Union of land and water

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Abstract. The author emphasizes the exceptional significance of interaction between the development and the water areas of the Neva delta to form the general look of St. Petersburg. He also analyzes the gradual development of methods for the reclamation and transformation of coastal areas. It is noted that the sophistication of the existing landscapes was ensured by the creative contribution of outstanding architects, huge amount of construction works and innumerable investments. The enormous popularity of the Spit of Vasilyevsky Island is also explained by the fact that a convenient observation platform was created here, which reveals ideally the merits of the panorama of the “main area of the Neva”. It is stated that, despite the damage suffered by the Neva delta waterway system in the second half of the 19th century, it retains an exceptional value. The circumstances that impede the full use of unique architectural and artistic resources are shown, and examples of solutions are presented that allow improving the contact of citizens and tourists with the historical landscapes of the center.

1. Background
St. Petersburg is sometimes called the "Venice of the North" and compared with Amsterdam, but no one denies the amazing originality and uniqueness of the landscapes of our city. It is generally recognized that "in the amazing harmony of architecture and water spaces lies the main feature and appeal of the historical center of St. Petersburg" [1]. The city fate was determined by Peter I - he laid a new fortress and placed his residence in that part of the Neva delta, which was the least developed and was distinguished by swampy soils and an abundance of waterways. Photo in figure 1 allows us to imagine, how the Neva looked like about 350 years ago.

At the first some strips of land along the banks of rivers were developed for building construction; the soils there were more dense due to the sand and gravel brought by the flow. These places were also preferable for arrangement of communications: boats and houseboats were more important at that time than waggons and carriages. The houses stood on a flat bank, their plots reached the water's edge, and each of the homeowners had to independently build the berth for the boats and strengthen the coastal strip using wooden piles, hurdles and backfilling with soil (this approach to construction of the water front buildings was used in Venice, where constructions gradually became linked with the water area). This option of the bank is presented in figure 2 — an extract of the plan of Saint-Hilaire (1765-1773) covered the portion of the Vasilyevsky Island opening onto the Bolshaya Neva between the 19th and 25th lines.
Over time, the development of St. Petersburg required the expansion of residential areas, the development of uncomfortable territories, and drainage amelioration. Hydrotechnical works had become an important part of urban planning in St. Petersburg, predetermining the order of development of areas and even the nature of land use (the areas with the most problematic soils were preferred not to be built, they were allotted for landscaping or for arrangement of squares).

2. Canals
Already in the second decade of the XVIII century, the routing of canals and the sewerage of existing rivers were actively developed in St. Petersburg. Besides the fact that they all contributed to the removal of excess moisture and drainage of the soils, the canals served also for pragmatic purposes.

Canal grouping by function can be represented as follows:
1. the very first paved were those that became part of the fortifications of the Peter and Paul and Admiralty fortresses (1705–1730s),
2. multifunctional canals (Ekaterininsky, Kryukov, Vvedensky, Ligovsky, Obvodny) together with natural water flows (Neva, Moika, Fontanka, Krivusha, Karpovka, Smolenka, etc.) were components of the utility system that ensured the daily functioning of residential areas. It provided water (including fire-fighting) supply and wastewater disposal, the basins were used for washing clothes and bathing,
3. canals, which were part of the process systems and served for the transportation of raw materials, blanks and semi-finished products in the shipbuilding complexes of Particular and Admiralty shipyards (including Masterskoy, Pryadilny, Novoadmiralteysky canals). This group includes the canal and the basin of the Sytny Yard, the largest wholesale warehouse in the XVIII century.
3. Granite Embankments of Canals and Rivers in the Neva Delta

Until the middle of the XVIII century, the coastal band of rivers and canals was strengthened only in places, where the site owner took care of this. Handicraft structures could not resist the pressure of water and ice, collapsed and endangered the nearby buildings. The record remained intact and kept in the Kunstkamera on Vasilyevsky Island witnesses on the dangerous situation: “Since the last 1744 year, to this day, more than two fathoms have been washed ashore, and the water approached the wall of the academic building in such way that the smallest weatherbeat, it is impossible not just to ride a horse past the academy, but to walk on foot near the chambers, and it’s very dangerous because in two years the entire coast to the academy will be washed out causing the entire building to fall down “ [6].

In the second half of the XVIII century, the town-planning activity of St. Petersburg entered a new phase. Since the beginning of the reign of Catherine II, there was a temptation to “bring the city of St. Petersburg into such an order and condition, and to give it the magnificence that a metropolitan city of a decent state has” [7]. A Commission was being created on the masonry construction of St. Petersburg and Moscow, which had developed specific plans for building the city, paying a lot of attention to the water system. Commission decided to fill the all sizzle and no steak canals on Vasilyevsky Island, but the unique potential of the Neva banks and the water system on the Admiralty side was actively attracted to decorate the city. To provide the solution to this large-scale installation, it was necessary to change the organizational and engineering approach to the arrangement of

4. a special group is represented by fire-fighting watercourses, which isolated the city buildings from the warehouses of combustible materials (canals of the Salny and Maslyany spaces, waterways of Tuchkov space)

During the city development, the number of canals changed frequently. The least stable canals turned out to be those, which served for process transportation in industrial and large warehouse complexes. At the end of the XVIII and first half of the XIX century, the canals of the Sytny Yard and the Admiralty Shipyard, which had lost their utilitarian value, were filled up.

In 1816, the fate of the canals of the Admiralty Fortress was discussed. During the discussion on the project of A.D. Zakharov it was assumed that they should be given a representative appearance on the model of the Moika embankments: to clad the coast with granite, to install a cast-iron fence, to throw over the stone bridges. By this time, the author of the project died, artistic and compositional considerations were neglected, economic calculations were decisive, and in 1817–1818 the canals were filled up [4].

An idea about that huge role which was assigned to the water area is presented on figure 3, where the buildings under reconstruction are shown in gray, the proposed by A.D. Zakharov ones with attached decorative porticoes are shown in black and water surfaces are in blue.

In the second half of XIX – early XX century, the number of canals in St. Petersburg is constantly decreasing; the role of pragmatic considerations is growing and the city's aesthetics are not taken into account. Even the Ekaterininsky Canal in the heart of the city was under threat; it was supposed to be filled in due to a horse-drawn railway line building. In those years, transportation problems were not as acute as they are now, and in 1872 the City Council rejected this project [5].
embankments. They switched to a centralized procedure, which used some of the proposals of B. Minich, expressed in 1727 [8]. The vertical coastal wall was erected in the water area, at some distance from the existing water edge, so that private land plots were not affected. The formed space between the buildings and the embankment fence was turned into a city street (a similar model of the formation of city canals was common in Amsterdam in the XVI-XVII centuries). Figure 4 presents the results of the design of the embankment of the Bolshaya Neva on Vasilyevsky Island in the 1830s. Shaded areas of the traffic way, formed after filling cavities between the coastal wall and the existing continental soil.

Taking into account regional climatic features, they began to use massive granite blocks for the face layer of the embankments, which effectively resisted the effects of ice. That distinguished St. Petersburg from Venice and Amsterdam, where red brick embankments are common. Another feature of the St. Petersburg embankments was the attention paid to the aesthetics of the design - a variety of stand lamps appeared here, and cast-iron guarding grids for each of the waterways were cast with an original design.

The construction of granite embankments was one of the largest and most expensive urban planning programs of the second half of the XVIII century. In a short time, not only were the main waterways of the Neva delta framed, but tens of kilometers of coastal roads were laid (Table 1).

|                            | Years of construction | The length of the embankments |
|-----------------------------|-----------------------|------------------------------|
| Neva Embankments (according to Wikipedia) |                       |                              |
| Kutuzova (Frantsuzskaya)    | 1764–1768             | 714.7 m                      |
| Angliyskaya                 | 1770-1788             | 1260 m                       |
| Dvortsovaya                 | 1764–1768, 1772–1773  | 1300 m (1.7 km as per [10])  |
| Universitetskaya            | 1805-1810, 1831-1834  | 1217 m                       |
| Leytenanta Shmidtta         | 1848-1854             | 1367 m                       |
| Embankment of the Spit of the Vasilevsky Island | | 548 m                       |
| Admiralteyskaya            | 1873-1874             | 414 m                        |
| Embankments of rivers and canals – as per [10] | |                              |
| Moyka                      | 1789-1810             | Left bank – 4 km, right bank – 3 km (as per [10]) |
| Zimnyaya ditch             | 1782-1784             | 0.5 km (as per [10])        |
| Yekaterininskiy canal      | 1779–1790             | 4.6 km (as per [10])        |
| Fontanka                   | 1780-1789             | Left bank – 6.4 km, right bank – 5.7 km (as per [10]) |
| Kryukov canal              | 1801-1807             | 1.9 km (as per [10])        |
The emergence of a clear stone fence at the rivers and canals in the center of St. Petersburg became a catalyst, which accelerated significant changes in the urban landscapes. This is evidenced by the presentation made in 1765 by the Commission about the masonry construction of St. Petersburg and Moscow to Catherine II: the architects recommended to increase the height of the buildings on embankments to 10 fathoms (approximately 21.3 m), so that “the buildings along the Neva corresponded to the currently created river stone bank” [11]. A new approach to the formation of urban development was manifested during the ordering of the territories along the Fontanka River, which in the middle of the XVIII century was the border of St. Petersburg. At that time the riverbed did not have a clear outline, and the building developed spontaneously. This allowed A.V. Kvasov to introduce solutions for which there was no place in the constantly developing centre of the city. According to him work in the water area was supposed to be seamlessly combined with the planned development of the adjacent building. The riverbed was straightened and taken in the strict framework of the embankments. It became the axis along which a number of regular, geometrically defined areas were located, which secured important planning nodes — the places where the river crosses the city's through-passages. These areas along with monumental bridges defined the image of the Fontanka. An idea of the transformation of the urban situation is represented in figure 5.

An integrated approach to the formation of urban development along the basin, demonstrated in the Fontanka development projects, became an example for Leningrad architects of the mid-twentieth century which was solving the problems of the development of the city along the Neva.

![Changing urban situation along the Fontanka in the late XVIII – early XIX centuries.](image)

4. "The main square of St. Petersburg"
"The full-flowing Neva gave the city exceptional spatial scope and spectacular wealth, became the main square and the main avenue of St. Petersburg” [1]. The significance of the Neva for the development of the city has not been questioned since the founding of St. Petersburg. The zone of the water area, where the river reaches a wide width before being divided into Malaya Neva and Bolshaya Neva became the basis for the formation of the “main square” of St. Petersburg. The Peter and Paul
Fortress was laid on the north bank, the Admiralty was laid on the south bank, the main administrative building of the Russian Empire, the building of the Twelve Collegiums, was erected on Vasilyevsky Island in the center. In order to draw its 400-meter foreside to the Neva space, they made many sacrifices and overcame serious difficulties. The boggy ground at the Spit were reinforced with earth and stones. It was necessary to drive more than 2,000 piles under the foundations of the building and for the drainage system along the main foreside to dig a canal [13]. In the late 1730s, Vasilyevsky Island became a depressive part of the city, and construction activity on the Spit was stopped.

In the second half, the southern bank of the “main water area” of the city took development: a granite embankment appeared along the water's edge, and in the place of the Petrine 2-3-storied buildings, the representative palaces of aristocracy were erected. The complex of the imperial residence was predominant: the block of joint facades of the Winter Palace, the Hermitage, the Old Hermitage and the Hermitage Theater exceeded 200 meters in length. Next was the Admiralty (along the main foreside it was about 400 meters) with a 70-meter vertical spire. In the 1779-1785s, they gave a festive view to the Peter and Paul Fortress: from the side of the Neva its monumental walls, stretching more than half a kilometer, were claded with stone. "The main square of St. Petersburg" began to resemble huge propylaea, which directed the course of the river and the eyes of citizens towards the Spit, and it remained the only gap in this magnificent panorama. At the turn of the XVIII to XIX centuries there remained “a large irregular, still unpaved, partly marshy area surrounded by the buildings of the Academy of Sciences, State Collegiums, the Exchange House and the Customs Barns” [14].

The shores of Vasilyevsky Island, which had been considered a suburb for several decades, were reinforced only in certain places with wooden slopes.

Catherine II decided to appropriately arrange an uncomfortable site in the eastern part of Vasilyevsky Island, which lies opposite the windows of the Winter Palace, and invited the famous architect D. Quarenghi to erect a representative Exchange building on the Spit. When the contours of new buildings began to appear, it became clear that the solution to the issue was not found. The construction was stopped. The new emperor Alexander I decided to reconstruct the unfinished building and entrusted J.-F. Tom de Thomon to complete the work. It was a very small object — the central premises of the Exchange had a 900 sq.m operating room, but the project quickly grew into a town-planning event of strategic level. Compositional town-planning tasks became decisive, and applied considerations faded into the background. Enormous forces and funds were invested to achieve the artistic and town-planning effect. In addition to Tom de Thomon, prominent architects such as A.D. Zakharov, D. Quarenghi, I.F. Lukin and, according to some assumptions, K.I. Rossi became the authors of the Spit ensemble. A huge amount of construction work was carried out not only on land, but also in the water area. A semicircle of area with a diameter of more than 150 meters with two sculptures of two Rostral columns 32 meters in height unfolded above the surface of the water. Under each of them, there is a grillage, recessed into five meters (a block of rubble stone with dimensions of 18 x 21 m in plan) and a field of six meters long piles [15].

Figure 6. Panoramas of St. Petersburg, opening from the Exchange House stylobate. (Ostroumova-Lebedeva, A.P. 1908).
The work on the complex was still ongoing, and there were already many curious citizens at the Spit. The Stock Exchange House Stylotope has become an excellent observation platform, from where one could enjoy the panoramas of the city arising. In 1814, K.N. Batishkov drew attention not only to the rising architectural structures, but also to their interaction with the Neva landscape: “Look at Vasilyevsky Island, forming a triangle, decorated with an Exchange House, Rostral Columns and a granite embankment, with beautiful descents and stairs to the water. How majestic and beautiful is this part of the city!.. Now, from the exchange, with what pleasure my gaze follows along the coast and is lost in the foggy distance between two embankments, the only ones in the world!” [16]. Thousands of tourists and landscape painters appreciated the uniqueness of the observation platform created at the Spit (figure 6).

In the early 1830s, the arrangement of the Spit complex was completed. The square conceived by Peter I and D. Trezzini, which should have a close connection with water, was implemented in the forms of the Empire style architecture (figure 7). The city acquired a wonderful architectural ensemble, and the framing of the “main square of the Neva”, the key element crowning the composition. In the first third of the XIX century, in the center of St. Petersburg, “a single continuous open space formed by water areas, squares, avenues, streets, and squares” took shape [17]. The unique system of landscapes of the historical center, which is distinguished by the inseparable compositional links of water areas and perfect works of architecture, which today defines the image of the “Northern Capital” of Russia (figure 8), was completed.

**Figure 7.** The view of the water area during the development of the Spit. A - sketch by D. Trezzini (1730s), B - development scheme (1830s). The buildings at the beginning of the XVIII century are highlighted in gray, the buildings in the first third of the XIX century are shown in red, and the shading shows the piled area.

**Figure 8.** “The main square of the Neva” at the beginning of the XIX century. Fragment of a map of St. Petersburg of the 1820s.

In the course of the subsequent 200-year development, the appearance of the “main square of the Neva” has undergone both positive and negative transformations (Table 2), but has retained its attractiveness both for citizens and for many tourists.
5. People On shore
Now the basins of the historical part of St. Petersburg, along with unique museums and architectural monuments, attract an increasing number of tourists: in 2010, 2.3 million foreign and 2.8 million Russian tourists visited St. Petersburg, and in 2017 — 7.5 million people [18,19].

| Years of construction | Name                                      | Architects, engineers                      | Impact nature                                      |
|-----------------------|-------------------------------------------|--------------------------------------------|---------------------------------------------------|
| 1899-1901             | Imperial Obstetrics Institute (“Ott Clinic”) | Benoit L.N.                                | Collegiate Square was dismantled                  |
| 1897-1900             | Own garden on the site of the Razvodnaya square near the Winter Palace | Katzer R. F, R.F. Meltser                   | The visual connection between Dvortsovoya Square and the Neva was eliminated. |
| 2000                  | High-rise building "Mont Blanc"           | Kislova S.V., Gaikovich S.V., Oreshkin S.I. | Historical landscape was distorted                |
| 1926                  | Redevelopment of the Exchange House Square | Ilyin L.A.                                 | Identiﬁed the conﬁguration of the Exchange House Square |
| 1911-1916             | Dvortsovy bridge                          |                                            |                                                    |
| 1894                  | Birzhevoy bridge                          | eng. Mazurov N. M., arch. Noskov L.A., Areshev P.A., eng. Demchenko V.V., Levin B.B. | The framing of the "main square of the Neva” was completed |
| 1957-1960             | Builders’ bridge                          |                                            |                                                    |
| 1947-1948             | Kunstkamera tower was completed           | R. I. Kaplan-Ingel                         | The historic landscape silhouette of the Spit was restored |
| 1960                  | The chimney of the Ott Clinic was cut      |                                            |                                                    |

The number of city residents who want to walk along the picturesque embankments is peaking not only on the days of mass holidays, but also on weekdays. However, the current situation does not allow proper use of the rich resources of the river landscapes. Cars become a barrier between man and water.

The present-day transport scheme of St. Petersburg is based on the use of embankments as an integral part of the main transit highways. Here cars move in several rows and at high speed. There are quite a few number of controlled crossings, and the pedestrian is cut off from the water [20]. Pedestrians can cross the traffic and approach the water edge only in a few points. The increased automobilization of the embankments of St. Petersburg makes it difficult or impossible for them to function as lively public spaces [21]. The degree of filling the streets with motor transport reached its peak: in 2016, the city’s fleet consisted of 1,665,300 cars (per 1,000 inhabitants — saturation is greater than Moscow’s) [22]. The perception of unique panoramas of the center is complicated; the possibility of including embankments in tourist walking routes is limited or excluded. Simultaneously with the
growth in the number of cars, the number of tourists and citizens is increasing. The situation is escalating.

Without waiting for the strategic conflict to be resolved at the system level, the traffic flow on the embankments will freeze, disappear or at least reduce speed, experts suggest improving the situation at the most critical points and facilitating people's access to the coastline. There was a proposal to arrange a transport tunnel on the Spit [23], but it is not clear how to get rid of the busy traffic in this area during the work. The laying of a pedestrian path near the watermark along the capital embankment on the Petrograd side [24] will not cause such pressing questions. High attractiveness of the proposed route (figure 9) will be ensured by good insolation by the midday sun and, especially, the views of the Spit and the entire “main square of the Neva”, which opens from here.

![Figure 9. The proposed pedestrian trail along the water's edge on the Petrograd side [24].](image)

Unfortunately, when developing the concept of building the “European Embankment”, this potential of the place was ignored, which also affected the results of the competitions held. The design task is dominated by utilitarian, pragmatic installations. The embankment profile is designed with consideration of the passage of fire trucks, and not based on contact with the broad spill of the Neva. Houses should almost adjoin the water's edge, and there is no space for a boardwalk with a unique panoramic view of the historic center.

6. Conclusions and Thoughts
The reason for reflection is the dynamics of changes in the situation with the number of watercourses in St. Petersburg: its territory is expanding, the population is growing, and the number of islands (hence, rivers and canals) is decreasing. In figure 10, blue shows the growth in the number of inhabitants of the city, and red shows the change in the number of islands (it must be borne in mind that the greatest number of canals and other waterways occurred at the beginning of the 19th century).

![Figure 10. Dynamics of population growth in St. Petersburg [25] and change in the number of islands in the city [10].](image)

The presented statistics should be of interest to the city authorities and city planners of St. Petersburg. First, the facts show that the inheritance left to us remains unvalued: the works of the landscape architecture, the uniqueness of the Neva water area, the talents of several generations of remarkable architects and the hard work of thousands of builders. We must not forget about the huge
financial costs. The unique observation resources remain cut off from the citizens by an intensive traffic flow along the embankments. The value of these resources belonging to the city was ignored when they gave permission for the construction of the high-rise "Mont Blanc" and a unique view of the city from the upper floors passed into private hands. Hope remains that when finalizing the European Embankment project this potential will be partially disclosed.

The geographical location of St. Petersburg and the nature of the soil contribute to the development of the water system of the city, but this area of urban planning is not given due attention. The new areas of the city do not differ from the average settlement in terms of watering. The experience of the mid-twentieth century was forgotten, when it was planned to lay the Southern Obvodny Canal. The concept was not implemented, but the proposed well thought out trace was fixed in the major highways of this part of the city. Unfortunately, the modern direction of urban development can be compared with the situation in St. Petersburg since the second half of the XIX century, when artistic and compositional installations were hardly taken into account, and the considerations of profitable housing construction were decisive. During this period, urban planning of the city refuses to use the European experience — both at the strategic level and in the development of coastal development methods (figure 11).

Nowadays, when the territory of St. Petersburg is expanding along the Neva River and has already covered the shores of the eastern part of the Gulf of Finland, the issue of interaction between the water area and the building becomes relevant again. There are so few places in the city where the citizens have direct contact with the waterline. I would like to hope that the future actions of the administration and city planners will increase the efficiency of using the resources of the central part and will strengthen the role of water in new quarters.

![Figure 11. Coastal pedestrian zone-galleries in the European practice of the second half of the XIX – early XX century: 1 – Alster-Arcade in Hamburg (1942, arch. A. de Chateauneuf), 2 – city hall and an onshore lawn in Stockholm (1911–1923, arch. R.Osterberg).](image-url)

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