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Sustainable Development of the City's Transport Infrastructure—A Project of a New Tram Line with a Linear Park along the Exhibition Channel in Warsaw

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Abstract: A new double-circuit tram route planned in Warsaw (V_{max} = 70.0 km/h), running through the Praga Południe district from Waszyngton Avenue (Washington Avenue) to Gocław loop (total length of about 3.5 km), is designed to reduce the existing road load in this area of the access routes from outside Warsaw to the center of the capital, as well as to improve the conditions of transport service in the areas of Saska Kępa, Międzynarodowa housing estate, Kępa Gocławska and Gocław, thereby increasing the use of public transport in Warsaw. This paper concerns the first part of the planned investment—a new tram route on the section between Waszyngton Av. (Washington Avenue) and Stanów Zjednoczonych Av. (United States of America Avenue) in Warsaw, along the historical Exhibition Channel in its immediate vicinity (Saska Kępa). Specialists-constructors (Tramwaje Warszawskie Llc.) cooperated with landscape architects (Landscape Architecture Department, Warsaw University of Life Sciences—SGGW), in accordance with contemporary canons of sustainable urban development. They aimed at restoring proper proportions in the use of the area, taking into account functional aspects (optimal communication and various forms of recreation), natural aspects (preserving valuable vegetation and enriching resources), landscape aspects ("recovering" water as the main element of space) and reconstructing connections with adjacent areas (residential areas and allotments).

Key words: Linear park, biologically active area, tram route Gocław-Saska Kępa, green tracks, green infrastructure, sustainable transport, social participation.

1. Introduction

Dynamic development of large urban agglomerations imposes the necessity of constant adjustment of the quality and efficiency of the public transport system to the growing social needs. Currently, as estimated, transport systems around the world have a significant impact on the environment, accounting for 20-25% of global energy consumption and emission of CO_2. In city centers, transport based on private cars is becoming a relic of the past, due to numerous negative social costs, including road accidents, air pollution, decline in physical activity of citizens and spending their free time on commuting, burdening household budgets with rising fuel prices.

The report on mobility development for passenger transport prepared by the McKinsey Center for Business and Environment in 2017 [1] indicates four areas that are rapidly developing, i.e. electrification, autonomy, communication and sharing. In accordance with a world-wide popular concept of "sustainable transport", being part of the cities of the future (the so-called smart city), measures are taken to create a balanced urban transport in terms of its impact on society, environment and climate.

In this context, the Capital City of Warsaw's strategic documents assume that the overall objective

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of transport policy is to improve and develop the transport system to create conditions for efficient and safe movement of people and goods while limiting harmful impacts on the natural environment and living conditions [2]. One of the tasks (Task 2) indicated for implementation in the above-mentioned internal act is modernization and development of the tram communication system[1]. Warsaw Trams, Llc. perform the Capital City of Warsaw's own tasks regarding public utility in the field of local public transport. As part of the implementation of the duties entrusted, the company constantly carries out works related to the modernization and purchase of tram rolling stock necessary to perform the tasks of the public transport operator connected with the track and power infrastructure. Activities related to the modernization of the existing network as well as its development are carried out on the basis of technical, economic and environmental analyses and studies based on comprehensive traffic research and mathematical motion models [3]. Preparing long-term traffic forecasts along with cost estimations allows assessing the economic effectiveness of the project and, finally, and making decisions regarding the use of public funds in the long-term perspective.

One of the elements of Warsaw's future communication system is a new rapid two-track tram route (V_{max} = 70.0 km/h) which is to run in the Praga Południe district—from Waszyngtona Av. to Gocław loop (total length about 3.5 km). The designed communication route is constructed to reduce the existing road load in this area of access routes from the direction of Praga Południe and Otwock as well as Mińsk Mazowiecki to the center of the capital, improving the conditions for transport service in the areas of Saska Kepa, Międzynarodowia housing estate, Kępa Gocławska and Gocław and increasing the share of public transport in Warsaw. Due to functional and spatial diversity of the development of areas adjacent to individual separate sections of this route, it is necessary to develop new forms of its surrounding. This requires taking into account the specifics of a given fragment of a new investment, while applying solutions that ensure a high standard of urban space quality.

The authors of this paper intend to present framework stages of formal and analytical work and obtained results in the form of designed guidelines for a fragment of the new tram route (the section between Washington Av. and United States of America Av.). The purpose of the analytical and project works undertaken is not only to prevent the transformation and degradation of the local environment as a result of a new investment, but, above all, to create a high quality public and natural space in the form of generally available green areas (linear park) connected with the planned public investment project [4].

2. Material and Methods

Since 2008, the Road and Communication Office of the City of Warsaw has been working on the legitimacy and technical feasibility of the tram route linking Gocław and Saska Kępa with Śródmieście Warszawa [5-7]. The analyses carried out confirmed the legitimacy of the new tram route in terms of economic, technical and transport functions. Based on these materials, the authorities of the Capital City of Warsaw made a directional decision on the need to implement this investment and to submit it for co-financing from the European Union assistance funds under the Operational Program "Infrastructure and Environment" for 2014-2020. In connection with the entrusting of Warsaw Trams, Llc. in 2015, the Company commenced conceptual and design work aimed at obtaining the first administrative decision in the investment cycle, that is, the decision on environmental conditions. As part of the work, five variants (W1-W5) of the route of the tram route were analyzed (Fig. 1) and examined in terms of transport forecasts, impact on the road and

1 Legal basis: (a) Act of 15 March 2002 on the system of the capital city of Warsaw [10]; (b) Founding Act of the Warsaw Trams, Llc. [11]; (c) Contract for the provision of public transport… [12].

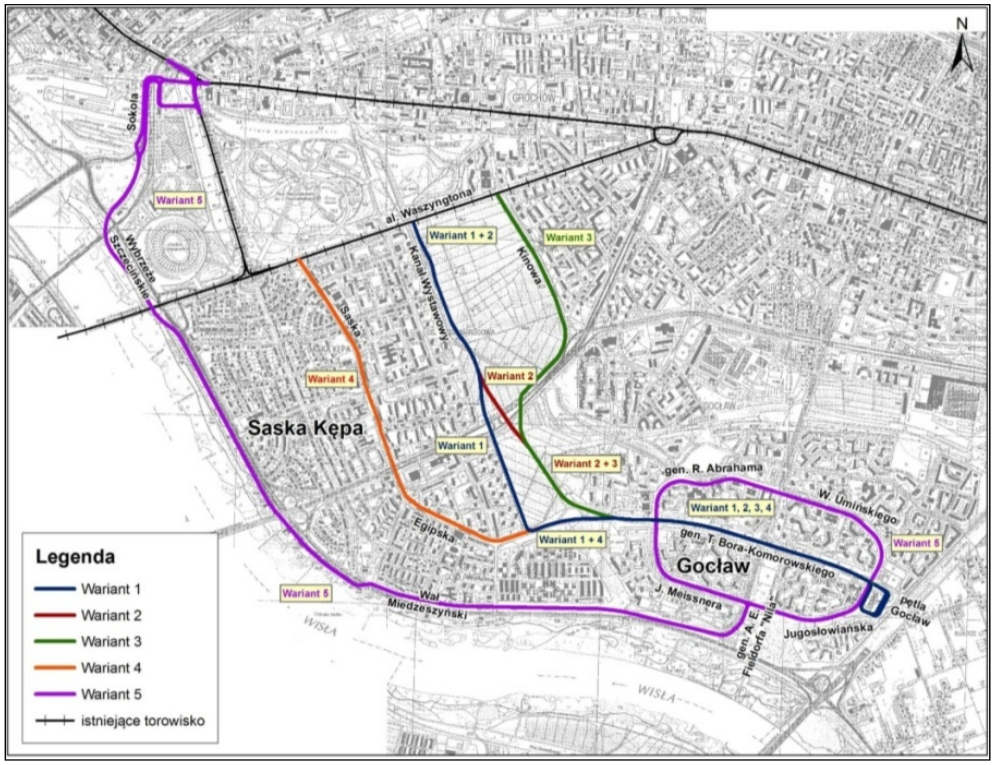

Fig. 1 Orientation map of the location of tram route variants linking Gocław and Saska Kępa with Śródmieście [8].

street layout and environmental impacts [8, 9]. As a result of multicriteria analyses and social consultations (II-XI 2016), further options were addressed to W1, W2 (along the Exhibition Channel) and W4 (along Saska St. and Egipska St.). Finally, based on multi-criteria analyses (technical, economic and environmental issues, public consultations carried out in X-XI 2016, the course of the planned tram route was selected in the W2 investment variant (Fig. 2), for which in December 2016 Warsaw Trams, Llc. [*in polish:* Tramwaje Warszawskie sp. z o.o. – TW] obtained the decision on environmental conditions [13].

The research presented in the paper concerns a fragment of the area indicated for implementation (variant W2), covering the areas adjacent to the Exhibition Channel (from Washington Av. to the south to United States of America Av.) on the eastern side (the area designated for the tram route and additional infrastructure) and western side with an existing pedestrian-bicycle route. In addition, the study includes a green area located between Zwycięzców St. and the Exhibition Channel, constituting the entrance zone to the Family Allotment Gardens [*in polish*: Rodzinne Ogrody Działkowe – ROD] grounds and access to the tram stop. It should be noted that the scope of the study covers a broader spatial context than the area of the investment itself (a tram route construction). The implementation of the final solutions will be carried out in stages by TW Ltd. and the Board of Greeners of the Capital City of Warsaw in cooperation with the Municipal Roads Authority and the Praga Południe District Office of the Capital City of Warsaw (Fig. 3).

As part of the basic analyses, Warsaw Trams, Llc. expert teams have made various studies that form the basis for further study work, including multi-criteria analyses of the tram route to Osiedle Gocław, analysis of current land use and functions, inventory of greenery and assessment of vegetation (potential and real vegetation communities, existing vegetation), report on the environmental impact of the undertaking, public

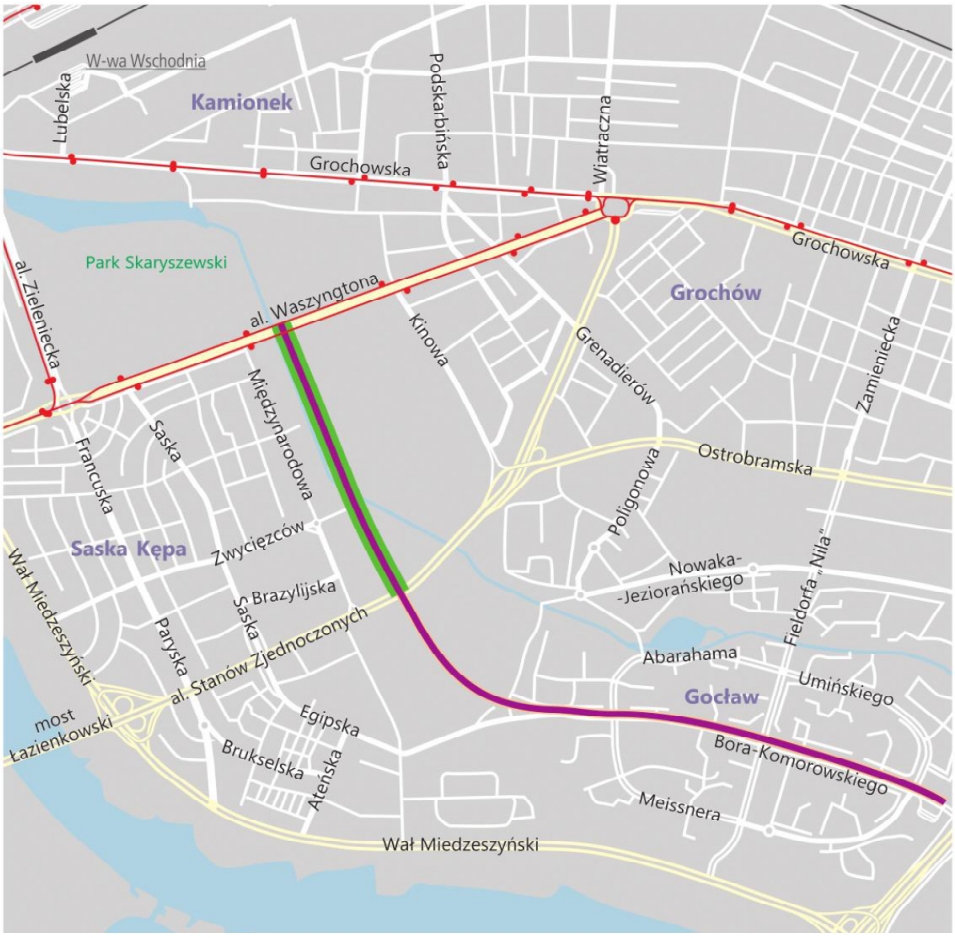

Fig. 2 Location of the section covered by social consultations—green (own elaboration).

Fig. 3 Diagram of investment implementation stages (own elaboration).

consultation on the tram route linking Gocław and Saska Kępa with Śródmieście [14], planning studies—designs of local spatial development plans: allotment gardens in the area of Kinowa St. and the area of Gocław in the area of lake Gocław.

Further work included the stage of studies and development of the concept of land development including the planned tram route along the Exhibition Channel (section between Washington Av. and United States of America Av.) in Warsaw (cooperation with Landscape Architecture Department, Warsaw University of Life Sciences—SGGW). The task was carried out in consultation with the entities—the city and Praga Południe district authorities (Praga Południe District Office of the Capital City of Warsaw) and related municipal institutions (the Municipal Transport Authority in Warsaw, the Municipal Roads Management in Warsaw, the Greenery of the Capital City of Warsaw; Architecture and Spatial Planning Office of the Capital City of Warsaw, Municipal Spatial Planning and Development Strategy Office).

The substantive scope of the work performed by the team of the Department of Landscape Architecture at WULS-SGGW provided for three basic stages:

Stage I: development of three initial variant program and spatial concepts of land development;

Stage II: open social consultations (in accordance with the gender mainstreaming principle) [15] [2] completed with the preparation of the written report;

Stage III: development of the final program and spatial concept of land development along with guidelines for construction and executive projects.

3. Results

3.1 Characteristics of the Investment Area

3.1.1 Transformations of Land Development Forms

Over the years, the study area has been subject to successive physiognomic fluctuation. The history of this place is connected with the commencement of construction of flood embankments along the Vistula river bed at the end of the 19th century, and then drying of the flooded areas cut off in this way. Some of them, after being incorporated into the administrative borders of Warsaw after 1916, were intended for the development of urban residential buildings. The drainage of land was carried out, inter alia, construction of drainage channels and regulation of existing natural watercourses. Such a natural watercourse regulated after the embankments protecting Saska Kępa was the Exhibition Channel. Conducting drainage works enabled, among others, protection and layout of the Skaryszewski Park grounds. The main fragment of the Exhibition Channel (currently flowing along the international estate) was created in the 1930s as the main composition axis of Saska Kępa. Until 1939, areas on the western side of the Canal were built; the eastern part was covered by pastures and meadows—it was the area designated for the planned extension of the district (Figs. 4 and 5).

The transformation of Saska Kępa into an elegant residential district, in connection with Skaryszewski's representative Park, was one of the prestigious

Fig. 4 In the interwar period, the shore area of the Channel, as well as extensive neighboring areas was devoid of high vegetation (tree stands).
(source: Historical maps of Warsaw [17]).

Fig. 5 The study area in 1945—no high vegetation.
(source: Historical maps of Warsaw [17]).

planning activities that brought back Warsaw's splendor at that time. The name "Exhibition Channel" derives from the concept of the device on this side of the Vistula land designated for national and international exhibitions (1930s). It was to include the area of today's National Stadium and a strip along the previously regulated Channel (Fig. 6) [16].

After the Second World War, the areas on the eastern side of the Channel were transferred to the Central Union of Workers' Gardens. At the end of the 1960s, on the west side, Międzynarodowa housing estate (multi-family ten-story residential buildings) was established. The potential estate aquatic boulevard fulfilled a communication function (exit from buildings) as well as service and economic functions

2 Compliant with Resolution No. LXI/1691/2013 of the City Council of Warsaw of 11 July 2013 on the principles and procedure for conducting public consultations with residents of the Capital City of Warsaw [15].

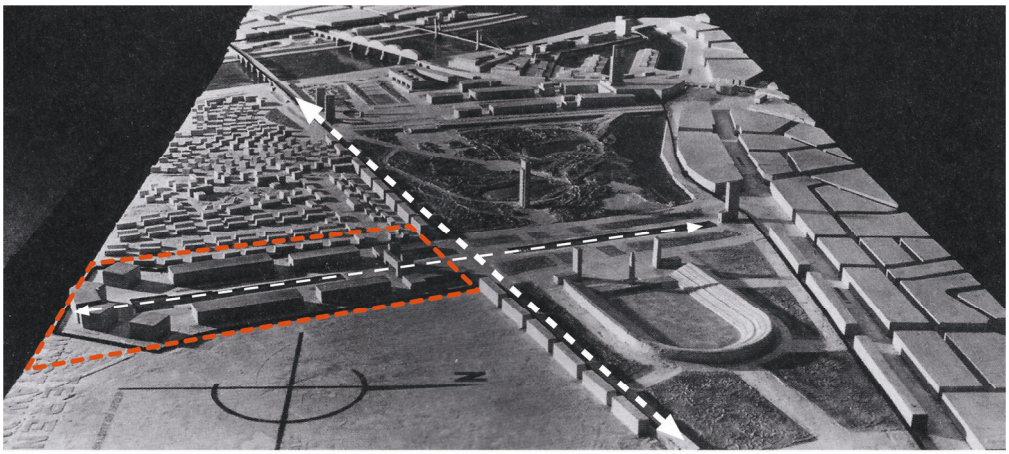

Fig. 6 Mapping of Saska Kępa development and the areas of the future international exhibition planned for 1944 in Warsaw.

The main compositional axis, running from the bridge crossing on the Vistula, is Waszyngtona Av. Perpendicular to it along the eastern border of Skaryszewski Park is the axis of the Exhibition Channel. An arbitrary location of the fragment of the study area is marked with a red envelope on the model [18].

(building service was done, among others, by the Municipal Department of Sanitation). A recreational function was considered to be subordinate (benches were situated back to the water). In recent years, a cycling communication belt has been separated from the pedestrian route, thus effectively separating the walking area from a direct contact with water.

The concept of development of areas adjacent to the tram route near the Exhibition Channel is designed to restore the right proportions in their use—considering functional aspects (optimal communication, various recreation), natural aspects (preserving valuable vegetation, enriching resources) and landscape aspects ("recovering" water as the main element of space) in accordance with the sustainable development of the city.

3.1.2 Current Forms of Use/Neighborhood

The planned investment (on the section from Washington Av. to United States of America Av.) will run in the western part of the family allotment gardens (pl. ROD) parallel to the Exhibition Channel. It is a natural area; it is aquatic and partially wooded. In the light of a spontaneous, primeval path running along the crown of the Channel and the ROD fence, there are few scenic openings. The area is used for recreational purposes (walks) to a limited extent. Potentially, this is an area with high landscape values with the possibility of developing various forms of recreation (vicinity of a watercourse, plant surroundings). On the eastern side, the neighboring extensive area is occupied by family allotments. On the western side of the Channel, "Międzynarodowa" housing estate (multi-family and residential-service buildings) is located, accompanied by estate greenery and a communication network (roads, bicycles, pedestrians, parking lots). The current terrain features are:

- natural function—a zone of diversified vegetation, including common vegetation and forms of high vegetation, located partly in allotment gardens (usable and decorative vegetation). Within the analyzed area, vegetation cover can be considered as common in most cases[3].
- recreational function—the area covered by the study is a generally accessible area; currently used by pedestrians (people walking, gardeners) and cyclists. Along the Channel's crown from the eastern side (parallel to the fence of allotment gardens) there is a dirt path that does not have any additional equipment

3 Data on the basis of Planning Studium (*pl.* S.U.iK.Z.P.)—"Report on the environmental impact of the project consisting in the construction of a tram route to Gocław on the section: Waszyngtona Av.-Gocław loop".

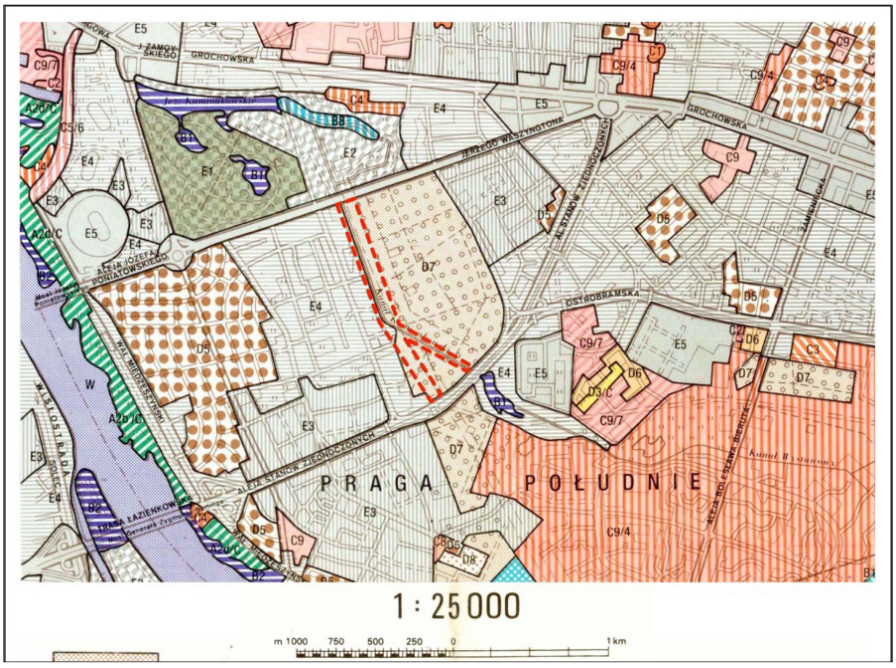

Fig. 7 Real vegetation of Warsaw—map on a scale of 1: 25,000.
Fragment near the Exhibition Channel (D7)—a complex of poorly developed segetal and ruderal communities in the areas of allotment gardens [20].

(including protection from the Channel's side); the path determines a series of observation sequences on the Channel and tree stands of the other bank, partially obscuring the elevations of the high buildings of Międzynardowa housing estate.

3.1.3 Natural Conditions—Existing Vegetation

According to Chojnacki [19], in the area of the study, the potential vegetation is the vegetation of the anthropogenically transformed habitats, i.e. the community of deciduous forests with clones and robinia, similar to rich oak-hornbeam with elements from the *Carpinion* and *Robinietea* class. The actual vegetation occurring here can generally be characterized [20] as a complex of poorly educated segetal and ruderal communities (dominated by *Galinsogo-Setarietum*) in the allotment gardens area (Fig. 7). There are no Natura 2000 habitats on the site that meet the criteria of the Annex of *The Habitat Directive*. There were also no rare and protected species of vascular plants, fungi and lichen fungi (lichens) [9].

The existing vegetation is primarily represented by woody vegetation, forming in the study area the so-called greenery made by the vegetation associated with allotment gardens and partly by the greenery accompanying housing estates, including vegetation composed on both banks of the Exhibition Channel (mainly on the western side). In the allotment gardens tree vegetation is represented mainly by fruit trees and bushes (apple, pear, plum, cherries, walnuts and hazelnuts) as well as ornamental trees (e.g. common spruces, prickly spruce, spindles, yew trees, junipers, maples, birches, sporadically valuable species, e.g. Magnolia) ranging in age from a few to several years. Along the Exhibition Channel (mainly on the side of the housing estate) there are planted plantings composed of decorative plants, including poplars (Italian poplar, Canadian poplar), willows (crying willow, white willow), clones (common clone, sycamore clone), lime, rowan, ash and hawthorn. There are no natural monuments in the study area. Generally, trees are in good or average health condition (except for willows) and will be allocated to be maintained as part of the design concept (after carrying out a detailed expertise on their condition in terms of safety).

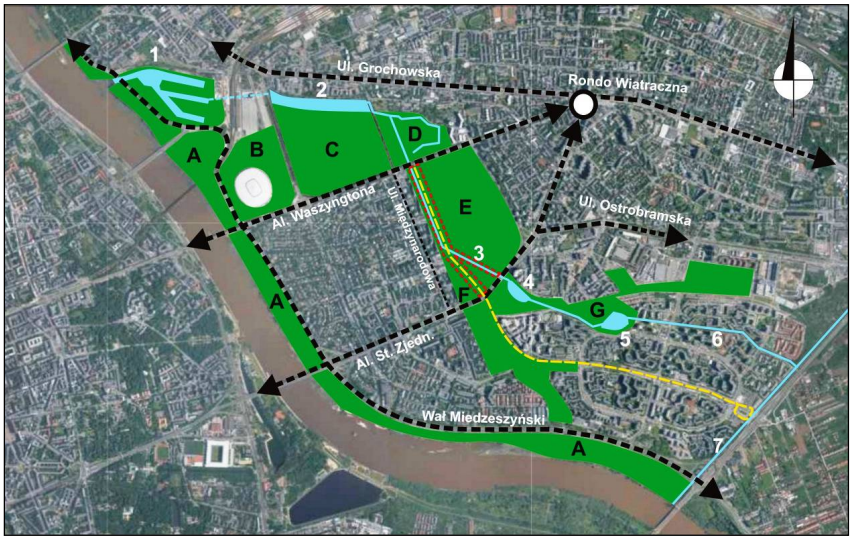

Fig. 8 Natural and communication links in the study area [24].

Legend and explanation:

- Area of the study
- Designed tram route
- Main communication routes of the district
- Watercourses and water reservoirs
- Biologically active areas (parks, allotments, open areas, etc.)

1	Praski Port and Kamionkowski Channel	A	Vistula coastal vegetation
2	Kamionkowskie Lake	B	The grounds of the National Stadium
3	Exhibition Channel	C	Skaryszewski Park
4	Gocławskie Lake	D	Kamionkowskie Błonie Elekcyjne
5	Balaton Lake	E	ROD "Górnik-Energetyk-Nauczyciel"
6	Gocławski Channel	F	ROD "Mandragora"
7	Nowa Ulga Channel	G	Nad Balatonem Park

Among the composed vegetation, the species considered to be expansive is present—the ash-leaf clone (*Acer negundo*). This species of foreign origin (neophyte) in the case of settling in valuable natural areas (e.g. forests) or anthropogenically disturbed habitats (as in the case of the Exhibition Channel and surrounding areas) may threaten their biodiversity in the future [21]. The emergence of this species should be treated as the stage of secondary substitution succession [22]. The gradual expansion of invasive plant species indicates an unfavorable course of plant succession [23]. Therefore, greenery in a given area requires control through permanent care treatments.

3.1.4 Natural Connections

The study area is an integral part of the extensive, coherent nature system located in this part of Warsaw. It consists of areas covered with vegetation[4] having different functions, but connected spatially and joined by a water system—a network of watercourses and water reservoirs connected directly with the Vistula (Fig. 8). The neighborhood of the Vistula, the main ventilation corridor of Warsaw, as well as the continuity and compactness of the so-shaped natural system in this part of the city determine its exceptional value.

4 Including, among others, the historical city park (Park Skaryszewski), the surrounding architectural objects (National Stadium) and engineering (Praski Port), areas of allotment gardens, coastal vegetation of the Vistula, unmanaged greenery.

3.1.5 Anthropopressure

The area of the tram investment is located in a highly urbanized area, which is subject to continuous processes of anthropopression [9]. This is manifested by the transformation of, among others, soil conditions—from the ground surface there are anthropogenic embankments with a thickness of at least several dozen centimeters and can reach up to several meters below the ground level. The natural relief of the area has been changed and transformed as a result of urbanization of the city. Currently, it is not very varied, and the denivelations do not exceed a few meters. According to the classification of the degree of anthropogenic transformation and land use, the landscape of the analyzed area can be classified as a disharmonious cultural landscape [25].

3.2 Variant Concepts of Land Development

In the first stage of works (September-November 2017), due to the occurrence of a number of conflicting expectations and social interests regarding the investment itself as well as its detailed solutions, a team of designers from Landscape Architecture Dep.—SGGW developed 3 variant concepts for the development of the tram route heading to Gocław in the Exhibition Channel area [26]:

V. I. the widest variant—a strip of land with a width of approx. 60.0 m, area approx. 10.2 ha;

V. II. an intermediate option—a strip of land with a width of approx. 42.0 m, area approx. 9.1 ha;

V. III. the narrowest option—a strip of land with a width of approx. 27.0 m, area approx. 8.3 ha.

Variant solutions presented for social discussion differed among others in terms of:

- scope of interference in the areas of allotments, that is, the width of the land strip and the surface of the study;
- location and distance of the tracks in relation to the bank of the Exhibition Channel;
- width of the buffer zone between the track and the allotments area;
- solutions regarding the pedestrian and bicycle communication area, including the possibility of separating the transit road for bicycles and calming them and adapting them to the pedestrian needs of the existing route on the western side of the Exhibition Channel;
- forms of land development adjacent to the tram route and possibilities of introducing new recreational and sports functions;
- a form of development of the entrance zone in the area of Zwycięzców St.

3.3 Application of Participative Methods, Public Consultations

Public consultations had an important role in the process of preparing the investment project consisting in the construction of a tram route to Gocław. Such a form of action is not authorized in the current legal provisions. It should be pointed out that in accordance with the provisions of the *Environment Protection Act* [27][5], which implemented the provisions of the EIA Directive (2011/92/EU) [28][6] into the Polish legal order, public participation in decision-making is ensured at the stage of proceedings for a decision on environmental conditions. It should be mentioned, however, that open access to the files of the proceedings, including the environmental impact report, is only possible in the case of projects for which the environmental impact assessment is mandatory or has been found by the authority conducting the proceedings after analyzing the project information card. In case of such an extended procedure, any interested entity may, in accordance with art. 33 and 34

5 Act of 3 of October 2008 on access to information on the environment and its protection, public participation in environmental protection and environmental impact assessments (consolidated text: Journal of Laws of 2017, item 1405, as amended) [27].

6 Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (unified text) (Journal of Laws of EU, L. of 2012 No. 26, page 1 with later changes) [28].

of the Environment Protection Act, before issuing a decision on environmental conditions, submit comments and conclusions to the collected evidence, while the public administration body, pursuant to art. 37 of the above mentioned act is obliged to consider them and consider the manner of the decision in the justification of the decision on environmental conditions. At the next stages of conducting the investment process, within which there is gradual materialization and specification of the scope of the undertaking (e.g. the location stage), both the provisions of European and national law do not provide for open public participation. Such an action is only possible at the stage preceding the issuance of an administrative decision enabling the execution of construction works, provided there are premises for carrying out the so-called re-assessment of the environmental impact referred to in art. 88 par. 1 and 2 of the Environment Protection Act. It should be pointed out that from the point of view of the state of advancement of preparatory works it is a relatively late stage because the so-called reassessment of the environmental impact takes place within the framework of the procedure in which the construction design is also approved. At the moment, significant design changes are significantly impeded due to the fact that the preparation of this type of project documentation is preceded by a number of agreements and opinions, and the introduction of changes is often associated with the necessity of re-performing these procedures which, in turn, postpones the commencement of construction works.

Bearing in mind, the above considerations, Warsaw Trams, Llc. as the entity responsible for the preparation of the project under study went beyond the general framework established by law and public participation in making decisions regarding investments, including linear public-purpose investments. In addition, the analysis of the local community activities at the pre-design stage conducted by the Office of Roads and Communication of the Municipal Office of the Capital City of Warsaw indicated that regardless of the location variant, there was a high probability of social conflicts, especially in the area of Saska Kępa. Preparatory work, conducted at the same time, included the component of environmental impact and indicated that the best solution in terms of technical, economic, transport and environmental considerations (including impact on monuments) was the W2 option. However, in order to carry out the whole work in a transparent manner, with the participation of the social factor, the start of work on the social diagnosis coincided with the start of the multi-criteria analyses preparation. In the first phase, the propositions of solutions for the course of the new route were identified, including those formulated by, for example, opponents of the W2 variant. Some of the proposed solutions, e.g. the W5 option, indicated a high collision with, for example, the Natura 2000 area already in the initial analyses. Nonetheless, in order to meet social expectations, they were subjected to the same assessment as the solutions studied since 2008. Having preliminary results of transport forecasts and implementation conditions related to particular variants, the next stage of diagnostic work started based on direct meetings with stakeholders, including groups clearly declaring their opposition to any other solutions than those indicated by them. The aim of those activities was to identify the conditions related to the planned social consultations regarding the choice of tram route. So far, the experience gained in the participating processes during the line-investment preparation has indicated that the most active in the course of the planned process are people and entities opposed to the solution preferred by the investor. It should be emphasized that the conclusions formulated after the social diagnosis concerned not only the investment itself, but also issues that are not the responsibility and supervision of the investor (Warsaw Trams, Llc.), for example, protection of the allotment gardens area, or information policy of the Capital City Warsaw. Taking into account some stakeholders' emotional attitude to the prepared investment, open

consultation points were adopted as a formula for conducting meetings in the course of public consultations. This formula assumes presence of a wide team of specialists with moderators who are at the disposal of those interested at certain hours (day off from work or/and weekday, afternoon). The activity aimed at focusing on individual conversations with meetings' participants and referring to their expectations and fears as well as avoiding the probability of a rally or conflict situations by not creating space for public speaking. It should be pointed out that the evaluation studies carried out in the course of social consultations preceding the selection of the course of the route presented very high marks as to the formula used, the substantive preparation and the general atmosphere of the meetings.

After the phase regarding the variant selection, which was crowned with the decision on environmental conditions, the next conceptual stage began. The analysis of the conclusions from the consultative activities conducted in the period October-November 2016 indicated that the section requiring special treatment was a part of the planned tram route in the area of the Exhibition Channel. In the opinion of stakeholders and participants of the consultation, the implementation of the planned investment would result in a significant negative impact on the unique, in their opinion, fauna and flora of the allotment gardens. It should be emphasized that the assessment was of an emotional and subjective nature—the presented research and analysis results did not constitute an argument for the opponents of the undertaking. In other words, in such situations, even the most professional team, equipped with the best knowledge, is doomed to fail to convince skeptical people.

Bearing in mind the above considerations and the undoubtedly difficult situation in terms of social perception, proposing investments and binding them with independent matters (e.g. building development of green areas, reprivatization processes) a decision was also made to carry out public consultations in the conceptual phase regarding the forms and manner of land development adjacent to the tram route near the Exhibition Channel. Focusing on the most controversial section and interest was a deliberate action. On the one hand, the area was to be subject to the largest transformations in the course of the tram route. On the other hand, there was a need to "involve" residents including stakeholders opposing investments in the discussion about the tram route shape and problems to be solved in the conceptual phase, such as location of the track in relation to the watercourse, which implies the extent of the liquidation of some family areas of allotment gardens, but also affects the possibilities of better acoustic and visual protection of residential buildings of Międzynarodowa housing estate.

Based on the above actions, conclusions can be drawn as to the purposefulness of using participative methods in design. Undoubtedly, it is a kind of novelty in the practice of preparatory work and in the work of designers, architects and project managers. Although conducting social consultations influences the prolongation of the investment process due to essential tasks (including preparation of materials, involvement of forces and resources in the process, as well as analyzing applications and their implementation), it is necessary to assess such activities as legitimate and often vital. Regardless of the characteristics of a given venture and its social evaluation, a direct approach to interested entities brings a number of benefits, including:

- opportunity to learn about the socio-cultural context of the space planned for transformation;
- chance to confront the proposed solutions with end users' expectations at an early stage of project work;
- occasion to build relationships with process participants and gradually gain their trust;
- way to conduct educational activities—the majority of participants in the consultation processes

are people who are not specialists in designing. Allowing for views' exchange of views and gathering opinions and comments constitute a way of organic education of local communities [14, 29, 30].

During public consultations on the development of areas adjacent to the tram route near the Exhibition Channel organized by Tramwaje Warszawskie Ltd., the tool enabling participants to assess the implementation of the consultation process was an evaluation questionnaire. The study group consisted primarily of the residents of Saska Kępa and Gocław, as well as users of neighboring allotment gardens. The conclusions and opinions collected in the course of public consultations presented a very wide and, above all, contradictory range of inhabitants' expectations [30].

3.4 Recommendations for the Development of Areas along the Exhibition Channel

As a result of the analysis of natural, legal, technical and social conditions, the target directions for the development of the surroundings of the two-track tram route along the eastern bank of the Exhibition Channel were set within the limits of Washington Av. to United States of America Av. The provisions of the Local Spatial Plan, investor's guidelines, the results of social consultations and an in-depth analysis of the existing development status with particular emphasis on the forest stand management were taken into account. Based on them, the following general project assumptions have been formulated [26]:

- designing a multi-functional public space with a recreational and leisure program for the residents of the housing estates adjacent to the planned tram route;
- preservation of the existing natural and cultural values of the study area;
- creation of attractive spatial, functional and scenic views;
- designing diversified, collision-free space intended for pedestrians, separation of access roads to tram stops and rest areas as well as the entrance zone to the ROD grounds;
- ensuring the availability of space for people with disabilities;
- adaptation of existing vegetation and its enrichment through new planting of trees, shrubs and herbaceous vegetation, taking into account the nature of the site, habitat conditions and aspects of seasonal variability [31];
- increasing the biologically active area, e.g. by introducing the so-called green tracks;
- application of pro-environmental solutions in the field of technology and materials in the planned recreational infrastructure.

4. Examples of Similar Spatial Solutions

In accordance with the principle of sustainable development of the urban environment aimed at minimizing the use of spatial resources of the city, degraded or unused areas should be re-used [32]. Often an attractive location in a dense urban tissue predisposes such areas to be transformed into fully-fledged, attractive recreation areas, parks, green areas, promenades and boulevards. In addition, a common trend in Europe and the world is to integrate the planned linear parks or boulevards with the tram lines and other means of transport that support them.

Recently the most interesting solutions include revitalization activities of the riverside Abandoibarra area in Bilbao run by Bilbao Ria 2000. As part of a large-scale program, degraded and abandoned areas along the Nervión riverbank have been revitalized. A part of the project was the implementation of the linear park de la Ribera and boulevards in the green belt with the introduced two-track tram line with the "green track" along the pedestrian route (Figs. 9 and 10). It is a section of route No. 1 that runs from the east from the center of Old Bilbao, Atxuri, west to the hospital in Basurto, along the waterfront [33]. The line serves the main attractions such as the famous Guggenheim Museum by Frank Gehry with the monumental green sculpture "Puppy" by Jeff Koons and other cultural functions such as the Maritime Museum in the old

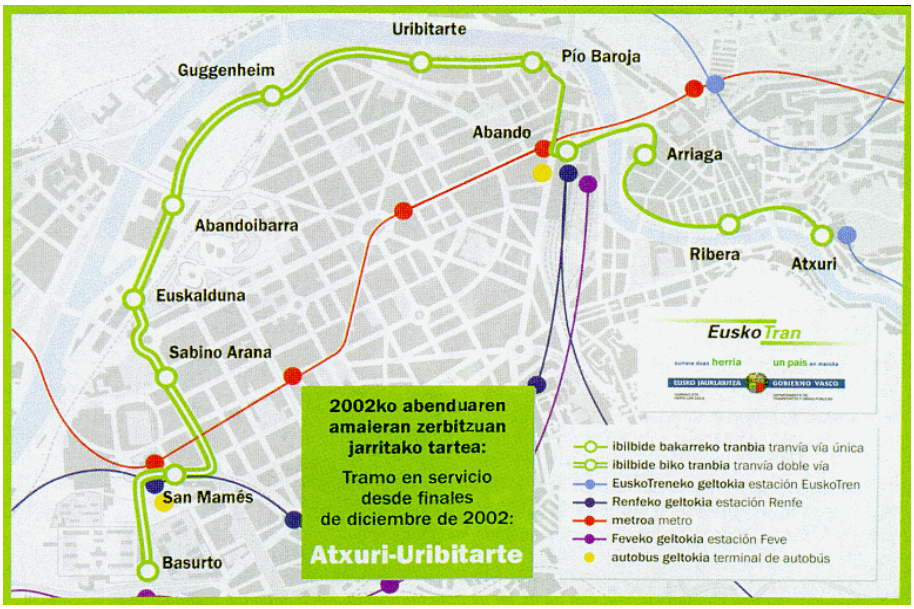

Fig. 9 Tram line 1 route along the Nervion riverbank in Bilbao.
(source: [34]).

Fig. 10 Green track of the new tram line in Bilbao (photo: J. Botwina 2017).

harbor dock on the waterfront, the Palacio Euskalduna Conference Center or the University Library. In addition, along the cycle walk and the tram line integrated with it, numerous leisure areas, terraces, viewpoints, playgrounds and restaurants have been designed. Thanks to the introduction of multifaceted activities, the revitalization of Bilbao presents itself as a model, speaking of the "Bilbao Effect", where it was possible to transform the mining and harbor industrial city into a Basque cultural, art and entertainment center.

5. Conclusions

The assessment of the existing recreational development of the analyzed area and the needs of residents in this area indicate the need for modernization and expansion of recreational infrastructure. The planned course of a two-track rapid tram route along the Exhibition Channel through a part of the area of today's allotment gardens creates an opportunity for the creation of a public, generally accessible linear park space with a varied leisure and recreation program. In addition, the Exhibition Canal could gain a key historic role as the main attractive element of the space of Saska Kępa.

Based on the analyses carried out (including natural, spatial, functional, technical, economic and social considerations), assumptions and guidelines for the implementation of the "friendly tram route" were set in a linear park environment, the nature and use of which

is conditioned by the shape and size of the investment area. The connection of this area with the planned route should be achieved through the use of pro-environmental solutions and technologies (including "green tracks") and shaping the space taking into account the existing natural resources and landscape values. The design solutions of the track and the way of spatial management (including plant composition) should aim at counteracting the negative transformation and degradation of the environment related to the construction of the tram route, including noise reduction, increase of biologically active area and visual integration of the building with the surroundings.

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