



## Landscape architecture and design Ландшафтная архитектура и дизайн

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### Creating Healing and Therapeutic Landscapes: Design Experience

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**Abstract:** Healthy longevity is becoming the main element in assessing the quality of the formed urban environment. The relevance of creating a comfortable urban environment is of great importance for leveling the negative processes of urbanization, burdened by globalization and COVID-19. The article presents the results of designing health-improving landscapes with their integration into the urban-ecological framework of the urban greening system of Sevastopol. The study of the design area was carried out using generally accepted methods of field research.

**Keywords:** healing landscape, therapeutic gardens, green frame, treatment facilities, hospital gardens

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**Authors contribution.** EEK — developed and designed the project; EEK, IVZ, IAZ collected the data; EEK, IVZ analyzed the data; EEK, IAZ — executed graphics, IVZ — wrote the paper.

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## Introduction

An integrated system of urban landscapes and natural landscapes in cities and megalopolises is the basis for formation of green infrastructure. The need to integrate, connect into a single ecological network greening objects different in their functional purpose, is an important component of the formation of a sustainable and healthy city, now and in the future. Currently, there are many examples of successful practice in the creation of green infrastructure in cities [1–3].

Health landscapes are currently represented mainly by therapeutic gardens of healthcare facilities (the experience of America, France, Spain, Singapore [4], Japan<sup>1</sup> and other countries). Therapeutic gardens are a structural element of healing landscapes, as they are landscape-planning organized into a garden. Therapeutic gardens are open healing gardens specially designed with trees and shrubs to meet the physical, psychological and social needs of people, primarily people undergoing treatment and rehabilitation in medical institutions [5]. A properly selected assortment of trees and shrubs and their compositional organization provides an attractive place for exercise and promotes physical health, improves mental health, reduces chronic pain, improves attention, and reduces stress. Therapeutic gardens located on the territory of medical institutions and designed specifically for the target group of patients (autistic, psychiatric, tuberculosis, oncological and other patients) are currently recognized by doctors as an important aspect of assistance in the progress of recovery and overcoming the disease [1]. The therapeutic garden on the territory of the hospital is not just a park, it is a public space that completes the picture of a medical institution [6]. The assortment of plants in the therapeutic garden is formed depending on the natural and climatic characteristics of the region, the healing properties of plants, their decorative properties, preserved during the entire growing season.

**The purpose of the study** was to analyze the principles and experience of creating health-improving landscapes. The main objectives of the study were to create and subsequently integrate health landscapes into the green infrastructure and into the urban ecological frame of Sevastopol greening system, to promote recovery and rehabilitation of hospital patients, city residents through the use of health and therapeutic landscapes, in particular, therapeutic gardens, contributing to normalization of psycho-emotional state of the citizens.

## Materials and methods

The environmental significance of the studied area is determined by the presence and degree of preservation of natural landscapes, including zonal types of vegetation, unique phytocenoses, rare species, as well as valuable park communities and green areas. The vegetation cover of the territory is determined by natural conditions of the region and is distinguished by a high phyto-diversity<sup>2</sup>.

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<sup>1</sup> Accessible Environment – Kansai Rosai Hospital Garden, Osaka, Japan [Electronic resource]. Access mode: <http://nsk.adme.ru/news/2006/07/03/2121.html> (date of the application: 17.10.2020)

<sup>2</sup> Main Directorate of Natural Resources and Ecology of Sevastopol. *Krasnaya kniga goroda Sevastopolya* [Red Book of Sevastopol. Kaliningrad: ROST-DOAFK publ.; 2018. (In Russ.).

Description of vegetation cover within boundaries of the objects was carried out by the route method of full-scale field research. The analysis of plant species composition was carried out using floristic and geobotanical descriptions. Identification of species was carried out according to the «Keys to Higher Plants of the Crimea»<sup>3</sup>. Floristic and geobotanical studies were carried out in accordance with generally accepted methods of field research. The vegetation of the territory was described according to the vegetation reports obtained in the course of field studies of the territory.

Based on the results of the research, it was concluded that vegetation of the studied territory of public health facilities in Sevastopol was an artificially created community of introduced plant species. Compared to natural cenoses, cultivated cenoses are less durable and stable. As a rule, they do not have a clearly defined structure, are one or two-tiered, perform mainly aesthetic and landscaping functions, require constant care to maintain and form the structure and assortment of species. Cultivated phytocenoses are ennobled areas of natural vegetation, where introduced species are combined with natural vegetation preserved during the establishment of parks in the territories of health facilities of Sevastopol, and are communities of a mixed type. Mixed communities in their structure and species composition are similar to background cenoses and include introduced species occupying the corresponding layers of communities.

## Results and discussion

A number of major international events dedicated to the return of «nature to cities», conservation, restoration of the natural environment and ecological health at the planetary level have been over the past ten years. Modern processes of urban development and urban planning are associated with the creation of a high-quality comfortable and safe urban environment — quality of life is the main criterion for the success and effectiveness of urban planning strategies. The problem of providing population with a high-quality urban environment that contributes to extension of life and creates comfortable living conditions for all categories of citizens comes to the fore. Healthy longevity is becoming the main element in assessing the quality of the formed urban environment.

Landscape urbanism based on an integrated interdisciplinary approach to the formation of a comfortable, socially-oriented and environmentally sustainable structure of cities, currently determines the main ecosystem directions in creating a healthy environment in our cities.

The perception of the city as a landscape is one of the ideological concepts of landscape urbanism. Therefore, speaking about formation of green infrastructure in the city, one should remember about creation of a complex integrated system of natural and urbanized landscapes that form a sustainable ecosystem of the city.

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<sup>3</sup> Rubtsov N.I. (ed.) *Opredelitel' vysshikh rastenii Kryma [Indicator of higher plants of the Crimea]*. Leningrad: Nauka publ.; 1972. (In Russ.).

Modern healing landscapes, in addition to therapeutic gardens, include landscapes that perform treatment functions and are public spaces, providing links between various buildings, recreation facilities and walking routes without intersecting with transport and technical passages and with the adjacent urban space. Thus, health landscapes are integrating into the green infrastructure of the city.

Currently, many countries integrate natural elements into the architecture of health facilities. The main purpose of this integration is the use of natural objects as an additional non-drug means of accelerating the patient's recovery process. Of course, during the spread of COVID-19, this practice becomes especially in demand.

A good example is the integration of the “Parc Sanitari Pere Virgili” in the Gracia district of Barcelona (fig. 1). As a result of urban regeneration, which began in 1999, an old military hospital was transformed into a medical center, currently providing medical, research and educational services [8].



**Fig. 1.** The integration of Parc Sanitari Pere Virgili therapeutic landscape into the public-pedestrian space of the street, Barcelona, Spain (Krasilnikova E.E., ©)

Schools of landscape aesthetics include the perspective-refuge theory (Appleton, 1975<sup>4</sup>), the savanna hypothesis (Orians & Heerwagen, 1986<sup>5</sup> and 1992<sup>6</sup>), and the later

<sup>4</sup> Appleton J. Landscape evaluation: the theoretical vacuum. *Trans. Inst. Brit. Geog.* 1975; (66): 120–123.

<sup>5</sup> Orians G. An ecological and evolutionary approach to landscape aesthetics. In: Penning-Rowsell, E.C. & D. Lowenthal (eds.), *Landscape Meanings and Values*, Allen & Unwin, London. 1986.

<sup>6</sup> Orians G, Heerwagen JH. Evolved responses to landscapes. In: J.H. Barlow, L. Cosmides & J. Tooby (Eds). *The Adapted Mind, Evolutionary Psychology and the Generation of Culture*. Oxford University Press; 1992.

biophilia hypothesis (Wilson, 1984<sup>7</sup> and 1993<sup>8</sup>), which have inspired many landscape design practitioners. The innate attraction of people to nature led to the formation of principles of biophilic design in creating an artificial environment: the created natural environment should provide optimal restorative benefits for its users [7–11].

Today, healing landscapes are natural, modified or specially designed landscapes based on a proven impact on meeting the physical, psychological and social needs of people using landscapes for health purposes. It is noted that even a short contemplation of the landscape is sufficient to relieve tension, equalize blood pressure, relax muscles and normalize mental and cardiac activity. The health-improving effect of the landscape is based on the principle of its orderliness and the ability to restore lost physical and psycho-emotional stability [12]. Modern landscape architecture does not deny the presence of this impact, but on the contrary, recommends initially laying the formation of the landscape, taking into account the principles of landscape design, medicine and psychology.

When designing modern recreational landscapes, it is necessary to lay the presence of a rigid landscape, vegetation, water bodies and paths [7, 8]. Plants must be selected so that they provide visual interest all year round; not only herbaceous and shrub plants, but also tree species should be used. It is woody plants that allow you to revive the landscape with play of light and shade and noise of foliage. Plants should be selected based on the principles of safety when inhaling aromas and touching foliage [10, 11].

It is recommended to design a rigid landscape as a component of a recreational landscape in the volume of no more than one third of the area using natural materials. The presence of water bodies in the landscape contributes to the relaxation and meditation of users in the presence of a smooth surface. The design of paths should proceed from the principles of promoting activation of physical activity, which is achieved not only by design of route, but also by the use of appropriate materials [13, 14]. Most non-specialized therapeutic landscapes are multi-sensory and stimulate the activation of all senses in users. Multisensory nature of the recreational landscape is also ensured by the presence of babbling ponds, birds, insects and small animals in the garden, which should also be safe for users [8, 15].

Therapeutic landscapes are created for widespread use and are functionally aimed at:

- gaining experience of communication with nature;
- promoting social interaction and physical activity of users;
- stimulating the user's sense system through interaction with nature;
- improving the physical and mental well-being of users;
- increased interest in plants and gardening.

The basis of color therapy is the principle of coloristic healing effect of plant color — color of foliage, color of flower, color of trunk [10, 15, 16]. The principle of the coloristic health-improving effect of plant color is associated with the use of plants with a certain dominant color range in the landscape composition.

<sup>7</sup> Wilson E. *Biophilia*. Harvard University Press; 1984.

<sup>8</sup> Wilson Edward O., Kellert Stephen R. *The Biophilia Hypothesis*. Shearwater Books; 1993. 484 p.

As part of the study, the therapeutic landscape of the city hospital no. 3 in Sevastopol was designed.

The city hospital no. 3 is located on the 15 Nadezhdintsev street, Nakhimovsky district, Sevastopol, on the southern side of the Sevastopol bay. In the north, the site is bordered by a passing active railway. There are Zheleznodorozhnaya street and private sector on the west side, a road and middle-rise buildings on the south side. The Ushakova Balka nature reserve is located on the east side. The entrance to the hospital is located from the Nadezhdintsev street (fig. 2). The physiotherapy department is located in the eastern part of the territory overlooking the Ushakova Balka nature reserve and the sea. The relief of the territory is of a hilly type. The height above sea level is 40 meters. There is a steep slope from the east towards Ushakovaya Balka.

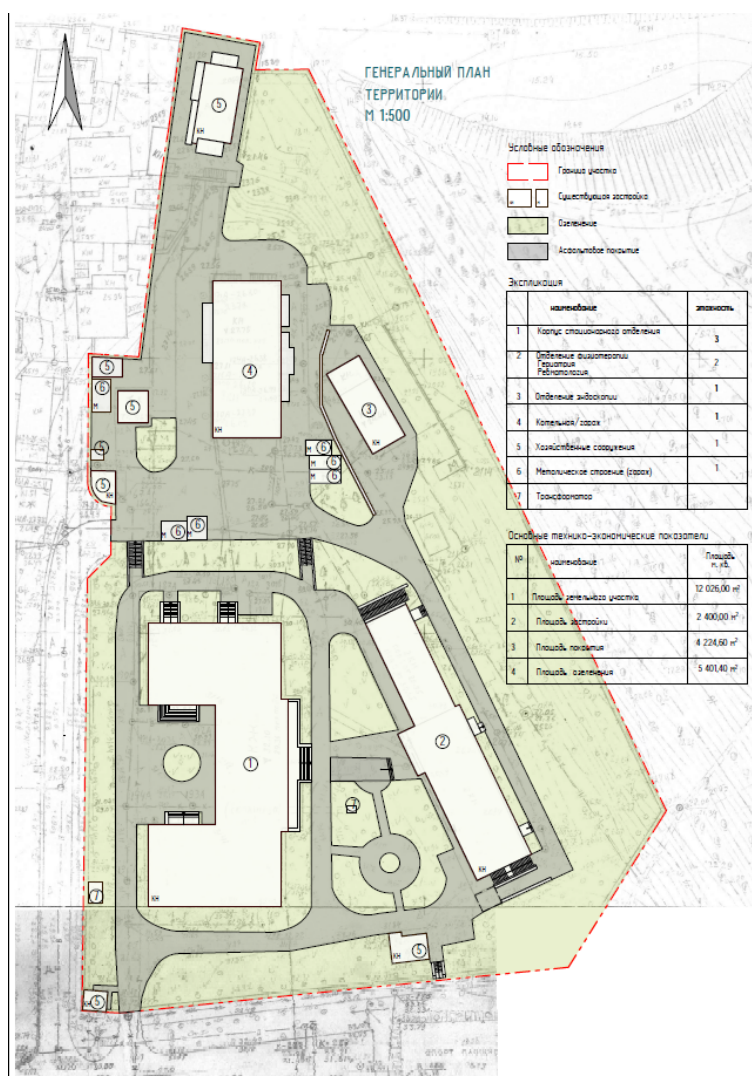


Fig. 2. General plan of hospital № 3. Current situation

The research results show that the total area of the hospital is 1.20 hectares. The green area is 0.5 hectares, which tells about violations of landscaping norms. The established norms provide for the volume of landscaping of the territory in the amount of up to 30 m<sup>2</sup> per patient, including paths and platforms<sup>9</sup>. There are 85 trees and 93 bushes on the territory of the hospital. The ratio of trees and shrubs that provide environmental comfort does not meet the standards. With the current standard of 1:6 for the territory of the hospital, a violation of the planting rate was noted: an additional 417 shrubs are required to be planted. For the southern zone, the planting rate is 330 trees per hectare. Therefore, it is necessary to plant 80 additional trees on the territory of the hospital.

About 34 % of tree plantations is occupied by black locust (*Robinia pseudoacacia*), 14 % — horse chestnut (*Aesculus hippocastanum*), 8.3 % — cherry (*Prunus subg. Cerasus*), 8.2 % — Japanese pagoda tree (*Styphnolobium japonicum*), 7 % — common ash (*Fraxinus excelsior*), 3.5 % — pink silk tree (*Albizia julibrissin*), 2.3 % common almonds (*Prunus dulcis*), 1.1 % each — loquat (*Eriobotrya japonica*) and holly (*Ilex aquifolium*).

The supporting tree planting plan for the territory of the city hospital no. 3 is on fig. 3. The general condition of the plantings is generally satisfactory. Many trees and shrubs grow in violation of landscaping standards, close to buildings and communications. There are dead trees that need replacement. Therefore, it is necessary to carry out thinning, landscape and sanitary felling. On the territory of the hospital, there are a small number of flower beds, which are mainly represented by roses. The state of the hospital's territory requires reconstruction, including the dismantling of metal garages, reconstruction of stairs, reconstruction of the asphalt pavement, earthworks for adding soil, replanting shrubs (fig. 4).

A weakly expressed diversity of perennial and annual flowers and herbaceous plants was noted. So, it is necessary to set up a medicinal rose garden in front of the main entrance to the hospital on the free square.

The assessment of the lawn showed its unsatisfactory condition, in some areas the lawn is absent (possibly due to the peculiarities of soil and climatic conditions). It is recommended to replace the lawn by planting ground cover plants such as lesser periwinkle (*Vinca minor*), common ivy (*Hedera helix*) or rockspray cotoneaster (*Cotoneaster perpusillus*). The aesthetic state of tree and shrub plantations is characterized by a low aesthetic level of the design of the lower tier of landscape compositions and landscape group plantings of flower crops and shrubs. The territory of the therapeutic garden requires equipping with small architectural forms.

The existing functional zoning of the hospital territory and the zoning of the territory within the framework of the project are on fig. 5.

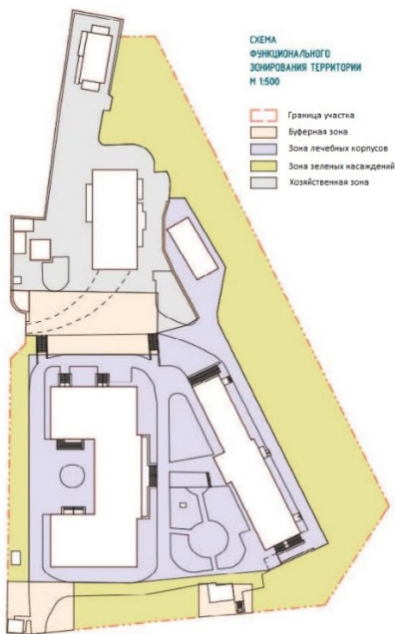
<sup>9</sup> Normy posadki derev'ev i kustarnikov gorodskikh zelenykh nasazhdenii [Planting rates for trees and shrubs in urban green spaces]. Available from: <https://gosthelp.ru/text/Normyposadkiderevevikusta.html> [Accessed 15th May 2021]. (In Russ.). Sanitary Regulations and Norms. SanPin 2.1.3.2630–10. Sanitarno-epidemiologicheskie trebovaniya k organizatsiyam, osushchestvlyayushchim meditsinskuyu deyatel'nost' [Sanitary and Epidemiological Requirements for Organizations Performing Medical Activities]. Moscow; 2010. (In Russ.).



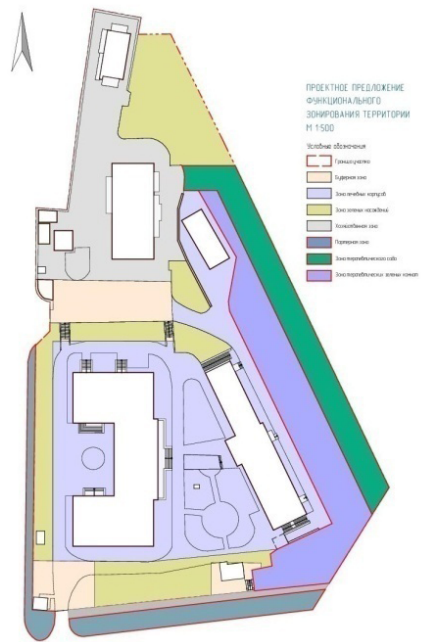
Fig. 3. Supporting tree planting plan for the territory of the city hospital № 3



Fig. 4. Project for the reconstruction of the territory of the city hospital № 3



A



B

Fig. 5. Functional zoning of the territory of the city hospital № 3: A – the current situation; B – project



To highlight the area of the therapeutic garden, it is proposed to use molded hedges of trees and shrubs, which are easy to cut and form a dense crown, abundant branching and foliage. Fences have a protective function: they protect from drafts, trap dust, decrease city noise and concentrate healing scent. We propose to use coniferous plants that enhance the therapeutic effect as plants for molded hedges, When using columnar plants, shaping sides of plants is not required. The hedge height can vary from 1.0 to 3.0 m depending on the area of use.

The limiting factors for the therapeutic garden project were:

1. Small area of the city hospital.
2. Specialization of the city hospital.
3. Preservation of trees on the hospital territory.
4. Correspondence of the therapeutic garden style to the architectural style of the buildings of the 1970s.
5. Limited expenses for the design and improvement of the hospital territory.

The presence of limiting factors determined the choice of the territory for design of therapeutic garden and selection of plants.

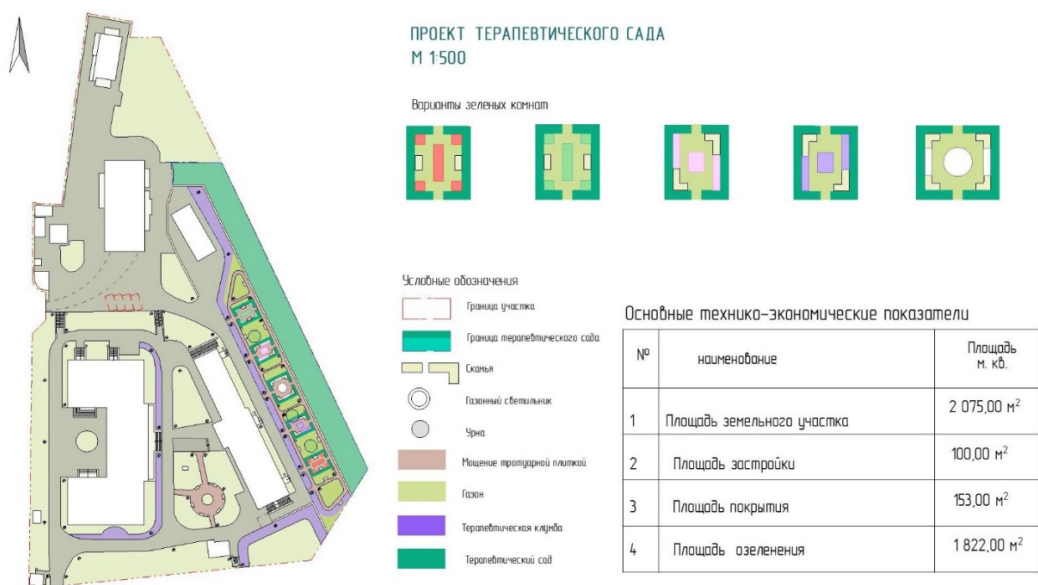
The project for organization of therapeutic garden on the hospital territory and the tree planting plan of therapeutic garden, indicating the main plantings is showed on fig. 6 and 7. We recommend to preserve the existing zoning of the territory as much as possible, using the space adjacent to the Ushakova Balka to create mini gardens (green rooms). The environmental significance of the studied territory of Ushakova Balka is determined by the presence and degree of preservation of natural landscape, including zonal types of vegetation, unique phytocenoses, rare species, and valuable natural communities and green areas. This arrangement of mini-gardens (green rooms) will allow for the subsequent integration of hospital's therapeutic garden into green infrastructure and into urban-ecological frame of the urban greening system of Sevastopol.

Within the framework of the project, digital models of mini-gardens (green rooms) were developed (fig. 8), an assortment of plants was selected by chromaticity, and coloristic matrices of all-season plants were developed. Mini gardens (green rooms) have a different functional focus, which is determined by the specialization of the city hospital no. 3:

1. Mini garden (green room) for cardiac patients.
2. Mini garden (green room) for patients with respiratory diseases.
3. Mini garden (green room) for patients with mental disorders.
4. Mini garden (green room) for diabetic patients.
5. Aroma garden.

The selection of plants by chromaticity was in accordance with the therapeutic effect of color (Table).

The matrix for pink (magenta) compositions is represented by a rosary, loosestrife, showy stonecrop, Shenandoah switchgrass, round-headed leek, reed grass, oregano, pink-silver heather, and bonesets (fig. 9).



**Fig. 6.** Project for a therapeutic garden

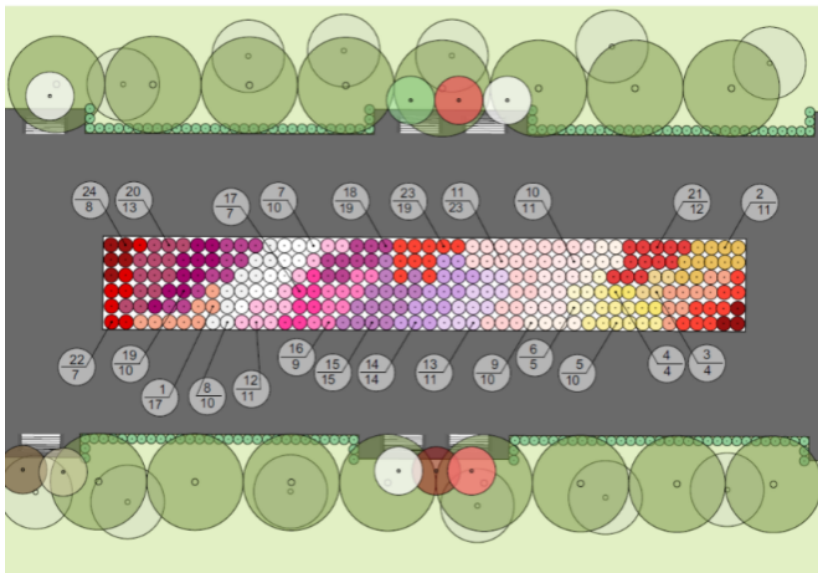


**Fig. 7.** Project of the tree planting plan (A) and the network of trailways (B) for the therapeutic garden



**Coloristic healing effects of plant color**

Color	Health disorders	Contraindications
Red	Low blood pressure; anemia; poor circulation; cold; runny nose	High blood pressure; bleeding; hot temper; aggressiveness
Orange	Diabetes; skin diseases; exhaustion of the nervous system	Severe stomach diseases; insomnia
Yellow	Constipation; diabetes; skin diseases; exhaustion of the nervous system	Severe stomach diseases; insomnia
Pink	Adrenal; kidneys; helps to cleanse the blood of harmful substances; acts as a laxative; lowers aggression; relaxes	–
Green	Heart diseases; bronchitis; lung disease; flu; claustrophobia	The need to make a quick decision
Blue	High blood pressure; fever; laryngitis; cut; insect bites; burns; prementsrual syndrome; frigidity; stress-induced migraine; childhood diseases – painful teething, measles, piggy; helps treat deafness, cataracts, bleeding, insomnia; is an anesthetic; helps with tonsillitis, rheumatism	Tendency to seasonal depression; endocrine diseases
Purple	Concussion; epilepsy; neurology; multiple sclerosis	Severe mental illness; alcoholism
White	Mental states	–



**Fig. 9.** The dendrological matrix of a flowerbed of scrub roses based on a coloristic approach

In the northern part of the territory of the city hospital, it is recommended to create a rain garden, for which a profile has been developed within the framework of the project.

There is an abandoned sports ground in the immediate vicinity of the hospital, where we recommended to arrange parking while preserving the existing tree plantations.

## Conclusions

In the context of globalization and the spread of COVID-19, cities need systematic urban development, creation of a comfortable urban environment in a densely built environment, adjustment of environmental and economic development goals, and strengthening of social ties among members of the urban community. It is important to consider natural component in development of the city in such a way as to support rather than slow down urbanization, and at the same time create a comfortable and healthy urban environment. Integration of health landscapes into the green infrastructure of the city is a logical continuation of the global trend towards the formation of an integrated, socially oriented and environmentally sustainable city greening system.

In modern conditions of re-functionalization of the city's greening system, creation of a comfortable multifunctional internal structure of city's green frame is possible in conditions of full or partial integration of therapeutic and health-improving landscapes. The territories of most city hospitals are closed urban planning objects with fenced areas, which are classified as limited-use landscaping objects. In order to integrate healthcare facilities into the green infrastructure of the city and the intracity greening system, new structural elements of landscaping of limited-use facilities should be introduced: landscaping of entrance zones, pocket and linear therapeutic gardens located both on the territory of healthcare facilities and in areas adjacent to healthcare facilities (located in the structure of pedestrian zones of streets),— public spaces for patients, their relatives and visitors.

To implement the tasks of creating a comfortable urban environment, the creation of recreational landscapes at various territorial levels (including therapeutic landscapes in the system of natural landscapes, public spaces, healthcare facilities, etc.) requires a systematic and professional approach to formation of an integrated multistage green infrastructure of the city, in which therapeutic landscapes should have priority.

The potential of the territories of healthcare facilities will make it possible to create new structural elements of landscaping of limited use — greening of entrance areas of healthcare facilities, which are located in the structure of pedestrian zones of streets. These are public spaces for patients, their relatives and visitors to relax. Thus, they will be integrated into the green frame of the city.

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## Создание лечебного и терапевтического ландшафтов: опыт проектирования

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**Аннотация.** Рассматривается значимость здорового долголетия как главный элемент оценки качества формируемой городской среды. Исследован опыт создания оздоровительных ландшафтов. Обоснована актуальность создания комфортной городской среды с позиции насыщения ее оздоровительной функцией и нивелирования негативных процессов урбанизации, отягощенных глобализацией и COVID-19. Приведены результаты проектирования оздоровительных ландшафтов с их последующей интеграцией в градоэкологический каркас системы городского озеленения Севастополя. Изучение территории проектирования осуществлялось с общепринятыми методами полевых исследований.

**Ключевые слова:** оздоровительный ландшафт, терапевтические сады, зеленый каркас, лечебные учреждения, больничные сады

**Заявление о конфликте интересов.** Конфликт интересов отсутствует.

**Финансирование. Благодарности.** Внутренний грант Севастопольского государственного университета № 29/06–31.

**Информация о вкладе каждого автора.** Красильникова Э.Э. — концепция исследования и проекта, сбор и обработка материалов, анализ полученных данных, выполнение графического материала; Журавлева И.В. — сбор и обработка материалов, анализ полученных данных, написание текста; Заика И.А. — сбор и обработка материалов, выполнение графического материала.

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