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Tools for strategic planning and management of urban water

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The concepts of sustainable development, including integrated water resource management have been incorporated into European Union directives, national laws and programmes, and are being successively transposed into regional plans and strategies. Unfortunately, this is not always reflected in cities' and communes' local activities and development strategies. In communes, spatial and environmental resource management lies within the competence of local governments (of communes/cities) which are not eager to set the objectives of integrated water management among their development priorities. There is also a lack of effective legal and planning tools for their execution. Yet it is precisely these decisions made at the local level, in rural and urban communes, that are essential for the achievement of the strategic goals laid out in superior documents.

In this chapter we highlight the most significant strategic goals and documents associated with water management, green infrastructure and sustainable development at the European and national level, and present the challenges associated with their implementation at the local (urban) level. We use the example of the "Integrated Development Strategy for Lodz 2020+" to show how the available local strategic management tools can be used to reinforce the role of water in the city through integrated actions.

Keywords: strategic planning, integrated planning, urbanism, climate change adaptation

Introduction

Ever since Poland joined the European Union (EU), Polish legislation has been undergoing continuous transformation to adapt to EU regulations. Two directives are crucial for water management: the Water Framework Directive and the Floods Directive, both of which place emphasis on integrated water resource management. The primary objective of water management in Poland, as stipulated in the Draft National Water Policy 2030 is: “to ensure common access to clean and healthy water and significantly reduce the threats caused by flooding and drought alongside maintaining water bodies and the associated ecosystems in good condition, meeting justified water-related economic needs, improving territorial cohesion and aiming to level regional disproportions”.

These objectives are also in line with the broader context of Polish and EU development strategies as well as the concepts of sustainable development, green economy and environmental protection.

The increased coherence of activities at the national and regional (voivodeship) levels with the broader European policy as well as the clarity of long-term goals based on the principles of sustainability are the unquestionable advantages of interdisciplinary integration and legal transformation. On the other hand, the European, national (programme-based) and regional legal and strategic tools lay the foundation for the use of local tools for the needs of particular activities in communes and cities. Superior guidelines point straightforwardly to the goals that are to be achieved and even the detailed activities to be carried out by communes. Strategic goals may be achieved on various levels, such as the financial/legal level through the introduction of economic motivation. This would mean fees for the use of environmental resources and penalties for environmental pollution, as well as financing for local retention systems.¹ However, spatial management-

related decisions as stipulated by the principal planning documents are equally important (studies of determinants and directions of spatial development, local spatial management plans; cf. next chapter on the role of urban planning and architecture in water management) since the effectiveness of urban water management depends not only on the capacity of water and sewage or anti-flood infrastructure, but above all on the degree of surface sealing and the possibilities of on-site stormwater management.

Communes and cities enjoy vast freedom in establishing their own strategic programmes to form the basis of effective actions within their boundaries. Unfortunately, the socio-economic objectives of local strategies are typically formulated in isolation from the benefits of managing the natural potential of

Communes and cities enjoy vast freedom in establishing their own strategic programmes. These should include not only socio-economic objectives but also environmental ones.

ecosystems. Water management also tends to be incorporated only to a limited extent to meet the water-related needs of residents and the economy, and to protect from flooding. Strategies and local programmes which take into consideration the need for local

retention in urban catchments or the renaturalization of rivers and valley biocenoses to improve water quality are rare. Therefore, the planning and coordination of activities designed for the effective use of ecosystem services and blue-green infrastructure in urban space is very complex, all the more so because transforming social awareness takes much longer than the amendment of legal acts.

European, national and regional tools

The strategic context of sustainable development

The principal document that defines the development priorities for EU member states is the Europe 2020 strategy.² This strategy is based on the priorities

¹ For example, the municipal authorities of Krakow allocated 1 million PLN in 2014 for the construction and installation of stormwater retention reservoirs as part of the “Small retention program for Krakow”. Cf. chapter on financial mechanisms: Burszta-Adamiak in this volume.

² Europe 2020: A European Strategy for Smart, Sustainable, and Inclusive Growth, Communication from the Commission COM(2010) 2020, Brussels 2010.

of smart, sustainable and socially inclusive growth and provides for the long-term challenges of globalization, population ageing and the need for rational use of resources. Europe 2020 highlights sustainable development and green development among the key areas for innovation, the establishment of new enterprises and strengthening Europe's leading role in the world. The purpose of this declaration was not only to promote sparing use of natural resources but also knowledge-based, low-carbon economies with environmentally-friendly technology, where new, green work places are created and social cohesion is maintained. Blue and green infrastructures are examples of such low-carbon and resource-sparing activities. Apart from being environmentally-friendly, blue-green infrastructure also helps reverse the effects of environmental degradation to a certain degree, by helping to improve the use of the existing natural resources and the natural system's ability to provide ecosystem services. This in turn translates directly into economic and social benefits.

The Polish government used the time frame outlined in Europe 2020 to determine the framework for national actions and establish medium and long-term visions and development guidelines for Poland by 2020³ and 2030.⁴ The priorities laid out in the National Development Strategy include rational resource management, improving environmental conditions and adapting to climate change. The action planned for the years 2012–2015 aimed at “introducing an integrated system of natural resource protection and management based on comprehensive inventory records and the integration of this system with spatial management plans” appears especially promising in the context of blue-green infrastructure

The National Development Strategy highlights the importance of green infrastructure in shaping user-friendly public space, and the need to establish sustainable development standards for urban areas.

implementation. This document highlights the importance of green infrastructure (particularly in urban areas) in shaping user-friendly public space, the need to establish sustainable development standards for urban areas and the need for a new approach towards environmental protection in cities.

Water resource management

The fundamental objectives of water management in Poland result from the provisions of the Water Framework Directive and the Floods Directive and have been included in subsequent amendments of Water Law,⁵ the Draft National Water Management Strategy 2030⁶ and Water Policy 2030. These objectives have also been reflected in major water management-related planning documents (cf. table

1 in the next chapter), such as: the National Water and Environmental Programme, water management plans for river basins, flood risk management plans and drought impact prevention plans for river basins, as well as the conditions for the use of waters in

a water region and, where appropriate, conditions for the use of waters in drainage basins (figure 1).

The Water Framework Directive sets the framework, objectives and actions for EU water policy.⁷ The main goal with regard to water management in Poland is to achieve a good condition of surface and underground waters by 2015. This goal is being attained through water management plans in drainage basins and supplementary Master plans for the Vistula and Oder river basins, as well as the National Water and Environmental Programme.⁸

The condition of waters may be improved e.g. by protecting aquatic ecosystems and preventing their further deterioration as well as limiting the amount

³ National Development Strategy 2020: Active Society, Competitive Economy, Efficient State, Ministry of Regional Development, Warsaw 2012.

⁴ Long-term National Development Strategy Poland 2030: Third Wave of Modernity, Ministry of Administration and Digitization, Warsaw 2013.

⁵ Act of 18 July 2001 Prawo wodne [Water Act] (Journal of Laws of 2001 no. 115, item 1229, as amended).

⁶ Water Management Strategy. Draft amendment. KZGW (National Water Management Authority), Warsaw 2006.

⁷ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy (the so-called Water Framework Directive, WFD).

⁸ The National Water and Environmental Programme also includes the requirements of other directives, such as the Nitrates Directive, the Urban Waste Water Treatment Directive and the National Programme for Municipal Waste Water Treatment).

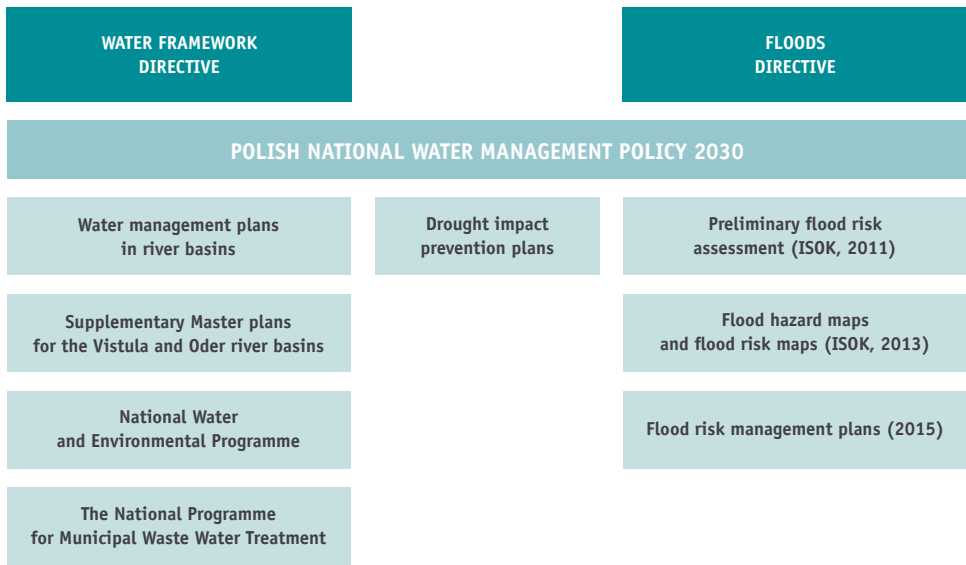


Figure 1. Major strategic documents for the execution of water management goals in Poland

of pollution introduced into waters. However, the achievement of this goal remains a great challenge, partly due to the need to integrate activities in many other fields. The Urban Waste Water Treatment Directive⁹ places the duty on member countries to equip all urban agglomerations with systems and installations to collect and convey urban waste water to treatment plants, and to meet specific requirements as to the quality of the treated waste water. The undertakings to be carried out with regard to the construction, expansion or modernization of urban waste water treatment plants and combined sewer systems by the end of 2015 have been laid out in the National Programme for Municipal Waste Water Treatment, a tool designed to help meet treaty requirements. In doing so, communes may benefit from EU funding (Infrastructure and Environment Operational Programme, regional operational programmes and Rural Development Operational Programme), national funds (National Fund for Environmental Protection and Water Management as well as voivodeship, or regional,

funds for environmental protection and water management) and other sources of funding. Unfortunately, there is a flip side to equipping urban areas with combined sewer systems: not only are investors not being motivated to introduce green solutions, but on the contrary, they are forced to direct stormwater into the sewer system,¹⁰ further overloading the existing networks.

Effective activities aimed at improving the ecological condition of waters (including those in urbanized areas) go far beyond waste water treatment. According to the Water Framework Directive, not only physicochemical elements but also morphological and biological elements are responsible for the good ecological condition of waters. These latter elements can benefit significantly from reducing extreme water flow in rivers fed by stormwater from cities, and limiting incoming pollution. This may be achieved in urban catchments e.g. through the use of the best practices in on-site stormwater management presented in this guidebook. There are many opportunities at the local level to imple-

⁹ Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment.

¹⁰ In accordance with article 28, section 5 of the Ordinance from the Minister of Infrastructure on the appropriate technical conditions for buildings and their location (Journal of Laws of 2002 no. 75, item 690, as amended)

ment these types of solutions. However, a shift in the approach towards urban water management is essential. Stormwater must begin to be viewed as a resource, and technical solutions integrated with blue-green infrastructure and innovative solutions as those described in this guidebook must be applied (cf. next chapter and chapter on technical tools: Wagner and Krauze in this volume).

Polish legislation lacks unequivocal provisions in support of local stormwater management practices (Łomotowski 2008; Kundzewicz 2014). These practices are currently regulated by two legal acts;¹¹ however, the ecological fundamentals of blue-green infrastructure or ensuring their connection in the city are not the subject of legislation at all. The Water Act and the Environmental Protection Act¹² cover retention programmes in drainage basins but fail to include activities at the local level, especially in cities whose connection with the drainage basin is being marginalized. These legal acts also make reference to the protection of species and habitat diversity yet do not apply to highly modified landscapes with few protected species but enormous demand for ecosystem services (i.e. cities). These objectives may be supported through the use of mechanisms such as recommendations in local spatial management plans and decisions on the conditions for land use¹³ as well as through public education and raising awareness, with the ultimate goal being the reassessment of the priorities in urban spatial planning.

Flood risk management

The Floods Directive¹⁴ brought about a radical shift in the perception of flood safety and the associated tasks. The strategic goal is no longer to protect from flooding and ensure full safety but to reduce and manage flood risk. This is achieved through better

integration with spatial planning (Januchta-Szostak 2012), e.g.: increasing the space available for rivers (controlled flooding), more effective water retention, and activities aimed at sustainable management of drainage basins (including urban catchments). These goals are also highlighted in Poland's strategic document, the National Environmental Policy¹⁵ which stresses the need to increase water retention and restore the adequate role of spatial planning.

The principal tool for the execution of the goals identified by the Floods Directive, are flood risk management plans that ought to be established by 22 December 2015 in accordance with the provisions of the Directive. However, it is flood hazard maps and flood risk maps, available since the end of December 2013, that are key for spatial planning and water management in cities. The information conveyed by these maps allows the management of river valleys and riverside urban areas to be adjusted to the threat level and to minimize potential flood damage (the proposed planning guidelines in this regard are presented in the next chapter). These documents are taken into consideration when establishing spatial management plans for voivodeships, studies of determinants and directions of spatial development for communes, local spatial management plans and in decision-making on the location of public investments or on the conditions for land use.

Urban floods and short-term inundations (not included in flood risk management plans) as well as the phenomena of urban drought and urban heat islands are a particular type of water-related threat, typical for the urban environment and increasingly common as climate change progresses. If these threats are to be minimized, the environment of urban catchments must be shaped in a responsible way and green infrastructure used.

¹¹ Ordinance of the Minister of the Environment of 24 July 2006 on the conditions for discharging waste water into water or soil and on substances particularly hazardous to the aquatic environment (Journal of Laws of 2006 no. 137, item 984, as amended) and Ordinance of the Minister of Infrastructure of 12 April 2002 on the appropriate technical conditions for buildings and their location (Journal of Laws of 2002 no. 75, item 690).

¹² Prawo ochrony środowiska [Environmental Protection Act] (Journal of Laws of 2001 no. 62, item 627, as amended).

¹³ Planning tools and guidance are discussed in more detail in the next chapter.

¹⁴ Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

¹⁵ The National Environmental Policy for 2009–2012 and Its 2016 Outlook. Ministry of the Environment, 2008.

The environment and green infrastructure

In 2013, the European Commission introduced a document entitled “Green Infrastructure: Enhancing Europe’s Natural Capital”¹⁶ in response to the European Union’s Biodiversity Strategy to 2020,¹⁷ where the Commission’s duty to develop a strategy to protect green infrastructure was established. In this document, the European Commission emphasizes the issues of insufficient protection of natural capital and underestimation of the value of ecosystem services. It also highlights the key role of natural capital in emerging from crisis, improving competitiveness and shaping new development areas for the EU. It also puts forward a proposal to recognize natural capital as the backbone of regional development strategies and job creation.

There are two directives that are inseparably linked with the implementation of the green infrastructure concept (especially in the context of water resources): the Habitats Directive¹⁸ and Birds Directive¹⁹ which set forth the objectives for the protection of aquatic and water-dependent ecosystems. Changes in urban drainage basin management (increased volume and speed of surface runoff) lead to changes in the tidal regime, which in turn alters the course of ecological processes and causes the physical structure and species composition to fade, eventually leading to the degradation of aquatic ecosystems. The provisions of the Ramsar Convention²⁰ and the European Landscape Convention²¹ grant protection as well. In Poland, the Environmental Protection Act and Nature

Conservation Act²² are the primary pieces of legislation in this regard.

Adapting to climate change

The management of underground and biological resources, the protection of these, and activities aimed at maintaining and restoring healthy, efficient ecosystems allow socio-economic systems to adapt to climate change and help prevent disasters. The need to establish and implement political strategies in this field was expressed in EU’s “White Paper — Adapting to climate change: towards a European framework for action”.²³ This paper highlights the fact that the use of nature for climate change mitigation and control in both urban and rural areas may provide a more effective method of adaptation than depending only on man-made infrastructure.

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In Poland, the “Strategic Adaptation Plan for Sectors and Areas Sensitive to Climate Change up to 2020 with a Perspective to 2030”²⁴ fits into the adaptive activities resulting from EU’s strategy. This document deals with the aspects of protecting biodiversity and adjusting the sectors of water management, spatial management and construction to climate change. Urban areas are among the main focal points of activities.

Planning urban development

The intensification of urbanization processes in Europe on the one hand and the challenges of sustainable development on the other, urged changes in the approach towards spatial planning and urban management. The New Charter of Athens²⁵ adopted

¹⁶ Green Infrastructure: Enhancing Europe’s Natural Capital, Communication from the Commission COM(2013) 249 final, Brussels 2013.

¹⁷ An EU Biodiversity Strategy to 2020, COM(2011) 244 final, Brussels 2011.

¹⁸ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

¹⁹ Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds.

²⁰ Convention on Wetlands of International Importance, especially as Waterfowl Habitat signed on February 2, 1971 in Ramsar, ratified in 1978.

²¹ European Landscape Convention adopted in Florence on October 20, 2000 (Official Journal of 2006 no. 14, item 98).

²² Nature Conservation Act (Journal of Laws 2004 no. 92, item 880, as amended).

²³ White Paper – Adapting to climate change: towards a European framework for action, COM(2009) 147, Brussels 2009.

²⁴ The Strategic Adaptation Plan for Sectors and Areas Sensitive to Climate Change up to 2020. Covering a Perspective to 2030 (SAP 2020), Ministry of the Environment, Warsaw 2013.

in 1998 by the European Council of Town Planners during a congress in Athens, later amended in 2003, laid out the current challenges associated with urban planning as well as the main priorities for urban planning in the 21st century.²⁶ One of the principal recommendations of the Charter with regard to shaping the urban environment was to perceive the city as an ecological system where the consumption of non-renewable resources and waste production ought to be reduced. "Perhaps the major issue in the 21st century will be the wise use of resources, especially natural, non-renewable ones, and primarily space, air and water. [...] Rivers, torrents, and floodplains will be used, via catchment zone management, to mitigate the effects of floods and other extreme weather phenomena caused by climate change and poor engineering. Forests and green areas in and around the city will be increased, so that they are able to play a major role in improving air quality and stabilising temperatures." The authors and signatories of the New Charter of Athens highlight the importance of ecosystems and the need to ensure biodiversity in urban areas. On the other hand, strong emphasis is also placed on shaping public space and on the identity, coherence and attractiveness of the urban landscape. Another document where these priorities are emphasized is the Leipzig Charter;²⁷ here the recommendations include ensuring high-quality public space, improving the quality of life in the city and of public municipal services e.g. through energy efficiency and the sparing and efficient use of natural resources.

By comparison, the Baltimore Charter holds key importance for the integration of water management with spatial planning in the USA. This was a commitment to develop new, decentralized water systems that mimic natural cycles. The goal is to

protect public health and safety and to regenerate the natural and anthropogenic landscapes based on the following principles: on-site and neighbourhood water management, the use of green infrastructure, restoration of urban drainage basin functions, creation of green cities and smart growth. Some American cities, e.g. San Francisco, Chicago and Portland boast exceptional accomplishments in the field of integrated water management in association with spatial planning, landscape architecture, and the design of transport and sewage infrastructure.

Europe's "Thematic Strategy on the Urban Environment" directly addresses urban areas and aims to improve the quality of the urban environment and make cities attractive and healthy places to live, work and invest, as well as to reduce cities' negative impact

Revitalization and regeneration of brownfields is preferred over the use of greenfields. New urban planning standards are necessary to limit the loss of biologically active areas.

on the natural environment through interdisciplinary cooperation. One of the proposed means of achieving this goal is the establishment of guidelines for integrating environmental issues with urban policy. These should be based on good practices and expert opinions, and lead to better planning and preventing discrepancies between the applied solutions.

Poland's National Strategy of Regional Development 2010–2020²⁸ is dedicated to the above issues. The strategy is based on the assumption that urbanization should not distort the rational proportions between biologically active and built areas. The protection and rational use of natural resources, and adaptation to climate change were included among the 11 strategic areas. The importance of urban natural enclaves is also highlighted in the National Spatial Development Concept 2030. Here, preference is given to regeneration over the development of new areas as well as to new architecture/construction standards that reduce the

²⁵ New Charter of Athens 2003: The European Council of Town Planners' Vision for Cities in the 21st century, European Council of Town Planners, Lisbon 2003.

²⁶ In principle, the New Charter of Athens modified the assumptions of the Athens Charter of the CIAM of 1933 by shifting from the idea of „functional city” to „sustainable city”.

²⁷ Leipzig Charter on Sustainable European Cities of 27 April 2007, adopted during a meeting of Member States' Ministers responsible for Urban Development in Leipzig, 24–25 May 2007.

²⁸ National Strategy of Regional Development 2010–2020: Regions, Cities, Rural Areas, Ministry of Regional Development, Warsaw 2010.

loss of biologically active areas. A National Urban Policy is being established by the Ministry of Infrastructure and Development based on these two documents. The policy will include: the need for integrated planning of functional urban areas to improve water and air quality; adaptation to climate change; improving the quality of the urban environment; and sustainable management of stormwater and of the natural system of a city.

Local tools

The integration of superior guidelines in local activities

European, national and regional sustainable development goals are implemented at the local level in individual communes which are responsible for the management of natural resources. The fundamental legal document that determines the tasks and duties of communes, such as those related to water and environmental management, is the Act on Local Self-Government.²⁹ While following superior guidelines, town authorities enjoy a relatively high degree of autonomy in the design of programmes and strategies for urban development and the creation of cities' quality and individuality. At the same time, however, local governments are under pressure from voters which means that the goals and directions for action are oriented primarily at meeting the most urgent socio-economic needs and ensuring quickly visible effects for improved quality of life. When designing a strategy it is difficult to predict the consequences that the decisions made in accordance with its priorities will have for water management and the environment, as the effects will only be observed in the long run. Environmental impact assessment tools are still being used all too rarely to aid in strategic planning and urban space management.

From the point of view of long-term and integrated urban water management, the ample freedom

to act makes room for the conscious inclusion of water-related aspects in the development of all urban sectors (such as transportation, construction, spatial planning, municipal services, education, sports or health). This ensures coherent actions and multidimensional benefits. Due to the fact that cities formulate and execute strategic tasks on their own, local governments are able to include the specificity of a city and region, including physiological determinants such as climate, landform, water relations, valuable ecosystems and fauna and flora species, as well as the most essential natural areas that are indispensable if urban residents are to be provided with high-quality ecosystem services (cf. next chapter). This is crucial since the same superior guidelines e.g. concerning blue-green infrastructure will be implemented differently in cities in sub-mountainous areas, where surface runoff is significant due to strongly inclined slopes than in lowland cities or those located near large rivers. This individual approach to the implementation of superior strategies allows for cities to be incorporated in the natural system of a region which is of utmost importance for the proper functioning of urban natural systems. An integrated and individualized approach may bring about local decisions to protect these areas; build the city inwards (compact

From the point of view of long-term and integrated urban water management, there is a need for the conscious inclusion of water-related aspects in the development of all urban sectors.

cities) and further condense invested areas (e.g. by way of revitalization or concentration of urbanized zones within the city centre), and to prevent urban sprawl. However, development must be compensated by

increasing the biologically active surface area in the condensed urban areas to ensure high quality of life. Biologically active areas create friendly, healthy and more attractive space – a goal that may be achieved by including green infrastructure at an early planning stage. Integrated actions to support water retention (cf. chapter on technical solutions: Wagner and Krauze in this volume) aid in the proper functioning of green infrastructure. Investing in city centres rather than the costly development of distant locations benefits all residents in the long

²⁹ Act of 8 March 1990 on Local Self-Government (Journal of Laws 1990 no. 16, item 95).

run by preventing urban sprawl, reducing the cities' operating costs, improving the quality of life and preserving suburban public recreation areas.

Strategic planning and water management tools established at the local level

Municipal authorities have at their disposal a wide range of local tools to support the above goals, including: environmental protection programmes, studies of determinants and directions of spatial development, local spatial management plans, river management plans, small retention programmes and projects, sectoral policies regarding water and natural resources as well as other visions and development strategies for cities. Some of these are not required by law (cf. table 1 in the next chapter) but may be very helpful tools in the implementation of specific activities. For example, small retention programmes may be a useful tool for the analysis of the hydraulic effects of spatial management, evening out the flow in urban aquifers or improving the retention capacity of urban catchments.

The environmental protection programme is a document that consolidates all actions at the commune level and its establishment may be viewed as an opportunity to introduce a coherent and efficient management system. Bearing in mind the strong ecohydrological links between the water cycle of a city and the functioning of its natural system, both the diagnosis and analysis of needs as well as the environmental protection programme itself create the perfect basis for the inclusion of urban water management goals as an important element of urban development.

The study of determinants and directions of spatial development may be a particularly potent tool to support sustainable stormwater management and green infrastructure in cities (Januchta-Szostak 2012; cf. also next chapter in this volume). It allows for example to exclude from construction green areas that are valuable for stormwater retention and infiltration; to protect water ecosystems together with their buffer zones from being built

up; to ensure spatial links between blue and green infrastructure; to indicate areas to be built up and/or determine the principles of development (e.g. the proportion of biologically active areas, the need for water retention or limits for the use of impervious surfaces) (cf. chapter on technical solutions: Wagner and Krauze in this volume). The principles established in the study regarding the protection of the environment and its resources as well as nature and the cultural landscape, particularly the guidelines concerning their determination in local management plans,³⁰ make it possible to harness the potential of blue-green infrastructure and ecosystem services.

The development strategy of a commune may be one of the fundamental documents determining the directions for development, including water resources. A properly and meticulously prepared strategy allows for a coherent vision of a modern, functional and friendly city to be implemented, while at the same time being a convenient planning tool for financing and monitoring progress in the implementation of integrated solutions. Water ecosystems, especially large rivers, are often crucial elements of such strategies. Some cities in Poland (e.g. Bydgoszcz, Tczew, Warsaw, Poznan) have adopted strategies and programmes aimed at

Development must be compensated by increasing the biologically active surface area in the condensed urban areas to ensure high quality of life.

“returning to rivers”. However, these programmes are aimed primarily at: improving the quality of waterfronts; tourism and economic activation of coastal areas; improving flood

protection, and rarely include e.g. the restitution of valley biocenoses or activities covering entire drainage basins that could help slow down and improve the quality of surface runoff from urban areas, thereby improving the quality of water and reducing flood risk. The wording in local strategies is another challenge since different communes have different priorities. Many cities grapple with urban floods and short-term inundations caused by excessive surface sealing in the city itself or too quick runoff from neighbouring communes. Effective water management requires the inclusion of hydraulic data

³⁰ Prawo ochrony środowiska [Environmental Protection Act] (Journal of Laws of 2001 no. 62, item 627, as amended), article 72.

from catchment areas which do not coincide with the administrative borders of communes (cf. next chapter in this volume). This requires cooperation between communes as well as the coordination of the objectives of strategies for various sectors.

Summary

The objectives of water management-related activities are strictly defined in European and Polish policies. However, when it comes to the implementation of these, local authorities are free to establish their own mechanisms for integration with the development strategy of cities, using the local strategic tools described in this article. The fact that objectives and priorities that incorporate sustainable water management are stipulated in strategic documents is only half of the success equation. The achievement of these goals requires the integration of actions in the social, economic and spatial domains as well as the adoption of a catchment-based approach to urban

water management and planning (cf. chapter on integrated management: Krauze and Wagner in this volume). This means including the ecohydrological effects of decisions concerning economic and spatial issues not only at the city level but also in surrounding communes located in the same drainage basin. Water management-related goals may be achieved faster and at lower cost when ecosystem-based water management methods and ecosystem services are put to use. In practice, this means incorporating integrated solutions in all activities in the urban space so that blue-green infrastructure, best practices in stormwater management and ecohydrological solutions are employed. On the other hand, making use of the social and landscape values of water and greenery (the subject of the next chapter) may help achieve other strategic goals associated e.g. with improving a city's image, the attractiveness of public space or resident integration. A holistic approach is necessary not only when strategies are developed but also to allow their content to be consistently transposed into the design and implementation stages.

Effective water management requires cooperation between communes as well as the coordination of the objectives of strategies for various sectors.

Case study:

water in the urban space of Lodz: example of a strategic approach

The city of Lodz is characterized by very limited natural water resources, land with significant slopes (for a city in central Poland) and poor retention capacity. The fundamental reason for this is the city's location in the primary watershed between the Vistula and Oder rivers, coupled with a large proportion of impervious surfaces and limited groundwater retention capacity. Eighteen small, radially arranged streams with limited retention capacity collect stormwater from an area of over 290 km². The result is the nearly complete loss of water from the city while excess water causes temporary inundations in Lodz and the downstream areas of its catchments.

One of the ways to improve urban water management is to increase the number of aquifer-based retention reservoirs. Some of these are being restored in their previous locations where they were damaged, filled or covered with vegetation. Some are being designed and created from scratch. The integration of all related actions became the basis for the "Annex to the assumptions of the general river project: reservoirs" prepared in 1999 and used by the City of Lodz's Department of Municipal Services to establish a small retention programme for Lodz in 2001. This programme is being implemented via projects that include not only rivers but also their valleys, drainage basins and local communities.

The Sokolowka river drainage basin (figure 2) is a good example of integrated efforts. The investment was based on a General Project established in 2003 that adopted an overall view of the drainage basin. The General Project served two main purposes: to assess the drainage basin's potential (e.g. the possible sites for reservoirs and areas of natural value) and indicate the tasks necessary for the achievement of the assumed goals (i.e. improved water quality, increased retention capacity of the river, increased biodiversity, improved living conditions for residents). The planned undertakings included environmental, landscape, engineering and social features. As part of the implementation process, reservoir retention was restored, a water

pre-treatment system was constructed (cf. chapter on technical solutions: Wagner and Krauze in this volume) and a technical project of river rehabilitation was developed which is currently awaiting implementation. A number of activities that improve (albeit indirectly) the quality of water and residents' quality of life were also carried out, such as a new, covered riverbed that effectively eliminated illegal dumps of sanitary waste. Furthermore, properties were connected to the newly completed sanitary sewage network (which eliminated cesspits) and local roads were equipped with drainage systems. The total cost of activities carried out in the years 2004–2012 in the upper Sokolowka drainage basin exceeded 26 million PLN: over 18 million PLN in rearranging the water and sewage management system and about 8 million PLN in the execution of investments in rivers. The innovative investments carried out in the Sokolowka drainage basin employ a number of ecohydrological solutions designed to improve the quality of water that feeds rivers and reservoirs. Similar solutions are currently being applied in other rivers of Lodz (cf. case study on reservoirs in Arturowek in the chapter on technical tools: Wagner and Krauze in this volume).

Still, extreme flows continue to hamper the functioning of overfilled rivers in Lodz and more advanced solutions that will enhance the stormwater retention potential of the city's natural system are needed. One of the goals of the Blue-Green Network concept described in the previous guidebook in this series (Zalewski et al. 2012; Wagner et al. 2013) was to enhance water retention in the landscape, bringing about a host of associated benefits for the city. This concept was included in the study of determinants and directions for spatial development for the City of Lodz in 2010 and in the Integrated Development Strategy for Lodz 2020+ established by the City of Lodz Office in 2012 (UMŁ 2012). The Strategy has 3 main pillars:

- pillar 1: economy and infrastructure;
- pillar 2: society and culture;
- pillar 3: space and the environment.

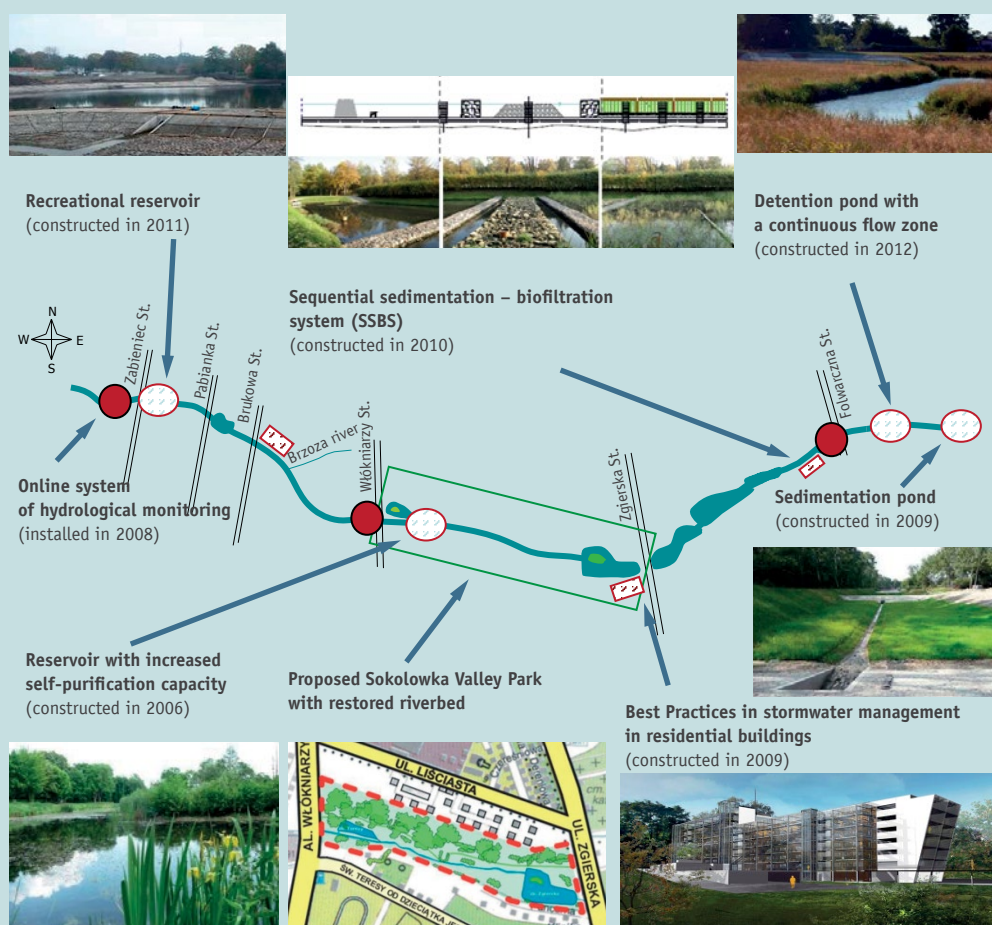


Figure 2. Construction of retention reservoirs on the Sokolowka river carried out during the last 10 years by the City of Lodz in the Sokolowka drainage basin as part of a small retention programme for Lodz. Some works were performed as a result of cooperation between city authorities and researchers within the framework of EU projects (SWITCH and POIG)³¹ (Wagner and Zalewski 2009)

The Blue-Green Network concept became one of the constituents of the third pillar. The goal of this pillar is to “improve Lodz residents’ quality of life and increase the attractiveness of the City by using the potential of the natural environment, maintaining and arranging biologically active and recreational areas, and building a healthy lifestyle”. According to the provisions of the Strategy, this goal is achieved through integrated actions such as:

- the skilful use of ecosystem services and nature’s potential to provide a stable base for further sustainable development of Lodz as a compact city;
- improving the quality of the natural environment, sustainable development, the creation of a centre with urban and spatial order to reduce the spread of the urban fabric;

³¹ SWITCH (FP6 EU, GOCE 018530); POIG.01.01.02-10-106/09-04 “Innovative resources and effective methods of safety improvement and durability of buildings and transport infrastructure in the sustainable development” (financed from the European Regional Development Fund as part of the Innovative Economy Operational Programme).

- minimizing negative environmental impacts through spatial, health, residential, educational and transport policy, economic and promotional activity, and the public procurement system;
- using the opportunities to create a Blue-Green Network integrated in a single, functional, readily accessible, well-connected and coherent network of urban and metropolitan green areas.

Since 2013, the City of Lodz Office has been implementing a comprehensive strategic management system comprising of sectoral policies. These policies set development guidelines for particular areas of urban activity and translate the main Strategy into specific activities. Sectoral policies are time-correlated with the Strategy and allow for the costs of executing specific goals to

be estimated as well as to identify, monitor and evaluate the results. The management of water and the natural environment have been included in the Municipal Management and Environmental Protection Policy adopted in 2013. It assumes the protection and integrated management of the city's natural capital which is deemed indispensable to ensure high quality of life, and highlights the fact that ecosystems require proper maintenance and often revitalization in order to provide services. The document lists the promotion, initiation and implementation of all activities aimed at drainage basin de-sealing and increasing on-site stormwater retention as the priorities of rainwater management. The construction of retention reservoirs is also crucial as these help eliminate the effects of excess rainwater.

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