

## Section 4

# City Assessment

### 4.1 PHYSICAL CHARACTERISTICS OF DEVELOPMENT

The urban dynamics of the various urban centres of Sikkim has been studied in the previous chapter wherein 11% of the total State population inhabits the nine urban centres. Since connectivity and accessibility is the bottom line for growth to take place, urban development in Sikkim has taken place along the main roads. All the urban centres exhibit ribbon development, i.e. linear growth pattern.



**Aerial View of Central Business District, Gangtok**

The regional imbalances in the population growth pattern have led Gangtok to emerge as the city of sole importance in Sikkim. Of the total urban population of Sikkim, Gangtok Notified Town Area has a share of 55.5%. Including Gangtok, East District has a share of 88% of the total urban population. Therefore the urban services are under pressure, intensified by the lack of availability of suitable land for infrastructure development.

Gangtok, the State capital exhibits a similar form of development, where growth has been accelerated as a response to increased economic opportunities. The primary growth axis for Gangtok is towards the South and South west direction, along the NH 31A on the

Selep-Ranipul axis. The terrain in this axis is relatively more favorable; and accessibility is enabled by the NH 31A. The urban fringe areas like Deorali, Tadong and Ranipul are the areas facing increasing pressure on land development. There are also several settlements growing along and off the Indira bypass and on the eastern slope from Chandmari to Syari.

The existence of steep slopes, vulnerability to landslides, large forest cover and inadequate access to most areas has been a major impediment to the natural and balanced growth of the city.

The existing physical pattern has been dictated primarily by availability of land that is safe with respect to stability. Intervention in planning at this stage is required to reverse this trend and not allow concentration towards south and southwest directions alone. Keeping in view, the development constraints like landform, topographical features, watercourses, drains, ecology and growth propensity, the future direction of growth needs to be spread over a larger area. Under developed areas within the notified city area need to be opened up for development so that the pressure in these densely populated areas is alleviated. Areas below Indira Bypass and the surrounding revenue blocks, Siyari, Tahtnagchen and Chandmari, Bojhoghari are areas that have a potential to absorb some of the growth momentum in Gangtok.



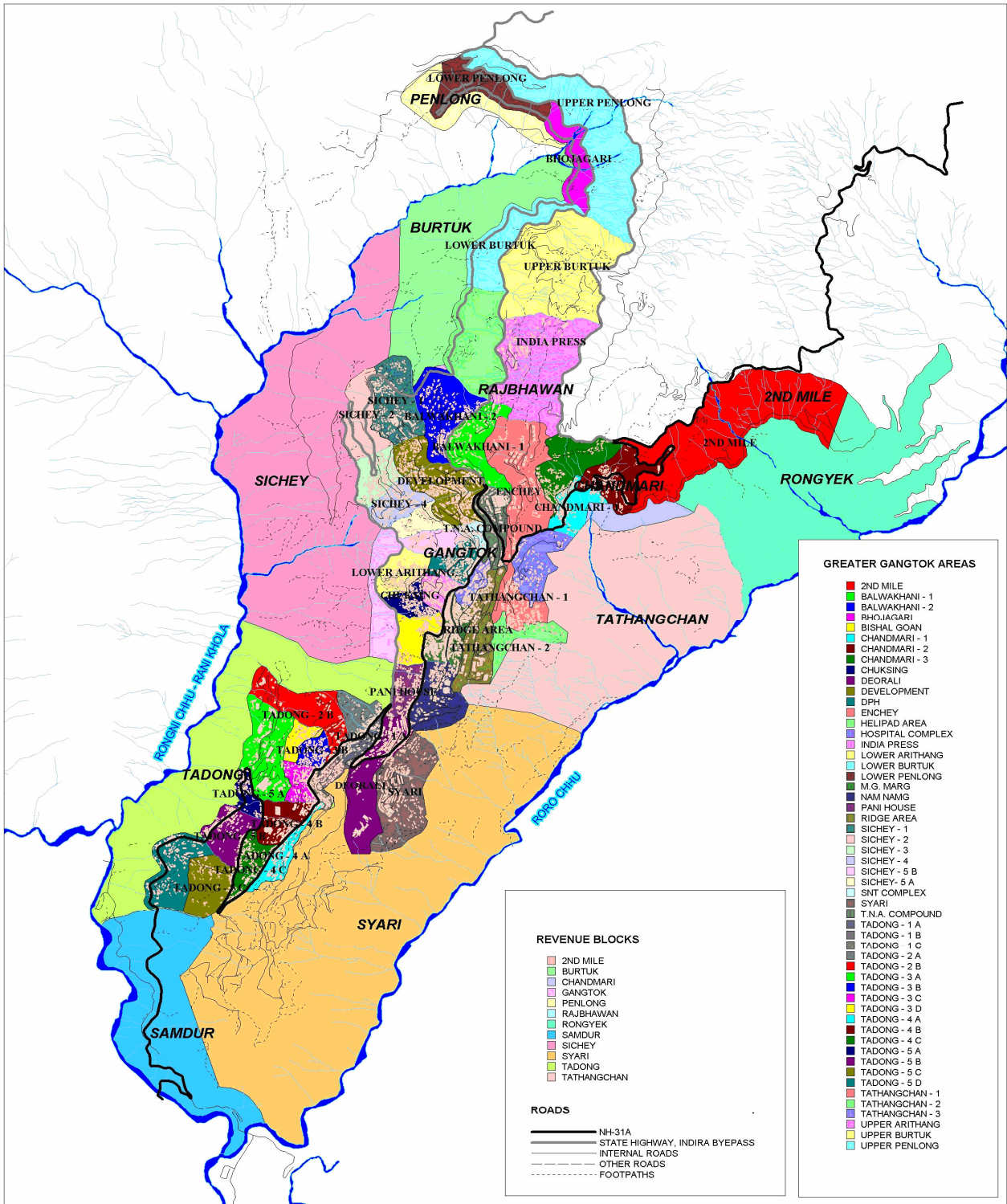
Aerial View of Gangtok City



Aerial View of Gangtok City



Aerial View of Deorali, Gangtok



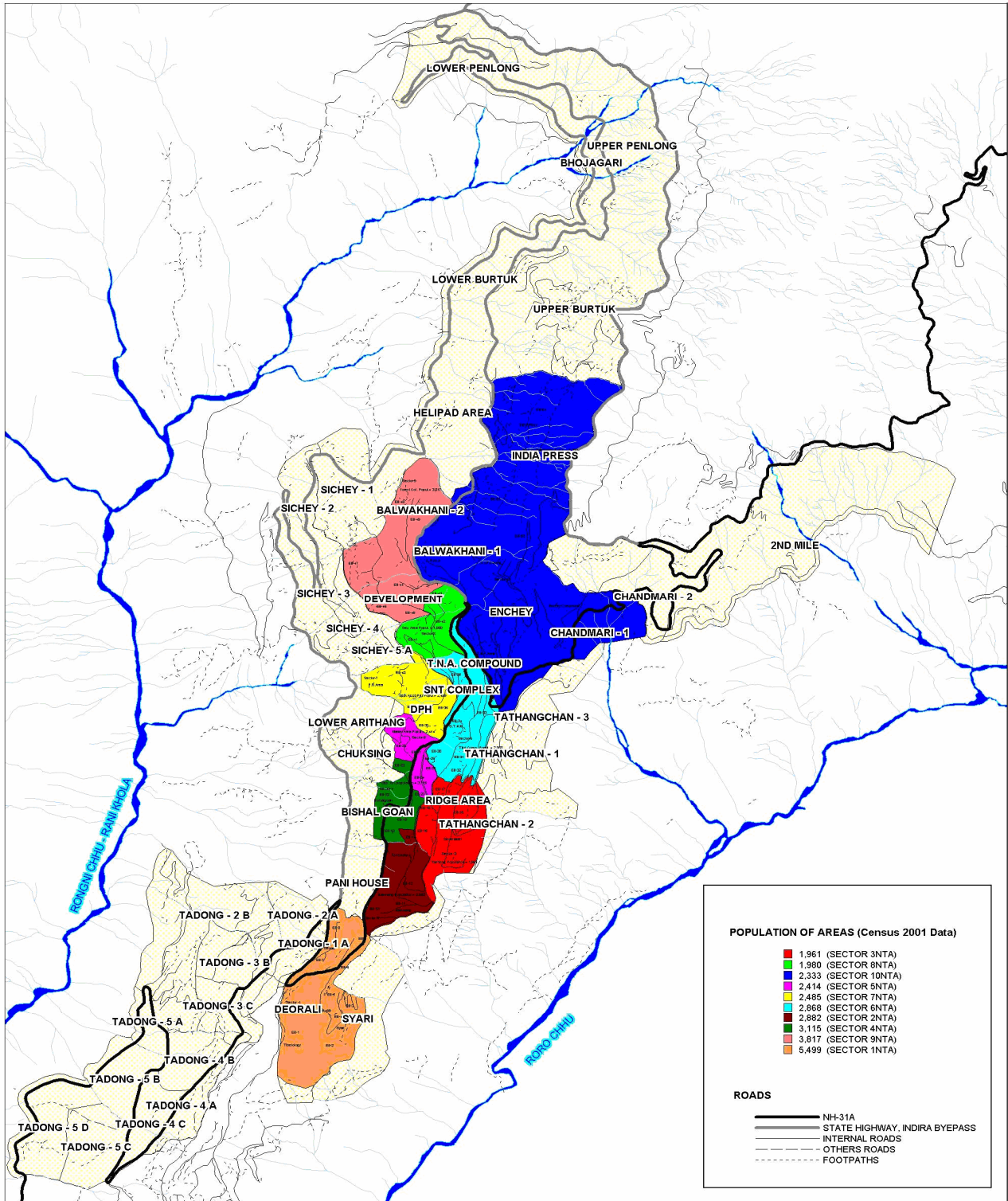
Print: 25/10/2005



GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD

# Map No.1: Gangtok Base Map

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GOVERNMENT OF SIKKIM

Courtesy: Town Planning Cell, UD&HD



## Map No.2: Census Town

## 4.2 EXISTING LAND USE PATTERN

Since the guiding factor for the development is accessibility and availability of suitable land profile, ideally planned urban areas in its true sense have not emerged in Gangtok. Gangtok's growth as a response to accessibility in the absence of proper planning intervention has been organic. This has resulted in a mixed land use pattern where no specific activity has been earmarked. *Gangtok Integrated Development Plan 2000* by GILCON, 1987 was planned for an area of 725 Hectares. Of this 725 Hectares, 70% of the area has already been covered while the remaining area comprises of vacant land, Jhoras, cultivation areas and areas under tree cover. Although no particular area is designated for industrial use, it is to be understood that service industry is an integral part of commercial areas.

The existing land use pattern of Gangtok is as follows:

- |     |                       |   |     |
|-----|-----------------------|---|-----|
| (a) | Residential           | - | 43% |
| (b) | Commercial            | - | 04% |
| (c) | Public and Semipublic | - | 15% |
| (d) | Roads                 | - | 19% |

(Source: NERUDP, Final Report, 2006)

Table 4.1: Land-use Changes 1975-95

S.No.	Land use (Ha)	Year			Percentage Growth 1975 - 85	Percentage Growth 1985 - 95
		1975	1985	1995		
1	Residential	119.5	132	225	10.5	70.5
2	Commercial	12.5	15.3	21	24.5	37.3
3	Industrial	1	4.1	19	24.5	37.3
4	Public & Semi Public	24.5	29.4	48	20	63
5	Recreational	2	17.5	41	775	134
6	Transport	23	42.5	100	85	135
	Total Developed	192.5	240.8	454	26	90
7	Cultivation	-	48.5	-	-	-
8	Undeveloped Area	58	85.5	-	-	-
9	Vacant	-	50.5	-	-	-
	Grand Total	240.5	425.3	-	-	-

Source: NEURDP, ADB Report, 2006

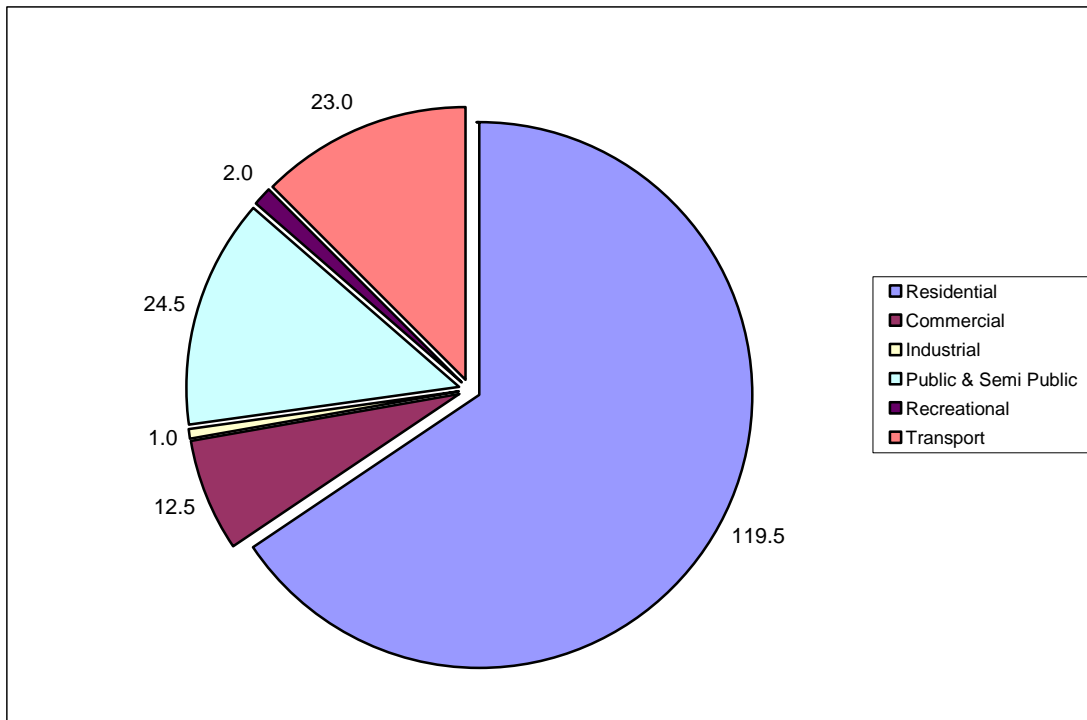


Figure 4.1: Land-use Distribution in 1975

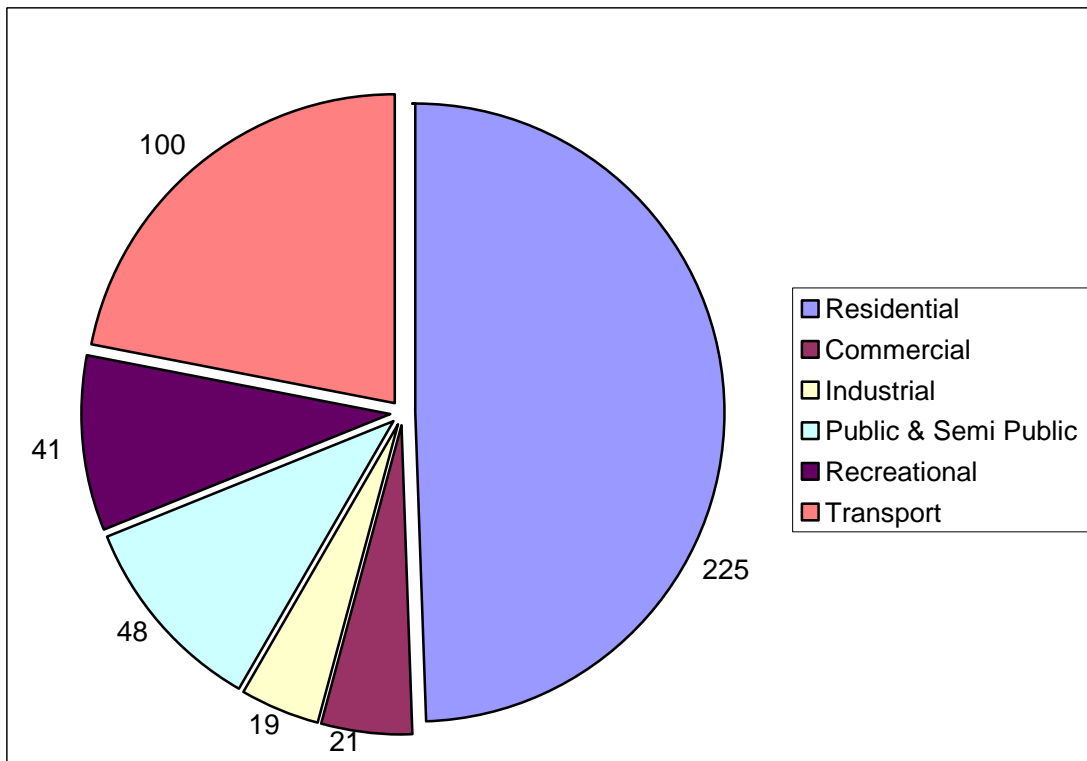
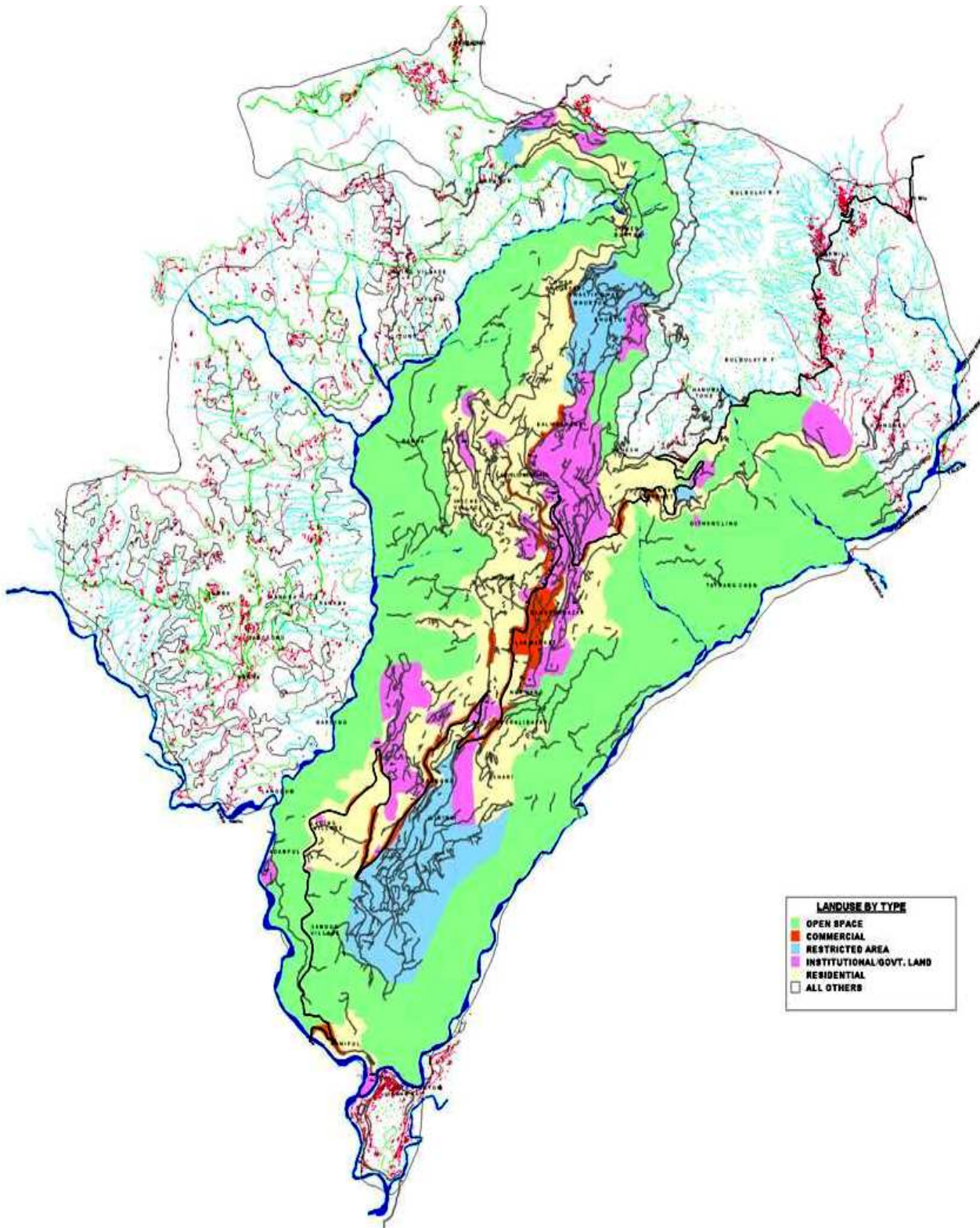


Figure 4.2: Land-use Distribution in 1995



GOVERNMENT OF SIKKIM  
Courtesy: Town Planning Cell, UD&HD

## Map No. 3: Existing Land Use Map of Gangtok



### 4.3 SITUATIONAL ANALYSIS

#### 4.3.1 General

According to census data, the urban population of Gangtok was 29,354 in 2001. However, the unofficial estimated population (UD&HD estimates) of Gangtok urban agglomeration including 16 surrounding revenue villages is between 1,20,000 to 1,50,000 as on today. Gangtok Notified Area at present houses 55.5% of the urban population of Sikkim (Census 2001). The quality of life, the pace of development and availability of basic infrastructure and employment prospects has been the major cause for rapid rural urban migration. This may be attributed to disparities in the regional development pattern. Due to the rapid increase of population in a limited area, the urban services are subjected to a great deal of pressure in Gangtok. RITES had prepared master plan for Gangtok in 1997 and their projection of population is as follows:

Table 4.2: Projected Population of Gangtok

Methods	2000	2010	2020
Linear Growth	106746	170794	239000
Geometric	102281	143193	191879
Exponential	103526	154254	206700
Conversion	<b>107297</b>	<b>183346</b>	<b>313296</b>
% of Urban Share	86578	124892	166567
Average Growth (%)	68.00	48.00	35.00

Source: RITES Report, 1997-98

#### 4.3.2 The Political, Social and Cultural Milieu of Gangtok

- The inhabitants of Gangtok are a mix of Buddhists, Hindus (of Nepali origin), Marwaris (the trading class from Rajasthan) and migrants comprising mainly of Biharis and Bengalis.
- The citizens are basically peace loving, law abiding and disciplined. The literacy rate at 69.7 % is quite high with women having literacy rate of 61.5 %. Education in Government schools is free and most parents send their children to school.
- With Government as the single largest employer in Gangtok, the economic status of most inhabitants is good and one does not come across poor or slums as seen in other large cities of India. Primarily, it is the migrants and other workers from outside the city who try not to invest in the infrastructure of their local home and live in poorly maintained and poorly serviced rented accommodation. These are the areas where the urban services need to improve.

- The environmental consciousness in Sikkim is high. Both the political leadership and the citizens realise the need for eco-conservation and have been proactive in this regard.
- Sikkim is one of the few states in India where plastics have been banned. Vehicular traffic is not allowed in M.G. Marg (the main shopping area of Gangtok) in the evenings. Recently, the M.G. Marg was declared as a Litter Free and Spit free Zone through the initiatives of the GWSSP.
- The citizens taken individually are highly sensitive to greenery, flowers and plants and it is not uncommon to see numerous pot plants in rooftop greenhouses on various houses. The surroundings of the city are green and the Forest Conservation Act is strictly enforced however, the greenery and horticulture maintenance of public areas in Gangtok leaves much to be desired.

#### 4.3.3 Challenges of Providing Urban Services in Gangtok

1. Greater Gangtok comprises of the Notified Town Area and surrounding rural areas that have slowly become urban colonies of Gangtok, though they continue to be classified as rural area and are administered through the Panchayati Raj system.
2. Gangtok is a town bursting at its seams with construction activity going on at every conceivable piece of open land. Although the UDHD has tried to regulate the growth, the high land prices and the lure of quick returns coupled with lack of a long-term town planning has resulted in short term and ad hoc decisions being taken.
3. Gangtok is not administered by a municipality but directly by the various departments of GOS, particularly the Urban Development and Housing Department (UDHD) and Public Health Engineering Department (PHED). The UDHD does not provide many of its urban services to the outlying areas as they are technically rural. Similarly, with limited budgets UDHD is unable to cope with increasing demand of services from the citizens. Elections to the ULB will be held in Early 2007.
4. Due to population pressure in Gangtok, which has outstripped the available pace of service delivery of the UDHD and the PHED, a considerable amount of their time is spent in crisis management.
5. Similarly, the building bye-laws need to be strengthened and updated to provide for sufficient open spaces, parking facilities and right of way for general public so that the buildings come up in a planned and proper method.
6. The roads of Gangtok city are in a poor condition and require urgent resurfacing and repairs. Traffic and its control is also of growing concern in the

city. Vehicular traffic is already straining the road carrying capacity, resulting in choking of roads and air and noise pollution. There is urgent need for traffic flow studies and actions to regulate/divert the traffic to reduce the current congestion. Problems of parking are already acute and innovative solutions are called for.

7. A large percentage of houses in Gangtok are located on slopes and not connected by motorable roads. Such houses can be accessed only through footpaths and stairways, which make providing services even more difficult.
8. Another problem of planning and providing services is the lack of unique house numbering in Gangtok. With houses on slopes and not on roads, it is very difficult to know the exact number of dwelling units, number of residents in an area etc. This makes planning, tracking the status of services and revenue collection very difficult.
9. Due to rapid expansion of population, the water distribution system has grown in a haphazard manner and hence many citizens complain of lack of enough pressure. This results in tail-enders moving their tapping of connections higher up the mains. This is one of the causes of ungainly and long spaghetti like pipes seen all over the city. There is an immediate need to have a total relook in the distribution network.
10. There is a dearth of land for infrastructure development, especially in Gangtok. Therefore, there is a dearth of social and cultural facilities like parks and play fields, clubs, community halls, and other leisure and entertainment facilities that are essential for its citizens.
11. The nature of our terrain is hostile and faces an ecological problem from its water ways that carry surface water. These natural drains or *jhoras* are potential for natural calamity to take place. These waterways are steadily being encroached upon alongside the increase in the volume of surface runoff of water. Intervention in formalizing these waterways is required.
12. Household drains and storm water drains are inadequate. During heavy downpour, the roads turn into rivers where water from the storm drains flood onto the roads.
13. Gangtok's stature has also made it the main tourist hub and transit centre for all tourism related activities. During the year 2003, Gangtok recorded an inflow of nearly 2,00,000 tourists. This adds to the additional burden on Gangtok's already overstrained infrastructure.
14. The opening of trade route through Nathula to the TAR of China, after a gap of 44 years has also emerged as a potential trading hub to mainland India and South Asia. Hence the economic and growth prospects for the city of Gangtok are immense.

#### 4.3.4 Area Specific Situations

An assessment of the areas within the NTA - Gangtok with regards to physical features and status of infrastructure had been carried out. The details have been studied for getting an impression of the built environment of the various localities within the city area.

##### i. Pani House

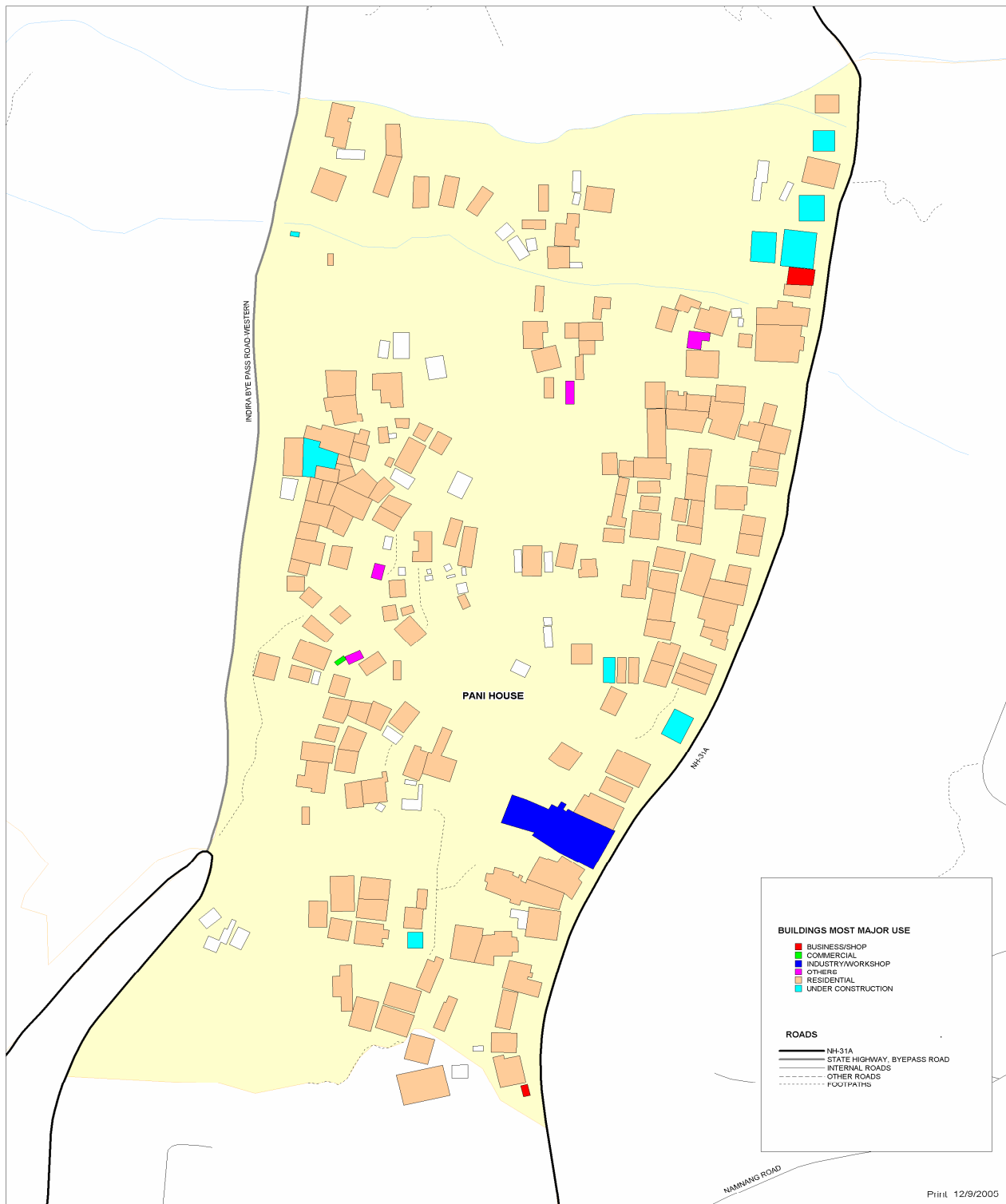
Located along the National Highway, this area is characterized by steep slopes. This locality is primarily a residential area, however, having the presence of a large number of hotels that have sprung up along the National highway. Commercial buildings and buildings of public uses are not present in this area (**Refer Map no.4: Pani House Building Information**). The drinking water facilities are provided by PHED. Garbage collection facility is provided only to the buildings located along the national highway, and the collection covers 25% of the total existing ones. Most houses in Pani House Area have septic tanks, while those along the lower reaches have been able to avail of the disposing their waste in the sewer line that runs along the Indira Bypass.

##### ii. Arithang

This area is a suburb of Gangtok. Due to its close proximity to the core urban area, a large number of commercial buildings are emerging especially along the roads. Primarily, the area is residential in nature. However, due to its locational advantage, there is a high incidence of rental housing, to the tune of 86% (**Refer Map no.5: Arithang Area Building Information**). Drinking water is provided by the PHED, RM&DD and some kutcha houses depend on spring sources. There are slums located in Arithang and the buildings types are characterized by a mixed type comprising mostly of RCC buildings as well as semi pucca types. Collection of Garbage along the roads is carried out by the UDHD while the rest of the area is covered by a CBO called United Arithang Development Society, an organization that was born during the presence of AusAID in Gangtok.

##### iii. Development Area

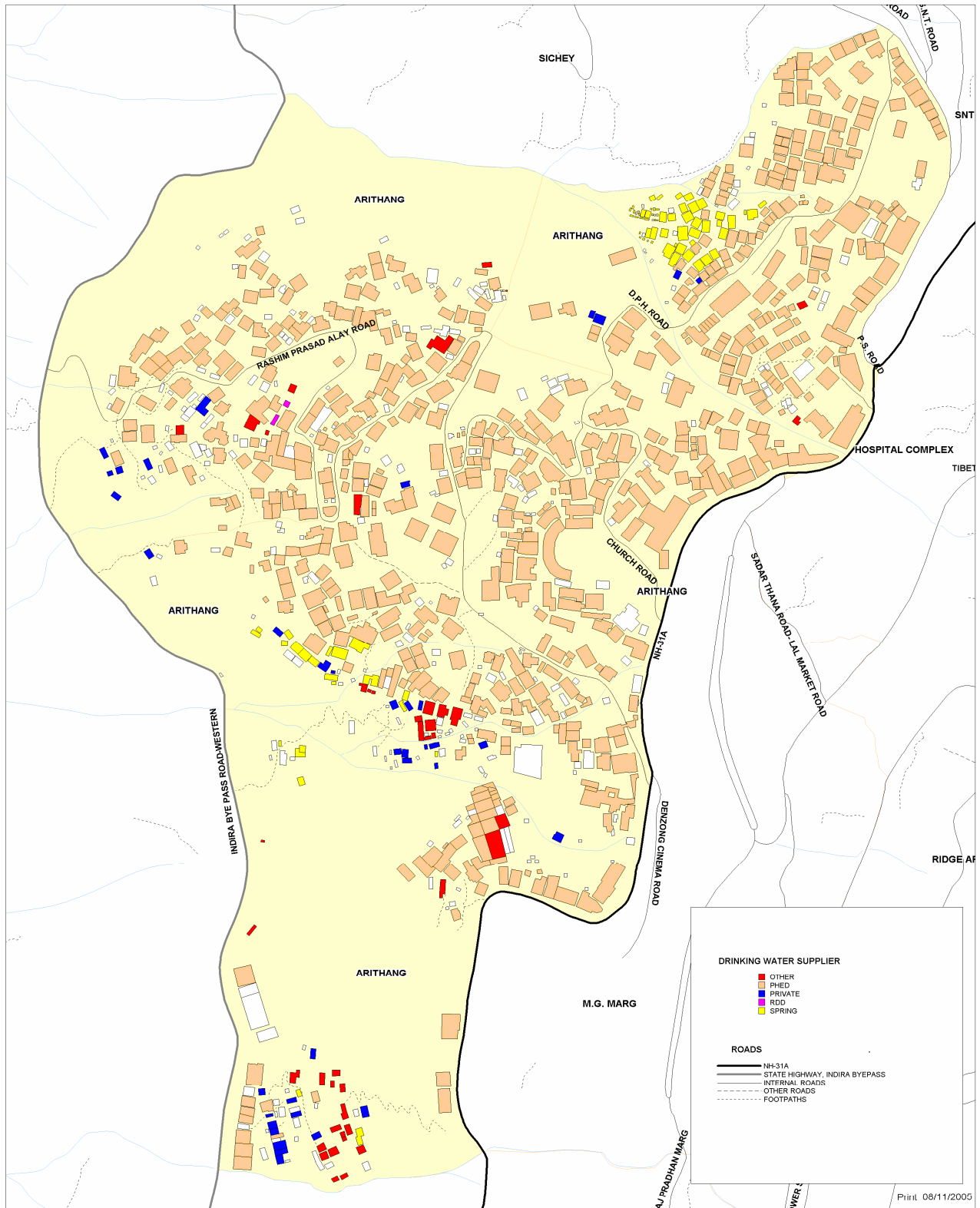
Within the city, Development Area as the very name suggests is the most developed area. There are residential, commercial, public and semi public use buildings. Banks, offices of FCI, NEDFI, PHED, PWD, Schools, Hostel, Center for blind, clinic and Himalayan Nursery are just few to name. The existing buildings have an average of 4-5 floors and maximum number goes upto 7. Nearly 70% of the construction is of RCC, 20% from wood and remaining 10% is of bamboo. Major water supply is through PHED but some connections are private. 70% of the area is served with garbage collection system.



GOVERNMENT OF SIKKIM  
Courtesy: Town Planning Cell, UD&HD



## Map No.4: Pani House Building Information



GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD



# Map No. 5: Arithang Building Area Information



**iv. Enchey Area**

This area is located in the upper reaches of Gangtok and is mainly an institutional area. It is characterised by the presence of Enchey School and the oldest monastery in Gangtok, Enchey Gumpa. Hostels, monastic hostel, schools, water supply substation, water supply tanks and some residential buildings are situated in this area. Drinking water is supplied by PHED, and only 50% of the buildings are provided with facility of garbage collection.

A large number of pilgrims congregate in this monastery on a daily basis. Due to the presence of VIP colony nearby, this entire belt generates a large volume of traffic and requires immediate intervention for creating a parking lot for the VIP colony and monastery bound traffic.

The zonal water reservoir is another important landmark of Enchey Area. This area needs intervention with regard to security for securing the quality of water.

**v. Syari**

Syari is primarily a residential area, and sits on the eastern side of the ridge. This area is characterized by the presence of a large number of State and Central Government employee housing. There are also a few buildings of public and semi public use. Health Centers, IT Education Center, NGO Offices, Rashtriya Gramin Vikas Office, Government schools, Teesta Urja Office and the Hotel Royal Plaza are some of the few institutional and commercial buildings in the area. There are not many commercial buildings in Syari. The presence of the residential colony generates a huge volume of traffic. The main bottleneck is the Deorali junction from where the traffic enters Syari. This junction needs a serious re-look in terms of design modification and improvement etc. There is even a lack of organized public open space. Most buildings have been provided drinking water facility by the PHED, while the rest rely on private or spring sources for their water supply. All the houses here have septic tanks since there is no sewer connection on this part of Gangtok. 70% of the area is covered by the UDHD's garbage collection system and rest of the houses dispose their garbage in the jhoras.

**vi. Balwakhani**

This area comprises of residential, public, semi public and commercial use buildings. Offices of CPWD, LIC, Forest Department, Metrological, State Lottery, Telecom and State legal office are located in this area. There is power substation and generator room, but this area does not have any private school, hence lacks the facility as well as organized business units. Nearly 75% buildings are Pucca and the remaining 25% buildings are made of wood. Water is supplied by the PHED and very few dwellings use springs as their water source. Garbage is collected only along the roads, while the rest of the area uses streets and Jhoras to dispose off their garbage.

**vii. Tathangchen**

This area is ecologically fragile. A large number of drainage and landslip protection work will have to be carried out in order to protect the soil cover. This area also sits on the eastern side of Gangtok. The area comprises of buildings of mix use, residential buildings being the predominant type. There are schools, offices such as District Institute of Education and training, Gram Panchayat, Administration center, Green Houses, Power Station and water storage tank in this area. Water is supplied by the PHED, RM&DD and some houses rely on spring sources. Only 10% area is served with garbage collection system along the approach road while the rest of the people use jhoras and streets for disposal of their garbage. All the houses have septic tanks since there is no sewer connection in this area.

**viii. India Press**

Residential, Industrial work sheds, offices, Press office, Guest house and public utility buildings as water tanks and generator house are situated in this area. Water supply is provided by PHED and few houses use springs as source of water. Garbage is collected from only 40% of area and 60% of area is being served by Jhoras for disposal of Garbage. Septic tanks are used for the disposal of sewage by all households in this area.

**ix. Chandmari**

There are building of various uses such as residential, public and semi public in this area. Green houses, Schools, ICDS School, monastery, BSNL office are some of the public facilities available in Chandmari. Water is supplied by the PHED, RM&DD and few private sources. 30% of the area, i.e. along the roads is covered by the garbage collection system. Rest of the houses dispose their garbage on the streets, natural slopes and jhoras. All the houses have septic tanks since there is no sewer connection in this area.

**x. M.G. Marg and Tibet Road and Kazi Road**

This area is the core business district of Gangtok NTA. This is a major hub for the tourists and most employment is in the service ere are buildings for residential, commercial, public and semi public use. Several office buildings such as Birth & Death Registration Office, CA office DIC, Education center, Health Center, LIC office, Police Station, State Excise office, tourism office, vigilance office and banks are located in this locality. The buildings are pucca and semi pucca in nature (**Refer Map no.6: M.G Marg & its Environs**). Water supply is through PHED and 90% buildings have access to the garbage disposal system. 90% of the houses are connected to the sewer line that runs through the entire locality. The drains following behind M.G. Marg are clogged due to unauthorized construction. The drain of the entire M.G. Marg required repairing & cleaning and may be identified as a project by itself.

**xi. Deorali**

Deorali is fast emerging to be a commercial and institutional hub of Gangtok. There are many business enterprises apart from institutional buildings. The Deorali Girls Senior



Secondary School, private schools, private Colleges, Clinics, Office of the Forest Department, State Trading Corporation of Sikkim Office, Geological Survey of India Office, Health center, Water Storage tank, Post Office, SITCO Office, Banks, Telephone Exchange, Office of the Auditor General, Office of the Divisional Engineer (Sewer) PHED, are also situated at Deorali. There are a number of upcoming hotels, restaurants and commercial centres, that indicate the potential of this hub becoming a major commercial centre in the future. 95% of the buildings in Deorali have access to garbage collection system and the remaining 5% buildings dispose off their garbage in the jhoras. Since the surface run-off volume is high, the storm water drains have to be made deeper. The water needs to be collected & channelised in an orderly manner. Water is supplied in Deorali by the Public Health Engineering Department. Most buildings are connected to the sewer line that runs along the national highway.

#### **xii. Namnang**

This area is essentially a commercial hub. It is an upcoming hospitality hub with a large number of hotels in the locality because of its location. The scenery of the surrounding hills from Namnang is exemplary and its proximity to the market centre, schools, offices, Tibetan Tantric study institute, Chintan Bhawan and the State Assembly have made it a place of demand for the tourists. During function in Chintan Bhawan and State Assembly, traffic is generated in large volumes. A separate parking facility needs to be create in Namnang. There is the Tibetan Health are centre which also brings in a large number of people. There are commercial units emerging in Namnang, along side the existence of schools, Press Club office. The buildings are mainly constructed of RCC and wood. The entire stretch along the Maximum area is served by the garbage collection system. Water supply is provided by PHED. The sewer lines serve most buildings that are accessible by road while the others maintain septic tanks.

#### **xiii. Ridge Park**

This area sits along the ridge and is one of the most beautiful locations in the city. It is one of the main recreation centres of Gangtok, with the buildings such as the White Hall Complex, an officers' club and the Samman Bhawan dominating the landscape. The Chief Minister's residence, Mintokgang stands on one end of the ridge while the Palace stands on the other end. During function in Mintokgang and Samman Bhawan, traffic is generated in large volumes. A separate parking facility needs to be create in Ridge Park area. It is the favourite destination for joggers and morning walkers, Tae kwondo, badminton and sports enthusiasts etc. The Flower Festival Pavilion located in this area exhibits flowers of Sikkim all year through while holding flower festivals during spring and autumn. The areas surrounding the Ridge is a notified Green Belt, hence building density along this location is low. The view of the mountains is spectacular from the Ridge Park. Tourists flock this area all round the year. All buildings are of RCC. The material used for construction is RCC in most of the buildings. Majority of the buildings have maximum of 5-6 floors and goes up to 7 floors. Water is supplied by PHED and garbage collection is done only for residential buildings. The Ridge Park has the potential to become one of the most beautiful recreation hub of Gangtok.

**xiv. Tibet Road**

Located off MG Marg, Tibet Road derived its name from the earlier trade route to Tibet. It was the road where mules transported goods to Tibet. It is now the second most important commercial centre of Gangtok. This area is one of the most densely developed, comprising of buildings of residential use, offices, public facilities & having a large concentration of hotels. The prominent buildings are Health Care Center, High Court, Telephone Exchange office, and Nurses Training Institute. The building type is mixed, most though made of RCC & wooden huts are prevalent in a few areas, and very few from bamboo. Water is supplied by the PHED. 90% area is covered for garbage collection and remaining 10% throw their garbage in the jhoras. Although a sewer line runs along this road and 80% of the houses, these wooden houses still rely on septic tanks for their sewage disposal.

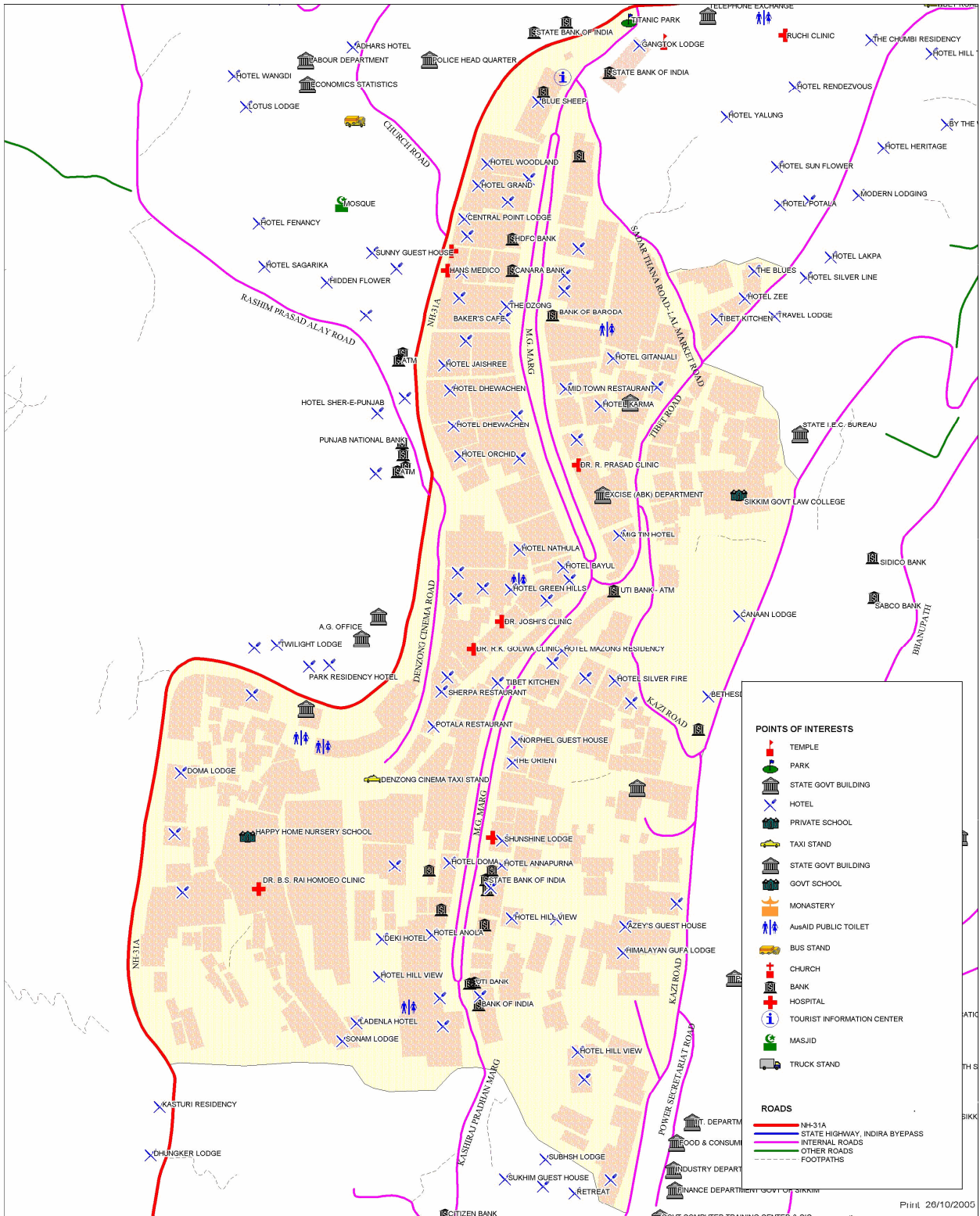
Drainage is a major problem in the Tibet Road area. The household drains need repair while new drains need to be constructed.

**xv. TNA area**

The dominant land mark in this area is the premier school of the State, Tahsi Namgyal Academy or TNA. This area adjoins the Ridge Park area and is an extension of the beautiful vast green landscape of the city. Since the surrounding areas have been notified as green belt area, the area is not densely inhabited. The buildings are of mixed type. There are offices such as the Akashwani, Department of Sports and Youth affairs, and a few Government quarters. Water is supplied by the PHED and garbage collection is once again done along the roads, hence covering around 50% of the households only. There is no sewer line laid in this area and all buildings have septic tanks.

**xvi. SNT Area**

This area's landmark is the bus terminal of the Sikkim Nationalised Transport, and its office. It has also over the years emerged as a institutional hub with Schools like the Holy Cross Missionary School, St. Thomas School, District Consumer Office, Fire office, Central Post Office, Tibetan Welfare Office, UDHD, Power Sub Station, Most Backward Class Office, Banks, Industrial Work Sheds, Computer Training Institute, St. Thomas Church and reputed hotels of Gangtok. The SNT Bus Terminal needs to be relocated in the fringe areas of Gangtok, preferably at Sokay Thang. In this place a multipurpose park of various uses such as exhibition centres, art galleries etc. could be proposed. Water is supplied through PHED and only 50% of buildings have a facility of garbage collection. The sewer line caters to buildings on the hill side of the road.



GOVERNMENT OF SIKKIM

Courtesy: Town Planning Cell, UD&HD

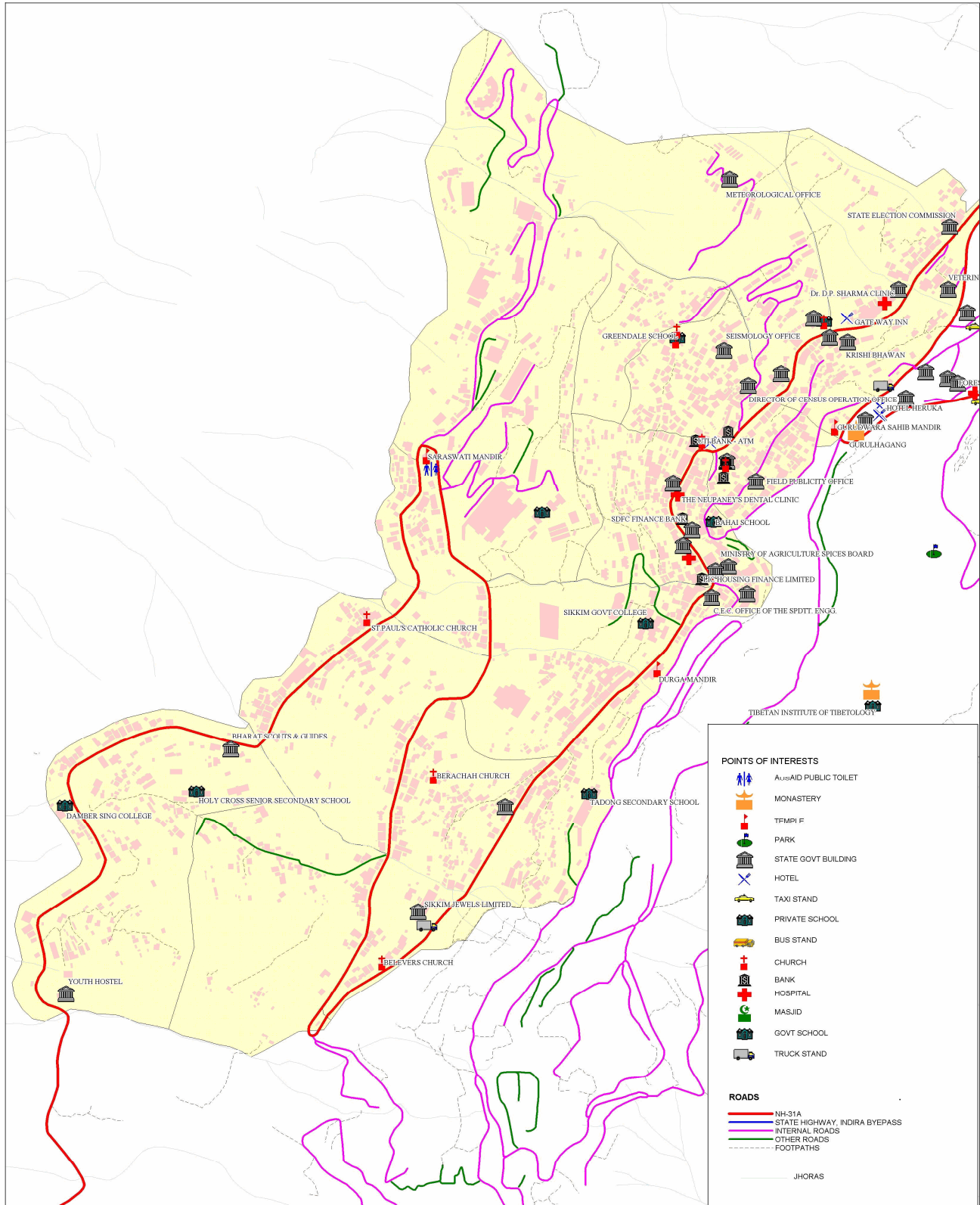
# Map No. 6: M.G Marg and Its Environs

**xvii. Upper and Lower Sichey**

Upper Sichey is predominantly a residential area, with a few hotel buildings, the Paljor Stadium, Department of Fisheries office, health care center, District Courts, District Collectorate Office, Zilla Panchayat office, IRB office, Power Grid Corporation Office, Orchid nursery, Special Bureau Office, Motor Training Institute. There are a few private schools and one Government School in the area. Buildings are mostly made of RCC, wood and in very few cases bamboo. Water is supplied by the PHED, but many households depend on water from the RM&DD sources as well. There are a number of spring water sources existing in Sichey. Garbage is collected throughout the area by the NGO, Golden Circle that was commissioned during the AusAID project in 2005.

**xviii. Tadong (Upper and Lower)**

The growth trend of Gangtok suggests development along the South and South Westerly axis wherein Tadong and Fifth Mile area is situated. This area is another of Gangtok's fast emerging commercial and institutional hub. All along the National Highway, commercial establishments of various kinds have come up. There are a number of private and Government Schools in this area while the major institutional buildings present here are the Krishi Bhawan, Animal Husbandry Department, BSNL office, Central Water Commission, Census Office, Sikkim Milk Union, Holy Cross Senior Secondary School, Baha'i School, Sikkim Government College, College Auditorium, Horticulture nurseries, Central Referral 500 bedded Hospital, NBCC Office and Banks. Trade activities along the roads such as motor car showrooms, workshops etc. are common in this entire belt (**Refer Map no.7: Tadong & its Environs**). Water supply is done through PHED, RM&DD and spring water. Similarly garbage is also disposed off by collection, dispersing on streets and Jhoras.



GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD



## Map No. 7: Tadong & its Environs

#### 4.3.5 Issues

- a. Most of the areas are characterized by dense building forms along the roads and in areas that are situated close to arterial roads. Due to inaccessibility, commercial activities are concentrated only along roads.
- b. Most of these areas have poor approach and internal roads, are located on steep slopes, do not have proper footpaths, have improper or no drainage at all, clogging of storm water drains, inadequate garbage disposal facilities and lack of proper water supply
- c. Drainage and landslide issues need to be addressed holistically for all the areas.
- d. Organized open space is required for most of these areas.
- e. Commercial units need to be earmarked for an organized growth pattern as there is no proper land use pattern in Gangtok.
- f. Up gradation of unstable housing is required with provision of proper piped water supply, drains and sewerage connections.
- g. Parking of cars is concentrated on the roads thus adding to the congestion. Creation of localized parking lots for private cars and taxis is very important.
- h. Most of these areas do not have sewerage connections whereby dependence on septic tanks and disposal in the jhoras is a common practice.

#### 4.4 PHYSICAL INFRASTRUCTURE

##### 4.4.1 Transportation

The National Highway (NH-31A) is the only connectivity with the outside world, connecting Gangtok with Siliguri, Darjeeling and Kalimpong. The nearest airport (Bagdogra) and rail head (Siliguri) are 120 km from Gangtok. Gangtok's regional influence mainly extends towards the South, the East and West Districts and less towards the North District. This is generally because of good linkages through out the East, West and South districts. It is expected that Gangtok will play a major role in the regional dynamics once trade with Nathula is fully established and the road linkages is further strengthened.

Gangtok is also the main tourism hub of Sikkim. This makes the economic base of the city tertiary based. The work force participation rate is 48%. Since the work centers, commercial centers, recreational centers and transport terminals are the major traffic generating nodes, a large amount of traffic is generated by to and fro traffic to these work centres. Seasonal traffic generated during the peak tourist season is heavy.

Bus and taxi terminals, cater to both inter-state and intra-state traffic. These terminals are located at Paljor Stadium Road and at the private taxi stand near the Police Headquarters. Being within the city core, a high volume of traffic is generated in these

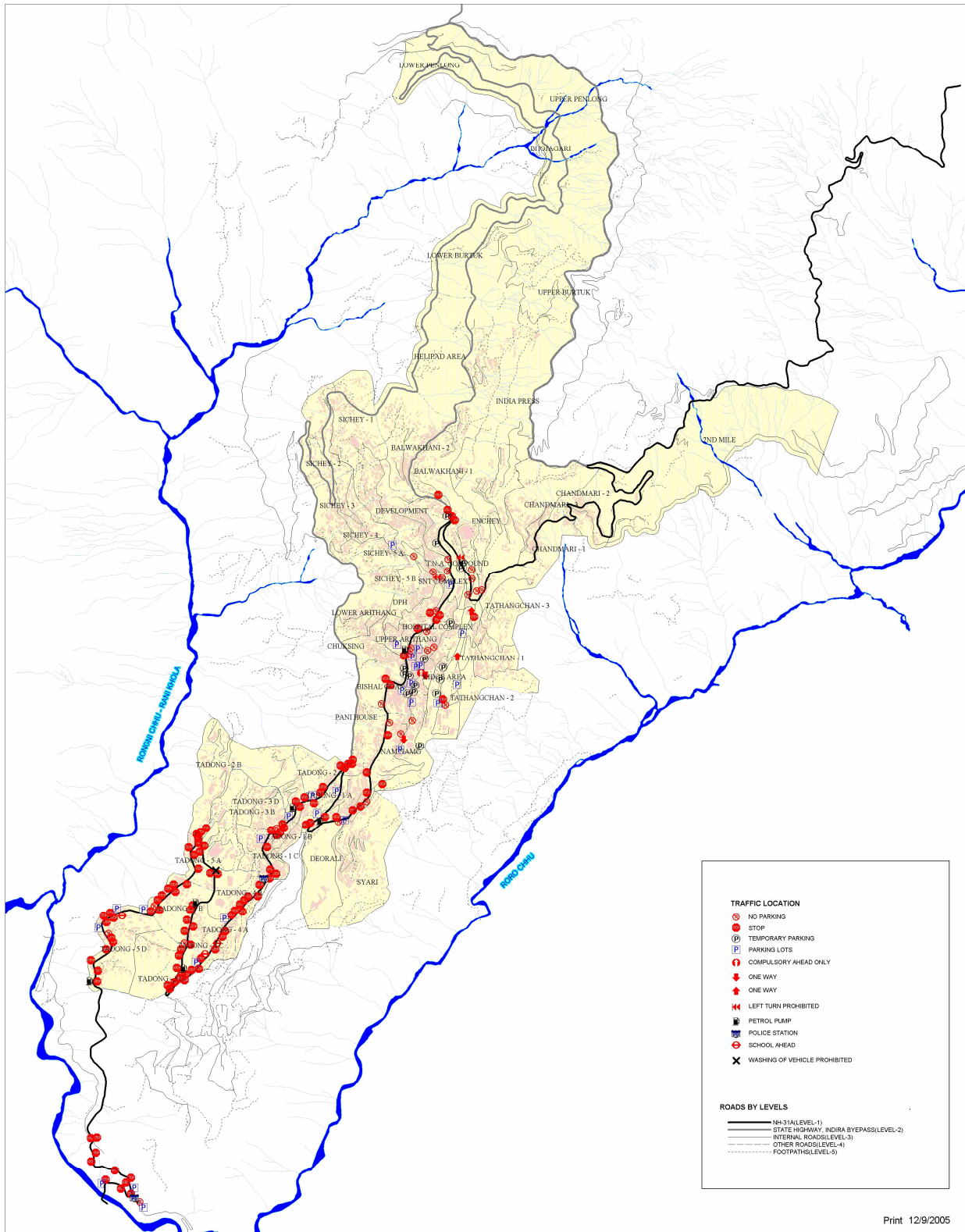
areas. However, there is also a high traffic volume between M G Marg and zero point area because of the location of work centres, commercial establishments etc. and easy access to the commercial hub of MG Marg, Tibet Road and Namnang. Due to the absence of other forms of transportation such as rail or air traffic, passengers and goods are transported by road. The major roads are the National Highway No.31A (Gangtok-Siliguri), North Sikkim Highway connecting Gangtok with the North District and Jawaharlal Nehru Road, which is the trade route link between China and India.

#### 4.4.1.1 Existing Situations

Gangtok is a linear city that has developed along the arterial roads, especially National Highway 31A. The length of the city is about 25 km. The NH-31A, North Sikkim Highway, Indira bypass and JN Road act as the major regional roads converging at or passing through the city. Apart from these, the other major city roads are Tibet Road, M.G. Marg, Kazi Road, Paljor Stadium Road, Indira by-pass and Namnang Road, that connects to the National Highway. In addition to these, there are several other roads in the city that provide internal accessibility.



- a. Most of the road length in Gangtok, is of two lane undivided carriageway with foot path on one side of the road and drain on the other. The steep gradient of the different road stretches coupled with spiral road configuration act as a constraint for smooth flow of vehicular as well as pedestrian traffic.
- b. About 75% of the primary road network has a carriageway ranging from 6-8m. Another 25% of the road length has carriageway ranging between 8-10m. There is no road apart from MG Marg, which has divided carriageway in Gangtok. The by pass road (Indira By Pass) has a total length of 11.2 km. The National Highway 31A has a footpath running along its entire length from Ridge Park, Zero Point up to Ranipul. The width of the footpath is 1.2 m inclusive of the railing and appears inadequate given the high pedestrian volume. The Right of Way (ROW) of NH 31A for 69% of its length in Gangtok NTA is 5-10 meters wide. The average Carriageway Width (CW) of other roads of Gangtok is 5.5 to 7.0m wide.
- c. The existing roads of Gangtok are essentially narrow to accommodate the high volume of traffic, and the road geometry inappropriate. The gradient of roads is also moderately high in certain lengths, to the tune of 1:10 gradient, especially along Kazi Road, Tibet Road, Namnang Road, Sichay Road and Paljor Stadium Road owing to the terrain.



GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD



# Map No. 8: Gangtok Transportations



- d. The vehicular accessibility to various areas is limited and no organized public transport is under operation. There is an urgent need to provide a suitable public transport system after assessing the travel demand and its pattern.
- e. There are no designated terminal facilities for goods vehicles from where goods are transported to the local sites in smaller vehicles.
- f. About 89% of passenger trips are intra-city in nature i.e. interact or have trip ends within Gangtok city. Only 11% is through traffic. The average trip length ranges between 8-10 km, which shows the interdependence of surrounding areas on Gangtok. Out of the total vehicular trips intercepted at the selected locations in and around the city, about 38% of the trips are made for work, 15% for education, 17% for shopping and remaining 30% for other purposes. Of the total goods vehicle intercepted at Gangtok city limits, approximately 66% of LCVs / Tempos and 75% of two and three axle trucks have both the origin and destination within Gangtok city. The goods traffic desire patterns reveal that 63% of the trips are to Gangtok.

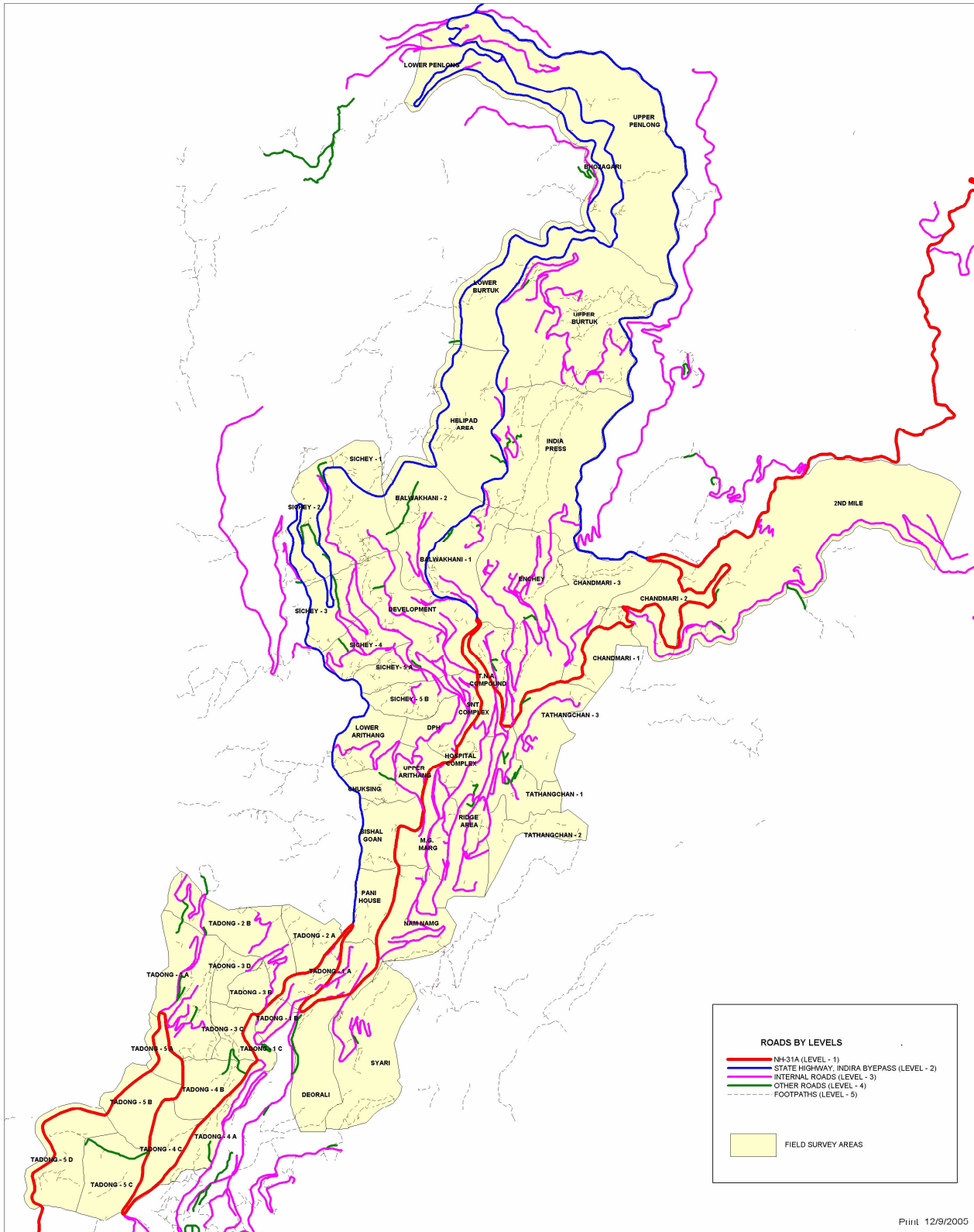
Table 4.3: Origin Destination Findings

Type	Destination Gangtok	Through Gangtok
Passenger	89%	11%
Goods traffic	63%	37%
Light Commercial Vehicles	66%	34%
Heavy Vehicles	75%	25%

- g. Interaction of Gangtok with other settlements is observed to be high. On an average day, about 30,000 vehicles enter and exit Gangtok. The maximum volume of traffic is between Indira bypass and Metro Point (55174 PCU) while the volume between Zero Point and Metro Point is quite high (approx. 36,500 PCU). Of the total trips, about 74% of the trips generated and 64% of the trips are attracted by Gangtok city itself. This clearly presents Gangtok as a major consumption and distribution center of the State of Sikkim.
- h. The various types of roads, areas and junctions which are critical and require intervention have also been listed below.

Table 4.4: Distribution of taxi users by purpose, Gangtok

S. No.	Purpose	%
1	Shopping	36
2	Education	16
3	Business	12
4	Sight seeing / Recreation	12
5	Health	12
6	Return Home	8
7	Work	4
	<b>TOTAL</b>	<b>100</b>



GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD



# Map No. 9: Gangtok Road Classifications



Two Way	One Way	Junctions
<ul style="list-style-type: none"> <li>Nam Nang</li> <li>Tibet Road</li> <li>Development Area Road</li> <li>Arithang Road</li> <li>Sichey Road</li> <li>J.N. Road</li> <li>Syari Road</li> <li>By-Pass Road</li> </ul>	<ul style="list-style-type: none"> <li>Sadar Thana Road</li> <li>DPH Church Road</li> <li>Portion of Tibet Road</li> <li>Kazi Road (Feeder)</li> </ul>	<ul style="list-style-type: none"> <li>Metro-MG Marg Junction</li> <li>Hospital junction</li> <li>Community Hall Junction</li> <li>Lall Bazar junction</li> <li>Deorali Junction</li> <li>Tadong (Daragaon) Bazar</li> <li>Sikkim Govt. College entrance-exit point</li> <li>M P Golai</li> <li>Zero point junction</li> </ul>

#### 4.4.1.2 Vehicle Population

The following table depicts the vehicle population in Gangtok. During the last five years time, the registered vehicle population has increased over 80%.

Table 4.5: Registered Vehicle

YEAR	TYPE OF VEHICLE						Total
	Two Wheeler	Private LMV	Taxi	Trucks	Bus	JCBs / Bulldozers	
2001-02	236	771	743	267	193	03	2213
2002-03	219	765	1176	311	10	03	2484
2003-04	241	1084	1517	325	12	05	3184
2004-05	217	1226	2010	219	23	04	3699
2005-06	267	1303	2165	232	01	09	3977
<b>Total</b>	<b>1180</b>	<b>5149</b>	<b>7611</b>	<b>1354</b>	<b>239</b>	<b>24</b>	<b>15557</b>

Source: Transport Department, MV Division, GoS

- The annual growth rate of registered motor vehicles in Sikkim is 11% to 13.6% during 1998-99 to 2004-05. In the last three years the annual growth rate of taxis and cars is observed to be very high to the tune of 33-46%. This has direct relevance to the road congestion as the road width has remained the same.
- 45% of the total registered vehicles is in the car/van category i.e. personalized vehicles while 26% was in the taxi or passenger car category. The reason can be attributed to absence of alternative transport mode.

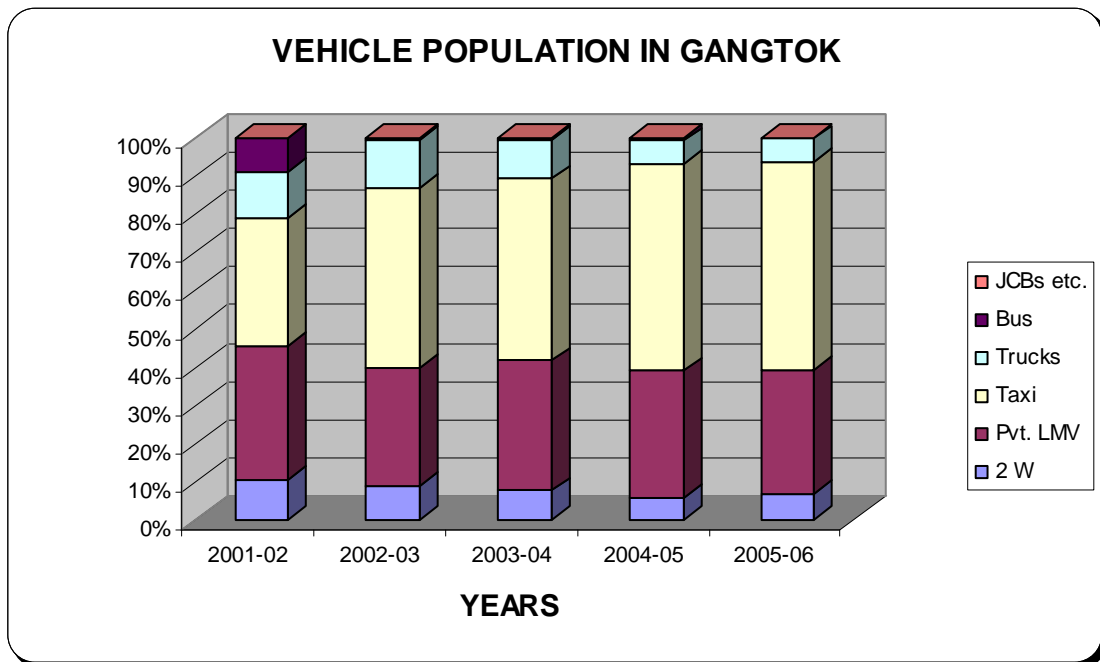


Figure 4.3 Vehicle Distribution in Gangtok

#### 4.4.1.3 System Inadequacy

Speed profiles on the primary road network in Gangtok reveal that journey speeds vary from 11 kmph to 27 kmph. The traffic volume data recorded at various locations bring to light that out of ten locations, six locations experience a gush of more than 10,000 PCU, during the day. The analysis of volume/capacity ratios (VCR) reveal that the maximum VCR is along the primary spine of the city as well as on the roads near the core commercial area of the city. Thus, on an average day the peak volume varies from nearly 350 to 590 PCUs.

The pedestrian traffic volume survey conducted at 4 locations show high pedestrian volumes mainly on MG Road, Indira Bypass and Deorali Bazar Road. This high volume of pedestrian traffic is due to commercial activities in these areas. Footpaths are present on all the major roads but their width is not adequate to carry the present load of pedestrians. M.G. Marg, the main shopping street is closed to vehicular traffic and records the highest volume of pedestrians from 5-9 pm.

An inventory of the major road network was undertaken for about 18 km length to understand the adequacy/inadequacy of the transport network. The data collected includes cross sectional details (right of way, carriage way width, footpath width) predominant land use pattern along the link, type of street lighting, signs and markings and surface condition, encroachment, road side parking etc. The surveys indicated that the road condition is fair and some roads need immediate resurfacing. The right of way (ROW) varied from 5m to 12m, while indicating that there is no scope for further widening of these roads.

Barring M.G. Marg, which is 4-laned and divided; the average carriageway of other roads including the NH-31A and Indira Bye-pass is 5.5m on an average. Only 12% of the road network in Gangtok has pedestrian sidewalk i.e. mainly along the National Highway. Cross drainage and longitudinal drains provided across and along these roads are not maintained adequately and lack in regular/periodic maintenance. The land use pattern around the area is typically mixed, comprising of residential/semi-public/commercial buildings.

A survey for on-street and off-street parking was carried out to make an estimate of the



duration and accumulation of vehicles in these locations. 80% of the parking is of short-term duration, with a high turnover. The maximum accumulation of parking is on MG Marg, which requires parking for around 100 taxis, 70 private cars and 34 two-wheelers. Lal Bazar area requires parking for 88 car spaces. There is a high demand for taxi parking in the city to accommodate both inter-city and intra-city traffic, and the high numbers of taxis.

The acute traffic problems that Gangtok faces presently are in the areas of:

1. Metro-MG Marg Junction
2. Hospital junction
3. Community Hall Junction
4. Lall Bazar junction
5. Deorali Junction
6. Tadong (Daragaon) Bazar
7. Sikkim Govt. College entrance-exit point
8. Zero point Junction

#### 4.4.1.4 Earlier Study Findings

A study on the traffic situation of Gangtok was carried out by CIRT, Pune in the year 2005. The findings of the study are:

The highest daily traffic in Gangtok is observed at Deorali i.e. 35,758 cars, followed by Hospital junction i.e. 32,296 cars and at Denzong Junction i.e. 30,484 cars.

Table 4.6: Traffic at intersections / mid blocks

Sl. No.	Intersection	Total volume of vehicles
1	GICI	12,809
2	Hospital	32,296
3	Metro	22,792
4	Denzong	30,484
5	Deorali	35,758
6	Indira bye-pass	26,224

The maximum hourly traffic volume was observed at Hospital junction of 4277 vehicles per hour. The other two important intersections at Denzong and Deorali recorded a volume of more than 3000 vehicles per hour.

Table 4.7 : Peak Hour pedestrian flows (along the road)

Location	Peak Hour flow
Police Head Quarters	1830
Bansi Lal Petrol pump	2022
Deorali Five ways junction	678
PS Road (Near Post Office)	927
Orthopaedic Hospital Junction	1321
Tadong School Crossing	236

**The share of personalized vehicles and taxis combined was observed at 98% of the total vehicles in Gangtok, which is very high.**

Table 4.8: Traffic Composition at Intersections (%)

Location	Two Wheelers	Car/Jeep/Taxi	Bus	Goods Vehicles
GICI	8.0	89.5	0.6	1.9
Hospital	7.7	91.5	0.4	0.4
Metro	10.6	88.7	0.4	0.3

92% of persons interviewed felt that minibus services should be introduced at higher frequency.

## Local taxi users

<b>Local residents</b>	<b>-84%</b> - 36% daily commuters - 64% occasional commuters
<b>Tourists</b>	<b>-16%</b>

## 4.4.2 Water Supply

### 4.4.2.1 Existing Situations

Water is supplied in Gangtok by the PHED, RM&DD and spring sources. While one pays for water supplied by the PHED, water supplied from RM&DD sources is free. The three major sources of water supply in Gangtok are

1. Treated and piped water supply by the PHED; access coverage ranges between 70-85%
2. Treated and piped water supply by the RM&DD; 21%
3. Private piped water supply from other sources

*(Source: Community Engagement, GWSSP)*

- RM&DD supplies treated water mainly to Burtuk, Sixth mile, Chandmari, 2<sup>nd</sup> mile, Sichay, Lower Arithang and Lower Syari. PHED supplies treated water to various areas of Gangtok such as the Town area, Arithang, Syari, TNHS and Tadong. 13.5 mld water, or an average of 150 lpcd water is supplied to the entire city. There is a huge amount of unaccounted water (50%), primarily due to distribution losses, pipe leakages, illegal tapping, mechanical damages etc. Lack of capacity and shortage of funds to carry out repair and replacement works, and dependence on Central Government for funding most of the capital works are the inadequacies in the present setup. The present water tariff is generating only about 1 INR per cubic meter delivered to consumers. This revenue generation is grossly inadequate and may not be enough to cover even staff salary.



- Most households, except those in rural areas are supplied by the central water system, which is maintained and operated by the PHED. They are responsible for the exploitation of the resources, treatment, storage and rough distribution. The household connection is under the responsibility of the house owners. Families pay for individual household connections. Applying for a connection to the PHED is complicated and can take several months. The legal status of the building,

property, and plot has to be verified. The PHED charges a flat rate of Rs 30 per tap for two months of supply.

- While around 83% of the population of GGPA has access to PHED's piped water supplies, only about 50% have individual water taps. There is widespread sharing of PHED connections and approximately 10% get their water from community taps. About 25% of households having access to PHED water taps receive water 24 hours a day and almost all get water for a few hours every day. Per capita residential water consumption averages about 135 liters per capita per day (lpcd) at present, accordingly the minimum water consumption is to be planned at 135 lpcd.
- Lack of metering makes it impossible to accurately measure the rate of leakage and wastage in Gangtok. However one only needs to walk around town during those times when water is being supplied to hear water hissing under pressure from fractured pipes and joints, and to visibly witness water from leaks flowing down roads and drains. The UFW is estimated to be in order of 50%.
- The water resources from where Gangtok gets its supply of water is abundant and of very good quality. The main source of PHED water supply is the Rateychu River, located about 16 kms from the city (water works complex at Selep) at an altitude of 2621 meters. The discharge of the source stream is about 20 cubic meters per second (cusecs) (48.5 mld) during the dry season and 40 cusecs (97 mld) during the monsoon. Raw water is supplied through five pipelines, comprising of a cast iron (CI) pipe of 350 mm, one 200mm GI pipe and three 150mm GI pipes. The river Rateychu is snow fed and has perennial streams with alpine characteristics. Since there is no habitation in the catchment area except for a small army settlement, there is very little environmental degradation and the source is of very good quality. 40 seasonal local springs sources are used by the RM&DD for water supply.
- As stated above three treatment plants of 4.5 mld, 9.14 mld and 22.68 mld capacities have been installed under three project phases since 1973. All the three plants are located within the same area at Selep. A fourth small treatment plant of 1 mld capacity was also installed some time back, to serve a locality at an elevation higher than Selep. Though the 22.68 mid plant has not become fully operational, water is allowed to flow through it, and the clarifier is operating without chemical dosing. The old treatment plants are in reasonably good condition. Their structures appear sound, and their mechanical equipment, although in need of some rehabilitation, appear usable.

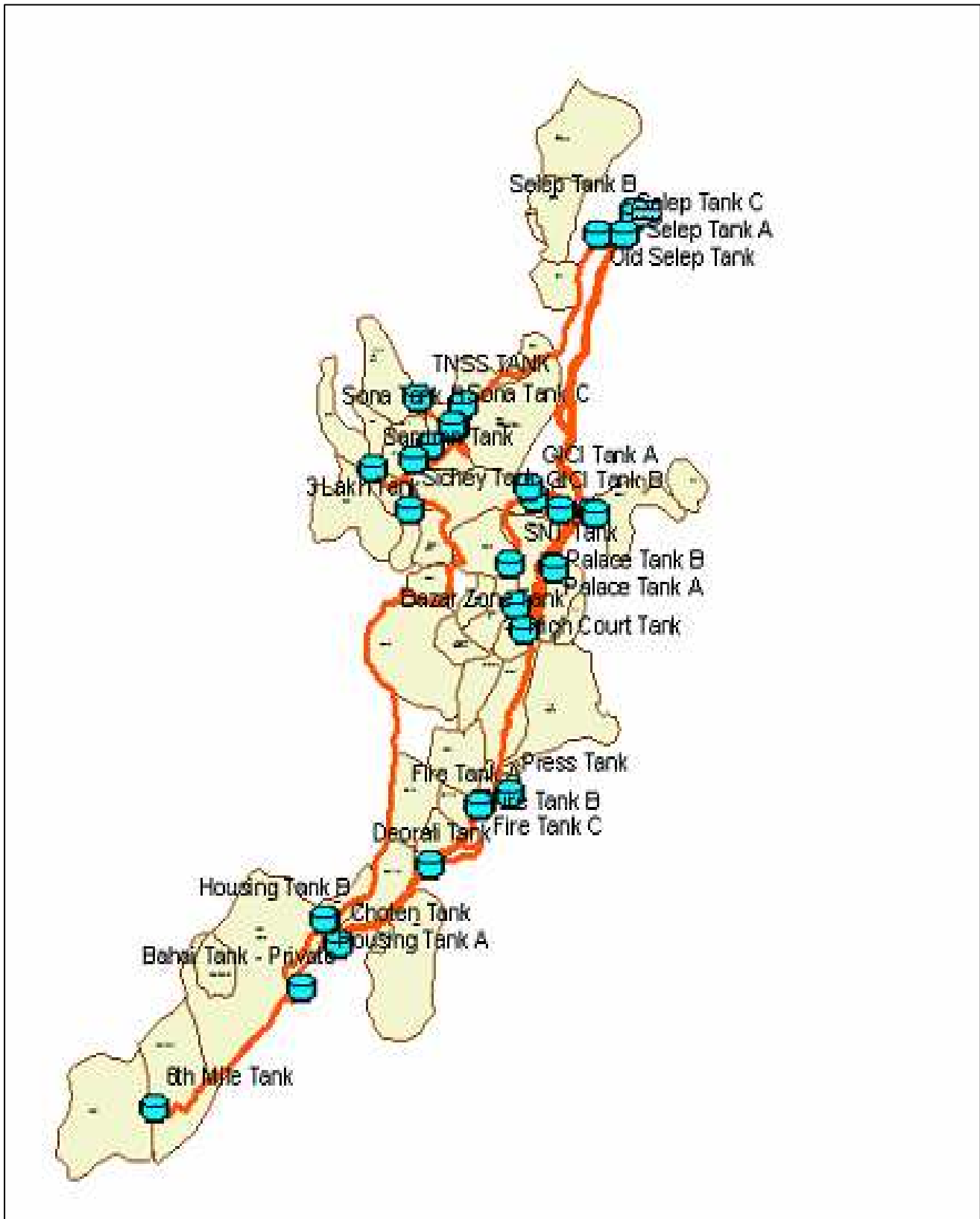




Selep WTP with pre-sedimentation tank in left foreground

#### 4.4.2.2 Distribution System

- PHED water is supplied intermittently in Gangtok and ranges between 2-4 hours daily from Selep tank and distribution reservoir at Enchey, and 23 zonal reservoirs and sub zonal tanks situated in different parts of the city. The PHED owns, operates and maintains the main supply line, which collect and transport the water from source to the treatment plant at Selep and from there distribute it to the reservoirs and then to the settlements. Small pipes connecting the houses to the main lines are owned by the households. The PHED has the authority to shut down or restrict water supply in times of shortage.
- Water from the treatment plant at Selep is stored in the main reservoir located within the same premises. There are three clear water reservoirs at Selep of 1.06 ml, 3.18 ml and 4.54 ml capacity respectively. In addition there is another reservoir called the Old Selep reservoir, of 0.454 ml capacity. The three main reservoirs at Selep transfer water to 23 zonal reservoirs situated in different parts of the city. The three main reservoirs at Selep alone have a total capacity of 8.78 ml. The remaining 23 reservoirs have a total capacity of 5.46 ml. Thus for the supply capacity of 33.75 mld, the total reservoir capacity is almost 45 percent of the supply, which could be portrayed as higher than required, especially for a continuous supply system.
- The water is transported by gravity flow only. The diameters of pipes vary from 1”to 8”. The pipes are made of cast iron, ductile iron and galvanized iron and often leak especially at the joints. The leakage is mostly repaired by inserting wooden sticks, rubber strips, plastic or overlaying stones. The water losses are considerably high. We estimate them to be around 50%.
- The households are responsible for financing of the connection pipe and its operation. They connect to the main distribution lines. These lines are maintained privately. The household pipes usually have a diameter of 1”and losses through leakage are high. Since all pipes are above the ground and unprotected, the danger of mechanical damage and consequential leakage, as well as contamination is high as the pipes often run along drains and jhoras.



GOVERNMENT OF SIKKIM  
Courtesy: Town Planning Cell, UD&HD

Figure 4.4: Distribution of Storage Tanks at Gangtok

#### 4.4.2.3 Supply Demand Balance

- The population of GGPA as counted in the 2001 census was 86,832. Going by a demand of 205 liters per capita per day (lpcd) and service coverage of 80%, the requirement for water at the consumer end in 2001 is worked out to 7.3 mld.
- Against this demand of 7.3 mld, the production for all sources in 2001 was 13.50 mld and is now substantially higher. These figures suggest that UFW is presently about 50 percent or more.
- Although the demarcation of Municipal boundary is underway, new rural areas lying in the suburbs viz; Bojoghari, Burtuk, Sichey, Lower Sichey, Lingding, Sokethang, Lumsay, Lower Samdung, Lower Syari, Rongnyek are sectors that need to be covered for water supply and sewerage system by the PHED in the immediate future.

#### 4.4.2.4 Ongoing Schemes

The development of Gangtok water supply is being accomplished through a two-phase improvement scheme covering a period of 26 years and a population of **188,069** by **2031**. Augmentation of the existing water supply system under Phase I of the scheme was undertaken by PHED, and is on the threshold of completion. The works carried out included:

- Augmentation of treatment plant capacity by adding a new plant of 22.68 mld,
- Augmentation of the capacities of clear water mains from Selep to Enchey, and Enchey to Nam Nang; and
- Extension of mains to Pani House and Arithang areas.

The estimated cost of these works was INR 84.397 million. Most of the works have been completed and the treatment plant is being commissioned.

PHED is now undertaking a Phase II scheme, which is estimated to cost INR 243.44 million (a total of INR 327.84 million for both schemes). The works to be undertaken in Phase II are:

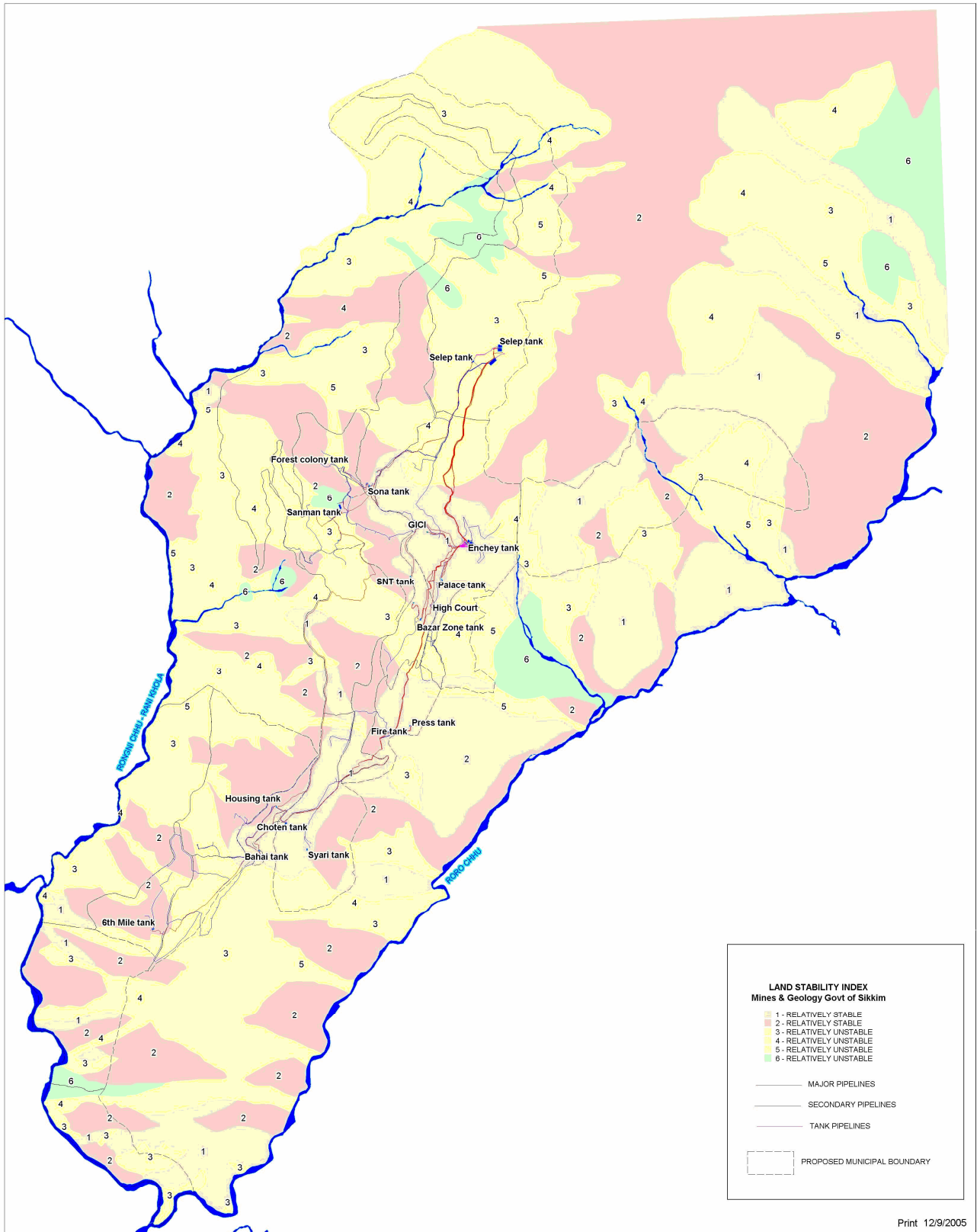
- Construction of new intake works at Rateychu,
- Strengthening of the raw water mains from Rateychu to the treatment plant,
- Some development works at the treatment plant site,
- Construction of 3 new zonal reservoirs in the Bhurtuk, GICI and Lumsey areas,

- Augmentation of some treated water mains and
- Extension of secondary and tertiary water supply networks in 11 development areas.

Most of the pipes have been procured and tenders for civil works are under process. The scheme is expected to be completed in late 2006/early 2007.

#### 4.4.2.5 Issues

- Adequate quantity of water available from Rateychu.
- UFW is more and can be a problem in near future.
- Abandon the sources from where people use untreated water.
- Lack of capacity to carryout repair and replacement.
- Lack of funding and depending on Government for it.



GOVERNMENT OF SIKKIM  
Courtesy: Town Planning Cell, UD&HD

Map No. 10: Gangtok Land Stability & Water Distribution Network

#### 4.4.2.7 Strategies

- Stopping or reduction in UFW
- Providing 100% metering
- Providing water supply networking to whole of population
- Development of natural sources of water for other than domestic usage
- Phased programme for repairs and replacement
- Capacity building of the institution, skilled workers & at slum level
- Exploring the possibility of PPP Scheme in water supply
- Enhancing the user charge for understanding the responsibility towards natural resource
- Making a system less dependent on capital gains

#### 4.4.3 Fire Fighting Service for Disaster Management

Currently there is no supply of water for fire fighting, i.e. there are no static tanks in NTA of Gangtok. Fire tenders is the only means providing for fire fighting services. There is a need to tap the raw water from perennial sources. In order to facilitate disaster preparedness with respect to threats from fire outbreaks, pipelines needs to be laid along all major arterial roads. In densely populated areas, not accessible by road, pipelines will need to be laid along the foot-paths. As a precautionary measure, fire hydrants will be required at every 100 meters interval.

Gangtok has approximately 13 Km of Highway, 8 Km of Bye Pass and 65 Kms of other major roads. The fire fighting Network will serve multipurpose functions namely (i) Fire Fighting (ii) Street & Road washing (iii) Clearing silt from Storm Water Drains during dry seasons (iv) Pollution Control (v) Watering of Road Side Plantations (vi) Jetting & Cleaning of choked sewer mains and finally (vii) alternate source for Gangtok Water Supply during times of crisis.

Gangtok Water Supply Trunk Mains are aligned along western face of Ranipul, Deorali, Gangtok, Hanuman Tok and Changu Ridge. Generally, the western face is geologically susceptible to landslides. In the past, at an interval of every three years a major landslide occurred, thereby completely washing away section of Gangtok Water Supply trunk lines. As an alternative source of water supply during the days of crisis / natural calamities, the proposed fire fighting network could serve the dual purpose by diverting the raw water to the water treatment plants whenever necessary. The Water Security & Public Health Engineering Department has a proposal to tap water from Rorochu River which is on the eastern side of Gangtok town. The pipeline alignment falls near Selep Water Supply Treatment Plant.

As per the departmental estimate Gangtok Water Supply Distribution Network require a minimum of 10 nos. of zonal distribution reservoirs of one lac ltrs capacity. Land is rarely

available to set up such reservoirs. Therefore, the department has proposed to construct/build zonal reservoirs above hill streams that flow down within Gangtok City.

#### 4.4.4 Sewerage and Sanitation

Gangtok has developed over a period of four decades without adequate urban infrastructure facilities proportionate to population growth. New areas have developed in Eastern, Southern, Western and Northern part of Gangtok. Without a proper sanitation system, the practice of disposing sewage through septic tanks and direct discharging into Jhoras and open drains is prevalent. The entire city drains into the two rivers, the Ranikhola to the west and the Roro Chu to the east through numerous small streams and Jhoras. Ranikhola and Roro Chu rivers confluence with River Teesta are the major source of drinking water to the population downstream. The sewage from the city ultimately drains into these rivers and pollute them. The water bodies and the soil are contaminated to a greater extent due to the improper disposal of sewage. This has led to the health hazard and people generally suffer from water and vector borne diseases in areas affected badly due to improper sanitation.

##### 4.4.4.1 Existing Sewerage Situation



Gangtok is one of the few cities in the North East India who have sewerage service. The current sewers were laid around 20 years ago and have a length of around 45 km. As part of the GWSSP activities a CCTV inspection over a random sample of about 3.5 km of the sewer was carried out which showed that several joints were open or damaged and required urgent repairs.

Traditionally and as per law, only the toilet waste is connected to the sewer while sullage is discharged into the drains. This exposes the children playing in the open and near the drains to health hazards.

Around 40 % of the population is currently connected to sewers. While there is a keen desire for households to connect to sewer there are also many households who could connect are not connected.

The existing sewerage system covers Central Business District (New Market, Old Market, Kazi Road, and Tibet Road Areas), as well as many other developed areas like Development Area, GICI Area, Diesel Power House Area, Arithang Area, Church Road Area, parts of Sichey Area, etc. The town's existing sewerage system consists of collection of domestic sewage from various zones through collection chambers. Sub mains of diameter vary from 150mm to 225mm diameter and mains of diameter range from 300mm to 600mm diameter, ultimately connecting to a 750mm diameter main trunk sewer, laid along and under NH 31A from the center of town to sewage treatment plant

at Adampul, 10 km from Gangtok. The STP at Adampul has a design capacity to handle 5 mld of sewage through trickling filter system, prior to final disposal into the River Rongni Chu.

Certain areas lack in sanitary system where people are using conventional methods such as septic and soak pits, or directly disposing waste into nearby drains. Besides this there are a large number of developing areas that are still to be covered by the sewerage system namely Upper Sichey, Development Area, TNA area, Burtuk, some parts of Tadong and Lower Tadong area. An immediate step towards improving sanitary conditions of the city has to be taken to avoid further worsening of the environment conditions.

#### 4.4.4.2 Sewerage Treatment Plant

Sewerage Treatment Plant of 5 mld capacity was constructed by PHED during 1985 connecting the trunk sewer of 750 mm of the western zone. The location of the STP at Adampool satisfies the site selection criteria including environment conditions for setting up sewage treatment plant.



The existing treatment method is of conventional type comprising screen chamber, grid channel, primary sedimentation, trickling filters, secondary sedimentation, thickener, sludge digester and sludge drying beds. The sewage flow upto 5 mld with BOD5 200-250 mg/ and suspended solids of 350 to 400 mg/ is treated in this sewage treatment plant. The treated effluent of BOD5 > 40 mg/ is discharged into river Rongni Chu, exceeding the stipulated discharge standards to inland surface waters.

The primary reconnaissance survey carried out by the Consultants reveals that the current sewage treatment plant is not working satisfactorily and the treated effluent is exceeding the effluent discharge standards in to inland waters with respect to BOD and suspended solids. It has been observed that the dislodging operation of Primary Sedimentation Tank (PST) is ineffective resulting the build up of sludge in the primary sedimentation tank. The sludge needs to be removed hydro statically once in 6 to 8 hours based on the rate of setting of suspended solids. There is no uniform flow in the outlet weir of PST. Due to this faulty operation of the trickling filters occurs, as these units do not receive the settled sewage flow from PST. Consequently nozzles of the rotating arms are often blocked. The filter media of the trickling filters have become anaerobic with insufficient aeration. The treated effluent is further taken to SST. The sludge from both PST & SST are taken directly to sludge drying beds, instead of taking to existing digester, and the sludge containing moisture content around 80% is accumulating in the sludge drying beds for the past years. The sludge's are not treated in the sludge digester and eventually there is no generation of sludge gas.



#### 4.4.4.3 Ongoing Schemes

Table 4.9: Ongoing Schemes

S.N.	Name of work	Area being covered
1.	Extension of sewerage system to lower Arithang	Lower Arithang area
2.	Extension of sewerage system to lower Tadong	Lower Tadong area
3.	Extension of sewerage system to VIP/Raj Bhawan	VIP colony, Staff qtrs Raj Bhawan area & qtrs, CPWD qtrs
4.	Extension of sewerage system to tourism qtrs/TNA	TNA premises, CPWD qtrs, Tourism quarters

#### 4.4.4.4 Issues

- Lack of formal assets register
- Lack of formal asset management plan
- Long-term financial plan
- Lack of implementation plan
- Lack of institutional action plan

#### 4.4.4.5 Strategies

- Increase in water supply will affect the sewer hydraulics
- Proper estimation of floating population.
- Planning for segregated systems for areas of floating population as far as possible
- Stopping of discharge into Jhoras
- Proper plan for periodic replacement and repairs of old pipes and system
- Strict implementation of Rules and Regulation
- Penalties for the defaulter
- Capacity building of implementing authority

#### 4.4.5. Drainage

Gangtok is a linear city that has developed atop a ridge. The physical growth pattern is dictated by the steep topography and accessibility. Gangtok is vulnerable to annual recurrence of landslides due to unregulated constructions on the fragile slopes and an improperly planned drainage network including obstruction of the flows in the Jhoras.

The city is flanked on east and west by two streams, namely Roro Chhu and Rani Khola. The soil formation is of loose sedimentary type, is highly porous and permeable and highly prone to landslides. The city falls under Seismic Zone V, which is highly vulnerable to earthquakes. Gangtok is vulnerable to recurrent landslides annually, resulting in damages to life and properties. The major disaster till date in Gangtok has been in June 1997, wherein 38 lives and hundreds of structures were lost.

The approach is to address the critical areas that are affected by landslips. The improvements are proposed through a phased approach that would, while being a part of a master plan, allow the investments to be spread over time. The improvements to the drainage conditions being planned would be further supplemented and substantiated through:

- The provision of an underground sewerage system and an improved access to environmental sanitation, which would lessen the vulnerability of these critical areas.
- Improved solid waste management practices that would enable the flows in the drains and jhoras.
- Improved awareness within the communities.
- Landslips / Protections: Micro piling, retaining structures
  - Pressure Grouting
  - Rock Sticking / Bolting

#### 4.4.5.1 Existing Situations

Gangtok is located on a nearly NE-SW trending range that forms part of the gentle to



rough hilly terrain on belted crystalline rocks of Sikkim. The city is flanked on east and west by two streams, namely Rorocho and Ranikhola. These two rivers divide the natural drainage into two parts, the eastern and western parts. The eastern part comprises of river Rorachu and 41 Jhoras draining into it. The western part comprises of river Ranikhola and 44 jhoras discharging into it.

Along its southwesterly course, a numerous easterly and westerly flowing feeder streams feed Rorocho. Unlike Ranikhola, Rorocho is younger, more energetic, and follows more or less a straight course. Numerous streams feed Ranikhola, especially from the western side of the city. Both the streams meet the Ranipul and flow south as the main Ranikhola before it joins the Teesta at Singtam.

Soil formation of Gangtok, is loose sedimentary type having high porosity and therefore, is highly permeable and susceptible to erosion. Gangtok has experienced several landslide/subsidence in the past. Frequent occurrence of landslides affects the infrastructure of the Gangtok city. Almost all slope failures of Gangtok occur during the rainy season and can be regarded as rain induced slide or rain triggered slides. Saturation of soil in general affects the slope stability adversely by increasing the weight and “reducing” the effective pressure. The percolating water when comes out as return flow also carries the finer fraction of soil, which adversely effects the shear strength parameter. Removal of finer fraction can also lead to gradual formation of piping in the subsurface and result in sudden subsidence. Water, percolating through the interface of

bedding plane oriented in the direction of slope, reduces the frictional resistance significantly and cause gradual failure of the slope. All these above processes along with poor drainage condition ultimately lead to slope failure, causing enormous problem.

At present the densely populated urbanized area of Gangtok does not have a combined drainage system to drain out the storm water, and wastewater from the buildings. With the increasing pace of urbanization, more and more built up and paved areas are coming up and therefore, the runoff volume is increasing. With the construction of new roadside and city drainage network the peak runoff in the jhoras is increasing and is likely to continue in future. It is worth mentioning that the same drainage system needs to carry the wastewater from the household also. Volume of wastewater is also increasing with the increase of population density. Further the telephone cables and water supply lines running in the jhoras cause the clogging of jhoras and cause overflowing and infiltration of storm water in subsoil, triggering landslides.

Therefore, the existing system has now become quite inadequate and has given rise to following problems:

- Erosion of the natural streams;
- Slope failure and creep causing damage to the existing structures;
- Road damages and
- Health hazards.

#### 4.4.5.2 Past and Ongoing Projects

Till date, no major drainage project has been taken up due to paucity of funds. Though the IFCD take up projects related to lining of jhoras, these measures have largely been relief measures to control landslides and to avoid / minimize damages to private properties. Most of these drains have been constructed partially due to scarcity of funds or lack of scientific basis for the design and implementation of the measures.

A detailed design of storm water drainage system for the Gangtok city has been prepared by WAPCOS. The report discusses the existing storm water drainage system of the city and had suggested measures such as surface drains, Jhora training works, slope protection measures and an institutional arrangement for Operation and Maintenance. Based on the recommendations of the Master Plan, the Irrigation and flood control department has already taken up the Jhora training works in some of the vulnerable stretches. There is a need for the efforts to be continued to refine and update the drainage master plan. Surface run off is also taken up along the roadway by providing roadside drains and discharging them into natural course of discharge.

#### 4.4.5.3 Issues

- Mapping of drains in Gangtok
- Inflow and MFL assessment
- Mapping of watershed areas
- Documentation of landslides
- Awareness campaign to educate the community

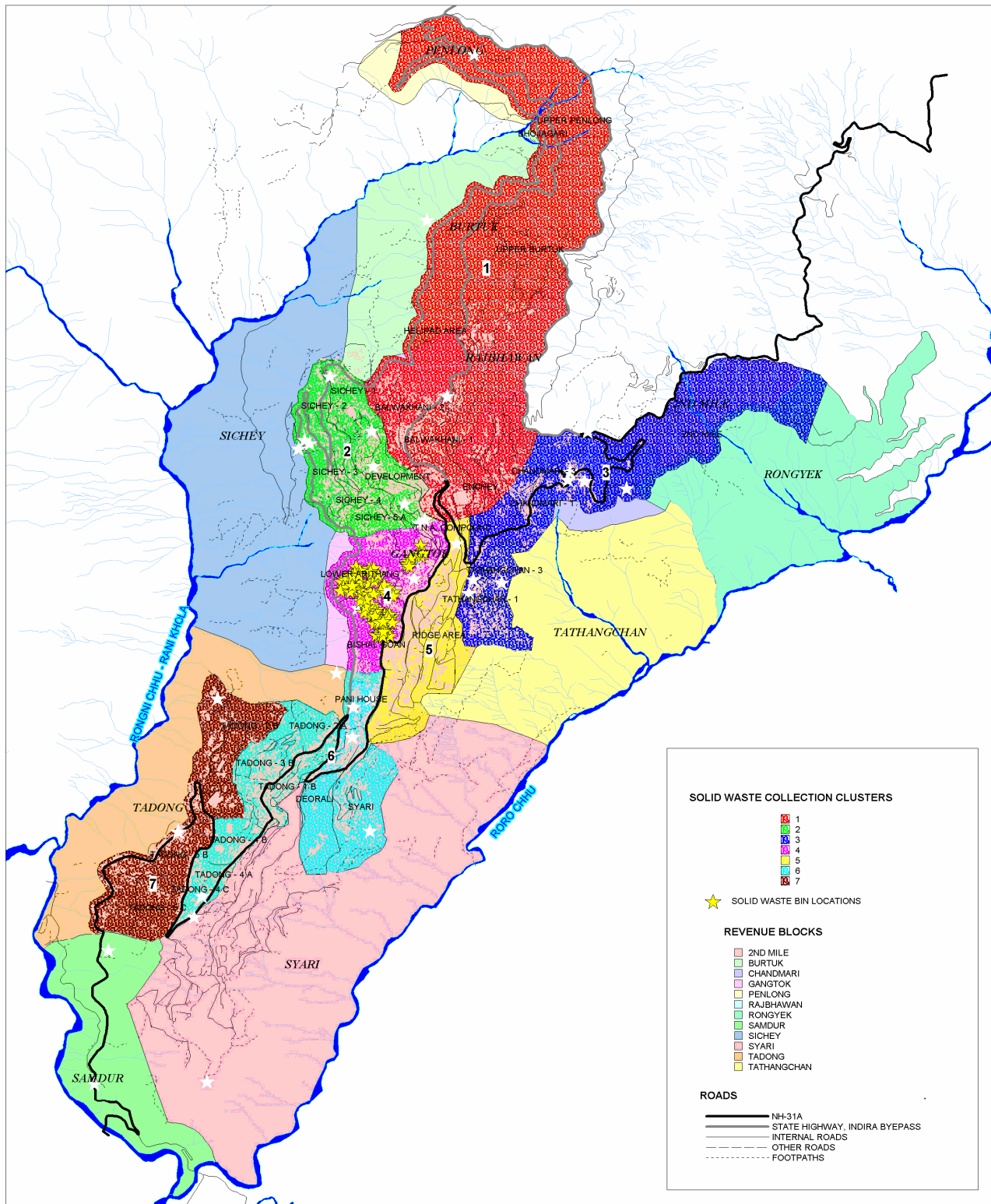
#### 4.4.5.4 Strategies

- Developing a better understanding of the situation through detailed investigation
- Awareness campaign to educate community for conforming to the development control rules
- Establishing the institutional and financial mechanism
- Water Harvesting to be explored

#### 4.4.6 Solid Waste Management

Solid Waste Management is perhaps one of the most pressing problems of the city of Gangtok. Highly unhygienic conditions prevail in many areas that do not have any regular service of solid waste collection. It is a common practice in such areas to throw the household garbage into the nearest water course (Jhora) where it not only chokes the Jhora, but causes a danger to public health by way of purification, breeding of insects and mosquitoes etc. A problem in improving Solid Waste Collection has been coverage of inaccessible houses and lack of service in the outlying areas, which are very much urban but not covered under the jurisdiction of notified town area. In view of the difficult topography and many houses being located in inaccessible areas, improving Solid Waste Management may well be described as the number one civic problem of Gangtok.

With the increasing physical growth of the city and development trends, it has become an urgent need to plan for a feasible and sustainable SWM for the GGPA, as an integral part of proposed urban development.



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GOVERNMENT OF SIKKIM  
 Courtesy: Town Planning Cell, UD&HD

## Map No. 11: Gangtok Solid Waste Management



#### 4.4.6.1 Existing Situation

UDHD is responsible for management of solid waste in Gangtok. The estimated Municipal Solid Waste generated in Gangtok city is approximately 45 MT based on a Solid Waste generation of 0.39 kg/capita/day. Out of this only about 18 tonnes (40 %) is being currently collected remaining 60 % of the waste is indiscriminately thrown into Jhora (storm water drains), streets and valleys. As part of primary collection, UDHD collects waste from notified area. There is no waste collection from inaccessible areas where vehicles cannot reach nor does any system of collection of waste exist in the adjoining rural areas, which form a part of Greater Gangtok.

No segregation at primary location is done. People deposit their waste directly to the collecting vehicle which moves along the designated route with bell system and is transported mechanically. Currently approximately 40 persons are engaged in loading / unloading of garbage to the vehicle. The Urban Development and Housing Department (UD & HD) is responsible for management of solid wastes in Gangtok. The Government of Sikkim (GoS) is amongst the first state in the country to successfully enforce a total ban on polythene bags. In its commitment towards an effective solid waste management (SWM), Government of Sikkim has:

- Passed the Non-biodegradable Garbage (Control) rules in 1997 to minimize the generation of non-biodegradable waste and its indiscriminate dumping on roads, streets and in jhoras and
- A new compost plant at Martam towards minimizing the quantity of waste generation for disposal.



**Collection:** Waste is collected through eight trucks and two smaller utility trucks by using a bell system to notify arrival of the truck. However these large vehicles are not suitable for the narrow roads of Gangtok. Their utilization is also restricted due to restriction of traffic beyond certain time. Thus, more than 70 % of the town is not covered by the

UDHD's house to house garbage collection system. The waste is disposed in the open at a dump site located about 20 km from city. A new covered compost plant of 50 MT/day capacities has been constructed with the technical assistance of Karnataka Compost Development Corporation. The plant is under operation for the past one year but is not functioning at its full capacity due to non segregation of waste at source.

Waste is also collected through street sweeping along major roads and in commercial areas within the city. Waste collected through street sweeping is stored in storage bins, which are then emptied through refuse vehicles. Collection frequency of solid wastes is

not uniform throughout the city. The collection service is better in the densely populated and accessible areas than in the inaccessible areas. Solid wastes in the inaccessible areas are collected through newly introduced system of collection by backpackers.

**Storage:** To encourage daily collection of Solid waste by bell ringing, storage of garbage in containers, dustbins as practiced in other cities have been discontinued in Gangtok. A transfer station have been constructed at Bye Pass, Gangtok to cater to the peri-urban areas of Gangtok i.e. Sichicy, Arithang, Chandmani, Thathenchen where Garbage Management Committees have been established and provided logistical support by the Department.

**Transportation:** UD&HD has the following facilities / capacities in Gangtok collection and transportation of the garbage:

Dustbin	:	30 nos
Trucks	:	08 nos
Utility Trucks	:	02 nos
Loader/Excavator (JCB)	:	01 nos

With the available vehicle fleet on an average, about 35 cubic meters (cum), about 21 metric ton per day (mtpd) of waste can be transported to the disposal site with optimal capacity utilization. The issues pertaining to the present transportation facilities for SWM are:

- Exposure of workers to wastes through manual lifting of wastes in and out of vehicles
- Transportation of waste are done through uncovered refuse vehicle, which result in waste spillage
- The available vehicle parking space does not have a shed and therefore the vehicles are exposed to extreme climatic conditions
- Lacking of garage facility affects vehicle maintenance
- Damaged odometers reduce the chance of tracking fuel consumption and number of trips actually made by the vehicles

#### 4.4.6.2 Compositing Plant

Towards meeting the compliance criteria of the SWHR, GoS has prepared a detailed project report on compost plant of 30-mtpd-production capacity through Karnataka Compost Development Corporation (KCDC). The Martam Composting Plant has been established and operational for disposal and treatment of solid waste collected from towns and Bazars of East District including Gangtok

Other areas served by UD&HD, the collected wastes are taken to the disposal site by the UD & HD vehicles (provided by AusAID). The collection service has been provided with a collection charge of INR 30 and INR 50 from the residential, commercial areas and INR 100 from hotels and restaurants respectively. Though the service is successful and has

been reported to be efficient by the communities, it does not conform to the compliance criteria of SWHR and manual handling of wastes continues.

The design of the SW collection takes into account segregation of waste. It is envisaged that the morning collection of SW will only be for Wet waste (i.e. kitchen and other biodegradable waste) and special trips will be made twice a week in the afternoon for collection of Dry Waste (non-biodegradable waste including cartons, cardboard, plastic bottles and packing material etc.)

This is an important element of design as it ensures that only biodegradable waste reaches the composting plant, so that composting plant produced high quality compost at a low cost. Similarly the recovery from segregated non-biodegradable waste increases because it has not been mixed with wet waste and has a higher recyclable value.

This indicates that there is a need to provide:

- Training to sanitary workers in waste handling techniques
- Personal protective equipments to the workers
- Improved waste carrying vehicles with automatic waste loading and unloading facilities and thereby reducing the chances of manual handling and minimum worker involvement during waste transportation and can be easily accommodated at the passenger compartments rather than on bed of truck.

#### 4.4.6.3 Issues

- Improvement of collection especially in inaccessible areas
- Improvement in existing system for transportation of waste
- Treatment and disposal of waste in accordance with SWHR

#### 4.4.6.4 Strategies

- Source segregation of biodegradable from non-biodegradable
- Manual handling to be reduced
- Separate collection and treatment facility to be arranged for biomedical and hazardous waste
- Storage of waste in mechanized containers
- Providing personal protective equipments to sanitary workers
- Capacity building and educating workers
- Awareness of community to be upgraded with the help of NGO's
- Employment generation aspects need to be explored
- Sustainability aspects need to be a given a look by corporatising its activities



## 4.5 SOCIAL INFRASTRUCTURE

The East District of Sikkim provides for a higher degree of social infrastructure than the other three districts of the state. The social infrastructure of the Gangtok sub division serves a large population base and hence requires augmentation in the sectors listed below:

- Education Facilities
- Health Facilities
- Entertainment and Recreational Facilities
- Public Services
- Sports Infrastructure
- Parks and Gardens
- Town Halls / Community Halls

### 4.5.1 Educational Facilities



Educational expansion in Sikkim during the last decade has been phenomenal. The state has one of the highest percentages of literate people. Beside I.C.D.S. Centers, pre- primary classes function in most of schools. Senior Secondary Schools are affiliated to the Central Board of Secondary Education, New Delhi.

Table 4.10: Educational Institutions

Educational Institutions		
1	Sr. Secondary School	16
2	Secondary School	24
3	Junior High School	43
4	Primary School	113
5	Lower Primary School	36
	Total	232

Source: Sikkim Statistical Profile 2004-05, Department of Statistics, Economics, Monitoring and Evaluation, Govt. of Sikkim

Sl. No.	Institution	Constituency	Affiliated To
1	Sikkim Govt. College, Tadong, Gangtok	Rumtek	North Bengal University
2	Sikkim Govt. Law College, Kazi Road, Gangtok	Gangtok	North Bengal University
3	SHEDA (Buddhist Education) Institute of Tibetology, Deorali, Gangtok	Rumtek	S.S.V, Varanasi
4	Research Institute of Tibetology, Deorali, Gangtok	Rumtek	S.S.V, Varanasi
5	Damber Singh College, Deorali (Now. Govt.)	Rumtek	North Bengal University
6	Manipal Institute of Medical Sciences, Tadong, Sikkim	Rumtek	Manipal University of Health, Technology and Medical Sciences
7	Manipal Institute of Technology (MIT), Tadong, Sikkim	Rumtek	Manipal University of Health, Technology and Medical Sciences
8	<u>Institute for Handicrafts, Gangtok</u>	Gangtok	
9	Industrial Technical Institute, Rangpo.	Central Pendam	

Source: Sikkim Statistical Profile 2004-05, Department of Statistics, Economics, Monitoring and Evaluation, Govt. of Sikkim

#### 4.5.2 Health Facilities

On the health side the achievements made by the Health Department, Govt. of Sikkim, in providing basic Health related services and the successful implementation of the various National Health Programmes are also given below.

Treatment for ailment for which facilities do not exist in the State are referred for treatment outside Sikkim and financial aid provided by the Government. This is a unique feature of the State. Free medicines and free diet in all the hospitals and Primary Health Centres have been a great incentive for the rural people to avail the Health Services.

Construction of an apex 500 bedded Central Referral Hospital at Tadong is on the threshold of completion. Construction of 21 units of staff quarters at Namchi Hospital has been taken up at a total cost of Rs. 64.00 lakhs.

A camp for providing artificial limb and other aid for the physically handicapped was organised at Gangtok. 336 patients received aids like wheel chair, crutches, artificial limbs, cosmetic gloves, etc.

Successful Free Cataract Eye Camp and Intraocular lens implantation were organised at Singtam and Namchi in collaboration with the Foundation Eye Care, Himalaya, Netherlands, Nepal. Sophisticated equipment have been received free of cost under the German Community Grant for the use of STNM Hospital, Gangtok.

Although, only 15 Primary Health Centres and 6 Primary Health Sub-Centre were functioning, substantial increase in the establishment of PHSCs, PHCs have been made through the years. There are now 24 PHCs and 147 PHSCs functioning through out the State. With this, Sikkim has been the only State in the Country to achieve the National Norms of establishment of 1 PHC for population of 20,000 and 1 PHSC for population of 3000. These Centres have Medical and Para-Medical Staff capable of rendering the basic Primary Health Care.

Construction of two, 100 bedded Community Health Centre at Singtam and Namchi have been completed and are functioning. A one hundred bedded Community Health Centre has been constructed at Gyalsing. Another hundred-bedded Community Health Centre at Mangan was constructed during 1997-98.

Although greater stress has been given to Primary Health Care, curative aspect of health has not been neglected. The Central Referral Hospital at Gangtok has been upgraded from 250 beds to 300 beds. To ease the congestion in the OPD Clinics, new emergency cum OPD complex has been added to the old building. For better diagnostic and treatment facilities, sophisticated equipments like Gastro scope, Ultrasound, Omni scope have been provided. Specialized services in the field of medicine, surgery anesthesia, orthopedics, paediatrics, ophthalmology, dental, dermatology and psychiatry have been added. Super-specialty in Cardiology with intensive coronary care unit has also been introduced. A State Level Blood Bank and Transfusion Unit with facilities for HIVF screening has also been set up.

**Table 4.11: Health Infrastructure in Sikkim**

Sl. No.	Health Institutions	East
1	State Referral Hospital/STNM Hospital	1
2	Community Health Centre	1
3	Primary Health Centre	8
4	Primary Health Sub Centre	48
5	Temporary Hospitalisation ward for Leprosy Patients, (Sazong, East Sikkim)	1

*Source: Sikkim Statistical Profile 2004-05, Department of Statistics, Economics, Monitoring and Evaluation, Govt. of Sikkim*

### 4.5.3 Other Social Infrastructure:

The capital town has the following social infrastructure available at Gangtok.

Table 4.12: Social Infrastructure at Gangtok

<ul style="list-style-type: none"> <li>▪ Police Training Center</li> <li>▪ Sikkim National Transport central workshop</li> <li>▪ Water Treatment Plant</li> <li>▪ Sikkim Armed Police office</li> <li>▪ Panchayat Bhawan</li> <li>▪ Cremation ground</li> <li>▪ Post and Telegraph Office</li> <li>▪ All India Radio</li> <li>▪ Doordarshan Kendra</li> <li>▪ Helipad</li> </ul>	<ul style="list-style-type: none"> <li>▪ Directorate of State Lotteries</li> <li>▪ Directorate of Social Welfare</li> <li>▪ CPWD office</li> <li>▪ Paljor Stadium</li> <li>▪ Former Guards' ground</li> <li>▪ Indoor gymnasium</li> <li>▪ White Hall club</li> <li>▪ Flower exhibition pavilion</li> <li>▪ Cinema halls</li> <li>▪ Parks and gardens - though they remain closed to public due to theft of flowers and plants, owing to lack of sensitivity exhibited by people</li> </ul>	<ul style="list-style-type: none"> <li>▪ Multicultural community centre (presently under construction)</li> <li>▪ Community centre library</li> <li>▪ Hotels</li> <li>▪ Notified car parks</li> <li>▪ Bus terminus at two locations</li> <li>▪ Government Institute of Cottage Industries</li> <li>▪ Handicraft training centre</li> <li>▪ Government of India press</li> <li>▪ District Court</li> </ul>
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Table 4.13: Police Stations and Check posts

Public Services		
1	Police Stations	9
2	Out Posts	12
3	Check Posts	3
4	Picket Posts	6
	<b>Total</b>	<b>30</b>

Source: Sikkim Statistical Profile 2004-05, Department of Statistics, Economics, Monitoring and Evaluation, Govt. of Sikkim

### 4.5.4 Issues

- Gangtok primarily lacks in social and cultural facilities like parks and play fields, State library, citizen's clubs, open air theatre, community halls, and other leisure and entertainment facilities that are essential for its citizens.
- Apart from a tiny park near the Paljor Stadium, Gangtok does not have a single park for the children to play.
- Lack of open spaces, exhibition centres for art, trade fair, and performing arts.
- Apart from the open green area in the Ridge area there is no other park in the entire stretch of Gangtok up to Ranipul.