

City Development Plan Chandigarh



Submitted By
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Under the
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CHAPTER-1: CITY DEVELOPMENT FRAME WORK AND PROCESS

1.1 Chandigarh – A Profile

Chandigarh is only planned city in India with a population of 9.01 lakh in the year 2001. It is one of the fastest growing city with a population decadal growth rate of 40.30%. The construction of capital city of joint Punjab was started in early 50s. The City Chandigarh was declared a Union Territory in the year 1966 with joint capital of both the states of Punjab and Haryana. It is situated in the foot of Shivalik hills.

The area of Union Territory of Chandigarh is 114 sq. km. only with 22 villages falling in the jurisdiction of Union Territory. Since the formation of Union Territory in the year 1966, all the functions such as water supply, sewerage, storm water drainage, city roads, solid waste management and fire wing etc. were looked after by respective departments of Chandigarh Administration. With the formation of Municipal Corporation Chandigarh in the year 1994 (with 20 wards) with its jurisdictional area of 79.34 sq. kms.; the functions of original works & maintenance for V4,V5 and V6 roads; water supply, sewerage, storm water drainage, solid waste Management and fire wing were transferred to Municipal Corporation, Chandigarh.

The city Chandigarh because of its unique concept is known as ‘City beautiful’. It is one of the greenest city of India with its 1400 nos. green belts / parks/ gardens. The quality of life is the consideration of people in Chandigarh. The maintenance of basic urban service is altogether different than the conventional old cities. Moreover it is the regional center of three adjoining States of Punjab, Haryana and Himachal. It is hub of political and bureaucratic activities of adjoining States. The high profile services provided by Chandigarh Administration & Municipal Corporation is a role model for other urban cities.

The city Chandigarh is located in western side of river Gaggar and Shimla National highway. It is linked by rail with National Capital Delhi and hill station Shimla. The National and state highways also connect this city with Ludhiana, Amritsar, Ambala, Patiala and Manali. The city Chandigarh is having direct air link to Delhi and Bombay and airport is also being upgraded. The Major Border Road Projects of Northern India are managed from Chandigarh by the respective departments of Govt. of India. The Chandigarh Administration has set up a Rajiv Gandhi I.T. Park nearby village Kishangarh wherein many MNCs have shown interest to set up their I.T. Industries.

The City Chandigarh is offering world-class services to its investors. In this context, it is imperative that Chandigarh has not only provided a good investment climate, but also world-class services comparable to other cities. However, the city is still developing its infrastructure, but due to rapid urbanization, growth and industrial development, the up gradation of infrastructure is further required.

1.2 Historical Background

Chandigarh derives its name from the temple of Goddess “Chandi” (the goddess of power) located in the area and a fort or “garh” lying beyond the temple. The city has a pre-historic past. The gently sloping plains on which modern Chandigarh exists, was in the ancient past, a wide lake ringed by a marsh. The fossil remains found at the site indicate a large variety of aquatic and amphibian life, which was supported by the environment. About 8000 years ago the area was also known to be a home to the Harappans. Since the medieval thru’ modern era, the area was part of the large and prosperous Punjab Province, which was divided into East & West Punjab during partition of the country in 1947. The city was conceived not only to serve as the capital of East Punjab, but also to resettle thousands of refugees who had been uprooted from West Punjab.

In March 1948, the Government of Punjab, in consultation with the Government of India, approved a 114.59 Sq.Kms. tract of land at the foothills of Shivaliks as the site for the new capital. The location of the city site was a part of the erstwhile Ambala district as per the 1892-93 gazetteer of District Ambala. The site was selected by Dr.M.S Randhawa, the then Deputy Commissioner of Ambala. Before the new capital came up, the original site had about 59 villages. The foundation stone of the city was laid in 1952. Subsequently, at the time of reorganization of the state in 1967 (01.11.1966) in Punjab, Haryana and Himachal Pradesh, the city assumed the unique distinction of being the capital of both, Punjab and Haryana while it itself was declared as a Union Territory and under the direct control of the Central Government.

1.3 Geology

The Union Territory of Chandigarh is located in the foothills of the Shivalik hill ranges in the north, which form a part of the fragile Himalayan ecosystem. It is occupied by Kandi (Bhabhar) in the north east and Sirowal (Tarai) and alluvial plains in the remaining part. The subsurface formation comprises of beds of boulders, pebbles, gravel, sand, silt, clays

and some Kankar. The area is drained by two seasonal rivulets viz Sukhna Choe in the east and Patiala-Ki-Rao Choe in the west. The central Part forms a surface water and has two minor streams. The stream passing through the central part is called N-Choe and the other Nala which initiates at Sector 29.

The basic geographical and demographic profile of Chandigarh

Area	114 Sq Kms)+25.42 Sq Kms additional hilly catchment area declared as Wildlife Sanctuary)
Longitude	76 ⁰ 47' 14 E
Latitude	30 ⁰ 44' 14 N
Attitude	304 to 365 meters above MSL with 1% drainage gradient
Annual Rainfall	111.4 cm/year average
Monsoon	July- September
Temperature	Winter Min.(Nov-Jan) 4 ⁰ C-14 ⁰ C Summer Max.(April-July) 37 ⁰ C-44 ⁰ C
Prevalent Winds	From the North West to South East in Winter and reverse in Summer
Total Villages	22 (As per 2001 Census)
Inhabited	22 (As per 2001 Census)
Un- inhabited	1 (As per 2001 Census)
Panchayats	17 (of 18 Villages)
Population (2001 Census)	900635
Density of population/sq.Km	7912
Birth Rate (per 1000)	21.17
Death Rate (per 1000)	10.01
Infant Morality (per 1000)	45.60
Sex Ratio (female per 1000 males)	777
Decennial Population Growth Literacy Rate	40.33 %
Literacy rate	81%

Chandigarh falls under Koeppen's Cwg category i.e it has cold dry winter, hot summer and sub tropical monsoon. Evaporation usually exceeds precipitation and the weather is generally dry. The area experiences four seasons: (i) Summer or hot season (mid- March to Mid-June) (ii) Rainy season (late-June to mid-September); (iii) Post monsoon autumn/transition season (mid September to Mid- November); (iv) Winter (mid November to mid-March). The dry spell of summer is long but with occasional drizzles

or under storms. May and June are the hottest months of the year with mean daily minimum & maximum temperatures being about 40°C & 25°C , respectively. Southwest monsoons with high intensity showers in late June and July. The weather at that time is hot and humid. The variation in annual rainfall on year-to-year basis is appreciable i.e. 700 mm to 1200mm. The 20 year average rainfall for Chandigarh is 1100.7 mm. January is the coldest month with mean maximum and minimum temperatures being around 24°C and 1.8°C respectively.

Chandigarh in National Scenario-Comparison with Benchmark cities

	Domestic	Hyderabad	Mumbai	Delhi	Chennai	Kolkata	Chandigarh
G.D.P.	Gross domestic product per capita	Rs.23000	Rs.43000	Rs.39000	Rs.34000	Rs.33000	Rs.29899
	Population below poverty line (2001)	23%	27%	8%	20%	6%	12.9%
	Economic Disparity (% of low and lower middle income households, 2002)	37%	27%	18%	42%	32%	16%
Education	Literacy Rate (2001)	79%	87%	83%	80%	81%	81.9%
	Drop out Rate (2001)	66%	42%	52%	46%	42%	37%
Housing	% of population living in slums 2001	37%	55%	35%	40%	31%	15%
Health	Child Mortality 2001	6.90%	NA	2.60%	3.70%	1.60%	4.56%
Water	Period water supply per day- hrs	2	NA	2	1	NA	12 TO 16
	Per capita Availability in Ipcd of potable water	110	168	180	106	173	332
	Household water connections (2001)	36%	58%	51.30%	NA	23%	100%
Sanitation	Sewerage connections (UA)	41%	NA	55%	55%	NA	100%
Transport	Average commute time (minutes)	60	30	45	NA	NA	60
	Public Transport Utilization rate	44%	NA	62%	36%	NA	22%
	% Area covered by roads	6%	10%	18%	10%	12%	6%
	Vehicles Density (Passenger car units per KM of road length.)	723	242	NA	293	NA	500%

Chandigarh in Inter-national Scenario-Comparison with Benchmark cities

		Hyderabad	Hanoi	Bangkok	Jakarta	Johannsburg	Chandigarh
Economic	Per capita income (USD)	511	3510	15053	7269	2900	1112
Outcomes	Population below poverty line(2001)	23%	1.80%	NA	NA	25%	12%
	Unemployment Rate (%) (1998)	22%	10.30%	2.20%	16.80%	26.40%	9.2%
Education	Literacy Rate 2001	79%	92%	97%	98%	93%	81.9%
Health	Child Morality Rate	6.90%	4.20%	3.30%	2.40%	5.50%	4.56%
Water	Household access to water	81%	100%	NA	91%	84.50%	100%
	Per capita Availability in lpcd of potable water	106	NA	NA	77	261	332
	Household water connections (2001)	64%	70%	99%	50.30%	50%	100%
Sanitation	Sewerage connections (UA)	41%	50%	100%	64.80%	84%	100%
Transport	Average commute time (minutes)	60	15	60	NA	50	15%
	Public Transport Utilization rate	44%	2%	28%	NA	33.40	20%

1.4 The Master Plan of Chandigarh

Le Corbusier conceived the master plan of Chandigarh as analogous to human body, with a clearly defined head (the Capitol Complex, Sector 1), heart (the city Centre, Sector 17), lungs (the leisure valley, innumerable open spaces and sector greens), the intellect (the cultural and educational institutions), the circulatory system (the network of roads, the 7 Vs) and the viscera (the industrial Area). The concept of the city is based on four major functions: living, working, care of the body and spirit and circulation. Residential sector constitute the living part whereas the Capitol Complex, city centre, Educational Zone (Post Graduate Institute, Punjab Engineering College, Punjab University) and the Industrial Area constitute the working part. The Leisure Vally, Gardens, Sector Greens and Open Courtyards etc. are for the care of body and spirit. The circulation system comprises of 7 different types of roads known as 7 Vs Later on a pathways for cyclists called V8 were added to this circulation system.

The Capital complex comprises three architectural masterpieces, the Secretariat, the High Court and the Lagislative Assembly, separated by large piazzas. In the heart of the Capital Complex stands the giant metallic sculpture of the Open Hand, the official emblem of Chandigarh, signifying the city's credo of "open to give, Open to receive".

The city centre (Sector 17) is the heart of Chandigarh's activities. It comprises the Inter-State Bus Terminus, Parade Ground, District Courts, etc. on one hand, and vast business and shopping centre on the other. The 4-storey concrete buildings house banks and offices above and showrooms/shops at the ground level with wide pedestrian concourses. The Neelam piazza in the center has fountains with light and water features. Proposal to set up an eleven story building in Sector 17 is in the offing. Sector 34 is another newly developed commercial sector. At least three blocks in Sector 34 are proposed to have 10 story buildings to have offices, multiplexes and hotels. As per the new proposal each building will have its own style and will not conform to the grey look.

An 8 Kms long linear-park, known as the Leisure Valley, runs through the city from its north eastern tip to its south-western end. The Rose Garden, Bougainvillea Garden, Shanti Kunj, Fitness Track, Topiary Park, Terrace Garden, Hibiscus Garden, Garden of Fragrance, Garden of Annuals, Garden of Herbs & Shrubs, Champa Park, Botanical Garden, etc. all form a part of this green belt in the city, combining modernity with ecology.

One unique feature in the layout of Chandigarh is its roads, classified in accordance with their functions. An integrated system of seven roads was designed to ensure efficient traffic circulation. Corbusier referred to these as the 7' Vs. The city's vertical roads run northeast/ southwest (The 'Paths') and the horizontal roads run northwest/southeast ('The Margs'). They intersect at right angles, forming a grid of network for movement. This arrangement of road-use leads to a remarkable hierarchy of movement, which also ensures that the residential areas segregated from the noise and pollution of traffic.

Type or Roads	Functions/Names
V-1	Roads connecting Chandigarh with other cities like Ambala, Kharar and Shimla. They have dual carriageway, good tree plantation and distinctive central verge lighting. The Madhya Marg and Dakshin Marg are two roads, which merge into V-1s leading the Kalka and Ambala, respectively.
V-2	They are the major avenues of Chandigarh, with important institutional and commercial functions running alongside. In Chandigarh they are identifiable as 'Marg', Madhya Marg, Dakshin Marg, Jan Marg, Himalaya Marg, Uttar Marg and Purv Marg are important examples.
V-3	They are the corridor- streets for fast moving vehicular traffic. A sector is surrounded either by V-2 or V-3 roads.
V-4	Roads bisecting the Sector with shopping complex located along their southern edge.
V-5	Roads meandering through the sector giving access to its inner lands.
V-6	Roads coming off of the V-5s and leading to the residential houses.
V-7	They are intended for pedestrian movement and run through the middle of the sector in the green areas. A few examples are along the Jan Marg, in the Punjab University & Sector-15.
V-8	They are intended to run parallel with V-7s for the bi-cycles. Not properly developed, as yet.

Each 'sector', or the neighborhood unit, is quite similar to the traditional Indian 'Mohalla'. Typically, each sector measures 800 meters by 1200 metres, covering 250 acres area. Each sector is surrounded by V-2 or V3 roads, with no buildings opening on to them. Access from the surrounding roads is available only at 4 controlled points which roughly mark the middle of each side. Typically a sector is divided in four parts by a V-4 road running from east to west and a V-5 road running from north to South. These four parts are easily identifiable as A, B, C and D corresponding to North, East, South and

West sides. However, sector 1, 2, 3, 4, 5 and 6 have no Sub sector and Sector 7 and 8 have only three parts A, B and C (This is because they are developed according to the concept proposed by the first planner of the City Albert Mayer to give his concept some recognition.). In case of quadripartite Sector, the houses from 1 to 1000, 1001 to 2000 to 2001 to 3000 and 3000 to 4000 are located in Sub Sectors A, B, C and D in clockwise direction.

Though all the sectors are structured more or less similarly, but they have their own characteristics and individuality. Each sector is meant to be self-sufficient, with shopping and community facilities within reasonable walking distance. The sectors of the city are numbered commencing from the northern most edge of the city with the highest numbers located at the southern edge. There is no sector 13 in Chandigarh, but the additional or multiple (eg. Sec.2+Sec 11-13, Sec.11 + Sec.15=26,etc). Through it is generally believed that No.13 was left out due to superstition but records indicate that Sector 12 and 13 were demarcated initially as a cultural zone in the lower halves of Sector 10 and 11 but later removed to avoid confusion. However, later No.12 was assigned to residual area at the edge of Sector 11 but No.13 was left out in absence of an appropriate area for its location. The location of Sectors 26,27,28,29, and 30 is also somewhat anomalous. As per records, the phase-I of the master plan was up to Sector 25. Later the city was extended in the space available east of Sector 7,19 and 20 and numbered 26,27,28,29 and 30

Though educational, cultural and medical facilities are spread all over the city, however, major institutions are located in Sector 10,11,12,14 and 26. The industrial area comprises 2.35 Sq. Kms, set-aside in the Master Plan for non-polluting, light industry on the extreme southeastern side of the city near the railway line, as far away from the Educational Sectors and Capitol Complex as possible. Of this, 136 hectares was developed in the first phase. In the event of expansion, creation of an additional Industrial area in the southern part of the city was envisaged. While the Industrial area is directly connected to the civic centre by a V-3 road, a wide buffer of fruit trees was planted to screen off this area from the rest of the city. Architectural controls have been established regarding site coverage and materials of construction, ultimately requiring all plans to be formed in consultation with the Capital Project Office. A maximum coverage up to 50 per cent is allowed with 2.5 percent of the space permitted to be used as quarters for essential staff. In Sector 3, which is sufficiently close to the Industrial Sector, multi-storied buildings for providing suitable tenements for the workers have been developed. Besides Industrial housing is also provided in sector 28 and 29.

Tree plantation and landscaping has been an integral part of the city's Master plan. Twenty six different types of flowering and 22 species of evergreen trees (Singh complexes, residential areas and in the city parks, to ameliorate the harsh climate of the region, especially the hot an scorching summers.

1. City Development Plan under JNNURM

Jawaharlal Nehru National Urban Renewal Mission has been launched by Govt. of India in the year 2005-2006 to carry out development of selected city. To access the funds under JNNURM, the selected city is required to prepare City Development Plans (CDPs) and implement the reforms at the state and the city levels by entering into a tripartite agreement. The Municipal Corporation of Chandigarh has consolidated the City Development Plan and the Municipal Action Plans respectively and strengthened them. The CDP took the inputs from studies viz., City Development Strategy and Concept Plan for Chandigarh. A series of consultations were organized involving a wide spectrum of stakeholders including the elected representatives, business and trade, government departments, etc. This CDP is result of extensive consultations with stakeholders of both in the Municipal Corporation, Chandigarh and Chandigarh Administration as per the guidelines of Jawaharlal Nehru National Urban Renewal Mission.

The CDP is conceptualized considering the position occupied by Chandigarh city as a strategic destination for various activities and initiatives planned by central and state governments and to guide the planning and investment decisions in future. The CDP envisages development and renewal and up-gradation of services in view of promulgation of Apartment Act and high-rise in population during the last decade. The I.T. Industries have been set up in city Chandigarh with development of Rajiv Gandhi I.T. Park in Kishangarh area as well as the satellite town of Mohali – Development of Chandigarh-A profile.

The city of Chandigarh covers an area of 15000 acres to be developed in three phases. Sectors 1 to 30 have been developed in Phase-I and the remaining sectors from Sector 31 to 47 have been developed in Phase-II. The sectors in Phase-I and II have been fully developed and the services in all the sectors in Phase-II have been provided except for part of Sector 43-C & D. The development of southern sectors in 3rd phase is in progress in which new sectors from 48 to 56 in Phase III has been taken up.

The development work of Phase-I was started in early 50s. Most of the work in Phase-I was completed by 1975: though some of the pockets were yet to be developed and had been kept as reserve area. The development in Phase-II sectors had been taken up simultaneously. The planned population of Phase-I and Phase-II was only 5.00 lac persons. However, this figure has already been exceeded. According to 2001, census the population of Chandigarh Union Territory was 9.01 lacs, which clearly indicates the steep rise in the population in the last decade from 1991 to 2001 having incremental rate of 4.03% per year. According to projected population and current growth rate, the population of the city would rise to 13.38 lacs in 2011 and 19.85 lacs in 2021. The figures are going to exceed further in view of rehabilitation programme of Chandigarh Administration for the jhuggi dwellers. The number of colonies such as Dhanas, Maloya, Dadu Majra, Palsora, Bapu Dham etc. have already been rehabilitated and there is another proposal to rehabilitate the jhuggi dwellers who have encroached the land in the eastern and southern part of the city. These people have to be rehabilitated by constructing about 23000 dwelling units near Dhanas as per plan of Chandigarh Administration.

1.6 Objectives of City Development Plan (CDP)

The main objective of the CDP is to have a planned growth of the city in the desired direction and to project Chandigarh as a Global City, guided by a shared vision for city's development. The CDP makes basic policy choices and provides a flexible framework for adapting to real conditions over time. It emphasizes on issues of priority local concerns for livability, and the implied requirements in terms of:

- Upgradation and automation of basic services.
- Generation of additional water.
- Extension of more facilities to public

The CDP comprises of sectoral plans for the identified sectors for a time horizon of 30 years outlining policy framework and investment interventions to achieve the vision. The CDP outlines the strategic policy and investment interventions to achieve the vision of Chandigarh including formulation of sectoral plans for the identified sectors. The scope of work is to:

- Assess the existing situation with regards to demographic and economic growth, infrastructure services, municipal finances, etc.

- Identify the gaps in service delivery such as water supply, sewerage system/treatment, roads, storm water drainage, transportation and solid waste management.
- Outline the issues faced by the City's poor
- Prepare a vision and sectoral strategic framework outlining the goals, strategies, interventions/projects to achieve the vision and
- Prepare a city investment plan with appropriate financing strategies and an implementation action plan.
- Focus on the reforms to be carried out at the level of administration and ULB in consonance with the vision and strategic plan outlined to sustain the planned interventions.

1.7 Consultative Process in Chandigarh Municipal Corporation

In Chandigarh, the preparation of municipal action plans through consultative and participative processes has been prioritized. Items were on the basis of works transferred by Chandigarh Administration. The major projects like city roads, water supply, sewerage system; storm water drainage and solid waste management have been tendered in consultation with Chairperson/Mayor of U.L.B. and other representatives.

The participatory process involved with stakeholders, which included government departments, Municipal Corporation, councilors, representatives of NGOs and women representatives, civil society, business and trade, economics, media, the urban poor. The discussions during consultations facilitated identification of needs, their prioritization and preparation of an accepted development plan for the city focusing on the poor. These consultations were supported by working groups on governance reforms, infrastructure and urban poor. The deliberations of these groups provided inputs to the consultative process. Consultations are mandatory in the preparation and finalization of master plan by Chandigarh Administration and Municipal Corporation. The Engineering Department prepared plan for major roads, Transportation Department has taken up the work for their field. The main contributor in preparation of CDP is Municipal Corporation, Chandigarh. The Municipal Corporation has assigned almost all areas/functions, which have been transferred to U.L.B. The Municipal Corporation has prepared investment plan for water supply, sewerage system, storm water drainage, roads and solid waste management. Extensive consultation has been held with elected representatives, Mayor, officers of different wings of Municipal Corporation before finalization of CDP.

The key stakeholders viz., Municipal Corporation of Chandigarh, Chandigarh Housing Board, Engineering Department, Chandigarh and Transport Department, Chandigarh involved in service delivery, public representatives and others have been involved in the process.

The stakeholders were identified through stakeholder analysis. They include:

- Engineering Department, Chandigarh Administration looks after National/State highway V1, V2 and V3 road in the city and govt. works and development of new sectors. (Phase-III)
- Municipal Corporation entrusted with water supply, sewerage system, storm water drainage, city internal roads V4,V5 and V6, solid waste management, sanitation, fire wing, property tax etc. in old sectors of Ph.I&II.
- Transport Department – Public transports.
- Chandigarh Housing Board – Construction of houses (dwelling units) for public.

The stakeholders/departments have been awarded with the purpose, process, and expected outcomes of the CDP, and build enthusiasm, understanding and commitment to the CDP. The process also helped in deriving a consensus along with the stakeholders firming the process and agreeing upon a structured programme to take the CDP forward. In addition, working groups were formed and each group was assigned a sector identified for interventions in the CDP. The nodal officers from departments have been appointed for preparing of CDP. The officers of various departments have contributed in focusing the city vision, define sectoral goals, and define strategies to achieve the goals. These officers have prepared the strategies and action plans in key sectoral areas viz.,

- Governance
- Poverty Alleviation
- Economic Development
- Environment
- City road and elevated highway.
- Water supply, sewerage system and storm water drainage.
- Solid Waste Management
- Transportation
- City institutions.
- Municipal Finance.

The CDP identified performance-monitoring/ sustainability indicators to assist the City of Chandigarh to review the progress of the CDP on an annual basis and to enable them in setting the agenda for the future. The process is iterative and enabled the city to review its outcomes through the identified indicators so as to make the process dynamic and in tune with the felt needs and requirements.

CHAPTER-2: Demography, Economy and Land Use

2.1 Demography

The Chandigarh is the first urban planned city in India. The up-gradation of service delivery outcomes in Chandigarh required by coordination of all departments in Chandigarh Administration and Municipal Corporation, Chandigarh Housing Board. The absence of an effective coordination mechanism, amongst municipal, Chandigarh Housing Board and state level agencies has implications for orderly spatial development, coordinated infrastructure provision, local economic growth, development management, service delivery and expenditure effectiveness. There is an urgent need to ensure spatial and functional integration of service delivery process through innovative institutional arrangements for achieving better service outcomes. There is a need for widespread reform in governance and service delivery framework with a focus on capital as Chandigarh.

Age structure, sex ratio and literacy

Sex ratio in Chandigarh urban agglomeration is 777 in 2001, the population below six years of age in 2001 was 1.16 lakhs constituting 12.9% of total population. This assumes significance, as amenities have to be planned for this age group to ensure a safe and healthy living. Census figures for 1991 & 2001 for Chandigarh general literacy and female literacy have improved. Literacy rate in women is considerable low. This is because of slum population, which was 107098 in 2001, and now it would be around 1.5 lacs

Population growth in the City

Chandigarh was planned for a finite population of half-a-million. In Phase I, 36 sq Km of land was acquired by the city administration for construction of 30 sectors. Land for seventeen additional Sectors (Sector 31 to 47) was acquired and developed during the second phase to cater for a population of 350000 the predominance of 3 to 4 storey apartments in second phase provide for higher population dimension. However, Chandigarh has now grown beyond its planned capacity. Hence, development in the third phase has started in sector 48 and beyond. Demographic data indicate that between 1961 and 1971, the population increased by 144.59 percent, one of the highest for urban areas in India. According to 1981 census, it grew by another 75.55 percent, followed by 42.16 percent in 1991 and by 40.33 percent in 2001 (with a total population of 900635). By

2021 the population of Chandigarh is projected to be around 19.5 lacs (at current rate of growth) almost four times, for which it was originally built.

Population and decadal growth		
Year	Population (lakh)	Decadal growth rate (%)
1981	4.52	75.55
1991	6.42	42.16
2001	9.01	40.33
2005(Estimated)	10.54	40.33
2011(Projected)*	13.33	40.33
*Straight-line projection		

Composition of the growth				
Year	1981-91	% of total	1991-2001	% of total
Natural increase	63505	1.41	86110	1.34
In-migration	126900	2.81	172510	2.69
Jurisdictional change	-	-	-	-
Total increase	190405	4.22	258620	4.03

Villages & slum areas

At present there are 18 villages namely Kaimbala, Khuda Alisher , Khuda Jassu, Khuda Lahora, Sarangpur, Dhanas, Dadumajra, Maloya, Palsora, Kajheri, Hallomajra, Behlana, Raipur Khurd, Raipur Kalan, Makhan Majra, Daria, Mauli jagran and Kihangarh. Four villages i.e Badheri, Butrela, Burail and Attawa are now under Municipal limits of Chandigarh, and area under the control of the Municipal Corporation. In additional, according to a survey by Labour department and Department of Food & Supplies, 14 unauthorized slums namely, (1) Ambedkar colony (2) Gursagar Bhattal colony (3) Kabari colony (4) Kalyan colony (5) Kumhar colony -25 (6) Labour colony-4 (7) Labour colony -5 (8) LBS colony (9) Madrasi colony (10) Nehru colony (11)Rajiv colony (12)Sanjay Labour colony (13) SBS Mauli Jagran and (14) Shahpur, exist around the city with population of about 70000.

Factors for the rapid growth

- The Chandigarh is going to become Hi-tech city by setting up of I.T. park in the northern-eastern sectors of Manimajra and it is expected that about 25000 families likely to ingress in the U.T. Chandigarh. The Chandigarh Administration has already provided excellent infrastructures in order to accommodate the large number of foreign/Indian based I.T. companies.
- The Chandigarh being the regional center is hub of political and bureaucratic activities of the 3 neighboring states of Punjab, Haryana and Himachal Pradesh. This has already impacted upon the services of Chandigarh because of tendency of the high income group people to settle down here and this also carried the floating population with them. This increasing trend of population in the city is also result of high profile services being directly provided by the Chandigarh Administration and Municipal Corporation.
- The high profile education and health facilities are available in the Chandigarh. The Punjab Engineering College has been converted into deemed university. The two new Engineering Colleges have come into existence in Sector 26 and Punjab University. The specialized medical services are also available in the city as well as in the satellite town of Mohali and Panchkula with the setting up of PGI, York, Fortis and CMC institution etc.
- Migration of population from the states of Punjab and Haryana as well as service providers from Bihar and U.P. has contributed to increase the population figure in the U.T. Chandigarh. It is evident that the construction activities in Chandigarh and its satellite towns of Mohali (Punjab) and Panchkula (Haryana) as well as adjoining areas are always at its peak as compared to the cities of neighboring states. So the construction workers have made a big head way in increasing the population.
- Most of the big companies in productions marketing have also set up their sub offices in city Chandigarh to transact their business in the states of Punjab, Haryana and Himachal Pradesh.

Impact of the Population Growth on the Provision of Basic Services

It is obvious that because of increasing impact of population in the U.T. Chandigarh the requirement of basic services used to increase rapidly. So the city developers have to prepare the scientific plan to upgrade the services in tandem with rate of increase in the population. The most important here is to seek the expert opinion not only to maintain the existing level of services but to upgrade the same upto international standards and to make the services providers quality conscious. The U.T. Chandigarh has to withstand the impact in respect of basic services like water supply, sewerage, storm water drainage, roads & building infrastructures, sanitation, medical facilities, transportation, electrification and security.

However the area of the operation of Chandigarh Administration and Municipal Corporation differs in certain functions but there are some basic services which are provided jointly by Chandigarh Administration and Municipal Corporation such as water supply, sewerage, drainage, roads, electricity, horticulture, but however the Municipal Corporation is entrusted with the planning, construction, augmentation, operation and maintenance of following services:

- **Water supply:** The water supply of urban area in the jurisdiction of Corporation is maintained by the P.H. Wing of Municipal Corporation. So the planning for augmentation of water supply scheme to keep pace with the rising population of area has to be made, detail of which has been depicted in the subsequent paras.
- **Waste water disposal:** With the increase in the water supply, it is obvious that the waste water disposal has also to be augmented after its proper treatment keeping in view the norms of Pollution Control Board/Committee. The total length of the sewer lines already laid in the city is about 982 KMs having size from 6" to 64" and circular brick drains of standard design.
- **Storm water drainage:** The Municipal Corporation is also responsible for augmentation of drainage of storm water as per the topography of the city. The city Chandigarh is provided with 713 KMs of main and branch storm lines with specially constructed letterbox type road gullies for quick disposal of the rainwater for better health of city roads.

- Internal roads: The city has designated its roads as V1, V2, V3, V4, V5, roads. The roads V1 to V3 are under the jurisdiction of Engg. Deptt. of Chd. Admn. for its construction and maintenance. The V4 to V6 called internal roads of the sectors are laid in front of the markets and residential houses are maintained by Municipal Corporation. The total road network under the control of Municipal Corporation, Chandigarh is 1250 km (approx.). The roads will have direct impact due to increase in the population requiring the addition alterations as well as widening of the parking areas.
- Streetlights: The influx of population in the city requires augmentation of streetlights a part of which is with the Municipal Corporation. There are about 17000 street light points under the control of Municipal Corporation, Chandigarh. With the increase of road length, parking area and due to development of Ph. II sectors, the area of jurisdiction is likely to increase.
- Horticulture: About 80% area in the city is maintained by the Municipal Corporation with its green trees on the both side particularly V1 to V5 roads. The large number of green belts, lawns and gardens such as Shanti Kunj Sector 16, Fragrance Garden Sector 36, Terrace Garden Sector 33 etc. are maintained by corporation. The most important is Mini Rose Garden, which is being developed in Sector 24 by the Municipal Corporation as well as Shivalik Park near I.T. Town Manimajra. It is the policy of the Municipal Corporation to develop at least one garden/green belt in every sector of the city every year.
- Solid Waste: The handling of solid waste, its transportation and disposal rest with the Municipal Corporation. In some areas, public private partnership programme has been launched for door-to-door collection of solid waste, which is successfully being operated. The Municipal Corporation has already entered into agreement with a private company for setting a solid waste treatment plant for conversion of garbage into pellets near Dadu Majra colony.

2. Economic Base and Occupational Distribution

The economy of Chandigarh is witnessing a transformation from traditional manufacturing towards a knowledge-based economy. This is primarily due to policies of the Central government/U.T. Administration to promote knowledge sector and tourism through a series of initiatives and programs. Knowledge sector, particularly Information Technology and IT enabled services (ITES) alongwith the Biotechnology is gaining momentum in the Chandigarh. The knowledge sector Corridor consists of:

- IT & IT enabled services
- Biotechnology and medical sciences
- Industrial technologies

ECONOMIC BASE		
ECONOMIC BASE, REGISTERED MANUFACTURING & SYSTEM		
Economic base	2002 Years	2005 (Estimated)
Manufacturing		
Employment (Nos.)	29338	14573
Production (Rs. Crore)	583.91	443.81

ECONOMIC BASE, OCCUPATIONAL DISTRIBUTION, 2001		
Occupation category	Number of workers (lakh)	% of total
Primary sector	124691	14%
Household industry	3880	1.18%
Manufacturing	17224	5.24%
Electricity, gas & water	6600	2%
Supply		
Construction	56000	1.70%
Transport, storage and communication	12298	3.74%
Banking and insurance	12000	3.65%
Trade and business	13296	4.04%
Services	83000	25.23%
Total	328989	

Manufacturing sector includes activities as disparate as the manufacture of pharmaceuticals, electronic goods, I.T. and other industrial products. I.T. industry is a dominant player of the manufacturing sector and is expected to play an increasing role

even in future in the exports of pharma products. Chandigarh is known only for service class people and hub for bureaucratic and political activities of the region.

The tertiary or service sector has increased over the recent years with a significant proportion of new jobs across a whole range of activities. Of late, this sector has emerged as the single largest employer and will continue to grow as the dominant sector in the future considering the developmental initiatives planned in the area. The city's workforce is engaged in manufacturing industry in Chandigarh, the migrating population from U.P. and Bihar plays a major role.

Chandigarh is emerging as one of the growing IT cities of the country and many M.N.C's are shifting from Bangalore. The state is making concerted efforts to promote key initiatives in this sector to leverage information technology to attain a position of leadership and excellence in the information age. The road map identifies "Chandigarh" as a large and thriving mega IT Hub with a significant number of top IT companies having their presence in Chandigarh. In addition, the focus on IT enabled services is likely to increase employment opportunities in this sector. Towards promotion of IT sector, several initiatives have been taken up such as setting up of Rajiv Gandhi I.T. Park, development of a hi-tech city, e-governance initiatives, and encouraging private sector presence in Chandigarh's Software Technology Park. Further steps have envisaged in the same direction are the Part-II of I.T. Chandigarh.

Acknowledging the vast potential of the sector and the spin-offs it offers, Chandigarh Administration is focusing on tourism and Chandigarh is being promoted as a major destination for tourists considering its advantageous location and the initiatives taking place in developing it as a major transit Hub between:

(A) Delhi and hill states of Himachal and J.K. The tourists used to destinate at Chandigarh for proceeding to hill states of Himachal and J.K. The airport of Chandigarh is being upgraded. The Five Star Hotel Mountview has already been operated by CITCO. The Taj Group being set up the five-star hotel, also besides Shivalikview maintained by CITCO.

(B) The high profile city parks/gardens such as rose garden, fragrance garden, terrace garden attracts the tourists. The lake and first of it own kind rock garden are attractions of tourists. The CITCO has made arrangement for city tour for tourists by introducing special tourist bus service.

Chandigarh being the capital of two states of Punjab and Haryana, but also regional center for MNCs & Central Government, it has a large population that is growing and hence the potential to power and propel the State's future economic growth is based on Chandigarh economy, trade, commerce, industry, transportation, communication and construction sectors. The northern part of city has already been developed. Now southern part of city and Manimajra town is under development. The work force involved in primary, construction and service sector is 328989, which is approx. 36% of total population.

The gross domestic product of Chandigarh has increased by more than 100% during 1993-94 to 1997-98 at current rate (price). At constant prices, the growth was more than 50% during the same period. Further the gross domestic product has increased again to more than 100% at current price during 1997-98 to 2003-04. At current price, increase is 55% during this period. Chandigarh is in better position as compared to other major cities like Hyderabad, Agra etc.

S.No.	Name of State	G.S.D.P.
1	Haryana	14757
2	Himachal Pardesh	11832
3	Rajasthan	7930
4	Delhi	27898
5	Pondicheri	24094
6	Chandigarh	29899

The per capita income of Chandigarh was Rs.19761/- in the year 1993-94 which has risen to Rs.51341/- in the year 2002-03 against national per capita income Rs.7690/- (in 1993-94) and Rs.18912/- (in year 2002-03). The per capita income of Chandigarh is highest in India at current assessment and assessed prices.

Land Use, Spatial Growth and Planning

The area of the municipal Corporation is 79.74 sq. km out of 114 sq. km. With regards the existing land use (excluding the extension areas of the city) about 65% of area is categorized as residential and commercial and a significant 10% each is assigned towards agriculture and water bodies and forest area respectively. On the other hand the proportion of public and semi public use land constitutes 9% and transportation land

constitutes only 1% of the total area. A detailed land use structure of the Corporation area has been enumerated as follows:

Category	% Area	Area in sq. km.
Residential	64.82	73.90 Sq.KM
Commercial		
Industrial	5.04	5.75 Sq.KM
Public/semi-public	8.92	10.71 Sq.KM
Recreational		-
Transportation	1.12	1.28 Sq.Km
Agricultural & water bodies	9.96	11.36 Sq.KM
Special area*	9.65	Forest 11.00 Sq.KM
Total area		114 Sq.KM

Emerging Concerns of Spatial Growth

The key issues that need to be addressed:

1. Need to augment the water supply, sewerage and drainage.
2. Upgradation of road/bridge infrastructure, widening of roads.
3. Housing stock for poor as well as for professional likely to be migrated to Chandigarh because setting up of I.T. Park.
4. Solid waste management and treatment.
5. Spatial plan needs integration with infrastructure and services
6. Need for a coordinated strategy to disperse economic activities in a sustainable manner
7. Controlled development in the surrounding ULBs
8. Redesigning the transport system.
9. Controlling the pollution because of heavy population of persons and vehicles.

CHAPTER-3: GOVERNANCE, INSTITUTIONAL FRAMEWORK AND REFORMS

1. Governance

Population growth of city makes the scale and complexity of urban problems very daunting. It requires efficient and effective governance framework. Urban governance refers to the management of civic affairs by institutions to improve the quality of life in an inclusive, transparent, equitable and accountable manner. The ‘good urban governance’ is characterized by equity, efficiency, transparency, accountability, civic engagement and security of people as well as environment. This is the urban governance that enhances city’s competitiveness and contributes to sustainability. A number of departments/ institutions are involved in governing a city. They include the state government departments, local bodies and parastatals. While the departments are part of government, the local bodies and parastatals are created through Acts of legislature or government orders.

Legal Framework

In Chandigarh up to 1994, there was no ULB but there was only advisory council of Administrator (U.T.). The Municipal Corporation, Chandigarh with 20 wards was formed in 1994 under Punjab Municipal Act, 1976 extended to Chandigarh with amendments.

Administrator (Governor – Punjab)	
Adviser to Administrator	
Finance Secretary	Home Secretary
Engineering Department	Police
Planning	Personnel
E&T Department	Revenue
I.T.	Local Self Govt.
Science & Technology.	Transport
Chief Administrator Capital Project.	Food
Environment and Forest	Health
Treasury & Accounts.	Education
	Agriculture
	Tourism

In Chandigarh, main departments such as Personnel Administration, Police, Excise, Education, Transport, Health, Rural Development, Engineering, Electricity, Sports, Estate Office, Industries, Tourism are with Chandigarh Administration headed by Administrator, U.T. who used to be Governor, Punjab with the help of Adviser to Administrator and Secretaries of Departments.

In 1994, the certain works such as water supply, storm, drainage, internal roads i.e. V6, V5 and V4 roads, sanitation, fire wing, enforcement, health were transferred to Municipal Corporation to manage the services falling in the jurisdiction of Municipal Corporation, Chandigarh. The area falls within the jurisdiction of Municipal Corporation, Chandigarh is 79.74 sq. km out of total area of UT 114 sq. km. Other agencies are also working besides Chandigarh Administration:

3.2 Functional Domain

Punjab Municipal Act 1976 was extended to Chandigarh Municipal Corporation in 1996. The functional domain of local bodies in the state is derived from respective legislations. The Municipal Act list the functions under two categories, namely, “Obligatory Functions” and “Discretionary Functions”. The functional domain was expanded in 1994 as per the 12th Schedule of the 74th Constitution Amendment Act. In Punjab, the Municipal Act provides for a majority of the functions listed in the 12th schedule of the Constitution. They include:

- Urban planning including Town Planning
- Regulation of land use and construction of buildings
- Planning for economic and social development
- Roads and bridges
- Water supply for domestic, industrial and commercial purposes
- Public health, sanitation, conservancy and solid waste management
- Fire services
- Urban forestry, protection of the environment and promotion of ecological aspects

- Safeguarding the interest of weaker sections including the handicapped and mentally retarded
- Slum improvement and up-gradation
- Urban poverty alleviation
- Provision of urban amenities and facilities parks, gardens and playgrounds
- Promotion of cultural and aesthetic aspects
- Burial ground; cremations, cremation grounds and electric crematoriums
- Cattle ponds; prevention of cruelty to animals
- Vital statistics including registration of births and death
- Public amenities including street lighting, parking lots, bus stops and public conveniences
- Regulation of slaughterhouses and tanneries

12th Schedule of the Seventy Fourth Constitutional Amendment has partially been incorporated and list of transferred functions is as below:

- Roads and bridges
- Water supply for domestic, industrial and commercial purposes
- Public health, sanitation, conservancy and solid waste management
- Fire services
- Safeguarding the interest of weaker sections including the handicapped and mentally retarded
- Provision of urban amenities and facilities parks, gardens and playgrounds
- Burial ground; cremations, cremation grounds and electric crematoriums
- Cattle ponds; prevention of cruelty to animals

- Vital statistics including registration of births and death
- Public amenities including street lighting, parking lots, bus stops and public conveniences
- Regulation of slaughterhouses and tanneries

There are several issues in the transfer of functions of state agencies to the local bodies. Transfer of functions need follow up legislation, institutional capacity of local bodies, financial resources, etc., which come in the way of transfer of these functions to the urban local bodies. It is also expected that transfer of officials as well as resources will follow the transfer of functions.

3.3 Institutional Framework

At the helm of the Municipal Corporation, Chandigarh there is the corporation democratically elected by the community as per the 74th CAA. The present Municipal Corporation was elected in December 2001 and has a five-year tenure.

Institutional Responsibility

Urban Infrastructure	Municipal Corporation of Chandigarh (MCC) (Planning, Design and Construction)	Engineering Department of Chandigarh Administration (Planning, Design and Construction)
Water Supply	In developed sectors	Only in newly developed sectors
Sewerage	-do-	Only in newly developed sectors
Drainage	-do-	Only in newly developed sectors
Storm water drainage	-do-	Only in newly developed sectors
Solid waste disposal	Fully responsible	(-)
Municipal roads (including flyover)	In developed sectors	Only in newly developed sectors
Street Lighting	Where no overhead conductor exists	Only where overhead conductor exists

Multiple Agencies Working Together

Name	Area of operation
Municipal Corporation, Chandigarh.	Water supply, Sewerage, drainage, roads, sanitation, fire wing, property tax
Chandigarh Housing Board	Construction of urban housing for the city.
Chandigarh Industrial & Tourism Corporation	Tourism and Industries
Chandigarh Transport Undertaking	Transportation.

As per the 74th Constitutional Amendment Act, following committees have been constituted and they are endowed with the functions of maintenance of sanitation, water supply and drainage, street lighting, roads, horticulture, five apni mandis and school buildings. They also review the revenue collection, prepare draft annual budget, and send it to the council for incorporation in the city's annual budget.

The following are the committees:

1	Finance & Contract committee.	This is the most powerful committee having 7 members including Commissioner, M.C.C Chandigarh and Mayor. This committee has power to sanction upto Rs.35 lacs.
2	Road committee	9 councillors and Executive Engineer (Roads) as secretary of committee and having power to sanction works upto Rs.25 lacs.
3	Water supply & Sewerage Disposal Committee.	9 councillors and Executive Engineer (Public Health) as Secretary of committee, has a power to sanction upto Rs.15 lacs work.
4	Environment committee	9 councillors and Executive Engineer (Horticulture) as Secretary of committee, has a power to sanction upto Rs.15 lacs work.
5	Electricity committee	9 councillors and Executive Engineer (Electricity) as Secretary of committee, has a power to sanction upto Rs.15 lacs work.
6	Fire wing committee	9 councillors and has a power to sanction upto Rs.15 lacs work.
7	Apni Mandi mmittee	To discuss & decide sites & mode.
8	House Tax ommittee.	To suggest the mode of assessment and monitoring
9	Sanitation Committee	9 councillors and Medical Officer Health, M.C. as Secretary of committee.

Institutional framework can be discussed at two levels viz. internal administrative structure and the agencies external to the ULBs but connected with them in development and service delivery. The Municipal Corporation is headed by the commissioner, who is always drawn from IAS cadre. He is assisted by a number of Additional/Joint Commissioners/Chief Engineer in the area of finance, administration, projects, fire and sanitation works etc. The organization of surrounding municipalities in Punjab and Haryana is much similar. The civic administration headed by the commissioner belonging to the cadre of state municipal commissioners. He is assisted by a group of officials of Engineering wing, Road & Public Health.

3.4 State government Agencies:

Secretary, Local Govt. (Chandigarh Administration, Chandigarh.)

Parastatals: Municipal Corporation, Chandigarh:

Commissioner

Additional Commissioner

Joint Commissioner

Secretary

Chief Engineer

Medical Officer Health

Each of the institutions listed above have specific functions and liaison with local government institutions in planning the provision of infrastructure and delivery of services. There are also central government institutions like railways, which are responsible for the provision of services in the city. In the absence of a coordinating agency, there are several constraints in the integrated and comprehensive planning and delivery of services. Interdepartmental coordination is one of the prominent issues and conflict that are becoming difficult to address or resolve even at the level of heads of the service delivery agencies. It is observed that the citizen is often concerned with the quality of service rather than who is delivering the service. The service delivery often suffers because more than one agency is involved and there is no mechanism for ensuring inters agency coordination. To illustrate, there are a number of agencies dealing with road infrastructure both construction and service delivery, and there is no clear distinction of scope. Road management is a key co-ordination issue and it can be built and maintained but the multiplicity in agencies involved making the task difficult. Road infrastructure development could suffer due to lack of co-ordination between agencies.

As a consequence, the traffic and transportation in the city faces uphill tasks with increased travel time, traffic congestion etc. in certain area in peak hours.

5. Key Issues in Governance

- The city governance, as observed earlier, is characterized by multiplicity of agencies. This results in lack of inter department coordination which is a serious roadblock plaguing the municipal governance.

Details of the Departmental Functions

S.No.	Department	Chandigarh Administration	Municipal Corporation	Chandigarh Housing Board	CITCO
1	Education	Yes	-	-	-
2	Health	Yes	-	-	-
3	Transport	Yes	-	-	-
4	Estate Office	Yes	-	-	-
5	Water supply, sewerage, drainage	New sectors under development and villages 18 nos.	All developed sectors and city area and Manimajra	-	-
6	Roads	V1, V2 and V3, roads of villages	V4, V5, V6 roads	-	-
7	Construction of houses.	For govt. employees	-	For public on sale/purchase	-
8	Tourism	-	-	-	Yes
9	Industries	Yes	-	-	Yes
10	Sanitation	-	Yes	-	-
11		-	Yes	-	-
12		-	Yes	-	-

The agencies have their own priorities, procedures, lines of accountability, financing patterns, which often may not be in conformity with those of the M.C.C and the ULBs. The critical issues that emerge from the existence of multiple agencies include:

- Spatial and functional fragmentation
- Overlapping functions
- Multiple accountability lines
- Service delivery gaps, and
- Increasing urban poverty
- Heavy migration.

Inter-Institutional Conflicts

Inter-jurisdictional and inter-institutional conflicts between public service planners and providers are common in city. Heads of departments, heads of parastatals and elected and non-elected officials of local bodies are required to coordinate their works on a day-to-day basis. The large number of departments, institutions, local authorities, agencies and officers undertaking similar, related or over-lapping functions or functions that are not clearly defined lead to conflicts in operation. Moreover, the various agencies operate over the same or overlapping jurisdictions and are not in a position to fully understand or evaluate the backward and forward linkages associated with these functions. Inter-institutional externalities, which occur abundantly in economies, account for most problems of city management. They call for effective coordination and mitigation mechanisms to be put in place.

In Chandigarh, the activated agencies are the various departments of Chandigarh Administration and several other parastatals, Central Government agencies including Municipal Corporation, Chandigarh Housing Board, CITCO, CPWD, Punjab PWD and Haryana PWD. Thus, there are many managers connected with service delivery and infrastructure and management. All these make the task of U.T. management highly complex and difficult. In addition to general coordination between urban and rural local authorities, there are several inter-departmental and inter-institutional coordination issues, which arise, in day-to-day administration of the U.T. area.

As per notification of Punjab Municipal Act, 1976 extended to Chandigarh, the original works (planned works) will be carried out by Engineering Department which consists of development of new sectors/colonies for providing basic estate services such as water supply, roads, storm water drainage, sewerage system, parks/gardens, electricity etc. But

now there is overlapping in certain area such as development of third phase of Chandigarh, Sector 48 to 56 is being provided by Engineering Department as well as Chandigarh Housing Board. The roads etc. have been provided by Engineering Department. The construction of colonies etc. is also being done by C.H.B. The Municipal Corporation is also taken up the work in sectors of Phase I & II as well Phase III including Manimajra town. Since the inception of Chandigarh, Engineering Department is expertise agency is to provide services whereas Chandigarh Housing Board is not expertise agency to provide estate services in the sectors. Even then in colonies, they are providing services. There is no coordination between these three Engineering agencies of Chandigarh Administration such as Chandigarh Housing Board, Municipal Corporation and Engineering Department. There should be certain coordination committee to sort out the matters.

A large number of cooperative societies have constructed the houses in Sector 48 to 51, the part of services have been provided by them own, part of them by Chandigarh Housing Board and Engineering Department. On the other hand Estate Office U.T. who used to be D.C., Chandigarh has not issued occupancy certificate but people used to start residing there making water, sewerage connection one way and other. So there is no coordination committee to sort out the problems of residents of newly developed societies in southern sectors.

Jurisdictional Issues

While subsidiarity is a desirable principle that can be adopted as a guide to draw boundaries for various functions, it is not possible to arrive at a common boundary for all services. The geographical area required to internalize the costs and benefits of a service like urban planning may not be the same for another service like urban transport or water supply or storm drainage. However, a large enough an area would be in a position to internalize most of the dimensions of key local services. The whole idea is to contain the spill over externalities so that the benefit areas match the revenue areas. If such matching is not ensured there will be perennial problems of service revenues falling short of service costs, mounting inter-institutional conflicts, increased cost of public administration, lack of integrated development and imposition of high social costs on the public. Thus, it is important that jurisdictional issues are sorted out carefully.

3.6 Grievance Redressal

The grievance redressal mechanisms in the city are weak and the people are made to run from pillar to post for grievance redressal. There is also no proper platform to make appeal for people to redress the issues. Particularly in the absence of political set at U.T./State level. The grievances of people are not heard particularly in departments like Estate Office, Police, Electricity Department, the officers dealing the establishment of employees etc. Even due right is not extended to common people. Lack of awareness and information is affecting the citizen's access to grievance redressal. Though citizen charters were established for the service providing agencies, majority of the public is not aware of the duties and rights under the same.

There is a need to address these institutional and other challenges to provide good governance to the city. Unless the roadblocks are removed, economic development is hampered and efficient service delivery becomes difficult. This adversely impacts the community - particularly the poor. There is need, therefore, to restructure the governance framework, remove the roadblocks and streamline the lines of accountability. The governance reforms become all the more critical in the context of Chandigarh becoming more competitive and investment destination. The city should offer more high quality services and promote inclusiveness and citizen friendly governance institutions. Only where it is environment friendly and is well governed the vision of the city can be realized. The institutional strategies required include:

- Spatial integration of MCC, CHB & Engineering Department for better planning and delivery of services.
- Establishing clear lines of accountability of all service delivery agencies, and - Constituting autonomous service delivery agencies in different sectors like water and sanitation, transport, roads, solid waste management etc.
- Performance based memorandum of understanding between the corporation and various service delivery agencies focusing on targets and outcomes.

Within this overall framework institutional and implementation mechanisms need to be worked out. They include:

- Establishing a Reform Monitoring Unit as a oversight body to monitor the reforms underway and being proposed;
- Strengthening local government capacities by outsourcing the project management functions;
- Establishing appraisal institutions and processes;

The institutional and governance reform strategies include;

- Strengthening decentralisation – 74th CAA
- Evolving inclusive governance mechanisms
- Institutional integration
- Evolving partnerships for service delivery

3.7 Reforms at the State and City Level

Reforms and Change are critical elements in development process; they become more significant in urban development in the context of growth of cities and consequent pressure on infrastructure and services, growth of poverty, etc. this is compounded by institutional constraints like in capacity, fragmented structures, functional overlaps and dated processes and procedures. In addition, there has been a paradigm shift in governance from the traditional top-down model. As a result governance reforms have become imperative for efficient delivery of services, provision and maintenance of infrastructure and to provide efficient and responsive governance to the people. Recognizing the significance of reforms to provide efficient and effective governance, Chandigarh Administration has initiated and implementing several urban sector reforms during the last few years. Similarly the urban local bodies particularly the municipal corporations have initiated city specific reforms to improve governance and delivery of services of water supply, roads & sanitation.

Reforms at the level of Chandigarh Administration.

The reforms initiated at the state level fall under three categories namely 74th CAA, Governance and Pro-poor. They are discussed below:

- Reforms related to 74th Constitution Amendment Act (CAA)
- Development State Urban Development & Poverty Reduction Strategy Governance
- Establishment of Strategy Performance and Innovation Unit (SPIU)

- Citizen charters
- E-Governance initiatives just e-sampark kendra
- Outsourcing of services
- Developing partnerships in service delivery
- Downsizing sizes of staff in ULB and Govt.
- Preparation of common municipal act for corporation and municipalities
- Simplification of planning regulations and procedure to make it public friendly.
- Framework for solid waste management
- Rationalization of stamp duty to the extent of 5%.
- Preparation of actions plans for poverty reduction by ULBs and Govt.
- Affordable water supply connection to BPL families
- New citizen friendly street vendor policy
- Rehabilitating slums

Reforms at the City Level – Municipal Corporation of Chandigarh

Municipal Corporation of Chandigarh has initiated several reforms to improve service delivery and strengthen municipal performance in the city. Some of these reforms are in tune with 74th Constitution Amendment Act. They include:

- Information technology for better civic services
- Area based property tax system
- Modified accrual system for accounting

- Utility mapping on GIS platform envisaged
- Efforts towards a fiscally prudent organization
- Levy of user charges
- Road widening
- Citizen charter
- Formulation of City Development Strategy
- Introduction of self - assessment schemes
- E-Governance initiatives
- Projection to make city free from open defecation.

CHAPTER-4: MUNICIPAL INFRASTRUCTURE

1. Introduction

Steep Urban population growth puts heavy pressure on infrastructure, particularly water supply, sewerage, solid waste, sanitation, road network, traffic and transportation etc., unless infrastructure is improved, quality of life suffers. Most importantly, it impacts economic development of the city and investment climate. The present status of infrastructure, gaps and future requirements strategies and investment requirements in the areas of water supply, sewerage, solid waste management, traffic and transportation are discussed critically.

Basic services

Basic services are important to everyone's survival and access to decent and standard life. All the people in urban areas have at least basic services they need in an affordable manner. There are large numbers of services that they provide, the most important of which are:

- Water supply
- Sewerage and sanitation
- Municipal roads and storm water drainage
- Solid Waste Management
- Traffic and transportation

Basic services minimum requirements

Service Type	Level 1 Basic	Level2 Intermediate	Level 3 Full
Water	Community standpipes	Yard taps, yard tanks	In house water
Sanitation	(Sewage collection/disposal	VIP Latrine Septic tanks	Full water borne
Roads	Graded	Gravel	Paved/tarred & kerbs
Storm water drainage	Earth lined open channel	Open channel lined	Piped systems
Solid Waste disposal	Community (Residents)	Community (Contractors)	Kerbside

State of Municipal Infrastructure		
Water availability	Installed capacity (mgd)	70 mgd
	Released/daily (mgd)	70 mgd
Source of water supply	<i>Within city limits</i>	20 mgd
	10-50 . km.	50 mgd
	50-100 .km.	-
Water coverage	<i>Population covered by public water supply %</i>	100%
	per capita supply (1pcd).	332 LPCD
	Supply duration (hrs.)	12 to 16 hours
Waste water Disposal	Wastewater generated daily (mld)	52 mgd
	Disposal (underground sewerage capacity (mld).	52 mgd
	Present operating capacity (mld)	52 mgd
	Households connected to underground sewerage %	100%
Solid Waste	Waste generation daily (tones / day)	350 ton per day
	Collection daily (tones/ day)	350 ton per day
Storm water Drainage	Annual rainfall (cm.)	1150 mm (115 cm)
	Length of storm water drains (km.)	713 Km
Street Lighting	Municipal roads (km.)	1536 Km
	State-level roads (km)	394 Km
	Public transport	Bus/taxi
	Buses (number)	417
	Bus capacity / passengers	52 passengers
	Private registered vehicles	4,50 lacs
Street Lighting	Number	38,000
	Area coverage %	100 % urban area

4.2 Water Supply

The climatic conditions in Chandigarh are hot summer, temperature touching up to 114°F and severe cold in winter - temperature dropping at times nearing freezing point. From the point of view of demand of water - the calendar year can be divided into the following distinct seasons.

a) Summer season From April to mid July.

These are dry and hot months and the demand of water during these months is very high both for domestic and irrigation requirements.

b) Monsoon season From mid July to mid September.

c) Winter & spring season From mid September to March.

Chandigarh experiences an annual average rainfall of about 42" (1050mm). The rain is mostly confined to the months of July and August. A small part of it occurs in the winter months of December and January also.

While planning the new city of Chandigarh, one of the most important points, which received consideration at the hands of the planners and engineers, was availability of suitable and dependable source of water supply needed for domestic, industrial and irrigation requirements of the city. These are two types of sources, which can be tapped for the city water supply:

1. Surface water source, and
2. Sub terrene water.

In the early 50's the population of the city was thin and the yield of tubewells was sufficient to meet the water supply demands of the city. As such, the water supply of the town was based on tubewell source alone. Moreover, no surface water source was available in the vicinity of the town. Over the passage of time, the population of the city has increased considerably due to Influx of population from other states resulting in corresponding pressure on city water supply system. Due to continuous tapping of underground source, the water table in the area started depleting. As such it was not possible to depend on the underground water source alone for the entire water requirement of the town in future. The idea of constructing a dam on Ghaggar river to tap the surface water source was also mooted in early sixties but this project has not made

any head way due to bifurcation of Punjab and could not see the light of the day. Since the construction of Ghaggar dam has been highly uncertain, the Chandigarh Administration decided to tap another source of surface water i.e. Bhakra Main Line flowing at a distance of 27.5 Kms. from Chandigarh to meet the immediate needs of the city. Since the level of Bhakra Main Line at off take point Kajauli is 177' lower than the ground level of water works, Sec.39, Chandigarh, the project has been based on pumping of water against gravity from Bhakra Main Line near Morinda (Pb) to Sector 39 water works in Chandigarh. Thus the first phase of Aug. W/S Scheme Chandigarh was commissioned in the year 1983 with the approval of Govt. of India, Ministry of Urban Development to carry 40 cusecs (20 mgd) of water through 46" o/d M.S. pipe line duly lined with concrete on both surfaces. It was decided by the Govt. of India that this quantity of water will be shared by Punjab, Haryana and Chandigarh Administration in the following ratios :

- a) Union Territory Chandigarh : 29 cusecs. (14.5 mgd)
- b) Punjab (for Mohali) : 5 cusecs (2.5 mgd)
- c) Haryana (Panchkula) : 3 cusecs (1.5 mgd)
- d) Chandimandir Cantonment : 3 cusecs (1.5 mgd)

Total 40 cusecs (20 mgd)

With the successful commissioning of Phase-I and increase in demand of the water in the city, the Chandigarh Administration was asked to go in for Phase-II of the project with similar specifications and the same was successfully completed in year 1988. Even after, the commissioning of Phase-II of Aug. W/S Scheme Chandigarh in the year 1988, the city of Chandigarh had only 29 MGD of water as its share. Still there remained a wide gap between the demand and supply of the water in the city. In order to bridge this gap, phase-III of the project was prepared and submitted to the Govt. of India at a cost of Rupees.13.69 Crore and the same was approved by the Ministry of Urban Development of the Govt. of India vide their letter No.Q-11018/3/88/ PHE dated 15.04.91. The rising main of Phase III project was executed with P.S.C specifications in order to economize its cost & early execution. The same has been successfully completed & commissioned in the year 1994 at a cost of Rs.28.30 crores as per the revised estimates. Similarly another scheme to bring additional 20 mgd water was approved by the Ministry of Urban Development in 1996 for Rs.47.23 crores under Aug. W/S Scheme Ph. IV. In the meantime, the execution and operation and maintenance of the services like water supply, sewerage, storm, sewer, inner roads, sanitation etc. was transferred to Municipal Corporation. The work of Ph. IV could be taken in hand only in the year 2001. The

same has already been completed and likely to be commissioned shortly which will provide relief to the consumers of city by adding another 14.5 mgd as its share.

Service Area

The present water supply service area of MCC is 114 Sq.Kms, which includes MCC area 79.34 sq.kms, and 34.69 sq. km. The urban area falls in jurisdiction of Municipal Corporation. The water supply system is entrusted to Public Health wing of MCC. The rural area comprises of 18 nos. villages falls in jurisdiction of Engineering Department. The villages are provided with tube wells water supply for urban/rural areas of Chandigarh:

- Surface: Bhakra Main Canal at 27.5 KM distance
from Chandigarh. 50 mgd
- Deep tubewell 200nos. around the of city
and surroundings. 22 mgd

Existing Transmission, Distribution and Storage Capacities

The transmission mains carry water from the raw water source (Kajauli) to the water treatment plants, Sector 39, Chandigarh. The surface water source is B.M.L. that is 27.5 KM from Chandigarh and pumping 60 mgd raw water from Kajauli. The city is getting 50 mgd raw water. The water pumped to treatment plant at water works, Sec.39. The water is treated, disinfected and stored at water works; Sec.39. This is further pumped to distribution five nos. Water works in the city. These water works further pumps the clear water to distribution system in the city for the use of the consumers.

The present availability of surface water to Chandigarh is as under:

Surface water	60 mgd
Less S.A.S.Nagar	7.50
Less Chandimandir	3.25
	10.75 (-) 10.75 mgd
	49.25 mgd
Ground water from 200 tube wells	22.00 mgd
	71.25 mgd

These 200 tube wells have been drilled on periphery of Chandigarh and its town Manimajra. About 100 t/wells are feeding water-to-water works in city, Chandigarh and Manimajra. The balance t/wells are directly pumping to the distribution system after disinfections. The rehabilitated colonies and Manimajra town are purely based on t/wells water supply. The average availability of water is 10 to 12 hours per day and availability is second highest in India @ 332 LPCD except Goa where water supply is around @ 342 LPCD.

The Aug. W/S Scheme Ph. IV was approved in 1996 and the work on the same could be started in 2001 and now scheme has been completed and ready for commissioning. Shortly Chandigarh will get 14.5 mgd water as its share. So with commissioning of the Ph. IV the availability of water will be 84.5 mgd because share of Haryana (Panchkula) (@ 1.5 mgd/per phase) 6 mgd would be utilized by U.T. till Haryana installs its infrastructure for treatment and transmission of water. The net available water will be only 78.5 mgd if Haryana starts drawing its share of raw water from Chandigarh.

Raw Water Pumping Stations and Treatment Plants:

Zone	Location of the plant	Capacity
1	Pumping station (water works), Kajauli near Morinda (Pb.).	Having the capacity to pump 80 mgd raw water including 50% stand by motorized and diesel pump sets.
2	Water works/pumping station, Sector 39, Chandigarh.	<ul style="list-style-type: none"> ▪ Water treatment plant of 70 mgd capacity. ▪ Clear water pumping machinery for pumping water after treatment to water works, Sec.12,26, 32 and 37. ▪ Raw water and clear water storage tanks.
3	MES Water works/pumping station, Sector 39, Chandigarh.	Having the pumping capacity of 3.5 mgd with 100% stand by for pumping raw water to Chandimandir Cantonment.

Distribution of Water Supply

The city has been divided into 7 zones for the purpose of distribution including town of Manimajra. The Chandigarh city area is sloping from north towards south. The zoning of the city has, therefore, been made keeping in view the slope of the land. Future sub-zoning within the zones has also been necessitated due to low-pressure complaints and higher demand than the supply/availability with the system. Each zone has a Headwork, which is named after its sector. These are listed as below:

Zone No	Location of water works:	Sector catered by this water works
1	Water work location In sector 12	12,14,15,16,17,18,22-A&B, 21-A, P.G.I, Punjab University, Sec.25.
2	Water work location In Sector –26 (Kirloskar side)	1 to 11 and Secretariate, High Court, Rock Garden.
3	Water work location In Sector –26 (Jyoti side)	19,26,27,28,29,Industrial Area, Phase – I , 20-A&B, 21-B,30-A&B
4	Water work location In Sector -32	31,32,33,34,43,44,45,46,Industrial Area,Phase II, 20-C&D, 21-C&D.
5	Water work location In Sector 37	22-C&D, 23, 24, 25(Part), 35, 36, 37, 38, 39, 40, 41, 42 and 43.
6	Water work-I Manimajra (Mansa Devi Road, Chandigarh)	Water is distributed to the old abadi of Manimajra Town.
7	Water works-2 Modern Complex Manimajra.	Feeding to Modern Housing complex Manimajra.

The biggest pipeline is 24" i/d cast iron pipe and smallest distribution line is 3" i/d of cast iron pipe. The system has been designed on gridiron system. The C.I pipes have been used for clear water line. But the distribution lines for raw water are of distribution system has been designed with terminal head of 54' as per byelaws of Chandigarh water supply.

The machineries installed in all the water work are electric pumps, with 50% electrical stand-bye. At present there are 50% diesel generator sets stand-bye, which is available for use during electricity failure. Each consumer plot is given one connection as per bye-laws

according to the requirement. The minimum size of ferrule is ½”i/d . Metered supply is given to all the consumers except in Dadu Majra colony, Karsan Colony and Bapu Dham Colony and E.W.S Houses in Sector –29,30,and 32.A separate estimate for providing metered connection in these colonies has been taken up. In view of this, it has been decided by the Chandigarh Administration not to give flat rate connection; at it has been found that there has been huge wastage of water in the system. The consumers are being persuaded to get the metered connection, failing which it has been intimated to them that water pressure cannot be maintained. Additionally there are about 60 tubewells which are connected to water works are also feeding. The present supply hours are 10-12 hours in a day.

Service Coverage

The total installed capacity of water from the four surface sources is about 49.5 mgd. Apart from the piped supply, about 20 Mgd is also abstracted through deep bore wells with power pumps. 85% connections metered and flat rate connections are given to rehabilitated colonies. There are also metered connections. Besides there are 800 stand post s in the city. 332 LPCD water is 10-12 hours.

Manimajra Area

Besides this, Manimajra is conventional old town. It is provided with 35 nos. tubewells, which are located in Manimajra area. These tube wells are feeding to two nos. water works. The water is collected in UGRs of water works and water is pumped to distribution system for 10 hours.

Water Demand and Deficit

Chandigarh’s current estimated demand stands at 110 mgd. However, its availability is merely 69.25 mgd, and this is made worse in same conditions that contained supply even further. The estimated ground water extraction that supplements water supply is 20 mgd, which accounts to only around 29% of supply.

Performance Indicators

Indicators	MCC
Total population	10.98
Network Coverage	100%
% Access to piped Water supply	100%
Unaccounted for water	22%
Duration of Supply	10 to 12 hrs
Connections	130000
% metered	85%
Average volume of water produced	69.25 Mgd
Unit Production Cost	
Water Tariffs	
Residential & Commercial	Rs.2 to 6/-
Industrial	Rs.11/-
O&M Cost Recovery	72%
Basis of billing	
o Residential	Flat Rate/ metered
o PSPs	Free of cost
o Commercial/ Industrial	Metered
Mode of Payment	Cash, Cheques, DDs,
Private sector involvement	Billing, collection, leak repair, maintenance, etc
Computerization/automation	Billing, accounting, complaint, handing
Management Information System	Partly developed.

Non-Revenue Water

Non-Revenue water (NRW) due to commercial losses and physical losses in the system, leads to loss of revenue. The water system has high NRW levels averaging to 28% in MCC area; the efforts have been made to replace transmission losses. These are compounded by commercial losses due to approximately flat rate connections; public stand posts and inefficiencies in billing and recovery.

Deficit in water supply for Different horizon year

Year	Projected Population (In Lacs)	Water Demand (In Mld)	Present water Availability (In Mld.)	Deficit (Mld)
2006	10.98	492.93	315	177.93
2011	13.38	519.47	315	204.47
2016	16.29	553.41	315	238.41
2021	19.85	620.92	315	305.92
2031	29.46	800.80	315	485.80

Water Tariff

The water tariff is low to moderate. The domestic rate varies from Rs.1.75 to Rs.6/- per KL for domestic depending upon the slab. The commercial rate of water is Rs.11/- per KL, which is average 2.5 times the domestic rate. The bulk consumptives of water are P.G.I., Punjab University and CSIO.

TARIFF STRUCTURE

S.No.	Category	Rates till 05.06.2000	Rates revised on 05.06.2000	Rates Revised on 18.12.2002
1	Domestic (metered)	Rs.0.70 per KL (0-15 KL)	Rs.1.40 per KL	Rs.1.75 per KL
		Rs.1.30 per KL (15-30 KL)	Rs.2.60 per KL	Rs.3.50 per KL
	Flat Rates	Rs.1.80 per KL (above 30 KL)	Rs.4.00 per KL Rs.100/- per flat	Rs.5.00 per KL (30 to 60) Rs.6.00 per KL (Above 60) Rs.100/- per flat
2	Lawn(Metered)	Rs.1.25 per KL	Rs.2.50 per KL	Rs.2.50 per KL
3	Govt/semi Govt &.Industrial/Semi Industrial Unit	Rs.3.00 per KL	Rs.6.00 per KL	Rs.12.00 per KL
4	Commercial	Rs.3.00 per KL	Rs.6.00 per KL	Rs.11.00 per KL
5	Institutions	Rs.3.00 per KL	Rs.4.50 per KL	Rs.9.00 per KL

Percent Change in Tariff Since 1999

S.No.	Category	Rates as per 05.06.2000 (% Age increase)	Rates Applicable from 05.06.2002(% Age increase)
1	Domestic (Metered) Flat Rate	100% 300%	165% 300%
2	Lawn	100%	100%
3	Govt. Offices	100%	300%
4	Industrial	100%	300%
5	Institutional	150%	200%

The above table depicts percentage increase in the year 2000 & 2002 as compared to tariff in year 1999.

Recycling of Waste Water

The Govt. of India agreed to the proposal of Chandigarh Administration for recycling of wastewater after its treatment. However, it was suggested by the Government of India that recycling of waste water can be treated as Augmentation of water supply scheme: because it will relieve the city water supply system of its load, so far as the irrigation requirement for public parks/lawns/open spaces is concerned. It is submitted that 52 mgd raw sewage is reaching at treatment plant, Diggian that was set up in 80's:

1. Primary & secondary treatment plant facilities to treat the sewage under Ph.I for 15 mgd effluent at BOD level less than 30.
2. Treatment plant of 15 mgd capable of treating the sewage upto BOD level less than 100.

So out of 52 mgd, effluent Chandigarh is presently having the capacity (both under Ph.I & II) to treat the sewage upto 30 mgd only. A proposal was drawn to treat the effluent received from the secondary treatment plant upto tertiary level having BOD below 10 so that tertiary treated water can be repumped back to city for irrigation for large green belts, parks in order to save the potable water which will further cope up the requirement of the city for drinking. Accordingly the scheme for recycling of waste water after treatment has been approved by Govt. of India vide their letter No.11019/3/87/PHE Dated 5.5.87 at a total estimated cost of Rs.333.00 lacs. The project has been completed and commissioned during the year 1991-92. This project consists of the following:

1. Treatment of effluent from Secondary sewage treatment plant phase-I- 10 M.G.D
2. Pumping of 10 M.G.D of treated effluent from sewage treatment plant up to the city and connecting the same with the existing raw water distribution system.
3. Laying of pre stressed cement concrete pipe line from sewage treatment plant up to the Rajindra park and connection with the existing system. This work has been completed. Thus water supply system of the city stands augmented by 10 M.G.D.

Although 10 mgd treatment plant has been installed to treat the sewage upto tertiary level yet the city is able to receive only 3 mgd recycled water because the separate distribution net work for irrigation of lawns and parks has been laid only in northern sectors because of non availability of rising mains and distribution net work.

For the last two years the utilization of the T.T. water has been extended by impressing upon the major users of irrigation water having large area in their premises maintained as green spaces. These major institutions like PGI, colleges, schools, technical institutions and Punjab University have been asked to disconnect the potable water supply from irrigation of lawns and make it convenient to get the connection of T.T. water in order to save the precious potable water for further utilizing in the city. The Municipal Corporation has got good response from the users. Accordingly, Municipal Corporation has prepared the estimate for up gradation of existing treatment plant of 30 mgd to 45 mgd and to treat the sewage up to standard of BOD 30 mgd per litre. The funds of the same would be made available by the Chandigarh Administration to the tune of Rs.32.76 crores.

In order to boost up the utilization of Tertiary treated (T.T.) water in the city and optimizing the use of T.T. plant proposal has been drawn by the Municipal Corporation for harvesting of sewage effluent tertiary treated water for irrigation purpose in Chandigarh under Jawahar Lal Nehru National Urban Renewal Mission to the tune of Rs.36.82 crores. This project is provided for laying of additional PSC rising mains, construction of UGRs and distribution net work of HDPE pipes from Sector 17 to Sector 47 in order to utilize the T.T. water in all the green belts and houses having area upto one kanal.

4.3 Sewerage System

The main sewage is running from west to east with inter connection of sewer line from south to north. There is country slope from north to south. The covered population with sewerage is 95% and no pumping is involved because of topography of city. The size of main line varies from 64" size to 6" size in the city. The length of S.W. pipe of different size network of sewage system is 742 km.

Sewage Treatment Plants

Primary treatment of 15 mgd capacity was constructed in early eighties having capacity to treat sewage upto BOD 100 which is situated in Mohali at south end sewerage system. The sewerage treatment plant of 15 mgd was constructed in 1989 having capacity to treat sewage upto 30 BOD. Out of 15 mgd, 10 mgd has the capacity to treat water upto tertiary level less 10 BOD. 22 mgd sewage is being dispose off dumping into 'N' choe.

Key Issues and Challenges:

- Insufficient size/capacity of sewer in rehabilitated colonies because of high degree of increase in population because of migration.
- Requirement of additional sewage treatment plant to treat the existing 22 mgd sewage and additional sewage to be generated because of Aug. of W/S.

4.4 Storm Water Drainage

The drainage system in Chandigarh comprises of a hierarchy of natural and man-made drains and water bodies that ultimately discharge surface run-off into 'N' choe. Numerous 'N' choe constituting the major storm water drainage system for the area drain the City. The 'N' choes are the major carriers of storm water. Currently, storm water drains in the city are constructed and maintained by the Municipal Corporation. Normally storm water drains receive the most priority.

No doubt city's country/natural slope is from east north towards south but still there are certain low attitude area in the city Chandigarh like Sector 11, 24, part of Sec.15 and part of Sec.35, Mauli Jagran, Gobindpura area of Manimajra.

Mainly storm has been laid in more than 90% area in U.T. Mainly discharge of rain water is disposed of in 'N' choe near Sector 47. With construction of railway line from Morinda to Ludhiana, Barrier has been around eastern southern area of Chandigarh because filling has been done to construct the railway track over right of way. The size of storm water drain varies from 12" size to 96" size including brick drain and R.C.C. box channels. The total length of storm is 713 KM

Flood Prone Areas in Chandigarh.

The key reasons for this situation are assessed as follows:

- Inadequate drainage system, which was designed for the rainfall of 12 mm/hour.
- Excessive concentration of flood due to heavy down pour.
- Disappearance of flood absorbing 'N' choe because of urbanisation.
- Dumping of debris and garbage into the open Nallahs/N-choe.
- Illegal encroachment of natural water courses
- Indiscriminate laying of service lines all along and across natural courses.
- Filling of 'N' choe in Chandigarh which decreases the drainage capacity.
- Diversion of natural water courses to accommodate habitations.
- Increased run off due to increase in impervious areas.

Improvements to Storm Water Drainage

The Municipal Corporation has undertaken a study to prepare a storm water drainage master plan to alleviate the problems of flooding by providing adequate measures. The study recommended deepening and widening of the nallahs for the sections affected by encroachments, critical sections for further improvement and a broad cost to carry out the improvements. The improvements proposed include:

- Deepening
- Widening
- Provision of retaining walls at critical sections

- Modification to cross drainage works and in addition suggested some soft measures such as prevention of dumping of waste into the nallah to prevent clogging.

5. Solid Waste Management

The city Corporation of Chandigarh has been making all out efforts to devise foolproof methods to organize the management of MSW in an efficient manner. The Corporation has been focusing its efforts to promote public private partnership to provide sustainable waste management system in the city. For the purpose of collection removal and storage of Municipal Solid waste, the Corporation has allotted about 1/5 of the city area to private entrepreneurs for providing sanitation services and has engaged 373 Nos. of safaiwalas through outsourcing.

The garbage is collected in the wheel barrows/small cycle carts during the road sweeping by the safaiwalas of the Corporation and is collected from house to house in large cycle carts by the Residents Welfare Associations and N.G.Os through the cart pullers. The Municipal Solid waste so collected is deposited in the community bins/Sehaj Safai Kendras. The garbage from these community bins/Sehaj Safai Kendras is transported to the dumping ground regularly through hydraulic fitted fast moving vehicles.

Treatment of garbage with EM solution and Dumping of Disposal

The Corporation has started the treatment of city garbage at the dumping ground with Effective Micro Organism Solution (E.M Solution) with effect from March 2005. The said treatment is helpful in the acceleration of decomposition process of the garbage, reduction in the volume of gas discharge with the result that foul smell has substantially minimized, minimization of larva of flies & mosquitoes, reduction in suspended dust particles, reduction in the volume of waste and fermentation period. This will continue till Garbage Processing Unit/Plant is commissioned.

The city Corporation has earmarked 45 Acres of low lying land situated in the west of Sector 38 near Dadumajra Labour colony where the garbage is disposed of through the process of 'Land-Filling'. The landfill site is being very well maintained. The garbage transported to Dumping Ground is compacted with heavy chain dozer, treated with EM solution, is covered with a thick layer of earth on daily basis as per MSW Rules,2000.

Introduction of 'Bin Free Sector Scheme'

The Municipal Corporation has introduced an innovative bin free Sector Scheme. Under this scheme, all the garbage bins placed at various locations for the collection and transportation of the city Municipal Solid waste are removed and one or two suitable sites are earmarked for the collection of Municipal solid Waste from that area where Sehaj Safai Kendras are constructed. The residents of the area are asked to arrange the disposal of their house hold waste at the Sehaj Safai Kendras by engaging cycle carts for House-to-House garbage collection on cost recovery basis. The corporation is getting very encouraging response of this scheme and the same is being extended in phased manner. So far the Corporation has extended this scheme in 20 Sectors. In these 20 sectors the Corporation has organized House-to-House collection of Municipal Solid waste by involving Resident Welfare Associations of their own. The Municipal Corporation is providing large number of cycle carts to the Resident Welfare Associations free of cost for arranging house-to-house collection of garbage. The Corporation has devised suitable method for collection of waste from slum, slaughterhouse etc. by providing suitable & adequate Garbage bins for the purpose.

Setting Up of a Garbage Processing Unit.

The MCC is planning to set up a Garbage Processing Unit as a joint venture with M/s Jaiprakash Associates Limited having a turn over of more than Rs.3000.00 Crores per annum. The Garbage processing unit is being set up by adopting 'pelletisation' technology for the processing of Municipal Solid Waste of the city on BOOT basis.

The Corporation has handed over the physical possession of 10 acres of land to the Project Developer for this purpose. The foundation stone of the unit was laid by His Excellency the Governor of Punjab and Administrator U.T. Chandigarh on 21.2.2006. The work at the site is in progress and is expected to be completed in the first quarter of 2007.

Central Population Control Board's Sponsored Demonstration Project

The Central Population Control Board has allotted one 'demonstration project' to the city Corporation of Chandigarh for the management of Municipal Solid Waste and to project the implementation of Municipal Solid Waste (Management & Handling) Rules, 2000. The Project covers works relating to road sweeping, its collection, storage and disposal as per norms. The Municipal Corporation has purchased one mechanical road sweeper,

garbage containers of and closing of the reclaimed area at the landfill site and development of a new sanitary landfill site. The total cost of the project is Rs.12.70 Crores to be shared by the Central Pollution Control Board, the Municipal Corporation Chandigarh and the Chandigarh Administration.

Components not covered under the Demonstration Project

The following 3 important components are not covered under the Demonstration Project allotted by the Central Pollution Control Board to Chandigarh.:-

(i) Disposal of Domestic Hazardous Waste

At present the hazardous household waste like old batteries and empty containers of chemicals, pesticides etc. are disposed off at the existing landfill site along with the other Municipal Corporation Solid Waste. This practice of disposal of Hazardous Household waste is contrary to the provisions of the Rules which inter-alia state that separate arrangements should be made for the disposal of hazardous household waste in the prescribed scientific manner to preserve environment. With a view to make such arrangements as per rules the Municipal Corporation has decided to set apart an area of about half acre land at the extreme south end of the existing land fill site for developing the requisite facilities for the disposal of such waste. The consultant of the Corporation has made and estimates of Rs.2.00 Crore for the development of such facilities.

(ii) Disposal of Slaughter House Waste

The city Corporation is according top priority for the collection and transportation of waste form Slaughter House, Meat Market and Fish Market etc.due to its peculiar nature. At present the waste from these places are dumped along with other Municipal solid Waste. The waste from the Vegetable Market is transported to the Dumping ground by city Market committee. With a view to arrange scientific disposal of slaughter house waste, it is proposed that a Bio-gas plant of 3000 Kg. capacity may be installed at the total cost of about Rs.45.00 lacs. The Corporation has arranged the cost estimates for the installation of the Bio-gas Plant prepared from M/s Mailhem Engineers Pvt. Pune.

(iii) Disposal of Carcasses

At present the disposal of dead animals are being carried out at 2-3 open spaces, which is creating unhygienic conditions and is also inviting public criticism. With a view to make scientific arrangement for the disposal of dead animals, it is proposed to set up Carcasses Utilization Centre in collaboration with the Punjab Govt. over an area of about 1 acre of land. The Corporation has prepared the cost estimates for the setting up of the proposed unit at the total cost of Rs.3.80 Crore.

CHAPTER-5: BASIC SERVICES TO THE URBAN POOR

5.1 Introduction

In Chandigarh, more than one fifth of population reside in slums, squatters and other rehabilitated colonies. Their contribution to city's economy has been also been growing over the period. In the absence of developed land and clear policy to address their problems, the poor suffer from many inadequacies in terms of access to basic services, socio- economic needs. It is necessary, therefore, to articulate policies and programmes to mainstream the slum communities with the city, both in terms of infrastructure provision and social and economic development.

Population below Poverty Line

As per the available data, the number of people living below the poverty line was 94485 as per census 2001 and fresh survey is in the process in U.T., Chandigarh in rural and urban sectors.

SOCIAL COMPOSITION OF POPULATION	
Year	Number of the poor*
1999 / 00	94485 (in 3/2000)
2004 /05 (Estimated)	Fresh survey under process.
*Below poverty line	

5.2 Growth of Slums and Slum Population

Chandigarh city is characterized by a very significant presence of the urban poor, with a growing poverty profile. Slum settlements have multiplied over decades and the living conditions of the poor have not improved. Environmental decline, vehicular pollution, inadequate basic services and infrastructure in the poor settlements hit the poor hardest. Slums are scattered around the city on its periphery, with high population densities and the number of people inhabiting them estimated to be around 1.5 lacs. It is estimated that more than 90% of these slums are on govt. land, and the rest on lands belonging to various farmers. Poverty has a visible gender dimension too. The incidence of poverty among women is higher and female-headed households constitute the poorest of poor.

The number of slums and slum population in the city has been increasing at a faster pace over the decades. The slum population is emerging on the out- skirting of city as detailed below:

1. Colony No.5 located in Sector 50 area of which is under development.
This is the biggest slum area of city.
2. Colony No.4 located near Industrial Area, Ph.I near Sukhna choe, which is being polluted by open defecation.
3. Bapu Dham Colony is located in northern eastern area Chandigarh near Timber Market, Sec.26.
4. Janta & Kumhar Colony is located in Sector 25.
5. Lal Bahadur Shashtri slum is located in Sector 56 area on border to S.A.S.Nagar (Pb.).
6. Rajiv colony slum is located in Sector 38 (W) area.

5.3 Socio-economic Characteristics of slum population

Communities

Slum population in Chandigarh is not much heterogeneous in character – because Hindus are in majority besides very less population of Muslims having migrated from U.P. and Bihar. A language predominantly spoken in slums in Chandigarh is Hindi. These people have migrated to Chandigarh in search of job. These workers are mostly engaged on construction work. The mason, fitter, electricians and helpers are their main profession. Actually there is demographic shift, the original professional work just carpenter, mason etc. have migrated to Gulf or European country where people from U.P. and Bihar have shifted to Chandigarh to take lead in construction work/activity, but Chandigarh Administration and Municipal Corporation used to make efforts from time to time to provide protected water supply, common toilet block, sanitation etc. Every slum in Chandigarh is provided with potable water supply as stand post as well as community toilet block and mobile toilet vanes. But with increasing pace of migration of slum population in Chandigarh, even then open defecation in certain area not ruled out. Now Municipal Corporation has made elaborated arrangement to provide sulbh sauchalyas in colony No.5 and 4 to eliminate open defecation from city.

Even Health Department Is also always on palm to avoid to any epidemic because usage of raw fruit, unhygienic meat, cold drink by the slum people. Even because of lack of civic sense by slum dwellers, the task of controlling the epidemic is very daunting. The status of water supply and sewer for slum is as under :

ACCESS OF THE SLUM DEVELLERS TO BASIC SERVICES				
Year	Number of slum dwellers	% of slum dwellers having access to		
		Water supply	Drainage System	Waste collection service
1991	0.5 lac	100%	70%	70%
2001	1.25 lac	100%	75%	80%
2005	1.5 lac	100%	80%	90%

Environmental Conditions and Health Status

The environmental conditions in slums are no doubt poor and lack basic civic amenities. Earlier studies have recorded that the common diseases prevalent in slums in Chandigarh are gastro-enteritis & dysentery, liver, Typhoid. To overcome these hazards health infrastructure have been geared up by distributing medicines and chlorine tablets and preventing hygienic conditions.

Basic Infrastructure

Access of slum population to basic services is a key indicator of the quality of life in slums in particular and the city in general.

Unorganised and Informal Sector Employment

The contribution of informal sector, with more than 30% of the industrial workforce, to the city's overall economy is considerable. The income per employed person in the organized sector may vary from 6.5 to 3 times the income per employed in the informal sector. Hence the informal sector contributes to more than 30% of the total income generation in the city and the same can be applied to Chandigarh. The salient features are:

- The sector derives its importance due to the scale and nature of operations;
- The activities are concentrated around the business centre Sec.17,22,15,26,19.

- The major areas of concentration of informal activities is noticed in Burail, Manimajra, Bapu Dham colony and Colony No.5 and Attawa.
- The people involved in the informal sector constitute a major portion of urban poor as these units have a low labour income though the entire family might be involved.

Poverty Reduction Initiatives

The urban poverty reduction programmes in city started in 1967.

Nature	MCC
Central sponsored	- Swaran Jayanti Sahari rozgar yojana (SJSRY)
	- National slum development programme(NSDP)
State Sponsored	- Urban Programme for Advancement of Household Incomes.
	- Welfare Programmes Sponsored by Women, SC, ST, Minorities and other corporations.

As we shall see later, several government agencies and NGOs also implement programmes relating to education, health, welfare and others. Studies indicate that there is lack of coordination and convergence in programme implementation. There is need to bring all these efforts under a single authority to facilitate coordination and convergence and to avoid duplication of effort and resources.

5.4 Institutional Structures

The Urban Community Development Department in MCH and Urban Poverty Alleviation Cells in the surrounding municipalities are the umbrella organizations for the implementation of programmes and schemes for the poor. In addition there are a large number of agencies responsible for implementing programmes aimed at poverty reduction. They include the revenue, education, health, housing and SC, ST, BC, Physically Handicapped, Women and Minority welfare departments and their organisations, urban development authorities, CBOs, NGOs and academic institutions, etc.

A serious problem in this arrangement is the overlapping jurisdiction and absence of coordination and convergence of programmes and activities. There is need for integrated and unified arrangements for addressing the problems of poverty reduction comprehensively. This will facilitate better targeting of programmes, effective identification of beneficiaries, facilitates participation of community based organizations, better institutional coordination, etc. Linkages should be established between the UCD/UPA Cells and civil society and their role in poverty reduction should be clearly understood.

In addition to ensuring better coordination across the public agencies, private sector and the civil society, it is recommended that a high level Task Force at city level should be set up with representatives of public sector, private sector and the civil society as the members. The Task Force should provide support for implementation of the action plans .

Key Challenges

In spite of several initiatives towards poverty alleviation there are several critical issues and challenges that need to be addressed. They Include:

- Lack of Data: Lack of dependable data on various aspects of poverty including number of slums, slum population, access to services like water and sanitation, livelihood, etc.
- Land: Land possession continues to be a daunting issue in addressing the problems of the poor. People living in non-notified slums are most vulnerable, as they are not officially recognized. They are most vulnerable with no regular incomes, access to basic services absence of tenure rights, etc
- Infrastructure Deficiency: Deterioration of infrastructure created by investments under various slum improvement programs due to inadequate maintenance, finance and direction in the post-project phase resulting in poor quality of service availability to the residents in the improved slums.
- Absence of Integrated Response: The experience of implementing poverty programmes clearly brings out the need for an integrated response to deal with the problems of the urban poor. The experience highlights the fact that no sectoral intervention would mitigate the problems of the urban poor or improves their quality of life. It is also noted that programmes for the poor need to focus on

particularly vulnerable groups among them, like women and children, disabled and destitute, the aged and children in difficult circumstances.

- Neglect of Informal Settlement: Programs are targeted mostly for notified and developed Slums. Non-notified slums and de-notification policy for developed slums leaves out the vulnerable group without getting much attention.
- Lack of co-ordination among various programs and institutions to address the problems in an integrated and meaningful way.

CHAPTER-6: URBAN ENVIRONMENT AND HERITAGE

6.1 Introduction

Chandigarh is one of the fastest growing cities in the country with a potential to become the I.T. capital city of Punjab and Haryana. The city is witnessing a rapid expansion, industrial boom, increased trade opportunities coupled with high population growth rate (decadal rate: 40.30%) accelerated due to migration from neighboring states as well as from U.P. and Bihar. Chandigarh is beset with increasing urban environmental problems due to the growth of unsustainable economic activities, increase in vehicular transport, inspite of public transport system. The most important issues of concern include air and noise pollution, depleting ground water and contamination of water bodies and lakes, destruction of natural and man made resources of cultural value and improper management of domestic and industrial effluents. This situation has (and will) lead to depletion of green cover, groundwater table and rising levels of air and noise pollution.

6.2 Air Pollution

Air Pollution is a growing problem in Chandigarh due to high rates of growth of motorized transport. The rising levels of air pollution can be attributed mainly due to increasing vehicular population, which had seen an average two vehicles per peso keeping in view population of city besides floating population of vehicles because capital of two states. The pollution levels in Hyderabad are increasing over the period. Oxides of Nitrogen (NOX) levels have reached to Indian Standards and an increasing trend can be observed there after. Suspended Particulate Matter (SPM) levels are well above indicating the alarming levels of pollution.

The Chandigarh Pollution Control Committee is monitoring the air quality in Chandigarh. The key parameters that are being monitored include :

- Total Suspended Particulate Matter
- Oxides of Nitrogen
- Sulphur Dioxide

An analysis of this data indicates that the Total Suspended Particulate Matter (TSPM) and Respirable Particulate Matter (RSPM) are very high in comparison to the ambient air quality standards.

Quality of Air

Summary of ambient Air quality Monitoring Results.

Location		Concentration of Pollutants (ug/m3) 24 Hour Average Value				
	MONTH	SO ₂	NO _x	RSPM	SPM	SOURCE
	OCT-05	2.4	14	-	230	
	NOV-05	2.4	12.8	-	224	
	DEC-05	2.3	22.6	-	216	
	JAN-06	2.2	22.4	-	188	
	Average	2.3	17.8	2.4	215	CPTL
AA2	OCT-05	2	12	104	234	
	NOV-05	2	9	103	226	
	DEC-05	2	17	166	336	
	JAN-06	-	-	-	-	
	Average	2	12.6	12.4	265	CPCC
AA3	OCT-05	2	13	92	212	
	NOV-05	2	9	104	234	
	DEC-05	2	17	127	248	
	JAN-06	-	-	-	-	
	Average	2	13	107.6	232	CPCC
AA4	OCT-05	2	12	111	254	
	NOV-05	2	9	110	240	
	DEC-05	2	14	130	245	
	JAN-06	-	-	-	-	
	Average	2	11.6	117	246	CPCC

Summary of ambient Air quality Monitoring Results.

Location		Concentration of Pollutants (ug/m3) 24 Hour Average Value				
	MONTH	SO ₂	NO _x	RSPM	SPM	SOURCE
AA5	OCT-05	2	12	79	187	
	NOV-05	2	9	117	255	
	DEC-05	2	8	103	237	
	JAN-06	-	-	-	-	
	Average	2	9.6	99.6	226	CPCC
AA6	OCT-05	-	-	-	-	
	NOV-05	2.4	18	-	182	
	DEC-05	2.2	20	-	176	
	JAN-06	2.8	20	-	168	
	Average	2.4	19.3	-	175	CPTL
AA7	OCT-05	2	15	154	336	
	NOV-05	2	10	162	396	
	DEC-05	4	21	457	1623	
	JAN-06	-	-	--	-	
	Average	2.6	15.3	206.3	785	CPCC
AA8	OCT-05	-	-	-	-	
	NOV-05	3.6	22	-	382	
	DEC-05	3.4	28	-	410	
	JAN-06	3.4	26	-	276	
	Average	3.4	25.3	-	356	CPTL
AA9	OCT-05	-	-	-	-	
	NOV-05	3.6	26	-	396	
	DEC-05	3.6	20		530	
	JAN-06	3.3	30	-	252	
	Average	3.4	28	-	392	CPTL
AA10	OCT-05	-	-	-	-	
	NOV-05	2.4	19	-	186	
	DEC-05	2.2	20	-	188	
	JAN-06	2.8	20	-	166	
	Average	2.4	20	-	180	CPTL

The monitoring for SPM, RSPM, SO₂ and NO₂ have been undertaken twice a week from October-December, 2005 and as per CPCB guidelines on running of NAAQM stations.

For CO levels 8- hours sampling as per NAAQM standards has been done at each site.

Ground level concentrations of CO Level

S.No.	Approximate location	1 Hour Average (mg/m ³)
		Peak Traffic Hours 04.30- 0.6.00 PM
1	Light points – Sector 26 (Madhya Marg / Purv Marg.)	4.8
2	Matka chowk sector 17 (Madhya Marg)	1.6
3	Aroma Light points -sector 22	2.0
4	Tribune (Chowk) (Dakshin Marg)	2.6

Annual Average Ambient Air Quality (NAAM) Data Chandigarh)

Location	Value	Concentration of Pollutants (Pg/m3) 24 Hour Average Value				
		RPM	SPM	SO ₂	NO ₂	CO
Industrial Area Chandigarh	Annual Average 1993	-	250	14	35	-
	Annual Average 2004	136	364	6	34	-
Sector 17 Chandigarh	Annual Average 1993	-	223	10	29	-
	Annual Average 2004	111	254	5	25	-
Punjab Engineering College, Chandigarh	Annual Average 1993	-	--	-	-	-
	Annual Average 2004	69	137	6	23	-

Source: CPCC. Noise : Ambient Air Quality Standards.

Limit dB(A) Leq

Area Code	Category of Area	Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

6.3 Noise Pollution**Location of Motoring of Points for Noise**

S.No	Location
N1	Project site(Plot No.32. Sector 17-A Chd) 0 KM
N2	Sector-24, Chandigarh (W&SW)@ 3 KM(Distance from Project site)
N3	Sector-17-C, Chandigarh 250 mtr
N4	Sector -12, Chandigarh (N&NW) @ 2 KM
N5	Village Kaimbwala, Chandigarh (N&NE) @ 5 Km
N6	Shivastik Vihar, Panchkula (E&NE) @ 6 Km
N7	Industrial Area, Phase I, Chandigarh (S&SE) @ 4 Km
N8	Sector 66 Mohali (W&SW) @ 10 Km
N9	Industrial Phase – VII Mohali (W&SW)@ 9 Km
N10	Kishangarh Chandigarh (E&NE) @ 5 Km
N11	Tribune Chowk Chandigarh (S&SW) @ 5 Km
N12	Aroma Light – Sector 22, Chandigarh (W&SW)@ 2 Km
N13	Matka Chowk Sector 17 Chandigarh (N&NW) @ 0.5 Km
N14	Light point sector 26, Chandigarh (E&NE) @ 3 Km
N15	Village Kajheri Chandigarh (W&SW) @ 6 Km
N16	Motor market Manimajra (E&NE) @ 5 Km

Noise Levels Leg dB(A)

Location No.	Day Time	Night Time
	(Hourly Equivalent) dB (A)	(Hourly Equivalent) dB (A)
N1	56	42
N2	58	41
N3	58	41
N4	56	43
N5	54	42
N6	52	44
N7	63	52
N8	52	44
N9	59	47
N10	52	46
N11	62	43
N12	64	44
N13	58	42
N14	62	44
N15	54	42
N16	55	44

6.4 Surface Water Pollution

Chandigarh is located between Sukhna choe and Patiala-ki-rao choe. The covering slope of U.T. is from north east towards south. These choes are running parallel to sector from north to south. The water of sukhna choe is polluted because sewage of Manimajra, Bapu Dham Colony, Mauli Jagran colony and villages is disposed without treatment. Some of industrial water is also disposed in the choes. Regarding choes on western side of city, the sewage of village Sarangpur, Dhanas, Dadumajra, Maloya and other colonies is disposed of in these chos. Besides this, MCC is treating sewage 30 mgd against the availability of 60 mgd. This 30 mgd new sewage is also disposed of into the choes. The surface and surface water of city have polluted having TDS more than 1000 mg/l and COD range is more than 200 mg/l.

Sukhna Lake: The water of Sukhna Lake is free from pollution because it is built on foot of shivalik and on upstream side of these choes mere a northern part of city on the higher attitude. This body developed as water body of the city also adds to beauty of city. Chandigarh Administration has also pleased to develop another artificial water body on northern western side of city on upstream side of Patiala-ki-rao.

Ground Water: Ground water plays major role in meeting the water requirement in villages Manimajra and certain rehabilitated colonis in Chandigarh. There are about more than 250 deep/shallow tubewells drilled by EngineeringDepartment, Chandigarh and Municipal Corporation to extract the drinking and potable water for U.T., Chandigarh. The quality of ground water is quite satisfactory with normal specifications of Water supply norms.

Sustainable Urban Environment Proposals:

To address the complex problem of remediation of urban environment of city area in a holistic manner covering various facets of urban pollution like air, water and noise. It is proposed to aim for sustainable improvement of the urban environment on coordinated approach. The following components of environmental interventions and upgradations are proposed

- Urban Greening
- Urban Parks and open spaces

Urban Greening:

To strengthen the urban greening efforts, it is proposed to conserve the existing greenery and develop urban greenery in the institutional lands, community lands, residential colonies and green belts along the roadways.

Afforestation of degraded wastelands:

Degraded wasteland do occur both in urban and rural settings. They occur less in number and extent in the urban areas than in rural areas. In carrying out afforestation in such lands the strategy would be one of developing a relevance to local inhabitants' broad preferences distinctly identifiable with urban and rural settings. In urban situations tree species chosen would reflect bio-diversity and bio-aesthetic attributes. In rural areas, silvi-pasture resources (and therefore the relevant species) are preferred to make up the cattle fodder deficiency. The women prefer multi-purpose tree species.

City forests in institutional and open-access lands:

Institutional open lands, owned by military cantonments, universities, and industries in urban areas are intended to be used, besides available open lands for creating city forests. These lands with institutions are mostly barren without any tree growth and remained as such more on account of lack of priority in the scheme of their activities. Once put under tree cover these lands could provide clean air. Other utilitarian values are not excluded and would depend on site planning mentioned later. Spaces will be chosen with relevance to other locality factors.

Peoples' nurseries/homestead planting and agro -forestry:

The planting material will be produced both through departmental nurseries as well as decentralized people's nurseries. Decentralized nurseries augment the income of the poorer section of the population. Urban slum dwellers are main beneficiaries. Horticulture Department can provide will provide material inputs like polythene bags, soil, fertilizer, seed etc. The nursery raiser may carry out other chores of raising the saplings through germinating the seed, irrigating and tending the saplings until they come of age for planting. All of this is usually done by women in their backyard in such space, as may be available, working from their homes.

Greening Residential Colonies

Large number of residential rehabilitated colonies that are spread over the urban localities can support avenue trees in their layouts. The residents also wish to plant in the available small open areas. The project would continue planting activity and support the Resident Welfare Associations (RWAs) to complete preparatory activity like fencing the open areas to be planted. The project would continue to provide the residents with free saplings and tree-guards at subsidized rate.

Greenbelt along Roadways and Urban Parks

Hydrocarbon related emissions and particulate matter are the major pollutants on the roadside. The greenery would help in reducing the air pollution of this nature besides providing bio-aesthetic environment to the commuting public. The plantation will be in multiple rows along National Highways and will depend on the space available in case of State Highways and Internal roads. The growing urban area needs establishment of parks in the residential colonies, lake front parks, temple parks, drive way parks as lung spaces and to improve the aesthetic value. The Municipal Corporation develops and maintains parks in various sectors and colonies of the city. These parks are developed in the areas earmarked for the purpose in the layouts approved for these areas. There is 1400 nos. of Colony parks/open spaces in Municipal Corporation of Chandigarh. Out of these, about 80% have been developed as green parks and the remaining are to be developed.

The Municipal Corporation, Chandigarh has developed the following major gardens/parks:

- Terrace Garden, Sec.33
- Fragrance Garden, Sec.36
- Mini Rose Garden, Sec.24
- Shanti Kunj, Sec.16

The Shivalik Park in Manimajra over 17 acre of land is under development with the cost of Rs.2.80 crores. In addition to these, MCH is encouraging the Colony Welfare Association for the maintenance of these parks within their areas to sustain their activities. A scheme to vest the maintenance of the colony park to the welfare associations is promoted with the community contributing a share towards the development of the park. But no associations of area are coming forward to accept the maintenance of parks. Now Municipal Corporation, Chandigarh is only agency maintaining parks in M.C. area of city.

CHAPTER 7: VISION, KEY PRIORITIES AND SECTORAL STRATEGY

7.1 Introduction

It is widely acknowledged that the 21st Century will emerge as the era of urbanization, with, rapid global economic integration driving forward growth, prosperity and social well being in cities across the world. Cities will emerge as important nodes in a network of flowing investments, information, goods and people, as well as centres of culture, innovation and knowledge management.

The emergence of the "urban space" as a vanguard of evolution and progress in socioeconomic development has largely been an organic process. The "urban space" is typified through complex and multi-dimensional interactions between various characteristics, including:

- *Social and demographic character* - size, composition and socio-economic make-up of the urban residents.
- *Historical character* - the temporal changes experienced by the city.
- *Geographical character* - largely driven by location, topography and climatic environment.
- *Economic character* - economic activities that enables sustenance and growth.
- *Cultural character* - the artistic, intellectual and literary milieu.
- *Physical character* - the physical spaces, infrastructure and built environment.
- *Institutional character* - the urban governance mechanism.

Till recently, urban planning was primarily considered as planning for physical spaces in anticipated new human settlements, and therefore was primarily focused on 'land-use planning'. Regulation too was focused on ensuring compliance with designated use of land and built environment

In recent times, however, planning has evolved into developing a long-term perspective, as encapsulated in a "vision", developing integrated multi-disciplinary strategies for achieving the "vision" and specific and identifying specific action plans and initiatives for implementing the identified strategies supported by a robust financial and capital

investment plan. The key objective of such a plan was to guide public investments, programmes and plans of various government agencies and also to identify opportunities for community and private sector participation. Therefore, urban planning has transformed into managing and building on the six types of "capitals" as identified in the framework above. Herein lies the genesis of the **City Development Plan**.

Vision and Strategies

A vision statement was outlined for the Municipal Corporation of Chandigarh involving the various stakeholders consisting of government departments, Municipal Corporation, councilors, representatives of NGOs and women representatives, civil society, business and trade, economics, media, the urban poor in the visioning exercise.

Each stakeholder has suggested a key word that could represent his or her vision for city. All the key words were listed and based on the common key words a few vision statement based on a consensus.

The following vision statement was adopted for the city of Chandigarh

“A beautiful eco-friendly city for all, providing 24X7 water supply”

The vision statement outlines that the citizens of the city should committee to maintain the Natural eco system and make the city eco-friendly. The city of Chandigarh should also envisaged to be an inclusive city for all including the poor and the vulnerable. The poor and the destitute will be integrated into the main stream and disparity will be reduced. The city administration would be responsive to all and development will be given highest priority.

High quality services including continuous water supply to all, 100% sanitation, door-to-door collection of solid waste and good quality roads will be provided to all the citizens. This will not only enhance the productivity of the city but also contribute to the economic development of the city as a whole.

7.2 Key Priorities

The CDP process of Chandigarh has been prepared after extensive consultative process with its key stakeholders in prioritizing the key sectors for investments and reform initiatives. The priorities of the national and Chandigarh Administration including the

REQUIREMENT OF WATER

S. No.	Year	Popula- tion (in lac)	Domes- tic requir- e-ment @150 Lpcd in MLD	Industrial/Com- m- ercial @4000 gallon/acres/day		Community/inst- i-tutional @4000 Gallon/acres/day		Require- ment for stand post and Lav.Bloc- ks (MLD)	Total 4+6+8+9	Wasta- ge of water in leakag- e (%)	Total leakag- e of water in MLD	Total require- ment (10+12)	Horticulture requirement @5400 gallon/acres/day		Gross require- ment (13+15) MLD
				Area in acres	Requir- ement in MLD	Area in acres	Requir- ement in MLD						Area in acres	Requir- ement in MLD	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	2006	10.98	164.70	1921.63	34.91	3048.50	55.34	16.47	271.42	22%	59.71	331.13	6600	161.80	492.93
2	2011	13.38	200.70	1921.63	34.91	3048.50	55.34	20.07	311.02	15%	46.65	357.67	6600	161.80	519.47
3	2016	16.29	244.35	1998.50	36.27	3170.44	57.56	24.43	362.61	8%	29.00	391.61	6600	161.80	553.41
4	2021	19.85	297.75	2078.44	37.72	3297.25	59.88	29.77	425.12	8%	34.00	459.12	6600	161.80	620.92
5	2026	24.19	362.85	2161.60	39.27	3429.15	62.28	36.29	500.69	8%	40.05	540.74	6600	161.80	702.54
6	2031	29.46	441.90	2248.00	40.82	3566.32	64.76	44.19	591.67	8%	47.33	639.00	6600	161.80	800.80
7	2036	35.91	538.65	2338.00	42.46	3709.00	67.35	53.86	702.32	8%	56.19	758.51	6600	161.80	920.31

DEVELOPING A VISION FOR A CITY**TABLE : 20 VISION AND GOALS**

Vision and goals	Year		
	2010	2015	2020
Sect oral agenda	100%	100%	100%
Water Supply	100%	100%	100%
Sewerage	100%	100%	100%
Sanitation	80%	90%	100%
Solid waste management	100%	100%	100%
Drainage/storm water drains	90%	95%	100%
Urban transport	80%	90%	100%
Heritage	60%	80%	100%
Reform agenda			
Decentralization	50%	80%	100%
Land & housing markets	80%	90%	100%
Transparency and accountability	80%	100%	100%
Community participation	10%	50%	100%
Financing management system	50%	80%	100%
Municipal finances	60%	80%	100%
Budgeting for the urban poor	5%	7%	10%

M.N.Cs. trends and Millennium development goals (MDGs) have been considered in prioritizing these critical sectors, presented below.

1. Water Supply
2. Sewerage
3. Storm Water Drainage
4. Roads infrastructure.
5. Solid Waste Management
6. Traffic and Transportation
7. Urban Poor

7.3 Sectoral Strategy Framework

The overall vision for the city and the prioritization of the key sectors paved the way to formulate sector specific vision and strategies. This sector specific approach with year wise strategies and corresponding year wise investments will be instrumental in framing the action plan/ implementation plan. The sector specific reforms and investments are an integral part of the year wise strategies.

Water Supply

Key Challenges

Based on the review of the current water supply scenario, the following key challenges are identified. There is huge requirement of raw water supply sources due to increase in population in city. The city, especially the surrounding areas are in short of adequate raw water supply available and. And moreover, the Municipal Corporation do not have adequate finances to mobilize capital for augmentation of new water supply schemes. There is a huge demand supply gap, which is likely to widen drastically in future. Frequency of water supply ranges from 10 hrs to 12 hr every day in MCC area. Lack of metering, illegal connections, flat rate and Public Stand Posts leading to high non-revenue water. No regulatory mechanism to oversee the functioning of the sector and to fix service standards as well as tariff to meet capital and operating expenditure.

Ministry of Urban Development, Government of India, has observed that conversion from intermittent water supply to continuous supply is both essential and achievable in the Indian context. Through a programme conducted to assess what it would take to move to a 24x7 water supply system, MoUD has concluded that a continuous supply of water could only be achieved through carefully structured strategies based on known practical procedures and investment programmes, tailored to the individual needs of each city.

According to MoUD, the country has the requirement capacity, resources & talent and expertise required to achieve & run 24-hour water supply system, which at present is the need of the time in view of projecting the city Chandigarh as the next I.T. HUB. The Global players in the field of I.Ts will set their foot in Chandigarh and thus water supply of International standards is a necessity. It makes no sense in continuing with the intermittent water supply and therefore 24x7 must become the norm now as that of electricity.

Requirement of Water

Chandigarh – one of the most beautiful and well-planned cities of the world is covered with well-designed network of protected piped water supply and underground sanitation system. Under “Water Bye-laws” of the city, every dwelling unit of Chandigarh is to be provided with water and sewerage connections.

While planning the city of Chandigarh, every emphasis has been laid for providing green spaces, through out the city. The open space per capita in the city was 82 sq.meter in the early stages of development. However, with the subsequent increase in population, the per capita green spaces in the city beautiful came down to 54 sq.mts. which is still quite high as compared to 5.4 sq.mts. per capita available in the Delhi, as per the present population .

An other important feature in the city is that being capital of two states & Regional center of central Govt, it has a large number of institutions such as Post Graduate Institute of Medical Research, Punjab University, Punjab Engineering College, Secretariat, High Court, Assembly Hall, Central Scientific Instruments origination etc., which serve not only the city of Chandigarh, but whole of northern region. In view of these stated factors by virtue of which the Chandigarh has a unique character of water supply demand, it has been decided that it will not be possible to follow an assumed lump sum norms on the basis of per capita for working out requirement of water.

The requirement of water as per Annexure-1 attached herewith would be 492.63 MLD in the 2006, 519.47 MLD in 2011 and 553.41 MLD in the year 2016 including the requirement for irrigation and commercial use. The horticultural requirement is about 1/3rd of total requirement. Even after commissioning of the Aug. of Ph. IV W/S Scheme, the total availability of the water with the Municipal Corporation Chandigarh would be

377 MLD (84 mgd) and will have the shortfall of about 116 MLD. After commissioning of the Ph. IV, it will not have any Aug. scheme up to the year 2011. Only way is to save the potable water by using recycled tertiary treated water. So the proposal has been drawn to treat 20 mgd water upto the tertiary level and recycle the same for using it for horticulture purposes. This will save part of the potable water, which will be utilized for drinking purpose. So with the addition of another 90 MLD water within 3 years, the shortfall will be only 26 MLD.

In the meantime, in 2011, the population will shoot up to 13.38 lacs and the requirement of the water will be 519.47 MLD which will be short by 52 MLD. In order to match this shortfall there shall be a need to further augment the water supply under Ph.V & VI to augment raw water from B.M.L. Kajauli water works. However, in view of land constrains because of limited width along the 50' wide strip already acquired and to avoid additional acquisition of land, it will be advisable to lay single rising main for Ph.V & VI having capacity 40 mgd (180 mld). Regarding long term planning to cope up with the requirement of the water, agenda has been introduced to check the detailed feasibility for tapping the surface water from up stream side of BML/Anandpur Hydly to bring the water under gravity for Chandigarh.

NEED OF 24x7 SUPPLY

Intermittent/Discontinuous water supply gives rise to several deficiencies, including:

- *Serious risks to health, resulting from ingress of contaminated groundwater into the distribution system because of creation of vacuum in line during off supply hours particularly in upper areas.*
- *Inability to manage efficient supply management;*
- *Inability to ensure effective demand management;*
- *Operational inadequacies which unduly weaken physical infrastructure; and*
- *Customer inconvenience, which for many people, particularly the poor, results in;*
- *A loss of household income or productive time as at least one family member has to cope with securing water on a daily basis;*
- *An unwillingness to pay for a sub standard service.*
- *Stored water is wasted because of tendency to use fresh water.*

- *Creating hygienic atmosphere because intermittent water supply creates unhygienic situation and to build trust over reliable water supply.*
- *Inequitable supply to different sections of city.*

Strategies and Action Plan

The Municipal Corporation, Chandigarh is the nodal agency to provide basic amenities to its residents. The corporation has prepared a prospective plan upto 2036 for the supply of potable drinking water of International standards. The implementation of the same is already in progress after completion of Aug. W/S Scheme, Ph.IV. The Municipal Corporation Chandigarh had planned to implement this perspective plan in an integrated programme to achieve the target upto 2021/36. The following guiding principles have taken into account:

1. Safeguarding the health, integrated management of water source, liquid & sold waste and protection of environment.
2. Organisational reforms promoting an integrated project by changing the procedure attitude, behavior to adopt the optimistic approach by the Administrators and Engineers rather changing their attitude from the administrators to managers.
3. Strengthening the capacity and capability of local utility (Municipal Corporation) and capacity building in implementation and sustaining the water and sanitation programme on the project and path suggested by the world bank (Water & Sanitation Programme) and Ministry of Urban Development suggested in the various workshops to achieve the self dependence of water sector by bringing the reforms such as to reduce the manpower, strengthen the monitoring and management system, reducing N.R.W. & the unaccounted for water, , dispensing with the subsidy.
4. To monitor the existing concept of Chandigarh to provide 100% coverage with safe drinking water to its residents as per stipulated norms and standards.
5. Focus of institutional structuring and managerial improvement to provide equitable services to the citizens and to encourage the greater degree of users participation.
6. Making special provision for economically weaker sections by rationalizing the user charges and conservation of water resources and its utilization.

7. To identify the new natural resources to carry the raw water under gravity against the pumping at present to save huge recurring cost on account of operation and maintenance and also of power which could be utilised for the other reforms of the state.
8. To make out the planning for utilizing the waste water after tertiary treatment in the city for irrigation of lawns and parks to save the potable water which would help to overcome the increased demand in the city because of increasing population. This will not only save the potable water but also provide the services at very low tariff to the consumer and further facilitate to maintain the green character of the city beautiful.
9. Encouragement of privatization to economize the services by reducing the operation & maintenance cost and for efficient management of infrastructure.
10. Master Plan for water supply has been prepared to develop the system in stages upto the year 2036 in the city Chandigarh. Presently corporation is responsible for providing water services in the city and certain villages falling in the boundary. The responsibility of the corporation is expected to be more as Chandigarh Administration is extending the limit of Municipal Corporation. The production cost of water in the city is slightly expensive because of the location perennial source at a distance of about 27.5 KM from the city and deeper aquifer in the region. In spite of the non availability of surface water and deeper aquifers, the corporation has the privilege to make available 332 LPCD water to the citizens with a supply of 10 hours in a day. This facility of the green and clean character has attracted the citizens for migration from adjoining states, NRIs and working class. This has resulted in high growth rate of population occurred in the recent years.
11. Notwithstanding the advantage of Chandigarh called city of gardens and green parks and having declared the most green city by Ministry of Forest, Govt. of India, the high cost of water and electricity is expected to be the constrained for its rapid development.
12. Projection for population growth and water requirement has been worked out as per Annexure A-1 based on the growth rate of 4.03%.

Cost recovery through adopting differential pricing system

Demand Management and improved customer awareness is critical to ensure that per capita consumption does not rise excessively as the levels of service progressively improve. Typical domestic customers are heavily subsidized and therefore demand management should focus on that customer segment. The following are the preferred options.

1. Collect and update data on consumption pattern across geographic region.
2. Increase resources available for leak detection and UFW reduction.
3. Conduct professional public information programs targeted at specific consumer groups for reduction of consumption.
4. Progressive reform water prices.
5. Conduct water audit on major industries.

Tariff revisions are essential and gradual transition to full cost recovery is proposed. The current cost of production is approximately 4.50/KL. The long run marginal cost is estimated to be increased @ 15% yearly. A new tariff structure is proposed that includes the following features to increase revenue and reduce inequities without penalizing the urban poor.

1. Minimum charge removed.
2. Numbers of slabs reduced to three
3. First slab reduced to 15 KL/month for lifeline requirement.
4. Progressive conversion of public fountains to shared connections and involvement of users in collection of revenue.
5. Increase the charges of consumption having consumed more than 15 KL/month.

RECOMMENDATIONS:

1. Data of water consumption patterns needs to be collected and updated regularly
2. Strong Demand Management program should be implemented
3. Water conservation and recycling should be encouraged among all consumer segments through appropriate communication, pricing, and partnerships with

other government, non-government and scientific institutions. Women as the primary managers of water in the households need to be consulted in this process.

4. Communication should target both men and women as the users of water resources within the household.
5. Water supply duration and timings need to be improved and regularized to reduce the need for in-house storage (which results in wastage) and inequity in supply across various parts of the city and different socio-economic groups
6. The present tariff schedule should be restructured and regularly reviewed and changed to progress towards full cost recovery.

7.4 ENVIRONMENTAL MANAGEMENT

A strategic environmental assessment of the master plan indicates that the beneficial environmental impacts of rehabilitating the existing water supply system by the Municipal Corporation, Chandigarh are significant. Moreover the negative environmental impacts of construction and operation will be minor if Municipal Corporation, Chandigarh adopts an Environment Management system.

RECOMMENDATION:

The Municipal Corporation, Chandigarh should adopt the draft Environment Management plan to ensure that all future works are implemented in an environmentally acceptable manner and adequate measures are taken to mitigate the anticipated adverse impacts on the project affected population.

SOCIAL AND GENDER ISSUES:

The proposed water supply activities are expected to improve service conditions for a wide cross-section of the population. A baseline socio-economic survey has identified the need for clean water as the highest priority among customers with improved supply duration and daily water supply being of similar significance. Investments that improve these services will result in greater client satisfaction and a climate in which revised tariffs can be negotiated. The willingness to pay survey confirmed that families would pay higher charges if there were improvements to the water supply. The time spent in water collection and management has a high economic value for women, many of whom are engaged in income earning activities in the urban areas.

Absence of water for personal hygienic tends to be more easily overcome by men with their greater mobility than women who are left to cope with the problem and this can lead to variety of ailments.

The problem of intermittent water supply is frequently overcome in upper and middle class households who provide storage and pumping system at a high unit cost. The urban poor are not able to afford these measures and are disadvantaged by the intermittent supply.

Land for new major pipeline and pumping station frequently impacts on the urban poor rather than the upper socio-economic groups. Care must be taken in the implementation of new works for this disruption to be minimized.

Recommendation:

Special attention must be given to women and the lower socio-economic groups to ensure that their needs are met and that they are not disadvantaged by construction activities or new management systems.

INSTITUTIONAL CHANGE:

A number of initiatives are required to strengthen the Municipal Corporation, Chandigarh capability for the systematic planning and delivery of services. Particular emphasis needs to be given to strengthen the advance technical inputs.

1. Institutional changes introduced by the Master Plan project include:
2. Implementing a process for implementation of beneficial change through regular meetings of senior staff to identify key issues and the establishment of task groups to develop approaches to addressing these issues.
3. Implementation of a small cell with responsibility for continuing to develop improved approaches for providing water and sewerage services to the urban poor and disadvantaged groups.
4. Implementation of an IT cell to ensure the Municipal Corporation, Chandigarh optimizes the benefits from IT.
5. Recognition of the Social Development function in improved planning and delivery of services to the poor and vulnerable sections. Some understanding of demand responsive approaches in planning and delivery of services.

However, Municipal Corporation, Chandigarh is keen to adopt new approaches, many appear to be resisting change. Further organizational capacity building initiatives are required for the Municipal Corporation, Chandigarh to achieve the capabilities necessary for full and effective implementation of the Master Plan. Improved capability is required in several areas, including :

1. Privatization;
2. B.O.T.
3. Planning
4. Commercial accounting
5. Customer relations management
6. IT Systems and Information Management
7. Demand responsive approaches.

To assist in establishing a basis for the further organizational development, the Master Plan project has developed proposals for a further capacity building project and has assisted in developing a proposal to implement a new structure for Municipal Corporation, Chandigarh that is better suited to the Municipal Corporation, Chandigarh's future needs. A strategy to progressively implement this new structure has been developed, linking in with the retirement profile of the organization.

RECOMMENDATIONS:

1. The MCC seeks further donor assistance to undertake the follow-on capacity building project proposed by the Master plan project.
2. The MCC progressively restructure to better meet its future needs, utilizing upcoming retirement as opportunities to redefine senior roles.
3. The MCC continue to further develop and implement an HRD strategy that accords with modern best practice.
4. Private sector participation must be carefully managed and the benefits to the MCC maximized and the risks minimized. A cell for the development and management of PSP initiatives should be established and provided with the specialized skills required.
5. An Environmental Cell should be created and an Environmental Management System developed.
6. That a Master plan coordinator be appointed together with further training focused at a core group.

The financial implications of the Master Plan on the Municipal Corporation, Chandigarh have been assessed and the levels of financial contributions from JNNURM that may be necessary for the Master Plan have also been identified.

The financial assessment of the water supply Master Plan alone on the Municipal Corporation, Chandigarh is that :

1. Full cost recovery of mtc. will be achieved in about 15 years.
2. The domestic tariff will have to be increased suitably every year for full recovery of its investment on mtc. system.
3. The higher tariff levels upto full cost recovery are expected to be affordable for domestic consumers.
4. If non-domestic and industrial tariffs are unchanged for the next four years, the difference between non-domestic and industrial categories will reduce to normal ratios.

Different service levels need to be developed to provide services in an affordable and sustainable manner to the poor.

7.5 RECYCLING OF WASTE WATER:

The Government of India agreed to the proposal of Chandigarh Administration for recycling of waste water after its treatment. However, it was suggested by the Government of India that recycling of waste water can be treated as Augmentation of water supply scheme: because it will relieve the city water supply system of its load, so far as the irrigation requirement for public parks/lawns/open spaces is concerned. It is submitted that 52 mgd. Raw sewage is reaching at treatment plant, Diggian which was set up in 80's:

1. Primary & secondary treatment plant facilities to treat the sewage under Ph.I for 15 mgd effluent at BOD level less than 30.
2. Treatment plant of 15 mgd capable of treating the sewage upto BOD level less than 100.

So out of 52 mgd, effluent Chandigarh is presently having the capacity (both under Ph.I & II) to treat the sewage upto 30 mgd only. A proposal was drawn to treat the effluent received from the secondary treatment plant upto tertiary level having BOD below 10 so that tertiary treated water can be repumped back to city for irrigation for large green belts, parks in order to save the potable water which will further cope up the requirement of the

city for drinking. Accordingly the scheme for recycling of waste water after treatment has been approved by Govt.of India vide their letter No.11019/3/87/PHE Dated 5.5.87 at a total estimated cost of Rs.333.00 lacs.The project has been completed and commissioned during the year 1991-92. This project consists of the following:

1. Treatment of effluent from Secondary sewage treatment plant phase-I- 10 M.G.D
2. Pumping of 10 M.G.D of treated effluent from sewage treatment plant up to the city and connecting the same with the existing raw water distribution system.
3. Laying of pre stressed cement concrete pipe line from sewage treatment plant up to the Rajindra park and connection with the existing system. This work has been completed. Thus water supply system of the city stand augmented by 10 M.G.D.

Although 10 mgd treatment plant has been installed to treat the sewage upto tertiary level yet the city is able to receive only 3 mgd recycled water because the separate distribution net work for irrigation of lawns and parks has been laid only in northern sectors because of non availability of rising mains and distribution net work.

For the last two years the utilization of the T.T. water has been extended by impressing upon the major users of irrigation water having large area in their premises maintained as green spaces. These major institutions like PGI, colleges, schools, technical institutions and Punjab University have been asked to disconnect the potable water supply from irrigation of lawns and make it convenient to get the connection of T.T. water in order to save the precious potable water for further utilizing in the city. The Municipal Corporation has got good response from the users. Accordingly, Municipal Corporation has prepared the estimate for upgradation of existing treatment plant of 30 mgd. to 45 mgd. and to treat the sewage upto standard of BOD 30 mgd per litre. The funds of the same would be made available by the Chandigarh Administration to the tune of Rs.32.76 crores.

In order to boost up the utilization of T.T. water in the city and optimizing the use of T.T. plant proposal has been drawn by the Municipal Corporation for harvesting of sewage effluent tertiary treated water for irrigation purpose in Chandigarh under Jawahar Lal Nehru National Urban Renewal Mission to the tune of Rs.35.05 crores. This project is provided for laying of additional PSC rising mains, construction of UGRs and distribution net work of HDPE pipes from Sector 17 to Sector 47 in order to utilize the T.T. water in all the green belts and houses having area upto one kanal.

Strategies and Action Plan

The Chandigarh Municipal Corporation has already been provided with treatment plant for treating water upto tertiary level having capacity of 15 mgd. whereas presently only 3 mgd water is recycled for irrigation of lawns and parks in the city. The potable water meet up the irrigational requirement for the balance areas. This under-utilisation of tertiary water is due to non availability of separate distribution net work for tertiary treated water. The proposal has been drawn for laying of distribution net work for all the big and small parks, gardens, green belts, institutions and houses upto one kanal including other appurtenances connected with the system such as rising mains and UGRs. This will not only facilitate to save the potable water but also meet up the mandatory provisions of the local pollution control authorities and optimum utilisation of existing treatment plant. Additionally there is a proposal to upgrade the sewage treatment plant to produce the T.T. water upto 35 mgd which is total requirement for irrigation in the city.

7.6 DETAIL OF PROJECTS & BUDGET ESTIMATES:

PROJECT NO.1

(i) 10 mgd treatment plant upto tertiary level already existing at treatment plant, Diggian/Sector 66, Mohali (Chandigarh). The capacity of the same is being underutilized because of non availability of rising mains and separate distribution net work of the city. The estimate for the same for laying of net work from Sector 17 to 47 has been prepared for submission to the Govt. of India, Ministry of Urban Development for allocation of the grant under JNNURM. The detailed estimate for harvesting the sewage effluent tertiary treated water for horticulture (irrigation of lawns & parks/gardens) purpose has been prepared for **Rs.35.05 crores for submission to Govt. of India, Ministry of Urban Development** for obtaining technical clearance and expenditure sanction under JNNURM. This project consists of for upgrading the existing treatment plant upto tertiary level for additional generation of 10 mgd recycled water having BOD 5.

- ii. A provision has been made for construction of 3 nos. one mg. capacity UGRs in Sector 26, 29 and 47 in order to store the T.T. water treating the non-requirement period for distributing the same during the day period according to requirement.
- iii. Laying of 2 nos. rising mains 18" and 16" by extending the connection from the existing rising main of 800mm.
- iv. Adding the additional rising main of 32" to augment the capacity of intake.
- v. Laying of distribution net work for the remaining Sector 17 to 47 with HPDE pipe covering all the green belts and houses upto one kanal.

There is a proposal to upgrade the sewage treatment plant under consideration at 3 BRD upto tertiary level having capacity 10 mgd. The sewage treatment plant stands commissioned at Raipur Kalan which will be upgraded upto tertiary level keeping in view the irrigation requirement of Manimajra and I.T. park. The comprehensive proposals recommended as above provide for treating the sewage water upto tertiary level to the capacity of 35 mgd which is ultimate irrigational requirement of the city.

PROJECT NO.2

In the recent years Ministry of Urban Development and World Bank had organized the various workshops to provide 24x7 water supply in the urban local bodies of the country by reducing the operational cost unaccounted for water, non revenue water, strengthening the metering and monitoring system by arresting leakage to reduce the loses. The Municipal Corporation has prepared a proposal to strengthen the monitoring, the quantity of water at the various locations such as raw water source, at treatment plant, pumping stations by providing actuators and flow meters and SCADA system at various water works and tubewells. This will not only reduce the loses but also upgrade the managerial information system as well as reduce the requirement of manpower at various installations. As already figured, unaccounted water in the net work is 22% which comprises of transmission loses, loses of raw water, wastage during the treatment, leakages regarding real and apparent loses in clear water transmission, distribution net work and thefts during the metering by the consumers including illegal connections. The availability of the water in the Chandigarh is second highest in India and loses are also moderate keeping in view the state of other water bodies in the country. This is also a result of conventional method of monitoring, measuring and operating the net work at the various stages such as treatment, transmission and distribution which has rather contributed more due to human errors at the operating, supervisory and consumers end. **It is visualized that in order to make break through in respect of these loses there is no alternative but to adopt the scientific automization and hi-tech means.**

Accordingly a proposal has been drawn to augment the existing infrastructure with remote terminal with computerized surveillance system at the various locations of water works, tubewells and monitoring situation for achieving the milestone of providing 24 hours water supply to the city. This detailed estimate provides for:

- i. Electro magnetic and ultra Sonics bulk water meters duly connected with the computational system at raw water, clear water, pumping stations, treatment plants, distribution system and tubewells which are located in the urban city in the Chandigarh and Manimajra Town.
- ii. Provision of actuated sluice valves provided with motorized system to be connected with the SCADA system with facility of operation at centralized locations.
- iii. Providing electronic sensors to monitoring level of UGRs at water works and spring level of the tubewells to avoid wastage of water, reduction in

consumption of power, consolidating the control over the work force engaged in the operations of various installations of water supply.

- iv. Provision of comprehensive GSM based SCADA system for frequency based monitoring of the installations of the water supply by the operational staff, Engineering staff and management of the corporation.

The budget estimate has been prepared for this scheme with the cost of Rs.21.36 crores with the detailed provision as under :

GRAND SUMMARY - WATER INFRASTRUCTURE AUGMENTATION AT MCC						
Sr. No.	System Head	Surveillance System		Instrumentation System		Total
		Total System	Per TW	Total System	Per TW	
1	TW with boosters (100)	100	249275	100	450000	69900000
2	TW without boosters (100)	100	214275	100	220000	43400000
3	Mother Water Works S39	Complete as per Annexure B3				57400000
4	Sector 37	Complete as per Annexure B4				5667000
5	Sector 32	Complete as per Annexure B5				5676000
6	Sector 26	Complete as per Annexure B6				6487000
7	Sector 12	Complete as per Annexure B7				10400000
8	Water works Kajauli(Pb)Ph.I&II	Complete as per Annexure B8				8857000
9	Mani Majra WWII	Complete as per Annexure B9				3751000
10	MES	Complete as per Annexure B10				2397000
						213935000
	Add 1% P.E. charges.					2139350
						216074350
	Credit for old sluice valves					2500000
	Total Project Cost					213574350

Say Rs.21.36 Crores.

7.7 PAY BACK FOR TUBEWELL MONITORING SYSTEM

Capital Cost of SCA and Communication System for tubewell:

Considering 100 sets with booster setup and 100 without booster setup: Rs4.6 Crore

Saving due to power optimization and manpower works out to approximately Rs.6 Crore per year. Hence from the view point of Return on investment, investment on surveillance system can be recovered in 1½ years and total cost including instrumentation system shall be recoverable in maximum 5 years.

CAPITAL SAVINGS

- Borewell are monitored for overload conditions and subsequent temperature rise on account of this conditions, under an overload Situation arising due to over current, over voltage or phase reversal, a cut-off signal shall trip the borewell and avoid costly replacement of TW.

A borewell of rating installed at MCC cost anywhere around 2.55 to 2.75 lacs, with 200 tubewells being monitored after installation of the system on round the clock basis, it is like saving the capital cost of all 200 tubewells, in disguise.

- For more than one pump/borewell system, where one or more are stand by units, these shall be operated under equal run time concept meaning thereby that the mechanical wear and tear is uniform for all driven equipments.
- Automatic maintenance schedules will ensure that the user is reminded of shut down schedules for individual driven equipment under a pro-active approach to maintain these machines and prevent break down maintenance as far as possible.

Every 2/3 months, each TW has to be overhauled costing some Rs.7000/- per unit, hence, per year per TW, this cost works out to Rs.28000/-; For a battery of more than 200 TW, this comes to around Rs.56.00 lacs per year and the same is not considered in the payback; but with the above two concepts implemented after installation of SCADA system, there is bound to be savings in the above investment on yearly basis.

Operational Advantages:

The operational advantages are directly dependent upon the extent of instrumentation used by the corporation :

- Central monitoring of entire generation and distribution systems from one location and resulting into efficient MIS and healthy & prompt decisions.
- 24x7 connectivity of the system since alarms and health status is available on mobile hand sets.
- Corporation can turn on/off the borewell/pump sets from the PC itself; dependence on manual labour is nullified. (Man power saved and can be used for other constructive purposes).

A large number of skilled and semi skilled labour has been employed for the shift wise operation of the Water works and t/wells. Even if we consider reduction of minimum 50% of the existing staff, it results in savings of salaries of these people OR utilizing their services to other productive set up.

- If the system is put in auto mode, borewells will operate automatically to ensure that the main sumps is always full to required safe level without over running of borewells. This will take care of morning peak loads and after noon off peak loads simultaneously.
- Actual discharge (flow rate in terms of m³/s) of the pump will be available on central computer.
- Actual power consumed by a typical pump for a particular discharge will be monitored on PC; this together with actual flow value will give the efficiency of the hydraulic machine.
- Discharge pressure monitoring of driven equipment helps in ensuring positive flow of water i.e. it helps in identifying churning of a particular centrifugal pump;
- If the flow from a particular pump is to be set to a desired limit, user can set it by controlling the opening of actuated discharge valve from PC itself.
- The SCADA system is modular and hence augmented mechanical system can be easily covered in existing system with minimum investments.

Advantages to the Management:

- Comprehensive reports of equipment run times and all process parameters for critical analysis of the system performance.
- Complete audit of water generation and distribution available to the top management. This aids the decision makers to identify and nip water wastage. This is not just metered water but also :
 - a. Water generated by tubewell
 - b. Water received by water works
 - c. Water filtered and discharged by water works
 - d. Water leaving the mother water works
 - e. Water received at booster water works
 - f. Water discharged from booster water works
- Reports of total electrical consumption data available on real time basis. This together with the hydraulic data gives the total system efficiency to MCC. Decisions relate to removal of faulty, non efficient system, rectification of such systems where required etc. can be taken by MCC from the analytical data which is available on the central system.
- Underground water monitoring creates that safety within the MCC staff regarding the health of the TW since the level information provides the DRAW DOWN levels of water underground, when the tubewell is turned ON and OFF.
- Helps in forecasting of water requirements of the city so as to plan future expansion of mechanical system.
- Helps keep tract of important conditions and events which need to be prevented in future.
- During actual emergency, the user can diagnose the location and nature of trouble and take necessary steps to maintain/restore services as quickly as possible since information is available on Mobile sets as well as from the MIMIC, can identify the exact location of the TW from among 200 locations.

FOR PUBLIC AT LARGE

Satisfaction of the general public at large is the prime aim of any executive or even the political setup of the corporation. Automation achieves just this on account of following merits:

- A LIVE MIMIC panel is proposed next to the computers in the control room so that any third party or senior political dignitary or Sr. Executive if comes to the control room, can easily co-relate himself with the familiarity of the system.
- Consumers get un-interrupted water OR at least committed water supply .
- In the event of problems in distribution system, these are attended faster than in manual set up since the cause and location of problem can be centrally identified and even immediate SMSs received on the mobile sets of the MCC executives.
- Sanitation control since sewage sump levels are controlled to prevent local overflow at all times.

Advantage offered to general public by this system, cannot be quantified, however, factually, the advantages to MCC due to satisfaction of public at large are just invaluable.

OTHER ISSUES AND RECOMMENDATIONS:

Non revenue water and unaccounted for water :

The city corporation of Chandigarh is providing 70 mgd water from surface and ground water resources. 28% of this does not produce any revenue. This has direct effect on the financial performance of Municipal Corporation in the water sector. In order to produce the non revenue water, a number of reforms are required to be made such as plugging of leakages in a big way in transmission as well as distribution system which comprises of repair and replacement of rising mains and distribution lines :

1. The increasing efficiency of pumping stations and filtration plants.
2. Providing metering system in 100% piped water supply.
3. Fixing the appropriate tariff in water sector to ensure judicious use of potable water.
4. Reducing the subsidies presently being extended to the certain sections of the society.
5. To dispense with the concept of providing stand posts.

The quantity of unaccounted for water is comparatively less than N.R.W., comprise of the non metered water at public stand posts, common toilet blocks, unauthorized connections in the city. The quantity of free water supplied in the city is approximate 4 mgd. In the projected figure, reduction in the loses in respect of N.R.W. would be brought down to 8%. It is certain that the Municipal Corporation Chandigarh would brought down the N.R.W. level by 15% within a period of 5 years and 8% within a period of 20 years. This will be achieved in parts by adopting higher quality consideration and consciousness and by ongoing remediation works. However the objective will be achieved as and when service duration increases and pressure level improve.

PROJECT NO.3

WATER RESOURCES :

Two main water resources in city water supply are:

1. Ground water.
2. Surface water.

Ground water :

It has already been projected earlier that since the inception of Chandigarh, water supply was based on ground water till the end of 80's. Because of regular pumping, the water table recedes considerably during the period of 30 years. Presently the corporation is extracting 20% mgd water from the 170 deep tubewells. It will not be advisable to drill any more tubewells because of compact area and exploitation of ground resources. The only alternative is to go for augmentation of surface resources of water.

Surface water :

Presently 50 mgd surface water is retrieved by the corporation as its share as received from BML canal which is treated 100% for utilizing as potable water in the city. Now it has become the major perennial resources of water supply. The characteristics of the raw water are such that it requires only filtration alongwith sedimentation with cogulation and it is free from the heavy metals and organic metals. The turbidity level used to be from 3 to 100. It fluctuates over the year. The treatment cost of the water is moderate and the required disinfection level is also within the tolerance.

In order to store the raw water, corporation has provided the storage capacity of 42 mg. However it does not meet the requirement of even one day rather insufficient keeping in view of the population growth and its requirement. **The proposals for augmentation of raw water capacity have been made in the vision.**

The Municipal Corporation has clear water storage capacity of 53 MG. Similarly the provision has been made for augmentation of the storage capacity of clear water.

RECOMMENDATIONS :

The source of present surface water is about 27.5 km from the treatment plant and raw water is pumped against gravity at the head of 100 meter. The recurring expenditure on account of single component of power used to escalate 10 to 15% every year. This becomes the part of the major expenditure of operation and mtc. for production of water.

The proposal has been mooted to bring the raw water under gravity from the surface source BML/Anandpur Hydly to go away from the incremental increase in the recurring expenditure of pumping to accomplish the goal to make the scheme self dependent and saving the power to the tune of 500 lacs units (KWH) which is likely to be used for industrialization in the country and may lead to save the capital expenditure worth crores on account of setting up of another power generating units. It is further recommended that the project for bringing raw water under gravity from Ganguwal to be taken up on BOT/BOOT basis. The Municipal Corporation is required to become regular buyer of raw water at Chandigarh from the private investors by signing MOU for a fixed stipulated period and keeping in view economics regarding generation of raw water per kilolitre in compatibility with the existing generation cost of raw water from Kajauli. It is further highlighted that adjoining towns falling in the jurisdiction of Punjab and Haryana are also required to be associated in this project with a view to upgrade their basic services.

The recommendation regarding bringing raw water under gravity is a long-term process and to be accomplished for a period 30 years for substitution of insitu system of pumping against gravity from Kajauli. In view of long-term process, it is recommended in the meantime to go **for V & VI phases** of Kajauli to meet up the demand of higher growth of population in Chandigarh and its satellite town of Panchkula and Mohali.

PROJECT NO.4

It is also recommended to rejuvenate average more than 20 abandoned/failed/low discharge tubewells to supplement the water supply of city Chandigarh.

The major recommendation regarding recycling of tertiary treated water has been made to save precious potable water now being utilized in irrigating the green areas of city beautiful. The scheme comprises of upgradation of treatment plant, rising mains and separate distribution net work in the city.

PROJECT NO.5

WATER SUPPLY SYSTEM IN CHANDIGARH :

The city water supply is delivered at consumption end through direct pumping system by the subsidiary 6 nos. water works divided into 7 zones under the pumping head of 100 to 200 feet having an average supply 10 to 12 hours in a day. 332 LPCD water is pumped into system daily through subsidiary pumping stations as well as through 90 tubewell boosters directly connected with the distribution system of the city. It is highlighted that the rehabilitated colonies situated on the outskirts of the city are provided with the ground water only having intermittent supply of 12 hours in a day but these colonies are having poor residual pressure because of lack of proper monitoring and operation of the system due to unauthorized encroachment by the consumers over the water supply lines and installation of direct online pumps/motors. The systematic project to equip these colonies with canal water is recommended. The capital cost incurred over the rehabilitation of canal water will be recovered by converting flat rate connections into metered supply. This will not increase the cost of pumping to connect these colonies with the canal water because action plan has been initiated to upgrade the existing machinery over the water works to achieve the target of 24x7.

RECOMMENDATIONS :

1. Upgradation of distribution system of the city in the sectors as well as colonies by replacing the old PVC/CI pipes which have outlived their lives with CI/DI pipes to facilitate the plugging of the leakages, reduction in non revenue water. The replacement of CI/DI pipes in old 5 sectors.
2. Upgrading the monitoring and automation system of the tubewells and boosters to extract the maximum quantity of water for optimizing the system.
3. Reconsideration of planning to exchange the zones in view of construction of new water works, Sector 52.
4. Installation of flow meters at the pumping mains on all the water works and monitoring the quantity of the water pumped in the system with the billed quantity of the water.
5. By inculcating a systematic approach for planning and management among the Engineers and workers for remedy of the problems in water supply.

PROJECT NO.6

With the promulgation of Apartment Act, the upgradation of water supply system required. The convention bungalows/old kothis are being converted into four storey flats. The occupancy of individual plot will rise to 4 to 5 time than normal. This increase in population will definitely increase the requirement of water. So provision has been kept for investment for upgradation of existing water supply distribution system.

PROJECT NO.7

The present raw water is pumped from water works, Kajauli at 27.5 KM from Chandigarh having altitude difference of 177'. The raw pumps of 100 mtr head are installed which require prime over of 1000 HP capacity each. Lot of power is consumed for raw water pump.

In order to reduce the operational charges on account of pumping against gravity, there is proposal to draw water from Ganguwal (P) which is 70 KM from Chandigarh. The feasibility is to be checked to bring raw water from Ganguwal under gravity. The provision for the same has been made.

- In city Chandigarh 85% connections are metered. The Chandigarh Administration has already taken the decision to provide meters to the balance 15% consumers within a span of one year for proper monitoring of the quantity of water to reduce the losses and wastage.
- The construction of this planned city started in the early 50s in the first phase of capital project. There are areas in which services were laid about 50 years back. The water supply distribution lines have worn out with the passage of time because of scaling and incrustations resulted in reducing the cross sectional area and carrying capacity which further reduces the losses because of high velocity in these distribution lines. The proposal has been drawn to replace these worn out pipes in phased manner over a period of 20 years.
- As the Chandigarh being Union Territory has the limited area of 114 square kilometer. The horizontal expansion of the city is limited. In view of high growth rate and to accommodate the citizens, Chandigarh Administration has promulgated apartment act on the Delhi pattern. So the possibility of construction of four storey dwelling units in the big size of plots is not ruled out in the near future rather construction of dwelling units has already started in certain areas which will ultimately put impact over the existing services already laid. In view of this the corporation has to manage to upgrade the existing system for which the proposal is under way.
- In view of the population projection and demand of potable water, the proposal has been kept in mind for aug. of water supply from Kajauli to

draw 20 mgd water from each phase of V and VI and Chandigarh will fetch only 14.5 mgd water as its share and proposal to be completed in the year 2011 and 2016.

- By the year 2016 all the phases of aug. w/s scheme Kajauli (to be drawn from BML) will be completed and Chandigarh will not have any surface source to tap water.
- In view of high growth rate of population, it has been proposed to draw the water from upstream side of BML or Anandpur Hydly and Ganguwal near Anandpur Sahib to bring the raw water under gravity at the lowest possible recurring operation and mtc. cost keeping in view the vision of 2036.

The preliminary study has been carried out by the Municipal Corporation in connivance with the Punjab Engineering College regarding feasibility to retrieve raw water under natural gradients from Ganguwal (Ropar) for the city Chandigarh. The difference in the altitude of source of water and treatment location is 15 meter. As per preliminary report

residual available head at treatment source is almost nil and which is not feasible to get water at present treatment location keeping in view the length of 70 km proposed closed conduit. The alternative routes and treatment sources have to be worked out to make the technical feasibility. The concurrence of Govt. of India, Govt. of Punjab, Chandigarh Administration is also required. Moreover it is of the opinion that clusters of ULB's in the State of Punjab, Haryana and U.T. have to be associated for the maturity of this project and to facilitate the saving of recurring cost and heavy consumption of power. However the proposal is under the active consideration of this utility being the major consumer of potable water in this region and have been projected in the long term planning on the basis of projected population and its water demand.

PROJECT NO.8

The rehabilitation colonies are provided with PVC distribution lines, which are not trust worthy and subjected to leakage prone. Moreover these pipes have been provided in backcourt yard of each unit. Now people have constructed room in courtyard, with the result these pipe lines have been encroached upon. It is very difficult to repair. A proposal has been made to lay water supply DI pipes in front of houses.

7.8 SEWERAGE SYSTEM

The sewerage system in Chandigarh is satisfactory on account of it being a planned city since its inception. 100% house holds, Commercial establishment and institutions have their own independent sewerage connections and thus discharging their sewage into the Municipal sewerage pipe network laid for the purpose. About 982 KM sewers including branch sewer has been laid till date.

There are two Sewerage Treatment Plants to treat the sewerage effluent generated from the above network of sewerage system. These are situated in Sector –66(Diggian) and Raipur kalan. The present capacity of these two S.T Plants is 35 MGD. The capacity of existing S.T. plant at Diggian is further proposed to be augmented from 30 MGD to 45 MGD by Dec., 2007 at a cost of Rs.32 crores. The sewage at these plants is treated to different levels, as prescribed by the pollution control Authority, before discharging it into the natural water body. Almost 62% of the sewage is treated at these plants. In addition to above, two no. additional S.T plants i.e. at 3BRD (10 MGD Capacity) and at Maloya (2MGD capacity) are in pipe line and are proposed to be completed by 2007 at a cost of Rs.25.00 Crore by Municipal Corporation Chandigarh from its own resources.

At the ST plant in sector 66 (Diggian), 10MGD plant is installed for tertiary treatment. Out of this 3 mgd is being used for irrigation of gardens, parks, open spaces and the remaining water is discharged into the natural water body due to non existence of required infrastructure. The distribution network & boosting system for the balance 7 MGD of tertiary water is expected to be laid in the next six months. However the tertiary treated plants are required to be upgraded/added to generate the tertiary treated water to meet the requirement of irrigation as projected in the water supply requirement for irrigation i.e. 35.64mgd.

Development of the new areas besides the promulgation of the Apartment act -2001 and allowing of commercial activities in the industrial area. The sewer lines in the northern sectors are required to be replaced being very old & worn out.

KEY ISSUES

1. Overloading of trunk mains along sector 23 to 29 and 39 to 47 and also Tribune Chowk to 3BRD ST plant.
2. Branch sewers likely to be overloaded on account of implementation of U.T Apartment act –2001 and commercial activities allowed in the plots of larger sizes in the industrial area.

3. To enhance the capacity of ST plants for treatment up to primary /secondary treatment to treat the 100% sewage.
4. To enhance the capacity of treatment plants installed for tertiary treatment so as to achieve the target of tertiary treated water in order to meet the requirements for irrigation of gardens, parks and open spaces so as to reduce the load on the infrastructure of the potable water supply system meant for drinking water.

VISIONS

1. Protection of environment and safeguarding the health of the general public by providing a complete underground sewerage system through an integrated programme for repairs to the damages occurred in the branch and main sewers over the passage of time i.e. 50 years approximately.
2. 100% Coverage of the whole green area in gardens, parks and open spaces with tertiary treated water in order to save the potable water of drinking purposes.

3 100% Augmentation of branch sewers and the main sewers in the areas being subjected to the additional load on account of introduction of U.T Apartment act – 2001 and allowing the commercial activities in the plots of large sizes in the industrial area.

4 To achieve the target of treating the whole waste water as generated before discharging it into the water body or elsewhere to meet statutory obligations and provide pollution free hygienic environment.

ACTION PLAN

The city will take following steps at appropriate time on priority basis:-

1. The city's priority is to install another tertiary treatment plant of 10mgd capacity by 2007 at a cost of Rs.35.00 Crore thus producing a total of 20 MGD of tertiary treated water for irrigation.
2. The Municipal corporation of Chandigarh is further planning to install one more tertiary treatment treated plant of 10 MGD capacity at 3 BRD, 5MGD Plant at Raipur Kalan, and 1MGD Plant at Maloya at a cost of Rs.50 Crore to meet the 100% requirement of water for irrigation of gardens, parks, lawns etc. The DPR'S shall be underway.
3. Augmentation of peripherals sewers along sector 24 to 29, Sector 39 to 47, Tribune chowk to 3 BRD ST plant at a cost of Rs.25 Crore by 2008 to cater to the additional need of the city for disposal of sewage effluent.

Municipal Corporation is committed to treat the 100% waste water, before discharging in to the water body to meet statutory obligations .The corporation has the proposals to Augment/Upgrade sewerage treatment plants, 5 MGD plant at Raipur kalan, 2 MGD plant at Maloya and 5 MGD plant at 3 BRD for Primary / Secondary treatment by 2016 at a cost of Rs.20.00 Crore to meet the statutory obligation and provide pollution free hygienic environment over and above the existing treatment capacity.

Project No.1 :

It is concert of replacement of under laid and out laid sewerage line in old sectors i.e. Sec.19,20,21,22 and 27.

Project No.2 :

This project is required for augmentation of existing sewerage network because increased demand of water. The quantity of sewerage will also increase.

Project No.3 :

With increase in water supply, sewage will increase proportionately. In order to treat the additional generated sewage, 15 mg S.T. Plant has been proposed.

Project No.4 :

In 2011, sewerage system of 5 nos. sectors has to be replaced/augmented.

Project No.5 :

The plants are required for treatment of sewage of :

- (i) 5 mgd at Raipur Khurd for disposal of sewage of Manimajra.
- (ii) 2 mgd at Maloya for treatment of sewage of colony of Dhanas, Maloya and Dadumajra colony.

Project No.6 :

The project consists of replacement of sewerage line.

Project No.7 :

Additional 5 mgd treatment of BRD proposed for treatment of additional sewage generate because of increase in water supply.

7.9 STORM WATER DRAINAGE

The position of Storm Water Drainage system in Chandigarh is almost satisfactory on account of the well-planned network laid in the city .The storm water has been disposed into the N-choe and the Sukhna choe at different places depending upon the availability of the levels. The tail ends have been constructed along the choe to avoid scouring of the embankments & its bed. About 720 k.m of main storm sewer & branch storm sewer have been laid so far.

THE KEY ISSUES

One of the, key issue is the silting of the N-choe and the Sukhna choe over the passage of time. The silting of the bed level of the choe has ultimately affected the efficiency of DRAINAGE SYSTEM during torrential rains. All storm water drains are held up for longer periods. Thus causing flooding of roads and low lying areas.

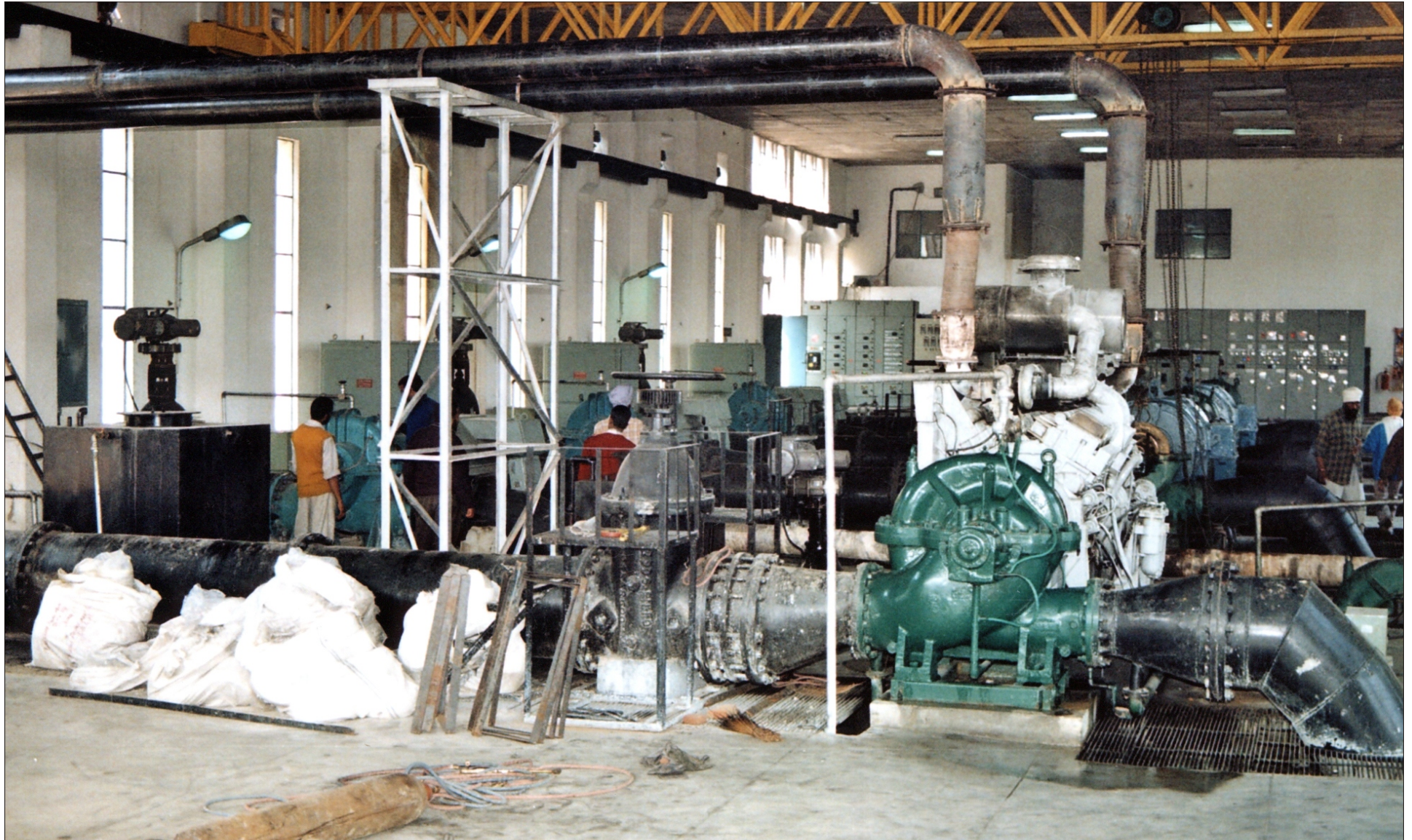
For this very reason, a part of pipe networks especially the Branch sewers have been silted and need either replacement or Augmentation. The storm water drainage system of northern sectors of Chandigarh City has been designed at 15mm rainfall intensity per hour whereas southern sectors have been designed at 20mm rainfall intensity per hour. The design of yester years was in order since the storm water use to spread in the open areas of southern side of the city but now due to development of southern part of the city, the run off has increased and there is dire need to augment the whole S.W.D. system of the city at 25mm rainfall intensity/hr in order to check flooding of roads, low lying and other critical areas.

VISION

The city proposes the desilting of the bed of the N-Choe and the Sukhna Choe so as to allow the free flow of water from the network. Also aspires channelisation of its embankments for protecting the surrounding areas and also to re-claim the surrounding land. The M.C.C. proposes to launch a campaign in a phased manner to replace the damaged / silted pipes and to augment the present system for the efficient drainage of the inner city and its colonies.



PUMPING MACHINERY AT WATER WORKS SECTOR 39, CHD



RAW WATER PUMPING MACHINERY AT WATER WORKS KAJAULI



SURGE CONTROL EQUIPMENT AT WATER WORKS KAJAULI



RAPID SAND FILTRATION PLANT AT WATER WORKS SECTOR 39, CHD

ACTION PLAN

The following steps will be taken to improve the storm water drainage system.

1. Desilting of the Choe bed and the channelisation of its embankments will be taken in hand at a cost of Rs.20.00 Crores.
2. The replacement of storm water drains / Augmentation is proposed to be taken in hand in a phased manner. The northern sectors in the inner city are proposed to be taken in hand on priority at a cost of Rs.12.00 Crore in the Ist Phase and Augmentation/Upgrading will continue further as per the ground condition in each sector in phased manner.

7.10 ROADS NETWORK OF CITY

One unique feature in the lay-out of Chandigarh are its roads, classified in accordance with their functions. An integrated system of seven roads was designed to ensure efficient traffic circulation. Le-Corbusier referred to these as 7 Vs (from the French word 'voie') The city vertical roads run northeast/southwest . The horizontal roads run northwest/southeast. They intersect at right angles, forming, gridiron network for movement.

V-1 roads connect Chandigarh to roads beyond i.e to roads leading to say Ambala or Kalka. Dakshin Marg, for instance, connects to National Highway and Madhya Marg connects to National Highway 22,V-2 roads are the major Avenues of Chandigarh, with important institutional and commercial function running alongside. Important V-2 are the Jan Marg, Himalya Marg, and Uttar Marg.V-3 roads are the corridor-streets for vehicular traffic only. The roads V-1 to V-3 are under the jurisdiction of Engineering Wings of the Chandigarh Administration and these roads constructed and maintained by them.V-4 to V-6 are roads internal to sectors and in front of market and residential houses are maintained by the Municipal Corporation Chandigarh.V-4,V5 and V-6,are the roads internal to sectors.V-7 roads are intended for pedestrians movement. The total Road network under the control of Municipal Corporation Chandigarh is about 1250 Km converted into 12' width.

This arrangement of roads-use leads to remarkable hierarchy of movement, which also ensure that the residential areas are removed from the noise and pollution of traffic. Le Corbusier's grid of roads created the 'sector'. Each measures 800 metres by 1200 metres, or 250 acres. Each sector is surrounded by V-2 or V-3 roads, with no building opening on

them.V-4 roads usually link with the shopping areas/other conveniences located within the sector.V-5 roads provide access to the internal lanes of the sector .V-6 roads lead from the V-5 roads and most residences open out on to the V-6 roads.

The world over, Chandigarh is the largest application of this cellular concept of urban planning. These sectors are structured more or less the same but they also have their own characteristics and individually. Each sector is meant to be self sufficient, with shopping and community facilities within reasonable walking distance. The sectors of the city are numbered commencing from the northern most edge of the city with highest numbers located at the southern edge. There is no Sector 13 in Chandigarh.

VISION REGARDING IMPROVEMENT OF ROADS NETWORK

The total road network under the control of the Municipal Corporation Chandigarh is 1250 Kms (approx.). The roads will have direct impact due to increase in population, its widening, additional alterations are required in the parking area, mainly the market area on V-4 roads in every sector because growing vehicle population in the city in manifolds. At present about 600000 vehicles are plying in city roads of Chandigarh. The average yearly growth rate of vehicle population in the city Chandigarh is about 6%. The parking problems in the city are being tackled by widening the parking areas of shopping centers on V-4 roads and by providing multi-storeyed parking places in busy/hectic shopping centers like Sector 17, Chandigarh.

Moreover, there are about 140 registered tourist buses in the city of Chandigarh. No permanent parking place has been earmarked for parking of these buses. As a result, the bus owners are parking these buses at unauthorized places in different part of the city causing inconvenience to the nearby residents. It has been a long demand of the bus operators to provide a permanent parking space with facilities of booking centers, toilet etc. etc.

Earlier the Chandigarh Administration has earmarked 16 temporary sites in different parts of the city without the facility of toilet/booking centers. Some of the sites were on katcha open space and it was desirable to provide such facilities at present parking places as it would have led to infructuous expenditure in the form of duplication of services.

In view of the long pending demand of the bus operators and hardship being caused to residents, the Chandigarh Administration has identified two bulk parking sites in sector-48 and Manimajra which can accommodate all the buses. These parking sites will be paid

parking sites having facilities, booking centers, security checkpost and dormitory for the drivers and the maintenance as well as the operational cost will be met out of parking fee to be charged from tourist bus operators. The main provisions of the said parking areas are as below:

Other Infrastructure

S.No	Description	Areas/Quantity	Cost
1	Parking area. Sector 48 and Manimajra.	1.50 lac sft.	75.00 lac.
2	Toilets	3 at each site.	30.00 lac
3	Boundary wall	-	10.00 lac
4	Security check post (At the entrance and exit)	2 each	1.00 lac
5	Booking Centers	8 each	10.00 lac
6	Dormitory for the drivers	1 each	10.00 lac
7	Campus lighting	-	10.00 lac
8	Storm water drainage	-	8.00 lac
	Total		15.40 lac
	3% contingencies.	-	4.62 lac
	2% petty establishment charges		3.08 lac
	G.Total		161.70 lac.

7.11 MANAGEMENT OF MUNICIPAL SOLID WASTE

The city Corporation of Chandigarh has been making all out efforts to devise foolproof methods to organize the management of MSW in an efficient manner. The Corporation has been focusing its efforts to promote public private partnership to provide sustainable waste management system in the city. For the purpose of collection removal and storage of Municipal Solid waste, the Corporation has allotted about 1/5 of the city area to private entrepreneurs for providing sanitation services and has engaged 373 Nos. of safaiwalas through outsourcing.

The garbage is collected in the wheel barrows/small cycle carts during the road sweeping by the safaiwalas of the Corporation and is collected from house to house in large cycle carts by the Residents Welfare Associations and N.G.Os through the cart pullers. The Municipal Solid waste so collected is deposited in the community bins/Sehaj Safai Kendras. The garbage from these community bins/Sehaj Safai Kendras is transported to the dumping ground regularly through hydraulic fitted fast moving vehicles.

Treatment of garbage with EM solution and its Present System of Disposal At Dumping Ground

The Corporation has started the treatment of city garbage at the dumping ground with Effective Micro Organism Solution (E.M Solution) with effect from March 2005. the said treatment is helpful in the acceleration of decomposition process of the garbage, reduction in the volume of gas discharge with the result that foul smell has substantially minimized, minimization of larva of flies & mosquitoes, reduction in suspended dust particles, reduction in the volume of waste and fermentation period. This will continue till Garbage Processing Unit/Plant is commissioned.

The city Corporation has earmarked 45 Acres of low lying land situated in the west of Sector 38 near Dadu- Majra Labour colony where the garbage is disposed of through the process of 'Land-Filling'. The landfill site is being very well maintained. The garbage transported to Dumping Ground is compacted with heavy chain dozer, treated with EM solution, is covered with a thick layer of earth on daily basis as per MSW Rules,2000.

Introduction of 'Bin Free Sector Scheme'

The Municipal Corporation has introduced an innovative bin free Sector Scheme. Under this scheme, all the garbage bins placed at various locations for the collection and transportation of the city Municipal Solid waste are removed and one or two suitable sites are earmarked for the collection of Municipal solid Waste from that area where Sehaj Safai Kendras are constructed. The residents of the area are asked to arrange the disposal of their house hold waste at the Sehaj Safai Kendras by engaging cycle carts for House-to-House garbage collection on cost recovery basis. The corporation is getting very encouraging response of this scheme and the same is being extended in phased manner. So far the Corporation has extended this scheme in 20 Sectors. In these 20 sectors the Corporation has organized House-to-House collection of Municipal Solid waste by involving Resident Welfare Associations of their own. The Municipal Corporation is providing large cycle carts to the Resident Welfare Associations free of cost for arranging house-to-house collection of garbage. The Corporation has devised suitable method for

collection of waste from slum, slaughter house etc. by providing suitable & adequate Garbage bins for the purpose.

Setting Up of a Garbage Processing Unit.

The Municipal corporation, Chandigarh is setting up a Garbage Processing Unit as a joint venture with M/s Jaiprakash Associates Limited having a turn over of more than Rs.3000.00 Crores per annum . the Garbage processing unit is being set up by adopting 'pelletisation' technology for the processing of Municipal Solid Waste of the city on BOOT basis.

The Corporation has handed over the physical possession of 10 acres of land to the Project Developer for this purpose. The foundation stone of the unit was laid by His Excellency the Governor of Punjab and Administrator U.T. Chandigarh on 21.2.2006. The work at the site is in progress and is expected to be completed in the first quarter of 2007.

7.12 TRANSPORT STRATEGY PLAN

PART- A

The components of the Strategy plan of Chandigarh Transport Undertaking comprise on vehicles and information technology infrastructure etc.

High Quality Standard Buses: In place of the ordinary buses, the C.T.U have introduced 116 High Capacity, Semi- Low Floor Buses with the latest world technology. These buses are environmental friendly, run on high acceleration and deceleration and have low maintenance cost. These buses are being monitored on all key operational parameters. These buses operate at a frequency 7-8 minutes on key route and 15 minutes on less density route.

The Grid Concept of Route Rationalized.

C.T.U at present operates 1649 trips by utilization 160 buses in City in the Grid pattern. Chandigarh being a planned city, the buses travel on horizontal and vertical routes only so as to facilitate the commuters. Only one change of bus required in order to reach one destination from any point in the city. These 160 buses are operating 40000 Kms.daily on the city roads with utilization of 320 Kms.per bus per day. A detailed map of the route grid system is depicted as under. The details of the route formed are Annexed.

Augmenting of the existing Bus infrastructure

Chandigarh is a growing city and the population over the years has been growing at a faster rate than anticipated. Chart indicating the increase in the population over various decades is depicted below:

1990	451610
2000	906635
2011	116610 (Anticipated)
2021	1500000
2026	2700000 (Anticipated)

It is anticipated that by the year 2011 the population of the city would be well over one million mark and by the year 2021 it would touch one and half million. Accordingly, the population of the adjoining urban estates Mohali in Punjab and Panchkula in Haryana is also increased . C.T.U caters to the needs of commuters in both these urban estate. Due to abnormal hike in prices of petroleum products, this mode of transport is becoming increasingly popular with all sections of the Society. There is a pressing demand from the student extend these services to the newly developed sectors of the city beautiful. Apart from this, the 4th phase of Chandigarh is also proposed to be developed by Administration and more buses would be needed to be introduced in these new areas. In addition, Chd.Admn has set up an information Technology Park with a Railway Station , Air Port and both the ISBTs at Sector-17 and Sector-43. Services from the Technology Park connecting the City Centre as well as Sub-urbs of Mohali and Panchkula are required to be instructed. Further the Chandigarh Transport undertaking intends to increase the frequency of five minutes. In order to increase the frequency as well as to cater to the needs of the residents of upcoming areas, it is proposed to add 100 nos. of Semi-Low Floor buses at a total cost or Rs.18.00 Crores in the fleet strength of Chandigarh Transport Undertaking. Due to increase in the no. of vehicles, two Light Motor Vehicle would be required to supervise/check the operation of these 100 no. vehicles cpsting about Rs.15.00 lacs. The total cost would be to the tune of Rs.18.15 Crores. Further as per the norms fixed by the Govt., 373 nos. of staff of various categories would be required , wages of which would cost the Administration around Rs.6.00 Crore per annum.

A detailed chart including the requirement of staff is as under:

Staff Norms.

1	Driver	2.3 per local bus running in two shift daily.
2	Conductor	2.3 per local bus running in two shift daily.
3	Inspector	12% of the total conductor staff.
4	Ministerial Staff	0.4 per bus
5	Workshop	1.3 per bus

S.No	Name of the Post	Scale of pay	No. of posts.	Exp. Per month	Total Exp. Per year
1	Drivers	4020-6200	230	1966500	23598000
2	Conductors	3120-5160	230	1544450	18533400
3	Inspectors	5000-8000	28	295400	3544800
4	Sub Inspectors	4400-7000	23	214498	2573976
5	Car Drivers	3120-5100	2	13430	161160

Chandigarh Administration intends to construct a dual carriageway, Elevated Highway from Jn.43 (Transport Chowk) to Kalka & Shimla. This will facilitate the through traffic from Chandigarh to Kalka, Shimla and Panchkula side. Also heavy traffic from Vegetable Market Sector-26, Purva Marg, Industrial Area and Transport area will not interfere with the city traffic of Chandigarh, Mani Majra and Panchkula area. This will also eliminate four Red signal light intersection at Jn.No.43, Railway Junction, Kala- Gram Junction and Housing Board Chowk at Mani Majra. The length of Elevated Highway will be 3315 mtr. and it will comprise of 2 lane dual carriageway of 7.5 mtr. wide on each side with a central median of 1.2 meter. The Elevated Highway will be constructed at a height of 8 mtr. above the existing road. It will also allow the smooth flow of traffic to & fro traffic of railway station, Modern Housing Complex and Chandigarh I.T. Park. The traffic will enter and leave the starting and end portion through two ramps of 8.5 mtr. width each. The entire Elevated Portion will be supported on the columns at the interval of 30 mtr. to 40 mtr. center to center.

The estimated cost of project will be as under: -

a)	Elevated Highway Main Portion	Rs.	12701 Lacs.
b)	Side Ramps of Elevated Highway	Rs.	2288 Lacs.
c)	Service Roads at Junctions	Rs.	2160 Lacs.
d)	Geo Tech Investigation, design, DPR and Consultancy Services.	Rs.	93 Lacs.
e)	Shifting of utilities, diversion roads and erection of safety barricades.	Rs.	100 Lacs.
Total =		Rs.	17342 Lacs.

CONSTRUCTION OF AIR CONDITIONED MARRIAGE PALACE IN CITY:

According to projected population and current growth rate, the population and current growth rate, the population of the city would rise to 13.38 lac in 2011 and 19.85 lac in 2012. The figures are going to exceed further in view of rehabilitation programme of Chandigarh Administration for the jhuggie dwellers. At present the City Chandigarh has a population of more than 10 lac. The city has small Banguet halls which caters to small gatherings. The city does not have any big Banguet Hall which can cater to the gathering of 1000-1500. The residents of Chandigarh are facing lot of inconvenience on account of this as for such gatherings they have to go to the banquets in the peripheral areas of Chandigarh like Zirakpur etc. in Punjab and Haryana. Many a times marriages are solemnized in the night and the host as well as the guests have to face lot of inconvenience as they have to go out of Chandigarh to organize such marriages. This becomes particularly difficult in winters and also poses security threats to the residents. In view of the hardship faced by the residents on this account, the Municipal Corporation Chandigarh has planned to construct an Air Conditioned Marriage Palace with the city of Chandigarh which can accommodate 1500 nos. persons at a time. It is being planned to identify 4-5 acres plot for this Marriage Palace. The main provisions of the Palace alongwith their tentative cost as detailed below :

Sr.No.	Description	Area/Quantity	Cost in lacs.
	<u>CIVIL WORKS</u>		700.00
1	Plot area	4/5 acre	
2	A.C. Hall, Ground floor incl. 3 VIPs.	20000 sft.	
3	A.C. Hall including 3 VIP, First/Ground Floor for small gatherings.	10000 sft.	
4	Toilet (Separate for ladies and gents)	6 each	
5	Kitchen/pantry/store.	2 nos.	
6	Built up stalls for services.	20 nos.	
7	Parking area having parking capacity for 600 vehicles.	-	
8	Lawn back and front.	-	
	<u>ELECTRICAL WORKS :</u>		80.00
1	Air conditioning.	-	
2	Back up generator 250 KVA	-	
3	Lighting both campus and building lighting.	-	
	<u>LANDSCAPING.</u>		
1	Development of lawn front and back.	-	30.00
	<u>PUBLIC HEALTH SERVICES.</u>		40.00
	<u>TOTAL :</u>		850.00

CHAPTER 8: FINANCES OF CHANDIGARH

8.1 Financial Profile (Plan and Non-Plan) of the MCC

This chapter details the finances of the Municipal Corporation of Chandigarh and the finances of other departments of the Chandigarh administration involved in the provision of services and outlines the receipts and expenditure over the last four years.

Plan Account: Income and expenditure items under this account are primarily accounted under Chandigarh Administration. Income includes loans and contributions from Chandigarh Administration. Expenditure items include expenses booked under developmental works. Major heads under which expenditure is incurred are public health, roads & bridges, health (medical officer) and land acquisition. Further the minor heads of public health are water supply and sanitation, housing, sewerage and horticulture etc. Under the head of roads & bridges, various expenses are categorized related to internal roads works, buildings and expenditure in provision of basic services to economically weaker sections. Solid waste management and animal hygiene expenses are categorized under the head of health (medical officer).

Non-Plan Account: Income and expenditure items under this account are primarily accounted under the Municipal Corporation of Chandigarh. All recurring items of Income and expenditure are included under this head. On income account, it includes receipts from tax, non-tax, revenue grants and estate receipts and on expenditure account, it includes expenses on establishment (wages and salaries), operation and maintenance works and interest payments (if any). Tax head at present mainly represented by the property tax only whereas non-tax receipts includes water charges, sewerage cess, road cutting charges, rents on buildings and removal charges etc. Major heads under the non-plan head are urban water supply, sewerage and sanitation, streetlights, parks, roads, horticulture and fire services etc.

DEVELOPING A VISION FOR A CITY

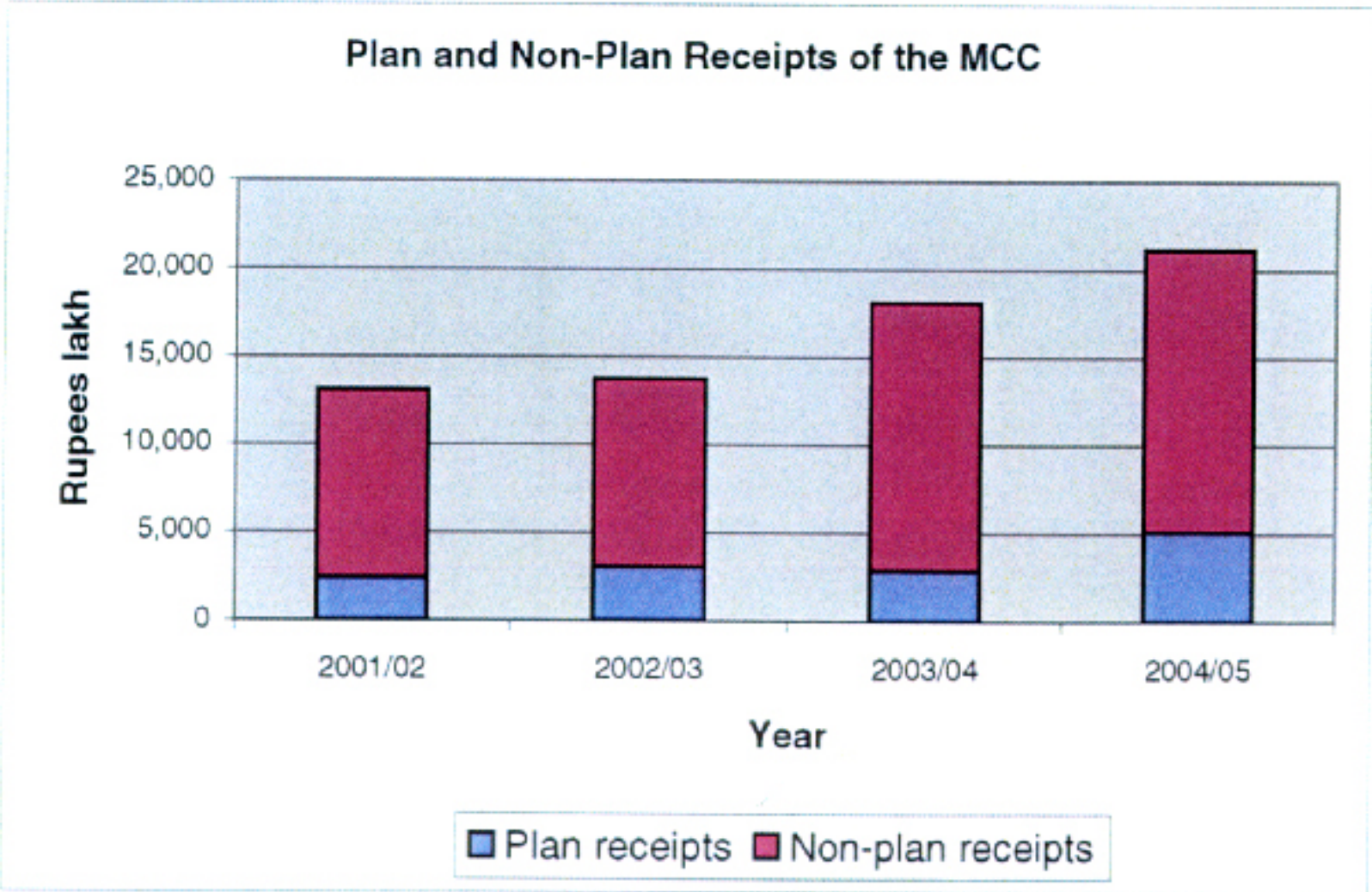
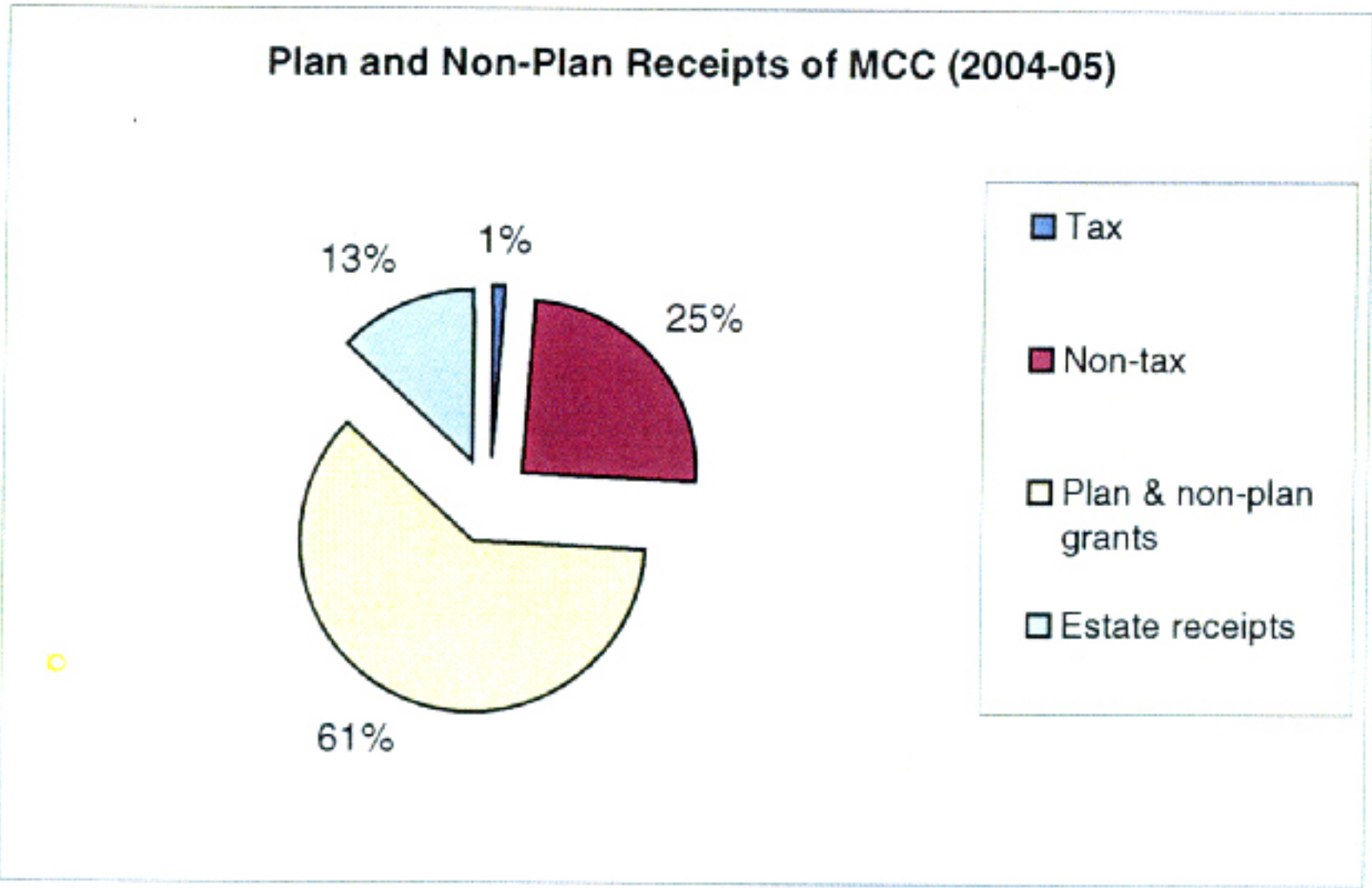
TABLE : 20 VISION AND GOALS

Vision and goals	Year		
	2010	2015	2020
Sect oral agenda	100%	100%	100%
Water Supply	100%	100%	100%
Sewerage	100%	100%	100%
Sanitation	80%	90%	100%
Solid waste management	100%	100%	100%
Drainage/storm water drains	90%	95%	100%
Urban transport	80%	90%	100%
Heritage	60%	80%	100%
Reform agenda			
Decentralization	50%	80%	100%
Land & housing markets	80%	90%	100%
Transparency and accountability	80%	100%	100%
Community participation	10%	50%	100%
Financing management system	50%	80%	100%
Municipal finances	60%	80%	100%
Budgeting for the urban poor	5%	7%	10%

8.2Financial Status

Income:

Plan and non-plan grants has contributed 61 percent of the total receipts whereas own receipts have contributed only 39 percent and further after deducting estate receipts which are mainly from sale of land etc., the tax and non-tax receipts have contributed only 26 percent of the total receipts for the year of 2004-05. It clearly indicates that the finances of Chandigarh city are highly dependent on state transfers in terms of plan and non-plan grants.



The total receipts have grown by 18 percent annually during the past four years. Plan receipts, which are mainly plan grants, have risen by 32 percent annually and non-plan receipts have risen by 16 percent.

Table 1: Plan and Non-Plan Receipts of MCC (Rs.lakh)

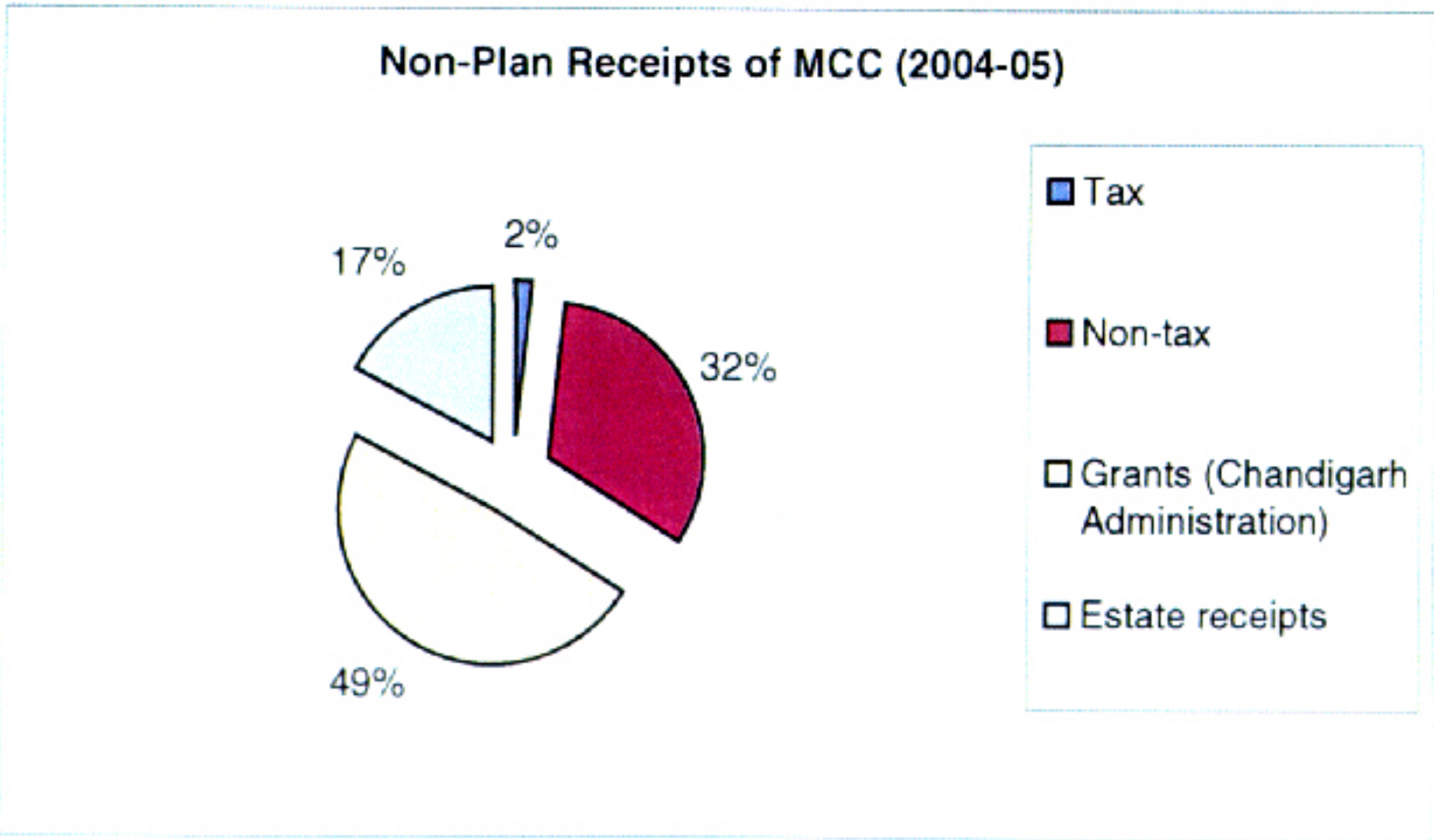
Year	Tax	Non-tax	Plan and non-plan grants	Estate receipts	Total receipts
2001/02	-	3,659.10	7,465.00	1,994.25	13,118.35
2002/03	-	3,797.40	8,334.00	1,599.54	13,730.94
2003/04	-	5,220.24	10,118.00	2,766.63	18,104.87
2004/05	258.42	5,264.44	13,094.68	2,806.91	21,166.03

Plan receipts comprises of plan grants only. Plan grants are mainly from the government of Chandigarh Administration and meant for only developmental works.

Table 2: Plan Receipts of MCC (Rs.lakh)

Year	Receipts from Chandigarh Administration			
	Loans	Grants	Financing Institutions	Plan receipts
2001/02	-	2,464.00	-	2,464.00
2002/03	-	3,044.00	-	3,044.00
2003/04	-	2,889.00	-	2,889.00
2004/05	-	5,118.68	-	5,118.68

Non-plan receipts include receipts from tax, non-tax, revenue grants and estate receipts. Once again the revenue grants contribute the major share i.e. nearly half of the non-plan receipts.



Non-tax receipts in terms of various charges, fees and fines have contributed 32 percent Tax receipts in terms of property tax have contributed merely 2 percent and estate receipts (sale of land etc.) have contributed 17 percent for the year 2004-05.

Table 3: Non-Plan Receipts of MCC (Rs.lakh)

Year	Tax	Non-tax	Grants (Chandigarh Administration)	Estate receipts	Non-plan receipts
2001/02	-	3,659.10	5,001.00	1,994.25	10,654.35
2002/03	-	3,797.40	5,290.00	1,599.54	10,686.94
2003/04	-	5,220.24	7,229.00	2,766.63	15,215.87
2004/05	258.42	5,264.44	7,976.00	2,806.91	16,047.35

Expenditure:

Establishment head, which is the expenditure incurred on establishment, wages and salaries has accounted 42 percent of the total expenditure whereas operation and maintenance head has accounted for 40 percent. Plan expenditure has accounted for the remaining 18 percent for the year 2004-05.

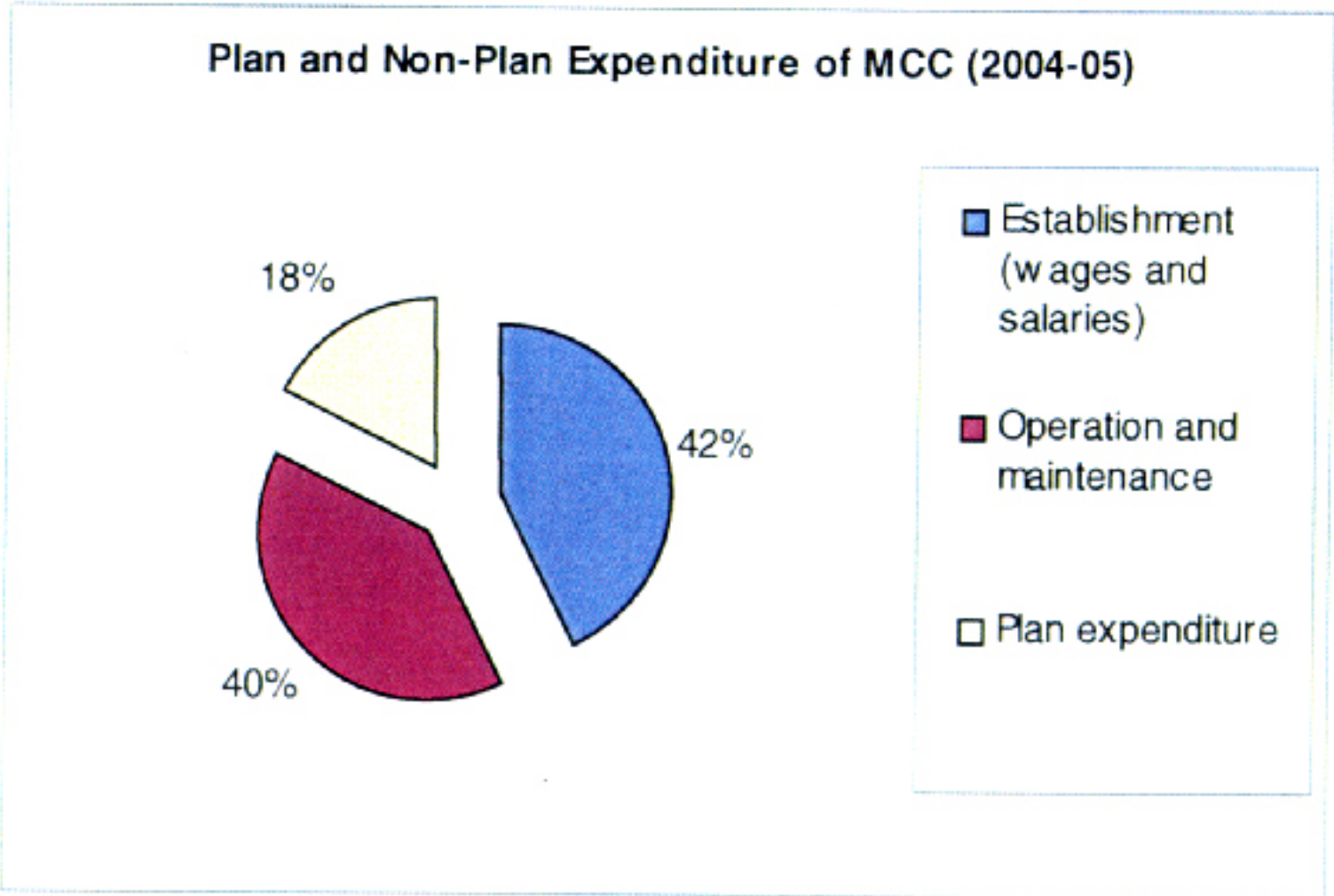
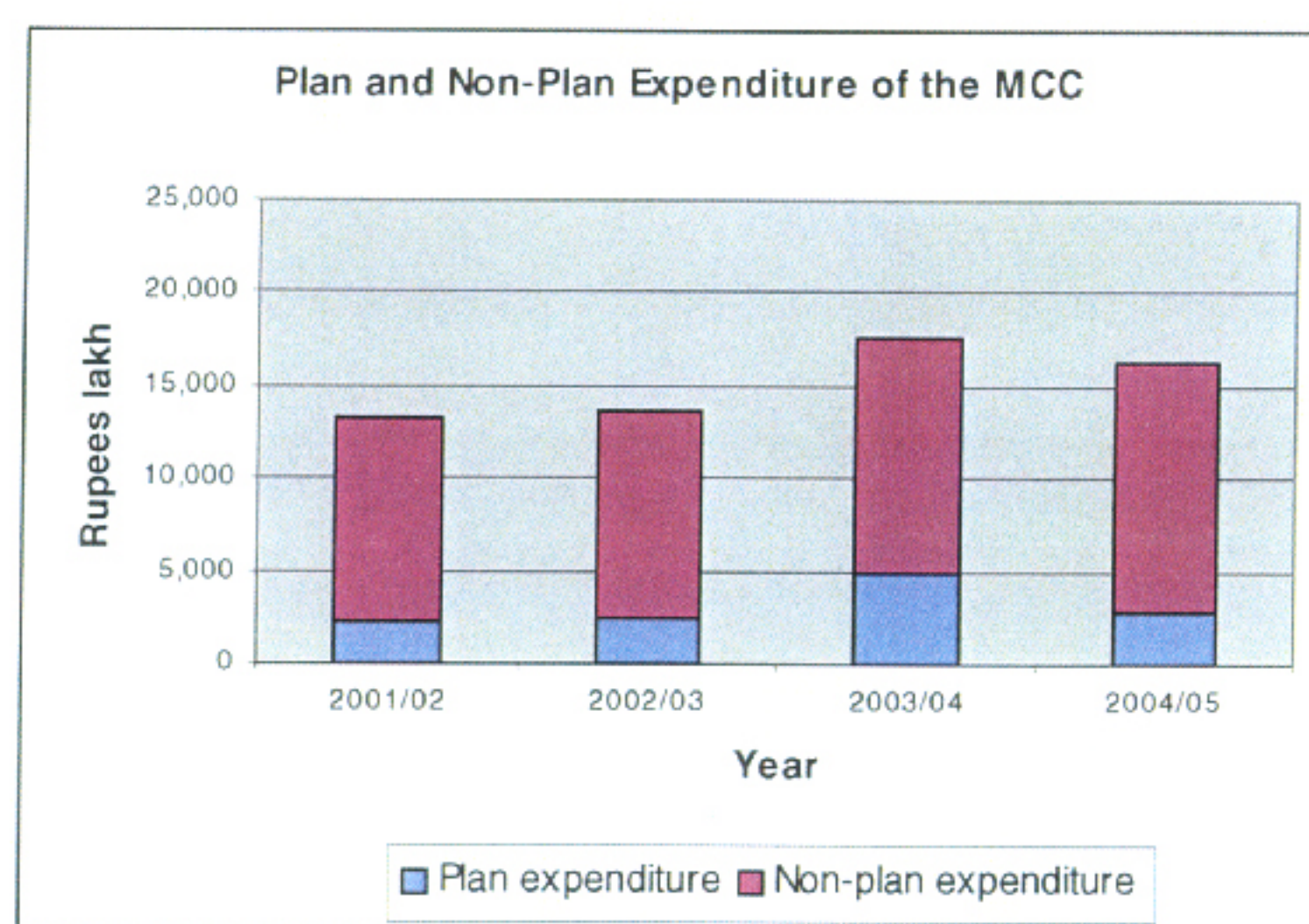


Table 4: Plan and Non-Plan Expenditure of MCC (Rs.lakh)

Year	Establishment (wages and salaries)	Operation and maintenance	Interest payments	Other non- plan expenditure	Plan expenditure	Total expenditure
2001/02	5,848.97	4,910.08	-	217.57	2,233.39	13,210.01
2002/03	5,840.92	5,200.24	-	250.33	2,428.41	13,719.90
2003/04	6,350.81	5,814.92	-	397.16	4,998.08	17,560.97
2004/05	6,922.68	5,979.37	-	432.62	2,862.30	16,196.97



The total expenditure has grown by 8 percent annually during the past four years. Plan expenditure, which are mainly from plan grants, have risen by 11 percent annually and non-plan expenditure has risen by 7 percent.

Under the plan expenditure of the MCC, seventy five percent of the total plan expenditure is incurred on the public health head which comprises of water supply and sanitation, housing, sewerage and horticulture followed by the buildings and roads with 21 percent which comprises of internal roads works, buildings and expenditure in provision of basic services to economically weaker sections and health (medical officer) which comprises of solid waste management and animal hygiene.

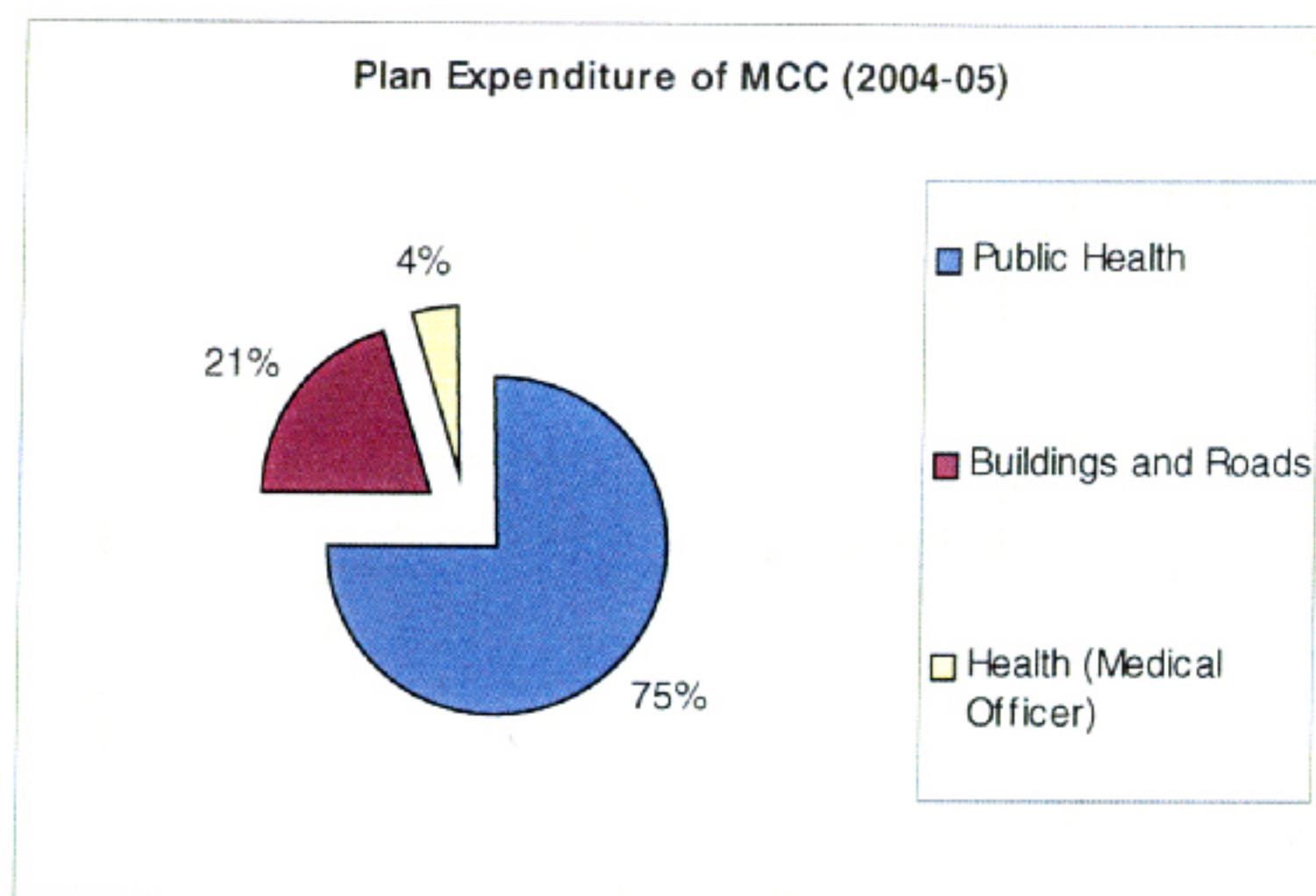
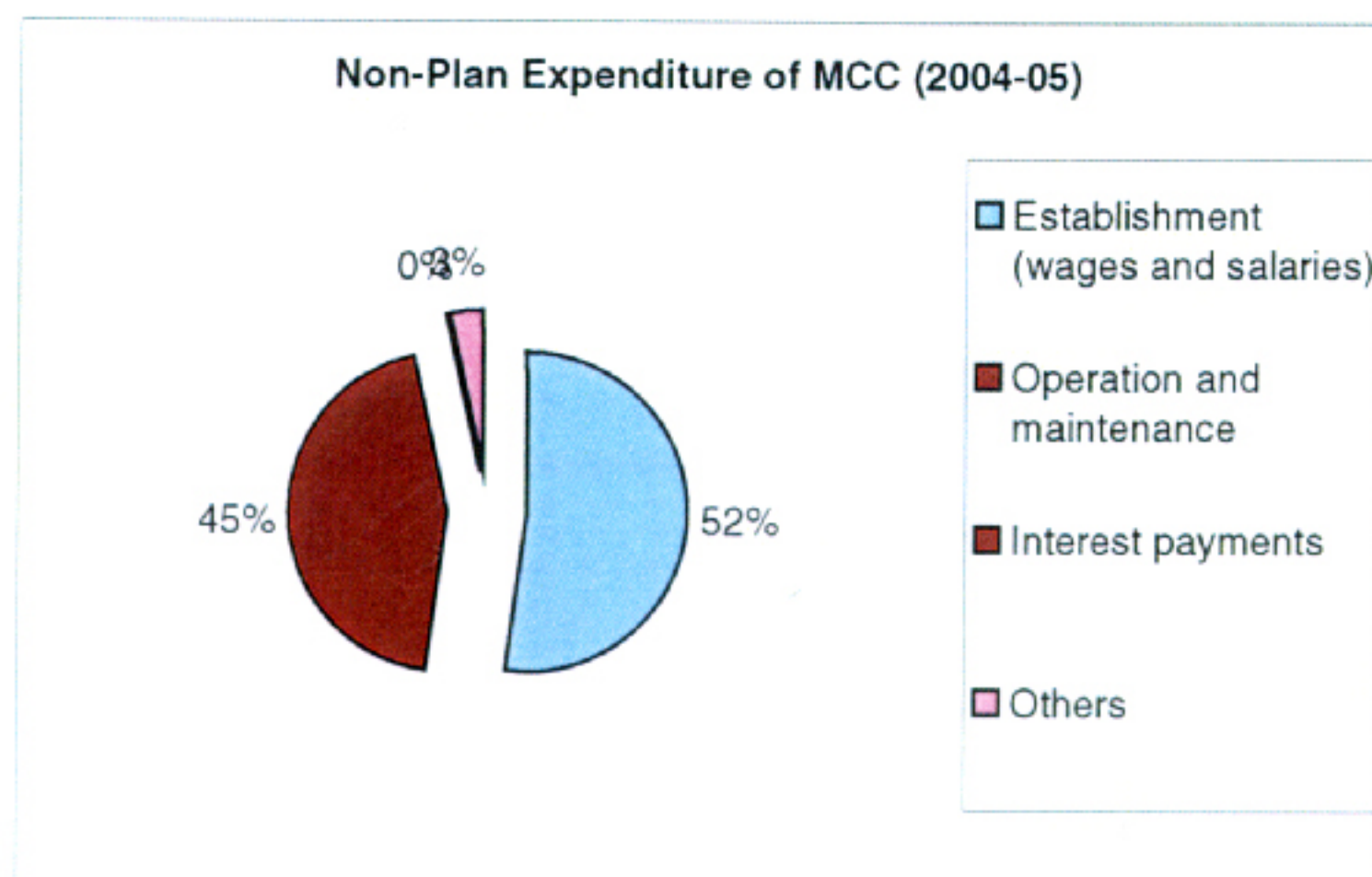


Table 5: Plan Expenditure of MCC

Year	Public Health	Buildings and Roads	Health (Medical Officer)	Land Acquisition	Others	Plan expenditure
2001/02	597.55	824.65	238.84	530.65	41.70	2,233.39
2002/03	851.56	683.33	421.09	325.51	146.92	2,428.41
2003/04	1,965.05	757.99	161.64	254.84	1,858.56	4,998.08
2004/05	1,840.77	516.75	108.16	66.02	330.60	2,862.30

All recurring items of expenditure are included under non-plan expenditure. It includes expenses on establishment (wages and salaries), operation and maintenance works and interest payments (if any). Major heads under the non-plan expenditure are urban water supply, sewerage and sanitation, streetlights, parks, roads, horticulture and fire services etc.



Fifty two percent and forty five percent of the non-plan expenditure is incurred on establishment and operation & maintenance heads respectively. Expenditure on establishment head has grown by 6 percent whereas expenditure on operation and maintenance including other non-plan expenditure has risen by 8 percent.

Table 6: Non-Plan Expenditure of MCC (Rs.lakh)

Year	Establishment (wages salaries)	Operation and and maintenance	Interest payments	Others	Non-plan expenditure
2001/02	5,848.97	4,910.08	-	217.57	10,976.62
2002/03	5,840.92	5,200.24	-	250.33	11,291.49
2003/04	6,350.81	5,814.92	-	397.16	12,562.89
2004/05	6,922.68	5,979.37	-	432.62	13,334.69

Recovery of water charges:

The water bills are 100% computerized. The frequency of issuing bill is bi-monthly. The receipt of water charges is also computerized through Sampark Centre. The timing of sampark centre is from 8 AM to 8.00 PM.

REVENUE RECEIPTS OF WATER SUPPLY

Year	Rupees (In Lacs)	Percentage Increase	Annual	Percentage Considering Base Year	Increase 1999-2000 As
1999-2000	1445.56	-		-	
2000-2001	2079.37	43.84		43.84	
2001-2002	2560.89	23.16		77.16	
2002-2003	2859.41	11.66		97.81	
2003-2004	4005.76	40.09		177.10	
2004-2005	4038.50	0.80		179.37	

Revenue receipt of water increases from 43.84% to 179.37% taking 1999-2000 as base and clearly depicts gradual increase in water tariff.

REVENUE RECEIVED PER MGD OF WATER

Year	Rupees (In Lacs)	Total water supplied per year	Revenue per MGD	Annual percentage increase
1999-2000	1445.56	22630 MGD	6284	-
2000-2001	207937	22630 MGD	9189	46.22%
2001-2002	2560.89	22995 MGD	11137	21.19%
2002-2003	2859.41	23360 MGD	12241	9.90%
2003-2004	4005.76	23360 MGD	17149	40.09%
2004-2005	4038.50	23360 MGD	17288	0.86%

The above depicts gradual increase in revenue per mgd from Rs.6284/- to Rs.17288/- in a span of six year.

Expenditure on Operation and Maintenance Water Supply

The expenditure on operation and mtc. of water supply was Rs.4217.29 lacs in 1999-2000. But now it rises to Rs.5615.39 lacs in 2004-05. The major increase in expenditure is because of increase in salary of staff members and escalation on electricity charges. The electricity charges comprise of major expenditure on operation and mtc about 65% of total expenditure. Rest 35% is on wages of staff.

EXPENDITURE OPERATION AND MAINTENANCE OF WATER SUPPLY

Year	Rupees (In Lacs)	Percentage Increase	Annual Percentage Increase Considering 1999-2000 As Base Year
2001-2002	4847.62	10.33	14.95
2002-2003	5092.50	5.05	20.75
2003-2004	5479.26	7.59	29.92
2004-2005	5615.89	2.49	33.16

The increase in expenditure is because of increase in power tariff and salary of staff members.

COST OF SUPPLYING ONE MGD OF WATER

Year	Total cost per year (In lacs)	Total water supplied	Cost per MGD (in Lacs)	Percentage increase
1999-2000				
2000-2001	4393.94	22630 MGD	19416	-
2001-2002	4847.62	22995 MGD	21081	8.57%
2002-2003	5092.50	23360 MGD	21800	3.41%
2003-2004	5479.26	23360 MGD	23455	7.59%
2004-2005	5615.89	23360MGD	24040	2.49%

COST OF SUPPLYING ONE MGD OF WATER

Year	Cost per MGD (in Lacs)	Revenue per MGD (In Lacs)	Gap (In Lacs)
2000-2001	19416	9189	10227
2001-2002	21081	11137	9944
2002-2003	21800	12241	9559
2003-2004	23455	17149	6306
2004-2005	24024	17288	6736

Gap between cost and revenue per mgd is substantially reducing.

CHAPTER 9: FINANCIAL OPERATING PLAN AND CAPITAL INVESTMENT PLAN

**Table 1: Average growth rates (2001-02 to 2004-05)
of Plan and Non-Plan receipts of MCC**

Plan and receipts	Non-Plan Average growth rate (%)
Total receipts	17.81

Plan receipts	Average growth rate (%)
Loans	-
Grants	31.88
Financing Institutions	-
Plan receipts	31.88

Non-plan receipts	Average growth rate (%)
Tax	-
Non-tax	14.03
Grants (Chandigarh Administration)	17.59
Estate receipts	18.21
Non-plan receipts	16.05

**Table 2: Average growth rates (2001-02 to 2004-05)
of Plan and Non-Plan expenditure of MCC**

Plan and Non-Plan expenditure	Average growth rate (%)
Total expenditure	8.03

Plan expenditure	Average growth rate (%)
Public Health	55.65
Buildings and Roads	-12.68
Health (Medical Officer)	-6.13
Land Acquisition	-44.82
Others	117.46
Plan expenditure	10.77

Non-Plan expenditure	Average growth rate (%)
Establishment (wages and salaries)	5.87
Operation and maintenance	6.85
Interest payments	-
Others	27.55
Non-plan expenditure	6.76

Plan and Non-Plan receipts	Average growth rate (%)	Assumed growth rate (%)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-2010	2010-1011
Total receipts	17.81		21,424.45	22,418.99	24,964.90	27,815.42	31,008.56	34,587.32	38,600.25
Plan receipts									
Loans	-		-						
Grants	31.88	12.00	5,118.68	3,235.68	3,623.96	4,058.84	4,545.90	5,091.41	5,702.37
Financing Institutions	-		-						
Plan receipts	31.88		5,118.68	3,235.68	3,623.96	4,058.84	4,545.90	5,091.41	5,702.37
Non-plan receipts									
Tax	-	5.00	258.42	1,268.00	1,331.40	1,397.97	1,467.87	1,541.26	1,618.33
Non-tax	14.03	15.00	5,264.44	6,054.11	6,962.22	8,006.56	9,207.54	10,588.67	12,176.97
Grants (Chandigarh Administration)	17.59	10.00	7,976.00	8,773.60	9,650.96	10,616.06	11,677.66	12,845.43	14,129.97
Estate receipts	18.21	10.00	2,806.91	3,087.60	3,396.36	3,736.00	4,109.60	4,520.56	4,972.61
Non-plan receipts	16.05		16,305.77	19,183.31	21,340.94	23,756.58	26,462.67	29,495.92	32,897.88

Plan and Non-Plan expenditure	Average growth rate (%)	Assumed growth rate (%)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-2010	2010-1011
Total expenditure	8.03	???	16,196.97	18,494.67	20,895.47	23,631.42	26,752.59	30,316.96	34,391.77
Plan expenditure									
Public Health	55.65	20.00	1,840.77	2,208.92	2,650.71	3,180.85	3,817.02	4,580.42	5,496.51
Buildings and Roads	-12.68	10.00	516.75	568.43	625.27	687.79	756.57	832.23	915.45
Health (Medical Officer)	-6.13	10.00	108.16	118.98	130.87	143.96	158.36	174.19	191.61
Land Acquisition	-44.82	5.00	66.02	267.58	280.96	295.01	309.76	325.25	341.51
Others	117.46	10.00	330.60	363.66	400.03	440.03	484.03	532.43	585.68
Plan expenditure	10.77		2,862.30	3,527.57	4,087.84	4,747.64	5,525.74	6,444.53	7,530.76
Non-Plan expenditure									
Establishment (wages and salaries)	5.87	10.00	6,922.68	7,614.95	8,376.44	9,214.09	10,135.50	11,149.05	12,263.95
Operation and maintenance	6.85	15.00	5,979.37	6,876.28	7,907.72	9,093.87	10,457.96	12,026.65	13,830.65
Interest payments	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Others	27.55	10.00	432.62	475.88	523.47	575.82	633.40	696.74	766.41
Non-plan expenditure	6.76		13,334.67	14,967.11	16,807.63	18,883.78	21,226.85	23,872.43	26,861.01

Capital Investment Plan of Municipal Corporation of Chandigarh (M.C.C) & Chandigarh Administration

S.No	Description of work	Year wise requirement of Funds (In crores)						
		2006-2011	2011-2016	2016-2021	2021-2026	2026-2031	2031-2036	Total
MUNICIPAL CORPORATION OF CHANDIGARH (M.C.C)								
1	WATER SUPPLY	162.31	135.42	163.00	234.00	146.00	57.00	897.73
2	SEWERAGE	46.38	32.00	30.00	25.00	27.50	65.00	225.88
3	STORM WATER DRAINAGE	27.00	13.00	15.00	17.00	20.00	55.00	147.00
4	ROADS	1.62	--	--	--	--	--	1.62
5	OTHER INFRASTRUCTURES	8.50	--	--	--	--	--	8.50
6	SOLID WASTE MANAGEMENT	6.25	--	--	--	--	--	6.25
TOTAL (M.C.C)		252.06	180.42	208.00	276.00	193.50	177.00	1286.98
CHANDIGARH ADMINISTRATION								
1	ELEVATED HIGHWAY	173.42	--	--	--	--	--	173.42
2	TRANSPORTATION	7.74	--	--	--	--	--	7.74
TOTAL CHANDIGARH ADMINISTARTION		181.16	--	--	--	--	--	181.16
GRAND TOTAL		433.22	180.42	208.00	276.00	193.50	177.00	1468.14
1	Funds to be provided by Govt. of India under JNNURM (80% of the total project cost)	346.58	144.34	166.40	220.80	154.80	141.60	1174.52
2	Grant to be provided by Chandigarh Administration (10% of the total project cost)	61.44	18.04	20.80	27.60	19.35	17.70	164.93
3	Funds to be provided by Municipal Corporation, Chandigarh. (10% of the total project cost)	25.20	18.04	20.80	27.60	19.35	17.70	128.69
GRAND TOTAL		252.06	180.42	208.00	276.00	193.50	177.00	1286.98

Capital Investment Plan of Water supply

Drinking water norms in LPCD	150						
Inflation in Percentages	4.03%						
Current Supply in Chandigarh (MLD)	300						
Development Cost Rs.Crore/MLD	898						
Year	2006	2011	2016	2021	2026	2031	2036
Chandigarh Population in Lacs	11.23	13.68	16.67	20.31	24.74	30.15	36.72
UFW in Percentage	15%	10%	8%	8%	8%	8%	8%
Water Requirement in MLD	337	364	399	467	550	615	773
Water for other Uses (irregation)	162	162	162	162	162	162	162
Total in MLD	499	526	591	629	712	777	935
Gap of water in MLD	199	27	35	68	83	65	158
Additional Investment required in Rs.Crore	162.31	135.42	163.00	243.00	146.00	44.00	13.00

INVESTMENT PLAN WATER SUPPLY

Amount in Crores

PROJECT REQUIRING FUNDING PROJECT UNDER NURM

S.No	Description of work	Year wise requirement of Fund							
		2006	2011	2016	2021	2026	2031	2036	Total
1	Augmentation W/S Scheme Ph.V &VI& and Up gradation of UGRS etc. Project cost 529.00	55.00	80.00	20.00	10.00	20.00	20.00	-	205.00
2	Up gradation of pumping machinery at various water works to achieve 24x7	33.00	-	-	-	-	20.00	10.00	63.00
3	Additional Pipe line & Tube Wells	5.00	4.00	4.00	4.00	4.00	4.00	3.00	28.00
4	Up gradation of Distribution System of Potable water with in the intercity to replace worn out pipes of oldest sectors of Chandigarh i.e. 19,20,22,23&27	16.00	16.00	16.00	17.00	18.00	-	-	83.00
5	Conservation of drinking water (10 mgd) by harvesting the tertiary treated sewage for irrigation of green spaces in city, Chandigarh.	35.00	30.00	20.00	-	-	-	-	85.00
6	Up gradation of the distribution system in the inner city on a/c of implementation of Apartment Act. And up gradation of water supply system in the villages already merged in UT Chandigarh.	15.06	5.42	3.00	3.00	4.00	-	-	30.48
7	Raw water carrier from Ganguwal (by gravity) to eliminate present pumping at Kajauli. Survey report.	2.00	-	100.00	200.00	100.00	-	-	402.00
8	Up gradation of water supply lines in rehabilitated colonies of U.T Chandigarh i.e Ramdarbar , Maloya ,Dadu Majra etc. (Replacement of P.V.C and G.I small size pipe line	1.25	-	-	-	-	-	-	-
	GRAND TOTAL	162.31	135.42	163.00	234.00	146.00	44.00	13.00	897.73
1	Funds to be provided byGovt. Of India under JNNURM (80% of the total project cost.)	129.85	108.34	130.40	187.20	116.80	35.20	10.40	718.18
2	Grant to be provided by Chandigarh Administration (10% of the total project cost.)	16.23	13.54	16.30	23.40	14.60	4.40	1.30	89.77
3	Funds to be provided by Municipal Corporation (10% of the total project cost.)	16.23	13.54	16.30	23.40	14.60	4.40	1.30	89.77

Capital investment Plan of Sewerage Sector

Sewerage Augmentation in Rs.Capital	225.88 Crores						
Inflation in Percentages	4.03%						
Current Sewerage connectivity in Chandigarh	100%						
Year	2006	2011	2016	2021	2026	2031	2036
Chandigarh Population in Lacs	10.98	13.38	16.29	19.85	24.19	29.46	35.91
Sewerage connectivity Gap (in Lacs of user)	-	3%	2%	1%	-	-	-
Additional Investment req.in Rs. Crore	46.38	32.00	30.00	25.00	27.50	30.00	35.00

INVESTMENT PLAN SEWERAGE SYSTEM

Amount in Crores

PROJECT REQUIRING FUNDING PROJECT UNDER NURM

S.No	Description of work	Year wise requirement of Fund							
		2006	2011	2016	2021	2026	2031	2036	Total
1	Replacement of old out lived sewer lines in 5 No. old Sectors of the city	19.45	--	--	--	--	--	--	19.45
2	Laying of additional trunk main from sector-24 to 29 to 3 BRD, Sector-39 to 47 and Egg shaped sewer from CTU to Tribune chowk	4.43	--	--	--	--	--	--	4.43
3	Construction of 15 MGD ST Plant in sector- 66	22.50	--	--	--	--	--	--	22.50
4	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	21.50	--	--	--	--	--	21.50
5	Construction of 5 MGD ST Plant in Raipur Kalan and 2 MGD ST Plant at Maloya	--	10.50	--	--	--	--	--	10.50
6	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	--	22.50	--	--	--	--	22.50
7	Construction of 5 MGD ST Plant at 3 BRD	--	--	7.50	--	--	--	--	7.50
8	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	--	--	25.00	--	--	--	25.00
9	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	--	--	--	27.50	--	--	27.50
10	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	--	--	--	--	30.00	--	30.00
11	Replacement of old out lived sewer lines in other 5 No. old Sectors of the city	--	--	--	--	--	--	35.00	35.00
	TOTAL	46.38	32.00	30.00	25.00	27.50	30.00	35.00	225.88

S.No	Description of work	Year wise requirement of Fund							
		2006	2011	2016	2021	2026	2031	2036	Total
1	Funds to be provided by Govt. of India under JNNURM (80% of the total project cost)	37.10	25.60	24.00	20.00	22.00	24.00	28.00	180.70
2	Grant to be provided by Chandigarh Administration (10% of the total project cost)	4.64	3.20	3.00	2.50	2.75	3.00	3.50	22.59
3	Funds to be provided by Municipal Corporation, Chandigarh. (10% of the total project cost)	4.64	3.20	3.00	2.50	2.75	3.00	3.50	22.59
	GRAND TOTAL	46.38	32.00	30.00	25.00	27.50	30.00	35.00	225.88

Investment required for Storm drainage Sector

Storm water drainage Augmentation in 147.00
Rs.Crores.

Inflation in Percentages 4.03%

Current Storm water drainage connectivity 95%
in Chandigarh

Year	2006	2011	2016	2021	2026	2031	2036
Chandigarh Population in Lacs	11.23	13.68	16.67	20.31	20.74	30.15	36.72
Sewerage connectivity Gap(in Lacs of user)	0.53	0.41	0.33	0.21	-	-	-
Additional Investment req.in Rs. Crore	27.00	13.00	15.00	17.00	20.00	25.00	30.00

INVESTMENT PLAN STORM WATER DRAINAGE

Amount in Crores

PROJECT REQUIRING FUNDING PROJECT UNDER NURM

S.No	Description of work	Year wise requirement of Fund							Total
		2006	2011	2016	2021	2026	2031	2036	
1	Replacement of old out lived storm water drainage lines in 5 No. old Sectors of the city	12.00	--	--	--	--	--	--	12.00
2	Desilting of natural Chloes and stone pitching of choe sides etc.	15.00	--	--	--	--	--	--	15.00
3	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	13.00	--	--	--	--	--	13.00
4	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	--	15.00	--	--	--	--	15.00
5	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	--	--	17.00	--	--	--	17.00
6	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	--	--	--	20.00	--	--	20.00
7	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	--	--	--	--	25.00	--	25.00
8	Replacement of old out lived storm water drainage lines in other 5 No. old Sectors of the city	--	--	--	--	--	--	30.00	30.00
	TOTAL	27.00	13.00	15.00	17.00	20.00	25.00	30.00	147.00
1	Funds to be provided by Govt. of India under JNNURM (80% of the total project cost)	21.60	10.40	12.00	13.60	16.00	20.00	24.00	117.60
2	Grant to be provided by Chandigarh Administration (10% of the total project cost)	2.70	1.30	1.50	1.70	2.00	2.50	3.00	14.70
3	Funds to be provided by Municipal Corporation, Chandigarh. (10% of the total project cost)	2.70	1.30	1.50	1.70	2.00	2.50	3.00	14.70
	GRAND TOTAL	27.00	13.00	15.00	17.00	20.00	25.00	30.00	147.00

GRAND SUMMARY - WATER INFRASTRUCTURE AUGMENTATION AT MCC						
Sr. No.	System Head	Surveillance System		Instrumentation System		Total
		Total System	Per TW	Total System	Per TW	
1	TW with boosters (100)	100	249275	100	450000	69900000
2	TW without boosters (100)	100	214275	100	220000	43400000
3	Mother Water Works S39	Complete as per Annexure B3				57400000
4	Sector 37	Complete as per Annexure B4				5667000
5	Sector 32	Complete as per Annexure B5				5676000
6	Sector 26	Complete as per Annexure B6				6487000
7	Sector 12	Complete as per Annexure B7				10400000
8	Water works Kajauli(Pb)Ph.I&II	Complete as per Annexure B8				8857000
9	Mani Majra WWII	Complete as per Annexure B9				3751000
10	MES	Complete as per Annexure B10				2397000
						213935000
	Add 1% P.E. charges.					2139350
						216074350
	Credit for old sluice valves					2500000
	Total Project Cost					213574350

Say Rs.21.36 Crores.

Bill of Materials Tube well Augmentation Project**Annexure B1****Tubewell Type B**

PROJECT: WATER INFRASTRUCTURE AUGMENTATION SYSTEM FOR TYPICAL TUBEWELL type B, MCC CHANDIGARH						
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES						
SN	DESCRIPTION	QTY.	Rate	UNIT	Amount	Value per tubewell basis
1	SCADA Software for monitoring of 100 tubewells ; this software shall be installed on the central computer for remote monitoring	1	375000	NO.	375000	3750
1.1	Software for tubewells beyond 100 nos will be monitored @ a special rate of Rs.5000/- per tubewell					
2	Remote Terminal Unit (required one unit on each tubewell); RTU stores data, controls the operation of tubewell and transmits the data to remote computer	100	225000	NO.	22,500,000	225000
2.1	Each RTU specifications as under					
	- Input Out put as per requirement in our system					
	- 3 dedicated serial ports					
	- Digital inputs (optical isolation)					
	- Digital outputs					
	-Isolated Analog Inputs					
	-Local Display, membrane key board and data storage					
	-GSM Modem					
	-Electrical Measurement sensors					
3	Cabling, Erection and commissioning of the system without instrumentation	100	20000	Jobs	2,000,000	20000
4	Computer, Printer, UPS (Part of central monitoring station; can be used for monitoring of 20 or more tubewells)	100		Set	52,500	525
	TOTAL WITHOUT INSTRUMENTATION				24,927,500	249275

Tubewell Type B Instruments

	<i>OPTIONAL ITEMS - Extra</i>				
1	<i>Instrumentation system as under on per tube well basis for booster based system</i>	Qty	Rate	Unit	Amount
1.1	150 MM NB size high torque value actuators for remote operation of valves at tubewell discharge line (required only if user wants to operate the valve from remote location); required one number per each valve;	4	70000	No	280000
	<i>Actuators are required for remote operation of the valves; this actuators open the valve automatically once the pump ON command is given from remote;</i>				
1.2	150 mm NB size Eletcrco magnetic Flow Meter at disharge line of Tubewell with 0.5% accuracy	1	70000		70000
	<i>Flowmeters are installed on pipe for local and remote display of real time discharge of each tubewell; the value is available on central computer;</i>				
1.3	Water Table Transmitter	1	80000		80000
	<i>Water table transmitters are installed in the annular space of the tubewell for real time availability of the sub-soil water level for each tubewell on remote computer</i>				
1.4	Level Switch for operation of booster pumps	1	20000		20000
	Total				450000

Total cost i/c instrumentation :

$$100 \times \left(249275 + 450000 \right) = 69927500$$

Say Rs. 6.99 Crore

Tubewell Type A

Annexure B2

PROJECT : SCADA SYSTEM AT MCC FOR TYPICAL TUBEWELL Type A, MCC CHANDIGARH						
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES						
SN	DESCRIPTION	QTY.	Rate	UNIT	Amount for 100 tubewell	Value per tubewell basis
1	SCADA Software for monitoring of tubewells (considered for a block of 20 Tubewells); this software shall be installed on the central computer for remote monitoring	1	375000	NO.	375000	3750
2	Remote Terminal Unit (required one unit on each tubewell); RTU stores data, controls the operation of tubewell and transmits the data to remote computer	100	190000	NO.	19,000,000	190000
2.1	Each RTU specifications as under					
	- Input Out put as per requirement in our system					
	- 3 dedicated serial ports					
	- Digital inputs (optical isolation)					
	- Digital outputs					
	-Isolated Analog Inputs					
	-Local Display, membrane key board and data storage					
	-GSM Modem					
	-Electrical Measurement sensors					
3	Cabling, Erection and commissioning of the system without instrumentation	100	20000	Jobs	2,000,000	20000
4	Computer, Printer, UPS (Part of central monitoring station; can be used for monitoring of 20 or more tube wells)	100		Set	52,500	525
	TOTAL WITHOUT INSTRUMENTATION				21,427,500	214275

Tubewell Type A Instruments

	<i>OPTIONAL ITEMS - Extra</i>				
1	<i>Instrumentation system on per tubewell basis as under for non-booster system</i>	Qty	Rate	Unit	Remarks
1.1	150 MM NB size high torque valve actuators for remote operation of valves at tubewell discharge line (required only if user wants to operate the valve from remote location); required one number per each valve;	1	70000	No	70000
	<i>Actuators are required for remote operation of the valves; this actuators open the valve automatically once the pump ON command is given from remote;</i>				
1.2	150 mm NB size Eletcrco magnetic Flow Meter at disharge line of Tubewell with 0.5% accuracy	1	70000		70000
	<i>Flowmeters are installed on pipe for local and remote display of real time discharge of each tubewell; the value is available on central computer;</i>				
1.3	Water Table Transmitter	1	80000		80000
	<i>Water table transmitters are installed in the annular space of the tubewell for real time availability of the sub-soil water level for each tubewell on remote computer</i>				
	Total Instrumentation				220000

Total cost i/c instrumentation :

$$100 \times \left(214275 + 220000 \right) = 43427500$$

Say Rs. 4.34 Crore

Annexure B3

Bill of Materials Water works Augmentation Project

Water works Sector 39

PROJECT : SCADA SYSTEM AT MCC FOR WATER WORKS AT SECTOR-39					
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES					
SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 39 with following	1 Job		656100	656100
1.1	SCADA software development version with unlimited tags for central monitoring and control through wireless communication	1	USL		
1.2	Front End Processor to manage data traffic	1	NO.		
1.3	Epson/HP eq. A4 size color printer	1	NO.		
1.4	Wireless Communication System	1	NO.		
1.5	UPS of suitable capacity	1	NO.		
1a	Pentium IV COMPUTER with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make : HP / COMPAQ eq.)	1	NO.		150000
2	SCADA Panels for Water Works with following	54	NO.	97500	5265000
2.1	CIMCON make flowchart programmable RTU with local data storage 16 bit ADC suitable enclosure alongwith battery back up hooked on serial connectivity upto respective LCS				
	- Input Out put as per requirement in our system				
	- 3 serial port				
	- Digital inputs (optical isolation)				
	- Digital outputs				
	-Isolated Analog Inputs				
	-Local Display, membrane key board and data storage				
	-Serial Convertor				
	-Electrical Measurement sensors				
3	PART - II (INSTRUMENTATION)				
3.1	Flow Meter Insertion type with 2% error				

a	48" Size	1	NO.	486000	486000
b	46" Size	3	NO.	486000	1458000
c	40" Size	3	NO.	486000	1458000
d	30" Size	1	NO.	486000	486000
e	24"Size	1	NO.	486000	486000
3.2	Turbidity Meter	1	NO.	1090000	1090000
3.3	Motorised On/Off Actuator S/Valve				
a	40" Size	6	NO.	583000	3498000
b	24"Size	4	NO.	293000	1172000
c	20" Size	8	NO.	243000	1944000
d	18" Size	5	NO.	216000	1080000
e	16" Size	32	NO.	195000	6240000
f	14" Size	48	NO.	176000	8448000
g	12" Size	97	NO.	142000	13774000
h	8" Size	4	NO.	121000	484000
l	4" Size	56	NO.	105000	5880000
3.4	Level Transmitter for UGSR (0 to 5 Mtr)	6	NO.	152000	912000
3.5	Level Switch for Filter Beds (0 to 4 Mtrr)	28	NO.	33750	945000
4	CABLES / ACCESSORIES	Unit rated		L.S.	500000
5	SYSEM ERECTION AND COMMISSIONING				100000
6	SOFTWARE CUSTOMIZATION				750000
	TOTAL WITH INSTRUMENTATION AND SCADA for S-39				57412100
		Say Rs.5.74 Crore			

Water works Sector 37**Annexure B4**

PROJECT: SCADA SYSTEM AT MCC FOR WATER WORKS AT SECTOR-37					
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES					
SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 37 with following	1 job		Various	336100
1.1	SCADA software development version with unlimited tags for central monitoring and control through wireless communication	1	USL		
1.2	Front End Processor to manage data traffic	1	NO.		
1.3	Epson/HP eq. A4 size color printer	1	NO.		
1.4	Wireless Communication System	1	NO.		
1.5	UPS of suitable capacity	1	NO.		
1a	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make : HP / COMPAQ eq.)	1	NO.		50000
2	SCADA Panels for Water Works	2	NO.		316750
2.1	CIMCON make flowchart programmable RTU with local data storage 16 bit ADC suitable enclosure alongwith battery back up hooked on serial connectivity upto respective LCS				
	- Input Out put as per requirement in our system				
	- 3 serial port				
	- Digital inputs (optical isolation)				
	- Digital outputs				
	-Isolated Analog Inputs				
	-Local Display, membrane key board and data storage				
	-Serial Convertor				
	-Electrical Measurement sensors				
3	PART - II (INSTRUMENTATION)				
3.1	Flow Meter insertion type with 2% error				
a	40" Size	1	NO.	486000	486000
b	24"Size	4	NO.	486000	1944000

3.2	Motorised On/Off Actuator				
a	24"Size	1	NO.	293000	293000
b	20" Size	1	NO.	243000	243000
c	18" Size	3	NO.	216000	648000
d	16" Size	1	NO.	195000	195000
e	12" Size	4	NO.	176000	704000
3.3	Level Transmitter for UGSR (0 to 5 Mtr)	1	NO.	152000	152000
4	CABLES / ACCESSORIES (L.S.)				100000
5	SYSEM ERECTION AND COMMISSIONING				200000
6	SOFTWARE CUSTOMIZATION				75000
	TOTAL WITH INSTRUMENTATION AND SCADA for S-37				5667850
		Say Rs. 56.67 Lacs			

Water works Sector 32

Annexure B5

PROJECT : SCADA SYSTEM AT MCC FOR WATER WORKS AT SECTOR-32					
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES					
SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 32	1 job		Various	336100
1.1	SCADA software development version with unlimited tags for central monitoring and control through wireless communication	1	USL		
1.2	Front End Processor to manage data traffic	1	NO.		
1.3	Epson/HP eq. A4 size color printer	1	NO.		
1.4	Wireless Communication System	1	NO.		
1.5	UPS of suitable capacity	1	NO.		
1a	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make : HP / COMPAQ eq.)	1	NO.		50000
2	SCADA Panels for Water Works	2	NO.		316750
2.1	CIMCON make flowchart programmable RTU with local data storage 16 bit ADC suitable enclosure alongwith battery back up hooked on serial connectivity upto respective LCS				
	- Input Out put as per requirement in our system				
	- 3 serial port				
	- Digital inputs (optical isolation)				
	- Digital outputs				
	-Isolated Analog Inputs				
	-Local Display, membrane key board and data storage				
	-Serial Convertor				
	-Electrical Measurement sensors				
3	PART - II (INSTRUMENTATION)				
3.1	Flow Meter Insertion type with 2% error				
a	40" Size	1	NO.	486000	486000
b	24"Size	3	NO.	486000	1458000

c	18" Size	1	NO.	243000	243000
d	16" Size	1	NO.	243000	243000
3.2	Motorised On/Off Actuator				
a	24"Size	3	NO.	293000	879000
b	20" Size	3	NO.	243000	729000
c	10" Size	4	NO.	121000	484000
3.3	Level Transmitter for UGSR (0 to 5 Mtr)	1	NO.	152000	152000
4	CABLES / ACCESSORIES				100000
5	SYSEM ERECTION AND COMMISSIONING (L.S.)				200000
6	SOFTWARE CUSTOMIZATION (L.S.)				75000
	TOTAL WITH INSTRUMENTATION AND SCADA FOR S-32				5676850
		Say Rs. 56.76 Lacs			

Water works Sector 26

Annexure B6

PROJECT : SCADA SYSTEM AT MCC FOR WATER WORKS AT SECTOR-26					
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES					
SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 26	1 job			336100
1.1	SCADA software development version with unlimited tags for central monitoring and control through wireless communication	1	USL		
1.2	Front End Processor to manage data traffic	1	NO.		
1.3	Epson/HP eq. A4 size color printer	1	NO.		
1.4	Wireless Communication System	1	NO.		
1.5	UPS of suitable capacity	1	NO.		
1a	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make : HP / COMPAQ eq.)	1	NO.		50000
2	SCADA Panels for Water Works	2	NO.	LS	315000
2.1	CIMCON make flowchart programmable RTU with local data storage 16 bit ADC suitable enclosure alongwith battery back up hooked on serial connectivity upto respective LCS				
	- Input Out put as per requirement in our system				
	- 3 serial port				
	- Digital inputs (optical isolation)				
	- Digital outputs				
	-Isolated Analog Inputs				
	-Local Display, membrane key board and data storage				
	-Serial Convertor				
	-Electrical Measurement sensors				
3	PART - II (INSTRUMENTATION)				
3.1	Flow Meter				
a	24"Size	7	NO.	486000	3402000

b	18" Size	1	NO.	243000	243000
c	12" Size	1	NO.	243000	243000
3.2	Motorised On/Off Actuator				
a	12"Size	4	NO.	142000	568000
b	10" Size	2	NO.	152000	304000
c	8" Size	2	NO.	152000	304000
d	6" Size	1	NO.	145000	145000
3.3	Level Transmitter for UGSR (0 to 5 Mtr)	2	NO.	152000	152000
4	CABLES / ACCESSORIES (L.S.)				150000
5	SYSEM ERECTION AND COMMISSIONING (L.S.)				200000
6	SOFTWARE CUSTOMIZATION			-	75000
	Total with Instrumentation and SCADA for S-26	6487100			
				Say Rs.64.87 Lacs	

Water works Sector 12

Annexure B7

PROJECT : SCADA SYSTEM AT MCC FOR WATER WORKS AT SECTOR-12					
DOCUMENT : BUDGETORY PROPOSAL TECHNICAL SCHEDULE OF QUANTITIES					
SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 12 with following	1 Job			336100
1.1	SCADA software development version with unlimited tags for central monitoring and control through wireless communication	1	USL		
1.2	Front End Processor to manage data traffic	1	NO.		
1.3	Epson/HP eq. A4 size color printer	1	NO.		
1.4	Wireless Communication System	1	NO.		
1.5	UPS of suitable capacity	1	NO.		
1a	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make : HP / COMPAQ eq.)	1	NO.		50000
2	SCADA Panels for Water Works	4	NO.		630000
2.1	CIMCON make flowchart programmable RTU with local data storage 16 bit ADC suitable enclosure alongwith battery back up hooked on serial connectivity upto respective LCS				
	- Input Out put as per requirement in our system				
	- 3 serial port				
	- Digital inputs (optical isolation)				
	- Digital outputs				
	-Isolated Analog Inputs				
	-Local Display, membrane key board and data storage				
	-Serial Convertor				
	-Electrical Measurement sensors				
3	PART - II (INSTRUMENTATION)				
3.1	Flow Meter insertion type with 2% error				
a	24"Size	4	NO.	486000	1944000
3.2	Turbidity Meter	1	NO.	1090000	1090000
3.3	Motorised On/Off Actuator				
a	24"Size	2	NO.	583000	1166000

b	20" Size	1	NO.	243000	243000
c	18" Size	4	NO.	216000	864000
d	12" Size	8	NO.	142000	1136000
e	10" Size	6	NO.	122000	732000
f	8" Size	8	NO.	121000	968000
g	4" Size	6	NO.	105000	630000
3.4	Level Transmitter for UGSR (0 to 5 Mtr)	1	NO.	152000	152000
3.5	Level Switch for Filter Beds (0 to 4 Mtr)	3	NO.	33750	101250
4	CABLES / ACCESSORIES (L.S.)				150000
5	SYSTEM ERECTION AND COMMISSIONING (L.S.)				100000
6	SOFTWARE CUSTOMIZATION (L.S.)				125000
	TOTAL WITH INSTRUMENTATION AND SCADA FOR S-12				10417350
		Say Rs.1.04 Crore			

ANNEXURE B8

Water works, Kajauli.

SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT Kajauli	2 Job		336100	772200
1.1	Development version of SURVELLIANCE software with unlimited tags for remote monitoring and control.	2	USL		
1.2	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make: HP / COMPAQ eq.)	2	NO.		
1.3	Front End Processor as specified.	2	NO.		
1.4	Epson/HP eq. A4 size color printer	2	NO.		
1.5	Communication Hardware	2	NO.		
1.6	UPS of suitable capacity	2	NO.		
2	Filed Surveillance Hardware – The Intelligent Remote Terminal Unit – IRTU				160000
2.1	Intelligent GSM based IRTU with analog and digital parameters as features as specified to control, store and transmit data on GSM backbone to MCS, LCS and mobile sets. Following are some specification that will be provided in the IRTU offered.	2 job	NO.		316750
	- Minimum 16x2 line LCD display.				
	- Minimum 4x6 membrane keyboard.				
	- Programmable memory must be minimum 64K				
	- Data memory shall be minimum 64K				
	-RTU shall support Flowchart programming software.				
	-For analog input resolution is to be 16 bit or more				
	-Three Serial Communication ports per RTU.				
	(All the specification shall be complying with clause 2.4 of volume 2 of this tender.				
3	PART - II (INSTRUMENTATION)				
3.1	Ultra Sonic Insertion Type Flow Meter				
a	46"/48" Size	3	NO.	486000	1458000
b			NO.		
3.2	Motorized On/Off Actuator for following valves				
a	24"Size	4	NO.	293000	1172000
b	20" Size	6	NO.	243000	1458000
c	32"/40" Size	4	NO.	583000	2332000
d	16" Size	1	NO.	195000	195000
e	12" Size	4	NO.	142000	568000
3.3	Ultra Sonic Level Transmitter for UGSR (0 to 5 Mtr)	1	NO.		

4	Modification in all Existing MCC Electrical Panel Compatible with IRTU			L.S	200000
5	CABLES / ACCESSORIES	1 job	Per job	Rs.50000	50000
6	SYSEM ERECTION AND COMMISSIONING	1 job	Per job	Rs.100000	100000
7	SOFTWARE CUSTOMIZATION	1 job	Per job	Rs.75000	75000
				TOTAL	8856950

Say Rs.88.57 lacs

ANNEXURE B9***Mani Majra Phase I & II***

SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 26	2 job		336100	672200
1.1	Development version of SURVELLIANCE software with unlimited tags for remote monitoring and control for water sector 39.	1	USL		
1.2	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make: HP / COMPAQ eq.)	1	NO.		
1.3	Front End Processor as specified.	1	NO.		
1.4	Epson/HP eq. A4 size color printer	1	NO.		
1.5	Communication Hardware	1	NO.		
1.6	UPS of suitable capacity	1	NO.		
2	Filed Surveillance Hardware – The Intelligent Remote Terminal Unit – IRTU	1 job			315000
2.1	Intelligent GSM based IRTU with analog and digital parameters as features as specified to control, store and transmit data on GSM backbone to MCS, LCS and mobile sets. Following are some specification that will be provided in the IRTU offered.	2	NO.		
	- Minimum 16x2 line LCD display.				
	- Minimum 4x6 membrane keyboard.				
	- Programmable memory must be minimum 64K				
	- Data memory shall be minimum 64K				
	-RTU shall support Flowchart programming software.				
	-For analog input resolution is to be 16 bit or more				
	-Three Serial Communication ports per RTU.				
	(All the specification shall be complying with clause 2.4 of volume 2 of this tender.				
3	PART - II (INSTRUMENTATION)				
3.1	Ultra Sonic Insertion Type Flow Meter				
a	24"Size	2	NO.	486000	972000
b	18" Size	1	NO.	243000	243000
c	12" Size	1	NO.	243000	243000
3.2	Motorized On/Off Actuator for following valves				
a	12"Size	1	NO.	142000	142000
b	10" Size	1	NO.	122000	122000
c	8" Size	1	NO.	122000	122000

d	6" Size	3	NO.	122000	366000
3.3	Ultra Sonic Level Transmitter for UGSR (0 to 5 Mtr)	2	NO.	152000	304000
4	Modification in all Existing MCC Electrical Panel Compatible with IRTU	1 job	Per job	50000	50000
5	CABLES / ACCESSORIES	1 job	Per job	50000	50000
6	SYSEM ERECTION AND COMMISSIONING	1 job	Per job	75000	75000
7	SOFTWARE CUSTOMIZATION	1 job	Per job	75000	75000
				TOTAL	3751200

Say Rs. 37.51 Lacs

MES Sector- 39.

SN	DESCRIPTION	QTY.	UNIT	RATE	AMOUNT
1	LOCAL CONTROL STATION AT SECTOR 39 (MES)	1 job		336100	336100
1.1	Development version of SURVEILLANCE software with unlimited tags for remote monitoring and control for water sector 39.	1	USL		
1.2	Pentium IV Operating Station with 17" monitor, 40 GB HDD, 128 MB RAM, 52X CDR, 1.44 FDR, Key board, 2 serial and 1 parallel ports, mouse (Make: HP / COMPAQ eq.)	1	NO.		
1.3	Front End Processor as specified.	1	NO.		
1.4	Epson/HP eq. A4 size color printer	1	NO.		
1.5	Communication Hardware	1	NO.		
1.6	UPS of suitable capacity	1	NO.		
2	Filed Surveillance Hardware – The Intelligent Remote Terminal Unit – IRTU	1 job	Job	50000	50000
2.1	Intelligent GSM based IRTU with analog and digital parameters as features as specified to control, store and transmit data on GSM backbone to MCS, LCS and mobile sets. Following are some specification that should be provided in the IRTU offered. No deviation would be acceptable.	1 job	NO.		316750
	- Minimum 16x2 line LCD display.				
	- Minimum 4x6 membrane keyboard.				
	- Programmable memory must be minimum 64K				
	- Data memory shall be minimum 64K				
	-RTU shall support Flowchart programming software.				
	-For analog input resolution is to be 16 bit or more				
	-Three Serial Communication ports per RTU.				
	(All the specification shall be complying with clause 2.4 of volume 2 of this tender.				
3	PART - II (INSTRUMENTATION)				
3.1	Ultra Sonic Insertion Type Flow Meter				
a	24"Size	1	NO.	486000	486000
3.2		1	NO.		
3.3	Motorized On/Off Actuator for following valves				
a	24"Size	1	NO.	293000	293000
b	20" Size		NO.		
c	18" Size		NO.		
d	12" Size	4	NO.	142000	568000
e	10" Size	6	NO.		
f	8" Size		NO.		
g	4" Size		NO.		

3.4	Ultrasonic Level Transmitter for UGSR (0 to 5 Mtr)	1	NO.	152000	152000
4	Modification in all Existing MCC Electrical Panel Compatible with IRTU	1 JOB	JOB	50000	50000
5	CABLES / ACCESSORIES	1 JOB	Job	20000	20000
6	SYSEM ERECTION AND COMMISSIONING	1 job	Job	50000	50000
7	SOFTWARE CUSTOMIZATION	1 job	Job		75000
				TOTAL	2396850

Say Rs. 23.97 Lacs

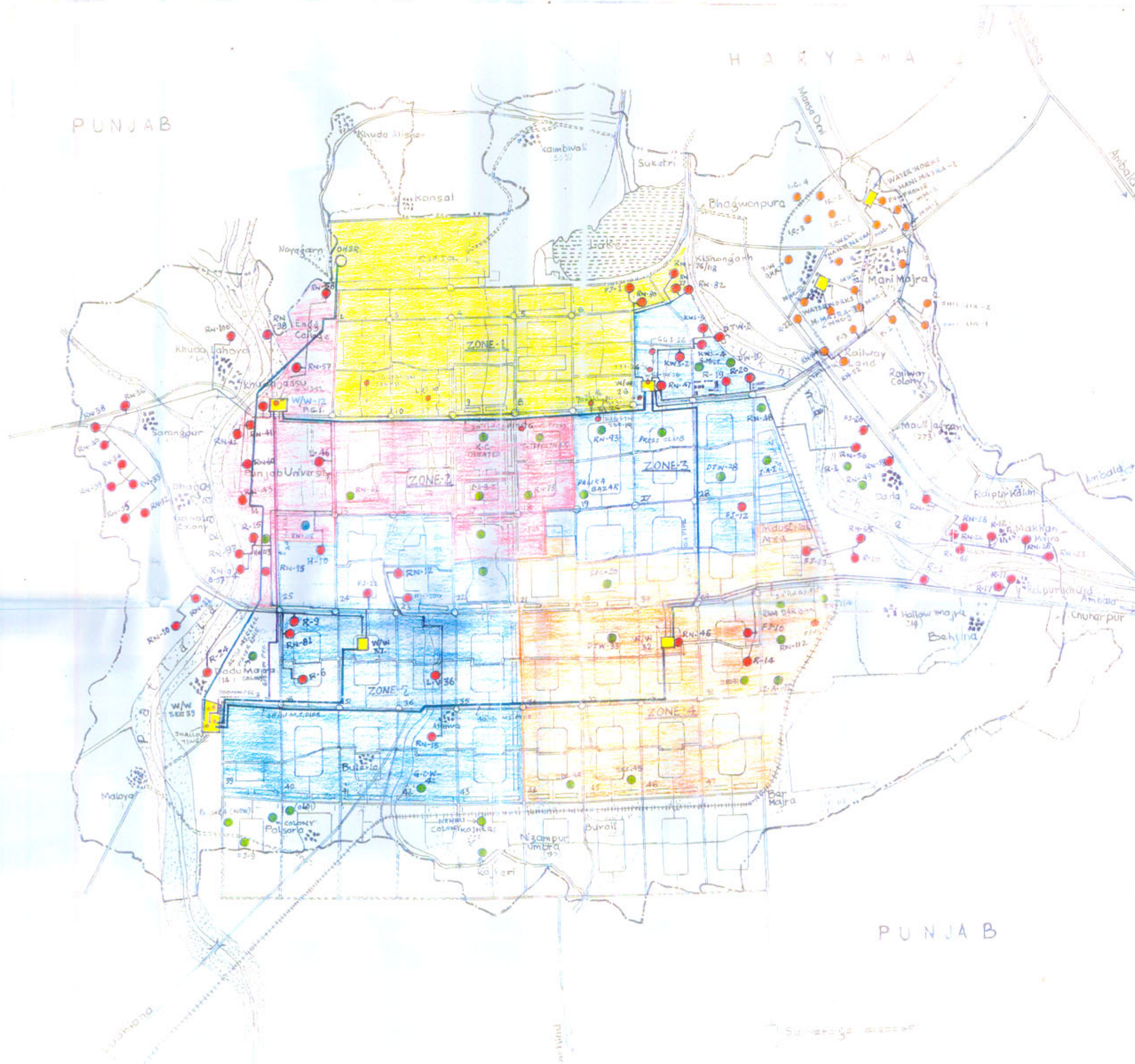
CHANDIGARH

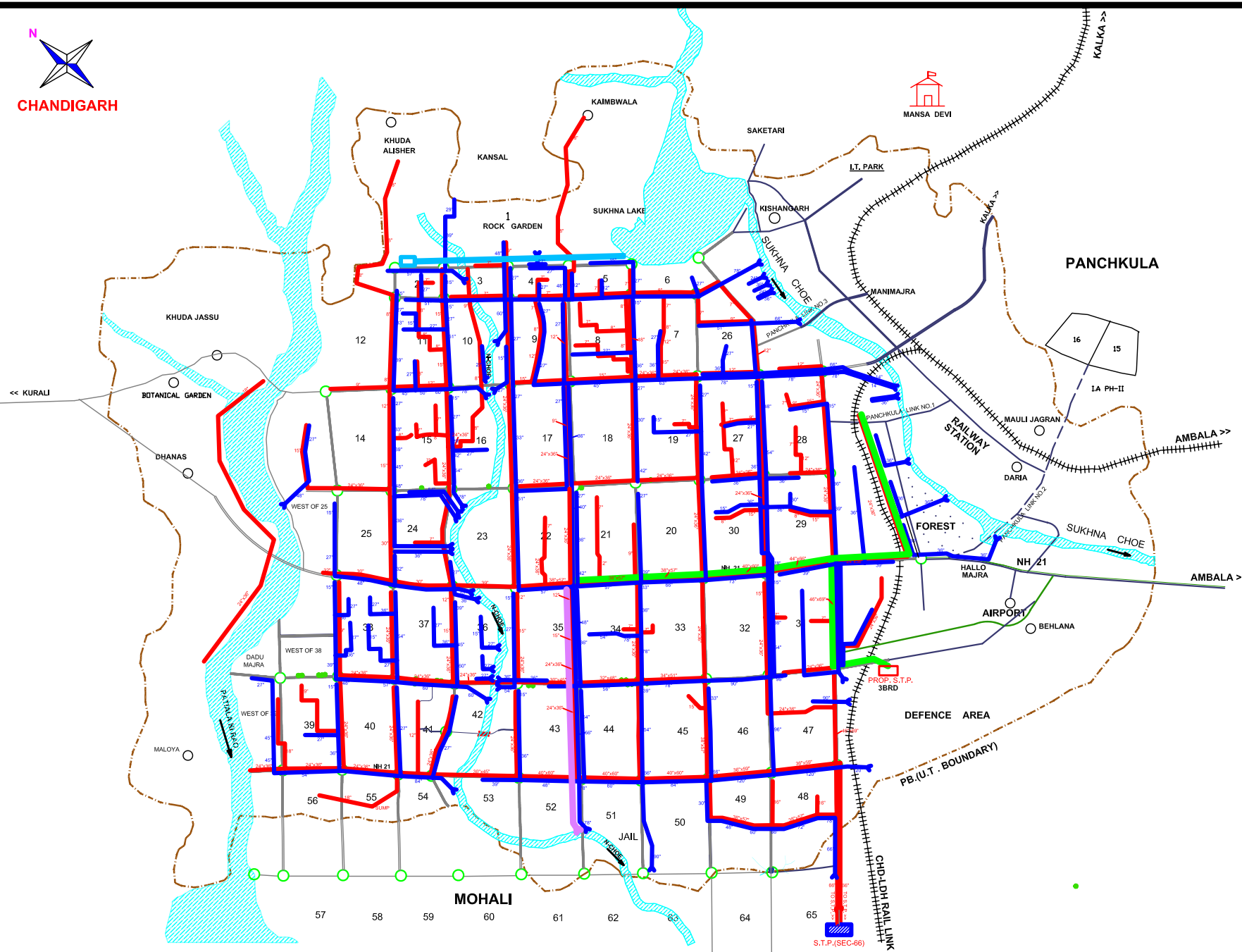


REF:-

1. WATER WORKS.
2. TUBEWELLS CONNECTED WITH W/WORKS.
3. TUBEWELLS CONNECTED DIRECTLY WITH CITY.
4. RISING MAINS CARRYING WATER FROM WATER WORKS TO WATER WORKS.
5. RISING MAIN CARRYING WATER FROM TUBEWELLS TO WATER WORKS.
6. RISING MAIN CARRYING RAW WATER.
7. TUBEWELLS SUPPLYING WATER TO HOUSES.

GUIDE MAP
U.T. CHANDIGARH





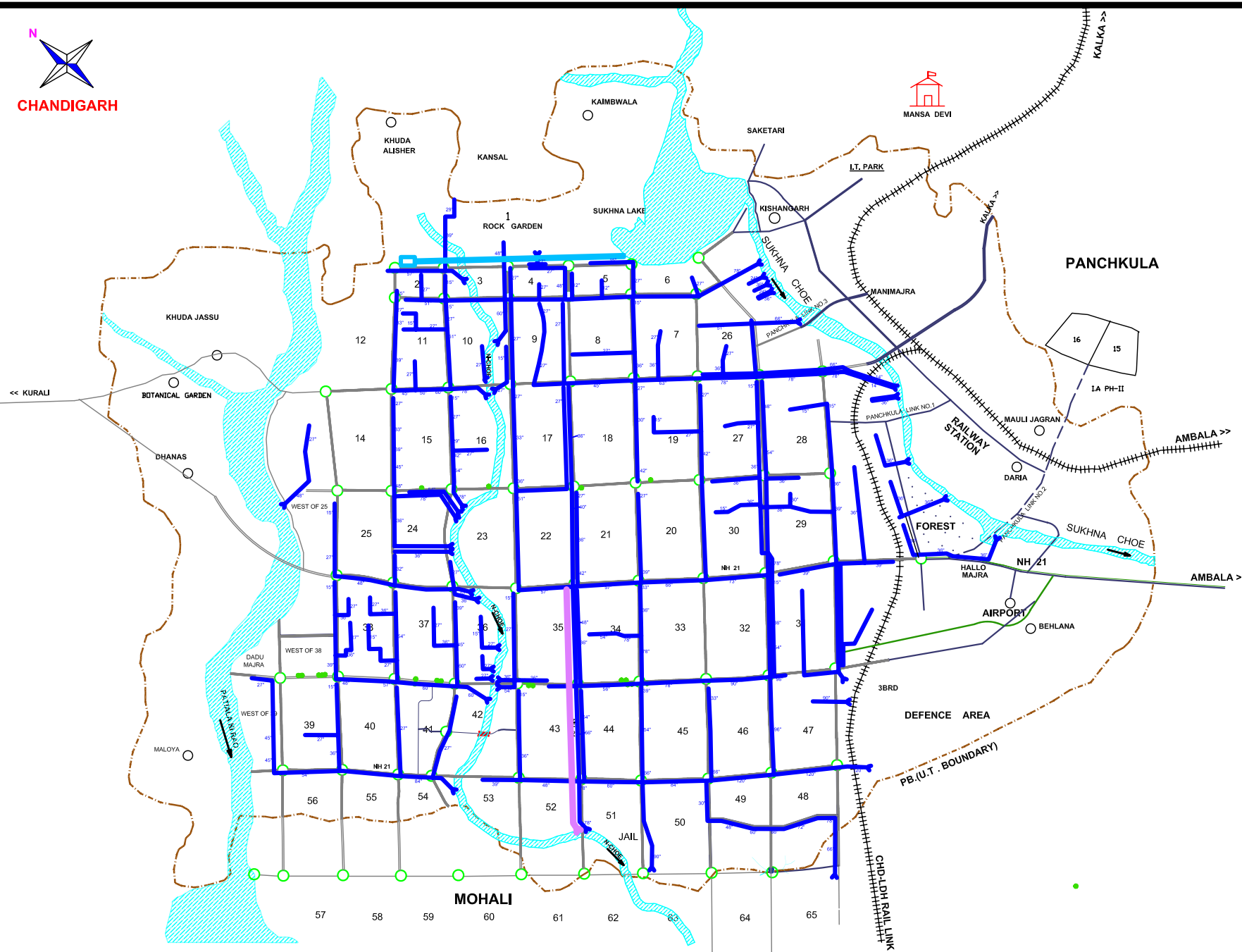
PLAN SHOWING OF SEWERAGE
&
STORM WATER DRAINAGE SYSTEM
FOR CHANDIGARH TOWN

LEGEND		
1	EXISTING METALLED ROAD	
2	EXISTING CHOWK	
3	EXISTING RAILWAY LINE	
4	CHANDIGARH BOUNDARY	
5	CHOE	
6	EXISTING SEWER LINE	
7	EXISTING S.W. DRAINAGE LINE	
8	EXISTING TAIL ENDS	
9	PROPOSED SEWER LINE	
10	PROPOSED S.W. DRAINAGE LINE	
11	PROPOSED CHANNEL LINE	

PLAN SHOWING OF SEWERAGE
&
STORM WATER DRAINAGE SYSTEM
FOR CHANDIGARH TOWN

MUNICIPAL CORPORATION,
PUBLIC HEALTH DIVISION NO.4
CHANDIGARH





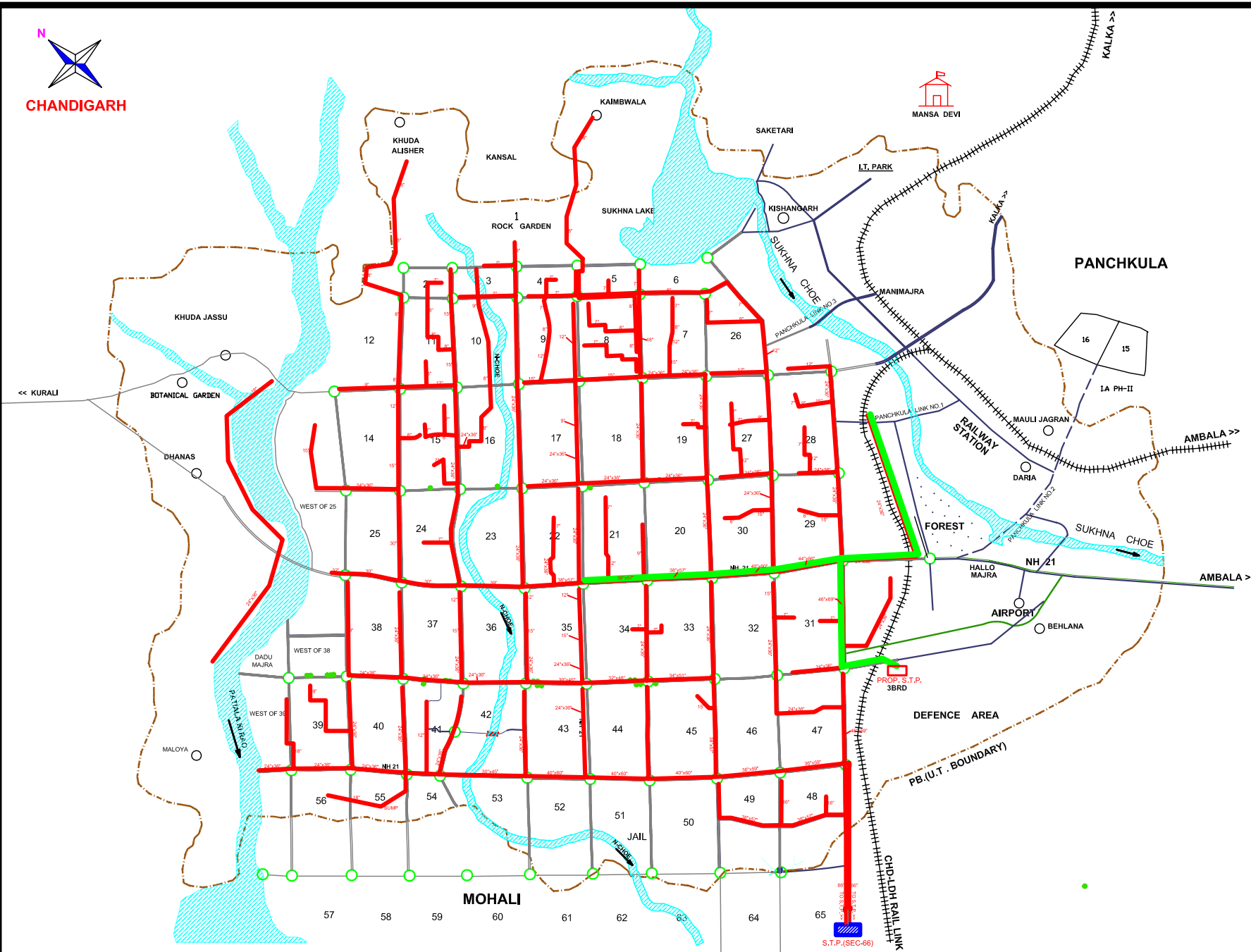
PLAN SHOWING OF STORM WATER
DRAINAGE SYSTEM
FOR CHANDIGARH TOWN

LEGEND		
1	EXISTING METALLED ROAD	
2	EXISTING CHOWK	
3	EXISTING RAILWAY LINE	
4	CHANDIGARH BOUNDARY	
5	CHOE	
6	EXISTING S.W. DRAINAGE LINE	
7	EXISTING TAIL ENDS	
8	PROPOSED S.W. DRAINAGE LINE	
9	PROPOSED CHANNEL LINE	

PLAN SHOWING OF STORM WATER
DRAINAGE SYSTEM
FOR CHANDIGARH TOWN

MUNICIPAL CORPORATION,
PUBLIC HEALTH DIVISION NO.4
CHANDIGARH





PLAN SHOWING OF SEWERAGE SYSTEM FOR CHANDIGARH TOWN

LEGEND

1	EXISTNG METALLED ROAD	
2	EXISTING CHOWK	
3	EXISTING RAILWAY LINE	
4	CHANDIGARH BOUNDARY	
5	CHOE	
6	EXISTING SEWER LINE	
7	EXISTNG TAIL ENDS	
8	PROPOSED SEWER LINE	

PLAN SHOWING OF SEWERAGE SYSTEM FOR CHANDIGARH TOWN

MUNICIPAL CORPORATION, PUBLIC HEALTH DIVISION NO.4 CHANDIGARH