Conclusion
The important findings which have emerged from the foregoing study are,

- **Urban expansion is ubiquitous.** It has posed the most profound challenges to the government and planners. Essentially the problem is one of urban infrastructure being unable to develop to keep pace with urban growth and expansion.

- **The problems prevailing in the residential suburbs** is not only the problem of large/metropolitan cities but it is also the problem of medium sized cities like Aligarh where it has also become very massive and vital.

- **Rapid urbanization has caused the expansion of cities and development of suburbs which is mostly residential in character.** The suburban growth is a result of combined process of spillover population from the city and an addition of people from the countryside and other areas.

- **The suburban growth is mostly seen along the edge of city and along the multiple corridors,** eating away many villages and absorbing good fertile land of the doab. There is no clear cut boundary which separates urban/suburban from rural.

- **Landuse of the suburbs changes from purely rural agricultural to non-agricultural and urban oriented.** Agriculture disappears or declines, farmers sell their land to private colonizers, developers and individuals, who have bought their lands in anticipation of the change to urban uses.

- **Cities built up area has expanded in haphazard/unplanned manner, having patchwork of different types of urban development** – high density of residential colonies interspersed with vacant land, educational institutions, nursing homes, marriage homes, petrol pumps, shops, markets, industrial building etc.

- **These suburbs do not receive any benefits of the city municipal services** because the area lies outside the city municipal limits, suburban residents do not pay the taxes and there is lack of administrative infrastructure and finances.

- **Housing structure varied from purely traditional ones in the core villages to the new suburban houses and apartments.** The provision of urban basic services was also transitional in nature, the traditional houses in most of the cases have neither water tap nor sewage system while in the new houses and apartments in most cases have water taps, sewage system, electricity etc. which is either provided by the colonizers or by the residents who arrange it themselves.
• The public utility services have not developed uniformly in the suburbs.

For centuries cities have struggled to find ways of controlling and mapping growth, to ensure that strains on the infrastructure and public services do not overwhelm them. For this a formal planning is required to map out broad strategies to provide for a livable environment in the residential suburbs. This is the focus of this work entitled, ‘Planning for Urban Basic Services in the Residential Suburbs of Aligarh City’. The problem of provision of urban basic services (water, sanitation etc.) and public utility services in the residential suburbs being unable to develop to keep pace with city growth and expansion has become so massive and vital that it has attracted the attention of researchers, administrators, planners etc. Earlier much work has been done in the suburbs of larger cities but little or no attention has been given to small/medium cities/towns which also face the similar problems of overcrowding, congestion, expansion, environmental deterioration etc. It presents the most profound challenges to the national and local authorities. How can the capacity of local governments especially the Municipal Corporation be enhanced to stimulate the investment required to provide the urban basic services, other infrastructure and social support necessary to sustain a livable environment in the suburbs? Meeting the challenges posed by the residential suburbs is the need of the hour because the city population will keep on growing, migration from rural areas cannot be stopped and the expansion of city is inevitable.

Keeping these aspects in mind this study was undertaken and the residential suburbs of Aligarh city (27° 53’ N latitudes and 78° 4’ E longitudes), a medium sized city located in the western part of Uttar Pradesh in the fertile Ganga-Yumana doab in North India has been selected as the study area. The city covers an area of about 44.82 sq. km. and its total population is 872,500 (Census of India, 2011; Aligarh Nagar Nigam, 2011). This study has certain specific research objectives, to trace the process of urbanization of Aligarh city, growth of city population and area, to assess and map the expansion of the city and development of suburbs, to analyze the suburban landuse changes from agriculture to urban uses, to assess the development of residential colonies, to examine the housing condition and provision of urban basic services and development of public utility services in the residential suburbs, to
examine the problems of residential suburbs. For the purpose of future planning to demarcate and map the residential suburbs on the basis of (i) provision of urban basic services, (ii) development of public utility services and (iii) demarcation of planning zones and to suggest suitable measures for providing a livable environment in the residential suburbs.

The study is mainly based on primary sources of data which have been collected through surveys of residential suburbs, residential colonies, suburban villages and households with the help of questionnaire interviews (Appendix I). Field work was conducted during the years 2008 and 2009. Some data has also been collected from various government bulletins, satellite imageries etc.

To achieve the objectives the following methodology was adopted,

- For mapping the expansion of Aligarh city from 1951 to 1971 and 1991 change detection was performed by using Survey of India topographic sheets (no 54I/1, 54E/13 for 1971, 1991) in GIS environment. For mapping the expansion of Aligarh city for 2000, 2007 and 2009 two satellite data sets were used (i) IRS 1D LISS III MSS data of 2000, band 2 green (0.52-0.59 μm), band 3 red (1.55-1.70 μm), band 4 near infrared NIR (0.76-0.86 μm) and band 5 short wave infrared (SWIR, 1.55-1.70 μm); (ii) IRS-P6 (Resourcesat-1) LISS-IV MSS of 2007, band 2 green (0.52-0.59 μm), band 3 red (0.62-0.68 μm), band 4 near infrared NIR (0.76-0.86 μm), Digital classification technique was used on these data sets for preparation of landuse/landcover map of 2000 and 2007, the images were geo-referenced with the help of Survey of India toposheets at a scale of 1:5,000, using Universal Traverse Mercator (UTM) projection/coordinate system, zone 44. IRS ID satellite data was re-sampled to 6 spatial resolutions using nearest neighborhood re-sampling technique in Erdas Imagine software to make it comparable to IRS – P6 data which has 6 m cell size, the supervised classification was performed using maximum likelihood algorithm (MLC) on the two satellite data sets of 2000 and 2007, the classified data was recorded to remove the spectral mixing and it was validated using Google Earth image for about 35 locations covering the whole study area, where there were doubts about the classification and thereafter, confusion matrix was generated for accuracy assessment for the classified landuse/land cover map of both 2000 and 2007.
• Landuse changes were assessed with the help of satellite data and field/household surveys. Digital classification technique was used on the satellite data sets for preparation of landuse/landcover map of 2000 and 2007. Landuse changes was also assessed with the help of survey of 147 villages located within 12 km radius from the city centre and data was collected from 1,470 suburban rural households. The respondents were interviewed personally.

• The suburban residential colonies were identified with the help of the Satellite data (IRS-P6 on 1:94,000 scale acquired in March 2007) and extensive field surveys.

• For the purpose of selecting the sample, for the assessment of urban basic services in the developed residential colonies, multistage stratified random sampling design was adopted. From 35 developed residential colonies 996 households were sampled. The households were visited frequently and respondents were interviewed personally for data collection.

• The provision of urban basic services were categorized into 3 levels (standards) i.e. level 3 (higher), level 2 (intermediate), level 1 (basic) for the purpose of planning, a total of 14 indicators under 3 subheads – housing condition (6 indicators), water supply condition (2 indicators) and sanitation condition (6 indicators) were taken into consideration. The average value of MCSI of housing, water supply and sanitation were calculated and further categorized into four levels for the purpose of planning – high, moderate, low and very low level with the help of mean and standard deviation methods (Standard Grading System) and were mapped with the help of GIS Arc view 3.1.

• For the purpose of uniform distribution of public utility services in the suburbs MCSI values were calculated and categorized into four levels for the purpose of planning – high, moderate, low and very low level of development with the help of mean and standard deviation methods (Standard Grading System) and were mapped with the help of GIS Arc view 3.1.

• For the purpose of demarcation of planning zones in the residential suburbs on the basis of overall levels of development of services, CMSI of overall services were calculated and categorized into four planning zones – Zone I, II,
III and IV on the basis of their requirements with the help of mean and standard deviation methods (Standard Grading System) and were mapped with the help of GIS Arc view 3.1.

In the foregoing chapters we have tried to analyze our data to test the hypothesis that we had set before us while undertaking this work. The major findings have been summarized below,

1. An overview of urbanization
   - Tracing urbanization forms an essential background of the study. The location of the city is an important geographical factor which has influenced its development. The early township evolved from a growing village of functional diversity. Urbanization of Aligarh city started from the ancient period with a Buddhist Settlement in 1500 B.C. and continued during the medieval and British periods. During the ancient period growth took place around the Achal Tal area which has the most ancient development of settlements around Achaleshwar temple. During the medieval period Balai Qila or Upper Kot on the great mound remained the socio-economic/political hub of development. During the British period development took place on the eastern side of the railway line known as the Civil Lines area which developed further away from the old area developed during ancient and medieval periods. In each period a different area of the city was developed (fig. 1.3). The Delhi-Kolkata railway line divides the city into 2 parts, old and new. A similarity existed between the process of urbanization and the morphology of the city. Morphologically the city is divided into four parts – (i) Achal Tal area, (ii) Upper Kot area (both are located in the old part of the city on the western side of the Delhi-Kolkata railway line), (iii) Civil Lines area (located in the new part of the city on the eastern side of the Delhi-Kolkata railway line) and (iv) the peripheral ring area (expanded area) developed around the old and new part of the city (fig. 2 in introduction). Although the earlier growth of city started slowly, separate parts developed during different rulers but with massive increase in population, commercialization and industrialization the city expanded beyond its municipal limits. The peripheral ring does not make
a well demarcated zone but appears in the form of clusters. Most of them are residential.

- On the basis of population Aligarh is a class I city and on the basis of area it is a medium sized city. Population size and density provides an essential background because it plays a significant role in the expansion of the city. The city population increased from 0.4 million in 1991 to 0.7 million in 2001 and 0.8 million in 2011 (Census of India, 1991, 2001, 2011; Aligarh Nagar Nigam, 2011) and it is estimated that by 2021, it will be 1,209,464 (Aligarh Development Authority, Aligarh Master Plan, 2001-2021). Aligarh city has high rate of population growth nearly 4 per cent annually of which 1.8 per cent is natural growth and 2.2 per cent is migratory. The decadal growth rate during 1991-2001 was 39.24 per cent, 2001-2011 was 30.40 per cent and from 2011 to 2021 it is estimated to be 38.62 per cent. The density also varies, the core areas (Achal Tal and Upper Kot area) has high density i.e. > 46,665 persons per sq. km (fig. 1.4) (Aligarh Nagar Nigam, 2009), the Civil lines area once had open space but now it has also become congested. The city is characterized by overcrowding, congestion and deteriorating environment. There is no land available, so people have outmigrated to suburban areas which is characterized by spaciousness, open air and availability of land at low prices. The total area of the city was 44.82 sq. km in 2001, 78.23 sq. km by 2011 and it has been estimated that by 2021, 114.70 sq. km area will be developed (fig. 1.5) (Aligarh Development Authority, Aligarh Master Plan, 2001-2021).

- The urban landuse of Aligarh city shows that the city covers an area of 44.82 sq. km of which only 67.48 percent was developed while rest of the area is lying undeveloped. The developed area of the city increased from 50.76 per cent in 1951 to 52.42 per cent in 1971, 60.90 per cent in 1991, to 67.48 per cent in 2001 and it has been estimated that by 2021 about 114.71 sq. km will be developed. Area under urban landuse shows that the residential area has increased very rapidly from 43.85 per cent in 1951 to 45.16 per cent in 1971, 49.1 per cent in 1991 and 51.14 per cent in 2001. Future projection shows that by the year 2021 53.42 per cent will be used for residential purposes. Area
under other uses like transportation, commercial, industrial and recreational purposes has remained almost the same (1971 to 2001).

2. City expansion and development of suburbs

In earlier time, the growth of city started slowly, but now with the spillover population of the city and addition of migrants, industrialization and urbanization the city has expanded tremendously and this has helped in the development of suburbs.

- The expansion of Aligarh city was mapped for the years 1951, 1971, 1991, 2002, 2007 and 2009 (figures 1.7, 1.8, 1.9, 1.10). The city has expanded beyond its municipal boundary in a spontaneous haphazard and unplanned manner. It has swallowed the rural villages and engulfed the agricultural fields. The rural agricultural land has been transformed into suburbs having residential colonies, educational, commercial and industrial buildings. The pattern of growth has changed from low density in earlier years to high density along the edge of municipal boundary (wedges) and along the roads. In 1951 the city was confined within 2 km radius, a bulge was seen along Anupshahar road and Ramghat road; by 1971 the city had spread in all directions covering 4 km radius; by 1991 all parts of city had spread equally in 4 km radius except along Anupshahar road, Ramghat road and GT road (Kanpur), the bulge spread upto 7 km; by 2000 high density expansion could be seen along Ramghat road, GT road (Kanpur) and Agra road; by 2007 extensive expansion along Ramghat road upto Harduajang, GT road (Kanpur), GT road (Delhi) and along Anupshahar road. Very high density spread could be observed along the wedges of Ramghat road and GT road (Kanpur), Ramghat road and Anupshahar road, GT road (Kanpur) and Agra road, Anupshahar road along the Northern railway line, between Khair road and Gonda road. This shows that many surrounding villages have been swallowed by the expanding city.

- Measuring expansion provides an overview of where growth is occurring and where it is likely to develop in future. The urban area of Aligarh city in 1971 was 17.32 sq. km only 0.43 sq. km of the urban area expanded beyond the municipal limit. Small ribbon expansion was observed along GT road (Delhi), Khair road, Ramghat road and Anupshahar road. By 1991 the urban area increased by about 18.07 sq. km, about 9.05 sq. km extended beyond the municipal limits. The growth was mainly on the northern, eastern and south-
eastern sides. The ten year period between 1991 and 2002 witnessed a further expansion of urban area by 11.16 sq. km mainly along GT road (Delhi), Khair road, Ramghat road, Anupshahar road especially along the northern fringe. By 2007, there was an increase in urban extent by 10.26 sq. km. Rapid development along the main corridors i.e. Ramghat road, GT road (Kanpur), GT road (Delhi) and Anupshahar road was observed. A strong correlation between the pattern of population growth and urban expansion i.e. development of suburbs was observed.

- Field survey helped in identifying the causes of urban expansion. The main cause of this expansion is spillover population from the city and addition of migrants from the countryside and other areas. Other factors were availability of un-built agricultural land at low prices, influence of speculators on agricultural land owners for selling their land to colonizers, developers etc., rapid expansion of economic activities, road connectivity, availability of some municipal services without paying for it, lower taxes on industries, crowding/congestion and failure to fulfill the demands of urban infrastructure, services etc. in the city.

3. Landuse changes in the suburbs

Today the need to accommodate the rising population is making the city expand outwards engulfing villages and agricultural land and transforming them into residential, commercial and industrial areas resulting in the development of suburbs.

- During 1974 to 2007, a decrease in land under agricultural uses (-38.31 per cent) and an increase in total built up area (increase of > 234 per cent), area under commercial uses (702 per cent), residential (282 per cent), industrial (156 per cent), govt. institutions (73 per cent) and social and recreational uses (9 per cent) etc. was observed. The residential suburbs recorded a significant increase in built up area this was mainly because of increase in population and change in occupational pattern. Various urban activities and urban influences led to this transformation.

- Indepth investigation of landuse changes was assessed with the help of survey of 147 suburban villages and data was also collected from 1,470 households located in 49 suburban villages (22 villages in inner suburbs and 27 villages in outer suburbs) (fig. 2.3). It also showed that land put to agricultural uses has
declined especially in the inner suburbs which has high density of built up areas. Land is mainly being utilized for residential and commercial purposes. The farmers were preferring to sell their land to colonizers, developers and individuals etc. There is lack of effective public control on such changes in landuse or on profits which can be made from them.

4. Development of residential suburbs and distribution of colonies

Rapid urbanization has caused the expansion of cities and development of suburbs which is mostly residential in character. During the period 1988 to 2008, 125 per cent increase in residential area was observed. The inner suburbs having higher density (286 per cent) as compared to outer suburbs (50 per cent).

- Satellite imageries and field surveys helped in identifying the 94 residential colonies, out of which 66 were developed (having all facilities and people were living in them) and 28 undeveloped (only plots have been demarcated and some construction work has started but no one was living there). Of the total residential colonies, 58 (62 per cent) were located along the main roads (Anupshahar road, Ramghat road, GT road (Kanpur), Agra road, Mathura road, Khair road and GT road (Delhi)) and 36 colonies (38 per cent) along the bypasses (Anupshahar road to Ramghat road bypass, Ramghat road to GT road (Kanpur) bypass, Mathura road to Khair road bypass, Khair road to GT road (Delhi) bypass and GT road (Delhi) to Anupshahar road bypass). Of the total 66 developed colonies, 39 (60 per cent) were located along the main roads and 27 colonies (40 per cent) along the wedges. Most of the developed colonies were located along Ramghat road (13 colonies), GT road (towards Kanpur, 11 colonies) and Khair road (5 colonies). Along the wedges most of the developed colonies were located along GT road (Delhi) to Anupshahar road bypass (7 colonies), Anupshahar road to Ramghat road bypass (6 colonies), Khair road to GT road (Delhi) bypass (6 colonies) and Ramghat road to GT road (Kanpur) bypass (6 colonies) (fig. 2.6). Most of the colonies (29) had developed after 2003, 26 developed between 2000-03, 19 developed during 1996-99. Of the total residential colonies, 59 (63 per cent) were located on the eastern side and 35 colonies (37 per cent) on western side of railway line (fig. 2.8).
• The personal profile of the sampled respondents living in the residential suburbs revealed that 42 per cent were original dwellers (53 per cent were from the core villages and 47 per cent were from Aligarh city) and 58 per cent were migrants (69 per cent migrated from the surrounding villages and 31 per cent from the nearby small urban centres). City people shift their residence due to availability of cheap land and open space, to be away from urban congestion and other reasons being family problems, religious and political causes etc. People migrate from surrounding villages/nearby urban centres due to better economic opportunities, better standard of living, availability of educational facilities, health facilities, nearness to institutional development/industrial establishment which offers employment and other reasons like family problems, religious and political causes etc. Field investigations revealed that the duration of stay varied from less than 5 years (49 per cent) to more than 20 years. Of the total sampled respondents, nearly 79 per cent were Hindus and 21 per cent were Muslims mostly belonging to general caste (64 per cent); their age varied between 21 to more than 65 years, mostly they were educated (89 per cent) and more than 26 per cent were graduates; nearly 51 per cent were involved in services, 26 per cent were labourers and 19 per cent were in business. More than 99 per cent households were having males as head of their family, most of them were having nuclear family type (73 per cent) with 4-6 family members. Family income ranged between > Rs. 20,000 to < Rs. 5,000 per month.

5. Provision of urban basic services

The residential suburb offers, perhaps, the greatest challenges to the government, administrator and urban planners because the provision of urban basic services is unable to develop to keep pace with the urban growth and expansion. The villagers have land which they sell for urban landuses at comparatively low prices to city land developers, private colonizers, industrialists, individuals who are attracted to buy these lands. As a result haphazard residential/urban development occurs in the suburbs. The land developers/colonizers are primarily concerned with profits they do not really develop the land which involves construction of roads, proper layout of residential plans, laying of water pipes and sewage, provision of roads, electricity etc before selling it. The provision of such services is beyond the means of private
developers, consequently the people who buy land or apartments have either to wait for decades or do something themselves to obtain the basic services. For most part the urban basic services (water supply, sanitation etc.) are not available because the municipality provides the services only to places within the municipal limits. Outside the municipal limits due to lack of administrative infrastructure and finances they are not provided. The different type of urban basic services were categorized into 3 service levels (standards) i.e. level 1 (basic), level 2 (intermediate) and level 3 (higher). The choice of the level of a particular service is influenced by affordability as well as needs.

- Change in housing structure from purely traditional ones of the original village residents living in core villages to suburban individual houses and apartments was observed in the residential suburbs. The traditional types were built up of bricks, stone, mud, tiles etc., while the new houses and apartments were made of brick, concrete etc. Mostly the residents were the owners of their house. Of the total sampled households, nearly 86 per cent were living in *pucca* houses, 82 per cent used the house only for residential purposes, in 86 per cent case the built up areas of the house was between 1000-2000 to > 2000 sq. ft., nearly 89 per cent of the households were having 3-5 and > 5 rooms, 70 per cent had separate kitchen and 86 per cent reported of having electricity facility in the house. Overall conditions in the residential suburbs showed that higher level (level 3) housing conditions existed along the main routes i.e. GT road (Kanpur), Ramghat road, Agra road, Anupshahar road and GT road (Delhi). Poor (level 1) housing conditions (i.e. *kutcha* houses, used for residential/commercial/industrial purposes, built up area was < 1000 sq. ft., < 3 rooms in the house, cooking food in open air, no electricity facility) existed along the Mathura road to Khair road bypass and Anupshahar road to Ramghat road bypass (fig. 3.2).

- The availability of urban basic services is also transitional in nature. Almost all new residential houses and apartments were having water tap, sewage system, electricity etc. while the traditional houses located in core villages have neither any water tap nor sewage system in most of the cases. Field survey revealed that there were two important sources of water supply i.e. handpumps and submersible/tubewells. Handpumps were routinely dug by the
original inhabitants and migrants while submersible/tubewells were installed by rich farmers in the core village or by the colonizers and owners of apartments. The overall water supply condition in the residential suburbs shows that higher level (level 3) water supply conditions (i.e. having submersible/tubewells inside premises and water quality being good) existed along the main roads i.e. GT road (Kanpur), Ramghat road, Anupshahar road, GT road (Delhi), Khair road and Agra road and poor water supply condition (i.e. handpumps as source of water and water quality being poor) existed along the Anupshahar road to Ramghat road bypass and Mathura road to Khair road bypass (fig. 3.5).

- Poor sanitation conditions existed in the suburbs. Of the total sampled households, nearly 71 per cent have flush latrines inside the house, more than 71 per cent reported of disposal of excreta into soak pits, 73 per cent reported of *pucca nali* in and around the house, 63 per cent reported of disposal of waste water in open plots/fields where it created waterlogging condition, 71 per cent reported of disposal of waste in open fields, 67 per cent reported that waste remained uncollected. The overall sanitation conditions in the residential suburbs clearly shows that good (level 3) and poor (level 1) sanitation conditions existed side by side. Good (level 3) sanitation conditions (i.e. flush latrines inside the house, disposal of excreta from flush latrines into soak pits, *pucca nali*, disposal of waste water/waterlogging in open plots/fields, disposal of waste in open fields/collection points, garbage collected by private agencies fortnightly/twice a week) existed in the residential suburbs along main roads i.e. Agra road and GT road (Delhi), Ramghat road, GT road (Kanpur) and Anupshahar road and poor (level 1) (no toilet facility in the house/open defecation practiced, no disposal of excreta, no drainage facilities in the premises, disposal of waste water/waterlogging around the house, disposal of waste on road/street sides, uncollected garbage) existed in the suburbs along Mathura road to Khair road bypass and Anupshahar road to Ramghat road bypass (fig. 3.11).

6. Development of public utility services

Field surveys have revealed that the public utility services have developed in the suburbs due to the demand of growing suburban population, dislocation of
services from the city centre to the suburbs and requirement of space for expansion of some services (schools and colleges and other institutions, malls/marketing complexes, marriage homes, hospital/nursing homes etc.) which is available in the suburbs. It can be safely said that city crowding, congestion and lack of open space has led to the development of residential suburbs and public utility services. Field surveys have shown that,

- The residential suburbs are now dotted with different types of educational services like primary schools, junior high schools, high schools, intermediate schools, technical/professional colleges etc. There are 88 educational institutions. Maximum numbers of educational services were located along Ramghat road (18), GT road (Kanpur) (10), GT road (Delhi) (9), GT road (Delhi) to Anupshahar road bypass (9) and least number along Mathura road to Khair road bypass (2) (fig. 4.2).

- Different type of health services like private clinics/medical stores, available of doctors, hospital/nursing homes were located in the residential suburbs. There were 93 health services and maximum numbers were located along Ramghat road (23), GT road (Delhi) (13), GT road (Delhi) to Anupshahar road bypass (13), GT road (Kanpur) (9) and least number were located along Khair road to GT road (Delhi) bypass (4), Agra road (5) and Ramghat road to GT road (Kanpur) bypass (5). No health services were available along Mathura road and Mathura road to Khair road bypass (fig. 4.5).

- Field surveys reveals that 242 different type of commercial units like wholesale, retail markets, individual shops, grocery shops etc. have developed in residential suburbs to fulfill the daily needs of requirement of the people. Marketing complexes having new shops (shoes, clothes, medicine, hardware, plastic, toys etc.), hardware and malls have also developed in the residential suburbs. Maximum number of shops/commercial units were developed along Ramghat road (46), GT road (Kanpur) (38), GT road (Delhi) (29), GT road (Delhi) to Anupshahar road bypass (26) while least number along Mathura road (2), Mathura road to Khair road bypass (6) and Anupshahar road (8) (fig. 4.8).

- The suburbs are dotted with various types of social and recreational services like marriage homes, petrol pumps, play grounds etc. About 29 social and recreational services were located in the residential suburbs. Maximum
number being located along GT road (Kanpur) (7), Ramghat road (6) and least number along Anupshahar road (1), Agra road (1), Khair road to GT road (Delhi) bypass (1) and Khair road (1) (fig. 4.9).

- Field surveys reveals that10 new industrial units have developed in the suburbs. Maximum number were located along Ramghat road (5), Anupshahar road (2) and minimum along Khair road (1), GT road (Delhi) to Anupshahar road bypass (1), Mathura road to Khair road bypass (1) (fig. 4.10).

- The road connectivity conditions in residential suburbs are not very good. Three types of road facility i.e. *pucca*, *kharaja* and *kutcha* was observed. The older colonies have better quality of roads then newer one. More than 45 per cent households reported of having *pucca* roads, 32 per cent *kutcha* roads and 23 per cent *kharaja* roads (fig. 4.11). More than 50 per cent households living along Anupshahar road, Ramghat road, GT road (Kanpur), GT road (Delhi) and Agra road reported of having *pucca* road facility while more than 40 per cent households living along Agra road and GT road (Delhi) to Anupshahar road bypass reported of having *kharaja* road facility (fig. 4.11).

- Field observations have revealed that the public utility services have not developed uniformly (fig. 4.12) in the residential suburbs.

7. Problems of residential suburbs

At the time of field survey four types of problems i.e. related to landuse, related to infrastructure, administrative problems, problems related to social aspects were identified in the residential suburbs.

- Problems related to landuse – there is no clear cut demarcation between the city boundary and rural countryside. The physical expansion of the built up area beyond the municipal boundary is in a spontaneous, haphazard and unplanned manner. What were essentially agricultural lands and rural villages have been transformed by urban residential, commercial, industrial complexes. There is loss of productive agricultural land, concentration of land ownership, speculation on land and rapidly rising land values. Bold steps and planning is required to tackle these problems.

- Problems related to infrastructure (urban basic services and public utility services) – these problems are ignored by municipal authorities because this area lies outside the municipal limits and residents do not pay taxes. In most
cases the private colonizers make all the promises but do not provide all the services. It is the residents who do something about it. Public utility services are not provided uniformly in all the colonies of the suburbs. Educational institutions have developed well in most of the suburban areas, health services are not evenly distributed.

- Administrative problems – Suburbs remain a virtual administrative jungle with no responsible authority for management of its complex problems.
- Problems related to social aspects – due to presence of people from various background like the original village inhabitants and city inhabitants and migrants, social problems are present in the suburbs. Original village inhabitants have their social interaction with the villagers and city inhabitants have attachment with the city centre. Migrants have their own group by language, religion etc. None of the suburban population mix with the villages.

8. Demarcation of suburban areas on the basis of different levels of urban basic services and public utility services for the purpose of planning

Proper planning for the residential suburbs requires collection of data for identification of different levels of urban basic services (housing, water supply, sanitation) and development of public utility services (education, health, commercial, social, recreational, industrial, road connectivity) in the residential suburbs. Then only maps could be prepared. The researcher has tried to assess and map the suburban areas for the purpose of future planning.

- For measurement of different levels of provision of urban basic services a total of 14 indicators were taken into consideration (6 indicators of housing condition, 2 indicators of water supply condition and 6 indicators of sanitation condition). Development index (DI) of each indicators were calculated with the help of Standard Index Method and Composite Mean Standard Index (CMSI) was calculated through Standard Index (SI)/aggregate score model. For the purpose of demarcating the residential suburban areas on the basis of different levels of urban basic services, the average values of MCSI of housing, water supply and sanitation conditions were calculated and categorized into four levels of development i.e. high, moderate, low and very low with the help of mean and standard deviation methods (Standard Grading System) and were mapped (fig. 5.4) for the purpose of planning for
different areas. The residential colonies (18) located along Agra road (0.890), GT Road (Kanpur) (0.862), Ramghat road (0.856), GT road (Delhi) (0.814) and Anupshahar road (0.788) were having high levels of development of urban basic services (> 0.742). Whereas, 13 residential colonies located along Ramghat road to GT road (Kanpur) bypass (0.689), Khair road (0.665), Khair road to GT road (Delhi) bypass (0.562) and GT road (Delhi) to Anupshahar road bypass (0.536) were having moderate levels of development of urban basic services (0.742 – 0.454). While 4 residential colonies located along Anupshahar road to Ramghat road bypass (0.293) and Mathura road to Khair road bypass (0.225) were having low levels of urban basic services (0.454 – 0.166).

- For the purpose of planning for even distribution of public utility services in the residential suburbs MCSI values were calculated and categorized into four levels of development i.e. high, moderate, low and very low with the help of mean and standard deviation methods (Standard Grading System) and were mapped (fig. 5.5). Public utility services in the suburbs along Ramghat road (0.953) was highly developed (> 0.718). Along GT Road (Kanpur) (0.584) and GT road (Delhi) (0.516) was moderately developed (0.718 – 0.471). Whereas, in the suburbs along Anupshahar road (0.380), GT road (Delhi)to Anupshahar road bypass (0.362), Khair road (0.322), Agra road (0.251), Khair road to GT road (Delhi) bypass (0.242) and Anupshahar road to Ramghat road bypass (0.227) low levels of development of public utility services (0.471 – 0.224) was observed.

- The researcher has already identified and mapped on the basis of different levels of provision of urban basic services (fig. 5.4) and development of public utility services (fig. 5.5) in the residential suburbs of Aligarh city for the purpose of planning. Now, the researcher has tried to identify and prepare another map (fig. 5.6) on the basis of overall levels of development of services (urban basic services and public utility services) for the purpose of planning for the residential suburbs of Aligarh city. The researcher has calculated the CMSI for overall services. The suburban areas were further classified in four categories on the basis of overall levels of development with the help of mean and standard deviation system and a map (fig. 5.6) was prepared for the
purpose of planning. Residential colonies located along Ramghat road, GT road (Kanpur) and GT road (Delhi) were having high levels of overall development of services (> 0.596). Whereas, residential colonies located along Anupshahar road, Ramghat road to GT road (Kanpur) bypass, Agra road, Khair road, Khair road to GT road (Delhi) bypass and GT road (Delhi) to Anupshahar road bypass were having moderate levels of development services (0.596 – 0.350). While residential colonies located along Anupshahar road to Ramghat road bypass and Mathura road to Khair road bypass were having low levels of development of services (0.350 – 0.104). Residential suburbs located along Mathura road was having very low level (< 0.104) of overall development of services.

9. Identification of planning zones

There is uneven development of urban basic services and public utility services in the residential suburbs of Aligarh city. A perusal of figures 5.4, 5.5, 5.6 shows the differential in the levels of development of both the services. Thus, there is need to address and plan for the different areas differently. The residential suburbs have been further categorized into 4 planning zones on the basis of their requirements for the purpose of formulation of planning strategies (fig. 5.7).

- Planning Zone I comprises of those residential colonies which requires provision of urban basic services. The residential suburb along Ramghat road has 13 developed residential colonies. During field survey it was observed that some of the colonies like Harizan Basti, Chaudhary Vihar, Raj Vihar, Shankar Vihar, Ramseni, Vinay Nagar requires better provision of urban basic services. There is need to plan for twenty four hours potable water supply, flush latrines connected with septic tanks, proper garbage disposal and waste water disposal system, cemented drains, cemented roads, electricity facilities etc.

- Planning Zone II comprises of those residential suburbs which requires development of public utility services. The residential suburbs along GT road (Kanpur), GT road (Delhi), Anupshahar road and Agra road posses 21 developed residential colonies. During field survey it was observed that these suburbs lack public utility services. There is need to develop social, recreational and health services in the residential suburbs of GT road (Kanpur); social, recreational and educational services in the
residential suburbs of GT road (Delhi); social, recreational, educational, health and commercial services in the residential suburbs along Anupshahar road; social, recreational, health and educational services in the residential suburbs along Agra road. There is need to provide urban basic services in few of the colonies like Nai colony located along GT road (Delhi), few colonies (Keshav Vihar, Vishnu Dham, Baghel Nagar, Natrajpuram, Baba and Shiva) located along GT road (Kanpur) and Anupshahar road (Sagar Housing Complex and Gulistan Apartment) also needs garbage services.

○ Planning Zone III comprises of those residential suburbs which requires both the provision of urban basic services in the residential colonies and development of public utility services in the suburbs. The residential suburbs along Khair road, Ramghat road to GT road (Kanpur) bypass, GT road (Delhi) to Anupshahar road bypass, Khair road to GT road (Delhi) bypass, Anupshahar road to Ramghat road bypass, Mathura road to Khair road bypass has 32 developed residential colonies which lack in both urban basic services and public utility services. During field survey it was observed that in some of the colonies located along these suburbs like Engineer’s colony along Ramghat road to GT road (Kanpur) bypass and Shiv Dham colony along Khair road have good (level 3) provision of urban basic services. While in other colonies, there was lack of urban basic services like *pucca* houses, electricity, flush latrines, *pucca* nali, garbage disposal facility etc. These suburbs also lack in public utility services like social, recreational, health and educational services. The residential suburbs along Mathura road to Khair road bypass and Anupshahar road to Ramghat road bypass also have very few commercial services. Although residential colonies have developed in the residential suburbs along Anupshahar road to Ramghat road bypass and Mathura road to Khair road bypass but it appears that there is an urgent need to provide for urban basic services in these colonies and public utility services in the suburbs like educational, health, social, recreational and commercial services.

○ Planning Zone IV comprises of those residential suburbs which do not have any residential colonies like along Mathura road. Few public utility
services like educational, commercial, social and recreational services have developed here. There should be a proposal to develop residential colonies in this area.

**Policy Implications**

What is clear from the proceeding analysis is that urban expansion is ubiquitous and it poses great challenges to the researchers, administrators and planners. Essentially the problem is one of provision of urban basic services and public utility services to the people living in the residential suburbs which is unable to keep pace with the growth and expansion of the city. This has attracted the attention of the planners. The municipal authorities do not provide the basic services i.e. water, sanitation etc. beyond the municipal limits. The colonizers and land developers make all the promises at the time of selling the land/apartment but they fail to fulfill it. Although the public utility services develop upon the demand of the growing suburban population but it has not developed uniformly. These are haphazardly developed. Government intervention is required to guide urban development in the suburbs to achieve an orderly development. Spatial planning is needed to ensure best of plans and smooth management of functioning of services.

A meaningful and pragmatic suburbanization policy should recognize the significance of the spontaneous and voluntary suburbanization at work in the country. It is obvious from the present study that there are disparities in the residential suburbs in terms of landuse, infrastructure, administrative and social aspects. This is bound to happen as the process of growth and development of suburbs are not properly planned. The government/local bodies did take up the challenge to control the haphazard growth by introducing the Urban Land Ceiling Act in 1976 to stop the transaction of land within 5 km from the periphery of the city, the Urban Development Plan to control the landuse pattern of the city and its suburbs. The main problem was that all these acts were introduced in mid-seventies but even today the land transaction is still going on in the suburbs. The government plans have changed from time to time. The Green Belt plan also introduced in seventies which aimed to control the physical expansion of the city, but the government has abolished the idea in June, 1983.
A number of action programmes have been suggested which should be implemented in a comprehensive manner to have a well planned livable residential suburbs,

- **Managing residential suburbs requires local solutions rather than state, national ones.** There is an urgent need to build and support the capacity of local/municipal bodies to manage the problems of rapidly growing residential suburbs. Local municipal authorities need to be empowered with financial and human resources to develop the required infrastructure and deliver the services in the residential suburbs. Proper strategies should be laid down by them for the provision of urban basic services in the residential suburbs.

- **Large investment is needed for the creation, expansion and maintenance of water supplies, system for collection and disposal of waste both garbage and waste water, electricity, roads, houses etc.** The financial resources of the municipalities is derived from taxes on residential and commercial properties and financial loans from state/central governments. Basic municipal functions will be performed properly if there is financial assistance. **People living in the residential suburbs should pay the taxes so that they are also provided with these services.** These services must reach all the sections of people living in the residential suburbs.

- **To overcome the local government fiscal crisis, the remedy seems to be a shift towards the privatization of services provision.** ‘Unbundling’ has occurred in both the provision of infrastructure and services in building, financing and managing – solid waste, water, sanitation and housing. The private services, prioritize these areas for providing services.

- **Policies should be framed so that the colonizers and land developers before selling the apartments/land for residential purposes should properly develop it** i.e. there should be proper layout of residential sites, roads, sewage and water pipes, electricity, street lights etc. All the urban basic services should be provided in the individual houses and apartments before selling it.

- **Every city should have a Master Plan not only for the city but also for the suburban areas and planning should not be entrusted to the State Town**
Planning Department but to the City Town Planning Department. Presently they have only a regulatory function and they cannot directly provide the basic services in the residential suburbs. Master plans provide projections and guidance for location, extent and intensity of particular landuses in the city, the kind of planning required. These plans should be implemented properly.

The focus of the Master Plan of the Aligarh city (fig. 7), prepared for the period 2001 to 2021 was to properly plan for the development of residential, industrial, commercial, educational and other social/recreational facilities not only within the city but also beyond the city municipal boundary. Since the cities population has registered a fast growth and the city is expanding in the same pace, this plan is for 1.7 million population and 150 sq. km extended area. Nearly 407 villages will be included in this city area. Due to the increasing population and expanding area of the city there will be further loss of agricultural land. Land will be put to non-agricultural uses like area under residential uses will increase. Simultaneously area under commercial, educational, hospital and other social and recreational uses will also increase. This plan is basically to restrict unplanned and uncontrolled development of the city and to prepare a guideline for future development. The Aligarh Master Plan has proposed to develop 140.76 sq. km land outside the municipal limit. Under this proposed plan, nearly 14.76 sq. km of area between Ramghat road and GT road (Kanpur) will be used for residential purposes (major portion has been developed by the government); 4.41 sq. km area was used for development of Tala Nagri along Ramghat road; 1.64 sq. km was used for core activities (retail shops, commercial and market community facilities) and social purposes (marriage homes, petrol pumps, play grounds, parks etc.) along Ramghat road and 3.54 sq. km area was used for opening of two bus stands along GT road (Kanpur) and GT road (Delhi) to improve the road network. Large scale illegal residential colonies have developed on the proposed industrial land, commercial land, proposed land for parks and playgrounds etc.

- **There is need for good urban governance for the residential suburbs.** The cities provide concentration of infrastructure, housing and services that have
Aligarh Master Plan (2001-2021)

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- Rural population
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- Aligarh Muslim University
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- Agriculture
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- Garden
- Village boundary
- Municipal boundary
- Development area boundary
- Built up area boundary
- Overhead bridge
- Regional park

Source: Aligarh Development Authority (ADA), 2001-2021, Aligarh

Fig. 7
made them attractive locations but the residential suburbs do not provide all these. We have to make the residential suburbs which is livable and attractive for the settlers.

As Indian cities continue to spread outwards, the problems faced by suburban areas will assume greater visibility and importance. Policy-makers must begin to act now and either give such areas more civic autonomy or provide, via the local/state government a modicum of urban basic services. Local level initiatives can clearly augment such efforts but local level initiatives with no backing by local /state government are unlikely to succeed.