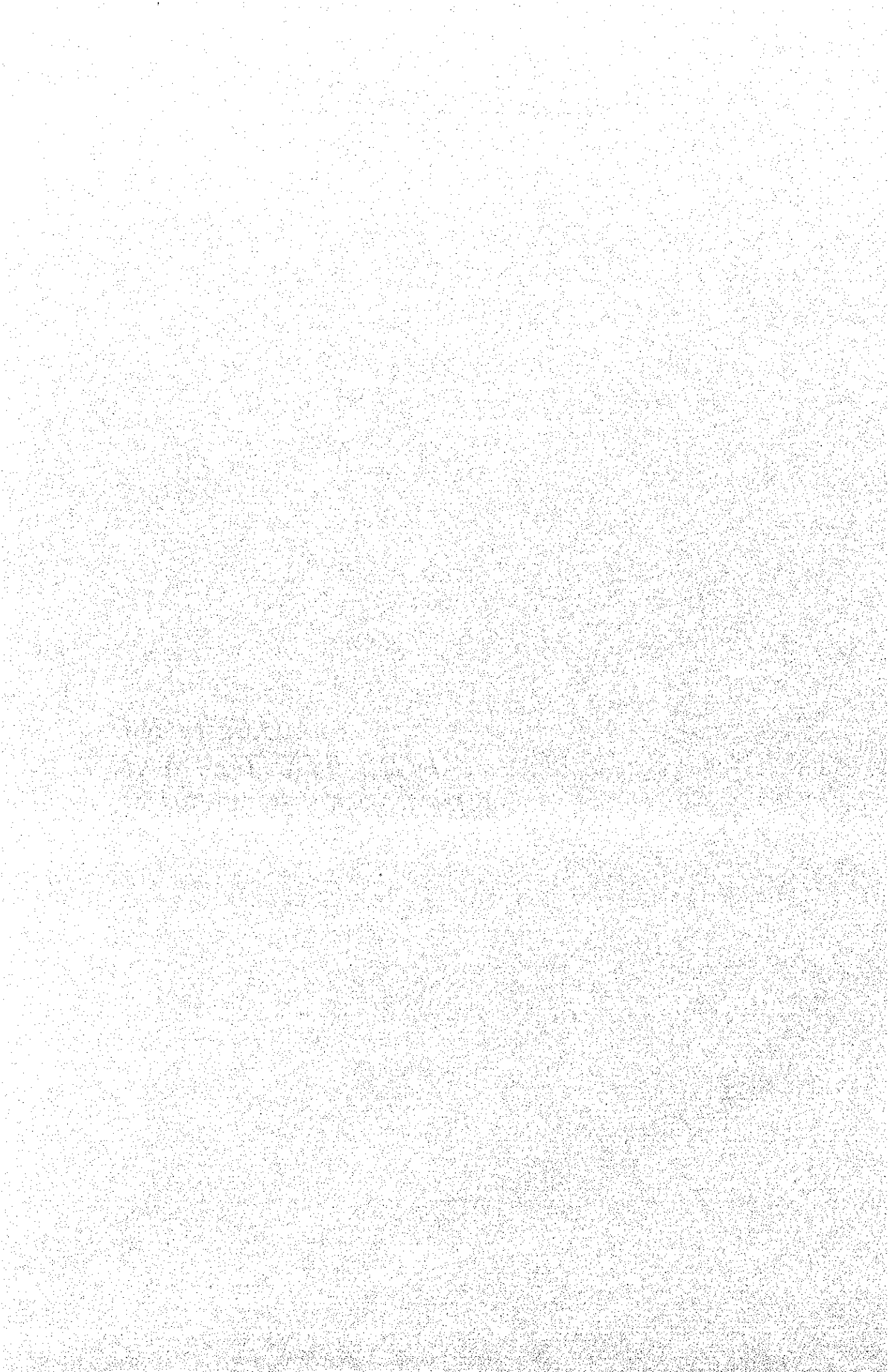


CHAPTER C

FORESTATION AND GREENERY PLANNING



SUPPORTING REPORT C: FORESTATION AND GREENERY PLANNING

Contents

C.1	General	C-1
C.1.1	Basic Policies on City Greenery	C-1
C.1.2	Effect of Greenery	C-1
C.2	Current Status of the Greenery in Astana City.....	C-2
C.2.1	Characteristics of the Natural Environment around Astana City	C-2
C.2.2	Current Status of the Forestation in Astana City	C-5
C.2.3	Administrative Organization of Greenery in Astana City	C-10
C.2.4	Current Status of Seedling Production in Astana City	C-11
C.2.5	Constraints and Potential for Greenery Plantation	C-14
C.3	City Greenery Guideline for Astana City.....	C-14
C.3.1	Planning Framework	C-14
C.3.2	Target of Greenery Area	C-15
C.3.3	Planning of Greenery Arrangement	C-15
C.3.4	Policies for Realization of the City Greenery	C-17
C.3.5	Arrangement Patterns of Urban Parks	C-19
C.3.6	Basic Methodology on Greenery in the City	C-22
C.4	Recommendations	C-26

List of Figures

Figure C.1.1	The Structure of Green Plantations of the City
Figure C.2.1	The Planned Establishment of City Parks in 2000
Figure C.2.2	Map of the Location of City Park in Astana City
Figure C.2.3	Map of Forestation Area
Figure C.3.1	Park for Green Network
Figure C.3.2	General Image of Arrangement of City Parks
Figure C.3.3	Arrangement Pattern of Public Open Space Relating Residential System
Figure C.3.4	Land Suitability for Tree Plantation in the City
Figure C.3.5	Land Suitability of Outside of the City

Annexes

- Annex C.1 List of Recommended Tree Species**
- Annex C.2 Regulations on Establishment, Maintenance and Protection of Green Plantations in Astana City” Prepared by V.P.Bobrovnik.(2000)**
- Annex C.3 Feasibility Study on creation of the buffer zone of Astana City prepared by Kazgiprolekhov**

C.1 General

C.1.1 Basic Policies on City Greenery

The basic policy of the Master Plan is the formation of "Eco-City" which aims at the reduction of environmentally negative impacts, *symbiosis* with nature and creation of urban amenity.

To realize the objective, from the viewpoint of city greenery the creation of greenery space such as "Biotope" (diverse habitat for wildlife) and environmental protection forest (called "Eco-Forest" in this Master Plan) is indispensable. These spaces should be formed based on the greenery master plan focusing on environmental protection function.

Greenery unit should be arranged systematically, not independently, in order to form an "Eco Corridor" that will function to ensure the bio-diversity in the city. Eco Corridor consists of parks, river, cultivated land, natural grass land, Eco Forest, lakes and ponds including even artificial one and so on. **Eco Corridor** provides habitat to small animals including birds and insects, and function as a path for fresh air which will function to alleviate the "Heat Island Phenomena" in the City.

C.1.2 Effects of Greenery

Building-up of greenery is one of the main factors in the creation of an amiable city provided with recreational of opportunity facilities for the population. In terms of improving the sanitary conditions of the city, greenery makes favorable influence on microclimate, such as creating a source of oxygen, serving as an environmental filter for air and increasing humidity. Greenery protects from wind and snow. Trees and bushes reduce noise.

Throughout the year strong winds blow in Astana City. Winds carry over dust in streets and yards and even penetrate into the buildings.

Green plantations could be effective means of protection from the winds. Windbreaker plantations can reduce wind velocity by 50-80%, if located properly taking into account wind conditions. The effect of the windbreaker plantations depends on the angle of green barrier regarding wind flow direction, planting density and height of plantations. Appropriate spatial structure and location of green strips alleviate turbulent flows and vortex formation and provide reliable protection from strong winds.

Another main function of green plantations is formation of shade. In Summer, the air and ground surface temperature would be very high with the air generally dry, which could make the living in the city unbearable, unless some measures are taken to alleviate the semi-desert microclimate. Shading by trees depends on thickness, size and shape of the tree crowns, as well as on location regarding shaded surfaces.

Snow-fence plantations are one of the means to provide protection from snowdrifts. Main principle of the snow-fence effect is the reduction of velocity of snow-wind flow, so that snow particles and dust could accumulate inside the snow-fence belt. Density and height of plantations are the most important factors affecting the efficiency of the snow-fence belt. In summer the snow-fence belts can also serve as protection from sand drifts. In the summer period the air dust contents under trees is generally 20-30% less than in the open areas without cover. Filtering properties of green plantations prove themselves not only regarding dust, but also smoke.

Effect of noise reduction in green plantations depends on the character of greenery, relating to species of trees and shrubs, as well as on weather and other conditions. Crowns of deciduous trees could absorb 26% of the incident energy. For noise reduction plantations must have vertical continuous density by trees and shrubs filtering in any gaps and occupy all the space under the crowns.

It is considered that green plantation has a certain function of absorbing carbon dioxide, purification of pathogens and creating a source of ozone, oxygen and phytoncides.

System of green areas is a form of rational use of the nature, serving for enhancement and improving of the amenity of urban environment. Greenery system is designed according to the purpose and location of its components. A structural planning of green plantations inside and outside the city is considered as shown in the Figure C.1.1.

C.2 Current Status of the Greenery in Astana City

C.2.1 Characteristics of the Natural Environment around Astana City

(1) Climate

Astana City is situated in the steppe zone, southern subzone of dry fescue-and-stipa steppe with distinct continental climate, characterized by significant low humidity, cold winter and hot summer.

Annual average of precipitation is 300 mm, 150 mm out of which falls during the period with the temperature higher than 10°C. The maximum temperature in June reaching +42°C, and the minimum in January as low as -49°C.

Wind activity is observed in all seasons. The prevailing winds are northeast in winter and southwest ones in summer with a velocity of about 4-6 m/sec. The winds of high velocity are the southwest and the westerly ones. Number of days with winds higher than 15 m/sec is 29 annually. Usually they cause snow storms (in winter) and dust storms (in warm season), in some cases reaching the devastating level of 30 m/sec and more.

(2) Hydrography and Hydrology

The main water artery in the area is the Ishim River. Within the city territory the width of the river channel is about two kilometers, and the average width of the riverbed 15-25 m.

Ground water level is high, essentially in new development part of the area. Water-logging in depression and low lands relates to the poor drainage of the area.

On main sources of impoundment, causing water-logging and subsequent salinization of the territory are Taldy Kol Lake and the Ishim River.

Ground water levels in the immediate vicinity of lakes and swamps vary between 1.5 to 5.5 meters deep. The groundwater is classified based on the salt content from fresh (salt content less than 1g/l) to salty (11-15 g/l). Average salt content in the groundwater is 2-3 g/l. Chloride, sulfuric chloride are most commonly seen and less commonly sodium chloride, sodium sulfide. As cation, sodium and magnesium are frequently seen, less commonly calcium and sodium. High content of salt in the groundwater causes salinization of soils, which is wide spread in the area.

(3) Natural Vegetation Areas closed to Astana City

Natural vegetation in and around Astana City belongs to dry steppe with chestnut soil sub zones.

There are grasses on the virgin field such as: sheep's fescue (*Festuca ovina*), European feather grass (*Stipa pennata*), Striped field mouse (*apodemus agrarius*), Wormwood (*Artemisia*), Milfoil (*Achillea millefolium*).

Water logging area represented by reed and sedge vegetation: Great reedmace (*Typha latifolia*), Tufted sedge (*Carex caespitosa*), etc.

Natural forest is located in the depressed areas and mostly consists of birch, poplar, white willow, sharp-leaved willow, and purple willow. The undergrowth's of willow, dog rose, tartar honeysuckle, oleaster are also observed in the floodplain of the river.

(4) The Surrounding Area of the Taldy Kol Lake

The Nura River, which runs south of the Ishim in parallel, comes close to the Ishim near Astana, where the terrain is slightly rolling between the rivers. There are natural depressions forming small lakes and grassy swamps. Natural vegetation is represented by herbage of the genus Wormwood. In the western part of the area there is Taldy Kol Lake with a network of small lakes around, formed originally due to the ground water percolation. The north area of Taldy Kol Lake is fully occupied by rush and is not suitable for greenery planting. It is necessary to give a special consideration to the network of natural lakes located to the east of Taldy Kol Lake. Lakes are a peculiar feature in the steppe landscape with grassy lakeside, which diversifies the natural environment. There are a great number of habitats for wildlife including birds. Presently the intensive work on establishing of the environmental protection forest is carried out on the area. This effort is considered to enhance the landscape. There are several large-sized glades among steppe vegetation and natural saucer-shaped lakes among the forest ranges. The forest range with a network of small lakes, located eastward of Taldy Kol Lake, and to a great extent will affect the climatic characteristics of the designed central part of the city. Green plantation and lakes will provide humid conditions of the city, which are important for the steppe regions as well, reduce negative influence of the south-western winds, purify the air from dust and prevent snow drifts, as well as serve as a potential recreational zone for the population of the City.

(5) Floodplain of the Ishim River

Floodplain of the Ishim River consists of meadows and plantations including grasses, such as willow (shrub type) and wild rose along the riverbanks. Soils are liable to swamping. This delicate ecological environment should not be affected by man-caused activities as much as possible. Floodplain of the Ishim River has a potential as locations for parks and recreational zones, while paying attention to preserve typical natural landscape. For example the establishment of the buffer zone along the river should be considered where any construction should be prohibited on the riverbank buffer. Only

in this way the natural environment around the Ishim River, which has a substantial significance and essential role for the city, could be preserved.

There is another natural landscape area within the city boundaries that can be used only for greenery planting. This area starts at Telman Settlement located in the upstream of the Ishim River and stretches up to Maibalyk Lake. The terrain substantially declines and there are floodplain meadows gifted with large-scale swamps and natural lakes. This floodplain is a potential link between the Maibalyk Lake and the Ishim River.

(6) Collective Gardens (*Dacha*)

Close to the old city boundary along the Ishim River there are collective gardens (*Dachas*). Every *Dacha* is traditionally managed by city residents for producing crops for own consumption as well as for recreational purposes in the weekends. These *Dachas* were constructed on the lands originally unsuitable for agriculture due to soil condition. The area has been gradually changed from the secondary salinization and heavy clays into the present loamy soil through the long time effort of the *Dacha* owners.

The *Dacha* area has formed a kind of green belt around the city. These green belts provide positive environmental impacts on the city in terms of microclimate, i.e. generating clean humidified air.

The area of *Dacha* consists of number of collectives. One collective has approximately 400 land plots in an area of about 0.06 ha. On the land plot there is usually a *dacha* house, plantations of fruit trees (pear, apple, sea-buckthorn), shrubs (current, black chokeberry, ground cherry) and seedbeds for cash crops (potato, tomato, cucumber, beet, carrots, etc.) They often grow grapevine at *dachas* and Virginia creeper (*Parthenocissus quinquefolia*) which can be used for the urban greenery for wall greenery. Several types of flower plants are grown at *dachas*.

C.2.2 Current Status of the Forestation in Astana City

(1) Urban Greenery

Existing greenery in Astana city shows limited variation in plant species. Species that are usually planted in the city are poplar, ash-leaved maple, Chinese elm, Siberian pee-tree. Also there are common elm, green ash, common birch, silverberry, shadbush, golden current, siberian pee-apple, scots pine, larch, ash-leaved maple, tartar maple, tartar honeysuckle in

Astana city. Besides, there are also white poplars, lombardy poplar, pedunculate oak, colorado spruce, white willow.

The following describe the present condition of tree growth in green plantation in the city;

- General growth condition of green plantations is poor.
- Trees and shrubs planted by the communal enterprises are suffering from severe climate conditions, dust and gas pollution, and moisture demands.
- The authority takes care of tillage, binding down, repair and others.
- A number of dead trees due to disease, spring frosts, and droughts are observed.

The green areas for public use in Astana City are summarized as the table below.

Existing Green areas for Public Areas

1	Name of Green Entity	Area (ha)	Notes
1.	City park	104.0	<u>Under construction</u>
2.	Park of "150 years of City"	12.0	
3.	Square of engineering workers	1.0	
4.	Square near to Republic Palace	2.2	
5.	Square close to Ministry of Finance RK	2.0	
	Total	121.2	

Source: Information of "Zerenstroj"

According to the calculation of the areas of green planting of common use per person is approximately 3.7 m²/person. (121.1ha/330,919persons) The SNiP 2.07.01.89 stipulates the necessary areas of greenery formation in Metropolitan city must be 12m²/person (normally 10 m²/person, however, in case of steppe areas like Astana the number should be increased by 20%.) Therefore, the greater effort for increasing the volume of city greenery in Astana city should be encouraged from now on to meet the requirement of SNiP.

It would be clear that Astana city has far less in number and area of city parks than the major cities in the world. The table below shows the numbers and an area of city parks in the major cities in the world.

The numbers and areas of city parks in the major cities

No.	Name of city	No. of parks	Area of parks (ha)
1	Chicago	560	2,962
2	Detroit	390	5,869
3	Huston	322	7,627
4	New York	1338	10,203
5	Philadelphia	428	3,983
6	Montreal	624	2,070
7	Taipei	318	663
8	Kobe	607	444
9	Osaka	801	765
10	Tokyo	4497	2,714
11	Soul	155	8,756
12	Vienna	2384	2,050
13	Prague	114	2,073

Source: Statistics of World Large Cities (Tokyo Metropolitan Government.1990)

In order to increase greenery in the city "Zerenstroi" has been making great effort. A plan of establishing city parks based on the Social Economic Fund in the city in 2000 is given below. (refer to Figure C.2.1)

The plan of establishing city parks in The Astana-City in 2000

No	Name/Place	No. of Trees	No. of Shrubs	Flower Garden (m ²)	Lawn (m ²)
1	Square of in front of shop "Moscow"	27	-	110	780
2	Square of Ishim Riverside	100	20	834	3,667
3	Al-farabi Housing complex	381	-	-	-
4	Exit area of the city (in front of the gas station)	10	-	2333	2,550
5	Square of Bogembai street (Opposite side of Emergency hospital)	60	20	1104	4,037
6	Square of Bogembai street	155	20	220	4,520
7	Manas street park	666	117	-	24,438
8	Mini square (Abai street)	23	34	30	979
9	Square of Baraev street	600	10000	-	33,907
10	Birzhan-Sala Street	84	16	-	3,150

Source: Information of Zerenstroi (2000)

Access time to district parks is stipulated to be within 15 minutes. However, this stipulation is seldom satisfied.

The general descriptions of main city parks are given below.

Astana City Park

The central park of Astana City is located on the left bank of Ishim River across the pedestrian bridge and occupies the area of 104 ha. Species of trees and shrubs planted in the park include local species such as willow, buckthorn (*Rhamnus*), common birch (*Betula pendula*), Scots pine (*Pinus*

sylvestris), Smooth-leaved elm (*Ulmus foliacea*) and those imported from Russia such as Tartar maple (*Acer tartaricum*), White poplar (*Populus alba*), Spindle-tree (*Euonymus europaea*), etc.)

From 1932 the park on the left bank of the Ishim River became a park of the railway workers. In 1964 the park of the railway workers became the City Park for culture and rest, though the area did not increase over the past years. Species of trees and shrubs in the process of dying-out were replaced by Laurel poplar (*Populus laurifolia*), Common elm (*Ulmus*), Siberian pec-tree (*Caragana arborescens*).

Nowadays the City Park belongs to the Management of the City Park. Plenty of commercial and entertainment facilities and grounds, attractions are operated, as well as new alleys are provided in the park. There are mainly low trees and shrubs such as Tartar maple (*Acer tartaricum*), Smooth-leaved elm (*Ulmus foliacea*), Siberian pee-tree (*Caragana arborescens*). Conifers and birch have by now completely disappeared. And the park seems to have become less attractive. In 2000 the design competition on reconstruction of the City Park has been held and now the design work is taken up.

Square of Engineering Workers

Square of engineering worker is located in the southern part of Moskovskay st. of the area of between Pushkin st. Anezov st. It was established in 1943-1945 and reconstructed in 1983. Species of trees and shrubs are similar to the previous ones: Smooth-leaved elm (*Ulmus foliacea*), Silverberry (*Elaeagnus argentea*), Siberian pee-tree (*Caragana arborescens*), Laurel poplar (*Populus laurifolia*).

Square near the Republic Palace

Square near the Palace of Republic is located in the southern part on the right bank of the Ishim River. It was established in 1893 as a city park by order of the Head of *uyezd* (district), lieutenant colonel Troitskii. Formerly it occupied the area from Bukeikhan Street to Zheltoksan Street, from the bank of Ishim River to Kenesary Street. Part of the park disappeared due to the city development.

Currently the volume of green plantations is substantially reduced due to the construction activities and the number of species is small. The quality of the square is aggravated largely by man-caused activities which reduce the

green plantations area. In addition, low-quality maintenance and insufficient replanting of trees is a cause.

Square closed to Ministry of Finance of the RK

Square near the building of Ministry of Finance of the Republic of Kazakhstan was established on the former Soldier Park by order of the local military commander Zhuzlov in 1894. Afterwards the residential 2-storeyed buildings were built up in this park and these buildings were lately demolished and a square was constructed in 2000. The tree species are: Common birch (*Betula pendula*), Siberian pee-tree (*Caragana arborescens*), Colorado spruce (*Picea pungens*).

The location of the city parks mentioned above is shown in C.2.2.

(2) Environmental Protection of Forest

- Beginning of forestation

First artificial forest plantations in the rim of the City were created by A.L.Adamovich in forest dacha "Krasny Yar" in 1904. The main tree species were: Pine, Birch, Poplar, Elm. The species of shrubs were: Siberian pee-tree, common lilac, round-leaved shadberry, bird cherry tree, and hybrid cherry tree. This plantation became an example for reforestation in dry steppe conditions of Astana vicinities.

- Formation of the environmental protection forest (refer to Figure C.2.3)

The formation of the environmental protection forest of the Astana City was started in 1997 in compliance with the order and decree of the Government of RK.

The Committee of Forestry, Fishery and Hunting of the Ministry of Natural Resources and Environment Protection of the Republic of Kazakhstan conducts the works.

The "Kazgiproleskhoz" institute has elaborated the Feasibility Study for the green zone formation. The total area of 28,141 ha was allocated for the study and 23,900 ha of them have already been surveyed. Buffer zone at width of 800m is designed along the ring road of Astana City. It consists of strip plantations of 24m width and interspaces of 12m in width.

In spring and autumn 1997 protection forest along a part of the section of northeast of the outer ring road (R1) and the road to Eleimentau city was planted, using grown trees with clods. In spring 1998 these works were continued in the area of 22 ha, and totally 10,600 trees were planted. The

same year mechanized forest planting in the area of 2500 ha was conducted with trees and shrub of seedlings. During the summer period the necessary care of seedlings was taken, including watering.

The forest plantation was conducted in two stages considering the recommendations of scientists and specialists. At the first stage the deciduous species were planted in outer row and in 3-4 years later, coniferous species, such as pine, larch, were planted within the row of the deciduous species.

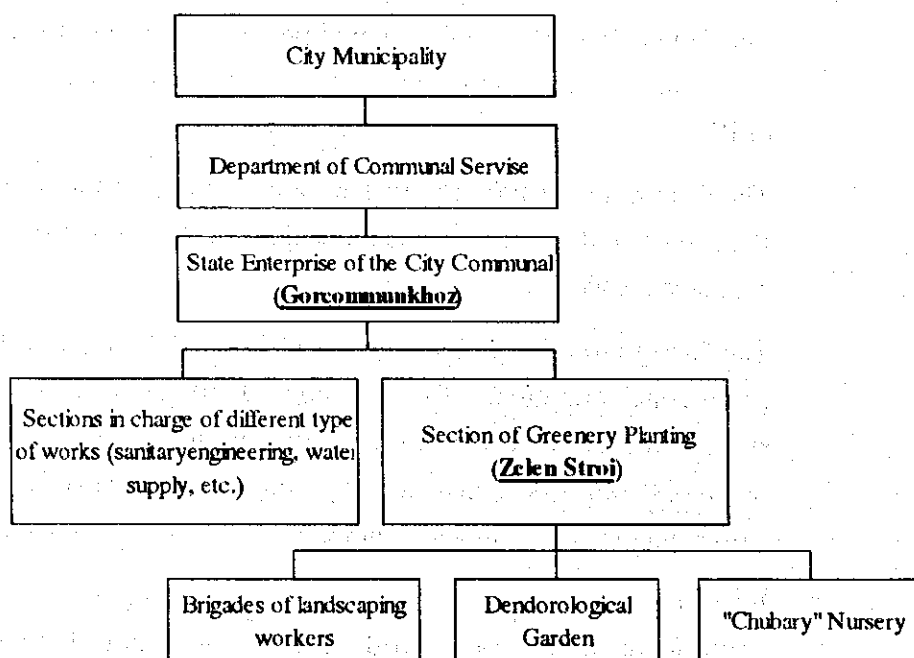
In 1999 the forest planting with seedlings was done at the area of 2,500 ha under the forest-park plantations formation project.

In 2000, the forest-plantation zone was established in the area of 2500 ha and the total area of the forest-plantations for the period of 3 years became 7500 ha. All the plantations established in 2000 shows an optimal growth at present.

C.2.3 Administrative Organization of Greenery in Astana City

(1) Urban Greenery

The Section of Greenery Planting (Zelen Stroi) is in charge of urban greenery planting under the control of State Enterprise of the City Communal Service (Gorcommunkhoz). The section maintains Chubary nursery and dendrological garden as shown in the figure below.

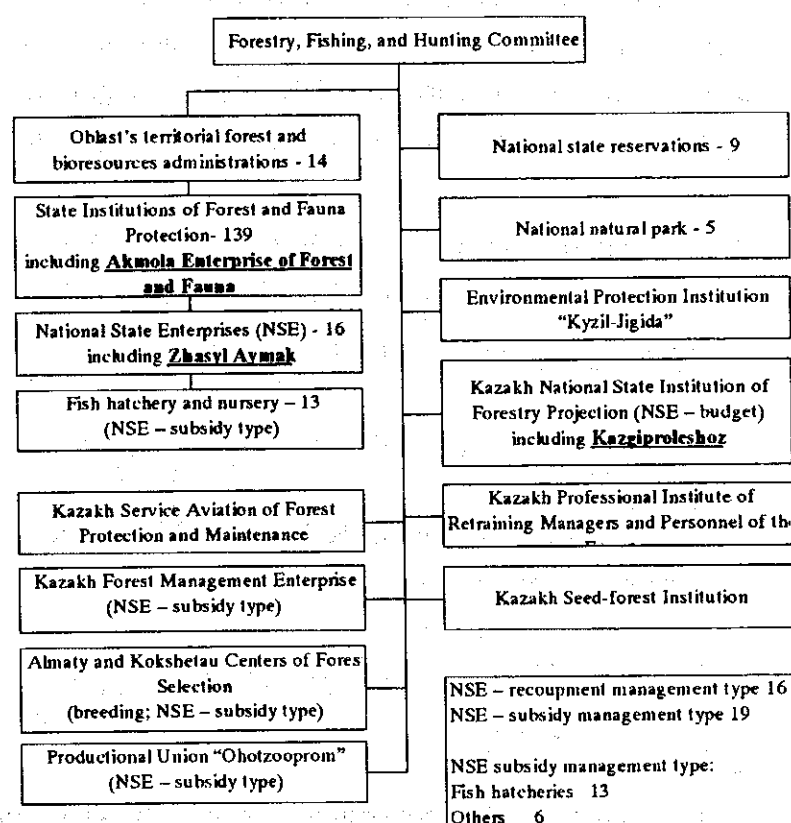


The organization of responsible agency for urban greenery

(2) Forestation

“Kazgiproleshov” is in charge of design work for government. Government work to create buffer green zone is done by Republican State enterprise “Zhasyl Aymak”, directly controlled by the Committee of forestry, fishery, and hunting of the Ministry of Natural Resources and Environmental Protection of RK.

Control, register, and acceptance of the forest plantation after their inauguration was accomplished by Akmol Enterprise of Forest and Fauna Protection as shown in the figure below.



The organization of responsible agency for forestation

C.2.4 Current Status of Seedling Production in Astana City

There are two main nurseries in Astana city. The Chubari nursery under control of Zelenstroi, and Koshi nursery under control of the Committee of Forestry, Fishery, and Hunting of the Ministry of Natural Resources and Environmental Protection. The general descriptions of the nurseries are given below; (regarding the location of them is shown in Figure 2.14.4)

(1) Chubary

Chubary Nursery is located 45-50 km away from Astana on the territory of Chubary Forestry Division occupying on the area of 430 ha. It was founded in 1970 for growing of planting stock to be planted in the city. Chubary Nursery belongs to the State Enterprise "Gorcommunkhoz" of the Department of Greenery Planting "Zelenstroj".

At present the working area of nursery is 60 ha of irrigated areas and 150 ha of dry areas, and these area is being further expanded. The nursery can provide around 500-600 thousand of seedlings per year. Number of staff is not constant and depends on seasonal works: up to 54 workers in spring-summer and fall period, 12 people (they are permanent staff of the nursery) in winter period. There is 1 engineer, 1 technician, 1 administrative officer, and the remaining are workers (mechanic, foresters, etc.)

Annual work schedule is as follows:

- Seed collection from mother planting yards of the Chubary Nursery and from the other nurseries and forest tracts.
- Seeding
- Preparation of cuttings and their planting
- Weeding
- Irrigation (part of the lands is not irrigated due to the absence of necessary water reserves)
- Treatment with insecticides
- Dressing with mineral fertilizers (organic fertilizers are applied only before ploughing)
- Crowning
- Preparation for sale (preparation of baskets for clods, lifting (digging) of saplings, transportation)

Species of seedlings is vary – up to 30 species. Main tree and shrub species of the nursery are as follows: Lombardy polar Populus fastigiata), Crack willow (Salix fragilis), Siberian crab-apple (Malus baccata), Green ash (Fraxinus viridis), Scots pine (Pinus sylvestris), Colorado spruce (Picea pungens), Common larch, Tartar honeysuckle, Siberian pee-tree (yellow acacia), Ash-leaved maple (Acer negundo), Sessile oak (Quercus petraea), Silverberry (Elaeagnus argentea) and others.

(2) Koshi

The nursery of Akmola Establishment for Protection of Forests and Fauna is located near Koshi Settlement. It was founded in 1998-2000. The nursery has a director and one nursery foreman. At present the number of workers of the nursery is 25 people. Total area of the nursery is 110ha including sown areas and mother planting yards.

<Budget>

- Budget allocated and expenditure on the nursery construction:

In 1998 – 34,187.3 thousand tenge; in 1999 – 8,955.7 thousand tenge; in 2000 – scheduled 10,000 thousand tenge.

- Funds allocated and spent on growing of planting stock:

In 1999 – 8,434.2 thousand tenge; in 2000 – 8,000 thousand tenge scheduled for allocation.

<Facilities>

- Irrigation network was constructed on the area of 30 hectares;

- Large-scale layout was carried out on the area of 24 hectares;

- Water pumping unit was constructed;

- Three-apartment houses were constructed. The nursery was fenced with a wire net.

- One electric power line and transformer substation was set up.

In the current year, 1,376 thousand of seedlings and 145 thousand trees were grown in the nursery

Construction of the nursery infrastructure was not completed due to the lack of finance and technology of container planting (pot system) has not been applied yet.

(3) The Basic Policies on the Improvement of Nursery System in the City

Lack of allocation of budget is basic constraints on the management of nurseries. The items as followings are considered as policies on the improvement of nursery system in the City.

- Establishment of proper management plan for production of seedlings

Some seedlings that grew too high and have no destination were observed in Chubary nursery. It is very important that the shipping of seedlings is carried out timely. The seedlings allowed to grow in the nursery too long

become difficult to transplant. In order to avoid these kind problems, the comprehensive management plan for the nursery in accordance with a proper seeding demand plan should be established.

- Establishment of production facility for flower seedlings

The demand for the flower seedlings will be increased in future in accordance with diversification of the citizen life in the City. At present there is only one place for the production of flower seedlings in Chubary village. It is desirable that the related facility will be established in order to meet the demand.

C.2.5 Constraints and Potential for Greenery Plantation

There are several constraints on the establishment of the greenery plan of the Astana City. The city area is located on the flat, poorly drained, clay-loamy plains with high level of mineralized ground water. In addition, throughout the year strong winds blow on the City.

In order to establish the greenery plan, it is essential to take into consideration the land suitability for tree plantation properly.

Regarding the land suitability in the city area there is the results of the study carried out by V.P.Bobrinik. He classified the city area by the level of difficulty of plantation based on the ground water table and content of salt in the groundwater. The "Kazgiproleskhoz" institute has also studied the land suitability of the area outside of the city in the Feasibility Study for the green zone formation.

In this Master Plan "City Greenery Guideline for Astana City" will be established by discuss the greenery network and methodology, based on the data mentioned above.

C.3 City Greenery Guidelines for Astana City

C.3.1 Planning Framework

(1) Target Year

The year is set at 2030, the same as the target year of this Master Plan. This target year denotes the ultimate image of Astana.

(2) Perspective Population and Urban Area

The projected population and the estimated area of urban area are summarized below.

Year	2000	2010	2020	2030
Population	322,000	490,000	690,000	800,000
Urban Area	17,241 ha	69,881 ha	69,881 ha	69,881 ha

C.3.2 Target of Greenery Area

There are two targets for city greenery in this Project; one is for urban greenery and the other is for buffer belts. As for the city greenery, the standard is 12 m²/person, or 960ha for 800,000 persons in the year 2030, stipulated in the SNiP 2.07.01.89 as necessary areas of greenery formation in large city. Meantime, the norms of GOST 17.53.01-78 stipulate the necessary area of buffer belt as 250m²/person, which corresponds to an area of 20,000ha for the projected population of 800,000 in 2030.

C.3.3 Planning of Greenery Arrangement

(1) General

The basic policy in the planning of greenery is to arrange greenery network so that the network maintains close relationship with each component greenery unit. From the point of view of mitigating the harsh urban climate, the greenery network generally provides moisture. Also it functions as an ecological corridor, which provides the path for ecological system with diverse functions such as below.

- To form a habitat for wildlife such as birds and insects
- To contribute to the improvement of landscape of urban areas
- To be used for recreation activities
- To be used as evacuation route or shelter in case of natural disaster

(2) Greenery Network

The greenery network should be planned so as to prevent disorderly expansion of urban areas and to clearly delineate the shape of the city.

The water bodies of Astana (the Ishim River, Solyonaya Balka, Saryblak, Taldy Kol Lake and Maibalyk Lake) should be considered in conjunction with the greenery network, as they contribute to the control of temperature, moisture and ventilation in combination with the greenery.

The plan of greenery arrangement is as shown in Figure C.3.1. The major elements of the planned greenery axes are as follows.

- Green belt along the outer ring road

The greenery corridor along the outer ring road consists of tree plantation along the road and constitutes part of "Eco-Forest" around the city. This greenery belt constitutes the greenery frame of the city and thereby delineates the shape of the city. This greenery belt protects the city from unfavorable climate factors. "Eco-Forest" is an environmental protection forest, which could be used for recreation as well. It is located on the area between the outer ring road and the City.

- Main greenery axis in the city area

Greenery axis to be formed along the Ishim River will be the main greenery axis in the city. In addition, the greenery axis proposed along the railroad track would provide a buffer between the industrial and residential areas and provides for an ecological corridor.

- Minor greenery axes

The wedge-shaped minor greenery axes entering from the outer green belt to the main greenery axis function to alleviate the increasing temperature in the new urban areas. The minor greenery axes are planned as follows.

- Greenery Axis along the Solyonaya Balka and Saryblak
- Greenery Axis from the Maibalyk Lake towards the village of Telman on the left bank of the Ishim.

- Formation of greenery cores

Construction of urban parks within the urban areas of Astana could enhance the core of greenery in the city. New parks will be provided in a systematic manner, taking into consideration of the population and the importance of each area.

- Environmental protection area

The area-extending southwest of the city maintains a vernacular landscape. It consists of steppe, swamps, lake, grazing of livestock, habitats of wild life such as waterfowl's etc. This area, therefore, should be preserved as an environmental protection area with minimum allowable development. An advantage of Astana is that environmental protection area could be maintained in the close proximity of the City Center. To preserve this vernacular landscape, it is essential to achieve the ultimate goal of establishing an "Eco-City".

Part of this area could be planned as nature-oriented recreational area, as the area has easy access for the city residents. The city dwellers could paddle boats on the canals connecting the small-scale swamp, enjoy bird watching on the lakeside, do fishing and horse riding and even camping.

C.3.4 Policies for Realization of the City Greenery

(1) Development of Urban Parks

Urban parks could be cores of the city greenery and they have the basic elements of the greenery network. The scheme of urban park system in Kazakhstan is summarized in the table below.

Scheme of Urban Parks in Kazakhstan

Category	Size (ha)	Radius of served area, km	Remarks
City Park	15ha and more	Up to 5(20minutes)	In residential area
District Park	10ha and more	Up to 2(15minutes)	In the city district
Residential Area Garden	3ha and more	Up 1	In residential area closed to the center
Neighborhood Park	1ha and more	Up to 0.5	In micro district
Square	0.5ha and more	Up to 0.3	In plaza or the area in the set back of buildings along streets
Boulevards	-	-	-

Source: "SniP2.07.01-89"

The square, neighborhood park, residential area garden and district park are planned mainly for the space required for recreational activities in the daily life of local residents. The city park has a wider range of objectives and is planned basically for all the citizens living in the city.

In addition, special parks should be planned based on the characteristic of each area and for specific objectives.

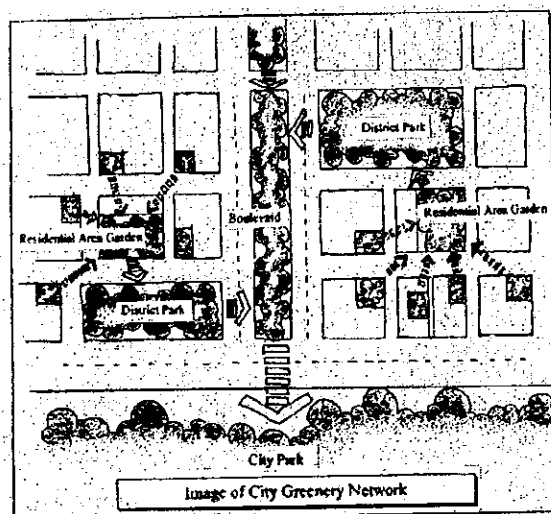
Biotope such as birdbath and sanctuary should be introduced to these urban parks. People could communicate with natural environment at these spaces and realize symbiosis with wild life.

(2) Boulevards

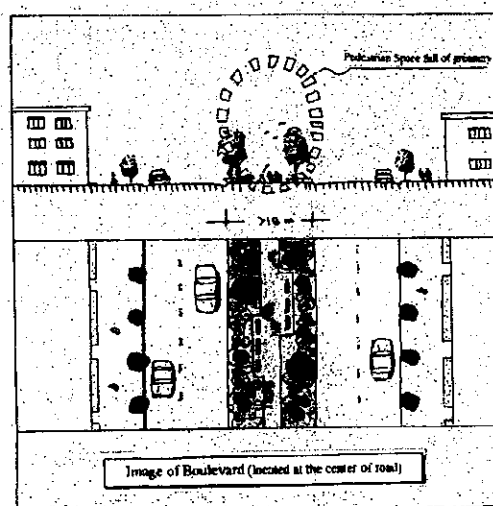
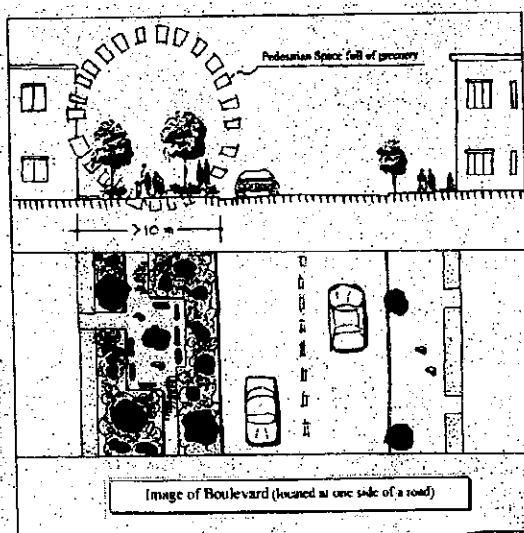
As mentioned above, urban greenery should be formulated in a structure of network in relation to each other. In order to establish a robust network, introduction of boulevards is considered highly effective. Boulevards are open space consisting of full of greenery pedestrian paths and roads, which is virtually non-existent at present in Astana. Boulevards will connect the

greenery components such as neighborhood parks utilized in daily life to the greenery cores such as the city park.

Necessary conditions for the pedestrian space in boulevards stipulated in the SNiP are mentioned below.



- If located at the center of road, the required width is more than 18m.
- If it is located on the one side of the road, it should be more than 10m.
- The general image of boulevards are shown as below,



(3) Greenery Enhancement Area

Greenery Enhancement Area is proposed for designation in specific areas in the existing city. The area should have a pleasant atmosphere fully lined with greenery. The following three areas are proposed as Greenery Enhancement Area.

- Beibitshilik Street (greenery corridor of south-north axis)
- Abai Avenue (greenery corridor of east-west axis)
- Batyr Bogembai Avenue (greenery corridor of east west axis)

In these areas, greenery should be enhanced by additional planting of trees and shrubs, as well as the existing greenery preserved. This area will be an ideal model for city greenery enhancement in the future.

(4) Greenery in the Atrium Space belonging to Buildings

In view of enhancing urban greenery, new buildings will be encouraged to have an atrium space, where small-scale urban greenery could be provided. As the people living in Astana have rather a generally short period of enjoying greenery due to the climatic condition, an atrium space could provide greenery for the enjoyment of citizens throughout the year.

C.3.5 Arrangement Pattern of Urban Parks

(1) Target Greenery Area

As mentioned in C.2.2 the target greenery area for urban parks is at least 12m²/person, being equivalent to more than 960ha/800,000persons. At present the greenery area of the city parks is 121ha. (city park:104ha, public open space relating to the residential system:17ha)

(2) Necessary Greenery Area for the Urban Parks

In order to establish a well-balanced arrangement of urban parks, they should first be separated into two park categories, i.e. city parks and public open space based on the residential system, and should be planned individually. The former fulfills the demand of wide range of recreational activities for all the citizens of the city, whereas the latter is a network of small scale parks for the use in daily life of the local residents.

In the park system of Kazakhstan, squares, neighborhood parks, residential area gardens and district parks could be categorized under public open space relating to the residential system.

In Kazakhstan, there is no standard for the balance between the city parks and the public open spaces based on the residential system. Therefore, the proportion of areas of the city parks and the public open space relating to the residential system will be determined at 40:60 in accordance with the Japanese standard of urban park development.

By the use of this standard, the additional areas that need to be developed as city parks is 280 ha, and that for the open space based on the residential system is 559 ha as shown in the calculation below.

Park category	Target area	Existing area	Additionally necessary area
City park	960ha*0.4=384ha	104ha	384ha-104ha=280ha. (approximately 1.7km*1.7km)
Parks based on the residential system	960ha*0.6=576ha	17ha	576ha-17ha=559ha . (approximately 2.4km*2.4km)

(3) Arrangement Pattern of the Main City Parks

General description of city parks to be planned including special parks is as follows. (refer to Figure C.3.2)

-Natural Park

- The park is to be planned in the flood plain of the Ishim River, which is Southwest of the existing City.
- There are dachas and small-scale settlements in this area of present. Unique plants such as willow, poplar could be observed in the in flood plain.
- In this park people could enjoy static recreational activity such as walking and dynamic one such as sport as well.

-Riverside Park

- It is located at riverside of Ishim River.
- In this park people will enjoy quiet environment with characteristic natural landscape of riverside as well as distant view of urban landscape of New City Center.
- In winter, people could play cross-county skiing in this park.
- Kiosk should be minimized as much as possible in this park.

-Presidential Park

- It is located in front of Presidential Residence.
- In this park some space for memorial events should be planned.
- It will function to enhance the greenery of center city.

-Island Park

- The island is located at the south of Presidential Park.
- Communities of natural forests are observed on the left hand of the riverbank, the forest of former resort house for young people, and on the right, the forest of Telman village

- At present there is no settlement in this island. Natural environment in terms of vegetation in this area is considered as valuable.

-Hillside Park

- It is located at hillside of east of the City.
- In terms of topographical viewpoint, it is advantageous. People could enjoy the city landscape from a high viewpoint.

-Sport Park

- It is located at south of New City Center.
- The park for playing sport by citizens
- Facilities such as sport stadium, football ground, swimming pool etc. are arranged in the abundant greenery.

-Botanical garden

- It is located at north of residential district 16 of southern planning region left bank of Ishim River
- Park that exhibits endemic plants of Kazakhstan as well as ornamental plants.
- It provides consultation service on greenery to city citizens

-Zoo

- It is located at east of the botanical garden.
- Park where children could watch and communicate with wildlife

Target greenery areas in each city park and in each target year are summarized as below.

(unit:ha)				
Items	2010	2020	2030	Total
Nature Park		20	20	40
Riverside Park	26	4		30
Presidential Park	30			30
Island Park		30	10	40
Hillside Park		30		30
Sport Park		28	22	50
Botanical garden			30	30
Zoo			30	30
Total	56	112	112	280

(4) Arrangement Pattern of Public Open Space relating to the Residential System

The Figure C.3.3 shows the result of the case study in the district located southeast of the city on the arrangement pattern of public open space relating to the residential system. The case study is carried out on the premise that the planned population of the district is 20,000 persons and the necessary area of the public open space relating to the residential system is approximately 15ha.

C.3.6 Basic Methodology on Greenery in the City

(1) Required Greenery Characteristics

In order to create and conserve high quality urban landscape, the greenery to be introduced in the city should have the following characteristics.

- Potential to be a greenery core or constituting greenery axis

The areas such as symbolic parks and the squares in front of city hall are considered as very important places because many people gather frequently and consider the area as an important symbol or landmark of the city. Therefore, in this kind of places certain greenery volume and characteristics in terms of plant species and planting pattern are required.

- Constituting greenery axis

The importance of continuous greenery along the river bank, tree planting along the road and boulevard is that it can be enjoyed for a long period of time as the people travel. People have impression that the city is full of greenery from this kind of continuous greenery. Therefore, the greenery is desirable to be located continuously with abundant greenery volume.

- Adding accents on, and reinforcing urban landscape

Places of intersections and the end of streets are sometimes conspicuous in the city. The greenery of these points could work as landmarks and are helpful for clarifying the structure of the city. This kind of greenery, even in small portions, is important for adding accents to urban landscape and improving the urban amenity.

- Harmonized with water body environment

Greenery harmonizes well with water bodies. Therefore, it is recommended to introduce greenery to improve the landscape of the waterside such as riverside, riverbanks, lakeside etc.

- Harmonized with artificial structure such as buildings and houses

Greenery introduced to the foot of buildings will alleviate the solidness of townscape composed of straight line.

(2) Quality of Greenery

In the standpoint of improving urban landscape, greenery itself should have the following qualities.

- Creating unified and integral image

Greenery locating in line such as tree plantations along roads and hedges should have certain order in style (height of trees, tree species, spaces between each plants and proportion of trees and shrubs and so on)

- Having reasonable variety in tree species and planting pattern

Unification in greenery sometimes provides a boring impression although it is very important in terms of improving greenery quality. Therefore, it is recommended that reasonable variety in tree species and planting pattern be introduced without giving any impression of disorder. The landscape will become familiar and enjoyable with the reasonable variety of tree species and planting pattern. This will also give identity to the city structure and help distinguish the different locations.

- Well maintained

Hedges pruned orderly and well-maintained homogeneous plantations give the impression of unification and improve urban landscape.

(3) Land Suitability

Soil condition is one of the main factors in planning greenery. The soil containing high salinity is the main constraint in the greenery planning in the City. There are two existing studies on the land suitability of the area in the City and the surround area for tree plantation as followings. (refer to Appendix C.2, 3)

Regulations on establishment, maintenance and protection of green plantations in Astana City” Prepared by V.P.Bobrovnik.(2000)

Feasibility Study on creation of the buffer zone of Astana City prepared by “Kazgiproleskhoz”.

The results of these studies are summarized as followings,

-In the City area (refer to Figure C.3.4)

In this study, the area was divided into 3 regions in terms of soil quality as followings.

- Region of best condition for tree growing
- Region of satisfactory conditions for tree growing
- Region of very low suitability for tree growing
- Outside of the City area (refer to Figure C.3.5)

According to the survey on soil suitability for tree planting done by “Kazgiproleskhoz”, the periphery of Astana City which is the subject area for Eco-Forest is divided into 4 categories by the soil condition as mentioned below.

- Group I: Area suitable for greenery by any plants
- Group II: Area observed with medium level salinization and possible planting by salt resistance plants
- Group III: Area observed with high level salinization but conditionally possible planting only by salt resistance plants and dry resistance plants
- Group IV: Area observed with heavy salinization of soil and greenery is impossible by any plants

In the detailed design stage it is important in order to select appropriate planting methodology and plant species for the proper greenery planning that a comprehensive survey and analysis on the existing soil is carried out based on the results of these studies.

(4) Planting Species

Plant species used in the greenery should be of the following nature.

- To be adaptable to the soil and climate condition of Astana region
- To have characteristics that suits the planting purposes (symbolization, landscaping, resistance to dryness, salt and low temperature)
- To have availability of seedlings and trees
- To be easy for maintenance

Recommended planting species are shown in Appendix C.1. The selection was carried out based on the recommendation of “Kazniilha” Kazakh Scientific Research Institute of Forestry and Agricultural Forest Improvement.

The main recommended planting species is shown in the table below.

These species could be used for both urban greenery and Eco-Forest.

Scientific Name	Common Name	Russian Name
(Trees)		
<i>Betula platyphylla</i>	Asian white birch	Береза плосколистная
<i>Ulmus laevis</i>	Russian elm	Вяз гладкий
<i>Picea obovata</i>	Siberian spruce	Ель сибирская
<i>Salix alba</i>	White willow	Ива белая
<i>Acer tatarika</i>	Tartar maple	Клен татарский
<i>Larix sibirika</i>	Siberian larch	Лиственница сибирская (хакасская)
<i>Pinus silvestris</i>	Scots pine	Сосна обыкновенная
<i>Populus alba</i>	White poplar	Тополь белый
(Shrubs)		
<i>Crataegus sanguinea</i>	Red haw	Боярышник кроваво-красный
<i>Jasminum fruticans</i>	Ground jasmine	Жасмин кустарниковый
<i>Lonicera tatarika</i>	Tatar honeysuckle	Жимолость татарская
<i>Amelanhier ovalis</i>	Shad bush	Ирга круглолистная
<i>Suringa vulgaris</i>	Common lilac	Сирень обыкновенная

(5) Standard Planting Patterns

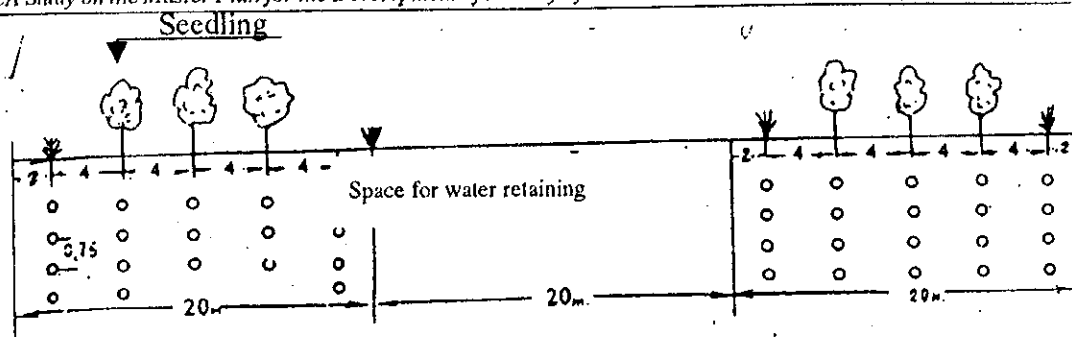
Densities of planting in each greenery categories are shown in the table below.

Unit: number of trees /hectare

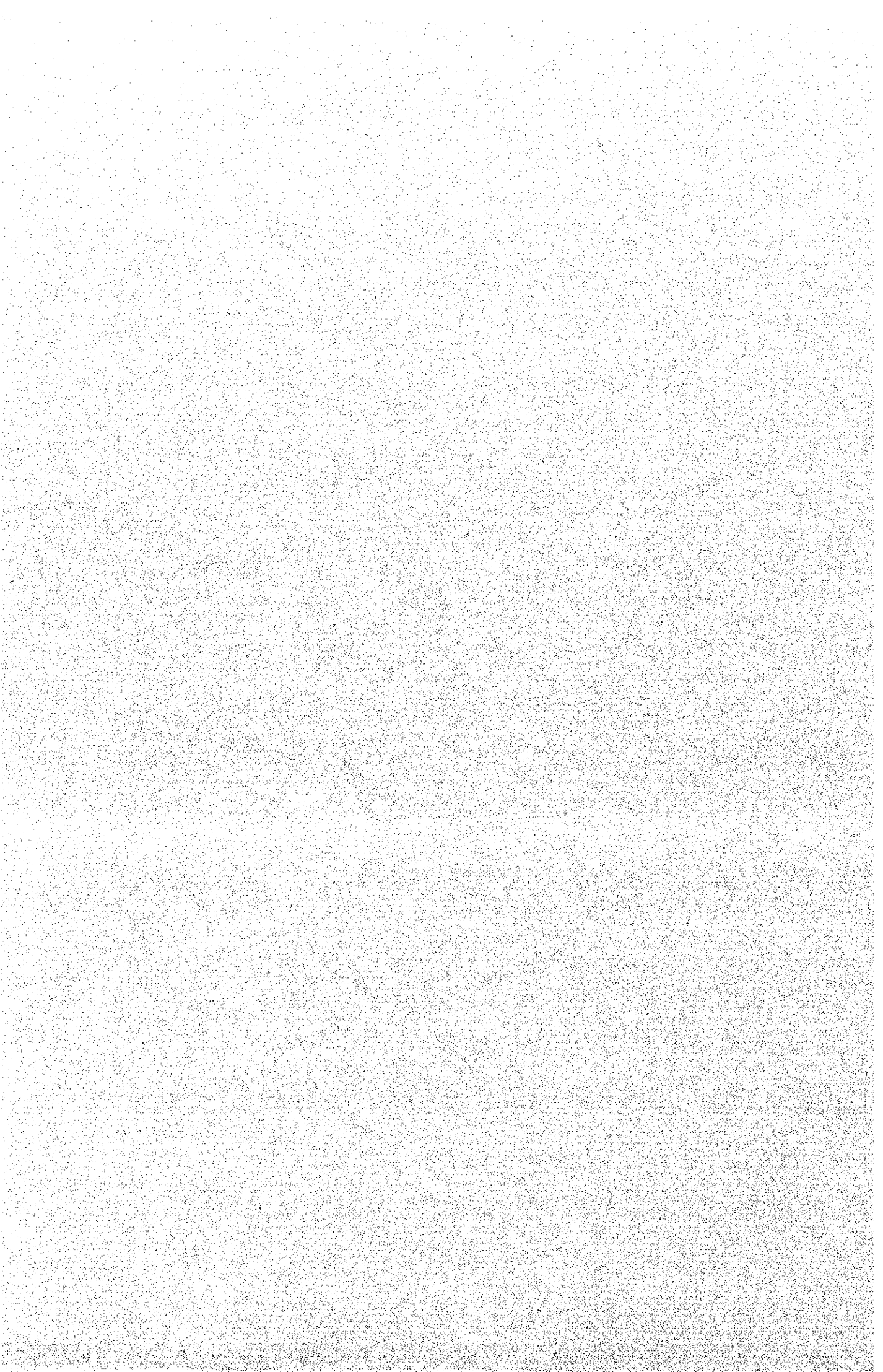
Category	Trees	Shrubs
Parks	200-250	1500-2000
Squares	150	1500
Boulevards	250	2500-4500
Residential area	150-200	2500-1500
Territories of public institutions and sport facilities	150	2000-2500
Buffer zones	400-1000	1000-3000

Source: "Regulations on establishment, maintenance and protection of green" V.P.Bobronik

As the Eco-Forest will be exposed to the harsh environment such as strong winds in its location at the periphery of the city, the plantation by seedlings is to be carried out in high density. The seedlings grow steadily while adapting to the climate year by year. Eco-Forest consists of plantations of several rows. This type of plantation is considered to have the advantageous characteristics in terms of resistance to strong wind, air filtration and noise suppression. The general planting pattern of Eco-Forest is as shown below.



FIGURE



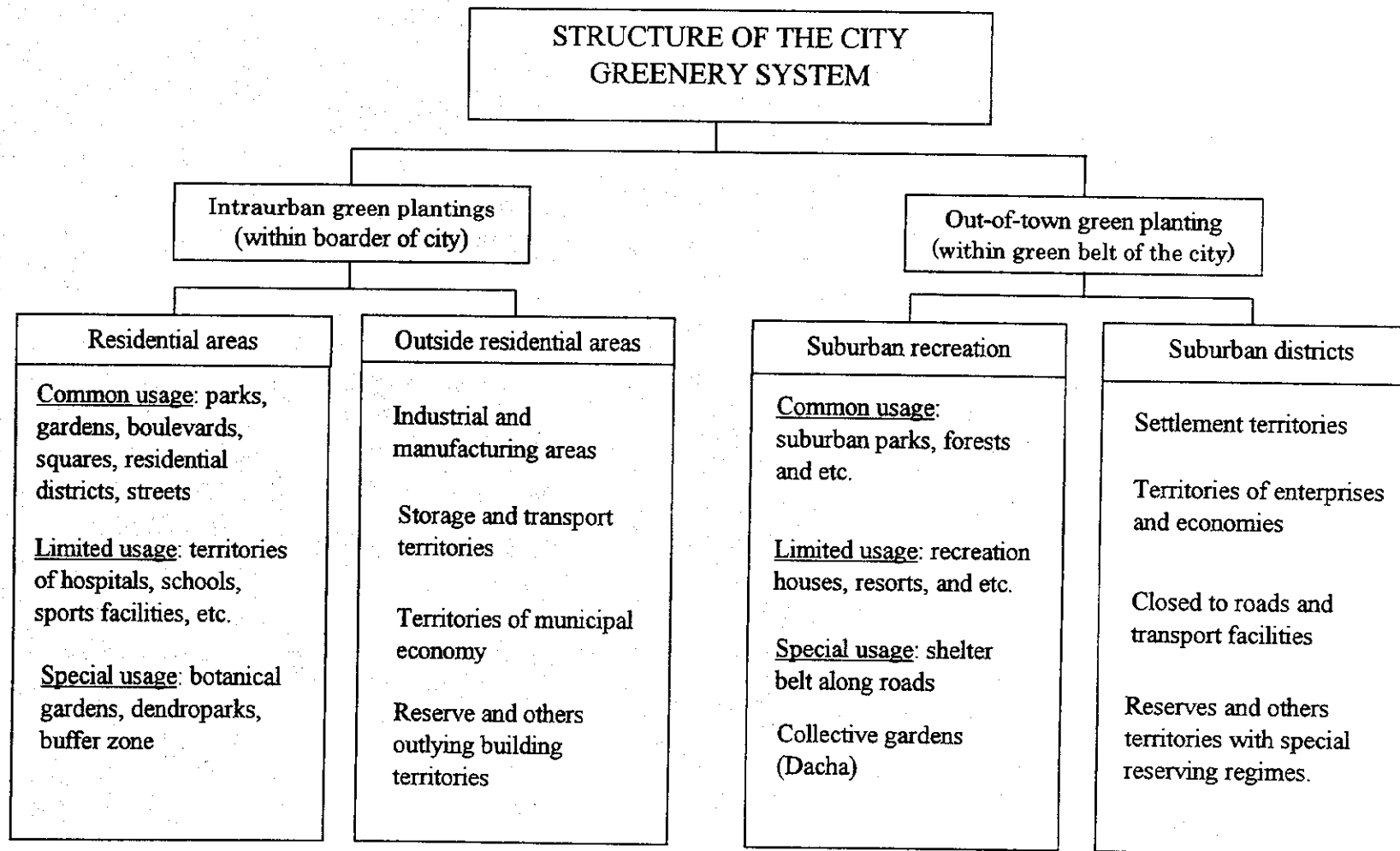
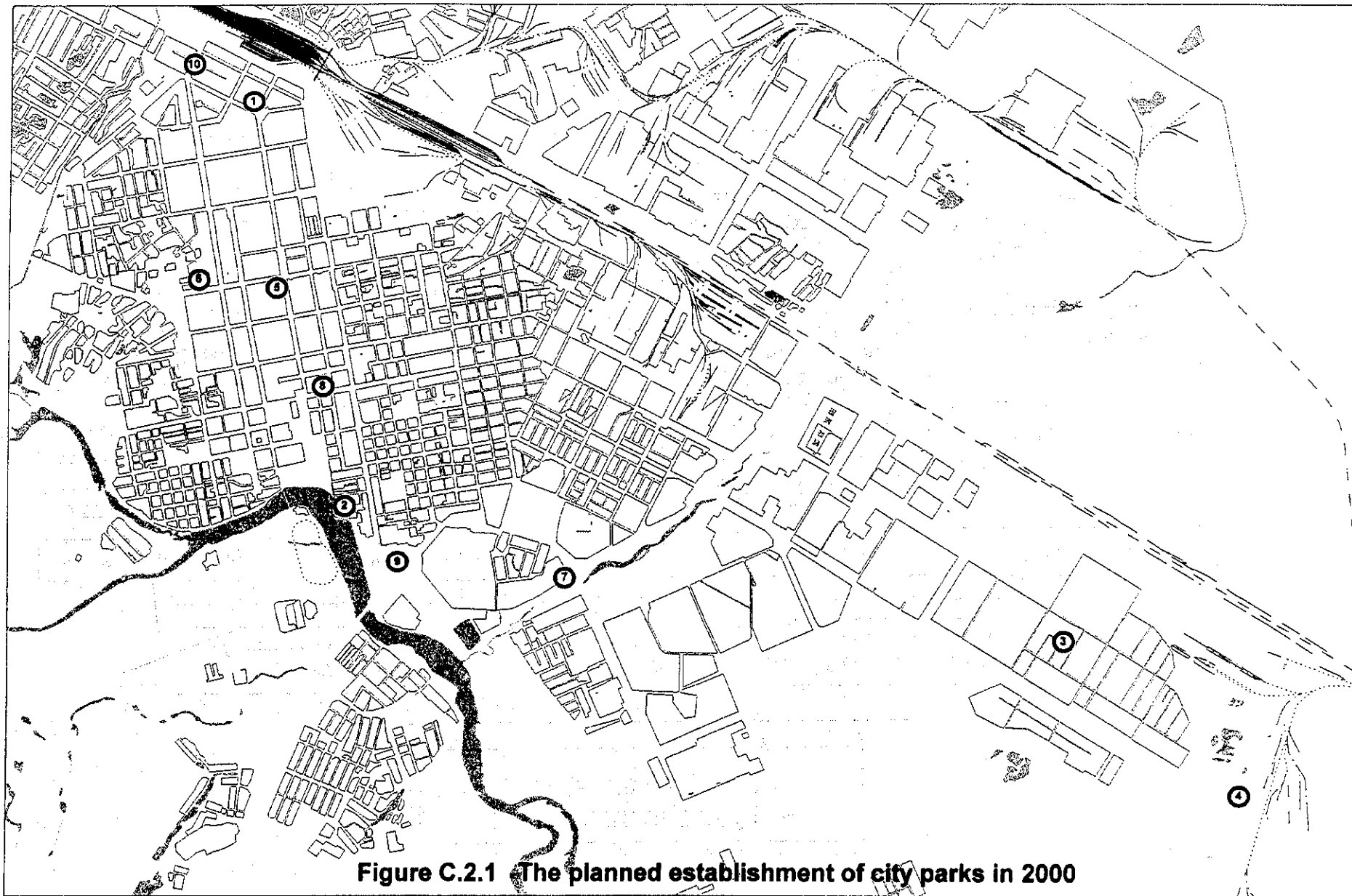


Figure C.1.1 The Structure of Green Plantations of the City



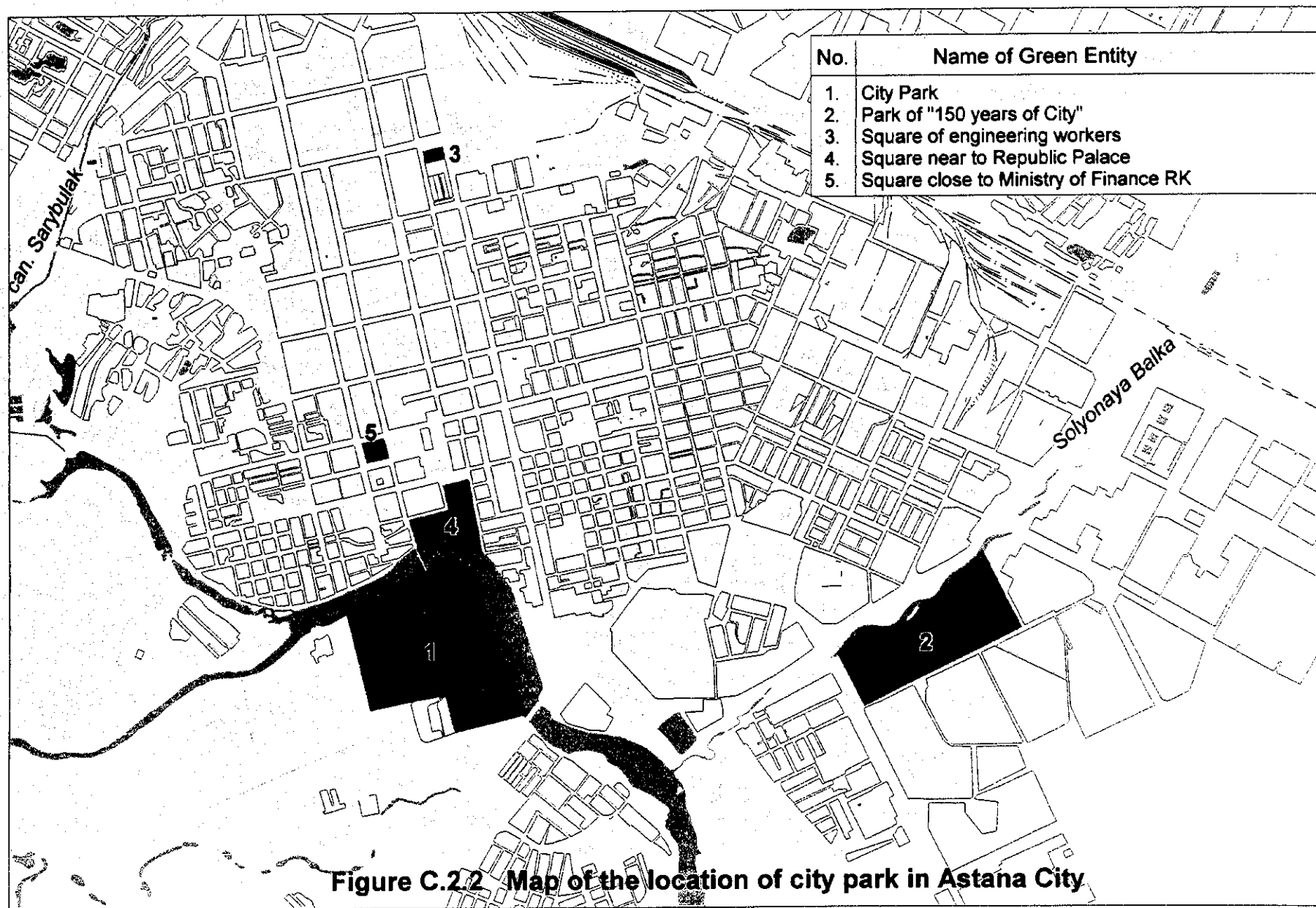
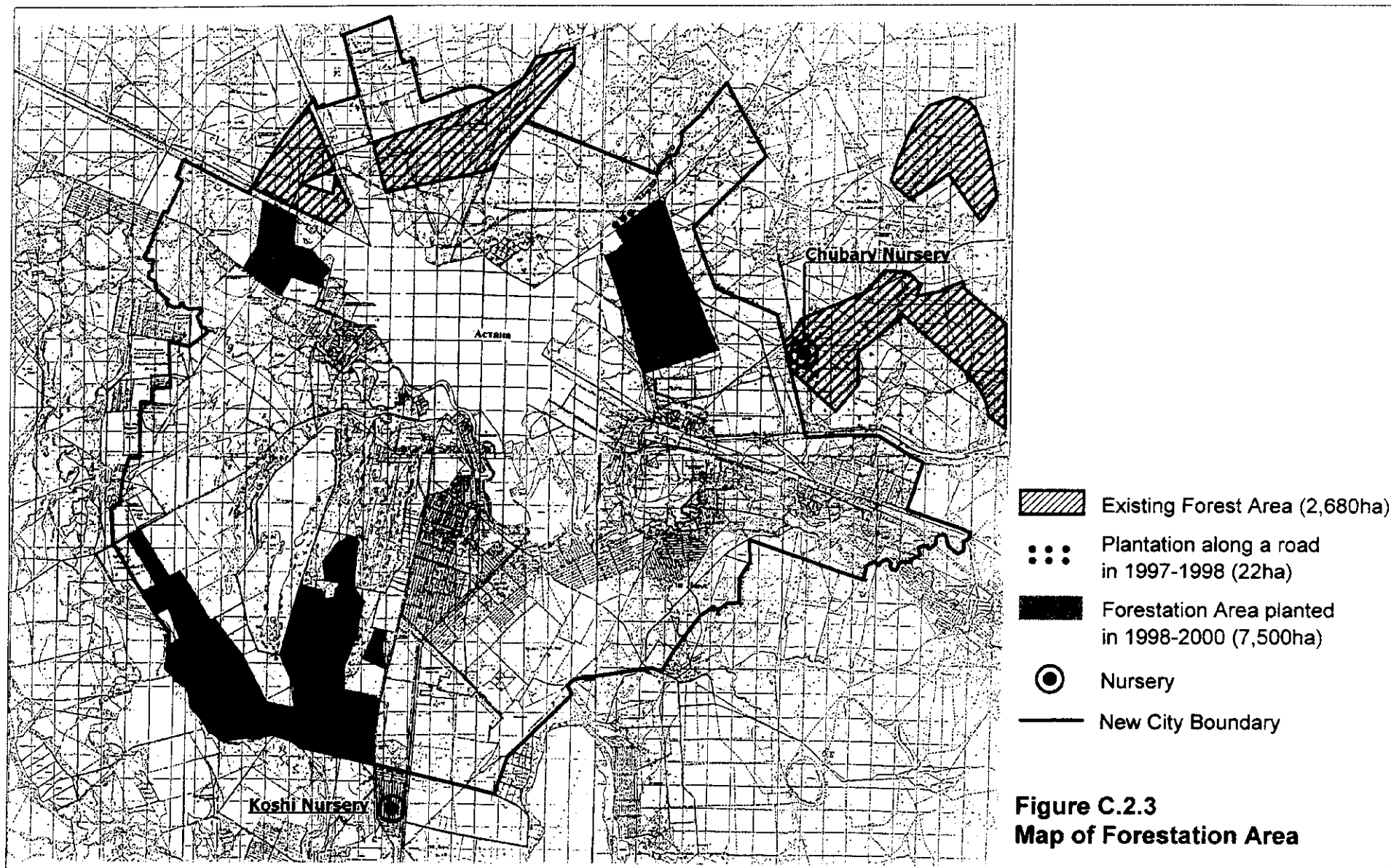







Figure C.2.2 Map of the location of city park in Astana City

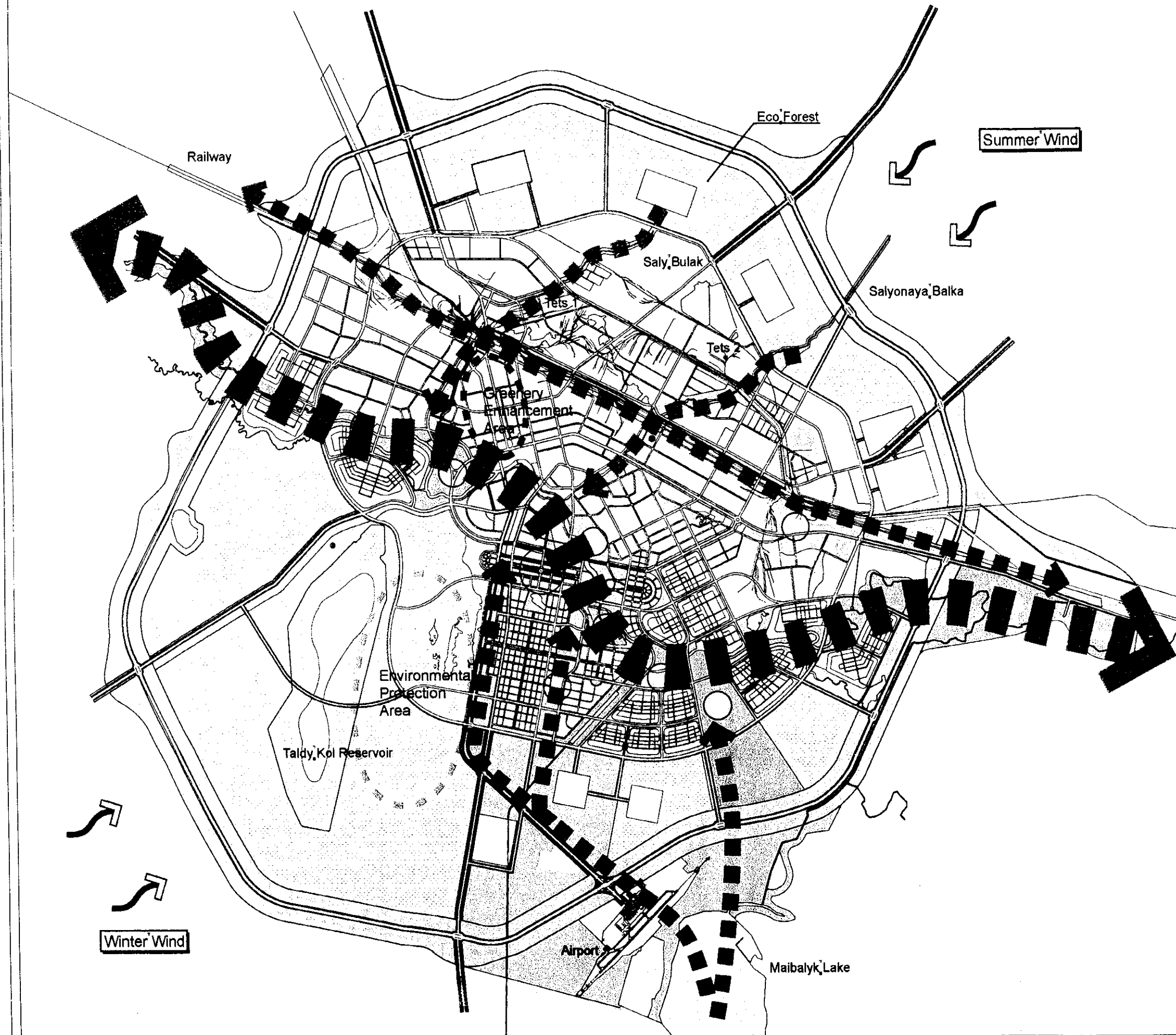


ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

-  MAIN GREENERY AXIS
-  MINOR GREENERY AXIS
-  CORE GREENERY (CITY PARK)
-  ECO FOREST
-  BUFFER BELT



PLAN FOR GREEN NETWORK

2010, 2020, 2030

JICA MASTER PLAN TEAM
HEADED BY YOSHIO KAWAKI, JICA

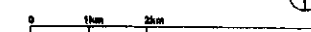


FIGURE C.3.1

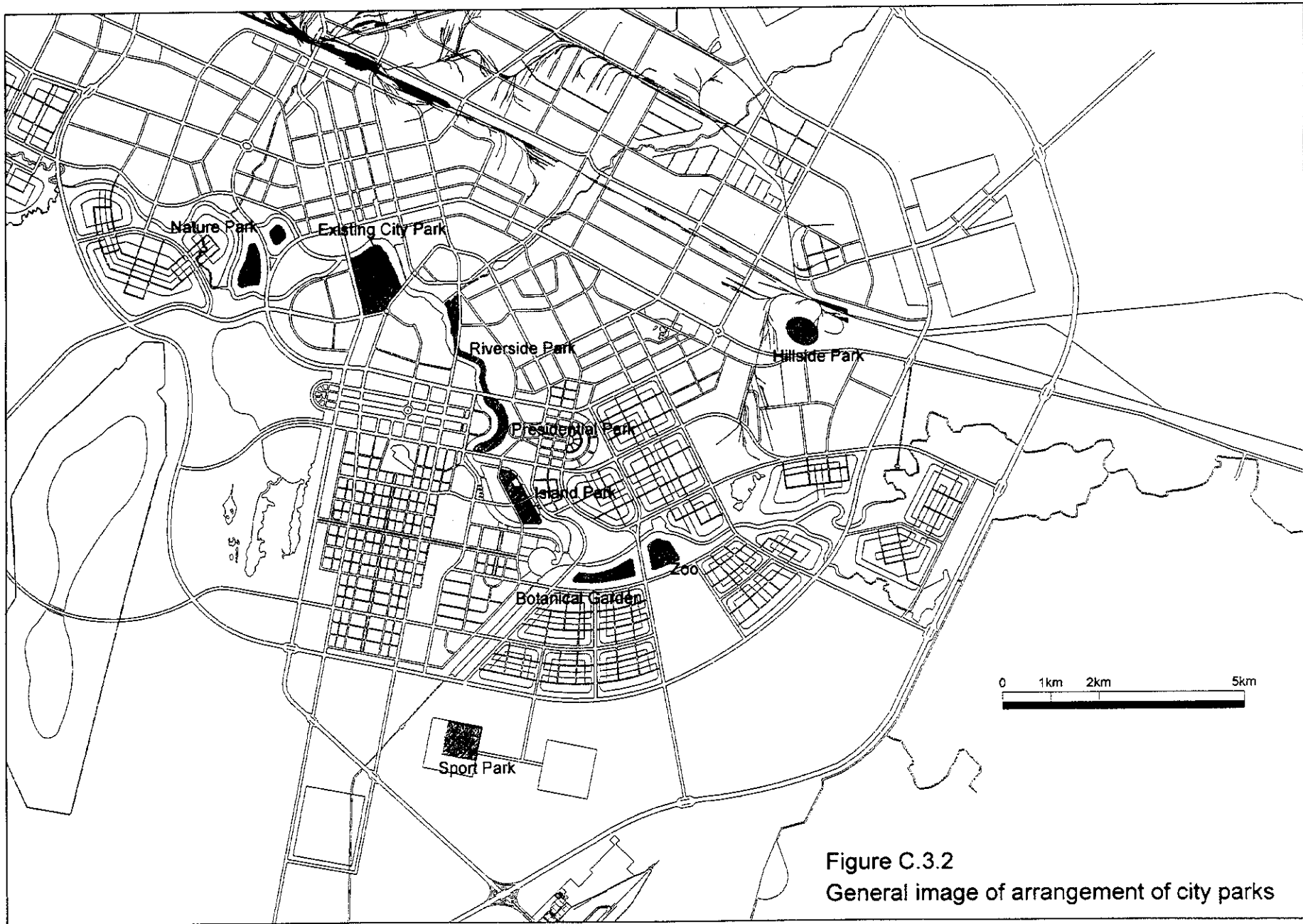


Figure C.3.2
General image of arrangement of city parks

Place: District 16 Located in Southeast of the City

Projected Population: 20,000PERSONAL

Necessary Park Area: 15ha(20,000persons*12m2/person*60%)

Detailed Park Area in Each Park category

District Park (DP): 4ha*1place= 4ha

Residential Area Garden (RAG): 1ha*5places=5ha

Neighborhood Park (NP): 6ha

Total: 15ha

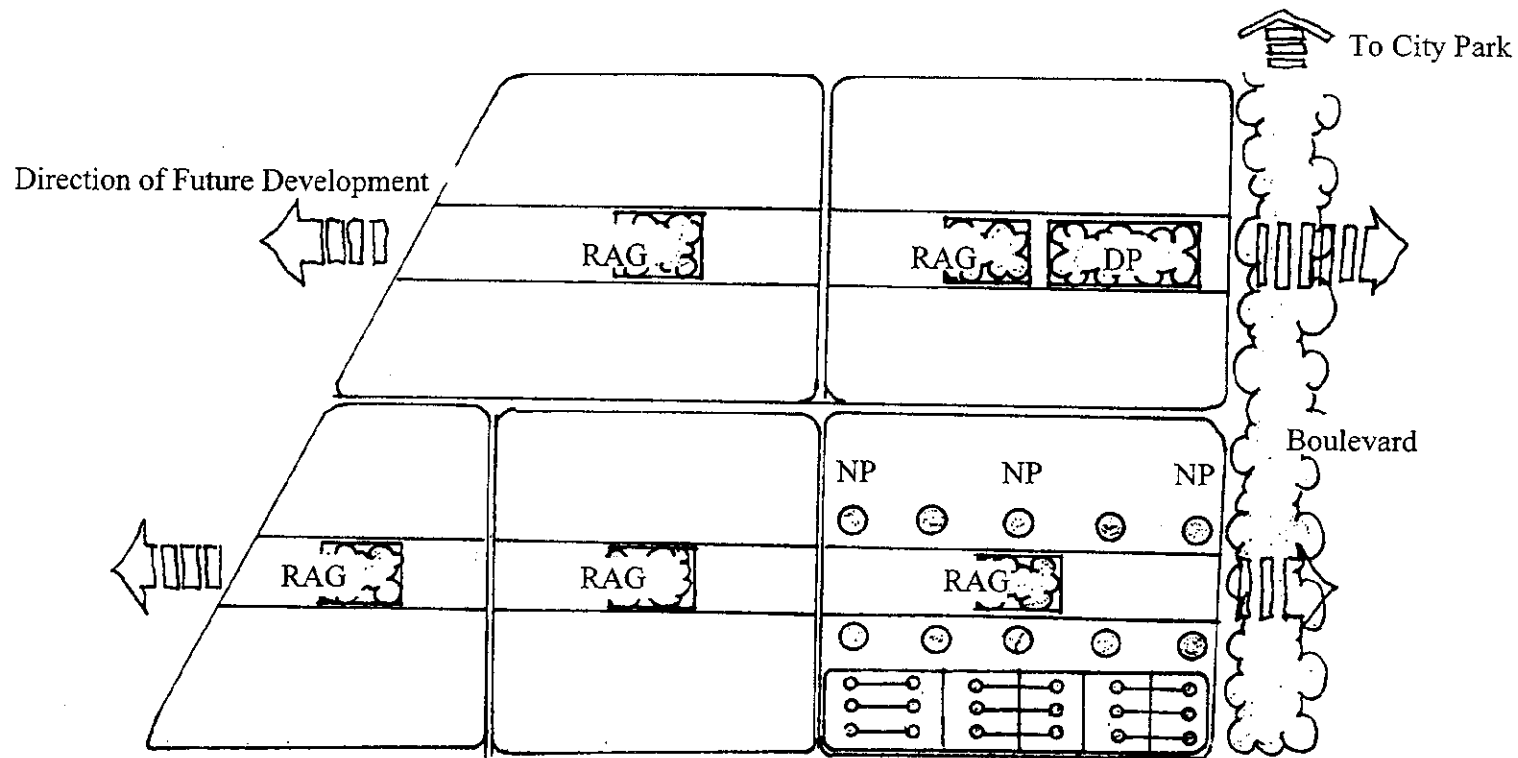


Figure C.3.3 Arrangement Pattern of Public Open Space Relating to the Residential System

