

WATER CITY INDEX 2023

EFFICIENCY RANKING
OF WATER RESOURCES
USE IN POLISH CITIES.

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SCIENTIFIC EDITORIAL

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PREFACE



"LOCAL GOVERNMENTS HAVE ADAPTED TO CIRCUMSTANCES, WHICH THEY MOST PROBABLY NEVER ENCOUNTERED BEFORE."

You are looking at the fifth edition of the Water City Index (the 2023 WCI). When we started working on the first edition, we envisaged for this project to constantly develop. Every year, our study has been gaining more and more interest of local government officials, scientists, experts, and journalists, which shows just how important and necessary the Water City Index is.

In order to meet expectations, we take great care to add new elements to each year's edition of the ranking. For the last five years, our ranking has covered various issues and aspects of water management in cities, which at that time faced difficult and unexpected problems, such as COVID-19 or the war in Ukraine and the resulting vast number of refugees. These have been significant challenges also for urban water policies. Challenges that contributed to the increased awareness of local governments in relations to handling crisis in water management. Local governments have adapted to circumstances, which they most probably never encountered before.

At the Water City Index, we praise and reward local governments. We try to use objective methods to inspire and stimulate local governments to discussion and action. Having released five editions of the ranking, we are able to distinguish the Poland's water policy leaders, but also cities requiring support within the area of the building urban water policy - not with a view to giving them high ranking scores, but to ensure implementation of effective actions in the area of water policy. This is important because the consequences of ongoing climate change and sometimes imprudent spatial policy will be more and more severe.



The authors of the report, we intend to develop and improve the ranking. Drawing on the experience gained in previous editions, we have drawn attention to the need to connect the Culture and Residents area with the Economy and Business area. This year, we have also undertaken the task of creating a comparative context for our metropolises with selected European counterparts.

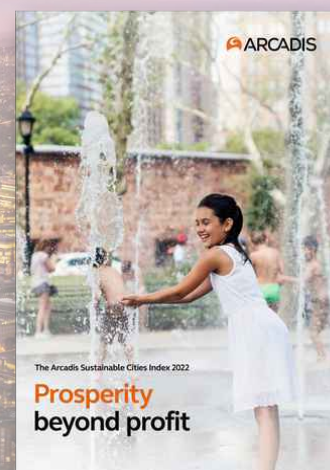
By means of the Water City Index, we intend to continuously provide information on the activity of those Polish cities, for which water management is a key segment. Our goal is to continue making suggestions and drawing conclusions. We hope this current edition of the report will inspire reflection and action. Included in the current edition of WCI have been examples of the use of blue-green infrastructure in the urban tissue as an element of adaptation to climate change, with a view to encouraging cooperation to stimulate similar development of cities.

Jerzy Hausner
Michał Kudłacz
Krzysztof Kutek

The **Arcadis** Sustainable Cities Index 2022



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A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a body of water towards a coastal town. The town is built on a hillside, featuring numerous white buildings with red-tiled roofs. A large, prominent white building with a classical facade is visible on the right side of the hill. The water is calm, and the sky is overcast. The entire scene is overlaid with a semi-transparent blue filter.

CHAPTER 1.

The applied research
methodology.



THE APPLIED RESEARCH METHODOLOGY.

The 2023 Water City Index was developed on the basis of the method applied in previous rankings. Similarly to the previous year, great emphasis was placed on measuring the activity of local governments and on direct effects of their policies through the use of indicators, the value of which has changed in the years 2018-2022.

The 2023 Water City Index ranking was drawn up, as previously, for three categories of Polish cities: metropolises (8 cities), other cities with poviatic rights (58) and cities without poviatic rights, which had at least 20,000 residents in the year of creating the first WCI (152) [1]. Eight metropolises were separated from the group of cities with poviatic rights on the basis of criteria such as the number of residents (at least 200,000 residents [2]), the degree of technological advancement of water supply and sewage infrastructure, and the complexity of social and economic problems.

A great added value in this year's report is the comparison of the largest Polish cities with other European cities of similar size. The applied research methodology (indicators, weights, and survey questions) was identical to the one used in the case of Polish metropolises.

The 2023 WCI includes 3 categories and 15 subcategories of assessment. Their arrangement is shown in the figure below:



Figure 1. Areas and categories of the assessment of the water policy of cities

Source: own study

[1], [2] Based on data from the Local Data Bank of the Central Statistical Office for the year 2022.



In calculating the index for cities with poviata rights, there were used over **40 different indicators** sourced from the following:

- Local Data Bank of the Central Statistical Office (Bank Danych Lokalnych Głównego Urzędu Statystycznego, BDL GUS);
- Database of Topographic Objects (BDOT10k);
- Flood Hazard Maps (MZP);
- Institute of Meteorology and Water Management – National Research Institute (Instytut Meteorologii i Gospodarki Wodnej – Państwowy Instytut Badawczy, IMGW – PIB);
- Polish Waterworks Chamber of Commerce (Izba Gospodarcza Wodociągi Polskie);
- own survey conducted among cities with poviata rights.

The rating in the **"Life"** category was based, among others, on the following indicators: price and change in water consumption in the city, price and production of sewage, density of the water supply and sewage network in the city, and expenses incurred by cities on sewage management and water protection.

In the **"Threat"** category, the index was calculated on the basis of such indicators as: the share of the city's area in the flood risk area, length of flood embankments in relation to the area of the flood risk area in the city, annual rainfall per sealed area, number of water supply failures per total length of the network or the percentage of biologically active areas within the city.

The index for the **"Economy and business"** category was calculated, among others, on the basis of water consumption by industry, the number of companies operating in the water transport industry, or the number of watercourses crossing (bridges) in relation to the length of watercourses in the city. The **"Culture and residents"** area was based on such measures as: the length of the riverbank in the city, percentage of surface water in the city's area, change in the share of parks, green areas and residential green areas in the total area, and change in the share of city expenditures on maintaining greenery in the city's own income.

The index of cities without poviata rights was developed on the basis of one collective category. All indicators were subject to a standardization process with the use of the following procedure:

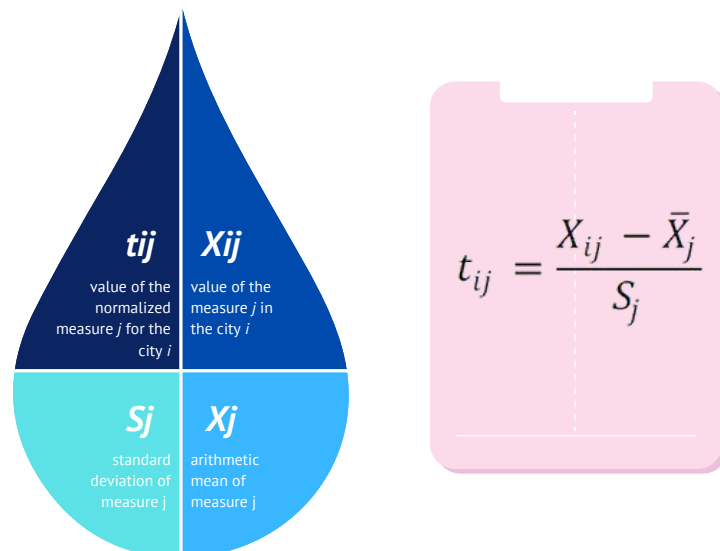


Figure 2. Model of the data standardization process

Source: own study



As a result of the standardization procedure in individual assessment categories, there were created four indices (WCI-Ż, which stands for WCI-Life, WCI-Z, WCI-Threat, WCI-G, WCI-Business and Economy, and WCI-K, WCI-Culture and residents), which constituted the basis for building one main index (WCI). The values achieved by metropolises and other cities with poviats rights were the basis for drawing up main and detailed rankings (separate for each category) presented in this report.

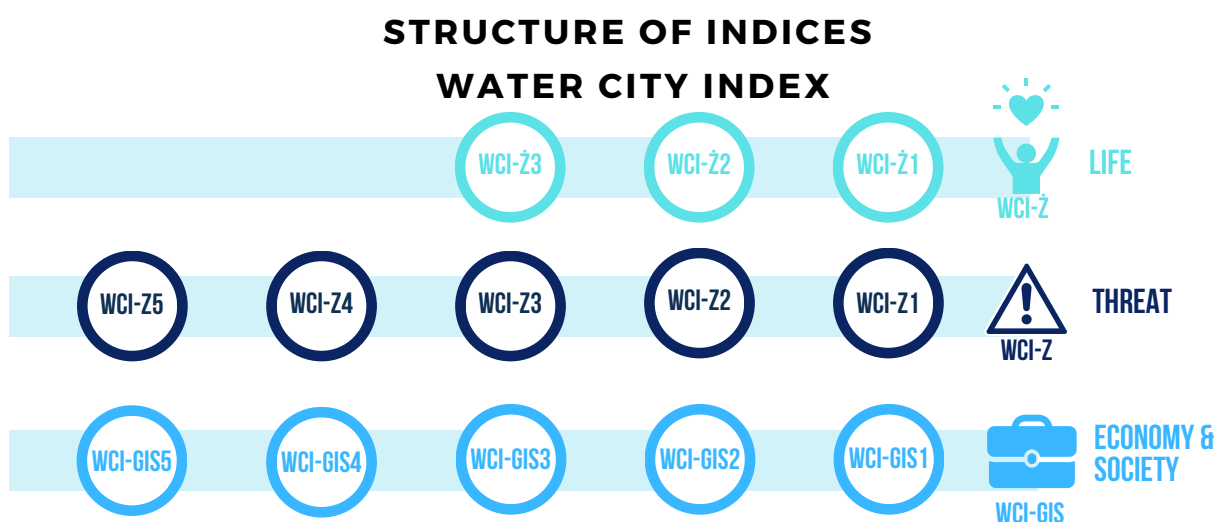


Figure 3. Structure of indices - Water City Index

Source: own study

The research method, which has given basis for creating the ranking, draws on five years' worth of experience in developing the WCI index. The authors are aware that some of the strengths and weaknesses of cities in the context of the Water City Index may result from natural conditions (determinants which are uncontrollable from the point of view of city authorities), and some from controllable factors: spatial, environmental, economic and social ones. Therefore, as part of the Water City Index, the first step was to analyse the conditions (number, types, area of reservoirs and watercourses; average total amount of precipitation and degree of insolation of the analysed cities) and the degree of sensitivity to flood occurrence (delimitation of flood areas).

In the second step, water policies of the cities were analysed within the context of their identified characteristics. For example, in the case of cities with low rainfall, which favours the occurrence of drought, activity to counteract drought is important (indicator weight) than in the case of cities where a similar problem does not occur. Therefore, the sequence of activities is as follows:

- division of urban water policy into 3 areas;
- division of areas into 13 categories;
- quantification of 13 categories with the use of a set of over 40 indicators;
- obtaining quantitative data;
- determining specific features of cities;
- assigning weights to indicators and indices for individual categories;
- aggregation of results and data interpretation.

A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a wide river. In the distance, a city with numerous buildings and a prominent white building on a hill is visible under a cloudy sky. The entire scene is overlaid with a semi-transparent blue filter.

CHAPTER 2.

Key areas of water resource
management in the city.



KEY AREAS OF WATER RESOURCE MANAGEMENT IN THE CITY.

This year's edition of the Water City Index presents a new perspective on the issues of urban water policies, however, we do continue to adhere to the assumptions made in previous editions. In 2022, we wrote that adaptation of cities leads to an evolution in understanding of their functionality and development. This transformation is well illustrated by the diagram below:



Figure 4. From traditional to the regenerative city

Source: www.worldfuturecouncil.org/wp-content/uploads/2016/01/WFC_2010_Regenerative_Cities.pdf

In the past, the essence of city functioning was the linear flow of matter, where it did not matter where the resources came from, how they were obtained or processed, or what environmental effects they generated along the way before reaching the city. To prevent this, it is necessary to move to the regenerative city formula [3]. We are still looking for an appropriate form for this approach when assessing urban water policies.

Every year, we emphasise that WCI is a quantitative ranking. We develop the results in a maximally objective way, by obtaining the most up-to-date, comparable indicators from various databases (more on this in the chapter on research methodology), as well as information developed through survey questionnaires. It is also worth pointing out that the Water City Index is the basis and starting point for creating in-depth and individualised projections on areas, which require improvements in urban water policy. In order to present the idea of a regenerated city, for the first time since the creation of the Water City Index, we have decided to change the areas for which we analyse urban water policies. Undoubtedly, water is a multi-functional resource and there are numerous opportunities to use this critical resource in cities, as shown in previous editions of the WCI. However, we do observe uneven access to the data, which we have aggregated in the four assessment areas proposed so far, and in order to ensure that the areas of city analysis are equally important, we have decided to combine the areas into three: Life, Threat, and Economy and Society.



[3] Regenerative cities are urban areas developed in relationship with nature and through creation of inclusive well-being; health and happiness for all, both in the short and long term.



KEY AREAS OF WATER RESOURCE MANAGEMENT IN THE CITY.

Thanks to this change, the weights between individual areas, which bear influence on the final result, are more balanced and, in our opinion, render the ranking more credible.

Quantitative indicators have been aggregated for each of the three areas indicated above. On the basis of available data, we have calculated scores for each city in individual areas. Efficiency of the water use has been measured separately in each area. Behind the analysed areas Life (1), Threat (2), Economy and Society (3) there are various urban water policies. In the case of the **Life** area, we refer primarily to water and sewage management. This category also includes the area measured separately in previous editions, which concerned the possibility of using water to increase the locational attractiveness of cities (mainly in the eyes of investors), as well as to achieve energy independence through this resource.

The **THREAT** category aims to measure how the city responds to new threats related to floods, especially flash floods, as well as the degree of preparation for the increasingly frequent long-term droughts and phenomena accompanying them. **Economy and Society** is a sector whose importance is constantly growing - both due to the quality of life of residents, tourist attractiveness, as well as rational space management and increasing resistance to possible water crises.

The following areas were presented in detail in the annual rankings created in the years 2019-2022.



WATER CITY INDEX

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Key areas of water resource management in the city.

A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a body of water towards a coastal town. The town is built on a hillside, with numerous white buildings and a prominent large white building at the top. The water is calm, and the sky is overcast. The entire scene is overlaid with a semi-transparent blue filter.

CHAPTER 3.

The ranking results.



RANKING RESULTS

Based on the above methodology, a water ranking of cities in Poland was created. The results of the ranking are presented below in the following order:



THE MAIN RANKING FOR METROPOLISES

1. Ranking for metropolises in the "Life" area
2. Ranking for metropolises in the "Threat" area
3. Ranking for metropolises in the "Economy and Society"



THE MAIN RANKING FOR CITIES WITH POWIAT RIGHTS

1. Ranking for metropolises in the "Life" area
2. Ranking for metropolises in the "Threat" area
3. Ranking for metropolises in the "Economy and Society"



THE MAIN RANKING FOR MID-SIZED CITIES

The ranking is based on partial values of indicators in four areas:

- "Life"
- "Threat"
- "Economy and Society"



Photo 1. Representatives of the winning cities Water City Index 2022.



WINNERS

WATER CITY INDEX 2023

THE MAIN RANKING FOR METROPOLISES



THE MAIN RANKING FOR CITIES WITH POVIAT RIGHTS



THE MAIN RANKING FOR MID-SIZED CITIES

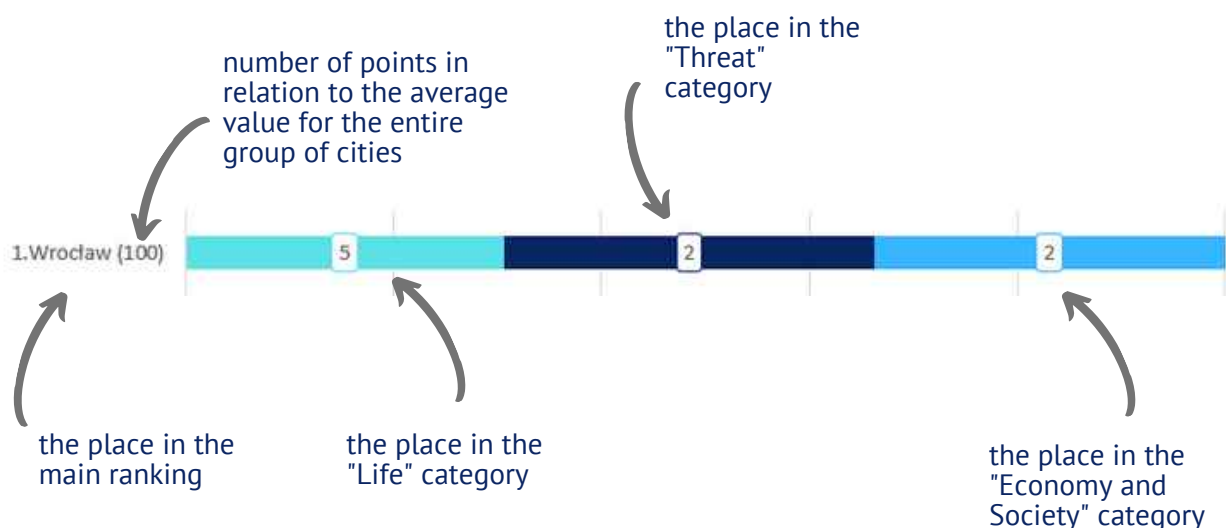




INTERPRETATION OF THE RANKING

For **metropolises** and **cities with poviats status**, the main ranking lists the results of the rankings in individual categories: The results are presented in the form of numbers indicating the position of a given city in each category, shown on the corresponding bar of the graph.

In the case of the charts prepared for the ranking of **metropolises** and the ranking of **cities with poviats rights**, the width of individual blocks in the chart reflects the share of a given category in the overall rating of the city, and since different weights were used for the three categories in the final rating, the width of these blocks is not always comparable between cities.



Ranking results



THE MAIN RANKING FOR METROPOLISES

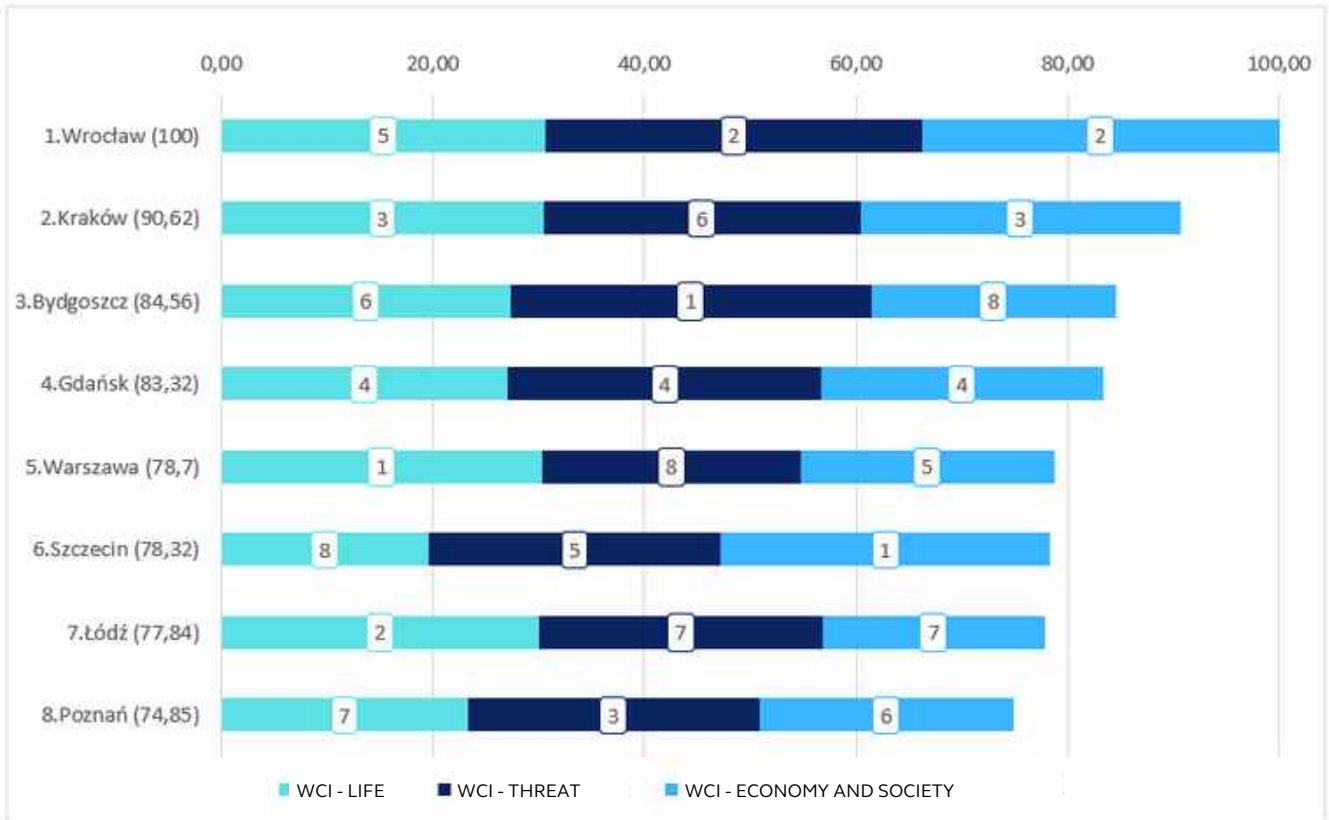


Figure 5. The results of the Water City Index 2022 ranking for metropolises.



Ranking results



THE MAIN RANKING FOR CITIES WITH POWIAT RIGHTS

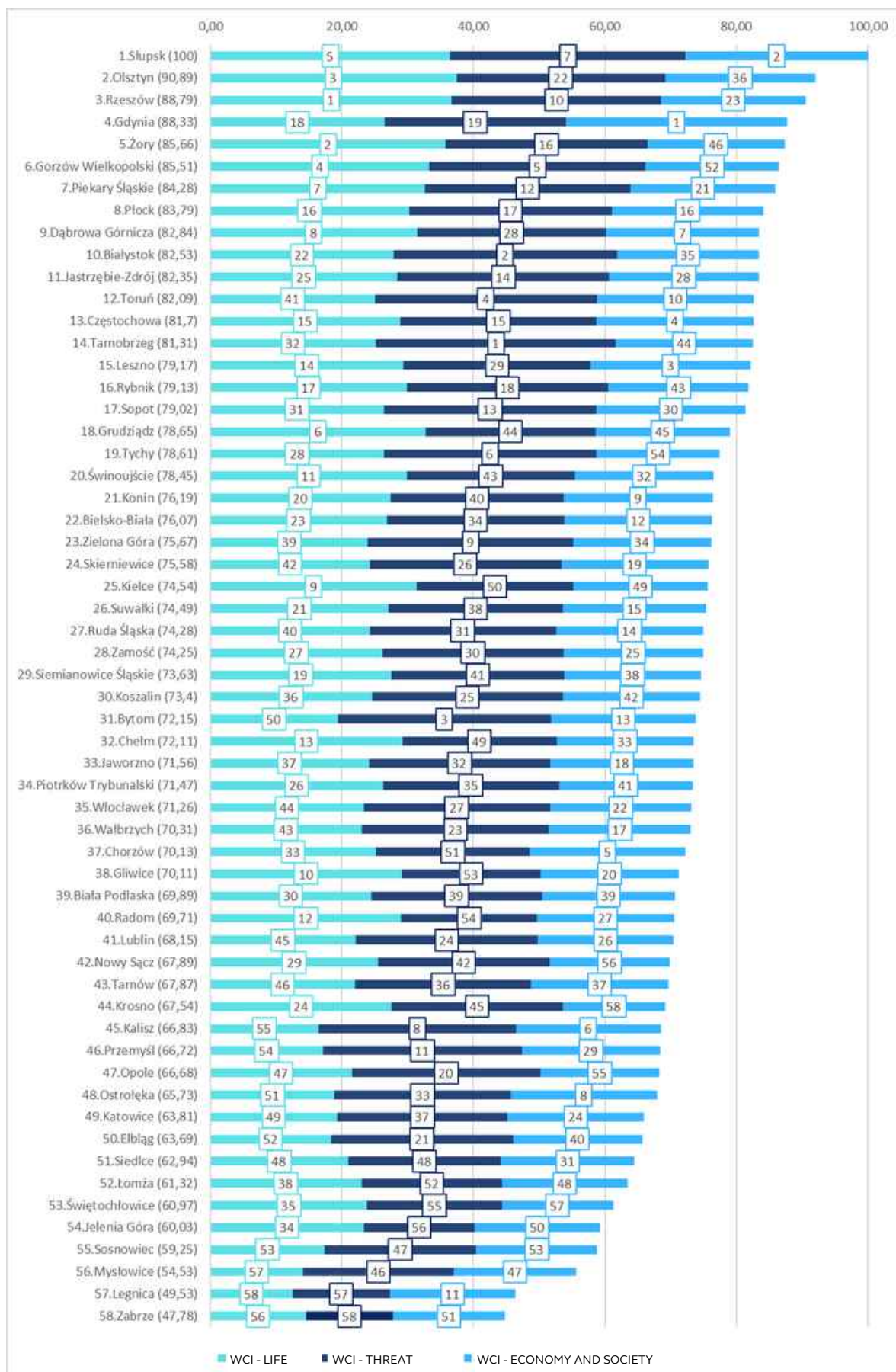
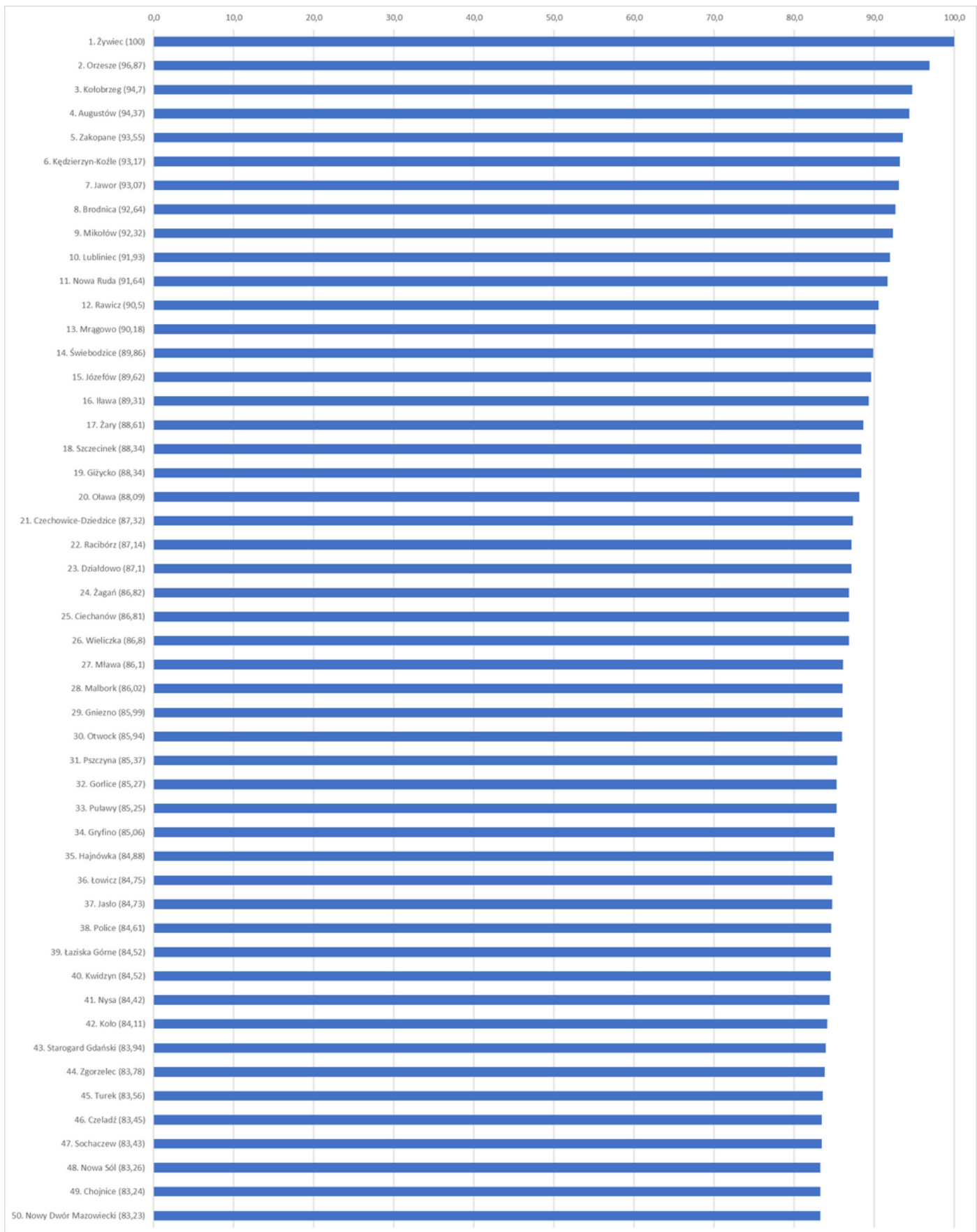


Figure 6. The results of the Water City Index 2022 ranking for cities with powiat rights. Ranking results

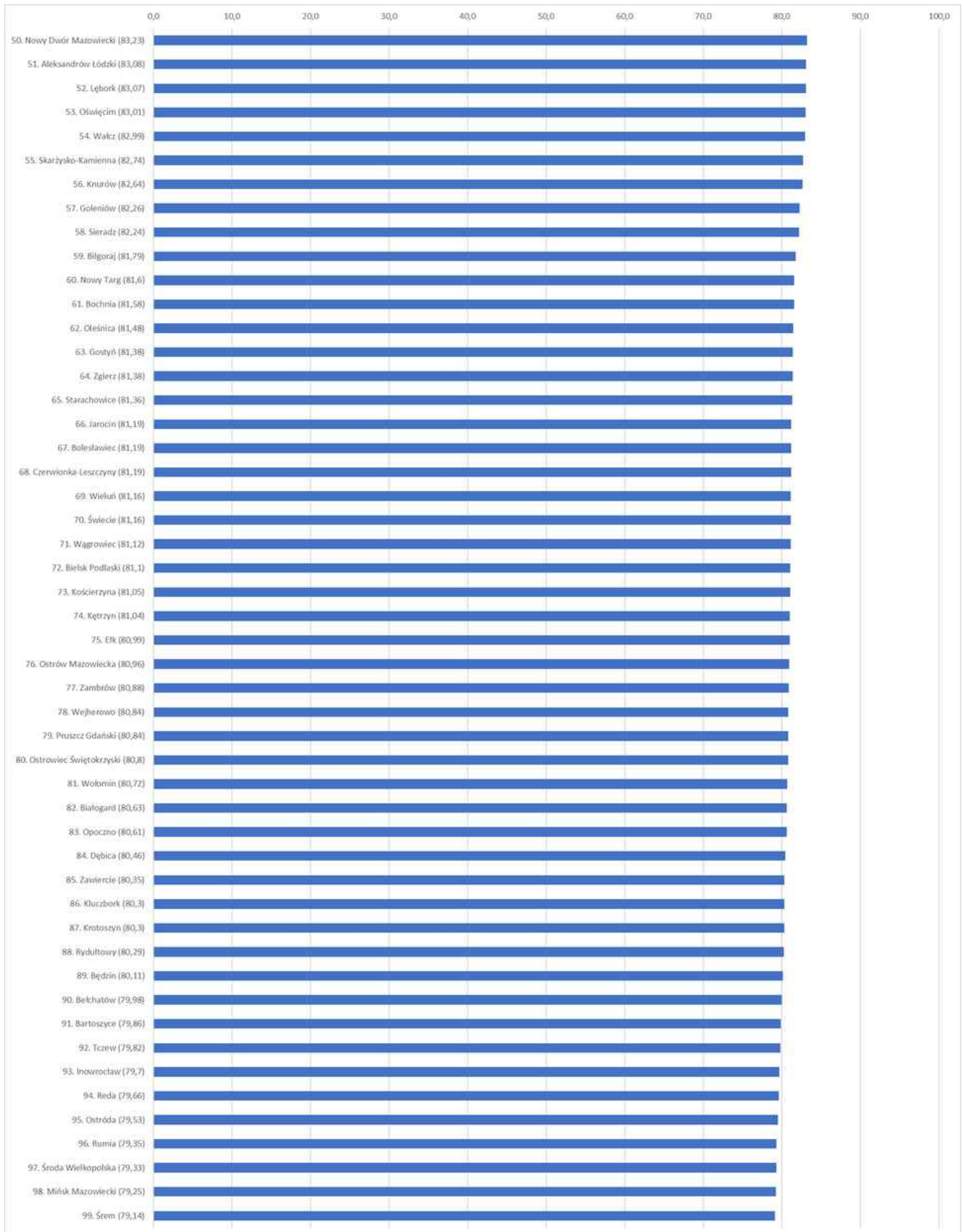


THE MAIN RANKING FOR MID-SIZED CITIES





THE MAIN RANKING FOR MID-SIZED CITIES CONT.





THE MAIN RANKING FOR MID-SIZED CITIES CONT.

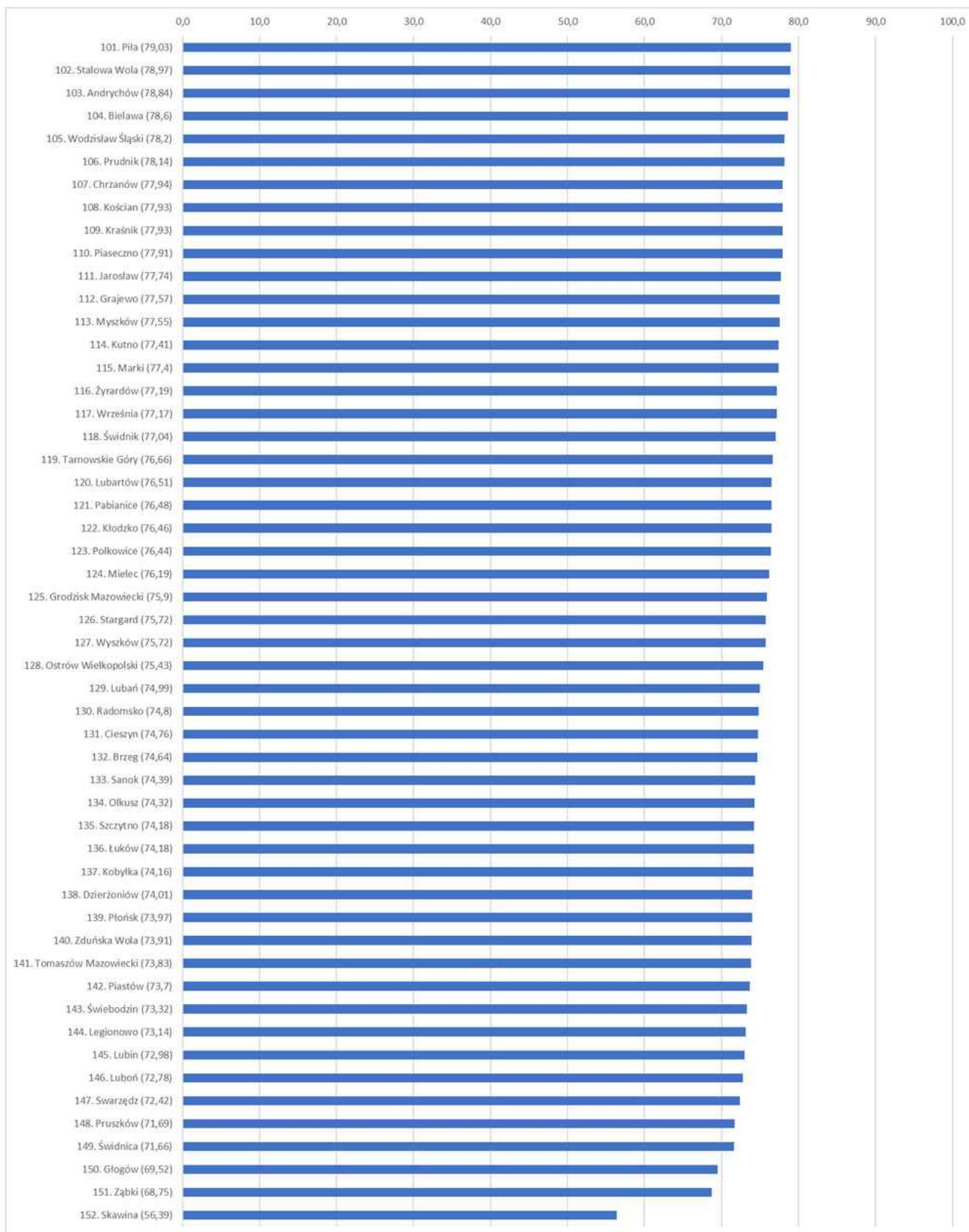
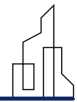


Figure 7. Water City Index 2022 results for medium-sized cities.

A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a wide river. In the distance, a city with numerous buildings and a prominent white building on a hill is visible under a cloudy sky. The entire scene is overlaid with a semi-transparent blue filter.

CHAPTER 4.

Model urban water policy solutions from foreign cities.



MODEL URBAN WATER POLICY SOLUTIONS FROM FOREIGN CITIES.



PRAGUE HEAT ISLANDS

Climate change affects particularly metropolises, including the capital of the Czech Republic - Prague. Surface sealing, intensive urbanization, and population density has led to problems related to the growing number of urban heat islands and the emergence of threats resulting from urban heat island effects.



THE CHALLENGE

In 2014, experts from the Prague City Hall and the Institute of Hydrometeorology completed heat island research in Prague. They were primarily interested in how a city with a million residents, and especially its centre, could protect itself against the effects of more and more common heat islands, which are characterized by a higher temperature than that of the immediate surroundings. In the centre of Prague, the temperature is usually 2.5 degrees higher than in non-built-up areas.

This phenomenon intensifies in the summer months, especially during heatwaves. Consequences for people and the environment may be serious (e.g. overheating of the body, lack of sleep, health problems for persons suffering from chronic diseases, losses in the fauna and flora structure).

In the opinion of climate change experts, measures should be implemented in order to mitigate the effects of heat islands as the problem is worsening. Taking into account the planned further development, in ten years' time, the temperature difference between the centre of Prague and its suburbs may be as much as three degrees.

Rivers and water reservoirs may play a particular role in reducing negative effects of the urban heat

Model solutions



island. Unfortunately, artificial development of the Vltava river flowing through Prague in a deep concrete bed does not significantly change the temperature in the city centre. Moreover, predominance of the westerly wind at the meridional location of the river means that the impact of the river on lowering the temperature in most districts of Prague is insignificant. Changing development of the river bed towards a direction consistent with development of green areas would significantly reduce the temperature in the city and improve its ventilation. Good examples in this respect are found in Rohanské nábřeží in Karlín or near one-way streets in Holešovice.



STRATEGIC ACTIVITIES AS SHOWN IN THE PRAGUE EXAMPLE

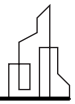
In order to reduce the impact of climate change on lives of residents and the strive for climate neutrality, in 2019, the city presented a plan to reduce CO₂ emissions by 45% in the entire urban area by the year 2030. Water-related energy consumption is estimated to amount to 13% of national energy consumption. Pražské vodovody a kanalizace a.s. (PVK), the largest water supply and sewage company in the Czech Republic, provides drinking water to Prague and the surrounding area. Calculating the carbon footprint, which is the starting point for reducing an entity's impact on the environment, is not an easy feat. Therefore, the company has established cooperation with scientific institutions to share knowledge on calculating the carbon footprint. Additionally, it is looking into ways to minimize environmental impact and improve water management by improving infrastructure resilience, reducing water losses, and recovering water and resources. It is also working on ways to stop the temperature rise in the city and develop leisure areas for residents.

While striving to reduce water losses in the water supply network, PVK has implemented an innovative method of satellite leak detection, which involves searching for places with unusual soil moisture, which may be caused by water leaking from the water supply network into the ground. In 2021, the company launched a new leak detection project on the basis of the analysis of many data performed by artificial intelligence. Another innovative idea is recovering water from sewage for the purposes of irrigating green areas, washing streets, and cooling surfaces particularly exposed to temperature surges. This is related to the urban heat island problem. Greenery is the key ally in reducing urban heat islands.

Green roofs and vines on the southern facade of buildings help to reduce the temperature. Additionally, evapotranspiration supports cooling the surface. The main strategic goals of Prague are to increase the coefficient of heat reflection from surfaces and buildings, increase the share of vegetation (green roofs, parks, street greenery), reduce runoff (open water reservoirs, reservoirs, less impermeable surfaces), reduce anthropogenic heat sources (air conditioning, industrial buildings, transport), increase the share of structural and natural shading, i.e. return to the structure of old cities. In addition, the material used, as well as its colour and total Surface are of great importance.



Model solutions



IMMEDIATE ACTIVITIES

Changes in spatial development and expanding green areas are long-term processes. PVK analysed possibilities of getting involved in the immediate reduction of urban heat islands.

An effective way to cool outdoor spaces during hot weather is generating water mist, which increases humidity and reduces air dust. It lowers the ambient temperature by several degrees. It may help to reduce energy costs by decreasing the temperature outside buildings, which in turn can reduce the need for air conditioning. The drops absorb part of the solar energy, thus turning water into mist, which produces a cooling effect.

The mist generating device may also serve as a so-called drinking fountain. The company places devices in the most problematic spots to help residents get relief from heat. The challenge is to reduce water consumption, that is why manufacturers focus on producing water-saving devices mounted on the hydrant of the water supply network.

PVK also invests in energy and heat recovery from wastewater.



Photo 2. Prague waterworks and sewerage



COMMUNICATION WITH RESIDENTS

The Prague's waterworks company is committed to raising awareness and knowledge through playing an active role in the city projects. Social awareness and education are of extreme importance because they help stakeholders to understand the impact of climate change on their city and engage them in specific actions. Guided tours, open days to visit and learn about how water and sewage infrastructure work, and water and environmental competitions for schools are meaningful aspects of awareness-raising campaigns.

In addition, residents are encouraged to plant greenery on balconies and terraces, establish rain gardens, use every inch of land for plants, and thus increase local biodiversity.

A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a body of water towards a coastal city. The city is built on a hillside, with numerous white buildings and a prominent large white building at the top. The water is calm, and the sky is overcast. The entire scene is overlaid with a semi-transparent blue filter.

CHAPTER 5.

Polish metropolises compared
to selected foreign cities.



POLISH METROPOLISES COMPARED TO SELECTED FOREIGN CITIES.

A few years ago, the Water City Index team undertook a task of expanding the WCI to include European countries, which was the subject of analyses in previous editions. This has not been an easy task because Europe is a continent of many cultures and climates, with diverse approaches to urbanization and diversified financial possibilities. However, we have not stopped trying to harness numbers, data, and statistics in a rational manner.

In this chapter, we have performed for the first time a comparative analysis of Polish metropolises with selected European cities. This has been achieved by analysing indicators available for Polish metropolises in databases, while foreign cities were sent a survey including questions about similar data.

In this year's ranking, the following data sources from public databases have been taken into account:

- Price of supply of 1m³ of water for households
- Price of collecting 1m³ of sewage from households
- Average water consumption [m³/person]
- Share of the city's area in the flood risk area
- Share of railway and road lines in the flood risk area in relation to the total length of transport lines in the city.
- Share of area [km²] of industrial or commercial development in the flood risk area in the total area of industry and services.
- Share of urban development area in the flood risk area within the total urban development area.
- Share of water surface in the city area
- Average surface sealing [%] in the city area
- Average intensity of surface sealing [%] in the city area
- Length of the coastline (rivers, reservoirs and sea) [km]
- In 2022, did the City conduct educational activities for residents with a view to teaching behaviours in the event of crisis phenomena (flood/drought)?
- Have there appeared any new areas in the City which are deemed to be at risk of flooding (so-called flash urban floods) within the last 3 years?
- To what extent does the City finance development of waterfronts and watercourses for leisure purposes?





POLISH METROPOLISES COMPARED TO SELECTED FOREIGN CITIES.

We analysed data from the following cities: Antwerp, Brno, Budapest, Bydgoszcz, Cluj-Napoca, Düsseldorf, Gdańsk, Gothenburg, The Hague, Krakow, Łódź, Mannheim, Poznań, Prague, Rotterdam, Szczecin, Tallinn, Varna, Warsaw, Vienna, Vilnius, and Wrocław.

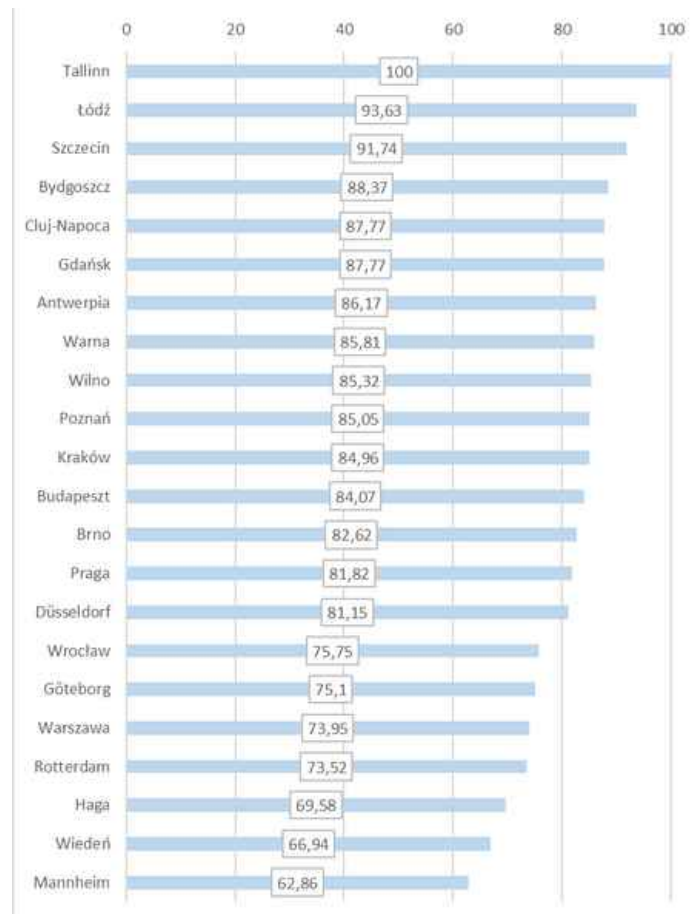


Figure 8. Results of the Water City Index Europe

The winner in this year's ranking was Tallinn, ahead of Łódź and Szczecin. However, the performed analysis does not reflect many nuances resulting from the location of cities, their wealth, or history. Due to the above, we decided not to publish the full ranking list for European cities. We have undertaken an attempt to indicate the most interesting aspects ensuing from the analyses.



Polish metropolises compared to selected foreign cities.



POLISH METROPOLISES COMPARED TO SELECTED FOREIGN CITIES.

The first conclusion arising in the analysis of the comparison results is as follows: despite millennia's worth of civilization development, natural conditions have remained a strategic criterion for the quality of functioning of cities. This is especially visible now when climate change exerts significant negative consequences in places where biodiversity has not been preserved. Sealing surfaces, eliminating biologically active areas, turning rivers into canals have led and will continue to lead to deterioration of the quality of life in the city.

Polish metropolises fit into the development trends of Europe. They face similar challenges in ensuring the well-being of residents. The environment is under particular pressure due to urbanization, but on the other hand, there is growing awareness of the need to preserve biodiversity also in cities. Sustainable land use and nature-based solutions in cities are key drivers of the quality of life in cities. The European Commission has been underlining the need to contain reduction of urban green space, and has even encouraged the systematic expansion of green areas in cities. It also calls on all cities with over 20,000 residents to develop ambitious urban greening plans that could ensure that green space is taken into account in a systematic manner.

COASTAL CITIES

The city's location by the sea best exemplifies benefits resulting from natural conditions. Taken into consideration were several coastal cities, including three Baltic cities: Tallinn, Riga, and Gdańsk, also with very different coastline lengths (e.g. 2 km Rotterdam, 118 km Gothenburg). Location by the sea has different definitions. The location of Rotterdam is more associated with that of Szczecin than with the open sea as seen in Varna. Taking advantage of the location in relation to the sea has a key impact on the city's development. In comparison to coastal port cities, Rotterdam has as many as 48.7% of railway and road lines in the flood risk area in relation to the total length of transport lines in the city. Tallinn or Varna have less than 1% of such railway and road lines, and Gdańsk - 16.3%. Infrastructure is essential for the functioning of ports. Rotterdam has by far the longest coastline (made up of rivers, reservoirs, and the sea), amounting to over 500 km, whereas Gothenburg has over 200 km of the coastline, and Gdańsk - 94 km. The size of the port and natural conditions determine development of the city.

Among the cities selected for analysis, Gdańsk has the largest area, although it ranks 13th in terms of population. Among the seaside cities, Gdańsk is one of the seaside cities with a biologically active area exceeding half of the city's area. Varna is the only city which fares better with its 74 percent. A good ratio is also confirmed by data from the Joint Research Centre of the European Commission presenting the area of public green areas per capita [4]. For Gdańsk, it is 15-20 m², which is lower than in other seaside cities, where this coefficient falls into the range of 20-50 m²/person.

Coastal cities certainly have a natural advantage, nevertheless, we should not forget that the way in which the coastline is developed affects flood safety and attractiveness of the city.

[4] <https://urban.jrc.ec.europa.eu/thefutureofcities/space-and-the-city#the-chapter>



POLISH METROPOLISES COMPARED TO SELECTED FOREIGN CITIES.

SEALING COEFFICIENT

The sealing coefficient is quite an interesting indicator with a direct impact on the flash floods threat, the intensity of emergence of urban heat islands, and the climatic comfort of urbanized areas. The Dutch cities: Antwerp, The Hague, and Rotterdam have the highest average sealing coefficient. This is not surprising and is consistent with Eurostat data [5], which shows that this European region is characterized by the highest population density. Cities with large water areas (Antwerp, Rotterdam, or Szczecin) are able to better handle the problem of urban heat islands.

Łódź, on the other hand, is quite unique since it has no river or lake, but there are as much as 50% of biologically active areas. In Łódź, there are no areas at risk of flooding, which significantly increases the city's safety factor. Moreover, Łódź has a relatively low average sealing coefficient, similarly to Szczecin or Cluj-Napoca (below 20%).

Reduction of sealed areas in favour of solutions based on blue-green infrastructure is an important strategy for European cities.



TOURIST ATTRACTIVENESS

The tourist attractiveness of cities is differentiated by their geographical location and history. The analysed group included cities which see crowds of tourists only in the summer (e.g. Varna), as well as historical cities with all-year-round tourist traffic (Kraków, Prague and Vienna).

Tourist trends are subject to noticeable changes. For example, Warsaw is becoming an increasingly attractive tourist destination. In 2013, in a comparative analysis of 18 cities drawn up by the Central Statistical Office, Warsaw was ranked penultimate after Prague and Vienna [6]. In 2023, it won the European Best Destinations award given by a travel website [7].

Among the analyzed cities, the authorities' efforts to make them more attractive are visible. This can be seen in the ranking winners who take intensive actions for this purpose. An interesting example is Łódź, which over the last few decades has made an effort to transform post-industrial areas into attractive tourist and cultural places.

[5] <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20200430-1>

[6] https://warszawa.stat.gov.pl/download/gfx/warszawa/en/defaultaktualnosci/810/9/1/1/warszawa_na_tle_wybranych_stolic_europejskich_ang.pdf

[7] <https://www.europeanbestdestinations.com/european-best-destinations-2023/>



POLISH METROPOLISES COMPARED TO SELECTED FOREIGN CITIES.

THE PRICE OF WATER

The collected data on water fees for households show that the highest prices per 1m³ of supplied water supplied are seen in Antwerp and Vienna (over PLN 13). In turn, it is Rotterdam that charges the highest fee for sewage collection (over PLN 24/m³). The cheapest water is found in Tallinn and Budapest (a little over PLN 2/m³). By far the cheapest sewage disposal services are in Varna, where households pay less than PLN 2/m³. Comparison of water prices in the international context should not be based solely on tariffs, which in individual countries have different legal bases for their estimation, hence further criteria in this area may be added in the future. The price may result from the rules for shaping tariffs, but also the wealth of the society, local prices of services, the value of work, etc.

The Goods and Services Tax itself can fluctuate significantly, which affects the fees paid by consumers. Among the analysed cities, the lowest VAT on water supply services is in Antwerp, Belgium (6%), and the highest in Budapest, Hungary (27%). The amount of used water also affects the value of the bill for a household. Our data shows that the least amount of water is used by residents of Vilnius (80 l/m³), and the highest in Budapest (150 l/m³), where water is the cheapest.

This year's edition of the WCI brings us closer to developing a ranking of Polish cities against the background of the European ones. We will be happy to benefit from the experience of the participants and readers of our ranking, therefore we kindly ask you to contact the team.



A person with long blonde hair, wearing a white dress and a wide-brimmed white hat, stands with their back to the camera, looking across a wide river. In the distance, a city with many buildings is built on a hillside. The scene is overlaid with a semi-transparent blue filter. The text 'CHAPTER 6.' is written in large, white, sans-serif capital letters across the middle of the image.

CHAPTER 6.

Water policy of cities in Poland



WATER POLICY OF CITIES IN POLAND

Comparison of the results of this year's Water City index with its previous editions allows to draw several important conclusions.

1. In Poland, local governments are increasingly aware of threats resulting from the ongoing climate change. We mentioned this issue in last year's Water City Index. We are glad to see this trend to be maintained. Many cities in Poland are implementing the provisions of urban adaptation plans to climate change, although some of these studies probably require updating. All municipalities in Poland should consider developing a document which organizes and hierarchizes development activities in relation to, among others: blue-green infrastructure.
2. Total financial outlays on water infrastructure in Polish cities remain high. This applies, to a lesser extent, to water and sewage infrastructure, which is already at a high level, therefore, Polish cities are investing in safety and the broadly understood infrastructure of the leisure industry.
3. There are at least three context-based conditions which we see as worth mentioning: firstly, financial dysfunctionality of local governments is growing. Secondly, the Act on Spatial Planning and Development favours chaotic and thoughtless development and individual short-term benefits over responsible development or maintaining developed greenery. Thirdly, we are dealing with deepening climate and water crises.
4. We attach here an abbreviation of the summarizing speech of Professor Jerzy Hausner at the 3rd Round Water Table, which was held on 22 March 2023 and concerned water management in crisis situations. This event clearly highlights the role that citizen experts should play as individuals who feel responsible for public affairs. Our basic task is to: provide reliable information, formulate diagnoses and recommendations, demand them, oppose opinions which are inconsistent with the facts and knowledge, and invite the public opinion. This is our guiding principle as the organizers of the Wrocław-based "City - Water - Quality of Life" Congresses and subsequent water round tables. It refers also to the initiators and authors of the Index. At the same time, in times of crisis, the issue of water management is also critical for the cities surveyed in our Index.

It is necessary to look at the ecological disaster of the Oder river in the year 2022 from two perspectives. One is an analysis of this particular disaster. Thinking about its causes, course, consequences, and actions. The second perspective is reflection - what is its meaning for diagnosing the crisis management system in relation to water.





There arises the first question: do we have sufficient analytics and monitoring system? The system for monitoring and recording pollution sources is not an integrated one. What should this system be used for? One of these functions is diagnostic. The second function is of interventional nature, and it stands for the early warning system. The trouble is that, even if we had the best-designed monitoring system, it would serve no good if we are not able to react quickly. The Oder river disaster is an example of initial denial and non-reaction.

The problem erupted also as a result of institutional weaknesses. Or errors that were included in the institutional system of water management in Poland. The primary goal is to separate this issue from the Ministry of Climate and Environment and, at the same time, assign to the Polish Waters State Water Holding a double role – consisting in management (ownership) and regulating. And this creates a deficiency of strategic imagination and strategic thinking.

The issue of strategic thinking seems to be the most important. I therefore ask two fundamental questions about the Oder river disaster - what happened and why, and what are its consequences? We were dealing with a very complex system. The relations in this biological and technical system are a set of non-linear dependencies that may as well be described, but even if they are described, the system will not necessarily work in the same way if critical parameters are different.

At the same time, in the case of the Oder river, we are dealing with a river ecosystem which, under the influence of anthropogenic pressure, indirectly - the climate change, directly - multiple pollution from numerous sources and river regulation, has for several decades been gradually losing its natural regeneration capacity. This means permanent immunological impairment of this biological organism. The Oder river is not capable of self-purification.

What is the role of the Oder river? A flow channel or a river ecosystem? How should it be understood and treated? What is more important – the depth, which provides greater opportunities for river transport, or the natural flow? Unfortunately, the perspective that the Oder river is a river ecosystem playing multiple ecosystem roles of existential importance for all living organisms is being undermined. And yet, if it does not fulfill this essential function, there is no point in considering other utilitarian functions it could fulfill.

The basic assumption to be taken is that the Oder river is an ecosystem and its natural regenerative capacity should be restored. There must be two sides to this restoration. On the one hand, there is a significant reduction in the destruction of this river ecosystem. On the other hand, the need to naturalize the river is just as important. One may not exist without the other. In this case, both aspects are a must. And they may not happen some day in the future - but immediately. Even if it is one step at a time. We need a new strategic programme for the Oder river. The programme which was already implemented was a response to the 1997 flood. Many things have changed for the better, but now we are dealing with a different situation and a different disaster. A dominant feature of strategic thinking must now be the naturalization of the Oder as a river system capable of providing basic existential services, which it has once lost.



5. The first place in this study in the metropolises category was taken by Wrocław, which returned to the top of our ranking. Wrocław performed well in each of the three categories, thus showing that its urban water policy is stable and implemented consistently, which certainly contributes to the high quality of life of residents. Attention is drawn to the reasonable price of water per cubic meter in relation to its consumption (similarly in Cracow), but, above all, to activities undertaken in the area of water safety and efforts made to develop river banks and expand green areas.

Cracow is a city with very high parameters in terms of water and sewage policy. To a large degree, this has remained unchanged for the five years during which we have been conducting our analyses as part of the Water City Index. We congratulate Cracow on taking the second place in our 2023 ranking, however, attention should be paid to the need of determining actions in the area of water security and further development of waterfront areas for city users.

This year, the third place has been taken by Bydgoszcz - invariably one of the leaders in the development of retention infrastructure, but also a city which in a conscious, rational, and effective manner builds its water policy.

6. In the category of cities with powiat rights (which do not count as metropolises), the first place was taken by Słupsk, which, although it does not stand out significantly in any of the analysed categories, nevertheless, it consistently implements municipal water and sewage services, activities in the area of safety, and also water-related development of leisure infrastructure. Another city already reaching the top of our ranking in several previous editions is Olsztyn. This time, it has taken the second place chiefly due to activities related to coastal development and protection against the consequences of climate change. Water supply and sewage disposal activities are assessed equally high.

Rzeszow is a city that took third place in this year's ranking in the category of cities with powiat rights, although the city could just as easily be categorized as a metropolis (when selecting metropolises in our ranking, we are guided exclusively by demographic criteria). A modern metropolis, Rzeszow implements water policy at a high level, adequately to its high aspirations. Attention is drawn primarily to the quality of operation of the municipal company dealing with water policy, as well as activities aimed at ensuring climate safety.

7. Żywiec, Orzesze, and Kołobrzeg are the three winners of our 2023 ranking in the area of medium-sized cities. This has been determined by high values of indicators in each of the three areas covered by our analysis, which points to the fact that these cities are aware of both the threats and opportunities offered by blue infrastructure in terms of increasing competitiveness of cities and improving the quality of life of their inhabitants.





INDICATORS USED FOR CALCULATING THE WCI

AREA	INDICATOR
LIFE	Price of 1 m3 of cold water in the city for private customers.
	Average water consumption per capita (2022 vs. 2017).
	Length of water mains per 10,000 inhabitants.
	Price of 1 m3 of collected sewage in the city for households (in PLN).
	Average volume of sewage discharged to sewerage system (in m3) per 1 inhabitant.
	Length of sewage network per 10,000 inhabitants.
	Expenditure in chapter 90001 (sewerage and water protection) per 1,000 inhabitants.
	Does the city have water reuse solutions on its sites?
	Is the city implementing the adopted municipal programme on water and sewage policy?
THREAT	Share of city area in flood risk area.
	Length of levees in relation to the area of the city at risk of flooding.
	Insolation zone according to IMGW maps x share of sealed area in the city.
	Share of industrial areas in flood risk areas.
	Share of commercial areas in flood risk areas.
	Percentage of sealed land in the city area.
	Rainfall zone x share of sealed area in the city.
	Expenditure in chapter 90001 (waste management and water protection) converted into own revenue.
	Number of water main failures per length of water network.
	Number of sewerage system failures per length of network.
	Does the city have rainwater retention solutions on its land?
	What innovative solutions for developing green infrastructure (e.g., green roofs and building facades, rain gardens, planting of smog-absorbing plants, etc.) are included in the city's policies?
	Does the city have its own local legislation enforcing water retention and delaying run-off?
	Has the city adopted a municipal climate change adaptation plan?
	Did the city conduct education activities for officials on how to behave in the event of emergency events (flood/drought) in 2022?
Has the city provided education to residents on how to behave in the event of emergency events (flood/drought) in 2022?	
Have there been any new flood hazard areas (known as urban flash floods/flash floods) in the city in the last 3 years?	
ECONOMY AND SOCIETY	Change in water consumption for the industrial sector (2017-2022).
	Sewage discharged to sewerage network (change).
	Number of enterprises registered in section H division 50 (water transport).
	Number of enterprises registered in section E divisions 36 and 37 (water collection, treatment and supply, sewerage collection and treatment).
	Number of waterway crossings (bridges) to the length of waterways in the city.
	Length of railway and road lines in the flood risk area in relation to the total length of lines.
	Length of lakeshore line [km].
	Length of river shoreline [km].
	Length of sea shoreline [km].
	Percentage share of surface water in the city area.
	Share of parks, greens and residential green areas in total area.
	Expenditure in chapter 90004 - Maintenance of green areas in the cities and municipalities for own revenue (change in share 2022-2017).
	Number [units] of water ports or harbours in the city.
	How is the city developing its waterfront areas?
	Does the city include events using publicly accessible green spaces in its plans for cultural events? If so, how many such events took place in the previous year?
Are there places in the city along waterways and rivers where you can use facilities such as a free beach, a guarded bathing area, an open marina, etc.?	

Table 1. Indicators used for calculating the WCI.



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RECOMMENDATIONS...

"The origins of many cities are closely linked to rivers, which played a key role in transporting goods, providing natural boundaries, and providing food for the inhabitants of settlements. With the development of civilization, however, we began to change the natural river beds, hiding them under concrete roads and buildings. Now, with the increasing threats and environmental disasters on Polish rivers, we are facing the harsh consequences of these actions. The role of rivers in the economy, especially in terms of their economic impact, is currently under intense discussion. It is worth taking a closer look at studies such as the Water City INDEX, which evaluates the activities of local authorities in the field of water management and promotes a sustainable development approach. Through such rankings, we can learn what practices are effective and ecologically sound, and what steps can help protect our rivers and their ecosystems. In the face of increasing ecological threats, understanding the role of rivers in the economy is increasingly important for both our future and the preservation of nature."

SEBASTIAN PYPŁACZ
EDITOR-IN-CHIEF OF "ŚLĄSKA OPINIA"

"Global, European and national warming, worsening droughts and increasingly damaging meteorological anomalies are forcing us to take rapid, well-considered action to safeguard the quantity and quality of water resources. A good example of this is the work of EU institutions such as the European Economic and Social Committee (EESC), which has started to work on a comprehensive regulation of water management in the European Union. These proposals - in the form of a series of opinions - are expected to be developed and presented as early as October 2023. This is expected to coincide with the announcement by the EESC of an initiative to establish a Blue Deal in the European Union to complement the Green Deal already being implemented. This initiative will in turn lead to a call for the European Commission to make water conservation a priority for action at the European level. The aim of these actions is to ensure access to water for the inhabitants of the EU Member States and to shape a favorable water geopolitics, with a particular focus on the protection of clean and sufficient water resources, as well as to accelerate work on access to water worldwide. Another strategic objective of the future Blue Deal is to ensure sustainable water management and, in particular, to reduce water consumption and improve water and wastewater management by households, public administrations, agriculture and industry, especially water-intensive industries. The EESC has also proposed the development of a so-called Blue Economy for the Union."

In the context of these and many other important activities, it is particularly important to have a good overview and a clear focus in order to ensure the effectiveness of actions. In this respect, the successive editions of the Water City 2023 Index, i.e. the water efficiency ranking of Polish cities, play a key role, the value of which cannot be overestimated. Therefore, I encourage you to familiarize yourself with this valuable publication."

ROBERT GORCZYŃSKI
EDITOR LEADING THE MONTHLY "WODOCIĄGI-KANALIZACJA"

The Water City Index (WCI) is one of the annual studies through which it is possible to track the implementation of water policy in our country, including in the case of Polish cities. The WCI2023 is a comparative tool that can be used to discuss water efficiency. The WCI is a quantitative ranking that is as objective as possible. This ensures that urban water policies are evaluated in a professional manner. The monthly magazine "Water Management" has again taken the study under its media patronage."

MATEUSZ BALCEROWICZ
DEPUTY EDITOR-IN-CHIEF OF "GOSPODARKA WODNA"

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