Legal Conditions and Theoretical Basis for the Arrangement of Water-Based Areas in Polish Cities

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Abstract. A series of diversified factors affect the arrangement of water-based areas in Poland. One of the most important elements are planning documents, such as the Act on Planning and Spatial Development, Water Law, or the Environmental Protection Law. These and other documents regulate the mutual relations between natural and cultural conditions as well as urbanized areas. At the same time, they affect the ability to conduct new investments in water areas – including those requiring the revitalization of post-industrial areas. The intense development in the last thirty years has meant that currently industrial facilities are in the city centre area. Authorities of many cities are trying to solve this problem, but it requires the application of not only interdisciplinary solutions, but also the establishment of large economic resources, without which it is impossible to restore the use of these areas. The adequate protection of the city against the effects of floods is an important issue related to the development of the water areas in the city. In this respect, there is a tendency to use expensive and ineffective methods of securing investment zones. The possibilities of water retention in flood control reservoirs are nearly five times smaller in Poland than in most other European countries. The scarce examples of polders show that this is one of the most effective methods of preventing damage caused by floods in urban areas. Such reservoirs are simultaneously valuable natural areas. In many intensively developing cities around the world, the generally accepted action is to strive to use the quays to create the signatures of cities. These places are designed to become an interesting space that people want to visit and which they want to use. Important city functions are located there, which are easily accessible due to public transport. However, it should be noted that in these spaces, their users have close contact with water. The current legal status and general public awareness (sometimes also of the city authorities) make it seem necessary to pay more attention to the comprehensive approach to the revitalization of vast water-based areas. It is important to integrate neighbouring functions and the way and quality of the arrangement of the whole area, and not just its fragment. The changes taking place in legal documents make the administrative path related to the transformation of water-based areas excessively complicated. However, it would be beneficial to specify the provisions of local spatial development plans and the general increase in coverage of plans of urban areas. The use of foreign standards seems to be valuable, where the revitalization of even vast areas is carried out in accordance with the precise assumptions. Such activities allow for creating interdisciplinary solutions, integrating numerous elements, which often leads to obtaining the synergy.
1. Introduction
In Poland, one of the most important factors affecting the way the areas are located in the vicinity of watercourses, are the planning documents based on the Act on Spatial Planning and Development [1] and legal acts regarding nature conservation. These issues are implemented primarily through the Environmental Protection Law Act [2]. Significant regulations in this area result additionally from the Water Law [3+4] and the Water Framework Directive [5].

2. The legal norms applicable in Poland and the conditions of the aquatic areas
The basic documents regulating the management of water resources in Poland are the Water Law (hereinafter referred to as the WL)\(^1\) and the Water Framework Directive (hereinafter referred to as the WFD). One of the main goals included in them is the improvement of water quality. At the same time, the importance of issues such as the matter of flood protection and alleviation of its effects is emphasized. These aspirations should be carried out using solutions consistent with the principles of sustainable development [6]. These provisions to a large extent translate into the spatial development plans of voivodeships \([7+8]\)^2. It happens that due to different priorities, the objectives of the voivodeship described are included in more detail in the plan of the neighbouring voivodeship. The Spatial Development Plan of the Lesser Poland Voivodeship (hereinafter referred to as SDPLPV) includes numerous provisions on the actions that should be taken to establish a correlation with the Spatial Development Plan of the Silesian Voivodeship (SDPSV) \([8]\). The specification of many records that determine the location for individual investments begins in the spatial development plans.

The WFD provisions of the Polish law were to be implemented by means of the Water Law Act \([9]\)^3. After the amendment in 2017 of PW, the WFD provisions were included into PW. The new document has been expanded by a number of provisions. However, the leading idea is the fact that “water management is carried out in accordance with the public interest, preventing (...) the deterioration of ecological functions of waters and deterioration of the condition of land ecosystems dependent on water ” \([4]\).

\(^1\)In previous years, the resolution of July 18, 2001 was in force along with subsequent amendments, which significantly influenced the current way of developing the aquatic areas in cities located in Poland. The Act was thoroughly modified in 2017 – the current document is from July 20, 2017.

\(^2\)In the Spatial Development Plan of the Silesian Voivodeship (hereinafter referred to as SDPSV) there is a provision: “(...) about the basis for the development of the voivodeship and ecological safety of its inhabitants there is now the issue of relation between the city and open areas. (...)” (SDPSV - chapter II, pt. 3.3, p. 76), and about the complicated spatial and ecological situation of the voivodeship (SDPSV from 2004, as amended, chapter II, § 3, par. 3, p. 76).). The plan provides for supporting and promoting the so-called “innovative instruments for space management” (It should be kept in mind the SDPSV was passed in 2004 and for that time these activities could be considered as innovative methods in our country. In 2010, an amendment to SDPSV was passed, however, new records focus on the development of the International Airport “Katowice” in Pyrzowice), among others by setting the main directions of activities in these areas. They also cover the issues of “restructuring and revalorization of cities ” (SDPSV – chapter II, § 3, par. 5 pt. 2, point 1). The plan also assumed the effect of highlighting the identity of the region and creating a new image – including “shaping external and internal ecological connections and (...) revitalization and assigning new functions to post-industrial and degraded areas” (SDPSV – chapter I, § 5, par. 3, pt.1, p. 57). Thanks to these and other provisions in the SDPSV, further efforts are being directed that should be included in the lower level documents. Difficulties in the transformation of degraded and post-industrial areas are also emphasized due to the “lack of system solutions aimed at a comprehensive process of transforming them, or even lack of reliable inventory” (SDPSV – chapter I, § 5, par. 3, pt.1, p. 58).

\(^3\)This document contains information that the PNWMB is the superior body in making decisions related to the aquatic areas. For this reason, city authorities do not have full decision-making in the development of these areas. What is more, except for a few cases, which include standing water and water in ditches falling within the real estate boundaries (Water Law Act – art. 12, par. 1), waters and lands covered with them are owned by the Treasury or are at the disposal of the foremen, who are ordered with the tasks of government administration in this area (Water Law Act – resolution of July 18, 2001 – art. 14 and art. 14a).
Determining the responsibility for supervision over investments carried out in riverside areas, water resources management and areas located in their surroundings, was allocated to the President of the National Water Management Board (hereinafter referred to as PNWMB). This leads to a situation in which custody of projects implemented in these places is not exercised by an architect or urban planner. In addition, PNWMB is obliged to watch over all actions taken in the areas adjacent to the river. This results from the findings and powers granted by the Water Framework Directive [5].

Conflict between the interests of the city and the provisions existing in the PW Act is also present in most of the changes taking place in the areas of riverbeds. The 2001 regulations imposed the need to maintain good water status as well as existing biocenoses and the current terrain [3]. It is these elements that often undergo the greatest changes during the transformation of the riverbed in urbanized spaces. At the same time, when using vertical fortifications, it seems impossible to preserve existing biocenoses in the original state. The amended act also includes “retaining walls, boulevards, wharfs, jetties, bridges and piers” among the water devices [4]. The Water Law also regulates the way of participating in economic outlays allocated for flood protection. Art. 237.1 shows that the plant, which received a permit for water regulation, incurs costs related to its implementation, as well as “withdrawal of the water and legal permit held by another plant [4], if it is necessary to perform water regulation” [4]. These actions apply at the same time to the performance of flood control polders, due to the low popularity of such investments, it seems that it is probably more cost-effective to perform vertical flood protection in the form of embankments and walls compared to conducting earthworks with the construction of the accompanying hydrotechnical devices that would protect the city from the effects of floods.

However, the Water Law allows locating buildings in particularly endangered areas. In relation to this situation, the provisions of the aforementioned art. 166.1, and more precisely art. 2, 5 and 8 apply. The applicant has the right to request a reconciliation made in the form of a decision to the Polish Waters. In the case of positive consideration of the application, the requirements for the planned development and land development are specified.

Discrepancies between PW and urban activities can also be found in art. 166.1, and art. 169.1, which indicate the necessity of estimating the flood hazard. The areas that have been recently qualified as floodplains are continually being developed. The pressure exerted by investors can affect the final shape of documents related to spatial planning, so that areas exposed to flooding are excluded from the list of threatened areas. Investors do not always understand the need to leave a strip of land between the riverbed and the land of investment that could, at least partially, reduce the damage. This is despite the current flood risk maps and the coverage of hundred-year-old and thousand-year-old water on the planning documents.

The Act on Spatial Planning and Development [1] is the basic document specifying the principles and scope of shaping the spatial policy by self-government units and state administration bodies. The sea water areas were excluded from the scope of the study, which means that the provisions contained in the Act refer to the vast majority of water-based areas in Polish cities. The basic activities include the preparation of a study of conditions, in which spatial order is assessed, and also the most important issues related to the state of the natural environment and cultural heritage are taken into account. The next stage is the preparation of a local spatial development plan, which is an act of local law and has a significant impact in the shaping of the city structure – including the aquatic areas. The pace of works related to the transformation of the water areas is influenced by art. 27 [1] stating that changes in the study or local plan can be made in the mode in which they are adopted. This results in significant delays of activities related to revitalization compared to original intentions. In the management of

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4According to the definition of the Water Law Act, the establishment “is understood as the entities using water within water services, making water devices or other activities requiring water and legal consent” – art. 16, par. 73, p. 20.
post-industrial areas, the provision of art. 37f may be of importance [1] which talks about the possibility of adopting a local revitalization plan, provided that the municipality has a revitalization program. Guidelines regarding the shaping of water areas are not included. The exception is the confirmation of the need to agree on issues requiring a legal water permit with the director of RWMB or the minister competent for water management matters.

The Environmental Protection Law (EPL) [2] includes a set of the most important requirements relating to the necessity of acting in accordance with the principle of sustainable development, which is intended to enable the preservation of the natural environment in good condition. This document includes, among other, inland waters, so the provisions of this legal act apply to the formation of urban water areas. This document organizes the issues of rational management of natural environment resources – also in relation to the Act on Planning and Spatial Development. They are of particular importance in the case of water surface rehabilitation in brownfield areas, as well as in relation to the protection of existing surface waters flowing through areas with a production function [1]. With regard to the detailed scope of water protection, this document refers directly to the provisions of the Water Law Act. EPL assumes that it is possible to preserve “environmental, economic, social and cultural functions” [1] while creating biocenoses.

3. Securing the city against the effects of floods

The adequate protection of the city against the effects of flood is an important issue related to the development of aquatic areas in urbanized sections [10]. The simplest division of methods that can be used to protect invested areas distinguishes technical and non-technical measures. The first group includes all hydrotechnical constructions and engineering activities that are to prevent the water from spilling beyond the limits provided for it. Such solutions include the creation of polders, embankments and relief channels. Non-technical measures are primarily a set of factors influencing the development of the city’s areas, public awareness and, in critical cases, also the methods of early warning of floods. In Poland, the most common way to prevent river flooding in urbanized areas is to build flood embankments.

Zbigniew Kledyński in his article [11] points out that embankments are classified in terms of their importance, depending on the surface of the area they protect. This evaluation does not include the method of development of the protected area. This leads to a situation in which valuable areas, due to the existing cultural conditions, are classified as less important for protection, in relation to large areas where the level of investment is small. The most advantageous form of securing the city against the effects of flooding is the system of structures and hydro-technical equipment located in the upper course of the river. This allows to minimize the flood protection inside the city. Retention reservoirs and polder areas allow to retain surplus water, both rainfall and thaw. In this case, the danger of flooding of urban areas is reduced to a minimum. It also allows you to retain water that could be useful in periods when there is less rainfall. The largest number of polders in Poland was implemented along the Oder and the Warta rivers. The polders located in the middle course of the river, such as Zagórów and Jeziorsko, are becoming increasingly important in the national hydrographic network. Zagórów has an area of over 17 000 hectares and is able to store up to 398 million m³. The first plans for the construction of retention reservoirs in this area took place as early as 1977. There was a plan to implement a total of nine, however, after the change of authorities in 1989, only two were implemented. Polder is part of the Warta Landscape Park. Jeziorsko is a reservoir with an area of 42.3 km² and a capacity of 202.8 million m³. It was built in 1986. Areas of this type are still too scarce in our country. It is estimated that the capacity of reservoirs in Poland is about six times lower compared to other European countries. In Poland, they are able to stop 6% of the outflow from Poland, while in some European countries this figure reaches 30% [9].
Figure 1. A graph showing the optimization of the cooperation of the retention reservoir and the river with a regulated course in the flood protection system. (Kledyński Z. “Protection against floods and its infrastructure in Poland”)

However, it is often noticed that there is a difference in the priorities of the city authorities and pro-ecological organizations. Due to the development, which was located a short distance from watercourses, the authorities are trying to make efforts to maintain the best possible state of engineering structures. The means that can be used for the maintenance of the embankments are too small in relation to the demand. The situation is hampered by pro-ecological organizations that care for the greatest possible re-naturalization of the water areas, including attempts to limit the renovation works.

The issue of flood assessment can be analysed on the example of Krakow^5 in the case of which there is documentation describing the extent of the flood over several hundred years – the first notes on this subject come from 988. The oldest part of the city is located not far from the river bed. The Vistula basin consists mostly of mountain rivers, the level of which can grow rapidly, whether due to sudden snow melts or during heavy rainfall [12].

1903 was a breakthrough date, when due to the size of the losses, a comprehensive approach to flood protection started being considered^6. In 1934 there was another, even greater, flood. However, due to the spill of water on earlier sections, Krakow did not experience its effects as severely as in 1903. Many losses would most likely be avoided if some negligence did not take place^7.

To this day, we meet a similar lack of implementation of activities planned years ago, and the subject of adequate security of the city usually returns shortly after each flood.

In Krakow, the construction of the relief channel has been postponed for over a hundred years. Its implementation was planned in the years 1904-1906. This concept assumed faster discharge of large amounts of water from the city centre area. The assumption implementation did not take place and the floods in 1997 and 2010 proved once again that the threat of flooding large areas of the city is real. As

^5 Floods occurred in 1816, 1826, 1830, 1834 and 1899. Significant floods also occurred in 1270, 1528, 1533, 1867, 1903, 1940, 1997 and 2010.

^6 The water level on the Vistula was +4.55m above the zero water level (even at the entrance gate on Grzegórzecka street the average level of +1.4m was noted).

^7Eng. Andrzej Kędzior gives in his elaboration the problems, such as: low-gradient embankments, insufficient light of bridges, suspending security works in 1931, failure to carry out maintenance work on the embankments, interruption of afforestation of some areas.
a solution, it was decided to use the method of raising the embankments, which did not affect the removal of the main threats. This even relates to the problem of bridges hanging over the Vistula river, with the Dębnicki bridge at the forefront. The subject of the ditch designed over one hundred years ago invariably returns in periods when the city is in danger of flooding. The construction of the Relief Channel, however, is no longer possible due to the increasing level of land investment. It should be noted that when the relief channel was designed, the city occupied a much smaller area than it does today. Expertise carried out by a team led by prof. dr eng. Elżbieta Nachlik [13] proved that making the channel would have a positive impact on the city’s protection against flooding, but it would mainly concern its oldest part. The creation of the channel would also increase the number of areas for recreation purposes. There are open discussions about the need to extend the activities to build a larger number of retention reservoirs in the upper course of rivers flowing through Krakow.

![Image of flood extent from 1813 and 1903](image.jpg)

**Figure 2.** Illustration of the extent of floods from 1813 and 1903, applied on the current state of development of the city. (author’s study)

In areas where flooding has occurred in the past, there are currently areas with a high level of investment. Thus, the flood can easily spread, while causing significant material damage. The scope of places that have been found under the water can be traced on the basis of graphic materials collected by the Coordination and Information Centre for Flood Protection in Krakow. Certain terrain conditions also affect the course of floods, such as the low location of some districts of the city in relation to the level of flood waters or those flowing directly into the Vistula, such as Rudawa and Wilga, through which the retracting Vistula waters expand the extent of damage. An important factor is also a narrow bed with numerous and relatively sharp turns.
Figure 3. Map showing areas threatened by flood in Krakow. (Coordination and Information Centre for Flood Protection in Krakow)

Over the centuries, the city has also grown in areas covered by floods. This is contrary to the historical approach to building the city. Through the implementation of protections, efforts are made to secure the invested areas against the adverse consequences of river floods. However, these are solutions that do not guarantee 100% efficiency. Extensive engineering structures often adversely affect the image of the river in the city and the functionality of the spaces located in the vicinity of water.

4. Conclusions
In many intensively developing cities around the world, a generally accepted activity is the desire to use quays for creating business cards of the cities [14]. These places were designed to become an interesting space that people want to visit and which they will want to use. Important urban functions located here [15], which are easily accessible due to public transport. However, it should be noted that in these spaces, their users have close contact with water. This is often the case due to the stable level of the water table, which considerably simplifies the management of such areas. It is difficult in Krakow. High walls that divide the boulevard areas from the city space constitute a serious communication barrier. Sometimes even five-metre-high, they makes it possible to overcome this height along some sections only with a narrow staircase. This limits the eye contact between people walking on both levels. Currently, the aim is to shape architecture and its contact with valuable natural areas depending on the location and climate of the city [16]. This ensures not only a coherent connection between the urban structure and the right silhouette of the city, but also the correct functioning of numerous biocenoses located in the urbanized areas.

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The current legal status and general public awareness (sometimes also of the city authorities) make it seem necessary to pay more attention to the comprehensive approach to the revitalization of vast water areas. It is important to integrate neighbouring functions and the way and quality of the arrangement of the whole area, not just its fragment. The changes taking place in legal documents make the administrative route related to the transformation of water areas excessively complicated. There is also a growing number of provisions necessary to comply with, the content of which is not always clear. However, it would be beneficial to specify the provisions of local spatial development plans and the general increase in coverage of urban areas with plans. It would allow to increase spatial order and overall control over investments – also those implemented in the areas near water. It seems valuable to use foreign standards, where the revitalization of even vast areas is conducted according to one main idea, even if the final result consists of the sum of many elements. Such activities allow for building interdisciplinary solutions, integrating numerous elements, which often leads to synergy.

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