Off Escort-II	66 kV	0.5	0.15 Sq inch(Wolf)
42		66kV Sector-31 - Palla Ckt-I	66 kV	4	0.2 Sq inch (INVAR)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
43		66kV Sector-31 - Palla Ckt-II	66 kV	4	0.2 Sq inch (INVAR)
44		66kV A-5 - Badrola. S/C	66 kV	8	0.15 Sq inch(Wolf)
45		66kV Fatehpur - Chhainsa (A-5 - Chhainsa)	66 kV	7.855	0.15 Sq inch(Wolf)
46		66kV A-5 - Fatehpur Ckt-I	66 kV	13.158	0.15 Sq inch(Wolf)
47		66kV A-5 - Fatehpur Ckt-II	66 kV	13.158	0.15 Sq inch(Wolf)
48		Sector-31 - Bhopani	66 kV	10	0.2 Sq inch (Panther)
49		66kV S/C T-off line from TL no. 46 of Ballabgarh - Sohna line to Dhouj	66 kV	2.5	0.15 Sq inch(Wolf)
50		66kV Palla - NH-3 Ckt-I	66 kV	11.3	0.2 Sq inch (INVAR)
51		66kV Palla - NH-3 Ckt-II	66 kV	11.3	0.2 Sq inch (INVAR)
52		66kV Palla - FCI Ckt-I	66 kV	13	0.2 Sq inch (INVAR)
53		66kV Palla - FCI Ckt-II	66 kV	13	0.2 Sq inch (INVAR)
54		66kV S/C T-off line from TL No. 106 of ring main line to 66kV S/S USA	66 kV	1.9	0.2 Sq inch (INVAR)
55		66kV Ballabgarh - Palwal Ckt-I	66 kV	20.0	0.15 Sq inch(Wolf)
56		66kV Ballabgarh - Palwal Ckt-II with LILO at 66kV S/S Bhagola	66 kV	24.0	0.15 Sq inch(Wolf)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
57		66kV D/C Palwal -Mandkola Line Ckt-I	66 kV	10.72	0.15 Sq inch (Wolf)
58		66kV D/C Palwal -Mandkola Line Ckt-II	66 kV	10.72	0.15 Sq inch (Wolf)
59		66kV Palwal - Palwal Ckt-I	66 kV	5.9	0.15 Sq inch (Wolf)
60		66kV Palwal - Palwal Ckt-II	66 kV	5.9	0.15 Sq inch (Wolf)
61		66kV S/C Palwal - Chandhut line.	66 kV	18.0	0.15 Sq inch (Wolf)
62		66kV Fatehpur Biloch to Allawalpur (S/C)	66 kV	9.1	0.15 Sq inch (Wolf)
63		66kV S/C Hathin - Palwal Line.	66 kV	14.2	0.15 Sq inch (Wolf)
64		66kV S/C Palwal - Hodal line	66 kV	31.0	0.15 Sq inch (Wolf)
65		66kV Aurangabad to Hassapur Ckt-I	66 kV	18.5	0.2 Sq inch (Panther)
66		66kV Palwal-Aurangabad Ckt-I	66 kV	14.32	0.2 Sq inch (Panther)
67		66kV Palwal-Aurangabad Ckt-II	66 kV	14.32	0.2 Sq inch (Panther)
68		66lV S/C line from 220KV BBMB to 66kV S/Stn Sohna.	66 kV	32.5	0.15 Sq inch (Wolf)
69		66kV sohna – Tauru line S/C	66 kV	14	0.15 Sq inch (Wolf)
70		66kV Mandkola - Nuh line S/C	66 kV	18	0.15 Sq inch (Wolf)
71		66kV Sohna - Nagina line S/C	66 kV	42	0.15 Sq inch (Wolf)
72		66kV BLB – Palwal-Bhagola T-Off Line	66 kV	1.2	0.2 Sq inch (Panther)

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
73		66kV Hodal - Punhana Line	66 kV	16.26	0.2 Sq inch (Panther)
74		66kV BBMB-Hydrabad	66kV	3.5	U/G 630 mm sq power cable
75		66kV Ford-Escort-II	66kV	3.5	0.2 sq inch ACSR
76		BBMB-Globe Steel	66kV	3.5	U/G 630 mm sq power cable
77	Gurgaon, Mewat & Rewari District	66 kV B/Pur- Sec-56- Ph-IV Ckt-I	66 kV	17.27	0.15 sq inch Wolf
78		66 kV B/Pur- Sec-56- Ph-IV Ckt-II	66 kV	17.27	0.15 sq inch Wolf
79		66 kV B/Pur- Sec-34 Ckt-I	66 kV	7.0	0.15 sq inch Wolf
80		66 kV B/Pur- Sec-34 Ckt-II	66 kV	7.0	0.15 sq inch Wolf
81		66 kV B/Pur- Sec-10 Ckt-I	66 kV	4.1	0.15 sq inch Wolf
82		66 kV B/Pur- Sec-10 Ckt-I	66 kV	4.1	0.15 sq inch Wolf
83		66 kV B/Pur- Gurgaon Ckt-I	66 kV	12	0.125 sq inch
84		66 kV B/Pur- Gurgaon Ckt-II	66 kV	12	0.15 sq inch Wolf
85		66 kV D/C Delhi- Gurgaon Ckt-I	66 kV	42	0.125 sq inch
86		66 kV D/C Delhi- Gurgaon Ckt-II	66 kV	42	0.125 sq inch
87		66 kV Sec-52 A –Sec-44 Ckt-I	66 kV	1.0	0.15 sq inch Wolf

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
88		66 kV Sec-52 A –Sec-44 Ckt-II	66 kV	1.0	0.15 sq inch Wolf
89		66 kV Gurgaon- Rico Line	66 kV	12.0	0.10 sq inch
90		66 kV Gurgaon Maruti Line	66 kV	9.92	0.15 sq inch Wolf
91		66 kV Maruti MUL Line	66 kV	1.25	0.15 sq inch Wolf
92		66 kV Maruti- Sec-23 A line	66 kV	2.2	0.15 sq inch Wolf
93		66 kV Dundahera- Sec-23 A line	66 kV	2.3	0.2 sq inch Panther
94		66 kV D/C B/Pur- Sec-56 Ckt-I	66 kV	14	0.15 sq inch Wolf
95		66 kV D/C B/Pur- Sec-56 Ckt-II	66 kV	14	0.15 sq inch Wolf
96		66 kV Sec-56 – DLF Ckt-I	66 kV	14	0.15 sq inch Wolf
97		66 kV Sec-56 – DLF Ckt-I	66 kV	1.0	0.15 sq inch Wolf
98		66 kV DLF- Dundahera Ckt-I	66 kV	20.54	0.15 sq inch Wolf
99		66 kV DLF- Dundahera Ckt-II	66 kV	20.54	0.15 sq inch Wolf
100		66 kV Sec-52 A- Dundahera Ckt-I	66 kV	12.6	0.4 sq inch Zebra
101		66 kV Sec-52 A- Dundahera Ckt-II	66 kV	12.6	0.4 sq inch Zebra
102		66 kV B/Pur Manesar Line Ckt-I	66 kV	11.775	0.15 sq inch Wolf
103		66 kV B/Pur Manesar Line Ckt-II	66 kV	11.775	0.15 sq inch Wolf

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
104		66 kV Gurgaon –Maneasar Line	66 kV	14.4	0.1 sq. inch
105		66 kV Manesar sec-4- Sec-3 –IMT Manesar Ckt-I	66 kV	2.0	0.2 sq. inch Panther
106		66kV Manesar sec-3 IMT Manesar Ckt-I	66 kV	1.5	0.15 sq inch Wolf
107		66 kV Sec-I manesar-Sec-4 IMT Manesar Ckt-II	66 kV	3.0	0.15 sq. inch
108		66 kV Sec-2 Manesar-Sec-4 IMT Manesar	66 kV	2.5	0.2 sq. inch
109		66 kV Manesar-Pataudi line Ckt-II	66 kV	15	0.15 sq. inch Wolf
110		66 kV Gurgaon Pataudi line	66 kV	23	0.1 sq. inch
111		66 kV Harsaru- Farukh Nagar line Ckt-I	66 kV	14	0.15 sq. inch Wolf
112		66 kV Manesar Bhora Kalan lineCkt-I	66 kV	14	0.15 sq. inch Wolf
113		66 kV B/Pur- Harsaru Line	66 kV	11	0.15 sq. inch Wolf
114		66 kV Sec-1 Manesar-Sec-2 IMT Manesar Ckt-II	66 kV	2	0.2 sq inch panther
115		66 kV Daultabad- sector-9 Ckt-I	66kV	6.257	0.4 sq. inch ACSR
116		66 kV Daultabad- sector-9 Ckt-II	66kV	6.257	0.4 sq. inch ACSR
117		66 kV Daultabad-sector-23 A Ckt-I	66kV	10.783	0.4 sq. inch ACSR

Sr. No.	District / Circle	Name of Existing Line	Voltage	Length (Km)	Type of Conductor
118		66 kV Daultabad- sector-23 A Ckt-II	66kV	10.783	0.4 sq. inch ACSR
119		66 kV Sector-44 to Sector-38 Ckt-I	66 kV	4.59	0.4 sq. inch ACSR
120		66 kV Sector-44 to Sector-38 Ckt-II	66 kV	4.59	0.4 sq. inch ACSR
121		66 kV Sector-52 to Sector-28 Ckt-I	66 kV	4.56	0.4 sq. inch ACSR
122		66 kV Sector-52 to Sector-28 Ckt-I	66 kV	4.56	0.4 sq. inch ACSR
123		66 kV Sector-2 to Sector-23 Ckt-I	66 kV	4.50	0.4 sq. inch ACSR
124		66 kV Sector-2 to Sector-23 Ckt-II	66 kV	4.50	0.4 sq. inch ACSR
	Total	**220 kV= 886.57 Km, 132 kV=791.19 Km, and 66 kV=1080.38 Km**		**1080.38**	

7.4.3.iii Distribution Sub-stations & Lines

Table 7-8 : Distribution Sub-Stations & lines

Sr. No.	Description	*Gurgaon & Mewat	*Faridabad & Palwal	Rohtak	Sonepat	Panipat	Jhajjar	Rewari
1	No. of Existing 33 kV substations	4	1	19	27	19	21	19
2	No. of 33 kV/ 11 kV Transformers	8	2	29	46	40	39	30
3	Capacity in MVA	36.0	12.6	197.8	325.4	272.6	239.5	214.90

Sr. No.	Description	*Gurgaon & Mewat	*Faridabad & Palwal	Rohtak	Sonepat	Panipat	Jhajjar	Rewari
4	No. of 11/0.415 kV DT	12695	14137	4428	11348	10748	5067	9465
5	Capacity in MVA for DT	990.47	934.667	345.639	667.084	867.6	324.414	495.33
6	Length of HT line in Kms	6007	5126.615	2243.83	4334.59	3209	2518	4031.141
7	Length of LT line in Kms	8898	9875.096	2691.60	5700.441	5497	3693	7465.112

* The data for Mewat and Palwal districts is available from their formation year.

The data above indicates high LT / HT ratio contributing to unacceptable levels of technical losses. Many of the transmission lines and most of the distribution lines and substations are over loaded and need augmentation and expansion. The distribution system is not based on technical criteria for planning, design and construction and is also responsible for poor quality of supply and high losses.

7.4.3.iv AT&C Losses in the Sub-Region in percent (%)

Table 7-9 : Percentage of AT&C Losses

Year	HERC Target for DISCOMS	Actual Figures								
		Gurgaon	Faridabad	Rohtak	Sonepat	Panipat	Mewat	Palwal	Rewari	Jhajjar
2002-03	-	29.59	32.11	-	-	-	-	-	32.93	47.15
2003-04	-	26.97	32.27	55.32	39.59	33.57	-	-	23.17	55.32
2004-05	36.8	25.99	30.36	61.08	38.61	36.25	-	-	39.01	61.08

2005-06	32.3	23.87	27.88	61.24	37.11	34.91	-	53.41	42.95	61.24
2006-07	30.5	21.50	26.19	56.21	33.21	29.75	72.96	46.94	38.30	56.21
2007-08	28.5	19.63	22.52	57.74	29.23	29.75	50.51	42.08	15.69	45.30
2008-09	25.0	14.46	18.00	59.83	29.60	28.39	70.08	39.45	32.57	46.00
2009-10	23.0	15.11	19.87	61.35	29.06	28.35	70.05	45.50	28.45	43.30

The values for Rohtak, Sonepat, Panipat and Jhajjar districts for the year 2002-03 are only for Distribution Losses and NOT AT&C losses.

7.4.4 IDENTIFICATION OF ISSUES

1) There always have been deficits in meeting power requirement in Haryana. Further, both peak power demand and annual energy requirement reflected in the published data are suppressed figures. The power demand in Haryana has doubled up every 10 years at a cumulative rate of 9% per year and that in the sub-region doubling up every 5 to 6 years at a cumulative rate of 14%.

2) Haryana is not blessed with many natural resources like rivers, coal mines and gas fields etc. for producing power and Nuclear power option has remained limited. However, nearness to the National Capital and the states with major hydro potential; viz., Himachal Pradesh, Uttrakhand and J&K is an advantage to Haryana. Act-2003 has opened up power sector to trading and feasibility of setting up generation projects anywhere in India. Development of safe technologies and extension of possible war zone have wiped out the disadvantage in exercising nuclear power option. Power transmission now is open to public private participation and the Act encourages total privatization of distribution sector.

3) Haryana needs to enter into collaboration and share projects agreements with neighboring states on its own and central Government set up more nuclear and gas based power projects in Haryana and other neighboring states.

4) Haryana Sub-Region has recorded a high percentage of AT&C losses. Use of low efficiency equipment on load side contributes as adversely as the AT&C losses. It is possible to bring down both AT&C losses and load side wastage to reasonable level with remunerative and self generating investment.

5) The state in general and the sub-region in particular, thus, need higher investments levels than envisaged in the present Planning process so as to wipe out deficit and maintain parity of supply and demand up to 2021. Besides; the state need to work hard on reducing AT&C losses and conserve electricity through demand side management particularly in view of a large agricultural base.

6) Haryana needs to upgrade outdated technical specifications and construction standards, privatize distribution sector, rationalize tariff and invest in load side management to bring down losses to acceptable levels and thereby release generation capacity and save energy.

7.5 LONG TERM DEMAND PROJECTIONS AND POWER PLANNING

7.5.1 ANTICIPATED REQUIREMENT OF POWER IN HARYANA SUB-REGION UPTO 2021-22:

Looking to the rapid development expected and planning of a dedicated freight corridor Kundli-Manesar-Palwal passing around NCR Region a requirement of 8,895 MW by 2021-22 is anticipated in Haryana Sub-Region of NCR as furnished by the state government as per details given below:

Table 7-10 : Districtwise anticipated peak requirement of power

Name of District	Anticipated Peak Requirement of Power (MW)		
	2011-12	2016-17	2021-22
Gurgaon including Mewat.	885	1420	2290
Faridabad including Palwal.	735	1185	1905
Rohtak	300	500	750
Sonepat	400	650	1050
Panipat	550	850	1400
Jhajjar	310	500	800

Name of District	Anticipated Peak Requirement of Power (MW)		
	2011-12	2016-17	2021-22
Rewari	270	435	700
Total	**3450**	**5540**	**8895**

7.5.2 DEMAND FORECAST BY CEA

During the first Meeting of the committee of Power/Energy Principal Secretaries / Financial Commissioners/Secretaries of NCR Planning Board for implementation of policies/proposals of Power Sector of RP-2021 held on 09.03.2009, it was decided that CEA would review and work out the projected demand for power of various constituent Sub-Regions of the NCR. Accordingly CEA has reviewed and worked out the demand projections of power of various constituent regions of the NCR

It has been considered that the per capita consumption of all the constituent Sub-Regions of the NCR shall be equal at the end of 2016-17 & 2021-22. The per capita consumption of NCT of Delhi at the end of 2016-17 & 2021-22 has been considered as benchmark for all the constituent Sub-Regions of NCR. Based upon this per capita consumption, the energy and peak load requirements have been worked out for Haryana Sub-Region of NCR as per details given below:

Table 7-11 : Energy and peak load requirements for Haryana Sub-Region

Energy Requirement (GWh)		Peak Load (MW)		Installed Capacity required (MW)	
2016-17	2021-22	2016-17	2021-22	2016-17	2021-22
34341	48377	5383	7689	7689	10760

However, as per the 17th EPS Report issued by CEA the power demand for the entire State of Haryana is about 6839 MW by the end of 11th Plan (2011-12), 9375 MW by the end of 12th Plan (2016-17) and 12557 MW by the end of 13th Plan (2021-22) and Haryana Sub-Region contributing to 50%, 59% and 71% to the demand respectively for 2011-12, 2016-17 & 2021-22. As against this we estimate that unsuppressed demand for Haryana state shall be 8150 MW by 2011-12. 12403 MW by 2016-17 and 17500 MW by 2021-22. The difference in estimates by SWI and CEA are on account of the following factors:

i) We have taken into consideration a situation with no. power cut and supply to tube wells & rural area in one single group.

ii) We have also taken into consideration a scenario arising out of rapid urbanization of the sub-region due to investment in DMIC, DFC & other similar projects

7.5.3 ANTICIPATED INSTALLED GENERATION CAPACITY IN HARYANA SUB-REGION UPTO 2011-12

Table 7-12 : Anticipated Installed Generation Capacity in Haryana Sub-Region

Sr. No.	Particulars	Availability (MW)
1	Panipat Thermal Power Station, Panipat	1367.8
2	Faridabad Gas power Project, Faridabad	432.00
3	Magnum International Power	25.00
4	MGTPP Jhajjar Case- II (2x660 MW) (90% share)	1188.00
5	IGSTPP Jhajjar (3X500 MW) (50% share)	750.00
6	Adani case-1 bidding (IPP) (1424 MW)	475.00
	Total	**4237.8**

7.5.4 ANTICIPATED INSTALLED GENERATION CAPACITY OF POWER IN HARYANA STATE UPTO 2011.12

Table 7-13 : Anticipated Installed Generation Capacity in Haryana Sub-Region 2011-12

Sr. No.	Particulars	Availability (MW)
1	(a) PTPs and WYC Hydro Electric Station	1430.50
	(b) DCRTPP Yamuna Nagar (2x300 MW)	600.00
	(c) RGTPP Hisar (2x600 MW)	1080.00
	(d) MGTPP Jhajjar Case- II (2x660 MW)	1188.00
	Total of State Owned Projects	**4298.50**
2	Central Sector Share	1566.33
3	Shared Projects - BBMB	875.00
4	IGSTPP Jhajjar (3X500 MW)	750.00

Sr. No.	Particulars	Availability (MW)
5	Bhoruka H.E. Project Yamunanagar (IPP)	6
6	Additional availability through PPA with IPPs/ CPSU	2440.10
	Total	**9935.93**

7.5.5 LIST OF PROJECTS EXPECTED TO SUPPLY POWER FOR WHICH PPAS HAVE BEEN SIGNED

Table 7-14 : List of projects expected to supply power

Name and Location of Project	Type	No. of units (MW)	Capacity (MW)	Haryana's Share (MW)
Added during 2009-10				75
Amarkantak (IPP) through PTC (Chattisgarh)	Thermal	2 x 300	600	300
Budhil HP (IPP) through PTC (H.P.)	Hydro	2 x 35	70	70
Sewa II HEP (J&K)	Hydro	3 x 40	120	9
Chamera III, HEP (H.P.)	Hydro	3 x 77	231	16
Uri II, HEP (J&K)	Hydro	4 x 60	240	13
Mejia B TPS (DVC) (West Bengal)	Thermal	2 x 500	1000	100
Parbati III HEP (H.P.)	Hydro	4 x 130	520	34
Koteshwar (Uttranachal)	Hydro	4 x 100	400	20
Koderma TPP (DVC) (West Bengal)	Thermal	2 x 500	1000	100
Pragati Gas Power Station (Delhi)	Gas		1371	137.1

Name and Location of Project	Type	No. of units (MW)	Capacity (MW)	Haryana's Share (MW)
Total during 2010-11				**799.1**
Barh Stage I ER NTPC (Bihar)	Thermal	3 x 660	1980	68
Koldam HEP NTPC (H.P.)	Hydro	4 x 200	800	43
Raghunathpur TPP Phase I (DVC) (West Bengal)	Thermal	2 x 600	1200	100
Tehri PSP (Uttranachal)	Hydro	4 x 250	1000	100
Karcham Wangtoo HEP (IPP) (H.P.)	Hydro	4 x 250	1000	200
Teesta III, Sikkim (IPP)	Hydro	6 x 200	1200	200
Mundra UMPP (Gujarat)	Thermal	5 x 800	4000	80
PTC (GMR Project) Case-I (IPP) (Orissa)	Thermal		300	300
Adani Case-I Bidding (IPP) (Gujarat)	Thermal		1424	475
Total during 2011-12				**1566**
Total Upto 2011-12				**2440.10**

7.5.6 RENEWABLE ENERGY RESOURCES

18 MW, 12 MW & 1.8 MW is available from sugar mills of Shahbad (Dist. Kurukshetra), Bhali Anandpur (Rohtak) & Meham (Rohtak) from November to April every year, being seasonal in nature.

7.5.7 PROJECTS CONCEIVED AFTER 2011-12 UPTO 2022

7.5.7.i List of projects expected to supply power for which PPAs have been signed

Table 7-15 : List of projects expected to supply power for which PPAs have been signed

Name and Location of Project	Type	No. of units (MW)	Capacity (MW)	Haryana's Share (MW)
Kameng HEP (Arunachal Pradesh)	Hydro	4 x 150	600	16
Barh, Stage II, ER (NTPC)	Thermal	2 x 660	1320	46
Parbati II, HEP (H.P.)	Hydro	4 x 200	800	26
Rampur HEP (H.P.)	Hydro	6 x 68.67	412	15
Subansari, ER NHPC (Arunachal Pradesh)	Hydro	8 x 250	2000	53
Rihand Stage III (U.P.)	Thermal	2x500	1000	57
Kishanganga (J&K)	Hydro	3 x 110	330	16
North Karanpura ER (Jharkhand)	Thermal	3x660	1980	68
Kotli Bhel(All 3 Stages) (Uttranachal)	Hydro	3x65 + 4 x 80 + 8 x 66.25	1045	58
Pakal Dul, HEP (J&K)	Hydro		1000	57
Siang Middle HEP (Arunachal Pradesh)	Hydro		1000	56
Tipaimukh (IPP) (Manipur)	Hydro		1500	40
Sasan UMPP (IPP) (M.P.)	Thermal		4000	450

Name and Location of Project	Type	No. of units (MW)	Capacity (MW)	Haryana's Share (MW)
Mundra UMPP (IPP) (Gujarat)	Thermal	5 x 800	4000	320
Orissa UMPP (IPP) (Orissa)	Thermal	5x800	4000	400
Tilaiya UMPP (Jharkhand) (IPP)	Thermal	5x800	4000	200
Adani-Case-1 bidding (IPP) (Gujarat)	Thermal		1424	949
Vishnugarh Piplakoti (Uttarakhand)	Hydro	4 x 111	444	24
Total				**2851**

7.5.7.ii Other Projects Conceived after 2011-12 to 2016-17 and 2021-22

Table 7-16 : Other Projects Conceived after 2011-12 to 2016-17 and 2021-22

Year onward	Name of Projects	Capacity (MW)	Resource	Haryana (MW)	Remarks
2016-17	Mega Power Plant – I, II, Fatehabad (Haryana)	1400	Nuclear	700	
2016-17	Mega Power Plant, Kota (Rajasthan)	1400	Nuclear	350	
2016-17	New HEPs in HP, UK&J&K	6000	Hydro	1500	
2016-17	Thermal Power Plant, Palwal	1320	Coal	1180	
2016-17	Ultra Mega Power Plant Satpura (M P Coal Fields)	3960	Thermal Coal	200	

Year onward	Name of Projects	Capacity (MW)	Resource	Haryana (MW)	Remarks
2016-17	Mega Power Plant Dewas (M P Coal Fields	1320	Thermal Coal	200	
2016-17	Mega Power Plant, Stage-I Faridabad	1050	Gas	1050	
2016-17	Wind Farms (Gujarat), Rajasthan	1000	Wind	100	
2016-17	Solar PP Gujrat, Rajasthan & Haryana	1200	Solar	150	
2016-17	Bio-mass & Bagasse	200	Agr.waste	200	
2016-17	Captive Power Plants	850	Liquid Fuel	850	
	Sub Total :			**6480 MW**	
2021-22	Mega Power Plant, III, IV, Fatehabad, Haryana	1400	Nuclear	700	
2021-22	New HEPs in HP, UK&J&K	20000	Hydro	4000	
2021-22	Thermal Power Plant, Mohindergarh, Haryana	1320	Lignite	1180	
2021-22	Yamuna Nagar Extn.	600	Coal	600	
2021-22	Ultra Mega Power Plant Udaipur (Lignite)	3960	Thermal Coal	500	

Year onward	Name of Projects	Capacity (MW)	Resource	Haryana (MW)	Remarks
2021-22	Ultra Mega Power Plant Alibagh (Imported Coal)	3960	Thermal Coal	200	
2021-22	Ultra Mega Power Plant Daman (Imported Coal)	3960	Thermal Coal	200	
2021-22	Mega Power Plant, Stage-II Faridabad	1050	Gas	1050	
2021-22	Bio-mass & Bagasse	200	Agr.waste	200	
2021-22	Wind Farms (Gujrat), Rajasthan	1000	Wind	100	
2021-22	Solar PP Gujrat, Rajasthan & Haryana	3000	Solar	300	
2021-22	Captive Power Plants	820	Liquid Fuel	820	
	Sub Total:			**9850 MW**	

7.5.8 CAPTIVE GENERATION

A review of the performance data in the past many years reveals that most of the generation projects have not been commissioned as per schedule. In fact the performance is only 50 – 60 % of the targets. Therefore, it can be assumed that the planned capacity shown in the tables above would also not materialize as per schedule. Some of the processes in the potential industries & business that are projected to grow in this sub-region shall need process & stand by captive power. It is also advisable for certain industries with steep & high power peak requirements to meet the base load from the grid and the peak load from its own captive generation. With a view to cut down high cost of power to meet short term peaks in an industry/ other similar establishment, in-house availability of captive generation shall serve a useful techno economic

purpose. The captive generation is therefore likely to play important role not only in taking care of initial shortages but also for other techno- economic reasons. Initially the requirement of total captive generation (CPPs) is assessed at a little over 10-15% of Industrial / Commercial demand in the entire sub-region.

7.5.9 GENERATION CAPACITY DEDICATED TO SUB-REGION

Major demands for power in the sub-region shall be met through inter state / inter region transmission of power. It is, however, proposed to install within the sub-region itself, additional generation capacity dedicated to the sub-region to cater to the demand for maintaining essential loads and services as well as to ensure good levels of reliability and availability. This can be done by setting up additional gas & coal based units in and around the sub-region. The need for generation capacity dedicated to the sub-region is assessed at 25% of the total requirement on the basis of consumption pattern in the sub-region.

7.5.10 PROPOSED AUGMENTATION OF TRANSMISSION SYSTEM BY THE END OF 11TH PLAN 2011-12

7.5.10.i The district wise approved / under planning capacity addition in MVA

Table 7-17 : district wise approved / under planning capacity addition in MVA (Figures in MVA)

District	Status	400/220 kV	220/132 kV	220/66 kV	220/33 kV	132/33 kV	132/11 kV	66/11 kV	66/33 kV
Gurgaon & Mewat	Approved	2575	0	1200	500	0	0	904.5	0
	Under Planning	315	0	1400	400	0	0	400.5	0
	Total	**2890**	**0**	**2600**	**900**	**0**	**0**	**1305**	**0**
Faridabad & Palwal	Approved	630	-	600	200	-	-	341.5	20
	Under Planning	0	0	400	100	0	0	135	0

District	Status	400/220 kV	220/132 kV	220/66 kV	220/33 kV	132/33 kV	132/11 kV	66/11 kV	66/33 kV
	Total	**630**	**0**	**1000**	**300**	**0**	**0**	**476.5**	**20**
Rohtak	Approved	630	300	0	200	105	20	0	0
	Under Planning	-	100	-	100	25	20	-	-
	Total	**630**	**400**	**0**	**300**	**130**	**40**	**0**	**0**
Sonepat	Approved	1000	700	0	400	200	72	0	0
	Under Planning	630	200	0	200	50	20	0	0
	Total	**1630**	**900**	**0**	**600**	**250**	**92**	**0**	**0**
Panipat	Approved	0	500	0	0	212.5	20	0	0
	Under Planning	0	0	0	100	0	0	0	0
	Total	**0**	**500**	**0**	**100**	**212.5**	**20**	**0**	**0**
Jhajjar	Approved	0	500	0	0	50	36	0	0
	Under Planning	315	200	-	100	50	60	-	-
	Total	**315**	**700**	**0**	**100**	**100**	**96**	**0**	**0**
Rewari	Approved	0	150	0	100	75	48	40	0

District	Status	400/220 kV	220/132 kV	220/66 kV	220/33 kV	132/33 kV	132/11 kV	66/11 kV	66/33 kV
	Under Planning	-	-	-	-	-	-	-	-
	Total	**0**	**150**	**0**	**100**	**75**	**48**	**40**	**0**
NCR Total Capacity Addition	Approved	4835	2150	1800	1400	642.5	196	1286	20
	Under Planning	1260	500	1800	1000	125	100	535.5	0
	Total	**6095**	**2650**	**3600**	**2400**	**767.5**	**296**	**1821.5**	**20**

7.5.10.ii Tentative Action Plan of HVPNL

a. Sub-Stations

Table 7-18 : Sub-stations and their capacity

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
	400KV Sub-Station						
1.	Nawada (Fbd)	630	-	200	100	-	-
2.	Deepalpur (Snp)	630	200	-	-	20	-
3.	Daultabad (Ggn)	630	-	-	-	-	-
4.	Qaboolpur (Rtk)	630	200	-	-	-	-

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
	200KV Sub-Station						
1.	HSIIDC Barhi	-	200	-	100	-	20
2.	Sect-6 Sonepat	-	-	-	100	-	-
3.	HSIIDC Rai	-	100	-	100	-	-
4.	Mohana (SNP)	-	100	-	100	-	-
5.	RGEC (SNP)(U/P)	-	200	-	200	-	-
6.	Kharkhoda (Snp)	-	100	-	-	-	-
7.	Chhajpur	-	200	-	-	-	20
8.	Bijawa	-	100	-	100	-	-
9.	Samalkha	-	200	-	-	-	-
10.	IMT Rohtak	-	100	-	200	-	-
11.	Bamla (RTK)(U/P)	-	100	-	100	-	-
12.	Nuna Majra (Jjr)	-	100	-	-	-	-
13	Sinkanderpur (Jhajjar)	-	200	-	-	-	16
14.	Sampla (Jhajjar)	-	200	-	-	-	-

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
15.	Sampla Urban Complex (U/P)	-	200	-	-	-	-
16.	Badhana (Jhajjar) (U/P)	-	200	-	-	-	-
17.	A-2 Faridabd (U/P)	-	-	200	-	-	-
18.	A-4 Faridabad	-	-	200	-	-	-
19.	A-5 Faridabad	-	-	200	100	-	-
20.	Palwal	-	-	-	-	-	16
21.	Meerpur (Palwal)(U/P)	-	-	200	100	-	-
22.	Mau (Dharuhera)	-	-	200	100	-	-
23.	Rewari	-	50	-	-	25	-
24.	Sector-72, GGN	-	-	200	100	-	-
25.	Panchgaon GGN	-	-	200	100	-	-
26.	HSIIDC Manesar	-	-	100	-	-	-
27.	Daultabad	-	-	100	-	-	-
28.	Sector-33 GGN	-	300	-	-	-	-

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
	(U/P)						
29.	Rangla Rajpur	-	-	100	100	-	-
30.	M/S Uppal SEZ (U/P)	-	-	200	-	-	-
31.	Gwal Pahari (U/P)	-	-	200	100	-	-
32.	Sect-20 Gurgaon	-	-	200	-	-	-
33.	Sec-2 Gurgaon (U/P)	-	-	200	-	-	-
34.	Sec-57 GIS GGN	-	-	200	100	-	-
35.	Sohna	-	-	100	100	-	-
36.	DLF (U/P)	-	-	200	100	-	-
37.	Sec-52 GGN	-	-	100	-	-	-
38.	Sec-56 GGN	-	-	100	-	-	-
39.	Orient Craft GGN (U/P)	-	-	200	-	-	-
40	IMT Manesar New (U/P)	-	-	200	-	-	-
132 kV Sub-Station							

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
1.	Khewra (SNP)	-	-	-	-	50	-
2.	Tajpur (SNP)	-	-	-	-	50	-
3.	Nahra (SNP)	-	-	-	-	50	-
4.	Nangal Kalan (SNP) (U/P)	-	-	-	-	50	20
5.	Rai	-	-	-	-	-	16
6.	Kundli	-	-	-	-	-	16
7.	Gohana	-	-	-	-	25	-
8.	Murthal	-	-	-	-	25	-
9.	Seenkh (PNP)	-	-	-	-	50	-
10.	Beholi (PNP)	-	-	-	-	50	-
11.	Bega (PNP)	-	-	-	-	50	-
12.	Naultha (PNP)	-	-	-	-	25	-
13.	Kabri (PNP)	-	-	-	-	25	-
14.	Chhajpur (PNP)	-	-	-	-	12.5	-
15.	Machhrauli (RTK)	-	-	-	-	50	-

Sr. No	Name of S/Stn.	Capacity (MVA)					
		400/220 kV	220/132 KV	220/66 KV	220/33 kV	132/33 kV	132/11 kV
16.	Garnawati (RTK)	-	-	-	-	25	20
17.	Hisar Road RTK	-	-	-	-	50	20
18.	MDU Rohtak	-	-	-	-	5	-
19.	Sampla HUDA	-	-	-	-	25	20
20.	Badli (JJR)	-	-	-	-	50	20
21.	Medicity (JJR)	-	-	-	-	25	20
22.	Cybercity (JJR)	-	-	-	-	25	20
23.	Gangaicha Jat	-	-	-	-	50	-
24.	HSIIDC Bawal	-	-	-	-	16	16
	Total	**2520**	**3050**	**3800**	**2100**	**828.5**	**260**

66 kV Sub-Station

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/11 kV
1	Ghoshgarh (U/P)		40
2	Ph-I Udyog Vihar (U/P		20
3	Sector – 4, Gurgaon (U/P)		40
4	Vipul (New)		64

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/11 kV
5	Canton Buildwell (New)		71.5
6	Munjal Kiriu (New)		16
7	Sunbeam (New)		16
8	Technology Park IMT Manesar (U/P)		40
9	DLF Ph-V (New)		80
10	HLF (New)		72
11	Unitech Sector-47 (New)		80
12	Sector-17 Ggn (New)		40
13	Sector-51 Gurgaon (New)		63
14	Raheja (U/P) New		48
15	Ansal Patheri (U/P) New		32
16	Sector-45 Ggn (U/P) New		63
17	Aar dee City (U/P) New		63
18	Sheetal International (U/P) New		63
19	Sector-8 IMT MNS (New)		40
20	Bhondsi (GGN) (U/P)		32
21	Mohammadpur Ahir (Tauru) (New)		32
22	Baliyar Kalan (Rewari) (New)		40
23	Rundhi (Palwal) (New)		16

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/11 kV
24	Sector – 2, Palwal (New)		31.5
25	Barauli (Palwal) (U/P)		40
26	Sector-64 Ballabgarh (New)		32.0
27	Green field (U/P)		63
	TOTAL		1238 MVA

66 kV Sub-Station Augmentations

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/33 kV
1	Sector – 9, Gurgaon (Aug.)		31.5
2	Sector-2, IMT Manesar (Aug.)		16
3	Manesar (Aug.)		15.5
4	Sector-56, Gurgaon (Aug.) (U/P)		15.5
5	Bhore Kalan (Gurgaon) (Aug.)		15.5
6	Palwal (Aug.)		16
7	Aurangabad (Palwal) (Aug.)		16
8	Bhagola (Palwal) (Aug.)		16
9	Chandhut (Palwal) (Aug.) (U/P)		16
10	Hathin (palwal) (Aug.)	8	
11	Hassanpur (Palwal) (Aug.) (U/P)		16

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/33 kV
12	Ford, Faridabad (Aug.)		16
13	Palla (Aug.)	12	15.5
14	Oswal Steel, Faridabad (Aug.)		15.5
15	Hyderabad Asbestos (Aug.)		15.5
16	NH – 3, Faridabad (Aug.)		15.5
17	Sector – 31, Faridabad (Aug.)		15.5
18	Northern India, Faridabad (Aug.)		15.5
19	A2, Faridabad (Aug.)		15.5
20	A4, Faridabad (Aug.)		15.5
21	Fatehpur Biloch, Faridabad (Aug.)		16
22	A5, Faridabad (Aug.)		15.5
23	Escort – II, Faridabad (Aug.)		16
24	Badraula, Faridabad (Aug.)		16
25	Chhainsa, Faridabad (Aug.)		16
26	Badshshpur (Aug.)		31
27	Sector-52 (Aug.) (U/P)		20
28	Maruti (Aug.) (U/P)		15.5
29	Sector-1 IMT Manesar (Aug.) (U/P)		16
30	Pataudi (GGN) (Aug,) (U/P)		16

Sr.No.	Name of S/Stn.	Capacity (MVA)	
		66/33 kV	66/33 kV
	TOTAL	20 MVA	492 MVA

b. Transmission Line

Table 7-19 : Proposed Transmission line

	Proposed 400 kV Lines
Sr. No.	Project Name
1	400 kV D/C line from Jhajjar TPS to Daultabad (Gurgaon).
2	400 kV D/C line from Daultabad (Gurgaon) - 400 kV substation Sector-72, Gurgaon (PGCIL) with quad moose conductor
3	400 kV D/C Quad Moose Line from Jharli (Jhajjar) to Kabulpur (Rohtak)
4	400 kV D/C Quad Moose Line from Kabulpur(Rohtak) to Dipalpur (Sonepat)
5	Jhajjar case 2 - Dhanoda 400 kV D/C line.
6	400 kV Dhanaunda - Daultabad D/C quard line.
7	400 kV D/C Bhiwani - Rohtak line with twin moose conductor matching with commissioning of 765 kV PGCIL substation at Bhiwani.
	Proposed 220 kV Lines
Sr. No.	Project Name
1	LILO of 220 kV D/C Palli -Sector-52A, Gurgaon line at proposed 220 kV sub-station Sector-56, Gurgaon.
2	LILO of Mohana - Samalkha 220 kV D/C line at Israna (Now Bijawa).2 km

3	LILO of 2nd circuit of 220 D/C Badshahpur - Rewari line at 400 kV PGCIL substation Bhiwadi- 15 km
4	220 kV D/C overhead line with twin moose AAAC conductor with total line length of 6.5 km approx. from Daultabad to Railway line.
5	220 kV D/C line with power cable equivalent to twin moose AAAC conductor with total line length of 2.5 km approx. from Railway line to proposed 220 kV GIS Sector-2 or 3 Gurgaon.
6	220 kV D/C line with power cable equivalent to single moose AAAC conductor with total line length of 6.5 km approx. from proposed 220 kV GIS Sector-2 or 3 Gurgaon to proposed 220 kV substation Sector-20 Gurgaon.
7	220 kV Double Circuit 1200 sq. mm XLPE cable (Copper) for takeoff arrangement of 220 kV Double Circuit Badshahpur – Sector 72 line at 400 kV substation PGCIL Gurgaon with approximate length of (550x8) meter.
8	220 kV Double Circuit Dabodha Kalan (Bahadurgarh, PGCIL) – Sikanderpur line with 0.5 sq" ACSR conductor (22 km)
9	220 kV D/C line with 0.5 sq" ACSR from 400 kV substation Jajji (PGCIL) to 220 kV substation Barhi. The line shall be constructed on cost sharing basis between HSIIDC & HVPNL.(35 km)
10	220 kV D/C Barhi - Sector 6 Sonipat line with 0.5 sq" ACSR.(18 km)
11	LILO of 220 kV D/C Palli -Sector-52A, Gurgaon line at proposed 220 kV sub-station Sector-56, Gurgaon.
12	220 kV D/C line with twin moose (2x0.5sq") ACSR from 400 kV substation Deepalpur to 220 kV substation Sector-6 Sonipat. (10 km)
13	220 kV D/C Sector-6 Sonipat - HSIIDC Rai line with twin moose (2x0.5 sq") ACSR. The line shall be erected on cost sharing basis with HSIIDC. (10 km)

14	220 kV D/C line with 0.5 sq" ACSR from 400 kV substation Jajji (PGCIL) to 220 kV substation Kharkhoda. (30 km)
15	220 kV D/C Kharkhoda - Sonipat (Fazilpur) line with 0.4 sq" ACSR. (25 km)
16	220kV D/C Sohna–Rangla Rajpur(Firozpur Zhirka) line with 0.5 sq. inch ACSR conductor. (45 km)
17	220 kV D/C Daultabad - Mau line {0.5 Sq" ACSR} - 40 km
18	LILO of 220 kV D/C Sector 72 - 52A line at 220 kV Sector 57 Gurgaon {0.5 Sq" ACSR} – 2x2 km
19	2 No. 220 kV D/C line from 400 kV Sector 72 to 220 kV Sector-72 {0.5 Sq" ACSR} - 0.2 km
20	220 kV D/C Sector 72 - 220 kV Sector-20 {0.5 Sq" ACSR} - 12 km
21	220 kV D/C line from 220 kV substation Sector 72 Gurgaon to 220 kV substation Sector 56 Gurgaon line {0.5 Sq" ACSR} - 15 km.
22	220 kV Gurgaon Sector 72 (220 kV) - Sector 52 A line {0.5 Sq" ACSR} - 5 km
23	LILO of existing 220 kV D/C Bahadurgarh-Rohtak line at 220 kV substation Sampla {0.4 Sq" ACSR} - 10 km
24	220 kV D/C Sampla - Mohana line {0.5 Sq" ACSR} - 38 km
25	220 kV D/C Mohana - Samalkha line {0.5 Sq" ACSR} - 25 km
26	220 kV D/C Samalkha - Chhajjpur line {0.4 Sq" ACSR} - 24.81 km
27	220 kV D/C Sewah-Chhajpur line {0.4 Sq" ACSR} - 20 km
28	220 kV D/C PTPP-Gharaunda line {0.4 Sq" ACSR} - 23.73 km
29	220 kV D/C Ghauranda-Kaul lne {0.4 Sq" ACSR} - 56 km

30	LILO of 220kV D/C Badshahpur-Bhiwadi line at 220kV S/stn Dharuhera{0.4 Sq" ACSR} - 5 km
31	LILO of 220 kV D/C Dadri-Rewari line at 220 kV substation Lula Ahir {0.4 Sq" ACSR} - 5 km
32	220 kV D/C Palwal – Rangala Rajpur (Firojpurzirka) with 0.4 sq. " ACSR Conductor - 51 km
33	Const. of a new 220 kV D/C line with 0.5 sq. " ACSR from A-3 Palla to A-5 -14 km
34	LILO of 1 ckt. Of 220 kV D/C A-3 Palla to A-5 line at proposed 220 kV sub-station A-4 Faridabad.
35	220 kV D/C Sector 72 Gurgaon to Rangla Rajpur (Firojpurzirka) line with 0.5 sq" Moose via Sohna -80 km
36	Const. of a new 220 kV D/C line with 0.5 sq. " ACSR from proposed 400 kV sub-station Nawada to 220 kV sub-station A-5 Faridabad
37	220 kV D/C Ganaur – Israna line with 0.4 sq."ASCR (Zebra) 20 km
38	220 kV D/C Sonepat (PGCIL) – Ganaur line with 0.4 sq."ACSR (Zebra) 20 km
39	220kV D/C Sonepat (HVPN) – Rai (Sonepat) line with 0.4 sq."ACSR (Zebra) 15 km
40	220kV D/C Manesar(Gurgaon) (PGCIL)-Pahrai(Pataudi) line with 0.5 sq."ACSR(Moose) 30km
41	220 kV D/C Pahari (Pataudi) – Mau line with 0.4 sq."ACSR (Zebra) 15 km
42	LILO of 220kV Sampla–Mohana at Kharkhoda (Sonepat) line with 0.4 sq."ACSR(Zebra) 10 km
43	220 KV D/C Sec 72- Sec 48, Gurgaon line with 0.5 sq. " ACSR (Moose) 2 km
	Proposed 132 kV Lines

Sr. No.	Project Name
1	132 kV S/C line from proposed 132 kV substation Seka to 132 kV substation Ateli (20 km)
2	132 kV substation Patti Khot at Sirta Road Bye Pass on Padla Road (Kaithal) with 2x20/25 MVA 132/33 kV + 1x0.2 MVA 33/0.4 kV transformers.
3	Aumentation of 132 kV substations at Gohana
4	132 kV S/C line on D/C towers 132 kV Sataudi - Munak with 0.4 Sq" ACSR (10 km) including 132 kV controlling bay each at Sataundi & Munak.
5	LILO of 132 kV S/C line from 132 kV substation Kundli to 132 kV substation Rai at HSIDC Kundli
6	LILO of Mohana - Samalkha 220 kV D/C line at Israna (Now Bijawa).2 km
7	LILO of 132 kV S/C Chandoli - Chhajpur line at 220 kV sub-station Chhajpur
8	132 kV S/C line D/C towers from 220 kV sub-station Chhajpur to 132 kV sub-station Sector-29, Panipat
9	LILO of 132 kV S/C line on D/C towers with 0.4 Sq" ACSR from proposed 220 kV substation Lula Ahir to existing 132 kV substation Kosli - 13 km including controlling bay at Kosli
10	LILO of one circuit of 132 kV Rewari - Kosli line at 132 kV substation Gangaicha Jat - 3 km.
11	New 132 kV D/C Lula Ahir - Gangaicha Jat line with 0.4 Sq" ACSR conductor - 30 km.
12	LILO of 132 kV Rohtak—Dadri line at 132 kV substation Kalanaur (2 km)
13	Stringing of 2nd ckt of Rohtak -MDU -Sampla 132 kV line - 21 km
14	Loop in loop out of 132 kV Rohtak – Kalanaur 132 kV single circuit line at 132 kV substation Hisar Road Rohtak 0.5 km

15	132 kV D/C Mohana - Mundalana line with 0.2 Sq" ACSR conductor including its controlling bays at Mundalana.
16	LILO of existing 0.15 Sq" ACSR 132 kV S/C Harsana Kalan - Kharkhoda line at 220 kV substation Mohana with augmentation of 132 kV S/C Sonepat - Harsana Kalan - Kharkhoda line (17 kms) with 0.15 Sq" all alloy alluminium conductor (AAAC) to improve its curre
17	LILO of existing 132 kV S/C line from 220 kV substation BBMB Narela to 132 kV substation Bahadurgarh at Assaudha
18	LILO of existing S/C Jhajjar - Rewari line with 0.2 sq" ACSR at 132 kV substation Machhrauli. (1.5 km)
19	Loop in Loop out of one circuit of 132 kV Israna – Mundlana line at 220 kV substation Bijawa.
20	132 kV Double Circuit line with 0.2 sq inch ACSR from 220 kV substation Bijawa to 132 kV substation Seenkh (22 km)
21	132 kV Double Circuit Sikanderpur – Machhrauli line with 0.2 sq inch ACSR conductor. (18 km)
22	132 kV Double Circuit Sikanderpur – Badli line with 0.2 sq inch ACSR conductor. (18 km)
23	132 kV D/C Barhi - Gannaur line with 0.2 sq" ACSR.(6 km)
24	Interlinking arrangement through 132 kV D/C line with 0.2 sq" ACSR between 220 kV sub-station Kharkhoda and 132 kV substation Kharkhoda.
25	132 kV D/C line with 0.2 sq" ACSR from 400 kV substation Deepalpur to 132 kV substation Khewra. (5 km)
26	132 kV D/C line with 0.2 sq" ACSR from 400 kV substation Deepalpur to 132 kV substation Tajpur. (15 km)
27	132 kV D/C line with 0.2 sq" ACSR from 220 kV substation Kharkhoda to Nahra. (10 km)

28	LILO of existing S/C 132 kV Kaithal-Siwan line at proposed 132kV substation Patti Khot (2 km).
29	132 kV S/C line on D/C towers with 0.4 Sq. inch ACSR from Samalkha-Beholi line - 8 km.
30	132 kV S/C line on D/C towers with 0.2 Sq. inch ACSR from Samalkha-Naultha line - 16 km.
31	132 kV S/C line on D/C towers with 0.2 Sq. inch ACSR from Samalkha to Bega - 12 km.
32	LILO of 132 kV S/C line from 400 kV substation Sewah to 132 kV substation Israna at 132 kV substation Naultha - 1.1 km.
33	132 kV S/C line on D/C towers with 0.4 Sq. inch ACSR from Beholi to Chhajpur - 13 km.
34	LILO of existing S/C Jhajjar - Rewari line with 0.2 sq" ACSR at 132 kV substation Machhrauli. (1.5 km)
	Proposed 66 kV Lines
Sr. No.	**Project Name**
1	66 kV D/C Daultabad (220 kV) Sector-10A, Gurgaon line
2	66 kV D/C line from 220 kV sub-station Palli to 66 kV sub-station Dhauj
3	Laying of 66 kV XLPE power cable from BBMB Ballabgarh to Globe Steel Faridabad including 66 kV controlling bay each at BBMB Ballabgarh to Globe Steel.
4	66 kV D/C line with 0.4 Sq. inch ACSR from proposed 400 kV substation Nawada to 66 kV substation Fatehpur Biloch (8.8 km)
5	66 kV 2 No. bay at Fatehpur Biloch for accommodating of Nawada - Fatehpur Biloch line
6	66 kV D/C line with 0.4 sq. inch ACSR conductor from 400 kV S/S Nawada to 66 kV substation Sector-64 Ballabgarh (10 km)

7	LILO arrangement of one circuit of 66 kV D/C BBMB – A-5 line on D/C Towers for providing supply to proposed 66 kV substation Sector-64 Ballabgarh - 5 km.
8	LILO of 2nd circuit of 66kV Badshahpur–Dundahera line at 66 kV substation "Q" block, Gurgaon - 2 km
9	Stringing 2nd ckt of 66kV Sector 23A - Dundahera line (22 km) including 66 kV controlling bay each at Sector 23 A Gurgaon & Dundahera Gurgaon.
10	LILO of 66 kV D/C line from 220 kV substation Rohtak Road Delhi to 66 kV substation Mehrauli Road at the proposed 66 kV substation Sector-3 Gurgaon - 2 km
11	Underground cable connection at 66 kV level (double circuit nature with one core spare) from proposed 220 kV substation Sector 20 Gurgaon to 66 kV substation Phase-IV Dundahera - 4 km.
12	Underground cable connection at 66 kV level (double circuit nature with one core spare) from proposed 220 kV substation Sector 20 Gurgaon to 66 kV proposed substation Sector-17 Gurgaon- 10 km
13	LILO of existing 66 kV (0.15 Sq") D/C line Badshahpur – sector 34 – sector 10 line at sector-72 Gurgaon. Augmentation of Badshahpur – sector 72 – sector 34 – sector 10 line with higher capacity INVAR conductor so that maximum amount of power can be transp
14	66 kV D/C line from 220 kV Mau to Bhore Kalan with 0.4 Sq" ACSR (10 km)
15	66 kV 2 No. bay at Bhore Kalan for accommodating of Mau - Bhore Kalan.
16	66 kV double circuit line from 220 kV substation Sector-57 Gurgaon to proposed 66 kV substation Sector-45 Gurgaon. The supply will be given through underground cables or overhead system equivalent to 0.4 Sq" ACSR conductor - 4 km.
17	66 kV D/C line from 66 kV Rangala Rajpur - Nagina line with 0.4 Sq. inch ACSR conductor (18 km) including 66 kV controlling bays at Nagina

18	66 kV S/C Rangala Rajpur - Punhana line on D/C towers with 0.4 Sq. inch ACSR conductor (40 km) including 66 kV controlling bay at Punhana
19	66kV D/C Sohna-Nagina line with 0.4 sq. inch ACSR conductor with LILO of one circuit at 66kV substation Nuh (in place from Kheri Kanker) including controlling bays at Nuh & Nagina.
20	66 kV S/C Mandkola - Nuh line (New line) on D/C towers (20 km) including controlling bay each at Mandkola & Nuh.
21	LILO of existing 0.15 Sq" ACSR 66 kV S/C Taoru - Dharuhera line at Mau - 11 km .
22	LILO of existing 0.15 Sq" ACSR 66 kV S/C Pataudi - Dharuhera line at Mau - 3 km.
23	66 kV D/C line from 220 kV substation Mau to Baliyar Kalan with 0.4 Sq" ACSR conductor - 14 km.
24	66 kV Double Circuit inter connecting line between 66 kV substation Sector-9 and 66 kV substation Sector 10A Gurgaon with 0.4 sq inch ACSR conductor
25	66kV D/C Sohna-Mohammadpur Ahir (Tauru) line with 0.4 sq. inch ACSR conductor. (20 km)
26	66kV S/C Sohna-Nimoth line with 0.2 sq. inch ACSR conductor on D/C towers. (15 km)
27	66kV D/C line from 66kV substation Mohammadpur Ahir (Tauru) to Tauru with 0.4 sq. inch ACSR conductor having one circuit LILO at 66kV substation Bhora Kalan (8 km)
28	66kV D/C line from 220kV S/S Palwal to Sector – 2, Palwal with 0.4 sq. inch ACSR conductor and utilization of existing bays meant for 66kV Palwal to feed 66kV S/S Sec-2, Palwal (5.5 km)
29	LILO of 66 kV S/C Aurangabad – Hasanpur line at 66 kV substation Rundhi (0.8 km)
30	66 kV D/C Transmission line from 220 kV sub-station Sector-72, Gurgaon to 66 kV sub-station Sector-51, Gurgaon.

31	LILO of one circuit of Badshahpur - Sector-15 II Gurgaon 66 kV D/C line at Sector-51 Gurgaon. (2.5km).

7.5.11 TRANSMISSION SYSTEM AUGMENTATION & BASE MAPS

Transmission Plan geared to meet additional requirement of transmission capacity in the sub-region shall be part of National Electricity Plans developed from time to time by CEA. It is to be kept in view that the electricity Generation units and Transmission networks of all the states/region are interconnected. Any changes in the spatial distribution of loads that may arise could be met by suitable changes/modifications to the transmission systems. Sub-region Specific Projections only have limited utility in planning generation and transmission network; but the National Electricity Plan ought to take care of the fresh/ additional demands generated in the sub-region.

Base maps showing existing, planned and proposed electric power plants, electric / grid sub-stations, and major transmission lines based on available data and incorporation of proposals to fill up the gaps in the base maps is annexed.

7.6 SYNOPSIS AND RECOMMANDATIONS

Recommendations for changes in policies, legal framework and planning processes considered necessary to achieve the identified aims & objectives are discussed as follows:

7.6.1 POWER PLANNING PROCESS & DEVELOPMENT OF CURRENT SITUATION

7.6.1.i Review of the Act & Rules

The 17th Electric Power Survey report by the Central Electricity Authority (CEA) gives a detailed forecast year wise electricity demand up to the end of 11th Plan (2011-12) and projections of the prospective electricity demand for the terminal years of 12th and 13th Five Year Plans (2016-17 and 2021-22) based on GDP growth rate of 8 to 10% during the 11th Plan period. Plan wise targets for generation and actual achievements are given in the table below:

Table 7-20 : Plan wise targets for generation and actual achievements

Plan	Target MW	Achievement	Per Capita Consumption

		MW	%	
1st Plan (1951- 1956)	1300	1100	84.6	31
2nd (1956- 1961)	3500	2250	64.3	46
3rd (1961- 1966)	7040	4520	64.2	74
Annual Plans (1966- 1969)	5430	4120	75.9	98
4th Plan (1969- 1974)	9264	4579	49.4	126
5th Plan (1974- 1979)	12499	10202	81.6	171
Annual Plan (1979- 1980)	2813	1799	64	172
6th Plan (1980- 1985)	19666	14266	72.5	229
7th Plan (1985- 1990)	22245	21401	96.2	329
Annual Plan (1990- 1991)	4212	2776	65.9	-
Annual Plan (1991- 1992)	3811	3027	79.4	347
8th Plan (1992- 1997)	30538	16423	53.8	465
9th Plan (1997- 2002)	40245	19119	47.5	559
10th Plan (2002- 2007)	41110	21180	51.5	672
1st Year 11th Plan (2007-08)	16335	9263	56.7	-
2nd year 11th Plan (2008- 09)	11061	3453	31.2	704

Source : CEA

It is concluded from a perusal of the above table that targets for power development have rarely been achieved in the past especially from 8th Plan onwards. It was considered to be so primarily due to the planning not being supported by a matching organization, rewarding tariff policy and adequate resource mobilization. Unbundling of power sector through promulgation of Electricity

Act-2003 was expected to address this situation; but it is not endorsed by performance. One reason may be the time being taken in stabilization and compliance of the Act; but it warrants a real time review of implementation of EA-2003 itself by power utilities and a review of all applicable laws and rules governing technical and financial criteria for award and grant of clearances and permits with a view to make these more pro-active and result oriented.

7.6.1.ii Right of Way

Obtaining Right of Way for power transmission projects is getting increasingly difficult due to rising cost of land and awareness in the land owners that Indian Telegraph Act-1885 is obsolete in so far as it describes even an EHV transmission line as a telephone line and a transmission tower as a telegraph "post". The Act and rules governing compensation for RoW need a thorough review.

7.6.1.iii Liberalization & Unbundling of Demand without Commensurate Removal of Constraints in Permissions, Execution & Funding.

Demand & consumption liberalization that followed globalization of Indian economy was faced with a stiff resistance from old & time worn rules for granting permits clearances, blockades in execution & constraints in mobilizing funds from indigenous and foreign resources. The result is that achievement of targets is still lower than those before globalization of economy.

7.6.1.iv Investments in Implementation of Power Plans

Assessment for power requirement should take into consideration the factor of power cuts resulting into suppression of annual energy requirement and unrealistic peak power demand projections. The state in general and the sub-region in particular need higher investments levels than envisaged in the present Planning process so as to wipe out deficit and maintain parity of supply and demand up to 2021. The shortfall in targets contribute to perpetual shortages and there is need to plan for higher installed capacity than projected requirement even while the performance levels need to be raised.

7.6.1.v Technology Up-gradation

Organizations like REC should revive their technical cells and upgrade construction standards and technical specifications to meet the need of the time.

7.6.1.vi AT&C Losses

AT&C losses even in the comparatively well developed sub-region are high due to inadequate technology and poor implementation by distribution companies. Privatization envisaged in the Act needs to be implemented in the letter and spirit of the same.

7.6.1.vii Short term Strategy to meet shortages and Peaking

The economy has registered a growth of 9% during this period. The utilities have, by and large, spared the industries from power cuts by restricting the hours of supply to agriculture, grouping agricultural loads and restricting supply hours in rural and semi-urban areas. This strategy could address any future power shortages to industry; but it is intended to plan for full Peak Power demand and energy requirement in the in the sub-region.

7.6.1.viii National Electricity Plan to take care of Additional Demand for Generation & Transmission

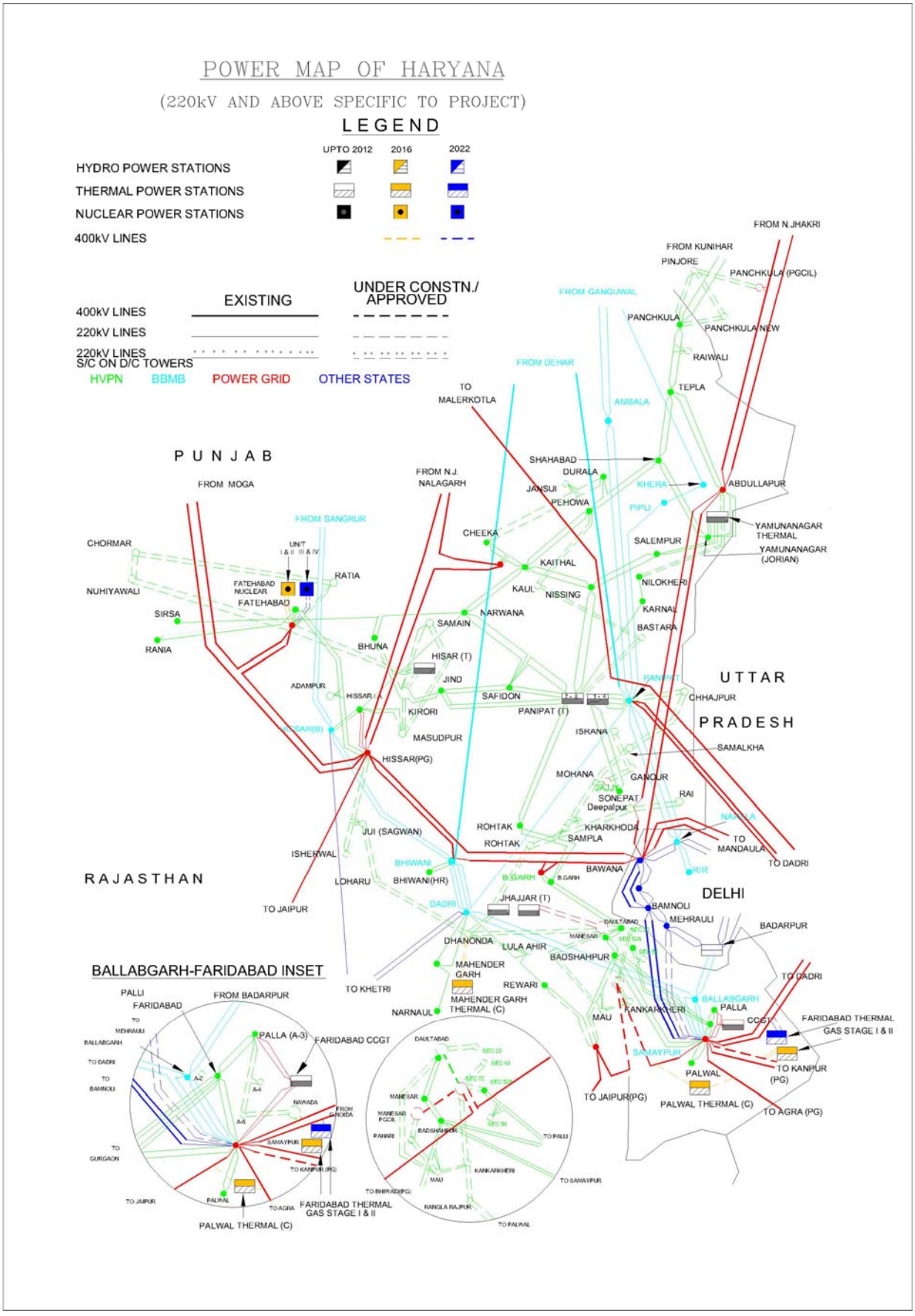
The requirement for additional generating capacity during the 12th Plan (2012-17) is worked out as a part of the National Power Plan. The inter-regional transmission system for the early part of the 12th Plan is also covered in order to initiate advance action on the identified schemes. The detailed power demand projections for the country for preparation of 12th Plan (2012-17) are to be taken up by the CEA as a part of the preparation of the next National Electricity Plan. In a similar manner the CEA is expected to take cognizance of and provide for the required generation and transmission capacity to meet additional demand for Power and energy.

7.7 CONCLUSIONS

It is to be kept in view that the electricity Generation units and Transmission networks of the state / sub-region are interconnected. Any changes in the spatial distribution of loads that may arise could be met by suitable changes/modifications to the transmission systems. Specific Projections only have limited utility in planning generation and transmission network dedicated to the sub-region; but the National Electricity Plan ought to take care of the fresh/ additional demands generated through additional investments.

Below map showing existing and proposed power stations and power lines in Haryana state.

Map 7-1 : Power map of Haryana for 2022



Chapter 8 : WATER

8.1 *Background*

Water is an important resource for meeting the water requirements for irrigation, domestic and industrial uses. In the Sub-Region the ground water is extensively used for irrigation and domestic purpose. Due to tremendous increase in the requirement of ground water for agriculture, industries and by newly developed urban areas, the water levels have shown a continuous declining trend in a number of districts. On the contrary, the excessive use of canal water for agricultural purpose coupled with unfavorable geological conditions, lack of natural surface drainage.

8.2 *Planning Parameters*

- Planning Horizon: 2021
- Integrated regional scheme to augment drinking water supply in the Region
- Construction of upstream reservoirs to store excess water in monsoon for use in lean period
- Augmentation of groundwater resources through rain water harvesting
- Protection and reservation of 2-5% of total area for water bodies
- Rationalization of water charges so as to cover at least the minimum O&M cost
- Discouraging intensive development of areas of ground water shortage identified by Central Ground Water Board
- Emphasizing on maintaining quality of water as per the norms set out by the Bureau of Indian Standards
- Inter basin transfer of water to be encouraged to divert water from water surplus basins to water deficit basins.

- The proposed Satluj Yamuna Link Project for linking river Satluj with river Yamuna be taken up on top priority so that water requirements of Yamuna sub basins can be met with.

- While considering the requirement for the projected period 2021, it has been assumed that about 25% of the rural population will come under the umbrella of urban areas due to urbanization.

- The norms and standards for water supply based on the recommendations of the NCRPB report.

Urban Settlements

Towns/ Cities	Norm in liters per capita daily (lpcd)
Population 1 lakh & above	200
Population below 1 lakh	135

(This includes demand for commercial areas and floating population)

Rural Settlements

A minimum of 70 lpcd including a supply of 30 lpcd for cattle, for independent connections: a minimum of 100 lpcd; for spot sources: a minimum of 40 lpcd which can supplement the piped supply: stand posts in rural areas: 40 lpcd; urban villages: similar to the town with which it is surrounded. Besides this, following aspects may have to be kept in view:

- Fire fighting requirement to be added to this as per norms in the CPHEEO Water Supply Manual.

- Unaccounted for water (UFW) to be limited to 15%.

8.3 *Identification of all the potential surface water sources, ground water aquifers and inter-basin transfer of water in the sub-region.*

8.3.1 Policies and Proposals

In order to improve the overall situation in the Haryana Sub-Region (SRP) of the National Capital Region (NCR) for the perspective 2021, for the harmonized and balanced development of the region, following strategies and policies are proposed:

Blueprint for Water Resources in the Region: Blueprint for water resources in the region including augmentation of drinking water should be prepared for HSR identifying all the potential surface water sources, ground water aquifiers and inter-basin transfer of water. This should include water mapping, desilting, augmentation of existing lakes / depressions for storage of rain / flood water, rain water harvesting, reuse and recycling of waste water, measures for conservation of water, inter-basin transfer of water and include integrated land and water management for the region.

Although water/rainfall scarce, Water is still available as Haryana is a land of canals. It has tapped its ground water resources to maximum. Lift irrigation schemes, pump sets, and water channels supply adequate amount of water to the fields and industries.

8.3.2 Surface Water Source Identification

Streams

Haryana districts covered under the sub-regional plan, has no perennial rivers. The river Yamuna flows along its eastern boundary and river Ghaggar along its western boundary. The Markanda river or Aruna is a seasonal stream like the Ghaggar, it originates from the lower Shivalik hills and enters Haryana near Ambala, hence cannot be used. However, all these seasonal streams are selectively used for irrigation.

The Markanda Stream (ancient name was Aruna), a seasonal stream, it originates from the lower Shivalik hills and enters Haryana near Ambala. During monsoons, this stream swells up into a raging torrent notorious for its devastating power. The surplus water is carried on to the Sanisa lake where the Markanda joins the Saraswati.

A new canal from Yamuna river has been proposed. An ambitious Rs 5-crore canal drinking water scheme for Sonipat is among the development projects. Work on this project would begin soon. Once constructed, this canal will supplement the demands of both drinking and irrigation water.

In view of the above, the water supply for potable and other non-potable uses has to depend primarily on ground water and on canal water. The canal-based water supply schemes are mainly implemented in Rewari district.

Canal water

To cater to the needs and to harness the agricultural potential of the fertile land, rulers of different era, got several canals and diversions works (barrages) constructed in Yamuna and Ganga basin. Earliest canal system of NCR, dates back to 1356 A.D, is still in use. The canal systems have been upgraded and expanded over a period of time and now form a network in NCR. There are a few inter-basin water transfer canals which transfer water from Indus basin to Yamuna basin. These are shown in Figure 8 1. These canals primarily supply water in Haryana, NCT Delhi and some parts of Rajasthan. A detailed discussion and estimation of water supplied through the canals flowing through Haryana Sub-Region are discussed below.

Major Canals and diversions works

The major irrigation works, diversion works and canal systems in NCR are discussed in this section. The necessary data for the analysis presented here was collected from state irrigation departments of Uttar Pradesh & Haryana.

Major Diversion works and Head works in the Sub-region Haryana

There are several river diversion works from where water is supplied to Haryana sub-region of NCR. There are several head works & regulators that are also used to divert water in different parts of Haryana sub-region of NCR.

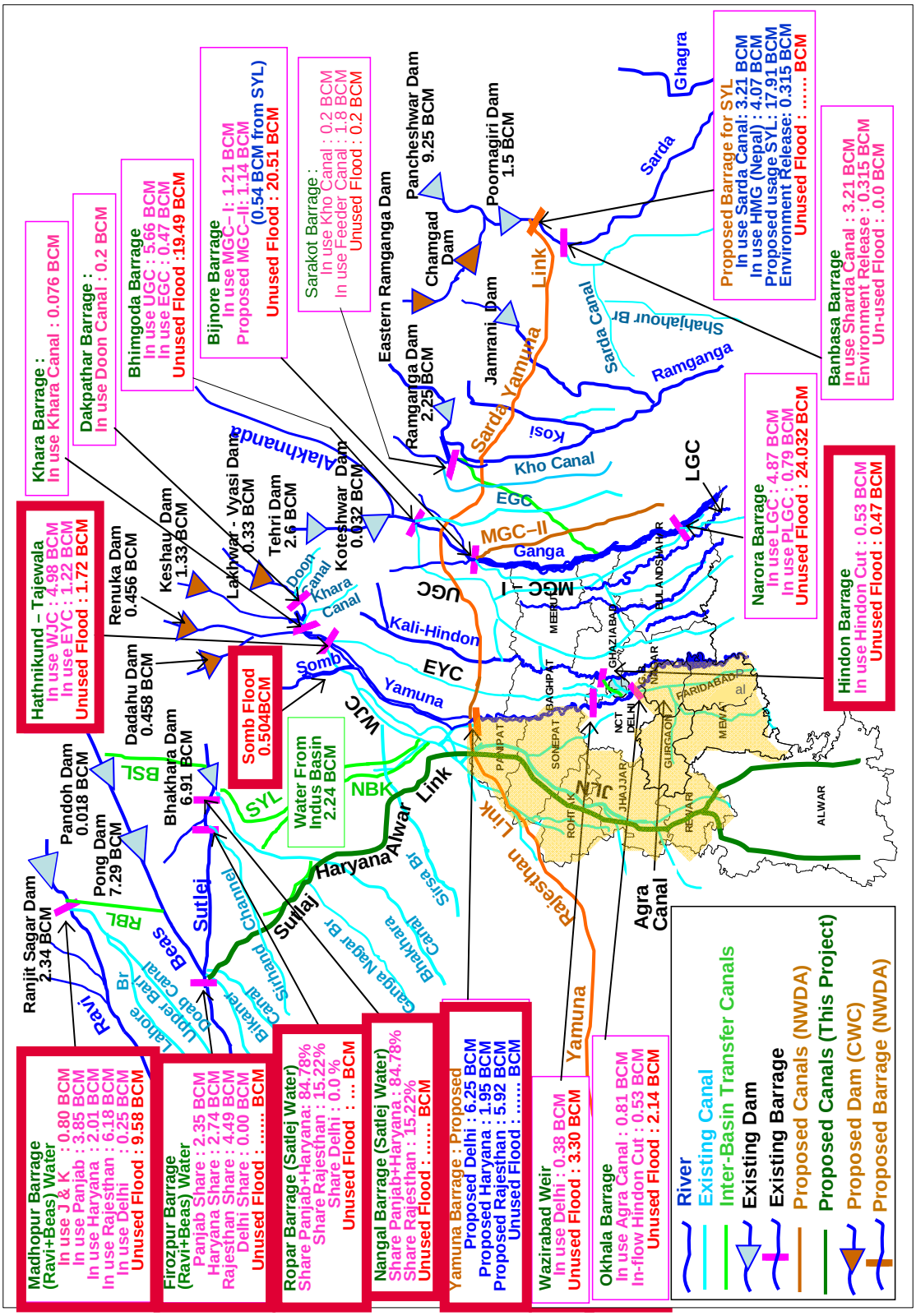
Major Canal Systems in Haryana

The canal network of entire Haryana state is presented in Figure 8.1

- *Western Jamuna Canal System*

To cater to the water needs and to harness the agricultural potential in Yamuna Basin the then Indian Emperor constructed the canal in 1356 AD which is now called Western Jamuna Canal in western region of NCR. Subsequently, these canals were re-shaped and control structures introduced by the then Emperor, in 1626 AD. It was reconditioned in 1819 AD for Delhi Branch Canal and in 1825 AD for Hansi Branch Canal. Subsequently, the engineers of British Government remodeled (probably re-designed) it by 1908 AD and named it as ``Western Jamuna Canal (WJC)'' system (British misspelled ``Yamuna'' as ``Jamuna''). After independence, this network is continuously getting augmented.

Figure 8-1 : Drainage system of entire Haryana and their share with other states



The districts of Panipat, Sonipat, Rewari, Rohtak and Jhajjar are supplied water through WJC system. Part of the drinking water to Gurgaon is supplied through Gurgaon Water Supply

Channel (GWS) and Delhi sub-branch canal system. Figure 8.1 presents a complete map of WJC system which caters to irrigation and drinking water needs of several other districts of Haryana that are outside NCR sub-region.

8.3.3 Ground Water Aquifiers

Groundwater is saline in almost all of the Bhakra Canal System in Punjab & Haryana and the lift canal system in south-western Haryana. Certain places in Haryana are also found to have dangerously high levels of mercury and flouride. An uncontrolled use of the borewell technology has led to the extraction of groundwater at such a high rate that often recharge is not sufficient. The causes of low water availability in many regions are also directly linked to the reducing forest cover (only @6% in Haryana) and soil degradation. Water extraction without proper recharge and leaching of pollutants from pesticides and fertilizers into the aquifers has polluted groundwater supplies. In addition, leachates from agriculture, industrial waste, and the municipal solid waste have also polluted surface- and ground-water.

It is important to realize that groundwater is not a resource that could be utilized unmindfully simply because it is available in abundant quantities. Problems and issues such as water logging, salinity, agricultural toxins, and industrial effluents, all need to be properly looked into.

Other than legislation and checks to conserve and improve the quality of groundwater, society itself plays a very important role. During the last decade there has been a rising awareness among the common people on the need for conservation and development of groundwater. Water use has to be integrated effectively with water regeneration, as was done in many traditional technologies.

Similarly, in some urban cities of Haryana, there is a need to regenerate groundwater aquifers because of the high degree of dependence on them for drinking water.

Temple tanks need to be renovated and urban wetlands protected. All these will contribute to a rise in the groundwater level and a reduction of salt water ingress. Community awareness and management of freshwater resources should be enhanced. The government should implement effective groundwater legislation and regulations through self-regulation by communities and

local institutions. External support agencies should support freshwater resource management. Environmental restoration should be promoted along with household water security.

The effective answer to the freshwater crisis is to integrate conservation and development activities – from water extraction to water management – at the local level; making communities aware and involving them fully is therefore critical for success. All this will ultimately pave the way for combining conservation of the environment with the basic needs of people.

Ground Water Quality Problems

Contaminants Districts affected (in part) Salinity (EC > 3000 μS/cm at 25 ° C) Gurgaon, Jhajjar, Rewari, Rohtak, Sonepat Fluoride (>1.5 mg/l) Faridabad, Gurgaon, Jhajjar, Panipat, Rewari, Rohtak, Sonepat Chloride (> 1000 mg/l) Rohtak, Iron (>1.0 mg/l) Faridabad, Gurgaon, Jhajjar, Panipat, Rohtak, Sonepat, Nitrate (>45 mg/l) Faridabad, Gurgaon, Jhajjar, Panipat, Rewari, Rohtak, Sonepat. It is seen from the above that, all the districts are having fluoride-bearing ground water with most districts suffering from saline water influx. The parameters of iron and nitrate are reasonably easy to handle and could be termed safe. Since Rewari depends primarily on canals, the main districts of concern regarding ground water usage are Gurgaon, Jhajjar, Rohtak, and Sonepat.

District-wise Ground Water Information

1. Gurgaon

Ground Water Resources

Ground Water Resources estimation of the district was done in 2004 for Gurgaon district by CWGB. Perusal of the Estimates reveals overall stage of ground water development in the block is of the order of 209% which has exceeded the available recharge and thus the district has been categorized as over exploited. Net annual ground water availability of the district is 20215.12 ham and existing gross ground water draft for all users is 33055.33 ham. The Table below shows the details.

Table 8-1 : Ground Water Resources of Gurgaon District, Haryana State

Assessment Unit / Block	Net Ground Water Availability Units (ham)	Existing Gross Ground Water Draft for Irrigation (ham)	Existing gross Ground Water Draft for domestic and industrial water supply (ham)	Existing Gross Ground Water Draft for all uses (ham)	Allocation for domestic and industrial requirement supply upto next 25 years (ham)	Net Ground Water Availability for future irrigation development (ham)	Stage of ground water develop-ment (%)
Farukhnagar	3989	5809.33	99.55	5908.88	201	-2640.45	148
Gurgaon	5985.16	8442.17	10167.50	18609.67	20538	-3508.41	311
Pataudi	4917.64	10723.63	179.57	10899.20	355	-6131.40	222
Sohna	5323.32	8080.20	144.00	8225.00	292	-3191.15	155
Total	**20215.12**	**33055**	**10587.42**	**43642.75**	**21386**	**-15471.41**	**209**

2. Jhajjar

Ground Water Resources

The stage of ground water development ranges between 53% (block-Matenhail) to 107% (block-Jhajjar). The total replenishable ground water resource in the district is 356.46 mcm, while the existing ground water draft is 308.73 mcm. Ground water availability for future irrigation development is 45.37 mcm. The stage of ground water development in the district is 87%.

SUITABILTY OF WATER

Domestic: - Ground water occurring in the shallow aquifer is by and large saline; however potable water at places along canals and surface water bodies like ponds, where salinity has decreased, is collected for drinking purposes.

Irrigation:-The shallow ground water to a depth of 20m is by and large fresh and fit for irrigation. The deep ground water is saline, salinity increases with depth and that water is not fit for

irrigation. In a very small patch in the extreme southwest of Jhajjar approximately 50 to 60m thickness of granular zones (within 80m depth) bearing fresh water has been identified and this area need to be protected.

The tubewells constructed with in a depth range of 12m to 20m are drilled using locally developed drilling techniques in fresh water areas would yield about 150 to 300 lpm. The depth of tubewells may however be more upto 80 m in the southwest area of the district.

Table 8-2 : Ground Water Resources of Jhajjar District, Haryana State

Assessment Unit / Block	Net Annual Ground Water Availability (Ham)	Existing Ground Water Draft for Irrigation (Ham)	Existing Gross Ground Water Draft For domestic and industrial water supply (Ham)	Existing Ground Water Draft for all uses (Ham)	Allocation for next 25 Years for Domestic and Industrial uses (ham)	Stage of groundwater development (%)
Bahadurgarh	10329	9413	45	9458	848	92
Beri	5919	4162	14	4176	1735	71
Jhajjar	8811	9351	43	9394	-605	107
Matenhail	5527	2875	27	2902	2611	53
Salahwas	5060	5073	25	5099	-52	101
Total	**35646**	**30874**	**154**	**31029**	**4537**	**87**

3. Sonepat

Ground Water Resources

The stage of ground water development ranges between 44% (block-Kathura) to 152% (block-Ganaur). The total replenishable ground water resource in the district is 449.58 mcm, of which the total existing ground water draft by all means is 511.10 mcm. The net utilizable ground water resources for future irrigation development are –75.31 MCM.

Status of Ground Water Development

Irrigation from ground water is being done in large parts of the district. Maximum numbers of minor irrigation units have been installed in Sonipat and Ganaur blocks. Density of MI units is also highest in these blocks, while it is lowest in Kathura block. The depth of shallow tubewells is mainly in the range of 20-30m with discharge in the range of 8-10lps. However in parts of Ganaur and Sonepat block the shallow tubewells upto 45m haaving discharge more than 12 lps are prevalent.

A well assembly of 203mm dia, using about 20m to 30m long housing pipe and MS slot pipe with slots of 1.19 mm to 1.59 mm size would be ideal in the district area. "V" wires galvanized Screen having 0.50- 1.5mm slot can also be used as it can provide more open area thenconventional slotted pipes. Entrance velocity of water in the well has to be kept in mind while designing the well assembly.

Table 8-3 : Ground Water Resources of Sonipat District, Haryana State

Assessment Unit / Block	Total Replenishable Ground Water resource (ham)	Utilizable ground water Resources for irrigation (ham)	Existing GW draft For Domestic Industrial & other uses (ham)	Gross draft (ham) as on 31.3.04	AllocationFor next 25 Years for Domestic and Industrial uses (ham)	Net ground Water availability for future irrigationdevelopment (ham)	Stage of groundwater development (%)
Ganaur	11305	16089	1047	17137	1540	-6324	152
Gohana	4921	5009	54	5063	80	-168	103
Kathura	3093	1369	0	1369	0	1724	44
Kharkhoda	4892	3107	94	3201	138	1647	65
Mundlana	5696	3958	0	3958	0	1738	69
Rai	5356	6708	691	7399	1015	-2367	138
Sonepat	9693	11938	1045	12983	1536	-3781	134
Total	**44958**	**48179**	**2931**	**51110**	**4309**	**- 7531**	**114**

4. Rohtak

Ground Water Resources

The stage of ground water development ranges between 47% (block- Lakhan Majra) to 101% (block-Sampla).

The total replenishable ground water resource in the district is 253.13 mcm, while the existing ground water draft is 167.90 mcm. Ground water availability for future irrigation development is 85.22 mcm. The stage of ground water development in the district is 66%.

STATUS OF GROUND WATER DEVELOPMENT

The drinking water supply is mainly canal water based in the district. The short fall in water supply to the towns, cities and villages is met with the installation of hand pumps by the public individually as spot and convenient source of water. There are 16995 minor irrigation units with the depth ranging from 15 m to 20m and 410 sq.km. area is irrigated by these tube wells in the district. The proper drainage system created and regulated over the years has helped in maintaining proper balance between soil moisture and air thereby water logging, salinity and marshy condition associated with ground water at places has considerably declined in the district.

Table 8-4 : Ground Water Resources of Rohtak District, Haryana State

Assessment Unit / Block	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for Domestic and Industrial water supply (ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation For next 25 Years for Domestic and Industrial uses (Ham)	Net ground Water availability for future irrigation developmen t (Ham)	Stage of ground water development %
Rohtak	9888	6554	0	6554	0	3334	66
Kalanaur	4046	2645	0	2645	0	1401	65
Lakhan Majra	2494	1179	0	1179	0	1317	47
Meham	5185	2689	0	2689	0	2495	52
Sampla	3698	3723	0	3723	0	-25	101
Total	**25311**	**16790**	**0**	**16790**	**0**	**8522**	

SUITABILTY OF WATER

Domestic: Ground water is potable at places along canals and surface water bodies like ponds and depressions, where salinity has decreased and could be collected for drinking purposes. This calls for protection along canals and connectivity of catchment of all ponds.

Irrigation: The shallow ground water to a depth of 20m is by and large fresh and fit for irrigation. The deep ground water is saline and salinity increases with depth and that water is not fit for irrigation.

5. Panipat

Ground Water Resources

The ground water development in all the blocks has exceeded the available recharge and thus all the blocks have been categorized as over exploited. The stage of ground water development ranges between 137% (block-Panipat) to 187% (block-Bapoli). The net ground water resource in the district is 720.81 MCM, of which the net utilisable ground water resources availability is 554.86 MCM. The net ground water draft is 1350.53 MCM thus having an over draft of 701.80 MCM, which shows 156% as stage of ground water development.

Table 8-5 : Ground Water Resources of Panipat District, Haryana State

Assessment Unit / Block	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation For next 25 Years for Domestic and Industrial uses (Ham)	Net ground Water availability for future irrigation development (Ham)	Stage of ground water development %
Panipat	6508	8579	9017	202	-2273	137
Samalkha	5176	9301	9523	195	-4320	181
Madlauda	8051	10319	14254	338	-2605	129
Israna	7058	11314	11332	280	-4526	161
Bapoli	6149	11426	11360	217	-5494	187
Total	**32942**	**50939**	**55486**	**1232**	**-19229**	**156**

6. Faridabad

Ground Water Resources

The stage of ground water development ranges between 32.95% (HASSANPUR) to 75% (FARIDABAD). The total replenish able ground water resource in the district is 5073.81 of which

the total existing ground water draft by all means is 27812.99. The net utilizable ground water resources for future irrigation development are 27300.92.

Status of Ground Water Development

The hydro geological data generated through exploratory drilling by CWGB has proved a vital information regarding identification of aquifer system, demarcation of their vertical and lateral extent , and delineation of potential aquifer characteristics. A well assembly of 203 mm dia, using about 20 m to 30 m long housing pipe and MS slot pipe with slots of 1.19 mm to 1.59 mm size would be ideal in the district area. "V" wires galvanized Screen having 0.50-1.5 mm slot can also be used as it can provide more open area conventional slotted pipes. Entrance velocity of water in the well has to be kept in mind while designing the well assembly. Reverse /Di rect ci rculat ion rig is suitable for carrying out the drilling in alluvial parts of district whereas percussion or Down the Hole Hammer (DTH) technique with Odex attachement are suitable for drilling in boulder format ion.

7. Rewari

Ground Water Resources

The stage of ground water development ranges between 88% (Nahar) to 170% (Khol).The net ground water resource of Rewari district have been estimated to be 260.65 MCM and the gross ground water draft of the district is 313.91 mcm leaving behind a shortfall of (-)54.68 MCM. The stage of ground water development in the district is 120%.

Table 8-6 : Ground Water Resources of Rewari District, Haryana State

Assessment Unit / Block	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross round Water Draft for all uses (Ham)	Allocation For next 25 Years for Domestic and Industrial uses (Ham)	Net ground Water availability for future irrigation development (Ham)	Stage of ground water development %
Bawal	75.64	78.64	79.34	1.06	-4.06	105
Jatusana	51.45	57.63	57.89	0.40	-6.59	113
Khol	27.54	46.08	46.79	1.09	-19.63	170

Nahar	47.41	41.50	41.67	0.26	5.66	88
Rewari	58.60	87.06	66.23	1.79	-30.24	151
Total	**260.65**	**310.90**	**313.91**	**4.60**	**-54.68**	**120**

Status of Ground Water Development

The drinking water supply is mainly through ground water in the district. The short fall in water supply to towns, cities and villages is met with the installation of hand pumps by public individually as spot and convenient source of water. The shallow tube wells tap unconfined aquifer and depth varies from 30 to 120m.The tube wells constructed by the municipal corporation and other agencies have been constructed tapping deeper aquifer down to 200m. The shallow tube wells irrigate about 1130 sq.km. of the area in the district. The discharge of these shallow tube wells/cavity wells range 240 – 480 lpm.

8. Mewat

Ground Water Resources

The net annual ground water availability in Mewat district is 31298 Ham out of this 1682 Ham has been kept reserved for domestic and industrial purposes upto next 25 years. The present net ground water draft in the district is 23446 Ham. The average level of ground water development in the district is 75% and falls in critical category. Therefore care is required for further development of ground water. In Tauru block which fall in overexploited category (164%), no further development of ground water should be taken up. Since a large area has shallow ground water levels with in 5.0m, there is substantial potential recharge in the district.

Table 8-7 : Ground Water Resources of Mewat District, Haryana State

Assessment Unit / Block	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation For next 25 Years for Domestic and Industrial uses (Ham)	Net ground Water availability for future irrigation development (Ham)	Stage of ground Water development %
Firozepur Zirka	4501	3440	3565	252	808	79
Nagina	3147	2481	2620	282	385	83

Nuh	6062	2740	2905	333	2988	46
Punhana	4938	2662	2783	245	2081	59
Tauru	4254	6779	6956	358	-2882	164
Hathin	8396	4512	4617	212	3673	55
Total	**31298**	**22614**	**23446**	**1682**	**7003**	**75**

SUITABILITY OF WATER

Domestic: Ground water occurring in the shallow aquifer is by and large saline, however potable water at places along canals and surface water bodies like ponds, where salinity has decreased, and in the areas falling near foot hills is collected for drinking purposes.

Irrigation: The shallow ground water upto a depth of 20m is by and large fresh and fit for irrigation. The deep ground water is saline, salinity increases with depth and that water is not fit for irrigation. However in a proximity of the hills fresh water occurs and is fit for irrigation.

Potability of Water: Geophysical surveys in the district have brought out the following picture regarding ground water quality:

(i) Ground water is saline at all levels in almost 55% of area (1050 sq.km.) which includes mainly the Central, Southern and Southeastern parts of Mewat around Nuh, Malab, Punhana.

(ii) Only 26 to 30 % (500 to 575 sq,Km.) area bears fresh water within 30m depth in entire Mewat. This area lies over northwest and southwest and includes the localities around Tauru block, Mohun, Ghata-shamsabad.

(iii) Only 13 % area (250 sq.km.) bears fresh water vertically beyond 40 m depth.(over Northwest and Southwest) in entire Mewat.These areas lie around Touru block in Northwest, Patkhori, Patan-udaipuri in Southwest of Mewat.

Status of Ground Water Development

Most of the villages and towns in Mewat district is having piped water supply . The water supply is mainly based on canal water and tube wells located at the base of the ridges and hillocks in

the district and maintained by Public Health Deptt. The water supply is erratic in Nuh, Nagina, Punhana, Firozpur Jhirka and Hathin blocks the ground water quality is brackish to saline.

The ground water is found to be fresh along the hill ranges. Hence, Public Health Department has started a number of schemes for rural and urban water supply from these areas .Taoru block has a total population of about 126169 with 97 tubewells which supply to 78 villages. The annual draft for domestic purpose of all tubewells is 2.21MCM with present supply of 48 lit / Capita / day .Nuh block has a total rural population of 73559 with 48 numbers of tubewells whose annual draft is 1.10 MCM with present supply of 41 lit / capita / day. Hathin block has a rural population of about 152625 with 52 numbers of tubewells whose annual draft is 2.87 MCM with present supply of 51 lit/capita/day.The "Renney Well Project" drinking water supply scheme is under execution and on completion in the year 2009, would cover almost entire population of the district.

The district is mainly irrigated by shallow tube wells. In Nuh and Nagina blocks the density of minor irrigation units is 4 per sq.km. In some parts of these blocks there is fresh water but it is confined upto 20 metres depth only. The dug wells and tube wells (cavity and filter type) in these areas to meet the irrigational requirements are constructed down to a depth of 10 to 20 metres and their discharge ranges from 150 to 750 lpm.Hathin and Punhana blocks have some area under canal irrigation.

Ground Water Development Prospects

A review of ground water budget of Mewat district shows that the average stage of ground water development is 75% and falls in semi critical category. Therefore caution is required for the further development of the resources. The block viz. Taoru is already over exploited. The stage of ground water development is 164% , therefore there is no scope in this block for further development of the ground water resources until some measures like artificial recharge or supplementing the requirements by other sources are taken up. The block Ferozpur Jhirka falls in semi-critical category, Nagina falls in critical category. Nuh, Hathin and Punhana fall in safe category. Due to presence of saline ground water in these blocks, efforts have been taken up to delineate the fresh water pockets/areas for development. In these blocks about 5856 Ham of surplus ground water is available which can support additional 12500 shallow tubewells of 1.0

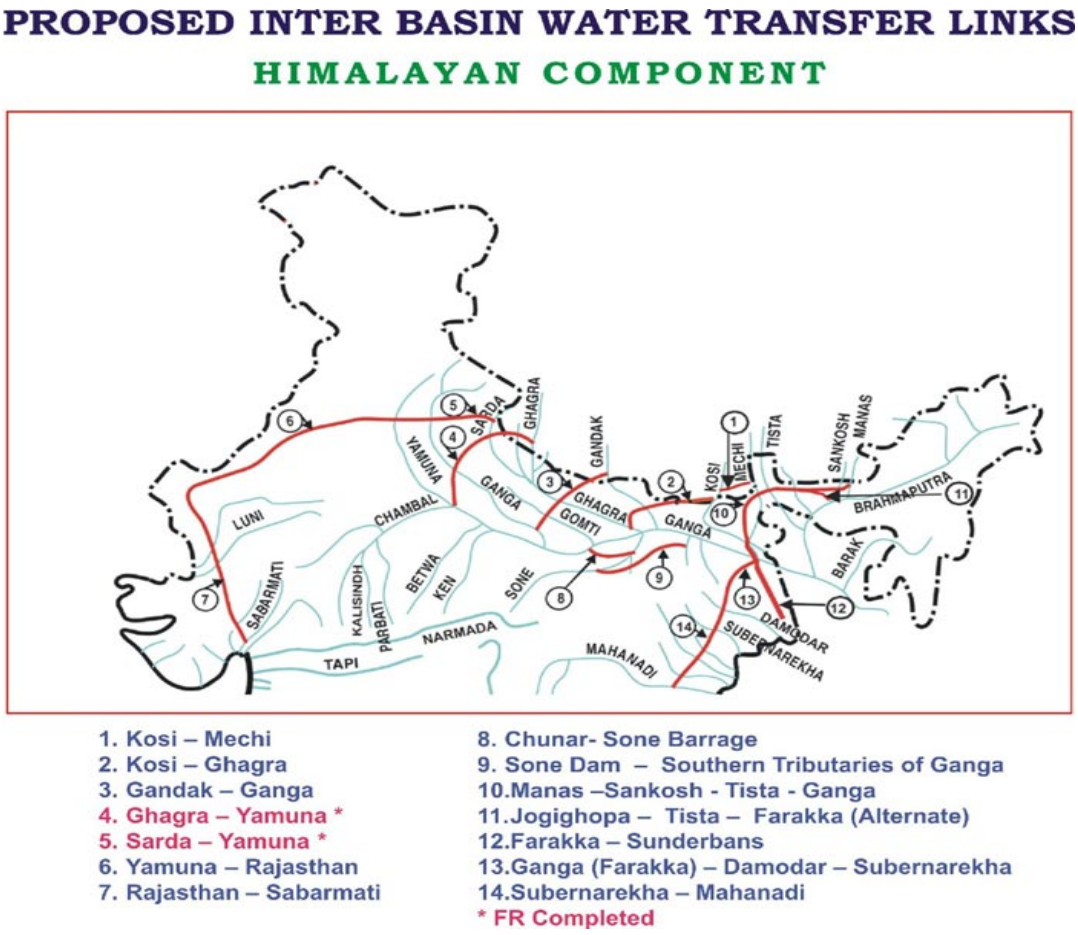
ham of annual draft. While ground water is available practically everywhere in the study area but for economical abstraction of water, proper design of ground water structure is very significant. The type and design of structure to be constructed at the site is dependent on formation characteristics like hydraulic properties of formations, quality of water and prevailing hydrogeological conditions. Shallow tube wells and cavity wells upto a depth of 50 m and 20m respectively can make sizeable contribution for irrigation in the district. The design of shallow tubewells should have 80-100 mm dia. straight assembly tapping 5-10 m of saturated zones with slot size 1.16 mm or coir strainer with pea gravel of 3 to 6 mm. For economy as well as to avoid corrosion, PVC pipes can also be used. The shallow tubewells within the Quaternary alluvium can be constructed by rotary drilling rig. The well should be developed by over pumping to remove finer particles from the aquifer in the vicinity of tubewell. These shallow tubewells can be operated by submersible pumps or by centrifugal pumps in case water level is shallow. The other type of shallow tubewells is cavity type. The cavity types of tubewells are feasible where compact clay bed overlies the sand aquifer. The cavity wells are open at bottom and blank pipe is lowered upto bottom of the clay bed which is of considerable thickness in the district. After construction over pumping is done to remove fine sand from the aquifer which causes formation of semi-spherical cavity in aquifer. The cavity wells are operated by centrifugal pumps. The average discharge of shallow tubewells/cavity wells range between 150-400 lpm. The average cost of a cavity well using PVC pipe is about Rs. 60,000/-.

8.3.4 Inter-Basin Water Transfer

The Inter-Basin Water Transfer has little relevance to the seven districts covered under the sub-regional plan 2021 of Haryana as the benefits of the same is mostly applicable to Delhi NCR with Faridabad City benefiting partially.

Studies indicate that there is an overall water shortage in the areas of NCR covered by Yamuna basin as compared to the main Ganga basin. Technically it is possible to remove such regional disparities with regard to irrigation and other developments and water availability by transferring water from one basin state to another.

Figure 8-2: Layout of proposed inter-basin water transfer canals for NCR



8.4 *Identification of ground water rechargeable area with map.*

8.4.1 Gurgaon District

Ground Water Development

There is no scope for further ground water development. Only measures should be taken to reduce on the dependence on ground water and to enhance the ground water resources.

Water Conservation & Artificial Recharge

The stage of ground water development for the district is 209% that means the net annual withdrawal is more than the net annual recharge. During the last 20 years the ground water level has declined in whole of the area of the district and the decline is in the range of 0.77 to 1.2 m/yr. So there is a need to take measures to arrest the decline of ground water level and artificial recharge to ground water is one of such measures. Whole of the district is suitable for artificial

recharge to ground water. Excess rain water in agricultural field, surplus canal water and rooftop rain water can be injected to ground water system. Recharging shafts and injection wells are recharging structures suitable for the district.

Recommendations

1. In order to arrest the declining trend of water levels in the district, rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir.

2. The construction of roof top rainwater harvesting structures should be made mandatory in building bye-laws in all the blocks, which will help in checking the falling water level trend in the district.

3. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilising the surface monsoon runoff.

8.4.2Jhajjar District

Ground Water Development

The stage of ground water development ranges between 53% (block-Matenhail) to 107% (block-Jhajjar). The total replenishable ground water resource in the district is 356.46 mcm, while the existing ground water draft is 308.73 mcm. Ground water availability for future irrigation development is 45.37 mcm . The stage of ground water development in the district is 87%.

Water Conservation and Artificial Recharge

There are about 375 tank/pond in the district. Their block wise distribution and recharging contribution are shown in the following table.

Table 8-8 : Water Conservation & Artificial recharge

Block	No. of Tanks / Ponds	Average water spread area (ha)		No of days water is available		Recharge in Ha.m. during	
		monsoon	Non-monsoon	monsoon	Non-monsoon	monsoon	Non-monsoon
Bahadurgarh	80	150	80	85	200	18.36	23.04
Beri	70	120	70	85	205	14.688	20.664
Jhajjar	105	200	105	90	180	25.92	27.216
Mataheil	60	100	60	80	150	11.52	12.96
Salhawas	60	100	60	80	150	11.52	12.96
Total	**375**	**670**	**375**	**420**	**885**	**82.008**	**96.84**

Only the over-exploited blocks of Jhajjar and Salhawas are suitable for ground water recharge by constructing recharge structure (percolation tanks/recharge shafts/cement plugs) in or around the ponds/tanks of these areas.

8.4.3 Sonepat District

Ground Water Development

Irrigation from ground water is being done in large parts of the district. Maximum number of minor irrigation units have been installed in Sonipat and Ganaur blocks. Density of MI units is also highest in these blocks, while it is lowest in Kathura block. The depth of shallow tubewells is mainly in the range of 20-30m with discharge in the range of 8-10lps. However in parts of Ganaur and Sonepat block the shallow tubewells upto 45m having discharge more than 12 lps are prevalent.

A well assembly of 203mm dia, using about 20m to 30m long housing pipe and MS slot pipe with slots of 1.19 mm to 1.59 mm size would be ideal in the district area. "V" wires galvanized Screen having 0.50- 1.5mm slot can also be used as it can provide more open area

thenconventional slotted pipes. Entrance velocity of water in the well has to be kept in mind while designing the well assembly.

The stage of ground water development ranges between 44% (block-Kathura) to 152% (block-Ganaur).

Water Conservation and Artificial Recharge

There are few isolated pockets located in the eastern part of the district where water levels are declining very fast. Fresh ground water at deeper level is being exploited by deep tubewells. Limited possibilities of artificial recharge exist in these areas (Gannaur, Rai & Sonepat) during monsoon season, where excess runoff from upland areas can be utilized. Some of drains which were constructed to drain out excess water can be utilized for artificial recharge by constructing suitable recharge structures, such as injection wells, recharge shafts etc.

Water Conservation Structures

About 402 ponds exist in all the blocks, which act as fresh rainwater conservation structures. Out of these 75 ponds exist in Ganaur, 52 in Gohana, 30 in Kathura, 50 in Kharkhoda, 38 in Mundlana, 65 in Rai and 92 in Sonepat block.

Recommendations

1. Construction of shallow tubewells in areas along active flood plains of river Yamuna, which have shallow water level can help in augmenting water supplies in the area

2. Areas witnessing decline of water levels have to be demarcated and rainwater harvesting to artificial recharge measures be taken up in a big way to reduce the impact.

3. Areas having shallow water levels and soil water salinity be improvised using subsurface drainage.

8.4.4Rohtak District

Ground Water Development

The drinking water supply is mainly canal water based in the district. The short fall in water supply to the towns, cities and villages is met with the installation of hand pumps by the public individually as spot and convenient source of water. There are 16995 minor irrigation units with the depth ranging from 15 m to 20m and 410 sq.km.area is irrigated by these tube wells in the district. The proper drainage system created and regulated over the years has helped in maintaining proper balance between soil moisture and air thereby water logging, salinity and marshy condition associated with ground water at places has considerably declined in the district.

The stage of ground water development ranges between 47% (block- Lakhan Majra) to 101% (block-Sampla).

Water Conservation and Artificial Recharge

There are about 377 tanks/ponds and their recharging contribution in the district. Is as follows-

Table 8-9 : Lakes & ponds in Rohtak District

No. of Tank/Pond	Average water spread area(ha)		No of days water is Available		Recharge in Ha.m. during	
	monsoon	Non-monsoon	Monsoon	Non-monsoon	monsoon	Non-monsoon
377	750	375	450	1050	97.2	113.4

Only the over-exploited block of Sampla is suitable for ground water recharge by constructing recharge structure (percolation tanks/recharge shafts/cement plugs) in or around the ponds/tanks of these areas.

8.4.5 Panipat District

Ground Water Development

The ground water development in all the blocks has exceeded the available recharge and thus all the blocks have been categorized as over exploited. The stage of ground water development ranges between 137% (block-Panipat) to 186% (block-Bapoli).

Shallow tubewells are the most important ground water development structures in the district and have shown a tremendous growth in the past years. There are 32,244 shallow tubewells in the district. Most of the existing units are cavity wells. Filter wells are found along the river Yamuna in the eastern part of the district. The average depth of tubewells in the district is 60m, varying between 12 to 80m tapping aquifer between 10 to 80m. The discharge varies from 8 to 14 lps. There are 29 deep Direct Irrigation Tube wells of the State exist only in two blocks viz. Panipat and Samalkha.

Though the entire district is suitable for ground water development i.e. feasibility exists but due to over exploitation a check on ground water development is required.

Water Conservation and Artificial Recharge

There are 344 tanks and ponds in the district which act as both water conservation and recharge structures. Their blockwise distribution and recharge to ground water is as follows:

Table 8-10 : Lakes & ponds in Panipat District

No. of Tank/Pond	Average water spread area(ha)		No of days water is Available		Recharge in Ha.m. during	
	monsoon	Non-monsoon	monsoon	Non-monsoon	monsoon	Non-monsoon
377	750	375	450	1050	97.2	113.4

Possibility of Artificial Recharge

Artificial Recharge is feasible in Panipat, Samalkha, Bhapoli blocks and also in parts of Israna and Madlauda blocks. The major source of water for recharge is rainfall. The type of recharge

structures suitable in the terrain are recharge shafts, trenches, injection wells, gabion structures in river bed. As a first approximation, an area of 695 sq.km has been identified for artificial recharge in the district which has a subsurface storage potential of 242 MCM. A volume of 321 MCM of water would be required to attain this recharge. Besides this roof top rain water harvesting should also be taken up in the district.

Areas Notified by CGWB/SGWA

Samalkha block has been notified for Ground Water registration and regulation. Consequently aquifers upto 150 m depth have been declared as "Protected Aquifers" which can only be used for construction of tube wells for drinking and domestic water supply.

Recommendations

The following remedial measures are recommended to minimize the declining ground water trend in parts of the Panipat district as safeguard against environmental degradation.

* It is necessary to notify the district for regulation of all ground water abstraction structures and for the construction of any tubewell prior permission should be sought from the Central Ground Water Authority.

* Artificial recharge to ground water should be taken up in the urban and rural area to avert the further lowering of ground water level since natural recharge to the aquifer system is not adequate to support such heavy ground water withdrawal.

8.4.6 Faridabad District

Ground Water Development

The stage of ground water development ranges between 32.95% (HASSANPUR) to 75% (FARIDABAD).

The hydro geological data generated through exploratory drilling by CGWB has proved a vital information regarding identification of aquifer system, demarcation of their vertical and lateral extent, and delineation of potential aquifer characteristics.

Water Conservation and Artificial Recharge

In order to arrest the declining trends of water levels in the block, the roof top rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas (Faridabad, Ballabhgarg, Hodla, & Hathin) where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir.

Recommendations

* The corps consuming less quantity of water may be grown in place of crops requiring more water in the over exploited block.

* The construct ion of roof top rainwater harvesting structures should be made mandatory in building byelaws, which will help in checking the falling water level trend in the Faridabad town.

* The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.

* The conjunctive use of poor quality groundwater and canal water by mixing in different ratio.

* Cyclic use of canal water and poor quality groundwater.

8.4.7 Rewari District

Ground Water Development

The present stage of block wise ground water development varies from 88% (Nahar) to 170% (Khol). Out of five blocks, four fall in Over Exploited and one in Semi critical category. In Semi critical block i.e. Nahar, there is scope for ground water development but with caution, but, there is no scope of largescale ground water resource development in the over exploited blocks. However, the shallow ground water can be exploited with caution through shallow tube wells (Cavity Type).

In view of depletion in ground water resources due to overexploitation in the area, Khol block has been declared notified area and imposes prohibition and restriction on the construction and

installation of any structure for extraction of ground water resources to avoid its further depletion and deterioration in its quality.

Water Conservation and Artificial Recharge

The whole district except Nahar is suitable for ground water recharge by means of Recharge trench with Injection Wells.

Recommendations

1. The dug wells traditionally used for the monitoring the water level in the area are either dried or abandoned in major part of the area.So, it is recommended to install shallow piezometers in the blocks.

2. On the declining trend of ground water level, a close watch should be maintained and water level should be measured at different places. For this, 10 shallow (30 m) and 10 deep (50 m) piezometers 152 mm (6") dia. should be constructed for regular monitoring of ground water level. These piezometers should be uniformly distributed with the proper provision of collection of water samples.

3. High fluoride areas can be mapped and the public be educated about its harmful effect on human body. Small defluoridation plants can be used and mixing of water can be practiced.

4. It is necessary to notify the entire district for registration of all ground water abstraction structures and for the construction of any tube well, prior permission should be sought from the Central Ground Water Authority.

5. More canals should be laid for irrigation so that stress on ground water can be reduced.

8.4.8 Mewat District

Ground Water Development

A review of ground water budget of Mewat district shows that the average stage of ground water development is 75% and falls in semi critical category. Therefore caution is required for the further development of the resources. The block viz. Taoru is already over exploited. The stage of

ground water development is 164% , therefore there is no scope in this block for further development of the ground water resources until some measures like artificial recharge or supplementing the requirements by other sources are taken up. The block Ferozpur Jhirka falls in semi-critical category, Nagina falls in critical category. Nuh, Hathin and Punhana fall in safe category. Due to presence of saline ground water in these blocks ,efforts have been taken up to delineate the fresh water pockets/areas for development. In these blocks about 5856 Ham of surplus ground water is available which can support additional 12500 shallow tubewells of 1.0 ham of annual draft. While ground water is available practically everywhere in the study area but for economical abstraction of water, proper design of ground water structure is very significant. The type and design of structure to be constructed at the site is dependent on formation characteristics like hydraulic properties of formations, quality of water and prevailing hydrogeological conditions. Shallow tube wells and cavity wells upto a depth of 50 m and 20m respectively can make sizeable contribution for irrigation in the district. The design of shallow tubewells should have 80-100 mm dia. straight assembly tapping 5-10 m of saturated zones with slot size 1.16 mm or coir strainer with pea gravel of 3 to 6 mm. For economy as well as to avoid corrosion, PVC pipes can also be used.

Water Conservation and Artificial Recharge

Artificial Recharge is feasible in Taoru, Nagina, and Firozepur-Zilka blocks and also in parts of Hathin block. The major source of water for recharge is rainfall. The type of recharge structures suitable in the terrain are recharge trenches with injection wells, gabion check dams.

About 140.29 sq.km. area is underlain by hard rock of Delhi System, may be taken up for artificial recharge through bunding across the seasonal streams flowing to the area. And the area can be exploited for ground water.

Recommendations

(i) Excessive surface runoff should be drained out of the area.

(ii)Shallow borewells be installed so that the withdrawal of ground water at least equals the annual recharge. This will control the rise of water table and reduce the scope of evaporation.

(iii) Plantation of eucalyptus trees should be encouraged where water table is less than 5 m deep. This will serve a dual purpose, first by lowering the water table through rapid transpiration and secondly by providing economic support to local farmers.

(iv) Regulated irrigation by fresh water through canals may be arranged. Use of saline ground water for the irrigation should be discontinued, if not discontinued; it will enhance the salinity and render the marginal soil as wasteland.

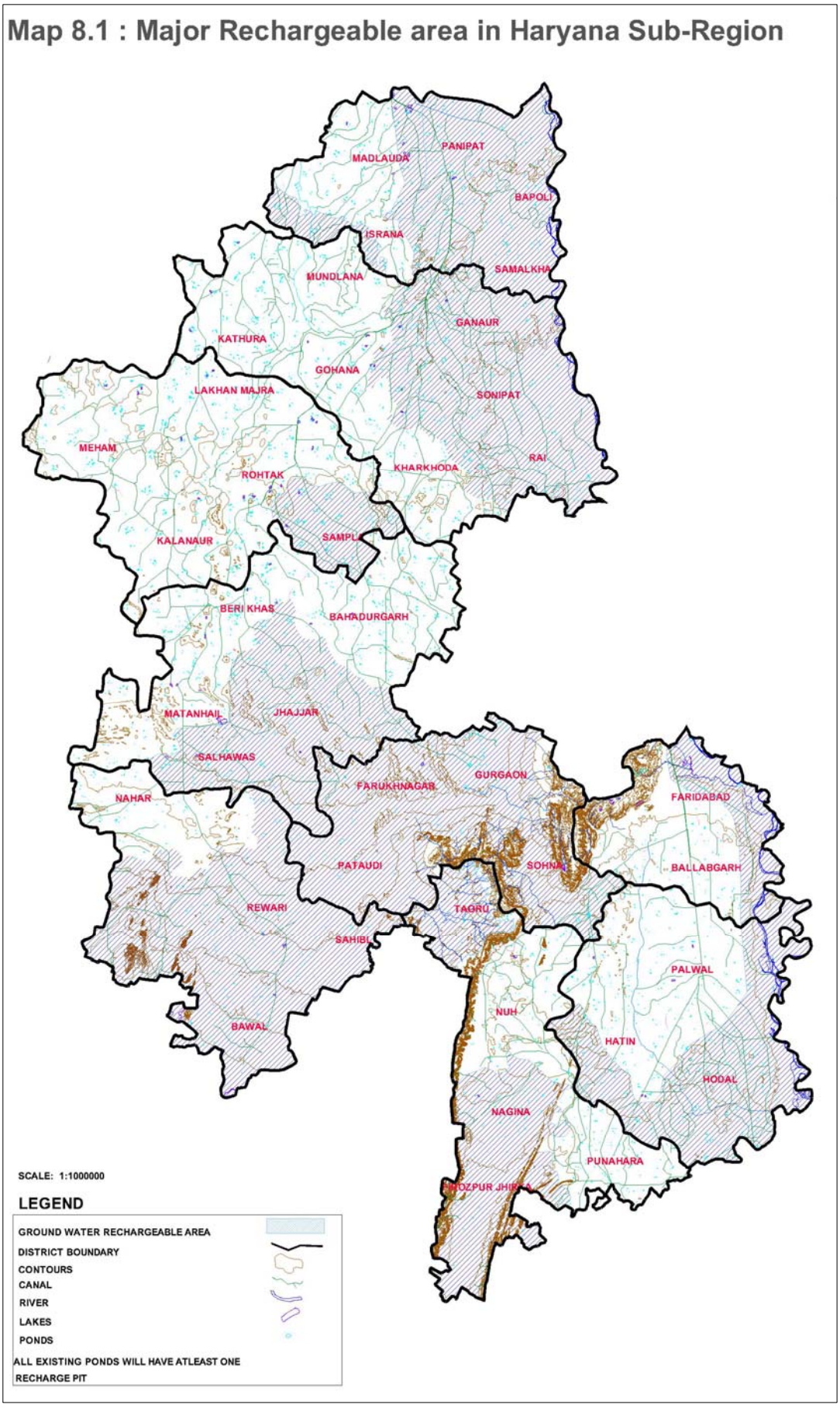
(v) It is necessary to notify the Taoru block (stage of development 164%) of the district for registration of all ground water abstraction structures and the construction of any tubewell , prior permission should be sought from the Central Ground Water Authority. Local populace to be educated regarding consequences of mining of ground water and need for its economic use.

8.4.9 Map of NCR, Haryana showing Rechargeable Areas

The Map showing the possible artificial recharge areas in each district are shown in the Map No. 8-1 . This map has been prepared on the basis of the following parameters:

- CGWB Ground Water Information Booklets
- Contour map of all areas, specially the depressions
- Recharging below existing pond/tanks and other water bodies
- Ground water tables
- Status of ground water development.

Map 8-1: Map showing major rechargeable area in Haryana Sub-Region



8.5 *Existing Water Situation*

The per capita rate of water supply in urban centers of Haryana Sub-Region ranges from 45 lpcd in Ganaur to 145 lpcd in Panipat. Per capita availability of water in most of the urban centers had dwindled over the last decade due to rapid urbanisation and lack of financial and water resources. The status of drinking water supply in rural areas also presents a dismal picture. Moreover, many villages did not have local sources of water and almost equal numbers did not have adequate sources.

Although, there is no estimate available for the ultimate industrial requirement of water up to the year 2021, from secondary data collection, the industrial water demand has been assessed by us and addressed later in this section.

Part demand is also met from ground water. However, entire Haryana Sub-Region has been witnessing decline in ground water levels. The decline has been higher in areas underlain by fresh water as compared to areas having marginal to saline ground water. In the districts of Panipat, Sonepat, Rewari, Rohtak, Faridabad and Gurgaon, the decline in ground water table during the last 20 years was of the order of 3 to 7 meters, the decline being more pronounced in Gurgaon, Faridabad and Rewari Districts. There are several places in southern Haryana where EC values of ground water is greater than 10000 μS /cm at 25o C making water non-potable.

Lack of ground water recharging, higher rate of withdrawal, fast pace of urbanization and reduction in run off time for rain water, are the primary causes in retarding the rate of development of ground water. Thus, recharge of groundwater is a priority.

Some of the cities/towns in the region have laid canals/pipe lines to obtain water from the already existing canal system at farther places which has resulted in laying of 3-4 parallel canals/pipes causing duplicity of work and expenditure.

Hence, there is a need to adopt regional approach for providing water in the region to examine all the aspects discussed above and prepare a Functional Plan which will lead to preparation of an integrated water supply scheme for the region which is technically viable and suggest sustainable long term measures which may include dams in the Himalayas, inter basin transfer of water, etc.

In addition to above, there are several ongoing and proposed projects from where a significant quantity of water will be available for Haryana Sub-Region in future. An assessment and analysis of scenario after construction of these dams will be discussed later. Similarly, it is also proposed to construct new barrages (Figure 8.1) and inter basin water transfer canals to transfer additional quantity of water to NCR. NCR will also receive a significant quantity of water from Poornagiri and Pancheswar dams on Sarda river via Sarda Yamuna Link and Rajesthan Yamuna Link inter basin link canals. A pre-feasibility study of this canal system has been completed by National Water Development Agency (NWDA). Similarly, Sutlej-Haryana-Alwar Link canal is proposed during the course of this study. There are several sewerage that are also proposed in NCR.

The data on status of water supply for domestic, industrial and irrigation use has been collected for various towns of Haryana Sub-Region from respective PHED and Irrigation Department offices in Haryana Sub-Region.

8.5.1 Domestic water consumption and coverage

The level of service in urban area of Haryana Sub-Region varies from 45 lpcd in Ganaur to 145 lpcd in Panipat. The level of services and population coverage is given in Table below.

Table 8-11 : Water Supplied and population covered by Govt. schemes

Sub-Region	Consumption(in lpcd)		Coverage of Population(% Population)	
	Urban	Rural	Urban	Rural
Haryana	45–145	20–100	40–100	17–100

Source: Department of Irrigation and Agriculture, Haryana

The domestic water supply at present for Haryana Sub-Region has been compiled from Annexure 8.1 respectively and is given in following Table.

Table 8-12 : Quantity of domestic water supply

Sub Region	Unit	Present Water Supplies		
		Urban	Rural	Total
Haryana	MLD	521.46	195.04	716.50
	MCM	190.33	71.19	261.52
	BCM	0.19	0.07	0.262

Source: Department of Irrigation and Agriculture, PHED Haryana

8.5.2Industrial Water Supply and Coverage

Data on industrial water supply was collected from state PHED and Industrial departments and compiled in Annexure-8.1 showing the district wise summary of industrial consumption as per Yr. 2009.

8.5.3Agricultural water supply/consumption and coverage

Requirement of water for agriculture has been estimated on district basis. Details of agricultural demand are calculated on the basis of *average water usage of 2.4 cusecs for 1000 acres of agricultural land*. Also the total estimate of irrigation water demand as per Regional Plan 2021 has been adopted. (*Source: State Irrigation Department, Haryana.)*

The crop water requirements are primarily met by rain water and irrigation water supplied by canal systems and tube wells. Data on irrigation water supply was collected from state irrigation departments. The Haryana Sub-Region agricultural water consumed is given in the following Table:

Table 8-13 : Haryana Sub-Region water supplied/consumed for Agriculture.

Sub Region	Agriculture consumptions in BCM/ Year		
	Rain	Irrigation Water (Canal + TW)	Total
Haryana	2.662	2.267	4.929

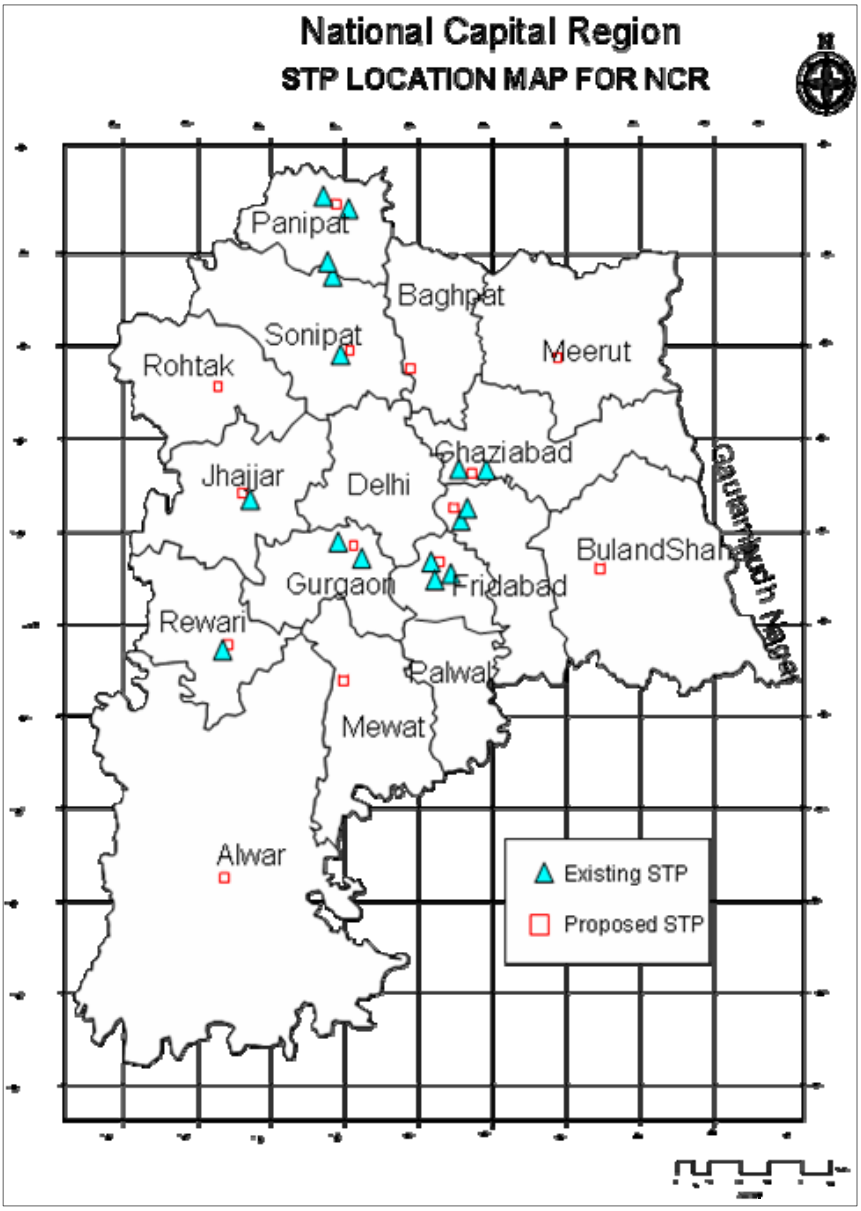
Source: Department of Irrigation and Agriculture ,Haryana

8.5.4 Recycle of Sewage/Wastewater[1]

- **Objective of recycling:**

It is estimated that almost 80% of water supplied find it's way into the sewerage system. With rise in population & depleting water resources, the need for recycling of waste water is becoming more & more important. The treated water can be used for irrigation, wash rooms, air-conditioning of large buildings, flushing of toilets, cooling towers, thermal power plants, motor garages for washing of cars, etc.

Figure 8-3 : STP Location Map for NCR



Treated sewage for recycling :

There is a non-conventional source of water that is available in the form of treated sewage (STP locations shown in Figure 8.2. Presently, it is being used for canal irrigation and direct utilization on land for agriculture. Part of this water applied for irrigation percolates deep into the aquifer. There is a threat of ground water contamination if treatment effluent standards are not met.

[1] Study on water supply and its Management In National Capital Region by WAPCOS

- **Recycling of waste water in the sample towns:-**

1. **Gurgaon**

Amount of wastewater generated from STP's after treatment - 98 mld

(30 mld from UASB(PHED) + 68mld UASB(HUDA)

Newly constructed STP's (to be commissioned) - 50 mld

About 25-30% of treated wastewater is being used by near-by farmers for irrigation during non-monsoon season. The balance treated sewage effluent outfalls into Najafgarh drain which ultimately meets river Yamuna.

From newly constructed STP, 10 mld of recycled wastewater would be used in Horticulture and the balance would be disposed off in Najafgarh drain.

2. **Faridabad**

Amount of wastewater generated from STP's after treatment - 115 mld

(45 mld UASB+20mld UASB + 50 mld UASB)

About 25-30% of wastewater is being used by the near-by farmer for irrigation during non-monsoon season, the balance is being discharged into Buria nala, Agra canal and Gaunchi drain.

3. **Panipat**

Amount of wastewater generated from STP's after treatment - 45 mld

(10 mld UASB (Jatal Road) +35 mld UASB (Village Siwah))

About 30-40% of wastewater is being used by the near-by farmers for irrigation during non-monsoon season, balance treated wastewater is discharged into Nohra drain and Panipat drain which ultimately meets river Yamuna.

4. **Gohana**

There is no sewage treatment plant in operation. One 3.5 mld sewage treatment plant is under construction, hence no recycling of treated wastewater at Gohana town. The plant under construction is based on Waste Stabilization Pond technology.

Hence, the total recycled sewage water used for non-potable purposes = 10 + (115*0.25) + (45*0.4) = 56.75 MLD.

- **Observations:**

In many of the towns it was observed that the sewerage system was quite old. Many of the joints are leaking and it is a cause of concern because it pollutes the ground water.

It was observed that sewage (with or without treatment) is being discharged in to the nearest river or nala. However during the non monsoon period, some sewage is used for irrigation purpose but is limited to small area and for few months only.

Discussions with the agencies concerned revealed that they are aware of the fact that no untreated sewage should be discharged into the river/water courses, but this not followed because of several reasons i.e. insufficient treatment capacity, power breakdown, breakdown of STP, etc. The government agencies were not very receptive to the idea of using the recycled waste water for industrial or non drinking purposes because of the requirement of parallel pipelines & pumping systems, which was considered to be impractical.

8.5.5 Total water supply

The total water supply for Haryana Sub-Region has been compiled from the Annexure 8.1 and the summarized figures are given in Table below.

Table 8-14 : Present (Yr. 2009) water supply in the sub-region of HARYANA

Sub Region	Unit	Present (Yr. 2009) supply					
		Domestic	Fire Fighting	Industrial	Irrigation	Recycled Sewage	Total
Haryana	In MLD	716.50	24.54	21.11	13504	56.25	14266
	In BCM	0.262	0.009	0.008	4.929	0.021	5.208

Source: Department of Irrigation and Agriculture, PHED Haryana

8.6 *Year 2011 & 2021 Water Demand Summary*

8.6.1 Water Demand Summary

Population Projection

From the population projection analysis carried out in Chapter 5 of our Interim Report, and based on the assumption that about 10% of the rural population in 2011 and 25% in 2021 will come under the umbrella of urban areas due to urbanization as per Haryana PHED Engineer-in-Chief's letter dated 24th. February, 2009 to NCR Planning & Monitoring Cell, Panchkula, the projected population figures in the HSR districts are presented in Table below:

Table 8-15 : Population Projections for 2011 and 2021

S. No.	District	Population for 2011 (souls)			Population for 2021 (souls)		
		Total	Urban	Rural	Total	Urban	Rural
1	Faridabad	2102108	1750000	352108	3278943	2900275	378668
2	Palwal	1068246	289966	778280	1375315	538328	836987
3	Rohtak	1217914	586461	631453	1477498	832491	645007
4	Panipat	1184091	551666	632425	1429418	776812	652606
5	Sonipat	1581663	542486	1039177	2493937	1450000	1043937
6	Gurgaon	1751968	1067322	684645	4762373	3988496	773877
7	Jhajjar	980614	305243	675371	1100118	478777	621341
8	Rewari	1012206	401206	611000	1346880	750000	596880
9	Mewat	985508	93806	891702	1157566	149646	1007919
Total		**11884317**	**5588157**	**6296161**	**18422046**	**11864825**	**6557222**

8.6.2 Domestic Water Demand

To arrive at the future water demand for the HSR the consultants have prepared a statement taking into consideration the drinking water demand, fire fighting demand, industrial demand and the losses in transmission and distribution. The agricultural demand has been kept separate.

Data has been compiled for all the towns / rural areas and authenticated by the consultants. The methodology adopted to arrive at each demand figure is as the norms and standards for water supply as fixed by the Engineer-in-Chief, Haryana and based on the recommendations by the NCRPB report.

Detailed calculations on above and the water demand figures of the HSR region are enclosed herewith as Annexure 8.2, from where the settlement-wise water demands are shown in Table below:

Table 8-16 : Total Domestic Water Demand, 2011 & 2021

Sub-Region/City/Town	Population		Domestic Demand (MLD)		Domestic Demand (BCM per annum)	
	2011	2021	2011	2021	2011	2021
Panipat District						
Panipat	506866	709612	118.8	165.9	0.0434	0.0605
Samalkha	44800	67200	7.0	11.3	0.0025	0.0041
Rural	632425	652606	53.4	55.1	0.0195	0.0201
Sub- Total	**1184091**	**1429418**	**179.2**	**232.2**	**0.0654**	**0.0848**
Sonipat District						
Sonepat	357990	1000000	84.2	233.2	0.0307	0.0851
Gohana	82480	150000	13.7	35.7	0.0050	0.0130
Ganaur	55109	175000	9.3	41.6	0.0034	0.0152
Kharkhoda	46907	125000	7.3	29.9	0.0027	0.0109
Rural	1039177	1043937	86.9	87.3	0.0317	0.0319
Sub-Total	**1581663**	**2493937**	**201.4**	**427.6**	**0.0735**	**0.1561**
Rohtak District						
Rohtak	534644	748501	125.3	174.9	0.0457	0.0638
Kalanaur	22752	32990	3.5	5.1	0.0013	0.0019

Maham	29065	51000	4.5	8.6	0.0016	0.0032
Rural	631453	645007	53.3	54.5	0.0195	0.0199
Sub-Total	**1217914**	**1477498**	**186.7**	**243.1**	**0.0681**	**0.0887**
Jhajjar District						
Bahadurgarh	198000	300000	46.9	70.7	0.0171	0.0258
Ladrawan #	10209	13016	1.6	2.0	0.0006	0.0007
Jhajjar	74034	133261	12.4	31.8	0.0045	0.0116
Beri	23000	32500	3.6	5.0	0.0013	0.0018
Rural	675371	621341	57.0	52.5	0.0208	0.0192
Sub-Total	**980614**	**1100118**	**121.4**	**162.1**	**0.0443**	**0.0592**
Faridabad District						
Faridabad	1750000	2900275	406.7	672.4	0.1484	0.2454
Rural	352108	378668	30.2	32.4	0.0110	0.0118
Sub-Total	**2102108**	**3278943**	**436.9**	**704.9**	**0.1595**	**0.2573**
Palwal District						
Palwal	200720.7	400000	47.6	94.0	0.0174	0.0343
Hodal	57249.053	85553.11	9.6	14.2	0.0035	0.0052
Hasanpur	11588.794	14774.493	1.8	2.3	0.0007	0.0008
Hathin	20407	38000	3.2	5.9	0.0012	0.0022
Rural	778280	836987	65.4	70.3	0.0239	0.0256
Sub-Total	**1068246**	**1375315**	**127.6**	**186.7**	**0.0466**	**0.0681**
Gurgaon District						
Gurgaon	920127	3700000	214.7	857.1	0.0784	0.3128
Farukknagar	11266	13332	1.7	2.1	0.0006	0.0008
Sohna	76230	167706	12.7	39.9	0.0046	0.0146

Pataudi	59699	107458	10.0	25.8	0.0037	0.0094
Rural	684645	773877	57.7	65.1	0.0211	0.0238
Sub-Total	**1751968**	**4762373**	**296.9**	**989.9**	**0.1084**	**0.3613**
Rewari District						
Rewari	250000	450000	59.1	105.6	0.0216	0.0386
Dharuhera	93706	200000	15.5	47.4	0.0057	0.0173
Bawal	57500	100000	9.7	16.5	0.0035	0.0060
Rural	611000	596880	51.7	50.5	0.0189	0.0184
Sub-Total	**1012206**	**1346880**	**135.9**	**220.1**	**0.0496**	**0.0803**
Mewat District						
Firozpur Jhirka	28408	46000	4.4	7.1	0.0016	0.0026
Taoru	27725	45000	4.3	7.0	0.0016	0.0025
Punhana	20012	30388	3.1	4.7	0.0011	0.0017
Nuh	17661	28258	2.7	4.4	0.0010	0.0016
Rural	891702	1007919	74.8	84.3	0.0273	0.0308
Sub-Total	**985508**	**1157566**	**89.3**	**107.5**	**0.0326**	**0.0393**
Total for Haryana Sub-Region of NCR	**11884317**	**18422046**	**1775.4**	**3274.0**	**0.6480**	**1.1950**

8.6.3 Industrial Water Demand

Data on industrial water supply was collected from state PHED and Industrial departments and compiled in Annexure-8.1 showing the district wise summary of industrial consumption as per Yr. 2009. Based on this, the industrial water demand for the various districts are as shown in Table below:

Table 8-17 : Total Industrial Water Demand, 2011 & 2021

Districts in Haryana Sub Region	Industrial Water Demand (BCM per annum)	
	2011	2021
Panipat	0.122	0.198
Sonipat	0.086	0.18
Rohtak	0.034	0.064
Jhajjar	0.068	0.108
Rewari	0.028	0.068
Gurgaon	0.274	0.408
Faridabad*	0.364	0.512
Total	**0.976**	**1.538**

** - Includes Palwal*

8.6.4Irrigation/Agriculture Water Demand

Requirement of water for agriculture has been estimated on district basis. Details of agricultural demand are calculated on the basis of average water usage of 0.068-cumecs for 1000 acres of agricultural land. Also the total estimate of irrigation water demand as per Regional Plan 2021 has been adopted.

Based on the above data, the irrigation water demand for 2011 and 2021 has been computed in Table below:

Table 8-18 : Total Irrigation Water Demand, 2011 & 2021

Districts in Haryana Sub Region	Irrigable Area Acres		Irrigationl Water Demand (BCM per annum)	
	2011	2021	2011	2021
Panipat	257,810	296,482	0.553	0.636
Sonipat	437,500	503,125	0.938	1.079
Rohtak	353,940	407,031	0.759	0.873
Jhajjar	387,500	445,625	0.831	0.956
Rewari	322,750	371,163	0.692	0.796
Gurgaon	242,350	278,703	0.520	0.598
Faridabad*	336,100	386,515	0.721	0.829
Mewat	358,000	411,700	0.768	0.883
Total	**2,695,950**	**3,100,344**	**5.78**	**6.65**

*Source: State Irrigation Department, Haryana., * - Includes Palwal*

8.7 *Surface Water Resources*

8.7.1 Present Sources of Water & Hydrological cycle of NCR

Presently NCR receives water from several sources. These can be grouped as following.

- Rainfall
- Canals originating from
    - river run-off schemes (barrages)
    - dams as inter basin water transfer canals
    - other Inter-basin transfer canals from barrages and
- ground water
- Flood water of river basins
- Dams
- Lakes and Ponds
- Treated sewage for re-cycling

8.7.2 Future Sources of Surface Water

In addition to above, there are several ongoing and proposed projects from where a significant quantity of water will be available for NCR in future. It is expected that three additional dams namely Renuka, Lakshar-vyasi and Keshau will come up soon in Yamuna basin. Similarly, it is also proposed to construct new barrages and inter basin water transfer canals to transfer additional quantity of water to NCR. NCR will also receive a significant quantity of water from Poornagiri and Pancheswar dams on Sarda river via Sarda Yamuna Link and Rajesthan Yamuna Link inter basin link canals. A pre-feasibility study of this canal system has been completed by National Water Development Agency (NWDA). Similarly, Sutlej-Haryana-Alwar Link canal is proposed during the course of this study. There are several sewerage systems (Figure 5.5 and 5.6) that are also proposed in NCR. Analysis and assessment of these future water resources that would be available after completion of ongoing and proposed projects is discussed subsequently.

Figure 8-4: Proposed Barrage locations- NCR

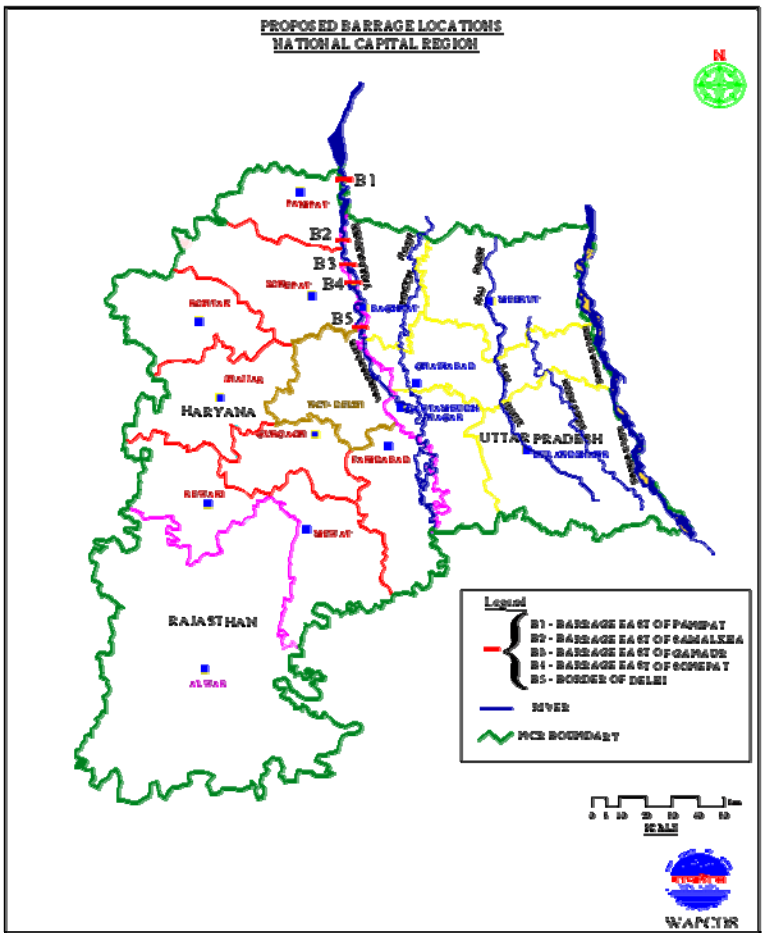


Table 8-19 : Details of major canals/Distributories in WJC system in NCR

Sl No	Name of the Channel	Design Discharge in cumecs (cusecs)	Districts Served
1.	WJC canal	396.43 (14000)	Haryana, North Rajesthan
2.	Augmentation Canal	169.9 (6000)	Parallel to WJC
3.	Dewana Distributary	0.1 (3.5)	Rewari
4.	Barwas Distributary	0.05 (1.75)	Rewari
5.	JLN Feeder Canal	42.47 (1500)	Rohtak, Rewari, Jhajjar
6.	Bhaulat Sub-Br Canal	34.81(1229.35)	Rohtak, Jhajjar,
7.	Delhi Branch Canal	50.49 (1783)	Sonipat, NCT Delhi

8.	Delhi Sub-Branch Canal	3.20 (112.9)	Sonipat, NCT Delhi
9.	Gurgaon WS Channel	3.82 (135)	
10.	Bhalaut Distributary	2.17 (76.63)	Rohtak, Jhajjar
11.	Jhajjar Town supply	0.85 (30)	Rohtak, Jhajjar
12.	Rohtak Town supply	1.13 (40)	Rohtak
13.	Rohtak Distributary	3.24 (114.4)	Rohtak.
14	Pai-distributary	2.30 (204.65)	Sonipat.
15.	Jua-distributary	3.67 (129.5)	Sonipat
16.	Rajpura-distributary	1.73 (61)	Sonipat, Panipat,
17.	Irsana distributary	4.84 (171)	Panipat,
18.	Samalkha distributary	1.53 (54)	Panipat

Source: Final NCRPB Report (WAPCOS)

There are several other direct outlets, minors and sub-minors of WJC system that supply irrigation and drinking water to different parts of Haryana Sub-region of NCR. On an average, 4.9823 BCM/year of water is diverted to WJC canal at Tajewala and 1.5802 BCM/ year of water is diverted in WJC canal through Narwana Branch Canal (NBK Link). Out of 6.5625 BCM/year of water received in WJC system, 2.31557 BCM/ year of water is supplied to various districts of NCR for meeting irrigation and drinking needs. The remaining quantity of water is supplied to other districts of Haryana that are outside the NCR. Hence, without increasing the flows in WJC system, the share of NCR in WJC water can not be increased.

The Agra canal takes off from Okhla weir near Delhi. The flow of the Agra canal is supplemented at Okhla weir by the UGC and Hindon river waters through the Hindon cut. During the non-monsoon period when there is little or no flow in the Hindon, the supply in the Agra canal is supplemented by the Upper Ganga Canal system via Jani Escape, to Hindon weir and the Hindon cut. Only small part of its command area lies in NCR (Faridabad, Mewat and Gurgaon districts).

Table 8-20 : Details of canals/distributaries in Agra Canal System in Haryana sub-region of NCR

Sl. No.	Name of the Channel	Design Discharge in cumecs (cusecs)	Districts Served
1.	Agra Canal	113.27 (4000)	Gurgaon, Faridabad, Mewat
2.	Gurgaon Br Canal	8.052 (284.38)	Faridabad, Gurgaon
3.	Meerka Minor	0.37 (13)	Faridabad, Gurgaon
4.	Mandkala Distributaries	0.88 (31)	
5.	Rajaulka Distributaries	0.30 (10.6)	Faridabad, Mewat
6.	Malai Distributaries	0.61 (21.5)	Faridabad, Mewat
7.	Pundari Distributaries	1.36 (48)	Mewat
8.	Uleta Distributaries	0.82 (29)	Mewat
9.	Uttawar Distributaries	28.53 (93)	Mewat
10	Ujaina Distributaries	0.88 (31)	Mewat
11.	Ladki Minor	0.24 (8.5)	Mewat
12.	Ferozepur-Jhirka Distributaries	1.53 (54)	Mewat.

Source: Final NCRPB Report (WAPCOS)

8.7.3Major Inter-basin canal systems.

In addition to WJC and Agra canal systems, water is also being transferred from Indus Basin to Haryana sub-region via NBK canal. The proposed SYL canal will augment the system. The NBK transfers a significant quantity of water to WJC system at Munak head works. This entire system is referred as WJC system. Excerpts of these are presented in Table below:

Table 8-21 : Details of major Inter-basin canals in Haryana sub-region of NCR

Sl. No	Name of the Channel	Areas/ Districts Served
1.	Narwana Branch Canal	Haryana, NCR Districts
2.	UGC-Hindon Cut	Gurgaon, Faridabad, Delhi
3.	Beas – Sutlej Link	Series Command Transfer
4.	Ravi – Beas Link	Series Command Transfer

Source: Final NCRPB Report (WAPCOS)

On an average, Haryana receives 1.5802 BCM/year of water from Narwana Branch Canal (NBK Link); it receives 0.66321 BCM/ year of water from Sutlej Yamuna Link canal (SY Link) and 0.52838 BCM/year of water from Ganga via Hindon cut channel as inter-basin water transfer canal. Out of this 2.77179 BCM/ year of water received through inter-basin transfer, several districts of Haryana and Uttar-Pradesh that are outside NCR also have a share.

As an area share of 39.95% for NCR region of Haryana to total area of Haryana state, about 1 BCM/year of water could be received through inter-basin transfer for the NCR districts.

8.8 *Ground Water Resources for HSR*

The main source of ground water recharge is rainfall. The other sources of recharge include canal seepages, recharge from surface irrigation, recharge from surface water bodies and water conservation structures such as check dams and roof top and related water harvesting resources.

In Haryana, shallow water table conditions exist in the districts of Rohtak and Jhajjar, being in depth range of 2m to 10m. Water levels are deeper in the southern parts of Haryana, covering parts of Gurgaon, Faridabad and Rewari. However in Mewat district and parts of Faridabad, shallow water levels in the depth range of 2m to 5m also exist.

In most parts of Haryana the decline is in the range of 0-2m. The Southern Haryana, covering parts of Gurgaon, Rewari and Faridabad district exhibit a groundwater level decline in the range of 2m to 4m.

The district-wise area-wise position of ground water resources availability of Haryana sub-region is given earlier in our report.

For Haryana sub-region of NCR, the net annual ground water availability and annual extraction for various types of uses is as given in Table below:

Table 8-22 : Availability of Haryana sub-region of NCR Ground Water

1.	Total net Annual Ground Water Availability (Ha m / yr)	264116
2.	Annual Ground Water Extraction for irrigation, domestic & industrial uses. (Ha m/Yr)	272040

The over all stage of ground water development ranges from 51% for Faridabad district to as high as 156% for Panipat district.

8.8.1 Secular Ground Water Reserves

In addition to annual availability of replenishable ground water resource there is also the availability of large quantities of ground water resource below the zone of fluctuation that are also partly recharged from foot-hills of Himalayas.

The CGWB has made an estimate of such Secular Reserves for the Haryana sub - region of NCR. The magnitude of these reserves available in multi–layered sequence of Alluvial sediments are given in table below.

Table 8-23 : Position of Ground Water Storage beyond zones of water level fluctuation

(Secular Ground Water)

Sub region	Ground water storage (in MCM)
a) Panipat	11500
b) Sonepat	7908
c) Faridabad	1570
d) Rohtak	628
e) Rewari	237
f) Gurgaon	214
Total	**22057**

** Estimates for Mewat, Jhajjar and Palwal are not separately assessed by CGWB and are included in the undivided districts of Gurgaon, Rohtak and Faridabad.*

It is observed that there is huge quantity of ground water down to 300-400 meters depth occurring below the lowest levels of ground water fluctuations in some districts of above mentioned sub regions of NCR. These reserves can meet the drinking water & other water requirement of towns / villages that fall in the respective areas. These reserves when put to controlled development in combination with surface water as well as through water conservation and augmentation measures could meet most of projected demands of water supply of NCR for various types of usages.

8.8.2 Ground Water Development Prospects

Advances in technology have resulted in enormous increase in extraction of ground water, the world over, thereby disturbing natural ground water balance. Rapid urbanization coupled with enhanced ground water extraction for irrigation, have adversely affected the ground water resources of the Region. Water levels have declined in most parts of the Haryana Sub-Region of NCR and alarmingly in a few districts namely, Gurgaon, Rewari, and Faridabad.

Based on the available hydrogeological data, the NCR area has been divided into three areas namely 'A', 'B' and 'C'. In the area 'A', fresh water aquifers exist down to 450 m depth and the tubewells yield 150 m^3/hr or more for moderate draw-downs. Only Panipat town and its surroundings fall in this area. In the 'B' category area, small to very thick fresh ground water aquifers exist down to 50 m to 300 m depth and are underlain by saline ground water. Tubewells in this zone yield 50 m^3/hr to 150 m^3/hr for moderate to heavy drawdowns. Faridabad (Part) falls in this 'B' area. The remaining towns fall in 'C' category area having limited thickness of fresh water aquifers and hard rock aquifers. The yield from these aquifers is low to moderate being 50 m^3/hr or less for moderate to heavy draw-downs.

The chemical quality of ground water in different districts of Haryana Sub-Region of NCR has already been described in para. 2.3.4(b). Areas with brackish quality of water (EC between 3000-6000 micromhos/cm at 25° C) occur in northwestern parts of Sonepat district, northern and northwestern parts of Rohtak district, north-west and northern parts of Gurgaon district, western parts of Rewari district, and southwest parts of Faridabad district.

8.8.3 Depth-Wise Salinity Variations

The ground water salinity conditions in the deeper aquifers are revealed by electric logs of bore holes and quality (zone) tests on exploratory bore holes drilled by CGWB and State Govt. Organizations. The thickness and extent of potable water zones and saline water zones vary widely both laterally and vertically. The following zones have been made out.

Areas with Fresh Ground Water at all Levels

In this category are included areas in which ground water in both the phreatic and confined / semi confined aquifers is fresh upto very deep levels. Exploratory drilling has confirmed the presence of such areas in parts of Panipat and Sonepat districts falling along Yamuna, in the northeastern part of Sahibi river basin.

Areas with Fresh Ground Water Underlain by Saline Water

In most of the areas falling in Haryana, saline or brackish ground water is overlain by fresh ground water. The thickness of this fresh water zone is generally not more than 50 to 60 m. The salinity of water increases rapidly with depth in these areas.

Areas with Saline Ground Water at all Levels

The areas falling in this category occur in north-western part of Sonepat district, western parts of Rohtak district, north western and southern parts of Gurgaon district, southwestern parts of Rewari district, southern parts of Faridabad district, and in the north-eastern parts of Sahibi Nadi basin.

8.9 *Proposed Integrated Water Resource Management*

The quantity of water presently (Year 2009) in use and in demand has been presented in Chapter earlier. The estimated demands for year 2011 and 2021 have been indicated above. Also, present the quantity of canal water, irrigation water, flood water and treated sewage water that is presently available and/or supplied to HSR has been detailed out in the report. It also presents the water presently being used for various purposes. Similarly, an assessment of the quantity of available ground water and present utilization are presented in Sections above.

8.9.1 Gap Assessment

The shortage and surplus of water for various uses is presented in this section. The quantity of unused water is also presented subsequently. It also presents the problems and challenges involved in using conventional solution and puts forward Integrated Functional Plans as follows:

- *IWRM Plan A: After Construction of proposed dams.* A water supply scenario after construction of proposed dams in Yamuna basin is analyzed first. The effectiveness of these dams in meeting the demands is evaluated.

- *IWRM Plan B: Using Aquifer for storage of Flood waters*. An alternate functional plan to meet the deficit and to improve the water supply situation in NCR is developed. Various sub-alternates explored during the course of this alternate plan are also discussed. The efficacy of this proposed functional plan is evaluated. Though, this is a low cost option and will be sufficient for meeting the demands for an average monsoon year, its efficacy for extreme hydrological events such as worst droughts of 50 years or 100 years remains questionable.

Source Water Availability

From the description of surface and ground water sources discussed in previous sections above , we summarize below, the direct source water availability at present in the different districts of Haryana sub-region.

Table 8-24 : Direct Source Water Availability at present

Sub-Region/City/Town	Surface Water Availability (BCM per annum)	Ground Water Availability (BCM per annum)	Remarks/Total
Panipat District			
Panipat		0.066	No GW can be used for irrigation in future
Samalkha		0.054	
Madalauda		0.104	
Israna		0.08	
Bapoli	0.402	0.061	
Sub-Total	**0.402**	**0.365**	**0.766**
Sonepat District			
Sonepat		0.097	
Gohana		0.049	
Ganaur	0.672	0.113	
Kharkhoda		0.049	
Mundlana		0.057	
Rai		0.054	
Kathura		0.031	
Sub-Total	**0.672**	**0.450**	**1.122**
Rohtak District			
Rohtak		0.099	
Kalanaur		0.040	
Meham	0.553	0.052	
Lakhan Majra		0.025	
Sampla		0.037	
Sub-Total	**0.553**	**0.253**	**0.806**
Jhajjar			
Bahadurgarh		0.103	
Ladrawan	0.581	Included in Bahadurgarh	
Jhajjar		0.088	No GW can be used for domestic & industrial in future
Beri		0.059	
Matanhall		0.055	
Sahlawas		0.051	
Sub-Total	**0.581**	**0.356**	**0.938**
Faridabad District			
Faridabad			
Palwal			
Hodal			Future GW Availability for Irrigation = 0.23 BCM
Hasanpur	0.669	0.551	
Ballabhgarh			
Sub-Total	**0.669**	**0.551**	**1.220**
Gurgaon District			
Gurgaon		0.060	
Farukknagar		0.040	
Sohna	0.397	0.053	No GW can be used for irrigation in future
Hailey Mandi		Included in Gurgaon	
Pataudi		0.049	
Rural Areas		Includede in Gurgaon	
Sub-Total	**0.397**	**0.202**	**0.599**
Rewari District			
Rewari		0.001	No further GW can be used
Khol		0.0003	
Bawal		0.001	
Nahar		0.0005	
Jatusana	0.505	0.001	
Sub-Total	**0.505**	**0.003**	**0.508**
Mewat District			
Taoru		0.043	No further GW can be used for Irrigation
Punhana		0.049	
Nuh		0.061	
Firozpur Jhirka		0.045	
Hathin		0.084	
Nagina	0.476	0.031	
Sub-Total	**0.476**	**0.313**	**0.789**
Total of Haryana Sub-Region of NCR	**4.255 BCM**	**2.492 BCM**	**6.747 BCM**

** Estimates for Ground Water were obtained from the CGWB. The total Surface Water availability for the entire Haryana sub-region was obtained from the final NCRPB report. The district wise break-up has been based on the ratio of the areas of each district to the total area of the sub-region.*

Deficits

The deficits and shortages in water supply for various uses are evaluated in this section. These deficits for year 2011 and 2021 are calculated using the demands for respective year and assuming the same quantity of water keeps getting supplied.

Shortages in Domestic & Industrial Supply

Drinking and industrial water demands for the years 2011, 2021 have been worked out from the projected demand in earlier sections and the availability of surface and ground water for present and future use has also been given above. The district wise summary of the drinking + industrial water shortages for the years 2011 and 2021 based on present source water availability are given in the following Table:

Table 8-25 : Area wise shortages of drinking+industrial water in HSR

District	Present Source Water Availability BCM/Yr	Drinking + Industrial Demand BCM/Yr		Irrigation Demand BCM/Yr		Deficit (-) / Surplus (+) BCM/Yr	
		2011	2021	2011	2021	2011	2021
Panipat District	0.766	0.1874	0.2828	0.553	0.636	0.026	-0.152
Sonepat District	1.122	0.1595	0.3361	0.938	1.079	0.024	-0.293
Rohtak District	0.806	0.1021	0.1527	0.759	0.873	-0.055	-0.220
Jhajjar District	0.938	0.1123	0.1672	0.831	0.956	-0.006	-0.185
Faridabad District*	1.220	0.5701	0.8374	0.721	0.829	-0.071	-0.447
Gurgaon District	0.599	0.3824	0.7693	0.520	0.598	-0.303	-0.768
Rewari District	0.508	0.0776	0.1483	0.692	0.796	-0.262	-0.437
Mewat District	0.789	0.0326	0.0393	0.768	0.883	-0.012	-0.134
Total	6.747	1.6240	2.7330	5.7813	6.6485	-0.658	-2.635

** - Includes Palwal*

While the demand for irrigation is to be met through various MOUs signed / to be signed / entered into by various riparian states, the demand for drinking water supply and industrial use is to be given priority in respective policies of the State.

Apart from restricted ground water and canal water, the long term solution will include utilizing the unused flood water of the river basins and sub-basins, construction of upstream reservoirs to store excess water during monsoon for use in the lean period and inter-basin transfer of water such as the Sarda-Yamuna link canal which envisages transfer of surplus waters of Sarda river for meeting various requirements in U.P., NCT-Delhi and further transfer for use in water short areas of Haryana and Rajasthan. The system should be planned to provide water to the entire Haryana Sub Region, through regional schemes of water supply for all the urban and rural areas considering NCR as a single entity. Since Tehri Dam is likely to be commissioned soon, the water should be allocated from this dam for drinking water supply and industrial use of the entire HSR. All the future planning for multi-purpose dams should be done considering further demands of HSR.

8.9.2 Available Sources of Water: Un-used waters[2]

The estimates of available water that are not in use are presented in this section.

Surface runoff or overland flow

Estimates of annual surface water yield for the Haryana sub-region of NCR are summarized below:

Table 8-26 : Quantity of Surface runoff in BCM/year

Quantity of Surface runoff in BCM/ year						Annual Total BCM/ Year
Monsoon			Non-monsoon			
Cultivable	Non–Cultivable	Total	Cultivable	Non-Cultivable	Total	
1.3412	0.2121	1.553	0.4471	0.0707	0.5178	2.0708

[2] *Source : Haryana Irrigation Department and WAPCOS Report.*

Source: Final NCRPB report (WAPCOS)

The challenge lies in utilizing this runoff water locally in sub-sub-catchments of NCR. The problems and issues associated with utilizing this water are discussed in subsequent sub-sections.

Tail cluster over flow from canals.

The tail cluster over flows from canals and field channels are obtained using the daily measurement records at tail of canals. Presently, it flows down the natural drainage system and is lost from use. The Haryana sub-region summary of irrigation tail over flows is presented below. The challenge lies in utilizing the irrigation tail over flows effectively.

Table 8-27 : Irrigation tail overflows in BCM/year

Irrigation tail overflows (Canal + Tube well) in BCM/ year		
Kharif	Rabi	Total
0.3522114	0.3445820	0.6967934

Source: Final NCRPB report (WAPCOS)

Un-used flood water.

These were estimated by WAPCOS using the daily measurement records obtained from Haryana irrigation department.

The Haryana sub-region summary of legal share of NCR in un-used flood waters of different sub-basins is presented below.

Table 8-28 : Quantity of Un-used flood water share for HSR in BCM/year

Quantity of un-used flood water share for HSR in BCM/ year					
Name of the sub-basin					
Sarda-Kosi-Ramganga	Ganga Basin	Yamuna basin	Kali-Hindon basin	Beas + Ravi +Satlej Basin	Total
1.0	1.5456	0.5485	0.0000	5.986	9.080

Source: Final NCRPB report (WAPCOS)

The share of unused flood water can be re-allocated considering NCR as one entity as done. The challenge lies in utilizing 9.08 BCM/ year of available unused flood water share of HSR.

Un-used treated sewage

The distribution of presently available treated sewage, projected quantity treated sewage that will be available by 2011 and by year 2021 are presented in earlier chapter. Only excerpts are presented here. The projected sewage for Haryana sub-regions of NCR is summarized below.

Table 8-29 : Quantity of Treated Sewage in BCM/year

Quantity of Treated Sewage in BCM/ year		
2005	2011	2021
0.113	0.36	0.444

Source: Final NCRPB report (WAPCOS)

It is further assumed that 100% of treated sewage will get recycled at least for irrigation. Presently, except NCT Delhi, by and large, the treated sewage from NCR towns is being mixed with irrigation water. The challenge lies in utilizing 0.44 BCM/ year of treated sewage effectively. A new design of treating domestic and industrial (mixed sewage) to drinking standards at low cost is presented subsequently.

Un-used ground water

Large quantity of brackish ground water exists as discussed earlier. This brackish ground water can be blended with canal water and used for drinking, industrial or agricultural use. In addition to this large magnitude of deeper ground water resources (static ground water reserves) are available for use in drinking, industrial and agricultural use. Both un-used replanishable and static storages can be utilized. The challenge lies in planned exploitation of these resources. These are discussed subsequently.

8.9.3 Problems and challenges in using conventional solutions.

As stated in our Report earlier, a very significant quantity of water in the form of,

- existing ponds and lakes,
- surface runoff,
- aquifer recharge techniques,
- canal water and tail over flows,
- flood flows,
- Treated sewage water.

remains un-utilized and flows down the natural drainage system in to the bay of Bengal. This water can be utilized to meet the short-falls in NCR.

8.9.4 Outlines of functional plan for integrated water resource management in NCR.

With a view to meet the short falls discussed above, an integrated water resource management plan has been developed. The projection for total demands inclusive of drinking, fire, industrial and agriculture demands represent the saturation demand with in Haryana Sub-Region of NCR. Since the future urbanization and industrialization will occur partly over cultivable and non-cultivable lands, the agricultural demand will get re-allocated in the form of urban drinking demand and industrial demand. In fact, drinking and industrial demands per hectare of land are less than the agriculture demands. Thus, total water demands presented in paragraph 3 and its sub-paras represent more or less saturation water demands for the region. Based on these demands, the deficits were obtained. Similarly, the available quantity of water presented above, also represent the saturation availability i.e. no more than the quantity of water discussed above will be legally available to HSR in future. Hence, it shall be emphasized here that the proposed functional plan is based on concept of saturation demand and saturation water availability.

The proposed functional plan can be outlined as below.

- Use aquifer to store as much water as possible or to its potential and pump it where ever and when ever need arises.
- Recharge more and pump more.
    - o Use surface runoff generated within HSR to recharge aquifer.
    - o Use irrigation tail cluster and field channel over flows also to recharge aquifer.
    - o Store or transfer un-used flood water all over the HSR via canals and inter basin transfer canals and store it in aquifers.
- Use numerous village ponds and lakes effectively for both surface storage and aquifer recharge.
- Use saline or brackish ground water by mixing it with canal water in desired ratio.
- Treat sewage to drinking standards as far as possible and recycle it for non-drinking usages such as industrial and agricultural water requirements.

Proposed Functional Plan A: After construction of proposed dam.

As mentioned earlier that there are proposals to construct new dams namely Renuka, Lakhwar Vyasi and Keshau dams in Yamuna basin (Renuka – 0.456 BCM/ year, Lakhwar Vyasi – 0.330 BCM/year and Keshau – 1.330 BCM/ year). The total capacity of all three dams is 2.116 BCM/ year whereas the total quantity of available un-used flood water in Yamuna basin for Haryana Sub-Region of NCR is 0.55 BCM/ year. These dams will store water during the monsoon season and such stored water can be released subsequently during the winter and summer months to substantially increase drinking water availability during these months when surface water availability is reduced.

Proposed Plan B: A combination of various actions including using of aquifers for storage of water.

The proposed functional plan can be outlined as below.

- Use existing infrastructure to its limits.
    - o Change Canal Operations by running canals daily. Make them operation free.
    - o Improve Canal Design for equitable distribution.
    - o Reduce UFW losses in piped network.

- Use aquifer to store as much water as possible or to its potential and pump it where ever and when ever need arises.
- Recharge more and pump more.
    - o Use surface runoff generated within HSR to recharge aquifer.
    - o Use irrigation tail cluster and field channel over flows also to recharge aquifer.
    - o Store or transfer un-used flood water all over the HSR via canals and inter basin transfer canals.
- Use numerous village ponds and lakes effectively for both surface storage and aquifer recharge.
- Use the additional storage to be provided by the three new dams to augment surface water supplies to the maximum during the lean periods.
- Use saline or brackish ground water by mixing it with canal water in desired ratio.
- Treat sewage to desired standards and recycle it for further use.

8.9.5 Use existing infrastructure to its limits.

The shortages can be reduced by using the available infrastructure of canal network and piped water supply system to its limits by doing the following.

Reduce UFW losses in piped water supply system

Studies and other data collected indicate that UFW losses in all HSR towns range from 30% to 50% of supplies. Similarly, the data collected also indicate that losses in treatment, difference between water generated/ produced and water supplied are also very significant. These losses vary from 15% to 43%. However, as per the design manuals and standards on water supply (CPHEEO manual), the treatment losses shall be less than 5% and UFW losses including treatment losses shall be less than 15%. These losses can be reduced by improving the operation and management of the water supply systems to design standards. These will improve the water supply situation considerably.

Optimum utilization of canal waters

Better performance and utilization of canal waters can be achieved by,

- Suitable Operational control of canal system.

- Optimal design of cross-regulators that will ensure equitable distribution for all discharges in the parent canal.

8.9.6 Rain water harvesting or using un-utilized surface runoff.

2.078 BCM/ year of surface water is generated from catchments of HSR. This surface runoff gets collected and subsequently flows down the drains of HSR. A part of it also gets collected in numerous village ponds and lakes. This surface runoff can be harvested by increasing recharge from the basins more specifically placing recharge structures over drains, recharge trenches, roof top drains etc as discussed below.

Table 8-30 : Quantity of Surface runoff in HSR in BCM/year

Quantity of Surface runoff in HSR in BCM/ year						
Monsoon			Non-monsoon			Total C
Cultivable	Non–cultivable	Total A	Cultivable	Non-cultivable	Total B	
1.3412	0.2121	1.553	0.4471	0.0707	0.5178	2.0708

Source: Final NCRPB report (WAPCOS)

Rain water harvesting using lakes and ponds:

It is proposed to use above said recharge structures at all lakes and ponds. Depending upon the size of the surface storage one or more standard recharge radial wells can be used in the same pond. The increased seepage rate of the ponds will make them empty to absorb the surface runoff due to next rain storm in the same monsoon year. Depending upon the storage capacity of the ponds and lakes, surface run-off, on an average, it is expected that each recharge wells would run at full capacity for at least 100 days/ year. During this period, the standard recharge well would at least (under worst conditions) seep roughly seep 0.1 MCM of water per year.

Roof top rain water harvesting :

In urban areas the proposed recharge radial wells of suitable size can be placed in every building, residential apartment blocks and commercial establishments including parks, etc since,

it requires no-digging and it is low cost. The intake of recharge radial wells can be directly connected to the storm water drain pipes of the roofs.

Rain water harvesting & recharging techniques

There are four main techniques of rain water harvesting,

- Surface Recharge method using water spreading & infiltration basis
- Sub-Surface Recharge Method deeper aquifers recharge need less land surface & use Recharge well technique
- Combination of (1) & (2) above using pit, trench, well & shaft methods.
- Indirect method using infiltration galleries near hydraulically connected surface water bodies
- The storage of rain water on surface is a traditional technique and structures used are underground tanks, ponds, check dams, weirs etc. Recharge to ground water is a new concept of rain water harvesting and the structures relevant to NCR are :
    - Recharge pits
    - Recharge trenches
    - Recharge through dug wells
    - Recharge tube wells
    - Vertical recharge shaft
    - Radial recharge wells.
    - Lateral trench with recharge well
    - Check dam
    - Percolation pond

Proposed recharging structures in NCR Sub-Regions

The estimates on shaft type recharge structures, recharge potentials and costs for using surface runoff for rain water harvesting are presented in Table below:

Table 8-31 : Proposed recharging structures in HR sub-region

S.No.	District	Available Surface Run-off (BCM/Year)	Sub-Surface Storage Potential (MCM)	Proposed No. of Recharge Structures	Estimated Cost (Rs. in Crores)
1.	Gurgaon	0.192	1150	1000	15.00
2.	Panipat	0.214	250	400	6.00
3.	Sonipat	0.360	150	400	6.00
4.	Rohtak	0.263	300	550	8.00
5.	Faridabad	0.277	1000	650	10.00
6.	Jhajjar	0.252	350	300	4.50
7.	Rewari	0.223	2000	1250	18.0
8.	Mewat	0.288	750	700	10.50
	Sub-Total	**2.069**	**5950**	**5250**	**78.00**

Source: Final NCRPB report (WAPCOS)

8.9.7 Using un-utilized tail-cluster over flows from irrigation canals.

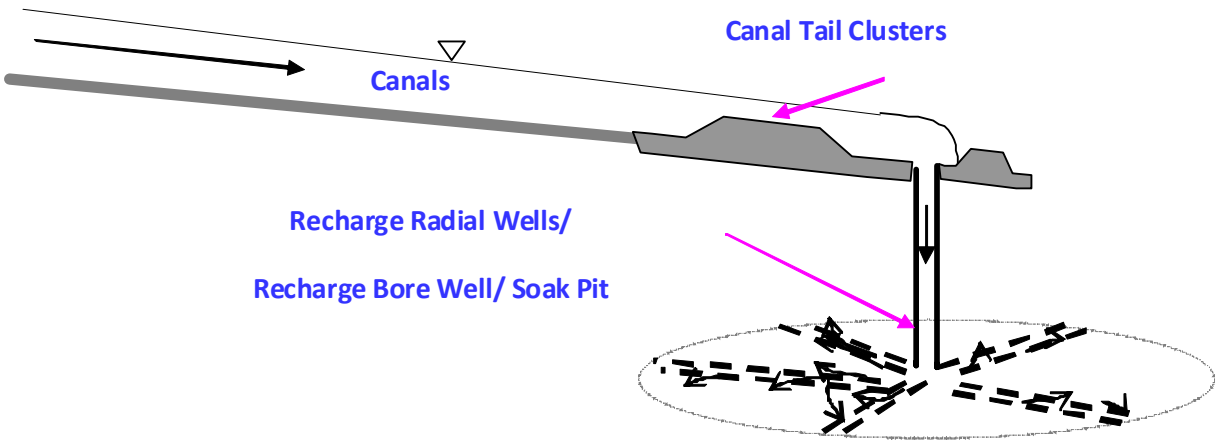
As mentioned earlier, 0.697 BCM/ year of canal water appears in the form of tail-cluster over flows and gets wasted. This water can be used to recharge aquifer by placing a recharge structure at tail cluster of all canal, branch canal, distributary canal, minor ends as shown in Figure below. The capacity of the recharge structure shall be same as that of the canal/ channel. The aquifer recharge techniques are elaborated below. Structure recommended are given below to utilize excess tail-end flows are given below for the Haryana sub-region of NCR.

Table 8-32 : Details of proposed recharge structures to harness Irrigation Drainage due to tail-cluster overflows.

S.No.	District	Available tail-cluster and out flow (BCM/ year)	Recommend no of Recharge Structure (Shafts, Shafts into Bore-well)	Estimated Cost (Rs. in Crores)
1.	Panipat	0.094	50	0.75
2.	Sonipat	0.088	50	0.75
3.	Gurgaon	0.064	50	0.75
4.	Rohtak	0.106	80	1.20
5.	Jhajjar	0.080	70	1.05
6.	Rewari	0.080	70	1.05
7.	Meerut	0.094	70	1.05
8.	Faridabad	0.087	70	1.05
	Total	**0.693**	**500**	**7.65**

Source: Final NCRPB report (WAPCOS)

Figure 8-5: Irrigation drainage (tail cluster overflows) flow harvesting by using it for aquifer recharge



8.9.8 Using un-utilized flood water: Store in aquifer using flood plains of NCR.

Quantity of unused flood water at Tajewala - Hathnikund barrage is 1.72 BCM/ year out of which nearly 0.7561 is the natural (first right) riparian water right share of NCR. This can be harnessed by constructing small weirs/ barrages in Yamuna basin. It is proposed to construct five barrages as shown in Figure 8.4. Similarly, 0.47 BCM/ year of un-used flood water are proposed to be utilized by increasing the recharge from Hindon flood plains. Similarly, it is also proposed to use the flood plains of Ganga basin to increase the aquifer recharge as well. Details of recharge structures for this are presented below.

Table 8-33 : Details of proposed flood plain harvesting recharge structures.

S. No.	Type of Structure	Yamuna Flood Plain	Ganga Flood Plain	Hindon Flood plain	Total (Nos.)	Estimated Cost Rs. in Crores
1.	Recharge pit-cum-infiltration Galleries	15	15	3	33	20.0
2.	Multiplan recharge basins.	25	20	2	47	5.0
						25.00

Source: Final NCRPB report (WAPCOS)

Additionally it is proposed to construct initially 500 village recharge ponds in NCR sub-regions at approximate cost of Rs. 25 Crores

8.9.9 Using un-utilized flood water: Inter-basin transfer canals & augmentation of main canals

HSR has more than 9 BCM/year of share in Ravi, Beas, Sutlej, Ganga and Sarda basins as in Table 8-34. However, topographically it may not be possible to economically transfer share of various sub-regions in true spirit.

- It has been found that though Sutlej share in un-used flood water can be transferred, further series transfer of commands for Ravi and Beas water is not economically possible. Thus this option is dropped as un-feasible.

- Due to presence of Aravalli ridge which does not permit such a transfer as economical, the existing WJC network does not extend to Faridabad and Mewat district. This option is dropped as ``un-feasible.''

- Similarly, possibility of transferring Sarda river un-used flood water to Gurgaon, Faridabad and Mewat district via UGC-Hindon cut Agra canal was also explored. It was dropped in favour of water transferring route via proposed Yamuna-Barrage via Yamuna River up to Okhla. From Okhla it is diverted into to Agra canal for supplies in above said three districts. The earlier option required augmentation of capacity of UGC main stem, treatment of Hindon river bed, Hindon cut channel and Agra canal system whereas second option only required the augmentation of Agra canal by same extent. Hence, the first option required construction of additional lengths of canals of same capacity as compared to second option. Thus, the first choice was dropped in favour of second one i.e. transferring un-used flood water via Yamuna barrage and Okhla into Agra canal.

From above discussions, it is obvious that though there may be enough water available in three sources, it is not possible to transfer in true spirits of shares discussed above.

For solving the water problem having legal provisions, deficits, technical and economical constraints, NCR planning board's provision on "…..treating NCR as one entity" is the way forward. This allowed

Relaxation of the legal constraints after natural and legal rights. Considering the deficits and topographical and economical constraints and honoring legal constraints, the HSR's share in unused flood water is proposed to be reallocated within the sub region.

Table 8-34 : Proposed distribution (re-allocation) of share of HSR in un-used flood water of river basins.

Sub-Region	Quantity of unused flood water of river basins (BCM/ year)				
	Name of the sub basin				
	Ganga	Yamuna	Sutlej, Beas, Ravi	Sarda Yamuna Link	Total
Haryana (WJC) excluding below districts	0	0.548	5.986	2.638	9.172
Agra Canal (Gurgaon + Faridabad + Mewat)	2.790	0.208	0	2.252	5.250
Total					**14.422**

Source: Final NCRPB report (WAPCOS)

It is proposed to utilize this water by transferring it through inter-basin canals and augment the supplies in the existing canal systems from these new canals. Presently, canals in Haryana are operated eight days per 32 days. It is proposed to change the roster for canal system to operation free canal systems where in all canals are proposed to run daily. By doing this it will be possible to transfer, three times additional quantity of water being supplied presently. This additional quantity can be made available by inter-basin transfer canals and existing network will distribute to all parts of HSR without major augmentation of existing canal systems, except the main canals and few branch canals. These schemes are discussed separately in the subsequent paragraphs.

8.9.10 Un-used flood of Sarda basin: Use proposed Sarda Yamuna Link canal

It is proposed to utilize the flood water share in Sarda basin by utilizing proposed inter-basin Sarda Yamuna link canal. As per agreement, 2.252 BCM/ year was to be diverted into Agra

Canal from Okhla weir to meet the shortage in Faridabad, Gurgaon and Mewat districts of NCR. it has to transfer 2.638 BCM/ year water into WJC canal system to be supplied in remaining 5 Haryana districts of NCR.

Although a large part of this canal is already constructed in Haryana, its construction in Punjab has been stopped due to a dispute on water sharing. Currently the matter is in the courts and it is unlikely to be resolved in the near future. Hence it will be prudent to assume that the SYL canal is unlikely to be commissioned in the near future and should not be considered in the future planning process.

8.9.11 Un-used flood waters Yamuna and Sarda River: Augment Capacity of Agra Canal System – II

As discussed earlier, it is proposed to divert 2.252 BCM / year of un-used flood waters of Sarda river and 0.208 BCM/ year of un-used flood waters of Yamuna into Agra canal system to meet the short-falls in Faridabad, Gurgaon and Mewat districts of NCR. The existing capacity of Agra canal system is 113.27 Cumecs (4000 cusecs). Thus, given the flow patterns in river basins and canals it can transfer at most 1.06 BCM/ year of water into Agra Canal (including dry season flows), out of which 0.806 BCM/ year is presently being transferred into Agra canal. The capacity of this canal is being augmented to 124.59 Cumecs (4400 cusecs). This work is under progress. Assuming no un-used capacity will be available in the main canal, it is proposed to lay a new parallel canal hereafter named as Agra Canal – II of carrying capacity of 2.5 BCM/ year to meet the short falls in Faridabad, Gurgaon and Mewat district of NCR. As discussed earlier, by changing the roster to daily operation (running) of canal system, the off-take canals such as distributary, minors, etc will be able to transfer 3 time additional quantity of water. Thus, these canals need not be augmented to transfer additional 2.46 BCM/ year of water. Hence, augmentation of capacity of main canal will be sufficient to utilized additional quantity of water that is being proposed to be transferred to Faridabad, Gurgaon and Mewat canal system.

Cost of laying new Agra Canal – II system

The cost of proposed augmentation schemes for Agra Canal system by laying Agra Canal -II system stated above is estimated to be Rs 830 Crores. This is the cost of component of transferring and distributing the NCR share of flood water of Sarda and Yamuna basins.

8.9.12 Un-used flood of Ganga basin: Proposed UGC – III canal

It is proposed to utilize the un-used flood water at Ganga basin by augmenting the UGC and MGC-I main and branch canal systems. It is estimated that this old stem of old UGC canal, which is abandoned from use, still has a capacity of 8000 cusecs. This will easily transfer at least 4.237 BCM/ year of un-used flood water from Bhimgoda. It is proposed to de-silt and use the old UGC main stem of canal system. In addition to this, it is also proposed to construct another parallel canal to UGC from Bhimgoda barrage to all towns of NCR. This canal shall be of 3.5 BCM/ year capacity. For the remaining share of 1.5 BCM/ year in Ganga water it is proposed to augment the capacity of MGC-I canal system and transfer it from Raolighat / Bijnore barrage. It shall be noted that this quantity is available only in monsoon season. Thus, it needs to be stored in aquifer for use in Rabi season.

Cost of Upper Ganga Canal –III Scheme.

The cost of proposed augmentation schemes for UGC and MGC system stated above are estimated to be Rs 1230 Crores. This is the cost of component of transferring and distributing the NCR share of flood water in Ganga basin.

8.9.13 Un-used flood of Sutlej-Ravi-Beas basin: Proposed Sutlej-Haryana-Alwar Link

It is proposed to construct a new 386 km long inter-basin water transfer canal here after named as Sutlej-Haryana-Alwar Link starting from Firozpur barrage. It will be in cutting up to Sirhand channel crossing and would run parallel to Sirhand – Bhakara Canal Link canal. It will cross Bhakara canal and enter Haryana. It meets WJC system at Munak Head works and runs parallel to Parallel Delhi Canal up to Khbru head works in Sonepat district. At this location, it collects 5.138 BCM/ year from proposed Sarda - Yamuna - Rajasthan Link canal for further distribution in Alwar and other districts of Haryana. The proposed canal moves parallel to JLN canal up to Rajasthan Border. These two branch canals will supply 7 BCM/ year of irrigation and drinking water and recharge aquifer. Since, Sutlej - Haryana - Alwar Link canal is fed from Bhakara, Pong and Ranjit Sagar dams, these will receive water in Rabi-season and other dry months. Thus, the proposed link will be a perennial channel.

Cost of Sutlej Haryana Alwar Link.

The cost of proposed augmentation schemes for UGC and MGC system stated above are estimated to be Rs 10208 Crores. This is the cost of water component of transferring and distributing the NCR share of water. The proposed alignment can also be used to transfer water of other districts (out side NCR) of Haryana and Rajasthan.

Storage of un-used flood water made available by Inter-basin transfer canals into Aquifers.

The proposed inter-basin transfer canals shall be unlined. This would increase the recharge of the aquifer without any effort. Similarly, it is expected that increased availability of canal water will encourage the farmers to grow higher cash yield crops that require more water such as rice, sugar cane, etc. Thus, it is also expected, rather recommended, that farmers will use flood irrigation method and abandon the use of costly water conserving techniques such as sprinkler, trickle and drip irrigation systems. This will increase the ground water recharge automatically. This water can be pumped during the dry season. Thus no additional cost has to be incurred towards storage of this water into aquifer.

8.9.14 Ground Water Utilization: Flood Plain Aquifer Development Plan

Some schemes are proposed to provide ground water based water supply under gravity through transmission main along flood plains for meeting drinking and industrial water demands. The scheme envisages cluster of tube wells in Yamuna, At least 8 Ranney wells are also recommend (2 each in four sub-area of Yamuna Flood Plain). Likely sustained yielded from the scheme is expected to yield following prospects.

Table 8-35 : Flood – plain aquifer sustained water supply

S. No.	Aquifer Area	Recommend Tube well No.	Recommended Ranney wells	Sustained Water Yield (MLD)	Estimated Cost (in Crore)
1.	Yamuna Flood Plain Aquifer	875	8	2147.42	33.00
				0.783 BCM/year	

Source: Final NCRPB report (WAPCOS)

8.9.15 Using Saline Ground Water: mix Ground Water with Canal Water

As discussed earlier that ground water is saline in several parts of HSR and farmers have almost abandoned its use. The farmers have also shown reluctance to use of salinity resistant crops. The reduced pumping and continued recharge has made water logging eminent is few districts of HSR. This has added to shortages of water for domestic consumption. In these circumstances, it is proposed to use the saline water by mixing it with canal water in appropriate quantity so that the dissolved substances in mixed water remain within the permissible limits. For this purpose the water from saline aquifer formations will have to be pumped into the canals. Hence, it is proposed to construct Ranney wells (pumping wells) on canal beds and pump sufficient quantity of saline water from the aquifers. This will increase the flows in the canal systems and will thus improve the canal supplies. The additional quantity of canal water can be used to increase the command area of canal system. The increased pumping from aquifer will flush out saline water at least from aquifer and fresh water recharge will help in reducing the salinity of the ground water over a long run. This mixed water can be used to meet all types of demands.

8.9.16 Using treated sewage: Recycling of treated sewage

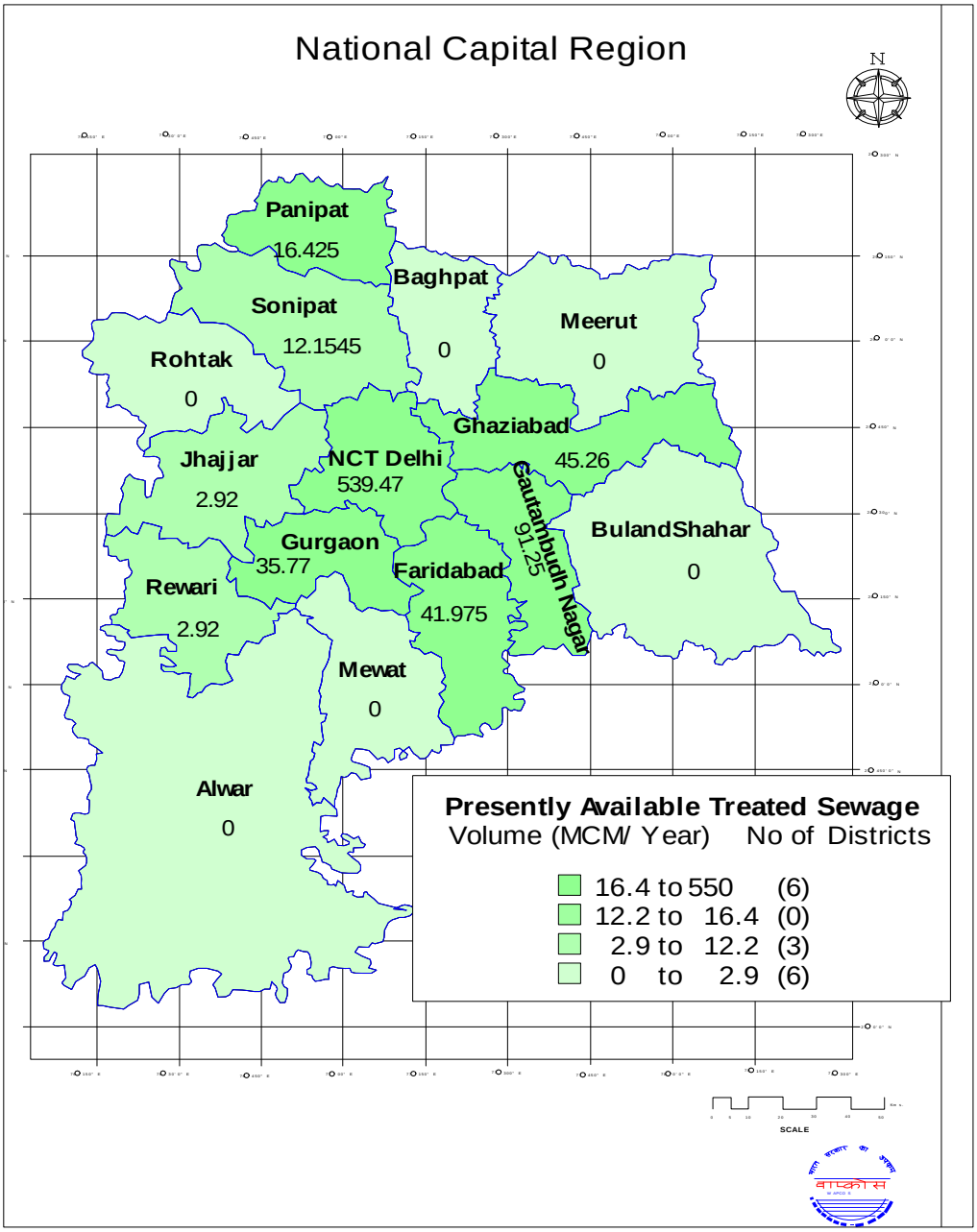
As mentioned in Annexure 8.2 that 0.36 BCM/ year of treated sewage water will be produced with in HSR by 2011 and 0.444 BCM/ year of treated sewage water shall be produced with in HSR by 2021 against the 0.11 BCM/year in the year 2005 as shown in Table 8.29. This water can be utilized for irrigation and non-food industrial application as discussed below.

Treating Sewage to present MOEF standards

It is expected that short comings in existing sewage treatment plants of HSR will be rectified by year 2021 and the treated sewage will be well within the pollution control norms of the Ministry of Environment and Forest. Since, present sewage treatment plants are based on biological digestion process of organic matter; the faecal coli form count in treated sewage will be higher. Further, the use of anaerobic processes for treatment of sewage results in higher count of pathogens in treated sewage as compared to sewage treated using aerobic processes. This may result in spreading of diseases among the users mostly farmers. Hence, it shall be disinfected before being used for horticulture or irrigation. Since, the conventional method of disinfection

using chlorination will severely hamper the self purification capacity of natural streams, rivers, canals, etc since aerobic organisms present in natural streams will get oxidized (killed) by the residual chlorine that would remain in disinfected treated sewage which gets finally mixed with natural waters. Hence, treated sewage shall not be disinfected by using chlorination process. It is proposed to disinfect treated sewage using Ultra-Violet method which is not only economical but also does not have any residual disinfection effects. Thus, it will not result in killing of naturally growing micro-organisms that are present in all natural waters and contribute to self purification capacity of streams.

Figure 8-6: Presently available Treated Sewage in MLD



Treating sewage to reuse standards

A new technology for low cost treatment of sewage up to reuse standards should be developed. In this technology, such a design would require more effective designs of flocculation unit, tube settlers, graded series sand filters in addition to primary treatment units such as sedimentation tank and skimmer and more effective grit removal channel upstream of existing sewage treatment plant or membrane bio-reactors, and other modern technologies. It will also require disciplined operation of sewage treatment plant in terms of sludge removal and regular cleaning of polishing / oxidation ponds.

There are several pros and cons associated with this technology.

- Since, the treated sewage can be easily supplied to non-beverage industries at less than present water supply rates for industries, it will generate additional revenue and would make the sewage treatment self sustainable. Presently, the sewage treatment is a liability on local urban bodies and many municipalities and municipal corporations are forced to (planning) to introduce tariffs on sewage.

- Even if it is not consumed for domestic or industrial usage, it can be simply discharged into the river. It will greatly reduce pollution in rivers and water bodies.

- Since, this technology is new its use shall be under strict monitoring and supervision and scale up shall only be done only after its successful (without failure) operation for a prolonged period say 3-5 years.

- Since, the use of this technology is risky, it shall be only be adapted as a regular practice after sufficient trained manpower is available for its design, operations and maintenance. The risk is higher because the biological treatment process discharges very large quantity of E-Coli forms with high percentage of pathogens and slight failure of disinfection unit say due to power failure may result in out break of epidemic in the town. This area is still experimental and we need to tread with caution.

- Since the quantity of colloidal suspended matter is high in sewage treated using conventional treatment plants, the required dosage of coagulant would be higher. Similarly, due to increased count of micro-organisms in finally treated water the cost of

disinfectant would also be higher. Please note that prior disinfection by Ultra-Violet rays would not reduce the dosage of chorine for secondary disinfection since the chlorine which is a strong oxidizing agent would also react and get consumed in oxidizing the mutated (dead) micro-organisms.

Revival and De-eutrification of lakes and ponds :

Placing of recharge structure such as recharge radial wells will allow percolation of putrefied of the ponds by seeping the existing polluted water into the aquifer during the first year of its use. This seepage of polluted water will not cause any environmental hazards since,

- It is done only once for ever i.e. the year in which the recharge structures are placed in the lakes and ponds.
- The filtering capacity of the existing soil layers will filter the pollutant and only the unpolluted naturally filtered water will join the aquifer formations.
- The quantity of under lying aquifer water is huge as compared to the putrefied water in ponds. Thus it will get diluted to safe limits.
- There will be no pollution in subsequent years. Due to increased seepage rates further eutrification of lakes or ponds will not occur in coming years since dissolved substance brought every year will get soaked every year and no accumulation of these putrefying compounds will occur in ponds. This will further dilute the effects of first year.
- Hence, it is advised that these recharge structures be placed in ponds in summer season because,
    - The subsequent monsoon will nullify – reduce the ill effects of putrefied water.
    - The ponds have less water, hence it is easier and economical to place recharge structures in ponds.

A numerous number of village ponds and a few large lakes are present in HSR. The capacity of small ponds can be increased by digging the pond bottoms and raising the height of bunds.

However, it is not the case with large lakes. The existing status and possibility of augmenting the capacity of a few of the lakes are presented below.

Table 8-36 : Status of existing major lakes.

District	Lake/Pond	Capacity	Remarks
Mewat	Kotla Lake	4000 ham	Often does not get filled.
			Used for minor irrigation.
			May be uneconomical to increase the present storage capacity of Lake.
	Dumdama	300 ham	Used for recreation purposes.
			Cap. Can be increased by further land acquisition.
Faridabad	Badkhal Lake	260 ham	Used for recreational purposes.
			Bed rocky and silted.
			Due to excessive mining on 3 sides deep depressions created.
			Depressions, do not permit rain water to reach lake.

Source: Final NCRPB report (WAPCOS)

Proposal on improvement of Lake Water Availability

It is being proposed to do the following towards improving Lake Water availability from these lakes and ponds by doing the following.

- De-silting of lake beds.
- Placing the recharge structures to increase the aquifer recharge.
- Carry out catchment treatment through vegetative checks, plantation and by putting up silt-traps on nalas and drains contributing to run-off to lakes & ponds.
- Channelise surface run-off to lakes and ponds in HSR.

8.10 *Water Scenario 2021*

Expected water availability and demand are as follows.

8.10.1 Estimated Water Demand

From Table 8.24 above and Annexure 8.1, Chapter 8, it is observed that the available water source is 6.747 BCM/Year and from Table 8.25 the estimated deficit in the year 2021 is 2.635 BCM/Year. Thus total requirement for the HSR for the year 2021 works out to be 9.382 BCM/Year (6.747 BCM/Year + 2.635 BCM/Year).

8.10.2 Estimated water availability in 2021

The detail of water quantity which is estimated to be available from different sources in the year 2021 is as follows:

- The water available from recycling of treated sewage for Haryana, will be 0.63 BCM/Year as given in Para. 6.6.8 and Annexure 8.2.
- Water available from harnessing irrigation drainage due to tail cluster overflows by proposing recharge structures in HSR is estimated to be 0.697 BCM/Year as given under para.6.2.
- Water which can be made available by constructing recharging structure in NCR sub region is 0.693 BCM/Year as given in table 14.
- By re-allocation of share of HSR in flood water of river basins is 14.422 BCM/Year is as given in the Table above.
- Expected sustained water supply as per Table above is to be 0.783 BCM/Year and this can be considered as share of U.P. Sub-region.
- In addition to this a quantity of 0.7561 BCM/Year is an unused flood water as share of riparian states. This can be distributed among the states i.e. Harayana, U.P., Rajasthan and N.C.T. Delhi in the same ratio as mentioned in MOU dated 12/05/1994. The share for Haryana is 0.373 BCM/Year. The quantity of 0.47 BCM/Year which is proposed to be utilized after increasing the recharge from Hindon flood plains can be considered as share of U.P. Sub region.
- From the above, the total water expected to be available in the year 2021 is 17.412 BCM/Year.

Table 8-37 : Total Water available in 2021

Sl. No	Sub-Region	Haryana
1	Quantity from Proposed distribution in unused flood water of river basins in BCM/ year	14.422
2	Quantity of Treated Sewage in BCM/ year	0.63
3	Unused water from Irrigation Drainage overflows (Canal + tube well)	0.697
4	Water available from Proposed recharging structures to harness irrigation drainage due to tail-cluster flows	0.693
5	Flood plain aquifier sustained water supply	0.783
6	Storing in aquifier using flood plains of HSR (0.7561 of unused flood water to be harnessed by construction of small weirs/ barrages over Yamuna. The water will be shared on the basis of the MoU dated 12.05.1994 between the states)	0.373
	Total Water Available	**17.566**

8.10.3 District-wise Deficit/Surplus of water in the year 2021 in NCR

Table 8-38: District-wise Gap Assesment in Demand and Availability in HSR

District	Water Demand 2021 in BCM/Year				Deficit /Surplus[2] BCM/Year
	Domestic	Industrial	Irrigation	Total	
Panipat	0.0848	0.1980	0.6358	0.9185	1.986
Sonepat	0.1561	0.1800	1.0789	1.4150	2.584
Rohtak	0.0887	0.0640	0.8729	1.0256	0.796
Jhajjar	0.0592	0.1080	0.9556	1.1228	1.106
Rewari	0.0803	0.0680	0.7959	0.9443	0.669
Gurgaon	0.3613	0.4080	0.5977	1.3670	0.347
Faridabad*	0.3254	0.5120	0.8289	1.6663	0.791
Mewat	0.0393	-	0.8829	0.9221	-0.095
Total	**1.1950**	**1.5380**	**6.6485**	**9.3815**	**8.184**

1 MLD converted to BCM ; 2 (+) means surplus (-) means deficit ; * - Includes Palwal

From the above, the water which can be expected to be available in the year 2021 for HSR is 17.566 BCM/Year. In addition to this 0.84 BCM/Year can be made available by constructing small weirs/ barrages in Yamuna Basin and increasing the recharge from Hindon flood plan as given in para 6.6.4. Thus total water which is expected to be available by harnessing different sources is 18.406 BCM/Year.

Hence, if all the measures 1 to 6 of Table 8-37 are achieved, the total water demand of Haryana Sub-Region of NCR can be effectively met with enough surpluses, except for Mewat district, where conservation of water in all areas has to be practiced. However, if the re-allocation of flood water of river basins fails to deliver partly or fully, we will be left with about 5.11 BCM/year of water incurring a deficit of maximum 4.14 BCM/year.

District wise Water Source and Treatment

For each district of Haryana sub-region, raw water source has been identified and its mode and capacity of treatment worked out for meeting the domestic and industrial water need of 2021 as described below. For irrigation, untreated canal water and ground water will continue to be used.

Table 8-39 : District wise Domestic Water Demand in HSR

Sub-Region/City/Town	Population		Domestic Demand (MLD)		Domestic Demand (BCM per annum)	
	2011	2021	2011	2021	2011	2021
Panipat District						
Panipat	506866	709612	118.8	165.9	0.0434	0.0605
Samalkha	44800	67200	7.0	11.3	0.0025	0.0041
Rural	632425	652606	53.4	55.1	0.0195	0.0201
Sub-Total	**1184091**	**1429418**	**179.2**	**232.2**	**0.0654**	**0.0848**
Sonipat District						
Sonepat	357990	1000000	84.2	233.2	0.0307	0.0851
Gohana	82480	150000	13.7	35.7	0.0050	0.0130
Ganaur	55109	175000	9.3	41.6	0.0034	0.0152
Kharkhoda	46907	125000	7.3	29.9	0.0027	0.0109
Rural	1039177	1043937	86.9	87.3	0.0317	0.0319
Sub-Total	**1581663**	**2493937**	**201.4**	**427.6**	**0.0735**	**0.1561**
Rohtak District						
Rohtak	534644	748501	125.3	174.9	0.0457	0.0638
Kalanaur	22752	32990	3.5	5.1	0.0013	0.0019
Maham	29065	51000	4.5	8.6	0.0016	0.0032

Rural	631453	645007	53.3	54.5	0.0195	0.0199
Sub-Total	**1217914**	**1477498**	**186.7**	**243.1**	**0.0681**	**0.0887**
Jhajjar District						
Bahadurgarh	198000	300000	46.9	70.7	0.0171	0.0258
Ladrawan #	10209	13016	1.6	2.0	0.0006	0.0007
Jhajjar	74034	133261	12.4	31.8	0.0045	0.0116
Beri	23000	32500	3.6	5.0	0.0013	0.0018
Rural	675371	621341	57.0	52.5	0.0208	0.0192
Sub-Total	**980614**	**1100118**	**121.4**	**162.1**	**0.0443**	**0.0592**
Faridabad District						
Faridabad	1750000	2900275	406.7	672.4	0.1484	0.2454
Rural	352108	378668	30.2	32.4	0.0110	0.0118
Sub-Total	**2102108**	**3278943**	**436.9**	**704.9**	**0.1595**	**0.2573**
Palwal District						
Palwal	200720.7	400000	47.6	94.0	0.0174	0.0343
Hodal	57249	85553	9.6	14.2	0.0035	0.0052
Hasanpur	11589	14774	1.8	2.3	0.0007	0.0008
Hathin	20407	38000	3.2	5.9	0.0012	0.0022
Rural	778280	836987	65.4	70.3	0.0239	0.0256
Sub-Total	**1068246**	**1375315**	**127.6**	**186.7**	**0.0466**	**0.0681**
Gurgaon District						
Gurgaon	920127	3700000	214.7	857.1	0.0784	0.3128
Farukknagar	11266	13332	1.7	2.1	0.0006	0.0008
Sohna	76230	167706	12.7	39.9	0.0046	0.0146
Pataudi	59699	107458	10.0	25.8	0.0037	0.0094
Rural	684645	773877	57.7	65.1	0.0211	0.0238
Sub – Total	**1751968**	**4762373**	**296.9**	**989.9**	**0.1084**	**0.3613**
Rewari District						
Rewari	250000	450000	59.1	105.6	0.0216	0.0386
Dharuhera	93706	200000	15.5	47.4	0.0057	0.0173
Bawal	57500	100000	9.7	16.5	0.0035	0.0060
Rural	611000	596880	51.7	50.5	0.0189	0.0184
Sub-Total	**1012206**	**1346880**	**135.9**	**220.1**	**0.0496**	**0.0803**
Mewat District						
Firozpur Jhirka	28408	46000	4.4	7.1	0.0016	0.0026
Taoru	27725	45000	4.3	7.0	0.0016	0.0025
Punhana	20012	30388	3.1	4.7	0.0011	0.0017
Nuh	17661	28258	2.7	4.4	0.0010	0.0016
Rural	891702	1007919	74.8	84.3	0.0273	0.0308
Sub-Total	**985508**	**1157566**	**89.3**	**107.5**	**0.0326**	**0.0393**
Total for Haryana Sub-Region	**11884317**	**18422046**	**1775.4**	**3274.0**	**0.6480**	**1.1950**

1. Panipat

Water Supply

From Annexure 8 & Table (8.17 and 8.39), it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.0848 + 0.198 = 0.2828 BCM/Yr. = 775 MLD

Treated Water being supplied at present = 65 MLD

Hence, capacity to be augmented = 775 – 65 = 710 MLD.

It is proposed to locate the major water treatment facilities at the major towns namely, Panipat and Samalkha covering the surrounding villages as far as possible, the water source at Panipat is primarily surface water and that at Samalkha mainly ground water. Panipat will also take up the entire industrial water demand.

Treatment at Panipat

Water Demand 2021 = 0.0605 + 0.198 = 0.2585 BCM/Yr. = 709 MLD

Existing water supply facility = 65 MLD

Hence, new water supply system capacity = 644 MLD, may be constructed in 2 phases of 367 MLD each.

Possible Source: Rajpura & Israna Distributary canals, Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.322 crore

Treatment at Samalkha

Water Demand 2021 = 0.0041 BCM/Yr. = 11.3 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 11.3 MLD.

Possible Source: Samalkha Distributary canal and Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.6.78 crore

Sewerage

By 2021, only Panipat and Samalkha towns may be covered by sewerage system.

Total Sewage in Panipat in 2021 = 0.75*0.0605 = 0.045 BCM/yr. = 125 MLD

STP facilities at present = 45 MLD

Hence, capacity to be augmented at Panipat = 125 – 45 = 80 MLD.

Total Sewage in Samalkha in 2021 = 0.75*0.004 = 0.0031 BCM/yr. = 8.5 MLD

STP facilities at present = Nil

Hence, STP to be constructed at Samalkha = 8.5 MLD.

Cost of Sewerage System @ Rs.200 lakh per MLD = 88.5*2 = Rs.177 crore

2. Sonepat

Water Supply

From Annexure 8 & Table (8.17 and 8.39) above, it is seen that,

Total Water Demand for entire Sonipat district in 2021 (domestic + industrial) = 0.156 + 0.18 = 0.336 BCM/Yr. = 921 MLD

Treated Water being supplied at present = 73 MLD

Hence, capacity to be augmented = 921 – 73 =848 MLD.

It is proposed to locate the major water treatment facilities at four places namely, Sonepat, Ganaur, Kharkhoda and Gohana the surrounding villages as far as possible. Sonipat will also take up the entire industrial water demand.

Treatment at Sonepat

Water Demand 2021 = 0.0851 + 0.18 = 0.2651 BCM/Yr. = 726 MLD

Existing water supply facility = 40 MLD

Hence, new water supply system capacity = 686 MLD, may be constructed in 2 phases of 345 MLD each.

Possible Source: Delhi sub-branch canal, Rai & Jua distributary canals, Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.345 crore

Treatment at Ganaur

Water Demand 2021 = 0.0152 BCM/Yr. = 42 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 42 MLD.

Possible Source: Minor distribution canals, ground water, and recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.25.2 crore

Treatment at Gohana

Water Demand 2021 = 0.013 BCM/Yr. = 36 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 36 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.21.6 crore

Treatment at Kharkhoda

Water Demand 2021 = 0.0109 BCM/Yr. = 30 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 30 MLD.

Possible Source: Distributary canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.18 crore

Sewerage

By 2021, only Sonepat and Gohana towns may be covered by sewerage system.

Total Sewage in Sonepat in 2021 = 0.75*0.0851 = 0.064 BCM/yr. = 175 MLD

STP facilities at present = 30 MLD

Hence, capacity to be augmented at Sonepat = 175 – 30 = 145 MLD.

Cost of Sewage System @ Rs. 200 lakh per MLD = 145*2 = 290 crore

Total Sewage in Gohana in 2021 = 0.75*0.013 = 0.01 BCM/yr. = 27 MLD

STP facilities at present = Nil

Hence, STP to be constructed at Gohana = 27 MLD.

Cost of Sewerage System @ Rs.200 lakh per MLD = 27*2 = Rs.54 crore

3. Rohtak

Water Supply

From Annexure 8 & Table (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.0887 + 0.064 = 0.1527 BCM/Yr. = 419 MLD

Treated Water being supplied at present = 53 MLD

Hence, capacity to be augmented = 419 – 53 = 366 MLD.

It is proposed to locate the major water treatment facilities at three places namely, Rohtak, Meham, and Kalanaur and the surrounding villages as far as possible. Rohtak will also take up the entire industrial water demand.

Treatment at Rohtak

Water Demand 2021 = 0.0638 + 0.064 = 0.1278 BCM/Yr. = 350 MLD

Existing water supply facility = 53 MLD

Hence, new water supply system capacity = 297 MLD.

Possible Source: JLN Feeder canal, Rothak distributary canal, Bhaulat Sub-Br Canal, and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.148.5 crore

Treatment at Meham

Water Demand 2021 = 0.0032 BCM/Yr. = 8.6 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 8.6 MLD.

Possible Source: Minor distribution canals, ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.5.16 crore

Treatment at Kalanaur

Water Demand 2021 = 0.0019 BCM/Yr. = 5.1 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 5.1 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.3.06 crore

Sewerage

By 2021, only Rohtak town may be covered by sewerage system.

Total Sewage in Rohtak in 2021 = 0.75*0.0638 = 0.048 BCM/yr. = 131.2 MLD

STP facilities at present = 50 MLD

Hence, capacity to be augmented at Rohtak = 131.2 – 50 = 81.2 MLD.

Cost of Sewerage System @ Rs.200 lakh per MLD = 81.2*2 = Rs.162.4 crore

4. Jhajjar

Water Supply

From Annexure 8 & Table (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.0592 + 0.108 = 0.1672 BCM/Yr. = 458 MLD

Treated Water being supplied at present = 70 MLD

Hence, capacity to be augmented = 458 – 70 = 388 MLD.

It is proposed to locate the major water treatment facilities at three places namely, Jhajjar (including Bahadurgarh), Beri, and and the surrounding villages as far as possible. Jhajjar and Bahadurgarh will share the industrial water demand.

Treatment at Bahadurgarh

Water Demand 2021 = 0.0258 + 0.054 = 0.0798 BCM/Yr. = 219 MLD

Existing water supply facility = 50 MLD

Hence, new water supply system capacity =169 MLD.

Possible Source: JLN Feeder canal, Bhaulat Sub-Br Canal, Bhalaut Distributary, ground water, and tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.84.5 crore

Treatment at Jhajjar

Water Demand 2021 = (0.0116+0.054) BCM/Yr. = 0.0656 BCM/ Yr. = 180 MLD

Existing water supply facility = 20 MLD

Hence, new water supply system capacity = 160 MLD.

Possible Source: Minor distribution canals, recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.96 crore

Treatment at Beri

Water Demand 2021 = 0.0018 BCM/Yr. = 5 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 5 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.3 crore

Sewerage

By 2021, only Jhajjar and Bahadurgarh towns may be covered by sewerage system.

Total Sewage in Jhajjar in 2021 = 0.75*0.0116 = 0.087 BCM/yr. = 24 MLD

STP facilities at present = 5.5 MLD

Hence, capacity to be augmented at Jhajjar = 24 – 5.5 = 18.5 MLD.

Total Sewage in Bahadurgarh in 2021 = 0.75*0.0258 = 0.0194 BCM/yr. = 54 MLD

STP facilities at present = 54 MLD

Hence, No need for additional STP facilities in Bahadurgarh

Cost of Sewerage System @ Rs.200 lakh per MLD = 18.5*2 = Rs.37 crore

5. Faridabad

Water Supply

From Annexure 8 & Table (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.3254 + 0.512 = 0.8374 BCM/Yr. = 2295 MLD

Treated Water being supplied at present = 300 MLD

Hence, capacity to be augmented = 2295 – 300 = 1995 MLD.

It is proposed to locate the major water treatment facilities at following places namely, Faridabad, Palwal, and Hodal with the surrounding villages as far as possible. Faridabad and Palwal will take up the entire industrial water demand in the ratio of about 80:20.

Treatment at Faridabad

Water Demand 2021 = 0.2454 + 0.512*0.8 + 0.0118

= 0.6669 BCM/Yr. = 1827 MLD, say 1830 MLD

Existing water supply facility = 300 MLD

Hence, new water supply system capacity = 1530 MLD, may be constructed in 3 phases of 510 MLD each.

Possible Source: Yamunai sub-branch canal, Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD on an average in 3 phases ≈ Rs.918 crore

Treatment at Palwal

Water Demand 2021 = 0.0343 + 0.512*0.2 + 0.0256

= 0.1623 BCM/Yr. = 445 MLD, say 450 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 450 MLD.

Possible Source: Yamuna sub-branch canal and Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.225 crore

Treatment at Hodal

Water Demand 2021 = 0.0052 BCM/Yr. = 14.2 MLD say 15 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 15 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.9 crore

Sewerage

By 2021, only Faridabad and Palwal towns may be covered by sewerage system.

Total Sewage in Faridabad in 2021 = 0.75*0.2454 = 0.1841 BCM/yr. = 505 MLD

STP facilities at present = 42 MLD

Hence, capacity to be augmented at Faridabad = 505 – 42 = 463 MLD in 2 stages of 232 MLD each.

Cost of Sewerage System @ Rs. 150 lakh per MLD on an average

=464*1.5 = Rs. 696 crore

Total Sewage in Palwal in 2021 = 0.75*0.0343 = 0.0257 BCM/yr. = 71 MLD

STP facilities at present = Nil

Hence, STP to be constructed at Palwal = 71 MLD.

Cost of Sewerage System @ Rs.150 lakh per MLD on an average

= 71*1.5 = Rs.106.5 crore

6. Gurgaon

Water Supply

From Annexure 8 & Tables (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 for Gurgaon district (domestic + industrial)

= 0.3613 + 0.408 = 0.7693 BCM/Yr = 2108 MLD

Treated Water being supplied at present = 79 MLD

Hence, capacity to be augmented = 2108 – 79 = 2029 MLD.

It is proposed to locate the major water treatment facilities at all the urban centers with their surrounding villages as far as possible. Gurgaon will take up the entire industrial water demand.

Treatment at Gurgaon

Water Demand 2021 = 0.3128 + 0.408 + 0.0238/4 = 0.7268 BCM/Yr.

= 1992 MLD

Existing water supply facility = 79 MLD

Hence, new water supply system capacity = 1913 MLD, may be constructed in 3 phases of 638 MLD each.

Possible Source: Gurgaon canal, Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD on an average in 3 phases ≈ Rs.1148 crore

Treatment at Farukknagar

Water Demand 2021 = 0.0008 + 0.0238/4

= 0.0067 BCM/Yr. = 19 MLD, say 20 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 20 MLD.

Possible Source: Gurgaon canal, Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.10 crore

Treatment at Sohna

Water Demand 2021 = 0.0146 + 0.0238/4 = 0.0205 BCM/Yr.

= 57 MLD, say 60 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 60 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs. 30 crore

Treatment at Pataudi

Water Demand 2021 = 0.0091 + 0.0238/4 = 0.0153 BCM/Yr. = 42 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 42 MLD.

Possible Source: Minor distribution canals and ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.50 lakh per MLD ≈ Rs.21 crore

Sewerage

By 2021, only Gurgaon town may be covered by sewerage system.

Total Sewage in Gurgaon in 2021 = 0.75*0.3128 = 0.2346 BCM/yr. = 643 MLD

STP facilities at present = 33 MLD

Hence, capacity to be augmented at Gurgaon = 643 – 33 = 610 MLD. in 2 stages of 305 MLD each.

Cost of Sewerage System @ Rs.150 lakh per MLD on an average

= 610*1.5 = Rs.915 crore

7. Rewari

Water Supply

From Annexure 8.2 & Tables (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.0803 + 0.068 = 0.1483 BCM/Yr = 407 MLD

Treated Water being supplied at present = 41 MLD

Hence, capacity to be augmented = 407 – 41 = 366 MLD.

It is proposed to locate the major water treatment facilities at three places namely, Rewari, Dharuhera, and Bawal with their surrounding villages as far as possible. All these 3 towns will take up the entire industrial water demand in the ratio of about 61:25:14.

Treatment at Rewari

Water Demand 2021 = 0.0386 + 0.068*0.61 + 0.0184/3

= 0.0862 BCM/Yr. = 236 MLD

Existing water supply facility = 41 MLD

Hence, new water supply system capacity = 195 MLD

Possible Source: Dewana Distributary, Barwas Distributary, Recharged ground water and Tertiary treated sewage.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.117 crore

Treatment at Dharuhera

Water Demand 2021 = 0.0173 + 0.068*0.21 + 0.0184/3

= 0.0377 BCM/Yr. = 104 MLD, Existing water supply facility = Nil

Hence, new water supply system capacity = 104 MLD.

Possible Source: Dewana Distributary, Barwas Distributary, Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.62.4 crore

Treatment at Bawal

Water Demand 2021 = 0.0060 + 0.068*0.14 + 0.0184/3

= 0.0217 BCM/Yr. = 60 MLD

Existing water supply facility = Nil

Hence, new water supply system capacity = 60 MLD.

Possible Source: Dewana Distributary, Barwas Distributary, Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.36 crore

Sewerage

By 2021, only Rewari town may be covered by sewerage system.

Total Sewage in Rewari in 2021 = 0.75*0.0386 = 0.0289 BCM/yr. = 80 MLD

STP facilities at present = 3 MLD

Hence, capacity to be augmented at Rewari = 80 – 3 = 77 MLD. , say 80 MLD

Cost of Sewerage System @ Rs.200 lakh per MLD on an average

= 80*2 = Rs.160 crore.

8. Mewat

Water Supply

From Annexure 8 & Tables (8.17 and 8.39) above, it is seen that,

Total Water Demand in 2021 (domestic + industrial)

= 0.0393 + 0 = 0.0393 BCM/Yr. = 107.5 MLD

Treated Water being supplied at present = 36 MLD

Hence, capacity to be augmented = 107.5 – 36 = 71.5 MLD.

It is proposed to locate the major water treatment facilities at all small urban centers, with the surrounding villages as far as possible.

Treatment at Ferozpur Zilka

Water Demand 2021 = 0.0026 + 0.0308/4 = 0.0103 BCM/Yr. = 28.2 MLD

Existing water supply facility = 10 MLD

Hence, new water supply system capacity = 19 MLD

Possible Source: Ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.11.4 crore

Treatment at Taoru

Water Demand 2021 = 0.0025 + 0.0308/4 = 0.0102 BCM/Yr. = 28.1 MLD

Existing water supply facility = 10 MLD

Hence, new water supply system capacity = 19 MLD.

Possible Source: Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.11.4 crore

Treatment at Punhana

Water Demand 2021 = 0.0017 + 0.0308/4 = 0.0094 BCM/Yr. = 25.8 MLD

Existing water supply facility = 8 MLD

Hence, new water supply system capacity = 18 MLD.

Possible Source: Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.10.8 crore

Treatment at Nuh

Water Demand 2021 = 0.0016 + 0.0308/4 = 0.0093 BCM/Yr. = 25.5 MLD

Existing water supply facility = 8 MLD

Hence, new water supply system capacity = 18 MLD.

Possible Source: Recharged ground water.

Mode of treatment: Conventional with settling, filtration and chlorination

Cost of Treatment @ Rs.60 lakh per MLD ≈ Rs.10.8 crore

Sewerage

By 2021, no town is expected to be covered by sewerage system.

Summary of Capacities and Costs

Table 8. 40 : District-wise Summary of Capacities and Costs

District	Capacity (MLD)		Approx. Cost (Rs. Crore)		
	Water Supply System	Sewerage System	Water Supply System	Sewerage System	Total Cost
Panipat District	775	88.5	329	177	506
Sonepat District	921	172	409.8	344	753.8
Rohtak District	419	131.2	156.7	162.4	319.1
Jhajjar District	458	78	183.5	37	220.5
Faridabad District*	2295	576	1152	802.5	1954.5
Gurgaon District	2108	643	1209	915	2124
Rewari District	407	80	215.4	160	375.4
Mewat District	107.5	-	44.4	-	44.4
Total of HSR (MLD)	**7490.5**	**1768.7**	**3699.8**	**2597.9**	**6297.7**

** - Includes Palwal*

Annexure 8.1 : Existing Water demand , Supply and Coverage

Sr.No.	Sub-Region/City/Town	Type of settlement	Civic Status 2001	2001 Census Population Tehsil wise (souls)		Present Population Tehsil wise as on 2005 (souls)		Domestic Drinking Water Demand (mld)		Industrial Demand (mld)	Fire Demand (mld)	Drinking Demand (including 15% transmission & distribution losses) (mld)			Total Water Demand including Drinking, Industrial, Fire and 15% transmission & distribution losses (mld)	Distribution & Transmssion Losses (15% of Demand) (mld)			Total Demand including Drinking, Industrial, Fire and 15% transmission & distribution losses (mld)	% Water supply coverage of the population		Actual service level of water supply (lpcd)		Actual water supply (Mld)			Actual water Generated (Mld)		Actual Water Loss (UFW) (Mld)		Existing water supply(by source) to urban areas (Mld)	
				Urban	Rural	Urban	Rural	Urban	Rural			Urban	Rural	Total	Urban	Urban	Rural	Total	(Urban+R	Urban	Rural	Urban	Rural	Urban	Rural	dustri	Urban	Rural	Urban	Rural	Ground	Surf
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	9	10	11	12	13	14	15	16	17	18	19	20	21
I	**Haryana**					@ 3% pa	@ 3% pa																									
1	Panipat District																															
1	Panipat	I	UA	354148	235168	398597	264684	79.72	18.53	0.00	2.00	91.68	21.31	112.99	93.97	12.26	2.78	15.04	115.28	60	54	130	55	31.09	7.86	0.00	38.00	7.86	6.91	0.00	38.00	0.00
2	*Asan Khurd #*	V	CT	8066		9078		1.23	0	0.00	0.00	1.41	0.00	1.41	1.41	0.18	0.00	0.18	1.41	90		70		0.57		0.00	0.58		0.01		0.58	0.00
3	Samalkha	III	MC	29866	218195	33614	245580	4.54	17.19	0.00	0.00	5.22	19.77	24.99	5.22	0.68	2.58	3.26	24.99	90	56	78	55	2.36	7.56	0.00	2.56	7.61	0.20	0.05	2.56	0.00
4	Israna	Rural		0	122006	0	137319	0	9.61	0.00	0.00	0.00	11.05	11.05	0.00	0.00	1.44	1.44	11.05	0	54	0	55	0.00	4.23	0.00	0.00	4.26	0.00	0.03	4.23	0.00
	Sub-Total			392080	575369	441289	647583	85.49	45.33	0.00	2.00	98.31	52.13	150.44	100.61	13.12	6.80	19.92	152.74			278	165	34.02	19.65	0.00	41.14	19.73	7.12	0.08	45.37	0.00
2	Sonepat District						@ 3% pa																									
5	Sonepat	I	UA	225074	377822	253323	425242	50.66	29.77	1.78	1.59	58.26	34.24	92.49	62.14	8.11	4.47	12.57	96.37	90	37	135	55	30.78	8.65	0.76	34.90	13.55	3.36	4.90	16.74	18.16
6	Gohana	III	MC	48532	291370	54623	327940	7.37	22.96	0.00	0.74	8.48	26.40	34.88	9.33	1.22	3.44	4.66	35.73	90	61	110	20	5.41	4.00	0.00	5.58	4.04	0.17	0.04	5.58	0.00
7	Ganaur	IV	MC	29006	146781	37036	165203	5	11.56	0.17	0.00	5.75	13.29	19.04	5.94	0.77	1.73	2.51	19.24	100	63	135	55	5.00	5.72	0.09	5.50	7.30	0.41	1.58	5.50	0.00
8	Kharkhoda	V	MC	18763	141827	21118	159628	2.85	11.17	0.00	0.00	3.28	12.85	16.12	3.28	0.43	1.68	2.10	16.12	95	74	40	40	0.80	4.72	0.00	0.81	4.77	0.01	0.05	0.00	0.81
	Sub-Total			321375	957800	366100	1078013	65.88	75.46	1.95	2.33	75.76	86.78	162.54	80.68	10.52	11.32	21.84	167.46			420	170	41.99	23.10	0.85	46.79	29.66	3.95	6.56	27.82	18.97
3	Rohtak District						@ 3% pa																									
9	Rohtak	I	UA	294577	447352	331549	503499	66.31	35.24	2.31	1.82	76.26	40.53	116.78	81.01	10.57	5.29	15.85	121.54	70	25	112	55	25.99	6.92	0.65	34.97	7.14	8.32	0.22	0.00	34.97
10	Kalanaur	IV	MC	16853		18968		2.56	0	0.00	0.00	2.94	0.00	2.94	2.94	0.38	0.00	0.38	2.94	85		121		1.95		0.00	2.25		0.30		0.00	2.25
11	Maham	IV	MC	18174	163172	20455	183652	2.76	12.86	0.00	0.00	3.17	14.79	17.96	3.17	0.41	1.93	2.34	17.96	80	34	130	55	2.13	3.43	0.00	2.60	4.83	0.47	1.40	0.00	2.60
	Sub-Total			329604	610524	370972	687151	71.63	48.10	2.31	1.82	82.37	55.32	137.69	87.13	11.36	7.22	18.58	142.44					30.07	10.36	0.65	39.82	11.97	9.10	1.61	0.00	39.82
4	Jhajjar						@ 3% pa																									
12	Bahadurgarh	I	UA	126746	222291	142654	250190	28.53	17.51	9.17	1.19	32.81	20.14	52.95	44.73	5.83	2.63	8.46	64.86	70	100	135	135	13.48	33.78	8.18	22.70	35.50	1.04	1.72	15.80	6.90
13	*Ladrawan #*	V	CT	8008		9013		1.22	0	0.00	0.00	1.40	0.00	1.40	1.40	0.18	0.00	0.18	1.40	100		135		1.22		0.00	1.30		0.08		1.30	0.00
14	*Sankhol #*	V	CT	5179		5829		0.79	0	0.00	0.00	0.91	0.00	0.91	0.91	0.12	0.00	0.12	0.91	100		135		0.79		0.00	0.85		0.06		0.85	0.00
15	Jhajjar	III	MC	39002	343423	43897	386526	5.93	27.06	0.00	0.00	6.82	31.12	37.94	6.82	0.89	4.06	4.95	37.94	70	16	85	70	2.61	4.33	0.00	3.60	6.47	0.99	2.14	0.25	3.35
16	Beri	IV	MC	16162	119261	18190	134229	2.46	9.4	0.00	0.00	2.83	10.81	13.64	2.83	0.37	1.41	1.78	13.64	60	46	70	70	0.76	4.32	0.00	3.42	7.86	2.66	3.54	1.67	1.75
	Sub-Total			195097	684975	219583	770945	38.93	53.97	9.17	1.19	44.77	62.07	106.84	56.69	7.39	8.10	15.49	118.75					18.86	42.43	8.18	31.87	49.83	4.82	7.40	19.87	12.00
5	Faridabad District																															
17	Faridabad	I	M.Corp	1055938	115700	1188468	130221	237.69	9.12	1.60	3.45	273.34	10.49	283.83	279.15	36.41	1.37	37.78	289.64	94	59	204	70	229.00	5.38	1.32	240.00	10.31	9.68	4.93	240.00	0.00
18	*Tilpat #*	V	CT	6369		7168		0.97	0	0.00	0.00	1.12	0.00	1.12	1.12	0.15	0.00	0.15	1.12													
19	Palwal	I	MCl	100722	303414	113363	341495	22.67	23.9	0.00	1.06	26.07	27.49	53.56	27.29	3.56	3.59	7.15	54.78	45	57	100	70	5.10	13.63	0.00	10.00	13.66	4.90	0.03	10.00	0.00
20	Hodal	III	MC	38309	173719	43117	195522	5.82	13.69	0.00	0.00	6.69	15.74	22.44	6.69	0.87	2.05	2.93	22.44	40	61	105	70	1.81	8.35	0.00	3.10	14.07	1.29	5.72	3.10	0.00
21	Hasanpur	V	MC	9090		10231		1.38	0	0.00	0.00	1.59	0.00	1.59	1.59	0.21	0.00	0.21	1.59	50		90		0.46		0.00	0.87		0.41		0.87	0.00
23	Ballabhgarh	Rural		0	187458	0	210986	0	14.77	0.00	0.00	0.00	16.99	16.99	0.00	0.00	2.22	2.22	16.99	0	65	0	60	0.00	8.23	0.00	0.00	8.30	0.00	0.07	8.30	0.00
	Sub-Total			1210428	780291	1362347	878224	268.53	61.48	1.60	4.51	308.81	70.70	379.51	315.84	41.20	9.22	50.42	386.54					236.37	35.58	1.32	253.97	46.34	16.28	10.76	262.27	0.00
6	Gurgaon District																															
24	Gurgaon	I	UA	228820	380541	257539	428302	51.51	29.98	1.92	1.60	59.24	34.48	93.71	63.29	8.25	4.50	12.75	97.76	60	100	120	70	18.54	30.82	1.01	20.00	35.19	0.45	4.37	20.00	0.00
25	Farukknagar	V	MC	9521		10716		1.45	0	0.00	0.00	1.67	0.00	1.67	1.67	0.22	0.00	0.22	1.67	90		65		0.63		0.00	0.68		0.05		0.68	0.00
26	Dundahera	IV	CT	10626		11960		1.61	0	0.00	0.00	1.85	0.00	1.85	1.85	0.24	0.00	0.24	1.85	100		70		0.84		0.00	0.90		0.06		0.00	0.00
27	Sohna	III	MC	27570	112504	31030	126624	4.19	8.86	0.00	0.00	4.82	10.19	15.01	4.82	0.63	1.33	1.96	15.01	80	77	80	40	1.99	3.90	0.00	2.61	4.07	0.62	0.17	2.61	0.00
30	Hailey Mandi	IV	MC	17081	67791	19225	76299	2.6	5.34	0.00	0.00	2.99	6.14	9.13	2.99	0.39	0.80	1.19	9.13	95	100	112	200	2.05	15.26	0.00	2.10	27.42	0.05	12.16	2.10	0.00
31	Pataudi	IV	MC	16085		18104		2.44	0	0.00	0.00	2.81	0.00	2.81	2.81	0.37	0.00	0.37	2.81	95		80		1.38		0.00	1.40		0.02		1.40	0.00

	Sub-Total			309703	560836	348574	631225	63.80	44.18	1.92	1.60	73.37	50.81	124.18	77.42	10.10	6.63	16.73	128.23					25.41	49.98	1.01	27.69	66.68	1.26	16.70	26.79	0.00
7	Rewari District																														
34	Rewari	I	MCl	100684		113321		22.66	33.06	0.00	1.06	26.06	38.02	64.08	27.28	3.56	4.96	8.52	65.30	70		110		8.73		0.00	11.10		2.01		7.10	4.00
35	Dharuhera	IV	MCl	18892	419680	21263	472354	2.87	0	20.68	0.00	3.30	0.00	3.30	27.08	3.53	0.00	3.53	27.08	65	17	105	40	1.45	3.21	9.09	12.00	3.54	1.46	0.33	7.46	4.54
36	*Rewari(Rural) #*	VI	CT	4454		5013		0.68	0	0.00	0.00	0.78	0.00	0.78	0.78	0.10	0.00	0.10	0.78	70		105		0.37		0.00	0.40		0.03		0.40	0.00
37	Bawal	IV	CT	12144	98532	13668	110899	1.85	7.76	0.00	0.00	2.13	8.92	11.05	2.13	0.28	1.16	1.44	11.05	95	88	105	40	1.36	3.90	0.00	1.66	4.38	0.30	0.48	1.66	0.00
38	Kosli	Rural		0	110965	0	124892	0	8.74	0.00	0.00	0.00	10.05	10.05	0.00	0.00	1.31	1.31	10.05	0	65	0	40	0.00	3.23	0.00	0.00	3.23	0.00	0.00	3.23	0.00
	Sub-Total			136174	629177	153265	708145	28.06	49.56	20.68	1.06	32.27	56.99	89.26	57.27	7.47	7.43	14.90	114.27					11.91	10.35	9.09	25.16	11.15	3.79	0.80	19.85	8.54
8	Mewat District																														
22	Hathin	IV	MC	10916	192951	12286	217168	1.66	15.2	0.00	0.00	1.91	17.48	19.39	1.91	0.25	2.28	2.53	19.39	50	79	55	55	0.34	9.44	0.00	0.58	9.49	0.24	0.05	0.58	0.00
28	Firozpur Jhirka	IV	MC	17755	226113	19983	254492	2.7	17.81	0.00	0.00	3.11	20.48	23.59	3.11	0.41	2.67	3.08	23.59	95	33	110	40	2.09	3.36	0.00	2.15	3.43	0.06	0.07	2.15	0.00
29	Taoru	IV	MC	17328	108841	19503	122502	2.63	8.58	0.00	0.00	3.02	9.87	12.89	3.02	0.39	1.29	1.68	12.89	75	60	100	40	1.46	2.94	0.00	2.00	3.78	0.54	0.84	2.00	0.00
32	Punhana	IV	MC	13179	193679	14833	217987	2	15.26	0.00	0.00	2.30	17.55	19.85	2.30	0.30	2.29	2.59	19.85	85	63	80	40	1.01	5.49	0.00	1.15	5.49	0.14	0.00	1.15	0.00
33	Nuh	IV	MC	11039	201816	12424	227146	1.68	15.9	0.00	0.00	1.93	18.29	20.22	1.93	0.25	2.39	2.64	20.22	95	50	110	40	1.30	4.54	0.00	1.39	4.79	0.09	0.25	1.39	0.00
	Sub-Total			70217	923400	79029	1039295	10.67	72.75	0.00	0.00	12.27	83.66	95.93	12.27	1.60	10.91	12.51	95.93					6.20	25.77	0.00	7.27	26.98	1.07	1.21	7.27	0.00
Sub-Total of Haryana				2964678	5722372	3341159	6440581	632.99	450.83	37.63	14.52	727.94	518.45	1246.39	787.91	102.77	67.62	170.40	1306.37					404.83	217.22	21.11	473.71	262.34	47.39	45.12	409.24	79.33

Annexure - 8.2

Sub-Region/City/Town	Type of settlement	Water Supply Rate lpcd	Population		Domestic Demand (LPD)		Domestic Demand (MLD)		Domestic Demand (BCM per annum)		Recycled Sewage @ 60% (BCM per	
			2011	2021	2011	2021	2011	2021	2011	2021	2011	2021
Panipat District												
Panipat	I	201	506,866	709,612	101,880,066	142,632,012	101.88	142.63	0.04	0.0521	0.0223	0.0312
Samalkha	III	121	44,800	67,200	5,420,800	8,131,200	5.42	8.13	0.0020	0.0030	0.0012	0.0018
Rural	Village	71	632,425	652,606	44,902,148	46,335,005	44.90	46.34	0.0164	0.0169	0.0098	0.0101
Sub-Total			1,184,091	1,429,418	152,203,014	197,098,217	152.20	197.10	0.0556	0.0719	0.0333	0.0432
Sonepat District												
Sonepat	I	201	429,588	731,982	86,347,188	147,128,438	86.35	147.13	0.0315	0.0537	0.0189	0.0322
Gohana	III	121	97,326	188,549	11,776,494	22,814,463	11.78	22.81	0.0043	0.0083	0.0026	0.0050
Ganaur	IV	101	65,029	136,477	6,567,891	13,784,151	6.57	13.78	0.0024	0.0050	0.0014	0.0030
Kharkhoda	V	101	56,288	158,750	5,685,128	16,033,750	5.69	16.03	0.0021	0.0059	0.0012	0.0035
Rural	Village	71	1,039,177	1,043,937	73,781,568	74,119,499	73.78	74.12	0.0269	0.0271	0.0162	0.0162
Sub-Total			1,687,408	2,259,695	184,158,269	273,880,301	184.16	273.88	0.0672	0.1000	0.0403	0.0600
Rohtak District												
Rohtak	I	201	584,901	870,357	117,565,008	174,941,750	117.57	174.94	0.0429	0.0639	0.0257	0.0383
Kalanaur	IV	101	21,394	26,324	2,160,821	2,658,712	2.16	2.66	0.0008	0.0010	0.0005	0.0006
Meham	IV	101	31,797	59,160	3,211,508	5,975,160	3.21	5.98	0.0012	0.0022	0.0007	0.0013
Rural	Village	71	631,453	645,007	44,833,146	45,795,479	44.83	45.80	0.0164	0.0167	0.0098	0.0100
Sub-Total			1,269,545	1,600,848	167,770,483	229,371,100	167.77	229.37	0.0612	0.0837	0.0367	0.0502
Jhajjar												
Bahadurgarh	I	201	249,678	439,500	50,185,278	88,339,500	50.19	88.34	0.0183	0.0322	0.0110	0.0193
Ladrawan #	V	101	12,874	19,068	1,300,228	1,925,912	1.30	1.93	0.0005	0.0007	0.0003	0.0004
Jhajjar	III	121	93,283	194,961	11,287,224	23,590,262	11.29	23.59	0.0041	0.0086	0.0025	0.0052
Beri	IV	101	22,704	29,384	2,293,135	2,967,734	2.29	2.97	0.0008	0.0011	0.0005	0.0006
Rural	Village	71	675,371	621,341	47,951,326	44,115,220	47.95	44.12	0.0175	0.0161	0.0105	0.0097
Sub-Total			1,053,909	1,304,254	113,017,191	160,938,628	113.02	160.94	0.0413	0.0587	0.0248	0.0352
Faridabad District												
Faridabad	I	201	1,855,000	3,190,303	372,855,000	641,250,803	372.86	641.25	0.1361	0.2341	0.0817	0.1404
Palwal	I	201	211,961	444,000	42,604,237	89,244,000	42.60	89.24	0.0156	0.0326	0.0093	0.0195
Hodal	III	121	60,684	94,108	7,342,757	11,387,104	7.34	11.39	0.0027	0.0042	0.0016	0.0025
Hasanpur	V	101	12,284	16,547	1,240,718	1,671,235	1.24	1.67	0.0005	0.0006	0.0003	0.0004
Hathin	V	101	21,631	41,977	2,184,773	4,239,687	2.18	4.24	0.0008	0.0015	0.0005	0.0009
Rural	Village	71	1,137,785	1,223,610	80,782,746	86,876,331	80.78	86.88	0.0295	0.0317	0.0177	0.0190
Sub-Total			3,299,346	5,010,545	507,010,232	834,669,160	507.01	834.67	0.1851	0.3047	0.1110	0.1828
Gurgaon District												
Gurgaon	I	201	1,003,859	4,197,650	201,775,570	843,727,650	201.78	843.73	0.0736	0.3080	0.0442	0.1848
Farukknagar	V	101	19,152	15,145	1,934,372	1,529,660	1.93	1.53	0.0007	0.0006	0.0004	0.0003
Sohna	III	121	83,472	190,514	10,100,094	23,052,196	10.10	23.05	0.0037	0.0084	0.0022	0.0050
Hailey Mandi	IV	101	37,400	32,176	3,777,400	3,249,728	3.78	3.25	0.0014	0.0012	0.0008	0.0007
Pataudi	IV	101	39,000	37,152	3,938,970	3,752,395	3.94	3.75	0.0014	0.0014	0.0009	0.0008
Rural	Village	71	1,303,151	1,408,117	92,523,696	99,976,275	92.52	99.98	0.0338	0.0365	0.0203	0.0219
Sub-Total			2,486,033	5,880,754	314,050,101	975,287,904	314.05	975.29	0.1146	0.3560	0.0688	0.2136
Rewari District												
Rewari	I	201	284,750	521,099	57,234,750	104,740,843	57.23	104.74	0.0209	0.0382	0.0125	0.0229
Dharuhera	IV	101	106,731	217,023	10,779,845	21,919,279	10.78	21.92	0.0039	0.0080	0.0024	0.0048
Bawal	III	121	65,493	115,800	7,924,593	14,011,766	7.92	14.01	0.0029	0.0051	0.0017	0.0031
Rural	Village	71	611,000	596,880	43,381,013	42,378,512	43.38	42.38	0.0158	0.0155	0.0095	0.0093
Sub-Total			1,067,974	1,450,801	119,320,200	183,050,399	119.32	183.05	0.0436	0.0668	0.0261	0.0401
Mewat District												
Firozpur Jhirka	IV	101	36,788	74,520	3,715,624	7,526,520	3.72	7.53	0.0014	0.0027	0.0008	0.0016
Taoru	IV	101	35,765	72,307	3,612,290	7,302,987	3.61	7.30	0.0013	0.0027	0.0008	0.0016
Punhana	IV	101	25,815	49,532	2,607,363	5,002,776	2.61	5.00	0.0010	0.0018	0.0006	0.0011
Nuh	IV	101	22,783	46,061	2,301,052	4,652,115	2.30	4.65	0.0008	0.0017	0.0005	0.0010
Rural	Village	71	273,198	373,681	19,397,058	26,531,351	19.40	26.53	0.0071	0.0097	0.0042	0.0058
Sub-Total			394,350	616,101	31,633,388	51,015,749	31.63	51.02	0.0115	0.0186	0.0069	0.0112
Total of Haryana NCR			12,442,656	19,552,415	1,589,162,876	2,905,311,458	1,589.16	2,905.31	0.58	1.06	0.35	0.64

Chapter 9 : SOCIAL INFRASTRUCTURE

9.1 *Education and Health facilities*

The following table highlights the status of educational & Health infrastructure in the region.

Table 9-1 : District wise status of health and education facilities

NAME	Higher/ Senior Secondary schools	Colleges & Technical Institutes	Allopathic Institutes	Hospital beds
Panipat	193	11	114	293
Sonipat	377	20	209	374
Rohtak	328	23	157	1633
Jhajjar	308	9	149	268
Rewari	261	10	130	292
Gurgaon	187	21	101	397
Faridabad	578	25	162	724
Total	**2232**	**119**	**1022**	**3981**

The level of infrastructure facilities is still inadequate. The sectors of protected water supply and medical facilities are way below the required standards. The district level data indicate serious variation in the levels of facilities. Particularly the objective of *HEALTH FOR ALL* as agreed by India in the ALMA ATA convention. The district plans and urban area plans should designate land at suitable location to meet the desired standards.

Table 9-2 : Townwise status of health and education facilities

Town Name	Hospitals	Dispensaries	Nursing Homes	University	Techechnical Institutes	Higher Educational Facilitiy
Panipat	2	2	57	0	2	5
Asan Khurd	0	0	0	0	0	0

Samalkha	0	1	6	0	2	4
Gohana	0	0	4	0	2	3
Ganaur	0	1	9	0	1	1
Sonipat	2	4	24	0	5	13
Kharkhoda	0	0	14	0	0	0
Maham	0	0	3	0	2	3
Kalanaur	0	0	4	0	0	1
Rohtak	6	3	31	1	8	30
Beri	0	1	5	0	2	2
Ladrawan	0	1	0	0	0	0
Bahadurgarh	1	3	13	0	3	5
Sankhol	0	0	0	0	0	0
Jhajjar	0	1	12	0	3	5
Dharuhera	0	1	7	0	0	0
Rewari	2	1	22	0	3	8
Bawal	0	0	10	0	0	1
Haileymandi	1	1	2	0	0	1
Pataudi	0	1	10	0	5	5
Farrukhnagar	1	1	0	0	0	0
Dundahera	0	0	0	0	0	0
Gurgaon	3	0	61	0	1	3
Sohna	1	1	3	0	2	3
Taoru	1	0	2	0	0	1
Nuh	0	1	0	0	0	1
Ferozepur Jhirka	0	0	3	0	2	3
Punahana	0	0	0	0	0	0
Tilpat	0	0	0	0	0	0

Faridabad	4	26	70	0	9	14
Palwal	2	1	11	0	4	6
Hathin	0	0	3	0	2	2
Hassanpur	0	0	1	0	0	0
Hodal	0	0	3	0	1	3
Total	**26**	**51**	**390**	**1**	**59**	**123**

As per the UDPFI norms the educational Infrastructure & Social Infrastructure has been projected as given below:

Table 9-3 : District wise Projections for health and education facilities (2021)

District	Additional requirements Hospital Bed by 2021	Additional requirement for College & Secondary School by 2021
Panipat	6868	59
Sonipat	7592	60
Rothak	3795	0
Jhajjar	5063	4
Gurgaon	25320	500
Mewat	255	6
Rewari	4417	81
Faridabad	15813	215
Palwal	2790	35
Total	71913	960

From the above table it is clear that that will be a sharp increase in demand of Hospital beds by 2021 due to high population growth.

9.2 *Housing*

An outlay of Rs.260.00 crore was approved for Housing (including Police Housing) during Tenth Five Year Plan 2002-07 against which expenditure is Rs. 180.11 Crore.

Approved Eleventh Five Year Plan (2007-12) has been prepared with the central theme of Approach Paper-"Faster and Inclusive Growth" as spelt out by Planning Commission, Government of India. During the past six decades of planning, large

sums of money have been invested in all the sectors of the economy. Encouraging results have been experienced in many sectors. The percentage of population living under poverty line has been incessantly declining and Per capita income has been increasing but still much remains to be done. Socio-economic infrastructure has been significantly strengthened. In spite of all this, impatience and uncertainty has been growing among the people.

State owned transport has not only been of great help in accelerating the pace of socio-economic development of the State but has also been substantially contributing financial resources to the State. The State has already achieved the distinction of linking all villages in the State by roads. Therefore, the stress has been on the strengthening/ improvement of the road network. An outlay of Rs.59500.00 Lakh has been approved for 11th Five Year Plan for Road Transport. The incremental transport demand is being met through privatisation. An outlay of Rs. 45718.00 Lakh has been approved for 11th Five Year Plan. This scheme covers the programme for acquisition of land and construction of bus stands, workshops and bus queue shelters etc. An outlay of Rs.2500.00 Lakh has been approved for 11th Five Year Plan under this scheme

In the Haryana Sub-Region, as per the census 2001 there are around 4777 houseless house holds out of which 2024 houseless house holds are in urban area which is 42% of the total houseless house holds.It indicates that not only urban area but rural area is also having housing shortage. Below table gives the districtwise details of housing condition in the Sub-Region:

Table 9-4 : District wise Detail of Housing Condition in Sub-Region

District	Total Household	Total Houseless Household	Urban Houseless Household	% Houseless Household	% Urban Houseless Household
Panipat	174388	346	198	0.20	57.23
Sonipat	223342	1,144	208	0.51	18.18
Rohtak	167593	285	136	0.17	47.72
Jhajjar	158075	450	254	0.28	56.44
Rewari	135560	978	380	0.72	38.85

Gurgaon	273881	1,074	450	0.39	41.90
Faridabad	391426	500	398	0.13	79.60
Total	**1,524,265**	**4,777**	**2,024**	**0.31**	**42.37**

From the above table it is seen that in the Faridabad district out of total houseless house holds (HHH) 80% are in the urban area. So in the districts of Faridabad, Panipat and Jhajjar more HHH are in urban areas where as in the district of Sonipat maximum HHH are in rural areas.

Haryana Housing Board:

The Housing Board Haryana came into existence during the year 1971 in pursuance of the Haryana Housing Board Act (Act No. 20 of 1971). The Act was published in the State Government's Extraordinary Gazette of May 18, 1971. The main objective of the Board is to construct houses for allotment to the public in accordance with the guidelines issued by the State Government and the prescribed procedure. The emphasis is to construct houses for socially and economically weaker sections of the society. At the apex level, there is a Board of members appointed by the State Government under Section 3 of the Act. Chairman heads the Board. The Board so set up decides all the policy matters. Chief Administrator is its Chief Executive. The Board has set up construction divisions, design cell, and other necessary para-phernalia for carrying out various activities.

The housing colonies constructed by the board generally have a few hundred houses of different categories and properly planned with provision of metalled roads, street lighting, water and sewerage services, storm water drains, open spaces, parks, shopping booths and provision for school etc. Such a colony improves the outlook of an average Haryana town which has normally experienced an unplanned growth and has been lacking in public amenities. This way, a housing colony works as an agent of change as regards the habits and life styles of people.

Since its inception in 1971 and till 31st March, 2010 the Board has constructed 64,687 houses under different schemes such as Hire Purchase, Rental Housing and Self Financing in urban areas mostly by taking loan from Housing & Urban Development Corporation, (HUDCO), a Government of India's undertaking. Out of these houses,

45,518 houses are meant for Economically Weaker Section (EWS) and Low Income Group (LIG).

The Board has also constructed 3033 houses in 44 villages of Haryana. The Rural Housing Scheme was taken up by the Board in October, 1980. The houses were constructed on the plots allotted to beneficiaries under 20 Point Program, free of cost by the Revenue Department. The construction was started during the year 1981-82 and continued till March, 1985.

Now coming to the additional housing demand in the urban areas we find that by the end of 2021 the Sub-Region will need around 11 lakhs additional houses. The details of urban housing demand are given below:

Table 9-5 : Townwise Housing Demand in Sub-Region

DISTRICTS	TOWN_NAME	HH_2001	HH_2011	ADITIONAL HH 2011	HH_2021	ADITIONAL HH 2021
Faridabad	Faridabad*	218885	362757	143872	601197	238440
Palwal	Palwal	17,174.00	34225	17051	68204	33979
	Hodal	6,055.00	9049	2994	13522	4474
	Hathin	1,672.00	3126	1454	5820	2695
	Hassanpur	1,375.00	1753	378	2235	482
Rohtak	Rohtak	54,593.00	99084	44491	138717	39633
	Maham	3,323.00	5314	1991	9325	4011
	Kalanaur	3,045.00	4111	1066	5961	1850
Panipat	Panipat*	68,900.00	96460	27560	135044	38584
	Samalkha	5,217.00	7826	2609	11739	3913
	Asan Khurd	1,782.00	0	0	0	0
Sonipat	Sonipat*	41,834.00	66539	24705	185868	119329
	Gohana	8,605.00	14628	6023	26604	11975
	Ganaur	5,139.00	9764	4625	31005	21241
	Kharkhoda	3,178.00	7945	4767	21172	13227
Gurgaon	Gurgaon*	46151	185582	139431	746258	560676
	Sohna	4,828.00	13349	8521	29368	16019
	Pataudi	2,647.00	9824	7177	17684	7859
	Haileymandi	2973	0	0	0	0
	Dundahera	2,382.00	0	0	0	0
	Farrukhnagar	1,671.00	1977	306	2340	362
Mewat	Taoru	3,001.00	4802	1801	7793	2992
	Ferozepur Jhirka	2,835.00	4536	1701	7345	2809
	Punahana	2,002.00	3040	1038	4616	1576
	Nuh	1,733.00	2773	1040	4437	1664
Jhajjar	Bahadurgarh	25,024.00	37536	12512	56873	19337
	Jhajjar	6,803.00	12914	6111	23244	10331
	Beri	2,858.00	4067	1209	5747	1680
	Ladrawan	1592	2030	438	2588	558
	Sankhol	991.00	0	0	0	0
Rewari	Rewari	18,706.00	36756	18050	66161	29405
	Dharuhera	9,968.72	19938	9969	42554	22616

	Bawal	**1,945.00**	**9209**	**7264**	**16016**	**6807**
Total		578888	1070912	500152	2289436	1218524

Considering the total fulfillment of housing demand in the year 2001 by the year of 2021 sub-region will need around 12.18 lakhs of houses. In this Gurgaon-Manesar urban complex alone will need 5.6 lakhs of houses i.e half of the housing demand is from Gurgaon-Manesar urban complex followed by Faridabad (2.38 lakhs).

Chapter 10 : HERITAGE AND TOURISM

10.1 *Introduction*

Sub regional plan focuses on the balanced and harmonized development of heritage and tourism, keeping in mind the importance of these areas as great potential for the economic boost and medium for employment generation. This sector is projected to flourish in the perspective years.

Haryana's great culture and heritage is well preserved in its rural towns and villages. This plan particularly visualization on integrated development of Heritage and Tourism in the region beside development of rural area. The effort would be to promote idle areas of Heritage, Adventure, Eco, Medical & Farm/Rural Tourism in order to promote large scale employment opportunities while protecting environment and heritage.

The main identified Tourist and Heritage sites in Haryana Sub region are

Mewat - beautiful 27 holes gulf course in a lush green.

Panipat - A mute spectator of many battles that were fought

Rohtak - Land of mythological and Historical importance

Gurgaon - number of places worth visiting

Faridabad - A major attraction is the Surajkund crafts mela

Jhajjar - The Ancient Temple of Pandva's Bhimeshwari Goddess and Jhajjar Museum

Objectives listed from NCR Plan and Haryana Tourism policy for the Heritage and tourism in Sub Region are given as:

(A) To promote tourism as a major source of economic growth and capitalize potential of sustainable tourism for economic and employment generation.

(B) To promote sub region as a tourist destination to take benefit of the global travel trade and to develop untapped potential of Sub region of Haryana.

(C) To promote private sector in the development of tourism with government working as proactive facilitator and catalyst. The objective is to broaden and diversify the concept of tourism from only Highway Tourism to Eco Tourism, Adventure Tourism, Pilgrim Tourism, Farm Tourism, Golf Tourism, Medical Tourism and Heritage Tourism etc. in order to meet new market requirements.

(D) To enhance the infrastructure up to world class level

(E) To enhance professional excellence in training human resources and providing infrastructure for Human Resource Development.

(F) Developing sustained and effective marketing strategy and plan.

10.2 *Heritage*

Haryana Sub Region is prosperous in his built and natural Heritage. Many ground-breaking tales of mythology and history were known to associate with this region which changes the fate of India.

There are 2 types of heritage areas

a) Built Heritage

b) Natural Heritage

10.2.1 Built Heritage

Built Heritage is deemed to mean those buildings, artifacts, structures, areas and precincts that are of historic, aesthetics, architectural or cultural significance and should include natural features within such areas or precincts of the environment significance or scenic beauty such as scared groves, hills, hillocks, water bodies (and area adjoining the same), open areas, wooded areas, etc.

Sub region is gifted with various number of such man made Heritages.

Different organizations works on the listing of the Built Heritage in the sub region

a) Archaeological Survey of India (ASI)

b) State Archaeological Department

c) INTACH

10.2.1.iHeritage sites listed by ASI are:

In NCR Plan 2021 the ASI gives var

Table 10-1 : Number of Protected Monuments in various States of NCR by ASI

Protection/ State	Haryana Sub Region
Centrally Protected	63
State Protected	01

Source: Regional Plan 2021, NCR

Name of some ASI identified built heritage sites in Sub Region are listed in the table given below.

Table 10-2 : List of some of the built Heritages Listed by ASI in the Haryana Sub Region

S. No.	Name of the monuments/sites	Locality	District
1	Kos Minar No. 18	Alanpur	Faridabad
2	Bund or Dam	Anangpur	Faridabad
3	Kos Minar No.22	Aurangabad	Faridabad
4	Kos Minar No. 24	Banchari	Faridabad
5	Kos Minar No. 25	Banchari	Faridabad
6	Kos Minar No. 27	Phulwana	Faridabad

7	Kos Minar No. 16	Gadhpuri	Faridabad
8	Kos Minar No. 17	Gadhpuri	Faridabad
9	Kos Minar No. 26	Hodal	Faridabad
10	Kos Minar No. 23	Khatiala	Faridabad
11	Kos Minar No. 21	Khera Sarai (Bamani Khera)	Faridabad
12	Kos Minar No. 20	Khusropur (Kusalipur)	Faridabad
13	Kos Minar No. 10	Khawaza Sarai (Ghosi pur Sarai)	Faridabad
14	Mughal bridge over Buriya Nala	Khawaza Sarai (Atamadpur)	Faridabad
15	Suraj Kund Masonary	Lakar pur	Faridabad
16	Kos Minar No. 11	Mawai (Faridabad Sector - 29)	Faridabad
17	Kos Minar No. 13	Mazzessar	Faridabad
18	Kos Minar No. 19	Palwal	Faridabad
19	Kos Minar No. 15	Sikri	Faridabad
20	Baoli Ghas Ali Shah	Farruknagar	Gurgaon
21	Mosque of Ala Vardi Khan	Sarai Ala Vardi Khan	Gurgaon
22	Group of Monuments	Jhajjar	Jhajjar

23	Kos Minar	Jatipur	Panipat
24	Obelisk, Commemorating Third battle of Panipat	Kala Amb	Panipat
25	Kos Minar	Kiwana	Panipat
26	Kos Minar	Manana	Panipat
27	Bab-e-Faiz gate	Panipat	Panipat
28	Kabuli Bagh Mosque with enclosure wall	Panipat	Panipat
29	Ebrahim Lodi's Tomb	Panipat	Panipat
30	Two Kos Minar	Panipat Taraf Unsar	Panipat
31	Kos Minar	Taraf Afghan	Panipat
32	Kos Minar	Siwali (Sewah)	Panipat
33	Kos Minar	Baiyan pur	Rohtak
34	Ancient site	Khokra Kot	Rohtak
35	Shah Jahan-ki-Baoli	Mahem	Rohtak
36	Mughal Kos Minar	Akbar pur Barota	Sonepat
37	Mughal Kos Minar	Gannaur	Sonepat
38	Mughal Kos Minar	Jagdish pur	Sonepat

39	Mughal Kos Minar	Jawa Hari	Sonepat
40	Mughal Kos Minar	Panchi Gujran	Sonepat
41	Mughal Kos Minar	Rajpur	Sonepat
42	Tomb of Khwaja Khizer	Sonepat	Sonepat
43	Mughal Kos Minar	Sonepat	Sonepat

Source: Archeological survey of India, Chandigarh circle, Haryana

10.2.1.ii Heritage sites identified by INTACH are:

INTACH has listed various numbers of monuments. As per NCR plan 2021 the number of monuments listed are 334 in Haryana Sub region.

Table 10-3 : Number of Monuments and Conservation areas listed by INTACH

Sub region	Haryana
Monuments	334
Conservation Areas	0

Source: Regional Plan 2021, NCR

Table 10-4 : Numbers of the different types of monuments listed in INTACH as per Districts are given as in Panipat

Religious Buildings	Total No.	Secular Buildings	Total No.	Royal Buildings	Total No.
Temples	17	Residential	201	Forts	2
Mosques	53	Educational	2		

Gurudwaras	2	Civic	15
Tombs/Memorials	8		

Total no. of buildings: 305

Table 10-5 : Numbers of the different types of monuments listed in INTACH as per Districts are given as in Rohtak

Religious Buildings	Total No.	Secular Buildings	Total No.	Royal Buildings	Total No.
Temples	34	Residential	91	Forts	2
Mosques	81	Civic	49		
Gurudwaras	8	Administrative	1		
Churches	1	Educational	10		
Tombs/Graveyards	5				

Total no. of buildings: 282

Table 10-6 : Numbers of the different types of monuments listed in INTACH as per Districts are given as in Samalkha

Religious Buildings	Total No.	Secular Buildings	Total No.	Royal Buildings	Total No.
Temples	3	Civic	9		
Mosques	1	Residential	30		

Total no. of buildings: 43

10.2.2 Natural Heritage:

Haryana Sub region is gifted with maximum natural sites not only of Haryana State but also among NCR region. These natural Heritages illustrate the Bio Diversity of the Sub Region. They can be divide as

10.2.2.i Special Protection Areas:

Sultanpur national Park - Gurgaon Haryana

Bhindawas Birds Santantury - Jhajjar, Haryana

10.2.2.ii Hilly areas:

Aravallis at Gurgaon, Faridabad and Mewat

10.2.2.iii River Systems, Wetlands and Water Bodies:

Yamuna

Yamuna Wetland Systems

Damdama Lake, Gurgaon, Haryana

Sohna Lake / Hot water Spring, Gurgaon

Badkal and Surrounding Lakes, Faridabad

Kotla Dhar Lake, Mewat

All existing constructed and natural water bodies including village ponds

10.2.2.iv Habitations:

This include urban and rural settlements, biodiversity in large variety of crops that grows in these areas, livestock, green areas and open spaces in the developed areas where biotic resources manifested themselves.

10.3 *Tourism*

10.3.1 Types of Tourism in Haryana Sub region

10.3.1.i Eco Tourism:

Ecotourism entails the sustainable preservation of a naturally gifted area or region. This is becoming more and more significant for the ecological development of all regions that have tourist value. Various Eco tourism destination spots are located in the sub region such as Sultanpur Birds Sanctuary and Bhindawas Bird Sanctuary.

10.3.1.ii Farm Tourism:

Haryana have primarily an agrarian economy, so Haryana Tourism has taken the initiative to introduce the concept of Farm Tourism in India. The farms offer you an experience of a lifestyle that's true of a real India - rich in age old traditions, ethnic arts and crafts. The farms are located near Delhi. Almost 14 farms are located in Haryana Sub region.

10.3.1.iii Golf Tourism:

The state of Haryana is blessed with many lush green plain lands and meadows making it ideal for Golf tourism. This tourism is about providing excellent golfing facilities and latest amenities to spend a wonderful vacation. It attracts gofers from all over the world and sub region becomes pioneer and prime destination for the golf tourism in India. In sub region, numbers of lush green international level golf courses are located in Gurgaon, Faridabad and Mewat.

10.3.1.iv Adventure Tourism:

Adventure tourism is exceptionally renowned amongst the youngsters. It has recently grown in India. This involves exploration of remote areas and exotic locations and engaging in various activities. For adventure tourism in Haryana, tourists prefer to go for trekking, climbing boating etc to places near hills, lakes, wildlife, etc.

10.3.1.v Heritage Tourism:

Heritage tourism is a branch of tourism oriented towards the Built heritage and natural heritage of the location where tourism is occurring. In Sub region maximum heritage tourism can easily seen in all districts, but prominently seen in Panipat, Gurgaon and Faridabad.

10.3.1.vi Medical Tourism:

Many tourists have been come India to avail cost-effective healthcare facility in terms of surgical procedures and general medical attention. There are several medical institutes in the country that cater to foreign patients and impart top-quality healthcare at a fraction of what it would have cost in developed nations such as USA and UK. It is expected that medical tourism in India will hold a value around US$ 2 billion by 2012.

10.3.1.vii Cultural Tourism:

Haryana is known for its rich cultural image and an element of religion. The tourist like to visit various fairs and festivals. In Sub region tourist can visit Suraj Kund mela, Faridabad.

10.4 *Existing Scenario of Heritage and Tourism in Haryana*

10.4.1 State and its Surroundings

The sub region have an excellent infrastructure and many of the top most economic amplify industries are set up in the sub region, but in field of tourism industry Haryana state is lacking behind. In terms of Tourist destinations Haryana stands on Domestic Rank 15 and Foreign Tourist destination rank 16, where as rest of NCR states attracts higher number of tourist (as given in the table below).

Table 10-7 : Tourist Visit and Percentage share

S.No	State/ U.T.	Tourist Visits		Percentage Share		Rank	
		Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
1	Delhi	2388330	2018848	0.4	15.3	19	1
2	Haryana	6252945	64711	1.2	0.5	15	16
3	Rajasthan	25920529	1401042	4.9	10.6	5	5
4	U.P.	116244008	1493157	22.1	11.3	2	4

Source: India Tourism Statistics 2007

If we see the annual growth rate of the tourist in and around Haryana then there is slightly increase in Domestic tourist in Haryana which is lowest in comparison to surrounding states and negative growth in the Foreign Tourist. (as shown in table Below)

Table 10-8 : Annual Growth rate and Tourist flow in Haryana and its Surrounding

State/ U.T.	2005		2006		2007		GR 05-06		GR 06-07	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
Haryana	5913394	59353	6019927	67854	6252945	64711	1.80	14.32	3.87	-4.63
Delhi	2061782	1511893	2237130	1974836	2388330	2018848	8.50	30.62	6.76	2.23
Rajasthan	18787298	1131164	23483287	1220164	25920529	1401042	25.00	7.87	10.38	14.82

U.P.	95440947	1174597	105549478	1328974	116244008	1493157	10.59	13.14	10.13	12.35

Source: India Tourism Statistics 2007

10.4.2 Sub Region and its Surrounding

The data reveal maximum foreign and Indian Tourist attracted to Faridabad not only at sub regional level but also at State level. The sub region includes maximum tourist potential sites. In Sub region the least tourist conspicuous site is Jhajjar. (as Shown in Table below)

Table 10-9 : Number of Tourist Spots and Tourist Visited in Districts of Haryana

District	Tourist Spots	Tourist Visitors (2007)			Percentage			Rank		
		Foreigner	Indian	Total	Foreigner	Indian	Total	Foreigner	Indian	Total
Ambala	1	1365	65158	66523	1.90	1.09	1.10	8	13	13
Panchkula	5	1931	787415	789346	2.68	13.21	13.08	7	4	4
Yamuna Nagar	1	1	38614	38615	0.00	0.65	0.64	15	14	14
Kurukshetra	4	19986	889753	909739	27.76	14.92	15.08	2	3	3
Kaithal	1		84889	84889	0.00	1.42	1.41	17	12	12
Karnal	3	11630	109384	1105471	16.1	18.3	18.	3	2	2

			1		5	5	32			
Panipat	2	5078	444591	449669	7.05	7.46	7.45	5	5	5
Sonipat	1	596	123299	123895	0.83	2.07	2.05	9	8	8
Rohtak	2	14	162661	162675	0.02	2.73	2.70	11	7	7
Jhajjar	1	2	97153	97155	0.00	1.63	1.61	14	11	11
Faridabad*	8	21586	1551916	1573502	29.98	26.03	26.08	1	1	1
Gurgaon**	4	5791	295942	301733	8.04	4.96	5.00	4	6	6
Rewari	2	3885	110481	114366	5.40	1.85	1.90	6	10	9
Mahendragarh	0	0	0	0	0.00	0.00	0.00	17	19	19
Bhiwani	1	8	32732	32740	0.01	0.55	0.54	12	15	15
Jind	1	4	29864	29868	0.01	0.50	0.49	13	16	16
Hisar	3	115	110920	111035	0.16	1.86	1.84	10	9	10

Sirsa	3	1	20925	20926	0.00	0.35	0.35	15	18	18
Fatehgarh	1	0	21912	21912	0.00	0.37	0.36	17	17	17
Total	44	71993	5962066	6034059						

*Faridabad includes Palwal ** Gurgaon include Mewat

Source: Statistical Abstract Haryana 2006-07

Haryana have many Heritage and tourist destination sites and other places which are yet to be developed. Many of those destination lies inside Haryana Sub Region.

10.4.3 Some of the key features of Haryana Sub Region are:

- Sub region have heritage sites at Panipat and Surajkund,
- Vicinity of Delhi, U.P. and Rajasthan which have major tourist attraction points in India
- Gurgaon, Mewat and Faridabad have Strong connectivity with Indira Gandhi international Airport
- Haryana has adventure tourism sites at Gurgaon and Jhajjar besides excellent resorts for holidaying.
- Introduction of Highway Tourism, Medical Tourism and Farm Tourism

10.4.4 Some Negative Features:

- Many places with Heritage Importance (e.g. Jhajjar, Rohtak) are yet to be developed.
- No Proper Tourist Development plans are prepared.
- Some towns such as Gurgaon, Heritage tourism get overhaul by modern tourism.

- Poor tourist nomadic facility.

10.5 *Major Identified Tourist sites in Haryana Sub Region are:*

In Haryana Sub region total heritage and tourist site are 92 and number of tourist resorts are 20 which are distributed in various districts of sub region. District wise listing of different type of tourism in the sub region are given below in the matrix

Table 10-10 : Existing Scenario of Tourism in the Haryana Sub region

District/ Tourism	Heritage Tourism	Farm Tourism	Eco tourism	Golf Tourism	Adventure tourism	Cultural Tourism	Business Tourism	Medical Tourism
Faridabad	✓	✓	✓	✓		✓		
Palwal	✓							
Panipat	✓							
Gurgaon	✓	✓	✓		✓		✓*	
Mewat	✓			✓				
Rohtak	✓	✓						
Sonipat	✓							
Rewari	✓							
Jhajjar	✓				✓			

*proposed as per National Tourism Policy 2008

Details of tourism and Heritage, district wise in sub region is confer below:

10.5.1 Faridabad

History: The city was founded in 1607 by Shaikh Farid, treasurer of Jahangir, with the object of protecting the highway which passed through the town. Faridabad city is the most populated and most industrialized in whole of Haryana.

Table 10-11 : **Famous Places and Tourism in Faridabad:**

Type of Tourism	Name	Tourist Resort
Golf Tourism	Aravalli Golf Course	Aravalli Golf Course
Cultural Tourism	Surajkund Crafts Mela & Tourist Complex	
Heritage Tourism	Raja Nahar Singh Palace	Badkhal Lake
Eco Tourism	Badhkal Lake	
Farm Holidays	Prakriti Farm	Hermitage Huts
Farm Holidays	Progressive Farm	
Farm Holidays	Sheilma Farm	Hotel Rajhans
Farm Holidays	YMCA Rural Center	
ASI Heritage	Kos Minar No. 18	Sunbird Motel
ASI Heritage	Bund or Dam	
ASI Heritage	Kos Minar No. 27	Magpie
ASI Heritage	Kos Minar No. 23	

ASI Heritage	Kos Minar No. 10	
ASI Heritage	Mughal bridge over Buriya Nala	
ASI Heritage	Suraj Kund Masonary	
ASI Heritage	Kos Minar No. 11	
ASI Heritage	Kos Minar No. 13	
ASI Heritage	Kos Minar No. 15	

Source: compiled from various sources

10.5.2 Palwal:

History: Newly formed District carved out from Faridabad. It supposed to form in the initial Aryan civilization known by 'Apelava', part of the Pandava kingdom of Indraprastha, which was later restored by Vikramaditya

Table 10-12 : **Famous places and Tourism in Palwal :**

Type of Tourism	Name	Tourist Resort
Heritage Tourism	Panchwati Temple	Dabchik tourist resort
ASI Heritage	Kos Minar No. 19	
ASI Heritage	Kos Minar No. 26	
ASI Heritage	Kos Minar No.22	
ASI Heritage	Kos Minar No. 24	

ASI Heritage	Kos Minar No. 25	
ASI Heritage	Kos Minar No. 16	
ASI Heritage	Kos Minar No. 17	
ASI Heritage	Kos Minar No. 21	
ASI Heritage	Kos Minar No. 20	

Source: compiled from various sources

10.5.3 Panipat

History: Panipat is a mute spectator of many battles that were fought in Indian history. It was a place where the fate of great empires was decided more than once. It situated on the banks of the river Yamuna. Panipat is known for its handloom products.

Table 10-13 : **Famous places and Tourism in Panipat :**

Type of Tourism	Name	Tourist Resort
Heritage Tourism	Ibrahim Lodi's tomb:	
Heritage Tourism	Kabuli Shah mosque	Skylark
ASI Heritage	Kos Minar	
ASI Heritage	Obelisk, Commemorating Third battle of Panipat	Blue Jay
ASI Heritage	Kos Minar	
ASI Heritage	Kos Minar	

ASI Heritage	Bab-e-Faiz gate	
ASI Heritage	Kabuli Bagh Mosque with enclosure wall	
ASI Heritage	Ebrahim Lodi's Tomb	
ASI Heritage	Two Kos Minar	
ASI Heritage	Kos Minar	
ASI Heritage	Kos Minar	

Source: compiled from various sources

10.5.4 Gurgaon

History: Gurgaon is the known to be the ancestral village of Guru Dronacharya. It has been under the control of a succession of rulers of Delhi and their appointees

Table 10-14 : **Famous places and Tourism in Gurgaon :**

Type of Tourism	Name	Tourist Resort
Eco Tourism	Sultanpur Lake Bird Sanctuary	Sultanpur Birds Santuary
Adventure Tourism	Sohna sulphur springs and Tourist Complex	
Farm Holidays	The Surjivan Farm	Saras
Farm Holidays	Botanix Nature Resort	
Farm Holidays	Golden Creeper	Shama
Farm Holidays	Golden Dunes Retreat	

Farm Holidays	Herambh Aushadh	Barbet
Farm Holidays	Kalki Mystic	
Farm Holidays	The Great Escape	
Farm Holidays	Anugrah Vatika	
Farm Holidays	Healthec Farm & SPA	
Adventure Tourism	Damdama tourist Complex	
ASI Heritage	Baoli Ghas Ali Shah	
ASI Heritage	Mosque of Ala Vardi Khan	
Adventure Tourism	Shama Tourist Complex	
Heritage Tourism	Shiv Temple	
Heritage Tourism	Sheesh Mahal	
Heritage Tourism	Sheetala Devi Temple	
Heritage Tourism	Dhankot	
Heritage Tourism	Saiyad	
Heritage Tourism	Ata	

Source: compiled from various sources

10.5.5 Mewat

History: Hasan Khan Mewati was Chief of Mewat, fought battle of Khanwa against Babur in 1527. Under Mughal rule Mewat came under Rajputs. It was a part of Alwar princely state until independence.

Table 10-15 : **Famous places and Tourism in Mewat :**

Type of Tourism	Name	Tourist Resort
Golf Tourism	Classic Golf Resort	Classic Golf Resort
Golf Tourism	Country Club	
Heritage	Malab	
Heritage	Sanghel	
Heritage	Ujina	

Source: compiled from various sources

10.5.6 Rohtak

History: Khokhrakot, the capital city of Yaudheyas,a Republic of historical period. It is presently converted into a huge mound near Rohtak. The excavations at this site have yielded terracotta seals and sealing, coins moulds, silver and copper coins, copper and iron implements, stone sculptures etc. along with backed brick houses and pottery of B.C. to 11th Century A.D.

Table 10-16 : **Famous places and Tourism in Rohtak :**

Type of Tourism	Name	Tourist Resort
Heritage Tourism	Ruins of the ancient town are found at Khokrakot or Rohtasgarh.	

Farm Holidays	Banni Khera Farm	Myna
ASI Heritage	Kos Minar	
ASI Heritage	Ancient site	Tilyar
ASI Heritage	Shah Jahan-ki-Baoli	

Source: compiled from various sources

10.5.7 Sonipat

History: It is believed that Sonipat was founded as 'Suvarnaprastha' by the five Pandava brothers during the times of Mahabharata. Another legend ascribed it to Raja Soni, the thirteenth descendent of Arjuna, one of the Pandava brothers

Table 10-17 : **Famous places and Tourism in Sonipat :**

Type of Tourism	Name	Tourist Resort
ASI Heritage	Mughal Kos Minar	Ethnic India
ASI Heritage	Mughal Kos Minar	
ASI Heritage	Mughal Kos Minar	
ASI Heritage	Mughal Kos Minar	
ASI Heritage	Mughal Kos Minar	
ASI Heritage	Mughal Kos Minar	
ASI Heritage	Tomb of Khwaja Khizer	

ASI Heritage	Mughal Kos Minar	
Heritage Tourism	Shri Gita Bhawan Mandir	
Heritage Tourism	Nirankari Sant Bhawan	
Heritage Tourism	Shri radha Swami Satsan Sabha	
Heritage Tourism	Shri Ram Mandir	
Heritage Tourism	Sri Gurunanak Gurudwara	
Heritage Tourism	Ibadat Khana	
Heritage Tourism	Methodist Mission Church	

Source: compiled from various sources

10.5.8 Rewari

History: Rewari, the land of Ahirs, is a city of historical importance. Its history is told in the Indian epic Mahabharata. The last Hindu king of India, a great warrior Hemu Vikramaditya, belonged to Rewari. He won 22 battles during 1554-1556, spanning the entire north of India. He was the only Hindu king to rule from Delhi during the medieval period. His Haveli in Rewari still stands in the Qutabpur area.

Table 10-18 : Famous places and Tourism in Rewari :

Type of Tourism	Name	Tourist Resort
Heritage Tourism	Lal Masjid	Jungle Babbler
Heritage Tourism	Baag wala Talab	

Heritage Tourism	Rao Tej singh Taalab (Bada Talab)	Sandpiper

Source: compiled from various sources

10.5.9 Jhajjar

History: Jhajjar district was carved out of Rohtak district on July 15, 1997.

Table 10-19 : **Famous places and Tourism in Jhajjar :**

Type of Tourism	Name	Tourist Resort
Adventure Tourism	Bhindawas Bird Sanctuary	Gauriyya
ASI Heritage	Group of Monuments	

Source: compiled from various sources

10.5.10 District wise analysis of the Existing facilities in the Sub Region of Haryana.

Sightseers are mainly travel for tourism, leisure, culture and Heritage. If given aspects are analyzed in the each District of the sub region the consequence will appear

Table 10-20 : **District wise Tourism Potentials**

Districts of Sub Region	Tourism	Leisure	Culture	Heritage	Hotels & Resorts
Faridabad	✓	✓	✓	✓	✓
Palwal	✓	×	×	✓	✓
Panipat	✓	×	×	✓	✓
Gurgaon	✓	✓	×	✓	✓

Mewat	✓	✓	×	✓	✓
Rohtak	✓	✓	×	✓	✓
Sonipat	✓	×	×	✓	✓
Rewari	✓	×	×	✓	✓
Jhajjar	✓	×	×	✓	✓

Note: Tourism includes any type of tourism

Leisure includes Golf tourism and Farm Tourism

Culture includes any cultural festival or cultural places

Heritage includes Heritage sites allocated by ASI and INTACH

Hotels and Resorts include tourist resorts of Haryana Tourism

Faridabad is top rank among all the districts of Haryana, not because of number of tourist spots but also due to presence of many additional tourist attracting amenities.

10.6 *Existing Projects appraisal*

10.6.1 Development of Tourist Circuit

As per Tourism Policy, tourist circuit passes inside the Sub region is Panipat-Kurukshetra-Pinjore. This circuit is identified by the ministry of Tourism as the 'Mega circuit of National importance' (Tourism Ministry Annual Report 2007-08). This plan would involve for integrated development of tourist circuit. Plan would be made for setting up world class infrastructure in Private-Public Partnership. The policy of the Government is to encourage emergence constructive and mutually beneficial partnership between the private and public sector. Services of specialist consultancy

agencies will be taken for implementation and evaluation of public private participation in tourism projects. Sub region of Haryana also plans to have, Sufi Circuit, Eco Tourism Circuit and Heritage Circuit.

10.6.2 Gurgaon as Convention, Exhibition Hub and Golf City

The Tourism Policy also proposes to develop Gurgaon as a convention and exhibition hub with requisite world class infrastructure, recreation, Information Technology and support facilities. A comprehensive convention centre would be setup in public private partnership in Gurgaon.

It is proposed to setup adventure sites in public & private partnership in Sohna and Damdama for theme parks and camping sites for recreation and holidaying. The existing Golf Courses, spas and polo etc. near Gurgaon will be an added attraction.

10.6.3 Eco Tourism

To promote Sultanpur as eco tourism sites in close coordination with the Forest Department.

10.6.4 Farm/Agri Tourism

Haryana Tourism has taken the initiative to introduce the concept of Farm Tourism in India. This is first of its kind in India. The Department of Tourism, in partnership with 21 farm owners in Haryana, out of which 14 are located inside the Haryana Sub region (as given in Table below)

Table 10-21 : The Department of Tourism, in partnership with 21 farm owners in Haryana

Location	Name of Farms
Faridabad	Prakriti Farm
	Progressive Farm
	Sheilma Farm
	Ymca Rural Center
Gurgaon	The Surjivan Farm

	Botanix Nature Resort
	Golden Creeper
	Golden Dunes Retreat
	Herambh Aushadh
	Kalki Mystic
	The Great Escape
	Anugrah Vatika
	Healthec Farm & Spa
Rohtak	Banni Khera Farm

Different tourist circuits of farm/agri tourism, local folk art and culture etc. will be engraved and promoted in order to provide large scale employment opportunities.

10.6.5 Adventure Tourism

Haryana Tourism Corporation is carrying out various activities of adventure tourism at different places in the sub region such as camping trekking, rock climbing, para sailing etc. Adventure Tourism has become very popular amongst the young people. Some initiatives have also been taken by private sector. The Government will identify existing hubs and create new hubs of adventure tourism activities and implement the projects under public-private partnership. Such activities would provide large scale employment opportunities in Sub region of Haryana. It is proposed to set up adventure camping sites in Surajkund, Badkhal and Damdama.

10.6.6 Heritage Tourism

It is proposed to promote Surajkund in Sub region as heritage destination. The Deputy Commissioners of each district would identify the historical sites and the Tourism Development Council will take a decision regarding the heritage sites to be chosen for private-public partnership for conservation and preservations so that these sites are a point of attraction for the

tourists. The Government will formulate appropriate scheme for identifying and renovation of the historical sites in association with the private sector/business houses under corporate social responsibility scheme so that these sites are made as a point of attraction for the tourists. The private sector would maintain these sites for a specific period as per the conservation plan prepared by the Archaeology Department, Haryana. The publicity mileage will be given to private sector in the form of installation of plaque etc.

10.6.7 Medical Tourism

The Government would coordinate with leading hospitals especially Medi City for promotion of Medical Tourism. Appropriate land will be identified by the HUDA for creation of speciality hospitals in all the important towns of the state. The Haryana Tourism Corporation would introduce Panchkarma and spa facilities in their hotels to make it more tourist friendly either by itself or in public-private partnership on long lease basis i.e. 5 to 10 years.

10.7 *Conclusions*

- All districts of Sub Region except Faridabad Missing Cultural tourism in the District like Fete, Village Haats, etc.
- Leisure is also an important element to attract tourist in the sub region, but they are very less in Number in the Sub Region.
- Proper tourist roving facilities are not present in the districts.
- Many circuits are yet to be developed such as Sufi Circuit, Eco-Tourism Circuit, Heritage Circuit and small circuits.
- Highway tourism has immense potential to develop and link various small circuits of one district to other district.

10.8 *Final Proposals*

10.8.1 Integration of tourism

a) Integration of Tourism and Agriculture

Modern agriculture and rich cultural heritage in Haryana needs to be leveraged for promoting tourism and meeting the need for the tourists to go back to nature and back to the roots. It will be the endeavor of the Government to promote this concept further and to link it with agri tourism and cultural tourism with a view to involve community participation. This concept can integrate as well as promote rural sector with tourism and generate employment in the sub region. The infrastructure leading to Farm Lands shall not be treated as commercial units by the line departments.

b) Integration of Tourism & Culture

Efforts would be made to integrate tourism with culture especially in the resorts run by Haryana Tourism Corporation. Special efforts will be made to identify Event Managers/companies in the hospitality business for running Crafts Bazars, Food Bazars and Cultural shows in the tourist complexes especially Surajkund, Pinjore and Rai etc. Cultural department, Haryana will organize cultural programmes in the tourist complexes on regular basis to increase tourist inflow.

c) Integration of Tourism & Leisure

Introduction of leisure activities in this modernize and urbanize culture such as Golf, SPA, yoga, medi tourism, etc. will definitely attract tourist from various places to the sub region.

d) Integration of Tourism and Business

Introduction of Conference halls, convention centres, exhibition hub, etc. with world class infrastructure, recreation, Information Technology and support facilities. Facilities should be at par level to attract Business activites of national as well as international level. Places which have proximity of infrastructure and facilities are listed for such type of development.

10.8.2 Strengthening and updating existing infrastructure

Efforts would be made to upgrade the existing resorts and plan integrated development including setting up theme parks and multiplexes.

10.8.3 Facilitation

- To ensure safety and security of tourists and efficient facilitation services at local tourism plan.
- To introduce regularity measures to ensure social, cultural and environmental activities.
- To ensure involvement of local community so that the benefits accrue to them in the form of employment generation.
- To concentrate on development basis infrastructure by coordinating with all the departments.
- To develop and promote souvenir handicrafts.
- To identify heritage buildings and to develop them in public/private partnership. It is proposed to involve the business houses for development of heritage buildings.
- To set up Tourist Reception Centres for the convenience of tourists and compilation of data by the Department of Tourism.
- Radio taxies would be introduced.

Identification of the special controlled area for the heritage site

Development of tourist circuit plan at building level as well as small scale level for the site.

Each district would identify the historical sites on the basis of historic significance, historic integrity and historic context and the Tourism Development Council will take a decision regarding the heritage sites to be chosen for private-public partnership for conservation and preservations

Preparation o f tourism Development plan

Studies have shown that lower order settlements in the NCR (service centres, central villages and basic villages) have enough localized traditional skills like potteries, handloom weaving, leather work, murtikari, carpet weaving etc., which if properly nurtured, can play the role of a vibrant component of the tourism sector and rural economy . Agro based tourism also stabilizing the rural economy and generate employment in the area.

Proposals for Business Tourism as many industries are setting up in the sub region this can give boost to tourism related to business and potential to attract business crowd from NCT.

Chapter 11 : ENVIRONMENT AND DISASTER MANAGEMENT

11.1 *Environmental Concerns: District Wise*

With the help of maps prepared by National Bureau of Soil Survey and Land use Planning, and, Resource Atlas of Haryana, by Science and Technology Department, the details for physiography, soil description and soil taxonomy, ground water quality, natural resource, agro-ecological areas and climatic condition of areas are studied.

11.1.1 Climatology of the districts:

Sonipat: The climate of the district is dry with intensely hot summer and cold winter. Only during the three monsoon months of July to September, the weather becomes mild. The average annual rainfall in the district is 612.3mm.. About 74 percent of annual rainfall is received during the monsoon season. On an average there are 24 rainy days in a year in the district.

The district experiences extreme temperatures. During winter, temperature goes down to below 4^0C. In January, which is the coldest month, the mean daily maximum temperature is about 21^0C and the mean daily minimum temperature is about 70^0C. On the arrival of cold waves with western disturbances, temperature may go down to freezing point.

Panipat: Hot summer, cold winter and dry air, except during rainy season characterize the climate of the district. Temperature starts rising from March and continues till the end of June. May and June are the hottest months with mean daily maximum temperature of about 40^0C, which may sometimes rise to 45^0C. It starts decreasing by the middle of November. January is the coldest month. The average annual rainfall in the district is 625.8mm. The variation is annual rainfall is very large. About 84 percent of the annual rainfall in received during the monsoon month i.e. July to September.

Gurgaon: The district experiences dry air except during the monsoon, hot summer and cold winter. The average annual rainfall for the five years i.e. 1995-99, 1996-2000 and 1997-2001 was 665.2, 628.4 and 560.1 mm respectively it increases towards east. About 77 per cent of annual rainfall in the district is received during the monsoon months. The mean daily maximum

temperature is about 41^{0}C in the months of May and June. It may go up to 45^{0}C or more in June. During winter the mean daily maximum temperate in January in 21^{0}C and minimum is about 7^{0}C.

Faridabad: The climate characteristics of the district are dry air, except during monsoon, hot summer and clod winters. The normal annual rainfall is 537.1mm. It increases towards east. About 77 percent of annual rainfall in the district is received during the monsoon months. The temperature reaches up to 45^{0}C in June. During the months of May and June, average maximum temperature is 37^{0}C. During winter, the mean daily maximum temperature in January is 21^{0}C and minimum is 7^{0}C.

Mewat: The total average rainfall of 577mm distributed over a period of 23 to 35 days is erratic. Rainfall distribution also varies between the blocks. May and June are the hottest months, while January is the coldest. Temperature variations are high ranging from 4^{0}C to 25^{0}C during winter and 30^{0}C to 40^{0}C during summer. Relative humidity is generally low. High velocity desiccating winds are common between March and August. The area also experiences climatic uncertainty and there is sporadic occurrence of drought.

Rewari: The climate in the district varies from arid to semi arid. The incidence of thunder storm also occurs during August and September. These are sometimes accompanied by heavy shower and occasional hail. The district has an average annual rainfall of about 686.6 mm. the major part of it (70 to 80%) is received during summer monsoon i.e. July to September. Due to western cyclonic disturbances coming through Afghanistan and Pakistan, the district receives about 10 to 15 percent of total rainfall during winter season. Eastern part of the district gets more rainfall and it starts decreasing towards west and south west. The summer months are very hot with maximum temperature ranging from 41^{0}C to 46^{0}C in May and June. June is the period of highest incidence of dust storm. Sometimes, the temperature may rise to 48^{0}C.

Rohtak: The climate of the district is dry with intensely hot summer, and cold winter. The average annual rainfall of the district is 577.0 mm. It generally increases towards north-east. About 74 per cent of annual rainfall is received during the monsoon season. The district experiences extreme temperatures. During January the temperature goes down to below10 ^{0}C May and June are the hottest months with mean daily maximum temperature at about 40^{0}C. Temperature sometimes may rise to 45^{0}C.

Jhajjar: The climate of the district is dry with intense hot summer, and cold winter. The average annual rainfall of the district is 577.0 mm. The maximum rainfall received during the months of July and August. About 74% of annual rainfall in received during the monsoon season. Temperature starts rising from March and continues till the end of June. May and June are the hottest months with mean daily maximum temperature is bout 40^0C. During winter, the temperature starts decreasing by the middle of November, January is the coldest month.

11.2 *Natural area Conservation Zone*

Major natural features identified as environmentally sensitive areas, are the extension of Aravalli ridge in Rajasthan. In NCR, these areas have been demarcated as Natural area conservation zone in the regional plan 2021. Similarly, ground water recharging areas such as water bodies, ox bow lakes, and paleo channels have also been identified. Therefore all the Aravallies within the Haryana state, in addition to the local agricultural zone have to be further detailed out in sub regional plan.

The extension of Aravalli ridge, sanctuaries and other ecologically sensitive areas to be conserved with utmost care and afforested with suitable species. The development in this area be in accordance with the Environment Act, 1986 from time to time.

In view of the very low existing forest cover (4.02%), it is imperative to bring more areas under forest so as to maintain the ecological balance in this region. Accordingly, all wastelands identified in the existing landuse plan and proposed land use plan 2021, ROW of irrigation canals, drains, roads and railway lines are proposed to be brought under forest cover which is proposed to be 10% of the total area of the region.

The areas under water bodies and ground water rechargeable areas will be kept free from any encroachment/ development to allow free flow of water. construction activities for human habitation or for other ancillary purpose thereto not be permitted. Suitable measures be taken to maintain the water bodies with the minimum flow or water level.

In the flood prone areas / river banks, no construction or habitation activities be permitted. Flood protection plan be prepared by the concerned state government / agency.

Detailed conservation plan be prepared for the areas shown in Natural conservation zone in the Landuse Plan 2021 given at the end of discussion.

The monuments / man made heritage sites and conservation areas be identified in the master plan / zonal plan of each town and detailed conservation.

Agricultural zone outside controlled / development / regulated areas;

Agricultural (Rural) area of NCR has to be regulated by village and block plans to be drawn under district planning process. At the regional level, agricultural zone be designed for primary sector production and as open areas comprising of farmlands, orchards, and pastures etc.

The new employment opportunities in non agriculture sector and consequent concentration of population, the urban expansion would have to be largely made from the agricultural land and other non urban uses. In view of this, following policies have been proposed;

(i) existing cultivated land be conserved for agricultural use as far as possible

(ii) efforts be made to increase the production through intensive cultivation by providing irrigation facilities and other necessary infrastructure

(iii) measures to be initiated for protection of prime agricultural land and ensure its needless conversion into non agricultural use

(iv) utilization of less and least valuable land for urban expansion / new urban centre / development purposes.

11.3 *DISASTER MANAGEMENT*

11.3.1 Introduction

Natural disasters are the most unpredictable and perilous phenomenon of the nature which can sweep many lives. They can destroy the city structure and demolish its growth. In India about 31 different types of disasters are listed by high Powered committee under 5 categories (as given in annexure 13.1).

Objectives of Disaster management plan

- To prevent loss of human life and property
- To study the disaster cycle, study of disasters and hazard analysis.
- To identify the highly vulnerable areas.
- Preparedness prevention and mitigation of natural and man made disasters.

11.3.2 Disasters

The National Disaster Management Act 2005 defines disaster as "*a catastrophe, mishap, calamity or grave occurrence affecting any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as beyond the coping capacity of the community of the affected ared*".

UNDRO Disaster Management Training Manual defines" Disaster as a serious disruption of the functioning of a society, causing widespread human, material ,or environmental losses which exceed the ability of the affected society to cope using only its own resources.

The United Nations (UNDRO 1987, cited in Hanisch 1996, p.22) define disasters in the following way:

"*A disaster is an event that is concentrated in space and time and that subject a society to severe danger and such serious losses of human life or such major material damage that the local social structure breaks down and the society is unable to perform any or some of its key functions.*"

The High Powered Committee of the Government of India ,in its October 2001 Report defines12 Disaster as "*an occurrence of a severity and magnitude that normally results in deaths, injuries and property damage and that cannot be managed through the routine procedures and resources of government. It usually develops suddenly and unexpectedly and requires immediate, coordinated and effective response by multiple government and private sector organizations to meet human needs and speedy recovery*"

WHO defines disaster as "*any occurrence that causes damage, economic destruction, loss of human life and deterioration in health and health services on a scale sufficient to warrant an*

extraordinary response from outside the affected community or area." A disaster is the product of a hazard such as earthquake, flood or windstorm coinciding with a vulnerable situation, which might include Communities, cities or villages.

Types of Disasters:

Natural Disaster- disasters with meteorological, geological or even biological origin such as Earth Quake, Floods, High Winds, Fire Hazard, etc.

Unnatural or Man Made Disaster- disasters with human caused or technological origin such as nuclear, chemical, etc.

11.3.3 Hazards

Hazards are defined as "Phenomena that pose threat to people, structures or economic assets and which may cause a disaster". They could be either man made or naturally occurring in our environment (UNDRO). A natural hazard pertains to a natural phenomenon which occurs in proximity and poses a threat to people, structures and economic assets caused by biological, geological, seismic, hydrological or meteorological conditions or processes in the natural environment.

A disaster is the product of a hazard such as earthquake, flood or windstorm coinciding with a vulnerable situation which might include communities, cities or villages. There are two main components in this definition: hazard and vulnerability.

Without vulnerability or hazard there is no disaster.

11.3.3.i Classification of Hazards

There are four basic types of hazardous events that put societies at risk. Those are:

i. Those based in **nature**: Earthquake, Flood, Drought, Cyclone, Tsunamis, Heat /cold wave, Landslides, Hailstorm, Avalanche.

ii. Those based in **violence**: War, armed conflict, physical assault, etc.

iii. Those based in **deterioration**: Declining health, education and other social services, environmental degradation, etc.

iv. Those based in the **failing of industrialized society**: Technological failures, oil spillage, factory explosions, fires, gas leakage, transport collisions.

11.3.4 Vulnerability

Vulnerability is defined as "The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of particular hazard, on account of their nature, construction and proximity to hazardous terrain or a disaster prone area."

11.3.4.i Vulnerability and Risk Assessment of the region due to natural Hazards

The vulnerability Atlas of India indicates that the National Capital Region falls within:

1. High damage risk zone (MSK VIII) with regard to earthquake
2. Very High damage risk zone B (V_b = 50 m/s) with regards to wind and cyclone hazard and
3. Area liable to floods

11.3.5 Risk

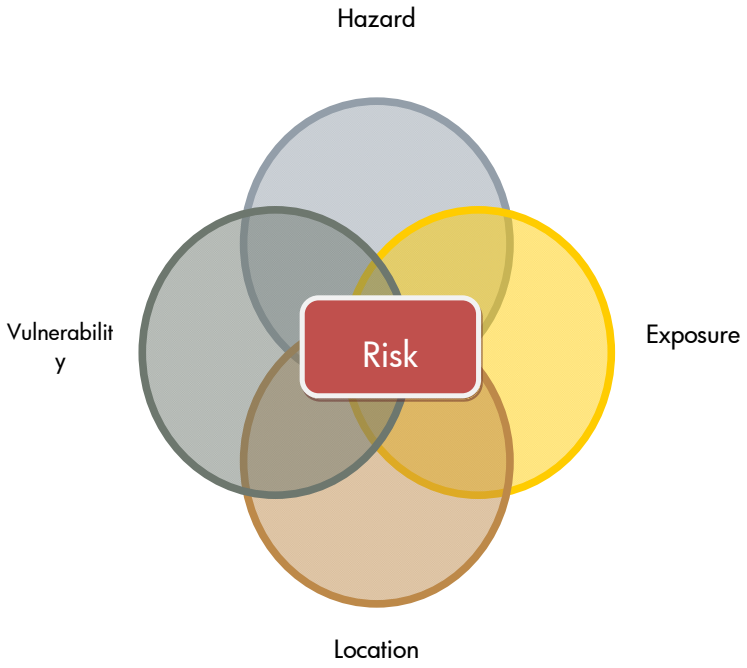
Risk is a measure of the expected losses (deaths, injuries, property, economic activity etc) due to a hazard of a particular magnitude occurring in a given area over a specific time period.

The figure on the right illustrates essentially the four factors essentially hazards, location, exposure, and vulnerability which contribute to risk. They are:

- **Hazards** (physical effects generated in the naturally occurring event),
- **Location** of the hazards relative to the community at risk,
- **Exposure** (the value and importance of the various types of structures and lifeline systems such as water supply, communication network, transportation network etc in the community serving the population, and

- **Vulnerability** of the exposed structures and systems to the hazards expected to affect them during their useful life.

Figure 11-1 : Relationship between various aspects of disaster



11.4 *Disaster Management*

According to the Indian National Disaster Management Act 2005, disaster management means a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for

(1) Prevention of danger or threat of any disaster

(2) Mitigation or reduction of risk of any disaster or its severity or consequences

(3) Capacity building

(4) Preparedness to deal with any disaster

(5) Prompt response to any threatening disaster situation or disaster

(6) Assessing severity or magnitude of effects of any disaster

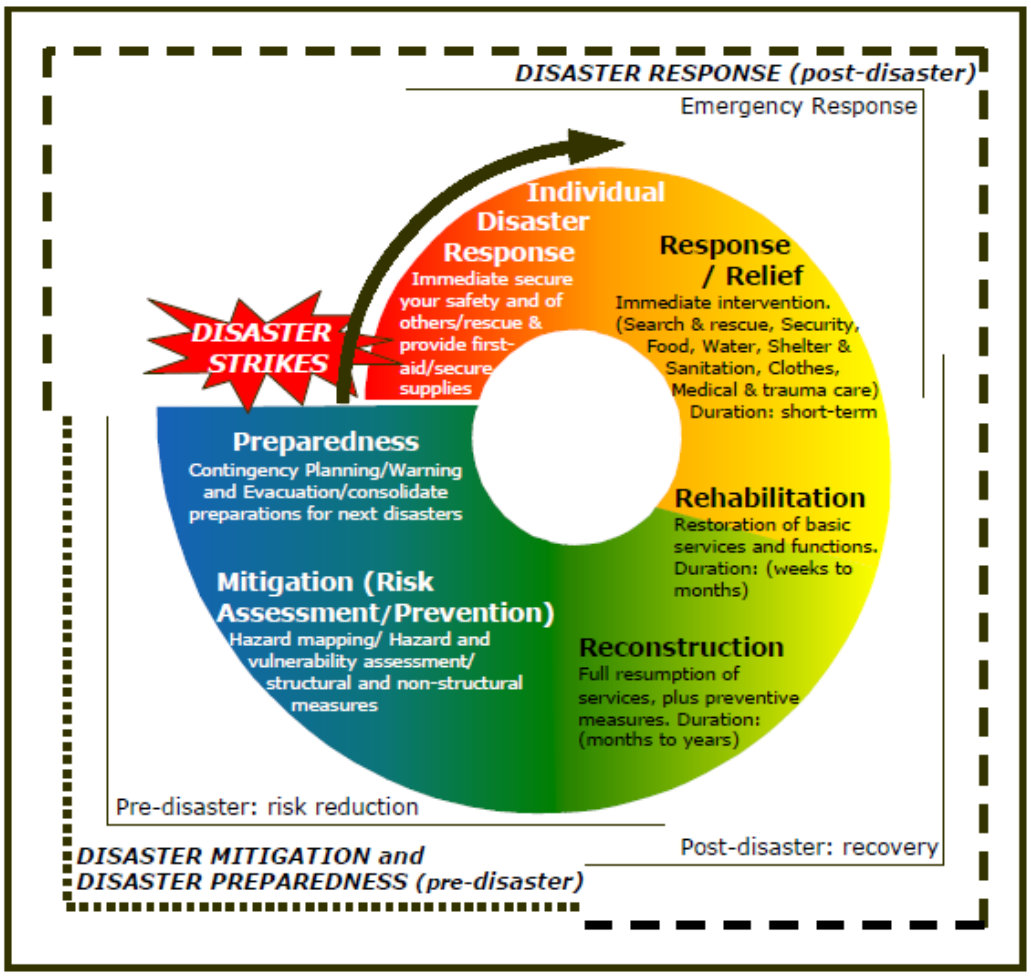
(7) Evacuation rescue and relief and

(8) Rehabilitation and reconstruction.

The High Powered Committee defined Disaster Management as "a collective term encompassing all aspects of planning for and responding to disasters, including both pre and post disaster activities. It may refer to the management of both the risks and consequences of disasters".

Clearly the term management has emerged as an umbrella term that encompasses the entire disaster cycle, including mitigation. This needs careful noting and wide spread awareness because traditionally the term management was restrictively used to address only post disaster

Figure 11-2 : Disaster Mitigation and Preparedness



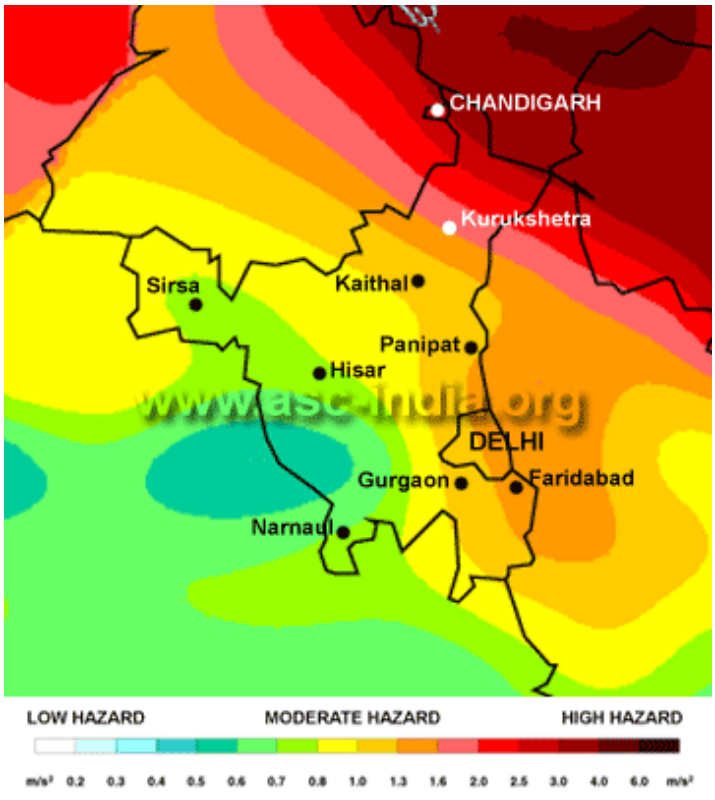
Source: Hazard Disaster and your community, GOI, MHA, NDM Division

11.5 *Sub Region and Hazards*

The Sub region of Haryana is vulnerable to a gamut of natural hazards. Geological and geomorphologic setup of Haryana made it prone to a number of natural hazards i.e. floods, water logging, soil salinity, soil erosion, landslides, drought etc. Natural hazards affect the infrastructure and cause loss of natural resources and human lives. Of these, earthquakes, floods, cyclones and landslides rank among the most feared disasters in India, and the fear is naturally heightened in the districts Faridabad and Gurgaon in sub region of Haryana and Ambala, Bhiwani, Fandabad, Hissar, Jind and Kurukshetra in rest of Haryana which are affected by multiple hazards.

11.6 *Types of hazards in Sub region*

11.6.1 Earthquake Hazard & Disaster



An Earthquake is a series of underground shock waves and movements on the earth's surface caused by natural processes of writhing the earth's crust.

a) Earthquake History

Eastern parts of Haryana along with Delhi lay in the Gangetic Plain. This is a fore-deep, a down warp of the Himalayan foreland, of variable depth, converted into flat plains by long-vigorous sedimentation. This is known as a geosynclines and the Gangetic Plain is the Indo-Gangetic Geosynclines. This has shown considerable amounts of flexure and dislocation at the northern end and is bounded on the north by the Himalayan Frontal Thrust. The floor of the Gangetic trough (if see without all the sediments) is not an even plain, but shows corrugated inequalities and buried ridges (shelf faults). The region sits atop the Delhi-Haridwar ridge which

is a sub-surface ridge, trending NE-SW. There are numerous faults in this region, like the Moradabad, Panipat and Sohna faults. Delhi, Chandigarh and many parts of Haryana lie in Zone IV and thus they are extremely vulnerable to earthquakes. Most earthquakes in this region are shallow though a few earthquake of intermediate depth have been recorded in Haryana. The alluvial cover of the Indo-Gangetic plain makes even distant earthquake felt here quite strongly. This region often feels deep-seated earthquakes that are centered on the Pakistan-Afghanistan Border and in the Hindukush mountains in Afghanistan. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes.

b) Seismic Hazard

All districts of Haryana Sub region lies in Zone IV and High damage risk zone (MSK VIII) with regard to earthquake. Since the earthquake database in India is still incomplete, especially with regards to earthquakes prior to the historical period (before 1800 A.D.), these zones offer a rough guide of the earthquake hazard in any particular region and need to be regularly updated.

Table 11-1 : The list of other earthquakes felt in the Haryana sub region and surroundings are:

Date	Place	Intensity	Northing	Easting	Depth	Origin Time
27 August 1960	Gurgaon-Faridabad	6.0	28.20	77.40		15:58:59.20
20 June 1966	Delhi-Gurgaon Border	Mb 4.7	28.50	76.98	053.0 kms	13:42:57
29 July 1980	Western Nepal	Mw 6.8	29.60	81.09		14:58:40
21 October 1991	Near Pilang (Uttarkashi), Uttaranchal	Mw 6.8	30.78	78.77		21:23:14
12 November 1996	Near Kurukshetra (Haryana-U.P. bdr. region)	Mb 4.5	29.928	77.207	055.0 kms	04:20:58
4 May 1997	Rothak-Sonepat Districts	ML 4.1	28.984	76.588	28.8 kms	07:19:22

	(Haryana),					
30 March 1998	Mahendragarh-Bhiwani Districts (Haryana-Rajasthan Bdr.)	Mb 5.0	28.211	76.240	010.0 kms	23:55:45
22 March 1999	North of New Delhi, (Haryana-Uttar Pradesh Border region),	Mb 4.1	29.257	76.940	207.6 kms	09:56:16
29 March 1999	Near Gopeshwar (Chamoli), Uttaranchal	Mw 6.5	30.492	79.288		19:05:11
28 April 2001	Sonepat-Delhi region	Mb 4.3	28.591	77.044	15.4 kms	03:06:27
22 December 2003	Jind region, Haryana	ML 3.5	29.235	76.401	15.4 kms	20:19:08
27 November 2004	Chandigarh-north Haryana region	ML 3.9	30.352	77.129	19 kms	23:53:54
8 October 2005	Kashmir-Kohistan, Pakistan-India border	Mw 7.6	34.432	73.537	020.0 kms	03:50:40
25 November 2007	Delhi metropolitan area	Mb 4.6	28.677	77.204	10 kms	23:12:17

c) Status of Sub region

Sub region lies in Zone IV and Shaking Intensity VIII

Destruction of buildings

i) **Persons and surroundings -** Fright and panic; also persons driving motor cars are disturbed, Here and there branches of trees break off. Even heavy furniture moves and partly overturns. Hanging lamps are damaged in part.

ii) **Structures of all kinds** - Most buildings of Type C suffer damage of Grade 2, and few of Grade 3, most buildings of Type B suffers damage of Grade 3. Most buildings of Type A suffer damage of Grade 4. Occasional breaking of pipe seams. Memorials and monuments move and twist. Tombstones overturn. Stone walls collapse.

Note: Type of Structures (Buildings)

Type A - Building in field-stone, rural structures, unburnt-brick houses, clay houses.

Type B - Ordinary brick buildings, buildings of large block and prefabricated type, half timbered structures, buildings in natural hewn stone.

Type C - Reinforced buildings, well built wooden structures.

Definition of Quantity

Single *Few - About 5 percent* ***Many*** *about 50 percent* ***Most*** *About 75 percent*

Classification of Damage to buildings

Grade 1	*Slight damage*	*Fine cracks in plaster; fall of small pieces of plaster*
Grade 2	*Moderate damage*	*Small cracks in walls; fall of fairly larger pieces of plaster; plantiles slip off; cracks in chimneys parts of chimney fall down.*
Grade 3	*Heavy damage*	*Large and deep cracks in walls; fall of chimneys.*
Grade 4	*Destruction*	*Gaps in walls; parts of buildings may collapse; separate parts of the buildings lose their cohesion; and inner walls collapse.*
Grade 5	*Total damage*	*Total collapse of the buildings*

iii) **Nature -** Small landslips in hollows and on banked roads on steep slopes; cracks in ground up to widths of several centimeters. Water in lakes becomes turbid. New reservoirs come into existence. Dry wells refill and existing

d) Analysis from Existing situation

Number of Earth quacks with centre in Haryana Sub region -

Largest instrumented earthquake in Chandigarh, Delhi & Haryana

27 August 1960 – Gurgaon- Faridabad (Haryana), 6.0 (TS)

15:58:59.20UTC, 28.20N, 77.40E

Damage from this earthquake extended into New Delhi where at least 50 people were injured. Structural damage was reported in Karol Bagh and cracks in houses in RK Puram

e) Conclusions

Table 11-2 : Focus areas analysis:

	Major Focus Areas	Minor Focus Areas
Sub region	Faridabad and Gurgaon	Sonipat
Surrounding	Delhi	

f) Mitigation strategies

Plans should be prepared with the view that

1. Main Mitigation Strategies

Engineered structures (designed and built) to withstand ground shaking. Architectural and engineering inputs put together to improve building design and construction practice. Analyze soil type before construction and do not build structures on soft soil. To accommodate on weak soils adopt safety measures in design.

***Note**: Buildings built on soft soils are more likely to get damaged even if the earthquake is not particularly strong in magnitude. Similar problem persists in the alluvial plains and conditions across the river banks. Heavy damages are concentrated when ground is soft.*

Follow **Indian Standard Codes** for construction of buildings. Enforcement of the Byelaws including Land use control and restriction on density and heights of buildings

Strengthening of important lifeline buildings which need to be functional after a disaster. Upgrade level of safety of hospital, fire service buildings etc.

Public awareness, sensitization and training programmes for Architects, Builders, Contractors, Designers, Engineers, Financiers, Government functionaries, House owners, Masons etc.

Reduce possible damages from secondary effects such as like fire, floods, landslides etc. e.g. identify potential landslide sites and restrict construction in those areas.

2. Community Based Mitigation

Community preparedness along with public education is vital for mitigating the earthquake impact. Earthquake drills and Public awareness programme.

Community based Earthquake Risk Management Project should be developed and sustainable programmes launched. Retrofitting of schools and important buildings, purchase of emergency response equipment and facilities, establishing proper insurance can be the programmes under Earthquake Risk Management Project. A large number of local masons and engineers will be trained in disaster resistant construction techniques. A large number of masons, engineers and architects can get trained in this process.

11.6.2 Flood Hazard & Disaster

Flood is a temporary inundation of large region as the result of an increase in reservoir, or of rivers flooding their banks because of heavy rains, high winds, cyclones, storm surge along coast, tsunami, melting snow or dam bursts.

ii. History of flood

Two major known flood disasters mishap takes place in the sub region were in the year of 1980 and 1995 respectively.

Table 11-3 : Major known flood disasters mishap takes place in the sub region

Duration	Area Affected	Synoptic Systems	Yamuna	
			Date	Gauge (mm)
17-23 July 1980	Central & Southwest Uttar Pradesh	Land depression	16.07.1980	205.55
5-15 September, 1995	Haryana	Low pressure area	08.09.1995	206.93

iii. Flood hazard

Flood hazard is Flood hazard can be urban i.e. flood due to faulty drainage system.

iv. Flood status in sub region

Among the major disasters that occur in Haryana sub region the river floods are the most hazardous as they cause heavy damage to agricultural crops. The cause of flood is primarily attributed to peculiarities of the rainfall in the state. The geomorphic setting of the state comprising of Himalayan topographic high in the north and Aravalli mountain in the south resulted in the development of a saucer type of topographic depression in the central part of the state. The flood occurs mainly due to heavy run off in the mountainous terrain and over flow in the river Yamuna in the plain areas during monsoon season. The active and old flood plain areas in sub regions are located in parts of Panipat, Sonipat and Faridabad are dominantly flood prone. In sub region, Faridabad

v. Analysis from existing situation

Major flood areas which cause disaster in the past were Faridabad and Panipat. The gauge level of the Yamuna was rises upto 205-207 mm.

vi. Conclusions

Table 11-4 : Focus areas analysis:

	Major Focus Areas	Minor Focus Areas
Sub region	Panipat, Sonipat, Rewari & Faridabad	Gurgaon, Mewat & Rohtak
Surrounding	Delhi, Karnal	Mahendragarh

vii. Mitigation strategies

There are two different ways to mitigate floods: -

- Structural
- Non- Structural

Structural measures are in the nature of physical measures and help in "modifying the floods", while non- structural measures are in the nature of planning and help in "modifying the losses due to floods". In the structural measures we keep the water away from people and in the non-structural measures to try to keep the people away from water. All of these works can be individually divided into long term and short-term measures.

Structural Measures:

a) **Water Shed Management:** Timely cleaning, de-silting and deepening of natural water reservoir and drainage channels (both urban and rural) must be taken up.

b) **Reservoirs:** The entire natural water storage place should be cleaned on a regular basis. Encroachments on tanks and ponds or natural drainage channel share to be removed well before the onset of monsoon.

c) **Natural water retention Basins:** Construction and protection of all the flood protection embankments, ring bunds and other bunds. Dams and levees can also be constructed which

can be used as temporarily storing space which reduced the chances of lower plains getting flooded.

d) **Buildings on elevated area:** The buildings in flood prone areas should be constructed on an elevated area and if necessary on stilts and platform.

Non Structural Measures:

a) **Flood Plain Zoning:** Flood plain zoning, which places restrictions on the use of land on flood plains, can reduce the cost of flood damage. Local governments may pass laws that prevent uncontrolled building or development on flood plains to limit flood risks and to protect nearby property. Landowners in areas that adopt local ordinances or laws to limit development on flood plains can purchase flood insurance to help cover the cost of damage from floods.

b) **Flood Forecasting and warning:** These are issued for different areas mostly by the central water Commission/ Meteorological department and by the State Irrigation/ Flood Department.

11.6.3 Drought Hazard & Disaster

The imprudent irrigation through canals leads to introduction of salts and alkalies in the soil. Due to over irrigation

a) History of Drought

On an average, severe drought occurs once every five years in our country, though often they occur on successive years causing severe losses to agriculture and allied sectors. Haryana is predominantly an agrarian economy so they are majorly depends on the various water sources and rainfall. The water needs in agricultural sector are going to be very high, as several thousand tons of water is required to produce each metric ton of food grains. Therefore, there is a need for effective monitoring of agricultural drought, its onset, progression and impact on crops to minimize the damages. It is prominently 4 types:

Meteorological drought - Meteorological drought is simple absence/deficit of rainfall from the normal. It is the least severe form of drought and is often identified by sunny days and hot weather.

Hydrological drought- Meteorological drought often leads to reduction of natural stream flows or groundwater levels, plus stored water supplies. Main impact is on water resource systems.

Agricultural drought- This form of drought occurs when moisture level in soils is insufficient to maintain average crop yields. Initial consequences are in the reduced seasonal output of crops & other related production. An extreme agricultural drought can lead to a famine, which is a prolonged shortage of food in a restricted region causing widespread disease and death from starvation.

Socioeconomic drought- Socioeconomic drought correlates the supply and demand of goods and services with the three above-mentioned types of drought. When the supply of some goods or services such as water and electricity are weather dependant then drought may cause shortages in supply of these economic goods.

b) Drought Hazard

Drought results from deficient rainfall (less than 75% of the normal rainfall) causing an acute scarcity of moisture in the soil. The deficiency of moisture leads to loss of soil productivity, deprivation of the vegetation and initiation of desertification. Drought is a perpetual attribute in some parts of Sub region. Satellite images exhibit the district of Rewari in sub region and Mahendragarh, Bhiwani and Hissar the surrounding districts of sub region affected by sand spread. Formation of sand dunes and sand spread causes acute moisture stress on the agricultural lands producing drought like situation in these areas every year.

c) Drought status in sub region

In Haryana the status of drought is once in every 3 years ant eh administrative districts frequently affected by drought are Gurgaon and Rohtak in Sub region and Mahendragarh & Bhiwani in rest of state.

d) Analysis from existing situation

- Average frequency of occurrence of drought is 3 yrs
- Majorly affected by agricultural drought

- Areas affected most by the drought are Gurgaon, Rewari and Rohtak

e) Conclusions

Table 11-5 : The major and minor focus areas are

	Major Focus Areas	Minor Focus Areas
Sub region	Gurgaon, Rewari and Rohtak	Jhajjar
Surrounding	Bhiwani and Mahendragarh	Hissar (counter magnet area),

f)Mitigation strategies

Major mitigation strategies:

Drought monitoring is continuous observation of rainfall situation, water availability in reservoirs, lakes, rivers and comparing with the existing water needs of various sectors of the society.

Water supply augmentation and conservation through rainwater harvesting in houses and farmers' fields increases the content of water available. Water harvesting by either allowing the runoff water from all the fields to a common point (e.g. Farm ponds, see the picture) or allowing it to infiltrate into the soil where it has fallen (in situ) (e.g. contour bunds, contour cultivation, raised bed planting etc) helps increase water availability for sustained agricultural production.

Expansion of **irrigation** facilities reduces the drought vulnerability. **Land use** based on its capability helps in optimum use of land and water and can avoid the undue demand created due to their misuse.

Livelihood planning identifies those livelihoods which are least affected by the drought. Some of such livelihoods include increased off-farm employment opportunities, collection of non-timber forest produce from the community forests, raising goats, and carpentry etc.

Drought planning

Components of drought plan include establishing drought taskforce which is a team of specialists who can advise the government in taking decision to deal with drought situation, establishing

coordination mechanism among various agencies which deal with the droughts, providing crop insurance schemes to the farmers to cope with the drought related crop losses, and public awareness generation.

Public awareness and education

Public should know about what would help in effective drought mitigation. This includes organizing drought information meetings for the public and media, implementing water conservation awareness programs in the mass media like television, publishing and distributing pamphlets on water conservation techniques and agricultural drought management strategies like crop contingency plans and rainwater harvesting and establishing drought information centers for easy access to the farmers.

11.6.4 Fire Hazard & Disaster

Fire disasters can occur above the ground (in tall buildings and on planes), on the ground, and below the ground (in mines). Sometimes they occur in circumstances that are unexpected or unpredictable.

a) History of fire

Analyses of data showed that the total number of deaths due to fire in 2001, 2002 and 2003 was 5787 and total property loss was estimated to be Rs. 1046 crore in India. Fire disasters are of majorly 2 types:

Natural: Fires which are considered as natural are basically earthquake, volcanic eruption and lightning - generated fires. The fire and explosion risk associated with an earthquake is a very complex issue. Compared with ordinary (normal) fires the fire and explosion hazard related to earthquakes can constitute a substantial and heavy risk. Damage to natural gas systems during an earthquake is a major cause of large fires. Again probably the most significant direct impact of power systems on fire following an earthquake is that electric power is a major fire ignition source. In addition to dropped distribution lines, power circuits in damaged houses are another major ignition source. There have been cases where as many as two-thirds of all ignitions after an earthquake has been attributable to power system.

Manmade: Fire caused by human/machine errors are considered as manmade fires, e.g. industrial or chemical fire disasters, fires at social gatherings due to Electrical short circuit fires, accidental fire and kitchen-fires. Rural and urban residential and non-residential structural fires are also largely manmade fires. Any confined fire could be due to many reasons like, cooking

b) Fire Hazard

In Haryana various major fire incidents happened. Over 500 people were dead and 300 injured due a fire in school function in Dabwali, Haryana on 23/12/1995.

c) Fire status in sub region

Some of the major fire disasters in the sub region are mentioned as

- Explosion at a firecracker factory in Rohtak, Haryana on 24/5/95 resulted in a death toll of 23 people, which included 13 women, 6 children and 4 men.
- At least 45 people were killed (16 women and eight children were among the death) and 16 seriously injured on 7/11/1999 in Sonipat, Haryana, when a fire began after sparks from some high-tension wires over the market fell over a firecracker shop an adjoining clothes store. Some 25 stores, some of them selling plastic wares, were completely gutted.

d) Analysis from existing situation

- Natural fire hazard is very less in the region but vulnerability of urban/ man made fire disasters is very high in the sub region.
- Major fire incidents are related to industries, power, buildings and Public gathering.
- Rural areas are lacking fire freighting facilities.

e) Conclusions

- Rural Fire Service in Sub region
- Training of fire services for carrying out search and rescue operations in the aftermath of disasters and provision of adequate number of trained manpower.

- Meeting the deficiencies as per minimum requirements in the availability of fire stations and fire units at Sub region and district level. This would help to reduce response time 3-5 min. in urban area & 7-10 min. in rural areas.

- Establishing one Fire Training Institute in Sub region.

- Public awareness campaign, protective clothing to operational staff, better command & control system.

f) Mitigation strategies

Flammable Chemical Proper Handling and Storage procedures:

Chemicals use and storage at the university are either covered under the specific Chemical Hygiene Plan in each or laboratory or under the Hazard Communications Policy. These plans and policy define safe storage and handling of chemicals. Basically we either follow the manufactures recommendation or industry standards and guidelines.

Potential ignition sources and their control procedures:

Open flames, electrical equipment, heat producing devices, and use and disposal of chemicals. The control procedures for these sources are detailed in the Chemical Hygiene Plan, and the following guidelines 5.1 Office Safety, 7.1 General Shop and Work Site Safety, 7.10 Welding and Cutting, and 11.6 Hazardous Waste Satellite Accumulations Areas. Smoking is not permitted in the interior of any University vehicle or building, with the exception of residence halls.

Types of Fire Protection Equipment and systems to control fires:

Many systems are in place including the following; Fire suppression equipment (sprinklers and fire extinguishers); Proper storage areas (flammable storage rooms and cabinets); Fire alarms and detectors; Building systems such as doors, walls, ceilings, and floors.

Job Titles responsible for maintenance of systems installed to prevent or control ignitions or fires: Various groups at Facilities Management (FM) including: Electrical Shop, Plumbing Shop, and Carpenter Shop. See Director of Facilities Management for details.

Job Titles responsible for control of fuel source hazards:

All employees who use or store fuel sources are responsible for control. Major sources such as heating plants and gasoline storage are the responsibility of Facilities Management (FM) shops such as the Steam Plant, HVAC shop, and the Garage.

Housekeeping:

Housekeeping is the responsibility of the individual employee and Facilities Management. In general the individual is responsible for their workspace and the Facilities management is responsible for waste receptacles and the common spaces on campus. Hazardous waste is removed upon request of the waste generators by the department of Environmental Health and Safety.

Training:

All employees are required to receive Basic Safety and Area Specific training upon beginning at the University and annually thereafter, included in this training are fire prevention and emergency action plan training.

Maintenance:

The maintenance of heat producing equipment is the responsibility of the department and employees using the equipment. In the case of area specific equipment such as coffee pots, microwave ovens, and hot plate it is the responsibility of the department using the workspace. In the case of building systems it would be the responsibility of Facilities Management. In all cases employees would follow the manufacturer's instructions and practices or industry standards as appropriate.

Specific Guidelines:

When decorating for any mass gathering event please observe the following safety precautions:

- All trees and wreaths are to be artificial and flame-resistant. Unless specifically inspected and approved by the Fire Department. Documentation should be available to prove their flame resistance.

- Only use decorations that are noncombustible or have a label that states that they are "flameproof," "flame-resistant," or "flame-retardant." Keep the label to document acceptability.

- Electric lights or lit decorations are acceptable only if they are labeled with Underwriters Laboratory or Factory Mutual approval. Inspect light strings for frayed or bare wires, cracked sockets, loose connections and damaged insulation. Replace the entire string of lights if any of these safety deficiencies are present. Always follow the manufacturer's recommendations.

- No lit candles, open flames, or spark-producing devices are permitted.

- Do not obstruct corridors, stairways, exits or doors from closing. Decorations are not to be hung so as to obstruct exit lights, sprinkler pipes or heads, smoke detectors, fire alarm pull stations, portable fire extinguishers or cabinets, or other safety apparatus.

- Do not place decorations near electrical equipment or other heat sources.

- Do not hang Decorations from sprinkler heads.

- Do not route electrical cords across aisles or corridors (tripping hazard) or under doors.

- Keep extension cords to a minimum. Extension cords must have 3-prong grounded outlets.

11.6.5 Chemical and industrial Accidents

a) History of Chemical and industrial accidents

Industrial disaster can be either rapid (minutes or hours) or sudden (no warning) depending on the nature of occurrence. As there is a series of processes and reactions involved the onset may vary accordingly. Release of chemicals may be because of human error, technological failure or natural activities which include geological activity like earthquakes, natural fires, floods etc. The industrial facility should have monitoring and warning systems for fire and building up of dangerous conditions. Explosion in some of the cases can be anticipated. Greatest mishap in the history was Bhopal Chemical Gas Leak Disaster was the worst industrial disaster known.

b) Chemical and industrial Accidents Hazards

Haryana has number of industries and in the vicinity of the Delhi the major industries are setting up in the Sub region. The industrial estates, industrial towns and SEZ are setting up like mushroom in the sub region. This rapid growth can leads to the chemical leaks or explosions in the industrial facilities. These industrial and chemical disasters lead people to expose various dangers like:

- The fire spread in the industry and residential areas nearby
- Heat conditions
- Chemical gas leak (poisonous)
- Combustion of various products and heat waves
- Low oxygen levels
- Falling of structural elements and machinery
- Contamination of the near by environment (land, water and air)

c) Chemical and industrial accident status in sub region

Explosion at a firecracker factory in Rohtak, Haryana on 24/5/95 resulted in a death toll of 23 people, which included 13 women, 6 children and 4 men. Industrial accidents are 12.24%.

d) Analysis from existing situation

Almost all districts have major and minor industries set up in the Sub region.

Major industrial centers are located in Gurgaon, Faridabad, Sonipat, Rewari and Panipat.

e) Conclusions

Hazardous industries should be identified and marked on the map

Districts or areas with number of hazardous industries should prepare disaster plan within the view of extent of vulnerability for those industries.

Prime hazardous industries should be located away from the residential areas

Two major hazardous industries should not be located in vicinity so that at time of mishap, one leads to other.

f) Mitigation strategies

Hazard Mapping – inventories and maps of storage locations of toxins or hazardous substances along with the possible characteristics should be displayed and known to all. The community staying in the immediate vicinity should be aware of this hazard and possible effects in case of an accident should be known. The map should also determine the area that may get affected in case an accident occurs. Hazard map should determine possible zone getting affected and safe route for evacuation should be marked.

Land use planning – densely populated residential areas should be separated far away from industrial areas. A buffer zone (green belt) should separate the industrial and the residential zone.

Community preparedness – The community should be aware of the hazardous installations and know how to combat the situation. The local community has to be informed about the response steps to be taken in case of an accident. Community members should monitor the pollution levels of the industry and participate in mock drills.

Other possible risk reduction measures: Maintain the wind flow diagram of the region, improve fire resistance and warning systems, improve fire fighting and pollution dispersion capabilities, develop emergency relief and evacuation planning for employees and nearby settlements, limit storage capacity of the toxic substances, insurance for industries and safety legislation

11.6.6 Other type of Hazard & disaster

Water logging

Water table rises if the soil is given more than the vegetation of crop needs. In areas where there is inadequate drainage such as in topographic depressions, the rise of water table is more conspicuous during wetter periods. Excessive irrigation and seepage from canals has aggravated the problem of the water logging in the sub region. Satellite images reveled that large tracts of

Panipat, and Rohtak were severely water-logged in addiction to the parts of Gurgaon, Rewari, Jhajjar and Sonipat where water logging exists in scattered locations. About 5.95 % area of the state is totally waterlogged (0-1.5m) whereas potential waterlogged (1.5-3m) areas constitute about 15.02%.

Soil Salinity- Alkalinity

The imprudent irrigation through canals leads to introduction of salts and alkalies in the soil due to over irrigation, the water table rises along with their soluble salts. In the Haryana sub region alkaline soils occurs in the districts of Panipat, while saline soils are encounters towards the end of the surface and sub surface flow directions particularly in areas of topographic depression with in sufficient drainage in the districts of Sonipat, Rohtak and Gurgaon. About 5.78% of the state area is affected by problem of soil salinity and alkalinity.

An Epidemic

It is defined as the occurrence of an illness or other health related event that is clearly in excess of unexpected occurrence. The onset of an epidemic can be either rapid or sudden and this depends on several factors. An epidemic can be anticipated by the rise in number of people suffering from a particular disease. In some cases an epidemic can be anticipated or predicted by an increase in the vector breading sites or in the death of the disease carriers (say plague is carried by the flea on rodents).

Table 11-6 : Some of the Major Epidemics observed in India are:

Year	Epidemic
2001	Cholera
2002	Plague
2003	Severe Acute Respiratory Syndrome (SARS) Dengue

2005	Meningococcal disease Japanese Encephalitis (JE)
2006	Avian influenza Chikungunya Dengue
2009	H1N1/ Swine flu

The measures to reduce the risk factors are:

- **Structuring the health services** is important to have clear understanding of roles and responsibilities of the public health system. Organizational preparedness and the coordination mechanism is required right from the State and District to the sub center level which is manned by the Village Health Nurses or the Health Workers.

- **Contingency Plan** for response should be prepared after identifying the epidemics that are likely to occur in the region. Early warning system through a surveillance system is the primary requirement so as to have an effective response and prevent any outbreaks. For this, surveillance needs to be carried out at a regular basis through the routine surveillance system by involving the health tier system. Maps of all the health facilities in the region with an inventory of drugs and vaccines, laboratory set ups, list of number of doctors and supporting staff etc. need to be kept ready and updated at regular intervals.

- **Training** need to be given to so as to build the capacity at all levels. Training will help to cope better during the emergency response period for epidemics.

- **Personnel protection** through vaccination is an effective mitigation strategy and will protect the persons at risk. Common sources of infection carriers can be tackled by many measures. Strategies included are improving the sanitary conditions, drive to check and fumigate breeding places of any vector (source of infection), improving disposal methods of waste, disinfecting the water source etc.

Heat waves

It is very complex phenomenon resulting from a certain combination of the temperature, humidity air movement and duration. Simply stated, a heat wave is an extended period of very high summer temperatures with the potential to adversely affected communities. Heat waves generally observed in month of April, May and June.

Urban structure fires

Fires are very dangerous. It is an event of something burning and is often destructive taking up toll of life and property. It is observed that more people die in fires than in cyclones, earthquakes, floods and all other natural disasters combined.

The most common human-caused hazard is fire in large occupied buildings and in slums built of combustible materials. Causes can be accidental or deliberate, but unless structures are built to safe fire standards as mentioned in the National Building Code, and sound emergency procedures are used, heavy loss of life can result.

There are numerous causes of Fire. It could be

1. Heating sources are often causes of Fire. Space heaters, electric heaters and fireplaces should be used with caution.

2. Cooking accidents are a major cause of home fires and cause us a lot of concern. Fires can result due to unattended cooking or due to mechanical failure of the stove or any cooking equipment.

3. Electrical wiring can cause a fire if it is not large enough to carry the load being supplied. Overheating of electrical appliances, poor wiring connections, use of unauthorized appliances, multi-point adaptors can result in fires starting.

4. Rubbish and Waste Materials that are left to accumulate can easily contribute to the spread of fire; they are also a place for malicious fires to be started. Make sure that you remove all waste materials from the workplace on a regular basis and place them in a suitable container located in a safe position outside the building premises. Do not burn rubbish on bonfire, even

if it is thought safe to do so. They can easily get out of control and spread fire to nearby buildings or structures.

5. Combustible Materials such as packing materials, glues, solvents, flammable liquids or gases stored in work place can be extremely dangerous. It is recommended to store materials both in terms of required quantity and in a secure area outside the premises.

6. Hazardous Materials such as paints, solvents, adhesive, chemicals or gas cylinders should be kept in separate storage areas and well away from any sources of ignition.

7. Arson and Deliberate Fire setting is also a cause.

8. Smoking is also a major cause of fire.

Transport Accidents

11.7 *District wise Disaster Management*

Table 11-7 : Analysis of existing situation

Districts of Sub Region	Earth quack hazard	Flood Hazard	Drought hazard	Fire	Chemical and Industrial	Other type
Faridabad	✓	✓	×	✓	✓	✓
Palwal	×	×	×	✓	×	✓
Panipat	×	✓	×	✓	✓	✓
Gurgaon	✓	✓	✓	✓	✓	✓
Mewat	×	✓	×	✓	×	✓
Rohtak	×	✓	✓	✓	×	✓

Sonipat	✓	✓	×	✓	×	✓
Rewari	×	✓	✓	✓	✓	✓
Jhajjar	×	×	✓	✓	✓	✓

Table 11-8 : Institutional Arrangements

Disaster	Nodal Ministry
Air Accidents	Ministry of Civil Aviation
Civil Strife	Ministry of Home Affairs
Railway Accidents	Ministry of Railways
Chemical Disasters	Ministry of Environment & Forest
Biological Disasters	Ministry of Health
Nuclear Accident inside or outside the country	Dept of Atomic Energy
Natural Disasters	Ministry of Agriculture

The institutions are under 4 tier hierarchy

STATE LEVEL

The Haryana States have to set up Disaster Management Authorities under the Chief Minister with Ministers of relevant Departments as members.

Re-structuring of the Relief Department in the States: At the State level, the work of post calamity relief was being handled by the Departments of Relief & Rehabilitation. The Government of India

is working with the State Governments to restructure the Departments of Relief & Rehabilitation into Departments of Disaster Management with an enhanced area of responsibility to include mitigation and preparedness apart from their present responsibilities of relief and rehabilitation.

The Haryana State have to restructure/re-group the officers/staff within the Department of Disaster Management with definite functions to pursue the holistic approach to disaster management. The four functional groups to be assigned with specific tasks within the departments are as indicted below:-

- Functional Group 1: Hazard Mitigation
- Functional Group 2: Preparedness and Capacity Building
- Functional Group 3: Relief and Response
- Functional Group 4: Administration and Finance

DISTRICT LEVEL

At the district level, the District Magistrate who is the chief coordinator will be the focal point for coordinating all activities relating to prevention, mitigation and preparedness apart from his existing responsibilities pertaining to response and relief. The District Coordination and Relief Committee is being reconstituted/ re-designated into Disaster Management Committees with officers from relevant departments being added as members. Because of its enhanced mandate of mitigation and prevention, the district heads of the departments engaged in development are now being included in the Committee so that mitigation and prevention is mainstreamed into the district plan. The existing system of drawing up preparedness and response plans will continue. There will, however, also be a long term mitigation plan.

BLOCK/TALUKA LEVEL

Similarly, sub-divisional and Block/Taluka level Disaster Management Committees are also being constituted. At the village level Disaster Management Committees and Disaster Management Teams are being constituted. Each village in multi-hazard prone district will have a Disaster Management Plan. The Disaster Management Committee which draws up the plans consists of elected representatives at the village level, local authorities; Government functionaries including

doctors/paramedics of primary health centers located in the village, primary school teachers etc. The plan encompasses prevention, mitigation and preparedness measures. The Disaster Management Teams at the village level will consist of members of youth organizations like Nehru Yuvak Kendra Sanghathan (NYKS) and National Service Scheme (NSS) and other nongovernmental organizations as well as able bodied volunteers from the village. The teams are provided basic training in evacuation, search and rescue, first aid trauma counseling etc. The Disaster Management Committee will review the disaster management plan at least once in a year. It would also generate awareness among the people in the village about dos' and don'ts for specific hazards depending on the vulnerability of the village.

11.8 *Safety Measures*

11.8.1 Risk reduction can take place in two ways:

1. Preparedness

This protective process embraces measures which enable governments, communities and individuals to respond rapidly to disaster situations to cope with them effectively. Preparedness includes the formulation of viable emergency plans, the development of warning systems, the maintenance of inventories and the training of personnel. It may also embrace search and rescue measures as well as evacuation plans for areas that may be at risk from a recurring disaster.

Preparedness therefore encompasses those measures taken before a disaster event which are aimed at minimizing loss of life, disruption of critical services, and damage when the disaster occurs. All preparedness planning needs to be supported by appropriate legislation with clear allocation of responsibilities and budgetary provisions.

2. Mitigation

Mitigation embraces all measures taken to reduce both the effect of the hazard itself and the vulnerable conditions to it in order to reduce the scale of a future disaster. Therefore mitigation activities can be focused on the hazard itself or the elements exposed to the threat. Examples of mitigation measures which are hazard specific include modifying the occurrence of the hazard,

e.g. water management in drought prone areas, avoiding the hazard by siting people away from the hazard and by strengthening structures to reduce damage when a hazard occurs.

In addition to these physical measures, mitigation should also be aimed at reducing the physical, economic and social vulnerability to threats and the underlying causes for this vulnerability.

11.8.2 Safety against Earthquake Hazards

As far as earthquakes are concerned the BIS codes are (1) IS 1893:1984 Criteria for Earthquake Resistant Design of Structures (initially published in 1962 and revised in 1966,1970,1975 and 1984 –divided into five parts to deal with different structure types (2) IS 4326:1993 Earthquake Resistant Design and Construction of Buildings (3) IS 13827:1993 Improving Earthquake Resistance of Earthen Buildings (4) IS 13828:1993 Improving Earthquake Resistance of Low Strength Masonry Buildings (5)IS 13920:1993 Ductile Detailing of Reinforced Concrete Standards subjected to Seismic Forces (6) IS 13935:1993 Repair and seismic strengthening of Buildings and (7)IS4967:1968 Recommendations for seismic Instrumentation for River Valley Projects.

11.8.3 Safety against Underground Blasts

Underground blasts are covered by(1) IS 6922:1973 Criteria for Safety and Design of Structures subject to Underground Blasts and (2) IS 4991:1968 Criteria for Blast Resistant Design of Structures for Explosions Above Ground.

11.8.4 Safety against Floods

IS 13739:1993- Guidelines for estimation of flood damages. Scientific procedure for collection of flood damages is given along with methods to quantify losses.

11.8.5 Safety against Landslides

Bureau of Indian Standards has published (1) IS 14496 (Part2):1998 Guidelines for preparation of landslide hazard zonation maps in mountainous terrain, (2) IS 14458 Guidelines for Retaining Walls for Hilly areas (3 Parts) , (3) IS 14680:1999 Guidelines for Landslide Control ,and IS

14804:2000 Guidelines for Siting, Design and Selection of Materials for Residential Buildings in Hilly Areas.

11.8.6 Safety against Fire Hazards

National Building Code, Part 4 provides comprehensive recommendations for minimum standards of fire protection. It specifies the demarcation of fire zones, restrictions on construction of buildings in each fire zone, classification of buildings based on occupancy, types of building construction according to fire resistance of the structural and non structural components and other restrictions and requirements necessary to minimize danger to life from fire,smoke,fumes or panic before the building can be evacuated.

It is essential to introduce accountability at all levels when it comes to safety of buildings and infrastructure.

Chapter 12 : RURAL DEVELOPMENT

12.1 *Background*

Haryana is a leading contributor to the country's production of food grain and milk. Agriculture is the leading occupation for the residents of the state, the flat arable land irrigated by submersible pumps and an extensive canal system. Haryana contributed heavily to the Green Revolution that made India self-sufficient in food production in the 1960s. Its Economy is basically agrarian in nature. According to census 1991-2001 about 71.07% of the Haryana population is living in rural areas. The agricultural sector contributed 31.19% (Rs. 16625.71 crores) of the total net state domestic Production. For the year 2006-07 this figure drops to 21.45% (Rs. 24795.16 crores) which shows decline in the Agriculture and animal husbandry sector. Land which is the main asset in rural area is concentrated in a few hands.

From the Economic survey the Primary Sector which comprises Agriculture, Livestock, Forestry, Fishing and Mining Sectors has increased from Rs. 21127.82 crore in 2006-07 to Rs. 21344.82 crore in 2007-08 showing an increase of 1.0 percent.

As per the data available, about 66% of the total Haryana Sub region i.e. 8862.48 Sq Km is under rural area which is accommodating about 57.22 lakhs i.e. 66% of the population of total sub region.

	NCR Plan	Sub region	status
Rural Area	91%	66%	⇩se
Population	43.61 %	65.87 %	⇧se

Comparing to NCR plan the percentage of rural area is less than NCR's average, where as population accommodation is more in than the NCR's average. This shows higher level of urbanization in the sub region but still maximum population accommodates in remaining rural areas and reckon on the employment generated related to primary sector in rural sector.

12.2 *Objective and overall Strategy*

12.2.1.i Objectives listed from NCR Plan

- Identification of comparably less developed Districts
- To prepare strategy for the balanced development of the District
- To provide urban amenities /facilities in rural areas
- To increase the demand for exotic agricultural products and high value commercial farming in the rural Sectors
- To identify and promote dairy growth centers in the Sub region

Table 12-1 : Objectives formed from various plans

S. No.	Objectives	Strategies
1.	To develop the backward Rural Areas	• Identification of the less developed rural areas • Identification of Service centers and central Villages • Providing Urban amenities/ facilities in rural areas
2.	To rise per capita income of the rural area	• Increase the demand for exotic agricultural products and high value commercial farming in the rural Sectors • To identify and promote dairy growth centers in the Sub region • Initiating measures which, apart from raising productivity of assets for rural poor, also lead to acceleration of their assets.

3.	To increase the quality of life in the rural areas	• Provision of safe and hygienic conditions in the all villages such as facilities of untainted drinking water, hygienic toilets, proper sewage and drainage disposal system. • Availability of basic infrastructure such as roads, Electricity, Education, health facilities, etc to the villages. • Availability of all facilities at systematic hierarchy i.e.
4.	To maximize productivity in the agriculture	• A massive increase in irrigation through private minor irrigation schemes for the benefit of small and marginal farmers. • Improvement in the delivery systems of providing credit for agriculture inputs to these farmers. • Introducing high value crops vegetables and fruits which although are more labor intensive yield high income. • A big thrust on animal husbandry programmes, particularly of the milk production, dairy development, poultry and horticulture. • Creation of capacities for processing agriculture produces to secure more remunerative prices for farmers.
5.	To achieve a faster growth in manufacturing sector and promotion of such industries	• Promoting growth of the industries which leads to growth of the ancillaries and where processes of the production can be decentralized, providing work and wages to people in neighboring areas.

		• Giving more emphasis on development and growth of small villages industries with improved technology and institutional support for raw material and marketing their produce.

12.3 *Present Scenario of rural areas in Haryana Sub region.*

The Rural Development Department, Haryana plays a crucial role in amending the socio-economic conditions of the state by raising the living status of the rural poor. It executes the program of rural development by enforcing a number of welfare schemes to serve the backward section of the state.

Table 12-2 : QPR Reporting Status of Sub region of Haryana for Jun, 2009

District	Prog.	Number of Projects					All Due QPRs Reported Percentage
		Total	Latest Due QPR Reported	QPR Reporting	Only Work-Plan Reporting	Non-Reporting	
FARIDABAD	IWDP	1	1	0	0	0	100%
GURGAON	IWDP	1	1	0	0	0	100%
JHAJJAR	DDP	87	87	0	0	0	100%
MEWAT	IWDP	2	2	1	0	0	100%
PANIPAT	IWDP	1	1	0	0	0	100%
REWARI	DDP	75	75	0	0	0	100%
ROHTAK	IWDP	5	5	0	0	0	100%
SONIPAT	IWDP	1	1	0	0	0	100%
6 (12) Districts	IWDP	11	11	1	0	0	80.77 %
2 (7) Districts	DDP	162	162	0	0	0	96.63 %

Co-operative societies and banks classified by types in Haryana

District	Apex Societies	Central Co-operative Banks	Central Land Development Banks	Agricultural Credit	Non Agricultural Credit	Primary Land Development Banks	Marketing	Sugar cane Supply	Milk Supply	Weaver Societies	Consumer Societies/ Stores	Housing Societies	Farming Societies	Women Societies	Others	Total
Panipat	1	1	1	28	22	-	4	-	59	244	9	523	-	-	294	1186
Sonipat	-	1	1	33	22	-	4	-	106	-	4	1236	2	1	392	1802
Rohtak	-	1	1	21	62	-	5	-	302	9	6	26	3	1	403	840
Jhajjar	-	1	1	23	6	-	3	-	316	-	-	9	4	-	297	660
Farida	-	1	1	30	98	-	3	-	428	7	3	3935	-	-	294	480

bad															0
Palwal	District carved from Faridabad (Segregate data not available)														0
Gurgaon	-	1	1	33	50	-	5	-	288	13	3	3657	6	-	885	4942
Mewat	District carved from Gurgaon (Segregate data not available)														0
Rewari	-	1	1	24	20	-	2	-	113	-	1	515	3	-	293	973
State	12	19	19	573	974	-	80	10	5931	352	72	15685	131	8	9478	33344

Maximum numbers of societies are present in Gurgaon (including Mewat)

In Sub region the top 5 societies are

Housing Societies > Milk Societies > Non Agricultural Societies > Weavers Societies > Agricultural credit.> Marketing

In Sub region the bottom 5 Societies are

Primary Land Development Banks > Sugar cane Supply > Apex Societies > Women Sources

12.4 *Rural Development Schemes:*

Some of the major schemes that have been implemented by the Rural Development Department, Haryana are as follows:

- Swarnjayanti Gram Swarozgar Yojana (SGSY)
- Indira Awaas Yojana (IAY)
- Sampooran Grameen Rozgar Yojana (SGRY)
- Desert Development Programme(DDP)
- Members of Parliament Local Area Development Scheme (MPLADS)
- Rashtriya Sam Vikas Yojana (RSVY)
- Total Sanitation Campaign (TSC)
- Swaranjayanti Shahari Rozgar Yojna (SJSRY)
- Employment Assurance Scheme (EAS)
- National Rural Employment Guarantee Scheme (NREGS)
- Integrated Wasteland Development Projects (IWDP)

The department monitors the Progress of schemes through periodical reports viz. Monthly/Half-yearly/Annually. Besides this, to ensure proper implementation of the schemes at the district level, meetings are held regularly with the Additional Deputy Commissioners and representatives of the DRDAs.

At the Block Level – BDPO and other staff also help to execute the schemes. The Panchayati Raj Institutions – Gram Panchayats, Panchayat Samiti, Zila Parishad and Gram Sabha have substantial role in formulation and implementation of the wage employment scheme of SGRY, NFFWP/NREGA and self employment scheme of SGSY, rural housing schemes of IAY and area development schemes of DDP , IWDP.

12.4.1 Swaranjayanti Gram Swarojgar Yojana

The families living Below the Poverty Line belonging to Rural areas are assisted under this programme – individually as well as in Groups (Self Help Group). Funds to be received under the scheme are shared by Centre and State Govt. in 75:25 Ratio respectively. Assistance is provided for income generating activities. After 6 months of the formation of a Self Help Group Rs.10,000/- is provided as Revolving Fund and after completion of 2nd grading (one year) subsidy @ 50% subject to a maximum of Rs.125000/- is provided to a Self Help Group. An allocation of Rs.90.91 lacs has been made for the year 2005-06 against which we have so far received Rs.37.71 lacs.

12.4.2 Indira Awaas Yojana

IAY is a centrally sponsored scheme funded on cost-sharing basis between the GOI and State Govt. in the ratio of 75:25. Under this scheme Rs.25,000/- are provided for construction of a House, Kitchen, Smokeless Chulha and Toilet to a family living Below Poverty Line in rural areas in lump sum. Against the allocation of Rs.267.50 lacs for the financial year 2005-06, we have so far received Rs.113.43 lacs and all the funds have been released to the concerned Block Development & Panchayats Officers.

12.4.3 Sampooran Gramin Rozgar Yojana

The Primary objective of the scheme is to provide additional and supplementary wage employment and thereby provide food security and improve nutritional levels in all rural area. The Secondary objective is the creation of durable community, social and economic assets and infrastructural development in rural area. Under the scheme rural poor who are in need of wage employment and desire to do manual and unskilled work in and around his village is covered

Total funds to be received in the scheme are distributed amongst the Gram Panchayat, Panchayat Samities and Zila Parishad in the ratio of 50:30:20. 22.5% of the annual allocation (inclusive of foodgrains) allocated both at the Zila Parishad and Panchayat Samiti level shall be earmarked for individual/group beneficiary scheme for SC familing living below poverty line.

Against the allocation of Rs.498.57 lacs we have so far received Rs.192.41 lacs during the financial year 2005-06.

12.4.4 Ddp Watershed Development Projects/Hariyali Scheme

The objective of each watershed development project is to promote the economic development of the village community which is directly or indirectly dependent on the watershed and to encourage restoration of ecological balance in the village. It also includes Development of Agri. lands, horticulture, grassland, forest land, soil and water conservation measures, creation of water resources etc. It is a 4/5 year project and during this period funds amounting to Rs.30.00 lacs for one watershed development project are allocated for different components (works, training, community organization, entry point activity etc.) and an area of 1250 Acres(Approx. 500 Hect) is covered under this project. Under DDP, we have 4th phase, 5th phase, 6th phase, 7th phase and 8th phase and Hariyali-1st and Hariyali-2nd . Under Hariyali-1st and Hariyali-2nd total 21 Watersheds each are to be implemented. Against the total project cost of Rs.630.00 lacs each, we have so far received Rs.94.50 lacs each.

12.4.5 Mp Local Area Development Scheme (Mplads)

Under this scheme, funds amounting to Rs.2.00 Crores per year are placed at the disposal of a Member of Parliament (Rajya Sabha and Lok Sabha) of a Parliamentary Constituency. The scheme is implemented on the guidelines received under the scheme from the Govt. of India. The funds are released for the works recommended by the concerned M.P. and the works are got executed through the Line Departments/Implementing Agencies like Panchayati Raj, BDPOs, Municipal Committees etc. Against the allocation of Rs.2.00 Crores each of MP (RS) and MP (LS) we have so far received Rs.1.00 Crores in respect of MP(RS) for the current financial year.

12.4.6 Rashtriya Sam Vikas Yojana (Rsvy)

The Planning Commission, Govt. of India has launched a New 100% Centrally Assisted Scheme – "Backward District Initiative – R.S.V.Y. The main aim of this scheme is to solve the problems of Poverty, Low Growth and Poor governance in the backward districts of the country. Sirsa district is among the 100 district indentified and to implement the scheme. The funds shall be provided by the Govt. of India to the State Govt. as 100% grant @ Rs.15.00 Crore per year per district for

a period of 3 years i.e. total of Rs.45.00 Crores for Sirsa district will be made available. District Plan has already been approved and we have so far received funds amounting to Rs.7.50 Crores as 1st Instalment.

12.4.7 Total Sanitation Campaign (Tsc)

The main objective of the scheme is to bring about an improvement in the general quality of life in the rural areas; accelerating sanitation coverage in rural area, generating felt need through awareness creation and health education, covering schools in rural areas with sanitation facilities and bringing about a reduction in the incidence of water and sanitation related diseases. An allocation of Rs.5.00 Crores has been made under the scheme and a sum of Rs.32.00 lacs were received and stands utilised so far on start up activities i.e. prelimary surveys, initial publicity etc., IEC, construction of individual households latrines, school sanitation etc.

12.4.8 Swaranjayanti Shahari Rozgar Yojana (Sjsry)

Under the scheme assistance to the individual family is given with maximum bank loan of Rs.50,000/- and 15% subsidy maximum limit of Rs.7500/- is provided for establishing the economic viable unit employment venture. The Self Help Group is provided subsidy @ 50% with maximum of Rs.1.25 lacs. For development schemes, funds are provided for environment, improvement of slums, national slum development programme, and assistance under 10th Finance Commission for development of various urban areas.

12.4.9 Employment Assurance Scheme

The Primary Objective of the EAS is creation of additional wage employment opportunities during the period of acute shortage of wage employment through manual work for the rural poor living below the poverty line.

The Secondary objective is the creation of durable community, social and economic assets for sustained employment and development.

12.5 *District Rural Development Agency*

The District Rural Development Agency (DRDA) has traditionally been the principal organ at the District level to oversee the implementation of different anti poverty programmes. The primary objective of DRDA Schemes is to professionalize the DRDAs so that they are able to effectively manage the anti poverty programmes of the Ministry of Rural Development and interact effectively with other agencies.

The Department of Rural Development is implementing a number of programmes in rural areas through the state Governments for poverty reduction, employment generation, rural infrastructure habitant development, provision of basic minimum services etc. The important

12.5.1 Programmes implemented by the DRDA

- Panchayati Raj
- Pradhan Mantri Gram Sadak Yojana (PMGSY)
- Swarnjayanti Gram Swarozgar Yojana (SGSY)
- Sampoorna Gramin Rozgar Yojana (SGRY)
- Rural Housing (Indira Awaas Yojana)
- DRDA Administration
- Training Schemes
- Promotion of Voluntary Schemes and Social Action Programme, organization of beneficiaries, advancement and dissemination of rural technology through CAPART.
- Monitoring mechanism.

12.5.2 Organizational Structure

- Each District will have its own District Rural Development Agency. The DRDA would be headed by a Project Director, who should be of the rank of an Additional District

Magistrate. In respect of such States where DRDA does not have a separate identity, a separate Cell to be created in the Zilla Parishad to maintain separate accounts, so that these are capable of being audited separately.

- The DRDA should emerge as a specialized agency capable of managing the Anti Poverty Programmes of the Ministry on the one hand and to effectively relate these to the overall effort of poverty eradication in the District.

- Actual execution of programmes will be handled outside the DRDAs and the DRDA's role will be to facilitate the implementation of the programmes, to supervise/oversee and monitor the progress, to receive and send the progress reports as well as to account for the funds.

- DRDAs will develop the capacity to build synergies among different agencies involved, for the most effective results.

- If DRDAs are to be entrusted with programmes of other Ministries or those of the State Governments, it would be ensured that these have a definite Anti Poverty focus.

- The Chairman, Zilla Parishad would be the Chairman of the Governing Body of the DRDA. The DRDA shall also have an Executive Committee.

- The Project Director should cause the annual accounts of the DRDA to be prepared not later than 30th June. These shall be duly audited.

12.6 *Integration of Urban and Rural settlement pattern*

Haryana is dissecting high rate of urbanization. The main aim is to integrate urban and rural settlements and providing facilities within a reasonable distance. For the integration various hierarchy of the settlements have to be identified to bring about accessibility to all facilities and services with in manageable time and cost to the settlement pattern in the sub region. These hierarchies will be based on the size of population and its function in the overall settlement

NCR Regional plan 2021 suggests that the settlements with population size 50,000 to 3.0 lakhs should be marked as Sub regional centre. Within the influence of each sub region rural settlement lies in hierarchy of service centre, central village and basic village will be considered.

Service centers are those settlements which have population range in between 10,000 to 50,000 and are at the verge of rapid changes in their character and function and are expected to be urban centers. These centers will cater to rural hinterland as agro service centre in the collection and distribution of agricultural goods and services with processing, marketing, warehousing and storage facilities.

To integrate basic village to service center, small level facilities such as social and economic, commercial etc should be proposed. All basic villages should be provided with basic facilities like link roads, water supply and electricity, paved streets and low cost common sanitary facilities and minimum planning norms.

12.7 *Village development*

Each village has basic issues related to Shelter, Employment, Sanitation and Health. For the development, basic village should be linked to the nearby service Centre within 5 kms distance. It is essential to take account of above basic issues for each village and provide facilities according to requirement in each village for overall development of the village.

Table 12-3 : Distribution of proposed facilities in Proposed Hierarchy of Settlements:

Regional Centre	Sub regional Centre	Service Centre	Basic Village
Educational			
University, Medical College, Technical Institute	Degree College with Post Graduate	Degree college, Vocational Training Centre	Primary, Middle, Secondary School & Intermediate College
Medical			

Regional Hospital, Specialized Hospital, Regional Vetenary Hospital	Sub Regional Hospital with specialized facilities, Vetenary Hospital	Hospital Vetenary Hospital	Primary Health Centre, Dispensary, Child Welfare Centre
Communications			
Regional Post & Telegraph Office, Regional Automatic Telephone Exchange	Sub regional Post and Telegraph Office, Telephone Exchange	Post and Telegraph Office, Telephone Exchange	Sub Post and Telegraph Office, Telephone Booth
Banking			
Banks with Regional Offices	Banks with Sub Regional Offices	Banks Branches	Banks Branches, Primary Credit Society, Land Mortage Bank and Co-operative Bank
Transport Facilities			
Regional Bus Terminal, Air port, Railway Station	Sub regional Bus Terminal, Airport	Bus Stand with Depot	Bus Stop Provision of Railway Station, If situated near Railway Line
Marketing			
Regulated Wholesale Market	Regulated Wholesale Market	Regulated Small Wholesale Market	Weekly Markets, Daily Markets

Community Development Programme			
Agricultural Implements, Specialized for Agri Services	Agricultural Implements Distribution Centre	Large Size co-operative Society, Fertilizer- Pesticide Distribution Centre, Agricultural Implements distribution Centre	Seed Fertilizer, Pesticide Distribution Centre, Agricultural Implements distribution Centre, Poultry Farming Centre, Fishery Development Centre
Co-operatives			
Regional Co-operative Society	Sub- Regional Co-operative Society	Large Scale Co-operative Society	Co-operative Marketing Society, Co-operative Consumer Society
Warehousing			
Large Godowns and warehousing oil depots	Large Godowns and warehousing	godowns and warehousing	Small godowns and Warehousing

Chapter 13 : LAND USE

13.1 *Background*

Haryana State exhibits diversity in landuse- land cover owing to variations in the geomorphology, soils, climate groundwater quality and irrigation facilities etc. The landuse-land cover map of the Haryana Sub-Region depicts the distribution of forest area, agricultural land, wastelands, water bodies, built up land, mining area and other land. It is very important theme of the state resources for determining land use policy, planning of transportation and communication among districts.

In the Section 17 of the NCR PB Act, 1985 mentions about the preparation of the Sub regional Plan. Section 19 (3) of NCR PB Act states that the Sub regional Plan should be in conformity with the Regional Plan. So the Sub regional land use Plan details planning policies and proposals into physical (Spatial) form to illustrate the manner in which the land in sub region is to be used for various purposes. However, the detailed specific reservation of the areas for various landuse of Sub regional and urban importance will be detailed out in the Master Plans and Area level plans.

Issues relating to Land use planning in Sub regional Plan.

Following issues have been observed in our study region, which bears critical consequences on overall land use planning and should be addressed with adequate policy measures in the Sub regional plan:

1. Large scale conversion of the agricultural Land to Non agricultural Use
2. Unauthorized conversion of land use
3. Lack of Urban Rural Continuum in regional Development
4. Unplanned / Haphazard growth in environmentally sensitive Areas
5. Green Belts/ Green Wedges.

13.2 *Existing Land Use Analysis*

Haryana Sub region exhibits diversity in the Land use and land cover. This chapter depicts the distribution of forest area, agricultural land, waste land, water bodies and built –up land. This chapter is supportive to determine land use policy, planning of transportation and communication among districts.

The existing land use analysis has been done on the basis of satellite imageries for the year of 2008 and data provided by the forest department of Haryana .

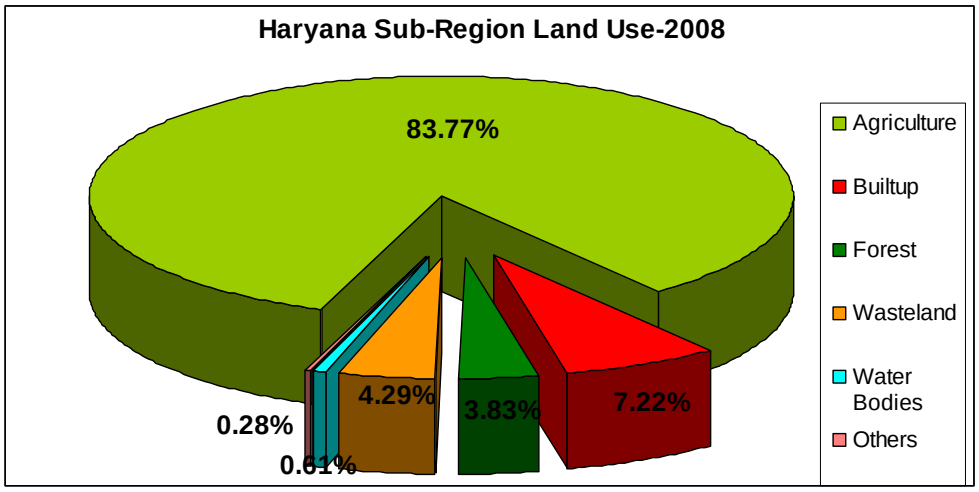
The total area as per the GIS analysis for the Haryana Sub-Region is 1342900 Ha. Out of the total area 83.77 % is agriculture area, 7.22% area is built-up area, 3.83% area is forest area, 4.29% area is wasteland , 0.61% area is under water bodies and remaining 0.28% area is under other/open area. The below table indicates the detailed landuse break-up for the Sub-Region.

Table 13-1 : Existing Land use breakup of Haryana Sub-Region

Classification	Area (in Ha.)	Percentage
Built-up	96940	7.22
Agriculture	1124922	83.77
Forest	51496	3.83
Wasteland	57608	4.29
Water Bodies	8220	0.61
Others	3714	0.28
Total	1342900.00	100.00

The Existing Land use analysis indicates that the maximum land in the sub region is under "agricultural use" i.e. 83.77 %.which indicates the region is having good agricultural activities. Agricultural land use consists of the cultivable land, fallow land, plantation, farm houses and horticulture. Haryana sub region consists of maximum agricultural cover in NCR, which constitutes of 46.28% (1,113,000 Ha.) of NCR.

Figure 13-1 : Existing Land use breakup of Haryana Sub-Region



It is observed that there is very little rise is observed in built-up area in comparison to NCR figures, the reason behind this is explained through increase in the density of the areas which are previously under moderate dense or spare dense. As the settlement near the high dense areas are growing at tremendous rate and induce the development in the surrounding too. District wise details of land uses area given in table 13.2.

Table 13-2 : District wise Existing Land use breakup(in Hac) of Haryana Sub-Region

District	Builtup	Agriculture	Forest	Wasteland	Water Bodies	Others	Total
Panipat	9881	105698	4175	3103	1124	82	124063
Sonipat	12934	193099	7357	2441	1388	211	217430
Rohtak	9117	151519	4594	1038	1006	231	167506
Jhajjar	9058	164520	3902	7004	875	1153	186513
Faridabad	13629	40858	6463	9110	906	739	71705
Gurgaon	19448	84595	8889	15866	210	62	129069
Mewat	6938	119252	8841	13545	308	265	149150
Rewari	8499	135325	5077	4156	730	602	154389
Palwal	7436	130056	2197	1344	1673	369	143075
Sub-Region Total	**96940**	**1124922**	**51496**	**57608**	**8220**	**3714**	**1342900**
Percentage	**7.22**	**83.77**	**3.83**	**4.29**	**0.61**	**0.28**	**100.00**

Source: Satellite imageries 2008, data provided by forest dept. for the year 2009-10

Now details of each landuse are described below which will give the clear picture of existing land uses in the sub-region.

13.2.1 Forest

The forests confer manifold ecological benefits on the State economy. They have great bearing on ground water occurrence, soil erosion, floods and environment. They supply a variety of raw material to many industries. Forests are source of revenue to the Government and provide employment to a large number of people. The forests in Haryana are classified under Reserved Forests, Protected forests, unclassed forests, closed U/S 38 of IFA (Indian Forest Act) and Areas closed U/S 4 & 5 of LPA (Land Preservation Act). Major reserved and protected forest areas in Haryana state are mainly confined to the Himalayan ranges in Panchkula and Yamunanagar districts. Small reserved forests are found at a number of places in the districts of Yamunanagar, Kaithal, Ambala, Jind and Hissar, Majority of forests in the State belong to subtropical dry deciduous category whereas subtropical thorny forests are found only in the Aravalli hills in the southern parts of the State.

Considering the district wise various types of forest distribution during 2000-01, Sonipat district has highest forest cover (7361.38 Ha) followed by Gurgaon including Mewat (6473.19 Ha) and Faridabad including Palwal district (5490.66 Ha). Jhajjar district has least forest cover (3862 Ha) in the Sub-Region. In the Sonipat district maximum forest covers are protected forests i.e. forest along roads, canals, bandh and rail. There is no reserved forest or compact forest in the district of Sonipat. Sonipat district is also having maximum Un-classed forest in the Sub-Region. This indicates, the district is having maximum forest cover because of social forestry and government initiatives of aforestation.

During the year 2007-08, total forest area of the sub-region increased to 36443.12 Ha as compared to 35866.77 Ha in 2000-01. This increased was mainly due to increase in the Un-classed forests, Forests u/s 38 of IFA 1927 and Forests u/s 4&5 of LPA 1900. Table 13.1 & 13.2 shows the status of forest area in the Sub-Region.

Table 13-3 : Division/District Wise Forest Area (in Ha) for the Year 2000-2001

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Panipat	0.00	15.81	967.9	295	2734.67	89.45	4102.83	0	72	0	4174.83
Sonipat	0.00	0	1851.14	331.58	4573.02	316.84	7072.58	284.4	4.4	0	7361.38
Gurgaon + Mewat	231.08	144.68	1806.43	142	619.35	226.77	2939.23	62.69	0	3240.19	6473.19
Faridabad +Palwal	314.24	37.78	1331.97	0	1305.76	29.59	2705.1	92.39	0	2378.93	5490.66
Rewari	514.04	0	1678.46	269.9	1471.57	117.51	3537.14	0.14	0	0	4051.32
Rohtak	0.00	41.20	1342.6	525.5	1917.99	198	4025.29	206.8	0	221	4453.09
Jhajjar	0.00	491.00	1294.16	146.57	1852.19	42.42	3826.34	4.66	31	0	3862
Haryana Sub-Region	**1059.36**	**730.47**	**10272.66**	**1710.55**	**14474.55**	**1020.58**	**28208.51**	**651.08**	**107.4**	**5840.12**	**35866.77**

Source : Department of Forest , Panchkula, Haryana

Table 13-4 : Division/District Wise Forest Area (in Ha) for the Year 2007-08

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Panipat	0.00	15.81	967.9	295	2734.47	89.49	4102.67	0	72	0	4174.67

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Sonipat	0.00	0	1851.16	331.58	4573.02	316.84	7074.60	284.4	0	0	7359
Gurgaon	214.89	144.68	1010.26	142	200.83	90.50	1588.27	22.66	247.37	308.36	2381.55
Mewat	16.19	0.37	1203	0	821.68	136.27	2161.32	39.66	0	1856.70	4073.87
Faridabad + Palwal	314.24	37.78	925.14	0	903.48	29.59	1895.99	92.38	0	3548.47	5851.08
Rewari	514.04	0	1678.46	269.9	1471.57	117.51	3537.14	55.04	0	0	4106.22
Rohtak	0.00	41.20	1335.26	505.5	1917.99	198	3997.95	375.40	0	221	4594.35
Jhajjar	0.00	491.00	1294.16	146.57	1852.19	42.42	3826.34	45.04	31	0	3902.38
Haryana Sub-Region	**1059.36**	**730.84**	**10265.34**	**1690.55**	**14475.23**	**1020.62**	**28184.28**	**914.58**	**350.37**	**5934.53**	**36443.12**

Source : Department of Forest , Panchkula, Haryana

Table 13-5 : Division/District Wise Forest Area (in Ha) for the Year 2009-10

District/ state	Reserved forests	Protected forests					Protected forests total	Un-classed forests	Forests u/s 38 of IFA 1927	Forests u/s 4&5 of LPA 1900	Grand total
		Compact	Road	Rail	Canal	Bandh	Total				
Panipat	0	15.81	967.9	295	2734.47	89.49	4102.67	0	72	0	4174.67
Sonipat	0	0	1851.16	331.58	4573.02	316.84	7072.6	284.4	0	0	7357

Gurgaon	214.89	144.68	1010.26	142	200.83	90.5	1588.27	22.66	238.15	6824.93	8888.9
Mewat	24.43	0	1136.32	0	694.74	167.96	1999.02	40.03	0	6777.99	8841.47
Faridabad	175.63	0	321.95	0	426.32	29.59	777.86	0.12	0	5509.72	6463.33
Palwal	138.61	37.78	1010.1	0	879.47	13.04	1940.39	92.26	0	25.49	2196.75
Rewari	514.04	0	1678.46	269.9	1471.57	117.51	3537.44	55.04	0	970.42	5076.94
Rohtak	0	41.2	1335.26	505.5	1917.99	198	3997.95	375.4	0	221	4594.35
Jhajjar	0	491	1294.16	146.57	1852.19	42.42	3826.34	45.04	31	0	3902.38
Sub-Region	**1067.6**	**730.47**	**10605.57**	**1690.55**	**14750.6**	**1065.35**	**28842.54**	**914.95**	**341.15**	**20329.55**	**51495.79**

Source : Department of Forest , Panchkula, Haryana

During the year 2009-10, total forest area of the sub-region increased to 51495.79 Ha as compared to 35866.77 Ha in 2000-01 and 36443.12 Ha in 2007-08. This increased was mainly due to increase in the Forests u/s 4&5 of LPA 1900. Table 13.1,13.2 & 13.3 shows the status of forest area in the Sub-Region.

From the above analysis it is observed that the due to active initiatives of forest department in the way of aforestation and social forestry the forest area is increasing in the Sub-Region. But these afforested areas are not reserved or protected, so the sustainability of the forested areas are under question. Despite of all the efforts taken by forest depart for increasing the forest cover it is much below the environmental standard.

In addition to the various categories of forest in the Sub-Region, over the year extensive plantations have been raised in the Aravalli region in the various villages of the district of NCR. The district wise details of Aravalli plantation is given in below table.

Table 13-6 : Division/District Wise Aravalli plantation Area (in Ha) in the Year 2009-10

S.No.	Name of District	No. of Villages	Area in Hectare
1	Faridabad	14	3636
2	Palwal	2	131
3	Gurgaon	32	5058
4	Mewat	94	11741
5	Rewari	35	4240.5
Total		**177**	**24806.5**

Source : Department of Forest , Panchkula, Haryana

For the improvement of the forest cover in the state, government of Haryana with the help of central government has initiated various programes, projects and schemes which are described below in brief.

1. **Integrated Natural Resources Management and Poverty Reduction Project:** The project area comprises 800 villages spread over the entire State of Haryana except the districts of Gurgaon, Mewat and Faridabad.

   The main objectives of the project are;

   (i) To rehabilitate degraded and blank forest lands/waste lands

   (ii) To rehabilitate forest lands in an ecologically sustainable manner.

   (iii) To improve the quality of life of the villagers adjoining forest.

   (iv) Development and management of degraded forests and common lands in an integrated manner through reforestation, afforestation, improved soil and water conservation measures.

(v) Encourage and motivate farmers to take up high yielding varieties of tree crops in farmlands.

(vi) Ensure active people's participation, especially women in implementation of programmes through training & extension services and strengthening of village forest committees.

(vii) Alleviate poverty through promotion of income-generating activities, skill development and establishment of cottage industries based on locally available raw material resources.

(viii) Facilitate empowerment of women through formation of Self Help Groups (SHGs) in villages.

(ix) Institution building –strengthening of village forest committees through training and extension services to enable them to participate fully in development and management of biological resources. The total area to be covered under various plantation models will be 48800 ha. during the project period of 7 yrs, from 2005-06 to 2010-2011.

Benefits of the scheme : This is an on-going externally aided project and will continue up to the year 2010-11. At the end of the project 48800 ha. area will be brought under afforestation on strip forest lands, block forest lands and 81 community lands besides 13800 ha. of farm forestry. 800 Village Forest Committees will stand constituted under the project. Besides this, the self Help Groups constituted under the project will continue with the income-generation activities after the project period. The project purposes likely to achieve are-

(i) improved capabilities of village communities to undertake a process of self-directed community development, emphasizing greater involvement and empowerment of disadvantaged groups;

(ii) improved and sustainable management of forest resources that have been degraded by loss of vegetation

(iii) increase in the number of financially viable and environmentally appropriate activities that will promote income generation amongst disadvantaged groups.

2. **State Resource Management and Livelihood Project :** The project purpose is to develop a process for sustainable management of natural resources through active participation of the local people.

   Benefits of the scheme: The project beneficiaries include the primary users of biomass: women, households dependent on degraded land/sand dune areas, scheduled castes who generally are landless, small and marginal farmers, all users of common property resources, communities living in the degraded and drought prone areas and any other disadvantaged groups who eke out a subsistence living in arid areas. The project will be implemented in the same 11 districts of the State of Haryana that have been covered by the Haryana Community Forestry project; namely, Ambala, Panchkula, Kurukshetra, Yamunanagar in the north and Sirsa, Hisar, Fatehabad, Bhiwani, Jhajjar, Rewari and Mohindergarh in the west and south, but will exclude the villages covered under the on-going JBIC funded project and those covered under the Haryana Community Forestry project.

3. **Integrated Forest Protection Scheme (Sharing Basis) :** This is a centrally sponsored scheme on 75:25 sharing basis (Centre: Share). The scheme was started in the year 2002-03 and is a continuing scheme.

   The main Objectives of the project are:

   (i) Protection and conservation of forests from devastating forest fires to prevent loss of productivity.

   (ii) Protection of environment and saving bio-diversity.

   (iii) Checking the emission of green house gases.

   Benefits of the scheme : World over, the efforts are being made to protect and conserve the forests for healthy and clean environment. Government of India launched "Integrated Forest Protection Scheme", commencing from the year 2002-2003. The scheme makes judicious use of all available methods for better protection and conservation of forest

resources of the country. These methods include management of forest fires, maintenance of fire lines, purchase of fire fighting equipment, demarcation of forest boundaries, enumeration of trees, improving communication through wireless equipments and creation of awareness among the local masses. After the initiation of this scheme the annual loss of forests and wildlife during the fire season has considerably come down.

4. **Raising of Strip Plantations on Government Lands :** It is a continuing state plan scheme to bring the strips along roads, rails and canals, declared as protected forests in the State, under the tree cover.

   The main aim of the scheme is to undertake tree plantation on strips of lands along roads, canals, railway lines and bunds which have been declared as protected forests. Every year the strip forests are felled as a part of working plan prescriptions and are regenerated by way of fresh plantations or through maintenance of natural regeneration.

   Benefits of the scheme : Strip forests occupy a pivotal place in Haryana Forestry. Out of the total forest area of 1,55,066 ha., strips cover 81,167 ha constituting 53% of the forests in the State. Similarly in the Sub-Region also out of total forest area of 36443 Ha, strip cover 28184 Ha constituting about 77% of the forest of the Sub-Region. Major part of forest revenue comes from strip forests only. Strip forests are felled as a part of working plan prescriptions from time to time. Therefore, these strips need to be regenerated immediately after felling by way of fresh plantations or through maintenance of natural regeneration. Some of the trees die due to natural death and calamities like floods, storms and fires. Therefore, Gap filling plantations in these strips also become essential. The strip plantations play a vital role in pollution control because of high density of traffic in Haryana. Some strips are either low lying or have compact soils; hence quality of earthwork plays a decisive role in successful establishment of plantations. Ridge work, mechanized auger-hole plantations and treatment of saline-alkaline sites would be main focus at the time of raising strip plantations. As these strips are located along national highways, state highways and other lines of communication open to people for use, extra efforts for protection have to be ensured.

5. **Rehabilitation of Degraded Forests :** It is a continuing state plan scheme to rehabilitate the degraded forest areas and will continue throughout the plan period.

Aims of the project is :

(i) to rehabilitate the degraded forest areas particularly in Shivaliks to stall their further degradation and bring them under green cover and in the process check soil erosion.

(ii) Conservation of soil and water through construction of water harvesting structures in Shivaliks to increase the moisture regime in these areas.

Benefits of the scheme : The degraded Forest lands will be regenerated through plantations. Protection will be provided in the areas wherever the areas are likely to be filled up through natural regeneration. The scheme will improve the density of open forests in Shivaliks. Hill Resource Management Societies (HRMSs) and Village Forest Committees (VFCs) will also be constituted to spread the concept of joint forest management. This would help in preservation of the catchments by community participation and natural regeneration through observance of social fencing. Construction of water harvesting structures, besides being beneficial to forests, will provide great relief to farmers in the area through recharging of ground water. The scheme will be implemented throughout the state wherever the degraded block forests exist.

6. **Protection of Forests (TFC) :** The scheme was started in the year 2002-03 and is a continuing plan scheme.

   The main objective of the scheme is to ensure protection of forests from encroachments and thefts for which demarcation of boundaries of block and strip forests will be carried out. For protection of trees in urban areas, tree guards will be installed around the young saplings. Building maintenance work will also be undertaken under the scheme.

   Benefits of the scheme : The scheme will benefit in protection of forests from illegal thefts and encroachments and maintenance of buildings in the forest areas.

7. **Social and Farm Forestry :** It is a state plan scheme to bring about tree plantation on panchayat lands, community lands and farm lands and will continue throughout the plan period.

   The main objectives of the programe is to realize the objectives of State Forest Policy of bringing 10% area of the State under forest and tree cover by 2010 and 20% eventually

through Farm and Agro Forestry activities on Farm lands. Farm lands have rich potential to bring increase in tree cover in the State. Because of this programe the Forest U/S 38 of IFA 1927 has increased from 107 Ha in 2000-01 to 350 Ha in 2007-08 in the Haryana Sub-Region.

Benefits of the scheme : Social and Agro-forestry was started with the help of World Bank Aided Project during 7th five year plan and continued as a part of the state plan scheme during the 8th and 9th five year plans. The Social and Agro-forestry work is to be continued further with some modifications. The main emphasis under this scheme will be to supply seedlings to farmers, government institutions and other general public free of cost for plantation by them on their own lands with an objective to bring about an overall increase in tree cover in the state. Emphasis will be on raising plants of commercial value like Eucalyptus, Poplar, Shisham to enhance income of tree growing farmers and thus there interest in tree planting activity. Institutions and other public will also be encouraged to plant ornamental and shady trees on their private lands from ecological considerations.

8. **Herbal Nature Park :** This scheme was started in the year 2006-07 and is a continuing scheme.

   The main objective of the programe is to make general public, especially farmers, aware of the importance, scope and potential of herbal plants. Cultivation and propagation of medicinal plants outside forest is important for conservation and meeting the demand.

   Benefits of the scheme : The setting up of Herbal parks in each district help in generating awareness, preserving gene pool and production of quality seeds and seedlings for distribution to farmers. These herbal parks, in the long run, will also emerge as potential tourist attraction sites in Haryana.

9. **State Forest Research Centre :** It is a continuing plan scheme to carry out research activities.

   The main objective of the scheme is to bring about improvement of planting stock and production of improved quality seeds to enhance tree productivity in the forests and on farmlands.

Benefits of the scheme : In view of limited area under forests in the State, the option available to increase the production from forests is by increasing its productivity through genetic improvement and better management of forestlands. The other option available for production of enough wood in the state is through diversification of agriculture with tree crops. The farmers in the state have adopted planting of short rotation crops like eucalyptus and poplar on their farmlands.

10. **Survey Demarcation & Settlement of Forest Area :** This is an on-going plan scheme. However, there will be an increased emphasis on activities undertaken in the scheme during the previous year.

    Benefits of the scheme : As the land resource is limited and is fast becoming a scarce resource, there is a greater tendency to encroach on state owned forest areas by unscrupulous elements. If the forest area is properly demarcated by erecting suitable boundary pillars or making ridges along strip boundaries, detection of encroachments and their removal becomes easier.

11. **Clonal Agro-forestry :** The scheme has been introduced from the current year 2008-09 but will effectively start from the year 2009-10 and is likely to continue through the 11th Plan period.

    Main objectives of the project are;

    (i) To produce quality seedlings of Eucalyptus, Shisham and other species at a high-tech clonal propagation centre in district Kurukshetra.

    (ii) To encourage practice of agro-forestry on farmlands for crop diversification and increase in the productivity of farmlands.

    (iii) To raise woodlots on Panchayat lands, community lands and other Institutional lands.

    (iv) To ensure sustained supply of raw material to wood-based Industries from farmlands and in process to ensure preservation of gene pool and bio-diversity in natural forests.

(v) To increase the tree cover outside forests in consonance with the State and National Forest Policies.

(vi) To benefit the farmers through carbon credits.

Benefits of the scheme : Agro-forestry is a dynamic land management system that combines agriculture with silviculture, horticulture, medicinal plants and/or animal husbandry on the same piece of land. It utilizes production potential of land in two to three tiers with suitable crop-tree combinations. Because of greater economic returns per unit area of agro-forestry, the latter has acquired national and international recognition as models to be emulated. The demand for agro-forestry products and services in the country is increasing with rapid economic growth, industrialization and increase in population. Agro-forestry is emerging as diversification and resource conservation options with the farmers.

12. **Urban Forestry :** The scheme has been introduced from the year 2008-09 and is likely to continue through the 11th Plan period.

Main objectives of the project are;

(i) To take up tree planting activity in urban areas along roads, in parks and in blank areas available in various localities for beautification.

(ii) To increase the green cover in urban areas for amelioration of the local environment and to check air pollution.

Benefits of the scheme : The urban areas are most affected from vehicular and industrial pollution. The population in the urban areas, therefore, suffers from respiratory and water borne diseases. The amelioration of urban environment through tree plantation will bring about greenery in the area and will effectively check the air pollution bringing respite to the residents.

13. **Preparation of Working Plan :** It is a state plan scheme and will continue through the 11th Plan period.

Main objectives of the project are;

(i) Forest areas are managed as per approved Working Plans prepared every ten years for each Forest Division.

(ii) A working plan includes the management prescriptions for the forest areas falling under a particular forest division.

(iii) The preparation of Working Plans which have expired or likely to expire in the coming years is taken up under the scheme.

Benefits of the scheme : Since, the preparation of working plans is a continuing activity in the department and all the forest areas are worked according to working plan prescriptions, this will help in the planning process.

Although various policies,projects and programes has been initiated by Haryana government yet as per the 2008 land use land cover analysis only 2.71% of Haryana Sub-Region is under forest cover which need to be given more attaintion to achieve the minimum level of standards of Ministery of Environment and Forestry for the forest cover i.e. 20% of the land area.

13.2.2 Agricultural Land:

Haryana Sub region is a part of Indo Gangetic Plains; the agriculture practice forms the main land use of the Sub region. There are mainly 2 cropping seasons, namely Rabi and Kharif. Majority of the area in the region utilized for agriculture during the Rabi and Kharif (double crop) seasons due to better irrigation facilities in the region. Major Kharif crops include rice, jowar, bajra, gaur, maize, cotton, sugarcane, groundnut and pulses. Rabi crops include wheat, barley, gram, rapeseed/mustard and pulses. The short period available in between Mid-May and July is sometimes also used for raising a third crop particularly in the areas where assured irrigation is available for watering the crop during the dry season.

Haryana Sub-Region being a part of fertile Indo-Gangetic Plains, the agriculture practice forms the main landuse of the region. There are two main cropping seasons, namely Kharif and Rabi. Majority of the area is utilized for agriculture during Rabi and Kharif (double crop) season due to better irrigation facilities in the region; major kharif crops include rice, jowar, bajra, gaur, maize, cotton, sugarcane, groundnut and pulses. Rabi crops include wheat, barley, gram rapeseed/mustard and pulses. The short period available between mid-May and July is

sometimes also used for raising a third crop particularly in the areas where assured irrigation is available for watering the crop during the dry season.

Northern portion of the region is characterized by good agricultural area due to fertile alluvial soils, marginal to food quality of ground water, network of irrigation, canals, tube wells and relatively better natural drainage. On the contrary southern part like Gurgaon and Rewari, due to lack of rainfall, poor irrigation facilities, poor Ground water quality coupled with desertic terrain with and dunes, result in relatively less cultivation during Kharif season.

In the whole sub-region wheat is the dominant crop. In the district of Panipat, Sonepat and Faridabad rice is also produced. Rewari is the region where after wheat, mustered and bajara is produced significantly.

Because of the good agriculture potential around 83.77% land of the sub-region is under agriculture uses.

13.2.3 Land utilization

The region is having maximum percentage of net shown area and lack in forest land. Land not available for cultivation is also in significant percentage. Only in the districts of Jhajjar fallow land other than current fallow are there where as adding the current fallow, Sonepat has maximum fallow land followed by Mewat and Jhajjar.

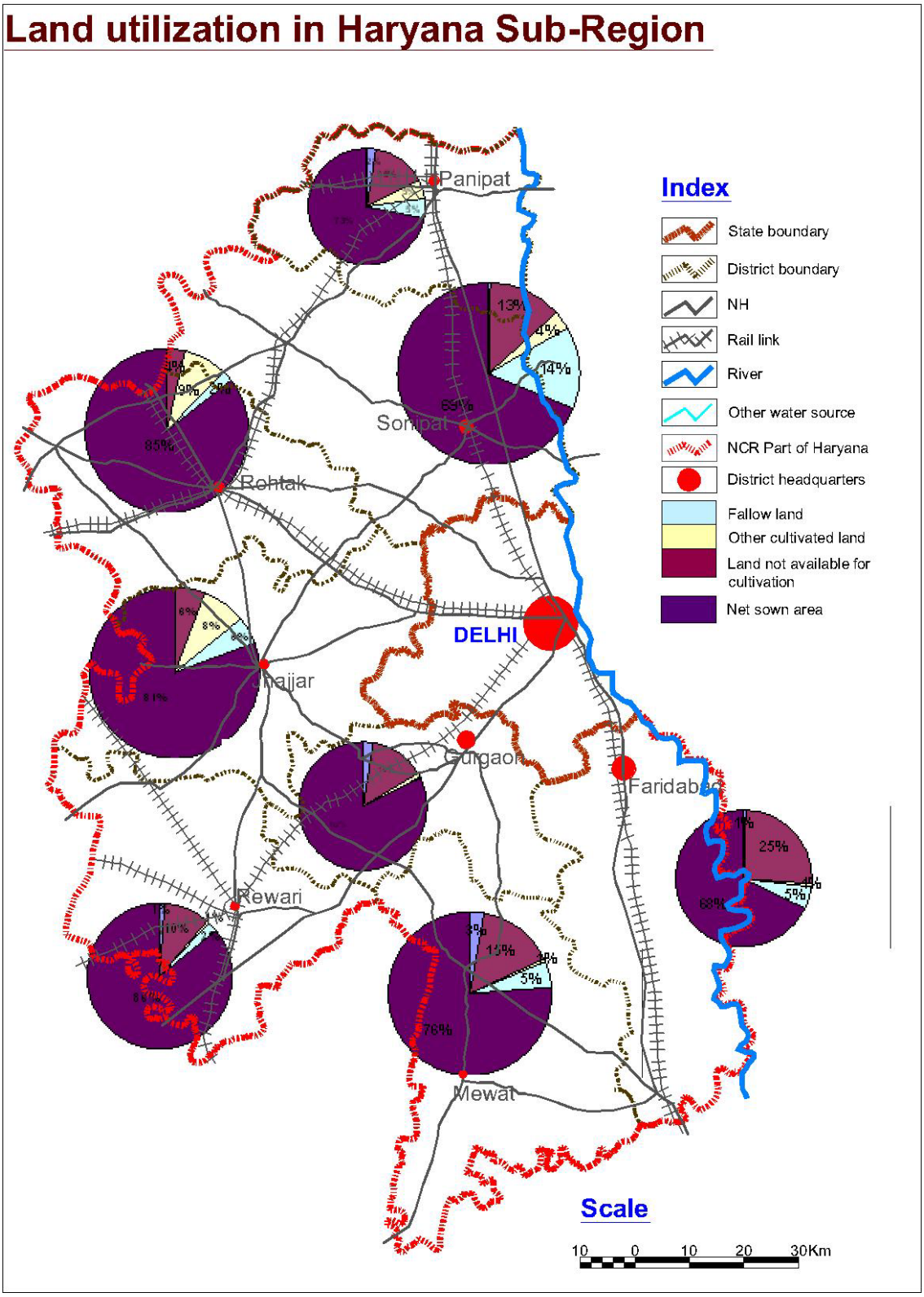
Table 13-7 : Districtwise Land utilization Area (ha.) for the Year 2006-2007

Name	Total area according to Village paper	Forests	Not Available For Cutivation			Other Uncultivated Land Excluding Fallow Land			
			Area Under Non Agri Uses	Barren & Un-Cultura ble Land	Total	Permanent Pastures & Other Grazing Lands	Land Under misc Tree Crops and Groves not Included in net Area	Cultura ble Waste Land	Total
	(1)	(2)	(3)	(4)	(5) = (3)+(4)	(6)	(7)	(8)	(9) = (6)+(7)+ (8)
Panipat	130000	3000	20000	1000	21000	4000	0	2000	6000
Sonipat	213000	1000	19000	8000	27000	2000	5000	1000	8000
Rohtak	167000	40	4000	2000	6000	3000	0	11000	14000
Jhajjar	191000	0	7000	4000	11000	0	0	10000	10000
Faridabad	172000	1000	40000	5000	45000	2000	0	0	2000
Gurgaon	120000	4000	31000	400	31400	1000	400	0	1400
Mewat	184000	5276	26000	11000	37000	1000	0	0	1000
Rewari	151000	1856	15000	4000	19000	1000	0	16000	17000

Name	Fallow Land			Net Area Sown	Total Cultura ble area	Area Sown More than Once	Total Cropped Area	Net Irrigated area	% to net area sown
	Fallow Lands Other than Current Fallows	Current Fallow	Total						
	(10)	(11)	(12) = (10)+(11)	(13)	(14) = (9)+(12) +(13)	(15)	(16) = (13)+(15)	(17)	(18)
Panipat	0	6000	6000	94000	106000	90000	184000	94000	100
Sonipat	0	19000	19000	158000	185000	130000	288000	152000	96.2
Rohtak	0	5000	5000	142000	161000	77000	219000	111000	78.2
Jhajjar	6000	5000	11000	159000	180000	80000	239000	114000	71.7
Faridabad	0	9000	9000	115000	126000	100000	215000	115000	100
Gurgaon	0	500	500	84000	85000	37000	121000	76000	90.5
Mewat	0	13000	13000	133000	147000	85000	218000	85000	63.9
Rewari	0	2000	2000	112000	131000	82000	194000	96000	85.7

Source : Statistical Abstract Haryana 2007-08

Map 13-1: Land Utilization map



The total cultivable land in the sub region is 1,124922 Ha. (83.77%). The Northern parts of the sub region consist of good agricultural land due to young fertile alluvial Plain, Marginal to good quality of ground water, network of irrigation, canals, tube wells and relatively better natural

drainage. Whereas on contrary the south west districts of the sub region i.e. Gurgaon and Rewari , due to lack of rainfall, poor irrigation facilities, poor ground water quality coupled with desertic terrine with sand dunes, results in relatively less cultivation during Kharif season.

13.2.4 Wastelands:

The major wasteland in the sub region are identified as

a) Gullied/ Ravenous land Shallow

b) Gullied/ Ravenous land Medium

c) Land with Scrubs

d) Land without Scrubs

e) Permanently water logged and Marshy Land

f) Seasonal water logged and Marshy Land

g) Land (Strongly) affected by salinity /Alkalinity

h) Land (Moderately) affected by salinity /Alkalinity

i) Land (Slightly) affected by salinity /Alkalinity

j) Sands (Flood Plain)

k) Sand Dunes (Semi stable to stab. Low<15m)

l) Sand Dunes (Closely spaced inter dune area)

The majority of stoney waste, salt affected lands associated with waterlogged areas are under wasteland category. The area under wasteland in the sub region is 57608 Ha. (4.29%). In Sub region they are mainly spread over the parts of districts of Gurgaon, Faridabad, Mewat and Jhajjar. Around 13% area of Gurgaon and Faridabad are under wasteland.

13.2.5 Built-up:

The land constituting 3 types of settlement in the sub-region namely high Dense, Medium Dense and Spare Dense areas. The high dense areas are generally limited to major towns and cities of Gurgaon, Faridabad, Panipat, Sonipat, Rohtak , Jhajjar, Mewat and Rewari. Medium dense are generally lies in the proximity of the high dense areas, whereas Spare dense areas include low density settlements such as villages. The areas such as Bahadurgarh, Gurgaon and Panipat are emerged as major Residential-industrial towns because of the proximity to Delhi. The Built-up percentage in the Sub region is 7.22%. Within last decades it is observed that the medium dense settlements grow rapidly within the proximity of the high dense settlements.

13.2.6 Water Bodies:

In Sub region the water bodies include Yamuna River, Lakes and Ponds. Yamuna River originates from Yamunotri Glacier in higher Himalayan ranges in Gharwal. Numbers of Lakes are also dappled in the Sub region; some of the famous lakes in the region are Sohna Lake (hot water Springs), Gurgaon, Kotladhar Lake, Mewat, Jahajgarh Lake, Jhajjar and Badkhal Lake, Faridabad. There are several numbers of Ponds in the Haryana sub region. The sub-region has 0.61% of land under water bodies

13.2.7 Others:

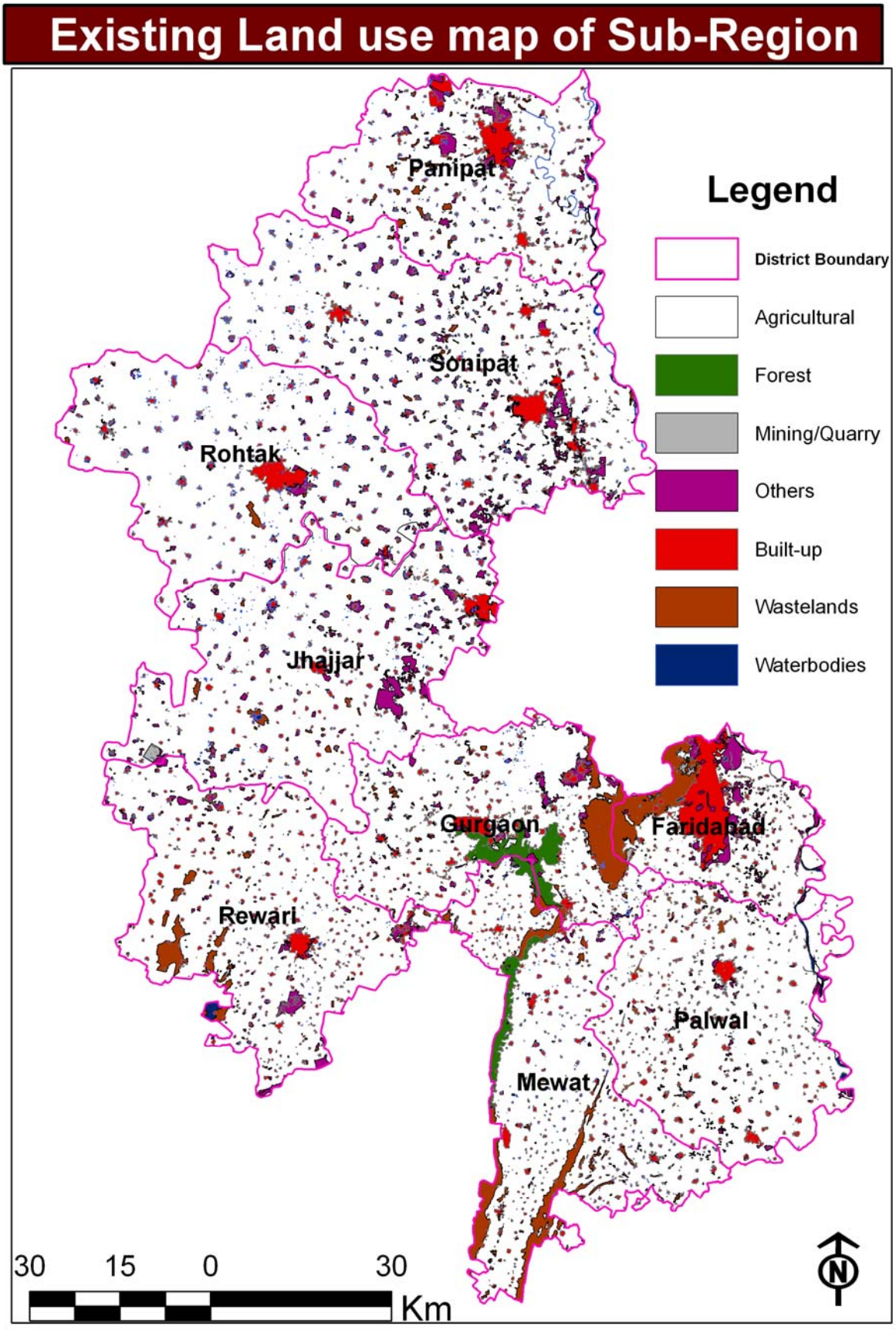
The other land consists of the lands under Mining use, Industrial affluent discharge lands and other miscellaneous used land. The sub-region is having around 0.28% area under this category.

Existing Sub Regional Land Use

The Existing Land Use for the sub region is prepared by satellite imageries for the year of 2008 and authenticated by various sources such as Statistical Handbook 2007-08, Wasteland atlas, Data from various government departments, GIS, Survey of India Toposheets, etc.

The below map is the existing landuse map of the Sub-region for the year of 2008.

Map 13-2: Existing Land use map

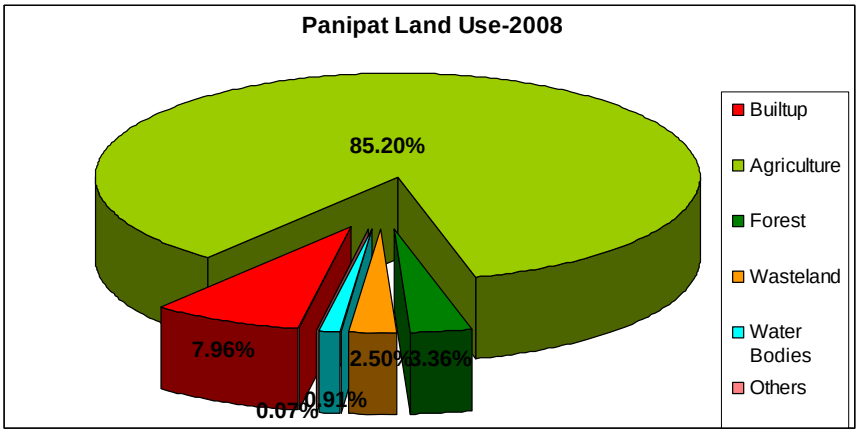


13.3 *District wise Land use distribution*

13.3.1 Panipat

Panipat lies in the medium fertility zone of the Sub region. There are Number of Textile and Food Processing industries in the Panipat District. The major portion of Land is covered under Agriculture (85.20%) which is around 3% more than the Sub-region agricultural land use average. The forest cover is 3.36% which is less than Sub-region average i.e. 3.83 % and it ranked 5th among the districts under per unit forest cover area in Sub Region.

Figure 13-2 : Land use distribution of Panipat



Land use	Area	Percentage
Built up	9881	7.96
Agriculture	105698	85.20
Forest	4175	3.36
Wasteland	3103	2.50
Water Bodies	1124	0.91
Others	82	0.07
Total	124063	100.00

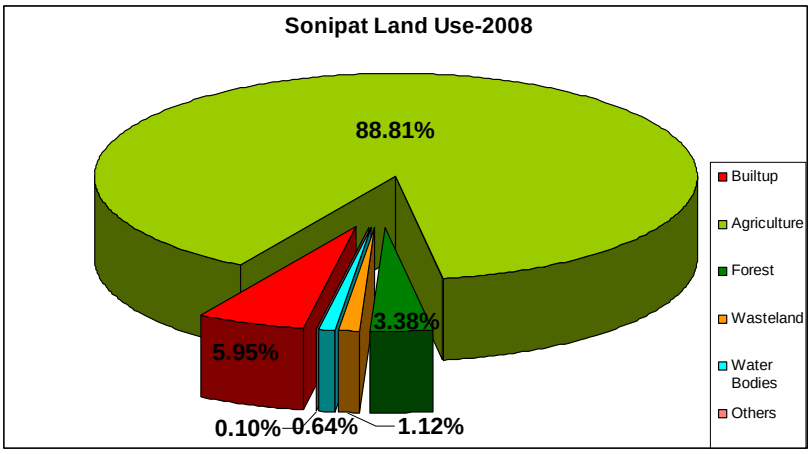
Built up: Panipat is accommodating 8.91% of the total Built up of Haryana Sub region and 3.18% of the total NCR.

13.3.2 Sonipat

Sonipat district falls under low to medium and medium fertile zone of the sub-region. It has around 89% land under agriculture. It has relatively average percentage of land under built up (6%) in comparison to other districts of sub-region. The forest cover is 3.38% which is less than Sub-region average i.e. 3.83 % and it ranked 4th among the districts under per unit forest cover area in Sub Region.

Land use	Area	Percentage
Built-up	12934	5.95
Agriculture	193099	88.81
Forest	7357	3.38
Wasteland	2441	1.12
Water Bodies	1388	0.64
Others	211	0.10
Total	217430	100.00

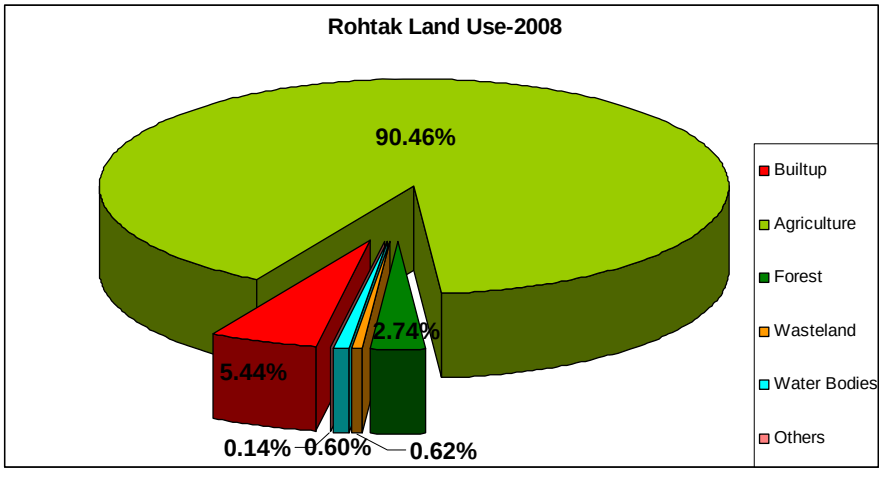
Figure 13-3 : Landuse distribution of Sonipat district



13.3.3 Rohtak

Rohtak district falls under low fertile zone of the sub-region but it has around 90% land under agriculture and land under built up is around 5.44%. It indicates although the soil is not fertile but due to less urban development maximum area is under agriculture. The forest cover is 2.74% which is very less than Sub-region average i.e. 3.83 % and it ranked 7th among the districts under per unit forest cover area in Sub Region. It indicates very poor condition of forest in the district.

Figure 13-4 : Landuse distribution of Rohtak district



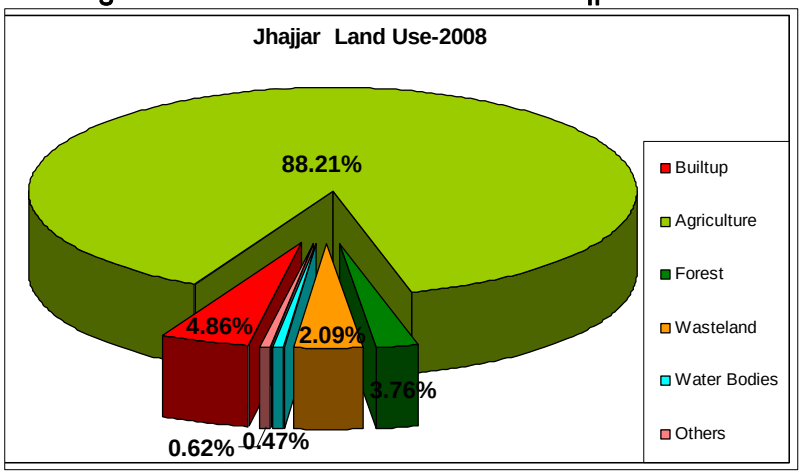
Land use	Area	Percentage
Built-up	9117	5.44
Agriculture	151519	90.46
Forest	4594	2.74
Wasteland	1038	0.62
Water Bodies	1006	0.60
Others	231	0.14
Total	167506	100.00

13.3.4 Jhajjar

Maximum part of Jhajjar district falls under low fertile zone of the sub-region. Only north eastern part of the district is under medium fertility zone. It has around 88.21% land under agriculture

and land under built up is around 4.86%. It indicates the district has very less urban development and it is mainly rural in nature. The forest cover is 2.09% which is very less than Sub-region average i.e. 3.83 % and it ranked 8th (second lowest) among the districts under per unit forest cover area in Sub Region. It indicates very poor condition of forest in the district.

Figure 13-5 : Landuse distribution of Jhajjar district



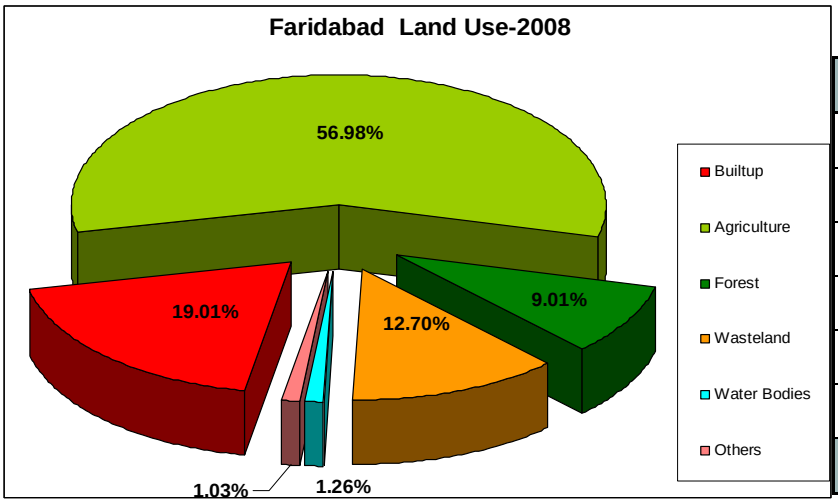
Land use	Area	Percentage
Built-up	9058	4.86
Agriculture	164520	88.21
Forest	3902	2.09
Wasteland	7004	3.76
Water Bodies	875	0.47
Others	1153	0.62
Total	186513	100.00

13.3.5 Faridabad

Eastern part of Faridabad district falls under low to medium fertile zone where as western part falls under poor fertile zone of the sub-region. It has around 57% land under agriculture and land under built up is around 19.01%. It indicates that the district is highly urbanized or non-agricultural activities are more prominent. In terms of per unit built-up area it ranked highest in the sub-region but in total it has second highest buit-up area in the sub-region. The forest cover is 9.01% which is higher than Sub-region average i.e. 3.83 % and it ranked 1th among the districts under per unit forest cover area in Sub Region. Faridabad district consists of Faridabad-Ballabhgarh urban complex widely spread on both sides of the Delhi-Mathura National Highway-2 (NH-2).

The perennial River Yamuna flows all along the eastern boundary of the Faridabad District. There are number of lakes and reservoirs such as the Suraj Kund and Badkhal Lake. The Suraj Kund is close to Delhi. In other words, it is about 18 km away from the Tughlaqabad which is located in south Delhi. It is a water tank which resembles to the Roman amphitheatre. It consists of a semi-circular stepped stone embankment to impound rain water from the hills. It's bed is about 130 meters in diameter. Almost touching it is a fresh water pond called Pea Cock lake surrounded by hillocks.

Figure 13-6 : Landuse distribution of Faridabad district



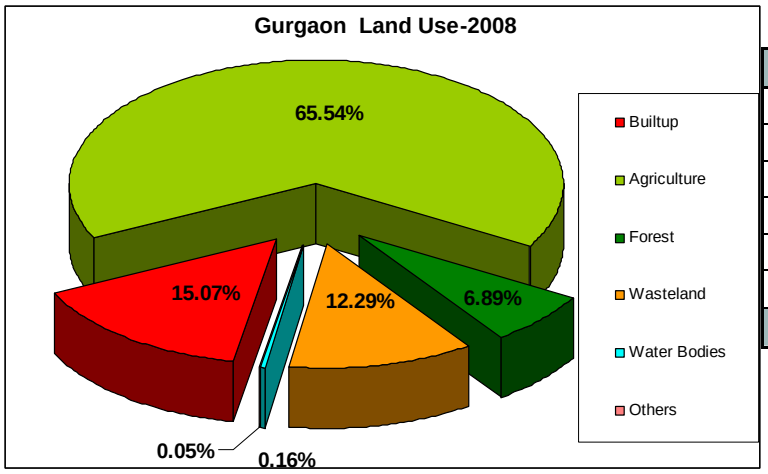
Land use	Area	Percentage
Built-up	13629	19.01
Agriculture	40858	56.98
Forest	6463	9.01
Wasteland	9110	12.70
Water Bodies	906	1.26
Others	739	1.03
Total	71705	100.00

The Badkhal Lake nestling amidst rocks to the west of Faridabad Old and northwest of Faridabad township. Badkhal lake is about 32 kms away from Delhi and 3.5 kms. away from Delhi-Mathura National Highway-2 (NH-2). The rain water harvest is done by joining toes of the two hillocks and by constructing a check dam which is 644.5 meters long and 6 meters wide. Thus, a beautiful lake was created on one side of the check dam while the rock remnants of the Aravalli Range on the other side presented a beautiful picturesque. The rocks and ridges surrounding the lake provide natural landscape with greenery of trees and shrubs. So, both the Suraj Kund and Badkhal Lake are connected through a six kilometers inner forest road.

13.3.6 Gurgaon

Maximum part of Gurgaon district falls under low and poor zone. It has around 65.54% land under agriculture and land under built up is around 15.07%. It indicates that the district is highly urbanized or non-agricultural activities are more prominent. In terms of per unit built-up area it ranked second highest in the sub-region but in total it has highest buit-up area in the sub-region. The forest cover is 6.89% which is higher than Sub-region average i.e. 3.83 % and it ranked 2nd among the districts under per unit forest cover area but in total area cover it has highest area under forest in Sub Region. Gurgaon district consists of Gurgaon-Manesar urban complex which cover around all area of Gurgaon tehsil.

Figure 13-7 : Land use distribution of Gurgaon district

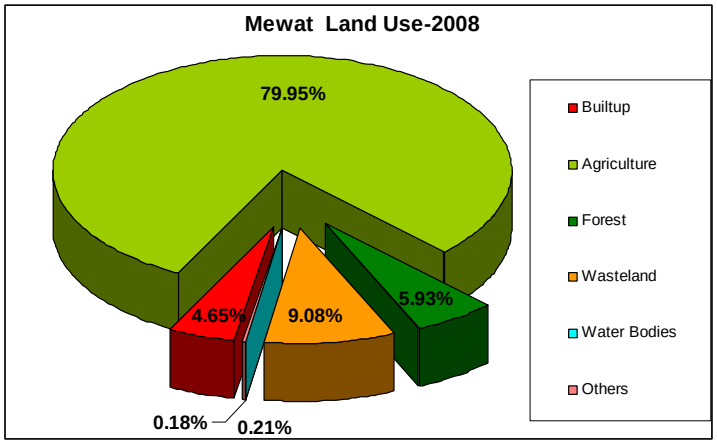


Land use	Area	Percentage
Built-up	19448	15.07
Agriculture	84595	65.54
Forest	8889	6.89
Wasteland	15866	12.29
Water Bodies	210	0.16
Others	62	0.05
Total	129069	100.00

13.3.7 Mewat

All most all part of Mewat district falls under poor fertile zone of the sub-region. It has around 80% land under agriculture. Land under built up area is around 4.65% which is lowest in terms of per unit land or even in total land under built-up area in the sub-region. It indicates the district has very less development either in terms of agriculture or in terms of urbanization. It is mainly rural in nature. The forest cover is 5.93% which is higher than Sub-region average i.e. 3.83 % and it ranked 3rd highest among the districts under per unit forest cover area.

Figure 13-8 : Land use distribution of Mewat district



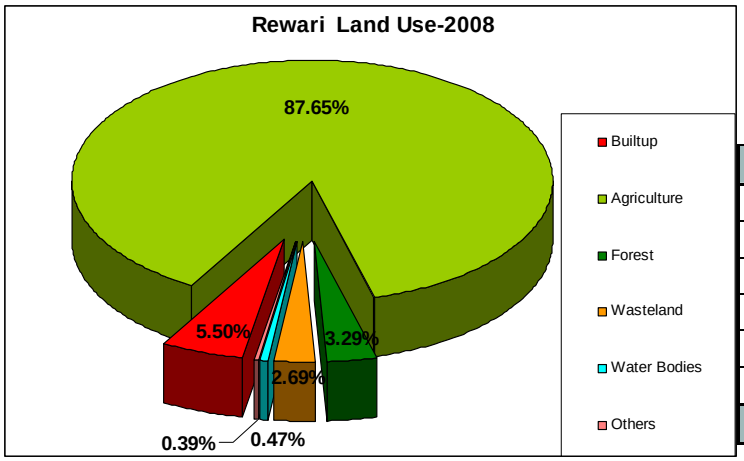
Land use	Area	Percentage
Built-up	6938	4.65
Agriculture	119252	79.95
Forest	8841	5.93
Wasteland	13545	9.08
Water Bodies	308	0.21
Others	265	0.18
Total	149150	100.00

13.3.8 Rewari

All most all part of Rewari district falls under poor fertile zone of the sub-region. It has around 87.65% land under agriculture. Land under built up area is around 5.50% which is 5th lowest in terms of per unit land and 3rd lowest in terms of total land under built-up area in the sub-region. It indicates the district has very less development in terms of urbanization. It is mainly rural in

nature. The forest cover is 3.29% which is lower than Sub-region average i.e. 3.83 % and it ranked 4th lowest among the districts under per unit forest cover area in Sub Region.

Figure 13-9 : Land use distribution of Rewari district

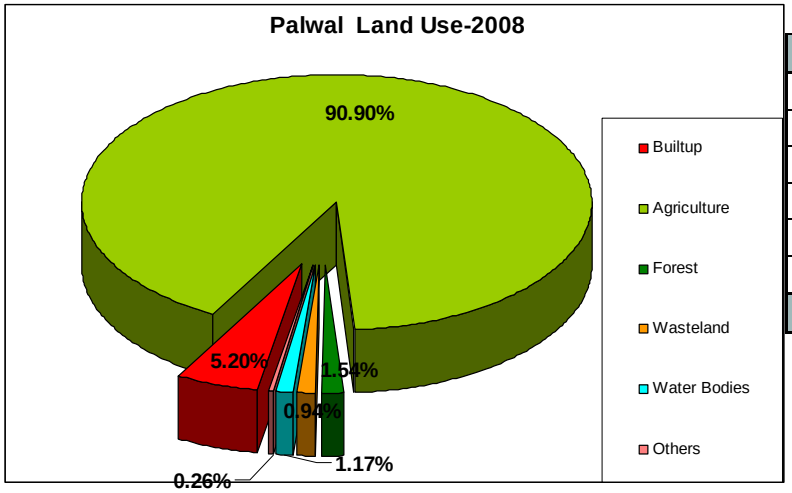


Land use	Area	Percentage
Built-up	8499	5.50
Agriculture	135325	87.65
Forest	5077	3.29
Wasteland	4156	2.69
Water Bodies	730	0.47
Others	602	0.39
Total	154389	100.00

13.3.9 Palwal

Palwal is also less developed district in the sub-region in terms of urbanization. It has around 90% area under agriculture. It has least area under forest cover either in terms of per unit area or in terms total area under forest. Only 1.54% area is under forest cover which is almost null for the region.

Figure 13-10 : Land use distribution of Palwal district



Land use	Area	Percentage
Built-up	7436	5.20
Agriculture	130056	90.90
Forest	2197	1.54
Wasteland	1344	0.94
Water Bodies	1673	1.17
Others	369	0.26
Total	143075	100.00

Table 13-8 : Detailed Land use break up of Haryana Sub-Region

District	Builtup		Agriculture		Forest		Wasteland		Water Bodies		Others		Total	
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
Panipat	9881	7.96	105698	85.20	4175	3.36	3103	2.50	1124	0.91	82	0.07	124063	100.00
Sonipat	12934	5.95	193099	88.81	7357	3.38	2441	1.12	1388	0.64	211	0.10	217430	100.00
Rohtak	9117	5.44	151519	90.46	4594	2.74	1038	0.62	1006	0.60	231	0.14	167506	100.00
Jhajjar	9058	4.86	164520	88.21	3902	2.09	7004	3.76	875	0.47	1153	0.62	186513	100.00
Faridabad	13629	19.01	40858	56.98	6463	9.01	9110	12.70	906	1.26	739	1.03	71705	100.00
Gurgaon	19448	15.07	84595	65.54	8889	6.89	15866	12.29	210	0.16	62	0.05	129069	100.00
Mewat	6938	4.65	119252	79.95	8841	5.93	13545	9.08	308	0.21	265	0.18	149150	100.00
Rewari	8499	5.50	135325	87.65	5077	3.29	4156	2.69	730	0.47	602	0.39	154389	100.00
Palwal	7436	5.20	130056	90.90	2197	1.54	1344	0.94	1673	1.17	369	0.26	143075	100.00
Sub-Region Total	96940	7.22	1124922	83.77	51496	3.83	57608	4.29	8220	0.61	3714	0.28	1342900	100.00

Table 13-9 : Ranking of districts in various Land uses per unit area in Haryana Sub-Region

District	Builtup			Agriculture			Forest			Wasteland			Water Bodies			Others			Total
	Total area	Area per Ha	Rank	Total area	Area per Ha	Rank	Total area	Area per Ha	Rank	Total area	Area per Ha	Rank	Total area	Area per Ha	Rank	Total area	Area per Ha	Rank	
Faridabad	13629	0.190	1	40858	0.570	9	6463	0.090	1	9110	0.127	1	906	0.013	1	739	0.010	1	71705
Gurgaon	19448	0.151	2	84595	0.655	8	8889	0.069	2	15866	0.123	2	210	0.002	9	62	0.000	9	129069
Panipat	9881	0.080	3	105698	0.852	6	4175	0.034	5	3103	0.025	6	1124	0.009	3	82	0.001	8	124063
Sonipat	12934	0.059	4	193099	0.888	3	7357	0.034	4	2441	0.011	7	1388	0.006	4	211	0.001	7	217430
Rewari	8499	0.055	5	135325	0.877	5	5077	0.033	6	4156	0.027	5	730	0.005	6	602	0.004	3	154389
Rohtak	9117	0.054	6	151519	0.905	2	4594	0.027	7	1038	0.006	9	1006	0.006	5	231	0.001	6	167506
Palwal	7436	0.052	7	130056	0.909	1	2197	0.015	9	1344	0.009	8	1673	0.012	2	369	0.003	4	143075
Jhajjar	9058	0.049	8	164520	0.882	4	3902	0.021	8	7004	0.038	4	875	0.005	7	1153	0.006	2	186513
Mewat	6938	0.047	9	119252	0.800	7	8841	0.059	3	13545	0.091	3	308	0.002	8	265	0.002	5	149150

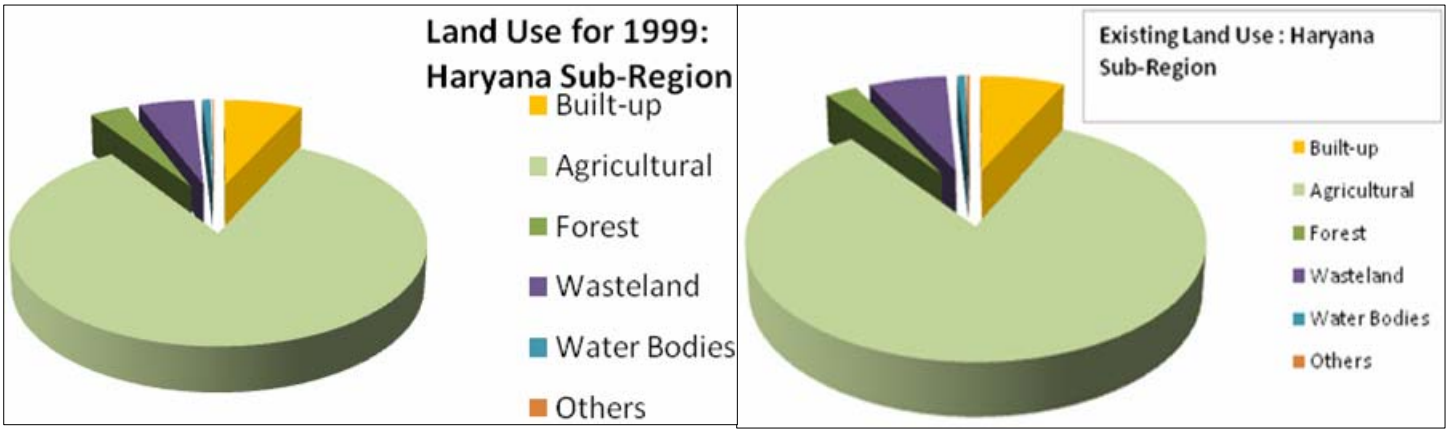
13.4 *Land use Change Analysis*

The existing land use has been prepared based on the satellite data and google earth for the year of 2008. The NCR Planning Board used satellite date for the whole NCR for March 1999. A comparative analysis of the land use data for the year of 1999 and 2008 has been undertaken and is indicated in the table below.

Table 13-10 : Land use change analysis

Classification	1999		2008	
	Area (Hec)	Percentage (%)	Area	Percentage (%)
Built-up	93597	6.98	96940	7.22
Agricultural	1123017	83.73	1124922	83.77
Forest	46002	3.43	51496	3.83
Wasteland	66392	4.95	57608	4.29
Water Bodies	9953	0.74	8220	0.61
Others	2339	0.17	3714	0.28
Total	1341300	100.0	1342900	100.0

Figure 13-11 : Graphs showing distribution of landuse in 1999 and 2008



There is very minor land use changes have been observed during 1999-2008. However Major changes have been observed in the case of built-up, waste land, water bodies and forest cover.

Agricultural: The agricultural use which includes cultivated land, fallow, plantation, farm house and horticulture, was constitutes of about 83.73% in 1999. The land use change analysis reveals that there is no change of agricultural land is observed during the periods 1999-2008, indicating a positive sign to the agricultural sector in the sub-region, especially considering the changes observed during 1986-1999. At that time approximately 8% decline in agricultural use was observed. Agriculture has been one of the prime contributor s in the state economy.

Built-up: There are marginal amount of increase in built-up area observed during 1999-2008. The built-up area has increased nearly 0.25% and stands at 7.22%. Considering the urbanization trends it may appears unusual. This is mainly attributed that huge land parcels were considered as built-up area in anticipation of population growth during 1986-1999. The built-up area increased nearly 166% by conversion of agricultural land.

Wastelands: The wastelands accounted for 4.95% of total area in 1999, which decreased substantially by 20,000 hectares, recording an increase of more than 0.66% in a span of 9 years. This is mainly attributed towards conversions of forest, water bodies into waste land.

Forest: The analysis indicates a marginal decrease of 0.7% in the forest cover during 1999-2008. There is a dire need to substantially increase the forest cover in order to improve the environmental conditions, particularly the ridge/undulating areas of the sub-region as well as both within the large settlement in the form of city forest and on their periphery as protective buffer.

13.5 *Proposed Land Use:*

13.5.1 Introduction

The state has observed an increasing rate of urbanization, which leads towards one of the most urbanized states in the country. More preciously the sub-region accounts maximum level of urbanization in the state, which is mainly attributed towards close proximity and better connectivity with New Delhi. As per the population projection the sub-region is expecting to

accommodate 1 crore population in the urban centers by the year of 2021. This accounts approximately 70 lakh additional population in the urban centers. Realizing the fast urbanization in the sub-region the following density norms to be adopted with control regulation.

Urban Centers with Population	Persons/Hectare
Below 50,000	60-80
50,000-1,00,000	80-100
1,00,000-5,00,000	110-125
5,00,000-10,00,000	125-150
10,00,000-50,00,000	150-200
More Than 50,00,000	200-250

The govt. of Haryana has proposed a uniform density limit of 100-120 persons per hectare for all the major towns in the sub-region. This can be considered to be a good move in order to control the haphazard urbanization and achieve the regional balance.

13.5.2 Important Factors of Land use Plan

Land Capability

It indicates the physical potentials of each parcel of land in terms of physiography, geology, pedology, drainage and vegetation etc, classified by NBSS and LUP. Land capabilities are divided into 8 sub classes - the first four classes describe the land which can be utilised for agricultural purposes and next four criteria describe the non agricultural categories.

Carrying Capacity of Land

The carrying capacity of land indicates production capacity of land compared to the demand of population. In other words it reflects the population supporting capacity of land which takes care of the natural production system.

Settlement Hierarchy

The concept of settlement zone is applied in a wider perspective so as to include the residential, commercial, institutional, recreational, cottage and service industrial uses, open space, playgrounds etc., which may be permitted from the planning point of view. The settlement zone conforms to the traditional pattern of development blending at the same time the compactness as well as contiguity for planning purposes. Adequate settlement area has to be earmarked in order to cater to the needs of projected population by 2011 A.D. at a desirable density. Also ultimate impact of human activities evolved in a range of human habitations basically divided into rural and urban types which have further hierarchies as per the population and availability of infrastructure facilities. For the sustainable land use pattern the hierarchy of settlements should be equitably distributed over the region (Refer Chapter 3).

Ecological Balance

The landuse can be sustained for a long period if the development activities maintain a balance in the environment. This concept emerges because any development activity on the land tends to interfere and change its natural set up. If these human impacts become too dominant then it results in environmental degradation and natural hazards. To avoid these a proper harmony should be maintained between nature and needs of development.

Water Management

Water is a basic human need so a proper water management is also an integral, subsidiary part of landuse. For water management total water resources has to be assessed and its proper allocation is to be decided which needs not only networking but also proper tapping and storage of water in form of reservoirs, tanks, canals etc.

13.5.3 Estimated Land Requirement:

We have estimated the land required for industries, housing and social infrastructure for year of 2021, which comes close to 20675 hectare for industrial development and 10,500 hectare for housing and social infrastructure development.

Category	Land required (Ha)
Industrial	20675
Housing (Urban)	7992
Social Infrastructure (Education & Health)	2506

The existing and proposed built-up areas have to be regulated and guided by their Master/Development Plans of urban centers. It is strongly recommended that all the urban centers should revise their respective master plan for 2021. The Master Plan should accommodate the land for housing and necessary social and physical infrastructural provisions for the estimated additional population. All the urban centre should compliant with the density norms mentioned in the above table. All the revised Master Plans for the urban centers should ensure that the proposed development would not be permitted in the national conservation zones (if any), planned green areas, agricultural areas (especially double cropped nature), ground water recharging areas and water bodies. Land also is reserved for the basic activities such as disposal of solid waste generated from the respective centers, utilities services such as power plant, grid station, water and sewage treatment plants, urban transport system etc.

13.5.4 Major consideration of Sub-Regional Land Use for 2021

- **Built-up Area:** In order to accommodate the proposed development with the name of built-up land classification, top priority will be given to convert waste land and non fertile agricultural land. First the review of proposed master plans of different urban centers and proposed KMP cities and townships, should be conducted to accommodate the land required for additional population and future industrial development.

  The report covers a detailed analysis of most suitable land for industrial development however it is also recommended that a synchronized approach of identification of industrial estate is required. The state nodal agency HSIIDC has already identified the industrial estate and centers anticipating the proposed industrialization. It is recommended that proper utilization of these industrial estates is required in order to establish an efficient land use in the sub-region.

- **Forest Land:** Development of forest resources is of vital importance in preserving the environment and eco-system which greatly influences the climate pattern for better. Their presence is also essential as a safeguard against flood and erosion.

  The existing land under forest in Sub-Region covers 3.83% (51496 Ha), which less than the other regions of NCR. Viewing the situation of the forests in the sub-region with reference to the National Forest policy, special attention would be required to increase the forest cover under protected, reserved and social forestry in the areas not fit for agricultural use. A detailed study need to be conducted in consultation with the concerned departments of the Centre/State Government to ascertain the barren lands, rocky areas and water logged areas. The efforts should be made continuously to redensify the depleted forest cover and regularize the use of forest product to establish a balance between afforestation and cutting of forests.

  In the proposed land use, the special emphasis has been given to convert the waste land in to forest cover. Proper action plan in district level is required to implement the program. As a result the forest cover can be increased up to 3.25% and reach at 7.07%. However the state forest policy aims at achieving 20% of forest cover by 2021. This would be a challenging task considering the provisions available in the existing land use and the time frame. Special adjustment needs to be considered between unused agricultural land especially fellow land, unfertile agricultural land in the district like Palwal, Jhajjar, Mewat etc.

  To achieve the sub-regional forest cover of 20% by 2021, the govt. should initiate a sub-regional level social forestry program and specific budgetary allocation should be available to implement the program. The following recommendation is being suggested to increase the forest cover;

  a) To promote the passive recreational centre it is recommended to adequate area in suitable location should be developed as Sub-regional Park. This area should be developed under Social Forestry Program.

  b) One of the major natural features in the sub-region are the ridge, an extended part of the Aravalli range and bird sanctuary like Sultanpur. The Sanctuaries are harboring a

large number of wild animal and birds. The ridge areas and the sanctuaries should be conserved with utmost care and should be afforested with suitable species.

c) It is also suggested that, the fellow lands, where no agricultural activities have been taken place since two or three consecutive years should be covered with proper plantation to increase the forest cover in the sub-region.

d) It is strongly recommended to increase the green cover along transportation corridor (i.e. railway, national highway, expressway etc) and should be protected under the management of forest department. This would increase the forest cover in the sub-region.

- **Agricultural Land:** The demand of agricultural production is directly correlated with the growth rate of population. With the increased rate of urbanization, the sub-region will witness an increased demand of food. Therefore it is most essential to preserved the resources i.e. land for agricultural use.

  In view of the anticipated changes in land use, there would be a major impact on land requirement of agricultural sector. To the extent that new employment opportunities are proposed in non-agricultural sector in the region and consequent concentration of population, the urban expansions would have to be largely met from agricultural and other non-urban uses. It is however necessary to institute measures for the protection of prime agricultural land and to ensure against its needless conservation.

  In the proposed land use plan, a higher consideration has been given to preserve the agricultural land as much as possible through utilization of waste land and unfertile agricultural land for likely urbanization.

- **Water Bodies:** In the Sub-Region the water bodies includes Yamuna River, Lakes (such as Sohna Lake, Badkhal Lake etc) and Ponds. The area under water bodies in the Sub-region covers 0.61% of total land, which is estimated at 8220 Ha. These water bodies should be preserved and conserved with sustainable manner. No development would be allowed in the forms of reclamation of water. Especial regulatory body can be created to preserve the water bodies. It is strongly recommended to create Lake Development Authority to preserve the water bodies/wet land in the sub-region. A comprehensive plan for

restoration and rehabilitation of all existing water bodies (especially lakes, ponds etc) in the sub-region is urgently required.

- **Master Planning for Rural settlement:** This is a significant task to regulate the haphazard development especially for the settlement those are coming under buffer areas of conservation zones like Rivers, water bodies, forest, Hills etc. These rural settlements should be controlled so that the further expansion and haphazard development cannot take place. The various ties of Panchaya Raj Institution need to take appreciate measure and this has be incorporated their list of obligatory functions.

- There should be no settlement, economic activities such as mining, industry etc. in the catchment areas of irrigation projects to prevent the quality of water, soil erosion, and retention of soil cover.

- Multiple use of land should be encouraged such as forestry and tourism

  Agriculture and tourism

  Agriculture and pisciculture

  Social forestry and fodder cultivation

  Agriculture and horticulture

- A scientific land management programme which includes soil conservation and afforestation to mitigate the environment impact of mining activities like pollution of land, water, air and degradation of good agricultural land.

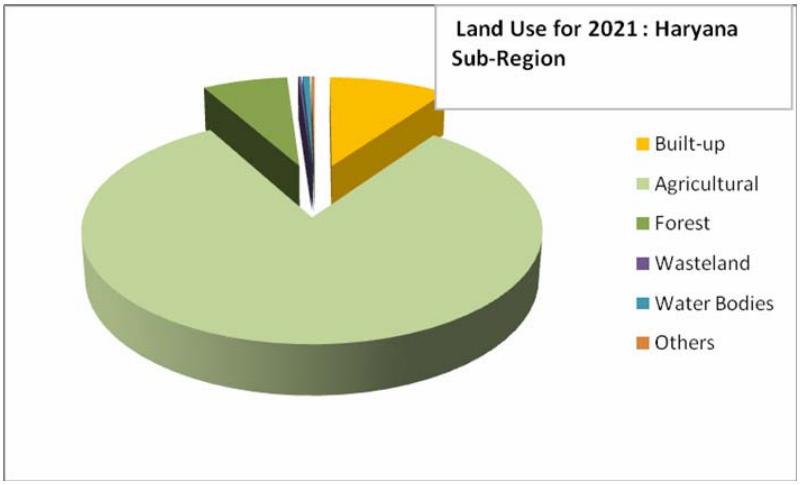
- There should be compactness rather than haphazard and scattered development of rural settlements.

Table 13-11 : Proposed Land Use

Classification	2021	
	Area	Percentage (%)
Built-up	132788.95	9.89
Agricultural	1099827.73	81.90

Forest	95077.32	7.08
Wasteland	3271.99	0.25
Water Bodies	8220	0.61
Others	3714	0.28
Total	**1342900**	**100**

Figure 13-12 : Graph of Proposed Land use for 2021



13.5.5 Land Use Control: Zoning Regulation

Considering the rapid urbanization and the adverse consequences to the environment, zoning regulation is a legislative tool to ensure orderly development in the use of land and building. These zoning regulations have to be designed, keeping in view the function and the population assigned and the desired character to be achieved by induced development in the Sub-region and the settlements designed.

At the sub-regional plan level, land use may be guided and regulated in selected areas; especially the urban centers will be dealt in the lower hierarchy plans like Master Plans, Action Area Plan/Community Plans and Estate Plans etc. Such areas should considers the aspects of planned development & conservation in the patches of green areas, highly dense areas, water bodies etc to ensure an overall physical form with adequate lunge spaces judiciously located everywhere, from densely built-up areas to peripheral areas of the open countryside.

As per NCR Regional Plan-2021, four broad zones have been identified and analyze to implement zonal regulation.

1. **Controlled / Development/regulate Zone:**

(a) Urbanisable Areas (including existing built-up/urban areas)

The urbanisable areas should be controlled as per the approved Master/Development Plan of respective town/urban centers. Within the Urbanisable area proposed in the Master/Development Plan of the respective towns, the functions and uses designated are prescribed:

- Residential
- Commercial
- Industrial
- Government offices, public and semi-public
- Recreational
- Utility services
- Transport and communications
- Open spaces, parks and playgrounds
- Graveyards/cemeteries and cremation ghats
- Man-made heritage areas
- Natural heritage areas/eco-sensitive areas/conservation areas

The local authority according to the prescribed uses in the Master/Development Plans will govern detailed land uses within the Urbanisable area. The Master/Development Plans of all the towns will be prepared within the framework of the Regional Plan – 2021 and Sub-regional Plans. In case any amendment is required in the acts to implement the policies of Regional Plan – 2021 that be done by the respective State Governments appropriately.

It is recommended that, it must be made mandatory that all new projects in the commercial, housing and industrial sector should include rain water harvesting in their schemes. The Master/Development Plans of all the towns should adapt the provision as mandatory.

(b) Agriculture (Rural) Zone within Controlled/Development / Regulated Areas

Special consideration needs to be taken by the local urban bodies (LUBs) to control the area. The Master/Development Plan of each town should cover the zoning regulation and development guild line aspects to achieve the sustainable growth of the towns. As per recommended in the NCR Regional Plan-2021, within the zone the functions and uses designated are prescribed;

- Agricultural, horticultural crops and cash crops
- Dairy and poultry farming including milk chilling station and pasteurization plants
- Social forestry / plantations including afforestation
- Non-polluting industries registered as RSI/SSI units subject to one of the following conditions:

o Located within half kilometer belt encircling the existing village abadi and approachable from a public road/rasta other than scheduled road, national highways and state highways

o On public road/rasta not less than 30 feet wide other than schedules roads national highways and state highways outside the half kilometer zone referred to in above up to a depth of 10 meters along the approach road.

- Non-polluting agro-based industries on public roads/revenue rasta not less than 30 feet wide other than scheduled roads, National Highway and State Highway.
- The site should not fall within 900 meters restricted belt around defence installations.
- Land drainage and irrigation by hydro-electric works and tube well for irrigation
- Sanitary landfill, compost processing plant and other such activity sites with adequate protected belt as prescribed in the CPHEEO Manual of the Ministry of Urban Development and Poverty Alleviation and the notifications issued by the Ministry of Environment and Forests from time to time.

- Mining and extraction operations including lime and brick kilns, stone quarries and crushing subject to the rules and approved site.
- Bus queue shelter and railway station.
- Airports with necessary buildings
- Wireless Station
- Grain godowns, storage spaces at site approved by competent authority
- Weather station
- Telephone and electric transmission lines and poles
- Cremation and burial grounds
- Fuel filling station, Service stations and repair workshops
- Power plant/sub-station/water works/treatment plants and other utility services
- Storage godowns for inflammable petroleum products such as LPG, petrol, diesel, kerosene, aviation turbine fuel, light diesel o8il and other petroleum products and lubricants with the approval of the competent authority
- Village houses within abadi-deh
- Farm houses outside abadi-deh, and
- Expansion of existing village contiguous to abadi-deh including social institutions like schools, dispensaries, veterinary centers and police posts strictly for the requirements of the village and located within 500 meters of the abadi-deh, if undertaken as a project approved or sponsored by the Central Government or State Governments.
- Recreational/tourist facilities not more than 4.5 meters height, FAR not exceeding 5% of the plot areas.

(c) Green buffers

The green buffers along the transportation corridors should be maintained and regulated as per the provisions of the respective Master/Development Plan of the towns.

Table 13-12 : Proposed buffers along Transportation Network

Transportation Network	Buffer (meters)-Distance from the either side of ROW
Expressway/Bypass	100
National Highway	60
State Highway	30
Railway Line	30

It is strongly recommended to increase the green cover along transportation corridor (i.e. railway, national highway, expressway etc) and should be protected under the management of forest department. This would increase the forest cover in the sub-region.

However the following soft development may be permitted as per the existing development regulation of the Master Plan.

- Approach / service roads
- Agriculture and horticulture
- Social forestry/plantations including afforestation
- Fuel filling stations
- Toll Plaza, bus queue shelters, police boot, first aid centers and telephone booth

2. Highway Corridor Zone

The Highway Corridor Zone will have to be notified controlled /development /regulated area and master/Development Plans will have to be prepared accordingly. In the Highway Corridor Zone (excluding green buffers along highways, activities permitted in 'Urbanisable area') Zoning Regulations will be permitted through Master/Development Plans. The competent authority will regulate access to the expressways and highways.

In the sub-regional plan, it is recommended to control the areas of 500 meters on either side of the ROW of the highways in the name of Highway Corridor Zone.

Theme based eco development is being recommended to be considered along the corridor zone. District level action plan/development plan needs to be prepared by the District Planning Committee. However the primary focus of development should be given for large scale social forestry program with community level participation especially in management part.

Agro based industry, agricultural outlets/market, horticulture and social forestry would be given higher priority for these zones. In order to promote tourism and increase forest cover in the region, theme based Regional Park; botanical garden etc should be incorporated along Highway Corridor Zone.

The following uses/activities may be permitted;

1. Non polluting ago based industry
2. Agricultural outlets/market specially close to the major town
3. Horticulture & social forestry
4. Promoting eco-tourism: Theme based regional park
5. Botanical Garden
6. Social fishery
7. Highway Tourism
8. Educational Institute

It is strongly recommended that, large scale industrial (especially polluting) and commercial activities would not be permitted within the zone.

3. Natural Conservation Zone:

This zone refers the environmentally sensitive areas including extension of Aravalli ridge, forest areas, the rivers and tributaries, sanctuaries, major lakes & water bodies etc. These areas have been demarcated as Natural Conservation Zone. These areas should be well preserved and protected. These areas should be kept away from any urbanisable development. In order to preserve these areas and regulate the surrounding development, buffers of suitable distance have been proposed in the form of green belt. The dimensions of buffers are recommended as below;

Table 13-13 : Proposed buffers around conservation area

Areas	Buffer (meters)-distance from either side
River	2000
Lake & Ponds	50
Conservation areas like Aravalli ridge, forest area and sanctuaries	1000

No development of any kind shall be permitted in these areas and no change of land use permissions under the Punjab Scheduled Roads and Controlled Areas Restriction an Unregulated Development Act, 1963 shall be permitted.

In this zone the following uses activities may be permitted:

- Agriculture and horticulture
- Pisiculture
- Social forestry/plantations including afforestation
- Regional recreational activities with no construction exceeding 0.5% of the area with the permission of the competent authority.

There are numbers of villages are falling under these buffer zone, especially in the district in Mewat, Gurgaon, Faridabad and Rewari. A detailed study on spatial planning regulation is required for those villages in order to control further expansion. The district Planning Committee should be in place to take care rural spatial development. There are few towns are partially also falling at one side under the buffer zone including Sohna, Faridabad, Kharkhoda. The future expansion of these towns/cities should guide accordingly so the conservation zone is protected.

4. Agriculture (Rural) Zone outside Controlled / Development / Regulated Areas

In the agriculture (rural) area zone outside controlled/development/regulated areas the following activities / uses may be permitted in addition to the activities / uses permitted in the "agriculture zone within controlled / development / regulated area' as indicated:

- Intensive agriculture and allied activates such as dairying and poultry farming
- Afforestation especially on the wastelands and barren lands
- Regional recreational uses such as, regional parks, wildlife sanctuary etc.
- Cemeteries, schools, hospitals, etc
- Quarrying
- Brick kilns
- Existing village Mandis / agricultural markets
- Rural industries

It is recommended that the land use change for commercial activities should be restricted and controlled. The rural settlements should be controlled so that the further expansion and haphazard development cannot take place; especially those are falling under conservation buffer zones. The various ties of Panchaya Raj Institution needs to take appreciate measure and it is recommended to prepare a spatial plan (Master Plan) to restrict the haphazard development.

A spatial buffer of 50 meters has to be demarcated in each village for the provision of future expansion. However the villages which fall under environmental sensitive areas, the further expansion should be restricted.

13.5.6 Recommendation for peri-urban areas:

The rapid expansion of peri-urban areas presents both opportunities and enormous challenges for urban and rural Sustainability. The peri-urban interface is characterized by a co-existence of urban and rural activities and institutions. It is increasingly recognized not solely in spatial terms, but in terms of dynamic flows of commodities, capital, natural resources, people and pollution as well as the intensification of urban/rural linkages. It is often seen as a transition zone, where particular (often conflicting) pathways for development are considered inevitable, yet predictions are that peri-urban areas are expanding rather than diminishing.

The ambiguity of the peri-urban interface, which is split between urban and rural jurisdictional boundaries, presents significant governance challenges. There are often contradictory or absent regulatory frameworks, contradictory technology arrangements and poor health, water and sanitation service provision.

Table 13-14 : Major peri-urban areas in the sub-region

Major City/Town	Nearby Settlements
Gurgaon	Daulatabad
	Basai
	Garauli
	Kherki Daula
	Badshahpur
	Wazirabad
	Chakalpur
Faridabad	Sihi
	Barauti
	Tilpat
	Barkhal
	Ankhi
	Unchagaon
Panipat	Nurwaja
	Kabri
	Siwah
Rohtak	Bohar
	Sunai

There are numbers of such areas especially near to the town such as Gurgaon, Faridabad, Rohtak, Panipat have not even basic level of physical infrastructure facilities. These areas should come under the jurisdiction of ULBs and essential physical infrastructural facilities should be made available.

Chapter 14 : Projects, Proposals and Recomendations

14.1 *Integrated Development of Haryana Sub-region*

In the globalize world of today, it is imperative to have high speed connectivity, world class infrastructure and an enabling environment to attract investment in any potential area. Accordingly DMIC Development Corporation envisaged Dedicated Freight Corridor (DFC) based development of its influence area and Haryana government's proposals of KMP & Orbital rail in the Haryana Sub-region of NCR stimulated the transit oriented development.

The vision for the Sub-Region is to create strong economic base and infrastructure keeping in view the highly potential agriculture land, scarce water resoureces, environmentaly sensitive areas and balanced and sustainable regional development of the region.

In order to fulfil the vision and realize the full potential of DFC, KMP and Orbital corridor it is important to have an integrated approach wherein, Nodes (all IAs/ IRs and Urban Centres) Networks (railways, highways & power lines) and Area - the geographical space within which the envisaged activity nodes and networks function, are planned together as inter-related aspects with efficient physical and functional linkages. Thus, the Haryana Sub-regional Plan has to have following as parts of the whole plan, in its integrated approach:

- Connectivity (with its nodes, modes and networks)
- Economic activities (Industrial estates development)
- Logistic hubs
- Infrastructure (physical, social and economic)
- Environment (environment sustainability)

14.2 *Spatial Development Strategy*

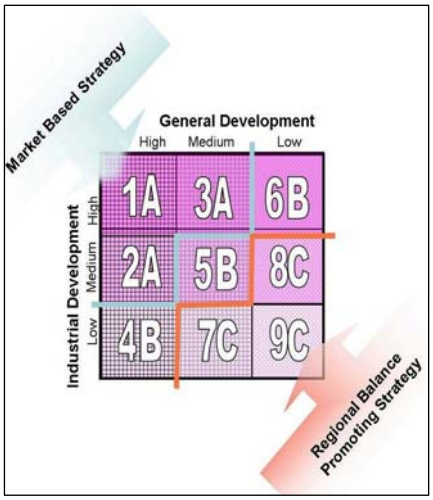
The economic forecasts suggest, not surprisingly, that development in some IRs (investment regions) and IAs (industrial areas) of DMIC propjects in Haryana will proceed more quickly and

on a larger scale than development in some other IRs and IAs. Investors are likely to choose to invest in areas with an established tradition of manufacturing, with a reserve of skilled and unskilled labour and with good access to local and international markets. Where as the established industrial areas in Haryana sub-region around Delhi are also likely to continue to grow. The only obstacle to continued success, given the likely scale of development, is increasing congestion, water availability, higher labour, land and housing costs and deteriorating environmental conditions: the problems associated with economic development.

Therefore, strategy X will focus on market driven, rapid economic development and seek to ensure that the economic forecasts are met primarily by focusing on the established industrial areas and the potential problems that might arise from over-development. Where as, strategy Y will focus specifically on encouraging and facilitating those areas which will make the most positive contribution to inclusive growth. This strategy will seek to intervene in the predicted outcome from the economic forecasts, encouraging more extensive and rapid development in those areas which are in need of development.

For implementing the above straitegies various towns/economic centres has been identified and their industrial development and human development indexe has been assessed. The towns/economic centre falling under various sub-zones are described below with the sub-zones criteria.

After overlapping NCR Landuse zones and Policy zones and analysis of development potentials each policy zones which are described in the chapter 3 will have following policy sub-zones:



Sub-Zone A : This zone will have either high industrial and high general development status or medium industrial and high general development or high industrial and medium general development. It includes major urban complexes/towns. This zone is most developed zone. Therefore this zone will be treated by market based development strategy.

Sub-Zone B : This zone will have either high and low development combination or both medium status. It generally includes smaller towns and

surrounding villages around most developed urban ares or along developed corridors. It can be called as unutilized potential zones which need mixed approach of development. It does not need more care for development.

Sub-Zone C : This zone will have either low industrialisation and low general development or low industrialisation with medium development or low development with medium industrialization. It is the most backward area of the region which creates regional imbalance in the region. Threfore this sub-zone need regional balance promoting strategy.

Sub-Zone D : This zone will have all the environmentally sensitive area which need to be conserved and treated as per the standard environmental laws and controlled/regulated development zones under which development will be done in controlled way as per the norms and standards . In these areas there will be restricted development. In this zone maximum area is under no development zones and rest are in restricted development.

In the Haryana sub-region following are the towns/economic centers/areas which fall under above described zones:

Table 14-1 : List of towns/economic centers/areas which fall under various sub-zones

		INDUSTRIAL DEVELOPMENT		
		HIGH	MEDIUM	LOW
HDI	HIGH	Gurgaon , Faridabad, Sonipat Zone A	Panipat, Bahadurgarh, Rohtak,	Dharuhera, Kharkhoda,
	MEDIUM	Kundli , Manesar	Bawal, Murthal, Ganaur Zone B	Gohana, Sampla, Sohna, Pirthala, maximum part of Palwal
	LOW		Rai, Barhi, Samalkha, Zone C	maximum part of Mewat , Jhajjar and Rewari

There are various settlements which come under sub-zone-D and need special treatment has been identified and detailed strategy has been given for their controlled development under the

land use zoning regulations. For the balanced regional development of the Sub-Region Palwal and Jhajjar has been identified as a new development node to be developed.

For the development of the region various proposals and strategies has been made which are described below.

14.3 *Development Potential*

The potential for development for the sub region has been assessed on the basis of present state of development, levels of infrastructure, environment resources, area which has to be conserved, etc. In addition, these factors, viz, Human development index, Infrastructure index and propensity to growth as measured by observed trend of population growth.

14.3.1 Human Development

Human development means increased capabilities of people that enable them to access larger opportunities in life. In the context of India, human development implies promoting basic capabilities among those who lack them. It also means supporting those who are marginalized and excluded from the mainstream of development. It is now widely accepted that human development, and not economic growth, is the ultimate goal of any society and that economic growth per se does not ensure human development.

HDI is a summary measure of human development that measures the average achievement in a country or a geographic entity in three basic dimensions of human development:

1. A long and healthy life, as measured by life expectancy at birth (LEB).
2. Knowledge, as measured by the adult literacy rate (with two-thirds weight) and combined primary, secondary, and tertiary gross enrolment rate.
3. A decent standard of living as measured by GDP per capita (PPP US$).

The achievements in the three dimensions are measured in the context of 'goal posts', which have constant value. HDI reduces all the three basic indicators to a common measuring rod by measuring achievement in each indicator as the relative distance from a desirable goal. The maximum and minimum values (goal posts) are reduced to a scale between 0 and 1 with each

country at some point on the scale. HDI is constructed by defining a country's measure of relative achievement in each of the three basic variables and taking a simple average of the three indicators.

14.3.1.i Human Development Index

HDI incorporates the following components and indicators:

Standard of living, which refers to control over resources: This component should ideally be measured by per capita consumption expenditure using the data from the NSS (National Sample Survey) Rounds. Income data at district level are available for only some states in India. In that case, any one of these proxies can be used: (a) per capita output in agriculture and industries together; (b) per capita bank deposits; and (c) percentage households having specified assets. For district level HDI, per capita bank deposits have been used as an indicator.

Access to knowledge or educational attainment: This component is measured in terms of (a) adult literacy rate, and (b) Female literacy rate. These data are available from the population censuses for the states as well as districts of India disaggregated by gender.

Ability to lead a long and healthy life: This component can be measured in terms of: (a) LEB, (b) incidence of disability, and (c) incidence of morbidity (short-term and long-term/chronic). Data for (a) and (b) are available, but that for (c) are not reliable. Data on morbidity are not reliable as the incidence of diseases measured is more dependent on their being reported than on actual incidence. For states where the health infrastructure is good and/or literacy rates are higher, reporting of morbidity is higher. Its use therefore cannot be recommended. LEB remains as an indicator that can be used. But LEB data are not available for districts. Instead, IMR (Infant Mortality Rate), which has a strong positive correlation with LEB, has been used.

Goal-posts for Indices

Fixing the goal-posts for constructing indices at regional levels is an important exercise. Since our aim is to see the relative Human Development in the districts falling within the Haryana Sub-region the goal-posts selected is maximum or minimum values in the series. Four different indicators are used for HDI district level. Hence, for each of these, the goal-posts are separate. The three indicators and their goal-posts are:

1. Since district incomes are not available, the indicator used is per capita bank deposits. The goal-posts set are the best performing and the worst performing districts in the sub-region. In 2001, the maximum was Rs. 16,906 in Gurgaon and minimum was Rs. 6787 in Jhajjar district.

2. For literacy rate, the maximum value is taken as 75.2% (Rewari) and minimum value is taken as 62.9% (Gurgaon). For Female literacy, the maximum is taken as 62.6% (Rhotak) and minimum is taken as 47.8% (Gurgaon)

3. For Infant Mortality rate, the worst is taken as 77 (Faridabad) and best is taken as 26 (Sonipat).

Construction of Indices

The first step is to construct the component indices. The indicators are made scale-free for this purpose by applying the following formula:

$$HDI_{ij}\,(\text{Index}) = \frac{Value_{ij} - Min_j}{Max_j - Min_j}$$

Where HDI_{ij} is the factor score for each district in the index. Min. value and max. value are minimum and maximum goal-posts selected for the indicator.

Giving of Weights

In a composite index, equal weight is given to all the component indicators.

HDI- Haryana Sub region

For Computing HDI for Haryana- Sub region three indices for Literacy, Health & Economical well being are constructed as explained below:

1. **Literacy Index:** the overall literacy rates as well as the female literacy rates for districts coming under the sub –region are indexed to arrive at average Index value.

Table 14-2 : Districtwise Literacy index

NAME	AVG_LIT_RATE	Index-Edu-1	F_LIT_RATE	Index-Edu-2	Index-Edu
Panipat	69.2	0.5075	58.0	0.6881	0.5978
Sonipat	72.8	0.8010	60.7	0.8710	0.8360
Rohtak	73.7	0.8762	62.6	1.0000	0.9381
Jhajjar *	72.4	0.7676	59.6	0.8012	0.7844
Rewari	75.2	1.0000	60.8	0.8807	0.9404
Gurgaon	62.9	0.0000	47.8	0.0000	0.0000
Faridabad	70.0	0.5772	56.3	0.5758	0.5765
Haryana	68	0.4127	56	0.5549	0.4838
India	65.0	0.1696	54.0	0.4199	0.2948

2. **Health Index:** Infant Mortality rate all the districts have been indexed to arrive at Health Index.

Table 14-3 : Districtwise Health index

NAME	IMR	Index-Health
Panipat	61	0.3137
Sonipat	26	1.0000
Rohtak	60	0.3333
Jhajjar *	59	0.3529
Rewari	38	0.7647
Gurgaon	65	0.2353
Faridabad	77	0.0000
Haryana	62	0.2941
India	66	0.2157

3. **Economic Index:** Per capita Bank deposits for all the districts have been indexed to arrive at the Economic index.

Table 14-4 : Districtwise Economic index

NAME	per capita Bank Deposits	Index-Economic
Panipat	10978	0.4142
Sonipat	8143	0.1339
Rohtak	12227	0.5376
Jhajjar *	6787	0.0000
Rewari	8043	0.1241
Gurgaon	16906	1.0000
Faridabad	12798	0.5940
Haryana	9405	0.2587
India	9210	0.2394

4. **HDI:** combining all the above three index gives the HDI, which indicates the overall development of the district in comparision to each other.

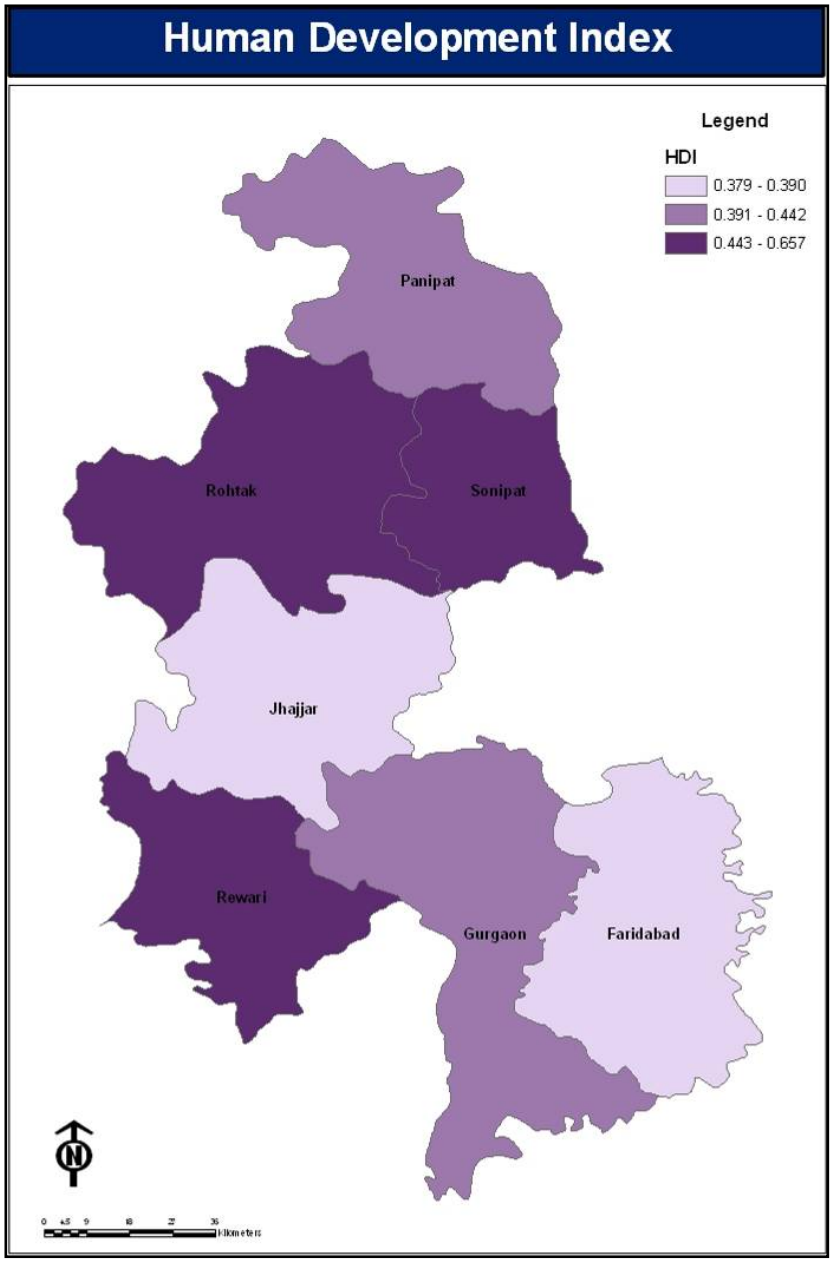
Table 14-5 : Districtwise HDI

NAME	HDI
Panipat	0.442
Sonipat	0.657
Rohtak	0.603
Jhajjar *	0.379
Rewari	0.610
Gurgaon	0.412
Faridabad	0.390
Haryana	0.346
India	0.250

From the above table it is clear that the Study region is above the national as well as state average in terms of Human development. The districts with high score of HDI are: Sonipat, Rohtak & Rewari. The districts with medium score of HDI are: Panipat & Gurgaon. The districts with low HDI Score are Jhajjar & Faridabad.

From the above table it is clear that Jhajjar, Faridabad & Gurgaon are the three districts which need to be looked in terms of providing better opportunities for improving Health, education & economic well being. Gurgaon is worst in case of literacy (both overall & Female literacy), Faridabad is worst in case of Health and Jhajjar is worst in case of economy.

Figure 14-1: Human development index map



14.3.1.ii Infrastructure Index

The infrastructure Index is computed to understand the comparative advantage of infrastructure provision in a district as compared to other. Infrastructure index includes Both Social & Physical infrastructure.

1. **Education Infrastructure Index:** the number of Higher & Senior secondary institutes & Colleges & Technical Institutes for higher education is taken for measuring the parameter. Per capita institute is indexed to arrive at the Education Index.

Table 14-6 : Districtwise Education index

NAME	Higher /Senior Secondary Institute	Higher /Senior Secondary Institute /lakh pop	Index-Edu-1	Colleges & Technical Institutes	Colleges & Technical Institutes /lakh pop	Index-Edu-2	Edu_index
Panipat	193	18	0.3636	11	1.0	0.0769	0.2203
Sonipat	377	27	0.7727	20	1.4	0.3846	0.5787
Rohtak	328	32	1.0000	23	2.2	1.0000	1.0000
Jhajjar	308	32	1.0000	9	0.9	0.0000	0.5000
Rewari	261	31	0.9545	10	1.2	0.2308	0.5927
Gurgaon	187	10	0.0000	21	1.1	0.1538	0.0769
Faridabad	578	24	0.6364	25	1.0	0.0769	0.3566

2. **Health Infrastructure Index:** the no. of hospital beds per capita is indexed to arrive at the Health Infrastructure Index.

Table 14-7 : District wise Health index

NAME	Hospital Beds	Hospital Beds /lakh	Health Index
Panipat	293	27	0.0448
Sonipat	374	26	0.0373
Rohtak	1633	155	1.0000

Jhajjar	268	27	0.0448
Rewari	292	34	0.0970
Gurgaon	397	21	0.0000
Faridabad	724	29	0.0597

3. **Physical Infrastructure:** Road length per unit area & Road length per capita is taken to arrive at the Physical Infrastructure Index.

Table 14-8 : District wise Road index

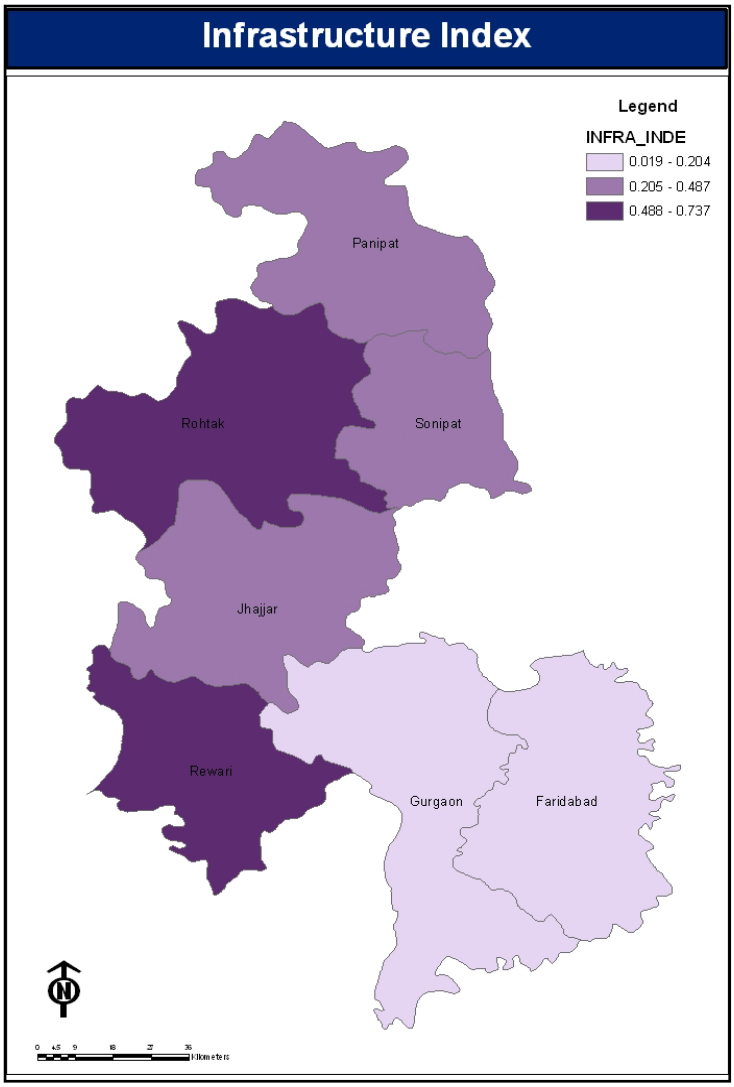
NAME	Total Metaled Road length	Road length/ '00 Sq Km.	Index-Road-1	ROAD/lakh pop	Index-Road-2	Road_index
Panipat	973	77	1.0000	101	0.6829	0.8415
Sonipat	1139	54	0.5493	89	0.5473	0.5483
Rohtak	821	47	0.4197	87	0.5272	0.4734
Jhajjar	929	51	0.4900	106	0.7416	0.6158
Rewari	976	61	0.6968	128	1.0000	0.8484
Gurgaon	706	26	0.0000	43	0.0000	0.0000
Faridabad	970	45	0.3790	44	0.0198	0.1994

4. Infrastructure Index: Combining above three index we get the Infrastructure Index, which is a inter district comparison of Infrastructure.

Table 14-9 : Infrastructure index

NAME	Infrastructure Index
Panipat	0.487
Sonipat	0.428
Rohtak	0.737
Jhajjar	0.444
Rewari	0.597
Gurgaon	0.019
Faridabad	0.204

Figure 14-2 : Infrastructure index map



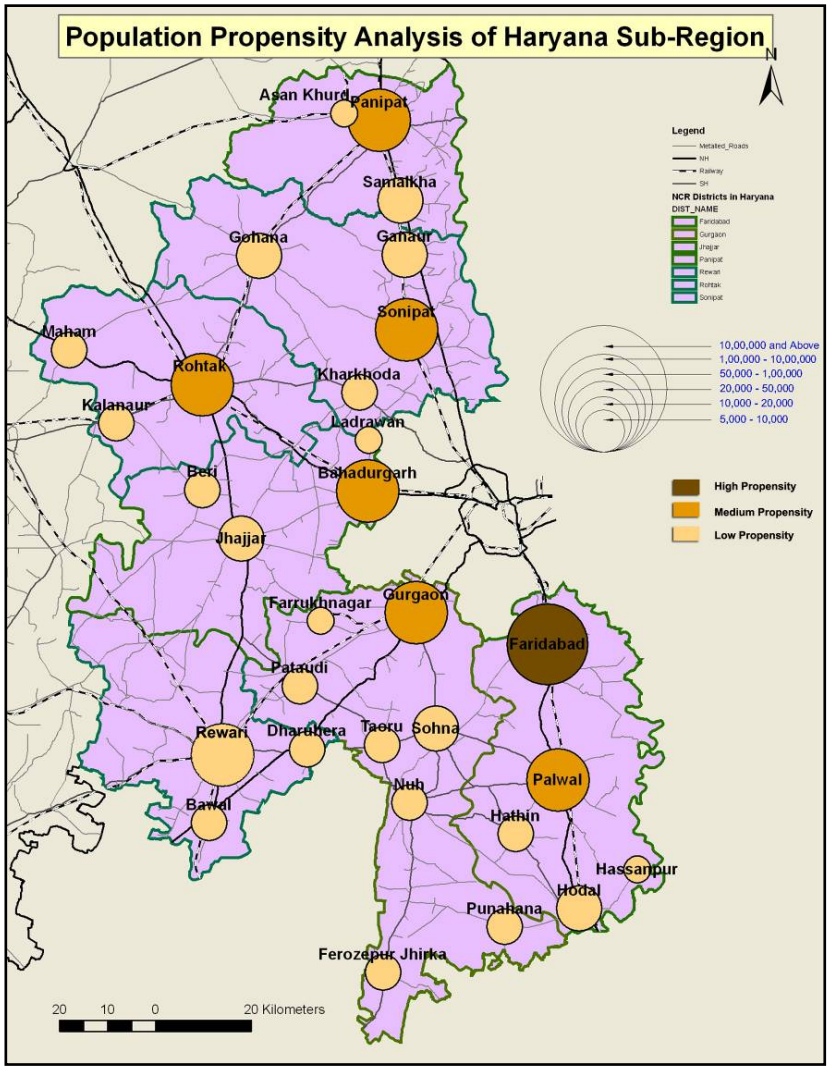
From the above table it is clear that high score Infra Index districts are: Rohtak & Rewari, Medium score index districts are: Panipat, Jhajjar & Sonipat and Low scoring districts are Gurgaon & Faridabad.

From the above table it is clear that Faridabad & Gurgaon are the two districts which need to be looked in terms of providing better infrastructure. Gurgaon is worst in case of all indicators.

14.3.1.iii Population Growth Propensity Indicator

Propensity of growth has been assessed on the basis of correlation between rate of population growth and size of population in different urban centers of the sub-region. It is worth noticing that the size of the present population has a positive correlation with population growth except in the Rewari. Whether this trend will continue will depend on various endogenous and exogenous factors. This will particularly be reflected in the policy for future growth.

Figure 14-3 : Population Propensity map



Comparison of HDI, Infrastructure Index, Population propensity

1. Sonipat & Gurgaon have comparatively better HDI rank than their Infrastructure Index Rank. The economical aspects in these two districts have evolved but supporting infrastructure has yet not evolved. Hence there is a need to develop Infrastructure in two areas.

2. Jhajjar has better Infrastructure Index rank than its HDI rank. This means economical development needs to be focused particularly in this area.

3. Mostly, population propensity is best shown in the towns more close to Delhi. This means that there is a need for economical development to be induced in towns away from Delhi so that development is more homogeneous within the region.

14.3.2 Identification of land suitable for development

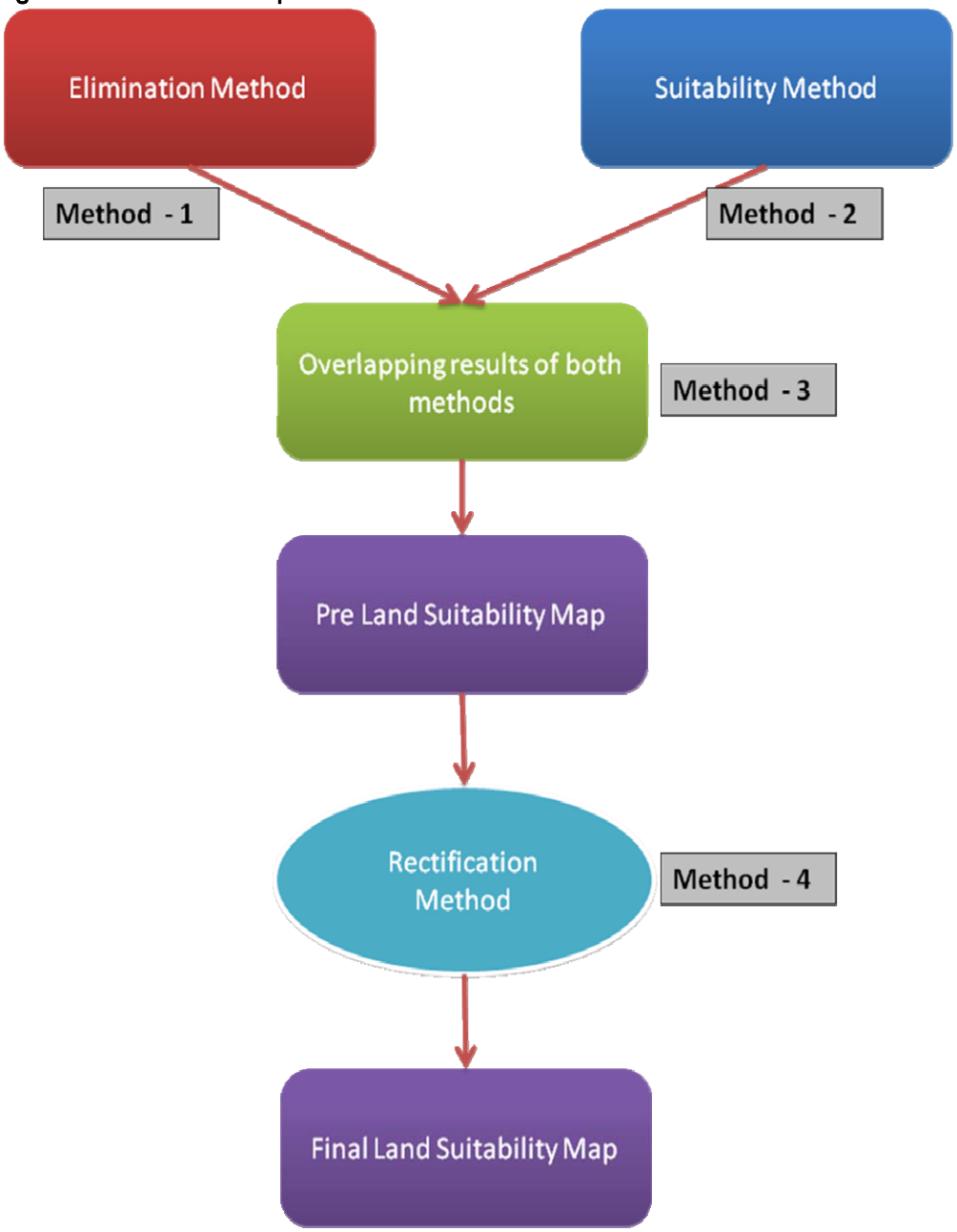
Now coming to the Development potential of land for industrial development , we have used the various parameters for identification of land suitable for the development of industry in the Sub-Region.

14.3.2.i Introduction

The Land Suitability Analysis (LSA) is a Geographic Information Systems (GIS) based tool for evaluating the relative suitability of land for development in NCR Haryana. The end product is a generalized map showing areas of the county that are categorized as having either least, low, moderate, or high suitability for development. The analysis does not provide site-specific results, nor does it make recommendations about how individual landowners may or may not use their land.

Suitability, for the purpose of this analysis, can be primarily defined in terms of physical limitations and/or regulatory restrictions. Physical limitations such as steep slopes or poorly drained soils make the land less suitable for development. Features subject to regulatory restrictions, such as farmland preservation areas, also pose challenges to development. The method adopted to asses the suitable Land is drawn below:-

Figure 14-4 : Method adopted to asses the suitable Land



14.3.2.ii Documents used for the references are

1. Regional Plan – 2021 - National Capital Region, NCRPB
2. Final report- Development of Global Corridor along KMP Expressway in Haryana, T&CPD, Haryana
3. Zoning Atlas for location of Industries, CPCB

14.3.2.iii Software used for Analysis

1. Arc Info GIS 9.3 with extensions 3D Analyst and Spatial Analyst
2. Microsoft Excel 2007
3. Microsoft Word 2007

14.3.2.iv Data required for the analysis

1. Roads- Expressway, NH and SH
2. Railways- Primary rail Network and Orbital railway
3. Conservation zones
4. National Parks and Wild Life Sanctuaries
5. National Forest, Protective Forests and Degraded Forests
6. River, Lakes and Ponds
7. Water recharge areas
8. Soil Quality
9. Water Quality
10. Flood Prone Areas
11. Mining
12. Land with Scrub
13. Airport

14.3.2.v Verious Methods adopted for LSA (Land Sutability Analysis)

A : Elimination Method:

In this method all those areas which are environmental sensitive or restricted to development or areas under controlled development are identified. Those areas which have to be protected are identified and buffer has been created around them. As per KMP report areas such as 50m on the either sides of the existing canals have been marked as buffer area. Similarly forest area and

Birds Sanctuary areas are protected with a buffer of 1 Km. Also Scrub lands are protected with buffer of 50 m around them. As per NCR Plan 2021 the roads have green buffers and highway

Table 14-10 : Buffer criteria for various features

	Layers	Type	Buffer
1	Expressway	Controlled	100m
		Uncontrolled	500m
2	NH	Controlled	60m
		Uncontrolled	500m
3	Highway Corridor Zone		500m
4	State Highways	Controlled	30m
		Uncontrolled	500m
5	Railways	Controlled	30m
		Uncontrolled	500m
6	Ponds		50m
7	River		2000m
8	water Recharge		500m
9	Lakes		50m
10	Mining/Query		100m
11	Conservation Areas		1000m

corridor zone are also marked. The list of buffers has been compiled in given table

B : Suitability method:

In this method list of factors which can affect the location of Industries are considered. Overlapping all the factors results the final locations of the Industries. For the reference, the zoning atlas of CPCB for citation of Industries is used. As per zoning atlas the factor which affects the location of industries in our area are Soil quality, Water quality, Lakes, Mining areas, land with scrub, forests, conservation areas, water recharge areas, river and flood plains. All these areas should be divided into 4 zones Zone 1, Zone 2, Zone 3 and Zone 4 which are 2000m, 5000m, 7000m and more than 7000m respectively. The locations of the industries are favorable as per their types but in general the most suitable place for the industries is in Zone 4. For

Table 14-11 : Zones and classes used to identify Industrial Land

S. No.	Layers	Class / Zones
1.	Ground Water Status	Safe Semi Critical Critical Over Exploited
2.	Soil Fertility	Medium Medium to Low Low Poor
3.	Lake	2000 5000 7000 more than 7000
4.	Ponds	2000 5000 7000 more than 7000

5.	Mining	2000 5000 7000 more than 7000
6.	Forest	2000 5000 7000 more than 7000
7.	Ground Water Recharge Areas	2000 5000 7000 more than 7000
8.	River	2000 5000 7000 more than 7000
9.	Conservation	2000 5000 7000 more than 7000
10.	Flood Plain Areas	2000 5000 7000 more than 7000
11.	National Highways (NH)	1000

		2000 4000 more than 4000
12.	State Highways (SH)	1000 2000 4000 More than 4000
13.	Major District Roads (MDR)	1000 2000 4000 More than 4000
14.	Region Railway	1000 2000 4000 More than 4000
15.	Dedicated Freight Corridor	1000 2000 4000 More than 4000
16.	KMP Expressway	1000 2000 4000 More than 4000
17.	Orbital Corridor	1000 2000

		4000 More than 4000

Note: 1) Air Port is not taken into account because it lies at a distance more than 7000 m from the Sub Region boundary.

2) Distance Criteria for the Transportation are taken from the KMP Report.

3) Equal Weight age is applied to

C : Overlaying Method

It is the 3 step adopted to identify the suitable land. As per this method the result of elimination is overlaid on suitability method result.

D : Rectification Method

This is the final method to demarcate the boundary of the suitable land. In this method the pre suitable lands which indentified are rectified. This method involves experience, logic and keen facts of the study area. The necessity of the this step is originates because before identified areas are computer generated suitable

14.3.2.vi Objectives and Limitations

- The results of the LSA will be used to support planning efforts throughout the unincorporated areas of Haryana Sub region. Objectives of the LSA and appropriate uses of the final analysis include the following:
- Identify areas that are more or less suitable for development on a coarse scale;
- Inventory existing spatial information available for Polk County;

- Identify data gaps that may be filled during later planning stages;
- Develop a tool that will assist the county in the implementation of new policies, actions, or regulatory language;
- Provide a base for GIS analysis to be used in other long range planning projects.

Limitations of the LSA include the following:

- The LSA results are not a zoning map, but will be used to support planning processes in the Sub region;
- Results and analyses do not support site-specific planning;
- The LSA does not make recommendations about how an individual landowner may or may not use their land;
- The LSA does not result in recommendations about where particular land uses (i.e., commercial vs. residential) should be concentrated;
- Results do not factor in projected population, carrying capacity, or commercial/housing demand.

14.3.2.vii Technical Approach

Spatial data sets were collected from Haryana's local, district, state, and National agencies, and private organizations. Data from the following sources were used in the analysis:

A : Primary Data Source

1. Land Use Data and Map.
2. Data from various concern Departments .

B : Secondary Data Source

1. Wasteland Atlas of Haryana -2006 - Haryana State Remote Sensing Applications Centre (HARSAC)
2. Resource Atlas of Haryana
3. Topo Sheets of Sub Region – Survey of India

4. District Planning Series - NATMO

5. District series of CGWR

6. Master Plan of various Cities in Sub Region

7. Report on the KMP

Table 14-12 : Suitability Classes and their Ranking

CLASS	RANK	RECLASS
Restricted	-2	Restricted/Nil
Least	0	1
Low	1	3
Moderate	2	6
High	3	9

Applying above techniques on the various aspects for the Haryana Sub-Region we find the following situations:

Figure 14-5 : Conservation zone buffer

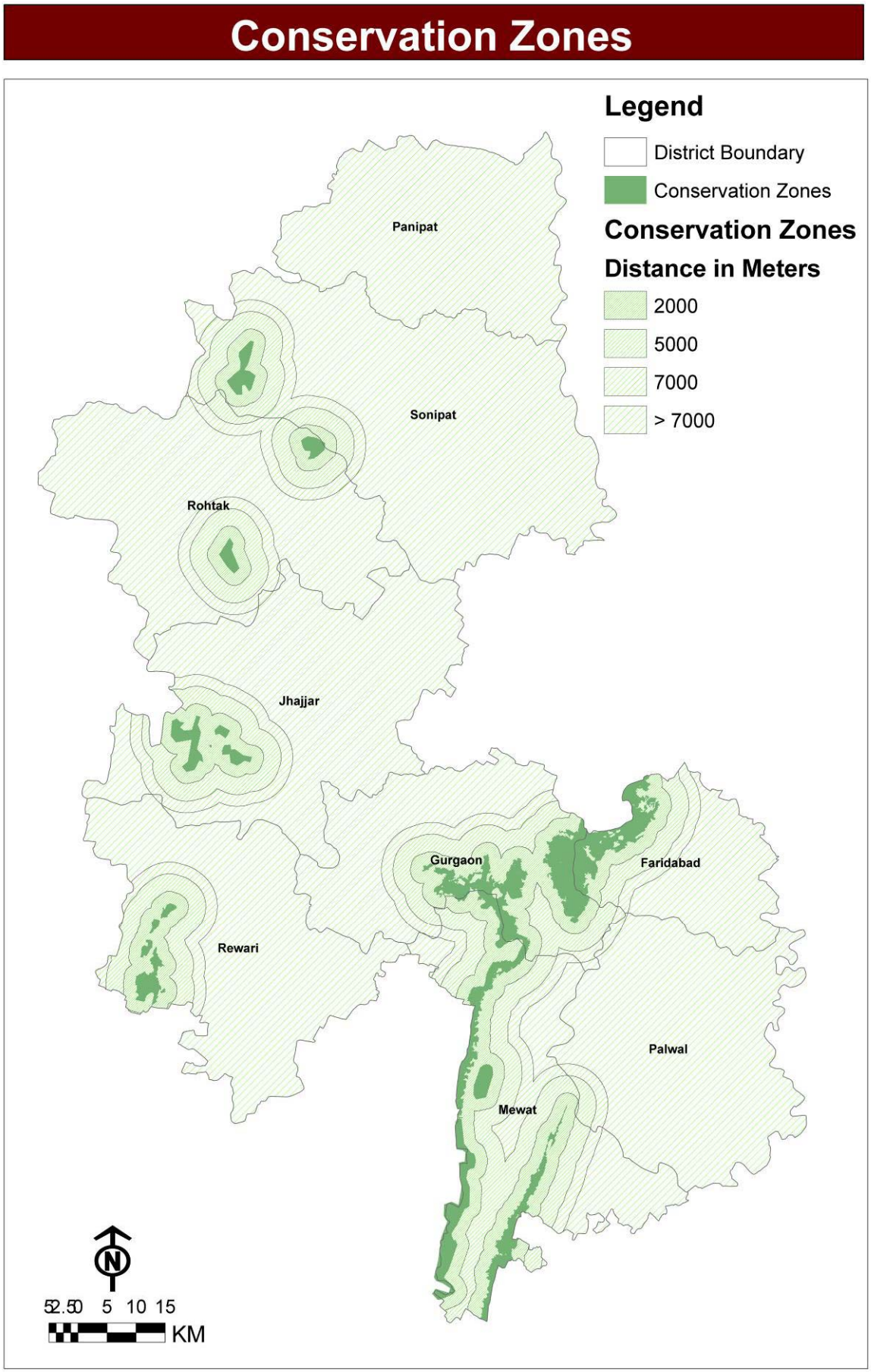


Figure 14-6 : River zone buffer

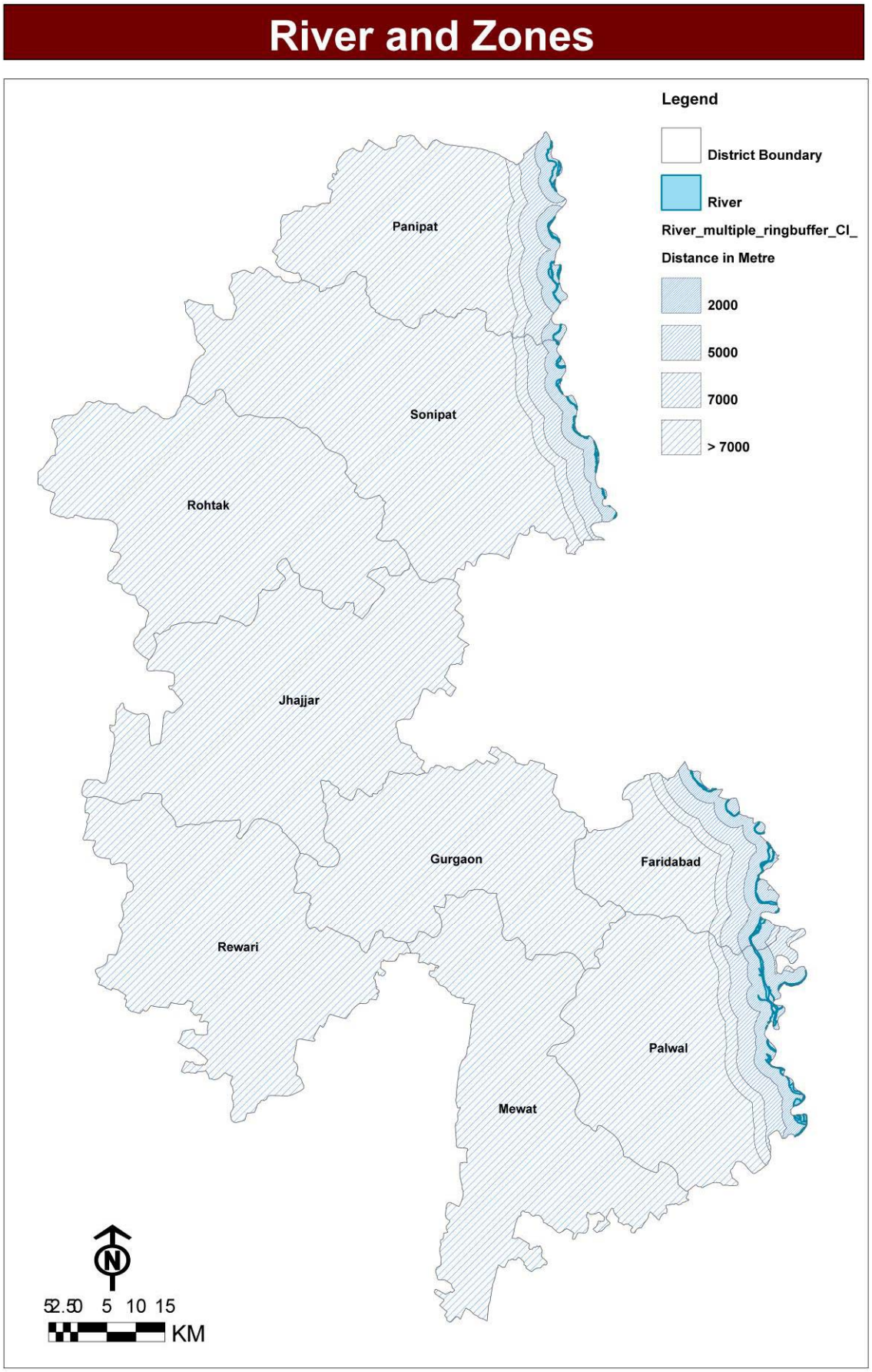


Figure 14-7 Flood plain zone buffer

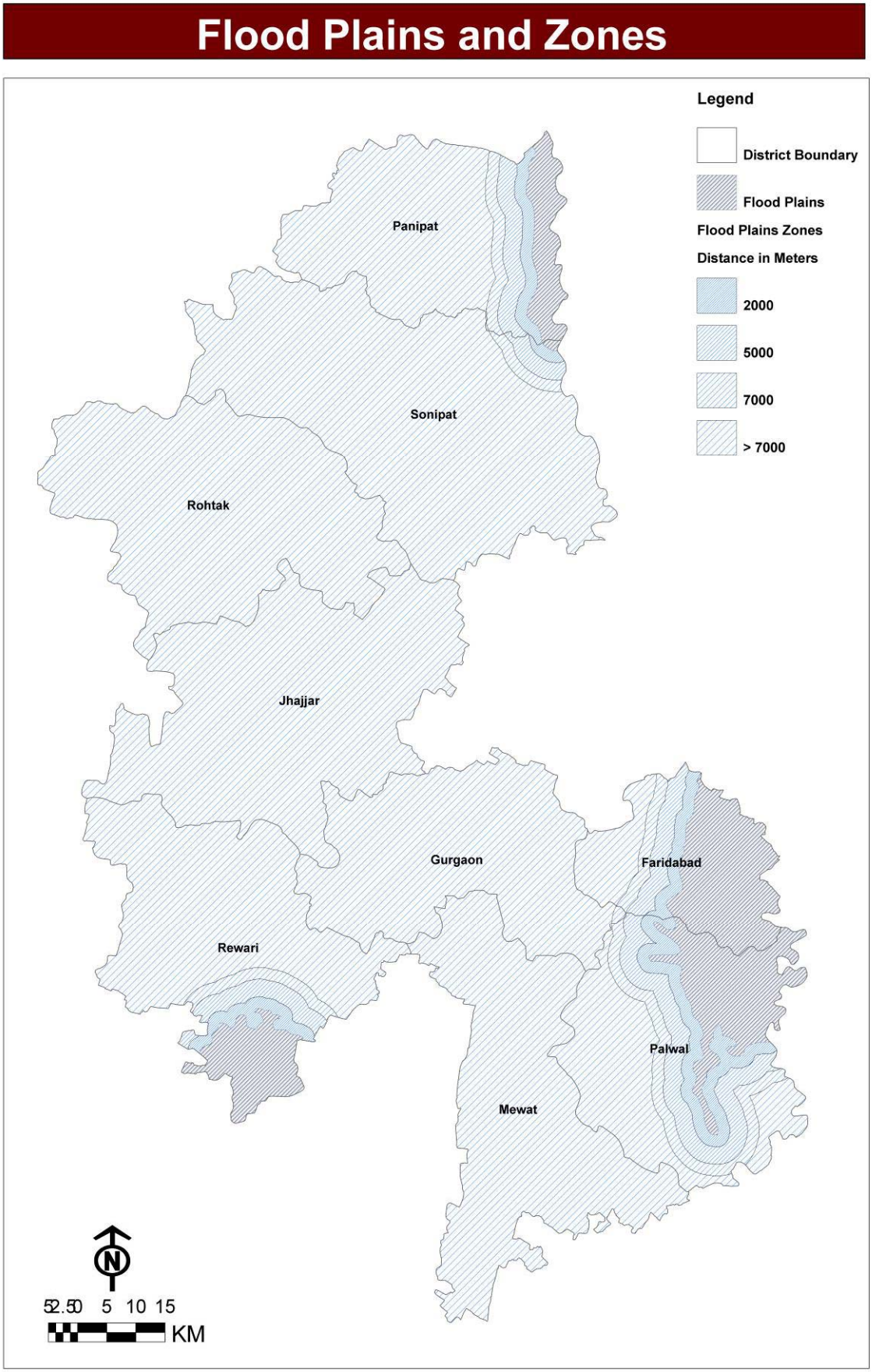


Figure 14-8 Lakes zone buffer

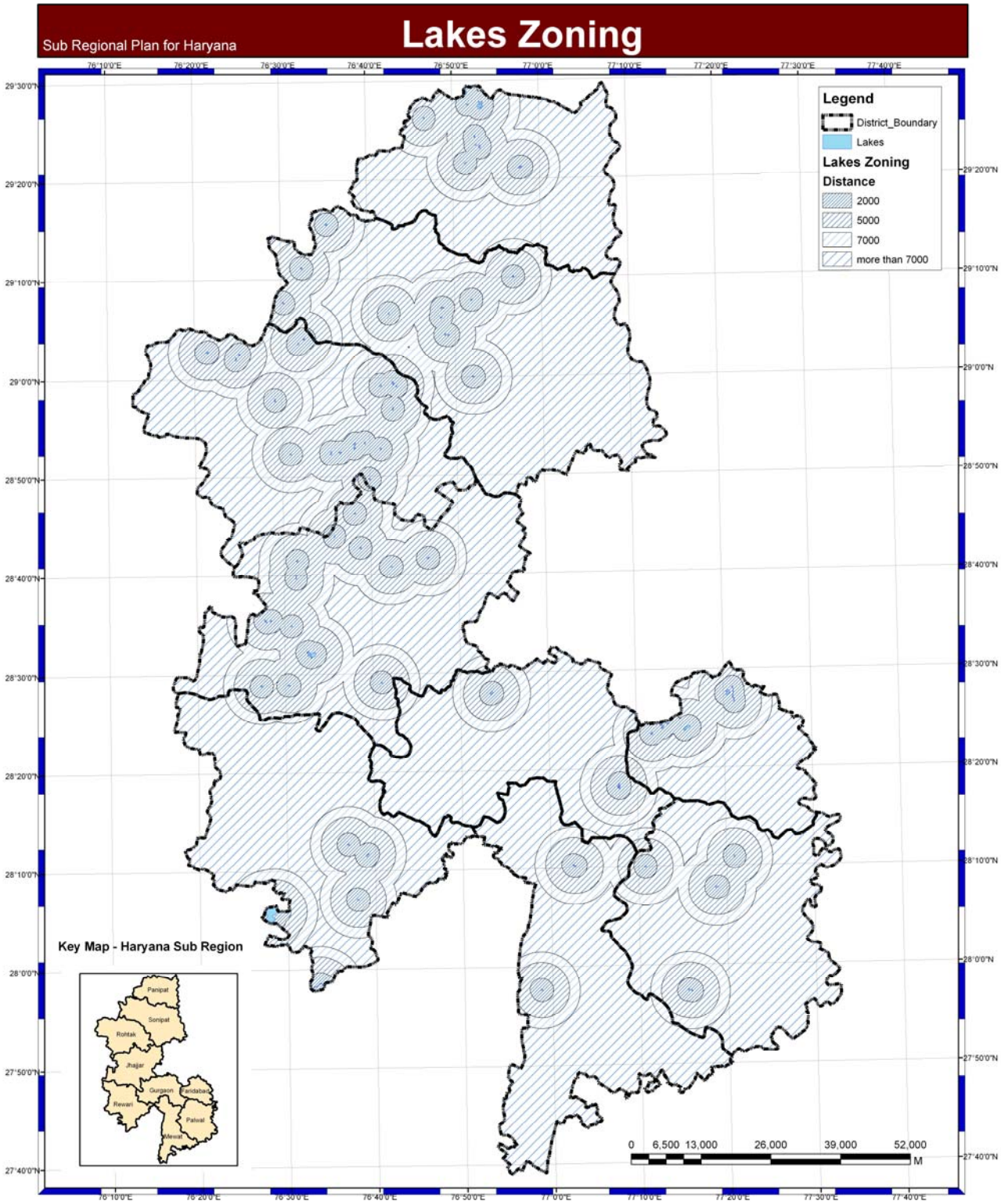


Figure 14-9 Ground water draft

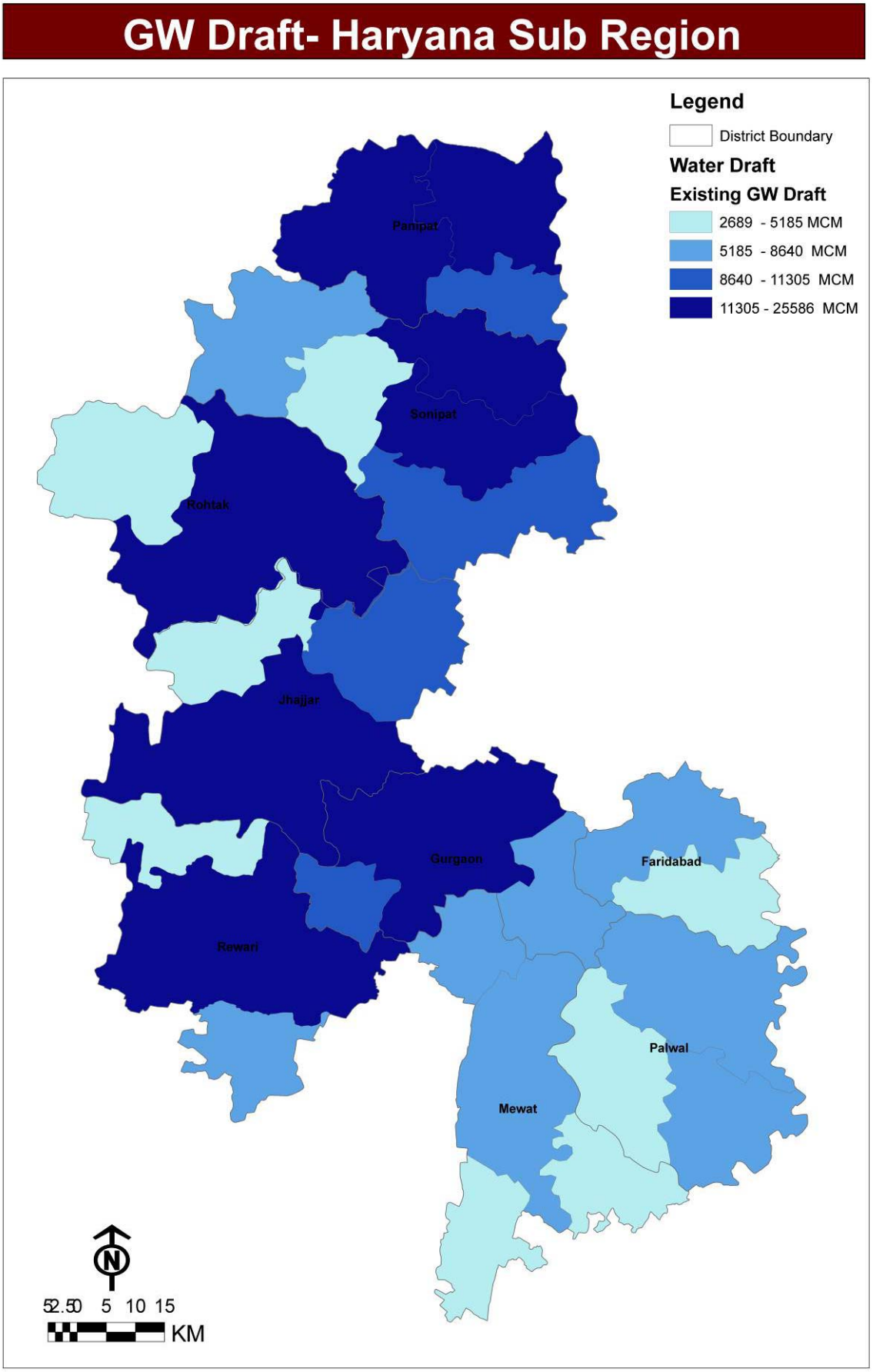


Figure 14-10 Ground water status

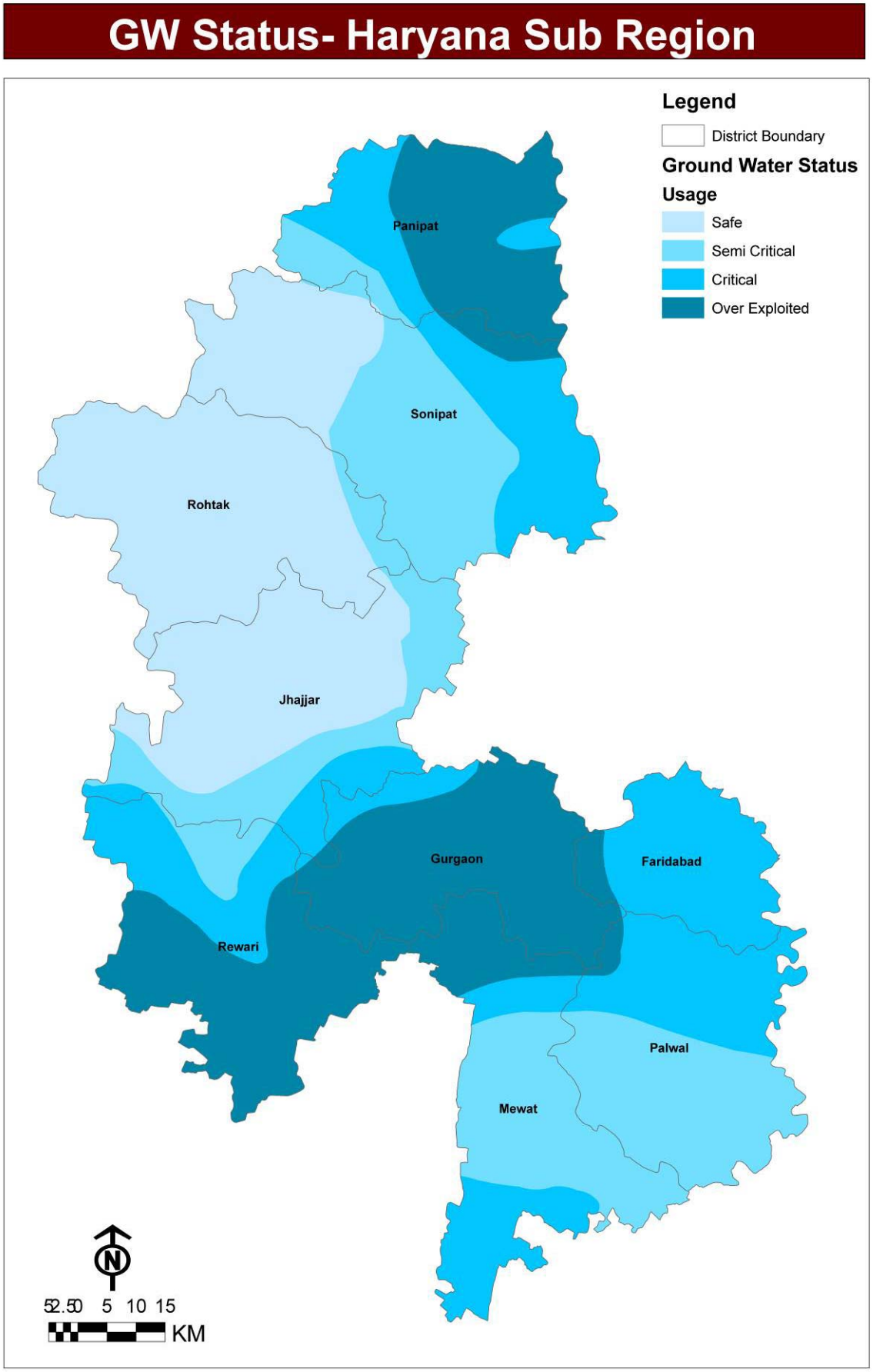


Figure 14-11 Soil Fertility

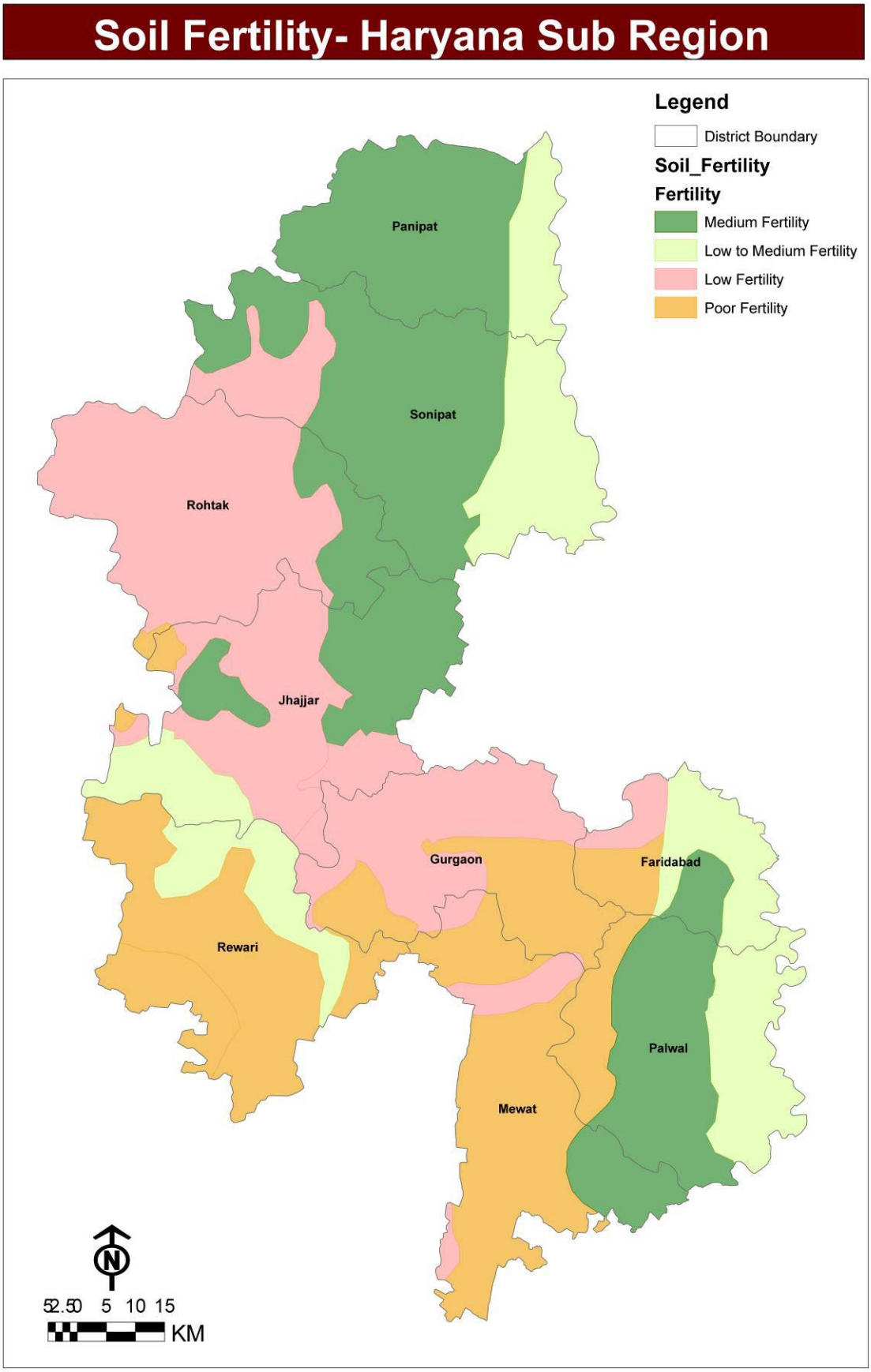


Figure 14-12 Forest Buffer

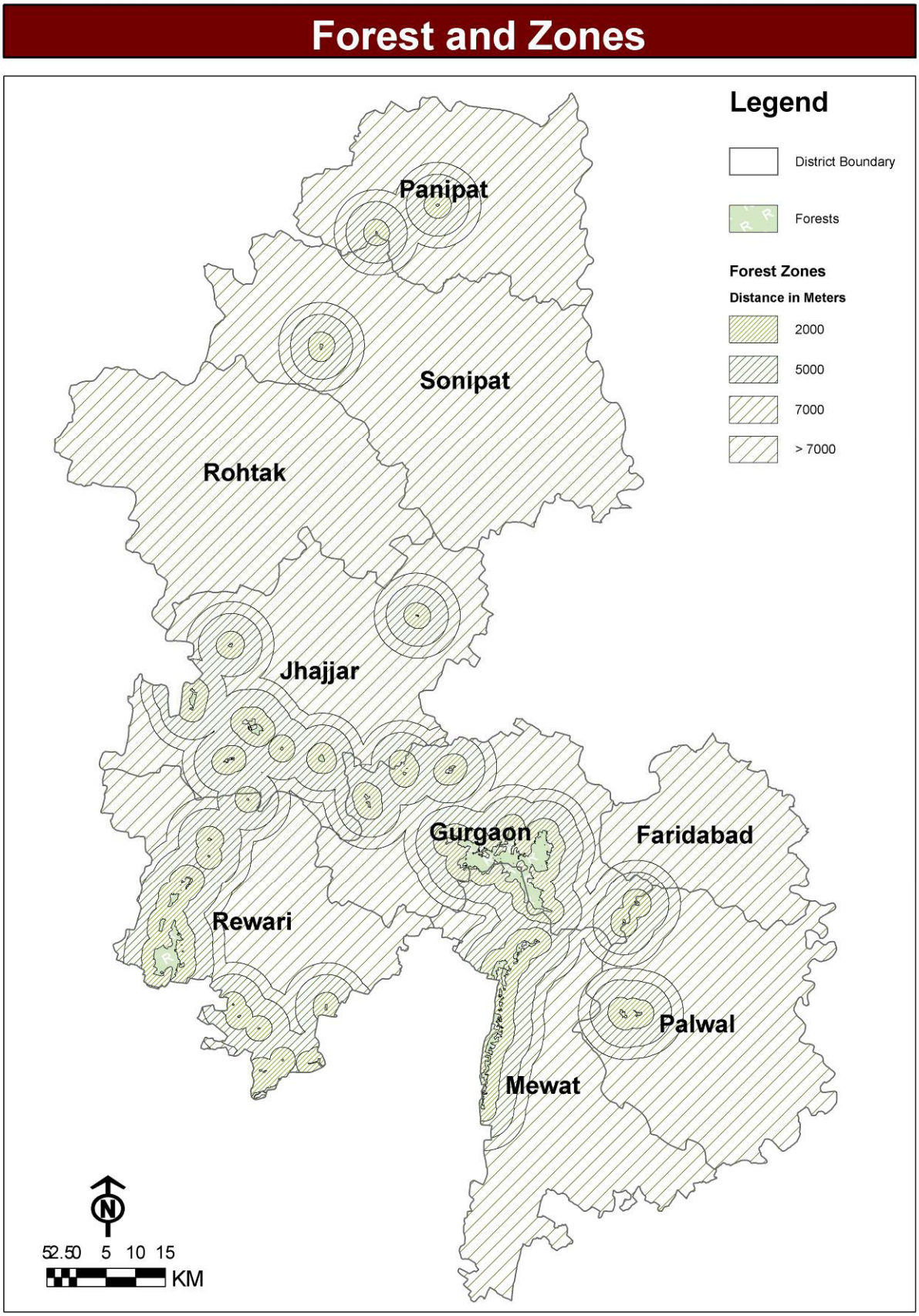


Figure 14-13 Minning Zone Buffer

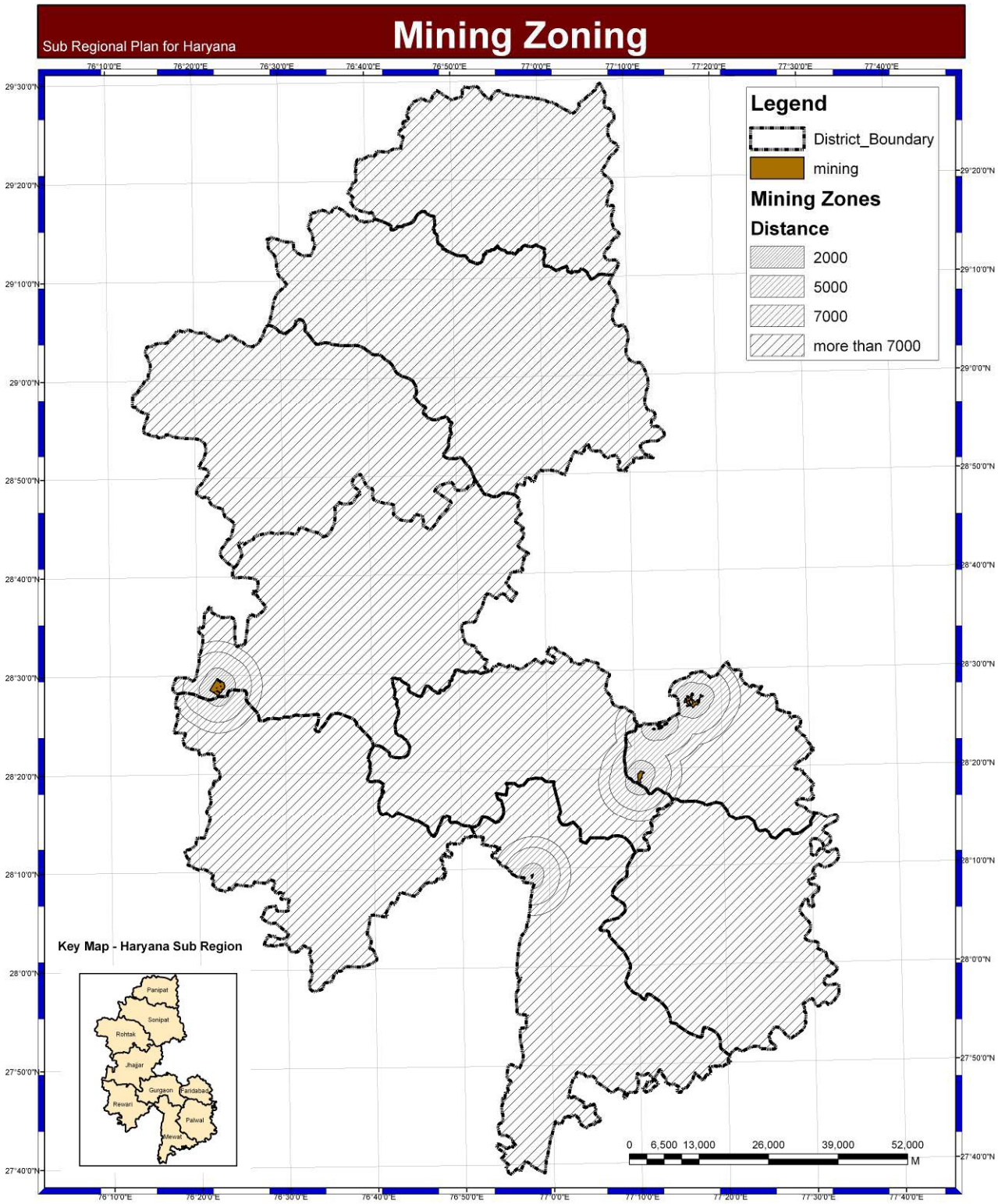


Figure 14-14 : Pond zone Buffer

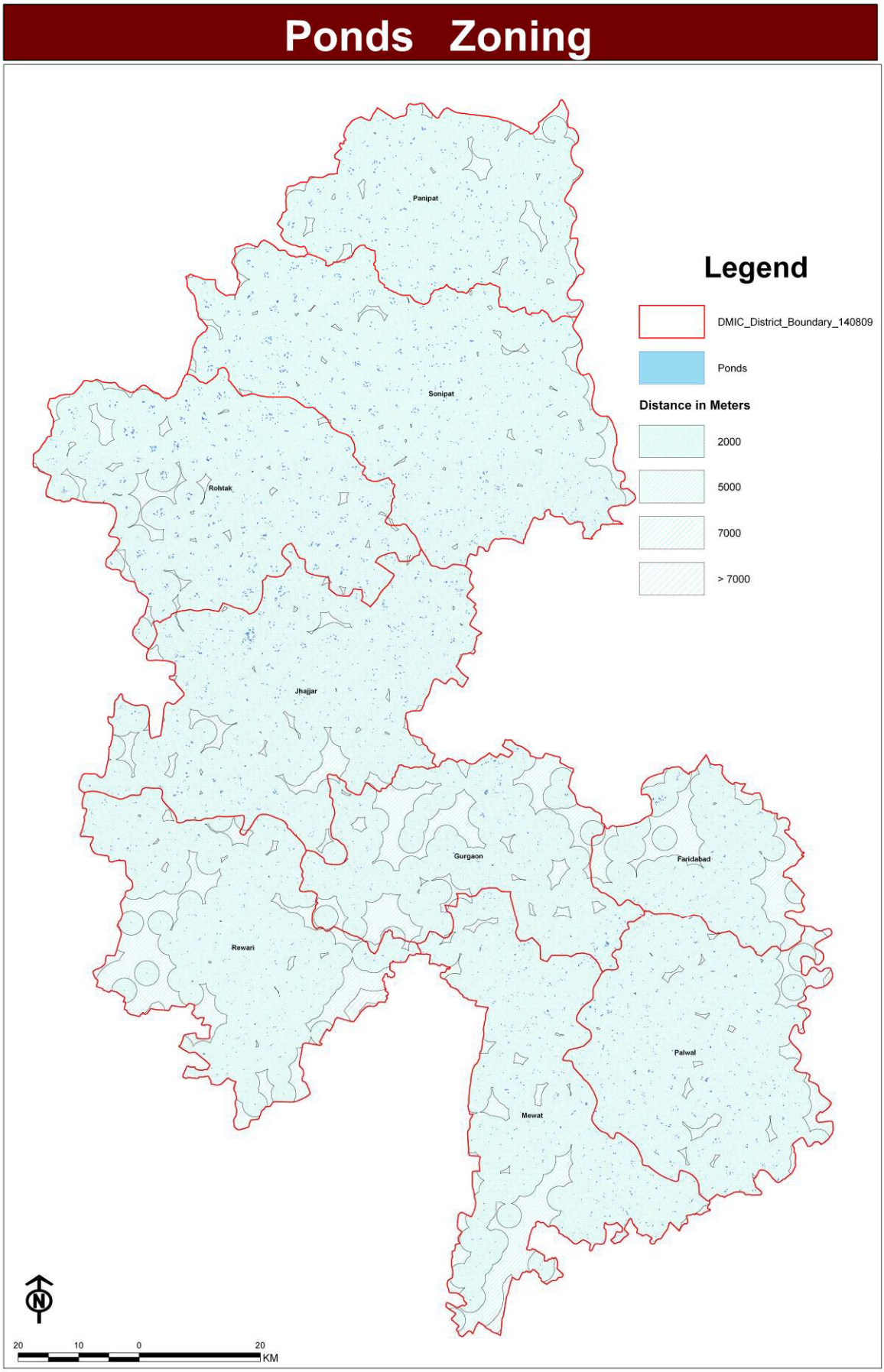
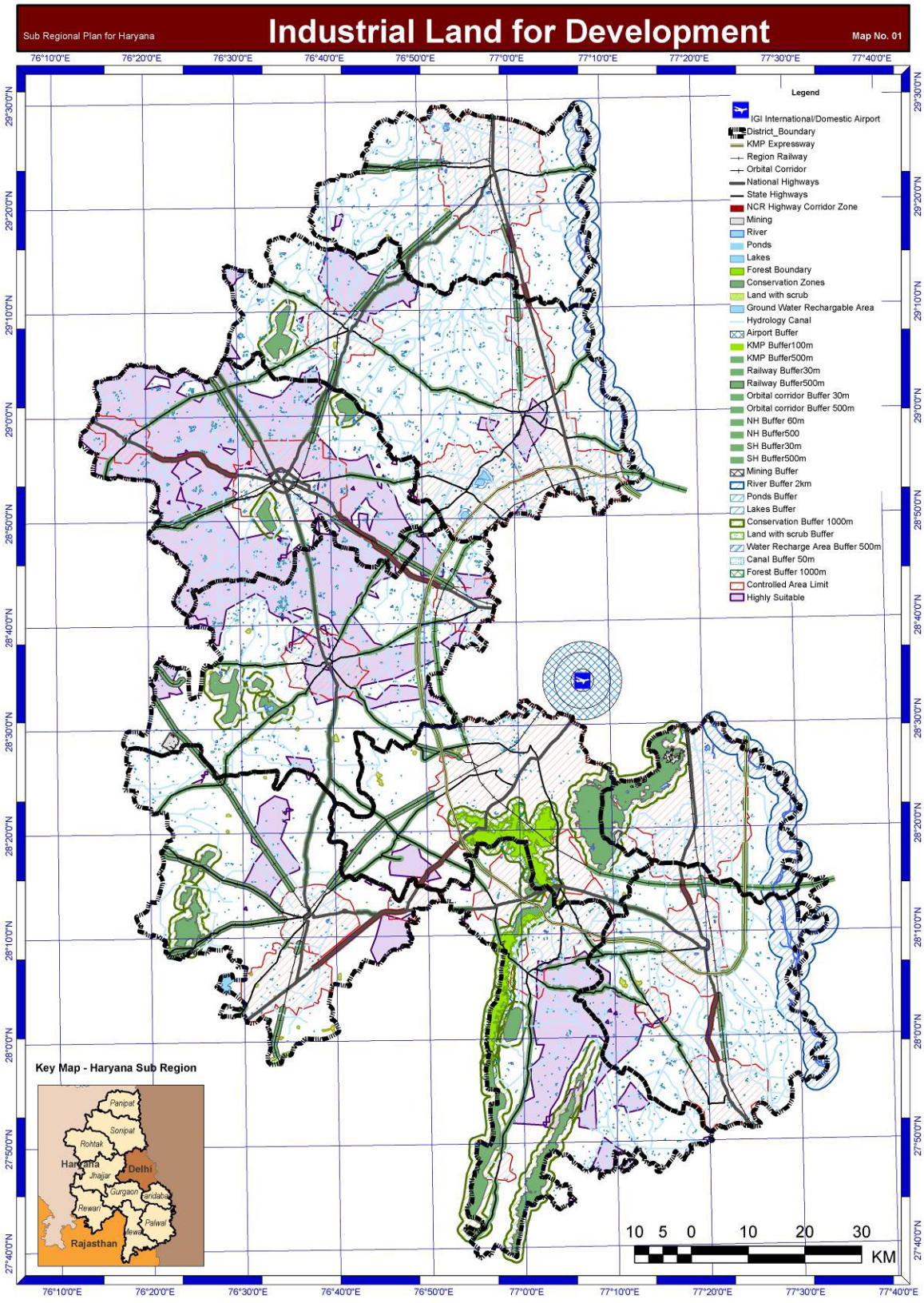


Figure 14-15 Land Suitable for industrial development



After analysis of all the above factors in the figure (14-15) the land most suitable for industrial development has been indicated.

14.4 *Infrastructure Proposals*

14.4.1 Trafic and Transportation

14.4.1.i Road Transportation

Since the formation of Haryana state, there has been a significant growth in the road transportation sector of Haryana. At present more than 99.88 percentages of villages are connected by metalled roads and road density is around 63.8 km per 100 sq. km area. However, economic development in the state is taking place at very higher rate in comparison to other states of India. This is the reason for large density of vehicles on this available roads.As per the projections done in chapter 6 of this report it is noticed that car, bus, truck and two-wheeler traffic is expected to grow at a rate of above 8 percentages per year on most of road sections for the year of 2014 to 2021. Share and growth rate of cars, Buses and Trucks are very high which will further bring down the level of service of the road network and give extra burden on carrying capacity of the road. These pressures of vehicles on road results to requirement of increased number of lanes and level of services on various roads as well as need of bypasses and parallel expressway on and along the various highways.

A :Expressway Requirements

Based on the projected traffic and corresponding lane requirements on the existing road network of the Haryana Sub-region it has been observed that some of the roads need additional road corridors. It has been observed from the table that high volume of traffic is traveling on NH-1, NH-2 and NH-8 in the sub-region. Hence, the augmentation of existing roads as well as additional corridor need have to be implemented in phased manner. The additional corridor in the form of expressway can cater large volume of traffic and it will provide better mobility and safety. Based on the traffic projections shown in table the following expressways and their lane requirements need to be developed.

Table 14-13 : Traffic lane requirements on proposed new expressways

Proposed Expressway Sections	Traffic Forecast (PCU)-Expected			Lanes Required		
	2009	2009-14	2014-21	2009	2009-14	2014-21
Delhi-Panipat-1	17250	40000	80000	2	4	8
Delhi-Palwal-2	17250	40000	60000	2	4	6
Palwal-Hodal-2	0	17250	40000	0	2	4
Delhi-Gurgaon-8	17250	40000	80000	2	4	8
Gurgaon-Bawal-8	17250	40000	80000	2	4	8

- **Delhi-Panipat** : In addition to the existing national highway NH-1an additional corridor in the form of expressway is required between Delhi and Panipat. This proposed expressway has to be augmented to 8 lanes in phased manner in the horizon years.

- **Delhi-Palwal- Hodal :** The traffic projection on Delhi- Palwal section of NH -2 shows the requirement of an additional corridor in the form of expressway between Delhi and Hodal.

- **Delhi- Gurgaon :** In addition to the existing expressway on NH-8 of Delhi-Gurgaon section an additional corridor of expressway is required between Delhi and Gurgaon.

- **Gurgaon- Bawal :** By year 2021, an expressway is required between Gurgaon and Bawal, which can be implemented at different phases. Moreover, increasing industrial growth in this region also enforces provision of an expressway on this section.

- **Gurgaon-Faridabad Expressway :** Gurgaon and Faridabad are two major urban centers in NCR. There would be intense interactions between them resulting in flows. Presently they are constrained to move mostly through Delhi region. The gurgaon-Faridabad Expressway provides a direct, fast, fast and quality link between the two important centers.

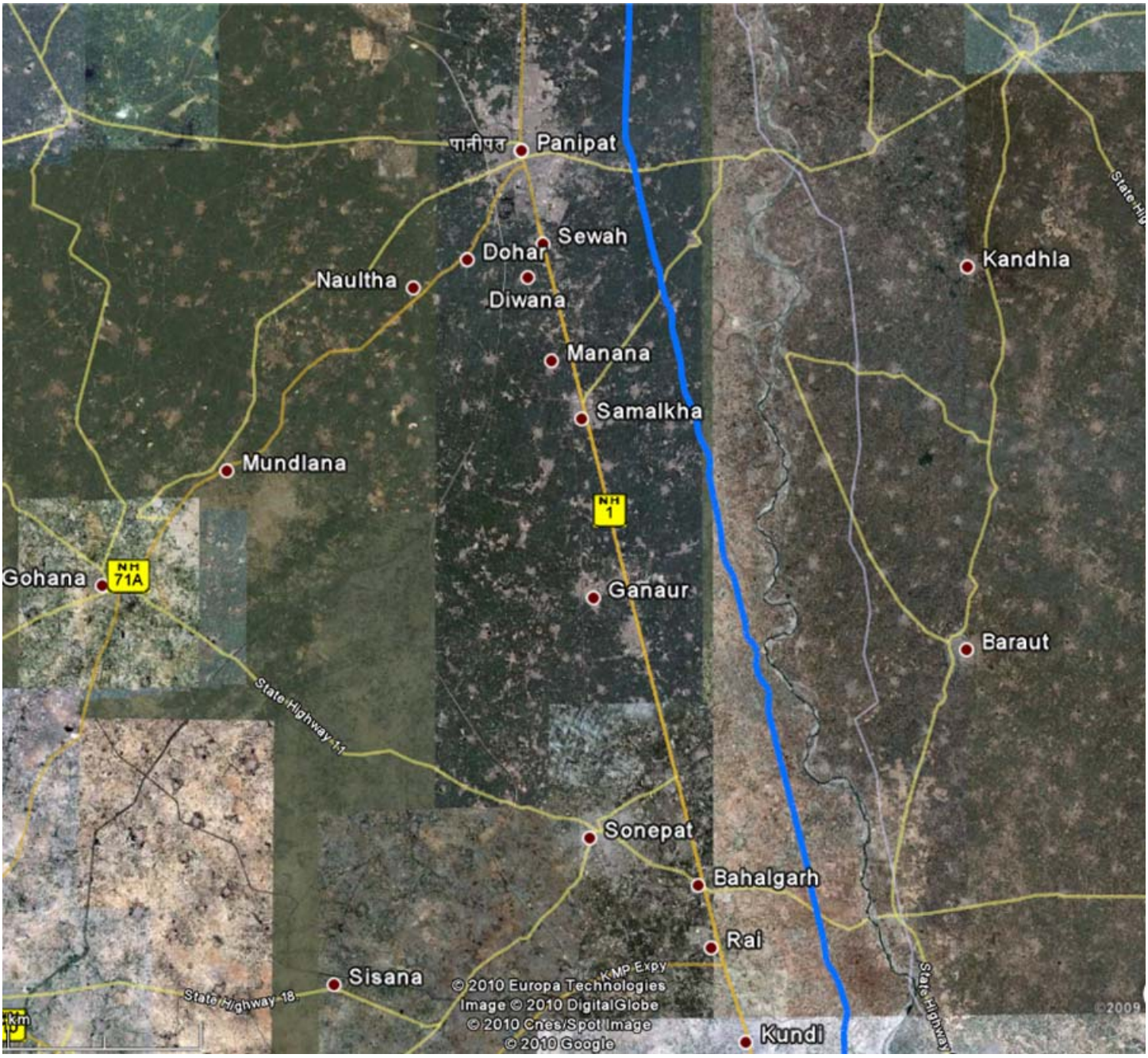
- **Kundli-Manesar-Palwal Expressway :** This expressway is under construction. It runs on the west of National Capital Territory of Delhi (NCTD) connecting Kundli, Manesar and Palwal. This Expressway, along with the palwal-Ghaziabad- Kundli Expressway (Easter Peripheral Expressway), is envised as a bypass system for NCTD.

The Supreme Court has strongly supported early development of the Expressway as it is expected to enable diversion of about 17,000 trucks presently passing through NCTD area causing

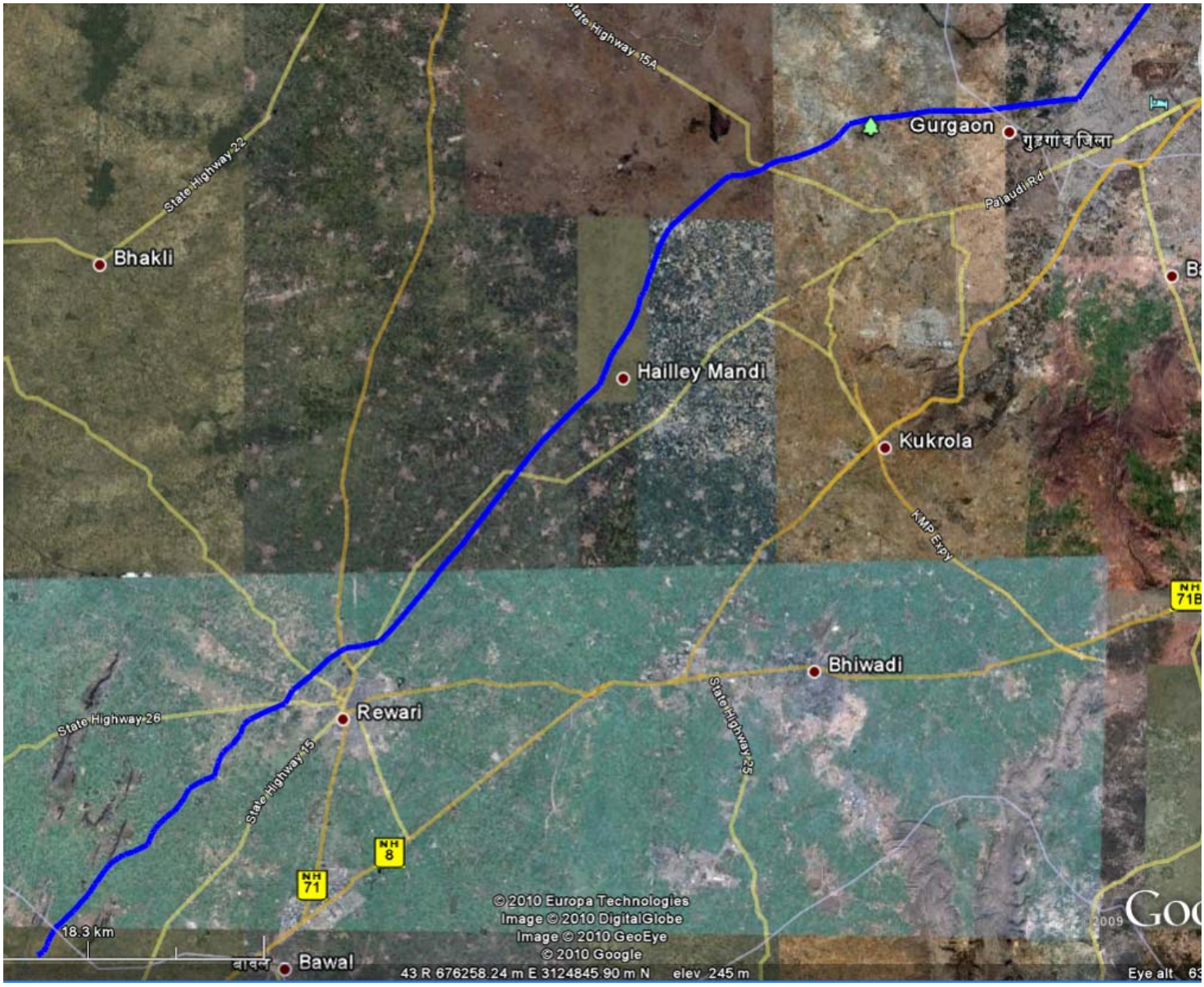
environmental pollution and accidents. With the rapid growth of Core National Capital Region (CNCR) policy zone due to high concentration of people and activities, there is a high degree of this expressway transferring into a intra-urban development corridor and losing its role as a bypass. The proposal of Government of Haryana for development of a number of theme towns along this corridor accelerates this change. There is a need to develop alternate corridor for bypass movements at the regional lavel.

Below figures will show the tentative alignment of expressways:

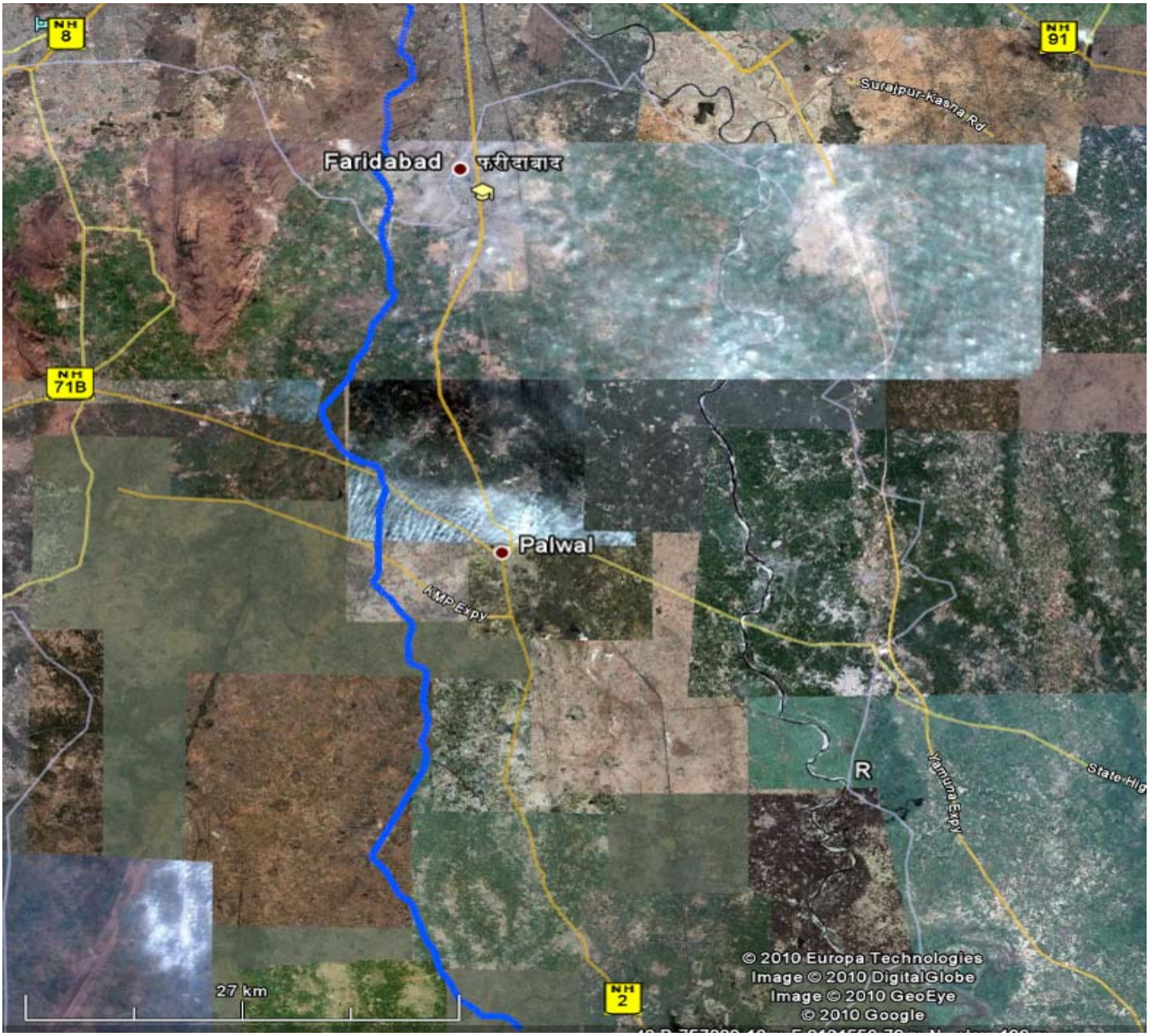
(i) **Delhi-Panipat Expressway :**



(ii) Delhi-Gurgaon-Rewari-Bawal Expressway :



(iii) Delhi-Faridaba-Palwal Expressway :



B :Grade separated intersections

Grade separated intersections are provided at the crossing of a major road with another road of similar category carrying heavy traffic. As per Manual of Specifications and Standards for Four Laning of National Highways through Public Private Partnership Government of India Department of Road Transport & Highways Ministry of Shipping, Road Transport & Highways, grade separated intersections shall be provided at all intersections of project highway with National Highways and State Highways. Grade separated intersections shall also be provided at

all other intersections of project highway with other category roads as when an at-grade intersection fails to handle the volume of traffic resulting in serious congestion and frequent choking of the intersection. This situation may arise when the total traffic of all the arms of the intersection is in excess of 10,000 PCUs per hour. Based on the above criteria the traffic volume at major intersections in the study area were analysed and it is found that grade separations should be provided for following intersections.

1. At grade intersection of NH 10 and NH 71 near Rohtak, at grade intersection of NH 10 and NH 71 near Qilla road and at grade intersection of NH 10 and NH 71 near Hari Nagar.

2. At grade intersection of NH71A and NH 10 near Chhotu Ram Chowk, Rohtak.

3. Intersection near ITI Colony, Sohna where SH-13(Gurgaon-Sohna-Nuh-Alwar Road) crosses NH71B.

4. Roundabout near Indira colony, Rohtak (Intersection of NH71 and NH71B).

5. At grade intersection of NH10 and SH 16 (Sanauli-Panipat-Rohtak-Bhiwani Road) near Rohtak.

6. At grade intersection of NH71 and SH 26(Gurgaon-Rewari-Narnaul-Singhana Road) near Rao Tula Ram Park, Rewari.

7. 4 legged intersection of NH 71, NH 71B, SH26 (Gurgaon-Rewari-Narnaul-Singhana Road) and SH15 near Sati Colony, Rewari.

8. Roundabout near Banglasaheb Gurudwara , Rohtak(Intersection of NH 71 and 71A).

9. Intersection of NH10 and NH 71A near Shri Baba Mastnath Public School, Hari Nagar.

10. At grade intersection of NH10 and SH22 (Bahadurgarh-Jhajjar-Kosli Road) near railway road, Bahadurgarh.

11. Intersection of NH71 and SH 24 (Rewari-Dahina-Mahendragarh-Satnali-Loharu Road) near Rewari railway station.

12. Intersection of NH 71 and SH16A (Gohana-Lakhanmajra-Meham-Chang Road) near Lakhan Majra.

13. Intersection of NH 71 and SH22 (Bahadurgarh-Jhajjar-Kosli Road) near Jhajjar.

14. Intersection of NH-10 and SH 20 (Murthal-Sonepat-Kharkhauda-Sampla-Jhajjar-Chhuchakwas-Jhajjar-Dadri-Loharu Road)near Sampla.

C :Grade Separations across Railways

According to IRC 62-1976(Guidelines for Control of Access on Highways), grade separations should be provided across existing railway crossings if the product of ADT (fast vehicles only) and the number of trains per day exceeds 50,000 within the next 5 years. Based on these criteria ROBs should be provided at the following locations.

1. Railway crossing on SH 20(Murthal-Sonepat-Kharkhauda-Sampla-Jhajjar-Chhuchakwas-Jhajjar-Dadri-Loharu Road) between Dehkora and Sampla

2. Railway crossing on MDR 138(GT road-Jatheri-Akbarpur-Rathdhana-Nahra-Kundal-Sohati-Bahadurgarh Road) near Ghevra village and Nai Basti Railway station

3. Railway crossing on SH 20(Murthal-Sonepat-Kharkhauda-Sampla-Jhajjar-Chhuchakwas-Jhajjar-Dadri-Loharu Road) near Sonepat railway station

4. Railway crossing on NH71A near to Panipat Museum

5. Railway crossing on SH 16A (Gohana-Lakhanmajra-Meham-Chang Road) between Kharanti and Khudali

6. Railway crossing on SH15 near Rewari Sector1.

7. Railway crossing on SH 16A (Gohana-Lakhanmajra-Meham-Chang Road) between Taska and Gohana village

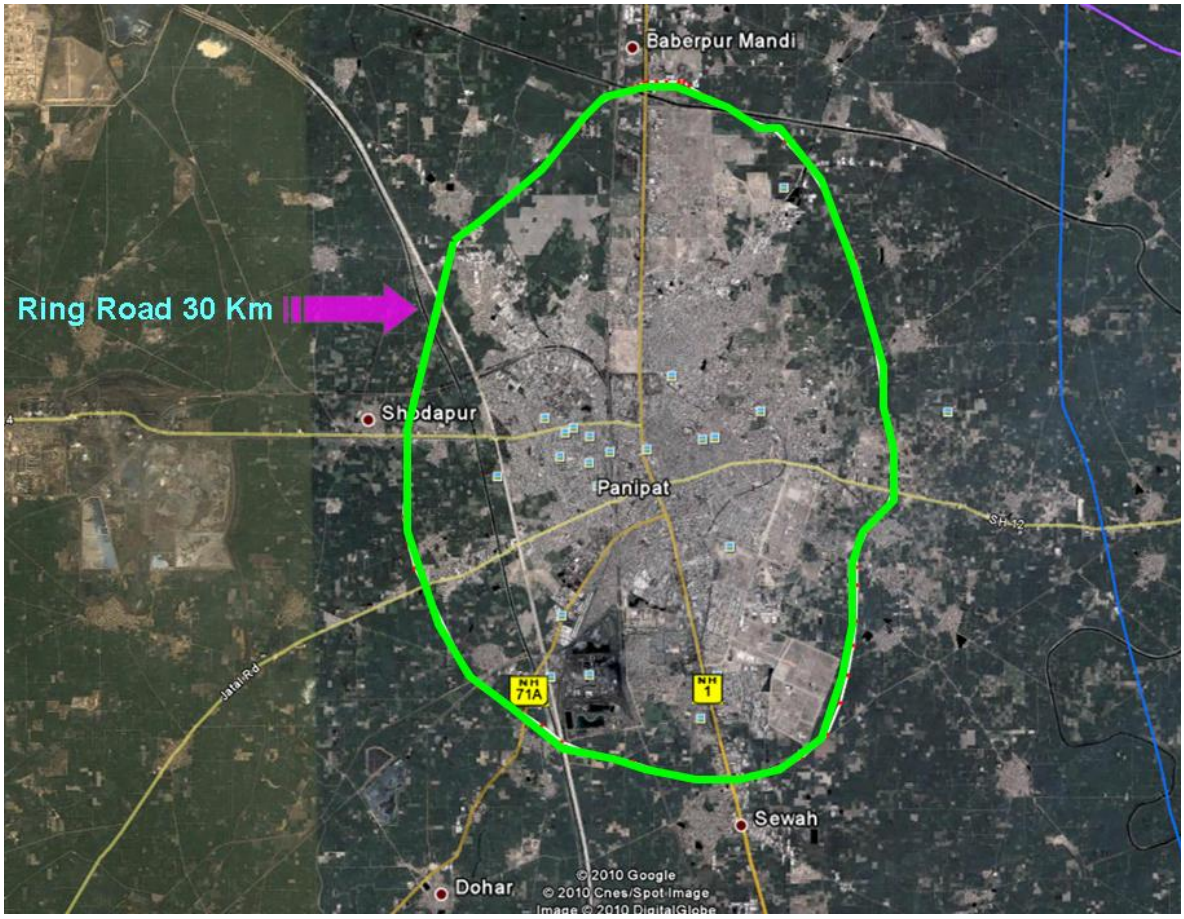
8. Railway crossing on SH-22 (Bahadurgarh-Jhajjar-Kosli Road) between Bhakli and Sudharna.

D :Bypasses/Ring roads for towns

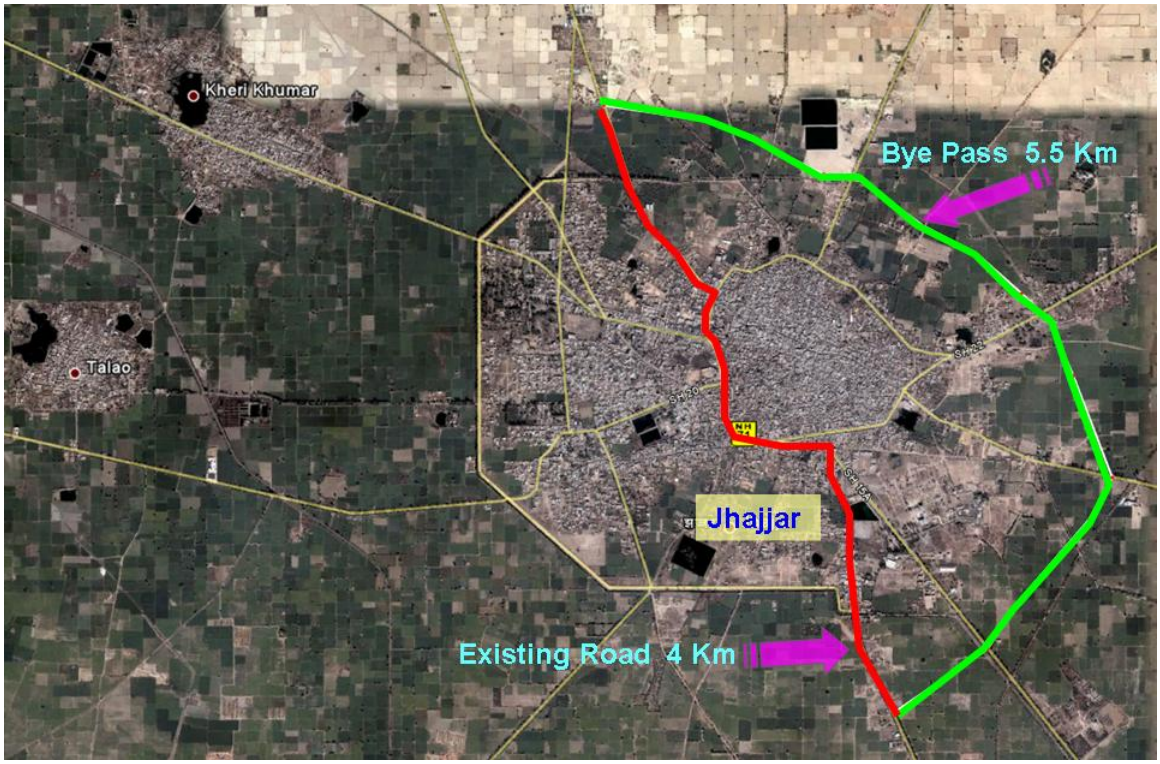
A bypass is a road or highway that goes around a town or village so that traffic which is passing that town does not have to go through the town centre. A road that goes all the way around the town in a large circle is called a ring road. Bypasses are good because they reduce the amount of traffic in the centre where the people live and work. It makes it much safer for them to cross the roads, and reduces pollution. It is better for the vehicles passing the town because their journey is made quicker. People are not always happy when a bypass is built. The main objections people sometimes have are that a new road uses up a lot of land. Also, some people who have businesses in the town (especially filling stations and restaurants) may think that they will not get so many customers. If there are no strong rules that control the use of land, buildings are built along a bypass, making it an ordinary town road so that it might become just as busy as a town street again.

In this plan numbers of bypasses are proposed considering the present conditions of the roads passing through a town, predicted traffic for the future, and proposals of bypasses/ ring roads in NCR master plan. Bypasses within the town should be elevated like Panipat and those outside the town should follow the norm of keeping the green belt of 500m on either side. It is required to avoid the bypass road becoming urban road in future. Following bypasses are proposed in this study for the future developments.

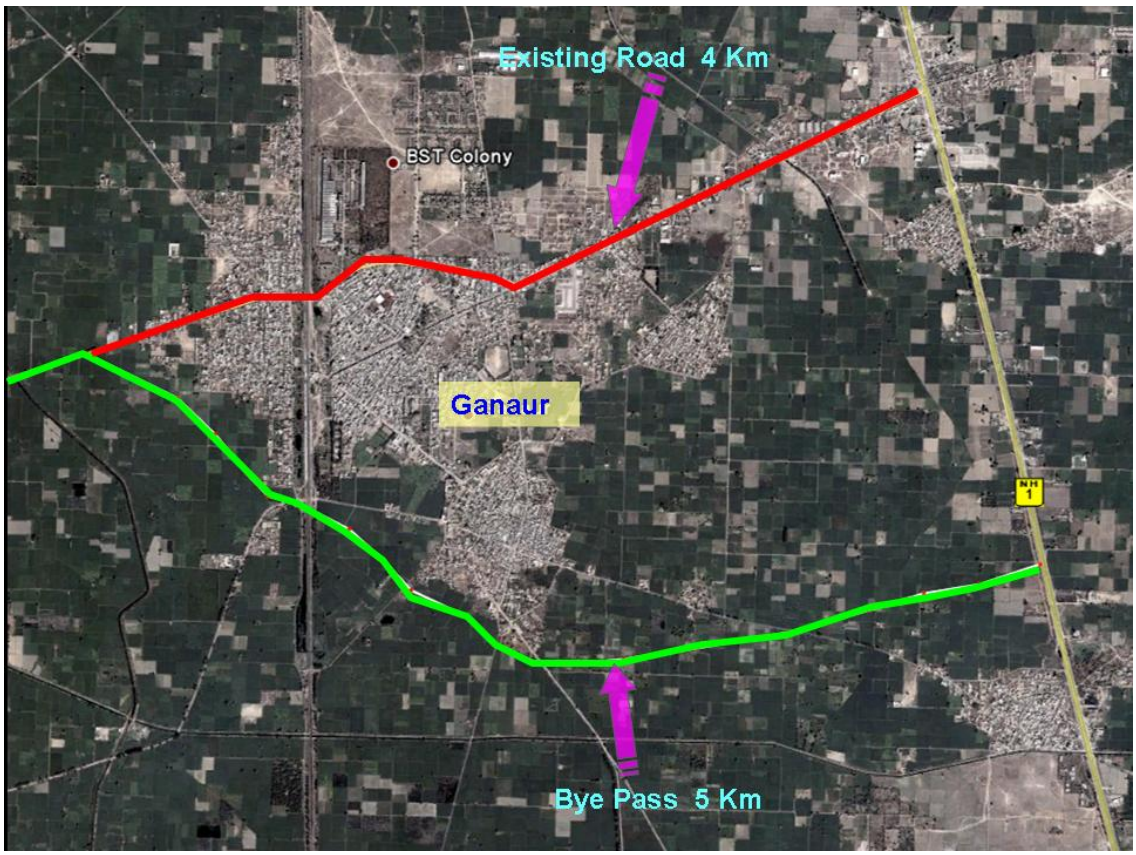
- **Panipat :** A ring road all around the Panipat town is proposed. The proposed ring road should connect NH 1 (south) - Gohana Road- Jatal Road- SH 14- NH-1 (north)- SH 12- NH 1 (South). This outer ring road will substantially reduce the external to external traffic passing trough the Panipat town in the present scenario. Length of ring road is approx. 30 KM.



- **Jhajjar :** A bypass is proposed all around the eastern periphery of the town to decongest Jhajjar from through traffic. The proposed bye pass should start at the southern end of the town along NH-71 and connects SH 15A- MDR123 –SH 22-SH 20 and NH-71 at the northern end of the city. Length of bypass is around 6 KM.This bypass is one part of the ring road proposed by the Dept. of town and country planning, of Haryana State in the land use plan of the revised draft development plan for the year 2031. The other part of the ring road can be developed subsequently.

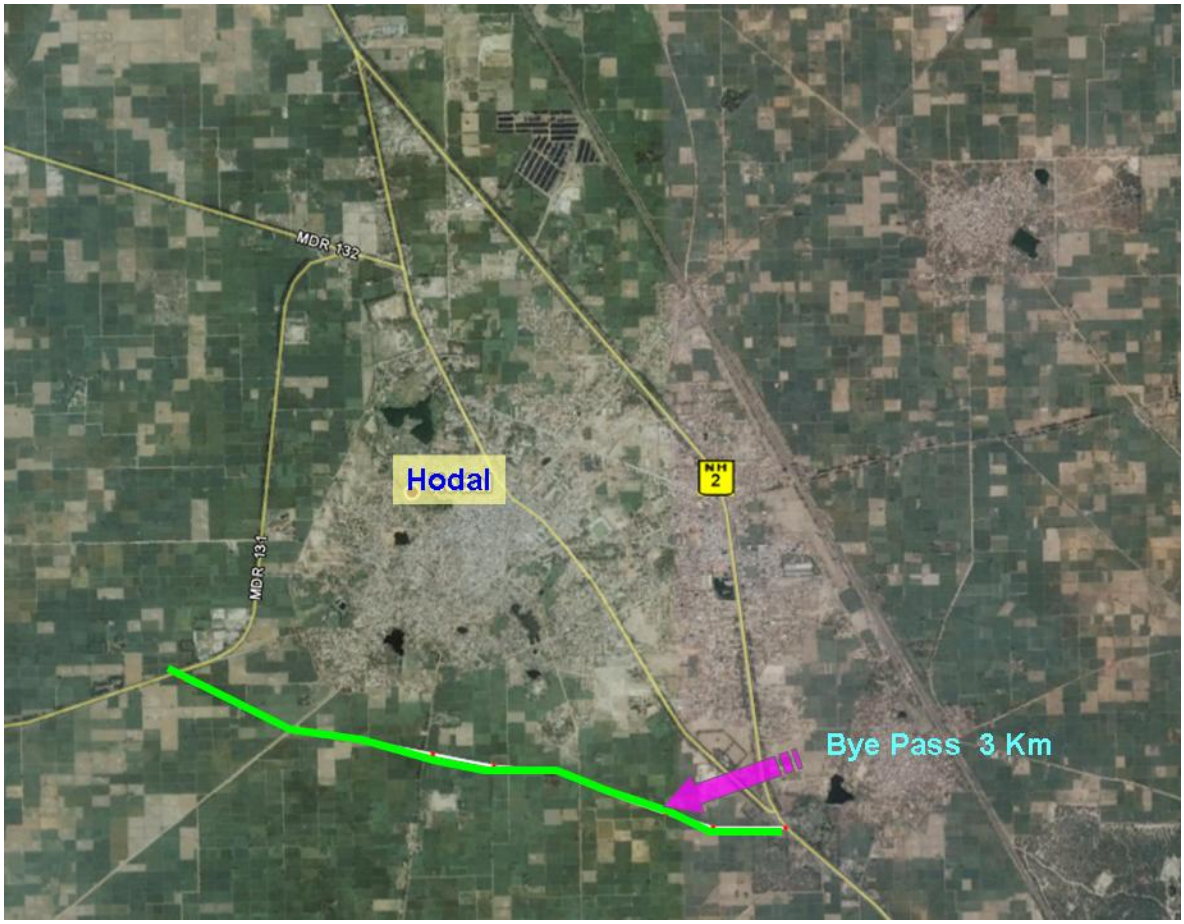


- **Ganaur :** The predicted traffic shows that the MDR 121 passing through Ganaur town need have to be augmented to four-lane divided road by the year 2014. In the prevailing condition if it is difficult to acquire lands for the augmentation of MDR 121 to four lane divided road

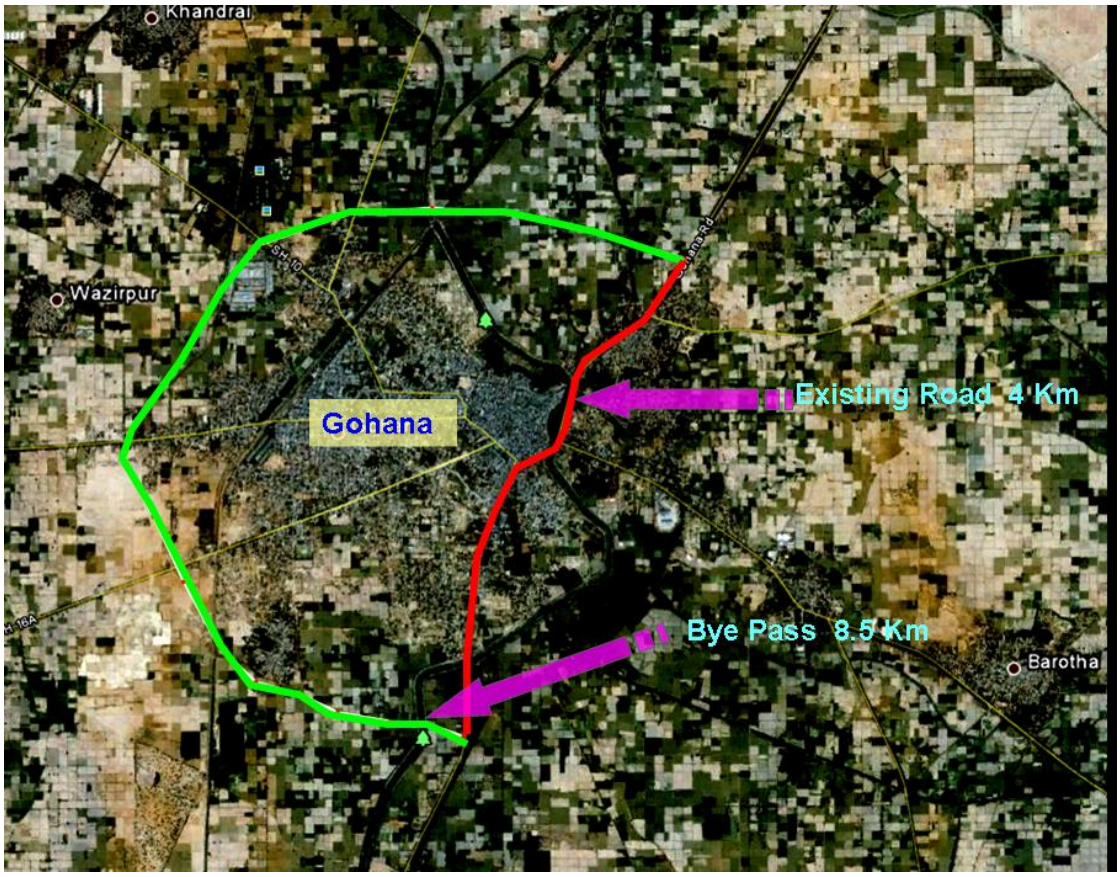


inside the town area; a bypass is proposed all around the southern periphery of the town to decongest the town from through traffic. The proposed bypass should start at the western end of the town along MDR-121 and merge with NH 1 at the eastern end of the city.

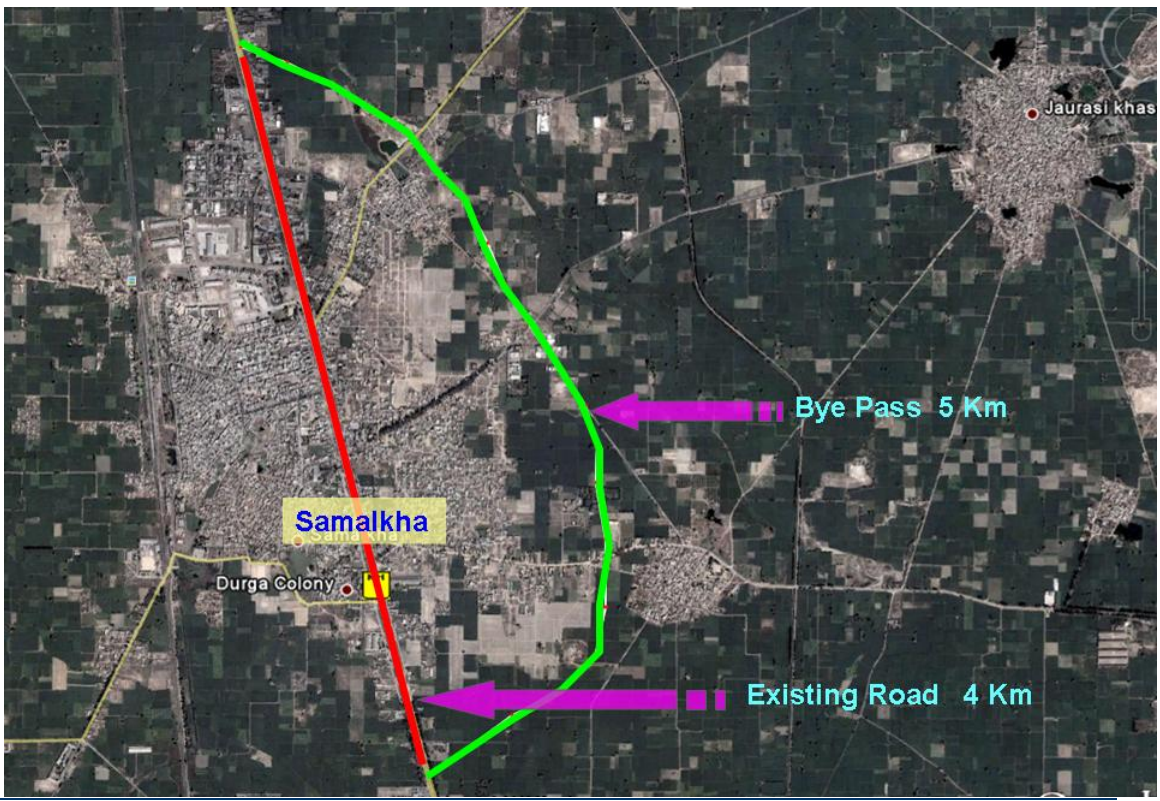
- **Hodal :** In the present scenario the south bound traffic towards Agra from the merging point of MDR 131 and MDR 132 preferably travels on NH-2 (through Hodal city). The predicted traffic shows that the MDR 131 and MDR 132 need have to be augmented to four-lane divided road by the year 2014. In this context a bypass is proposed around the south-western periphery of the town to decongest the town from through traffic. The proposed bypass should start at the southern end of the town (near the merging point of NH-2 and existing bypass on NH-2) and should merge with MDR 131 at the western end of the city.



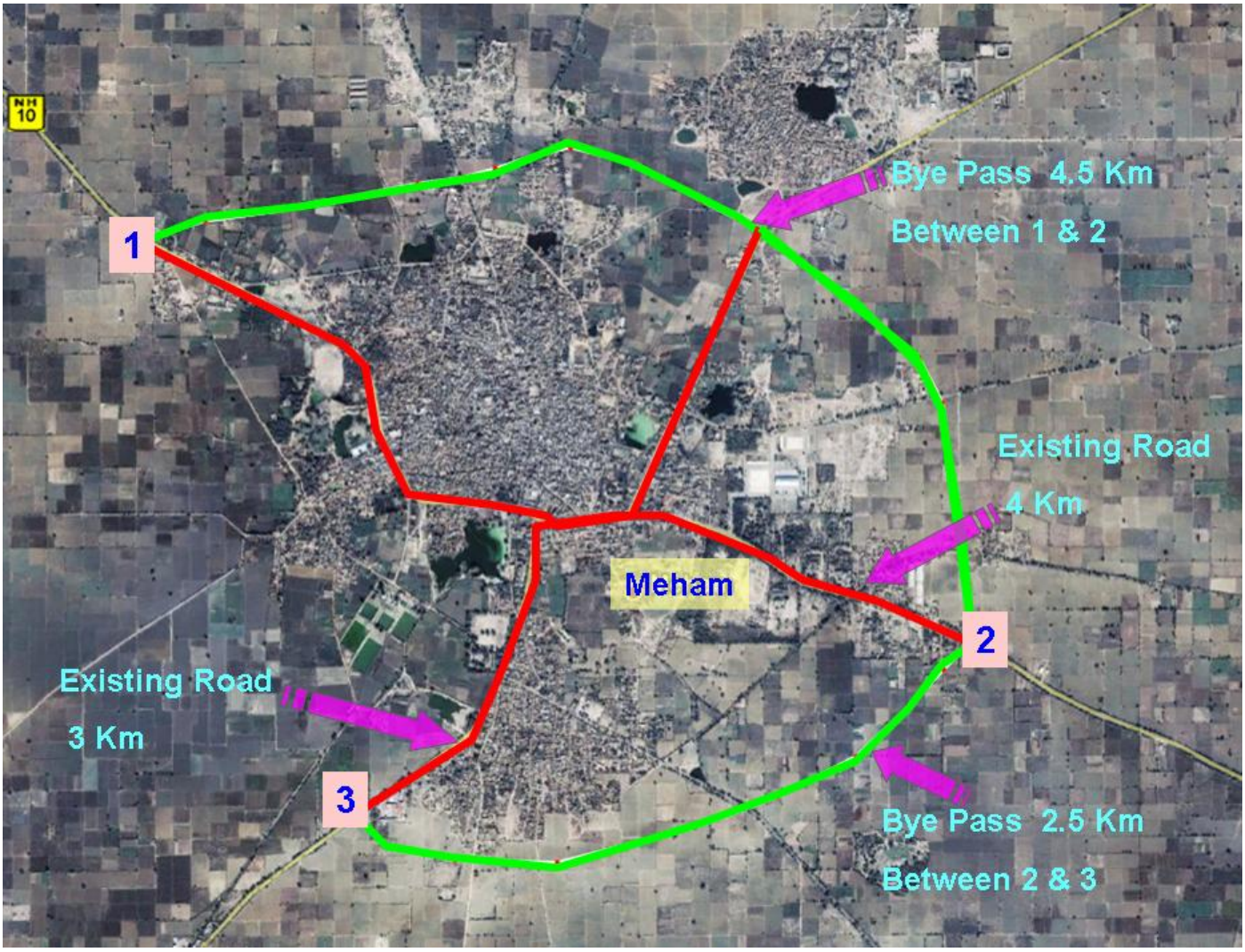
- **Gohana :** A bypass is proposed all around the Western periphery of the town to decongest Gohana from through traffic. The proposed bypass should start at the southern end of the town along NH-71A and connects SH 16A – Barauda road –SH 10, SH 11 and merge with NH-71A at the northern end of the city.



- **Samalkha :** A bypass is proposed all around the eastern periphery of the town to decongest Samalkha from through traffic on NH-1. The proposed bypass should start at the southern end of the town along NH-1 and terminates at the northern end of the city along NH-1.

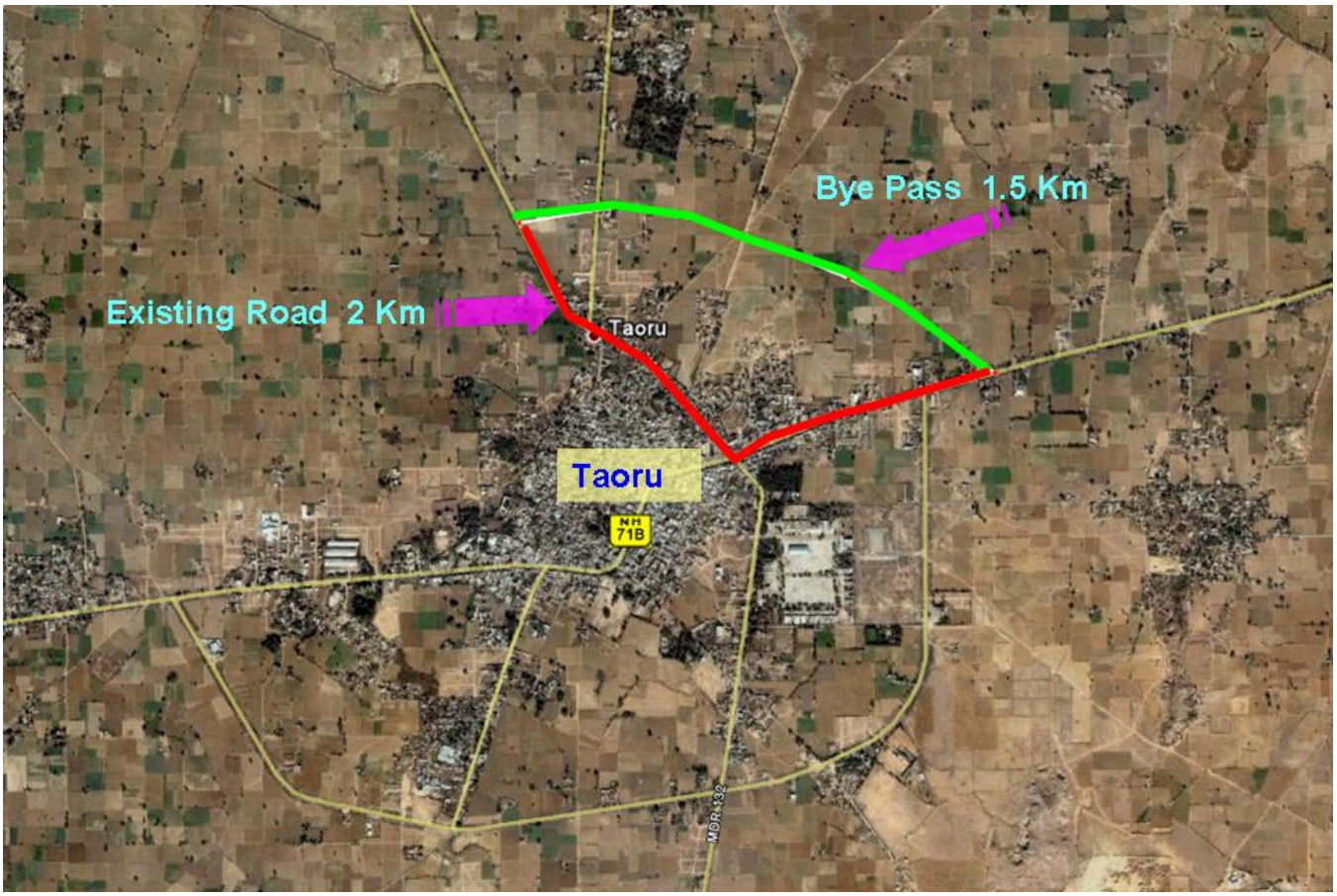


- **Meham :** A bypass is proposed all around the northern periphery of the town to decongest Meham from through traffic on NH-10. The proposed bypass should start at the eastern end of the town along NH-10 and terminates at the western end of the town along NH-10. Another bypass is also proposed around eastern periphery of the town to decongest Meham from through traffic on SH 16A. The proposed bypass should start at the southern end of the town along SH 16A and terminates at the eastern end of the city merged with NH-10.



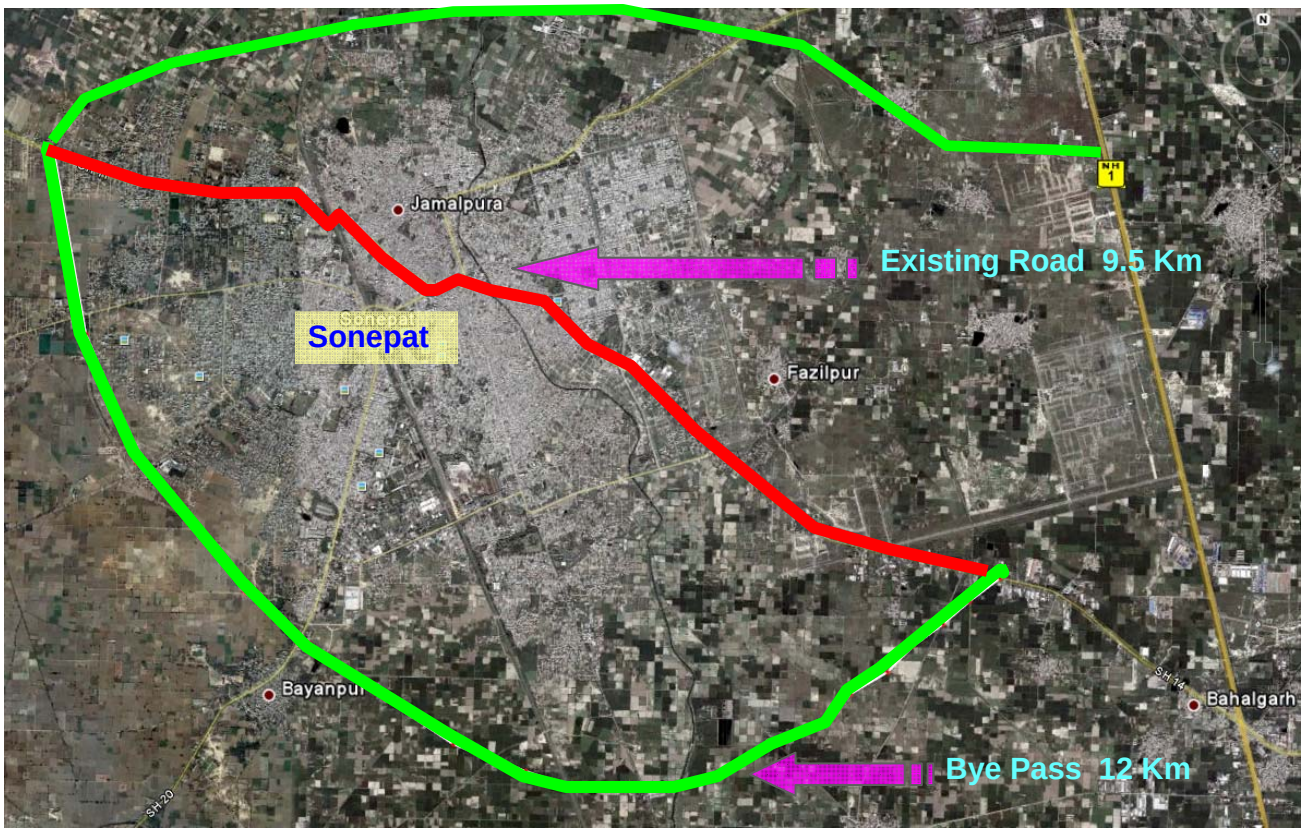
These bypasses are also part of the peripheral elliptical road proposed by the Dept. of town and country planning, of Haryana State in the land use plan of the draft report on the development plan 2031. The other part of the ring road can be developed subsequently. The remaining part of the bypass road should starts from western end of the Meham town along NH-10 and merge with SH 16A pasing through the western periphery of the town.

- **Taoru :** A bypass is proposed around the northern periphery of the town to decongest Taoru from through traffic on MDR-132. The proposed bypass should start at the north-eastern end of the town along NH-71B and terminates at the north-western end of the town along MDR-132. In future, this bypass can subsequently extend south bound to connect NH-71B at the western end of the town.

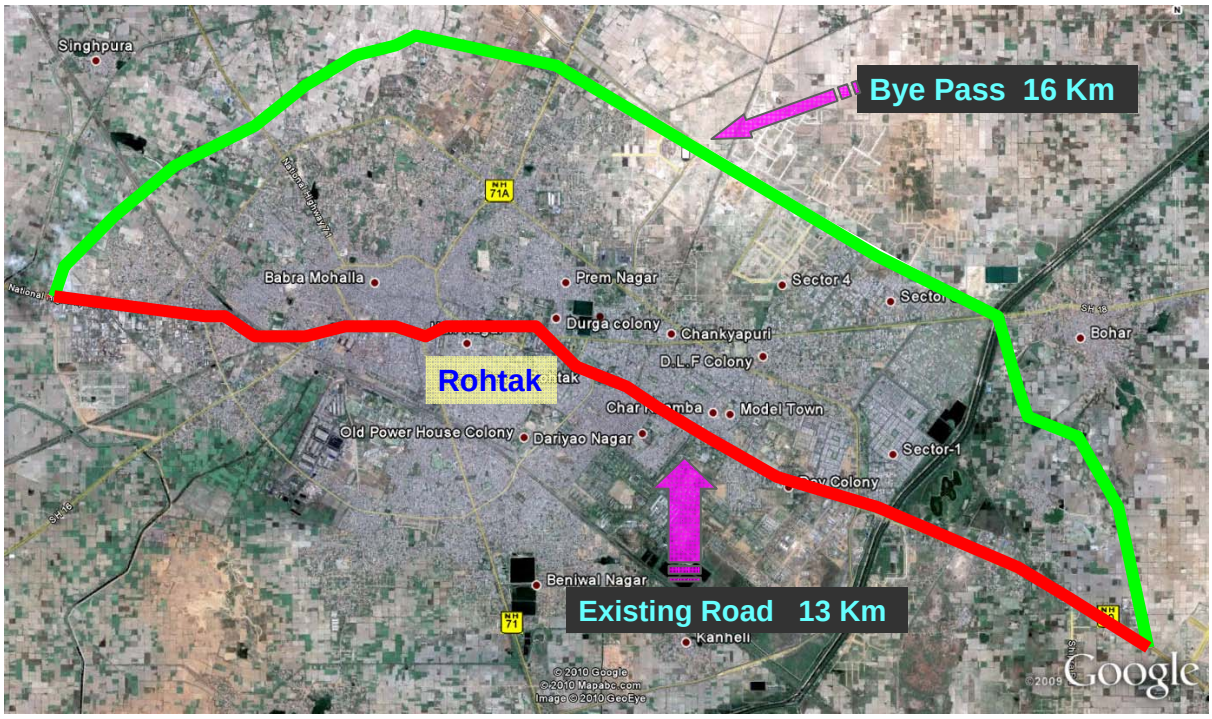


- **Sonipat :** The predicted traffic on SH-11 passing through Sonepat town demands for the augmentation of the existing road to six-lane and eight-lane divided road by the year 2014 and 2021 respectively. In the prevailing condition if it is difficult to acquire lands for the augmentation of SH-11 to six lane divided road inside the town area; a bypass is required all around the southern periphery of the town to decongest the town from through traffic. The proposed bypass should start at the northern end of the town along NH-1 and cover all around the western periphery of the town and merge with NH-1 at the southern end of the town. Also, this bypass will decongest the through traffic from SH20, so that through traffic from SH-20 will have less impact on Sonipat town. This bypass is also proposed by the Dept.

of town and country planning, of Haryana State in the land use plan of the draft development plan for year 2031.



- **Rohtak :** A northern bypass road and a southern bypass road all around the Rohtak town are



proposed. These bypasses are also proposed by the Dept. of town and country planning, of Haryana State in the re-revised land use plan of the draft development plan 2031.

- **Nuh :** A 75 meter wide periphery road with 50 meter wide green belt on both sides is proposed by the Dept. of town and country planning, of Haryana State in the land use plan of the draft report on development plan 2031.

- **Sampla :** A bypass is proposed in the draft development plan prepared by by the Dept. of town and country planning to divert the thorough travels on NH-10. The proposed bypass should start at the western end of the Sampla town and merge with KMP at the eastern end of the city. The bypass covers the southern periphery of the Sampla town.

14.4.1.ii Railways

Indian Railways play a major role in India's industrial and economic development by catering the needs of both Freight and passenger traffic.

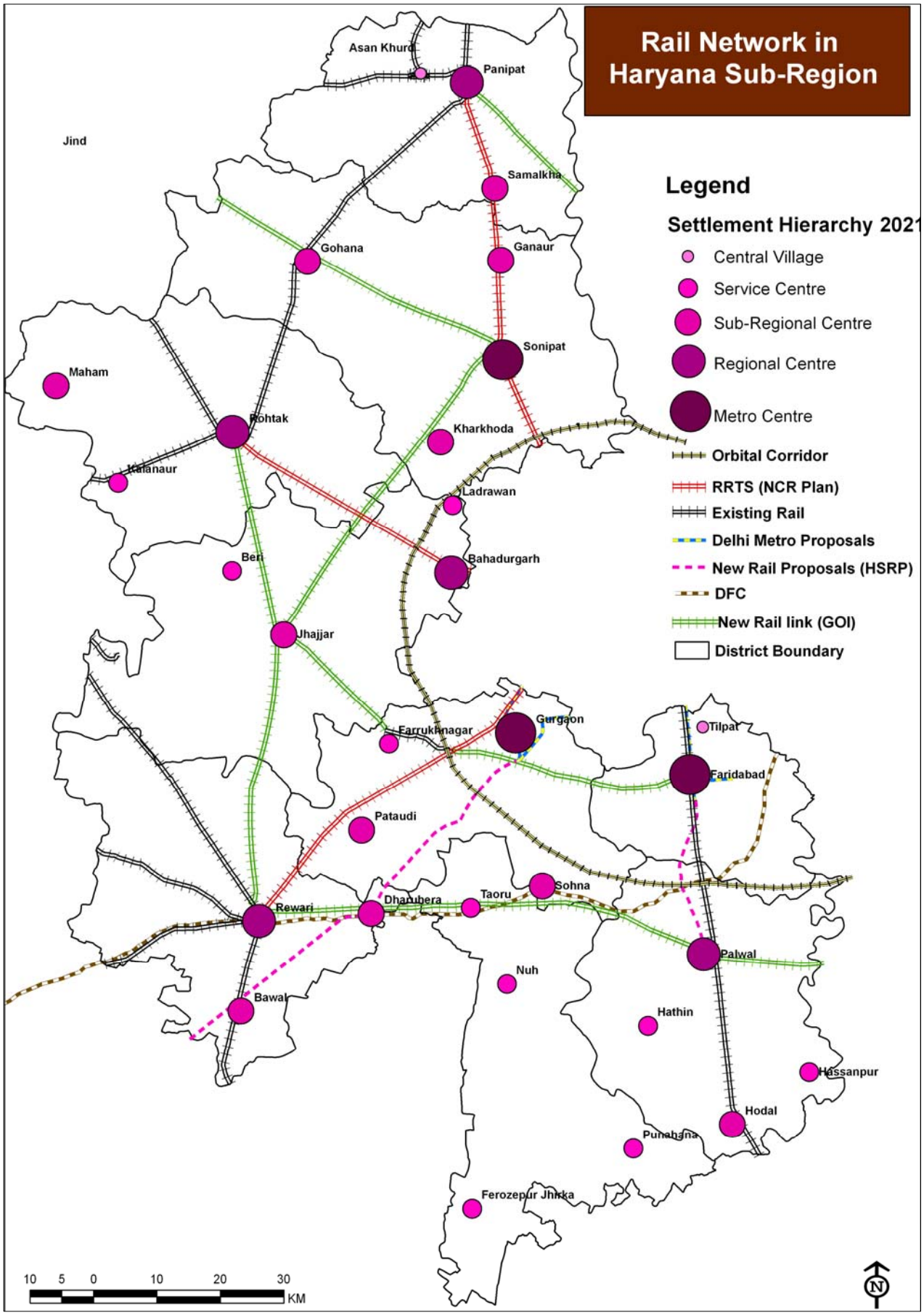
In view of the anticipated national growth in freight traffic to over 1100 million tones in 2011-12, besides developing two dedicated freight rail corridors (DFCs) Indian Railways have prepared a blue print for augmentation of line capacity of High Density Network (HDN) routes. Apart from the Government of India proposals for new rail links, upgradation of railway linkages and infrastructure few more railway links to be consider which are desired after the analys of existing, ongoing and proposed proposal of government and traffic projections in Sub-Region. These are :

- Regional Rapid Transit rail system linking Gurgaon with Dharuhera and Bawal,

- Extension of Delhi Metro Faridabad link to Palwal.

Below figure shows existing, proposed rail links by GOI and proposals of Sub-Regional plan.

Map 14-1 : Existing and Proposed Rai linkages



14.4.1.iii Integrated Multimodal Transport System (IMTS)

Proposed NCR Transportation plan recommends the following expressways, NHs, SHs, new rail links, metro extension, and regional rapid transit system proposals for the sub-region of Haryana. This will provide adequate connectivity of Haryana Sub-region to Delhi, UP and Rajasthan.

Roads

- Expressway

  Gurgaon-Faridabad Expressway

  Delhi-Faridabad-Palwal Expressway

  Delhi-Rewari

  Western Peripheral Expressway (Kundli-Manesar-Palwal)

  Eastern Peripheral Expressway (Kundli-ghaziabad-Palwal)

- National Highway

  Gurgaon-Alwar

  Behror-Khairthal-Hodal-junction with Taj Expressway

  Ballabgarh-Gulavati

- State Highway

  Pilana-Binaula

  Hodal-Nuh-Taoru-Pataudi-Kulana

Rail

- New rail links

  Panipat-Meerut

  Rewari-Bhiwadi-Palwal-Khurja

- Metro Extension

  Bahadurgarh to Rohtak

  Kundli to panipat

  Ballabgarh to Palwal

Manesar to Rewari

- Regional Rapid Transit System

  Delhi-Panipat

  Delhi-Ballabgarh

  Delhi-Rewari

  Delhi-Rohtak

Integrated Fright Complexes:

A high intensity of goods movement by road and rail systems is envisaged. They include consignments to a variety of destinations within and outside the region. The goods need to be received, stored, sorted and redistributed. Historically, this function is being carried out within or at the periphery of the city central area. Apart from sub-optimal utilization of valuable urban land space, this practice has led to lower productivity of the goods vehicles, high congestion, and high costs of handling the goods, environmental degradation, accidents and a number of other issues.

The need is to develop Integrated Freight Complexes (IFCs) at the outer edge of the urban area at the location of interfacing of the regional and urban network systems. Apart from the road system, the IFCs need to be integrated with the regional rail system. IFCs at all the regional urban nodes integrated with the Outer Grid Expressway System are proposed. The revision of city Master Plans need to provide for their use allocating adequate extent of land and integrating with intra-urban transport network system. The concerned city authorities my set up city based IFC Co. to plan, develop, operate and manage the city IFCs.

Logistic Hubs:

NCR is a high intense goods movement region. A large volume of goods, of all types move into/out of the region for consumption, storage and distribution. Import/export traffic from the northern region moves into the region for modal transfer. The NCR also produces goods of various types which need to move within and to other regions. Intensity of goods movement will get further intensified with the development of the 2 Dedicated Freight Corridors which traverse through the region and meet at Dadri. An extensive rail yard is being developed at Dadri. In

addition, an extensive Logistics Hub/Container Yard also needs to be developed at Dadri. Such yards and hubs need to be developed also at other locations within the region.

The integration of the Western and eastern DFCs has been planned to be at Dadri and Logistics Park has been proposed at Dadri. However, considering the development prospects of CNCR of which Dadri is a part, major constraints may arise for receipt and evacuation of goods from Dadri to different originating & destination points by road system. Also, availability of land for various related needs may prove to be difficult and costly. It is suggested interlinking the two DFCs at Khurja and development of Logistics Park and other related Facilities may be planned and developed at this location too. With the proposed Regional Expressway System and the Regional Cordon Rail Network System, it will be more efficient to receive and distribute the goods traffic.

The proposed locations of distribution centres are:

- Rewari (along western DFC)
- Khurja (along eastern DFC)
- Rohtak (along ORC)
- Panipat (along ORC)
- Meerut (along ORC)
- Hapur (along ORC)

Both Dadri and Khurja are part of UP state. While, the proposed locations of distribution centers under Haryana sub-region such as Rewari, Rohtak and Panipat are included in the revised report.

Highway Facility Centers:

The quality of the road network system is also affected by the user facilities provided along the road stretches. Road side amenities are needed and expected. In the absence of planned provision these facilities will develop in an adhoc manner, encroaching on the road right of way and causing bottlenecks and accidents. The Highway Facility Centres (HFC) needs to be planned

and developed on a comprehensive basis. They need to include parking, fuelling, servicing and repairs, telephone and telecommunication, restaurants and motels, medical, police, godown, Weigh Bridge, entertainment, banking (ATMs), and a host of other needed services. These HFCs need to be developed along the highways, spread over about 10 to 15 ha, at a spacing of 50-60 km.

Airports:

Small airports at Rewari, Jhajjar and Sonepat are proposed in the integrated transportation plan for National Capital region. However, these airports are under the influence zone of Indira Gandhi International Airport, Delhi. Similarly the small airports proposed for Rohtak and Panipat need clearance from Airport Authority of India (AAI), Ministry of Defence (MD), International Civil Aviation Authority, and Director General of Civil Aviation before the proposed plan comes to reality.

14.4.1.iv Cost Estimate

Development of proposed road network which includes Expressways, NHs, SHs, MDRs, bypasses, fly-overs and ROBs would cost 11,604 crores by the projection year 2021. The estimated cost (by the present value of rupees) of the road network is shown in the Table 6.15.

Table 6.15 Project Cost for the road network in the Haryana Sub-region

Sl. No.	Type of Facilities	Cost (in Crores)
1	Expressways	2779
2	National Highways	5010
3	State Highways	2290
4	Major District Roads	806
5	Bypass	453
6	Fly-overs	210
7	ROBs	56
Total		**11604**

14.4.2 Social Infrastructure:

The level of infrastructure facilities is still inadequate. The sectors of protected water supply and medical facilities are way below the required standards. The district level data indicate serious variation in the levels of facilities. Particularly the objective of *HEALTH FOR ALL* as agreed by India in the *ALMA ATA* convention . The district plans and urban area plans should designate land at suitable location to meet the desired standards.

14.4.2.i Education & Health:

As per the norms specified in UDPFI, the requirement of additional health and educational infrastructure has been estimated. The district wise social infrastructure requirement is given in the table below;

Table 14-14 : District wise social infrastructure requirement

District	Additional requirements Hospital Bed by 2021	Additional requirement for College & Secondary School by 2021
Panipat	6868	59
Sonipat	7592	60
Rothak	3795	0
Jhajjar	5063	4
Gurgaon	25320	500
Mewat	255	6
Rewari	4417	81
Faridabad	15813	215
Palwal	2790	35
Total	**71913**	**960**

The table shows the district like Rothak, Jhajjar and Mewat has better educational facilities in term of secondary school and colleges. The table indicates that the additional requirement of educational facilities in these districts is less in compare to other districts. Due to increased population growth especially in Gurgaon and Faridabad, the requirement of additional educational facilities is on much higher side.

The requirement of health facilities have been calculated based on the parameter of number of bed. The table shows Palwal, Mewat and Rohat has better health facility as the additional requirement of bed is less in compare to other districts.

14.4.2.ii District wise land requirement:

Based on the projected social infrastructure requirement for the towns in the sub-region, the requirement of land for health and educational facilities has been assessed. The following factors/assumptions have been considered;

- The unit land required for College, Secondary School and Hospital Bed, considered as per the UDPFI Guideline
- Secondary School=1.6 Ha
- College=4 Ha

Table 14-15 : District Wise Land Requirement for education and health facilities

District	Land Requirement (Ha) Hospital Bed by 2021	Land Requirement (Ha) for College & Secondary School by 2021
Panipat	82.416	96.8
Sonipat	91.104	98.4
Rothak	45.54	0
Jhajjar	60.756	8.8
Gurgaon	303.84	868.2
Mewat	3.06	11
Rewari	53.004	134.4
Faridabad	189.756	362.44
Palwal	33.48	63.96
Total	**862.956**	**1644**

14.4.2.iii Issues & Recommendation related to education and health facilities:

Quantitatively and statistically, Sub-Region is seems on averagely served by health facilities. However it is the quality of service that needs to be upgraded.

Major deficiency lies in the lower order facilities like PHC etc. The numbers need to increase in rural area.

There has been very less concern observed on the effort for separate collection, storage, transportation and disposal of bio-medical waste across the sub-region. De-centralized facilities in each district need to be put in place. PPP mode could be used to put in place a scientific plan in this field.

The major need that requires to be addressed on a war footing is the quality of education and education that matches actual needs, especially considering the economic segmentation of the sub-region. Special attention requires on improvement of high school drop-out rate.

Considering the tremendous potential on industrial development and modern urbanization in the sub-region, government should focus on to build the sub-region as an educational destination. To this end it should envision building institutions of caliber for high quality professional training and institution of international stature. ASn entrepreneurship Development Institute should be set up to meet actual needs of industry in sub-regional level.

Special thought needs to ensure a homogeneous geographical distribution of professional educational institutions so as to not form a cluster in just one area.

Every Panchayat should have library and reading room. Special scheme to encourage libraries including mobile libraries needs to be put in place.

The PPP format should be used to upgrade rural schools where infrastructure is poor and student shun going to these schools unless forced by poverty.

Village level access to basic medical service should be made easily available. Ideally every village should have sub-center. Upgrading the rural village health service should be given priority. Prevention health care should be the starting point for a sub-region health policy. Annual health

checks should be made mandatory at all levels of educational institutions so that prevalence of conditions like anemia in children can be identified and treated.

Sewerage systems need to be put in place so that there is no contamination of ground water sources. It is recommended to explore the possibility of introducing dry ecological toilets especially in rural areas.

Bio-medical waste should be handled at District level facilities which need to be set up in consonance with the Bio-Medical Waste (Management and Handling) Rules, 1998. The Governmnet should work on the system and the infrastructure for disposal of bio-medical waste which finds its way into public lakes, streams and also wells. While laws exist, enforcement is lacking.

The sub-region can be developed as a destination for medical tourism. It has very good connectivity with major urban centers in the surrounding states of the country. The Government must ensure adequate infrastructural inputs and let private sector make the investments. Medical tourism is a good example of infrastructure for visitors having both the purpose solved in terms of visiting tourist destinations and have access to good health care.

14.4.2.iv Housing Requirement:

The detailed housing requirement for all the towns in the Sub-Region is given as below;

Table 14-16 : Housing requirement for all the towns in the Sub-Region

Districts	Town_name	HH_2001	HH_2011	Aditional HH 2011	HH_2021	Aditional HH 2021
Faridabad	Faridabad	218885	362757	143872	601197	238440
Palwal	Palwal	17,174.00	34225	17051	68204	33979
	Hodal	6,055.00	9049	2994	13522	4474
	Hathin	1,672.00	3126	1454	5820	2695
	Hassanpur	1,375.00	1753	378	2235	482
Rohtak	Rohtak	54,593.00	99084	44491	138717	39633
	Maham	3,323.00	5314	1991	9325	4011
	Kalanaur	3,045.00	4111	1066	5961	1850

Panipat	Panipat*	68,900.00	96460	27560	135044	38584
	Samalkha	5,217.00	7826	2609	11739	3913
	Asan Khurd	1,782.00	0	0	0	0
Sonipat	Sonipat*	41,834.00	66539	24705	185868	119329
	Gohana	8,605.00	14628	6023	26604	11975
	Ganaur	5,139.00	9764	4625	31005	21241
	Kharkhoda	3,178.00	7945	4767	21172	13227
Gurgaon	Gurgaon*	46151	185582	139431	746258	560676
	Sohna	4,828.00	13349	8521	29368	16019
	Pataudi	2,647.00	9824	7177	17684	7859
	Haileymandi	2973	0	0	0	0
	Dundahera	2,382.00	0	0	0	0
	Farrukhnagar	1,671.00	1977	306	2340	362
Mewat	Taoru	3,001.00	4802	1801	7793	2992
	Ferozepur Jhirka	2,835.00	4536	1701	7345	2809
	Punahana	2,002.00	3040	1038	4616	1576
	Nuh	1,733.00	2773	1040	4437	1664
Jhajjar	Bahadurgarh	25,024.00	37536	12512	56873	19337
	Jhajjar	6,803.00	12914	6111	23244	10331
	Beri	2,858.00	4067	1209	5747	1680
	Ladrawan	1592	2030	438	2588	558
	Sankhol	991.00	0	0	0	0
Rewari	Rewari	18,706.00	36756	18050	66161	29405
	Dharuhera	9,968.72	19938	9969	42554	22616
	Bawal	1,945.00	9209	7264	16016	6807
Total		578888	1070912	500152	2289436	1218524

- Considering the anticipated population in the Sub-Region, there would be huge housing need by 2021, which is estimated at 12.18 lakh.

- The master plan of all the urban centers should be revised in case there is respective short to accommodate the required housing and infrastructure facilities by 2021.

- In order to decongest the already stressed urban centre, it is recommended that new growth centers to be encouraged. The Master plan of the special economic cities along KMP corridor should be prepared and kept sufficient provision to accommodate the additional housing need in the sub-region.

14.4.2.v District wise Land Requirement:

Based on the projected housing need for the towns in the sub-region, the requirement of land for urban housing has been assessed. The following factors/assumptions have been considered;

- Average Household Size=5
- Average Unit Size=950 sq.ft
- Average FAR considered=2
- Density Factor (Road & Open space)=30%

Table 14-17 : District Wise Land Requirement for Hosing

Districts	Additional Housing Need by 2021	Net Land Requirement (Ha)	Factor of road & open space (30%)	Total Land Requirement (Ha)
Panipat	42497	195.11	83.62	278.73
Sonipat	165772	761.12	326.19	1087.31
Rothak	45494	208.87	89.52	298.39
Jhajjar	31905	146.48	62.78	209.26
Gurgaon	584917	2685.56	1150.95	3836.51

Mewat	9041	41.51	17.79	59.30
Rewari	58828	270.1	115.76	385.86
Faridabad	238440	1094.7	469.16	1563.86
Palwal	41629	191.13	81.91	273.04
Total	**1218523**	**5594.58**	**2397.68**	**7992.26**

There would be 7992 hectares of land on demand in the sub-region to cater the housing requirement by the year of 2021. The private parties should be encouraged to address the need for housing.

14.4.2.vi Major Issues & Recommendation:

The housing industry in the Sub-Region has not been able to meet demand for housing especially affordable houses due to the following reasons;

- Scarce land available in settlement with marketable titles
- Rising trends of land price
- Cumbersome procedure and inordinate delay in getting construction licenses/occupancy certificates

The big challenge therefore is to build affordable houses keeping in mind that developable land is becoming a scarce resource in Sub-Region.

Land with potential for being in settlement land use zones in Sub-Region can be categorized in the following sub-group:

1) **Land not available for housing in settlement zones;**
   - Land falling in eco-sensitive zones which should not be allowed for settlements (except for improving housing in existing villages)

- Land locked areas, which do not have access road with prescribed right-of-ways
- Land without marketable title/disputed land
- Land marked as orchards/agricultural which are not available for settlement
- Institutional & Government lands or reserved for any other usage in the Master Plan
- Land already blocked by existing construction

2) Land available for housing

- All the proposed residential sectors mentioned in the master plan of respective towns in the sub-region

Providing affordable housing is not an isolated task. It is closely related to job locations and public transport. If the location of jobs is highly centralized, then the surrounding land prices rise- and affordable housing becomes impossible. The worker must live near his job or near a transport system that takes him to his job. These conditions are more likely exist in a poly-centered system of employment places, than in one that is centralized.

At present almost all the towns and maximum rural areas of the sub-region have access and connectivity. Therefore no need to infringe on productive lands to cater to housing needs, any approved settlement plans incorporated in the sub-regional plan.

There is a need to improve existing infrastructure in terms of road network, water, power, sewage disposal and solid waste disposal infrastructure. There is generally no need to take infrastructure to new development that leapfrogs the settlement fence. Proper network of road R/W's needs to be built to create access to land locked areas through a participatory process

Comprehensive schemes for Below Poverty Line (BPL) housing need to be introduced especially for migrated population. A distinct PPP model should be implemented with special consideration of LIG/EWS of urban people.

Unauthorized construction and encroachments in open spaces, road R/Ws, Government lands needs to be dealt with by strengthening the relevant Acts. Hostels for students & working men and women can be considered in the Master plan of all the towns in the sub-region. Financial incentives schemes are required for maintenance of heritage houses/building.

Government needs to set up expert committee to study implications of introducing Transfer of Development Rights (TDRs) and Land credit system especially in the congested towns in the sub-region

It is strongly recommended that special effort should be focused on formation of housing cooperative society. It is also suggested a high power committed should be set up to review the issue of affordable housing in the sub-region. Further, in order to ensure good practices in the housing industry, the industry should become self-regulating. Special associations, like CREDAI can then set and ensure standards in housing.

A special action plan to build affordable houses need to prepared by govt. organizations and through authorized private enterprise.

It is recommended to explore the possibility of levying property tax on all vacant (felloe) lands in settlement/ agricultural zones. This negative incentive will bring more land in settlement uses into the housing market and will also induce cultivation of fellow agricultural lands.

14.4.2.vii Area Reserved within the Special Economic Cities proposed along KMP Corridor

The Regional Plan 2021 for National Capital Region prepared by NCR Planning Board has proposed Kundli-Manesar-Palwal Expressway (KMP). It has also envisaged development of selected nodes at the inter-section of the proposed Kundli-Manesar-Palwal Express (KMP) and the radial Highways. The DPR for development of this Expressway has already been completed and work has already been awarded to the contractor for construction of this Expressway.

Simultaneously, looking at the experience of the National Capital Region and the unabated growth of Delhi, it is being increasingly felt that **development of a world class corridor** along the proposed KMP Expressway with state of art facilities will act as catalyst for development and attract Private Participation in the Development of region. In consideration of above scenario Government of Haryana intends to develop area along the KMP-Expressway as the Global Corridor in order to develop Sector specific parks/sub-cities. There are ten numbers of special economic cities have been proposed along the corridor which largely fall under the district like Palwal, Sonipat, Gurgaon, Jhajjar and Rohtak.

Table 14-18 : Area reserved in KMP Township

		Area Reserved (HA)	
Special Economic City	District	Residential Purpose	Social amenities
Leisure City	Palwal	15	97.5
Dry Port City	Palwal	395	150
Knowledge City	Sonipat	100	230
WTC	Gurgaon	0	27
Entertainment City	Gurgaon	5	20
Fashion City	Gurgaon	0	31
Cyber City	Jhajjar	0	62
Medi City	Jhajjar	8	143.5
Bio-Science City	Jhajjar	178.2	231.7
Sampla Township	Partly Jhajjar & Partly Rohtak	1292	68
Total		1993.2	1060.7

It is recommended that the revised master plan of each urban center should incorporate the proposed KMP cities. The additional land requirement for housing sector can be explored in these cities as per their master plan provision.

14.4.3 Role of HUDA

The Haryana Urban Development Authority (HUDA) needs to play an important role to address the housing need in the sub-region. The Haryana Urban Development Authority (HUDA), a statutory body of Haryana Government was constitutes under the Haryana Urban Development Authority Act, 1977. HUDA is mostly responsible for the overall development of the town - including infrastructure, waste and water management.

Its key functions include public service and welfare and catering to take up all the developmental activities itself and provide various facilities in the urban estates expeditiously.HUDA, as a

constitutional body has a vital role to play in the development of the major cities of Haryana and Gurgaon is no exception. From the changing scenario in the real estate sector in Gurgaon, it is very much evident about the involvement of HUDA in its various capacities.

As per its statutory role in the urban development the role of HUDA in the development of Sub-Region involves:

- The promotion and secure development of the city with the power to acquire sell and dispose off both movable and immovable property.
- To acquire, develop and dispose land for residential, industrial and commercial purpose.
- To make developed land available to Haryana Housing Board and other similar bodies for providing shelter to the economically weaker sections of the society.
- To undertake building and construction works.

This is remarkable to mention that Gurgaon zonal wing of HUDA has rejuvenated the look of the city at par with some of the best standards in urban development. One of the main features of HUDA since its conception has been to encourage Group Housing schemes to ensure optimum utilization of scarce urban land and for creating greater housing stock. This scheme became an instant hit with those buyers who were willing to invest in the Gurgaon real estate sector as it sent the vibes across to its potential buyers of providing affordable houses on one hand and a sense of community living on the other.

14.4.4 Role of Housing Board:

The housing board has prime function to provide houses for economically weaker section. The Housing Board Haryana came into existence during the year 1971 in pursuance of the Haryana Housing Board Act (Act No. 20 of 1971). The main objective of the Board is to construct houses for socially and economically weaker sections of the society.

Since its inception in 1971 and till 31st March, 2010 the Board has constructed 64,687 houses under different schemes such as Hire Purchase, Rental Housing and Self financing in urban areas mostly by taking loan from Housing & Urban Development Corporation, (HUDCO), a

Government of India's undertaking. Out of these houses, 45,518 houses are meant for Economically Weaker Section (EWS) and Low Income Group (LIG). However the board is required to increase the volume of work and implement the housing schemes to address the growing demand of affordable housing.

14.4.5 Role of Private Sector:

The private sector has the major role to address the housing requirement in the sub-region. The state has been pioneer in involving Private Sector towards development of residential colonies with a condition to provide plots/flats for EWS category of our Society. However more similar steps would be needed to solve/reduce the problem.

While granting a Licence for development of any residential colony by a Private Developer under Haryana Urban Development and Regulations of Urban Areas Act 1975, a condition of allotting 20% of the number of plots in the colony to EWS category of persons having a family income upto the prescribed limit by draw of lots, is imposed, through a Bilateral agreement of the colonizer with the Haryana Govt. Such plot sizes vary from 50 sq.m. to 125 sq.m. each. The rate of such plots is also fixed by the Govt. which has been varying from Rs. 100/- per sq. yd. to Rs. 500/- per sq. yd. as at present and not even levy of external development charges is involved in such plots.

In the case of Group Housing colonies, the licensee is required to construct EWS flats not less than 200 sft. each to the extent of 15% of the total number of flats sanctioned in the scheme to be allotted by draw of lots as above at Govt. fixed rate

14.4.6 Rural Housing Need:

Rural housing requirements should be delivered by;

- Encouraging private players by introducing development incentives
- Effective implementation of centralized housing schemes
- Introducing the concept of compulsory master plan of rural settlements which is under stress

14.5 *Industrial Proposals*

Analysis of major industrial development, major steps taken by HSIIDC in the field of industrial & infrastructure development, projection of industries for the year of 2021and analysis of provision of industrial land in the various master plans for the year of 2021 revels that there are some districts in Haryana Sub-Region in which land allocated for industrial development in the masterplans are more than the land required for industrial development in 2021 but there are some districts which need more land out side the master plan area. These districts need carefull allocation of land for industrial development keeping in mind the land suitable for industrial development and availability of water resources.

Below table shows district wise gross land area required for major industrial development in 2021.

Table 14-19 : Gross land area required for major industrial development in 2021

District	Gross Land area required for industrial development in 2021 as per industrial demand in acres
Panipat	6643
Sonipat	5828
Rohtak	2045
Jhajjar	3648
Rewari	2380
Gurgaon+Mewat	11798
Faridabad+Palwal	19345
Haryana Sub-Region	**51687**

After the district wise gap analysis of supply and demand for industrial land we find that except the districts of Panipat, Jhajjar and Faridabad including Palwal all other districts of the Haryana Sub-Region has more land allocated under industrial uses in master plans than demand of land for industrial land in the district.

Table 14-20 : Demand gap assessment for major industrial development in 2021

District	Gross Land area required for industrial development in 2021 as per industrial demand in acres	Industrial land provided in master plan_2021(Acre)	Developed Industrial estates in master plan	Net Industrial land provided in master plan_2021(Acre)	Additional Land requirements (Demand Gap)
Panipat	6643	4547	238	4309	-2334
Sonipat	5828	11239	163	11076	5248
Rohtak	2045	3262	63	3198	1153
Jhajjar	3648	2149	107	2042	-1606
Rewari	2380	5901		5901	3521
Gurgaon+ Mewat	11798	18992	67	18925	7128
Faridabad+ Palwal	19345	9355	4	9351	-9994
Haryana Sub-Region	**51687**	**55445**	**643**	**54802**	**3115**

When we see the industrial land suitability analysis and land demand gap analysis we see that in the district of Jhajjar all required land for industrial development can be fulfilled from land most suitable for industrial development where as in Panipat and Faridabad including Palwal we have to move to those land which are moderately suitable for industrial development.

Table 14-21 : Land suitability assessment for major industrial development in 2021

District	Additional Land requirements (Demand Gap)	Most suitable lands as per land suitability(Acre)	Moderately suitable lands as per land suitability (Acre)
Panipat	-2334	0	24520
Sonipat	5248	2749	242690
Rohtak	1153	88061	231789
Jhajjar	-1606	19690	218031
Rewari	3521	9522	143716
Gurgaon+ Mewat	7128	9970	263838
Faridabad+ Palwal	-9994	2189	109007
Haryana Sub-Region	**3115**	**132182**	**1233591**

Issues & Recommendation:

The special initiative needs to be put in place for the aspects like recycling waste water, establishing buffer zones around industrial areas, providing warehousing & logistics and housing for industrial areas. Lack of housing adjoining industrial area coupled with non-maintenance of buffer zones/green around the industrial areas has resulted in illegal tenement sprouting up within and outside industrial areas or residential areas being set up undesirably close to the industrial periphery.

Table 14-22 : Industrial land potential

Districts	Projected Industrial Potential	Industrial land suitability
Panipat	High	Less
Sonipat	High	Moderate
Rothak	Low	High
Jhajjar	High	Moderate
Gurgaon+Mewat	Moderate	High
Rewari	Moderate	Low
Faridabad+Palwal	Low	Low

- 1st phase of industrial development should be concentrated within Sonipat and Jhajjar, considering the emerging industrial potential and the decent suitability of industrial land
- In order to create a regional balance the potentiality of industrial development in Panipat should be channelized to Rohat, as this district has good connectivity with Panipat and having suitable industrial land. The industrial infrastructure should be plug in at Rohtak to cater the additional industrial demand. The existing industrial estate should be utilized properly as the suitable land resource is restricted in the district
- 2nd phase of industrial development should be facilitate in the district like Rewari, Mewat
- Faridabad would be reached at the stagnation level both in industrial potential and available resources. However it is still at the top runner in industrial development and urbanized district. The potential should be further encouraged and extended to Palwal to cater the future development.

Chapter 15 : IMPLEMENTATION

With the establishment of NCR Planning Board, an apex body has been constituted at the central level with the requisite statutory power to prepare a Regional Plan for the balance, harmonized and coordinated development of the NCR and to enforce, oversee and monitor the implementation of the plan. However the Sub-Regional Plan-2021 which has been made in conformity of the Regional Plan-2021, it is required to be implemented by the state, which the schemes falling in the central sector will be implemented by the concerned central minister.

The land uses suggested in the Sub-regional plan will appear for various categories of settlements, both urban and rural. The specific designation of land use within the various categories of settlements will be as per the Master Plan prepared and approved by the competent Authority and as per procedure laid by the existing legal & institutional framework.

Multiple agencies are involved in order to sustain a coordinated plan over a long time frame. Main nodal agencies for the planning and coordination are the following:

15.1 *Nodal agencies*

Various agencies that operate in the region for the land use & development of land and property sector are (i) the Town and Country Planning Department (NCR) Govt. of Haryana,(ii) Town and Country Planning Office, State of Haryana,(iii) Haryana Urban Development Authority (HUDA), (iv)CII and(v) HSIDC. These agencies and their roles have been discussed in the section below.

15.1.1 Town and country Planing Dpartment (NCR), Government of Haryana

Major functions of the T& CP Dept are the following:

a) Priortising Sector development according to NCR and State's economic growth as per market needs and assessment

b) Planning and developing new cities in the region

c) Laying down zoning parameters

d) Approve zoning plans

15.1.2 Haryana State Industrial and Infrastructural Development Corporation (HSIDC)

Haryana State Industrial Development Corporation is the nodal agency to promote large and medium industries and develop land for overall industrial growth in the state. It is the first state level financial institution with ISO 9002 certification. Its primary functions are as follows:

- To identify and promote large scale industries
- To provide financial assistance in the form of long term loans, equity and capital
- To contribute to infrastructure development in the state
- To perform agency functions on behalf of the Government
- To provide merchant banking services

15.1.3 Confederation of Indian Industry (CII)

Information on markets and opportunities for investment in Haryana can be obtained from Confederation of Indian Industry which works with the objective of creating a symbiotic interface between industry and government.

15.1.4 State Development authorities (HUDA, Town planning department)

These should also become pro-active and take steps to increase the supply of land to meet the demand, so that no artificial speculation takes place and everyone can dream of a home at a reasonable and affordable cost.

- The Haryana Urban development authority (HUDA) and Town planning department should exercise its control by way of:-
  a) Ensuring planned development as per Sanctioned Layout Plans
  b) Laying down zoning parameters in the approved zoning plan
  c) Sanctioning of each building plan to ensure conformity to laid down building bye-laws.
  d) Issuance of Occupation Permissions to ensure proper construction, besides checking the building at DPC level.
  e) Issuance of Licence completions after site check of all internal development of the colony
  f) Keeping of Bank Guarantee equal to 25% of the development cost to safe guard the development interests of allottees

g) Collecting External Development charges to ensure well co-ordinated infrastructure development in respect of various sectors/colonies

At the same time, the various parastatals and urban local bodies have to ensure that the supporting urban infrastructure is put in place to achieve a fully conforming urban space - be it water supply, sewerage and drainage, street lights, power supply, roads, flyovers, transport, metros, parks, markets etc.

Some of the nodal agencies responsible for such works have been identified as follows:

- Forest department, Govt. of Haryana
- Irrigation, Govt. of Haryana
- PWD, Govt. of Haryana
- Power department, Govt. of Haryana
- Gas (GAIL)
- Tourism department, Govt. of Haryana
- Industries department, Govt. of Haryana
- Agriculture department, Govt. of Haryana
- Haryana Industry Promotion Board

Hence this requires a proper legal and regulatory framework conducive to urban growth. The Town and Country Planning Department of Haryana (NCR) and the urban state Authority has been identified as the Nodal agency for planning and implementing projects as per the responsibilities sited above for the respective agency.

15.2 *Institutional Framework*

Apprehensions that unplanned adhoc development of the corridor may present fait accompli and that the land in the zone may come under serious pressure from speculators are being expressed in various quarters. Questions are being raised whether existing legal and executive powers are adequate to address such issues; whether institutions exist to enforce effectively the planning norms in the sub region

15.2.1 Existing Statutes

Before an answer is attempted to the questions raised above, a brief review of the existing legal framework under which development of the sub region can be regulated may be highly desirable. The review is as under:

- **Haryana Development and Regulation of Urban Areas Act, 1975**

It is an Act to regulate the use of land in order to prevent ill-planned and haphazard urbanization in and around towns in Haryana. Urban area means any area of land within the limits of a municipal area or notified area of Faridabad or situate within five kilometers of the limits thereof, or any other area, where, in the opinion of the Government, there is a potential for building activities and the government by means of notification declares. The Act requires any person, colonizer, company to obtain prior license for developing an area. Such licenses may stipulate payment of fees or other conditions.

- **The Punjab Scheduled Roads and Controlled Areas Restriction of Unregulated Development Act, 1963**

It is an Act to prevent haphazard and sub-standard development along scheduled roads and in controlled areas in Haryana. "Controlled area" means an area declared under section 4 to be a controlled area. "Scheduled road" means a road specified in the schedule to the Act which is wholly situated in Haryana and where any road so specified is not so situated, the portion of such road which is situated in Haryana, and includes a by-pass but does not include any part of such road or portion, not being a by pass, which is situated in the limits of a local authority. The government has powers under section 4 of the Act to declare whole or any part of any area adjacent to and within a distance of –eight kilometers on the outer side of the boundary of any town; or two kilometers on outer side of the boundary of any industrial or housing estate, public institution or ancient and historical monument; as controlled area.

Prohibition exists to erect or re-erect buildings within stipulated distance along scheduled roads. Prohibited zone extends to one hundred meters of either side the road reservation of a bye pass or within thirty meters on either side of the road reservation of any scheduled road not being the by pass.

Director, Town and country Planning, Haryana has to get plans prepared for controlled areas. These plans can place restrictions on development and building activities. Section 6 of the Act stipulates that except as provided hereunder, no person shall erect or re-erect any building or make or extend any excavation or lay out any means or access to a road in a controlled area save in accordance with the plans and the restrictions and conditions referred to in section 5 and with the previous permission of the Director. Land use has also been curtailed. Other provisions include

- Application for permission
- Power to permit or refuse
- Power of entry on land or building for survey
- Offences and penalties, power to arrest, composition of offences

Importantly, revision in the schedule does not require an amendment to the Act. Section 18 empowers the state government, by notification, to omit any road existing in the schedule or add a new road in the schedule.

Civil courts have been barred to entertain or decide any question relating to matters falling under the Act or the rules made there under.

Nothing in the Act shall apply to:

- The area comprised in the abadi deh of any village
- Erection or re-erection of a place of worship
- Excavations of wells or other operations made in ordinary course of agriculture
- Construction of unmetalled road intended to give access to land for agricultural purposes

➢ The National Capital Region Planning Board Act, 1985

Regional Plan -2021 has been prepared under the Act and finally approved by the central government.

➢ Town and Country Planning Department

The Department of Town & Country Planning, Haryana is the nodal department to enable regulated urban development in the State of Haryana. The policies of the department aim at

encouraging a healthy competition amongst various private developers and public sector entities for integrated planned urban development. The department also renders advisory services to various Departments/Corporations/Boards such HUDA, Housing Board, HSIDC, Marketing Board. To name a few major functions of the department are given as under:-

1. Prevention of unauthorized and haphazard construction and regulation of planned urban development under the provision of Punjab Scheduled Roads and Controlled Areas Restriction of Unregulated Development Act, 1963 by declaring controlled areas around towns and public institutions preparation of their development plans and sectoral plans for planned urban development.
2. To regulate the development of colonies in order to prevent ill-planned and haphazard urbanization in or around the towns under the provision of the Haryana Development and Regulation of Urban Areas Act, 1975.
3. Prevention of unauthorized constructions and regulation of planned urban development under the provision of the Punjab New Capital Periphery (Control) (Haryana Amendment) Act, 1971 applicable around Chandigarh in Panchkula District.

To cater to needs of society, Haryana Urban Development Authority; a statutory body is executing the urban development projects in various towns. However in order to meet the requirement of different uses, the department is also granting licenses to the private colonizers to develop residential and commercial colonies in urban areas under the provisions of the Haryana Development and Regulation of Urban Areas Act, 1975. Apart from HUDA, other agencies involved in the urban development of the state are Housing Board, Marketing Board and HSIDC.

Since a significant portion of the State falls in National Capital Region Haryana, the department also co-ordinates with the NCR planning Board for formulation and implementation of development plans aimed at integrated regional development within National Capital Region.

Scope of services:

The services rendered by the Town & Country Planning Department are as under:-

1. Preparation of Development Plans for planned urban development of various towns and villages as well.

2. Granting licenses for development of residential, commercial and industrial colonies and layout plans/ building plans thereof.

3. Granting of CLU permissions of residential, commercial, institutional and industrial purpose in various controlled areas and approval of building plans thereof.

4. Issuance of licenses for brick-kilns, Stone Crushers and Charcoal kilns etc.

5. Detection of unauthorized constructions; and initiating appropriate action against the offenders.

6. Technical services to HUDA in persuasion of plans and related issues.

- **Haryana Panchayat Raj Act, 1994**

The Haryana Panchayat Raj Act first published for general information in the Haryana Government Gazette on 21st April, in the year of 1994. It has got amended several times with latest amendments in 2006. The act has clearly indicated three level administration operational systems i.e. Gram Panchayat, Panchayat Samiti and Zilla Parisad. Each stage has laid down functions to perform.

Gram Panchayat:

General Functions:—

- Every resolution adopted in a meeting of the Gram Sabha shall be duly considered by the Gram Panchayat and the decision and action taken by the Gram Panchayat shall form part of the report of Panchayat of the following year.
- Preparation of annual plans (including economy, social, physical infrastructure development) for the development of the Panchayat area.
- Preparation of annual budget and submission thereof to Gram Sabha in its Sawani meeting for consideration.
- Power for mobilising reliefs in natural calamities.
- Removal of encroachments on public place .
- Organising voluntary labour and contribution for community works.
- Maintenance of essential statistics of village (s)

Panchayat Samiti:

General Functions—

- Preparation of the annual plans in respect of the schemes entrusted to it by virtue of this Act and those assigned to it by Government or the Zila Parishad and submission thereof to the Chief Executive Officer within a period of two months of its receipt for the consideration of the District Planning Committee constituted under this Act;
- Consideration and consolidation of the annual plans of all Gram Panchayat in the block and submission of the consolidated plan to the Zila Parishad;
- Preparation of annual budget of the block and its submission within such time, as may be prescribed, to the Zila Parishad;
- Performing such functions and executing such works as may be entrusted to it by the Government or the Zila Parishad;
- Providing relief in natural calamities.

Zila Parishad

A Zila Parishad advice, supervise and co-ordinate the functions of the Panchayat Samitis in the district.

Without prejudice to the generality of the provisions of sub-section (1), a Zila Parishad shall have power to—

- give advice to Panchayat Samitis on its own motion or on the requirement of the Government or at the request of a Panchayat Samitis;
- co-ordinate and consolidate development plans prepared in respect of Panchayat Samitis ;
- secure the execution of plans, project, schemes or other works common to two or more Panchayat Samitis in the district ;
- exercise and perform such other powers and functions in relation to any development programme as the Government may, by notification, confer on or entrust to it ;
- advise Government on all matters relating to development activities and maintenance of services in the district, whether undertaken by Local Authorities or Government ;
- advice Government on the allocation work among Gram Panchayats and Panchayat Samitis and co-ordinate their work ;

- advice Government on matters concerning the implementation of any statutory or executive order specially referred to by the Government to the Zila Parishad ; and
- Examine and approve the budget of Panchayat Samitis in the manner laid down in section 102 of this Act.

The Zila Parishad may, with the prior approval of the Government, levy contribution from the funds of the Panchayat Samitis in the district.

Notwithstanding anything contained to the contrary in this Act, a Zila Parishad shall, when required by the Government to do so, by an order in writing, exercise such supervision and control over the performance of all or any of the administrative functions of the Gram Panchayat and Panchayat Samiti within the district or any part thereof, as may be specified in the said order.

15.2.2 Summary:

The Government of Haryana has three parastatals- to implement government policies in the fields of urban development, housing and habitat.

- Haryana Urban Development Authority
- Haryana Housing Board
- Haryana State Industrial Development Corporation

Although the Panchayat Raj Act has laid down the provision of District Planning Committee and the Zila Parishad, Panchayat Samiti, Gram Panchayat has specific function of preparation of development plan/Annual Plan for overall development of the area which falls under respective jurisdiction, there is no such provision exists for spatial planning in district level.

It is recommended to prepare and update the District Development Plan for each districts falls under sub-region and this should be integrated with the Sub-Regional Plan-2021. Planning Commission of India suggested (in 2008) institutional and other forms of professional support including capacity building to enable the District Planning Committee (DPC) to consolidate the plans of the various tiers of Panchayat Raj Institutions and the urban local bodies (ULBs) into the district plan.

15.3 *Legal Framework*

Based on the sub-regional land use, the following are some of the important central laws affecting the Project.

15.3.1 Environment Protection Act, 1986

This statute enables the Ministry of Environment and Forests, Government of India ('Ministry') to bring out notifications for the purposes mentioned therein.

- **Environment Impact Assessment Notification 2006**

In pursuance of the powers conferred by the Environment Protection Act, 1986 the Ministry has come out with a notification on Environment Impact Assessment. This notification is applicable to eight categories of projects, which includes majority of urban projects, for which environment clearance is required from designated environment clearance authorities.

For getting the said clearance, application has to be made to the designated authority attached proforma alongwith a Project Report, Environment Impact Assessment Report, Environment Management Plan and the details of a public hearing on the project. Without getting such environmental and site clearance no construction work, preliminary or otherwise, is to happen. Relevant extracts from the Notification is attached herewith.

- **Notification dated May 07, 1992 on Aravalli Range**

The Ministry has come out with a notification specifically on the Aravalli Range. Under this notification permission from the Ministry is needed for the following activities when such activity is carried out in the areas specified.

i. Location of any new industry including expansion/modernisation;

ii. (a) All new mining operations including renewals of mining leases

(b) Existing mining leases in Sanctuaries/National Park and areas covered under Project Tiger an/or

(c) Mining is being done without permission of the Competent Authority

iii. Cutting of trees;

iv. Construction of any clusters of dwelling units, farms houses, sheds, community centres, information centres and any other activity connected with such construction (including roads a part of any infrastructure relating thereto)

v. Electrification (laying of new transmission lines)

15.3.2 Forest laws

- **Forest (Conservation) Act, 1980**

Section 2 of the said Act provides:

Notwithstanding anything contained in any other law for the time being in force in a State, no State Government or other authority shall make, except with the prior approval of the Central Government, any order directing-

(i) that any reserved forest (within the meaning of the expression "reserved forest" in any law for the time being in force in that State) or any portion thereof, shall cease to be reserved;

(ii) that any forest land or any portion thereof may be used for any non-forest purpose;

(iii) that any forest land or any portion thereof may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organisation not owned, managed or controlled by Government;

(iv) that any forest land or any portion thereof may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for reafforestation.

Explanation - For the purpose of this section, "non-forest purpose" means the breaking up or clearing of any forest land or portion thereof for-

(a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants;

(b) any purpose other than reforestation; but does not include any work relating or ancillary to conservation, development and management of forests and wildlife, namely, the establishment of check-posts, fire lines, wireless communications and construction of fencing, bridges and culverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.

- **Notification dated January 10, 2003**

  Under this notification issued by the Ministry under the above-discussed Forest (Conservation) Act, 1980, every user agency who wants to use forest land for non-forest purposes is take permission from the Ministry by making suitable application.

- **Note on Forest (Conservation) Act, 1980**

  The following extract from the note on Forest (Conservation) Act, 1980 as publicised by the Ministry through its website is indicative of the policy of the Ministry in matters involving use of forestland for non- forest purposes. The note states in Paragraph 4.4 as follows:

  Some projects involve use of forestland as well as non-forest land. State Governments/project authorities sometimes start work on non-forest lands in anticipation of the approval of the Central Government for release of the forestlands required for the projects. Though the provisions of the Act may not have technically been violated by starting of work on non-forest lands, expenditure incurred on works on non-forest lands may prove to be infructuous if diversion of forestland involved is not approved. It has, therefore, been decided that if a project involves forest as well as non-forest land, work should not be started on non-forest land till the approval of the Central Government for release of the forestland under the Act has been given.

- **Indian Forest Act, 1927 (As Amended In 2004)**

  The Indian Forest Act was enacted to consolidate the law relating to forests. The Act specifically deals with

  1) Reserved Forests
  2) Village Forests viz, reserved forests which have been assigned to any village community, and
  3) Protected Forests,

However, the preamble and other provisions of the Act are wide enough to cover all categories of forests.

- National Forest Policy 1988

Basic objectives

1) maintenance of environmental stability through preservation and restoration of ecological balance
2) increasing substantially the forest cover through massive afforestation and social forestry programmes
3) Creating massive people's movement to achieve the objectives.

Management:

1) Existing Forests and Forest land should be fully protected
2) Vegetal cover should be increased along rivers, lakes and reservoirs, and ocean shores and on semi arid, and increased rapidly on all hill slopes, in catchment areas of rivers and desert tracts.
3) Diversion of good and productive agricultural land to forestry should be discouraged
4) Strategy.
5) The National goal should be to have a minimum of one-third of the total area of the country under forest cover
6) The hills and mountainous regions, the aim should be to maintain two thirds of the area under forest cover
7) Encourage the planting of trees alongside roads, railway lines, rivers, streams and canals, and on other unutilised land .
8) Green belts should be raised in urban/industrial areas as well a arid tracts.
9) Schemes and projects which interfere with the forests are to be severely restricted.
10) Tropical rain forests / moist forests should be totally safeguarded.
11) No forest should be permitted to be worked without the Government having approved the management plan.

- The Forest Conservation Rules 2003

(1) Every User Agency who wants to use any forest land for non-forestry purpose shall make its proposal in relevant forms appended to these rules.

(2) Restriction on the deservation of forests or use of forest land for non-forest purpose

Notwithstanding anything contained in any other law for the time being in force ina state, no state Government or othe authority shall make except with the prior approval of the Central Government, any order directing –

i. That any reserved forest(within the meaning of the expression" reserved forest" in any law for the time being in force in that state) or any portion thereof, shall cease to be reserved;

ii. that any forest land or any portion thereof maybe used for any non-forest purpose;

iii. [that any forest land or any portion thereof may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organisation not owned, managed or controlled by Government;

iv. that any forest land or portion thereof may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for reforestation]

[Explanation: For the purposes of this section, "on-forest purpose" means the breaking up or clearing of any forest land or portion thereof for –

a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticulture crops or medicinal plants;

b) any purpose other than reafforestation,

but does not include any work relating or ancillary to conservation, development and management of forest and wild life, namely, the establishment of check post, firelines, wireless communications and construction of fencing, bridges and cuverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.]

- Indian Forest Act (provisions)

Reserved Forest

The State Government may constitute any forest land or waste land, a reserve forest, specifying the situation and limits of such land

After issuing of notification under section 4, no right shall acquire in or over land comprised in such notification.

Village forests

1) The State government may assign to any village community the rights of the Government to or over any land which has been constituted a reserve forest, and may cancel such assignment. All forests so assigned shall be called Village forests.
2) The State Government may make rules for regulating the management of village forests
3) All the provisions of this Act relating to reserved forests shall apply to Village forests.

Protected Forests

The State Government may declare any forest land or waste land as protected forest.

Commentary

The law is restricted to the area declared to be Forest, of all descriptions. It does not specify any development control outside its boundary. As a result objectives of achieving ecological balance in the National Forest Policy is difficult to achieve.

The Forest Conservation Act 1980 and the Forest Conservation Rules 0f 2003 has not recognised the role of Urban and Regional Planner. They are not represented in the Forest Advisory Committee nor in the Regional Empowered Committee. These rules and the law have assumed the forest to be a discreet entity and unconnected with development in the surrounding area, thereby defeating the very process conservation. Control over the use of land in the surrounding area, particularly the catchment of a forest is critical to its conservation and sustainable management and this can be achieved through application of the Town and Country Planning laws.

Notification declaring forest reserved.is made under Sec 20. The State Government shall by notification in the Official Gazette, specifying definitely, according to boundary marks erected or otherwise, the limits of the forest which is to be reserved, and declaring the same to be reserved

from the date fixed by the notification. From the date so fixed such forest shall be deemed to be a reserved forest.

In the preparation and subsequent management of a Sub-Regional Plan, it is essential that the boundaries of the forests are incorporated accurately. Also the presence of physical markers would help local level management of development. Therefore, it is important that Town Planners collaborate with the Forest Settlement Officers and obtain necessary Plans from them including forest management plan made by them. In case the markers are missing it should be brought to the notice of the District Administration so that the markers are reinstated. The boundary of the forest should be demarcated on a Revenue Plan so that the Sarpanches of every village in he surrounding area is aware of the extent of forest land and does not allow any development of non- forest use . The village community should also be made aware of the forest and their role in conserving the forest, which will fulfil the objectives of public involvement in the National Forest Policy.

The land use within the forest is entirely under the control of the Officer in charge of the forest and his recommendation is vital for any diversion of forest land to non forest purpose. However, he does not exercise any control outside the forest, even if such activity is detrimental to conservation of the forest. Therefore, the Town Planner who controls the use of land through the power vested by the Town and Country Planning legislation needs to be proactive. However, at the moment the Town and Country Planners are not consulted nor informed at any stage.

Although the Forest Act does not provide for any land use control beyond the forest, many uses can have damaging effect on the forest. For example, discharge of effluent from air polluting industries can damage the forest vegetation substantially.

Similarly, a polluted water course flowing through a forest can have deleterious impact on both flora and fauna.

Therefore, designation of land for industrial land use should be made keeping this factor in view.

Sec 25 provides that "the Forest Officer may, with the previous sanction of the State Government or of any officer duly authorised by it in this behalf, stop any public or private right of way or water course in a reserved forest, provided that a substitute for the way or water course so stopped, which the State Government deems to be reasonably convenient, already exists , or has been provided or constructed by the Forest officer in lieu thereof."

Many of the major networks of roads, including National Highways pass through Forests, and many are being expanded, requiring diversion of forest land, on the promise of compensatory afforestation. These are being allowed on satisfactory EIA.

However, the Town Planner or the State Town Planning authorities at different levels are not part of the decision making nor are they informed of the locations where compensatory afforestation is to take place. Thus, local involvement, a cherished goal of the National Forest Policy is unlikely to be fulfilled.

Section 26 Acts prohibited in such forests

1) Any person who –

   a) Makes any fresh clearing prohibited by sction 5, or

   b) sets fire to a reserved forest, or, in contravention of any rules made by the State Government in this behalf, kindles any fire, or leaves any fire burning, in such manner as to endanger such a forest; or who in a reserved forest –

   c) kindles, keeps or caries any fire except at such seasons as the Forest-officer may notify in this behalf;

   d) trespasses or pastures cattle, or permits cattle to trespass;

   e) causes any damage any negligence in felling any tree cutting or gragging any timber;

   f) fells, griddles, lops, or burns any tree or strips off the bark or leaves from,or otherwise damages, the same;

   g) quarries stone, burns lime or charcoal, or collects, subject to any other manufacturing process, or removes, any forest-produce;

   h) clears or breaks up any Land for cultivation or any other purpose;

   i) in contravention of any rules made in this behalf by the State Government hunts, shoots, fishes, poisons water or sets traps or snares; or

   j) in any area in which the Elephants' Preservation Acts, 1879(6 of 1879), is not in force, kills or catches elephants in contravention of any rules so made,

Shall be punishable with imprisonment for a term which may extend to six months, r with fine which may extend to five hundred rupee, or with both, in addition to such compensation for damage done to the forest the convicting Court may direct to be paid.

2. Nothing in this section shall be deemed to prohibit –

   a. Any act done by permission in writing of the Forest office, or under any rule made by the State Government

   b. The exercise of any right continued under clause (c) of sub section (2) of section 15, or created by grant or contract in writing made by or on behalf of the government under section 23.

3. Whenever fire is caused wilfully or by gross negligence in a reserved forest, the State Government may (notwithstanding that any penalty has been inflicted under this section) direct that in such forest or any portion thereon the exercise of all rights of pasture or to forest-produce shall be suspended for such period as it thinks fit.

<u>Control over Forests and land not being property of the government (Sec 35)</u>

Government may by notification in the official Gazette regulate or prohibit in any forest or waste land the following:

Protection of forests for special purposes

1) The State Government may, by notification in the Official Gazette, regulate or prohibit in any waste land –

   a) the breaking up or clearing of land for cultivation

   b) the pasturing of cattle; or

   c) the firing or clearing of the vegetation

   When such regulation or prohibition appears necessary for any of the following purpose:-

   i. for protection against storms, winds, rolling stones, floods and avalanches;

   ii. for preservation of the soil on the ridges and slopes and in the valleys of hilly tracts, the preservation of landslips or of the formation of ravines, and torrents, or the protection of land against erosion, or the deposit thereon of sand, stones or gravel;

iii. for maintenance of a water supply in springs, rivers and tanks;

iv. For the preservation of the public health.

2) The State Government may, for any such purpose, contract at its own expense, in or upon any forest or waste land, such as it thinks fit.

3) No notification shall be made under sub section 1. nor shall any work be begun under sub section 2, until after the issue of a notice to the owner of such forest or land calling on him to show cause, within a reasonable period to be specified in such be, until his objections, if any, and any evidence he may produced in support of the same, have been heard by an officer duly appointed in that behalf and have been considered by the State Government.

Clause 36 provides power to the Government to assume management of forests in the event of neglect or wilful disobedience.

Clause 38 provides for protection of forests at the request of the owners.

15.3.3 The Wild Life (Protection) Act, 1972, as amended in 2002 called The Wildlife (protection) Amendment Act, 2002

It is "An Act to provide for the protection of wild animals, birds, and plants and for matters connected therewith or ancillary or incidental thereto with a view to ensuring the ecological and environmental security of the country."

The constitution of National Board for Wild Life (under Sec 5A) does not include any representation from the Ministry of Urban Development or Rural Development, or from the Chief Town Planner.It does not recognise the role of human settlements in conserving wild life.

- **Sec 18: Declaration of Sanctuary**

(1) The State Government may, by notification, declare its intention to constitute any area other than an area comprised within any reserve forest or the territorial waters as a sanctuary if it considers that such area is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance, for the purpose of protecting, propagating or developing wild life or its environment.

(2) The notification referred to in sub-section(1) shall specify, as nearly as possible, the situation and limits of the area.

- **Sec 18A : Protection of sanctuaries**

(1) When the State Government declares its intention under sub-section (1) of Sec 18 to constitute any area, not comprised within any reserve forest or territorial waters under that sub-section, as a sanctuary, the provisions of Sections 27 to 33A(both inclusive) shall come into effect forthwith.

(2) Till such time as the rights of affected persons finally settled under Sec 19to 24 (both inclusive), the State Government shall make alternative arrangements required for making available fuel, fodder and other forest produce to the persons affected, in terms of the Government records.

- **Sec 26A : Declaration of area as sanctuary**

(1) When –

(a) a notification has been issued under sec 18 and the period preferring claims has elapsed…..

(b) The State Government shall issue a notification specifying the limits of the area which shall be comprised within the sanctuary..

(2) No alteration of the boundaries of a sanctuary shall be made by the State Government except on recommendation of the National Board.

- **Sec 33: Control of Sanctuaries:**

The Chief Wild Life Warden shall be the authority who shall be the authority who shall control, manage and maintain all sanctuaries and for that purpose , within the limits of any sanctuary,---

(a) may construct such roads , bridges , buildings, fences or barrier gates ,and carry out such other works as he may consider necessary for the purpose of such sanctuary : (provided that no construction of commercial tourist lodges, hotels , zoos and safari parks shall be undertaken inside a sanctuary except with the prior approval of the National Board)

(b) shall take such steps as will ensure the security of wild animals in the sanctuary and the preservation of the sanctuary and the wild animals therein.

(c) May take such measures , in the interests of wild life as he may consider necessary for improvement of any habitat.

(d) May regulate control or prohibit , in keeping with the interest of wild life, the grazing movement of (livestock).

- **33B Advisory committee**

The committee shall render advice on measures to be taken for better conservation and management of the sanctuary including participation of the people living within and around the sanctuary.

- **National Parks**

Declaration of a National Park

(1) Wherever it appears to the State Government that an area, whether within sanctuary or not, is, by reason of its ecological, faunal,, geomorphological or zoological association or importance, needed to be constituted as National Park for the purpose of protecting, propagating or developing wild life therein or its environment, it may by notification, declare its intention to constitute such area as a National Park.

(2) No alteration to the boundaries of a National Park shall be made by the State Government except on the recommendation of the National Board.

- **36A Declaration and management of a conservation reserve**

The State Government may, after having discussion with the local community declare any area owned by the Government, particularly the areas adjacent to National Parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve forprotecting landscapes, seascapes, flora and fauna and their habitat.

- **36 B Conservation reserve management committee**

The State Government shall constitute a conservation reserve management committee to advice the Chief Wild Life Warden to conserve, manage and maintain the conservation reserve.

- **38 Power of the Central Government to declare area as sanctuaries or National Parks**

Where the State Government leases or otherwise transfers any area under its control, not being an area within a sanctuary, to the central Government, the Central Government may , if it is satisfied that the conditions specified in section 18 are fulfilled in relation to such area so transferred to it, declare such area, by notification, to be a sanctuary and the provisions of

(section 18 to 35 both inclusive,54 and 55 shall apply in relation to a Sanctuary as they apply to a Sanctuary declared by the State Government.

- **The Wild Life Protection Act 1972**

The Schedules I and II lists all the living creatures which cannot be killed, kept in captivity or traded.Majority of the people are not familiar with the variety of species, or are aware of their habitat and behaviour.Efforts should be made to prepare simple illustrative publications which can be part of school and adult education.

15.3.4 THE MINES AND MINERALS (REGULATION ANDDEVELOPMENT) ACT, 1957 ACT NO. 67 OF 1957 1* [28th December, 1957.)

An Act to provide for the regulation of mines and the development of minerals under the control of the Union

- **The Mines and Minerals (Regulation and Development) Act, 1957**
  - Extends to the whole of India.
  - It is expedient in the public interest that the Union should take under its control the regulation of mines and the development of minerals to the extent hereinafter provided.
  - Definitions.

In this Act, unless the context otherwise requires,-

- "minerals" includes all minerals except mineral oils;
- "mineral oils" includes natural gas and petroleum;
- "mining lease" means a lease granted for the purpose of undertaking mining operations, and includes a sub-lease granted for such purpose;
- "mining operations" means any operations undertaken for the purpose of winning any mineral;
- "minor minerals" means building stones, gravel, ordinary clay, ordinary sand other than sand used for prescribed purposes, and any other mineral which the Central Government may, by notification in the Official Gazette, declare to be a minor mineral;
- "prescribed" means prescribed by rules made under this Act

- "prospecting licence" means a licence granted for the purpose of undertaking prospecting operations ;
- "prospecting operations" means any operations undertaken for the purpose of exploring, locating or proving mineral deposit ; and
- The expressions, "mine" and "owner", have the meaning assigned to them in the Mines Act, 1952.

- **General Restrictions Of Undertaking Prospecting And Mining Operations**

Prospecting or mining operations to be under licence or lease.

(1) No person shall undertake any prospecting or mining hoperation in any area, except under and in accordance with the therms and conditions of a prospecting licence or, as the case may be, a mining granted under this Act and the rules made thereunder: Provided that nothing in this sub-section shall affect any prospecting or mining operations undertaken in any area in -accordance with terms and conditions of a prospecting licence or mining lease grant before the commencement of this Act which is in force at such commencement:

1[Provided further that nothing in this sub-section shall apply to any prospecting operations undertaken by the Geological Survey of India, the Indian Bureau of Mines, the Atomic Minerals. Division of the Department of Atomic Energy of the Central Government, the Directorates of Mining and Geology of any State Government (by whatever name called), and the Mineral Exploration Corporation Limited., a Government company within the meaning of section 617 of the Companies Act, 1956] 2[Provided also that nothing in this sub-section shall apply to any mining lease (whether called mining lease mining concession or by any other name) in force immediately before the commencement of this Act in the Union territory of Goa Daman and Diu.]

(2) No prospecting licence or mining lease shall be granted than in accordance with the provisions of this Act and the rules thereunder.

(3)Any State Government may, after prior consultation with the Central Government and in accordance with the rule made under section 18, undertake prospecting or mining operations with respect to any minerals specified in the First Schedule in any area within that State which is not already held under any prospecting licence or mining lease.

(4).Termination of Prospecting licences or mining leases: Where the Central Government, after consultation the State Government is of opinion that it is expedient in the interest of regulation of mines and mineral development preservation of natural environment, control of floods, prevention of pollution, or to avoid danger to public health or communications or to ensure safety of buildings, monuments or other structures or for conservation of mineral resources or for maintaining safety in the mines or for such other purposes, as the Central Government may deem fit, it may request the State Government to make a premature termination of a prospecting licence or mining lease in respect of any mineral other than a minor mineral in any area or part thereof, and, on receipt of such request, the State Government shall make an order making a premature termination of such prospecting licence or mining lease with respect to the area .

Restrictions on the grant of prospecting licences or mining leases

(1)No prospecting licence or mining lease shall be granted by a State Government to any person unless he- (a) is an Indian national; and (b) satisfies such conditions as may be prescribed: .

(2) No mining lease shall be granted by the State Government unless it is satisfied that-

(a) there is evidence to show that the area for which the lease is applied for has been prospected earlier and the existence of mineral contents therein has been established: Provided that nothing in this clause shall apply to any area if such area has already been prospected by a Department or an agency of the Government and the existence of mineral contents therein has been established-,

(b) there is a mining plan duly approved by the Central Government for the development of mineral deposits in the area concerned. 1)No person shall acquire in respect of any mineral or prescribed group of associated minerals- (a) one or more prospecting licences covering a total area of more than twenty-five square kilometres; or (b) one or more mining leases covering a total area of more than ten square kilometres:

(c) any mining lease or prospecting licence in respect of an area which is not compact or contiguous: Provided that if the Central Government is of opinion that in the interests of the development of any mineral, it is necessary so to do, it may, for reasons to be recorded in writing, permit any person to acquire a prospecting licence or mining lease in

relation to any area which is not compact or contiguous.individually, may not, in any case, exceed the total area specified in sub-section.

The period for which a prospecting licence may be granted shall not exceed three years. A prospecting licence shall, if the State Government is Satisfied that a longer period is required to enable the licensee to complete prospecting operations, be renewed for such period or periods as that Government may specify: Provided that the total period for which a prospecting licence is granted does not exceed five years: Provided further that no prospecting licence granted in respect of a mineral included in the First Schedule shall be renewed except with the previous approval of the Central Government.

The maximum period for which a mining lease may be granted shall not exceed thirty years: Provided that the minimum period for which any such mining lease may be granted shall not be of less than twenty years.

Royalties in respect of mining leases.

(1) The holder of a mining lease granted before the- commencement of this Act shall, notwithstanding anything contained in the instrument of lease or in any law in force at such commencement, pay royalty in respect of any 2[mineral removed or consumed by him or by his agent manager, employee, contractor or sub-lessee] from the leased area after such commencement, at the rate for the time being specified in the Second Schedule in respect of that mineral.

(2) The holder of a mining lease granted on or after the commence- ment of this Act shall pay royalty in respect of any 2[mineral remove or consumed by him or by his agent, manager, employee, contractor or sub-lessee] from the leased area at the rate for the time being specified in the Second Schedule in respect of that mineral.

The holder of a mining lease, whether granted before or after the commencement of the Mines and Minerals (Regulation and Development) Amendment Act, 1972,(56 of 19722) shall not be liable to pay any royalty in respect of any coal consumed by a workman engaged in a colliery provided that such consumption by the workman does not exceed one-third of a tonne per month.]

(3) The Central Government may, by notification in the Official Gazette, amend the Second Schedule so as to enhance or reduce the rate at which royalty shall be payable in respect of any mineral with effect from such date as may be specified in the -notification :

15.3.5 THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981

An Act to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

WHEREAS decisions were taken at the United Nations Conference on the Hum an Environment held in Stockholm in June, 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, include the preservation of the quality of air and control of air pollution;

AND WHEREAS it is considered necessary to implement the decisions aforesaid in so far as they relate to the preservation of the quality of air and control of air pollution;

- **Central Board for the Prevention and Control of Air Pollution**

The Central Board for the Prevention and Control of Water Pollution constituted under section 3 of the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974), shall, without prejudice to the exercise and performance of its powers and functions under this Act, exercise the powers and perform the functions of the Central Board for the Prevention and Control of Air Pollution under this Act.

- **State Boards for the Prevention and Control of Water Pollution to be, State Boards for the Prevention and Control of Air Pollution.**

In any State in which the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974), is in force and the State Government has constituted for that State a State Board for the Prevention and Control of Water Pollution under section 4 of that Act, such State Board shall be deemed to be the State Board for the Prevention and Control of air Pollution constituted under section 5 of this Act and accordingly that State Board for the Prevention and Control of Water Pollution shall, without prejudice to the exercise and performance of its powers and functions under that Act, exercise the powers and perform the functions of the State Board for the Prevention and Control of Air Pollution under this Act.]

15.3.6 THE WATER (PREVENTION AND CONTROL OF POLLUTION) CESS ACT, 1977

The foltowing Act of Parliament received the assent of the President on the 7th December, 1977, and is hereby published for general information:--

An Act to provide for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974.

- **THE WATER (PREVENTION AND CONTROL OF POLLUTION) CESS (AMENDMENT) ACT, 2003**

Short Title and Commencement

(1) This Act may be called the Water (Prevention and Control of Pollution) Cess (Amendment) Act, 2003.

(2) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint.

Amendment of Section 2

In the Water (Prevention and Control of Pollution) Cess Act, 1977.(hereinafter referred to as the principal Act), in section 2, for clause(C), the following clause shall be substituted, namely:-

'(C) "industry" includes any operation or process, or treatment and disposal system, which consumes water or gives rise to sewage effluent or trade effluent, but does not include any hydel power unit;'.

Power of Central Government to Exempt the Levy of Water Cess

"16.(1) Notwithstanding anything contained in section 3, the Central Government may, by notification in the Official Gazette, exempt any industry, consuming water below the quantity specified in the notification, from the levy of water cess.

(2) In exempting an industry under sub-section (1), the Central Government shall take into consideration –

- the nature of raw material used;
- the nature of manufacturing process employed;

- the nature of effluent generated;
- the source of water extraction;
- the nature of effluent receiving bodies; and

The production data, including water consumption per unit production, in the industry and the location of the industry."

15.3.7 THE BIOLOGICAL DIVERSITY ACT 2002 AND RULES 2004

Concerns & Issues

This note is meant to provide a brief orientation to growing area of concern and relevance to the vast majority of India's population. This population, in particular tribal and traditional communities – farmers, fisherfolk and indigenous peoples, is heavily dependent on biodiversity and biological resources for their survival and livelihoods. India's biodiversity is severely threatened; wildlife populations, traditional cultures, geological cycles, and a range of other attributes are being destroyed. There are a variety of reasons for this, including increasing exploitation of biological resources for trade both at national and international levels.

Why is this case? Are not our laws, policies and programmes effective enough to deal with this ecological crisis?

It is in this light that we need to view the Biological Diversity Act and Rules, individually and in conjuction with other laws and policies. Do they actually help tackle the forces of destruction and facilitate community control on their resources?

• THE BIOLOGICAL DIVERSITY ACT 2002

The Biological Diversity Act 2002 is a law meant to achieve three main objectives:

- the conservation of biodiversity;
- the sustainable use of biological resources;
- equity in sharing benefits from such use of resources.

Its key provisions aimed at achieving the above are:

1. Prohibition on transfer of Indian genetic material outside the country, without specific approval of the Indian Government;

2. Prohibition on anyone claiming an Intellectual Property Right (IPR), such as a patent, over biodiversity or related knowledge, without permission of the Indian Government;
3. Regulation of collection and use of biodiversity by Indian nationals, while exempting local communities from such restrictions;
4. Measures for sharing of benefits from the use of biodiversity, including transfer of technology, monetary returns, joint Research & Development, joint IPR ownership, etc.;
5. Measures to conserve and sustainably use biological resources, including habitat and species protection, environmental impact assessments (EIAs) of projects, integration of biodiversity into the plans, programmes, and policies of various departments/sectors;
6. Provisions for local communities to have a say in the use of their resources and knowledge, and to charge fees for this;
7. Protection of indigenous or traditional knowledge, through appropriate laws or other measures such as registration of such knowledge;
8. Regulation of the use of genetically modified organisms;
9. Setting up of National, State, and Local Biodiversity Funds, to be used to support conservation and benefit-sharing;
10. Setting up of Biodiversity Management Committees (BMC) at local village level, State Biodiversity Boards (SBB) at state level, and a National Biodiversity Authority (NBA).

While some of the above provisions are progressive, there remain important weaknesses, including the following:

1. It exempts those plants that are registered under the Protection of Plant Varieties and Farmers' Rights (PVPFR) Act, 2001. This Act provides corporations and scientists who are breeding new varieties of crops, to gain intellectual property rights (see more on the relationship between the Biodiversity and Plant Varieties laws, below). Such an exemption means that the progressive provisions listed above, many of which are absent from the PVPFR Act, would not apply to plant varieties registered under PVPFR Act.

2. It does not provide citizens the power to directly approach the courts; such power is restricted to an appeal in the High Court against any order by the NBA or the SBB.

3. It is unnecessarily soft on Indian corporate and other entities, requiring only "prior intimation" to a SBB for the commercial use of bioresources, rather than permission from the NBA as in the case of foreigners. This is unjustified, given that Indians (especially industrial corporations) are not necessarily any more responsible towards the environment or towards local communities, also some Indian companies could just be local fronts for foreign enterprises.

4. It does not fully empower local communities, to protect their resources and knowledge from being misused, or to generate benefits (except charging collection fees). It has very weak or no representation of local community members on the State Biodiversity Boards or National Biodiversity Authority.

5. The power of declaring a Biodiversity Heritage Sites lies with the state government (Article 37 of the Act): It is important that the heritage sites should be designated only after consultation and moreover consent of the affected communities. Further, these should be in the control/management of local communities, and the provision for compensation made in the State Biodiversity Fund (see Section 32) be applied only where there is a mutually agreed to dislocation/curbing of rights. Else we will have the people-parks conflict recurring in another form, as decisions for which areas need to be conserved would be top-down.

Several organisations and people feel that the basic framework of the Act is problematic, since it accepts intellectual property rights on biodiversity, could be used to further commercialise biodiversity, and does not truly empower communities. Others feel that the Act provides some potential for checking biopiracy, achieving conservation, and facilitating community action. They stress that a combination of strong rules, and amendments related to the above points, would help strengthen this potential.

• BIOLOGICAL DIVERSITY RULES 2004

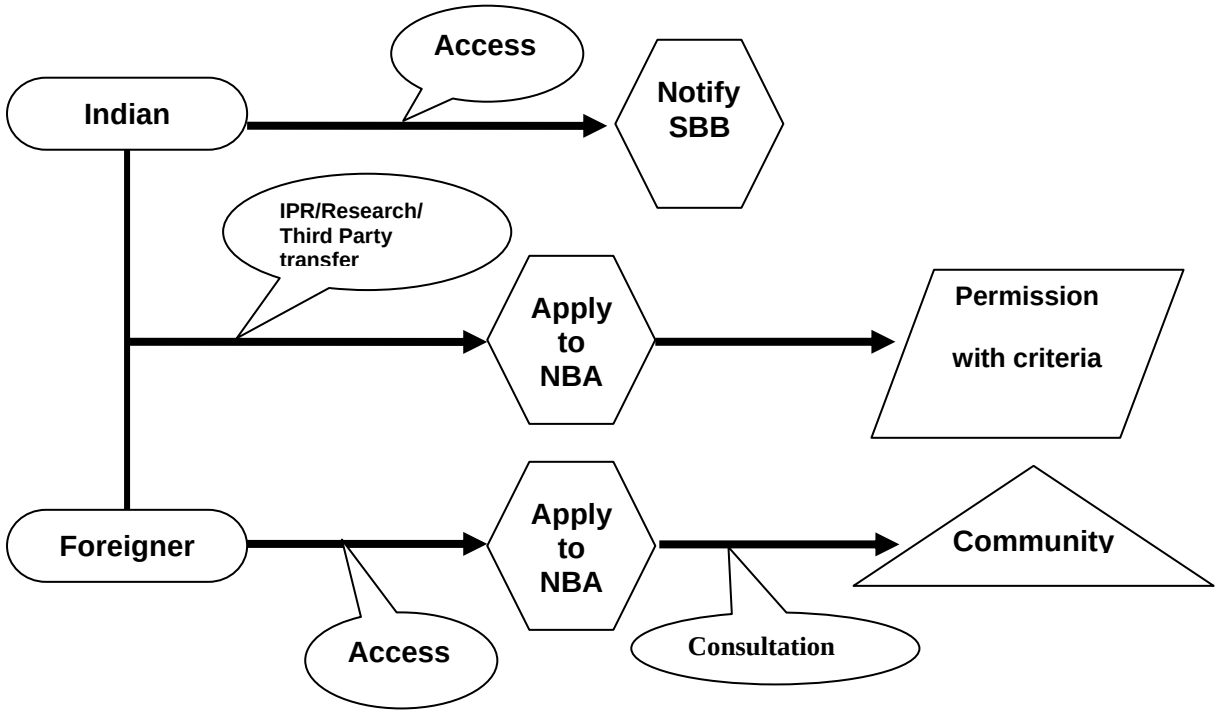
There was hope that Rules under the Act would strengthen the provisions on conservation, sustainable use, and equity. Unfortunately, that hope was shattered when the government notified the Biological Diversity Rules 2004 on 15th April.

The Biodiversity Rules are the executive orders made by the Government in order to carry out the purposes of the Act (Section 62)1.

The Rules among other things outline the procedures to be followed for access to biological resources (wild plants and animals, crops, medicinal plants, livestock, etc), their commercial utilization, transfer of rights of research, and intellectual property rights related to biodiversity.

From the point of view of local communities, it is important to understand the process of allowing access/utilization of bioresources and also the role of communities. Presented below is a diagrammatic representation of the same

Figure 15-1 : Process of allowing access/utilization of bioresources and role of communities



It is keeping this in mind that we need to look at some provisions directly relevant to local communities, the most critical of them being the Biodiversity Management Committee (BMC). Section 41 of the Act states:

"Sec 41(1) Every local body2 shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological

1 Every rule made under this Act is to be placed in the Parliament for a period of thirty days and the houses can make changes in the rules (sec 62(3)). This gives the space to make suitable changes in rules, by asking members of Parliament to raise issues in the Parliament

diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity".

<u>Under the Biodiversity Rule, Sec 22 expands on constitution and role of Biodiversity Management Committees, and states:</u>

(1) Every local body shall constitute a Biodiversity Management Committee (BMCs) within its area of jurisdiction…..

(6) The main function of the BMC is to prepare People's Biodiversity Register (PBR) in consultation with local people (this is a comedown from the broader role envisaged in Sec 41 of the Act. The Register is supposed to contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them) (italics ours).

(7) The other functions of the BMC are to advise on any matter referred to it by the State Biodiversity Board or Authority for granting approval, to maintain data about the local vaids and practitioners using the biological resources.

Therefore, the role for BMCs defined in the Biodiversity Rules are a complete comedown from what was envisaged in the Biodiversity Act, which itself had its own set of problems. Some of the critical problems both from the Act and Rules are:

<u>Constitution of the Biodiversity Management Committees (BMC)</u>

1. The definition of local body is problematic, as it leaves out gram sabha or other village assemblies. Since the local body has to appoint/select the BMC, the political affiliation and relationship between a village and the panchayat body will play an important role in the constitution and functioning of the BMC.
2. The process of local body constituting BMC, is by nomination. Rules 22(2) & (3) expressly mention that the members will be NOMINATED by the local body & the Chairperson will be

2 (h) "local bodies" means Panchayats and Municipalities, by whatever name called, within the meaning of clause (1) of article 243B and clause (1) of article 243Q of the Constitution and in the absence of any Panchayats or Municipalities, institutions of self-government constituted under any other provision of the Constitution or any Central Act or State Act

ELECTED by the committee, then the BMC could become another power center and might not actually function to conserve biodiversity or protect community rights.

Focus of work and functioning

1. The Act clearly spells out a list of functions for the BMC, among which are promoting conservation and maintaining PBR. The Rule dilutes this and states that the main role is to merely maintain PBR.
2. Peoples Biodiversity Register: The Peoples Biodiversity Register (PBR) is a document that records the diversity of species of flora, fauna, crops, livestock etc. As on date, there is no legal protection available for the knowledge recorded in the PBR. This is problematic when it comes to the question of access to this document. Even though communities create and maintain a database of their resources of knowledge, there is no or requirement that their consent would sought when it comes to accessing the information in the PBRs.

   Although Rule 17 says local bodies will be consulted before approval for access to bio resources is given, the definition of "consult" is not clear and in many cases it might remain a mere formality.
3. Though the Act clearly has spelt out criteria for rejecting applications, it has not listed community consent as one of them. Rule 7 is clearly biased, as it gives BMC only an advisory role in the of grant approvals.

15.3.8 Land acquisition laws

The following laws/ policies are highlighted:

i. Haryana Requisitioning and Acquisition of Immovable Property Act, 1973

ii. Land Acquisition Act, 1894

iii. Policy Regarding Acquisition of Land for Private Development and in Public Private Partnership for Setting Up of Special Economic Zones, Technology Cities, Industrial Parks and Industrial Model Townships

• Haryana Requisitioning and Acquisition of Immovable Property Act, 1973

This Act confers power on the State Government to requisition property which in its opinion is needed for any public purpose, being a purpose of the State. Section 3 of this legislation lays down the power of the State Government to make such requisition. Section 3 states:

1) Where the competent authority is of the opinion that any property is needed or likely to be needed for any public purpose, being a purpose of the State, and that the property should be requisitioned, the competent authority -

   shall call upon the owner or any other person who may be in possession of the property by notice in writing (specifying therein the purpose of the requisition) to show cause, within fifteen days of the date of the service of such notice on him, why the property should not be requisitioned; and

   may, by order, direct that neither the owner of the property nor any other person shall, without permission of the competent authority, dispose of, or structurally alter, the property or let it out to a tenant until the expiry of such period, not exceeding two months, as may be specified in the order.

2) If, after considering the cause, if any, shown by any person interested in the property or in possession thereof, the competent authority is satisfied that it is necessary or expedient so to do, it may, by order in writing, requisition the property and make such further orders as appear to it to be necessary or expedient in connection with the requisitioning:

   Provided that no property or part thereof-which is bonafide used by the owner thereof as the residence of himself or his family, or which is exclusively used either for religious worship by the public or as a school, hospital, public library or an orphanage or for the purpose of accommodation of persons connected with the management of such place of worship or such school, hospital, library or orphanage, shall be requisitioned:

   Provided further that where the requisitioned property consists of premises which are being used as a residence by a tenant for not less than two months immediately preceding the date of the service of notice under sub-section (1) possession of the property shall not be taken unless the competent authority has provided such tenant with alternative accommodation which, in its opinion, is suitable.

Section 4 lays down the power of the government to take possession of the requisitioned property. Section 4 provides:

Where any property has been requisitioned under Section 3, the competent authority may, by notice in writing, order the owner as well as any other person who may be in possession of the property to surrender or deliver possession thereof to the competent authority or any person duly authorised by it in this behalf within thirty days from the service of the notice.

If any person refuses or fails to comply with an order made under sub-section (1), the competent authority may take possession of the property and may, for that purpose, use such force as may be necessary.

The term 'public purpose' is defined in the Land Acquisition Act, 1894 and is quoted under the heading B of this memo.

- **Land Acquisition Act, 1894**

This statute empowers the State government to acquire land for any public purpose by following the procedure prescribed. The term 'public purpose' is defined in section 3(f) as:

The expression "public purpose" includes-

i. the provision of village sites, or the extension, planned development or improvement of existing village sites;

ii. the provision of land for town or rural planning;

iii. the provision of land for planned development of land from public funds in pursuance of any scheme or policy of Government and subsequent disposal thereof in whole or in part in lease, assignment or outright sale worth the object of securing further development as planned;

iv. the provision of land for a Corporation owned or controlled by the State;

v. the provision of land for residential purposes to the poor or landless or to persons residing in areas affected by natural calamities, or to persons displaced or affected by reason of the implementation of any scheme undertaken by Government, any local authority or a Corporation owned or controlled by the State;

vi. the provision of land for carrying out any educational, housing or slum clearance scheme sponsored by Government or by any authority established by Government for carrying out

any such scheme, with the prior approval o the appropriate Government, by a local authority or a society registered under the Societies Registration Act, 1860 or under any corresponding law for the time being in force in a State, or a co-operative society within the meaning of any law relating to co-operative societies for the time being in force in any State;

vii. the provision of land for any other scheme of development, sponsored by Government, or, with the prior approval of the appropriate Government by a local authority;

viii. the provision of any premises or building for locating a public office

But does not include acquisition of land for Companies'

For clarity on the acquisition process we quote herein below a few of the relevant sections from the Land Acquisition Act, 1894.

Section 4 prescribes that procedure to be followed for acquiring land. To begin with, the State Government needs to come out with a notification as detailed below:

1) Whenever it appears to the appropriate Government that land in any locality is needed or is likely to be needed for any public purpose or for a company a notification to that effect shall be published in the Official Gazette and in two daily newspapers circulating in that locality of which at least one shall be in the regional language and the Collector shall cause public notice of the substance of such notification to be given at convenient places in the same locality (the last of the dates of such publication and the giving of such public notice, being hereinafter referred to as the date of the publication of the notification)

2) Thereupon it shall be lawful for any officer, either generally or specially authorised by such Government in this behalf, and for his servants and workmen,-

   - To enter upon and survey and take levels of any land in such locality;
   - To dig or bore into the subsoil;
   - To do all other acts necessary to ascertain whether the land is adapted for such purpose;
   - To set out the boundaries of the land proposed to be taken and the intended line of the work (if any proposed to be made thereon)
   - to make such levels, boundaries and line by placing marks and cutting trenches; and where otherwise the survey cannot be completed and the levels taken and the boundaries

and lines marked, to cut down and clear away any part of the standing crop; fence of jungle: Provided that no person shall enter into any building or upon any other enclosed court or garden attached to a dwelling house (unless with the consent of the occupier thereof) without previously giving such occupier at least seven days notice in writing of his intention to do so.

After assessing the suitability of any area for the required 'public purpose' the State Government has to make a declaration to that effect as prescribed in Section 6, Section 6 states:

(1)Subject to the provision of Part VII of this Act, when the appropriate Government is satisfied, after considering the report, if any, made under section 5A, sub-section

(2), that any particular land is needed for a public purpose, or for a Company, a declaration shall be made to that effect under the signature of a Secretary to such Government or of some officer duly authorized to certify its orders and different declarations may be made from time to time in respect of different parcels of any land covered by the same notification under section 4, sub-section (1) irrespective of whether one report or different reports has or have been made wherever required under section 5A, sub-section (2);

The power to take possession is detailed in section 16. Section 16 provides:

When the Collector has made an award under section 11, he may take possession of the land, which shall thereupon vest absolutely in the Government, free from all encumbrances.

Section 17 provides for taking possession in case of an emergency. Section 17(1) state as follows:

In cases of urgency whenever the appropriate Government, so directs, the Collector, though no such award has been made, may, on the expiration of fifteen days from the publication of the notice mentioned in section 9, sub-section (1) take possession of any land needed for a public purpose. Such land shall thereupon vest absolutely in the Government, free from all encumbrances.

- **Policy Regarding Acquisition of Land for Private Development and in Public Private Partnership for Setting Up of Special Economic Zones, Technology Cities, Industrial Parks and Industrial Model Townships ("Policy")**

The Government of Haryana has notified the Policy on May 4, 2006. The Policy recognises the need for state intervention to make the private public participation a success. The introduction to the said Policy states:

The critical factor in creation of industrial infrastructure is the availability of land and, therefore intervention of State Government to facilitate the private sector in acquisition of land becomes important.

With regard to development of land for Special Economic Zones, Industrial Parks and Technology cities, the Policy states:

Size of SEZ/Industrial Parks/Technology Cities

The State Government would, however, assist the private sector developer in acquiring left out pockets to ensure contiguity of SEZ's.

Outside the NCR region, the State Government may assist the private sector in acquisition of land even in respect of single product SEZ where the minimum area requirement is 250 acres only.

Further, the Policy has a mandate that when a developer approaches the Haryana State Industrial and Infrastructure Development Corporation for development of a Special Economic Zone in public private partnership, then the State Government shall assist in the acquisition of land for such joint venture project. The relevant paragraph is quoted here under:

Public Private Partnership

Wherever the developer approaches the HSIDC for development of SEZ, industrial Park or Technology City in public private partnership, the decision on the terms and conditions of such partnership shall be left to the Board of Directors of HSIDC. The State Government shall assist in the acquisition of land for all such joint venture projects. The extent of land acquisition in such projects shall be decided by the State Government. However, in joint venture where HSIDC/state Government would have 26% or more share in equity, the State Government shall acquire the entire land for the project.

The Policy is unequivocal that it would not be possible to expect large-scale industrial infrastructure projects without State intervention. The Policy states:

General Terms & Conditions

While the State Government would endeavour to encourage the private sector to purchase land directly from the landowners, it would not be feasible to expect large-scale industrial infrastructure projects without the State intervention through acquisition of land for such projects. Keeping in view the need to give adequate compensation to the landowners, the State Government has also fixed floor rates in tune with the prevailing market rates for the purpose of giving suitable compensation to the landowners.

15.3.9 National Highways ACT, 1956 (amended 2002)

Sec 2

Declaration of certain highways to be NATIONAL HIGHWAYS

1) Each of the highways specified in the Schedule 2 is hereby declared to be a national highway.
2) The Central Government may, by notification in the Official Gazette, declare any other highway to be a national highway and on publication of such notification such highway shall be deemed to be specified in the Schedule.
3) The Central Government may, by notification, omit any highway from the Schedule and on the publication of such notification; the highway so omitted shall cease to be a national highway.

Sec 3A

Where the Central Government is satisfied that for a public purpose any land is required for the building, maintenance, management or operation of a national highway or part thereof, it may, by notification in the Official Gazette, declare its intention to acquire such land.

Sec 3D

1. Where no objection under sub-section (1) [Hearing of Objections] of the section 3C has been made to the competent authority within the period specified therein or where the competent authority has disallowed the objection under sub-section(2) of that section , the competent shall , as soon as may be, submit a report to the Central Government and on

receipt of such report , the Central Government shall declare, by notification in the Official Gazette, that the land should be acquired for the purpose or purposes mentioned in the sub-section (1) of section 3A.

2. On the publication of the declaration under sub-section (2), the land shall vest absolutely in the Central Government free from all encumbrances.

Sec 3E

Where any land has been vested in the Central Government under sub-section (2) of section 3D, and the amount determined by the competent authority under section 3G with respect to such land has been deposited under sub-section(1) of section 3H, with the competent authority by the Central Government, the competent authority may by notice in writing direct the owner as well as any other person who may be in possession of such land to surrender or deliver possession thereof to the competent authority or any person duly authorised by it in this behalf within sixty days of the service of the notice.

Sec 3G

Determination of amount payable as compensation:

Where any land is acquired under this Act, there shall be paid an amount which shall be determined by an order of the competent authority.

Sec 3J

Land Acquisition Act 1 of 1894 not to apply-

Nothing in the Land Acquisition Act, 1894 shall apply to an acquisition under this Act

Commentary

The Act does not specify the criteria for National Highway designation. They do not necessarily connect State capitals. Quite often they provide link roads between two NH's. Since the NH is paid for and maintained by the Central Government, State Govt's find it expedient to have them.

However, they are access controlled and majority of local connections are denied. This causes severance, whenever the NH travels through an urban built up area. It also creates conflict between people and fast moving vehicles, as these roads are not supposed to be crossed by

pedestrians. NHAI does not consult the Town Planning authorities, thereby causing problems to land use and market forces for development.

NH development is subject to EA by the MoEF. However since there is no specific r.o.w in the law, land use and development control becomes ineffective. The IRC specifies a r.o.w of 30-60m (av 45m) , distance between building lines 80m and control lines at 150m for open country. For urban areas it specifies 3-6m distance between road and building line. Therefore the min distance between building lines can be 36 m and max 72 m. Who has control over this development and how is it implemented, is not clear. In view of the lack of dialogue between Town planning and NHAI the control mechanism appears to be vague and undefined.

15.3.10 Haryana Urban Development Authority (Preservation of Trees) Regulations, 1979

This legislation applies in addition to the various forest laws discussed before. The key provisions of this statute are quoted below.

Section 3

(i) No person shall, except with the previous permission in writing of the estate officer or such other authorised officer cut down, lop or destroy or cause or permit the cutting down, lopping or destruction of any tree in any part of the wood land area shown in the zoning plan as "protected trees" or "protected wood land area".

ii) An application under sub-regulation (1) shall be in writing and shall specify the trees, group of trees or the wood-land area to which the application relates, and the operations for carrying out of which the permission is required; and where necessary for identification of such trees, groups of trees or wood land area, the application shall also be accompanied by a map or plan on a scale as may be required by the Estate Officer or such other authorised officer.

15.3.11 Punjab Land Preservation Act, 1900

This is yet another restrictive legislation on land use applicable to Haryana. Notifications issued under this Act are key to determining the land use permissions in the Aravalli range area within Haryana. The following are the key provisions of this Act.

Section 3.Notification of areas

Whenever it appears to the Provincial Government that it is desirable to provide for the conservation of sub-soil water or the prevention of erosion in any area subject to erosion or likely to become liable to erosion, such Government may by notification make a direction accordingly.

Section 4; Power to regulate, restrict or prohibit, by general or special order, within notified areas, certain matters

In respect of areas notified under section 3 generally or the whole or any part of any such area, the Provincial Government may, by general or special order temporarily regulate, restrict or prohibit—

(a) The clearing or breaking up or cultivating of land not ordinarily under cultivation prior to the publication of the notification under section 3;

(b) the quarrying of stone or the burning of lime at places where such stone or lime had not ordinarily been so quarried or burnt prior to the publication of the notification under section 3;

(c) the cutting of trees or timber, or the collection or removal or subjection to any manufacturing process, otherwise than as described in clause (b) of this sub-section of any forest-produce other than grass, save for bonafide domestic or agricultural purposes of rightholder in such area;

(d) The setting on fire of trees, timber or forest produces;

(e) The admission, herding, pasturing or retention of sheep, goats or camels;

(f) The examination of forest-produce passing out of any such area; and

(g) the granting of permits to the inhabitants of towns and villages situate within the limits or in the vicinity of any such area, to take any tree, timber or forest produce for their own use therefrom, or to pasture sheep, goats or camels or to cultivate or erect buildings therein and the production and return of such permits by such persons.

Section 5; Power, in certain cases to regulate, restrict or prohibit, by special order within notified areas, certain further matters

In respect of any specified village or villages, or part or parts thereof, comprised within the limits of any area notified under section 3, the Provincial Government may, by special order, temporarily regulate, restrict or prohibit—

(a) The cultivating of any land ordinarily under cultivation prior to the publication of the notification under section 3.

(b) the quarrying of any stone or the burning of any lime at places where such stone or lime had ordinarily been so quarried or burnt prior to the publication of the notification under section 3;

(c) the cutting of trees or timber or the collection or removal or subjection to any manufacturing process, otherwise than as described in clause (b) of this sub-section of any forest-produce for any purposes; and

(d) The admission, herding, pasturing or retention of cattle generally other than sheep, goats and camels or of any class or description of such cattle.

Section 19-Penalty for offences

Any person who, within the limits of any area notified under section 3, commits any breach of any regulation made, restriction or prohibition imposed, order passed or requisition made under sections 4, 5, 5-A, or 7-A shall be punished with imprisonment for a term which may extend to one month, or with a fine which may extend to one hundred rupees, or with both.

15.3.12 Haryana Special Economic Zone Act, 2005

This is the state legislation enacted by Haryana Government to facilitate the setting up of SEZ's in Haryana. Section 13 quoted below enables the Special Economic Zone to override any restrictive provision in any Haryana State law.

Section 13

Notwithstanding the provisions contained in the existing State law governing the use of the land and building, services, amenities, utilities, supplies and any other activity, the provisions of this Act shall prevail

Thus from a literal analysis, it seems the restrictions under the Punjab Land Preservation Act 1900 discussed above may be nullified if the area falling under the such restricted area is used for

developing a Special Economic Zone under the Haryana Special Economic Zone Act, 2005. However this overriding provision will be ineffective against the 1992 Aravalli notification issued by the Ministry of Environment and Forest, discussed in our memo of July 17, 2006.

The key provisions of the Haryana Special Economic Zone Act, 2005 are quoted hereunder.

Section 6

(1) A developer shall identify the area for the development of Special Economic Zone and apply in Appendix A (20 copies) to the Director, Industries and Commerce Department, Haryana, Chandigarh. The project inter alia shall contain the prefeasibility report, phased development components of Special Economic Zone and the object to be achieved.

(2) The Director, Industries and Commerce Department, Haryana, on receipt of application shall forward the proposal to the concerned department for comments.

(3) The project evaluation committee shall consider the comments received from the concerned departments and shall examine the viability and other economic indicators of the project justifying the necessity of setting up of the proposed Special Economic Zone.

(4) The recommendations of the project evaluation committee shall be sent to the project approval committee.

(5) The project approval committee shall accord approval in principle, if land for the project is not in possession of the Developer,

(6) The project approval committee shall forward the final concurrence to the Central Government subject to the terms and conditions as laid down by it, after the physical possession of the land has vested in the Developer.

Section 7

(1) The Government may transfer land owned, acquired or controlled by it to the Developer as per provisions of the Land Acquisition Act, 1894 (1 of 1894) ad the rules made thereunder and as per State Government policy.

(2) The Developer may acquire land independently from private parties by purchase, lease or otherwise.

Section 8

1) Subject to the provisions of this Act, the Developer shall have the duty to secure planned development of the Special Economic Zone and provide for the establishment, construction, installation, operation, maintenance and management of the infrastructure and amenities in the zone.

2) Without prejudice to the generality of the provisions contained in sub-section (1), the Developer shall exercise and perform the following powers and functions, namely:-

   a) to prepare a development plan of the Special Economic Zone in conformity with the rules framed under this Act or adhered to by the Developer under sub-section (3) or as may be adopted by the Government under sub-section (4) of section 17 and to implement such plan after obtaining the approval of the Approval Committee;

   b) to demarcate and develop sites for industrial, commercial including Free Trade and Warehousing Zone, residential an other purposes according to the approved plan;

   c) to allocate and transfer, either by way of sale or lease or otherwise, plots of land, building or installations for industrial, commercial, residential or other purposes subject to his own title in relation to such plots or land, building or installations;

   d) to regulate the erection of building and setting up of industries in accordance with the building plan as approved by the Development Commissioner;

   e) to demarcate the boundary of the Special Economic Zone and any parts thereof and to construct and maintain demarcation structures, as per provisions of sub-sections (3) and (4) of section 17.

   f) To fix rates for transfer of land, building or installations by way of sale, lease or otherwise from time to time;

   g) For the purpose of providing, maintaining or continuing any amenity and infrastructure in the Special Economic Zone, the Developer may levy such charges, as he may consider necessary, in respect of any land, building, installations or any other infrastructure upon the user/occupier thereof; and

   h) To perform such other functions as may be prescribed from time to time.

15.3.13 Foreign direct investment in real estate & urban development

• **Construction**

100% FDI under the automatic route is permitted by the Government of India in townships, housing, built up infrastructure and construction-development projects which includes housing, commercial premises, hotels, resorts, hospitals, educational institutions, recreational facilities, city and regional level infrastructure.

This general permission is subject to the satisfaction of the following conditions under each project. However these conditions are not applicable to investment by NRI's. Please note that Special Economic Zones are separately regulated.

Criteria for selection

- In case of development of serviced housing plots, a minimum land area of 10 hectares must be developed.
- In case of construction – development projects, a minimum built up area of 50,000 sq. mts must be developed.
- In case of a combination projects either a minimum land area of 10 hectares or a minimum built up area of 50,000 sq. must be developed.

Conditions on Investment and Statutory Clearances

The investment is subject to the following conditions:

- A minimum capitilastion of US $ 10 million for wholly owned subsidiaries and US $ 5 million for joint ventures with Indian partners. The funds are to be brought in within six months of commencement of business of the Company
- Original investment cannot be repatriated before a period of three years from completion of minimum capitalization unless permission to exit earlier is provided by the Foreign Investment Promotion Board of the Government of India.
- Within five years from the date of obtaining all statutory clearances, at least 50% of the project must be developed. The investor is not permitted to sell undeveloped plots. Undeveloped plots mean roads, water supply, street lighting, drainage, sewerage and other conveniences as applicable under prescribed regulations. The investor is required to provide

this infrastructure and to obtain the completion certificate from the concerned local body/ service agency before he is permitted to dispose of the serviced housing plots

The project is to conform to the norms and standards, including land use requirements and provision of community amenities and common facilities as applicable under building control regulations, bye-laws, rules and other regulations of the state government/municipal/local body concerned.

The responsibility for obtaining all necessary approvals, including those of building/layout plans, developing internal and peripheral areas and other infrastructure facilities, payment of development, external development and other charges and complying with all other regulations as prescribed under the applicable rules is on the investor.

The state government /municipal /local body concerned, which approve the building /development plans, would monitor the compliance of the above conditions by the developer.

Leases

There are only limited restrictions on foreign entities leasing property in India mainly that is it has to be up to minimum 5 years.

As the Government funds are limited, it is imperative that private sector funds be tapped through Private or Public-Private Participation. State Governments should become more and more an enabler and facilitator with actual implementation by private sector. In this connection, the concept of viability gap funding for schemes which may not be bankable like water supply, sewerage, waste management etc. becomes important. State Government could provide the minimum injection of capital either upfront or an annuity just enough to make the project bankable for the private sector to invest. The minimum adequacy of the injection can be ensured though an open bid mechanism and user charges for various services can be fixed with a regulatory mechanism to ensure the quality of services vis-à-vis price charged.

15.4 *Urban Land development process*

The land development process involves the acquisition of raw land, detailed physical planning, improvements of soil, construction of the infrastructure, implementation of the public areas, parcelling, and building site distribution. Voluntary purchases are mostly used at land acquisition, but expropriation is also possible. This is the first phase, when different agreements are possible.

Land use planning determines the building rights and regulations. Improvements of land involve drainage and raising to above the groundwater level, decontamination activities to clean up pollution and providing the infrastructure. Public areas to be implemented are the streets, parks, provision of services like Water supply, Power etc. Parcelling includes parcelling, registration in the cadastre and title registration.Public-private partnership (PPP) in land development

The land developer can be the municipality (local government) or a private enterprise or the two in co-operation.

- **Co-operation alternatives**

  a. Exchange of land for building rights

  The municipalities are no longer the only buyers on the land market. Many developers and building companies buy land in potential areas for building. Most of the municipalities consider the production of building land still as a municipal task. They are therefore anxious to buy the land. The developers and building companies are often willing to sell their land to the municipality. Their interest in the land is not primarily making a profit on the land, but a method of acquisition for building and project development. In exchange for the land they receive money (often less than they acquired the land for) and the municipality permits building volume for them. Thereafter the municipality takes care of the implementation of the infrastructure. After that the private partner gets the possibility of buying building sites. The private partner is often allowed to influence on the town plan of the area. In this model the municipality bares most of the financial risks of land development.

Table 15-1 : Supplementary agreements with building rights

Agreements	Percentage of locations with building rights
Site within location where building may take place	66%
Land prices	63%
Obligation to buy	56%
Right to be consulted in planning process	41%
Others	34%
No supplementary agreements	6%

It is mostly settled for which price and in which place the development company may buy back the plots to be developed. In about half of the locations in which building rights agreements are made, the development company also has the obligation to buy the plot. In

those cases the market risks of selling the plots are not transferred from the developer to the municipality.

b. Integral development

The municipality is responsible for the main structure of the area. The main roads, major parks and water works are developed by the municipality. In the integral development a part (say sites for 500 dwellings) of the planned area is transferred to the private parties. The programme and the recovery of costs for the main infrastructure are regulated in the agreements. IJburg (near Amsterdam), and Ypenburg (near The Hague) are examples of this model.

c. Joint development

In this model either a municipality or a company owns the land. It may be transferred to a joint public-private company. The risks and the management of the area are shared by the municipality and the private parties in the joint venture company. The share of the municipality differs. The risks are shared in this model.

d. Concession model

In the concession model the development is primarily private. The municipality recovers costs for the infrastructure outside the plan. Unlike the other models the municipality shares no market risk in this model. The agreement includes the stipulations between the private and the public partners. The private partner bears the risks and the concession model is therefore mostly used in economically good cases. When negotiating an agreement the municipality may choose the option that the land-owning constructor will not be developing the area. This alternative means more cost on interests on the bought land. A municipal land use plan or decision in anticipation of a new plan is a necessary precondition for development. In practice every developer makes an agreement with the municipality. The dominant form of co-operation between the market parties and the municipalities is that the land is sold to the municipalities in exchange for development rights.

Summarising all these co-operation alternatives together we find that there are many different versions. But when investigating them closer, we can find in principle all of them can be included in a four-dimensional model (Table 5). This means that every agreement can be placed in one category of all of these four dimensions.

Table 15-2 : Classification of public-private co-operation

Dimension	Category
Type of land	Raw land
	Unbuilt sites
	Renewal
Owner of land	Municipality
	Constructor
	Housing developer
	Other
	Mixture
Model of co-operation	Traditional
	Exchange for building rights
	Integral
	Joint
	Concession
Type of contract	Framework
	Pre-agreement
	Site disposal
	Infrastructure construction

The public-private co-operation in land development can have many different forms, from the traditional model, in which the municipalities produce building sites, to the concession model, in which the private partner takes care of the whole area according to the stipulations of the agreement. In India, especially Delhi, the traditional model has been used, where the development authority/ municipality have an 'active land policy', i.e., they buy the land, service it and sell the building sites to the market parties.

Whereas in Gurgaon, the private developers purchases lands from farmers within the stipulated zones of master plan by paying the prevalent market rates, prepares their schemes of development and procures licenses from Town & Country Planning Department, as per conditions stipulated in the Act, rules, Bye-laws and Polices. This also involves payments to the Haryana

Govt. towards Licence fees, Scrutiny fees, CLU charges, etc. While internal development within the residential colonies/mini cities being developed by the developers are carried out by the colonizers themselves, the external development works to various sectors as well as provision of city level facilities is being taken care of by the development authority (HUDA). The colonies are developed as mini cities having all the infrastructure and community facilities needed and based on the size of the colony/population planned therein. A minimum of 45% of the area has to be left for parks, open spaces, roads and community sites which include schools, dispensaries, community centres, creches, religious buildings, police posts, telephone exchanges, post offices etc. The design of all services like Water supply, Sewerage, Drainage are scrutinized by the Chief Engineer, HUDA and approved by the Director, town & Country Planning accordingly. While the Ground development is monitored through site checks by HUDA engineers, other controls are exercised by the Director, Town & Country Planning (Haryana).

Finally a land development model has to be developed, in which the landowners (farmers) sell the land to the government, which develops a master plan for the area, in consultation with the stakeholders, plans and lays down the requisite services such as main artery roads, large parks and recreational areas, along with provision for Water supply, Power, street lighting and solid waste management. Trunk sewers for arterial roads could be laid in accordance to the kind of sanitation system planned for. In the end this serviced parcel of land would be leased to the Private sector, for a long duration, say a lease period of 99 years, who would have a right to build on the plots and further lease the serviced plots. Normally the private sector is not interested in servicing the land, but in developing real estate on the land. Thus a concession model, in which the private parties are developing only the building areas themselves within a framework provided by public laws and plans, is recommended. The private developer after building on the serviced land would charge a rent from the building occupant, from which a certain share would have been paid to the government, as rent. Hence the Government still owns the land and generates annual revenue in lieu of the serviced land provided.

This is also relevant to the present realty culture whereby large multinationals in the field of IT, World trade city, Entertainment city, small industries and Bio-Sciences city are interested in renting of properties and not outright buying. Hence for an investment done in the initial stages the Government gets contiguous revenue at an annual basis.

15.5 *PPP in infrastructure delivery*

The Objective of Public Private Partnership is to maximise service to the common man at an affordable price with minimum use of government funds.

This objective can be best achieved in provision of infrastructure services. There are three Models available to government for public private partnership

– Model 1: Government Invests in the project along with the Private Sector Partner with an objective to earn returns from the investment

– Model 2: Government provides soft funds to the project to reduce user charges

– Model 3: Government does not invest but rationalizes the user charges

➢ **Modes of Private Sector Participation**

- Government an important stakeholder in the infrastructure sector
- In addition, government involvement is often the key in developing infrastructure projects
- The following are the Private Sector Participation Options available for infrastructure projects
  - Service Contract
  - Management Contract
  - Lease
  - Concession
  - BOT/ BOOT and its variants
  - Divestiture

15.5.1 Existing Large Scale Infrastructure Projects on PPP format

There have been many cases where PPP has been successful. Prominent ones are the Tirupur Water supply project, Tamil Nadu Urban Development fund, Delhi-Noida-Delhi Toll Bridge, Solid waste management system in Surat, National Highway development Programme (NHDP) using BOT Approach, Nhava Sheva Port Container Terminal, Pipavav and Mundhra Ports, Bangalore International Airport (underway), Cochin International Airport, Baspa Hydel Project in Himachal.

Here it is important to understand that State support is essential for establishing land rights, enabling and providing hinterland connectivity, and addressing rehabilitation and resettlement issues.

For the infrastructure provision separate agreements could be developed again on a PPP framework, on a sector wise criterion, especially for water and Power supply.

But there are certain requirements for successful Public private Partnerships in infrastructure delivery. These are:

- Stable Macro-economic Framework
- Efficient and well developed Financial sector
- Sound regulatory framework
- Suitable project revenues (cost recovery)
- Clearly laid out arbitration procedures / dispute resolution mechanisms
- Well developed bankruptcy laws
- Co-investment by Govt. loans / equity/ subsidies (Public service obligations)

15.6 *Suggested model of Land development*

It is envisaged that majority of the land is to be developed by Private developers who are already highly active in the sub-region. Government is to act as a regulatory body that provides the legal framework to control the development in the area.

Government and its assigned authority would:

- Locate the specific cities
- Identify total land area that should be developed
- Conduct Master planning for Land use of the area
- Invite Private developers for developing that land
- Notify land area and land use for development for suitable conversions

Private developer would:

- Decide on the priority sectors and identify the Zones for development.

- Make Development plans
- Get it approved from the government
- Invite investors
- Develop the cities actually through Private participation

Government would also help the Private developers in the land acquisition. This whole process would aid in planned growth of the region.Simultaneous to the land development, the Infrastructure services to be developed by the Participating Private developer. Private developer would also make the buildings and execute landscape development apart from the above. All other activities related to local site work would be carried out by the Private developer.

15.6.1 General Recommendations for Proposed cities along KMP global corridor/other township in the sub-region

Roads

All road network / transport network is to confirm to noise and air pollutions standards specified by the Government of India under the Air act. The standards of urban roads etc. are to be taken as per specified by the Ministry of Environment and Forests guidelines applicable for procuring Environmental clearances. For this the EIA notification'2006 gazette is to be followed. The guidelines for these are still under preparation, hence the consultant would not be able to incorporate these in the study, but these should be considered during the detailed designing of individual cities.

Space norms/ Standards

All new city developments will follow the draft guidelines issued by the Ministry of Urban Development. The existing Bye laws and regulations are obsolete hence these are to be revised as per the Ministry of Urban Development specifications.

Water

It is to be conserved, recycled as much as possible. Several systems based on the new technology being proposed for treatment will have to be employed which include constructed wetlands, Rain water harvesting and recharging at open spaces. Here the standards for open spaces would depend on the type of technology implemented.

Open spaces

The norms for giving open spaces would depend on the ambient air quality currently existing in the area and likely to be air quality after the city is built. It cannot be determined now as both the above are not known. Hence the Open space standards to be provided will be dictated by the actual Land use proposed.

15.6.2 Sources of Investment-Funding Models:

Traditionally initial investment in city development projects comes by way of equity. Respective parties show interest to put their money in real estate projects depending upon their strategy, which is driven by the location and the status of the projects. Under Haryana sub-region and also KMP global corridor, maximum projects being in tier III cities, the expected rate of return is going to be high enough to attract the large scale foreign as well as domestic investors to invest herein.

Initial investment traditionally comes via private equity. As per the new FDI policy (introduced in 2005), 100% FDI through automatic route is allowed in:

Townships	Housing
Commercial Premises	Hotels
Industrial parks	Resorts
Hospitals	Educational Institutions
Recreational facilities	SEZ's, etc.

The liberalized guidelines on foreign direct investment (FDI) in real estate coupled with the strong industry potential have put India on the radar for serious investors. A significant change is the lowering of the minimum development size from 100 acres to 25 acres. The lower threshold is more manageable for a first-time foreign investor. Further, there are limited holdings of 100-acre plots available in major cities. Another significant change is the removal of sectoral restrictions. The scope is expanded to cover residential, commercial centers or shopping malls.

In order to invest in the proposed cities either foreign investors would be coming through private equity capital to provide base capital required to undertake such projects and reduce exposure to debt financing or they can also be a part of the project specific SPV.

There are also various Real Estate Venture Capital Funds in the market, with specific investment strategies for e.g. Kshitij Venture Capital fund plans to focus only on malls and commercial space leased out to retailers, Ascendas India IT Parks Fund will invest only on IT parks while Dewan Housing will target mass housing. Other funds like HDFC and ICICI are more diverse as they plan to invest in commercial, residential as well as retail properties. These funds have paved the way for organized debt and equity instruments in the real estate market and the establishment of Real Estate Funds (REFs).

Unlike other businesses, in real estate, capital deployed for development will have to be repaid on completion of the project. The process of returning and re-investing money as equity capital is highly tax-inefficient and cumbersome, as it would involve a compulsory liquidation which is difficult and time consuming. Developers/investors, therefore, would prefer instruments like convertible preference shares and high-coupon debentures to structure their investment in the proposed cities or structure the ventures as partnership firms/Sub SPVs.

Additional funds required might be raised through loans, and after the project takes off and once the public confidence in it is established, capital markets would be approached.

Corporate borrowers (developers) are also eligible to raise External Commercial Borrowings (ECB) up to a maximum of US $ 500 million under automatic route. Thus, for the proposed cities as they fall into industrial/technology parks/ integrated township (as defined by Press Note 3 (2002 series) (i.e. the 100 acres criteria) categories, ECB can be raised for investment and for working capital requirement, during this phase.

15.6.3 Modes of Development-Private Participation Models

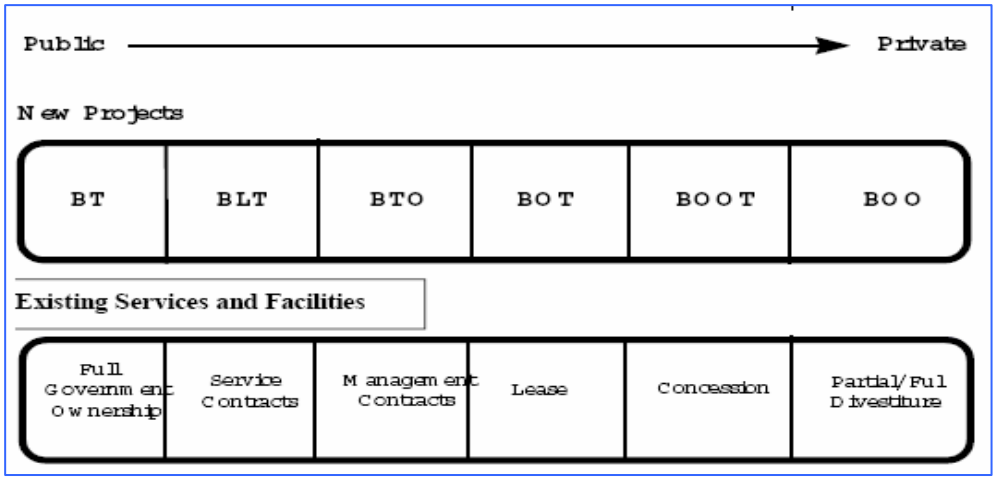
Private Capital shall be attracted towards the city development in Public Private Participation (PPP) mode. PPP is a broad umbrella for a relationship between public and private sector. The options available for delivery of public services range from direct provision by a ministry or government department to outright privatization, where the government transfers all responsibilities, risks and rewards for service delivery to the private sector. While there are no laid down models, the role of the partners may vary from sector to sector. While in some schemes/projects, the private provider may have significant involvement in regard to all aspects of implementation; in other they may have only a minor role.

Within this spectrum, public-private partnerships can be categorized based on the extent of public and private sector involvement and the degree of risk allocation.

The private sector may be called upon to provide one or more of the following functions:

- Project initiation and planning;
- Design;
- Financing;
- Construction;
- Ownership;
- Operation; and
- Revenue collection.

The nature of the partnership is really defined by the distribution of those roles in a service or project. The continuum goes from full public responsibility (standard public services) to full private



responsibility (commercialization/privatization) as follows:

As depicted above, partnership alternatives can be divided into two categories, depending on the type of project: new projects; and existing facilities and services.

• Partnerships for New Projects

Build-Transfer or Turnkey

The Build-Transfer (BT) option stands on the public end of the private participation spectrum. Build-Transfer or "turnkey" approaches involve the public sector "ordering" a project and the

private sector delivering it on site. The private participant provides design, construction and construction financing, and the public agency in charge provides permanent financing and operations. BT projects also result when a public infrastructure project is either located near or would otherwise provide significant benefit to a privately owned property or company. In these circumstances, by designing, building, and transferring an infrastructure facility to the public domain, the private sector can realize significant benefit while simultaneously creating real value for the public at large.

Build-Transfer-Operate or Design-Build-Operate (US)

In the Build-Transfer-Operate (BTO) model, the private sector designs and builds a facility or piece of infrastructure for the public sector, and usually provides the financing for it. Upon completion, the title for the new facility is then transferred to the government but the private sector contractor has the contractual obligation to operate the facility and recover its investment in the project over a set number of years. These terms are usually pre-negotiated. In the U.S., the method of design-build-operate (DBO) has become a most favored alternative, especially in the water and sewage treatment industries. The U.S. practice is to have the private sector design, build and operate the facility over the long term, while the public sector provides both the construction and permanent financing using tax-exempt financing, which is more cost effective than private financing. The existence of tax-exempt financing and its availability to creditworthy state and local governments makes the U.S. unique in the world, and skews the selection of public-private partnership when contemplating new facilities.

Build-Operate-Transfer (BOT)

Under the Build-Operate-Transfer (BOT) model, the government turns over development and initial operation of what typically would be a public-sector project to the private sector. The private sector contractor or consortium of contractors finances the project, accomplishes the construction, and operates the new facility for some specified length of time after which it is expected to transfer ownership to the government, usually at no cost. The eventual transfer to the government occurs so it ultimately can retain control of the public service.

The BOT approach is often appealing to a host government because it allows that government the following options:

- The ability to minimize its capital costs while still implementing a project at a time when it would not be able to provide the requisite funds, and/or might seek to use its funds for other projects;
- The opportunity to take advantage of operational efficiencies regularly associated with Private sector participation; and
- The chance to encourage outside investment and introduce new or improved technology. This technique works as well for rehabilitation or expansion of an existing facility, when it is sometimes call Rehabilitate-Operate-Transfer (ROT).

Build-Own-Operate (BOO)

When no operating contract binds the public and private partners, the project becomes more of a standard commercial venture. In these cases, the developer is much more like an owner. The eventual no-cost transfer of the facility to the public sector would most likely be well after the economic life of the facility has expired, or at least not until the financing has been repaid.

The Build-Own-Operate (BOO) method involves the greatest degree of private sector participation in development of a new facility. Under this model the sponsoring consortium finances the project and operates the facilities as owner; it is not required to transfer the facilities back to the host government. These types of facilities are sometimes called "merchant" facilities because the owner's risks are about the same as if it built and operated any other type of business, like a hotel. This type of arrangement works well when it can be anticipated that a strong and ongoing market will always exist for the service. The private sector often conceptually prefers the absence of a transfer component so it can maximize its return on investment. Thus, in a BOO the contractor is more committed to the investment than it would be with a transfer, particularly in cases when transfer occurs relatively quickly. For instance, it is likely to operate and maintain the facility most effectively. In essence, the facility is run like a pure commercial venture.

Other form of Public-Private interventions: Public-private partnerships are also available for the operation, redevelopment and financing of existing services and systems as well as new ones. In the case the question of asset transfer and ownership becomes a significant variable in determining the appropriate partnership structure, as well as the responsibility for system financial performance.

Service Contract

The public sector retains the greatest degree of control over its services and facilities when the private sector participates through a service contract. In service contracting, or "contracting out," the government contracts with private entities to supply functional responsibilities that the governmental previously performed, such as garbage pick up, billing and collection, janitorial services, etc. By allowing the private sector to compete for service contracts, the government introduces competition into a previously monopoly-driven area. The public can benefit from competition in reduced service delivery costs, improved service quality, and improved morale of public employees and managers.

Management Contract

Like the service contract option discussed above, in a management contract, a private partner operates a publicly owned facility under contract with the sponsoring government. A management contract is broader than a service contract; the private operator is responsible for all aspects of operations and maintenance as opposed to only certain functions. Private operation of a facility can result in improved service and efficiency, but this option is still on the public end of the spectrum as the private sector does not have a financial stake in the facility or service, but rather is merely providing it. Some U.S. cities outsource their entire public works functions to private service companies. This type of service provision is limited more by the availability of a competitive set of service providers than by the imagination and leadership of government leaders.

Lease

In a lease structure, the government grants a leasehold interest in some or all of the assets (usually the entire existing system) with the requirement that the private firm will operate and maintain them pursuant to a lease agreement. The private firm charges the utility an agreed upon amount for providing the service. Investments in new or expanded facilities would still be the responsibility of the public owner of the assets, while the private lessee would be responsible for repairs and rehabilitation as needed of the leased property. Meter reading, revenue billing and collection may be contracted to the private firm, but rate setting and responsibility for overall financial results would still be the purview of the public owner. In some cases, incentive payment plans with the private lessee may be used to try to improve financial results.

Concession

With a concession, the government grants to a private firm or consortium the exclusive rights to operate, maintain and manage the entire system for an extended period of time. The basic system is still owned by the public, but the private concessionaire owns all improvements and extensions. The operating requirements placed on the private firm are contained in a concession agreement that details all of the performance expectations that need to be met in order to maintain the concession in effect. The concessionaire sets the rates for the service under the regulatory requirements of the government. Unless neutral, informed regulation is provided, a concession arrangement will not work. For the rights to operate the system and reap the profits from such operations, the private firm may be required to pay an initial and/or annual concession fee to the government, and to commit to certain levels of investment over the course of the concession period. The concession yields total operational responsibility to the private consortium for the length of the concession without transferring or selling the assets. The U.S electrical sector serves the public under these arrangements.

The involvement and degree of risk allocation is decided on the basis of the amount of experience of PPPs in the concerned sectors.

PPP arrangements are growing in use and acceptance as an alternative and effective method to mobilize additional financial resources and benefits from private sector efficiencies.

The basic structure of a PPP is a system in which a government service or private business venture is funded and operated through a partnership of government and one or more private sector companies. Typically, a private sector consortium forms a special company called a "special purpose vehicle" (SPV) to build and maintain the asset. The SPV signs the contract with the government on one hand, as well as the subcontractors to build the facility and then maintain it.

The objective of SPV would be to allocate risks to those partners who are in the best position to control the particular risk factor. From the point of view of potential investors, the main risks involved relate to project completion, markets and supply of inputs. Other issues such as the legal status of the partnership, balance of power among the partners and conflict diffusing mechanisms would be satisfactorily addressed, if the PPP took the form of Joint Venture, under BOO structure. For this a separate Special Purpose Vehicle company ("SPV") which is to be set up by the parties after the agreement agreed upon. The SPV would comprise all stakeholders who believe in the

project. All partners will pool in their resources, monitory as well as non-monitory. They work out, jointly, a project proposal (capital investment, debt servicing, cost estimates, cost recovery strategy fully or partly through property development).

Table 15-3 : Mode of participation

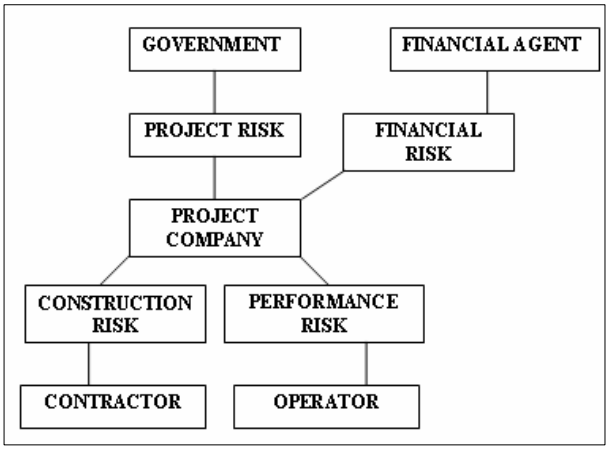
Options	Ownership for asset holding	Operation & maintenance	Capital investment	Commercial risk	Duration
BOT	Private and then Public	Private	Private	Private	20-30 years
BOO	Private	Private	Private	Private	
Service Contract	Public	Public & Private	Public	Public	2-3 years
Management Contract	Public	Private	Public	Public	3-5 years
Lease	Public	Private	Public	Shared	8-15 years
Concession	Public	Private	Private	Private	25-30 years

Table 15-4 : Requirements:

Options	Stakeholder support	Cost recovery	Regulatory framework
BOT	Moderate to high	Preferred	Strong capacity required
BOO	Low to minimum	Necessary	Monitoring required
Service Contract	Unimportant	Preferred but not necessary	Minimal monitoring required
Management Contract	Low to minimum	Preferred but not necessary	Minimal monitoring required

Lease	Moderate to high	Necessary	Strong capacity required
Concession	High level	Necessary	Strong capacity required

A joint sector venture will address the most important issue that either side is much concerned with, that relating to the risks regarding supply of inputs (in this case the commitment of the resources), markets and completion. Advantage of a contract of intent would be for both sides. The public sector would, by this process secure the financial commitment of the private sector, which would be crucial for completion of the project particularly in case the real estate markets fluctuate. Secondly, since the actual construction would take place a few years from the time of the initial agreement, covering the market risk is also extremely important for the public sector, particularly since it has not much experience of markets behavior. A joint sector venture would be used for allocation of this risk to the private sector that knows very well how to control this risk factor. For the private sector on the other hand, this would mean covering the political risks and ensuring that the government would continue to support the project, and the changes in the political environment would not make the PPP fall apart. This security will help the private sector, plan and mobilize its resources, in a better way.



• **Risk involvement in PPP Prioject**

Risk involved in PPP project could be divided into two broad categories

1. General or country risks

2. Specific project risks

1. General or country risks subdivided into three categories:

- Political risks
- Country commercial risks
- Country legal risks

2. Specific project risks subdivided in accordance with the phases of the project cycle:

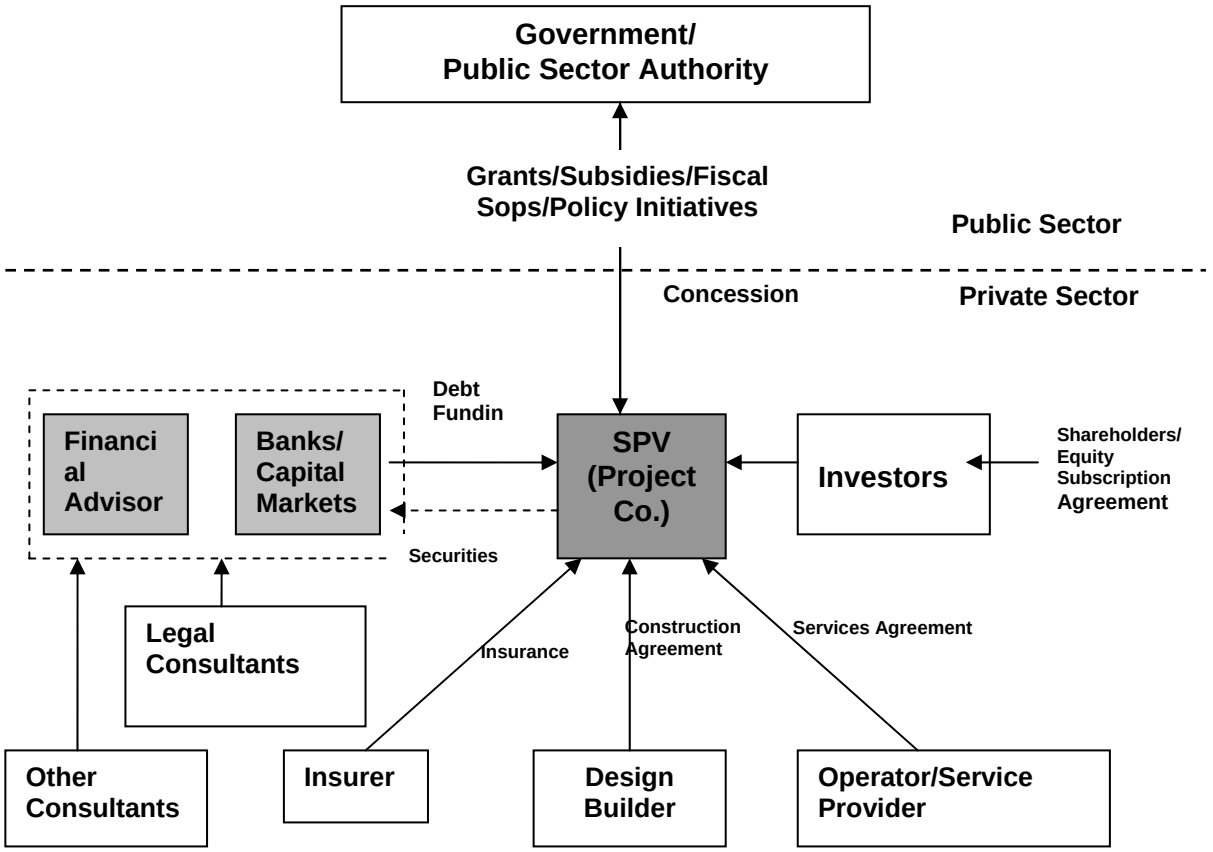
- Development risks

- Construction /completion risks Risk allocation
- Operating risks

Advantages and challenges for PPP Model of development:

Key advantage of PPP	Key challenge of PPP
1. Make use of private sector skills, modern technology and efficiency 2. Forces the public sector to focus on outputs and benefits (rather than inputs) from the start 3. Bring in private capital and make projects affordable 4. Risks are shared by the different parties 5. Budgetary certainty 6. Private providers are more accountable for service delivery within the right incentive environment	1. PPPs imply a loss of management control by the public sector and therefore may be politically unacceptable 2. Transfer of risk 3. Does the public sector have sufficient capacity and skills to adopt the PPP approach and set the correct incentive and regulatory environment? 4. Does sufficient private sector expertise exist to warrant the PPP approach?

Figure 15-2 : Typical PPP Framework



Under all PPP models, the government will emerge as a regulator to monitor the project and especially the quality of construction material. The term private in PPP will comprise of all non-government agencies such as the corporate sector, voluntary organizations, self-help groups, partnership firms, individuals and community based organizations.

A multiple of PPP structures can be selected for the various city types depending on project type, needs and sector. In some models market risk is transferred to the private party; while in others it is retained by the public authority or shared by both parties. The number of contract funding agencies varies from one (the public authority) to a whole population of users.

Management Patterns

The funding pattern and collaboration between the public sector and the private sector could take any one of the following forms:

- Public funding with private service delivery and private management.
- Public as well as private funding with private service delivery and private management.

Public as well as private funding with public/private service delivery and public/private/ joint management

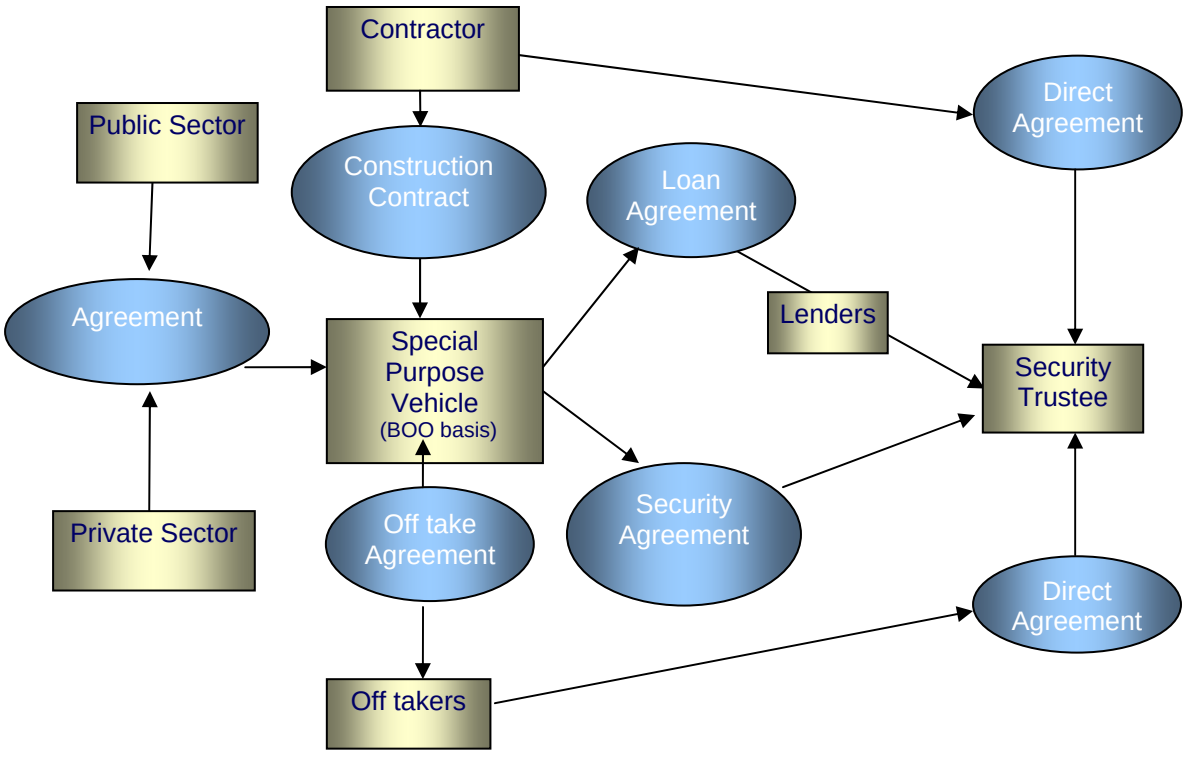
• Proposed PPP Structure

In India PPPs have been implemented on a regular basis in various infrastructure projects, IT giants have created huge campus on getting into PPP agreements with respective state governments, various real estate projects have been coming under this umbrella by the way of joint-ventures between government and private developers to create commercial as well as residential projects. Thus, the private sector involvement in such projects is always taken high.

After understanding all above probable models of Public-private partnership, two broad PPP structure suggested here for the proposed cities are BOO and Private Contract Fee model.

Build – Own – Operate (BOO):

Figure 15-3 : BOO Framework



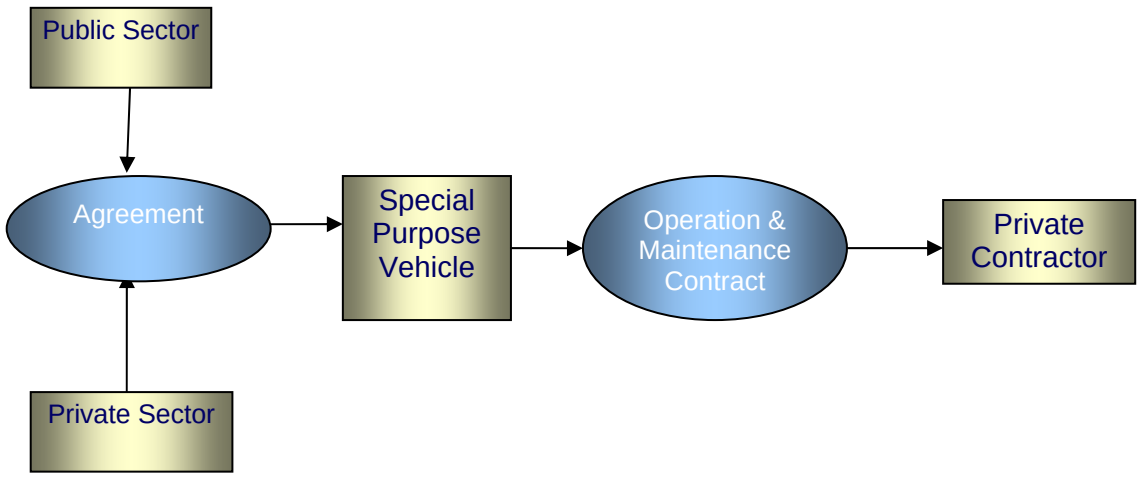
Under this structure, the private sector finance, builds, owns and operates a facility or service in perpetuity. The public constraints are stated in the original agreement and through on-going

regulatory authority. The private and public agencies will enter into a joint agreement through statutorily created "Special Project Vehicle".

PPP agreements with more of Private sector control are quite prevalent in the roposed KMP cities. Huge IT cities, Entertainment & Leisure zones, Knowledge City, Biosciences City and industrial based SEZs changes the demographics and the density of the area wherever they come up. Referring to the commercial success of these kinds of projects all over the country, state governments invite the industrial giants to set up their facilities in such zones, where the government offer them land at subsidized rates. In these zones, as the commercial expertise of these sectors in operating under the suggested PPP structure is well established, government easily give the full control to the private sector to build, own and operate these zones.

Private Contract Fee:

Figure 15-4 : Contract fee Framework



Under this format of PPP, the major control lies with the public sector (as SPVs) and operations & maintenance responsibilities are been handed over to the Private sector player/s.

15.7 *Strategy recomandation for District Planning*

15.7.1 Institutions for Preparation of Annual Development Plan

Although the Panchayat Raj Act has laid down the provision of District Planning Committee and the Zila Parishad, Panchayat Samiti, Gram Panchayat has specific function of preparation of

development plan/Annual Plan for overall development of the area which falls under respective jurisdiction, there is no such provision exists for spatial planning in district level.

It is recommended to prepare and update the District Development Plan for each districts falls under sub-region and this should be integrated with the Sub-Regional Plan-2021. Planning Commission of India suggested (in 2008) institutional and other forms of professional support including capacity building to enable the District Planning Committee (DPC) to consolidate the plans of the various tiers of Panchayat Raj Institutions and the urban local bodies (ULBs) into the district plan.

Haryana Panchayat Raj Act, 1994 says that the State Government shall constitute in every district A. District Planning Committee (DPC) to consolidate the development plans prepared by:

a) Zilla Parishad

b) Gram Panchayat and

c) Municipal Councils

in the district as a whole.

For preparation of development plan, that:

i) Every Gram Panchayat shall prepare each year a development plan and submit to the Panchayat Samiti and the Panchayat Samitis are suppose to review these and submit to Zilla Parishad for consideration,

ii) Every Zilla Panchayat shall prepare each year a development plan after including the development plans of Panchayats and submit to DPC.

When the annual Plans are prepared by gram panchayat, these should be based on Sub-Regional Plan and Govt. policies. These socio-economic plans should be properly integrated in spatial plans of the area, as envisaged in the 73rd & 74th constitution amendment Acts of 1992. On the basis of these integrated plans, projects should be identified.

15.7.2 Institutions for Implementation

The projects for implementation of Regional Plan will be either at Village Panchayat level or District level, apart from municipal and state levels. These agencies may be assigned the projects of their level. If a project is of village level or municipal level, it should be implemented by

Village Panchayat or municipal council as the case may be. If the project extends beyond the boundaries of village Panchayat or municipal limits, it should be handled by Zilla Parishad. The state level projects will be handled by various departments of the State Govt.

15.7.3 Coordination & Monitoring

To keep a watch on implementation of these projects and their monitoring, since the Regional Plan has been prepared by Town & Country Planning Deptt., respective Town Planners may be assigned the duties to monitor and coordinate their implementation. Sr. Town Planner (Head Quarter) should monitor the state level and prestigious/important projects. The implementation of district level projects should be monitored by Sr. Town Planner of the District. The Taluka level projects should be monitored by concerned Associate Planner and Village Panchayat level projects by concerned Asst. Planner. The city level projects will be implemented & monitored by Planning & Development Authorities.

A periodic review of implementation of these projects should be done by Chief town Planner with the assistance of Sr. Town Planner at the Head-Quarter. This will help in timely implementation of Sub-Regional Plan and removing bottlenecks at every level.

15.7.4 Assistance to Gram Panchayats

i) The Town and Country Planning Department should assist the Gram Panchayats in the preparation of latest physical survey map of the area at 1:2000 scales.

ii) Should assist in the preparation of a long range (10 year) spatial plan for the development of physical infrastructure, education, health and conservation of natural built environment.

Should assist the G.P. for the spatial plans to be ready within one year of the approval of the Sub-Regional Plan

15.8 *Organization Structure for Implementation*

The Sub Regional Plan for Haryana Sub-Region of NCR is prepared under the provision of section 17(1) of the NCRPB Act, 1985. The Act is to provide for the constitution of a Planning Board for the preparation of a plan for the development of the National Capital Region and for coordinating and monitoring the implementation of such plan and for evolving harmonized policies for the control of land-uses and development of infrastructure in the National Capital

Region so as to avoid any haphazard development of that region and for matters connected therewith or incidental thereto.

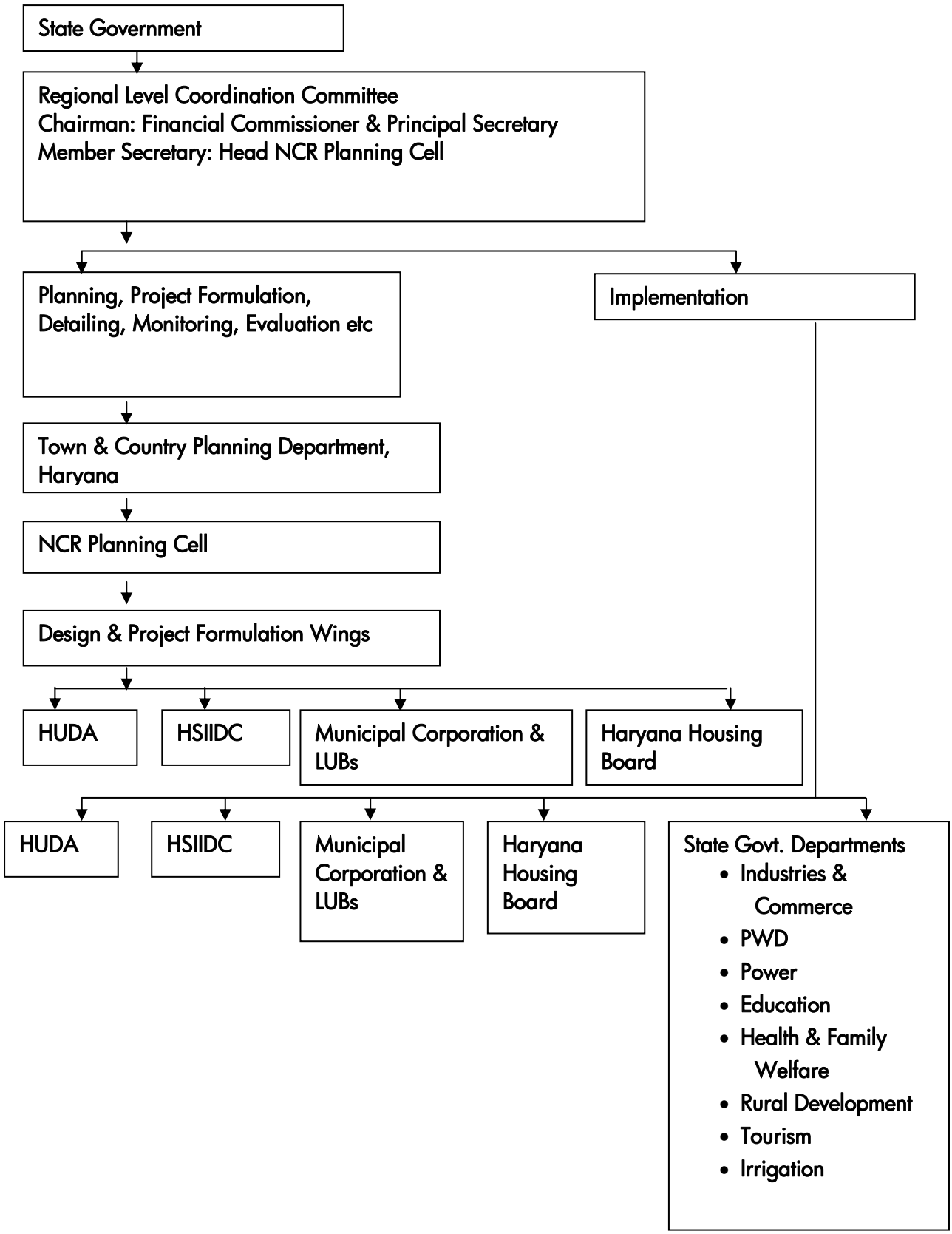
After the commencement of this Act, the board constitutes a Committee, called the Planning Committee, for assisting the Board in the discharge of its functions. The Planning Cell/Committee is consisted of members including Member Secretary to the Board, the Joint Secretary to the Government of India in the Ministry of Works and Housing, Secretary-in-charge of Urban Development and the Chief Town Planner of Haryana Govt,

Under the provision of Section 17(1) of NCRPB Act, 1985, the Government of Haryana is required to prepare a Sub-Regional Plan for the sub-region of NCR within the State. Before publishing any Sub-Regional Plan, each participating State or, as the case may be, the Union territory, shall, refer such Plan to the Boardto enable the Board to ensure that such Plan is in conformity with the Regional Plan. The After examining a Sub-Regional Plan, the board shall communicate, within sixty days from the date of receipt of such Plan, its observations with regard to the Sub-Regional Plan to the Govt. of Haryana. After considering the observations made by the board, the government will finalize the sub-regional plan and ensure its implementation.

For implementation of the Sub-Regional Plan the Govt. has appointed Town and Country Planning Department of Haryana. The Department is to coordinate with the several state govt. departments and parastatal bodies for effective implementation of the plan. The Chief Town Planner prepares the Regional Plan (s) and after approval by the Govt., he notifies the Regional Plan in the Official Gazette and the Regional Plan comes into force.

In order to implement the above mentioned policies and strategies of the Sub-Regional, it is required to have an efficient management system for speedy implementation of the plan proposals and proper monitoring of the projects. The implementation of Sub-Regional Plan requires a multi-disciplinary approach which involves tremendous amount of coordination and monitoring. The management structure can be as follows;

Figure 15-5 : Management structure



Detailed Transport Network in Sub-Region