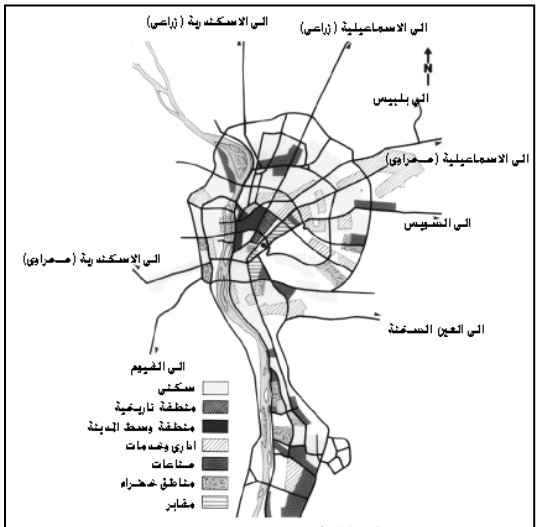
2.3 Overview of Urban Development

2.3.1 Existing Long Range Urban Development Plan for GCR

(1) Early history

The first urban master plan of Cairo was formulated in 1956. This plan proposed 6 suburban communities which were more or less industrial towns in nature, of which the only one that realized was Hilwan new town in the south. Among the two proposed suburban development, the only one that has materialized was Nasr City.



Master Plan of 1973

(2) Master plan of 1973

The Master Plan of 1970 was formulated in a situation where the urban areas of GCR were going through drastic changes and rapid expansion. The plan was approved in 1973. The target population was set for the year 1990, with the projected population in the range of 14.7 to 16 million, which turned out to be a little too high from today's perspective.

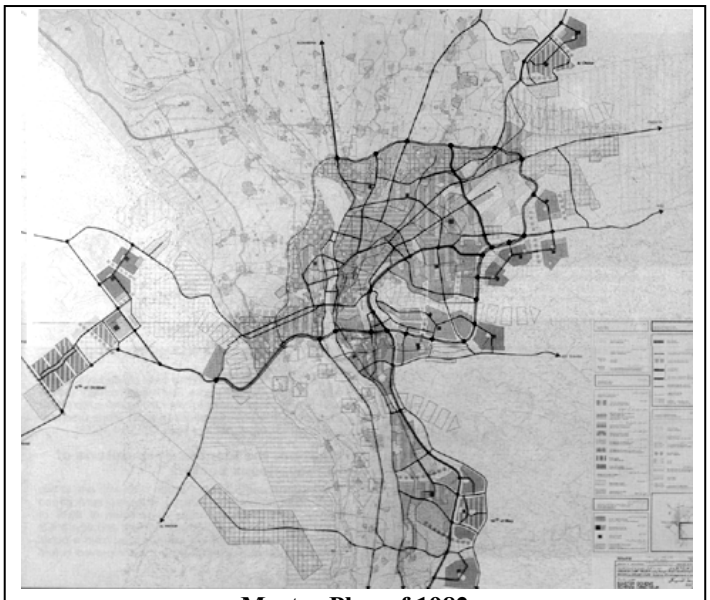
The plan defined the ring road as the outward boundary for urbanization of the city agglomeration, and proposed new urban communities outside of the urban areas in order to accommodate the rapidly growing population. Of the NUCs today, four NUCs, namely 6th October in the west, 10th Ramadan and El-Obour in the east and 15th May in the south, were constructed following this master plan.

(3) Master plan of 1982

The master plan was started in 1980 with the assistance from France, as a joint undertaking with GOPP.

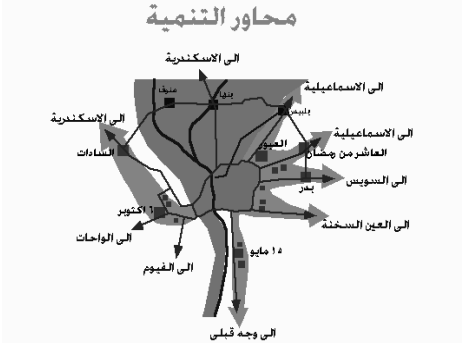
Rapid population growth had been experienced in GCR and the Master Plan called to limit the growth of population in GCR. For this, it was deemed important to organize unavoidable growth of GCR by physical planning, and make use of the private sector dynamism and resources.

This third master plan estimated the increase in population up to the year


Master Plan of 1982

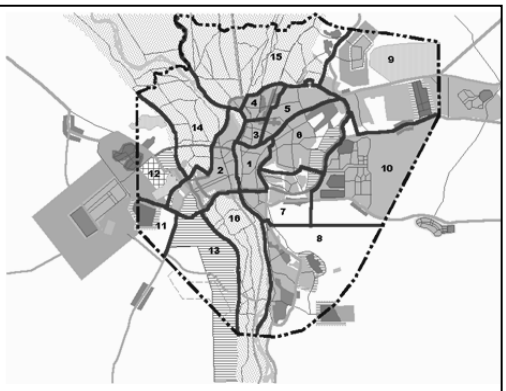
2000 as 16 to 16.5 million, and made a plan to accommodate this mostly inside of the ring road and NUCs outside of the ring road. The planned population in NUCs in 2000 was set at 900,000.

This plan has provided the basic directions for the urban planning of GCR today. One noticeable feature of the plan is the ring road that encircles the urban agglomeration in the city center. The ring road not only provides transportation artery, it was intended to demarcate the outer boundary for urbanization, and thus serve to limit the outbound expansion of urban areas.



Corridors in Master Plan of 1982

Also, Master Plan of 1982 proposed 5 Urban Corridors that connects Cairo with external cities, namely 1) Alexandria; 2) Suez; 3) Sokhna; 4) Ismailia; and 5) Upper Egypt to the south. NUC that were built by developing the desert area were chosen in one of the directions of urban corridors. These urban structures are still intact today with the regional transportation axis such as highways are strengthened, and NUCs are located alongside the regional axes.

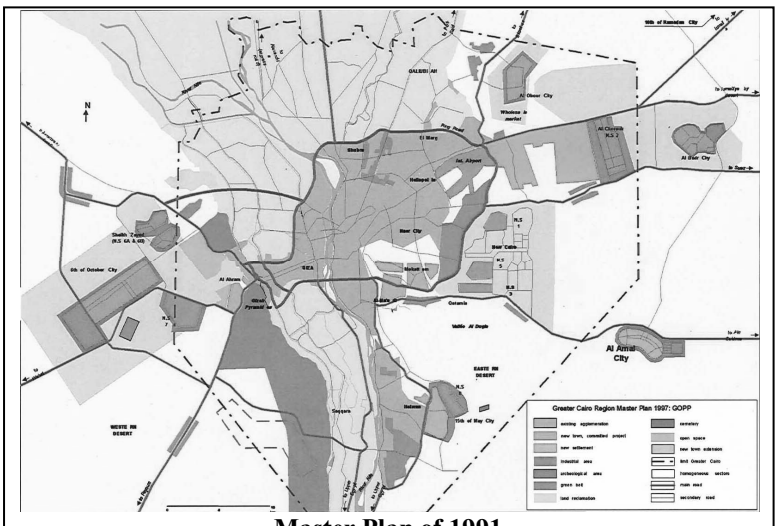


16 Homogeneous Sectors in 1982 Plan

Master Plan of 1982 proposed what they termed "Homogeneous Sector", which was a delineated planning unit having somewhat common characteristics, or homogeneous planning characteristics. In all 16 homogeneous sectors were established throughout the Greater Cairo Region, to each sector the population of 500,000 to 2 million were allocated. The delineation of homogeneous sectors reflected the historical urbanization process.

(4) Revised plan of 1991

From 1990 to 1991, some partial revision of 1982 plan was made, based on the work of GOPP with the French assistance. This revision did not include a change in the planning parameters (such as population), and was limited to minor updating of land use plan. The ring road proposed in Plan of 1982 was almost complete by this time and the revised plan showed the ring road.



Master Plan of 1991

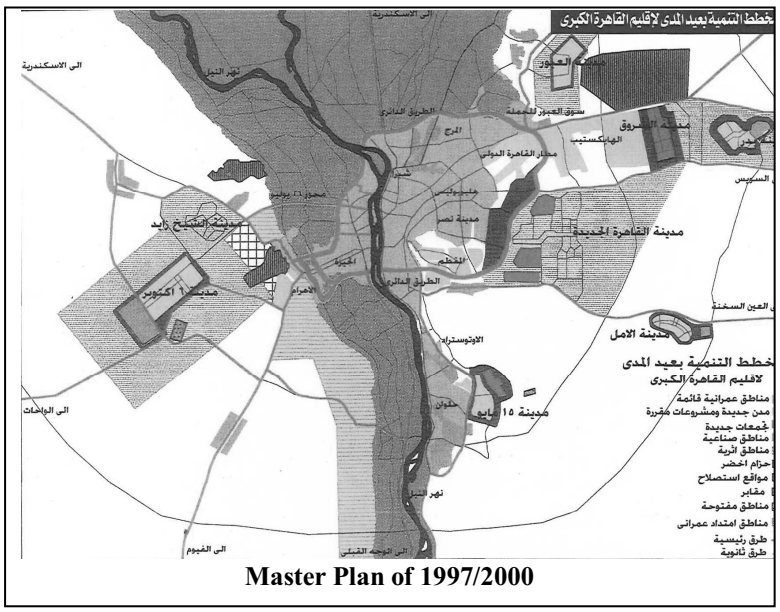
The 1992 Revised Plan called for accommodating 4 million people in NUCs, while the remaining 12 million would be accommodated in the existing agglomeration.

(5) The ongoing plan: master plan of 1997

In 1997, second revision of the Master Plan of 1982 was conducted. Now that the population of the Greater Cairo reached 13 million in 1996, a new target of 24 million was introduced for the target year of 2020.

Assuming that the population of GCR in 2000 was 16 million, the projected increase up to 2020 would be 8 million in total.

Master Plan of 1997 indicated that 5.8 million of the 8 million increase be accommodated in NUCs, and the remaining 2.2 million in and around the existing urban conglomeration.



Master Plan of 1997/2000

This plan thus accelerated the construction of NUCs outside of the ring road that had been completed almost to a full (except for a small stretch in Giza), and thence contemplated an outer ring road for future implementation.

2.3.2 Legal Framework and Organizations for Urban Planning and Urban Development

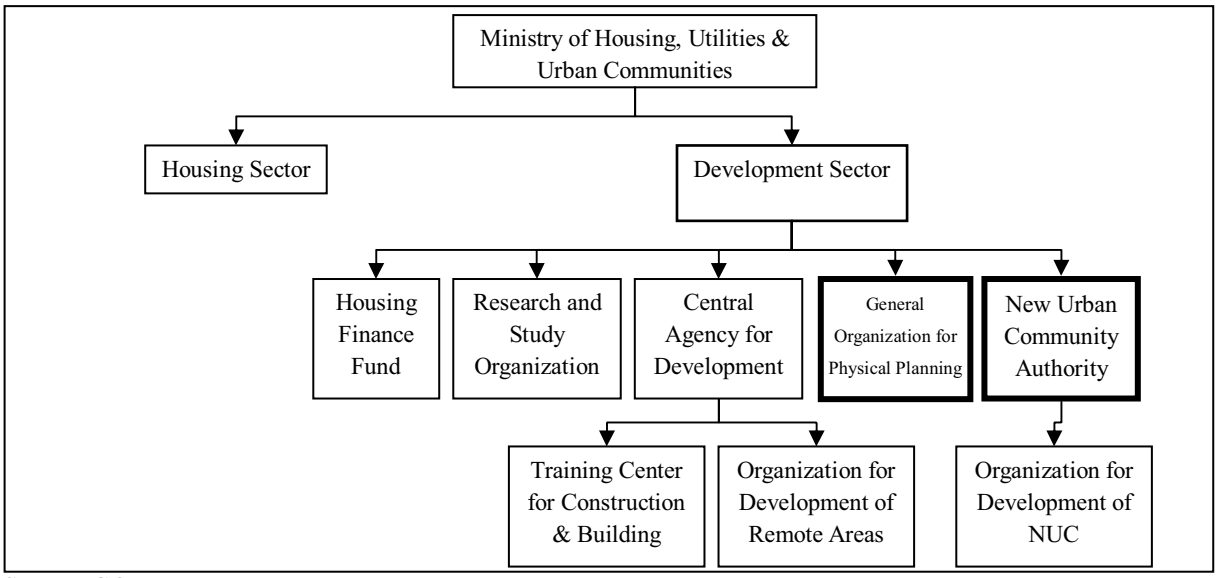
(1) Present legal structure and organizations

Legislative structure for urban planning has been established by Law No.3 of 1982 and Law No. 106 of 1976 for building works with its executive regulations.

General Organization for Physical Planning (GOPP) of Ministry of Housing, Utilities and Urban Development (MOHUUD) will be the responsible body for formulating the general policy for planning and sustainable urban development; setting up plans and programs for this purpose at the national and regional levels and revising urban plans at the local level.

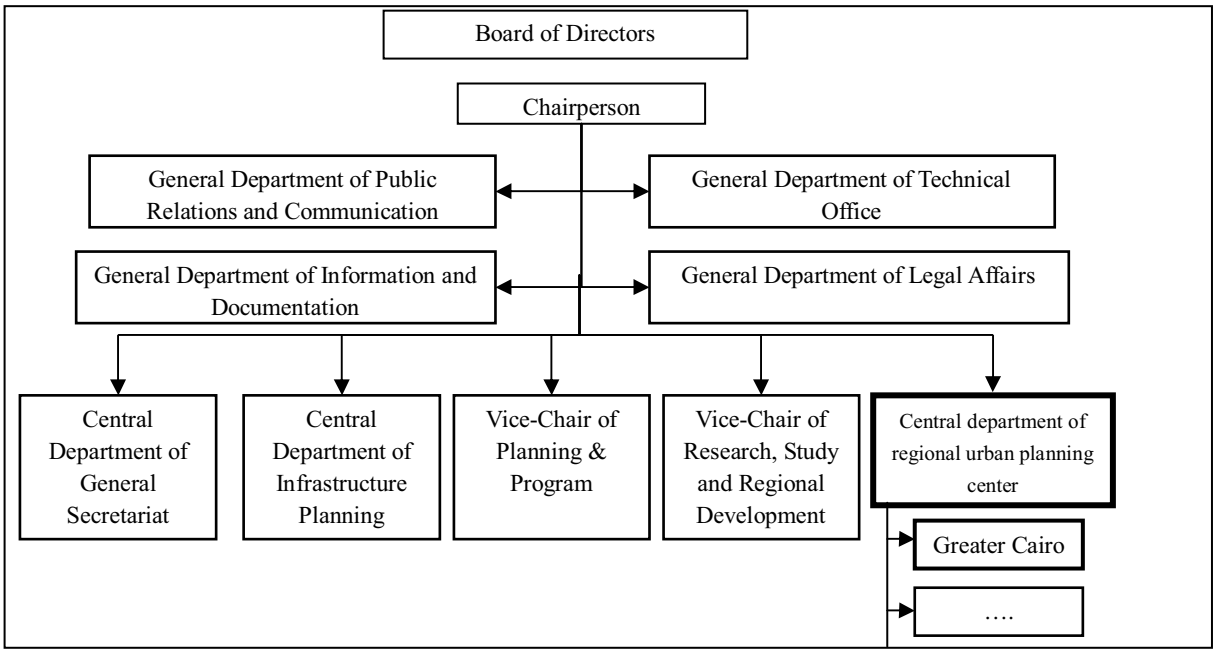
In each economic region of the country, a regional center under GOPP will be responsible for planning and urban development. The regional center will provide technical support for departments in governorates and follow up the implementation of the plans of cities and villages. Greater Cairo Region Urban Planning Center (GCRUPC) as the regional center takes responsibility for GCR.

The following figures show organization charts of MOHUUD, GOPP, and GCRUPC.



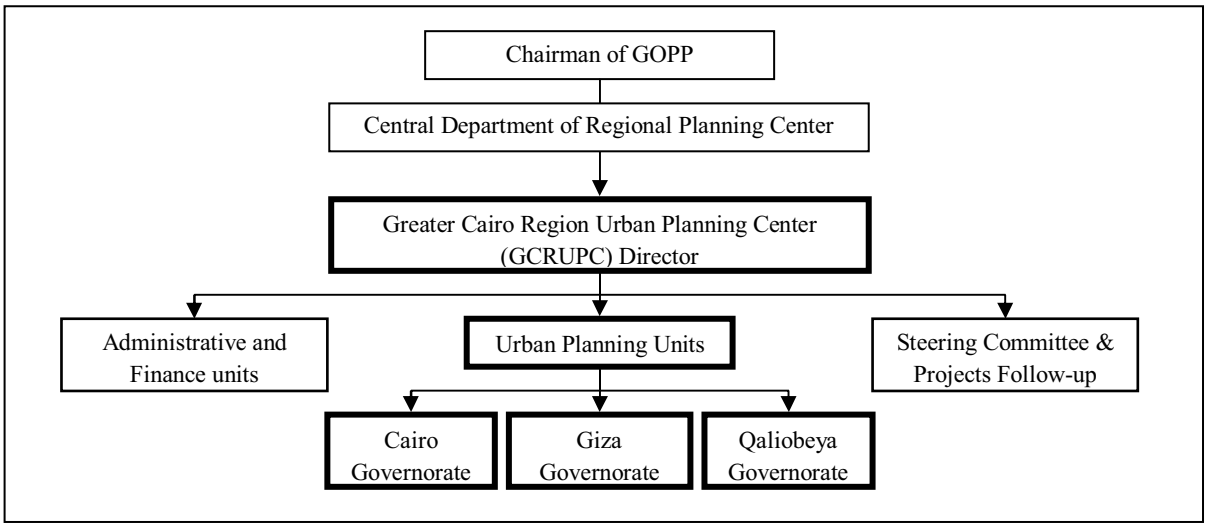
Source: GOPP

Figure 2.3.1 Organization Chart of MOHUUD



Source: GOPP

Figure 2.3.2 Organization Chart of GOPP



Source: GOPP

Figure 2.3.3 Organization Chart of GCRUPC

(2) Proposed modifications for the legal framework

Government of Egypt contemplates the new legislation which will integrate urban planning, building control, and urban preservation in the sole law. National Research Center for Housing and Building of MOHUUD drafted as a bill concerning physical planning, urban harmony, building and conservation of real estate wealth. The existing Law No.3 of 1982 and Law No. 106 of 1976 for building works with its executive regulations will be repealed by the new law.

The new law will consist of 12 articles and cover general provisions for administrative set-up and procedures for physical planning; national and regional planning; regulation of building works; conservation of the real estate wealth; penalty. The technical requirements will be specified in the executive regulations which will come within six months after the issuance of the new law.

The Higher Council will be chaired by the Prime Minister and formed by concerned ministers, heads of entities related to urban development, and ten experts. The higher council will have the right to approve the national and regional plans as well as the governorate plans.

Looking at the urban planning sector, the new law specifies in its first section definition of five different levels of plans, namely national, regional, governorate, strategic, and detailed plans.

Table 2.3.1 Definition of Spatial Plans specified in the New Law for Urban Planning, Building Control, and Urban Harmony

Type of Spatial Plan	Definition
National plan	・ To define policies and urban development programs in the country. ・ To specify national projects and implementation phases thereof. ・ To specify roles of public and private entities for the national projects.
Regional plan	・ To define policies and urban development for each economic region. ・ To specify national and regional projects and implementation phases thereof. ・ To specify roles of public and private entities for the projects.
Governorate plan	・ To define policies and urban development programs for each governorate, in accordance with the strategic plan for its cities and villages, and in the framework of the regional plan. ・ To specify the projects as well as priorities and implementation thereof. ・ To specify the roles of public and private entities for the projects.
Strategic plan	・ To draw up the future vision of the city or the village. ・ To specify the local socio-economic, environmental, and urban development plans to achieve the sustainable development. ・ To define the urban boundaries of the city or the village. ・ To specify its future needs for urban expansion and different uses of lands. ・ To identify actions plans, programs, priorities, mechanisms of implementation, and sources of finance.
Detailed plan	・ To set forth land uses, rules, requirements and implementation programs for the areas of the strategic plan of the city or the village. ・ To specify the development projects for the urban design, land subdivision and coordination of sites proposed for implementation within the strategic plan.

Source: English translation of new law concerning physical planning, urban harmony, building and conservation of real estate wealth

The new law will aim at realizing the urban harmony which is defined as the aesthetic and urban values created by façade of buildings, archeological spaces and visual patterns of the city with conservation of all elements of the natural environment. When the new law comes into effect, the national agency for urban harmony designated by the Presidential Decree No. 37 of 2001 will designate the areas, buildings, and establishments of distinguished value.

With regard to the building control, the new law specifies that the application for building permission will be prepared by the architect and submitted by the owner to the administrative body concerned with planning and organization affairs for their approval.

With regard to the operation and maintenance of establishments, the new law will specify that the occupants of buildings with five units or more will form the association which will be responsible for soundness of common spaces and annexes through conducting maintenance and repair works.

(3) Investment for urban development in the main agglomeration and new urban communities

MOHUUD has allocated a large part of the available public investment funds to development of the NUCs. The amount of funds has increased by more than seven times over a 20 year period between 1982 and 2001.

Table 2.3.2 MOHUUD Investment through the New Urban Community Authority as a % of the Ministry's Total Investments

Sector	1st 5yr Plan 1982/83 - 1986/87		2nd 5yr Plan 1987/88 - 1991/92		3rd 5yr Plan 1992/93 - 1996/97		4th 5yr Plan 1997/98 - 2001/02	
	LE million	% of Total	LE million	% of total	LE million	% of total	LE million	% of total
Water and Sanitation	271	10.2	542	8.6	1350	8.1	2818	17.9
Housing	492	5.1	743	4.9	1053	6.6	2220	12.0
Roads and Bridges	300	52.0	473	51.9	891	38.9	2133	38.8
Services	243	39.3	902	67.1	1852	69.8	2337	74.4
Total	1306	9.6	2660	11.2	5146	13.6	9508	22.2

Source: Arab Republic of Egypt, Urban Sector Update, 2007, World Bank

These consecutive installments have contributed to some extents in achieving significant population growth in NUCs during 1996-2006. On the other hand, it is true that still more than 70% of the existing population reside in and around the agglomeration area. Even though the development of NUCs is crucial to mitigate the population concentration in the main agglomeration, the measures need to be taken to upgrade and improve the living environment for the people who currently live in and around the main agglomeration.

2.3.3 Past Endeavours and Outstanding Issues in Long Range Urban Development Plans for GCR

(1) Planning principles

The past Master Plans follow the basic structure set forth by the 1982 Master Plan. The targets were reviewed and updated according to the latest outcomes, but the approach to the metropolitan urban issues remained unchanged.

The major points discussed in the Master Plan included:

- Protection of agricultural areas
- Opening the near desert land for urbanization
- Improvement of industrial (and business) location policy
- Improvement of transport efficiency
- Maximization of (the use of) existing infrastructure
- Protection of archeological and historical heritage, main support to tourism development
- Limitation of Greater Cairo Region continuous expansion
- Supply of alternative development zones to informal settlements
- Reorganization of the urban fabric to improve access to public services
- Increase of dwelling connections to utility networks
- Rehabilitation of ancient (old) neighborhoods

- Protection of water resources
- Control of air pollution

The major issues above still forms the core of the urban problems today, with minor modifications such as the ones given in parenthesis. In recognition of the major urban problems, the spatial organization proposed in the past Master Plans follow the basic concepts of 1982 Master Plan, which are in essence;

- Protection of arable land
- Urban development in the fringe of existing agglomeration mostly inside of the Ring Road
- Opening of urbanization towards desert areas through NUCs
- Organization of existing agglomeration with district planning method (Homogeneous Sectors) and improvement of self sufficiency

The basic approaches as adopted above are still valid today, and form the core of the urban planning policy for GCR.

(2) Institutional structure

In terms of jurisdiction, GCR encompasses three independent governorates, namely Cairo, Giza and Qaliobeya. The need for integrated planning for the capital area has long been recognized, and GOPP was established within MOHUUD as early as in 1973 for the purpose of setting the general policy for physical planning in the country. There are urban planning units for major regional cities including GCR, and this unit (GCRUPC), and this is one the counterpart organizations for the present study.

While GCR is administratively divided into three bodies, it is beneficial that there is the integral body, GCRUPC, in charge of the physical planning of GCR. GCRUPC works in collaboration primarily with the planning departments of three governorates while interacting within MOHUUD with Infrastructure Planning Department of GOPP, NUCA and others.

(3) Outstanding issues

1) Belated population shift to NUC

The past master plan often overestimated the population shift to NUCs. The 1982 Master Plan put the population target of NUCs in 2000 at 900,000, which was less than the total population of 16 to 16.5 million for GCR. Considering the fact that the Census population (permanent resident population) for all the NUCs in GCR was 218,000 in 1996, the target in 1982 Master Plan was somewhat high, but within the reachable range.

.The Revised Plan of 1991 stayed with the total target population in 2000 at 16 million, but put the NUC population target at 4 million. Considering that the existing population of GCR was about 12 million in 1991, this would mean that almost all the

increase in the population up to the year 2000 be accommodated in NUCs. As the existing agglomeration continued to be the focal point for housing needs for the city dwellers, this abrupt change in the NUC population target was not met. The shift in population to NUCs was much slower than the 1991 Master Plan, as mentioned above.

The population shift to NUCs started later than expected, but it took firm shape. The Census 2006 found the total population of NUCs 601,000 in 2006, which means that the annual growth rate for NUC population was 10.7%, as compared to 1.7% for Main Agglomeration. In this period the focal point for population shift took a clear turn towards NUCs.

.Though belated in occurrence, the population shift to NUCs looks to be firm in 1996 2006. Supportive measures need to be geared up to sustain the population shift so that the investment in NUCs would not be any wasted. The measures shall include the urbanization control in Main Agglomeration, improvement of living environment in NUCs such as introduction of commercial facilities and enhancing the public services, and improvement of transport systems.

2) Decongestion and adjustment of misuses in main agglomeration

Despite the efforts to decentralize the population concentration in main agglomeration, the population density of main agglomeration is gradually increasing at 1.7% per year in 1996-2006. Relocation of facilities presently located in Main Agglomeration to suburbs need to be accelerated. Relocation may include the manufacturing industries, particularly polluting industries, business offices including the Government Offices, for which a relocation plan is being contemplated, university/colleges and other facilities.

Misuses in Main Agglomeration include the aforementioned polluting industries, logistics facilities such as large freight yard, warehouses as well as cemeteries. One notable example in the history of urban planning in GCR is the relocation of wholesale market from the city center towards a suburban location. Generally, the sites after relocation of such facilities could be utilized for restructuring the urban area, such as a large scale park or cultural zone or any services, facilities needs in the area.

3) Insufficient urban planning enforcement mechanism

While the Master Plans continued to show the desired urban structure for GCR for the future, the mechanism for enforcement of controlling and stipulating the changes in the urban structure was generally insufficient.

Controlling urbanization is best conducted when new buildings are made. The location, type and function of the building could be checked with the Master Plan, and if serious disagreement exists in the building plan, then the building permit could be sustained until necessary modification is made.

The present Master Plan has insufficient building permit/control measures, so that buildings incompatible with the Master Plan presumption might not be stopped or modified. This is part of the reason that the informal sector in GCR is expanding.

In the proposed new law, modification in the building permit procedures are included, as discussed earlier. If this modification applies to the enhancement of building control measures for incompatible buildings according to Master Plan, the proposed procedures will have to be enacted as soon as possible.

4) Capacity building in GOPP

The basic organizational arrangement for urban planning for GCR looks to be sound and functional. While GOPP has the authority for formulating a physical plan for urban areas, urban planning units such as GCRUPC has the experience and knowledge in doing so.

The basic capacity of urban planning units, such as GCRUPC, for formulating master plans traces back to international cooperation programs with the French Government in 1980's. Some modern urban planning methodologies and techniques such GIS, remote sensing, etc. need to be enhanced in GOPP, so that they will play more positive roles in urban planning for the Egypt.

The role and expectation of GCRUPC should be enhanced as an integral part of GOPP as an institute for urban physical planning.

2.4 Urbanization Trend

2.4.1 Historical Context

(1) History of urbanization in Cairo

Cairo has a long history and this has affected the nature of districts in Cairo to a large extent. The history of urbanization in Cairo can be summarized as follows

1) Ancient Cairo

The history of Cairo started around BC 30, when the fortress of Babylon was built during the Greco-Roman period in what is known today as "Old Cairo" in the southern part of the city. When Christianity was introduced in Egypt in the 1st Century A.D this area became a site for Coptic churches.

In 7th Century, Egypt came under control of the Umayad dynasty located in Syria, and an Islamic architecture started to be built. A new city called Fustat and mosques were built outside of the fortress, which became the Islamic Cairo of today. In the 10th Century, an external force from the northern Africa invaded Egypt and set up a city called Qahira, which later became the city's name "Cairo".

2) Medieval Cairo

In the 12th Century, Saladin became the sultan here and he started to fortify the Citadel and extended city walls. This marked the beginning of the 400-year long era when a many large and magnificent Islamic architectural structures were created in Cairo. The Islamic Cairo, which is now registered in the UNESCO World Heritage list, was the center for architecture created during this period. In 16th Century, when the Ottoman Turkey took over, Cairo started to decline.

3) Modern Cairo

The momentum of Cairo's growth came back when the French occupied Egypt in late 18th Century, and some of the European nations such as France started to take interest in Egypt in early 19th Century. In the middle of 19th Century, Muhammad Ali, an Ottoman Turkish officer who has been sent to Egypt, started to build a city in his own way with a mosque on top of the Citadel.

A grandson of Muhammad Ali named Ismail (1863－1879) was relevant to the modern history of Cairo, as he formulated a plan to urbanize the area west of the Islamic Cairo to make a new city center. New roads were laid out in grids, and a number of new buildings were built, which became the downtown Cairo today.

From the late 19th Century, the British occupied Egypt to "safeguard the Suez Canal" (1882－1936). Cairo grew steadily as the center of the colonized Egypt. The population of Cairo

quadrupled from 374,000 in 1882 to 1,312,000 in 1937. This growth of population was accommodated in the new city designed and built by Ismail.

4) 20th century Cairo

Urbanization of Cairo did not weaken in the 20th century, and new city stepped out of the Ismail's plan and further beyond. In 1906, a land along the Nile then princely residence was now developed for Garden City, a fashionable quarter for residence with English style winding street and modern buildings. Just about the same time, Jazira, an isle of the Nile opposite Cairo, became a high-end residential area, and development started in the southern isle named Rodah, too. Urbanization took to islands of the Nile and thence reached the opposite side of the Nile, at Giza.

In Heliopolis, a private development company started a 2,500 ha development in 1906, and later 5,000 ha were added in 1910. This development followed the idealistic urban development concept of Garden City, created in the late 19th Century in England. The development first targeted the westerners at the outset, thence turned to relatively well-to-do Egyptian customers. The project later included low-income housing units, too, and this brought general public attention as a social experiment[1].

In 1936, Egypt and the U.K concluded a Peace Accord, but the British occupation continued virtually until the 1950's. In this period, the population growth of Cairo accelerated more and more, and in 1940's and 1950's, the annual growth rate exceeded 4%. This was extraordinarily high growth rate.

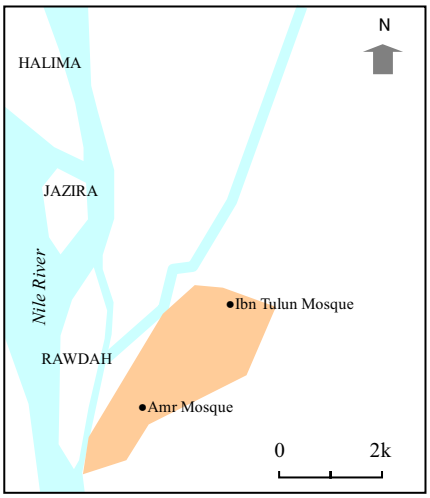
Nasr, who came to the political stage in 1952 introduced some important measures in urban planning. One prominent example is the development of the Nasr City, which is a new development in the desert area between Heliopolis and Cairo. The original plan included public offices, industries, business and residence developed over a land of 8,000 ha, with the planned population of 500,000.

As will be discussed in depth in the following section, the quick expansion of Cairo left the urban areas in a poor condition as the infrastructure was unable to catch up, leaving behind environmental pollution and congestion. This is how the urban planning in Cairo was started.

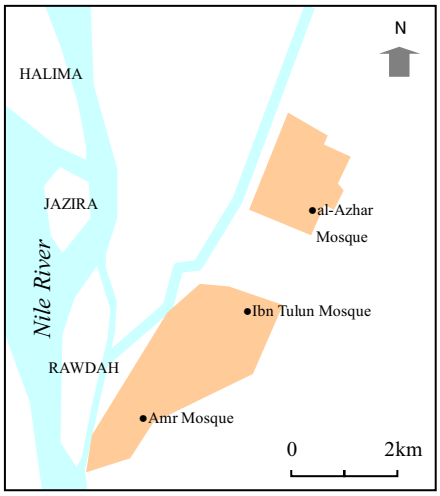
In 1977, the historical area as in Cairo where magnificent examples of historical architecture is abundant was registered in the list of World Heritage by UNESCO.

[1] Andre Raymond, Cairo - City of History, The American University in Cairo Press, Cairo 2000.

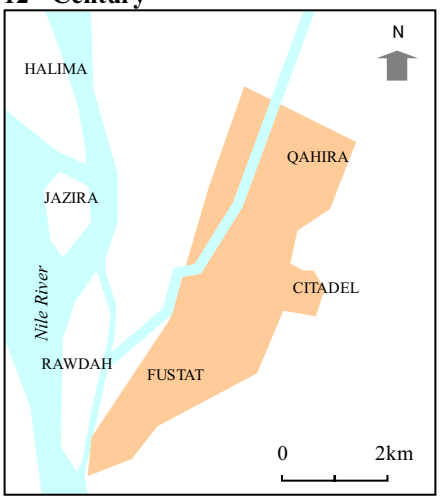
Late 7th Century



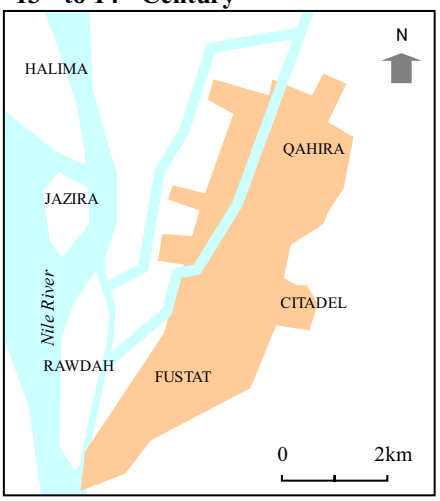
10th to 12th Century



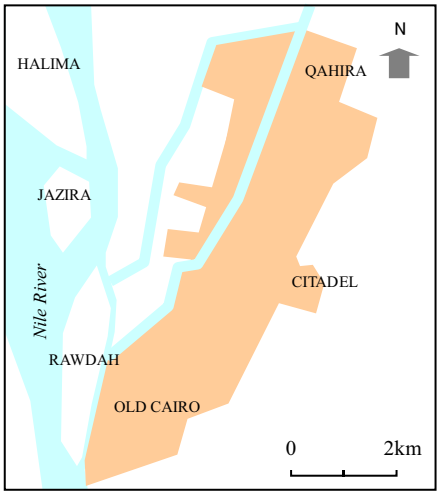
12th Century



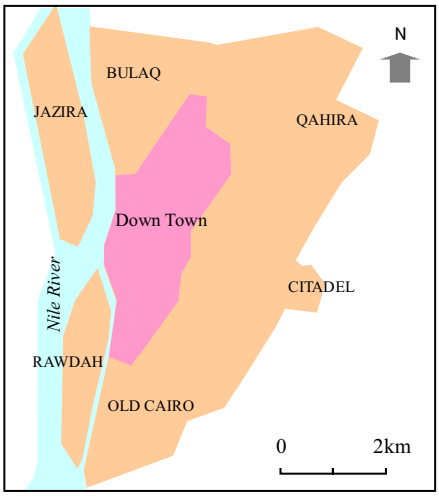
13th to 14th Century



Early 15th Century



1933



Source: City of History, Andre Raymond

Figure 2.4.1 Historical Change of Built-up Area

(2) Historical growth of population of GCR

The population of GCR started to grow around the mid 19th Century and reached 1 million in 1927. The population grew at an annual rate less than 3% up to 1936. After the end of WWII, Cairo experienced a rapid and almost explosive growth of population, which averaged 5.6% between 1937 and 1965, and the population exceeded 6 million in 1965. With the stabilization of livelihood, the population growth got back to the level of 3.3% after 1965.

Table 2.4.1 Historic Trends in Population of GCR

Year	Population	Growth rate (% per year)
1863	305,000[1)]	
1882	374,000[1)]	1.1
1927	1,060,000[1)]	2.3
1937	1,312,000[1)]	2.2
1945	2,162,000[2)]	6.4
1968	5,487,000[2)]	4.1
1982	8,600,000[2)]	3.3

Source 1) City of History, Raymond, 2004
Source 2) Greater Cairo Region Long Range Urban Development Scheme, GOPP

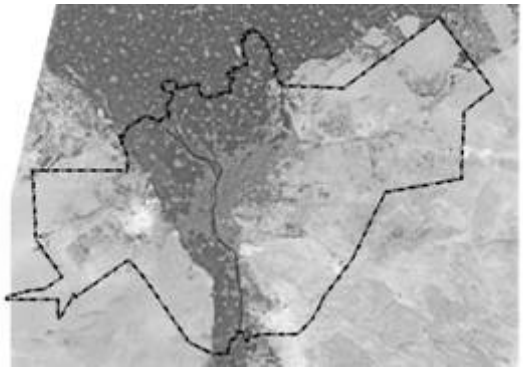
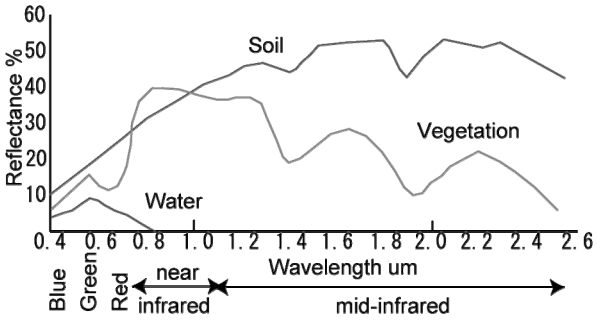
2.4.2 Recent Changes in Urbanized Area in Study Area between 2001 and 2007

(1) Data source and methodology for land cover analysis

The basic data source for the changes in urbanized areas within the study area that are described in this subsection are the Landsat images from 2001 and 2007, supplemented by IKONOS images from 2002 for location reference. The methodology adopted for this analysis is the commonly practiced remote sensing technique of utilizing spectral reflectance (color) to determine the type of land cover. This analysis is called automated land cover mapping, which constituted the preliminary step for doing land use analysis. The land use analysis formed the basic structure for mapping urbanization condition that is described in the section..

The basic procedures for the land cover analysis are explained in Table 2.4.2. The land cover categories that were established are shown in Table 2.4.3.

Table 2.4.2 Procedures for Land Cover Analysis

Step	Description	Reference
Step 1 Data Collection and Adjustment	• Landsat Imagery 2001 and 2007 obtained • All data are adjusted in correct geographical location system using the reference data of IKONOS 2002/UTM WGS1984 36N	 **Landsat Imagery 2007**
Step 2 Establish Land Cover Categories	• For the purpose of the land cover analysis, the 8 categories were established	Categories are shown in Table 2.4.3.
Step 3 Remote Sensing Analysis	• Land cover classification was analyzed utilizing the characteristics of standardized frequency measurements of the reflected sunlight according to the surface conditions.	 **Standardized reflectance for land cover category**
Step 4 Area Calculation	• Land cover compositions in area are calculated for the planning zones	

Source: JICA study team

Table 2.4.3 Land Cover Categories

Categories	Description
Built-up Area (High)	Urban areas that appeared to be highly built-up
Built-up Area (Medium)	Urban areas that appeared to be modestly built-up
Built-up Area (Low)	Urban areas that appeared to be sparsely built-up
Agriculture	Vegetated areas that generally appeared to be cropland, marshland, or orchard
Bare land	Non-vegetated areas that generally appeared to be base soil
Desert	Desert areas with little or no vegetation
Water	Water, including rivers, lakes, and channels
Open space	"Green" areas and "open space" within the urban environment

Source: JICA study team

(2) Expansion of urban area between 2001 and 2007

The land cover analysis above showed that an area of 12,600 ha was urbanized between 2001 and 2007 in the various parts of study area. Bare land, which is thought to be a precedent form of urbanization, increased by 3,700ha during the same period, showing extensive urban

development in progress. The reduction occurred in desert land with a total of 13,100ha and in the open space with a total of 1,100ha.

One noticeable phenomenon was the loss of agricultural land. In 2001, the total agricultural land 82,500 ha, which decreased to 80,500 ha in 2007, with a loss of 2,000 ha in the same period. The loss of agricultural area accounts for about 2.5% of total agricultural area in study area, which is substantial in magnitude.

Table 2.4.4 Land Area by Land Cover Categories in 2001 and 2007

Land Cover Category	Area (ha)		Change in 2001-2007 (ha)
	2001	2007	
Built-up area	57,200	69,800	12,600
Agriculture	82,600	80,500	-2,100
Bare Land	1,400	5,100	3,700
Desert	285,700	272,600	-13,100
Water	3,400	3,400	0
Open Space	6,200	5,100	-1,100
Total	436,500	436,500	-

Note: Built-up area includes urban area, airport, and cemetery.
Source: JICA study team

In order to clarify the land use categories in which urbanization took place, regarding the newly urbanized area of 12,600 ha, previous land use categories were analyzed. Desert land is the largest area of 7,100 ha, followed by 3,300 ha of open space and 2,000 ha of agricultural land. The decrease in open space does not necessarily mean sacrifice of green area, but rather urbanization on unused land near or on the fringe of the urban agglomeration.

Table 2.4.5 Area which was converted into Urban Area in 2001-2007

Land Cover Category	Area (ha)	Share (%)
Agriculture	2,400	19.2
Bare Land	60	0.5
Desert	6,740	53.0
Water	100	0.8
Open Space	3,300	26.5
Total	12,600	100

Source: JICA study team

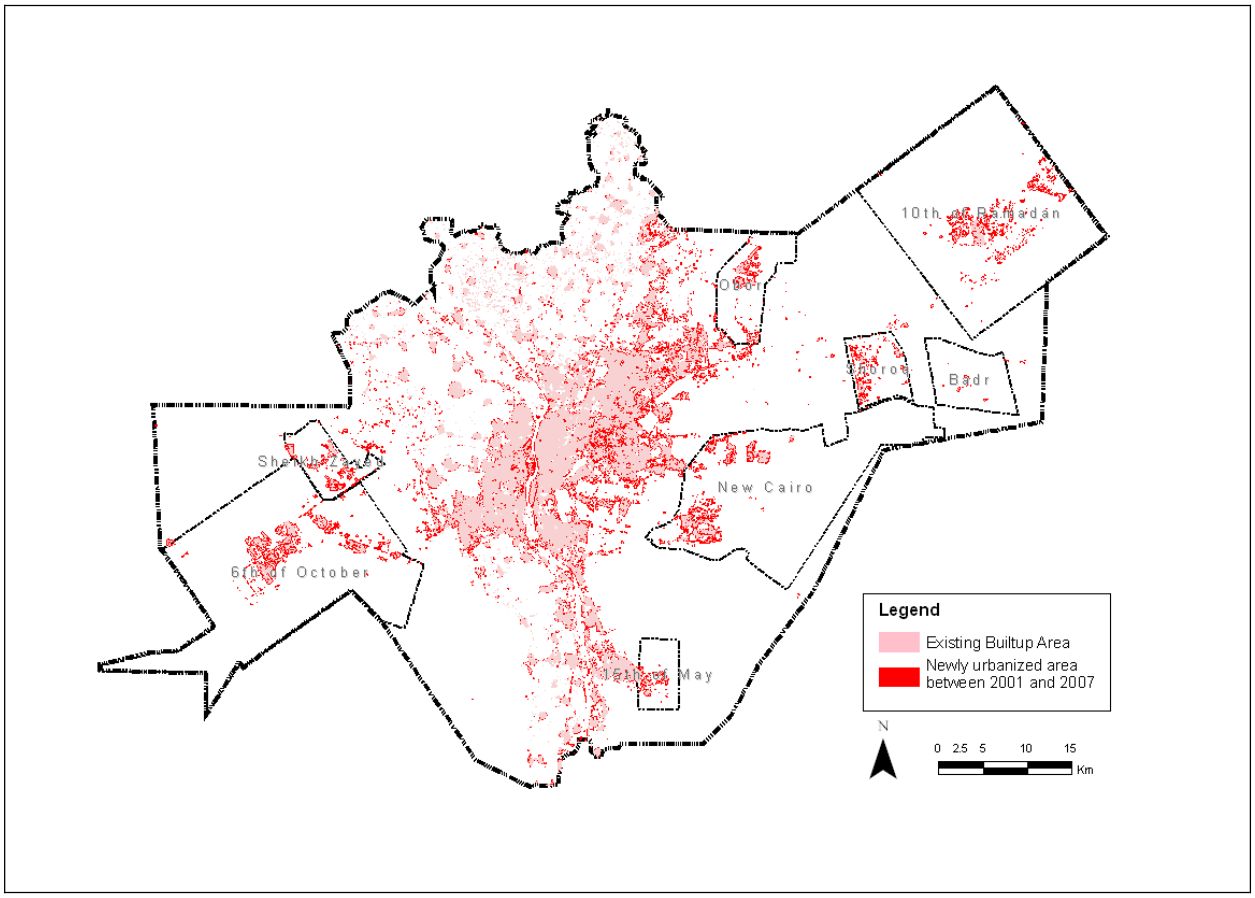
Figure 2.4.2 shows the location of the newly urbanized area in the study area between 2001 and 2007. The following characteristics of urban change can be this figure the following characteristics of urbanization;

1) New urbanization is actively occurring on the fringe of the existing agglomeration within a radius of about 20 km;

2) New urbanization areas are comparatively small less in the central part of the existing agglomeration, as most of the area had already been urbanized;

3) New urbanization is also active in NUCs even though they are beyond the 20km radius and;

4) New urbanization is taking place even though in agricultural areas to a lesser extend, particularly on the fringe of existing small towns and villages.



Source: JICA study team

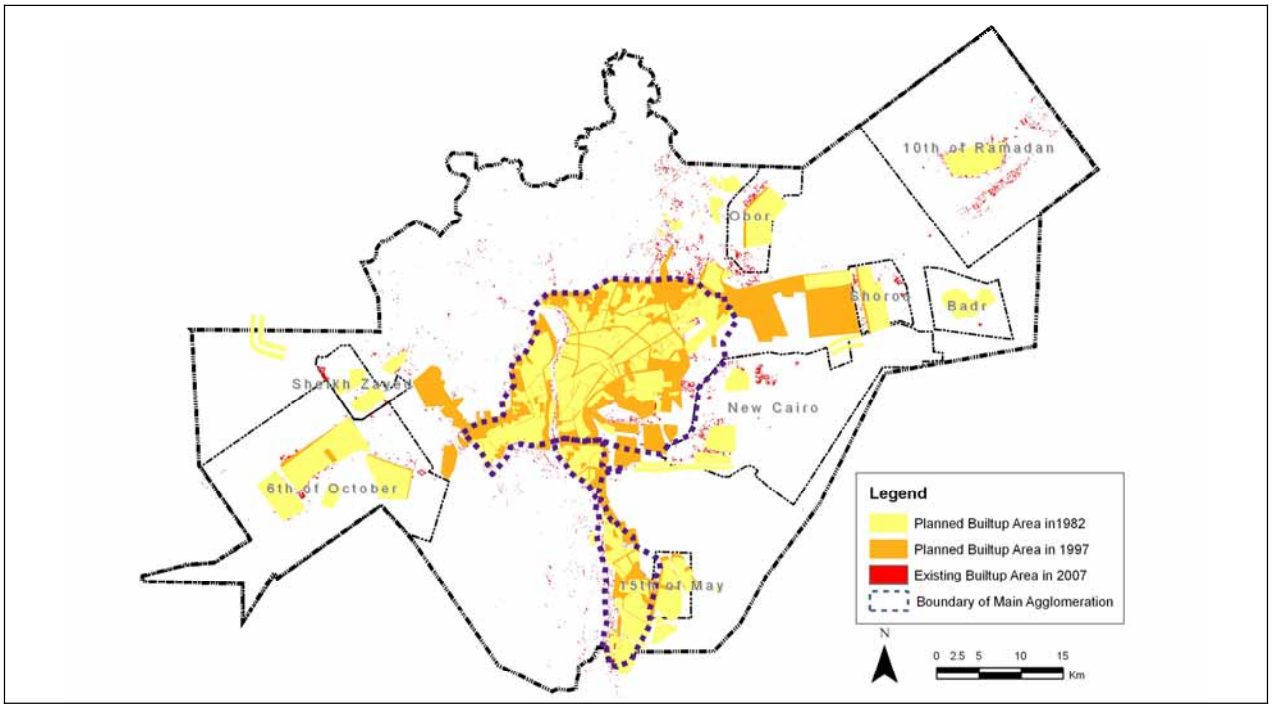
Figure 2.4.2 Urban Area Change between 2001 and 2007

2.4.3 Urbanization Trends in Historical Perspective

In order to look at the trends in recent urbanization as seen above in longer historical perspective, the urban areas for 2001 and 2007 were compared with then existing urban areas at the times of previous urban master plans[2]. The following map indicates urban area as planned in 1982, 1997 master plans, and the actual urban areas in 2007.

As the map shows, the urban area expanded toward the fringes in accordance with population growth all through the period. In 2007, the urban expansion grew in the way exceeding the planned urban area in 1997 in new towns as well as in the fringe of the built-up area.

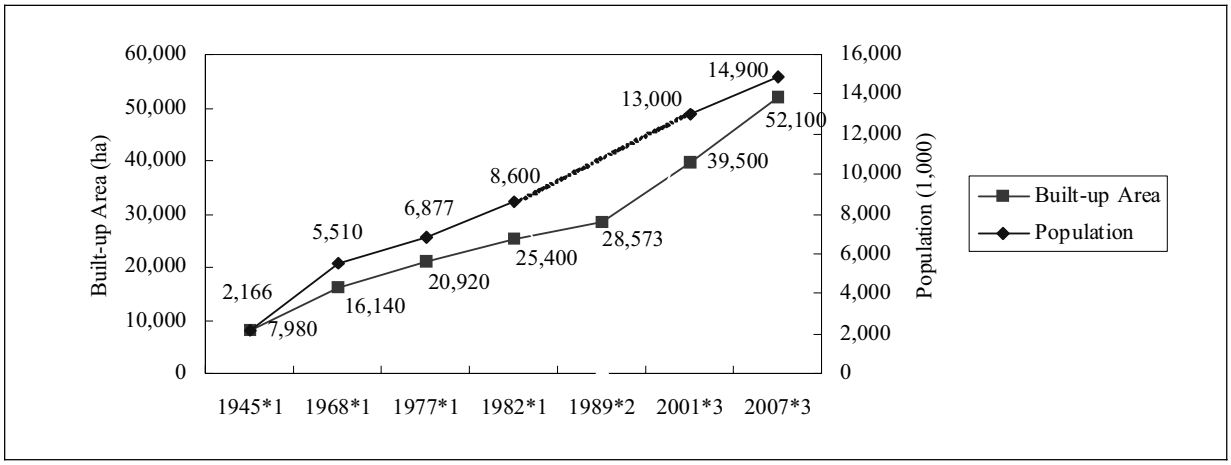
[2] As the methodologies of delineating urban areas for 2001/2007 and for previous master plan analysis differ, the comparison of 2001/07 and previous times shall be taken as being rough in precision.



Source: JICA study team

Figure 2.4.3 Extension of Built-up Area in 1982, 1997 and 2007

Figure 2.4.4 shows the changes in built-up area between 1945 and 2007. This table indicates that total built-up area in the study area expands approximately 2 times that of 1982. The expansion of urban area is accelerating in 1990's and thereafter, compared to the previous thirty years.

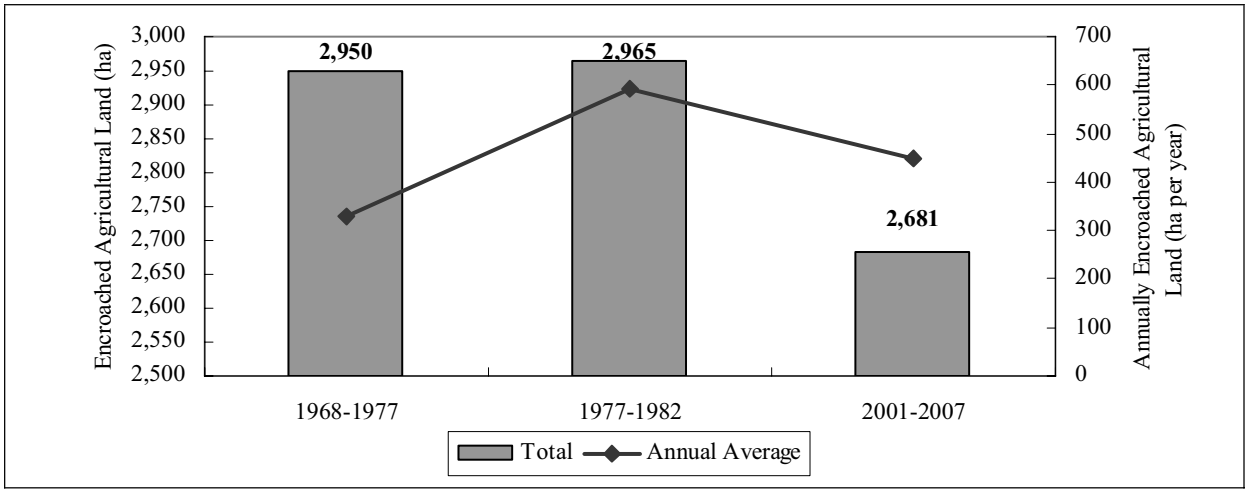


Source*1: 1982 Master Plan, GOPP
Source*2: GOPP/IAURIF-1990
Source*3: Technical Report on Analysis of Greater Cairo Urban Development by Satellite
Source*4: JICA study team
Note: Population in 2001 and 2007 was estimated on the basis of Census in 1996 and 2006.

Figure 2.4.4 Trend of Built-up Area and Population from 1945 to 2007

The scarce agricultural lands have been encroached upon by urbanization in 2001-2007. Its loss was estimated to 2,400ha with an average amount at 400ha per year. The average land

area which was transformed from agriculture land to urban slowed down in the period of 2001 and 2007, compared with a period such as 593ha per year in 1977-1982 (2,965ha in total) as shown in Figure 2.4.5.



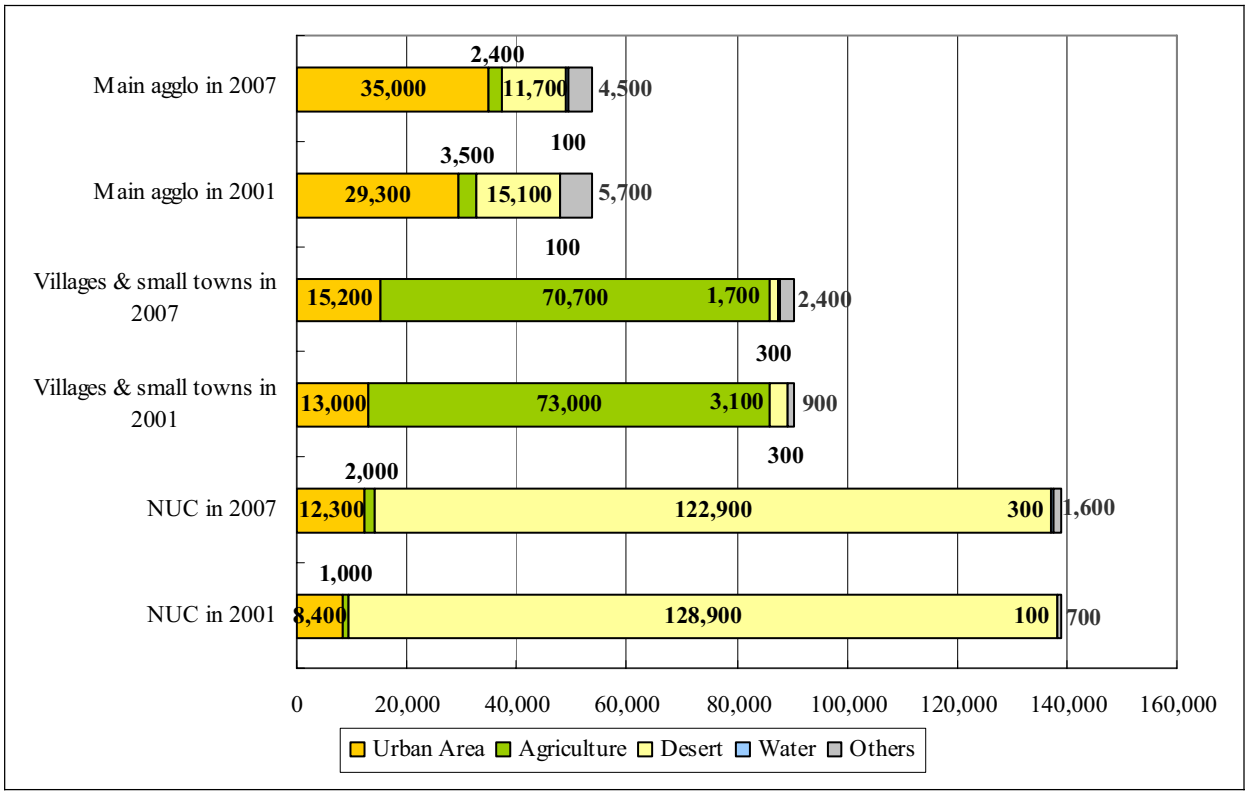
Source 1) GOPP for 1968-1977 and 1977-1982
Source 2) Remote sensing analysis of Landsat image in 2007 for 2001-2007

Figure 2.4.5 Encroachment on Agricultural Land and its Annual Rate in 1968-2007

2.4.4 Urbanization of Main Agglomeration, Villages & Small Towns, and New Urban Communities

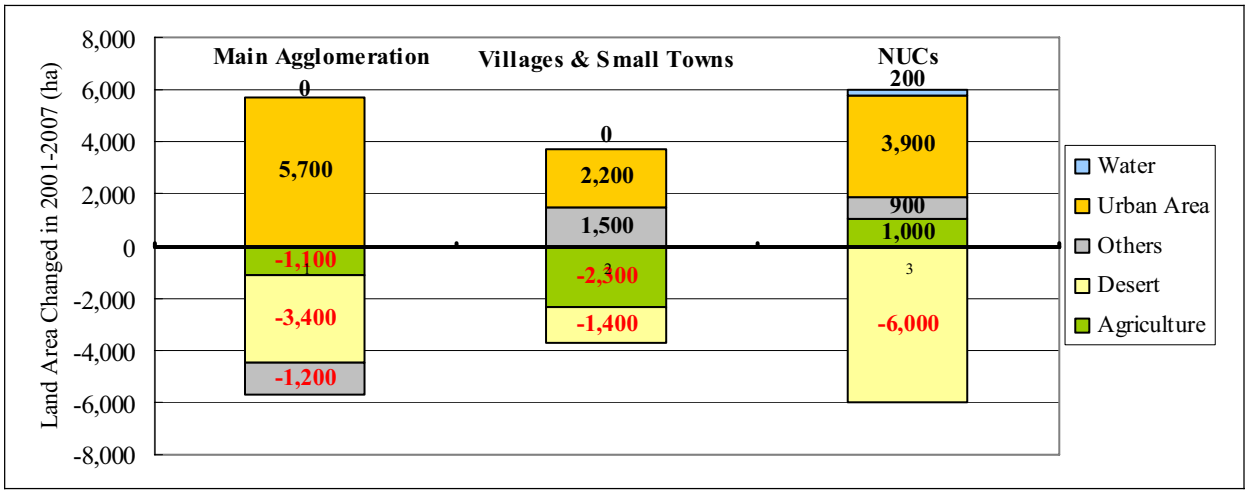
(1) Characteristics of urbanization by built-up area

The characteristics of urbanization differ according to the built-up areas. Figure 2.4.6 and Figure 2.4.7 shows the land area by land cover category in main agglomeration, villages and small towns, and NUCs as well as the land area changed in 2001-2007.



Source: JICA study team

Figure 2.4.6 Land Cover by Built-up Area in 2001 and 2007 (ha)

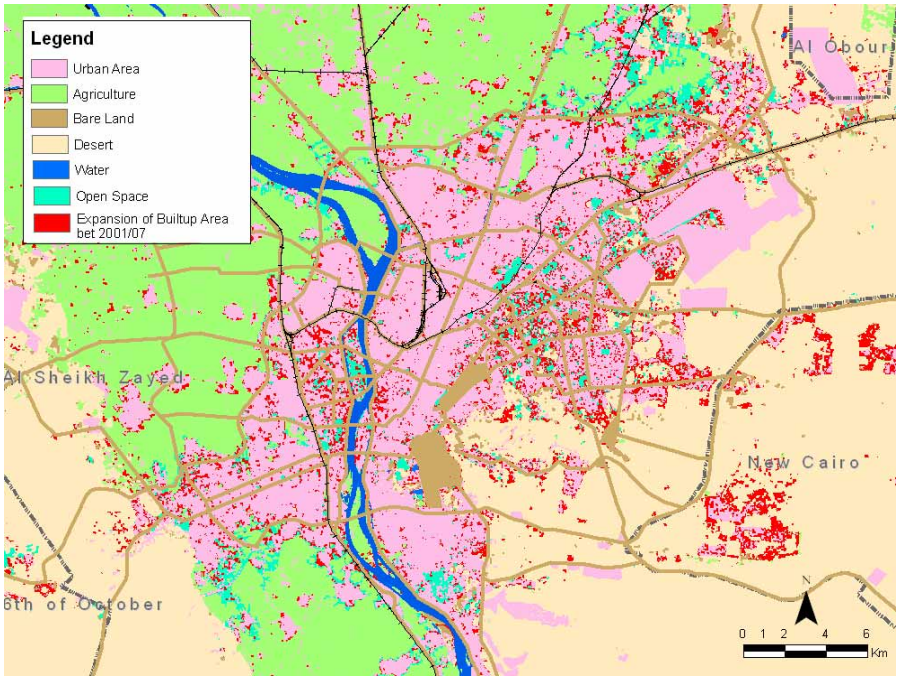


Source: JICA study team

Figure 2.4.7 Share by Land Cover of each Built-up Area in 2001 and 2007 (%)

1) Main agglomeration

Urban expansion in existing built-up area is observed in its fringes as shown in the two figures at next page. Red color in the figure indicates the area which was transformed into urban area in 2007 from non urban area in 2001. The fringes of existing built-up area tend to be expanded as urban area by eating up desert or arable land.



Main Agglomeration

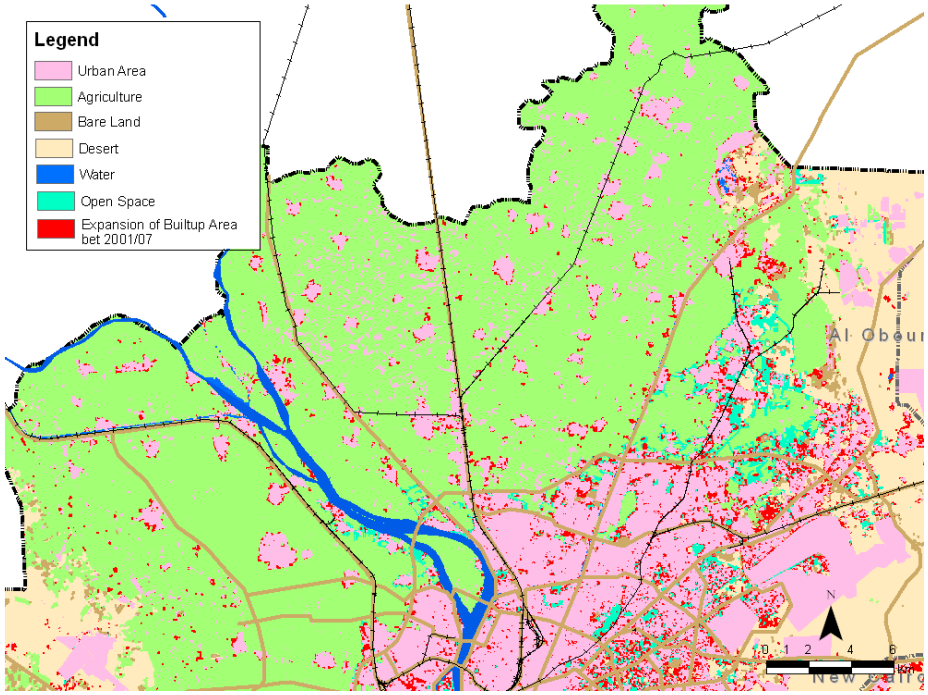
1) On the eastern side, urbanization is occurring mostly at the south eastern to north eastern fringes of agglomeration, mostly within 20 km of radius from city center.
2) On the western side, urbanization is prominent in Giza near the city center.
3) Scattered fill-in urbanization in all directions within the Ring Road other than the above.

Source: JICA study team

Figure 2.4.8 Expansion of the Built-up Area in Main Agglomeration

2) Villages & small towns

The agricultural area to the north of the study area is predominantly agricultural area with farmland and greenery. Urban areas such as villages and small towns are scattered in the agricultural area accommodating primarily the houses of rural communities. With improved accessibility to study area and population increase in the rural communities, the urban areas are expanding gradually outwards encroaching on the farm land around. New urbanization is more prominent near or along the regional roads and railway stations. On the basis of the satellite imagery analysis, new urbanization is observed the areas adjacent to the main agglomeration and existing built-up areas of villages & small towns in the period from 2001 to 2007.



Villages and Small Towns

1) Urban areas exist within agricultural areas just like scattered islands.
2) New urbanization is taking place at the external bounds of each villages & small towns encroaching on agricultural lands around.
3) New urbanizations are more visible along or near major roads and railways.

Source: JICA study team

Figure 2.4.9 Expansion of the Built-up Area in Villages & Small Towns

3) New urban communities

Table 2.4.6 indicates changes in built-up area in New Urban Communities between 2001 and 2007 from the result of land cover analysis.

As a whole, the urban area nearly tripled from 2,400 ha in 2001 to 6,300 ha in 2007, indicating aggressive urbanization taking place in most of NUCs. Nonetheless, all the new urban communities have developed less than 12% of the designated total area for development, which would indicate the total development boundary is far reaching.

The new total urbanization in NUCs between 2001 and 2007 was 3,911 ha in total, of which 1,147 ha took place in 6th of October and 1,021 ha in New Cairo. These two NUCs are the top two contributors of urbanization in NUCs.

6th of October and Sheikh Zayed are major new urban communities in the western part of the Study Area, and planned to be developed for urban community accommodating residential and industrial areas to provide working and living places for residents. The area for industrial zone located in the western part of the community is already developed as planned, and so is a part of residential area where major roads are installed connecting to existing urban area, Giza and Cairo city.

Table 2.4.6 Changes of Built-up Area in NUC between 2001 and 2007

NUC	Total Area (ha)	Built-up Area (ha)		% of Built-up Area to Total Area in 2007 (%)	Between 2001 and 2007	
		2001	2007		Change (ha)	Growth Ratio (%/year)
6th of October	41,500	735	1,882	4.5	1,147	26.0
Al Sheikh Zayed	4,515	163	534	11.8	371	37.9
Al Shorouk	4,696	208	499	10.6	291	23.3
Badr	6,142	10	34	0.6	25	41.7
10th of Ramadan	41,250	422	997	2.4	575	22.7
15th of May	3,542	160	277	7.8	117	12.2
New Cairo	31,200	519	1,540	4.9	1,021	32.8
Al Obour	6,654	198	563	8.5	364	30.6
Total	139,499	2,416	6,327	4.5	3,911	27.0

Source: the result of analysis of Landover interpolating from LANDSAT images (2001/2007), JICA study team

New Cairo, which is one of the largest new urban communities in the east part of the study area, is planned to accommodate residential, CBD, and industrial zones, and two major universities in the site, and also government buildings are to be relocated in near future adjacent to the New Cairo. The development activities during the past six years are seen in the west part of the community which is cross to existing urban area. Major roads to connect to the urban area and local roads in the residential zone are installed. In the east side, some parts as extended already developed area have developed premises.

2.4.5 Conclusion Related to Urbanization Trend

The major points discussed in this section are summarized as following.

- The present urban area of GCR has been formed in the course of the long historical process for more than 2000 years, and each area corresponds to specific time with different regimes that was in power. The population of GCR reached 1 million in the 1920's and it has grown constantly since then to become one of the largest urban agglomeration in the world today.
- The urban area of GCR has been expanding constantly since the end of WWII. The present day urban area is 52,100 ha, which is about 6 times larger than that in 1945, or about 2 times larger than that of 1982.
- .Expansion of urban area accelerated the decrease in arable areas in GCR. During 1960's to present, the decrease in arable land due to urbanization account for in the range of 300 to 600 ha annually. Despite efforts to protect arable land in previous master plans the reduction of arable area due to urbanization has not been controlled completely.
- In the recent years (between 2001 and 2007), urbanization in NUCs are taking place in rapid pace, almost tripling the urban area in NUCs in 2001 to 2007. Major contributors to such explosive expansion were 6th October and New Cairo, where more than 1,000 ha of urbanization took place.
- In the Main Agglomeration, urbanization is active at or near the fringe, within a radius of about 20 km from the city center.

- In villages and small towns, urbanization is occurring at the periphery of existing villages and small towns, and this phenomenon is outstanding in areas along the regional roads and/or railway stations.

2.5 Land Use

2.5.1 Present Land Use

(1) Source of data and land use categories

In order to analyze existing condition of urbanization in the Study Area, the land cover analysis was conducted utilizing Landsat satellite imagery for 2001 and 2007, as mentioned in Section 2.4. The land cover was further categorized into the eleven land use types shown in Table 2.5.1. To asses the density of built-up areas (low, medium and high), and to identify industry, cemeteries, and airports, other sources of data such as IKONOS and QuickBird images, and GIS layers from GOPP and CAPMAS were used.

Table 2.5.1 Land Use and Cover Categories

Land Use Categories	Land Cover Categories	Description
Built-up (High)	Urban (built-up)	Urban areas that appear to be highly built-up
Built-up (Medium)		Urban areas that appear to be moderately built-up
Built-up (Low)		Urban areas that appear to be somewhat built-up
Industry	Urban (others)	Industry (determined manually by photo-interpretation and other source)
Airport		Airports(determined manually by photo-interpretation)
Cemetery		Cemetery (determined manually by photo-interpretation and other source)
Bare land		Non-vegetated areas that generally appeared to be base soil
Agriculture	Agriculture	Vegetated areas that generally appeared to be cropland, marshland, or orchard
Desert	Desert	Desert areas with little or no vegetation
Water	Water	Water, including rivers, lakes, and channels
Open space	Open space	“Green” areas and “open space” within the urban environment

Source: JICA study team, 2007.

As for detailed land use, several layers for land use such as contours, open space larger than 5ha in the main agglomeration, misuse by polluted factories, CBD or sub-center, informal area and others were developed in addition to the land cover layer. These additional layers were based upon the following input from relevant sectors in order to analyze the existing condition of the study area:

- Input from GOPP through discussions on the existing condition and ongoing projects;
- Input from Cairo, Giza, and Qaliobeya governorates through discussions and workshops on existing conditions and ongoing projects;
- Site surveys; and
- Photo-interpretation of QuickBird and IKONOS satellite images.

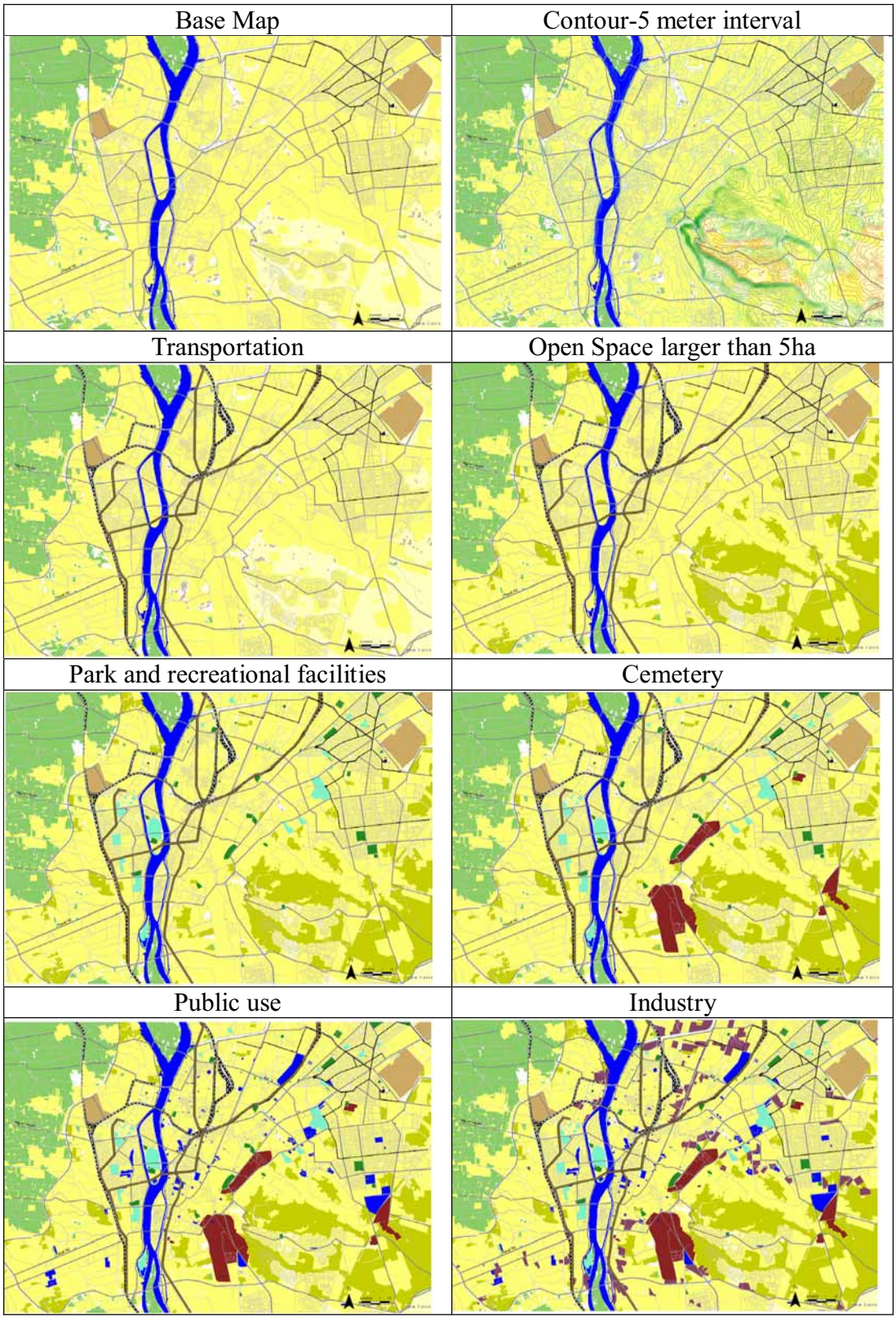


Figure 2.5.1 GIS Layers on Existing Condition (1/2)

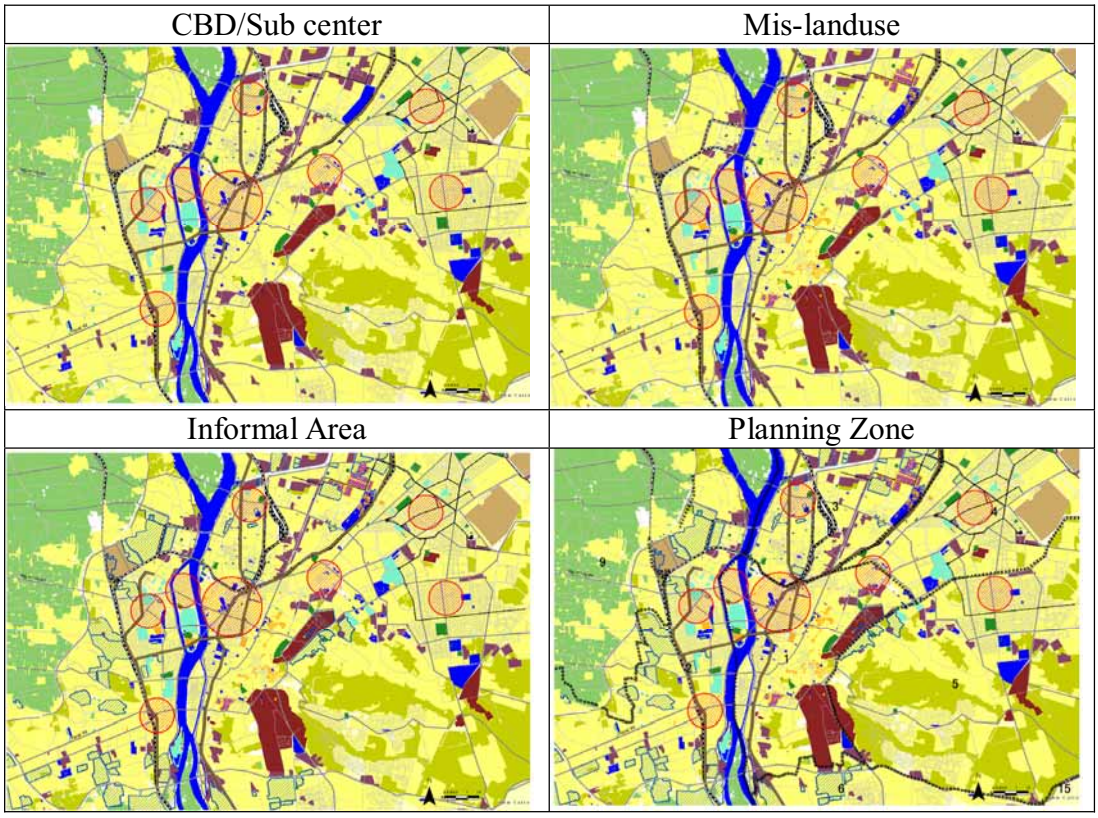


Figure 2.5.1 GIS Layers on Existing Condition (2/2)

(2) Growth of urbanized area in the study area

On the result of area by land cover categories, urban area including low to high density urban areas increased by 12,600 ha in the between 2001 and 2007, and in turn desert land decreased by 13,100 ha in the same period. The loss of agricultural land was 2,000 ha.

Table 2.5.2 Land Area by Land Cover Categories

Land Cover	2001(ha)	2007(ha)	Change (ha)
Urban Area (Built-up Area High/Medium/Low)	39,500	52,100	12,600
Industry	11,900	11,800	-100
Bare Land	400	4,100	3,700
Airport	5,900	5,900	0
Cemetery	1,000	1,000	0
Agriculture	82,500	80,500	-2,000
Desert	285,700	272,600	-13,100
Water	3,400	3,400	0
Open Space	6,200	5,100	-1,100
Total	436,500	436,500	-

Source: JICA study team, 2007.

(3) Overview of present land use in the study area

Current land use, as shown in Figure 2.5.2 is classified into eleven categories. Urban areas are mainly concentrated within the main agglomeration surrounded by the Ring Road. The northeast part of the main agglomeration has grown as urban area encroaching upon agricultural land. Industrial areas are concentrated in the north part of urban area such as Shobra and Shobra El Kheima and the south part of the main agglomeration such as south of Helwan and the industrial areas of Hawamdeya and Bodrashine. These industrial areas are located adjacent to residential areas and need more consideration regarding improvement of the environment for residents. Some residential areas are observed inside of the industrial area.

A major cemetery located in the central part of the main agglomeration is surrounded by urban areas since the urban area have expanded over the time. In the current situation, the area used by the cemetery occupies a large area of land in the urban area. This reduces the amount of land that is available for future urban expansion.
Green and open space in the main agglomeration is very sparse considering the size of the current population that resides in the area. The available area for development of green and open space is limited in the built-up area due to high density of the built-up area.

New urban communities have not been fully developed yet. Among NUCs, 6th of October which is located in the west part of the study area, 10th of Ramadan, and 15th of May which are located in the east and south part of the study area relatively progress their development.

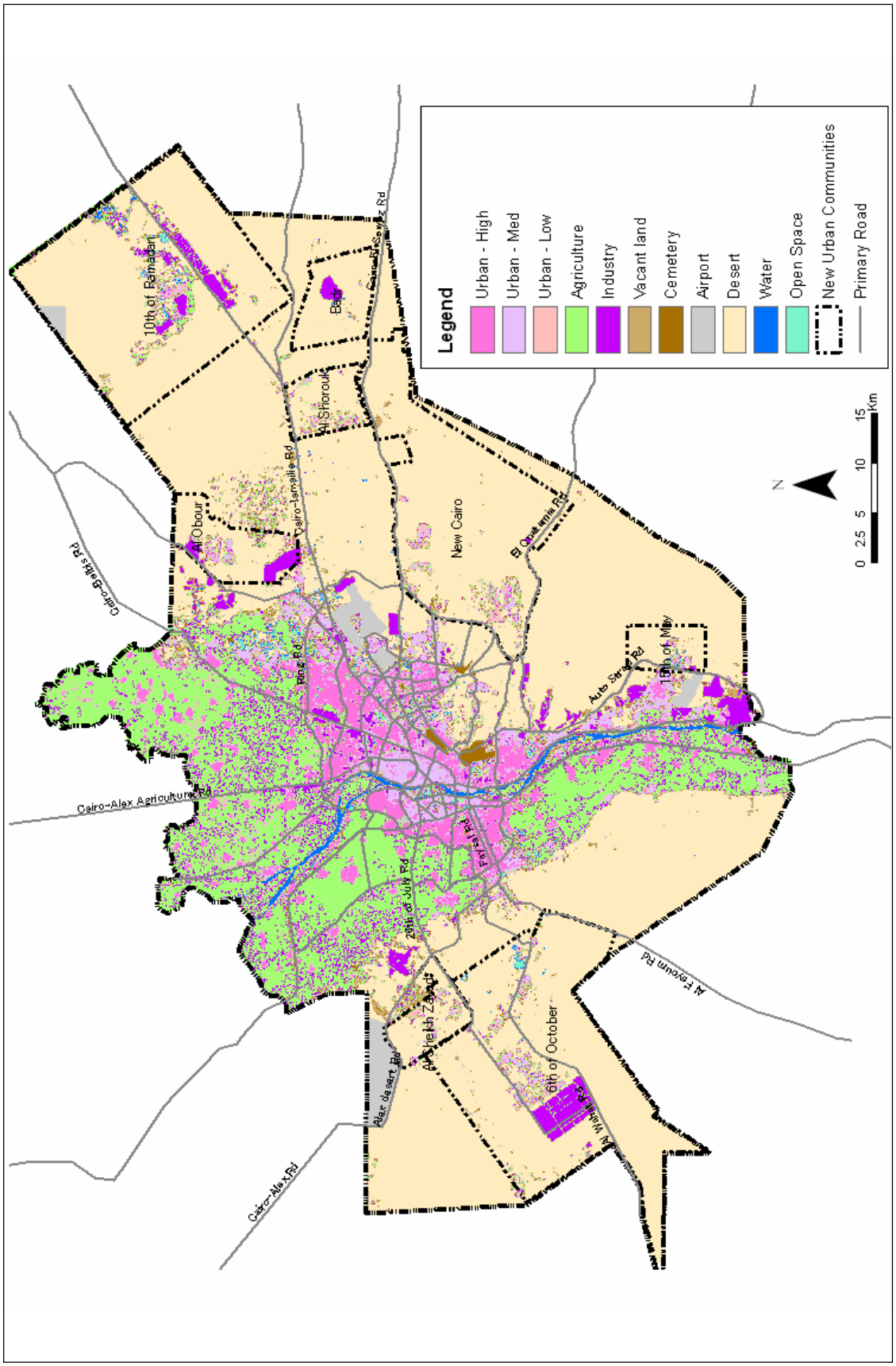


Figure 2.5.2 Existing Land Cover 2007

Source: JICA study team