112. Jahrgang · ISSN 0043 0978 · www.springerprofessional.de

Springer Vieweg

WasserWirtschaft

Extra

S1
2022

World Canals Conference 2022

Reshaping Landscapes – Waterways in Transition

Get a Grip on Success

For those who want to reach new heights, only the best will do. With **adhesion**, the international trade magazine for industrial adhesives and sealing technology, you will benefit from valuable insider knowledge, practical information and the latest trends and technologies. Get access to the industry's largest knowledge pool – essential for gaining competitive advantage. Try our comprehensive service: four issues per year available as print and digital editions, website and newsletters, now optimized for mobile devices. As a subscriber, you also gain access to our comprehensive online archive with all contributions since 2003, plus the "Adhesives Technology Compendium" - the reference book for adhesives practitioners.

For more information:
www.my-specialized-knowledge.com/adhesion

adhesion ADHESIVES + SEALANTS

Leipzig Neuseenland – an Exciting Transformation Area

© Rosenthal

Heiko Rosenthal
Mayor of the City of Leipzig

Dear Readers,
I would like to welcome you to the Leipziger Neuseenland – an exciting transformation area from a floodplain landscape to mining landscapes to tourist water destination with the city of Leipzig, currently the fastest growing city in Germany, at its heart.

The fact that the World Canals Conference has chosen this exciting area as the venue speaks for the uniqueness of this landscape construction site and the excitement of the projects still to come, be it the lock construction between Lake Zwenkau and Lake Cospuden (Harth Canal Lock), the connection of Lake Markkleeberg to the Pleiße or the connection of Lindenau Harbour to the Saale-Leipzig-Canal. The new construction of the city harbour in the centre of Leipzig, the opening of piped waterways in the city (e.g. the Elstermühlgraben or the Pleißemühlgraben) and the restoration of old watercourses in the Leipziger Aue are not without reason the cause of the nickname "water city".

Even without the Leipziger Neuseenland, Leipzig can boast some superlatives. Leipzig has more than 457 bridges and footbridges, the Leipzig alluvial forest covers an area of 2,100 ha, 240 km of waterways flow through the city, 104 ponds with a total area of 459 ha are located in the city and 300 hydraulic structures – from locks to weirs – are maintained.

And yet the path to becoming a tourist water destination was not preordained. In the Central German Lignite Mining District, lignite has been mined and utilised industrially since the 19th century. In 1985, 30 percent of the world's lignite production came from the German Democratic Republic (GDR). The mining of lignite massively changed the landscape and the natural environment. The autumn of '89 then changed the perspectives and possibilities overnight and led to rapid closures and the need to develop common visions of the future. Many people got involved and much has been achieved. The pride in what has been achieved bears the personal cut.

The industrial development of the 19th century did not stop at waterways. The industrial pioneer Karl Heine developed the idea of giving Leipzig access to the European waterway network by building an artificial waterway up to the Saale-Leipzig Canal. In 1856, construction began in Plagwitz on a navigable canal connecting the Weiße Elster and the Saale. In the end, the ruins of the locks in Wüsteneutzsch bear witness to this partially realised vision and at the same time provide an incentive to think about the future with today's possibilities of hydraulic engineering. The saying "From the Elster to the Alster" has already moved many things.

We welcome people from all over the world to the WCC. There will be exciting lectures, excursions and wonderful encounters. Discover this space steeped in history and be our guest!

© Philip Kirschner

Cover picture: The former Leipziger Buntgarnwerke

© Erik Eckstein, 2021

© Schiessel Harvey

Ausgabe S1 | 2022

3 **Commentary |** Leipzig Neuseenland – an Exciting Transformation Area
Heiko Rosenthal

Practice

8 **Water Bodies |** Water Tourism and Nature Conservation – Conflicts, Methods and Modern Solution Approaches

The Leipziger Neuseenland has developed to a recreational landscape characterized by water. On the initiative and under the leadership of the Grüner Ring Leipzig, a Water Tourism Concept has been developed. The aim is to develope, guide and control the water tourism in the region.
Klaus Müller-Pfannenstiel and Jens Kipping

12 **Water Bodies |** Lower Havelniederung – Most Significant River Restoration Project in Europe
Rocco Buchta

14 **Water Bodies |** The Overall Strategy for the Elbe – Jointly for a Living and Economic Space with a Future
Tobias Gierra

16 **Water Bodies |** 100 Years of the San Antonio River: From Flooding to the River Walk and Now a Return to Nature
Steve Graham

18 **Water Bodies |** The Waterway Link from Leipzig – A Vision that Reinvents Itself again and again
Sabine Heymann

20 **Water Bodies |** Bata Canal – From Coal to Tourism
Tomáš Kolařík

21 **Water Management |** Climate Change in Central Germany – Recent Years as an Indicator for the Near Future?
Dominic Rumpf and Johannes Franke

22 **Water Management |** The Water Balance Portal in Saxony
Karin Kuhn

24 **Water Management |** Global Water Partnership Supports Armenia to Achieve SDG 6 Targets
Alisa Y. Savadyan

26 **Water Bodies |** Positioning Waterways in Development Decision-Making: Evidencing Values
This session identifies how and where the Inland Waterways community can focus research and evidence to influence development decisions affecting waterways. It draws on findings of a literature review on the multiple, evolving values and valuations for Inland Waterways and related public goods.
Nicki Schiessel Harvey

28 **Water Bodies |** Planning Waterways for Added Value: Joint Research by PIANC and IWI
Arjan de Heer, Nicki Schiessel Harvey and David Edwards-May

30 **Water Management |** Automatized Drought Impact Detection Using Natural Language Processing
Jan Sodoge, Mariana Madruga de Brito and Christian Kuhlicke

32 **Water Bodies |** Cascade-Dammed Rivers and Flood Phenomena – An Example of Inland Waterway in Bydgoszcz
Dawid Szatten

34 **Water Bodies |** New Life in the Old Docks and the Re-opening of the Nederschelde in the City Centre of Ghent
Rudy Van der Ween

36 **Water Bodies |** Tbilisi Sustainable Waterfront Revitalization Project
Iva Vasadze and Giorgi Maisuradze

38 **Water Management |** Implementation of Nature-Based Flood Control Measures in Brno

The project focuses on the implementation of the first two stages of comprehensive flood prevention measures. The project aims to protect the persons and property of inhabitants of the Brno Metropolitan Area and overall make the affected area more attractive.

Radim Vítek and Bibiana Janebová

40 **Water Bodies |** New Concepts for Inner City Marina's and Water Use
Rob Vrolijks

42 **Water Bodies |** 400 Years of History Continued – How We Saved Germany's Oldest Canal and What Was Learned in the Process
Hartmut Ginnow-Merkert

44 **Water Management |** Everyone Can Do Water? Qualification Needs of the Engineers and Specialists of Tomorrow
André Niemann, Jan Balmes, Rüdiger Heidebrecht and Helene Opitz

46 **Water Bodies |** Digital Skipper Assistant (DSA)
Alexander Schmid and Hanno Schellenberg

48 **Water Bodies |** Citizen Scientists Assess the Ecological Status of Small Streams in Germany
Julia von Gönner, Lilian Neuer, Anna-Katharina Klauer, Jonas Gröning, Matthias Liess and Aletta Bonn

50 **Water Bodies |** Rivers in Metropolitan Areas: Gateways to Sustainability

Multifunctional blue-green infrastructure is a major locational factor and key to the quality of life and living in an urban environment – as a contribution to adapting to climate change, promoting preventive health measures, reducing leisure-time traffic and enhancing environmental justice.

Christine Baumgärtner

52 **Water Management |** Urban Waters – Modern Water Decentered
Ina Dietzsch

54 **Water Bodies |** A Systematic Review of Quantitative Studies on the Impact of Blue Space on Urban Human Health
Niamh Smith and Sebastien Chastin

56 **Water Management |** Water Plant Management for Improved Water Quality
Bengt Verworner, Walter Stinner and Mathias Stur

58 **Water Bodies |** Nature Conservation Assessment Concept for Water Tourism Use of Opencast Lakes
Andreas Bolle and Jürgen Stamm

60 **Water Bodies |** The Bridge in Tczew Linking the Past and Modern Times
Maciej Dutkiewicz and Jakub Obszański

62 **Water Bodies |** Shipping versus Water Management – River Unstrut from History to Present

Flood control and creation of natural floodplains represent the most important measures of the flood protection concept. A preservation of near-natural sections and promotion of long-term development combined with selective protection measures is the aim of future development work in the Unstrut floodplain.

Martina Große-Sudhues and Steffen Heling

64 **Water Bodies |** Sustainable Water Supply for the Ulster Canal Restoration Phase II (Clones)
Jon Hunt, Deirdre Felloni and Ruairi O'Carroll

66 **Water Bodies |** Long-term and Sustainable Management of Artificial Water Bodies
Cordula Jäger and Ute Urban

68 **Water Bodies |** Regional Economic Effects of Water Tourism Using the Example of the WIN Region
Matthias Wedepohl

© Svratka Association (A PLUS, ŠINDLAR, Václav Čermák, Miroslav Korbička, Miloš Trenz)

©VRS/G.Stoppel

© WIN-AG / Dr. Reinhard Schliebenow, Luftbild Barnim

© Andreas Berkner

© Heribert Dreistl

70 **Water Bodies |** Developing Infrastructure for Successful Water Tourism: Best Practice from the WIN Region

The North Brandenburg Water Tourism Initiative (WIN) has been active in developing water tourism infrastructure by restoring and connecting waterways since 2004. WIN projects are realized as publicpublic partnerships of various types. Two projects are completed; construction work of three further projects begins in 2022.
Julia Pollok

72 **Water Bodies |** Water Tourism in Germany – A Child of the German Reunification
Dagmar Rockel-Kuhnle

74 **Water Bodies |** Infrastructure Challenges for Water-based Tourism in Germany
Gesa Schwoon

76 **Water Bodies |** Inland Water Tourism in Germany: Economic Potential and Effects
Karsten Stahlhut and Robert Marx

78 **Water Bodies |** The Multifunctionality of the Flemish Waterways: Information Is Key
Véronique Sterkens

79 **Water Bodies |** The New Tourist Model for the Elbląg Canal
Julia Wleklińska

80 **Water Bodies |** Reshaped Canals for a Better Urban Future: Six Key Qualities of Effective Inland Waterways
Thomas Vonier

82 **Water Bodies |** New Projects, Old Ideas: Roman Past of European Canals' Projects
Yasmina M. Benferhat

84 **Water Management |** Lignite, Structural Change, Post-mining Landscapes – An Overview for Germany and Neighbours

The lignite age in Germany will come to an end in 2038 at the latest. This leaves around 20 years to cope with the upcoming structural change. Guidelines of development for the Rhineland, Central Germany and Lusatia are traced in the form of post-mining landscapes with mining lakes and water connections.
Andreas Berkner

86 **Water Management |** The Ongoing Transformation Between Mining and Tourism Region in Ha Long Area
Katrin Brömme, Mien Tran and Harro Stolpe

88 **Water Bodies |** From Pits of Sand and Clay to Dynamic Environments for Nature, Recreation, Tourism and Culture
Sabine Denissen and Igor Geubbelmans

90 **Water Bodies |** Fluid Thinking – As a Liberation to Resilience and Climate Justice
The challenges of the climate crisis will continue to increase and water in particular plays a central role in dampening, resilience in our communities and thus in the reality of life for future generations. We urgently need a deep understanding of what bodies of water and water structures can actually do in our communities.
Herbert Dreiseitl

92 **Water Management |** Design of a Lake Landscape in the Rhenish Lignite Area due to the Earlier Closure of Lignite Mines
Michael Eyll-Vetter and Hannah Udelhoven

94 **Water Management |** A Concrete Example of Structural Change: The Thermal Use of Coal Mine Lakes
Martin-Joseph Hloucal

96 **Water Bodies |** The Redevelopment of the Karl Heine Canal from 1990 until 1996 – A Success Story up to Today

The article describes the redevelopment of the Karl Heine Canal in Leipzig from 1990 to 1996 and retraces this success story.
Erika Hoentsch

98 **Water Management |** Strategic Water Management as the Basis for a Successful Structural Change
Christin Jahns and Lars Stratmann

100 **Water Management |** Aftercare Strategies to Ensure the Water Quality of Post-Mining Lakes in the South of Leipzig
Benno Janisch and Michaela Rumpel

102 **Water Bodies |** Finow Canal 3.0 – Revitalisation of a Historic Waterway
Adolf Maria Kopp

104 **Water Bodies |** Multifunctional Use of Floodplains along Waterways within a Unesco Biosphere Reserve
Guido Puhlmann

106 **Water Bodies |** Transformation: Industrial and Landscape Change

Lignite mining was actively practiced on a large scale in the former German Democratic Republic, leaving behind rugged landscapes and contaminated soil after the reunification. LMBV (Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft) has been dealing with this legacy since the 1990s.
Dirk Sonnen

108 **Water Bodies |** Brook Restoration with Citizens – Examples of the Metropolitan Region of Hamburg
Ludwig Tent

110 **Water Bodies |** Perspectives of Historical Waterways in Times of Structural Changes
Frank Thiel

112 **Water Management |** The Role of Water and Hydric Reclamations in the Transformation of the Ústí Region
Karel Tichý

114 **Water Management |** Aquathermal Energy: Sustainable Heat Source for the Energy Transition in the Netherlands
Marco van Schaik and Henk Looijen

116 **Water Bodies |** Geomembrane Systems to Restore the Watertightness of Canals in the Dry and Underwater

Canals transport water from the source to users who are often far away, and a large amount of water is lost over their length. Canals must therefore be designed, built and maintained to assure that the maximum possible amount of water is safely conveyed to the final users at the lowest possible costs.
Gabriella Vaschetti and Vanja Verdel

118 **Water Bodies |** City Port Leipzig
Jens Betcke

120 **Water Bodies |** Scotland's Canals in 2022
Catherine Topley and Richard Millar

122 **Interview |** "Even after Disasters and Strokes of Fate, there Must be People who Give Hope", with Heidrun Meyer, mayor of the town of Seeland
Benedikt Baikousis

124 **Interview |** "The Leipzig Neuseenland Was the Largest Landscape Construction Site in Europe", with Walter Christian Steinbach, German politician and former member of the Saxon state parliament
Benedikt Baikousis

Peer review

The journal WasserWirtschaft is registered in many citation databases for scientific publications as SCOPUS, Science Citation Index Expanded (SciSearch) and International Bibliography of Periodical Literature (IBZ). A summery you will find in the imprint.

All articles from 2004 onwards are available at www.springerprofessional.de/wawi.

Service

126 Imprint

Water Tourism and Nature Conservation – Conflicts, Methods and Modern Solution Approaches

The Leipziger Neuseenland has developed to a recreational landscape characterized by water. On the initiative and under the leadership of the Grüner Ring Leipzig, a Water Tourism Concept has been developed. The aim is to develope, guide and control the water tourism in the region.

Klaus Müller-Pfannenstiel and Jens Kipping

1 Water tourism in the river network Leipziger Neuseenland

The city of Leipzig, the district of Leipzig, and the district of Northern Saxony can look back on a 150 years tradition of water tourism. The end of the mining industries made a change possible from a devastated-mining landscape to a recreational landscape characterized by water – the Leipziger Neuseenland. In the water network, the planning envisages to connect the new lakes in the post-mining landscape south of Leipzig with the city of Leipzig by the different rivers and canals and to develop the lakes and watercourses for water tourism. To organize this process, the Water Tourism Concept (Wassertouristisches Nutzungskonzept – WTNK) was developed in a complex inter-municipal and cooperative process on the initiative and under the leadership of the Grüner Ring (GRL). The focus is on muscle-powered and alternatively powered/zero-emission boats. The WTNK represents the planning for the development of water tourism in the Leipziger Neuseenland. The concept defined and coordinated the necessary measures for the water network and agreed the water tourism with the requirements of nature conservation and water ecology.

2 Nature conservation framework for water tourism

The extensive waterways in the city of Leipzig and the surrounding forests are part of the European Natura 2000 Network. A large extend of the waterways and adjacent habitats are protected either or both as SAC Leipziger Auensystem or SPA Leipziger Auwald. Both protected areas are overlapping in large parts. The huge ecosystem serves as green lung and blue veins for the city of Leipzig and provides many ecosystem services, recreational functions, and offers a potential for the urban human community as well.

In addition to the conflicting goals of water tourism and nature conservation in European protected areas of the Leipzig floodplain forests, the requirements of the strictly species conservation by the EU Habitate Directive and the EU Birds Directive also applies. Water tourism with both muscle-powered and motor boats is fundamentally subject to the prohibition on damaging or destroying the habitats of European protected animal and plant species and to the prohibition on significantly disturbing animals during their reproduction, rest, and migration periods. These prohibitions account to all European bird species, and to strictly protected dragonfly, fish, clam, and crayfish species, as well as semi-aquatic strictly protected mammals such as Eurasian Beaver (*Castor fiber*) and Common Otter (*Lutra lutra*).

Consequently, the development of the water tourism must take into account binding European regulations on species and area conservation. The WTNK is a tool to consider the European regulations and the experiences made in Leipzig enable a transfer to comparable conflicting goals in other regions or projects.

Synopsis

- Water tourism in the river network Leipziger Neuseenland.
- Nature conservation framework for water tourism: sensitive species - Impacts of boat movements and water body maintenance.
- Conflict methods and controlling of boat use by usage regulations.

3 Methods of forecasting the prospective water tourism in the Leipzig region

The methods base on a good database of a WTNK-accompanying monitoring, which includes the following components:

- Monitoring of water tourism usage every 5 years,
- Water ecological monitoring every 5 years,
- Monitoring of flora and fauna every 5 years and
- in addition, since 2014, annual intensive Monitoring of the Common Kingfisher (*Alcedo atthis*) population at the Floßgraben.

To assess the conflicting goals between water tourism and nature conservation in the course of updating the WTNK, a so-called usage prognosis for touristic boat use was carried out. As start-

Figure 1: Female Common Kingfisher (*Alcedo atthis*) from the Floßgraben breeding site with prey; the species is considered as sensitive against watertourism

ing point, counts of boat movements in 2011 and 2017 from the monitoring of water tourism were used, supplemented by counts at the locks. Thereby, boats were distinguished between muscle-powered and motor boats, as well as between commercial and general use. Based on the counts, future boat movements were predicted for the year 2030.

4 Expected environmental impacts

The increase in boat movements and water body maintenance are causing disruptions to certain aquatic and semi-aquatic animal species and habitat types.

In the course of updating the WTNK and the boat use, differentiated between muscle-powered and motor boat use, the following effects are relevant:

- Direct effects in form of land consumption of habitats through structural measures (e.g., entrance points, docks, and jetties).
- Indirect effects through touristic boat use: Disturbance and rousing of animals, as well as, noise emissions.
- Mechanical effects on the waterbed, bank structures, and animals and their stages of development (possibly killing of spawn, larvae, and hatching insects).

In addition, impairment of the water quality by boats (turbulence of suspended matter and sediments) is possible and the effects of water body maintenance on submerse, floating, and bank vegetation, as well as animals in different stages of development needs to be taken into account.

In summary, the prognosis of boat-induced interferences, which will be explained in the following, concentrates on those indirect (especially acoustic and visual disturbances) and mechanical (e.g. waves, ground contact) effects.

The focus lies on the avoidance behavior as the decisive criterion for recognizing species-specific susceptibility of interference.

5 Water tourism and sensitive species, conflict or co-existence?

There has been a long-term discussion between conservation NGOs, stakeholders and decision makers about potential conflicts between water tourism and the conservation goals of the two Natura 2000 areas. One assumption is that a possible sensitivity of some bird and mammal species against human disturbances along the waterways will lead to a worsening of their conservation status. The increasing number of Leipzig' citizens (now about 610.000) together with the improvement of touristic infrastructure and growing pressure on land and water habitats is firing this debate. From the beginning, the Leipzig administration has put much effort on monitoring potential negative impacts of water tourism on protected flora and fauna. Especially possible sensitive and threatened species were in the focus of such monitoring and surveillance. A long-term monitoring program on protected species and habitats along the WTNK-watercourses has been established already in 2006. Slightly modified, it has been conducted since then in a 5-year cycle. Results revealed a high population dynamic of some species. As part of an expert workshop involving authorities, species experts, and nature conservation associations determined species and habitats, which are sensitive to an increase in boat movements.

Mostly an increasing population of some of the focal species under strict protection as Common Otter (*Lutra lutra*), Eurasian Beaver (*Castor fiber*), Green Clubtail (*Ophiogomphus*

cecilia), or Common Kingfisher (*Alcedo atthis*) were identified as sensitive species (**Figure 1**). The latter increasing its population about 250% between 2011 and 2016 alone, but generally shows an extreme population dynamic. Those species are all water-dependent and benefitted from the improvement of water quality. With this overlaying effect, human disturbance by water tourism was a minor factor on most waterways, affecting population dynamics only little or not. Ongoing and further surveillance work will show if this remains in the future.

6 Methods and results from the prognosis on the impact of boat use on disturbance-sensitive species

The approach to assess the environmental impacts in the course of updating the WTNK base on the fact that boat traffic occurs mainly from May to around the beginning of October of each year. Due to the summarized temperatures in April of the last few years, it is assumed as a precaution that relevant boat movements can take place directly with the season opening from first of April of each year. Highest boat frequency is usually expected from May onwards with exceptional peaks on holidays.

The literature review on the sensitivity to disturbance and the reaction of species sensitive to disturbances on the increase in boat movements has shown that a pure and general transfer of literature values with regard to escape distances, distances of disturbances or effect distances to touristic boat movements is not expedient. Therefore, the result of the method discussion within the expert workshop was to evaluate the escape/interference distances from the recognized literature and, as far as possible, to transfer and supplement them with empirical values from the WTNK-accompanying monitoring.

A bundle of target bird species that are defined as sensitive against human disturbances were selected and monitored along some of the watercourses. The monitoring scheme in the frame of the WTNK program is split in two parts. One is to survey all breeding sites in a defined corridor along the waterways. The second is a risk-management, analyzing disturbance behavior of the breeding birds of selected nesting sites that are visually exposed against passing boats and landsite disturbances. The risk-management were performed in 2021 for the first time with selected breeding pairs of both Black Kite (*Milvus migrans*) and Red Kite (*Milvus milvus*). Preliminary results reveal that the birds over different nesting periods (building territory, breeding, feeding) are not affected by boat traffic even if they breed right away the riverbank. In some cases a possible disturbance from waterways were superimposed by terrestrial human activities (pedestrians or cyclists). Birds mostly just took note of very close landsite approaches to their nesting trees.

© Jens Kipping, 2021

Figure 2: Watertourists entering the Floßgraben in southern SPA Leipziger Auwald; the banner informs boat users on the daytime entry prohibitions

Another bird species traditionally in the focus of Leipzig's conservationists is the Common Kingfisher. It has been brought into focus by some NGOs that the Kingfisher is being a seriously sensitive species against water tourism, especially against paddling. The Floßgraben, a small river meandering through the southern Leipzig forest forms an essential part of the waterway Course 1 that connects Leipzig's city center with the artificial Lake Cospuden south of town. At the same time, it is one of the strongholds of the Kingfisher population within the SPA Leipziger Auwald. Administration were aware of the possible conflict and took already in 2013 action in defining a special scheme with limitation of use for all boat traffic on the Floßgraben. Generally, only muscle-driven boats were allowed and periods were declared in which a passage is legally possible. The aim was to give the breeding population of the Floßgraben a certain daily time span for undisturbed foraging, breeding, and feeding of offspring. At the same time, since 2013, a continuous yearly monitoring has been started, a German-wide unique and elaborate program. Every year, the number of breeding pairs on the river stretch of the Floßgraben is recorded and the breeding success and their disturbance behavior is observed. In some years an accompanying monitoring mapped also the breeding population of the whole SPA.

There is no evidence that boat traffic on the Floßgraben had serious impact on the Kingfishers population and its breeding success so far. Many long-term observations on selected breeding pairs were additionally carried out in recent years. On consecutive days with high boat traffic (i.e. Sunday) on one day and low boat traffic (i.e. Monday) on the following day, the feeding activity had been observed between sunrise and sunset. Birds' activities at their nesting sites, as well as the passing of boats or landsite disturbances by pedestrians and cyclists were registered in 15 Minute sequences. Analyzing the results of about 20 day-pairs revealed no significant impact of boat traffic on breeding behaviour and feeding activity. Even though, the rhythm of feeding flights changed slightly on a few days with much traffic, the overall number of feeding flights, as well as the social behaviour were not affected at all. The number of chicks to feed, their age, and their food consumption obviously mainly controlled the behaviour of adult birds, not the frequency of boat traffic.

The dynamic of the Kingfisher population within the SPA extremely fluctuated between the years but the population number in the Floßgraben correlated strongly with the population number of the whole area. The deviation ranges from about 57 occupied territories for the whole SPA in favorable years (2020) and about 11 territories in unfavorable years (2021). The main driver for such a decrease are harsh winters with long-lasting frost periods that lead to dispersals and high mortality.

7 Controlling of boat use by usage regulations for nature conservation

Appropriate usage regulations are defined to react on individual water section-related nature conservation conflicts between boat use and the occurrence of disturbance-sensitive species. The usage regulations serve to avoid disturbances and damages to the protected animal and plant species and their habitats.

A special regulation is the "General decree on special protective measures for the Kingfisher (*Alcedo atthis*) at the Floßgraben" defined by the city of Leipzig from 25th of January 2016. This decree regulates the navigation in the Floßgraben for any type of watercraft (including even air mattresses and rafts) and the entering on the 20 m wide streambank area on both sides of the Floßgraben for the period from first of March until 30th of September. Navigating in the Floßgraben with muscle-powered watercrafts of any kind is only permitted between 11:00 and 13:00, between 15:00 and 18:00, and between 20:00 and 22:00. Motorized watercrafts are fundamentally prohibited. Large banners and signs inform boat users on the daytime entry prohibitions (**Figure 2**).

8 Summary

The political changes at the beginning of the 1990s with the subsequent ending of the lignite processing industry made it possible to revive the tradition of the 150-years-old tradition of water tourism in the Leipzig region. The devastated lignite-influenced landscape changed to a recreational landscape characterized by water – the Leipziger Neuseenland. On the initiative and under the leadership of the Grüner Ring Leipzig, the WTNK was developed. The aim is to guide and control the water tourism in the region. The development of water tourism must take into account Natura 2000 regulations on species and area conservation. Therefore, environmental assessments accompany the updating of the WTNK to solve the conflicting goals between water tourism and nature conservation. Complex assessment and prognosis methods, as well as a good database through an accompanying monitoring is required to predict future impacts on disturbance-sensitive species. The long-term experience made in Leipzig and the results from the WTNK of the Grüner Ring Leipzig enable a transfer to comparable conflicting goals in other regions or projects.

Authors

Klaus Müller-Pfannenstiel
Bosch & Partner GmbH
Herne, Germany
k.mueller-pfannenstiel@boschpartner.de

Jens Kipping
BioCart - Ökologische Gutachten & Studien
Taucha/Leipzig, Germany
biocartkipping@email.de

Lower Havelniederung – Most Significant River Restoration Project in Europe

The Naturschutzbund Deutschland e. V. (Nabu) is developing the Havel river over a length of 100 km with the publicly funded nature conservation project Untere Havelniederung (Lower Havelniederung). It unseals banks, connects river arms, flood channels and flood plains and initializes alluvial forests.

Rocco Buchta

1 Reason

The Lower Havel flows between the city of Pritzerbe and the confluence with the Elbe north of the Hanseatic city of Havelberg. The Lower Havel Valley, which extends along the river, is characterized by the meeting of four large glacial valleys. The water level gradient of the Havel is very low and because of the higher gradient of the Elbe, the Havel water accumulates at the mouth. A large-scale and usually long-lasting flooding of the Lower Havel Lowlands is the result (**Figure 1**).

Figure 1: Wetlands Untere Havelniederung

2 Major nature conservation project Lower Havelniederung

2.1 Project area

The approximately 19,000 hectare project area includes the lowlands of the Lower Havel (**Figure 2**). Of the 100 km running length of the river, 75 km belong to the Lower Havel waterway, which can be used by pleasure boats, passenger ships and hotel ships.

Measures are being implemented in a development area of around 9,000 hectares. This is completely secured by Natura 2000 protected areas and is also part of two large protected areas, the Middle Elbe Biosphere Reserve (Saxony-Anhalt) and the Westhavelland Nature Park (Brandenburg).

Synopsis

- The aim of the nature conservation project Untere Havelniederung is the development of near-natural structures in and on the approx. 100 km long river course of the Lower Havel. The project area covers around 19,000 hectares.
- Important measures are the unsealing of 29 km of banks, the connection of 34 cut-off meanders and 95 flood channels, the reconnection of 1,150 ha of floodplain and the initialization of 145 ha of floodplain forest.
- Nabu is the sponsor of the riparian strip project funded by the Federal Agency for Nature Conservation (75%) as well as the states of Brandenburg (11%) and Saxony-Anhalt (7%).

2.2 Objective

The maintenance of the Lower Havelniederung as a wetland of outstanding national and international importance is the core task of the waterfront strip project Lower Havelniederung between Pritzerbe and Gnevsdorf in the states of Brandenburg and Saxony-Anhalt [1]. The main objectives of the project are:

- Ecological improvement for the protection and development of communities, structures and functions typical of floodplains as well as securing the retention potential,
- near-natural development of the river and the recent floodplain, among other things to improve the structure of the water and to improve the dynamics of the embankment,
- Optimization of the link function in the biotope network system and development as a living and reproductive space.

2.3 Social involvement

There was intensive communication and discussion right from the start. The always transparent and democratic basic work was very complex, but essential for the success of the measures.

Feasibility studies and socio-economically oriented development concepts were already included in the preparation of the major nature conservation project. And for the project itself, a working group consisting of 130 institutional members has been set up to support the project, which represents all issues affected by the project. At the same time, the potential measures in the neighboring communities were presented and discussed in a total of around 90 meetings.

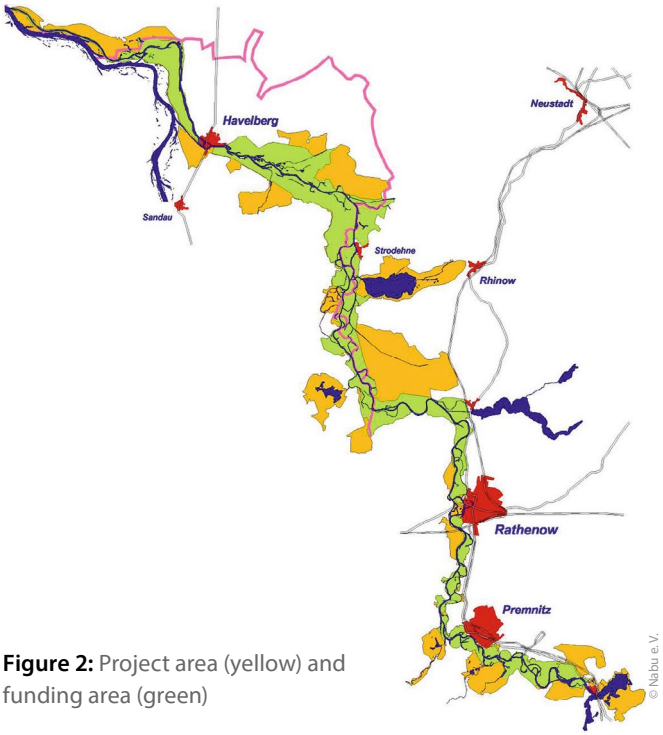


Figure 2: Project area (yellow) and funding area (green)

At the end of the participation process, there were always binding declarations containing mutually agreed lists of measures. In the case of the municipalities and districts, it was decisions made by the democratic bodies.

2.4 Course of the project

After about fifteen years of preparation, the official start of the waterfront strip project Untere Havelniederung took place in 2005.

In the years 2005 to 2009, a maintenance and development plan with an extensive feasibility study was first drawn up and coordinated. This forms the basis for the implementation of the measures, which has been ongoing since 2009.

So far, funds totaling 40.8 million euros have been approved for the project, of which the Federal Agency for Nature Conservation is contributing 75%, the State of Brandenburg 11% and the State of Saxony-Anhalt as well as the Nabu as project executing agency 7% each.

At the same time, individual measures from the maintenance and development plan, so-called accompanying measures, are financed through third-party funded projects.

The Untere Havelniederung riparian strip project is due to its scope of measures, its model character and its large-scale approach

Figure 3: connected flood gutters and unsealed banks

the most significant nature conservation project of its kind on a federal waterway to date. The project sponsor is the Nabu.

2.5 Types of measures and scope of measures

With the maintenance and development plan, a list of optimized and pre-planned measures has been available since 2009, which are suitable, implementable and also coordinated with local authorities, public bodies and users to achieve the project goals. These can be summarized as follows [2]:

- Removal of 71 bank revetments over a total length of at least 29 km,
- Networking of river and floodplain (connection of 95 flood channels and reconnection of at least 500 hectares of floodplain),
- Connection of 34 cut-off meanders,
- Enlargement of the alluvial forest by at least 225 ha,
- nature-friendly water maintenance in the entire core area,
- Improvement of water management as well as construction of ascent and descent aids for aquatic organisms at the barrages,
- Adjustment of the grassland management in the entire core area,
- Acquisition of land to secure the development goals on at least 620 ha.
- After the implementation of the priority measures, a clearly measurable improvement in water quality by two levels is expected (**Figure 3**).

3 Outlook

By the end of 2019, 14 km of bank revetments had been dismantled in the Untere Havelniederung project area. In addition, 37 flood channels and 9 cut-off meanders were connected, 44 hectares of floodplain forest were initialized, 1 weir was dismantled and 789 hectares of land acquired to secure the development goals.

Measures to improve the water balance have been tried out since 2016, and water maintenance has been geared towards the project goals since 2010. The implementation of all priority measures from the maintenance and development plan should be completed by 2031.

Author

Dr.-Ing. Rocco Buchta
Nabu-Institut für Fluss- und Auenökologie
Rathenow, Germany
rocco.buchta@nabu.de

Literature

[1] Naturschutzbund Deutschland e. V. (ed.): Untere Havelniederung zwischen Pritzerbe und Gnevsdorf in den Ländern Brandenburg und Sachsen-Anhalt. Projektkonzeption und Antrag zur Aufnahme in das Programm des Bundesamtes für Naturschutz zur Förderung von Gewässerrandstreifen im Rahmen der Errichtung und Sicherung schutzwürdiger Teile von Natur und Landschaft mit gesamtstaatlich repräsentativer Bedeutung, 2005.

[2] ARGE Untere Havel (ed.): Pflege- und Entwicklungsplan Gewässerrandstreifenprojekt Untere Havelniederung zwischen Pritzerbe und Gnevsdorf, 2009.

The Overall Strategy for the Elbe – Jointly for a Living and Economic Space with a Future

The Overall Strategy for the Elbe contains guidelines and possible measures to improve the main aspects along the Elbe, such as erosion, flood protection, environment and navigation. Its implementation will achieve the highest possible synergies in water management, nature conservation and transport.

Tobias Gierra

Introduction

The inland part of Elbe River is both a sensitive river landscape and a major European waterway. It runs from the German-Czech border to the river barrage Geesthacht south of Hamburg. As a waterway system, the Elbe, together with the entering navigable watercourses, creates a connection between the industrial centres of the Czech Republic, Saxony, Saxony-Anhalt, Lower Saxony, Brandenburg and Berlin and the port of Hamburg.

In 2017, a strategic concept for the Elbe – the so-called Gesamtkonzept Elbe (GKE) – was developed with the participation of stakeholders from business, environmental and nature conservation organisations as well as citizens' initiatives and churches (**Figure 1**). It was adopted by the two responsible federal ministries (transport and environment) and nine federal states located in the Elbe River Basin aiming at harmonizing the requirements of water resources management, the conservation of the valuable nature of both the river and floodplains, and the environmentally friendly inland navigation, as well as to positively influence the status of the Elbe [1]. The German Bundestag acknowledged the GKE in 2017 on the recommendation of the Committee on Transport and Digital Infrastructure and adopted a resolution to call upon the Federal Government to draw-up and implement corresponding measures for the Overall Strategy for the Elbe in a timely manner and within the available budget [2]. The GKE is thereby the essential basis for the administrative actions of the state and federal authorities serving as a complementary coordination and planning tool to find common approaches to solutions when interests such as water resources management, ecology and inland navigation overlap.

© [1]

Figure 1: Cover of the published Overall Concept for the Elbe

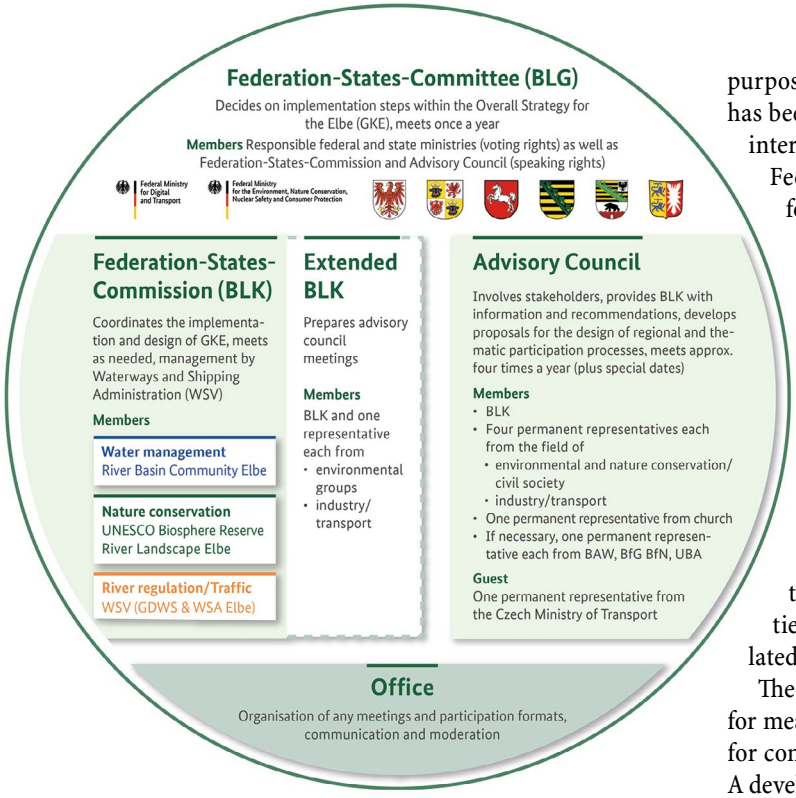
Synopsis

- The Overall Strategy for the Elbe or Gesamtkonzept Elbe (GKE) is the strategic concept for the development of the German inland part of Elbe River and its floodplains.
- In 2017, two federal ministries and nine federal states adopted the GKE in order to improve the condition of the Elbe in long-term with regard to the valuable natural landscape, water management requirements and navigation.
- The GKE contains guidelines for five thematically independent fields as well as 55 jointly developed options for measures to ensure a coordinated and sustainably positive development of the Elbe.

Objectives

The Overall Strategy for the Elbe includes guidelines with objectives for the four work packages water management (WP1), nature conservation (WP2), river regulation and riverbed stabilization (WP3) and transport (WP4). As result of an objectives analysis of potential interactions, synergies and conflicts, 5 separate fields plus the field Z (objectives that cannot be achieved in the short term and will be dealt with in the follow-up process) were identified and are to be treated equally:

- Erosion control and bed load balance (E),
- Improvement of flood protection, water retention, water balance (W),
- Reduction of substance inputs (G),



© WSA Elbe

Figure 2: Organisational structure for the follow-up process

- Improvement of navigation conditions (S),
- Conservation and restoration of habitats and habitat types in water bodies, on banks and in floodplains (N),
- Future considerations (Z).

In order to be able to implement the resulting tasks, the federal government, the states, associations and citizens' initiatives compiled jointly 55 options for measures. They are based on existing regulations and directives (e.g. European Water Framework Directive, Flood Risk Management Directive, and Habitats Directive with the Natura 2000 network of protected areas).

The options for measures in the Overall Strategy for the Elbe aim to:

- preserve or restore species and habitats of water bodies, banks and floodplains,
- improve protection against floods and possibilities for retention,
- counteract water pollution,
- counteract the erosion of the riverbed and the lowering of the water level,
- optimize river regulation structures in ecological terms,
- improve route information and offer shipping more planning reliability.

Task-related individual measures can be synergistically bundled across the topics and thus mutually promote economic and ecological interests. No measure should lead to disadvantages in any of the other topics.

Implementation

Since the adoption of the Overall Strategy of the Elbe in 2017, the agreed follow-up process has been underway. For this purpose, three committees have been constituted and an office has been set up. The federal government, the federal states and interest groups participate in the committees (**Figure 2**). The Federation-States-Committee, led by the Federal Ministry for Digital and Transport (BMDV) and the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), decides which steps will be implemented. The Federation-States-Commission works at the intersection of federal government and federal states. It coordinates how the Overall Strategy for the Elbe is implemented and developed. Stakeholders from nature conservation and the economy as well as the church actively participate in the advisory council. It gives guidance to the Federation-States-Commission on the implementation of the GKE. All participants agree on the implementation of the options for measures and discuss opportunities for public participation. The joint cooperation is regulated by rules of procedure [3].

The Overall Strategy for the Elbe specifies consensual options for measures, including for stretches of the Elbe with potential for conflict like the Elbe-Reststrecke and the Erosionsstrecke. A development to improve traffic conditions shall not take place in the future. However, river engineering measures are accepted if they serve ecological, water resources management and transport objectives at the same time and combine these objectives in a reasonable way.

In the so-called Elbe-Reststecke (remaining section) from Damnatz to Hitzacker, navigation is only possible to a limited extent. Irregular sediment transport leads to large migrating alternate bars that constantly require extensive maintenance measures. The initial aim here is to investigate the possibilities for adapting the Elbe in accordance with transport, ecological and water resources management objectives.

In other stretches of the Elbe River riverbed has deepened considerably over time. The so-called Erosionsstrecke, a river stretch that extends over 170 km from Mühlberg to Barby, is particularly severely affected. This occurs due to various human impacts on the river and its catchment area. In a first section, the pilot scheme near Klöden, specific planning and measures are carried out to stabilize the riverbed and promote natural bedload transport.

Author

Tobias Gierra
Wasserstraßen- und Schifffahrtsamt Elbe
Projektgruppe Gesamtkonzept Elbe
Dresden, Germany
tobias.gierra@wsv.bund.de

Literatur

[1] BMVI, BMUB (ed.): Gesamtkonzept Elbe - Strategisches Konzept für die Entwicklung der deutschen Binnenelbe und ihrer Auen. 2nd Ed. Bonn, 2017.
[2] Deutscher Bundestag: Drucksache 18/12 844. Berlin, 2017.
[3] BMVI, BMU (ed.): Projektseite Gesamtkonzept Elbe. 2021 (www.gesamtkonzept-elbe.bund.de, Access 13.03.2022).

100 Years of the San Antonio River: From Flooding to the River Walk and Now a Return to Nature

The San Antonio River Walk grew from a devastating flood in 1921. This story includes channelization, gates, tunnels, and urban ecosystem restoration. The San Antonio River Walk is now proving that flood mitigation, economic development, and healthy ecosystems can coexist in urban environments.

Steve Graham

1 Introduction

The San Antonio River Walk is garnering global recognition for its urban riverfront development and urban ecosystem restoration. Despite the growing international notoriety for its economic and environmental advances, many still do not fully appreciate the origin of the River Walk's success, which is flood mitigation. On September 9, 1921, a devastating flood dramatically changed the way the San Antonio River was managed, and those engineering solutions are still impacting the city of San Antonio today, more than 100-years later.

Figure 1: The Museum Reach includes nearly 5 km of pedestrian pathways, multiple water features, and over 70,000 plants

2 Methods

In the decade that followed the 1921 flood, the San Antonio River was cleared and straightened. Plans for what is known today as the San Antonio River Walk were presented in 1929 and they endorsed the bypass channel and recommended floodgates, a small dam, and a tainter gate. Construction began in 1939 and the River Walk was first opened in 1941.

In 1954, the U. S. Army Corps of Engineers was authorized to construct flood improvements, including the channelization of nearly 50 km of the river and its tributaries. By the 1980s, all the channelization work was done, and plans were developed to construct two flood tunnels. The first tunnel was 1.6 km long and was completed in 1991. The San Antonio River Flood Tunnel is 4.8 km long and was completed in 1997. Both tunnels are 7.3 m in diameter and about 46 m underground.

During the second half of the 20th Century, as the channelization and flood tunnel work was progressing, the original San Antonio River Walk grew into an economic driver for the city of San Antonio. To build upon this success, the $384.1 million San Antonio River Improvements Project was initiated in 1998 to expand the original River Walk, which was only about 4 km in length.

Construction on the Museum Reach (**Figure 1**) section began in May 2007 and was completed in May 2009. The 6.5 km Museum Reach stabilized the river channel, extended recreational navigation through the addition of a lock and dam, and created access along a linear park that links major cultural institutions and commercial centers.

Construction on the Mission Reach project began in June 2008 and was completed in October 2013 (**Figure 2**). The 14.5 km Mission Reach is one of the largest urban ecosystem restoration projects in the United States and one of the first significant river rehabilitation projects using fluvial geomorphic and sediment transport principles on a river within a semi-arid region.

Synopsis

- Twentieth Century engineering, which focused largely on river channelization, flood gates, and flood tunnels, solved flooding in San Antonio and advanced economic growth at the cost of the natural environment.
- Twenty-first Century engineering using fluvial geomorphology is restoring riparian and aquatic ecosystems while maintaining flood conveyance and promoting economic growth.
- During a 100-year engineering evolution and investment in riverine infrastructure projects, today's San Antonio River Walk successfully integrates flood protection, biodiversity, and economic development.

Figure 2: The challenge of the Mission Reach project was to maintain, or improve, the flood carrying capacity of the river channel while implementing ecosystem restoration in an urban environment

Figure 3: The San Antonio River Walk is world renowned for being lined with hotels, restaurants, and retail and it can host large river parades that bring over 100,000 people to the river as well as small intimate gatherings like private weddings along the banks of the river

The Mission Reach project was designed to mimic the diversity and density of a naturally occurring riparian area, including planting over 10,000 pounds of native grass and wildflower seeds of over 60 different species and close to 23,000 native trees and shrubs, including 40 different species.

River restoration was accomplished along the Mission Reach by restoring two historic river remnants and returning natural river features, such as riffles, runs, pools, and embayments, to provide different types of habitat to maintain a native, diverse, and healthy aquatic ecosystem.

3 Results

Today, the San Antonio River Walk is about 25 km in length and connects to over 8 sq. km of public park land, making it one of the nation's finest linear, urban parks (**Figure 3**). The most recent economic impact study concluded that 11.5 million people visit the River Walk annually stimulating an overall annual economic impact of $3.1 billion and supporting 31,000 jobs.

Since the May 2009 opening of the Museum Reach, the $72 million public investment in the river served as a catalyst to return nearly $2 billion in private development. Since the 2013 opening of the Mission Reach, which cost over $271 million to construct, over $600 million of new development has been built along the project.

The Mission Reach ecosystem restoration is less than a decade old, but the habitat is already demonstrating that ecosystem restoration can work in an urban environment. To date, over 300 species of native herbaceous and woody vegetation have returned to the riverine habitat.

The restoration project has also provided numerous opportunities for proactive studies and additional ecological repair. The first initiative was the reintroduction of Guadalupe Bass. This endemic species has successfully spawned five times in the urban environment and spread all the way from San Antonio, where it was reintroduced, to Goliad State Park, which is over 320 km away.

Additionally, a three-year avian study was conducted which counted over 65,000 birds using the restored habitat, including over 205 different species. This included both residential bird species and migratory bird species that travel through the Americas using San Antonio as a rest stop.

The Mission Reach aquatic habitat, which is within an urban environment, has also been determined healthy enough to support mussels, and plans are now moving forward for the reintroduction of four freshwater mussel species.

Finally, as the Mission Reach project restores the natural ecosystem of the river and provides new recreational benefits, it also reconnects the river to the historic Spanish Missions that relied on it three centuries ago. The San Antonio Missions were recognized in 2015 as a Unesco World Heritage site. The Mission Reach project was part of the nomination process and played an important role in the Unesco inscription process.

4 Conclusions

Since the 1921 flood, the San Antonio River has evolved from flood mitigation to economic development and more recently into ecosystem restoration. With the success of the San Antonio River Walk, the San Antonio community continues to learn from our past projects and invest in our waterways with upwards of another $500 million in waterway projects proposed over the next 10 years. Global recognitions, such as winning the 2017 Theiss International Riverprize, are allowing the San Antonio River Walk to serve as a model for the integration of flood mitigation, urban park design, riverfront development, and urban river ecosystem restoration.

Author

Steve Graham
San Antonio River Authority
San Antonio, United States
sgraham@sariverauthority.org

The Waterway Link from Leipzig – A Vision that Reinvents Itself again and again

The idea of a navigable waterway connection from Leipzig to the international waterways is almost 300 years old. It took generations with vision and the power to implement to get closer to this idea step by step. Ideas that were initially supported by kings are today the responsibility of a committed urban society.

Sabine Heymann

In the beginning there was the desire for connection, the connection of Leipzig with the oceans. At the end of the 18th and beginning of the 19th century, this was still a wish of the king, who wanted to link his country optimally with other countries. At that time, the means of choice for moving large quantities of goods was primarily by water. The Napoleonic wars almost caused this vision to be forgotten. It took a new idea and new energy to revive this vision. In the person of the entrepreneur and city councilor Dr. Ernst Carl Erdmann Heine, a visionary was found who combined the most diverse potentials of hydraulic engineering. With the construction of the canal from the Weisse Elster, he not only had the navigable connection of Leipzig to the Saale in mind. At the same time, he wanted to use the water and its excavated material to open up Leipzig's surrounding countryside for new industrial areas and settlements. The view no longer extended into the distance alone. Hydraulic engineering laid the foundation for diverse value chains in the region itself. Unfortunately, the vision did not carry far beyond his death. Leipzig gained two prosperous suburbs, but still not the connection to the oceans.

After the I. World War I, Germany had to reorient itself. This also affected the management and development of the waterways. Despite the steadily expanding railway network, river navigation continued to be the preferred distribution route for bulk goods. In 1920, it was decided to build the southern wing of the Middleland Canal, today's Leipzig-Saale Canal. It was not until the 1930s that work was intensified. In addition to the canal itself, the Lindenau harbor with quay wall and storage facilities was built, as well as numerous bridges and structures to regulate the water level. To overcome the difference in height to the Saale, the construction of the lock staircase at Wüsteneutzsch began, which was never completed. The next war, World War II, put an abrupt end to this.

Synopsis

- The reuse of waterways enhances the value of urban districts.
- Connecting regions via and along waterways is part of sustainable regional development.
- For new waterways, administration and citizens must pull together.

© Thomas Heymann

Figure 1: The first trip on the newly built canal accompanied by Dr. Karl Heine, himself

A new vision

Decades followed with little vision. The rudimentary water bodies were used either as rubbish dumps, as reservoirs for irrigating the fields or as bathing waters of dubious quality. Even before the peaceful revolution, it was a water sports enthusiast and future environmental mayor of the city of Leipzig, Jörg Hannes, who pursued the idea of a closer connection with the revitalisation of the canal and the link to Lindenau Harbor, the green connection of the newly built district of Grünau with the city centre. The focus of this vision was not on freight traffic, but on improving the quality of life for Leipzig's citizens. Until 1990, this was actually a vision that was considered as difficult to fulfil as Leipzig's connection to the oceans.

After the peaceful revolution in 1989 and the unification of Germany in 1990, spring dawned for Leipzig's waters, including the Karl Heine Canal (**Figure 1**). For almost 10 years it was renovated, cleared of contaminated sites and made usable not only for water sports enthusiasts and leisure captains. The accompa-

© Thomas Heymann

Figure 2: The start of the conection between Lindenauer Harbor and Karl-Heine-Canal

© Thomas Heymann

Figure 3: The flooding of the newbuilded Karl-Heine-Canal part

nying cycle path soon became Leipzig's most popular cycle route. An industrial watercourse that was never used as such experienced its renaissance as a recreational watercourse. Its revival not only brought the old vision a little closer. The neighboring districts were also kissed awake by its waters. Unsightly backsides of ruinous tenements and factories became and still become showplaces for the boating tourists.

But that was and is not the end of the former vision. On the one hand, a support association, Wasser-Stadt-Leipzig e. V., was founded, which has been promoting its completion with numerous campaigns since 1999. In 2003, Leipzig's application for the 2012 Summer Olympics (Leipzig is always good for visions) was added to the mix. Lindenau Harbor played a special role as a potential Olympic village. As is well known, Leipzig did not become the venue for the Olympic Games, but the floodlights on Lindenau Harbor remained switched on. The sponsoring association also made a major contribution to this by organising a design competition for the connection of the canal to Lindenau Harbor. Ideas were also collected on how to use the area then gained at the harbor in the meantime until a permanent use became foreseeable. Until 2010, Leipzig was still a shrinking city. Housing vacancies were still the order of the day. With this connection, the vision of the green and also blue connection of Grünau with Leipzig's centre was finally to be completed.

In 2015, the new waterway connection was finally flooded (**Figures 2** and **3**). As early as 2017, construction began on the new district at the harbor, because Leipzig was growing. In addition to affordable flats, high-quality flats in interesting locations were also in demand.

With the growth of the city and the ongoing densification, the need for local recreational opportunities is also growing. In addition to the sensitive Leipzig alluvial forest and the water bodies there, which need to be protected, it is precisely the completion of the artificial watercourse that can provide a balance for the densely populated city. Thus, the third decade of the 21st century is marked by the completion of the old visions for the Leipzig-Saale Canal, but under new auspices. In an extensive discussion process, it was worked out together with the surrounding area that first and foremost there must be a visualisation and valorisation of the canal's existing potential. Once again, it will be a cycle path that will serve this rediscovery. But it is not only in the distance that further stumbling blocks must be turned into construction sites. The warehouse site at Lindenau Harbor is waiting for new uses and the inner-city waterway connection of the harbor and the Leipzig-Saale Canal must be tackled so that visions for Leipzig can become visions for an entire region. Stepping stones along the way are being set not only by the administration, but also by the citizens themselves, such as the Association Wasser-Stadt-Leipzig e. V. It is now taking on the task of bundling the goals and ideas of as many people as possible in order to adapt the 300-year-old vision to today's sustainable demands and make it realisable. Above all, it should not take another hundred years, because Leipzig and its region already have the need and the possibilities today.

Author

Dr. Sabine Heymann
Wasser-Stadt-Leipzig e. V.
Association for the connection of the Karl-Heine-Canal to the Elster-Saale-Canal
Leipzig, Germany
mail@wasser-stadt-leipzig.de

Bata Canal – From Coal to Tourism

The 84 years old Bata Canal is a great example of renovation of historical waterway once built for transport of coal and transformation into the backbone of tourism in South Moravia.

Tomáš Kolařík

The aim of the presentation is to get acquainted with the interesting history of the Baťa Canal in Moravia in the Czech Republic. This historic monument is perhaps the youngest small waterway in Europe, inspired by French Péniche canals. The origin of the navigation canal between Otrokovice in the Zlín region and Sudoměřice in the Hodonín region is also remarkable in that it was built by a private investor - the company Baťa. The Baťa family dreamed of building the Danube-Odra-Elbe canal connecting three large European rivers across the territory of Czechoslovakia. To support this idea, they co-financed an extensive project to regulate the Morava River in connection with irrigation systems, which also included a navigation canal **(Figure 1**).

The construction of the 50-kilometer-long canal lasted only 4 years from 1934 to 1938. Most of the construction work was carried out manually – mainly to ensure higher employment during the economic crisis. The construction of the canal thus saved many families from poverty.

The main commodity transported was coal, as well as building materials and oil products. Coal was loaded into the barges by a special tipper device in Sudoměřice and sailed in cargo barges using a horse cover in the canal sections and using tugs in the river sections.

Largest cargo port in Moravia

At the other end of the canal, in the town named and owned by the Baťa company – in the town of Baťov – the largest cargo port in Moravia was established, where vessels for operation on the canal were also manufactured. The port was followed by a half-kilometer-long narrow canal terminated by a special hoover for transporting coal from barge to the power plant.

Operation on the canal began during the Munich crisis in 1938. The canal achieved the best transport results in the war years. In 1945, it was severely damaged by retreating German troops. After the resumption of operations in 1947, the main commodity transported became building materials for the construction of new factories in Otrokovice and Zlín.

After the nationalization of the shipping company, the importance of the canal began to decline and in 1962 the operation of the canal was officially terminated and all facilities were left to their fate.

Figure 1: Aerial picture of confluence of the canal and Morava river at Vnorovy

Finally in in 1989, the idea of resuming operations began. First for water freight transport, in the 1990s only recreational and passenger navigation was considered. The gradual renewal of the Baťa canal began, which lasted almost 10 years. In 2002, the last Petrov lock chamber was restored. At its opening, Tomáš Baťa Jr. he christened the waterway as the Baťa Canal.

During the 20 years of full operation of the tourist waterway, there has been a significant increase in the number of tourists both sailing on boats and cyclists on parallel trails, but there has also been an attractive tourist brand and destination, which is now the tourist backbone of South Moravia.

Today's visitor numbers reach 80,000 water tourists and over 200,000 cyclists along the canal.

In recent years, the state and the regions have intensified maintenance and investments in making the stay on the Baťa Canal more attractive and pleasant. New information centers, restaurants and cafes, but above all new docks and large recreational ports means a qualitative shift of the entire destination and a guarantee of further sustainable development of tourism in the region.

But that is not all! Two new locks are in preparation, which would extend the length of today's Baťa Canal from 50 kilometers to 80 kilometers in the next few years. Come and see Baťa Canal for yourself.

Synopsis

- Once forgotten monument brought back to life.
- Transformation from industry to tourist sensation.
- Cooperation of municipalities and regions on the renovation and development of the waterway.

Author

Tomáš Kolařík
Plavba a vodní cesty o.p.s.
Prague, Czech Republic
vodnicesty@seznam.cz

Climate Change in Central Germany – Recent Years as an Indicator for the Near Future?

The effects of climate change can already be observed in central Germany today. These are: increased temperatures, increasing drought, but interrupted by increased heavy rain. By the end of the century, the observed trends will intensify. The effects are already noticeable and corresponding adaptation measures are necessary in all sectors.

Dominic Rumpf and Johannes Franke

Due to its location and natural features, Central Germany has special climatic characteristics within Germany. The region is located in the transition zone from primarily continental to maritime air masses. In addition, the regional climate is strongly influenced by the highland area of the Harz and Thuringian Forest. The combination of the above-mentioned factors means that this region is low in precipitation and is referred to as the Central German Dry Area.

Climate development for Northwest Saxony

In the following, the climate development for the sub-region Northwest Saxony is described in more detail. In the period from 1991 to 2020, the air temperature increased by +1K compared to the reference period from 1961 to 1990. The last decade (2011-2020) is characterised by a strong temperature increase of +1.5K. Climate projections assume a further increase in temperature of +4.3K by 2100 compared to 1961 to 1990, assuming scenario RCP8.5 (globally no sufficient climate protection).

These changes have an impact on precipitation patterns. Average annual precipitation increased by about +4% from 1991 to 2020 compared to the reference period. However, there were shifts within the year. For example, in vegetation period I (April - June) there is approx. -5% less precipitation and in VP II (July - September) approx. +20% more. The occurrence of heavy rainfall events (90th percentile) has increased by approximately +10% compared to 1961 to 1990. This results in a higher share of heavy rainfall in the mean precipitation totals, especially in the summer months. This means that periods of low or no precipitation are interrupted by heavy rainfall events. Climate projections indicate that at least a continuation of the already observed development in precipitation patterns can be assumed. The dimension of the future change in precipitation patterns depends on the further temperature development.

The climatic water balance, which indicates the atmospheric (potential) water supply, is suitable for integrative balancing of atmospheric conditions. For this purpose, the difference between precipitation and potential evaporation is formed. Potential evaporation is a parameter primarily driven by temperature and has increased by approximately +7% in the period 1991 to 2020 compared to the reference period. For the climatic water balance, this results in a decrease to approximately -20mm per year compared to 1961 to 1990. Starting from a balanced balance (1961-1990), this means a significant deterioration of the potential water supply. The occurrence or development of drought events is favoured by these atmospheric conditions. Climate projections indicate that at least a continuation of the already observed development can be assumed.

The climate development described for Northwest Saxony is associated with risks in many sectors, e.g. water management, cultivation of arable land or urban planning.

Synopsis

- The high natural variability in regional climate development is increasingly overlaid by a warming trend.
- The risk of weather-related extremes has increased, including their simultaneous and/or prolonged occurrence.
- The changes in the temperature and precipitation regime increasingly favour the occurrence and long duration of drought.

Authors
Dominic Rumpf
Johannis Franke
Saxon State Office for Enviroment, Agriculture an Geology (LfULG)
Competence Center for Climate Change
Dresden, Germany
dominic.rumpf@smekul.sachsen.de
johannes.franke@smekul.sachsen.de

The Water Balance Portal in Saxony

In Saxony, the effects of climate change on water management have been measured for many years. With KliWES (Climate Change in the Catchment Areas of Saxony) water balance modelling with climate scenarios is worked on. Hydrological characteristics were calculated. Both information are available in the water balance portal.

Karin Kuhn

The climate changes observed in Saxony in recent decades and the expected climate changes made it necessary to present the effects on the water balance and to make the data obtained available to the general public. The State Office for the Environment, Agriculture and Geology has engaged external service providers from the fields of higher education, research and planning offices. Furthermore, projects with the support of EU funds were also used to create a uniform water management basis, especially with the Polish colleagues of the IMGW (Institute of Hydrology and Meteorology). The basics created in 2 complex edits are available on the Internet at www.wasserhaushaltsportal.sachsen.de.

The Project KliWES

The project KliWES (Climate Change in the Catchment Areas of Saxony) was the first processing complex. The process began with the analysis of level data in anthropogenically largely unaffected catchment areas, which provide long-term measured values. Nationally available data on land use, soil, geology, relief, water network and climate were used to regionalize the level information. With the help of the soil water balance model ArcEGMO, which calculates the paths soil-plant-atmosphere, the water balance for the years 1961 to 2015 could be represented. The adoption of various climate scenarios (1961-2100) provided information on possible water management changes in connection with climate change for the first time. Because of the complexity of the changes in the two lignite mining areas in Lusatia and Central Germany, these areas need to be dealt with in more detail. In the greater Leipzig area, the problem was solved in such a way that the existing groundwater model was coupled with ArcEGMO. As a basis, the data on the changes in the landscape, the formation of open-cast mining lakes, the relocation of rivers and the changed soil properties due to the formation of dumps were also used here. Since such a comprehensive groundwater model does not yet exist in the Lusatian region, a concept was created here.

Figure 1 shows an example of a diagram using climate scenarios for the development of land surface runoff in the Leipziger Land district. The tendency of the land surface runoff to sink is clearly visible, even if climate scenarios show different results. This tendency can also be seen in all other water balance components. All climate scenarios should always be considered, as the probability of occurrence is the same for all scenarios. Since the calculation is based on daily values, no statement can be made about the development of extreme flood events with this system. For the borders with the neighboring federal states of Saxony-Anhalt and Brandenburg, the data available there were used. On the border with the Czech Republic, data made available through cooperation within the framework of the German-Czech Border Waters Commission could be used. The border area with Poland was modelled on the Lusatian Neisse with ArcEGMO as part of 2 EU-funded projects (NEYMO and NEYMO-NW).

A lot of individual data can also be obtained in the download area of the portal and used for planning the use of water resources, but also for teaching and research. All data is provided free of charge. In the second complex, the high demand for hydrological characteristics, average flow characteristics (low water flowrates MNQ, flow rates MQ, flood flows MHQ) and flood peak flows with annuality HQ(T) for all river cross-sections of the Saxon watercourse directory in a Web application with interactive query. The additional information on continuity is provided via the connection of the database to the transverse structures. In **Figure 2** you can see an example of the water Tännichtbach.

It is possible to choose a water section, you get the water characteristics and at the same time you can inform yourself about the continuity of the water. Due to the methodological approach, these values document the anthropogenic largely unaffected state. In areas significantly changed by control, additional information must be used to check plausibility. This means that important water management input variables are available, e.g. in the determination of minimum waterflows, of multi-year average flow rates, in the designation of drinking water and flood areas or for all hydraulic engineering measures that have been drawn up on the basis of uniform procedures. Approval procedures can thus be accelerated. For the use of the data, detailed

Synopsis

- Available as a presentation and download in the water balance portal: Water balance modelling with measured state and climate scenarios 1961-2100 and taking into account different land uses, epecially in post-mining landscapes.
- Also available in the portal: Hydrological parameters as a basis for water law procedures.

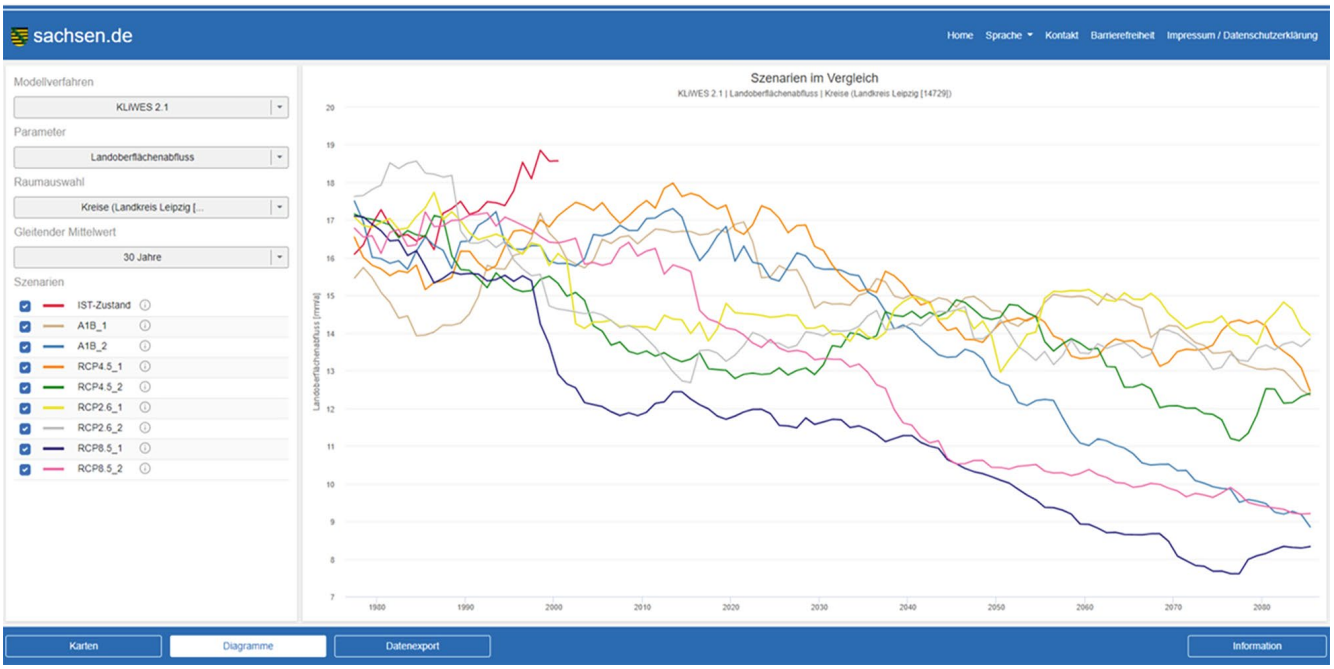


Figure 1: Corridors for the development of land surface runoff in Landkreis Leipzig taking into account various climate scenarios

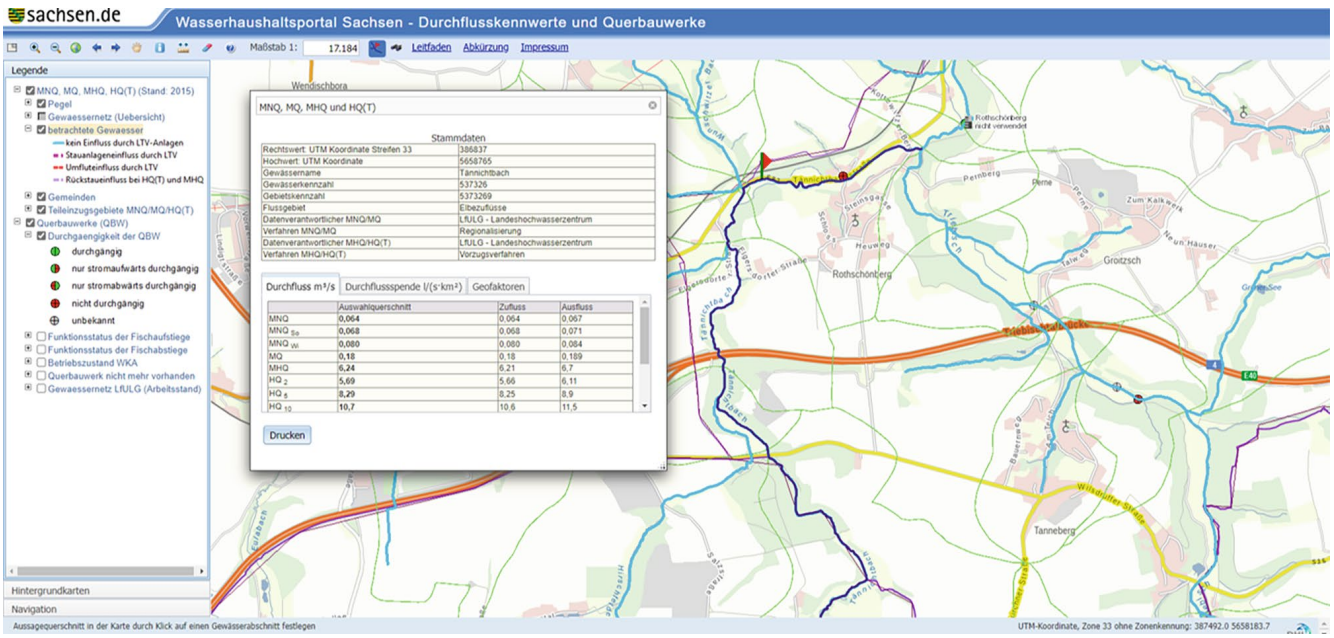


Figure 2: Water section of the Tännichtbach with flow characteristics

instructions for use have been provided for all applications in the water balance portal. The methods used and the data bases are important for the interpretation of the results. In addition, the portal names the many authors who have accompanied the corresponding subprojects professionally and are also available for further questions. The data will be updated if necessary.

Author

Karin Kuhn
retired (since 2020/02)
formerly Division Surface Waters, Water Framework Directive
Saxon State Office for Environment, Agriculture and Geology (LfULG)
Dresden, Germany
karinkuhn54@gmail.com

Global Water Partnership Supports Armenia to Achieve SDG 6 Targets

The Global Water Partnership (GWP) supports mobilization of national potential in water sector of Armenia and the implementation of principles of integrated water resources management (IWRM). GWP has started to support of the Sustainable Development Goal 6 (SDG 6) since the beginnings and continues its activity on this way until now. Armenia is on its way towards the implementation of IWRM and SDG 6 principles. In this regard wastewater treatment (WWT) is a challenge, but it must be solved.

Alisa Y. Savadyan

The GWP has started its activities in the Country since 2005 and continually supports the mobilization of national potential in water sector, supports the implementation of principles of IWRM and works with Armenian Government to achieve SDG 6 targets.

Several projects were implemented within the period 2016-2019 on the way of monitoring of SDG 6 some targets; methodology of implementation was provided and explained to state institutions and focal points.

The one very important for Armenia project, which has been implemented by GWP was the project aimed the development of SDG 6 implementation strategy, which was done with support of United Nations Development Programme (UNDP) and GoAl-Waters in 2020 -2021.

The Strategy paper outlined vision of the Armenian Government until 2030 towards to provide access to water supply and sanitation service for all, also keeping clean environment, treated wastewater and organize proper management of the infrastructure and resources.

Wastewater treatment and integrated water resources management

The strategy is an integrated document, which provides a program of measures and a mid and long term action plan for implementation of each measure to achieve SDG 6 all targets. However, I would like to pay your attention only to one and very significant problem for Armenia, which was also emphasized in the Strategy document. It is WWT, including treatment plants rehabilitation and properly operation of already constructed WWT Plants.

Operation of the WWT plants and wastewater treatment in the local rural areas are still problematic points for Armenia, which caused serious ecological issues. The best solution which is offered by SDG 6 strategy is construction of small natural based local facilities.

After the Soviet collapse serious reforms in the water sector were necessary, Armenia started fundamental reforms and it should be noted that serious steps were done in the country.

Starting from 2000 year the process of development of the new water legislation has been started, taken into consideration the main principles of IWRM and Water Framework Directive. According to the newly developed Water Code in 2002, two main actors were recognized in the water sector: resources manager body and infrastructure manager body.

The functions and responsibilities of these two managerial structures, as well as responsibility of independent regulator of public services are clearly defined by local water legislation.

It was a big and very important step for Armenia to understand how the main principles of IWRM and the management planning approach have to be implemented in the country.

© Melkonyan

Figure 1: View of Sevan Lake from Sevan peninsula; Lake Sevan is one of the biggest freshwater lakes in the world, situated in Gegharkunik region of Armenia at an altitude of 1,900 m

Synopsis

- A Global Water Partnership is supporting Armenias SDG 6 target implementation and monitoring.
- Armenia towards the implementation of IWRM and SDG 6 principles: wastewater treatment is a Challenge, but it must be solved.
- Lake Sevan, the big source of potable water, is endangered due to human activities.

Figure 2: View of Sevan from shore hotel in summer; Sevan Lake has an important recreational value, many hotels and recreational zones are located along the shore

Figure 3: Kechut Water Reservoir, located in Vayots Dzor Region of Armenia; the Water reservoir was constructed on 1980, for transportation of water from Arpa via Arpa-Sevan tonnel (constraction 1981-2004) and rising the level of the lake

Parallel significant reforms were done in infrastructure and resource management sectors.

In water resource management sector significant amendments were done, responsible body has started development of river basin management plans, balancing of water demand and use in different sectors, basin management bodies were established and water quality monitoring enhanced and improved.

The territory of Armenia is divided into six river basins and basin management plans development process has been run with support of European Union funds. Management plans were developed and approved by the Government for three basins, for the three others this process is continuing.

One of the biggest basins in Armenia is Sevan watershed basin, where freshwater Lake Sevan is located (**Figure 3**).

Lake Sevan

Lake Sevan is the biggest water body not only in Armenia, but also in the Caucasus region. It is the second highest freshwater lake on earth after Lake Titicaca in South America. The volume of lake is 33 billion m^3. The total surface area of its basin is about 5,000 km^2.The area of Sevan basin included Sevan National Park, Ornithological Preserve, State Sanctuary. Twenty-eight rivers flow into the lake and only one river flows out, which flows towards the Ararat Valley. Sevan Lake and Hrazdan river water are used for hydropower purposes. Lake Sevan has significant role in the process of forming the water balance of Caucasus. The biodiversity of the lake is also very important. Here are inhabited three endemic fish species. Previously fore sub-species of trout have inhabited in the lake, today two sub-species have disappeared, one is endangered and one trout is artificially cultivated at fisheries.

The Ramsar Site incorporates the entire hydrological system of the lake Sevan, including its watershed, tributaries and outflow. The site is important for numerous species of nesting and staging water birds, several of which are endangered in Armenia.

Lake Sevan, including its watershed, tributaries and outflow is one of the registered Ramsar sites in Armenia. Area of Sevan National Park is the one from the nine sites, included in the Areas of the Special Conservation Interest (Emerald network).

Sevan Lake has an important recreational value, many hotels and recreational zones are located along the shore (**Figure 1**).

Due to the Lake's importance for the socio-economic growth of the country, the restoration of its ecological balance, its water quality and its biological resources is one of Armenia's priority goals.

Unfortunately, caused by not reasonable human activities and overused of water in hydro energy purposes the level of lake decreases about twenty meters.

In the future, the level of lake was raised due to the construction of the Arpa Sevan tunnel, but the settlements and buildings built over 50 years and the planted forests went under water, which led to an ecological catastrophe. The quality of water has changed, the level of nitrogen and phosphorus increased and the lake became sick.

The problem of Lake Sevan is under attention of the government (**Figure 2**). In 2012-2013 Wastewater Treatment Plants (WWTP) were built in three towns nearby the lake. In the frames of EBRD loan project, the German company Ludwig Pfeiffer has designed and built the WWT facilities, only for mechanical treatment of wastewater, collected form the settlements.

The problem of lake blooms is growing every year, and now it can be considered as big environmental problem for Armenia. The international community provide their wilignace and support for cooperation with the Armenian government through various grant projects, but serious investments are needed to cure the lake.

This is a global problem and Armenia needs the support of partnership and international community to solve problem of Sevan Lake.

Author

Alisa Y. Savadyan
Global Water Partnership (GWP) Armenia
Yerevan, Armenia
asavadyan@gmail.com

Positioning Waterways in Development Decision-Making: Evidencing Values

This session identifies how and where the Inland Waterways community can focus research and evidence to influence development decisions affecting waterways. It draws on findings of a literature review on the multiple, evolving values and valuations for Inland Waterways and related public goods.

Nicki Schiessel Harvey

Introduction

For the full potential of post-industrial Inland Waterways to be appreciated within policy and development planning, advocates must promote robust messages about their value which align with prevailing ideas of what constitutes good development.

The UK Inland Waterways Association (IWA) commissioned a major literature review and scoping report on the Value of Inland Waterways [1] to help shape its campaigns focus and identify research gaps. As part of this, waterways-related themes and evidence on valuing other types of related public good were explored, as well as potential alliances.

This paper summarises some ways Inland Waterways advocates can draw on research approaches and findings in these other fields to help demonstrate the potential of Inland Waterways to address decision-makers' emerging priorities for city development (**Figure 1**).

Approach

Key focus areas derived from existing Inland Waterways literature and IWA priority areas were: Heritage; Green-Blue Infrastructure; Health & Wellbeing and Economic Development & Regeneration.

Synopsis

- To embed Inland Waterways into development policy agendas, we need to align to decision-makers' interests, motivations and priorities. These change over time and context.
- Reviewing how other public goods are valued and related to decision-maker priorities can inform Inland Waterways advocates how to position and negotiate the role of Inland Waterways in meeting wider development objectives.
- This paper gives examples of where research evidencing the transformational potential of Inland Waterways in development can be enhanced by adopting approaches from elsewhere.

Google keywords and Google Scholar identified sources in the policy and the industry arenas, including known organisations commissioning research (such as the Heritage Lottery Fund, Historic England, Canal & River Trust and DEFRA). Against each broad theme, the following questions were asked:

- What does [theme] mean? How is it defined, by who?
- What benefits, issues or values are associated with this theme?
- What are the main ways of measuring value for this theme?
- Who are the main stakeholders interested in or affected by this theme?
- How is this theme relevant to valuing Inland Waterways?

Initial review findings were used to identify and collate Inland Waterways-specific and wider water-related literature. The search was then widened to identify how the themes had been addressed in non-waterways arenas and consider how Inland Waterways evidence-creation processes could learn from these.

Findings

The review highlighted changes over recent decades in the socio-economic, environmental and political landscape in which decisions about Inland Waterways are made. These align with changing types of evidence being required and delivered for waterway-related projects.

In the UK in particular new priorities have emerged for politicians and decision-makers which are becoming embedded in development policy. New development drivers include: population health and wellbeing, housing supply, flooding, green transport, environmental enhancement and climate change mitigation and adaptation. The challenge for Inland Waterways advocates is to clearly demonstrate how post-industrial waterways are relevant and can help deliver decision-maker objectives.

This paper argues that actively aligning activities with other advocacy groups (for example cycling, heritage or housing), to target key policy priority areas, strengthens messages to decision-makers. The review found much research and evidence work by groups advocating for the support of other public goods can be applied to waterways. It recommended ways the Inland Waterways evidence and advocacy community could maximise impact, including:

© Schiessel Harvey

Figure 1: Canals in Birmingham, UK

Promoting inland waterway case studies within related research

The annual Heritage Counts reports [2] commissioned by English Heritage (now Historic England) are a good example of research aligned to changing agendas of heritage value (from Sense of Place and Place Branding to Economic Impact, Skills and Wellbeing). There is opportunity to embed more waterway-related examples; Inland Waterways are important cultural heritage assets as well as being built and industrial heritage assets. There is a need to frame heritage in current policy language by identifying how it can contribute to other values.

Adopting existing methodologies

There is a growing body of evidence on economic, health and environmental benefits associated with greenspace and bluespace, with transferable methodologies. For example, Natural Capital Accounting was used to value services from London's green spaces at £5bn per year through avoiding physical and mental health treatment costs, providing recreation facilities as well as temperature regulation and carbon storage. The approach calculated that for each £1 spent on public green space, Londoners enjoy at least £27 in value. [3]

The ecosystem services approach - increasingly used in studies of urban rivers and used in the comprehensive Jacobs review [4] - is also a useful way of articulating the multiple benefits inland waterways afford.

Building better alliances

Joined-up approaches to evidence-building are always valuable, especially where Inland Waterways have potential to address a challenge faced by other agents (e.g. industrial remediation, encouraging exercise or non-road transport). The review suggests potential alliances, notably in these 'new' areas of health and wellbeing not traditionally associated with industrial waterways.

Recent research commissioned by Canal & River Trust (CRT) [5] is an excellent example of creating an evidence base (and new organisation brand) very targeted at decision-makers. A focus on quantifying wellbeing benefits aims to secure ongoing waterways funding and to support negotiations with developers and city planners.

Consider waterways-specific gaps in knowledge

The notable gaps in the waterways and wellbeing evidence work to date in the UK is the contribution of navigation to wider policy priorities (maintaining fully navigable structures is normally not cost-effective if only for the boating benefits). There is a need for studies into the effects on wellbeing (as well as related aspects such as leisure use of waterways, or property desirability) of the presence of active water such as boats and canoes on Inland Waterways.

Where this gap-filling research can partner with related research and advocacy groups to target current policy priorities it will have the most impact.

Author

Nicki Schiessel Harvey
Birmingham City University
United Kingdom
nicki.schiesselharvey@bcu.ac.uk

Literature

[1] Schiessel Harvey, N.: The Value of Inland Waterways: A Literature Review and Scoping Report. 2019 (https://issuu.com/waterwaysassoc/docs/the_value_of_waterways_october_2019, Access 13.03.2022).
[2] Historic England (ed.) English Heritage (https://historicengland.org.uk/research/heritage-counts, Access 13.03.2022).
[3] Greater London Authority (ed.): Vivid Economics (2017) Natural capital accounts for public green space in London (www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/green-infrastructure/natural-capital-account-london?source=vanityurl, Access 13.03.2022).
[4] JACOBS for Defra and the Inland Waterways Advisory Council (ed.) The Benefits of Inland Waterways (www.waterways-forward.eu/wp-content/uploads/2012/06/The-Benefits-of-Inland-Waterways_Final-Report-July-2009_JACO.pdf, Access 13.03.2022).
[5] Canal & River Trust (ed.) Waterways and Wellbeing. Building the Evidence base: First Outcomes Report (https://canalrivertrust.org.uk/refresh/media/thumbnail/33802-canal-and-river-trust-outcomes-report-waterways-and-wellbeing-full-report.pdf, Access 13.03.2022).

Planning Waterways for Added Value: Joint Research by PIANC and IWI

Working groups formed jointly by PIANC and IWI are researching the leverage of ‚added value' from inland waterways by maintaining them for navigation, and by developing facilities that are suited to the needs of recreational boating. The paper describes the methodology of the two working groups, and early findings.

Arjan de Heer, Nicki Schiessel Harvey and David Edwards-May

PIANC, the World Association for Waterborne Transport Infrastructure, was founded in 1885 and brings together a huge community of engineers and professionals in seaports, maritime and inland waterways. PIANC has published more than 200 reports establishing references and standards for infrastructure projects. The more recently founded Inland Waterways International (IWI) has a diverse membership profile (waterway authorities, tourism operators, marine businesses, educators etc) and advocates and supports inland waterways for all uses. Users and their experience are key to knowledge sharing and contribute to project design and development. Aware of the complementarity, PIANC invited IWI to form two joint Working Groups whose initial findings are presented in this paper. The area of study covers all types of waterway, from extremely low use disused canals (**Figure 1**), through the main existing cruising waterway networks, to the busiest commercial waterways where recreational boating is not easily accommodated.

© David Edwards-May

Figure 1: The non-connected Saale-Elster Kanal and therefore an example of an extremely low use inland waterway

Working Group 228 is researching the Extended Values of Low Use Inland Waterways, while WG 219 is developing Guidelines for Inland Waterway Infrastructure to Facilitate Tourism. An early finding is the overlap between the two subjects, hence a need for cross referencing during the data collection processes and in the analysis of study cases.

Synopsis

- Understanding and defining added value is essential to securing the future of inland waterways for as many uses as possible, compatible with the basic environmental requirements of biodiversity and sustainability.
- Canal restoration projects may result in modest boat traffic while producing significant impacts, through conservation/enhancement of heritage, or by reviving small-scale urban logistics.
- Guidelines for nautical facilities aim to secure safer, hence more enjoyable, navigation through busy waterways (e.g. separate boat locks or ramps for portaging light craft).

Added value

‚Added value' is an overarching concept that will make the two reports relevant on all continents. Understanding and defining added value is essential to securing the future of inland waterways for as many uses as possible, compatible with the basic environmental requirements of biodiversity and sustainability.

For waterways that have lost their original commercial function of inland water transport, added value may be characterised by evaluating more comprehensively the various uses on and beside a well maintained and animated water space. Conversely, a better understanding of the unrealised potential and even the negative values attached to water bodies that are not maintained, in some cases stagnant or polluted, will be useful

Figure 2: Facilities for recreational navigation in Lyon

in analysing the overall economic benefit of any project. Examples include canal restoration projects where the resulting boat traffic is modest but produces significant impacts, through conservation and enhancement of the canals as heritage, or by the revival of intra-urban water transport with digitally-steered, automated intermodal units, as currently being tested in Berlin. ‚Low use' waterways may also be free-flowing rivers which cannot be used for navigation without dredging or other infrastructure investments.

The focus of the second group, chaired by IWI's president, is on the facilities provided to allow recreational navigation to develop. The waterway itself is not called into question as transport infrastructure. The focus is more on the conditions for co-existence of the commercial and recreational navigation functions. The guidelines aim to provide for safer, hence more enjoyable, navigation through busy river and canal sections. Examples are separate boat locks, or ramps for portaging light craft. The destination itself needs careful design, with mooring facilities adapted to the types of boat that are present on the waterways, or adapted to a new boating market that may be forecast to exist in the future by extrapolating current trends. The added value will be characterised by duration of stay and the amount of spend in the destination, which will depend heavily on the safety, comfort and quality of animation of the mooring facilities. Examples considered here are a large marina on the Mississippi River, the cities of Ghent and Lyon (**Figure 2**), the waterways of Serbia and the smaller waterways of the Nanjing region.

An appreciation of the inherent market is essential. For recreational navigation this relates to the quality of the urban and rural landscapes, including the banks and the parallel paths (former towpaths, or new cycle itineraries). Then, for both local and visitor populations, what is the position of the waterway segment or location compared to competing destinations in the region? Some segments or locations may not be mature for restoration and development because the potential market is currently too small.

Authors

Arjan de Heer
Witteveen+Bos Raadgevende ingenieurs b. v.
Deventer, the Netherlands
arjan.de.heer@witteveenbos.com

Nicki Schiessel Harvey, M. Sc.
School of Engineering & the Built Environment
Birmingham City University,
Birmingham, Great Brittain
nicki.schiesselharvey@bcu.ac.uk

David Edwards-May
Inland Waterways International (IWI)
Grenoble, France
david@edwardsmay.eu

Automatized Drought Impact Detection Using Natural Language Processing

Our Team developed a method for the automatized detection of drought impacts based on newspaper articles. The method can extract different classes of drought impacts and their geographic and temporal scope from text data. We generated a multi-sectoral dataset of drought impacts in Germany from 2000 to 2021.

Jan Sodoge, Mariana Madruga de Brito and Christian Kuhlicke

1 Introduction

Drought events impose a diverse set of impacts on social-ecological systems, ranging across social, economic, and ecological dimensions [1]. With an estimated annual cost of 9 billion USD in the European Union [2] [3] and the increasing likelihood of longer-lasting drought periods, assessing and understanding the complex impacts of droughts becomes increasingly relevant. Yet, current research lacks holistic, homogeneous drought impact assessment over long periods and geographical regions. Existing datasets present limitations in their composition due to the methods used for their creation. They are either focused on single impact classes or, if comprehensive, result from the manual extraction of drought impacts from text data. Thereby, the required workload of evaluating larger text corpora constrains the development of large-scale and multi-sector drought impact datasets.

To address this, we developed a novel method for the automatized detection of drought impacts based on newspaper articles. Our method allows classifying whether a drought impact is described within the newspaper article and extracting its geographical location. For both tasks, recent advances in natural language processing (NLP) are used [4]. Currently, the method allows assessing four distinct main impact classes: agriculture, forestry, livestock, energy & transport & infrastructure. However, our approach can be further extended to address additional impact classes (e.g. damages on inland waterways and canals). To exemplify the applicability of the proposed approach, we generated a multi-sectoral dataset of drought impacts in Germany between 2000 and 2021. In the past, significant drought events (2003, 2018/2019) and consequent impacts have been recorded in Germany across multiple sectors.

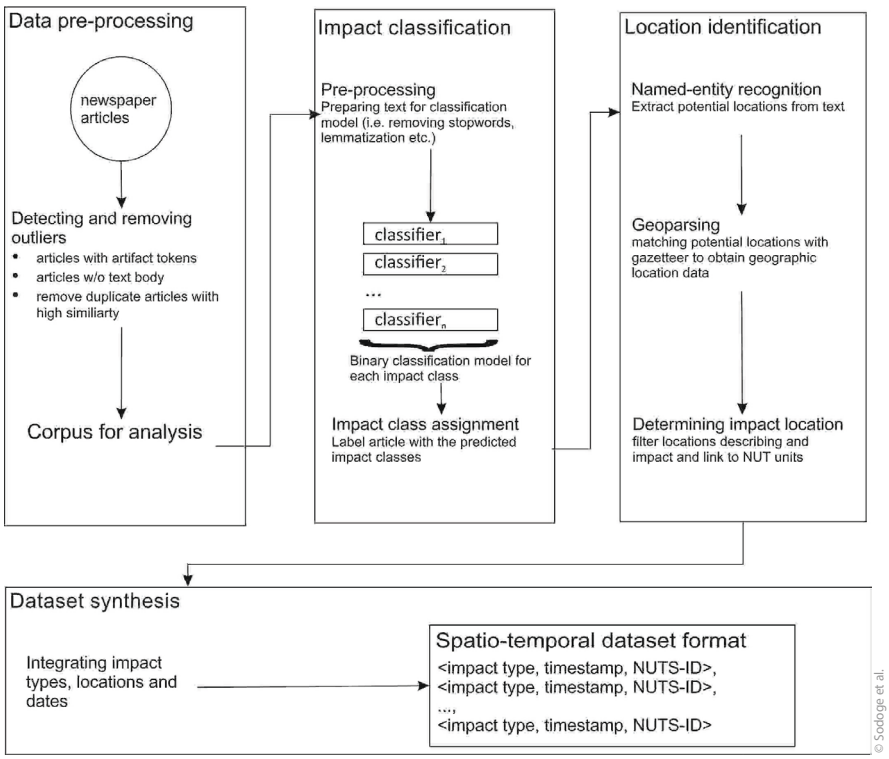


Figure 1: Schematic overview of the proposed method for automatized drought impact assessment

Synopsis

- A method for the automatized assessment of drought impacts based on natural language processing and machine learning is proposed.
- This method to derive a multi-sector drought impact dataset is applied in Germany between 2000 and 2020.

2 Methods

In this study, we integrated NLP tools and machine learning models for the spatio-temporal assessment of drought impacts based on newspaper articles. The developed method consists of four steps (**Figure 1**). First, we created a sample of newspaper

articles using a news aggregator database. This sample contains 41,000 articles that mention drought-related keywords (‚Dürre' or ‚Trockenheit'), published between 2000 and 2020 in ~250 different media outlets. Articles were then pre-filtered by removing highly-similar articles as well as those mentioning drought keywords within non-relevant contexts. Second, we used supervised classification models to predict whether an article describes any drought impact class on their text. For each of the four drought impact classes, a lasso-logistic regression classification model was trained on human-annotated data [1]. Third, we extracted the geographic locations of the potential drought impacts using named-entity recognition and matching with a gazetteer. We also derived heuristics to evaluate which locations concern the drought impact. Thereby, locations mentioned within different contexts (e.g. the place of an institution) are ignored for the impact location. For statistical analyses, the results were aggregated according to the Nomenclature of Territorial Units for Statistics (NUTS). Fourth, we merged the predicted drought impacts and geographic locations into a spatio-temporal dataset. Also, here we intend to correct for biases introduced from newspaper's reporting (e.g. overreporting in densely populated areas).

To ensure the validity of the produced results and evaluate their accuracy, we conducted an extensive empirical validation based on multiple datasets. These include, for instance, bio-physical data (soil moisture and precipitation) and drought impact-specific datasets (e.g. forest fire counts or agricultural yield statistics).

3 Preliminary results

Based on the application of the proposed method to a sample of 41,000 articles that address droughts, we compiled a multi-sector dataset of drought impacts in Germany between 2000 and 2020. We identified a total of newspaper articles 6,809 describing drought impacts where the largest share related to impacts on forestry. During the drought of 2018/2019, preliminary results indicate that the forestry and livestock impact classes predominated (**Figure 2**). The resulting dataset describes both longitudinal trends as well as spatial differences in drought impacts across Germany. For instance, the extreme drought events of 2003 and 2018/19 are reflected. Also, the resulting dataset highlights regional differences across Germany.

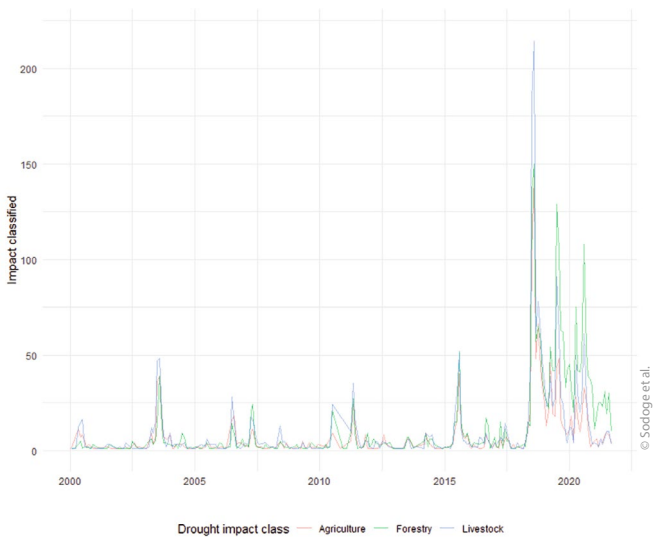


Figure 2: Longitudinal perspective on the classified drought impacts by month-year (preliminary)

When compared to the original annotated dataset [1], the drought impacts classification models achieved 92-96% accuracy levels. Furthermore, empirical validation showed that the created dataset correlates significantly (both temporal and spatial) with evaluated soil moisture, forest fire statistics, and agricultural yield statistics. Training samples of 100-200 annotated articles proved to be adequate to reach sufficient accuracy levels. However, the accuracy of models depends significantly on the presence of a set of characteristic words used to describe the drought impact classes.

4 Conclusion

Within this research, we develop an approach for automatizing drought impact assessments. Our approach advances existing techniques because it (1) requires a significantly lower workload, (2) allows addressing large amounts of data, (2) reduces subjectivity and human bias, and (4) is generalizable to other hazard types as well as text corpora while achieving sufficient levels of accuracy. Preliminary findings highlight the applicability of natural language processing and machine learning to create comprehensive, spatio-temporal homogenous impact datasets. Such impact assessments can help guide the development of drought risk assessments and impact models. Furthermore, they can assist in the identification of relevant compound and cascading patterns [5].

Authors

Jan Sodoge
Mariana Madruga de Brito
Christian Kuhlicke
UFZ-Helmholtz Centre for Environmental Research
Department of Urban and Environmental Sociology
Leipzig, Germany
jan.sodoge@ufz.de
mariana.brito@ufz.de

Literature

[1] de Brito, M. M.; Kuhlicke, C.; Marx, A.: Near-real-time drought impact assessment: a text mining approach on the 2018/19 drought in Germany. In: Environ Res Lett 15 (2020), p. 1040-1049.
[2] Cammalleri, C.; Naumann, G.; Mentaschi, L et al.: Global warming and drought impacts in the EU. Publications Office of the European Union, 2020.
[3] Naumann, G.; Cammalleri, C.; Mentaschi, L.; Feyen, L.: Increased economic drought impacts in Europe with anthropogenic warming. In: Nature Climate Change 11 (2021), p. 485-491.
[4] Hirschberg, J.; Manning, C. D.: Advances in natural language processing. In: Science 349 (2015), p. 261-266.
[5] de Brito, M. M.: Compound and cascading drought impacts do not happen by chance: A proposal to quantify their relationships. In: Science of The Total Environment 778 (2021), p. 146236.

Cascade-Dammed Rivers and Flood Phenomena – An Example of Inland Waterway in Bydgoszcz

The human activity in the transformations of fluvial systems was shown. It is affecting the occurrence of the flood phenomenon. The research was carried out on the Brda River, using the Indicators of Hydrologic Alteration (IHA) method. Results showed low flood risk for the cascade-dammed river.

Dawid Szatten

1 Introduction

The hydrological regime, including the occurrence of floods, is limited by climatic, hydrological, and catchment factors. In the last decades, human activity has had an increasing impact on hydrological conditions. Research by Belletti et al. [1] showed that rivers in Europe are dammed with more than 1.2 mln barriers. More than 50% of large world rivers lost hydromorphological and ecological continuity [7]. Also, the Brda river is strongly transformed by hydrological structures [11]. In the longitudinal profile of Brda river, there exist the Mylof dam (in 133 km, created in 1848) and three reservoirs of Lower Brda Cascade (Koronowo 49 km, Tryszczyn 30 km, and Smukała 21 km, commissioned in the 1960s and 1970s). In addition, the lower section of the Brda River within the city of Bydgoszcz is strongly hydrotechnically transformed. It is a part of the International Waterway (IWW) E70, connected IWW E30 (Oder River) with IWW E40 (Vistula River) [5]. It is commonly assumed that the presence of hydrotechnical infrastructure is conducive to the absence of flooding. It should be noted that this must be related to the maintenance of suitable water management, in conjunction with achieving the environmental requirements set out in the Water Framework Directive (2000/60/EC) [2].

The main aim of the research was to demonstrate the impact of hydrologic alternation of the dammed section of the Brda River to flood phenomena. The conducted research is essential for the water management of city areas with cascade-dammed rivers, showing long-term observation of human pressures on the environment.

Synopsis

- Brda in Bydgoszcz constitutes a section of the river strongly transformed by humans, affecting hydrological and morphological alteration.
- The presence of hydrotechnical structures on the lower section of the Brda River affects the low flooding phenomena.
- Human activity improved the navigation conditions of the inland waterway

2 Methods

The study area is the Brda River, which is the left tributary of the Vistula River. Detailed research was focused on down part of Brda river in Bydgoszcz city (c.a. 12 km sketch), flowing in the glacial outwash sand valley surrounded by postglacial formations [6]. In the studied section of the river, starting from the XIV century, there were strong transformations [4]. Later transformations were related to the development of the wood industry and inland shipping. Water management of the Brda River is controlled by weirs on two hydro-nodes: Bydgoszcz and Czersko Polskie (**Figure 1**).

The hydrological data was the daily water stages on gauging stations on Brda River (Smukała) and Vistula River (Fordon), obtained from the public database of Meteorology and Water Management National Research Institute in Warsaw for the years 1981-2020.

To determine flood phenomena on hydrological regimes resulting from cascade-dammed river functioning, the Indicators of Hydrologic Alteration (IHA) method was used. The IHA method was proposed by Richter et al. [8]. The result of the research was 33 parameters describing hydrological alteration. The Range Variability Approach (RVA) method [9] was used to determine the variability of IHA parameters.

3 Results and discussion

The IHA model results showed that the variability of the water stages of the Brda River is lower than that of the Vistula River. In addition to the presence of hydrotechnical structures (dams, weirs, etc.), it determines the catchment area and the abiotic type of the river. Water management of the Brda River has been carried out using hydro-nodes: Bydgoszcz (Farny weir, Miejska lock no. 2) and Czersko Polskie (lock and Walcowy weir). The hydrological conditions are also determined by the operation of the Lower Brda Cascade [11]. On the Vistula River, the influence of human activity is marked by the presence of the single water stage in Włocławek [3]. The impact of hydrostructure is shown in the values of parameters of the 2nd group of the IHA method, especially the magnitude of annual extreme water conditions. Also, hydrological alternation in frequency and duration of high

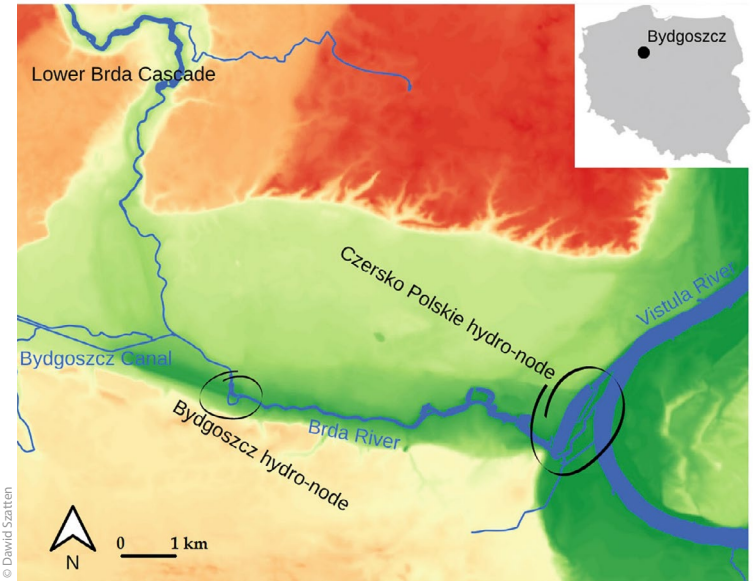


Figure 1: Study area of Brda River in Bydgoszcz on the background of the Digital Elevation Model (geoportal.gov.pl)

pulses (group 4th of IHA) and rate and frequency of water condition changes (group 5th of IHA) were shown. On the Brda River, the water stage is maintained artificially by weirs for most of the hydrological year. In the case of the Miejska lock no. 2, the damming level is around 35.9 m a.s.l., and in the case of the Czersko Polskie lock – around 32.7 m a.s.l. In the case of low water stages, the Brda river outflow to the Vistula is uninterrupted. Outflow problems begin in the case of high water stages recorded on the Vistula River. At the water stage on the gauging station on the Vistula River in Fordon at about 700 cm, the outflow of the Brda waters is dammed. These long-term conditions cause flooding of the lowest, close to riverside areas of Bydgoszcz city [10].

4 Conclusions

Based on the results of conducted studies of hydrological alteration of Brda river on the flood phenomena, the following conclusions were drawn:

1. The Brda in Bydgoszcz constitutes a section of the river strongly transformed by human activity for centuries, which affects hydrological and morphological transformations. Water alternation depends on the Lower Brda Cascade operational regime (the upper part of the catchment) and water management in hydro-nodes in Bydgoszcz. Also, it results from the operational regime of Włocławek Reservoir and natural conditions in the upper part of the Vistula River catchment.
2. On the lower section of the Brda River, flood events are rare. As it has been shown, flooding occurs only in the case of high water stages of the Vistula River. Then the outflowing waters of the Brda are dammed in the river channel. It may cause local flooding of the lowest, close to riverside areas in Bydgoszcz.
3. Human activity contributes to the improvement of the navigation conditions of the inland waterway. It should also be noted that flood risk is relatively low.

Author

Dawid Szatten, Ph. D.
Kazimierz Wielki University, Institute of Geography
Department of Inland Waterways Revitalization and
The Information and Promotion Center of Inland Waterways
Bydgoszcz, Poland
szatten@ukw.edu.pl

Literature

[1] Belletti, B.; Garcia de Leaniz, C.; Jones, J. et al. : More than one million barriers fragment Europe's rivers. In: Nature (2020), No. 588, p. 436–441.
[2] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 Establishing a Framework for Community Action in the Field of Water Policy (https://eur-lex.europa.eu/eli/dir/2000/60/oj, Access 21.10.2019).
[3] Gierszewski, P.; Habel, M.; Szmańda, J.; Luc, M.: Evaluating effects of dam operation on flow regimes and riverbed adaptation to those changes. In: Science of the Total Environment (2020), p. 136 202.
[4] Guldon, Z.; Kabaciński, R.: Sketches of the history of former Bydgoszcz from the 16th to the 18th centuries (in Polish). In: Proc. of the Bydgoszcz Scientific Society (1975), No. 9.
[5] Habel, M.; Szatten, D.; Nadolny, G.: Hydrological and navigational conditions of the Polish section of the International Waterway E70 (in Polish). Gdańsk: Marshal's Office of the Kuyavian-Pomeranian Voivodeship publish., 2017.
[6] Kondracki, J.: Regional Geography of Poland (in Polish). Warzawa: Polish Scientific Publishers, 2000.
[7] Nilsson, C.; Reidy, C. A.; Dynesius, M.; Revenga, C.: Fragmentation and Flow Regulation of the World's Large River Systems. In: Science (2005), No. 308, p. 405-405.
[8] Richter, B. D.; Baumgartner, J. V.; Powell, J.; Braun, D. P.: A Method for Assessing Hydrologic Alternation within Ecosystems. In: Conserv. Biol. (1996), 10, p. 1 163-1 174.
[9] Richter, B. D.; Baumgartner, J. V.;Wigington, R.; Braun, D. P.: How much water does a river need? In: Freshw. Biol. (1997), 37, p. 231–249.
[10] Szatten, D.: Influence of hydrotechnical structures on the occurrence of extreme water levels illustrated on the example of the canalized part of the Brda River (in Polish). In: Inżynieria Ekologiczna (2016), 46, p. 55-60.
[11] Szatten, D.; Habel, M.; Babiński, Z.: Influence of Hydrologic Alteration on Sediment, Dissolved Load and Nutrient Downstream Transfer Continuity in a River: Example Lower Brda River Cascade Dams (Poland). In: Ressources 10 (2021), No. 7, p. 70.

New Life in the Old Docks and the Re-opening of the Nederschelde in the City Centre of Ghent

In Ghent, there are two recent projects that, with European support, make water more prominent in the city; one brings new life to the inner city and to tourism; in the second the old docks connect two former industrial districts in an urban renewal initiative and they create a completely new district in themselves.

Rudy Van der Ween

In the next fifteen to twenty years the environment of the Oude Dokken (Old Docks area) of the city of Ghent will change into a completely new district on the water (**Figure 1**). Around 1500 new homes are being built in the area between the Dampoort and the Muide district, well equipped with green and open space and public facilities. New bridges for pedestrians, cyclists and car traffic ensure the connection to the historic city center. In short: Ghent will get a new vibrant part of the city.

The project zone is located around the three oldest docks in Ghent; the Houtdok (in the north), the Handelsdok (central) and the Achterdok (in the south).

Until the end of the last century, real harbor activities were carried out here. In the second half of the 20th century, however, these activities gradually began to move from the area around the Old Docks to the new port. Ships grew and in the Oude Dokken there was hardly any room for expansion. When the Port Authority decided to definitively withdraw from the old port area, it was time to look for a new purpose for this special site.

In 1999, the port decree pushed the boundaries of the Ghent port area. As a result, the Old Docks were no longer part of the Ghent port and the grounds were transferred to the City of Ghent. The Spatial Structure Plan for Ghent from 2003 then turned the Oude Dokken into an area for urban living. The possibilities for a new interpretation of the area were open.

Unique character of the Oude Dokken

The enormous vastness of the area gives the Oude Dokken a unique character. An immense water surface, three neighborhood parks, a lot of residential greenery and wide quay surfaces give residents and visitors plenty of room to breathe. The redesigned quay surfaces form the connection between the various public spaces: a dream for walkers and cyclists.

The link with the historic city center is essential for the project. New cyclists and pedestrian bridges ensure a smooth and safe connection between the two districts. A new tram line on the Dok Noord - Dok Zuid axis, with stops at the new bridges, ensures that pedestrians can easily transfer to public transport.

Striking in the design include the diversity in homes and public spaces, the attention to collectivity and the far-reaching ambitions in terms of mobility and sustainability. The developer goes for a neighborhood with 100 percent green heat and 100 percent green energy. This fits perfectly with the policy ambitions of the City of Ghent regarding climate neutrality.

In addition to the homes and residential green areas, various neighborhood functions, such as an extra day care center, catering and retail are provided.

At the same time, part of the water has been filled in, after which the City of Ghent will transform this piece into a recreational zone, with beach and greenery. The park will be ready in the course of 2019. Only then will the entire zone become accessible to the public.

Later there will be another marina in the Houtdok. That is why the construction of a sloping surface with a jetty was also part of these works.

The reopening of the Nederschelde (or Lower Scheldt) is about making the historic watercourse visible again in the city centre of Ghent. The Nederschelde was overgrown and filled in years ago and was mainly used as above ground parking. Now it's become a quiet waterway again for recreational boating with banks for walkers and cyclists.

It starts at Portus Ganda, the place where once the settlement Ganda (later named Ghent) arose, at the confluence of the rivers Scheldt and Lys. The project has been going on for decades. Earlier this part of the city was rejuvenated with an inland marina, three new bridges, a lock, a renewed old market place, a park and a bicycle underpass.

The last phase of the project started in November 2016: the remaining 200 meters of water between the streets, called the Reep and Bisdomkaai, were connected to the water at the Scaldis

Synopsis

- Re-opening of an overgrown and filled in waterway in the city centre.
- Old docks that create new life in a former industrial outport.

Figure 1: Project Oude Dokken – Handelsdok

lock, next to the old market place at the end of 2018. De Vlaamse Waterweg NV (the Flemish waterway authority) celebrated the official opening on 3 November of 2018. From that moment, boats were able to sail all around the historic city centre again, after nearly 50 years.

Author

Rudy Van der Ween
Inland Waterways International (IWI)
Ghent, Belgium
president@inlandwaterwaysinternational.org

Tbilisi Sustainable Waterfront Revitalization Project

The plan is to regenerate the riverfront infrastructure, develop transport services and reintegrate the river Mtkvari into the social life of Tbilisi, as part of the sustainable transformation agenda and contrary to the heritage of urban development policies left from the century before.

Iva Vasadze and Giorgi Maisuradze

1 Introduction

The river Mtkvari (known internationally as "Kura") is the largest river in the Caucasus, flowing eastward through Tbilisi, Georgia, to the Caspian Sea. Historically, the river shaped the cultural identity and the urban character of the city, rapidly changing and developing under the influence of forces of growing urbanization into its current form, which reflects what one would refer to as patterns and priorities of the city development policies dominant from Soviet up to modern times.

Over these years, the functional profile of the river began to shift – dams and reservoirs gradually started to build up over the channel and the river banks were transformed into the arteries for city-wide traffic to accommodate the demand under the rising automobile culture, leading to the authentic nature of the landscape being compromised.

From a physical phenomenon highly integrated into the social life of Tbilisi in its early days, the river Mtkvari has been remodeled to what appears to be a line of division within the city structure, creating an environment unwelcoming to livability, accessibility, and of universal mobility ideas newly-emerged into the planning vocabulary of the city, and representing a key challenge to the authorities and planners on their way forward to sustainable development agenda (**Figures 1, 2** and **3**).

© Royal HaskoningDHV

Figure 1: Mtkvari riverfront book market in winter times

In its attempt to seek transformation and smooth transition towards urban livability, the goal of the Tbilisi Sustainable Waterfront Revitalization Project is twofold – first, to regenerate the river infrastructure and revive the connectedness of the waterfront to the urban social life, and second, to provide long-term solutions to the current transport and mobility challenges of the city.

Synopsis

- Tbilisi riverfront revitalization project reflects the transition phase to the sustainable transformation agenda.
- Reintegrating the river back with the city goes hand-in-hand with the need for the long-term transport solutions.
- The Challenging task of balancing the smooth transition requires engagement and building trust in public.

2 Methods

2.1 Waterfront regeneration

The waterfront regeneration process would involve rethinking the role of the river in the development patterns of the city and adopting the approach based on the values and strategies of sustainable urban mobility planning, manifested into the project through the objectives of progressively reducing car traffic, and increasing pedestrian connections and car-free areas along the riverfront, first, in the center and then, to the other parts of the city.

Scattered urban fabric at the sections of the river banks contributes to the potential of establishing a new recreational network, as well as plazas, boulevards and public spaces to bring people close

Figure 2: View to the Old Town and Meidan Bazar

Figure 3: The Bridge of Peace is connecting Rike Park with the Old Town

to the river, strengthening the presence of the water and the need for care and responsibility in daily life. Eventually, an increase in the quality of the surrounding area would open up prospects for a healthy environment formation, with positive effects on the local climate action and the quality of life for residents.

The assessment of the waterfront potential based on a set of indicators enables us to identify the existing structures, the missing links to be filled in and the opportunities to be taken forward, translating into long-term vision planning, being at the heart of the methodology and technical actions used to lay the ground for carrying out the project objectives.

2.2 Transport

The revitalization of the surrounding area is coupled with a vision of developing river transport infrastructure and services, designed to incorporate public transport and tourist routes, with the aim of supporting the redistribution of the growing demand on mobility between the different modes of transport, and to enhance the experience and human interaction with the historic center at and around the riverfront.

At the core of the action, the city authorities and planners utilized the city-wide mobility patterns and the mode-based ridership demand to generate an input for conceptualizing the river transport system, and the emerging Tbilisi Sustainable Urban Mobility Plan (SUMP) provided the strategic background necessary to ensure the coherence of the project with the long-term goals and actions for Tbilisi.

The elaboration of legal and institutional structures with an emphasis on creating a regulatory framework for appropriate navigation rules, licensing and technical standards, sanitary and safety issues, intends to support the emergence of new transport services on the river Mtkvari and follows the project's designed scope of work.

3 Results

The challenges and opportunities at the center of the project are significant and tightly intertwined, insomuch as it bears relevance to the ambitions and capacities as well as to the constraints and contradictions of the city planning efforts. The transition to the new sustainable urban and mobility planning agenda entails an increased sense of deconstruction of the habits, modes, and practices of the existing social realm and requires building trust in public across the diverse segments of society. This is expected to be done by way of mixing political action, communication activities, and the public engagement efforts in multiple directions.

In light of uncertainty on the road of transformation, the multi-stakeholder planning and preparation process is key to the successful implementation of the project ambitions and goals. As a result, the know-how, the consistency of actions across the sectors of public life, and competent leadership are vital to balance the tendencies and needs of actors in the political, social, and economic level-playing field in the rapidly growing Tbilisi.

The current project is in the middle of this context, conditioned by the significance of the riverfront to the daily dynamics of urban life.

4 Conclusion

Up to this date, the potential of the river Mtkvari as a transport artery and a hub of social life has not been fully unlocked. A great deal of importance is put in place to ensure the project covers all the key aspects, from the environmental to the urban and mobility planning, as well as broader social and cultural elements characteristic to the city.

Authors

Iva Vasadze
Giorgi Maisuradze
Tbilisi City Municipality
Transport and Urban Development Agency
International Relations and Projects Unit
Tbilisi, Georgia
i.vasadze@tbilisi.gov.ge
gio.maisuradze@tbilisi.gov.ge

Implementation of Nature-Based Flood Control Measures in Brno

The project focuses on the implementation of the first two stages of comprehensive flood prevention measures. The project aims to protect the persons and property of inhabitants of the Brno Metropolitan Area and overall make the affected area more attractive.

Radim Vítek and Bibiana Janebová

Introduction

The city of Brno lies at the confluence of two important rivers, the Svratka and the Svitava. As a result of numerous and repeated modifications of the riverbeds in the city, there have been fundamental changes to the routes and the transverse profiles, and a cessation to the fluvial-geomorphological processes of riverbed and floodplain development throughout the entire city. Currently, the Svratka in the city of Brno is partially enclosed (**Figure 1**). It is most regulated in the central part of the watercourse, where the riverbed flows between sheer stone walls. This situation has had adverse consequences both in terms of fulfilling the ecosystem functions of the watercourse and the floodplain, and in terms of flood protection.

Figure 1: The Svratka river in the city of Brno

Floods in Brno

During the historical development of the city of Brno, its suburbs and the villages along both rivers were threatened by flooding, while on higher ground, the core of the city surrounded by walls remained out of the reach of the floods. With the gradual connection of these flood-affected suburbs and villages to Brno, the negative economic impacts on the city and its inhabitants also intensified. This was one of the reasons why the riverbeds of both rivers were regulated in 1847.

In the 20th century, two Q_{100} flood events occurred in Brno shortly after each other, i.e., in 1938 and 1941. Two Q50 floods of the Svratka were also recorded in January 1920 and February 1946. Brno was saved from potentially the most catastrophic flooding of the 20th century in July 1997 only thanks to the accumulation of water at the Vír dam, where the water level was temporarily reduced by 10 m due to repair work on the dam and the construction of a water supply system.

Based on the course of the flooding that occurred in 2006, the city proceeded to create a comprehensive flood protection plan using near-nature principles. As part of the concept, flood control measures on the main watercourses in Brno were divided into 28 separate stages.

Synopsis

- The main benefit of the project is the implementation of nature-based flood protection measures in the area.
- The increase in biodiversity in the centre of the built-up part of the city can be perceived as unique by creating a rich littoral zone along the watercourse and building an extensive wetland.
- In addition to the above, this project also brings great added social value by creating public spaces designed for the recreation of residents near the watercourse through a network of footpaths and cycle paths.

Nature-based flood control measures

The first section of flood control measures on the Svratka, the implementation of which has now begun, includes stages VII and VIII in the Poříčí Street. The aim of the project is to protect the inhabitants of the city of Brno and their property from flood-

ing, revitalize the watercourse, make the affected area more attractive, and free up land for further development, as existing buildings, and redevelopment areas close to the Svratka are now significantly limited by the established floodplain of the river.

The basic principle of the solution is the construction of offset flood protection levees or walls, and the improvement of the morphology of the watercourse and floodplain. In addition to the above, the project also brings great added social value by creating appropriately designed public spaces for the recreation of residents nearby the watercourse through a sophisticated network of footpaths and trails. The balanced share of public spaces and green areas is a counterbalance to the adjacent built-up land and tends to eliminate the heat islands in the city center. This solution also enables the completion and expansion of a backbone network of cycle paths, which significantly contribute to sustainable urban mobility (**Figures 2** and **3**).

The project of nature-based flood control measures is designed as a functionally interconnected unit, an integral part of which are the necessary investments in related technical infrastructure (e.g., vertical supporting structures, reconstruction and relocation of utilities, or protection of sewerage networks).

This is a Summary of the basic parameters of the project:

- Preparation of the project took place between 2018 and 2020;
- Implementation of the project is planned between 2021 and 2023;
- Construction of Q100 flood protection (395 m^3/s) with a safety increase in height of 30 cm;
- Protection of 5,823 inhabitants from the effects of Q100 flood waters;
- Protection of property worth 214 million EUR;
- Revitalization of 3.15 km (21 ha) of the watercourse; and
- Creation of a separate wetland covering an area of 2.6 ha.

The total project costs for the preparation and implementation of the projects are 66,5 million EUR including VAT. The project is planned to be co-financed by the State Environmental Fund of the Czech Republic, which received funding of 30 million EUR from the European Union from the Next Generation EU Fund.

Figure 2: Project visualisation – Svratka Riverfront

Figure 3: Project visualisation – Extensive Wetland

Conclusion

The implementation of nature-based flood control measures will increase the protection of built-up areas of the city of Brno while maintaining the maximum possible flow levels on the municipal floodplain. The project is inherently highly innovative and combines current approaches to the adaptation of urban areas to the impacts of climate change, i.e., it uses nature-based measures to combat drought and floods. The increase in biodiversity in the center of the built-up part of the city can be perceived as unique by creating a rich littoral zone along the watercourse and by building an extensive wetland. The project represents a comprehensive solution with multidisciplinary benefits and is in line with modern knowledge and approaches to the resolved issues. The project can be considered an exemplary solution not only on a Czech but also a European scale.

Authors

Radim Vítek
Bibiana Janebová
The Brno City Chief Architect's Office
Brno, Czech Republic
vitek.radim@kambrno.cz
janebova.bibiana@kambrno.cz

New Concepts for Inner City Marina's and Water Use

Climate change, heat stress, dry and wet periods and increasing density make the design of cities more complex. Water will be key issue for space, protection and cool down. This brings new opportunities for the use of water for recreation. New marina concepts that address that challenge are needed.

Rob Vrolijks

The world is changing rapidly. Urbanization is growing and inner cities become dense areas with high rise buildings, mix of functions, more houses per acre and increasing traffic and recreation. In the meantime climate is changing. Temperatures on average are rising and periods of extreme drought and extreme floods from sea and rivers will be more frequent. In city centers these challenges are even bigger. Heat stress will influence the urban quality of living and the lack of unused space will complicate an adaptive design to deal with floods and dry periods. Shared space is the only suitable solution.

At this point design of waterfronts, design of marina's and waterways is often not well enough connected to the new city center challenges. We try to make water ways and former harbors to be regenerated and to be used for boating, recreation craft, water sports and marinas. In other design offices people are redesigning these same waterfronts and water areas to cope with new climate challenges. The connection is not there.

One of the reasons is that design of marina and water sport concepts is too often only focused on the function itself. We design pontoons, quays, restaurants, sports areas and waterway connections as a function on its own. And for flood protection, water retention and temperature cool down we design other areas with no space for water sport and water recreation.

Synopsis

- Climate change, increasing density in cities and extreme wet and dry periods will change the needs and design of city centers in future rapidly. Water will be key issue in the redesign.
- Water brings space, lowers the temperature, offers recreation areas and defends biodiversity in a changing world. The water we design should also become water that we use for recreation.
- Marina and water sport concepts should adept to this new challenge and should be less introverted. New concepts of marinas and water use are needed to appeal to new inner city needs.

New concepts are needed

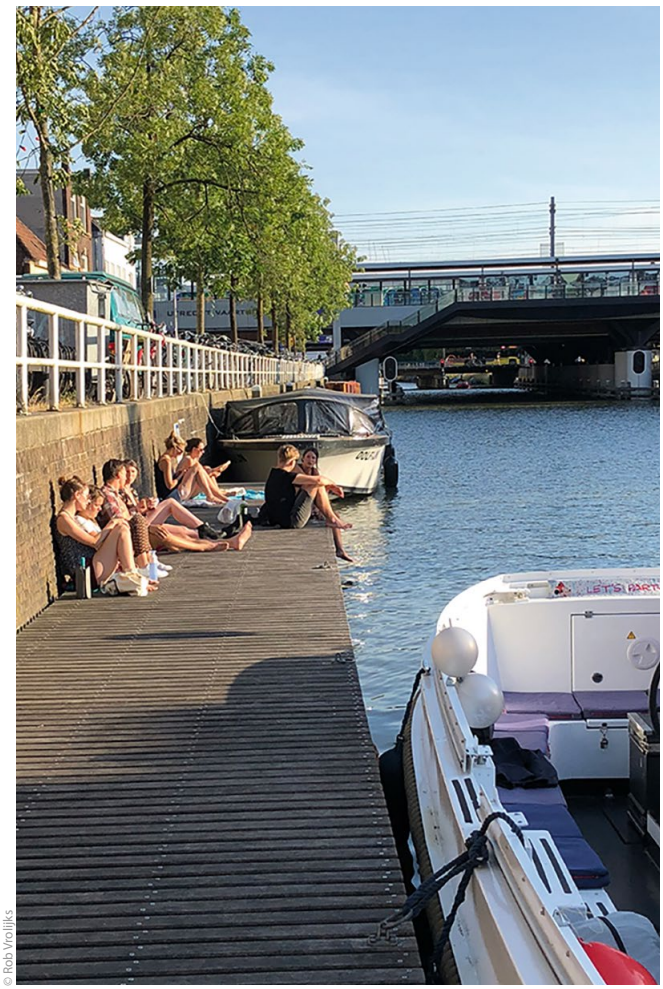
We need new concepts for marinas and waterfront designs. In those concepts the challenges of the earth are leading. Knowing what is needed to retain water and protect against water defines the space where water sports and water recreation can fit in. For

© Rob Vrolijks

Figure 1: Akersloot combining outdoor swimming and mooring

© Rob Vrolijks

Figure 2: Leiden mooring and park integrated



© Rob Vrolijks

Figure 3: Utrecht mooring places are public and used as chill out

those circumstances new marina and water use types have to be developed. Some picture exemples in this article (Utrecht, Leiden, Akersloot) might help to get inspired (**Figures 1, 2** and **3**).

In Holland a team of consultants (including author) designed a system of typologies of marinas, called Marina Menu. Over 60 types of marinas are determined, including information on the concept, spatial needs on land and water and types of use possible. This Marina Menu is used as an instrument in regional and local studies to define the type of marinas and water recreation use that is the best fit on a specific spot or area. The Marina Menu types are often based on a given spatial context. An old river bank, closed canal, industrial harbor or natural estuary defines the possibilities. New challenges bring new circumstances that ask for new concepts for marinas, waterways and water recreation use.

On the website www.marinamenu.com the brochure is presented with the initial set of typologies. History goes on and the challenge is to develop new marina concepts that meet the needs of today and the challenges cities have to deal with. This article might be a starting point. We enhance stakeholders to enrich the Marina Menu with new concepts and present those online and on site. That we we can inspire cities and regions to think forward, to think together, to design integrated and to add value to both the water challenges of city centers and to the regeneration of waterways and harbors for recreational use. The integrated arguments ánd budgets will bring more power into both these agendas.

Author

Rob Vrolijks
Independent consultant water sports and marinas
Breda, Netherlands
info@vrolijks.nl

400 Years of History Continued – How We Saved Germany's Oldest Canal and What Was Learned in the Process

A ten-year campaign by a local initiative not only managed to secure the financing and structure for the renovation of the twelve historic locks of the Finow Canal. Moreover, the Federal Government now recognizes the economic importance of water tourism on inland waterways as being on a par with that of commercial traffic.

Hartmut Ginnow-Merkert

Background

When Germany's oldest and still navigable artificial waterway, the 400+ year-old Finow Canal, was threatened by budget cuts following the global bank crisis of 2008, its 12 historic locks were already well past their expected life span (**Figure 1**).

A study commissioned by the Ministry of Transport recommended the closure of those federal waterways that were no longer needed for freight traffic.

Until then, the Federal Government considered itself responsible only for those waterways that were of commercial significance. The study conceded a special status to a very small number of inland waterways and infrastructure objects – e.g. locks – that it considered of high potential in a tourism-based economic development. The historic Finow Canal was one of initially five such objects. However, the Federal Government would only assume a 50% of the total cost if the remaining 50% were countersigned by a corresponding regional body that did not exist at the time.

© Hartmut Ginnow-Merkert

Figure 1: Leesenbrück Lock, representative of 12 historic locks on the Finow Canal

Synopsis

- With a clear vision in mind but lacking experience the author and his team developed their campaign strategy by trial and error.
- Looking back, a structure may now become visible that the author is happy to put up for discussion while at the same time conceding that its complexity may be at times overwhelming for a small NGO.

Content

Starting in 2012, the Finow Canal became the platform for a series of activities that drew an ever-increasing number of supporters and finally led to a contractual agreement between the federal government and a newly-founded legal entity securing the restoration and modernization of its 12 historic locks for the next several decades. In order to familiarize himself with the parameters defining the significance of the Finow Canal, the author obtained the approval to serve as a voluntary lock keeper for the boating season of 2013 (**Figure 2**). Many encounters gave the author insights into the expectations of boaters, charter companies, tour operators, environmental associations, politically active guests as well as canal management and operation.

First and foremost, the Finow Canal had disappeared from public awareness due to its abuse as an industrial sewer during the forty years of East German communist rule. After the end of the GDR, people from other parts of East or West Germany and from abroad moved into the region who did not have any knowledge of the historical significance of this canal.

The Friends of the Finow Canal Association was founded in 2013 and immediately embarked on a series of activities to bring the Finow Canal and its heritage treasures back into public awareness. The first of a series of regional activities was the Trojan Christmas Tree event. A Christmas tree displaying a dozen Christmas wishes was delivered to the city's new Finow Canal promenade by a fleet of eight festively decorated canoes.

In the months and years after its founding, the friends of the Finow Canal campaigned on the regional level via:

- Finow Canal History Hikes using local insiders as guides and storytellers,
- Presentations to groups of citizens, political parties, student groups,

© Hartmut Ginnow-Merkert

Figure 2: The author as lock keeper


© Hartmut Ginnow-Merkert

Figure 3: Presentation of the Eberswalder Erklärung to the members of the German Bundestag

- Monthly Stammtisch meetings with speakers on regional topics of interest,
- Installation of information boards explaining the most relevant industrial-era heritage objects in the Finow Valley,
- Annual Finow Canal symposia in the city of Eberswalde.

At the national level, we expanded our campaign by participating in boat shows and, above all, our central Threatened Waterways symposium in 2015. The result of this symposium was the establishment of the Network German Waterways (N:DW) with a number of signatories representing 15 secondary waterways throughout Germany. The Eberswalder Erklärung [1] received massive political attention and support and was presented to the members of the German Bundestag in front of the historic Reichstag building in the government district of our capital Berlin (**Figure 3**).

Two months later, the author received an invitation from the Federal Minister of Transport to a panel discussion on the topic of water tourism, which a few years later resulted in the establishment of an administrative unit focusing on Germany's so-called secondary waterways. The most important governmental documents in this context are the federal water tourism concept [2] of 2016 and the most recent Masterplan Freizeitschifffahrt [3] of 2021.

Campaigning continued on an international level by the author presenting the Finow Canal to an international audience at several World Canals Conferences. The Friends of the Finow Canal Association is a member of Inland Waterways International, an organization that actively supported our cause on many occasions.

Conclusion

Now that the financial arrangements and structures are in place, it makes sense for us to look back and analyze the activities that made our campaign successful so far:

- History walks, presentations, Stammtisch and other meetings with regional decision makers were instrumental in bringing back the Finow Canal to the attention of the general public and administrators;
- A high-level symposium, the formation of a nationwide network of secondary waterways as well as the formulation of the Eberswalde Declaration and its delivery to the members of the German Bundestag attracted the attention and support of decision makers at federal level;
- Joining an international platform of heritage waterways helped our mission gain international recognition and support, which in turn strengthened our campaign against our national and regional administrative bodies;
- An ongoing series of activities, continuously supported with low-level actions and materials, has kept the Finow Canal theme alive in the ten years since our campaign began;
- An effort to bring some of our activities to the digital world in times of Corona failed, presumably because a large part of our population was older and often was not familiar with the corresponding technologies and procedures;
- It is necessary for us to acknowledge that we owe a crucial part of the positive result to a handful of key persons without whom our campaigns would not have succeeded, among them: Sebastian Dosch, former administrative employee of the Federal Waterways Authority, David Edwards-May, former president of Inland Waterways International, Stefan Zierke and Jens Koeppen, Members of the German Parliament, Daniel Kurth, Barnim County chief administrator and his staff along with the members and supporters of Friends of the Finow Canal Association. Although we are satisfied that we have reached an important milestone for the Finow Canal and other threatened waterways in Germany, we are aware that our efforts must be continued with great commitment.

Author

Hartmut Ginnow-Merkert
Unser Finowkanal e. V.
Schorfheide, Germany
info@unser-finowkanal.de

Literature

[1] Unser Finowkanal e. V. (ed.): Eberswalder Erklärung (www.unser-finowkanal.eu/en/downloads-en, Access 02.11.2021).
[2] Bundesministerium für Verkehr und digitale Infrastruktur (ed.): Wassertourismuskonzept des Bundes (www.bmvi.de/SharedDocs/DE/Publikationen/WS/wassertourismuskonzept.pdf?__blob=publicationFile, Access 01.11.2021).
[3] Bundesministerium für Verkehr und digitale Infrastruktur (ed.): Masterplan Freizeitschifffahrt (https://masterplan-freizeitschifffahrt.bund.de, Access 01.11.2021).

Everyone Can Do Water? Qualification Needs of the Engineers and Specialists of Tomorrow

The planning, operation and maintenance of inland waterways are highly inter- and transdisciplinary. Engineers and disciplines involved must have highly developed methodological competence and expertise. The article shows the current state of training requirements, curricula in engineers education and change mechanisms because of digitization.

André Niemann, Jan Balmes, Rüdiger Heidebrecht and Helene Opitz

1 Introduction

The working world of planners, builders, operators, researchers and monitors in the environmental sector is thus subject to permanent change, and change is occurring at an increasingly rapid pace. What will the working world of tomorrow look like? What does Water Management 4.0 mean and what does it mean for me in my workplace? The educational landscape is changing rapidly. More than 20,000 different degree programs and over 300 vocational training programs are available for first basic education, and the number is growing. The digital transformation is only beginning and changing the working world of tomorrow. Retraining, adaptation training, shortage of skilled workers are some of the buzzwords. Europe continues to grow together and needs mobility and flexibility – also in the qualifications of its people.

In the following, an attempt is made to briefly present the various aspects to encourage people to think for themselves about the change in qualifications.

2 The educational framework in Europe and Germany

Water is the basis for many professions. The 2016 UN World Water Development Report writes powerfully „Three out of four occupations in the world are directly dependent on water". In Germany, around 250,000 people work in the water industry. About half of them are employed by the operators of the water infrastructure, at the waterworks, in the urban drainage area, at the sewage treatment plants, at the river master services, and in dam, or waterways and locks. Around 80% of these employees have been trained in dual vocational training programs. The rest are employed in public authorities, education and research, planning offices, construction companies and suppliers. Here, the proportion of academically educated people is higher than among operators.

The EU-Bologna process has turned european engineering degrees into bachelor's and master's degrees. Even after long discussions among university teachers, this change has been made, even if many still regret it today. Europe continues to grow together, not only in the financial world but also in technical standardization and legislation.

Vocational training has an important role in educating for the skilled trades, industry, the civil service, home economics, agriculture, maritime shipping and the liberal professions. The 324 (as of 2021) dual professions in Germany are unique in the world. Practical and accompanying theoretical training, usually over two to three years, form the basis for further training to become a master craftsman, technician or specialist. Water engineer (m/f), water management specialist (m/f), draftsman (m/f), well builder (m/f), pipeline builder (m/f), sewer builder (m/f), water supply technology specialist (m/f) - wastewater technology specialist (m/f) - pipe, sewer and industrial service specialist (m/f), to name just a few important ones. The European Ministers of Education met in Osnabrück in 2020 and adopted the Osnabrück Declaration. „In the age of digitization, changing requirements in the professional and working world, demographic development and climate change, vocational training has a key role to play. The requirements for skilled workers have become more demanding in many areas. Vocational education should open up career prospects for young people and adults through training, continuing education and lifelong learning and prepare them for the working world of the future."

But what is the qualification framework? The changes described above have their origin in the harmonization of European education systems. European standardization has been pursued in the water industry since the 1990s. Standards have been harmonized, and the euro is shaping our financial system. Harmonizing the european education systems is a complex task. There are numerous qualification frameworks worldwide.

Synopsis

- Life long learning.
- New competencies need to go along with a change in the working culture.
- Digitalization as a driver of changes.

Figure 1: Impressions from the Water Technology Contest at the WorldSkills Competition 2019 in Kazan, Russia

Anglo-Saxon education and German education differ. The educational landscapes have grown historically - now we want the mobility of Europeans - we need skilled workers from abroad. As a consequence, the European Qualifications Framework (EQF) was introduced in 2008. It serves the comparability of educational qualifications and ensures transparency among the educational systems of the countries. The German Qualifications Framework (DQR) The DQR was introduced in Germany in 2013 and implements the EQF accordingly. Several further actions had been carried out during the last years: The new National Continuing Education Strategy 2019 - a departure for more continuing education, Draft National Water Strategy 2021 - Focus on Education, BMBF/BIBB Initiative Vocational Training 4.0 - Digitization of the Working World to name just a few of them.

3 New aspects of a digitized learning and working environment

Data literacy in collecting and using environmental data – new qualifications emerge. With digitalization in practice, training content is changing rapidly. Data directives such as EU-INSPIRE, newly emerged geoportals, an increasingly broadly differentiated set of GIS/GDI – Geographic Information Systems and spatial data infrastructures are pushing their way into training. Also, new hardware – sensors, UAV, virtual and augmented reality (VR), Hololense etc. are leading to more and more digital literacy requirements. And the mega-topic of BIM (Building Information Modeling) is changing the way projects are planned and later operated. Learning platforms like EdX, Udemy and Coursera are just some of the active learning platforms around the world. Lectures are offered in MOOCs (Massive Open Online Courses). More and more Open Educational Resources (OER) are promoting course layouts and knowledge transfers. Many well-known universities are taking advantage of this and offering time-sovereign and location-independent learning. Finally, also Competitions – Worldwide learning with fun and recognition enter the scene (**Figure 1**). This new form of learning is becoming increasingly attractive. Learning in competition - fostering talent. These are slogans that are central to professional competitions and the Worldskills organization. Trainees, students or even professionals measure themselves in a competition, solve tasks and receive medals. There are national and european or even world championships. A vital way to educate our next generation of employees.

What does this mean for our location-based training in all areas of employment around the federal waterways? First and foremost, it means change. The already anticipated change to lifelong learning.

Authors

Prof. Dr.-Ing André Niemann
Main Committee Education and International Cooperation (DWA HA BIZ)
University of Duisburg-Essen
Institute of Hydraulic Engineering and Water Resources Management
Essen, Germany
andre.niemann@uni-due.de

Jan Balmes, M.Eng.
University of Duisburg-Essen
Institute of Hydraulic Engineering and Water Resources Management
Essen, Germany
jan.balmes@uni-due.de

Dipl.-Ing. Rüdiger Heidebrecht
Dipl.-Ing. Helene Opitz
DWA-German Association for Water, Wastewater and Waste e. V. (DWA)
Hennef, Germany
heidebrecht@DWA.de
opitz@DWA.de

Digital Skipper Assistant (DSA)

The Digital Skipper Assistant (DSA) is a cloud-based solution which addresses the need for a digital planning tool for inland navigation. It provides automated route planning with route length and estimated time of arrival. The display of current and future water levels along the planned route allows for optimization of load.

Alexander Schmid and Hanno Schellenberg

For inland waterway transport, digitization is one of the most important issues for the future and a lever for strengthening economic competitiveness. Within this process of change, the future will determine the preservation and meaningful development of inland navigation as a relevant carrier of transport. With digitization, data on vessels, the infrastructure and the various business processes in freight transport and in passenger shipping can be made available and usable via applications [1].

The design of the research project on the DSA focused on the question: „How can reliable, medium-term water level forecasts for inland shipping be made available digitally via an entire planned shipping route?“ From this, three main research questions emerged that had to be answered within the framework of the project:

1. How can a reliable water level forecast for an entire route be gained and made digitally available that can run across multiple water systems?
2. How can forecasts be incorporated digitally into the everyday economic life of inland navigation via a platform?
3. What additional benefits can be gained through the platform through additional assistance functions and the use of additional mobility data?

The three questions were systematically investigated in an agile project management approach in an interdisciplinary team, consisting of the consulting firm BearingPoint, the IT consultancy BearingPoint Technology, the Federal Institute of Hydrology and the Technical University of Berlin, and answered in this research report.

The research project DSA focuses on the topic of digitization on an individualized presentation of data relevant to inland navigation on a digital output device. For this purpose, existing data sources were connected digitally to an internet platform, processed digitally in order to be able to be displayed graphically for the end user. The DSA Demonstrator has been implemented as a cloud solution and was available to end users for evaluation for 6 months. The feedback from the ranks of the skippers, shipping companies, industry and authorities has been continuously incorporated into the further development during the field test.

Synopsis

- The DSA provides reliable information for long-term route planning and for the arrivals of inland vessels through the integration of water-level forecasts and points of interests (bridges, locks, harbors).
- As a digital platform the DSA enables new forms of cooperation between the stakeholders in the inland shipping sector with further services and functions.
- Using the potential of digitalization to compensate the deficits of infrastructure at inland waterways and strengthen the inland navigation within the modal split.

Key findings

As a result, there are three key findings from the questions on the DSA project:

1. The digital availability and visualization of water level forecasts for individual route planning in inland navigation is a great added value for the participants. The approach of artificial neural networks for level prediction has proven to be a valid extension/enhancement that may be refined in the context of further research
2. The visualization of information relevant to the barge in the form of an APP is a useful addition to the single cell solutions and sources available today.
3. The DSA has successfully demonstrated as a cloud solution how a future inland navigation platform could work. In particular, useful topics and requirements could be identified, which may be considered in a further expansion to a productive platform.

These projects results [2] were developed against the background and demand by the users:

The volume of transport in inland shipping is set to rise in the coming years. The Federal Transport Infrastructure Plan 2030 sees transport on inland waterways increasing by 23 percent in Germany. As the infrastructure of inland waterways will remain unchanged, new means for a more efficient use of existing infrastructure will be required.

The main target of the DSA project was to develop a digital ecosystem for the inland shipping sector by providing an added value to the customers by using existing data. All stakeholders along the value chain (skippers, shipping companies, industry, …) were involved in the requirement process, to bring in functions and features which can lower their costs and optimize their transport on inland waterways.

Objectives of the Digital Skipper Assistant (**Figure 1**):

- Use and consolidate open data sources,

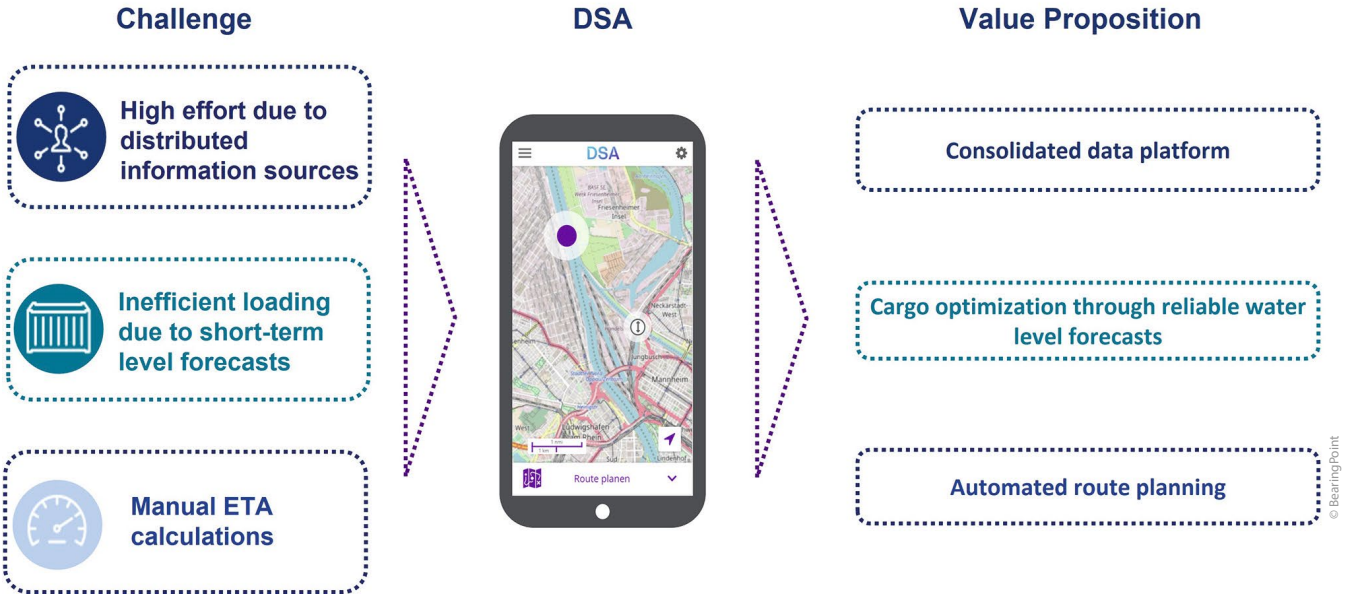


Figure 1: The Digital Skipper Assistant

- Provide robust water level information and forecasts to support a longer planning horizon,
- Maximize cargo load for a vessel based on relevant water levels,
- Optimize the planning process by providing exact distance and arrival time.

The DSA application enables reliable planning for long-term routes and for the arrivals of inland ships through the integration of water-level forecasts and traffic situations. It also allows a better planning for tonnage, and therefore increasing the profitability of transport.

The DSA as a cloud-based platform enables new forms of future cooperation between the stakeholders in the inland shipping sector providing further services and functions. Interfaces with ports and locks are a potential for harmonization of the traffic flow of vessels. More digital services can be added by third party applications via the DSA platform. The Digital Skipper Assistant is now available as a prototype to stakeholders along the value chain.

The development of the Digital Skipper Assistant is funded as a research project by mFUND, a program by the Federal Ministry of Transport and Digital Infrastructure [3]. The results of the research project have been published in 2019. The research project is a collaboration between BearingPoint, the German Federal Institute of Hydrology (BfG), and the Technical University Berlin.

As a result of the research project, innovative approaches for inland navigation operators, shipping companies and industries dependent on inland navigation are to be developed to use waterways for their respective transport tasks with improved economic efficiency.

Authors

Alexander Schmid
Hanno Schellenberg
BearingPoint
Berlin, Germany
alexander.schmid@bearingpoint.com
hanno.schellenberg@bearingpoint.com

Literature

[1] BearingPoint (ed.): Digital Skipper Assistant (DSA) (www.youtube.com/watch?v=pBDLuzjGCHM, Access 13.03.2022).
[2] BearingPoint (ed.): Digitaler Schifffahrtsassistent (www.bearingpoint.com/files/Digitaler_Schifffahrtsassistent_BearingPoint.pdf?download=0&itemId=498937, Access 13.03.2022).
[3] Bundesministerium für Digitales und Verkehr (ed.): Entwicklung eines Digitalen Schifffahrtsassistenten – DAS (www.bmvi.de/SharedDocs/DE/Artikel/DG/mfund-projekte/entwicklung-digitaler-schifffahrtsassist-dsa.html, Access 13.03.2022).

Citizen Scientists Assess the Ecological Status of Small Streams in Germany

In the Citizen Science project FLOW, trained citizen scientists (NGO members, senior school students and anglers) assess the ecological status of small streams. The trait-based biological indicator SPEAR is used to quantify the pesticide contamination of the stream sites by analysing the macro-invertebrate community.

Julia von Gönner, Lilian Neuer, Anna-Katharina Klauer, Jonas Gröning, Matthias Liess and Aletta Bonn

Introduction

Currently, only about 8% of German rivers reach the European Water framework directive's main objective, the good ecological status. To implement adequate protection measures, large-scale monitoring data on the ecological status of streams (especially small streams with <10km² catchment area) is needed.

Beside the hydromorphological degradation and diffuse nutrient inputs, the ecological status of many streams is affected by contamination with plant protection products. Pesticides have negative effects on the aquatic invertebrate fauna and disturb important ecosystem services [1]. A recent study shows that agricultural pesticide inputs are the dominant stressors for aquatic invertebrates [2]. The long-term conservation and sustainable use of stream ecosystems requires awareness and support from different stakeholders and the interested public. Citizen Science is an approach that permits the integration of environmental research and learning through participation. By enabling citizens to engage actively with scientific inquiry, Citizen Science can generate new environmental knowledge, raise awareness and encourage active citizen involvement in water and stream protection issues [3], [4].

The aim of the FLOW project (www.idiv.de/flow) is to establish a standardised Citizen Science programme for ecological stream monitoring in Germany - together with regional groups of Friends of the Earth Germany (BUND), the German ecobuses, anglers, school classes and other interested groups.

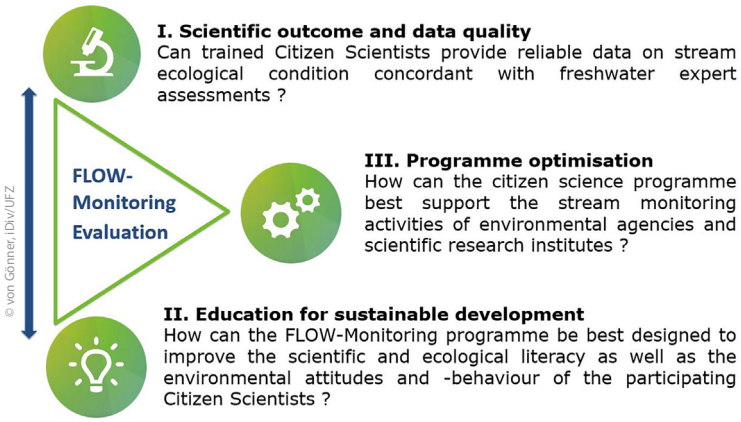


Figure 1: Research questions

To realise this aim, we organise stream monitoring campaigns and examine the quality of the Citizen Science stream monitoring data. Moreover, we assess the effects of the FLOW programme on the citizen scientists' ecological knowledge, attitudes and behavioural intentions (see Research questions in **Figure 1**). The FLOW project is funded by Bundesministerium für Bildung und Forschung (BMBF) and by Deutsche Bundesstiftung Umwelt (DBU).

Synopsis

- Citizen Science is a very promising tool to provide large-scale data on the ecological status and pesticide contamination of small streams in Germany.
- To ensure that our Citizen Science data is accepted and used by agencies, scientists and political decision makers, we systematical assess its quality by comparing it to official reference data.
- To optimize our training program and monitoring methods, we examine the effects of the FLOW project on the volunteers' ecological knowledge and attitudes using standardized questionnaires.

Figure 2: Students examining a stream in Saxony

Figure 3: Invertebrate identification with binoculars

Methods

The FLOW monitoring program complements the German national stream monitoring programme (Kleingewässermonitoring, see https://www.ufz.de/kgm/index.php?de=44480) of the Federal Environmental Agency (Umweltbundesamt) and of Helmholtz Centre for Environmental Research (UFZ). To organise the fieldwork and to accompany the citizen science groups, the FLOW project collaborates with the German working group of eco-buses (AG Umweltmobile, see https://www.umweltmobile.de/ and https://www.lanu.de/de/Bilden/Umweltmobil.html)

Before the stream monitoring events, the citizen scientists receive field equipment and online and onsite training on the monitoring methods: 1) analysis of the hydromorphological stream habitat quality, 2) point measurement of physical-chemical parameters - pH, dissolved oxygen, conductivity, flow rate, nutrient concentration and 3) standardised, multi-habitat macroinvertebrate sampling and identification to family level to determine the SPEAR-Index (SPEcies At Risk, [5], [6]).

This trait-based biological indicator quantitatively links pesticide contamination to the composition of invertebrate communities. It uses species trait information (life cycle, generation time, migration ability) to determine the relative abundance of pesticide-sensitive species present at a specific stream site. The SPEAR-index can thus identify pesticide pressure and their ecological effects in streams [2].

In the Citizen Science training, we provide macroinvertebrate identification guides and an online map for visualising the stream monitoring results. We also discuss the ecological and societal relevance of intact stream ecosystems.

In the first FLOW measuring campaign from April to July 2021, we assessed 30 stream sites with citizen science groups in Saxony, Thuringia, Saxony-Anhalt and Lower Saxony (**Figures 2** and **3**). To evaluate citizen science data quality, a reference monitoring was conducted by Helmholtz Centre for Environmental Research (UFZ) at the same 30 stream sites.

Currently, we assess to which extent the Citizen Science data on stream hydromorphology, chemical water quality and on macroinvertebrate communities correspond to the UFZ reference data. Specifically, we examine how successful trained citizen scientists can identify macroinvertebrates (e.g. taxonomic accuracy, abundance counts).

In order to analyse the potential of the Citizen Science programme for environmental education, we interviewed the participating citizen scientists about the monitoring program using an online survey (Pre-Post-FollowUp- design). The survey comprised items on FLOW training content, as well as on stream ecological knowledge, attitudes and behavioral intentions related to stream and water protection.

In 2022 and 2023, the FLOW project will be expanded to different German federal states and the monitoring programme will be carried out by Citizen Science groups all over Germany. Starting in May 2022, the Citizen Science monitoring data will be transmitted, visualised and hosted in a web-based application hosted by UFZ.

Authors

Julia von Gönner
Prof. Dr. Aletta Bonn
Department Ecosystem Services
Helmholtz-Centre for Environmental Research (UFZ)
Friedrich-Schiller-University Jena, Jena, Germany
German Centre for Integrative Biodiversity Research (iDiv)
Halle-Jena-Leipzig , Leipzig, Germany
julia.vongoenner@idiv.de
aletta.bonn@idiv.de

Jonas Gröning
Prof. Dr. Matthias Liess
Department of System Ecotoxicology
Helmholtz Centre for Environmental Research - UFZ
Leipzig, Germany
jonas.groening@ufz.de
matthias.liess@ufz.de

Lilian Neuer
Abteilung Biodiversität / Team Naturschutzgroßprojekte
Bund für Umwelt und Naturschutz Deutschland e. V. (BUND)
Friends of the Earth Germany
Berlin, Germany
lilian.neuer@bund.net

Anna-Katharina Klauer
Sächsische Landesstiftung Natur und Umwelt, Büro Leipzig
Leipzig, Germany
anna-katharina.klauer@lanu.sachsen.de

Literature

[1] Peters, K.; Bundschuh, M.; Schäfer, R. B.: Review on the effects of toxicants on freshwater ecosystem functions. In: Environ. Pollut. (2013), No. 180, p. 324–329 (doi.org/10.1016/j.envpol.2013.05.025).
[2] Liess, M.; Liebmann, L.; Vormeier, P. et al. (2021). Pesticides are the dominant stressors for vulnerable insects in lowland streams. In: Water Research 201 (2021), Art. 117 262 (doi.org/10.1016/j.watres.2021.117262).
[3] Hecker, S.; Haklay, M.; Bowser, A. et. al.: Citzen Science. Innovation in Open Science, Society and Policy. UCL Press, 2018.
[4] Turrini, T.; Dörler, D.; Richter, A.; Heigl, F.; Bonn, A.: The threefold potential of environmental citizen science - Generating knowledge, creating learning opportunities and enabling civic participation. In: Biol. Conserv. (2018), No. 225, p. 176–186 (doi.org/10.1016/j.biocon.2018.03.024).
[5] Liess, M.; von der Ohe, P. C. V. D.: Analyzing effects of pesticides on invertebrate communities in streams. In: Environ. Toxicol. Chem. (2005), No. 24, p. 954–965 (doi.org/10.1897/03-652.1).
[6] Knillmann, S.; Orlinskiy, P.; Kaske, O.; Foit, K.; Liess, M.: Indication of pesticide effects and recolonization in streams. In: Sci. Total Environ. (2018), No. 630, p. 1 619-1 627 (doi.org/10.1016/j.scitotenv.2018.02.056).

Rivers in Metropolitan Areas: Gateways to Sustainability

Multifunctional blue-green infrastructure is a major locational factor and key to the quality of life and living in an urban environment – as a contribution to adapting to climate change, promoting preventive health measures, reducing leisure-time traffic and enhancing environmental justice.

Christine Baumgärtner

Sustainability is a topic that sets the agenda at all political levels – with the United Nations' Sustainable Development Goals, the European Union's Green Deal, the New Leipzig Charter endorsed by the informal council of EU ministers on urban matters or the ruling of the German Federal Constitutional Court on greater climate protection being just a few examples. They all show the importance of giving equal consideration to ecological, economic and social matters. This also applies to regional and landscape framework planning which is the statutory task of the Verband Region Stuttgart and whose principles are committed to sustainably developing the region as a place for doing business and living in. This is mostly a highly complex task in Stuttgart Region as a specific demographic and economic dynamic meets high-quality ecological factors. It means that conflicting interests both between and within the three sustainability pillars must be taken into account and reconciled.

© VRS/G.Stoppel

Figure 1: Zugwiesen in Ludwigsburg: A diverse habitat for plants and animals right on the river and at the same time a wonderful place to relax

As such, sustainability in regional planning in Stuttgart Region goes beyond a judicious search for locations. It is underpinned by consistently applying the regional plan and by supporting towns and municipalities in developing different locations. This also includes an anticipatory, multifunctional approach to developing blue-green infrastructure as a way of securing and enhancing the high quality of life and housing which extends beyond the existing compensation requirements.

Healthy environmental and living conditions are essential to mental and physical well-being, to social cohesion and thus ultimately to sustainable and resilient towns and municipalities – this having been made very clear by the Covid-19 pandemic. Attractive and publicly accessible green and open spaces close to residential areas are crucial to achieving them: blue-green infrastructure. It provides everyone with an opening to recreation, exercise and experiencing nature at all times, and is key to diversity, integration and quality of urban life.

In planning and financial terms, Stuttgart Region's Landscape Park has given Verband Region Stuttgart an effective instrument since 2005 to actively invest in the region's blue-green infrastructure together with municipalities and other players and stakeholders. Concrete project ideas on characteris-

Synopsis

- The quality of blue-green infrastructure determines the future sustainability of regions.
- Regional landscaping is a supra-municipal task that calls for integrated approaches and strategies.
- Planning on a multifunctional basis means thinking in terms of health, social, environmental and green-space policies and developing them in an even more integrated manner in the future.

Figure 2: Neckaraue in Marbach am Neckar: With the renaturation of the bank areas, the residential quality on the river was also improved

Figure 3: Sandy beach in Remseck am Neckar: The Neckar beach at the confluence of the Rems and Neckar rivers offers a unique atmosphere

tic landscape and recreational areas have been developed jointly to secure them in the long term and to enhance their role as multifunctional spaces. As an incentive for implementation, the Verband Region Stuttgart awards financial grants every year as part of a competition. This is a statutory task that is unique in the federal state and, as such, significant from the aspect of policymaking – it is particularly important in respect of integrated development of residential areas and transport.

A highly diverse landscape

Stuttgart Region is characterised by a highly diverse landscape which is closely linked to residential structures. The defining landscape elements include deep valleys along the river Neckar and its main tributaries. The neighbouring cultivated landscapes – terraced vineyards, meadow orchards and arable land yielding a variety of crops – play a key part in defining the identity and habitat for many protected species of flora and fauna. Together with lakes and ponds, they provide high recreational and leisure value for the region's inhabitants.

Following the onset of industrialisation at the turn of the 19th century, the rivers, which until then had been in a semi-natural state, were in part straightened, channelised and obstructed by sites for industry and commerce. Heavily trafficked main roads and railway lines, some of which run parallel to the rivers, still affect river banks and create a physical barrier in the valleys. Habitats for animals and plants typical to watercourses and floodplains have been lost.

In recent years, work has begun on gradually restoring the rivers transformed and obstructed by industry to create attractive living and recreational spaces for man and nature, to make them re-accessible and open up a contiguous network of cycle ways and hiking trails.

In the past 15 years, over 250 projects have been implemented: regional cycling and hiking routes, bathing and recreational areas (**Figure 2**, Marbach und **Figure 3**, Remseck), large-scale re-naturalisation of water bodies with experiential outdoor offerings (**Figure 1**, Ludwigsburg), but also landscape-specific recreational activities such as downhill trails. Many of them create diverse incentives for exercising in nature for various target and age groups, thereby helping to promote health and prevent diseases.

Given its multifunctional orientation, Stuttgart Region's Landscape Park supports the three pillars of sustainability: it makes an effective contribution to providing services of general interest, to promoting environmental justice and quality of life in the region, to adapting to climate change, to establishing an uninterrupted biotope network and to safeguarding the region as a residential and business location. Last but not least, actively experiencing nature in a region with a high percentage of migrants presents a way of building identity and fostering integration. The result is a comprehensive package that provides the basis for implementing major policy objectives in Stuttgart Region with a view to specifically – and sustainably – developing and securing blue-green infrastructure. A closer future link between the functions of housing, work, culture and local recreation within the meaning of the Leipzig Charter is set to promote the city and region of short distances, producing new options for developing and raising the significance of blue-green infrastructure in respect of integrated, environmentally and climate-friendly, robust towns and municipalities. This makes it one of the central tasks that will determine the future viability of towns, municipalities and regions. It is also one that demands attention and – in spite of uncertain financial times – investment and commitment from various sides.

Author

Dr. Christine Baumgärtner
Verband Region Stuttgart
Stuttgart, Germany
baumgaertner@region-stuttgart.org

Urban Waters – Modern Water Decentered

Taking a perspective from cultural anthropology my paper will show, in which ways social relations with and through water are made differently, how we can grasp hydro-social complexities in relation to urban contexts.

Ina Dietzsch

Water is an ubiquitous substance of life. Humans consist to a large extent of water and their everyday lives are closely interwoven with it. Cultural and social sciences also speak of hydro-social relations and approach these relations by what they call „thinking through water“ [1]. Yet, water is more than H2O. Thinking cities “through water” draws the attention to social-technical assemblages of heterogenous elements which are held together by or with water of different ontologies: water as a physical materiality, as subject of political or economic activities of regulation, imaginaries of water, and water as calculating space. In my understanding I follow John R Wagner when he states, that „water connects different domains of social life to each other” [2] and circulates „continuously through complex hydrological cycles, it establishes connections among all life forms and between animate and inanimate worlds.” My work is also inspired by Astrid Oberborbeck Andersen, who understands mapping urban waters as “a grip on waters, where physical, institutional and epistemological aspects configure the urban waterworld” and an investigation on “how water becomes a contested element in particular contexts, valued in incommensurable ways by different actors” [3]. Taking a perspective from cultural anthropology my paper will show, in which ways social relations with and through water are made differently, how we can grasp such hydro-social complexities, for instance by no longer separating water from land, but specifically taking a closer look at the land-water nexus and speaking of „amphibious anthropology“ [4], or in postcolonial criticism taking experiences from tropical regions seriously, which quasi invert the part-whole relation in the hegemonic natural scientific understanding of water of H_2O, when it is considering to take water as a particular state of wetness [5] and not vice versa.

© Dietzsch

Figure 1: Urban scene: Rhine riverbank of Basel

Synopsis

- Water is an ubiquitous substance of life. Humans consist to a large extent of water and their everyday lives are closely interwoven with it.
- Basic assumption of the paper will be, that urban water is the result of historically differently organized technological production processes.
- The paper will elaborate on spaces of urban water, differing in who and what water gathers. It will consider them also in connection to different forms of rhythm and thus show how rhythms create order and disorder within an entanglement of divers urban waters.

The central argument of my presentation will be, that urban water is the result of historically differently organized technological processes of production. It is entangled with industrial power relations and the object of participation (**Figures 1** and **2**). And it is the result of the work of professional visualizers and designers, who bring data processing back into naturalizing forms. In the mode of modern water, urban waters had been conquered,

Figure 2: The reinvention of urban nature

Figure 3: "Don't jump from the bridge", new water practices, new rules

canalized and straightened. Reduced to their infrastructural importance for the city, they have become industrial and traffic waters, often stripped of their banks and made unusable for public bathing [6]. In large former industrial cities around the world, initiatives by urban users can be observed to liberate urban waters from this state and reclaim them as urban commons by „popularizing" urban river swimming (**Figure 3**). The Museum of Architecture in Basel gathered some of these initiatives under the title Swim City in an exhibition [7]. The authors of the exhibition catalogue understand urban river swimming as a „sensual capture of the city by its sovereign". Urban river swimming is thus a political practice that uses the body to oppose the materiality of what is often still „modern water" [8] in urban contexts and the demarcations that are associated with it. Urban river swimming purposefully erases the boundaries between river and city, and between human and non-human habitat. The authors of Swim City see Switzerland historically in a pioneering situation and write: „In this respect, the Swiss tradition of urban swimming provides contemporary democratic societies with a vital cultural technique to cultivate and celebrate their values and qualities." But river swimming must first be re-learned as such a „vital cultural technique". My paper will elaborate on this question and open up more spaces of urban water, differing in who and what water gathers. It will consider them also in connection to different forms of rhythm and thus show how rhythms create order and disorder within an entanglement of divers urban waters.

Author

Ina Dietzsch
University of Marburg
Institute of European Ethnology and Studies in Culture and History
Marburg, Germany
ina.dietzsch@uni-marburg.de

Literature

[1] Krause, F.; Strang, V.: Thinking Relationships Through Water. In: Society & Natural Resources 29 (2016), No. 6, p. 633–638.
[2] Wagner, J. R. (ed.): The social life of water. New York, Oxford: Berghahn Books, 2013.
[3] Overborbeck Andersen, A.: Mapping Urban Waters. In: Hastrup, K.; Hastrup, F. (ed.): Waterworlds. Anthropology in Fluid Environments. Oxford, New York, 2016, p. 162-181.
[4] Gagné, K.; Rasmussen, M. B.: Introduction – An Amphibious Anthropology: The Production of Place at the Confluence of Land and Water. In: Anthropologica 58 (2016), No. 2, p. 135-149.
[5] Cunha, D.: The invention of rivers: Alexander's eye and Ganga's descent. In: Penn studies in landscape architecture. Philadelphia: University of Pennsylvania Press, 2018.
[6] Hastrup, K.: Water and the Configuration of Social Worlds: An Anthropological Perspective. In: Journal of Water Resource and Protection (2013), No. 5, p. 59-66 (doi.org/10.4236/jwarp.2013.54A009).
[7] Ruby, A.; Shinohara, Y.: Swim City. Basel: Christoph Merian, 2019.
[8] Linton, J.: Modern water and its discontents: A history of hydrosocial renewal. In: WIREs Water 1 (2014), No. 1, p 111–120 (doi.org/10.1002/wat2.1009).

A Systematic Review of Quantitative Studies on the Impact of Blue Space on Urban Human Health

Blue spaces are an integral part of cities. This review of 43 articles found a positive association between urban blue spaces and health, with particularly strong evidence for positive associations with reduced premature mortality and obesity, and better self-reported mental health and wellbeing.

Niamh Smith and Sebastien Chastin

1 Introduction

Blue spaces are an integral part of cities. When we think about natural spaces in cities, we tend to visualise green spaces, such as parks; rarely do we consider the urban blue spaces that can be found within or nearby green spaces. We also rarely think about blue spaces independent of green space, such as urban rivers and canals, as natural spaces. Completely separating the health effects of green and blue spaces is difficult as blue and green spaces often co-exist. We are seeing a gentle shift towards discussions around 'blue spaces' and 'green and blue spaces'. There are an increasing number of quantitative research studies that have explored the salutogenic benefits of blue space in urban contexts and a review is required.

2 Methods

This review followed Cochrane and PRISMA guidelines. Seven databases (PubMed, CINAHL, PsychINFO, Scopus, Science Direct, Web of Science and MEDLINE) were searched for quantitative studies from inception until 1 August 2019 using keywords and MeSH terms. Two reviewers independently screened articles and appraised their quality using a tool developed by Gascon et al. [1].

3 Results

From 4493 screened citations, 43 studies were included. Eligible articles were published between 2003 and 2019. Quality appraisal rated the majority of studies as 'Excellent' (N = 7) or 'Good' (N = 24). Although synthesis proved challenging due to methodological and results heterogeneity, a positive association was found between urban blue spaces and health, with particularly strong evidence found for positive associations with reduced premature mortality and obesity, and better self-reported mental health and wellbeing.

4 Conclusion

Although evidence is growing within the field of urban blue health, the findings are heterogeneous. While standardisation in the way blue space and health outcomes are measured will improve consistency within the field, the positive associations reported to date in several areas of importance to health are promising, irrespective of confounding factors. Further research is required to harness the benefits of urban blue spaces for public health and guide blue space development. In particular, research should aim to understand the mechanisms which exist between urban blue space and health as well as how to maximise exposure to these spaces. It would also be worthwhile to explore further the impacts of smaller urban water features that may also provide benefits.

Synopsis

- From 4493 screened citations, 43 studies were included.
- A positive association was found between urban blue spaces and health.
- Strong evidence was found for positive associations with reduced premature mortality and obesity, and better self-reported mental health and wellbeing.

Authors

Niamh Smith
Sebastien Chastin
Glasgow Caledonian University
Glasgow, Scotland
niamh.smith@gcu.ac.uk
sebastien.chastin@gcu.ac.uk

Literature

[1] Gascon, M.; Zijlema, W.; Vert, C.; White, M. P.; Nieuwenhuijsen, M. J.: Outdoor blue spaces, human health and well-being: A systematic review of quantitative studies. In: International journal of hygiene and environmental health 220 (2017), No. 8, p. 1 207-1 221 (doi.org/10.1016/j.ijheh.2017.08.004).

Ceramics of the future.

GET YOUR FREE COPY NOW!

Expertise on all aspects of ceramic technology, in all application-relevant areas and presented at a technical-scientific level, together with the latest major trends and developments. Get the latest information five times a year with the exclusive combination of the **print edition** and **interactive e-magazine**, as well as the online archive, **a unique knowledge database with pdf download function**.

www.my-specialized-knowledge.com/interceram

Water Plant Management for Improved Water Quality

Common management usually includes disposal of the removed water plants. For cost saving, this is often done near the shore, leading to re-eutrophication of the water bodies. Efficient harvest and loading chain can enable the generation of value by biogas and fertiliser from this growths.

Bengt Verworner, Walter Stinner and Mathias Stur

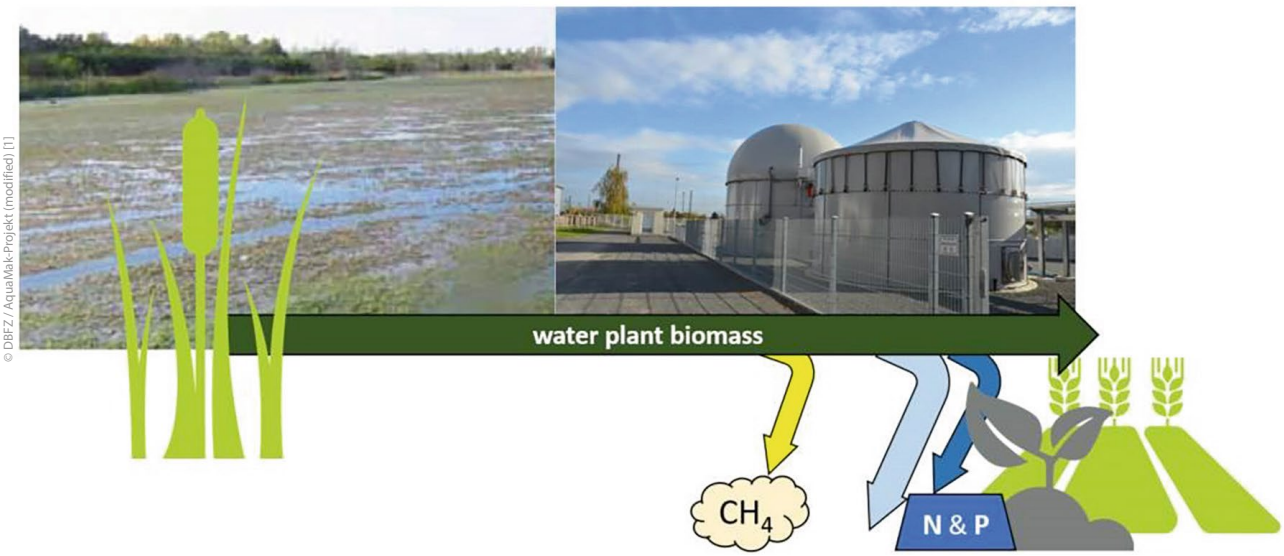


Figure 1: Water plant management with energetic usage and nutrient uptake for better water quality can ofer new potantials in the use of biomass

Water quality is essential for all living organisms in and around water bodies. A poor water quality is closely related with eutrophication and a low oxygen content. Eutrophy leads to overgrowing water plants. In some regions water bodies are already lost for a living environment of some species. Therefore, management of water plants is necessary for the health of aquatic biomass and a useful tool for the conservation of ecosystems.

Actual management of aquatic macrophytes in water bodies is often focussed on complete removal of water plants by a complete ripping away without regrow and disposal of the plant biomass, sometimes near to the shores in order to reduce costs. This kind of management can lead to other environmental problems, such as the destruction of shore lines and living places of some animals and plants. Also the disposal of the plant biomass is actually expensive and not related to a better use with a higher value.

Synopsis

- A continuous, consequent and environmentally friendly water plant harvest can lead to good water qualities in waterbodies.
- Waterplants can regrow and excreating oxygen into the water and also carry out nutrients when harvested.
- The use as a biogas substrate can use the potential for an energetic value.
- The later use of the digestate as a fertilizer closes the nutrient cycle.

Waterplant management in urban and rural areas can offer four effects: the outtake of exessive nutrients from water bodies, the improvement of oxygen status of water body, a potential substrate for biogas production for energy supply and a fertilizer when the digestate is used after the biogas process. In addition, space for energy crops, such as maize can be substituted. For this aim a case calculation can be made for the assessment of this potention. There is one excample with a good data base, wich can be used. The lake Goitzschesee in Germany will serve as a good excample (**Figure 1**).

The total surface area of the lake measures 13.3 km². The area, were waterplants grow is about 3.99 km². A dominant water plant species is western waterweed (Elodea nuttallii). The average fresh biomass harvested is about 26,000 t. With a mean dry matter content (DM) with about 8,2%, the total dry matter is about 2,100 t. Elodea nuttallii has a organic dry matter content (oDM) of 65 %, so the oDM of the plant biomass is about 1,365 t.

Researches have showen, that the biomethane potential of pure Elodea is about 250 m³/toDM. That means per year a total amount of 341,250 m³ biomethane only from this waterplant in the Goitzschesee. Under the assumption, that the benchmark substrate Maize has a biomethane potential of 325 m³/toDM, an oDM of around 80% and a DM of between 30-35%, the harvested water plant biomass can substitute 3.880 tonnes Maize per year.

When it comes to the nutrient outtake from the lake and a later use as a fertilizer, this path becommes also interesting.

The content of phosphorus and nitrogen in Elodea nuttalli are well known for this excample. The P-content is about 0,23% of the DM an the N-content is about 3%. That makes a total amount of 4.8 t of P and 63 tonnes N (losses not calculated) per year. With a C-content of a little bit more than 40%, this means a C-amount of 547 t per year. So, the submerse macrophytes takes 2006 t of CO_2 from the water body while photosynthesis and release 1459 t of oxygen into the water body. By harvest of the biomass, this oxygen is not consumed again for biomass degradation. Gentle harvesting enables further growth, i.e. further photosynthesis in the water body.

This can ilustrate the potential benefits and importance of a regular water plant management. A strategy with combined biogas prozessing can lead to long term water quality improvement by lowering the trophic state of water bodies, can supply energy and fertilizer in the meaning of a circular economy.

Therefore a more cost-efficient chance from harvesting to shore-protecting landing and loading is being developed. This allows for gentler, more frequent harvesting and, in terms of cost, easier utilization of biomass. Even more plant biomass can be expected to be gained with gentler harvesting technique. The amount of biomass of sumerged plants is directly correlated with the removal of nutrients fromthe water body and the enrichment of the water body with oxigen by an increase of the redox potential and self-purification capacity.

Literature

[1] Rönicke, H.; Beyer, M.: Wasserpestinvasion im Goitzschesee. In: Moeller, L.; Zehnsdorf, A. (ed.): Zum Thema Wasserpflanzenmanagement : Projekt AquaMak. Leipzig: Helmholtz-Zentrum für Umweltforschung - UFZ (2017), S. 63 - 71.

Authors

Bengt Verworner
Prof. Walter Stinner
Mathias Stur
Deutsches Biomasseforschungszentrum
Bereich Biochemische Konversion
Leipzig, Germany
bengt.verworner@dbfz.de
walter.stinner@dbfz.de
mathias.stur@dbfz.de

Nature Conservation Assessment Concept for Water Tourism Use of Opencast Lakes

The analysis of impact factors and their application to the various species has shown that navigation on the opencast lakes is not likely to result in the occurrence of prohibited species protection statuses, nor is it incompatible with the requirements for the protection of Natura 2000 sites, so further restrictions on navigation are not necessary.

Andreas Bolle and Jürgen Stamm

With the start of the closure of the lignite opencast mine in the south of Leipzig in 1990, the region needed to find new economic perspectives and to determine viable subsequent uses for the areas shaped by open-cast mining. Against this background, a strategic focus on water tourism was decided in 1996 with the Leipziger Neuseenland concept. In addition to the numerous watercourses, the four large lakes south of Leipzig play a central role: Lake Cospuden and Lake Zwenkau, which are to be connected in future with the navigable Harth Canal with a lock, as well as Lake Störmthal and Lake Markkleeberg, which already have a navigable connection with a lock (**Figure 1**). Since 2008, navigation with electric motorboats has been regulated in part by general decree, and in part navigability has been regulated within the framework of a temporary master permit. Public use (swimming, paddling, sailing without a motor etc.) has already been conclusively regulated for the lake areas in the district of Leipzig. An indefinite regulation of navigability on the lakes should take place as part of a procedure for the assessment of completion (FdF).

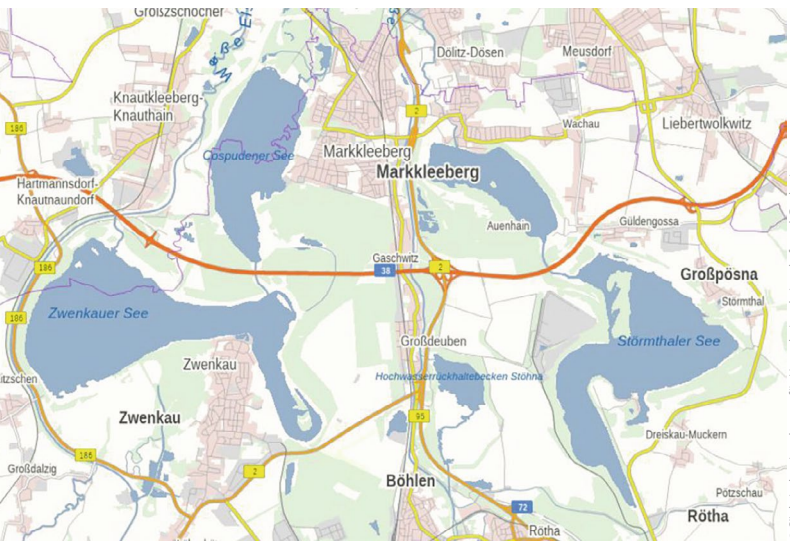


Figure 1: Lakes south of Leipzig

Synopsis

- The nature conservation assessment of the water tourism use of opencast lakes requires a conceptual approach.
- It needs to combine engineering and biological expertise as well as an active communication and participation approach.

In the context of FdF, nature conservation concerns (species protection, site protection etc.) must be taken into account in addition to other concerns. Because there was no experience with the type and scope of the consideration of species protection issues in a procedure for FdF, the Saxony State Directorate, as the lead institution for the report, planned an investigation of the chains of effects before the actual species protection test. This also seemed necessary because recreational boating is occasionally attributed major negative impacts with regard to species conservation.

In concrete terms, eight impact factors or groups of factors had to be worked through: exhaust and combustion residues, antifouling, nutrients (input and mobilisation), acoustic disturbances, visual stimuli, mechanical effects/wave impact, watercourse maintenance measures and traffic safety measures.

A coordinated concept

The systematic processing of these issues required the development of a coordinated nature conservation assessment concept, for which an integrative-structural framework was set including the following main aspects.

Based on the initial spatial situation and development trends (lake as flood retention area, urban development, afforestation etc.), the concerns and suggestions made during the preliminary planning and approval process, and the results of avifaunal mapping, the possible impacts of navigation were predicted and assessed. An aspect that was previously subject to a high degree of uncertainty, the forecast of traffic volume, was checked for plausibility using a new approach for three scenarios (worst case, normal and future scenario). This is of central importance, since

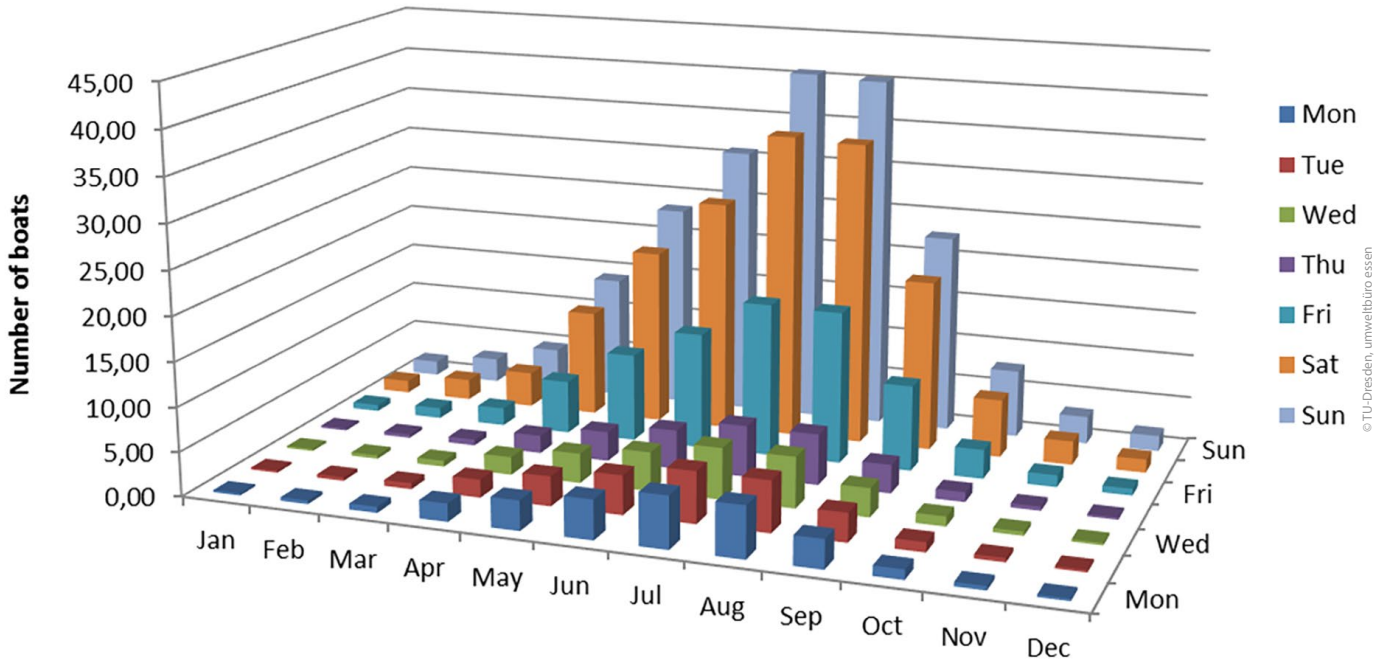


Figure 2: Temporal distribution of boats

the non-substantial impact factors must be considered in close context to the intensity of boat use, i.e. the number of boats on the lake at the same time and their duration of stay, when predicting impacts under species protection law. For the first time, this report provides an evaluation framework for this. The simultaneity factor is not to be regarded as a scalar constant, but as a variable with monthly, weekday and daylight dependency. This demonstrates a meaningful diametric relationship between temporal intensity and exposure duration.

The highest utilisation rates occur in the months of May to September, whereas in the winter half-year almost no traffic is to be expected, as the graph of boats on the lake (**Figure 2**) at the same time shows, with an annual operating time of 28 h/a and 320 berths derived from concrete measurements.

On this basis, the (impact) effects of shipping could be considered and evaluated in the form of a brief assessment of all impact factors.

The avifaunal assessment was based on recent mapping, which revealed 70 bird species of nature conservation importance in the study area, 46 of which are certain or highly probable to breed in the study area. Seventeen breeding bird species have the highest German protection status of strictly protected. The areas theoretically affected by the FdF in terms of nature conservation are characterized by a biotope structure that is undergoing rapid change. This is now entering a stage that is characterised by increasing wooded areas and decreasing amounts of open land. The banks are still predominantly slimly structured and wider reed zones - in contrast to the situation at other water bodies in the vicinity - are the exception. The rather low intensity of use and the currently still high proportion of open and semi-open land are reflected in a diverse avifauna, in which open land species are value-determinants. The value-determining species are therefore those of the terrestrial habitats, which are less likely to be affected by navigation, but all the more affected by natural processes and the intensification of land use. The assessment of the avifaunal impacts of recreational boating was based on disturbance ecology considerations. Finally, concrete measures for the compatibility of various water tourism uses with nature conservation concerns were proposed by taking into account the requirements of species protection law, and further landscape planning proposals were derived from the findings.

Authors

Andreas Bolle
umweltbüro essen Bolle und Partner
Essen, Germany
andreas.bolle@umweltbuero-essen.de

Prof. Dr. Jürgen Stamm
Technische Universität Dresden
Institut für Wasserbau und Technische Hydromechanik
Dresden, Germany
juergen.stamm@tu-dresden.de

The Bridge in Tczew Linking the Past and Modern Times

The paper concerns the architectural and structural aspects of Tczew bridge, from the point of historical and modern times. The bridge is shown in the background of the selected historical bridges, presenting context of Tczew bridge, that was built in the XIX century, as a part of planned route crossing Vistula's delta.

Maciej Dutkiewicz and Jakub Obszański

The bridge in Tczew is one of the most significant bridges in Poland due to its fascinating history and relevance to this day. XIX century bridge is in Tczew, Pomeranian Voivodeship, and crosses the Vistula River, the longest river in Poland, in its delta area. Of course, in present times could be unfairly dismissed as not impressive in comparison to longer span modern bridges, but still is a mark of great engineering minds left on this soil.

The history of the bridge starts way back in the first half of XIX century, when plans were drafted for building an East Prussia Railway connecting Berlin and Königsberg (todays Kaliningrad). The decision earn acceptance on 31st of December 1842, according to which railway had to cross Vistula in its delta with 2 bridges – first one near Tczew and second one near Malbork crossing Nogat River.

Before the construction works have started, special committee was formed based on the royal decree of Friedrich Wilhelm IV, king of Prussia, who singed it on 6th of July 1845. Committee works were led by Carl Lentze, skilled royal hydraulic engineering inspector whose career started with project throughout the Pomerania Province and Düsseldorf region. Lentze design was ambitious – he designed 6-span bridge, in which span length was 130,88m (free space between pears had length of 121,14m). The main structure was made of wrought iron truss girder with parallel chords, with vertical bracing and flat bar net, which inspired by Robert Stephenson tubular structure of Britannia Bridge across Menai Strait, North Wales.

The construction of the first pilar has begun on 27th of July 1851. To complete the project, many faculties in the area were working hard – structure elements were casted in Royal Machine Factory and Cast-Iron Foundry in Tczew, cement was prepared by Cement Products Factory, and Brick Factory was just opened to make yellow clinker bricks. Thanks to work industry around the Tczew, bridge was completed on 12th of October 1857 and first train drove through.

Synopsis

- The Tczew Bridge was built in 1857. When it was put into use, it was the longest bridge in Europe. The structure was designed by Carl Lentze. Hence, the spans were named after his surname.
- The bridge has survived for over 160 years, is currently in poor technical condition and is out of service. Its final reconstruction in the historical variant has been underway since 2012.

© Dutkiewicz

Figure 1: The reconstructed part of the bridge, view from the year 2021, Lentze span

© Dutkiewicz

Figure 2: The reconstructed part of the bridge, view from the year 2021, the brick towers

Figure 3: ESTB span, view from the year 2021

In time of completion, bridge in Tczew was the first iron bridge crossing the Vistula River and was a record holder of the longest bridge in Europe with a length of 785,28m without including the bridgeheads, and 837,3m including bridgeheads. The original structure was 6-span bridge of span length equal to 130,88m. Only two spans were above the river, while the rest of the bridge crossed the floodplain of near Lisewo village. On deck provided space for one railway and roadways on both its sides. The bridge was supported on massive bridgeheads on both ends and 5 pillars in between.

In the modern times there is an urgent need for the bridge reconstruction. On the one hand, the need arises from ensuring communication between the two banks of the Vistula river. On the other hand, it is a need to reconstruct a great monument of the history of engineering thought, which should be cared for for future generations (**Figures 1, 2** and **3**).

Authors

Maciej Dutkiewicz
Jakub Obszański
Bydgoszcz University of Science and Technology
Faculty of Civil, Environmental Engineering and Architecture
Bydgoszcz, Poland
macdut@pbs.edu.pl

Shipping versus Water Management – River Unstrut from History to Present

Flood control and creation of natural floodplains represent the most important measures of the flood protection concept. A preservation of near-natural sections and promotion of long-term development combined with selective protection measures is the aim of future development work in the Unstrut floodplain.

Martina Große-Sudhues and Steffen Heling

Introduction

The presence of water bodies has always been the decisive prerequisite for economic development of settlements. They have been adapted to the needs of people over centuries. However, making rivers navigable in particular has also led to a number of negative water management consequences. Therefore, in recent years numerous streams have been renaturalized and measures have been taken to preserve river landscapes as living and recreational areas. The field of tension between the different uses of flowing water is examined in more detail using the example of the river Unstrut (**Figure 1**).

Figure 1: The River Unstrut

Making the Unstrut navigable

Navigation at the Unstrut has been documented since 17th century. However, economic use was not possible due to the low water level and marshy shore areas. First regulations aimed at improving the navigability of the waterway were made in the mid-17th century with the introduction of a water and mill ordinance [1], [2].

In the end of the 18th century the river was expanded over a wide distance – minimum depths and widths were created and radii of curvature were widened. Between 1791 and 1795, a total of 12 ship locks as well as drawbridges and towpaths were built and the Unstrut was opened for navigation, which led to an economic boom in the region [1].

With the completion of a parallel railroad connection in 1889, freight shipping faced economic competition and began to lose importance. With loss of importance, water management facilities fell into disrepair. Continuous lock operation was no longer possible. In 1967 the Unstrut lost its status as an inland waterway [1].

Today, the Unstrut is becoming important as local recreation center, with numerous boat rentals offering canoes and paddle boats for water sports enthusiasts.

Synopsis

- Flood control and creation of natural floodplains represent the most important measures of flood protection concept.
- Hydraulic engineering facilities serve to maintain groundwater level.
- The Aim is preservation of near-natural sections and ecological continuity.

Water management challenges

In order to drain the wet lands which were also threatened by floods, in the mid-19th century a design for a large-scale melioration of the Untrut valley was commissioned. It included the deepening of the Unstrut, a change in the course of the river and the construction of drainage ditches. Furthermore, as the most important flood protection facility a 20 km long flood channel has been built. In addition to flood control, this solved drainage problems for adjacent lands [1].

Very good yields of the newly created arable land meant that a lot of energy was invested in discharging water, which compensated the effectiveness of flood protection systems. As a result, a large number of flood events were registered until the middle of the 20th century [1].

Consequently, a flood protection program for the Unstrut was initiated in 1956. Within this framework, the Straußfurt retention basin and the Kelbra dam were built. In addition, the flood channel was widened and the capacity increased. Five weirs and locks, including the one in Freyburg, were demolished [1].

For further protection, in 1989 the dikes were renewed and reinforced [1]. Despite sealing of surfaces and expansion of

Figure 2: Freyburg weir

Figure 3: Freyburg lock tailwater

almost all water bodies in the catchment area, there have been no extreme dangers to the local population since then. The storage space has essentially been able to compensate the measures taken to increase and accelerate runoff.

Restoration of Freyburg sluice in accordance with preservation order

The Freyburg weir (**Figure 2**) - originally built during making the Unstrut navigable in the years 1791 to 1795 - had a width of 103.5 m and a height of 4.15 m. The associated lock had a chamber length of 50.67 m. Presumably as part of a major repair project, an additional chamber - the lower main - was built in 1878. This made it possible to enter the lock even at lower water levels and to lift ships in two stages [3].

Due to age-related wear and tear, the Freyburg weir broke in 1966. Since economic navigation had already come to a standstill and the lock was no longer needed, the old weir was tear down in 1971 and the lock facility was filled in [1], [3].

The extent of the impact of the hydraulic engineering measures on the natural balance became apparent when the water supply at the Freyburg waterworks declined. Just six years after the weir was dismantled, a temporary dam had to be built to maintain the groundwater level. From 1989, the weir and the sluice were rebuilt at the historic location and in the historic style [1], [3].

For this purpose, the old lock chambers were uncovered at the beginning of the 1990s. The lock (**Figure 3**) was reconstructed in the upper trench by replacing damaged stones. In the lower trench, the old wooden sheet piles had to be replaced with steel sheet piles, which were covered with natural stones. The covering of the lock chamber walls was completely renewed and old gauges and inscriptions were refurbished. The new lock gates were made of steel instead of wood [3].

At the same time, the base gate of the weir and an ascent for fish and benthos were created. The sluice and bottom gate served as a water detour during the construction phase of the weir body. The new weir body - made of reinforced concrete with a width of 80 m and 4.4 m above the riverbed – was completed in 1995. Weir stringers and piers were clad with Freyburg natural stone in historical style [3].

With the reconstruction of the Freyburg weir, the groundwater level could be raised to its original level, thus stabilizing the water withdrawal. Furthermore, the landscape of the river floodplain was preserved [3].

Conclusion

The ecological and economic utilization requirements of the Unstrut pose special challenges for water management. On the one hand, the rehabilitation of the existing hydraulic engineering facilities serves to maintain the existing groundwater level. On the other hand, flood control and the creation of natural floodplains represent the most important measures of the flood protection concept. An extensive preservation of near-natural sections and the promotion of a long-term development combined with selective protection measures to safe the adjacent localities is the aim of future development work in the Unstrut floodplain.

Authors

Martina Große-Sudhues
Steffen Heling
Landesbetrieb für Hochwasserschutz und Wasserwirtschaft Sachsen-Anhalt (LHW)
Magdeburg, Germany
martina.grosse-sudhues@lhw.mlu.sachsen-anhalt.de
steffen.heling@lhw.mlu.sachsen-anhalt.de

Literature

[1] Strejc, W.: Geschichte des Wasserbaus an der Unstrut. In: Untere Unstrut – ein Fluß und seine Landschaft (1996/1997), No. 1, pp. 7-21.
[2] Strejc, W.: Die wasserwirtschaftlichen Verhältnisse im Unstrutgebiet. In: Untere Unstrut – ein Fluß und seine Landschaft (1996/1997), No. 2, pp. 22-26.
[3] Staatliches Amt für Umweltschutz (ed.): Neubau des Wehres Freyburg (Unstrut). Schrift zum Abschluß der Wiederaufbauarbeiten. Gehring Verlagsgesellschaft, 1995.

Sustainable Water Supply for the Ulster Canal Restoration Phase II (Clones)

Waterways Ireland has obtained planning permission to restore a section of the Ulster Canal from Upper Lough Erne to Clones. Phase I has been completed and Phase II now aims to open up a water space in the town of Clones. Critical to this space is the initial supply and replenishment of supply of water.

Jon Hunt, Deirdre Felloni and Ruairi O'Carroll

Waterways Ireland is a North/South Implementation Body established under the British-Irish Agreement in 1999. The organisation has the responsibility for the management, maintenance, development and restoration of inland navigable waterways, principally for recreation. In 2007 Waterways Ireland was tasked with exploring the potential restoration of the Ulster Canal between Lough Erne and Clones, which crosses the border between Ireland and Northern Ireland at several locations. Planning permission was successfully obtained in 2013. It is an ambitious project that is a key joint objective of the Irish and British governments. The canal was closed in 1931 but it remains an invaluable heritage and cultural resource with a fascinating history. Its strategic value lies in its contribution to rural development through acting as a recreational amenity and tourism asset in a disadvantaged area on the border and also acts as a key link within the island of Ireland's existing inland waterway network.

The initial aim is to reopen the section of the canal from Upper Lough Erne to Clones, which covers approximately 13 km of river and canal extending from downstream of Derrykerrib, within the Upper Lough Erne complex, to Clones town. Phase I has been completed and comprised dredging works within the River Finn and the construction of a new bridge and canal section at Derrykerrib and installation of new moorings at Castle Saunderson. The navigable waterway has now been extended some 2.5 km from Quivvy Lough on the Erne navigation and Castle Saunderson on the River Finn.

Synopsis

- Waterways Ireland has commenced restoration of the disused waterway, closed in 1931 and known as the Ulster Canal, along the border between Northern Ireland and Ireland.
- It is likely the project will be completed in phases depending on available budget.
- Phase I is complete and Phase II focuses on the opening of a water space with associated blueway amenities in Clones town.
- The water space requires its own water supply to fill and maintain water levels until subsequent development phases allow for water to flow from existing water courses.

Phase II of the restoration

Phase II, the focus of this paper, will involve undertaking works in Clones town and will comprise the development of a new recreational water space combined with a linear section of waterway extending towards the Clonfad Aqueduct. The Phase II work will be completed separate to the rest of the canal for the time being and this means it will require an independent water source. This source is required to initially fill the water space (approximately 40,000 m^3) and to maintain water levels for the foreseeable future until the remainder of the canal is reopened and it will then receive a supply from the River Finn/Upper Lough Erne. Several potential water sources have been examined including local municipal supplies, nearby rivers/lakes and groundwater. The most suitable source is likely to be groundwater, particularly because the technical and regulatory challenges are much less significant for a groundwater supply than for an equivalent surface water source e.g. an Environmental Impact Statement would only be required if a large volume of water was proposed to be abstracted (>10 million m^3). Therefore, it is to be expected that any abstraction will be sub-threshold. In addition, by sourcing the groundwater on site infrastructure and impact to important heritage structures are minimised.

A desk study, combined with a walkover survey reviewed all available source information (e.g. data and records at Geological Survey Ireland) and discussed past drilling experiences with drilling contractors and hydrogeologists experienced with drilling in the area, and the Local Authority. An initial review of the geology in the vicinity of Clones indicates that the area is underlain by fractured limestone. In addition, the desk study estimated the probability of success at four target drill sites within the planning boundary at the site. The probability of success was based on the estimates of drilling depths, yield and water quality. Of the four sites identified two trial water well sites were prioritised in terms of drilling (**Figure 1**). Pump testing was carried out on the more favourable of the trial wells while the other was used as a monitoring well to assess drawdown during the pumping tests.

Figure 1: Well drilling operation to identify suitable water supply, for Phase II (Clones) of the restoration of the Ulster Canal (Lough Erne to Clones)

Based on findings of drilling and pump testing, a civil engineering design will follow for the transfer of water from the source(s) to the marina. This will depend on several factors, not least the distance and topography between both. It is likely that a small pump house and pumping infrastructure will be needed at the source(s). A pipeline to the marina will then be planned and engineered based on standard hydraulic design principles, with specific details that depend on locations, distances, volumes and engineering constraints. The outlet point of the water supply is expected to incorporate a creative sculptural/architectural feature.

The new water space will be suitable for a range of water-based activities e.g. kayaking/canoeing, rowing and angling. There will also be a walking/cycling trail of approximately 1.5 km running along the banks of the new waterway. Supporting infrastructure will include the provision of a slipway/canoe landing space, vehicle parking, amenity and picnic areas and service block with toilets/changing facilities. This project will create a valuable local amenity in addition to becoming the focal point of a regional blueway, acting as a hub for the development of further water-based amenity developments east to Monaghan and beyond, and west towards Castle Saunderson and the Erne system.

Authors

Dr. Jon Hunt
Ruairi O'Carroll
CDM Smith Ireland
Dublin, Ireland
jon.hunt@cdmsmith.com
ocarrollr@cdmsmith.com

Deirdre Felloni
Waterways Ireland
Enniskillen, Northern Ireland
deirdre.felloni@waterwaysireland.org

Long-term and Sustainable Management of Artificial Water Bodies

By comprehensive micro-invasive aeration along the entire watercourse surface, the environment is transformed from oxygen-poor to oxygen-rich. The Results are a degradation of organic matter, a permanent binding of pollutants and nutrients to the sediment, an algae/cyanobacteria avoidance, an oxygen enrichment and a reduction of harmful greenhouse gases.

Cordula Jäger and Ute Urban

Introduction

Most of the artificially created water bodies are not able to regenerate naturally – they are silting up and becoming a nuisance for the residents due to their unpleasant smell and unsightliness. In addition, climate change is causing increased methane emissions.

Methods

The linear micro-invasive aeration system Drausy Professional provides a remedy – it is capable of discharging minute quantities of liquids and gases over long distances with only one feed. This makes the surrounding environment oxygen-rich and triggers biological processes [5].

Without sufficient oxygen, bacteria in the water body are not able to biodegrade the supplied organic substances within a reasonable time. Dead plants and inputs by animals (fish, birds) form dead biomass that settles on the bottom – the organic biomass forms decaying sludge – this causes a lack of oxygen. During the decomposition of biomass at the bottom of the water body, O_2 is consumed. In an anaerobic environment, decomposition must take place under septic conditions: the slow transformation of pollutants is incomplete and odour-intensive. Increased sludge volume (organics), leads to sedimentation processes, the aquatic habitat is damaged, climate-damaging gases such as methane are produced and rise to the surface – this is prevented by treatment [3].

Synopsis

- Pollutant binding/avoidance of eutrophication: nitrates and phosphates are permanently bound to the sediment and are no longer available to the water body. This prevents algae growth and the formation of cyanobacteria.
- The measure does not interfere with nature – biotopes and habitats created are completely preserved.
- The oxygen-rich environment created by Drausy Professional reduces and neutralises methane and CO_2 emissions and helps to reduce and avoid gases that are harmful to the climate. At the same time, it helps to maintain habitat/ avoid fish kills during hot spells.

© Drausy GmbH

Figure 1: The fine beaded outgassing of the nanobubbles, which are generated at the bottom by the linear system Drausy Professional, is visible at the surface

The Drausy linear aeration system works on the lake bottom. It can be recognised by the light line of air bubbles on the surface. The aim is to keep the residence time of the fine nanobubbles in the water body as long as possible, thus the bubble trace is very small [4]. The entire body of water is enriched with oxygen – the residence time is ensured by the fine distribution. We call this the champagne effect: the nanobubbles settle at the bottom (**Figures 1** and **2**).

During biological treatment, microorganisms break down the pollutants in the water: Aeration supplies oxygen to the bacteria in the water, which is needed for the treatment and stabilisation of the water – they are activated. The oxygen supplied is used by the bacteria in the water body to break down the carbon-containing organic substances into carbon dioxide and water.

Pollutants and nutrients that cannot be broken down are permanently bound to the sediment by the treatment – they are removed from the water body and keep the water habitat fresh.

Since oxygen is already present in the ambient air, no additives are used for the microinvasive basic aeration with Drausy Professional – the treatment is environmental-friendly and uses biotechnological processes.

Results

Aeration with the Drausy system supports the natural self-purification effect of the water body through the introduction of oxygen, in order to achieve a decomposition of the organic substances in the sludge and free water.

This leads to a reduction in the thickness of the sludge through the mineralisation of the existing organic matter. Each grain of sand is surrounded by organic mud. The decomposition of the organic sediment leads to a considerable reduction in the total volume of mud in the sediment. The loss on ignition is the burnt portion of the dry matter – it indicates the organic portion of the sediment and is one of the indicators of success as far as the volume reduction of the sediment in the water body is concerned. With loss on ignition from 10%, the chances of success for volume reduction are good.

The degradation of organic matter in the water and the sludge layers results in a reduction of the chemical and biological oxygen demand (BOD/COD), which in turn has a positive effect on the flora and fauna in the water body [2].

Conclusion

The reach of the linear aeration system is 5 m to each side. There is no turbulence and due to the flexible handling as well as the material, the measure is not considered to interfere with the water body. Since the measure can be practised independently of the watercourse depth and a hose length of several kilometres achieves the same discharge quantity, the treatment can be easily implemented area-wide, even in nature reserves or listed sites.

An area-wide coverage of 10% in length (m) of the square metre area is the standard calculation for the aeration measure with Drausy Professional. Depending on the objectives to be achieved, the section can also be laid more intensively or less densely.

Through extensive aeration on the watercourse bottom, the organic mass is mineralised, which leads to a significant reduction in volume. During mineralisation, mainly water, carbon dioxide, phosphate and inorganic nitrogen compounds are formed from organic compounds.

Phosphate, if the environmental situation is aerobic, is mainly bound in the form of calcium phosphate and iron phosphate and deposited in the sediment.

Aeration does not remove nutrients, but e.g. phosphate compounds are transferred to the sediment under strictly aerobic conditions. Phosphates are bound to calcium and iron and cannot be available as nutrients as long as the sediment is in an aerobic environment, i.e. well supplied with oxygen. This fixation (so-called phosphate trap) is created by the Drausy system, so that a re-dissolution of the phosphate, as it always occurs in anaerobic, i.e. low-oxygen environments, can hardly take place. This also largely prevents the supply of nutrients to aquatic plants and algae. If the phosphorus content is kept low enough, algae growth is also very low. Nitrogen compounds alone cannot cause critical algae growth.

The oxygen (air) introduced with the Drausy system keeps the water and sediment aerobic and the phosphate binding in the sediment becomes so strong that algae growth is largely suppressed.

Figure 2: The Drausy linear surface aeration system works on the bottom - the aim is to release the smallest possible air bubbles and keep them in the water for as long as possible

In short, the following treatments can be achieved with the System:

- Reduction of the total volume between 40% and 60% due to the biological degradation and the Compaction of the sediment,
- general Improvement of the water quality,
- Prevention of blue and green algae,
- Permanent binding of pollutants and nutrients to the sediment,
- Dissolution and avoidance of climate-damaging gases.

Extraneous inputs, existing pollutants, special conditions influence treatment – whether a water body can be remediated by Drausy is usually not the question, but since natural processes are involved, time plays a relevant role.

Therefore, it is important to act when problems have already been identified – so that the water habitat is preserved in the long term [1].

Authors

Cordula Jäger
Drausy GmbH
Offenbach am Main, Germany
info@drausy.de

Dr.-Ing. Ute Urban
Energie- und Umweltberatung Urban
Derenburg, Germany
ute.urban-energie@t-online.de

Literature

[1] Urban, U.; Pinna-Weth, C.: Klimaschutz und Klimaanpassung durch gezielte Bewirtschaftung von anthropogen geprägten Gewässern. 2021 (not published).
[2] Jäger, C.: Assainissement doux de l'environnement: contrôle des algues bleu-vert. In: Webinar, Hydreos, 2021.
[3] Dietz, A.: Neukonzeption einer denkmalpflegerischen Nachbildung am Beispiel des Luisengrabens im Schlosspark Charlottenburg. Bacherlo Thesis, Beuth Hochschule für Technik Berlin, 2017.
[4] Kaufmann, K.; Uehlecke, A.: Belüftungssysteme von stehenden Gewässern - Ökotoxikologie/Gewässersanierung. Project work, Ostfalia Hochschule für angewandte Wissenschaften, 2020.
[5] Urban, U.; Heilmann, A.; Schröder, F.: Neue Methode zur biologischen Entschlammung von Stillgewässern. Wernigerode, 2004.

Regional Economic Effects of Water Tourism Using the Example of the WIN Region

Water tourism has developed into one of the main pillars of the travel region of Brandenburg and makes a significant contribution to strengthening the regional economic structure in the predominantly rural, structurally weak regions of water such as the WIN region in northern Brandenburg.

Matthias Wedepohl

Regional economic effects from water tourism

The attraction potentials of the water bodies have an outstanding role for the entire tourist destination Brandenburg and the WIN (Wassertourismus Initiative Brandenburg) region in particular as a reason to visit for a vacation on and at the water as well as the central profiling feature in the competition. Against this background, the preservation of the water potentials and their consistent water tourism valorization is of central importance, especially considering the fact that the predominantly structurally weak water regions have only few alternatives in regional economic terms. The water tourism valorization of individual water areas always requires a regional, networked thinking and acting of all actors. Therefore, an economic evaluation is only possible in a regional context and not as an individual measure.

Regional economic effects result from the water potentials not only through tourism on the water (boat tourism, passenger navigation), but also through water-motivated tourism on the water. The core of water tourism in a networked water system like the WIN region in northern Brandenburg is boat tourism. In the first revenue stage, water tourism providers such as boat rental companies and harbor operators profit directly from the expenditures of boat tourists, as do retailers, restaurants, culture and recreational facilities in the neighboring towns, and the municipal budgets indirectly through the resulting tax revenues.

Synopsis

- The extensive public investments in the water tourism valorization of the water potentials have paid off in regional economic terms.
- Annual gross turnover from water-related tourism on and around the water is around 370 million euros for the WIN region.
- Water tourism thus makes a significant economic contribution to structural development in rural areas.

Since water tourism is characterized by a high degree of networking with downstream industries, part of the revenue in the form of operating expenses in turn leads to sales to businesses located in the region in the service industry, crafts or trade (2nd level of sales). The regionalization rate, i.e. the share of operating expenses that goes to local and regional businesses, is well over 90% for charter companies, quay rental companies, passenger shipping companies and port operators, and still averages 50% in the case of investment. This also applies to spending on public water infrastructure (investment, operation and maintenance). Almost every euro spent by the riparian municipalities of the WIN region on the maintenance of the infra-structure remains in the region and generates added value there (investment almost every second euro).

Public investments in the waterside infrastructure also have an important initiatory function in that they generate follow-up investments in the private sector, whether in boat charters or hotel facilities, with knock-on effects even for the retail sector. Example: The development of the Lange Trödel Canal for water tourism has led to a major private investment in the harbor village of Zerpenschleuse with 200 vacation homes. The resulting demand in turn led to the establishment of a local discount grocery store, for which the local purchasing power alone would not have been sufficient to justify the investment decision. The local residents also benefit from the investments in the water tourism infrastructure not only through a higher recreational quality, but also, as the example of Zerpenschleuse shows, through a better quality of supply.

Monetarily unquantifiable are also awareness and image effects for the region and the state of Brandenburg (so-called intangible effects) through the supra-regional and beyond Germany charisma of water tourism.

Boating tourism is highly interconnected with land-based forms of vacation. As a Brandenburg-wide survey of boating holidaymakers has shown, every fifth charter customer combines his boating vacation with a land-based stay before or after the boating tour. And more than half of the boating vacationers can well imagine spending a land-based vacation, e.g. a cycling vacation, in Brandenburg at a later date. Water tourism thus also makes an important contribution to land-based destination development.

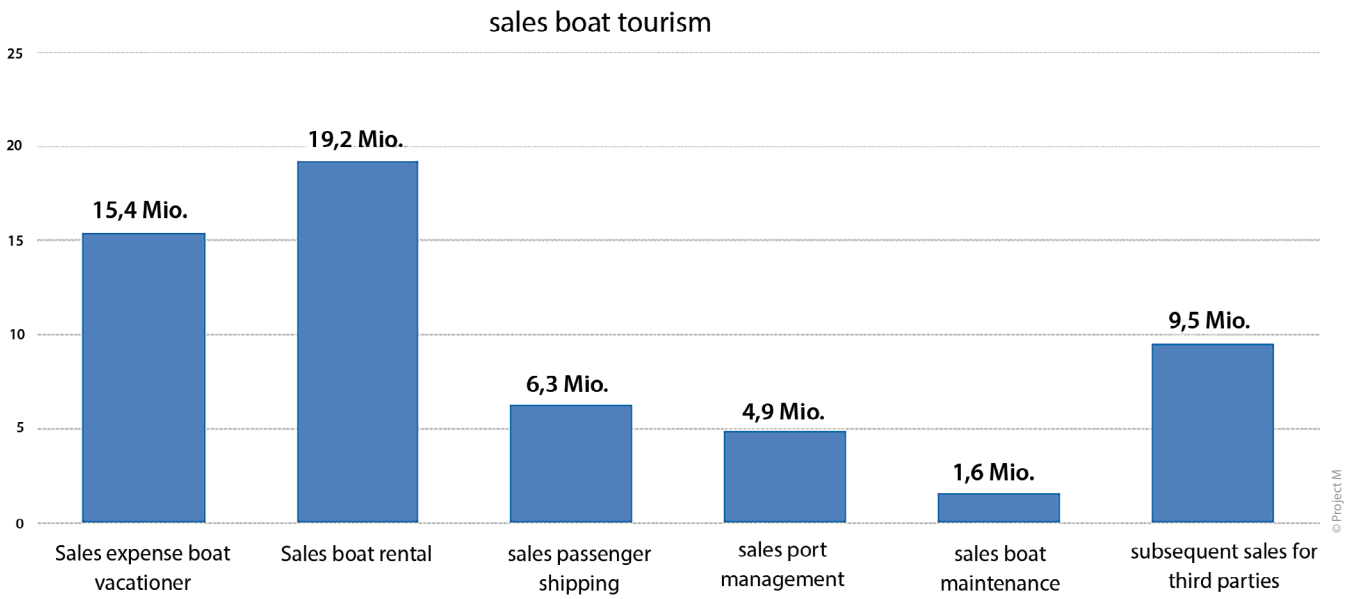


Figure 1: The 1.6 million sales from boat maintenance represent only a fraction of the total sales of the water sports industry; in addition to boat maintenance, this also includes the two high-turnover segments of boat trading and shipyard services, for which a calculation was not possible due to a lack of sales figures for the WIN region

Economic effects for the WIN region

Calculation basis is the Study Economic Effects in Water Tourism in Berlin and Brandenburg. Berlin, 2015 by Project M GmbH on behalf of the Chambers of Industry and Commerce in Berlin and Brandenburg (https://www.projectm.de/de/referenz/studie-wirtschaftliche-effekte-im-wassertourismus-berlin-und-brandenburg) For boat tourism in the sum of the turnover areas listed in the chart, the annual gross turnover for the WIN region is 56.9 million euros, which is distributed as follows (**Figure 1**).

Vacation on the water

Waters are of outstanding importance as a vacation occasion and activity space, also for land-based vacationer demand. When asked which activities play the most important role on their trip, an average of 35% of Brandenburg vacationers named activities on/at/on the water from 2012 to 2018 (DestinationMonitor Brandenburg). Against this background, the attractive water landscape of the WIN region generates not only market potential on the water, but to an even greater extent, vacationing on the water. Water-related activities, as a survey of all accommodation businesses in the WIN riparian towns by Project M 2015 showed, form the main argument for vacationing with them from the point of view of the landlords. In the calculation for the WIN region, water-related tourism in the riparian towns results in a total gross turnover of 182.8 million euros (for more, see the overall concept on the economic importance and prospects of water tourism in the region of the Wassertourismus Initiative Nordbrandenburg, www.win-brandenburg.de). In addition, there are the water-related revenues from overnight stays in businesses at the many solitary waters, which are not included in this study.

Water-induced day tourism

The waters also have an outstanding significance as a reason to visit the WIN region on a day trip. This results in a total annual gross turnover of 132 million euros. In total, the waterway network of the WIN region generates an annual gross turnover from boating tourism as well as vacation and leisure time on the water amounting to 371.7 million euros. Accordingly, water tourism makes a significant economic contribution to the structural development of rural areas.

Author

Matthias Wedepohl
Project M
Hamburg, Germany
matthias.wedepohl@projectm.de

Developing Infrastructure for Successful Water Tourism: Best Practice from the WIN Region

The North Brandenburg Water Tourism Initiative (WIN) has been active in developing water tourism infrastructure by restoring and connecting waterways since 2004. WIN projects are realized as public-public partnerships of various types. Two projects are completed; construction work of three further projects begins in 2022.

Julia Pollok

1 Introduction

Water tourism is an important economic factor and engine for the development of rural areas in Northern Brandenburg. The basic requirement for successful water tourism is a functioning, interconnected waterway infrastructure. There is a considerable investment backlog on waterway infrastructure primarily used by water tourists as well as a huge potential in interconnecting waterways.

2 Methods

The overarching goal of WIN is to develop one of Europe's most attractive inland waterway networks by creating an interconnected and predominantly license-free water tourism area between the Mecklenburg Lake District, Berlin, the Ruppin Waters and the rivers Havel and Oder. Therefore, the WIN initiative has been active in restoring and connecting waterways since 2004. WIN projects are realized as public-public partnership of various types and may serve as best practices for other regions. WIN itself is a communal working group consisting of three districts, five cities and one municipality [1].

Synopsis

- Water tourism is an important economic factor for Northern Brandenburg.
- The basic requirement for successful water tourism is a functioning, interconnected waterway infrastructure. There is a considerable investment backlog on waterway infrastructure primarily used by water tourists in Germany as well as a huge potential in interconnecting waterways.
- WIN has been active in developing water tourism infrastructure by reactivating and connecting waterways since 2004.
- As a result of the implementation of the core WIN projects, a license-free waterway network of 340 km in length will be created.

2.1 Expansion of the Werbellin Canal

The project comprised the construction of a 4 km long canal section between the existing Werbellin Canal and the Finow Canal that had been largely filled in in the 1920s. The reconstruction created a license-free connection between the Finow Canal and Lake Werbellin and was carried out by the municipality of Marienwerder. The majority of the investment costs was financed through structural aid from the European Union and the federal government. The state of Brandenburg, the district of Barnim and the municipality of Marienwerder also invested significant financial resources. The southern Werbellin Canal was opened in June 2011 after a three-year construction period [1]. In 2015, the canal had to be partially closed to shipping. After the renovation of a section, the southern Werbellin Canal has been navigable again since the start of the 2019 season.

2.2 Expansion of the Lange Troedel

After 90 years out of use, the Lange Troedel, the 10 km long western section of the Finow Canal, was restored with the aim of creating a license-free connection between the Upper Havel and the historic Finow Canal. The project included the construction of a new lock at the site of the historic Zerpenschleuse, of two bascule bridges and a lift bridge (**Figure 1**) [1]. After a three-

© WIN-AG / Dr. Reinhard Schliebenow, Luftbild Barnim

Figure 1: The new lock Zerpenschleuse on the day of its opening in 2016

year construction period and with a project volume of around 18 million euros (funding: 11.6 million euros), the Lange Troedel was opened in June 2016. In addition, the city of Liebenwalde built a city marina next to the bascule bridge and a large harbor village with around 200 holiday homes was established by a private investor next to the new lock.

2.3 Rebuilding Lock Friedenthal

This project aims at rebuilding lock Friedenthal filled in in 1959, in order to connect the Ruppin Canal with the city center of Oranienburg and further with the Havel-Oder-Waterway. The city of Oranienburg is the project sponsor, with the federal government covering 50% of investment costs and the State of Brandenburg contributing subsidies for almost 90% of the other half. Construction work will begin in 2022. The rebuilt lock Friedenthal is scheduled to go into operation in late summer 2023.

2.4 Preserving the navigability of the Finow Canal

The Finow Canal with its twelve historic locks (**Figure 2**) is the oldest still navigable artificial waterway in Germany and of central importance for the license-free waterway network in the WIN region. As the Federal Waterways and Shipping Administration (WSV) had to concentrate its capacities primarily on the maintenance and operation of the waterways used by commercial shipping, including the parallel Havel-Oder-Waterway, and due to the high need for renovation of the locks, the federal government intended to hand over the Finow Canal to the adjacent municipalities. As the successful result of many years of complex negotiations, the association Zweckverband Region Finowkanal, founded in 2020 for this purpose, will take over and renovate the twelve locks in two packages and finally operate them [2]. In a pilot project unique in Germany in this dimension, the Zweckverband will begin in fall 2022 with the gradual renovation and modernization of the six western locks. The federal government assumes half of the investment costs. The state of Brandenburg approved additional funding of 19.7 million euros. The aim is to complete the first six locks by 2025. At the same time, planning for the six eastern locks is already beginning.

2.5 Replacement of Lock Kannenburg

The replacement of lock Kannenburg differs from the other original WIN projects in so far, as the WIN member city of Templin in a pilot project volunteered to take over the planning and construction of the new lock on behalf of the WSV [3]. The WSV bears the costs of the measure, remains the owner of the lock and will continue to operate it. The approximately 100-year-old lock, located at the entrance gate from the Havel to the Templin waters, had to be closed to all shipping due to irreparable damages at the end of 2017. As a result, the Templin waters have been cut off from the rest of the waterway network. Construction work started in April 2022 and is scheduled to take one year.

3 Results

As a result of the implementation of the core WIN projects, a continuously navigable, license-free waterway network of 340 km in length will be created. The already completed WIN projects are successfully accepted by boaters. In the 2021 season, almost 3.000 boats passed lock Zerpenschleuse. A recent study shows the economic importance of water tourism for the WIN region: In total, the waters of the WIN region generate an annual gross turnover from boat tourism as well as vacation and leisure at the waterside in the amount of 372 million euros [2]. At the same time, a study examining the example of lock Zaaren has shown the negative effects of the closure of a central lock for the entire water tourism area [4].

Figure 2: Historic lock Leesenbrueck dating from 1878 at the Finow Canal

4 Conclusion

WIN will continue to work on its projects and the goal of developing one of Europe's most attractive contiguous inland water tourism areas. In this context, WIN welcomes the Masterplan Freizeitschifffahrt submitted by the Federal Ministry of Transport and Digital Infrastructure in 2021, as an important strategy for the future of water tourism in Germany [3].

Author

Julia Pollok
Wassertourismus Initiative Nordbrandenburg (WIN)
c/o WInTO GmbH
Hennigsdorf, Germany
pollok@winto-gmbh.de

Literature

[1] Uhlig, A.; Paul J.; Hennings R.: Wassertourismus Initiative Nordbrandenburg (WIN). In: Lehmann, J. (ed.): Die Obere Havel und der Finowkanal. Erfurt: Sutton Verlag, 2015, p. 134-143.
[2] Project M GmbH (ed.): Gesamtkonzept zur wirtschaftlichen Bedeutung und zu den Perspektiven des Wassertourismus in der Region der Wassertourismus Initiative Nordbrandenburg (WIN-Region) unter besonderer Berücksichtigung des Finowkanals. Berlin, 2020 (www.win-brandenburg.de/fileadmin/user_upload/Gesamtkonzept_wirtschaftliche_Bedeutung_finaler_Bericht_.pdf, Abruf 01.03.2022).
[3] Bundesministerium für Verkehr und digitale Infrastruktur (ed.): Masterplan Freizeitschifffahrt. Berlin, 2021 (https://masterplan-freizeitschifffahrt.bund.de/downloads/publications/0/Masterplan%20Freizeitschifffahrt_barrierefrei.pdf, Abruf 01.03.2022).
[4] Project M GmbH (ed.): Wirtschaftliche Auswirkungen der Sperrung einer zentralen Schleuse auf den Wassertourismus und die Region am Beispiel Schleuse Zaaren. Berlin, 2020 (www.win-brandenburg.de/fileadmin/user_upload/Endbericht_Zaaren_final.pdf, Abruf 01.03.2022).

Water Tourism in Germany – A Child of the German Reunification

Water tourism in Germany is a positive effect of the German reunification. It was only after the fall of the Berlin Wall that two important factors came together that were decisive for the formation of the new industry of water tourism. A great area between the Elbe and Oder rivers and the state framework conditions to use it commercially.

Dagmar Rockel-Kuhnle

For the younger ones: Until 1990, what is now the Federal Republic of Germany was divided: On the territory of today's federal states of Mecklenburg-Western Pomerania, Brandenburg, Saxony-Anhalt, Saxony and Thuringia as well as East Berlin, there was a socialist state system under the name of the German Democratic Republic with a planned economy and extremely regulated freedom of travel (other freedoms were also limited). On the territory of the federal states of Schleswig-Holstein, Hamburg, Bremen, Lower Saxony, Hesse, North Rhine-Westphalia, Rhineland-Palatinate, Baden-Württemberg and Bavaria, as well as West Berlin, there was the Federal Republic of Germany with a free democratic basic order with a social market economy. With effect from 3rd October 1990, the GDR joined the Federal Republic of Germany, and since then there has been only one Germany.

Water sports, i.e. physical exercise and competition on the water, began in Hamburg and Berlin in 1835 and really took off with Kaiser Wilhelm II, who was a seafaring and marine enthusiast. In order to be able to compare each other in competitions, water sports needed an organisational structure that defined classes and competition regulations for the respective sports. These structures still exist today - the club system.

On the role of water tourism

Water tourism, on the other hand, i.e. spending time on the water without physical exercise and largely without competition, developed from the 1960s onwards in a way that was highly suspicious in organised Germany on both sides of the Wall: chaotic, without fixed structures, people were out and about to relax, enjoy the sun and nature, go where it was nice, find the best beer or discover new areas by water.

Of course, there have been water tourists since the mid-1850s: Henry M. Doughty, for example, who explored German waters

Synopsis

- Water tourism and water sports are two completely different things.
- Water tourism needs a cruising area plus a private sector.
- Water tourism infrastructure is a state task.

© Quick Maritim Medien

Figure 1: The Mecklenburg and Brandenburg Cruising Area: A blue paradise of 1800 Kilometres of waterways between Elbe an Oder rivers, lakes, rivers, canals and stunning nature

with his Norfolk-Wherry Gipsy in 1890/91 from Friesland to Bohemia with a detour across the Mecklenburg Lake District (**Figure 2**). Or C. S. Forester, who in 1930, long before the success of his Hornblower novels, cruised Germany with an outboard motor and the open 4.5-metre wooden boat Annie Marble. Both have left us great travel accounts in book form.

Many people were out on the water without sporting ambition, both in East Germany with inflatable and folding boats that were transported to the water by train, dinghy cruisers, the legendary outboard engine Forelle, the rowing boat Anka or with self-built boats with Trabi windscreens and self-milled boat fittings. Likewise in West Germany, where getting the right boat was mostly a matter of financing, while GDR citizens had to rely on their technical skills or talent for bartering.

But in order to turn unorganised water tourists into an entire industry, one decisive factor was missing in both West and East Germany: in the East, there was no private sector worth mentioning for reasons of state policy, and in the West there was a lack of cruising areas.

For holidays on the water you need:

- as little to no commercial shipping as possible,
- an intact network with a few hundred kilometres of waterways,
- a mooring every 20 to 30 kilometres (from a piece of sheet pile wall with bollards on the shore to a large marina with its own shipyard),
- a colourful mix of countryside with villages, towns, cow pastures, forests,
- a few lakes for anchoring and swimming,
- a lot of untouched nature,
- now and then a restaurant/supermarket/museum/climbing park/fun pool with its own jetty or near a harbour.

These cruising areas existed before 1990 in France, the Netherlands, Ireland and Great Britain. Those who made money from water tourism in West Germany were either boat builders or importers, sold or repaired motors, were on the Baltic Sea, or rented out small boats on the local dam. All this took place on a small scale, in family businesses, craft enterprises, far from being a weighty industry.

On November 9th 1989, the GDR opened the Wall, ushering in its own end as a state. Two months later, at the industry meeting "boot" in Düsseldorf, a murmur goes through the exhibition halls „Go to the GDR, they have lots of water there."

New opportunities

Apart from a few Interhotels, there was no tourist infrastructure between the Elbe and the Oder that could have been offered to demanding West Germans. But there is water, clean water, many lakes, interconnected by canals, a huge area, the locks are intact and in operation (except for the one leading into the West). Nestled in a breathtaking nature with rare birds, large forests and brick churches in various stages of decay.

© Quick Maritim Medien

Figure 2: Henry M. Doughty gave us the first report of a water tourist in Germany; "Our Wherry in Wendish Lands" from 1892 is available in German language "Mit Butler und Bootsmann"

The first person to recognise opportunities here rather than decline and destruction was Harald Kuhnle, who eight years earlier as a student had opened an agency for sailing trips and boating holidays in France. Kuhnle orders four canal boats in Friesland, looks around for harbours in the summer and autumn of 1990, gets maps, compiles area information for his charter crews and takes photos for the catalogue.

Then everything happens quite quickly: not only the Kuhnle-Tours fleet grows in the coming years. Today – 31 years later – an estimated 2,000 boats are underway between the Elbe and Oder rivers, there are around 250 moorings that have been professionalised to the extent that they can accommodate guests – from commercial marinas to hospitable club harbours, plus countless restaurants near the water, plus a colourful country life from participatory museums to open-air festivals, from church gazing tours to stargazing nights, hotels, supermarkets, holiday flats, camping and motorhome sites (**Figures 1** and **3**).


© Kuhnle-Tours/Harald Mertes

Figure 3: Anchoring, swimming, SUPing: this boats and activities are typical in the Mecklenburg and Brandenburg cruising area

How could this succeed in such a short time?

The following factors were decisive for the development of water tourism as an economic sector in the waters between the Elbe and Oder rivers:

1. The state infrastructure was largely intact: The waterways were navigable, the locks worked.
2. The Unification Treaty stipulated that the Reich waterways would become federal waterways. If these structures had first had to be developed at the federal level, this would have led to a small-state chaos of the most diverse regulations and procedures.
3. The state has promoted investments in tourism offers from charter boats to the expansion of club harbours to large holiday resorts in a variety of ways, both at the federal level and at the state level: Via tax write-offs, as direct subsidies, via equity grants and favourable loans. Not every measure was successful, meaningful or purposeful, but most of them were.

Author

Dagmar Rockel-Kuhnle
Quick Maritim Medien
Rechlin (Müritz), Germany
post@quickmaritim.de

Infrastructure Challenges for Water-based Tourism in Germany

The governing parties in Germany have agreed to establish new priorities for the federal waterways that are only used for tourism or sporting purposes, in accordance with their navigability. In addition, it has been decided that new strategies for the individual waterways are to be developed together with the federal states and the regions.

Gesa Schwoon

In the 19th parliamentary term, the governing parties in Germany agreed to establish new priorities for federal waterways that are only used for tourism or sporting purposes, in accordance with their navigability. In addition, it has been decided that new strategies for individual waterways are to be developed together with the federal states and the regions.

Water-based tourism on federal waterways is an important economic factor. It generates a gross turnover of more than 4 billion euros [1]. Germany has established itself internationally as an important destination for water tourism. The main reason for this is the extensive waterway network for recreational shipping in Mecklenburg-Western Pomerania, Brandenburg and Berlin that forms Europe's largest interconnected water sports destination.

The user expectations in recreational shipping have risen, as have the relevance of protecting the environment and the challenges presented by climate change. While automation and digitalisation are becoming increasingly important, the unfavourable age structure and many years of investment shortfalls mean that the infrastructure is in urgent need of structural maintenance and replacement.

Against this background, the Recreational Shipping Masterplan [2] (**Figure 1**) was developed. It plots the course to be taken by recreational waterways going forward in five action areas.

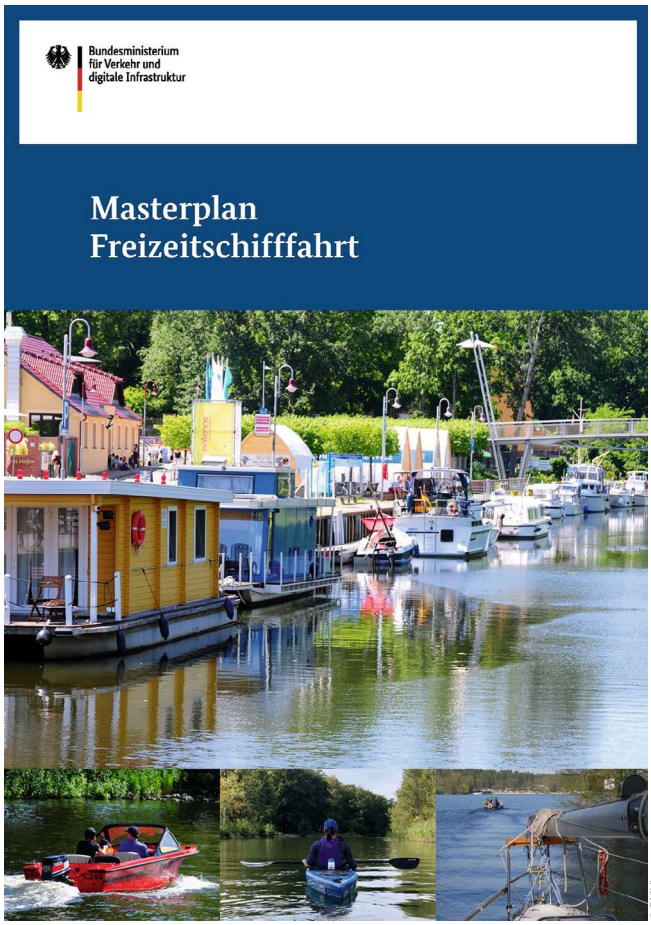


Figure 1: Cover Recreational Shipping Masterplan

Infrastructure

Many facilities for the recreational waterway network have reached an age that requires substantial investment in renewals. This offers an opportunity to modernise the waterway infrastructure in a way that meets current and future needs and is focused on the needs of users. The collection of data on traffic, structures or water will provide a basis for this.

The identified traffic demand is an essential basis for infrastructure decisions. It is becoming apparent that the water-based tourism amenities on some sections will have to be expanded, while on other sections the current usage figures do not always justify the replacement of facilities and the maintenance of existing operations. A new balance is to be struck between the use of resources for freight traffic and for recreational waterways.

To accelerate the implementation of construction projects along recreational waterways, a multi-project management approach is to be established, among other things. The use of new

Synopsis

- Water-based tourism on federal waterways is an important economic factor.
- The infrastructure of recreational waterways is to be modernised in line with demand.
- The Recreational Shipping Masterplan will be implemented in cooperation with the stakeholders on the ground.

© Deckbar photography

Figure 2: Regional conference

technologies and leaner processes for planning, construction and maintenance, e.g. building information modelling, the creation and promotion of strategic (construction) partnerships and collaborative schemes as well as the development and application of adapted standard construction methods, is intended to accelerate construction processes and make them more efficient, while also improving the implementation of construction projects.

Navigation

The recent amendment of the Federal Waterways Act has elevated the status of recreational shipping.

To promote sustainable, environmentally sound upgrading of recreational shipping, the development and implementation of alternative propulsion systems and vessels are to be promoted by strengthening research programmes and by dovetailing and expanding financial assistance programmes.

The provision of traffic information and services (e.g. information and guidance systems, rules on traffic and pilot behaviour), improving rules and cutting red tape, user-friendly lock operation management (e.g. cooperation in operating facilities; upstaffing lock personnel; traffic management) and pushing ahead with the remote and self-operation of locks, including links to lock control centres, are important aspects on the way to user-focused provision of services.

Digitalisation

To unlock the potential of digitalisation in recreational shipping, more widespread use of digital innovations (autonomous navigation; innovation in the area of digital design and building) will be promoted e.g. by installing test beds or other pilot projects. The feasibility of guaranteeing universal network coverage (e.g. free Wi-Fi, mobile connectivity, innovative connectivity systems, LoRaWAN) will be examined. The provision of digital services such as map services, user apps, e-learning platforms and streaming services is to be expanded and promoted. This can be significantly improved through the expansion of data provision in open data portals.

Environment

Advancing sustainable construction and maintenance measures (e.g. use of bank stabilisers), promoting environmentally and climate-friendly shipping (e.g. developing alternative ship propulsion systems, environmental management systems, waste management infrastructure, anti-fouling paint), consolidating traffic and ecological measures, information on environmental protection and nature conservation measures, promoting regional initiatives as well as incentivising specific user behaviours are measures to promote sustainable water use.

Communications and cooperation

The Recreational Shipping Masterplan will be implemented in the same way in which it was developed – in cooperation with the stakeholders on the ground (**Figure 2**). This applies especially to the development of regional and user-focused development strategies for individual waterways on the basis of overarching potential analyses. For this purpose, participation models are to be initiated to enable the waterway stakeholders to coordinate and discuss their plans.

Communication and coordination between the different working and organisational units is to be made clearer and more transparent, e.g. using appropriate platforms for external communication. This is to guarantee also that information is generally accessible and comprehensible and is provided in a timely manner.

Finally, sufficient coordination of current and planned public investment as well as of future developments will be targeted.

Litarature

[1] Federal Ministry for Economic Affairs and Energy (ed.): Die wirtschaftlichen Potenziale des Wassertourismus in Deutschland. (Commercial potential of water-based tourism in Germany), 2016.
[2] Federal Ministry of Transport and Digital Infrastructure (ed.): Recreational Shipping Masterplan, 2021.

Author

Dipl. Ing. Gesa Schwoon
Federal Ministry for Digital Affairs and Transport
Division Management of Federal Waterways
Focus on Recreational Waterways
Bonn, Germany
ref-ws13@bmdv.bund.de

Inland Water Tourism in Germany: Economic Potential and Effects

The economic potential and effects generated from water tourism on inland waterways are enormous. The gross turnover generated by tourism amounts to more than 4 billion euros per year, and a total of almost 70,000 full-time equivalents depend on this tourism segment.

Karsten Stahlhut and Robert Marx

The aim of this paper is to show the economic effects of water tourism of the German inland waterways.

Waterways and Water-Tourism

A waterway is understood to be navigable rivers and canals in inland areas. The waterways in Germany that are important for traffic are predominantly owned by the Federal Republic of Germany as federal waterways. They are under the administration of the Federal Waterways and Shipping Administration (WSV), which is part of the Federal Ministry of Transport and Digital Infrastructure. Other waterways are under the administration of the federal states as state waterways.

Water tourism is essentially divided into two segments. On the one hand, this is the area of water sports, on the other hand the area of shipping (**Figure 1**). Furthermore, there are segments associated with water tourism, such as major maritime events and the area of water-related tourism, e.g., bathing tourism. In the further course, however, we will concentrate on the water sports segment.

The role of maritime and inland waterways

The federal waterways are divided into sea waterways and inland waterways. The inland waterways have a total length of about 7,300 km, of which about 75 percent are natural bodies of water and 25 percent are canals. Berlin, Brandenburg and Mecklenburg-Western Pomerania is the region with the most inland waterways in Germany. Currently, about 2,800 kilometers of these 7,300 kilometers are used primarily for tourist purposes.

It should be particularly emphasized that „a network structure results from the individual waters of a region that are relevant for tourism, which, taking into account natural conditions and for marketing purposes, is referred to as a water tourism-district." It must be taken into account that only a coherent navigable region is attractive from the customer's point of view. Therefore, it is particularly important to maintain the infrastructure such as locks and weirs throughout.

Special features of the waterways in the different regions

In the regions of northern and central Germany, the waterway networks are primarily characterized by interconnected rivers, canals and lakes. This is an attractive area especially for houseboats and canoes.

The southern German districts with their many lakes, first and foremost Lake Constance with around 55,000 boats, are more characterized by sailing in terms of the absolute number of boats.

Basically, it can be said that the larger the contiguous water area in a region, the greater the resulting economic power. A large contiguous water area offers particularly varied water sports opportunities and is therefore perceived as particularly attractive. Especially against this background, the newly emerging region in Leipzig and Lusatia also has a particularly high development potential.

Importance of public infrastructure for inland waterways

The public infrastructure, such as locks and weirs, is of particular importance for the success of a water sports region. If even one lock in a connected network fails due to technical problems, the entire network is at risk, as round trips over several days are then no longer possible. This scenario must therefore be avoided as a matter of urgency.

Synopsis

- In Germany, there are about 7,300 kilometers of federal waterways, of which about 2,800 kilometers are regularly used for tourist purposes by recreational boats or canoes.
- The boat fleet consists of around 191,000 inland recreational boats, which are on the water a total of around 4 million days.
- In Germany, around 66,500 jobs are linked to water tourism on inland waterways. The gross turnover generated by water tourism is 4.2 billion euros per year.

Figur 1: Water tourism in Germany

Boat structure in Germany

There are approximately 483,000 sail and motor boats in Germany. These are divided as follows: 160,000 sailboats (7 to 11 meters in length), 35,000 sailing dinghies, 190,000 motorboats (7 to 11 meters in length) and 115,000 open recreational boats up to 6 meters in length (excluding inflatable boats).

Boat structures of inland waters

Around 191,000 boats out of the total number are underway on federal waterways (inland waterways). In addition, there are around 1,200 houseboats in regular charter. Furthermore, around 280,000 canoes ply the federal waterways.

Water tourism use of federal waterways

It is safe to assume that the 191,000 boats spend an average of about 20 boating days on federal waterways. This means that all together they have about 3.83 million boat days on the water. In addition, charter boats spend an average of 120 days per boat on the water, which adds up to about 0.144 million boat days. Together, this amounts to about 4 million boat days on federal waterways.

The 280,000 canoes are moved on average about 9.7 days with an average of 2.5 persons per canoe. This results in a further 2.7 million boat days.

Boats and canoes together account for 6.7 million boat days. Of this total number, 80% (5.36 million) are used during the season (6-7 months).

Economic significance

Overall, as determined by the Federal Ministry for Economic Affairs and Climate Action (Bundesministerium für Wirtschaft und Klimaschutz, BMWK), we assume that the gross demand generated by tourism on the federal waterways amounts to approx. 4.2 billion euros/year.

This results in approx. 66,500 people earning their living from inland water tourism, mainly in rural and structurally weak regions. Including the gross demand generated by tourism in the coastal area, the turnover amounts to about 7 billion euros.

Conclusion

It is impossible to imagine Germany without water tourism. This does not refer exclusively to the economic effects.

At least as important is the overall economic benefit in terms of regeneration. At a time when everyday stress and people's increasing workloads are becoming more and more of an issue, water tourism is becoming increasingly important.

Taking a short trip to the water, clearing the mind – whether with SUP, canoe or boat – or simply to enjoy the maritime flair of the sport boat harbors or the lock moorings, for many people this has increasingly become a valuable, welcome and regular change in everyday life.

Authors

Karsten Stahlhut
Robert Marx
Bundesverband Wassersportwirtschaft e. V.
Köln, Germany
stahlhut@bvww.org
info@bvww.org

The Multifunctionality of the Flemish Waterways: Information Is Key

At De Vlaamse Waterweg nv, we are fully committed to multifunctional use of the navigable waterways in Flanders. We want to significantly increase the share of transport via inland waterways, to achieve better water management and also to embrace the multifunctional character of the waterways.

Véronique Sterkens

Introduction

Flanders has more than 1,000 km of navigable waterways. In our position as waterways manager, we are fully committed to multifunctional use of this asset. At De Vlaamse Waterweg nv (Flemish Waterways plc), we want to significantly increase the share of transport via inland waterways and to manage flooding and water shortages better. We also want to take full advantage of the versatility of our waterways and increase their attractiveness for urban and municipal developments, recreation, tourism and natural experiences.

The Flemish waterways pass picturesque villages, unspoilt countryside, castles, medieval town centres, nature reserves and top tourist attractions. All accessible at the incomparably relaxing pace of being on a waterway (**Figure 1**).

During recent years, both strengthened natural and landscape values and improved infrastructure have ensured that the Flemish waterways have become ideal for all facets of recreational activities on and around the water. We are experiencing continuing interest in the wide range of recreational opportunities that the waterways have to offer.

Naturally, a balance needs to be found in facilitating these different functions (transport, water management and multifunctionality). De Vlaamse Waterweg nv has taken up this challenge.

Methods

Several sections of the Flemish waterways have been assigned to recreational speed boats, waterskiing and/or jetskiing. De Vlaamse Waterweg nv has also imposed restrictions, which are determinded by the applicable regulations, to the use of some new types of recreational watersports, such as flyboards. These policies and other policies needed to be communicated towards our customers, the users of our waterways.

An accurate, direct and real-time communication to all the users of our waterways is of the upmost importance. In this regard, De Vlaamse Waterweg nv launched the online platform VisuRIS, the Visualisation of River Information Services (www.visuris.be). On VisuRIS, (potential) users of the Flemish waterways can find all the necessay information regarding the waterways such as maps, a routeplanner, notices to skippers, legislation, valuable safety tips, etc. On top of the online tool, RIS centre, which is a team of De Vlaamse Waterweg nv employees, can be contacted 24/7 for urgent matters or additional information.

Figure 1: Kanaal Gent-Oostende (Moerbruggebrug, Oostkamp)

Results and conclusion

On VisuRIS De Vlaamse Waterweg nv had centralised all the availble information, policies and advices which are relevant for the different users of the Flemish waterways (Single Window). Real-time information and user-friendly communication is key in pursuing and maintaining the safety of all the different users of the waterways.

Synopsis

- A balance needs to be found in facilitating the different functions of the navigable waterways (e.g. transport, water management and multifunctionality). De Vlaamse Waterweg nv has taken up this challenge.
- An accurate, direct and real-time communication to all the users of our waterways is of the upmost importance. In this regard, De Vlaamse Waterweg nv has launched the online platform Visuris.

Author

Véronique Sterkens
De Vlaamse Waterweg nv
Hasselt, Belgium
info@vlaamsewaterweg.be

The New Tourist Model for the Elbląg Canal

The project showcases the revival of tourist traffic in the area of the Elbląg Canal – a unique system of canals and lakes on a Polish as well as global scale and its integration with the terrains located along the waterway by introducing a new tourist model allowing for optimal use of the region's charms and attractions.

Julia Wleklińska

The presented project is a result of an over five-years-long doctoral research and showcases the possibility of revival of tourist traffic in the area of the Elbląg Canal water system as well as its integration with the terrains located along the waterway by replacing the existing tourist model with a new one. Introducing the new tourist model would allow for optimal use of the charms and attractions offered by the region. The choice of this reservoir is deliberate. It is a unique system of interconnected canals and lakes on a Polish scale, and thanks to the use of an original 19th-century technology that facilitates overcoming significant differences in terrain elevation: the inclined planes it is also unique on a global scale as no other such constructions survived. The Elbląg Canal has great potential – although neglected for decades, it has undergone a process of renaturalization – endemic plant species have reappeared, as well as new ones for which the conditions along the canal have proved to be favourable for development.

Revitalizing the region

The assumption and thesis of the project were to show that the adoption of a new tourism concept, aimed at revitalizing the region is possible only if the designer respects the place itself, its surroundings, the existing nature, as well as culture and tradition. In the development of the adopted thesis, the project included considerations on the concepts crucial for the design practice: landscape, tourism, cultural tourism and sustainable development as well as slow tourism. Bibliographic studies, field studies and own observations, as well as the comparative studies of the selected navigable canal revitalization projects from around the world that I have undertaken so far, related to the already mentioned concepts are used to create design assumptions for the tourist land infrastructure in the form of small architectural objects, which will be tailored to the needs, but also the surroundings to interfere with the beauty of wild nature as little as possible. This concept also involves the study of a completely new means of transport adapted not only to the specificity of the canal but also to the needs of users, including a new type of tourists who would like to come to this place to spend time on the water region and be able to stop for further venturing inland. It should be emphasized that the creation of a concept by a designer allows for the consideration of the issues of the impact of culture, landscape and nature on the designed forms, and at the same time how the designed objects would affect the environment and how to achieve harmony in this field.

The proposed functional and stylistic solutions constitute a summary of the research and analysis carried out by me during my doctoral studies. They are characterized by generality and elementary nature, however, it is a deliberate action - they constitute a set of guidelines that are to suggest the direction of development of the micro-harbour project, excursion routes and a network of vessels, taking into account the influence of the broadly understood landscape, as well as the intended functions. The sketches I have drawn express the overriding design idea, but they are not final proposals.

Proposed design solutions in the form of:

- tourist and sanitary infrastructure facilities,
- a new type of vessel adapted to the specificity and scale of the canal,
- designated parking spaces and accessible bicycle and pedestrian routes,

would allow for the introduction of small and evenly dispersed objects in the area of the reservoir. They do not dominate the landscape but allow for fuller use not only of the currently inaccessible sections of the canal but also to draw on the rich heritage of the entire region. Such restrained measures will prevent the degradation of the canal landscape and its nature, as they assume the use of the reservoir in its present state, without the need for drastic removal of the quays and dredging the canal bed while removing the underwater ecosystem. Due to the complete, gradual elimination of the existing old massive (in the canal scale) cruise ships, the need to strengthen quays with reinforced concrete will disappear, as well as the risk of water contamination with fuel leakage, noise and exhaust gas pollution.

Synopsis

- A new tourist model is introduced for the Elbląg Canal.
- The Principle is minimal design intervention for a maximal result.

Author

Julia Wleklińska
The University of Technology in Bydgoszcz
Faculty of Design Arts
Bydgoszcz, Poland
julia.wleklinska@pbs.edu.pl

Reshaped Canals for a Better Urban Future: Six Key Qualities of Effective Inland Waterways

Disused canals can become public attractions and essential elements of urban infrastructure. Examples show that they must be adequate in length, complete in their facilities, secure for all people, connected to other paths, active with diverse uses, and fitting to their recreational purposes.

Thomas Vonier

What makes a redesigned canal successful?

Certain qualities make redesigned inland waterways successful. Specific attributes can help transform disused canals into vibrant public attractions and essential elements of urban infrastructure. A critical review of waterways in Europe and North America demonstrate that canals must be adequate, complete, secure, connected, active, and fitting (**Figures 1, 2** and **3**).

They must be adequate in length. To attract users, waterways must be of sufficient length and capacity. Short, shallow strips of water are usually not enough. Longer canals attract cyclists and hikers. Canals rich in artifacts attract history enthusiasts and tourists. Canals that are barren or too short do not generate the same level of attraction.

They must have complete facilities. All parts and pieces matter. Locks, towpaths, trestles, aqueducts, bridges – a canal needs all of them to be whole, and it must have water. Today, to its detriment, the Chesapeake & Ohio Canal (184 miles, or 297 km long) has multiple segments that lack water. Solid towpaths and healthy, abundant trees hold similar importance among recreational users.

They must be secure for all. Users and visitors must feel safe – free from the threat of harm. Footpaths, gathering spots, and parking areas must be secure day and night, on workdays, weekends, and holidays. Lighting, cleanliness, visibility, and maintenance are critical factors. The presence of other people brings a measure of safety [1].

© tvonier

Figure 1: Canals that have been neglected or damaged (as here in Chittagong, Bangladesh) represent lost opportunities

They must be connected to other paths. Canals are long paths punctuated by junctions with roads, railroads, towns, and villages – in other words, intersections with a series of consequential nodes and points of connection and interest along the way, with facilities for service and replenishment. Vitality depends on developing these connections, using signs, maps, and apps to highlight them.

They must be active with diverse uses. Programs, activities, and events give new life to former industrial landscapes. Outdoor concerts, theater performances, lectures, film series, festivals, antique markets, car shows, and other events attract people, but they also require special facilities, funding, and planning. Many canal communities build events and programs around long weekends and school vacation periods, with programs offered both day and night [2].

They must be fitting to their recreational purposes. Canals consist of both water and land. Some towpath surfaces are good for cycling, while others are better for hiking or horseback riding. Clean canals are suitable for wading and swimming. Frozen canals can become ice-skating parks. Designs should

Synopsis

- Canals can stimulate vibrant, environmentally responsible urban centers. They also offer effective ways to cope with flooding and changing water levels.
- We can improve upon historic hydraulic engineering principles that have worked well for centuries. We can rebuild and enhance these important public assets, giving them new cultural and environmental utility.
- Just as when they were first created, inland waterways and canals can again be the center of vibrant, livable communities. They can serve as vital tools for flood control and water level management.

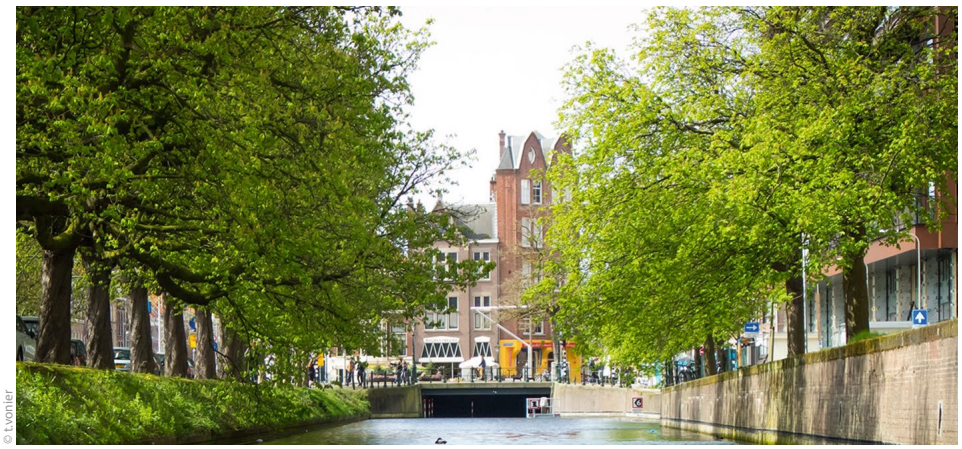


Figure 2: Most canals in the Netherlands (as here in The Hague) remain active and useful networks for recreation, goods delivery, and public transit

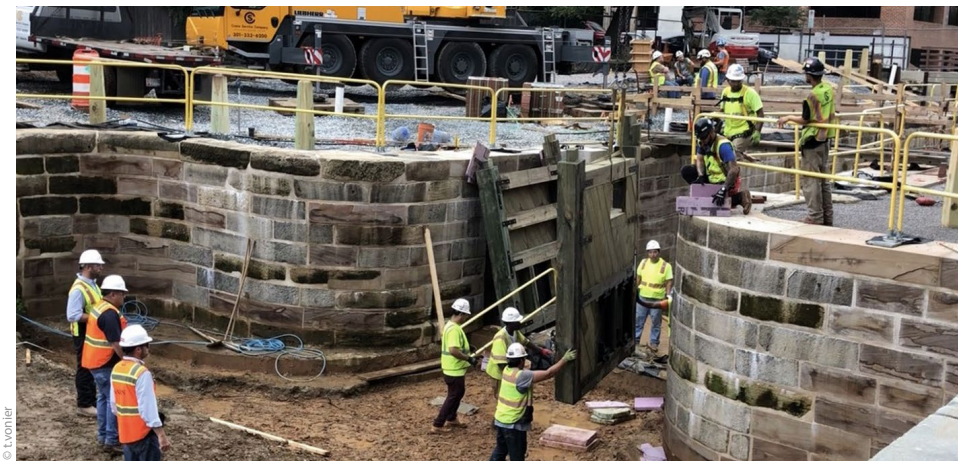


Figure 3: Restoration of stone locks along the Chesapeake & Ohio Canal in Maryland, USA

accommodate a full range of potential uses, taking an inclusive approach to planning for potential users in terms of age, physical abilities, and cultural preferences. Appropriate materials and facilities are key.

Why are canals more important now than ever?

In addition to their intrinsic beauty, three areas of potential give canals powerful new relevance and value in today's urban settings:

- They have great potential for economic growth. Redesigned canals can serve as economic engines and magnets for tourism. We can reshape inland waterways and canals to become lively attractions and important amenities in the center of prosperous, livable communities –just as many of them were when first built.
- They have great potential for environmental stewardship. Canals and inland waterways can help communities grapple with extreme weather and cope with the ravages of changing climate conditions. Chronic flooding and rising sea levels are of urgent concern to many cities across the globe. Let's recall the long and distinguished history canals have as systems for damping and mitigating floodwaters – and let's use them for this purpose again.
- They have great potential for transit and transport. Where people and goods once moved efficiently by water, they might very well do so again. Many European waterways have never lost their value as transitways, and some have achieved renewed vitality as a viable alternative to rails and motorways.

By rebuilding and enhancing these public assets, and by improving on techniques that have worked for centuries, cities can give inland waterways new value in efforts to rebuild local economies and bolster community resilience. A prime example: the massive investments by the state of New York in reimagining, restoring, and rebuilding the great Erie Canal.

Author

Thomas Vonier, MArch BScArch CPP
UIA International Union of Architects
Paris, France
t.vonier@uia-architectes.org

Literature

[1] World Tourism Organisation (ed.): Growth in International „Green" Tourism. 2011.
[2] Transport Geography (ed.): Transportation, Ecomomy and Society. 2017.

New Projects, Old Ideas: Roman Past of European Canals' Projects

The paper aims at underlining the permanence over 20 centuries of some projects of infrastructure in West Europe, especially the canals connected to the Rhine (Mosel-Saône-Rhône) to allow a circulation from the Mediterranean Sea to the North Sea, for commercial and military purposes.

Yasmina M. Benferhat

Around 61 CE the Roman legate Antistius Vetus in Germany wanted to build an interconnection between Rhine and Rhone thanks to a canal in North East of Gallia, nowadays France:

"Vetus prepared to connect the Moselle and the Arar by a canal, so that troops crossing the sea and then conveyed on the Rhone and Arar might sail by this canal into the Moselle and the Rhine, and thence to the ocean. Thus the difficulties of the route being removed, there would be communication for ships between the shores of the west and of the north." (Tacitus, Annals 13.53.2, translation Church-Broadribb)

The various translations of copiae – either troops or goods – are interesting because it underlines the two main advantages of this canal. Anyway, the canals were built by the armies for the armies first in ancient Rome, in order to send them easily on the main boundary then (the German limes) but also to bring them food and supplies. This was not the only aspect of trade, since many merchants followed the troops [1].

Nevertheless, this canal was never built: Vetus had to give up the project because of some political reasons [2]. Indeed, at that time building a canal was too prestigious to allow a senator legate or governor to do so: only the emperor would plan such big projects.

Last but not least, another interesting aspect of this text is the positive presentation of the canal. Was it really that advantageous? One may have doubts actually, since the historian wants to accentuate the consequences of a general moral corruption: he praises also the project to underline the bad influence of a bad emperor.

Synopsis

- A first point will be to list old projects of canals to focus on one significant example i.e. the fluvial interconnection North/South thanks to a canal from the Mosel to the Rhone over the Saône.
- A second point is to underline the difficulties and their variety which have been preventing from building this canal: political reasons in ancient time, ecological reasons nowadays.
- We aim at underlining the advantages of this project, the permanence through the changes: trade is still a good argument, while military operations (Roman imperialism) don't seem up to date.

Today canals are built by engineers, i.e. by civilians for civilians. The military aspect may seem obsolete, though it was still there in 1875-1882 when a first realization was done, the East Canal, now divided in North Canal (between the Maas and the Moselle) and South Canal (through the Vosges). East of France was then divided between a German zone and a French zone around Nancy and the Vosges mountains which needed a connection.

This old canal is 439 kilometers long and it has two main problems for its use today: first it was thought for much smaller boats than nowadays, and then the South part of it would need some renovation since it has been neglected.

Another canal aiming at connecting the Rhine and the Rhone has been built between the Saône and the Doubs (see map in **Figure 1**). It started at the end of the 18th century, and was achieved in the first half of the 19th century (1802-1834), before being renovated in the years 1882-1921 to take bigger boats (Freycinet size of 300 tons). But it is not wide enough for bigger boats (**Figure 2**): it had been decided to adapt it to the new standard size (5,000 tons) and the works had started, but it was all stopped around 1997 and the French Minister of Ecology (Dominique Voynet, who is a child of the Doubs area) played an important part then.

Underline the interest of the canal

So, what is the situation now? The old idea of a connection between North and South of Europe is still there, with some strong opposition. The arguments to promote this project are the followings: it would create a strong economical impulse for the firms which use the fluvial connections to import some raw material and semi-finished goods, but also to export their own finished goods.

Our method will be to cross the analyse of ancient texts – Tacitus, Plinius the Elder and the Younger for example – and the modern presentation to underline the interest of this canal's project through the centuries. We have started this study in 2017 when writing a book on the use and representations of water in Tacitus' monographies: so we could already use partly the corpus we need for this congress on canals.

We find testimonies mainly in Tacitus' Annals (about the Julio-Claudian era, first century CE), in Pliny the Younger's letters (actually about other projects of canals in Europe and in Turkey,

Figure 1: A canal aiming at connecting the Rhine and the Rhone has been built between the Saône and the Doubs

around 100-110 CE), in Pliny the Elder's Encyclopedy too [3], [4]. This author was even an officer of Corbulo when he built the canal on the territory of modern Netherlands. On the other side we have read newspapers about the recent difficulties to make this project a reality: this is the second part of the corpus, to be completed with administrative texts and political regional context [5].

The results are not definitive yet: we would like to answer two questions, i.e. why is this project so attracting through the centuries, and why it seems to be black birded. The answer is probably to be found somewhere between geographical realities and human mentalities.

It is about a reevaluation of the arguments pro and contra this project, considering that nowadays the net of canals and ecluses in France has been neglected and seems to be in a quite bad state according to some studies, though it might be of some interest to use the fluvial interconnections for trade.

Our conclusion, to be completed and confirmed, is that it would be time to stop neglecting the canals which already exist and reevaluate the ways to improve the fluvial interconnection.

Literature

[1] Campbell, B.: Rivers and the power of ancient Rome, Chapell Hill: University of North Carolina Press, 2012.
[2] Felici, E. : Nos flumina arcemus, derigimus, avertimus. Canali, lagune, spiagge e porti nel Mediterraneo antico, Bari: Edipuglia, 2016.
[3] Moore, F.: Three Canal Projects. In: AJA 54 (1950), p. 97-111.
[4] Smith, N.: Roman Canals.In: Transactions of the Newcomen Society 49 (1977), p. 75-86.
[5] Benferhat, Y.: Das Wassergefühl in Trajanischer Zeit. Am Beispiel Tacitus und Plinius. In : Wiplinger, G. (ed.): Proceedings of the International Frontinus Congress Rome. Leuven: Babesch, 2020, p. 363-372.

Figure 2: The canal is not wide enough for bigger boats

Author

Yasmina Benferhat
University of Lorraine
UFR ALL
Nancy, France
ybenferhat@mail.de

Lignite, Structural Change, Post-mining Landscapes – An Overview for Germany and Neighbours

The lignite age in Germany will come to an end in 2038 at the latest. This leaves around 20 years to cope with the upcoming structural change. Guidelines of development for the Rhineland, Central Germany and Lusatia are traced in the form of post-mining landscapes with mining lakes and water connections.

Andreas Berkner

The history of lignite mining in Germany goes back to 1382. In the 19th century it was a decisive starting point for industrialisation. With briquetting, smouldering, power generation and hydrogenation, high technologies of their time were established. While in the Rhineland, proper reutilisation had been taking place for decades, the phase of extensive raw material use in the former German Democratic Republic (GDR) did not end until 1990, and this was accompanied by an unprecedented structural break with the loss of over 100,000 jobs in central Germany and Lusatia. Since 1990, the polluter-pays principle has applied everywhere in Germany to active mining, which has to manage the rehabilitation of its areas through financial provisions. For the recultivation deficits accumulated in the east until 1990, it was necessary to create the financial basis for lignite rehabilitation by means of an administrative agreement between the Federal Government and the States. On this basis, more than €10 billion have been spent to date in Central Germany and Lusatia.

On this basis it was possible to transform former moon landscapes into new tourist destinations such as the Leipzig Neuseenland and the Lusatian Lakeland. There, the currently largest artificial lakes in Germany, each with an area of almost 19 km², were created (Geiseltalsee) or are being created (Cottbus East Lake). Most of the larger opencast mining lakes are designed for multiple uses for storage management with flood protection, leisure and recreation, and nature conservation. After decades of massive environmental pollution, the city of Leipzig is now benefiting from this development, which upgrades soft location factors and sustainably improves the quality of life in urban areas [1].

Synopsis

- Structural change is a societal challenge that affects economic, environmental and social concerns equally.
- The design of post-mining landscapes offers opportunities to create attractive post-coal landscapes after mining-related landscape destruction.
- The new water landscapes with open-cast mining lakes and their integration into the water network play a key role in water management, recreation and nature conservation.

The structural change

As a result of a broad social debate against the backdrop of climate change with the establishment of a Commission for Growth, Structural Change and Employment in 2018/2019 by the Federal Government, it is now clear that lignite-based electricity generation in Germany is to be phased out by the end of 2038. This entails a high degree of responsibility for politicians at all levels to avoid undesirable developments such as the structural break 30 years ago. For the purpose of reutilization, serious changes in planning bases, financing, time frames and concrete landscape design are emerging.

In the Rhenish mining district, the Garzweiler and Hambach opencast mines, each with production capacities of approx. 40 million tonnes per year, are currently open for further operation or phasing out. The configurations of the opencast mining lakes will change significantly compared to previous plans. Only Inden Lake is to be built as planned. In principle, sufficient surface water is available for flooding the mining cavities by drawing from the Rhine. However, this must be brought in over a greater distance and through densely populated areas, for which there is now considerably less time available. In Central Germany, development is focused on the United Schleenhain opencast mining area with the Peres and Groitzsch Lake. All in all, mining caverns with a total area of almost 40 km² are still to be flooded [2]. However, there will no longer be any groundwater from active mining available for this purpose. The dry years 2018/2019 have put the water volume balance in the region under considerable strain. On the other hand, the opencast mining lakes also offer management options for water retention, which could gain in importance in the future. The Leipziger Neuseenland is a success story, albeit not yet completed (**Figure 1**).

The situation is similar in the Lusatian mining district, where four mines are still in operation: Jänschwalde, Welzow (**Figure 2**), Nochten and Reichwalde. In most cases, the final configurations of

© Andreas Berkner

Figure 1: The Störmthaler See is an example of an opencast mining lake with a varied design. Since 2010, the Magdeborn peninsula has hosted a large annual music festival [3]

the opencast mining lakes have not yet been determined. Complicated geotechnical conditions with subsidence flow slides as a result of flooding and groundwater re-rise have an aggravating effect here. In addition, there is a pronounced water shortage. Nevertheless, with new lakes and navigable canals, Lusatia today also has new attractions linked to sights of industrial culture. A particular challenge here is the economic structural weakness with specific requirements for a successful structural change.

In total, the opencast mining lakes in Germany's lignite mining regions will cover a total area of 500 km² at the end of the design process, which is certain to last until around 2050 (roughly equivalent to that of Lake Constance). It will depend on how successful it will be to interlink new lakes, rivers and canals in such a way that old and new cultural landscapes are effectively connected. Despite all the mining related burdens of the past, it is now possible to establish design and utilisation potentials which were largely lacking in the pre-mining landscapes, without being able to retrieve what was lost at the same time.

Finally, we should take a look at our neighbours in Poland and the Czech Republic. With the opencast mines Belchatow and Turow (Poland) and in Northern Bohemia (Czech Republic), large opencast mines are still active there, which are expected to remain in operation until at least 2050. The local players refer to their energy industry framework conditions, which are very different from those in Germany. Planning concepts for the design of the new lakes are already available in basic features, but are subject to the imponderables of future developments. The success of the ongoing structural change in Germany will determine to a large extent whether this change will also be perceived positively outside our country.

© Andreas Berkner

Figure 2: In the Welzow opencast mine in Lusatia, one of the world's largest overburden conveyor bridges is in use to free up the coal for mining

Author

Prof. Dr. habil. Andreas Berkner
Regionaler Planungsverband Leipzig-Westsachsen
Regionale Planungsstelle
Leipzig, Germany
berkner@rpv-westsachsen.de

Literature

[1] Berkner, A.: Das Leipziger Neuseenland zwischen Bergbausanierung, Wasserwirtschaft und Regionalentwicklung. In: WasserWirtschaft (2019), No. 5, p. 14-21.
[2] RPV Leipzig-Westsachsen (ed.): Gewässerkatalog Mitteldeutschland 2019-2021. Leipzig, 2019.
[3] Berkner, A.: Hydrogeographische Verhältnisse, Landnutzung und Landnutzungswandel. In: Denzer, V. et al. (ed.): Leipzig. Eine landeskundliche Bestandsaufnahme. In: Landschaften in Deutschland (2015), Band 78.

The Ongoing Transformation Between Mining and Tourism Region in Ha Long Area

Ha Long area at the northern coast of Vietnam is undergoing a major transformation from an important coal mining area to an urban center and a tourism destination since 2005. Before characterized by environmental impacts and land use conflicts, the area started to shift to a clean and green image where the water resources play a major role.

Katrin Brömme, Mien Tran and Harro Stolpe

Ha Long area is famous for its picturesque landscape of nearly 2,000 limestone islands in Ha Long Bay which was declared a World Natural Heritage by Unesco in 1994. But the mountainous hinterland close to the coast also holds Vietnams largest hard coal reserves which are exploited since French colonial times, mainly using open pit technology. Where nature and mining are so close to each other (**Figure 1**), conflicts are inevitable.

The coal was one of the keys to Vietnams economic development after its opening in 1986. But increasing coal production created a moonscape with large pit holes, high waste rock dumps, and dust everywhere. Rivers and streams carried untreated mine water and sediment loads into Ha Long Bay. The local population, flora and fauna suffered under the environmental impacts.

As Unesco urged to reduce environmental impacts on the bay and the first Environmental Law was adopted, the state-owned Vietnam National Coal and Mineral Industries Holding Corporation Limited (Vinacomin) started with the afforestation of dumps (**Figure 2**) and treatment of mine water. Among other partners, the German Research Association Mining and Environment (RAME, funded by BMBF) supported Vinacomin e.g. in establishing a mine water treatment plant for a large underground mine [3], [5]. Afforestation, anti-dust spraying and band-conveyors for coal transport reduced the dust pollution in the surroundings. Further measures included the stop of coal transport in the bay and along public highways, the relocation of a coal processing plant, and an improved environmental management of mining facilities.

First post-mining land use plan

In 2015, RAME also developed the first post-mining land use plan [4] for the area as for many mines the closure date was already fixed. The plan introduced green corridors, concepts for local recreation, and ideas for preserving industrial history in a museum mine. The project also broached the issues of re-shaping the landscape including long term landslide prevention and water management including the use of former open pits as water reservoirs [1], [2]. In the future, these issues still need to be considered more in detail.

At the same time, infrastructure for tourism development was implemented: a bridge crossing a strait, relocation of marinas for tourism, construction of a waterfront and a theme park.

© RAME

Figure 1: View from the mining area to urban and industrial areas and Ha Long Bay

Figure 2: Active open pit mining in Ha Long with partly afforested waste rock dumps

The environmental management of tourism boats and visiting islands also was improved. New sport activities like climbing, kayaking, and even golf were introduced.

While today the number of visitors is increasing from year to year, the coal production stagnates and will further reduce according to the latest commitments of Vietnam at UN Climate Change Conference (COP26). The general environmental situation in the area has improved significantly, even though there is still work to do. Transforming an area shaped by coal mining into an area for living and recreation is a huge task, technically and economically, and it takes time.

Synopsis

- Ha Long area grew from a small fishing harbour to a city thanks to coal mining. But coal mining was accompanied by environmental impacts developing into conflicts with urban areas and tourism in Ha Long Bay.
- The area started a transformation process through environmental measures in mining and parallel infrastructure development. Gradually, tourism is outpacing mining economically due to millions of tourists visiting the area every year.
- As Vietnam just signed an initiative to phase out coal-fueled power generation by 2040, the region still has further transformation steps ahead.

Authors

Dr.-Ing. Katrin Brömme
Prof. Dr. Harro Stolpe
Ruhr-University of Bochum, Environmental Engineering and Ecology
Bochum, Germany
katrin.broemme@rub.de
harro.stolpe@rub.de

Mien Tran, M. Sc.
Vinacomin Informatics, Technology, Environment JSC
Hanoi, Vietnam
mient.tkv@gmail.com

Literature

[1] Brömme, K.; Stolpe, H.: Räumlich-zeitlich integriertes Management bergbaulicher Wässer in vietnamesischen Steinkohleminen. In: Dresdner Grundwassertage 2019, Dresden, 2019.
[2] Brömme, K.; Stolpe, H.; Jolk, C. et al.: Mine water management as an important part of mining and transition to post-mining in hard coal mining areas in Quang Ninh, Vietnam. In: Hu, Z. (ed.): Land Reclamation in Ecological Fragile Areas, Beijing, 2017.
[3] University of Bochum (ed.): Handbook Mining and Environment in Vietnam. 2015 (doi.org/10.2314/GBV:868016799).
[4] Brömme, K. et al.: Development of methods for post-mining land use planning for coal mines in urban areas in Quang Ninh, Vietnam. In: Hu, Z. (ed.): Legislation, Technology and Practice of Mine Land Reclamation. Leiden: CRC Press/Balkema. (2014), p. 517-526.
[5] Bilek, F.; Brömme, K.; Stolpe, H.: Active Treatment of Fe-, Mn- and Coal-dust Contaminated Mine Water as Part of the RAME-Project in Vietnam. In: Rüde, T. R.; Freund, A.; Wolkersdorfer, C. (ed.): 11th IMWA Congress „Mine water – Managing the challenges", Aachen (2011), p. 281-286.

From Pits of Sand and Clay to Dynamic Environments for Nature, Recreation, Tourism and Culture

Transforming historic industrial landscapes into dynamic environments enhancing the wellbeing of nature, inhabitants and visitors, is a time and energy consuming process. It needs fruitful partnerships, quick wins and long term visions and a constant plug in into innovative development, durability and the wellbeing of the involved communities.

Sabine Denissen and Igor Geubbelmans

1 The Rupelregion: clay, water and landscape

The tidal river the Rupel has created its trail in the landscape of the Scheldt valley [1]. On the northern bank surfaces a geological layer of clay which is extremely well-suited for brick production. Since the middle ages clay has been mined, peaking in the 20th century when there stood dozens of brickwork factories along the Rupel. 400 years of brick production came abruptly to an end at the end of the '70s of the past era. Due to lack of innovation the whole industry collapsed with devastating consequences for the landscape and the communities. Only brick company Wienerberger survives and the branch in Rumst still mines clay today for the production of quick building blocks.

2 The Campine Lakes: sand, water and nature

The Campine Lake area is located not far from the Rupel in the water flow area of the river Maas. 2 till 5 million years ago the Campine area was a coastal area. The estuary of Maas-Moezel flowed into the North Sea and from inland the river brought eroded material which settled in the mouth. The most important sediment was extremely pure sand, rich in quartz with a small grain size: the ideal raw material for glass production. The rich sand layers came to the surface when digging the Campine canal in the middle of the 19th century and mining activities on a big scale were soon started by local entrepreneurs. During and after the first World War the different sand pits were deserted but soon attracted not only local youngsters but also a variety of visitors from cities as Antwerp and Brussels to enjoy a camping holiday or sunbathing on the sandy beaches.

Synopsis

- Two geological formations in Flanders are the origin of two industrial branches still continuing till today.
- They are still the heartbeat of social and regional development and they still form the USP of both regions for industrial, recreational and touristic entrepreneurship.
- Fruitful partnerships are a very important key to success and quick wins and long term visions create trust.
- Connecting to the history and the local community goes together with plugging in into innovative development.

3 Fruitful partnerships

As well in the Rupel area as in the Campine Lake area initiative was badly needed to give the deserted mining grounds a new and healthy future. The Provincie of Antwerp played a major role in this development. Constant negotiating and fruitful partnerships are still the key to success. Not only the local communities are involved but also the still active mining companies and different dynamic entrepreneurs to create win-win results through public-private partnerships.

3.1 Recreational domain Zilvermeer

Together with the community of Mol, the Province took the initiative to transform the spontaneous and overwhelming success of sunbathing, swimming and camping in the Campine Lakes to a controlled and organized holiday activity [2]. Around 1959 the Province of Antwerp became operator of the Recreational Domain Zilvermeer with one goal in mind: to build a holiday resort from and for the people.

The lakes of Mol also inspired other entrepreneurs. In 1950 the Zilverstrand started on the south borders of Zilvermeer with a camping, swimming lake and later a tropical swimming pool. In 1994 Sun Parcs opened on the east side of Zilvermeer with more than 600 holiday houses and a tropical swimming pool.

The Campine Lakes are till today one of the most important touristic spots in Flanders. It became a lever for touristic development. Mol offers a capacity of 10,000 lodgings, which results in an average of more than 650,000 overnight stays the last 10 years. This means that only art cities like Antwerp, Bruges and Brussels and coastal cities score better.

3.2 Recreational domain De Schorre

The province of Antwerp bought a cluster of clay pits of 75ha from the community of Boom in 1986 and transformed it over several decades into the innovative Recreational Domain De Schorre. In 2009 a new congress centre opened its doors in one of the former machine halls. De Schorre offers facilities for recreation, meeting facilities, facilities for events and organises specific events that focus on art and fun for families. As the domain is embedded in a residential area, the partnership with the local community is crucial, because the development of the domain has an impact on the environment, e.g. mobility. An average of 100,000 visitors a year come to De Schorre for events, 420,000 people come to Tomorrowland, 10,000 visitors for meetings, and about 20,000 visitors for recreation.

The dance festival Tomorrowland became a worldwide festival. De Schorre developed a profound partnership with the organisation We Are One World (WAOW): by supporting the festival with their facilities, WAOW supports the development of De Schorre.

© Province of Antwerp

Figure 1: View from the ridge of the claypit on the event field with some of the trolls of artist Thomas Dambo

4 Quick wins and long term visions create trust

In both areas, the province started immediately with quick wins and intuitive actions: construction works and the organisation of activities to create attractive spots for recreation, sports and tourism. Actions and visible results gained the trust of the visitors.

Since the '90s the competition of low budget holidays by plane was a fact to take in account and it forced the recreational domains to not doze off. Visitors demanded also more and more comfort and diversity in activities. To attract people for repeated visits, it needed an upgraded quality and every year something new. Through new activities and new infrastructure the summer holiday period became enlarged in the domains to a year round program with winter festivities, sports and music events, education and school holiday activities.

Zilvermeer felt the need of long term visions after 45 years of rather organic growth. Since 2005, it has made long term plans to make sure it remains relevant as a recreational domain in the region. This results in an average each year of 135,000 visitors for recreation and 335,000 overnight stays.

De Schorre also, after 30 years, feels the importance of a long term vision and is located in a process of a vision development, in cooperation with WAOW and the province of Antwerp.

5. Plug in into innovative initiatives

Thanks to partnerships, De Schorre plugs in into innovative initiatives in terms of infrastructural development of the domain, art projects like the One World bridge by Arne Quinze, a new art staircase, the famous Trolls of Thomas Dambo (**Figure 1**). They all create a new dimension and an important level of experience for the visitor. Also Zilvermeer plugs in into innovative and durable initiatives. It is a partner in ClimateLakes where VITO - Flemish Institute for Technological Research investigates the possibility to use the lakes in the region for extra water buffering. Future planned investments in infrastructure take into account passive and circular building. As Zilvermeer is a domain for everybody, we develop social & accessible tourism through partnerships with organisations and paying attention to accessibility in general.

Authors

Sabine Denissen
Provincie of Antwerp
Leisure Department
Antwerp, Belgium
sabine.denissen@provincieantwerpen.be

Igor Geubbelmans
Province of Antwerp
Zilvermeer
Mol, Belgium
igor.geubbelmans@zilvermeer.be

Literature

[1] Province of Antwerp (ed.): The Rupel area: clay, water and landscape. Together we write our story.
[2] Government of the Provincie of Antwerp (ed.): De zee in de Kempen, Veertig jaar Provinciaal Domein Zilvermeer,1999.

Fluid Thinking – As a Liberation to Resilience and Climate Justice

The challenges of the climate crisis will continue to increase and water in particular plays a central role in dampening, resilience in our communities and thus in the reality of life for future generations. We urgently need a deep understanding of what bodies of water and water structures can actually do in our communities.

Herbert Dreiseitl

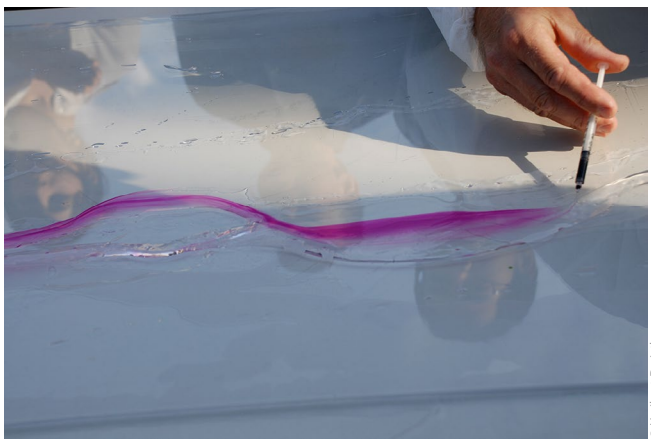
The way we think of water, we shape our bodies of water

Streams, rivers, and bodies of water have a special effect and fascination on us humans, the handling and their use reflect our perceptions, our knowledge and our ideas – in short, our thinking. But does this thinking correspond to the life-promoting regenerative properties, the dynamics, resilience and multifunctionality of water or rather a mechanically shaped, simple, monocausal world of ideas? Just as researchers, planners, investors, political decision-makers and ultimately society think of water, so do people change, shape and build their bodies of water.

When we come to a river, many of us only see the glittering surface, perhaps the reflections as a play of waves and the design of the banks that border on both sides. The focus is mostly limited to a moving two-dimensional band. It is seldom possible to tell where the water that is visible here has its origin and its catchment area, let alone what lives and goes on in its water body.

For a long time, streams and bodies of water were more of a nuisance in cities and small towns. They were buried and filled in, squeezed into canals and pipes and contaminated with sewage (receiving water) from mixed or separate sewer systems. But in the last few decades there has been a growing rethinking and in the meantime we have learned to think rivers and bodies of water larger and to consider the entire catchment area, which can also be located in an urban area.

That is good. But more is needed to create a water-friendly, resilient river design. That means actually getting involved in the dynamics of the water and, as it were, thinking out of the water system. In our projects, we therefore often start with exercises and experiments as preparation for planning and project developments and, above all, to sharpen the senses. I call this Fluid Thinking (**Figure 1**).



© Heribert Dreistl

Figure 1: Water experiments illustrate the flow dynamics of a river and teach us to think fluidly

Of course, water currents can now be calculated numerically and predicted mathematically. With the help of our computer technologies such as numerical flow simulations, we can predict three-dimensional complex configurations in the flow. But that's not enough for a good design. In order to understand the movements of the river, we immediately immerse ourselves in the water; in its main flow, but also in its numerous secondary flows, which can be read from the river body at best on the surface and the transformation of the river bed. There are many people who already have this ability and who can anticipate where the flow will go. Where does erosion take place and where does the deposit take place? Where does the river become the robber of the country and where does it spit out the substrate again?

Synopsis

- A key to success for water projects is a deeper immersion in the water itself.
- This includes the high sensitivity and ability to get used to the water world and to draw constructive conclusions from it.
- Those who immerse themselves in this flow will be able to set up the right framework conditions for the water for a resilient, climatically-adapted and regenerative-healthier future, which we urgently need now.

Are technical measures sufficient to cope with the climate crisis?

The increase in flood events but also drought, hot days and tropical nights are increasing worldwide. Even countries with well-developed infrastructures like Germany are increasingly afflicted by dis-

Figure 2: Kallang River in Bishan-Ang Mo Kio Park in Singapore before (left) and after redevelopment (right); park and integrated river space now provide valuable habitats for people, flora and fauna, flood waters can be absorbed in the new river space

asters. In the reactions, punctual repairs such as elevating the river banks or advance warning systems are mostly sought and created. Although the symptoms are partially treated, the causes are much more complex, can be seen on a larger scale and over a longer period of time. It is not only here that the destructive influence on the water balance and the environment in the Anthropocene is growing. However, far-reaching changes seem to fall short.

The climate crisis in particular calls for a radical rethinking of the future, the main features of which have increasingly shown encouraging examples in recent years. But much more has to happen here: in the area of political and economic decisions, in the discussion of values and in the basic understanding of the importance of nature-based solutions. Illustrative model tests with real water are often helpful in training, participation and decision-making processes. I have organized hands-on workshops or so-called Future Workshops for numerous large-scale projects, which allow a new perspective on bodies of water and, as a result, have made surprisingly positive decisions possible.

A body of water is therefore to be thought of as a network that reacts sensitively to weather conditions and absorbs and releases precipitation; most of it as evaporation. Only some of them have an effect on runoff and feed the waters with a delay. The idea of a breathing system with storage sponges that release water with a delay and at the same time filter and clean it is probably the most productive here.

The effect of the sponge city with blue/green infrastructure on the waters

In the meantime, not only the biological engineering construction methods of bodies of water, streams and rivers are mainstream, but also the handling of rainwater, rainwater management and the sponge city philosophy in urban water management have established themselves. The term "sponge city" describes the function of retention and decentralized intermediate storage and describes a movement that can often be found in Asia today, but which had its origins in Central Europe as early as the 1980s.

The general development has long recognized the importance of water and green as blue/green infrastructure. However, multifunctionality and thus an increase in value for our cities and settlements has not automatically been achieved. Today planners often work according to a certain automatism, according to fixed rules, norms and principles that were only laid down relatively recently and are now preached and ruminated almost dogmatically. Does this do justice to water in its lively creativity and dynamism, as shown by water bodies in their natural status? The key question here is: What do we need beyond a hydraulic, engineering understanding in order to really understand flowing water and to design the corresponding framework conditions for healthy water.

Numerous examples that the author will present at the World Water Conference follow the question of really understanding bodies of water in their depths. These include, for example, the opening of the lost wetlands and streams at Tanner Springs Park in Portland Oregon, USA, the redesign of the old port facility on the Main in Offenburg, the water trails in Hannoversch-Münden or the redesign of the Kallang River in Singapore (**Figure 2**).

Author
Herbert Dreiseitl
Dreiseitlconsulting GmbH
Überlingen, Germany
hd@dreiseitl.de

Design of a Lake Landscape in the Rhenish Lignite Area due to the Earlier Closure of Lignite Mines

The early lignite phase-out poses huge challenges for security of supply and the Rhenish lignite area. Large agricultural areas, forests and lakes are created within a few decades where lignite is still being extracted today. The two large open-cast mine lakes Hambach and Garzweiler will be flooded with water from the Rhine and the open-cast mine lake Inden with water from the Rur. This will create a completely different landscape in the Rhenish lignite area than before mining, opening up new economic and leisure potential.

Michael Eyll-Vetter and Hannah Udelhoven

The previous timetable for the Rhenish lignite area (**Figure 1**) stipulated that the Inden opencast mine would be completely mined, recultivated and made usable again after the year 2030. The Hambach and Garzweiler opencast mines, on the other hand, were to be operated until the middle of the century, supplying the power plants on the north-south railway (Neurath and Niederaussem) and the three refining plants (Fortuna-Nord, Frechen and Ville-Berrenrath).

At the beginning of 2019, the Kommission für Wachstum, Strukturwandel und Beschäftigung (Commission for Growth, Structural Change and Employment) set up by the Federal Government presented recommendations for the early phasing out of coal-fired power generation in Germany. This report provides for significant capacity reductions already by 2022. According to the Commission's recommendations, 9 GW of the formerly more than 20 GW will continue to supply electricity after 2030. In the negotiations from 2019 to the beginning of 2020, lignite-fired power plant operators agreed with the German government on a very ambitious shutdown plan for lignite use.

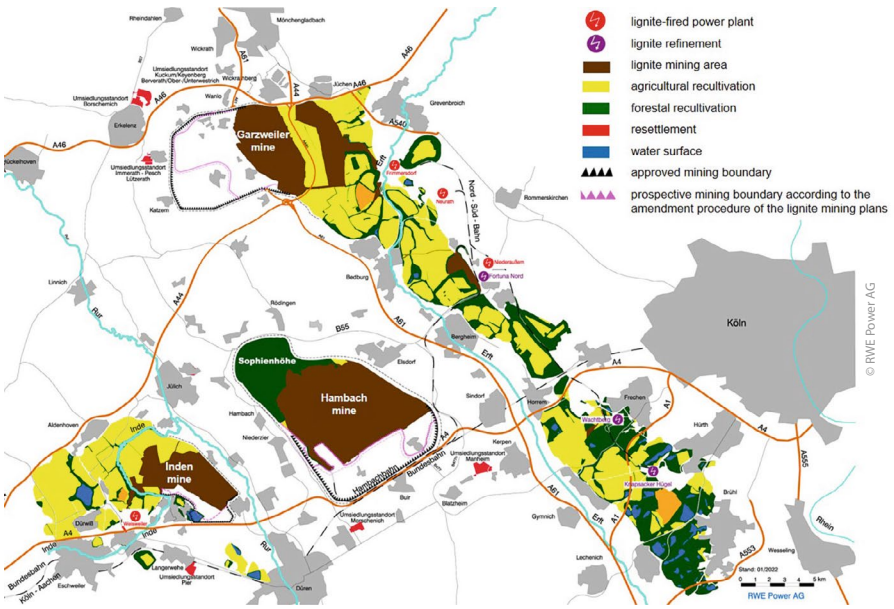


Figure 1: Overview – Rhenish lignite area

Synopsis

- Early lignite phase-out poses huge challenges for security of supply and region.
- Large agricultural areas, forests and lakes are created within a few decades where lignite is still extracted in three large opencast mines today.
- Decisive for the quality of the lake is the timely supply of sufficient amounts of water from the rivers Rhine and the Rur.

Lakes will be flooded with water from the Rhine and the Rur

Most of the decommissioning measures planned until 2022 will affect the Rhenish area. As a result of the capacity reduction and the wish to preserve the Hambach forest, as stated in the Commission report, the management of the Hambach open-cast mine has to be massively modified. Originating from an efficient mining operation with an annual capacity of 40 million tonnes of lignite, the opencast mine has been geared since 2020 to the design of the post-mining landscape including a large multi-functional lake. Coal production will end around 2029; during the subsequent phase of recultivation measures for agricultural

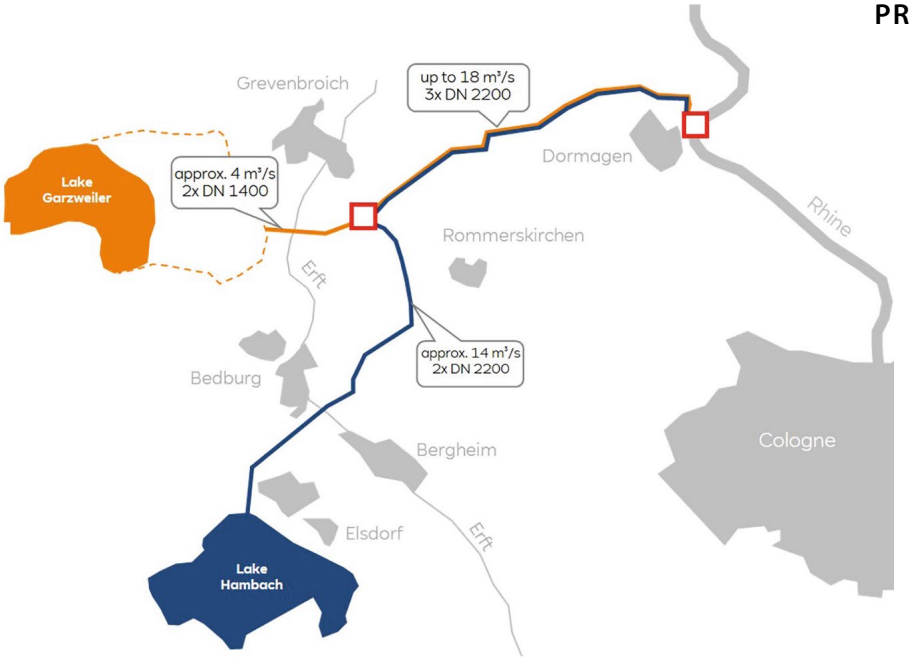


Figure 2: Connection line for filling the open-cast mine lakes Garzweiler and Hambach

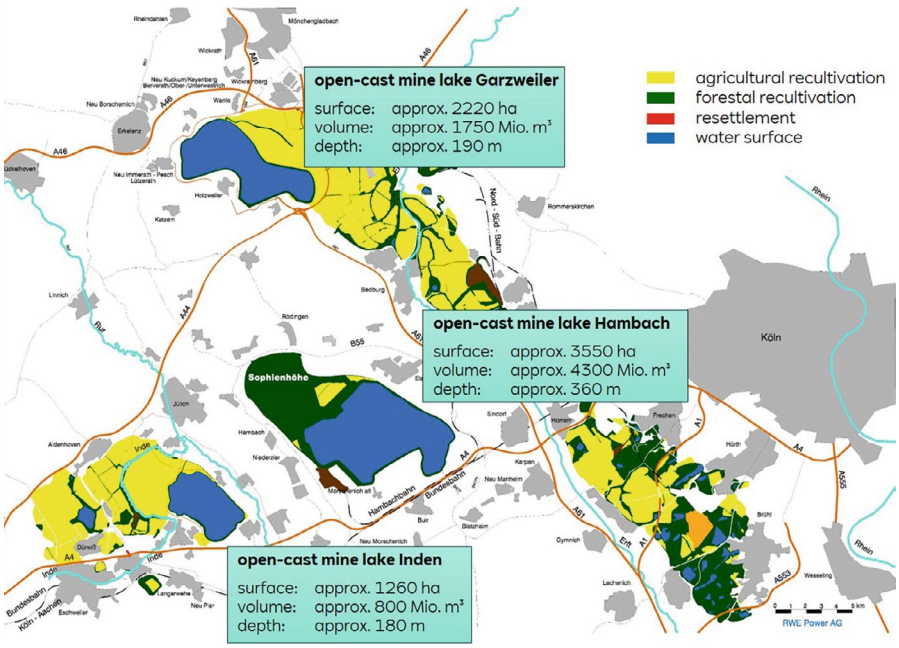


Figure 3: Landscape in the Rhenish lignite area

land, the lake is to be flooded with water from the Rhine from 2030. The duration of flooding is based on the maximum permitted quantity of water to be taken from the Rhine. For the supply of the water, which now has to start about two decades earlier than previously planned, a route between Dormagen and the Frimmersdorf power plant, which is already in the planning stage, is to be used to supply the wetlands in the north of the Garzweiler open-cast mine and later for its flooding. A double-strand connection line is to be laid from Frimmersdorf to Elsdorf (**Figure 2**). The level of the lake Hambach will be 65 m above sea level and results from the water management conditions in the region. In the long term, the lake of the former open-cast mine will be integrated into the water balance of the region as a receiving watercourse and thus receive an overflow towards the Erft. Due to the dense settlement in the area, an early route securing of this water drainage in a lignite plan procedure is planned.

The Inden open-cast mine will also end in 2029 with the gradual decommissioning of the Weisweiler power plant in accordance with the new lignite planning. The open-cast mine lake will mainly be filled via a water supply from the Rur.

From 2030, the Garzweiler open-cast mine will therefore be the only lignite-mining operation in the Rhenish area. The mining field will be completely mined by 2038 with the end of coal use in accordance with the Coal Power Generation Termination Act and the Guideline Ruling of the state of NRW. From that point on, water from the Rhine will also be released into this area. The filling time of this lake will be about four decades. The overflow of this open-cast mining lake will be into the Niers, which in turn will flow into the Meuse (Netherlands).

In view of the long filling periods, all lakes from former open-cast mines are to be used at an early stage. This is to be coordinated with the mining authority and the regional stakeholders, taking into account the mining and geotechnical aspects. By the end of the century, the Rhenish lignite area will then be characterised by three large lakes with a total area of more than 7,000 ha (**Figure 3**). The deep open-cast mining lakes will have good water qualities that will allow for a variety of uses. This will create a completely different landscape in the Rhenish area than before mining, opening up new economic and leisure potential.In the forthcoming replanning for the Hambach and Inden open-cast mines and the completion of the ongoing Garzweiler lignite plan amendment procedure, it will be important to carry out these changes quickly and in a legally secure manner so that interim stoppages, i.e. keeping the open-cast mine open without lignite-extraction and recultivation, are avoided. This is an important goal of the company as well as the regional and regulatory stakeholders, which can only be achieved with mutual effort.

Authors

Michael Eyll-Vetter
Hannah Udelhoven
RWE Power AG
Köln, Germany
michael.eyll-vetter@rwe.com
hannah.udelhoven@rwe.com

A Concrete Example of Structural Change: The Thermal Use of Coal Mine Lakes

This paper describes fundamental aspects of hydrothermal heat supply and its possible applications in coal mine lakes. In addition to selected current developments in the Central German mining area and Lausitz, major obstacles are mentioned and suggestions for the further development of the technology are made.

Martin-Joseph Hloucal

Many cities in the structural change region of Central Germany have to replace considerable generation capacities of their district heating systems until the coal phase-out and at the same time achieve ambitious GHG reduction targets. In the region, 73% of the heat in district heating systems still comes from large fossil-fuel power plants [1]. By 2045 at the latest, i.e. in 23 years, the heat supply in Germany must be climate neutral [2]. The heat in district heating systems will then very likely also come from heat pumps in the megawatt range that are powered by electricity from renewable energies. As a source of ambient heat for operating these heat pumps, the use of nearby bodies of water and especially opencast coal mine lakes is particularly suitable (**Figure 1**). Due to their size, the opencast coal mine lakes of former coal regions offer great potential for heat extraction. Compared to deep geothermal energy, which is an alternative heat source in the megawatt range, there is only a low exploration risk with hydrothermal heat supply. In addition, there is no direct competition with the thermal use of water bodies in terms of land use, as is the case with solar thermal energy. Compared to the use of ambient air as a heat source, the thermal use of bodies of water is more energy-efficient, especially at air temperatures below 0 °C, and causes less noise emissions.

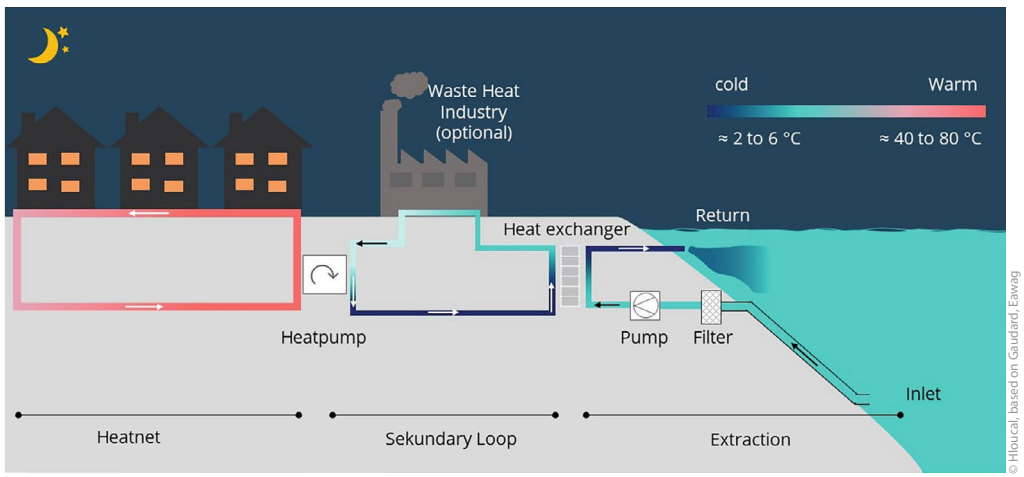


Figure 1: Principle illustration lake source heat supply

Synopsis

- Hydrothermal heat supply from coal mine lakes offers great potential for heat generation in the region undergoing structural change.
- The technology is marketable and successful examples exist in several European countries.
- Existing barriers to implementation should be removed through joint development work by authorities, researchers and market partners.

Decarbonised district heating with Megawatt-heatpumps

Cities with district heating networks in the vicinity of coal mine lakes therefore have a great opportunity to decarbonise district heating through this hydrothermal heat supply. Megawatt heat pumps are already available today, as the current example of the Danish city of Esbjerg shows [3]. There, district heating will in future be provided by a 50 MW heat pump system that uses the thermal energy of lake water. The development of these potentials is just in its infancy in the structural transformation region of Central Germany. In 2021, studies on the ecological effects of hydrothermal heat supply on coal mine lakes were carried out for the first time, using Lake Zwenkau as an example [4]. In addition, the use of the newly developed technology, vacuum liquid ice technology, was investigated [5]. In contrast to heat extraction via classic liquid heat exchangers, this technology also makes use of the latent heat of the body of water via the evaporation of water. Pilot plants of this kind are currently being prepared in Saxony. And the heat of the water can also be utilised via classic liquid heat exchangers made of plastic.

Today, however, the main obstacles to widespread development are permitting practices and few knowledge on the part of market partners. Since there is no proven permitting practice

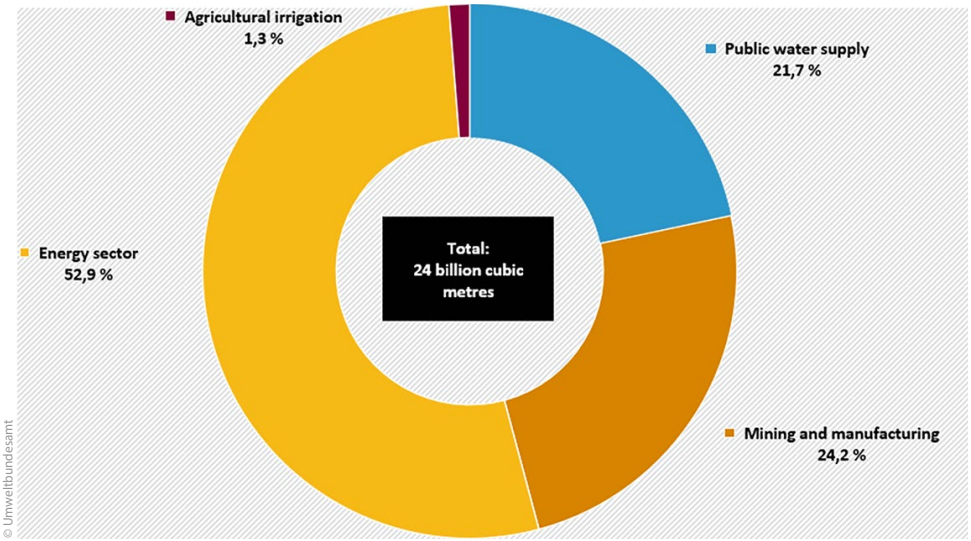


Figure 2: Water extraction and use in Germany 2016

for the thermal use of lake water today, the authorities generally take a negative stance and refer to the principle of the EU Water Framework Directive with its prohibition of deterioration. However, the thermal use of water bodies for heat supply by means of heat pumps represents a comparatively minor impact on the regional water system. The predominant use of the region's water resources today results from the cooling capacity required by the lignite-fired power plants. Data for Germany show, that 52,9% of the total used water is used by the energy sector (**Figure 2**) mainly for cooling the power plants. This use will decline as a result of the coal phase-out. Thus, it is expected that the region's water systems will provide a growing utilisation capacity in the long term, which could improve the chances of hydrothermal heat supply being permitted. Due to the heat extraction from the water body and thus the temperature reduction, positive ecological effects such as a postponement of the spring algae bloom could theoretically also occur. However, more research is needed on this.

Another obstacle lies in the ban on the use of substances hazardous to water on and in water bodies. This practically prevents the use of antifreeze in heat transfer fluids in the water body. As a result, the systems must be regularly shut down during the heating season when temperatures in the water body are too low. Since there are no explicit allowances yet, such as for the use of antifreezing agents in geothermal probes, suitable solutions still need to be worked out here as well. And finally, there is currently insufficient knowledge among market players about the technology and potential of hydrothermal heat supply.

Intensive cooperation of authorities, research institutes and market partners

For the holistic development of the possibilities and the reduction of the outlined obstacles, the intensive cooperation of authorities, research institutes and market partners in the sense of a network is proposed. The Netherlands has set a good example here with the Green Deal Aquathermie [6]. Particularly for the structural transformation region of Central Germany, the described framework conditions (district heating networks, coal mine lakes) offer great potential for developing and implementing hydrothermal heat supply up to megawatt-class plants. In addition to the effects for the reduction of GHG emissions in the heat supply, significant value contributions for the regional research landscape as well as for industry and trade can be expected.

The oral presentation at the World-Canals-Conference 2022, will go into more detail on these topics and present current developments in the region.

Author

Martin-Joseph Hloucal
Tilia GmbH
Leipzig, Germany
martin-joseph.hloucal@tilia.info

Literature

[1] Leipziger Institut für Energie (ed.): Energiekonzept IRMD. Leipzig, 2021.
[2] Bundesministerium für Wirtschaft und Energie (ed.): Dialog Klimaneutrale Wärme 2045. Berlin, 2021.
[3] MAN Energy Solutions (ed.): MAN Energy Solutions liefert erstes sektorübergreifendes ETES Wärmepumpensystem. 04.02.2021 (www.man-es.com/de/unternehmen/pressemitteilungen/2021/02/04/man-energy-solutions-liefert-erstes-sektor-%C3%BCbergreifendes-etes-w%C3%A4rmepumpensystem, Abruf 01.03.2022).
[4] Roselt, K.; Felgentreff, B.; Böttger, S. et al.: Seethermie - Innovative Wärmeversorgung aus Tagebaurestseen. Leipzig, 2021.
[5] Institut für Luft- und Kältetechnik Dresden gGmbH (ed.): Flüssigeis - zur Kälte- und Wärmeversorgung. Dresden, 2016.

The Redevelopment of the Karl Heine Canal from 1990 until 1996 – A Success Story up to Today

The following article describes the redevelopment of the Karl Heine Canal in Leipzig from 1990 to 1996 and retraces this success story.

Erika Hoentsch

1 Introduction

The story started in the middle of the 19th century. At that time, an economic upswing also began in Leipzig, the population was growing, new houses and streets were built and new routes for the transport of goods and merchandise also had to be created.

The Leipzig lawyer and merchant Karl Heine recognized this. And he decided to build a canal in the west of Leipzig, in the district called Plagwitz, to enable the transport of goods by water. As a side effect, he drained a marshy area and won building land. The construction of the canal from Plagwitz to the river Elster by Karl Heine was a success.

Synopsis

- The renovation of the Karl Heine Canal is described.
- A mixed water pumping station was installed.
- A cycle and foot path connects the quarter Grünau and its surroundings with Plagwitz.

2 The Karl Heine Canal during the time of the German Democratic Republic (GBR)

In GDR times the canal was very neglected. The GDR was unable to protect the environment sustainably in many places.
In addition the canal banks on both sides were completely overgrown except for a very narrow path of approximatly 30 cm and in some places where it was full of rubbish, which the residents simply disposed out of the windows. Rats felt very comfortable there. And one met a lot of them.

3 The political change – an opportunity for the Karl Heine Canal

In April 1990 I made acquaintance with the engineers Dr Günther Windsperger and Dr Karl Schultes who came from Vienna to Leipzig and they commissioned me to set up an engineering office for civil engineering in Leipzig whose office manager I became.

Figure 1: After the renovation of the Karl Heine Canal, it is once again possible to travel by boat or even a gondola through this tranquil, lushly overgrown oasis

Figure 2: Cycle path with space grid wall

At that time Mr Jörg Hannes, head of the department for environmental protection in the city administration of Leipzig and a member in the rowing club, was committed to upgrade the area in the interest of a positive urban development. He wanted to build a combined cycle path and footpath on one of the canal banks to connect the quarter Grünau and its surroundings with Plagwitz.

However, this only made sense if the water quality could be improved considerably. Therefore, Jörg Hannes involved Dr Peter Bracher, the former managing director of the municipal waterworks of Leipzig. He immediately pleaded for the construction of a mixed water pumping station in order to stop the wastewater entering the canal.

Our office was interested in the project. We closely examined the conditions at the canal banks together with Jörg Hannes and Dr Peter Bracher, and Dr Windsperger decided to accept the challenge.

4 Planning and construction of the path and the rehabilitation of the canal

The engineering office for civil engineering Dr Günther Windsperger Leipzig then drew plans that included three projects:

1. the desludging of the canal,
2. the construction of a mixed water pumping station for a capacity of 30,000 m³,
3. the construction of a combined cycle and footpath of 3,50 m width and 3,5 km length on the northern bank of the canal because the ownership there were more favourable and the path is not in the shade.

4.1 The renovation of the Karl Heine Canal

At the Luisenbrücke the desilting/desludging of the canal was started in 1992 and continued up to the river Weißen Elster. A total of 26,000 m³ of sludge was removed from the canal. There were also interesting and dangerous finds (**Figure 1**).

4.2 The mixed water pumping station

The construction of the mixed water pumping station began in 1991. Three basins of 10,000 m³ each were built to collect rainwater and wastewater from the Grünau district.

4.3 The cycle and foot path

The construction of the cycle path began in 1991. Right at the beginning of the work I was able to win Dr Merkel, the Federal Minister for Women and Youth at that time, as patron for the project. This should prove very helpful for the project.

On September 16, 1996, Dr. Merkel, now Federal Minister for the Environment, Nature Conservation and Nuclear Safety opened the completed path.

Now the canal and the path are an oasis of silence and natural beauty and the entire environment developed excellently [1] (**Figure 2**).

Author

Dr. Erika Hoentsch
Leipzig, Germany
hoentsch.leipzig@t-online.de

Literature

[1] Wasser-Stadt-Leipzig e. V. (ed.): Carl Heines Vision - Die Geschichte geht weiter. Leipzig:Achtner Media Verlag, 2018.

Strategic Water Management as the Basis for a Successful Structural Change

The planned premature fossil-fuel phase-out has set the course for an all-embracing structural change. One particular challenge is the remediation of water balance. Strategic water management is the only way to safeguard all of the concerns of water protection and its uses in the long term.

Christin Jahns and Lars Stratmann

The German Commission for Growth, Structural Change and Employment decided in 2019 that the two lignite mining areas of Saxony in Central Germany and Lusatia should phase out by 2038 prematurely in order to comply with the climate protection objectives of the Paris Agreement. In its coalition agreement of November 2021 [1], the current German government has already brought this exit forward to 2030, if possible. This requires a rapid structural change and short-term adjustments in water management in the German lignite mining areas.

In addition to the rapid expansion of renewable energies and the establishment of new industries to compensate for lost jobs, the sustainable remediation of the water balance of the lignite mining areas, taking into account the effects of climate change, is an urgent need for the sustainable and thus long-term successful development of these regions.

People, industry and recreational use along the rivers of the lignite mining areas have become accustomed in recent decades to the fact that in addition to the natural water resources, there is also water from opencast mining (water drained from opencast mines). The drained water account for up to 60% of the current available water resources in dry spells. This water is no longer available after the end of the mining. On the contrary, water is needed to fill the remaining opencast pits and the replenishment of the lowered groundwater areas. From the remediation of the opencast lignite mines to the establishment of new economic sectors and the development of landscapes to the implementation of the EU Water Framework Directive and the supply of drinking water: The availability of sufficient quantity and quality of water is essential.

Besides, both mining areas are located in the Central German drylands. Compared to the national average, the rainfall per year is very low, with about 650 mm of precipitation. At the same time, evaporation tends to increase due to higher temperatures. Climate projections predict a further reduction of the available water resources. In the years 2017-2020, an extreme drought has given an impression of the future. Additional to the requirements of the management of low water, flood protection must also be ensured in the event of increasing extreme events due to climate change.

In addition to the deficit of available water resources, in both regions, due to opencast lignite mining, it must be noted that the available water resource does not always have a sufficient chemical quality. High sulphate and iron contents are the primary problem.

Synopsis

- Huge amounts of water are needed for the remediation.
- There is a danger that existing water resources may not be sufficient for all of the planned uses.
- The implementation of a strategic water management concept has to be based on the substantiated knowledge and corresponding requisite structures.

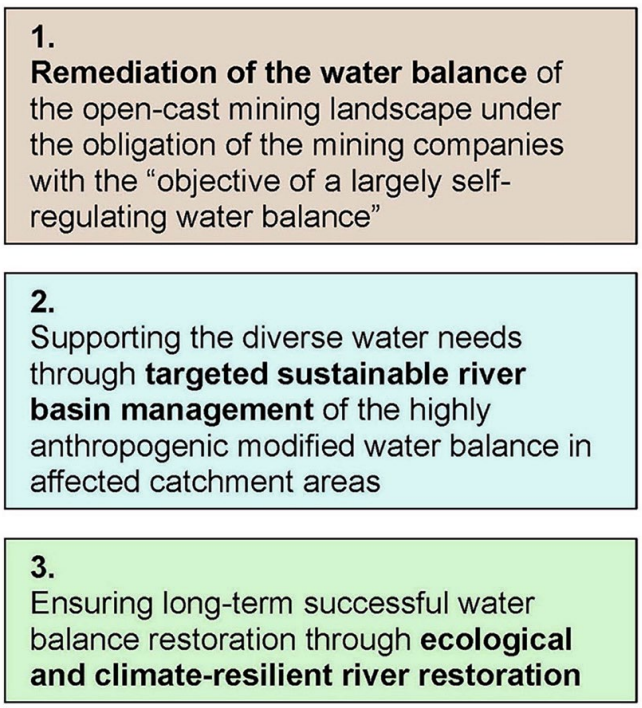


Figure 1: Three pillars of strategic water management as the basis for a successful transformation process

Strategic water management is necessary

Strategic water management with well-developed remediation concepts and an efficient water management for the lignite and

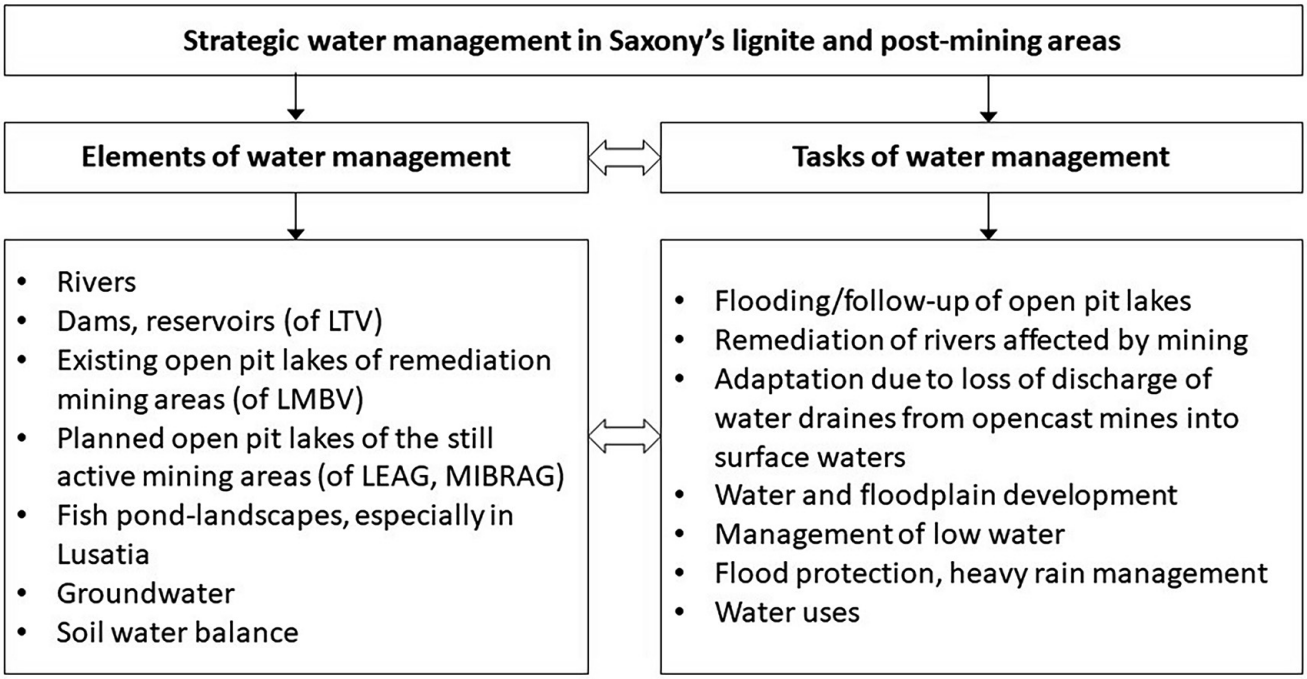


Figure 2: Elements and tasks of strategic water management in mining areas

post-mining areas (**Figures 1** and **2**), which are heavily affected by adverse environmental effects, is therefore necessary for several reasons. This means that for the flooding of the remaining opencast pits, the restoration of rivers, the development of the landscape the existing systems of dam and reservoir management and the supply of water from neighbouring catchment areas such as the Mulde (for the Central German mining area) and the Lusatian Neisse (for the Lusatian area) are to be further developed. The day-to-day control of the complex systems requires a centre for water management. Such a centre has been established a long time ago in Lusatia as a flooding control centre Lusatia. In the Central German area in the south of Leipzig, a water management centre is being set up. In addition, strategies for water retention are required for a climate-resilient and thus long-term stable development of landscapes. This will be particularly important in areas with lowered groundwater levels.

The challenges ahead require a strong network of competent authorities, mining companies and regional players. The big challenge here is not only that besides Saxony the federal states of Brandenburg, Berlin and Saxony-Anhalt are involved also. Nature conservation concerns, the EU Water Framework Directive and the requirements of a wide range of water uses like industry, tourism, agriculture, inland fisheries, water supply and water disposal must also be taken into account. Adequate availability of water in quantity and quality is often the crucial basis for economic profitability and new investments. However, previous usages also need to be reviewed and optimized.

To meet these challenges of water management, the National Water Strategy (Draft) provides an appropriate framework for action with its basic principles and ten strategic themes [2]. These issues need to be further elaborated and implemented at the country level.

As supporting systems for water management planning, remediation and the daily operation of water management, water management modelling and measurement networks for ground and surface water are required. The existing instruments will be upgraded in the coming years and new models will be built.

Conscious use of water as a valuable resource, sustainable water management and awareness of clean water and intact aquatic ecosystems is a challenge for society as a whole, so that we will continue to have a sufficient quantity of high-quality water available in the future – especially in post-opencast mining areas.

Authors

Christin Jahns
Lars Stratmann
Saxon State Ministry for Energy, Climate Protection, Environment and Agriculture
Division Surface Waters, Flood Protection
Dresden, Germany
christin.jahns@smekul.sachsen.de
lars.stratmann@smekul.sachsen.de

Literature

[1] Sozialdemokratischen Partei Deutschlands; Bündnis 90/Die Grünen; Freie Demokraten: Mehr Fortschritt wagen. Bündnis für Freiheit, Gerechtigkeit und Nachhaltigkeit. Koalitionsvertrag zwischen SPD, Bündnis 90/Die Grünen und FDP. Berlin, 2021.
[2] Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (ed.): Nationale Wasserstrategie. Bonn, 2021.

Aftercare Strategies to Ensure the Water Quality of Post-Mining Lakes in the South of Leipzig

The Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft (LMBV) has been pursuing two aftercare strategies to prevent the natural acidification of post-mining lakes in the Leipzig mining area: The discharge of alkaline river water (Lake Zwenkau) and the ship-based liming (Lake Hain and Lake Störmthal).

Benno Janisch and Michaela Rumpel

1 Introduction

The LMBV is responsible for the flooding and aftercare of the post-mining lakes, Zwenkau, Hain and Störmthal in the south of Leipzig (Germany). The rehabilitation of the former mining areas is realized according to the commitments of the Federal Mining Act.

The water bodies are subject to ongoing natural acidification by the inflow of iron and sulphate rich groundwater. After finishing the water transfer from the active opencast mines of Mitteldeutsche Braunkohlengesellschaft (Mibrag), the water quality is stabilized by discharge of alkaline river water or through ship-based liming. Without these measures, the pH values would decrease and cause high iron and aluminium concentrations in the water body. Therefore, according to the plan approval decisions (PAD), the post-mining lakes have to be managed in such a way that the pH in the discharge and water bodies keep stable between 6.0 and 8.0.

Lake Zwenkau is used for recreation and tourism. A functional replacement system was created for retention areas of the river Weiße Elster and the former Elster floodplain that were lost due to mining activities. According to the mine closure operations plan, Lake Zwenkau has the function as a flood retention basin. Surface water from the Weiße Elster River can be discharged into Lake Zwenkau by a flood canal on the west side of the lake for remediation purposes (**Figure 1**). With an area of 963 ha and a volume of currently 166 million m³, Lake Zwenkau is the largest mining lake in the south of Leipzig.

Figure 1: Flood canal with integrated bypass to supply Lake Zwenkau with alkaline river water

Lake Störmthal serves for leisure and recreational activities. With an area of 733 ha and 157 million m³, it is the second largest lake and with a maximal depth of about 55 m it is also the second deepest one in the south of Leipzig. It has a connection to Lake Markkleeberg to the north. The Lake Störmthal has no inflow of noteworthy receiving waters and is largely supplied via groundwater.

Lake Hain is already subject to intensive recreational use. It has an area of 565 ha and a volume of 98 million m³, making it the third largest lake in the South of Leipzig. The excess water is discharged into the river Pleiße via a canal. It also has no inflow of noteworthy receiving waters and is largely supplied via groundwater.

Synopsis

- After decommissioning of the LMBV flooding pipeline at the end of 2018, the LMBV is using alternative aftercare strategies to ensure the water quality of post-mining lakes in the south of Leipzig.
- Aftercare for the quality of Lake Zwenkau is realized primarily through discharging of alkaline river water from the river Weiße Elster. If necessary, the ship-based liming is also carried out.
- No external alkaline surface water is available to stabilize the water quality of the two mining lakes Hain and Störmthal. Hence, aftercare must be done through liming by ship.

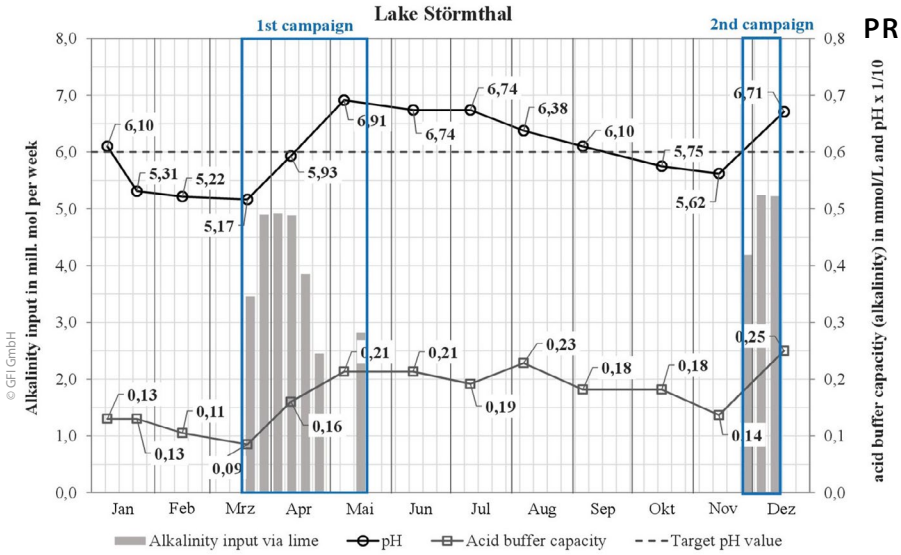


Figure 2: Development of the pH value and the alkalinity of the water body of the post-mining lake Störmthal in the course of liming campaigns throughout 2019

2 Methods

To guaranty the water quality of the three water bodies, the LMBV pursues two basic aftercare strategies:

2.1 Use of alkaline external surface water

For the Lake Zwenkau, river water from the Weiße Elster is used to guaranty the water quality. The alkalinity of the Weiße Elster varies depending on the runoff between 1.4 mmol/L for high and 2.8 mmol/L for low runoff rates. The Weiße Elster River has a mean discharge MQ_{365} of around 16.5 m³/s at the stream gauge Kleindalzig. Above a runoff of 7 m³/s, the LMBV is allowed to withdraw 0.5 m³/s. The median runoff from the Weiße Elster was only around 6.6 m³/s in 2019, which means the withdrawal was possible in less than 182.5 days. If the necessary amount of river water does not suffice, the second strategy needs to be applied for Lake Zwenkau.

2.2 Ship-based liming

For the two post-mining lakes Hain and Störmthal, the LMBV can only apply ship-based liming in absence of alternatives. The liming campaigns takes place discontinuously as required (**Figure 2**). Here, the lime (chalk) is delivered by silo vehicles and filled into the 15 m³ bunker of the water treatment ship. On the lake, a 2-5% lime suspension is created using lake water. The suspension is then applied below the water surface. In order to increase the yield of alkalinity (efficiency of lime dissolution) the lime suspension is applied at pH values as low as possible. Typically, pH values of the range between 5.5 and 6.0 when lime application is started. In 2019, altogether 3,000 t of lime was added to Lake Störmthal and 1,000 t to Lake Hain.

3 Results

In 2019, the requirements for water quality according to the PAD could be met for all three post-mining lakes using the two aftercare strategies outlined above. The individual results are as follows:

3.1 Lake Zwenkau

In 2019, around 11 million m³ of river water from the Weiße Elster could be used to guaranty the water quality of the post-mining lake, discharging an equivalent of about 17.4 million mol_{Alk}. The calculated alkalinity demand for 2019 was about 31 million mol/a. As a result, the pH value dropped from 7.2 to 6.3 between January and December 2019. The alkalinity also decreased from 0.30 mmol/L to 0.23 mmol/L. However, the water quality according to the PAD of pH ≥6.0 could be met throughout the year.

3.2 Lake Störmthal

Two neutralization campaigns took place in 2019. The calculated alkalinity demand for 2019 was about 24 million mol/a. A total of 3,000 t of lime were applied, which corresponds to an alkalinity input of 42 million mol. In the course of 2019, the alkalinity could be increased from 0.13 mmol/L to 0.25 mmol/L. Thus the alkalinity inventory could be increased by (42 - 24) = 18 million moles. The pH value temporarily dropped to around 5.5 before the neutralization campaigns, which led to high alkalinity yields (efficiency of lime dissolution) of 79% and 89%.

3.3 Lake Hain

The calculated alkalinity demand for 2019 was about 11 million mol/a. In April/May 2019 a liming campaign took place with about 1,000 t of lime, which corresponds to an alkalinity input of 14 million mol. In the course of 2019, the alkalinity could be increased from 0.19 mmol/L to 0.22 mmol/L. Thus the alkalinity inventory could be increased by (14 - 11) = 3 million moles and guaranteeing water quality requirements according to the PAD of a pH ≥ 6.0. The alkalinity yield (efficiency of lime dissolution) was estimated at 72% and is therefore lower than at Lake Störmthal. The reason for this are the higher pH values during liming.

4 Conclusion

With the two described aftercare strategies, the LMBV has permanent and reliable means to ensure the water quality requirements according to the applicable law of current plan approval decisions of the three largest post-mining lakes in the south of Leipzig.

Authors

Benno Janisch, M. Sc.
LMBV Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH
Leipzig, Germany
benno.janisch@lmbv.de

Dipl.-Ing. Michaela Rumpel
GFI Grundwasser-Consulting-Institut GmbH Dresden
Dresden, Germany
mrumpel@gfi-dresden.de

Finow Canal 3.0 – Revitalisation of a Historic Waterway

The Finow Canal is the oldest artificial waterway in Germany. After its economic prosperity in the 18th and 19th centuries, the canal lost its importance. After intensive negotiations, the riparian municipalities are working for its water tourism development through the Zweckverband Region Finowkanal (Finow Canal Region Association) they founded.

Adolf Maria Kopp

The Finow Canal is the oldest artificial waterway in Germany. For more than 400 years, the Finow Canal has connected the Havel with the Oder and enabled the transport of diverse goods via its 12 historic locks.

In 1603, Elector Joachim Friedrich ordered the construction of the Finow Canal to enable trade by water between east and west via the little Finow River (Finow Canal 1.0). During the Thirty Years' War (1618-1648), the waterway fell into disrepair. In 1743, Frederick II ordered the Finow Canal to be built again, which was completed after only a few years of construction (Finow Canal 2.0). Subsequently, the region achieved its great economic prosperity. Numerous industrial settlements were established in the 18th and 19th centuries. The high capacity utilisation of the Finow Canal led to the construction of parallel double locks. The locks were operated all around the clock. Despite the increase in capacity, the Finow Canal reached its limit at the end of the 19th century [1]. Therefore, the construction of the Oder-Havel Canal created a new high-performance inland waterway, which was opened in 1914. In addition, the ship lift built in Niederfinow made it possible to overcome the height difference of 36 m with only one lock operation. With these changes, the Finow Canal increasingly lost its importance as a waterway for commercial shipping [2]. The upheavals at the time of German reunification intensified this development. And the recent decision of the Federal Waterways and Shipping Administration (WSV) to focus primarily on the maintenance and operation of the waterways used by commercial shipping did not offer many prospects for the future use of the Finow Canal.

Figure 1: Heavily eroded masonry on the outer harbour bank wall in the underwater area

Synopsis

- Revitalisation of a historic waterway.
- Lock renovation as a basis for the water tourism development of the Finow Canal region and its sustainable attractiveness as a business location.
- Permanent navigability of the Finow Canal is of central importance for the waterway network in Brandenburg.

Primarily use for water tourism

Although the Finow Canal has lost its original importance for the transport of goods by commercial shipping, it is of central importance for the licence-free waterway network in the WIN region (WIN = Wassertourismus Initiative Nordbrandenburg). Various studies prove the economic potential of water tourism in Germany and underline the development opportunities especially in the predominantly rural Finow Canal region as part of Brandenburg's waterway infrastructure [3]. In order to realise the opportunities for water tourism development in the

region, extensive and complex negotiations were conducted. As a result of these successful negotiations, the Zweckverband Region Finowkanal (Finow Canal Region Association) was formed in 2020 as an association of the riparian municipalities. The association will take over the locks from the federal government in two packages. This Finow Canal Region association will also carry out the planning and implementation steps for the gradual rehabilitation of the 12 locks. This pilot project, which is unique in Germany, is 50% financed by federal funds. The state of Brandenburg has approved 19.7 million euros in funding for the first, western lock package, which consists of 6 locks.

The considerable investment backlog in the waterway infrastructure, which is primarily used for water tourism, is also evident in the locks of the Finow Canal. The locks were built in the 1870s as part of the capacity expansion of the Finow Canal, parallel to the existing locks at the time, and were subsequently only slightly improved (exceptions: new construction of the Schöpfurt lock (2007) and renovation of the Eberswalde city lock (2001)). With the loss of importance of the Finow Canal, the older lock chambers were successively filled in. Thus, in addition to the locks currently in use, the remains of the older locks can be found as ground monuments. Extensive investigations by the Zweckverband were necessary to obtain an assessment of the state of preservation of the locks of the first lock package. For this purpose, numerous samples had to be taken from the structures and the soil of the locks and analysed in specialised laboratories. The results of the sampling document the very poor condition of the locks (**Figures 1, 2** and **3**). Currently, preparatory measures for construction are being initiated (tree felling, archaeological documentation of soil and building monuments). The gradual rehabilitation and modernisation of the six western locks will begin in autumn 2022.

The renovation of the locks of the Finow Canal is not an end in itself, but serves the water tourism development of the region (Finow Canal 3.0). The considerable public investments in the lock infrastructure are already initiating private follow-up investments in the region. Ensuring permanent navigability for muscle- and motor-powered boats creates the basis for the networking opportunities offered by the Finow Canal as part of Brandenburg's waterway network. In addition, it contributes to securing and further developing water tourism in Brandenburg and Mecklenburg-Western Pomerania. In order to position the Finow Canal even more as a destination region in the future and to increase the number of land visitors and overnight stays, various infrastructure and networking measures are planned.

Figure 2: Nets as protection against falling parts of the chamber masonry, underneath extensively eroded chamber masonry

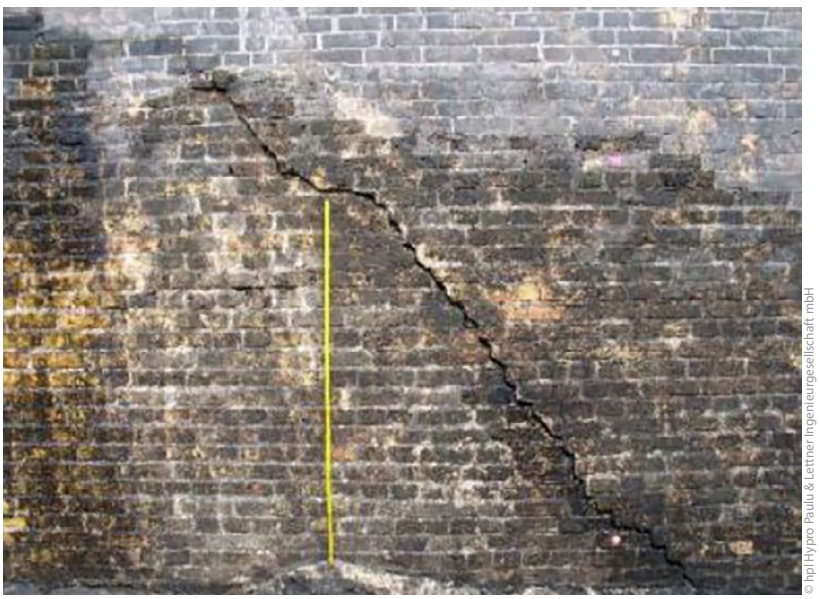


Figure 3: Inclined crack water-bearing

Author

Dr.-Ing. Adolf Maria Kopp
Zweckverband Region Finowkanal
Eberswalde, Germany
kopp@zweckverband-finowkanal.de

Literature

[1] Lehmann, J.: Die Obere Havel und der Finowkanal, Sutton Zeitreise, Erfurt: Sutton Verlag GmbH, 2015.
[2] Pilz, K.: Außer Betrieb - Industriekultur im Finowtal. Ein historischer Reiseführer. Berlin: Verlag für Berlin-Brandenburg, 2018.
[3] Wedepohl, M.: Gesamtkonzept zur wirtschaftlichen Bedeutung und zu den Perspektiven des Wassertourismus in der Region der Wassertourismus Initiative Nordbrandenburg (WIN-Region) unter besonderer Berücksichtigung des Finowkanals. Hamburg, 2020.

Multifunctional Use of Floodplains along Waterways within a Unesco Biosphere Reserve

The Unesco biosphere reserve Mittelelbe stretches about 400 km along the Elbe, Saale and Havel waterways and contains a natural environment of international importance. In this exemplary model region for sustainable development, solutions for various ecological, economic and social challenges have been developed and put into practice since 1979.

Guido Puhlmann

Introduction

Unesco biosphere reserves are model regions for a sustainable development. They combine different functions e.g. conservation, development, research and education. The Unesco currently has 727 biosphere reserves in 131 countries worldwide, including 16 in Germany. The Unesco biosphere reserve Mittelelbe was one of the two first reserves founded in Germany in 1979. At this time, it was located in the former GDR. After its foundation, it was extended in several steps. The fast extension of the territory was only possible due to a high acceptance within politics and society. In 1997 the biosphere reserve Mittelelbe became part of the trans regional biosphere reserve Flusslandschaft Elbe which stretches at a length of 400 km along the river Elbe (**Figure 1**). Today the biosphere reserve Mittelelbe located in the federal state of Saxony-Anhalt covers 300 km of river and 400 km of waterways (including tributaries). It extends on an area of 126,000 ha and is divided into three different zones (Core area, Buffer zone and Transition area). Furthermore, it contains the world heritage site Garden Kingdom of Dessau-Wörlitz with a size of 14,300 ha. The biosphere reserve covers a unique cultural landscape with extraordinary ecological and cultural potential.

© ö_Konzept Halle

Figure 1: Unesco biosphere reserve Mittelelbe (dark green area) as part of the transregional Unesco biosphere reserve Flusslandschaft Elbe (dark and light green areas)

Synopsis

- The reserve was continued (formerly GDR) as a successful model and has now been extended to five federal states (formerly East and West Germany).
- Reliable and transparent cooperation with stakeholders are the determinants of success for contemporary management and exemplary problem solving in this realm of river systems and waterways.
- Everything is interlinked with the water: Combined major projects in flood protection (dyke relocation) and floodplain revitalisation were able to set trends far beyond the reserve in accordance with the Unesco motto „Think globally, act locally".

The transformation of the social system in 1990 not only resulted in an improved water quality but also provided unique changes, experiences and chances for development. This transition process mainly occurred because of the radical economic changes.

Objectives

Biosphere reserves serve different objectives and tasks: They promote a sustainable economy, nature conservation, research, education for sustainable development as well as international cooperation. They typify a paradigm shift to nature conserva-

Figure 2: More than 25 oxbow lakes and tributaries were desludged and restored – at the Alte Elbe Klieken more than 500,000 m³ mud were obtained

Figure 3: One of the successful dyke relocation and revitalization measures near Dessau; the dark water surface (left side) marked the new flood plain area (flood 2013)

tion for and by human beings. Unesco biosphere reserves frame long-term sustainability procedures and maintain viable landscapes. They are quality labels for tourists; they stand for new employment possibilities and chances just as for identity and pride for a region that is part of a global network. Biosphere reserves do not protect nature from human beings; it is protected for and by them. The reserves encourage and demand sustainable economies and a social cohabitation of all their inhabitants.

In regards to the topic of the presentation: water and waterways inside of an Unesco biosphere reserve, the following key topics will be discussed:

- Protection of nature, animal- and plant species and of EU directives (Natura 2000) in the process of operating and maintaining federal waterways,
- Nature conservation in reliance on the operation and maintenance of complex systems for flood prevention (>1,300 km of dyke),
- Adaptation to climate change under the condition of anthropogenic caused river bed erosion and countermeasures,
- Large scale renaturation, revitalisation of flood plains and of tributaries of the river Elbe (**Figure 2**),
- Reestablishment and extension of decreasing floodplains (**Figure 3**).

Methods

Ecological transformation of river constructions during the process of waterway maintenance.

Cooperation in the draft of a concept for river management (Gesamtkonzept Elbe) and a concept for river bed stabilization.

Participation in establishing a concept for flood prevention in Saxony-Anhalt and a national flood protection concept. In particular in regards to the extension of flood plains.

Initiation, conception, organization and implementation of large scale and long-term nature conservation projects in cooperation with governmental and non-governmental partners.

Results

Short presentation on results and examples for ecological waterway management and ecological transformation of river constructions.

Short presentation on the overall strategy for the river Elbe (Gesamtkonzept Elbe) and a concept for river bed stabilization.

Short presentation on a project for dyke relocation at Lödderitzer Forst (Löderitz forest).

Restructuring of about 30 oxbow lakes/dead channels of the river Elbe since 1979, the renaturation of the Havel river (Untere Havel) and the pilot project Klöden for a reduction of river bed erosion.

Conclusion

Unesco biosphere reserves are a suitable instrument to cope with current and future challenges as well as the conflicting use in grand scale internationally protected and versatile cultural landscapes along international waterways. Almost every essential value in a river landscape depends on water. Due to that fact, a cooperation with the substantial social stakeholders and specifically those responsible for flood protection and waterway management is crucial. Transparency, reliability and open-mindedness for contemporary solutions are the main factors of success. A major goal for all partners should result in the development and establishment of long-term strategies and solutions.

Author

Guido Puhlmann
Administration Unesco -Biosphere Reserve Mittelelbe
Oranienbaum-Wörlitz, Germany
guido.puhlmann@mittelelbe.mule.sachsen-anhalt.de

Transformation: Industrial and Landscape Change

Lignite mining was actively practiced on a large scale in the former German Democratic Republic, leaving behind rugged landscapes and contaminated soil after the reunification. LMBV (Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft) has been dealing with this legacy since the 1990s.

Dirk Sonnen

The mining regions

Germany is an industrial and agricultural country. A very high proportion of industrial products are exported. The essential basis of industrial production is the stable and inexpensive supply of energy and raw materials. The coal mining areas in Germany offered the best conditions for this. The mines and open cast mines needed metallurgy and mechanical engineering, and the chemical- and building materials-industry were expanded. Good incomes and modern infrastructure attracted hundreds of thousands of people. That is why the mining districts include more than just coal mining.

The presentation of the areas is limited to the lignite industry in the federal states of Saxony, Saxony-Anhalt, Thuringia and Brandenburg. Due to a lack of foreign exchange, the GDR concentrated its energy supply almost entirely on domestic lignite and was the world's largest lignite producer in the eighties. The environmental impact was enormous. The extraction from large open-cast mines required the extensive lowering of the groundwater by up to 100 m. Five times more earth masses were moved than coal extracted to get to the lignite beds. In addition to CO_2, power plants and briquette factories emitted dust, sulfur dioxide and nitrogen oxides into the air. Gas plants, smoldering facilities and coking plants contaminated the soil and groundwater with pollutants due to inadequate precautionary measures, accidents and careless handling. Industrial waste was disposed of in inadequate or unsealed old pits created by the mining. Due to the tight supply situation, the state concentrated on production and postponed the rehabilitation of open-cast mines for later.

© LMBV/Radke

Figure 1: Lusatian lakes region

When Germany reunited in 1990, almost the entire GDR economy was state-owned. Industrial production and electricity collapsed within a short after. Lignite was increasingly replaced by natural gas, petroleum and hard coal. Numerous open-cast lignite mines, power plants and refinement plants were abruptly shut down. Those open-cast mines and power plants which were deemed viable in the long term, were privatized by the Treuhandanstalt by 1994. Laubag (Lausitzer Braunkohle AG) was established in the Lusatian mining district and Mibrag (Mitteldeutsche Braunkohlengesellschaft) and Romanta in the Central German district.

Synopsis

- Extensive rehabilitation was necessary in the east German lignite mining areas after the German unification.
- Two large lake regions are in development.
- Canals connect the lakes for touristic and recreational purposes.

Figure 2: Barbara canal, Lusatian lakes region

Promote economically promising and ecologically diverse uses

The unprofitable companies in the lignite industry that were decommissioned, or still in the process of being decommissioned, were assigned to the federally owned company Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft (LMBV), which was founded 27 years ago. Its task was to create public security on about 100,000 hectares of mining land, to make it usable again and to promote economically promising and ecologically diverse subsequent uses. The actions taken and financed by the federal government and the states concerned had a high employment effect in the initial phase. A long-term task is the large-scale restoration of a largely self-regulating water balance, by compensating for the mining deficit of around 13 billion cubic meters and the targeted development of the quality of surface and ground water.

To get the numerous large open-cast mining pits with a total displacement of around 4.5 billion cubic meters restored, flooding them to create lakes was practically the only alternative. Thus, 21 larger lakes with an area of almost 11,000 hectares were created in the Central German region and 30 larger lakes with almost 15,000 hectares in the Lusatian region (**Figure 1**). It was therefore obvious to use parts of the hydraulic connections to create waterways for boats or even passenger shipping. The additional costs are covered by grants from the states of Saxony and Brandenburg.

For the water tourism development of the rivers and canals in Leipzig and the post-mining lakes south of the city, seven routes were designed as courses; their implementation was to have as little affect as possible.

In the Lusatian region, ten lakes with around 7000 hectares of total water surface are currently developed with twelve canals. Six of the canals were built mostly on dry land before reaching the planned final water level and two are already in operation. In addition, three locks, three tunnels, nine bridges, four weirs and numerous ancillary facilities have been already built (**Figure 2**).

Although the new lakes and their navigable connections are only partially completed, they already have an enormous appeal in both areas and in the wider area for many people who want to spend their leisure time doing sports or wishing to relax. The LMBV has to consider the high expectations, the pressure to finish, investor wishes and on the other hand the different goals of those involved as well as changing environmental conditions. The approval procedures with public participation and the subsequent implementation of projects require a considerable amount of time, constructive cooperation and mutual understanding.

The results already achieved are nevertheless impressive and represent a positive element in the context of structural change, which is gradually developing in both regions during the coal phase-out and energy transition.

Author

Dirk Sonnen
LMBV mbH
Senftenberg, Germany
dirk.sonnen@lmbv.de

Brook Restoration with Citizens – Examples of the Metropolitan Region of Hamburg

The Water Framework Directive is not fulfilled. Of all stretches 80% (brooks and small rivers) are neglected. Public groups may help. Examples are given for urban and rural sites. Strong efforts have to be taken due to climate change, too. Agricultural and maintenance practice are to be changed.

Ludwig Tent

1 Improvements in riverine ecosystems still miss the goal

The official path to improve brooks and small rivers in Germany – excavated and destructed by hard maintenance – over the past decades has revealed as a humpy, ineffective attempt, not being enhanced by the Water Framework Directive. Up to now only 6,6% of watercourses` length have been restored in part, reaching a good status – the 80% of brooks and small rivers (we have to restore all waterways by law) is neglected. Especially groundwater fed brooks on morane ground, the headwaters, in the North German Lowland suffer by misunderstanding the natural temperature system and characteristic bottom structure (**Figure 1**). These watercourses once have been gravel brooks, functioning as habitats for the specific flora and fauna of the summer-cool stream, the trout region. – In this situation it has been shown that engagement of the public is a good tool to vitalize the forgotten stretches [1].

© Tent

Figure 1: A brook in the North German Lowland, overheated and without structure

2 Instream restoration with engaged citizens

2.1 Trout 2010 as a start in the city of Hamburg

The River Wandse within the Alster system in the area of the City/the Federal State of Hamburg, was taken as an example to prove, whether an urban brook might be altered to the trout brook it once was (project Trout 2010). With Hamburg being the owner, the water authority and responsible maintenance institution, the frame to realize improvements was given – especially because there is the will to include the public [2]. This example, run under the signs of Agenda 21 (informal learning/teaching) and sustainable development, has been applied to more brooks of the Alster catchment by the NGO Naturschutzbund Deutschland (Nabu), Landesverband Hamburg as Bach-Aktionstage since 2007 and the co-operation project Lebendige Alster with the NGOs Aktion Fischotterschutz and Bund für Umwelt und Naturschutz Deutschland (BUND). The installation of current deflectors by introducing structures of dead wood as well as gravel and boulders, are main part of the groups' activities. The city enhances such efforts by having introduced the gravel pot, part of the budget for river maintenance. This is an adaption of the Danish experience, giving public money to good ideas in practical help to aquatic ecological systems (once grus pulje, now forenings pulje). With the city's attempt to restore the fluvial continuum with pathways for fish and other organisms to and fro the river Elbe, e.g. sea trout is able now to reach re-installed spawning grounds.

Synopsis

- The improvement of all brooks and small rivers in the North German Lowland is necessary, applying best practice.
- Engagement of interested public groups may play a significant role.
- In headwater regions the characteristic trout stream will be regained.

2.2 Brooks in rural states

For urban environments in area states, as e.g. Lower Saxony and Schleswig-Holstein, similarities to the Hamburg example may

occur. A more complicated situation, however, results from organisational differences in the rural countryside, where a variety of concerned parties has to be involved – private owners down to small area strips along the riverine shores, privately dominated maintenance associations, accompanied by public water authorities. This situation may be overcome by starting best practice-experiments in a try and error attempt – contacting the maintenance association, the owners and, if necessary, convincing the water authority, that e.g. instream restoration in a given intensively used landscape improves the structures and biota, without affecting the discharge potential of the watercourse in a negative way [3], [4]. Joint education and learning leads this way. A lot of salmonid reaches have been restored up to now. The presence of characteristic plants like Water Starwort (*Callitriche*) and others is improved by the characteristic gravel ground. Trout, brook, river and sea lamprey, stone loach and accompanying characteristic invertebrates reveal the positive results. The growth of wetland trees is to be enhanced, wherever possible by natural succession – growth of local origin (**Figure 2**).

3 Outlook

Angling and environmental protection clubs, as well as adopt-a-brook groups and engaged individuals co-operate with water authorities, land owners and maintenance organisations to further improve the situation.

Figure 3: Semi-shaded stretch – alders and water plants, 35 years after instream restoration

Figure 2: Succession of alder trees along an instream restored brook, young stadium

To stabilize the results on catchment level and develop the necessary adaptations in the time of climate change, however, strong efforts have to be taken within the total system (cf. international projects like Keep your river cool). Stream corridors with deciduous trees as buffer to avoid the entrance of erosive materials, pesticides and nutrients as well as re-gaining the characteristics of the summer-cool stream are the inevitable basis. In the semi-shaded stretches under alders a high variety of organisms including plants like waterparsnip (*Berula*) thrive. (**Figure 3**) [5]. Altering present day subsidies for agriculture, adaptation of river maintenance to the legally set goals and consequent action of water authorities are needed to adopt these improvements to the system of watercourses at every place.

Author

Dr. Ludwig Tent
Edmund Siemers-Stiftung
Wedel, Germany
ludwig.tent@gmx.net

Literature

[1] Tent, L.: Lebendigere Bäche und Flüsse in Schleswig-Holstein. In: Behrendt, J.; Rechtenbach, D.; Otterpohl, R. (ed.): Hamburger Berichte zur Siedlungswasserwirtschaft 100 (2019), p. 139-163.
[2] Tent, L.: Trout 2010 – Restructuring Urban Brooks with engaged Citizens. In: Nijland, H.; Cals, M. J. R. (ed.): River Restoration in Europe; Practical Approaches. – Proceedings of the Conference on River Restoration, Wageningen, The Netherlands, 2000.
[3] Madsen, B. L.; Tent, L.: Lebendige Bäche und Flüsse – Praxistipps zur Gewässerunterhaltung und Revitalisierung von Tieflandgewässern. Norderstedt: BoD, 2000.
[4] Tent, L.: Instream Restaurieren – jüngere Beispiele aus Hamburg-nahen Fließgewässern. In: Gulyas, H.; Otterpohl, R. (ed.): Hamburger Berichte zur Siedlungswasserwirtschaft 91 (2015), p. 79-99.
[5] Janssen, G.: Auwaldbildung als Möglichkeit zur Umsetzung der Europäischen Wasserrahmenrichtlinie und der UN-Initiative „Bildung für nachhaltige Entwicklung "am Beispiel der Krückau in Südholstein. In: Natur- und Landeskunde, Zeitschrift für Schleswig-Holstein 121 (2014), p. 42-58.

Perspectives of Historical Waterways in Times of Structural Changes

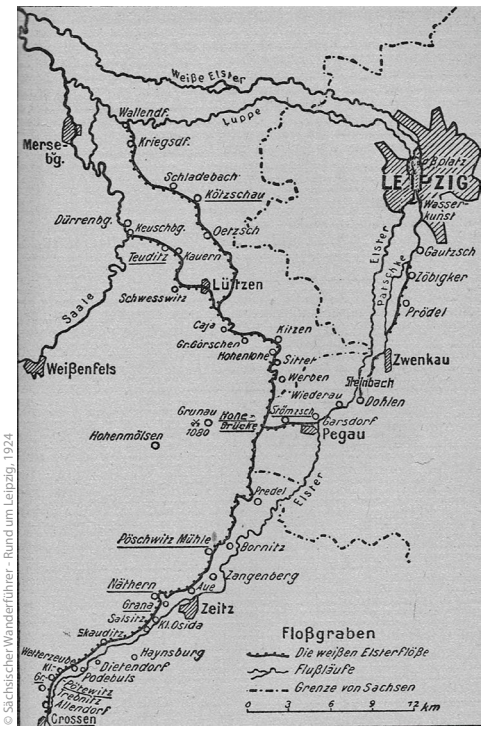
The lecture deals with the chances to safegurading the system of the Weißelster-Flöße, the most important energy pipeline of the past. The artificial raft ditches in the region have been destroyed by opencast lignite mining. Proposals for revitalisation and sustainable use are being made.

Frank Thiel

For many centuries, artificial waterways in combination with natural watercourses were the only way to transport goods and raw materials over long distances.

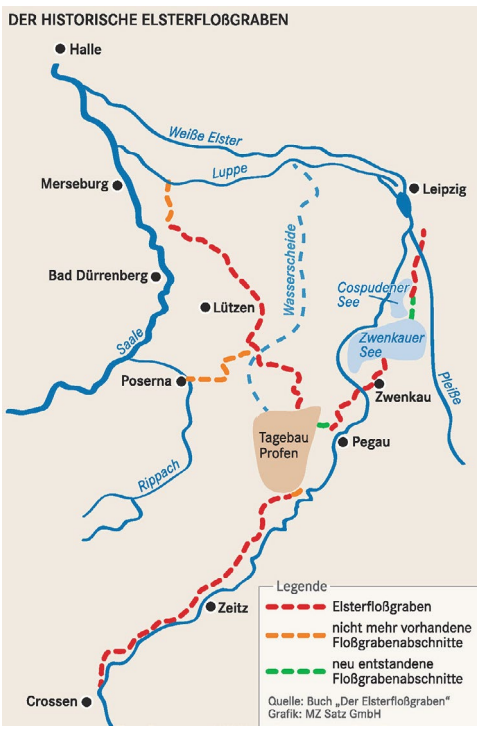
Timber rafting is the transport of wood in different forms on the waterway; as a bound raft as well as individual logs or firewood. Since the Middle Ages until the second half of the 20th century, rafting was used for commercial purposes in Europe. After the end of commercial use, a lot of associations beware the knowledge about rafting, developed and shared different aspects of this craftsmanship with next generations. Since 2014, timber rafting is official Intangible Cultural Heritage of Germany. Actually, the multinational nomination Timber Rafting submitted by Austria, Czechia, Germany, Latvia, Poland and Spain on 29 March 2021 will be considered by Unesco for possible inscription in 2022 on the Representative List of the Intangible Cultural Heritage of Humanity [1].

The so-called Weißelster-Flöße was the most important energy pipeline of the past, not only in our region, also at our continent. The system connected the river Weiße Elster with six watercourses. In addition, there were six artificial ditch systems, incl. in Muldenberg (Vogtland) and the Großer and Kleiner Elsterfloßgraben. The main parts at Halle and Leipzig were built between 1578 and 1610 (**Figure 1**) [2]. Until 1864, millions of logs were transported there as firewood to Halle/Saale and Leipzig. With the increasing use of lignite as fuel and the development of the railway system, timber rafting became less important. In the following decades the ditch system was used as a driving force for mills and for irrigation. The craftsmanship of timber rafting was forgotten. With opening of new open-cast mines, important parts were destroyed in the 60s and 70s of the 20th century (**Figure 2**). However, a lack of financial resources led to a neglect of the necessary maintenance measures.



© Sächsischer Wanderführer - Rund um Leipzig, 1924

Figure 1: The complete Elsterfloßgraben system in the year 1924



©MZ Satz GmbH

Figure 2: The historical Elsterflossgraben in the world of today

Synopsis

- The rafting ditch Elsterflossgraben as a technical monument is a significant example for perspectives of historical waterways in times of structural changes.
- It must be preserved as a monument to an artificial watercourse and as a cultural landscape element that creates identity.
- Because of climate change it´s necessary to hold water in the region so long as possible. Therefore, the supply of water don´t considered only from an economic point of view, but above all as an ecosystem service provider. This concerns all water systems, from the big river, the lake to the small stream.

Restore the technical monument Elsterfloßgraben

The Förderverein Elsterfloßgraben e. V., founded in December 2009 in Zeitz, wants to restore the technical monument Elster-

floßgraben in its beauty and engineering uniqueness and make it accessible to the public. The association commissioned a series of studies and plans for investments to enable long-term revitalisation and sustainable use for more than 75 km of the ditch system.

Through extensive literature research and the exchange of experience with other rafters' associations, the old craftsmanship was brought back to life here in the region.

In the present we have sometimes contradictory situations in the safeguarding and maintenance of artificial watercourses, not only with requirements of the European water framework directive.

But the rafting ditch Elsterflossgraben with his technically unique structure is a significant example for perspectives of historical waterways in times of structural changes. It´s a that bears witness to the knowledge and technical skills of our ancestors.

© Frank Thiel

Figure 3: Timber Rafting with children at the beginning of Elsterfloßgraben in Crossen

Climate change require to hold water in the region so long as possible. Therefore, the supply of water must not only be considered from an economic point of view, but above all as an ecosystem service provider. This concerns all water systems, from the big rivers over the lakes to the small creeks.

We would like to develop the Elsterfloßgraben equally as a monument route, nature protection path and recreation trail. There is a unique opportunity to combine a technical monument of hydraulic engineering (material cultural heritage) with an actor place of timber rafting (intangible cultural heritage), seen for example in **Figure 3**. It´s also an enrichment of the cultural and tourist offer in the region [3].

Structural change will not only be successful with new railways, energy and data lines, additional commercial space and roads. The quality of life of those living here in the district also includes: an intact environment, places for pleasure, relaxation or education.

The vision

As the largest European energy pipeline of the past, the Elsterfloßgraben has a future as a continuous stretch of water with numerous reminders of its history and significance, actively operated by log raftsmen with the care of the Intangible Cultural Heritage [4].

Now the opportunity exists to heal the wounds inflicted by mining over the past 75 years, urgent need to preserve the water landscape in times of climate change.

All these tasks cannot be accomplished by volunteer work alone. After all, some 25 to 30 million euros must be invested in this project over the next 20 years. A large part of this will be invested in the restoration of a continuous watercourse.

However, projects for tourist usage must also be developed, as well as projects for monument protection, nature conservation and education. Modern communication channels are to link the various adventure sites along the Elsterfloßgraben, also with hotspots for modern information technologies such as augmented reality.

The main part here is volunteer work, because:

- volunteering gives the water, which is so natural for most people, its uniqueness, volunteering gives the object the necessary,
- sustainability, as long as the water body is not self-organizing,
- volunteering tells stories about the water, its inhabitants and local residents,
- volunteering ensures that the water body is recognised and lived as an ecosystem service provider.

In such a process volunteer work needs professional support, e.g. from governments, regional administrations and parliaments or planning bureaus. Significantly improving the quality of life at and in the water, this should also be a feature of the future structural change in our lignite mining region. That is our aim. Every free-flowing body of water is of great importance in the present and future under the conditions of sustainable climate protection. Water in a cultural and industrial landscape is also a connecting element, not only between places but also between people. It makes work, it brings work, but it also contributes to relaxation and recreation [5].

Author

Dr. Frank Thiel
Förderverein Elsterfloßgraben e. V.
Zeitz, Germany
elsterflossgraben@gmx.de

Literature

[1] Thiel, F.: Flößerei als Immaterielles Kulturerbe vorgeschlagen. In: Mitteilungsblatt der Deutschen Flößerei-Vereinigung (2021), No. 28, p. 6.
[2] Hartmann, H.: Floßgräben im kursächsischen Raum. In: Sächsische Heimatblätter 36 (1990), No. 5, p. 249.
[3] Andronov et. al.: Der Elsterfloßgraben. Geschichte und Gestalt eines technischen Denkmals. Leipzig: Pro Leipzig, 2005pp. 21-40.
[4] Thiel, F.: »Wo die Gehölze sich dünne machen und der Wald geschwommen kam« Lützen – die Stadt am Großen Elsterfloßgraben. In: Reichel, M.; Rosenbaum, K.; Walther, H.-G. (ed.): Lützen - Kleine Stadt Großer Name. Markkleeberg: Sax-Verlag,2019, p. 382.
[5] Thiel, F.: Der Elsterfloßgraben – das längste Denkmal Mitteldeutschlands in Vergangenheit, Gegenwart und Zukunft. In: Artenschutzreport (2019), No. 40, p. 75.

The Role of Water and Hydric Reclamations in the Transformation of the Ústí Region

The Ústí Region in the Czech Republic will face a number of challenges in the transformation process shaped by the European Green Deal. These challenges are often perceived as threatening and undesirable, but they should also be seen as an opportunity. One of these opportunities is the possibility of exploiting the potential of hydric reclamation at the localities after the end of lignite surface mining as a part of the solution to the transformation and restructuring of the Ústí Region, i.e. in the areas of water management, energy and also employment.

Karel Tichý

The topic of water and water management is taken very seriously and responsibly as one of the main development factors within the Ústí Region. The perception of the importance of water issues is mainly given by historical developments. In particular, the factors of industrial activities – mining, chemical industry and the historical large-scale deforestation of the Ore Mountains due to emissions – emphasize the importance of a responsible approach to water issues. The importance of this topic has been growing in recent years with the need to address the economic restructuring of the region defined by the progressive slowdown in lignite mining, which will further accelerate in the coming years also in the context of commitments under the European Green Deal.

The range of issues at the level of the topic water can be divided, with respect to the specifics of the Ústí Region, into several sub-areas, which are mainly Surface Water, Drinking Water, Waste Water, Mine Water, Groundwater, Rainwater and Energy Water. The Ústí region covers an area of 5,335 km^2. Of this area, water areas occupy approximately 106.7 km^2.

With regard to the mentioned processes in the form of a gradual decline in mining activities, it is necessary to pay increased attention to the subsequent reclamation of areas in the mining-affected area. One of the possible variants of the reclamation solution appears to be the so-called hydric reclamation, i.e. the flooding of these areas and creating large artificial lakes. The creation of the entire system of large water reservoirs will have an undeniable impact on the local microclimate and at the same time will enable the development of a whole range of interconnected industries and related innovative solutions. These include, in particular, the development of renewable energy, agriculture and tourism. However, it must be emphasized, that the potential of tourism should not be overestimated in this respect (**Figure 1**).

If in addition to the already existing two large artificial lakes created by the flooding of lignite surface mines – i.e. Lake Milada (near the city of Ústí nad Labem) and Lake Most (near the town of the same name) – four other planned lakes (i.e. CSA, Nástup, Bílina and Vršany) will be realized in the future within the Ústí Region, the share of water areas will increase by 502%, water accumulation by 1,118% and coastal areas by 276%. This is a significant change, which requires a comprehensive approach. Examples of successfully implemented concepts can be found in neighboring Germany (Leipziger Neuseenland, Lausitzer Seeland).

Synopsis

- The transformation and restructuring of the Ústí region represents the most important development opportunity for the region in the 21st century.
- Hydric reclamations as a part of the solution of the areas after the end of lignite mining will fundamentally affect the character of the landscape of the Ústí Region and can become an important tool in solving the climate change challenges.
- The development of hydric reclamations need to be placed in the broader development context of the Ústí Region to maximize their balanced contribution both to the economy of the Ústí Region and to its environment.

Water shortage problems because of climate change

Climate change is causing water shortage problems in the Central European context, and the Ústí Region is one of the most endangered areas in the Czech Republic. It is therefore necessary to address the issue of water comprehensively, to work with water so that the Ústí Region is able to adequately respond to the expected period of droughts.

The topic of water has a number of specifics within the Ústí Region:

- the potential for the use of water in the reclamation and revitalization of the areas after coal mining and the interconnected possibility of using the potential of this water for renewable electricity generation;

Figure 1: Example of hydric recultivation – artificial lake "Marcela" in CSA quarry area as part of the Most Basin in the foothills of the Ore Mountains

- implementation of floating photovoltaic installations (bringing, among other things, benefits in the form of reduction of land use, reduction of evaporation from hydric reclamation sites and increase of water quality);
- development of pumped storage hydropower plants operating as storage systems with a unique stabilization potential for the electric power transmission system;
- increased risk of drought due to the rain shadow of the Ore Mountains;
- increased risk of floods on larger (Elbe, Eger rivers) and smaller watercourses;
- the scope of strategic water-intensive industries (e.g. chemical, paper, glass industry);
- high occurrence of groundwater and their solution at the level of (gradually attenuated) mining activities;
- occurrence of spa springs;
- potential for water transport development - Elbe waterway.

Potential of water as an opportunity

Apart from the risks, the potential of water needs to be seen primarily as an opportunity. Opportunity in the form of the possibility of adapting to climate change, ensuring future resilience and efficient use of water - among other things at the level of utilization of its energy potential. A specific opportunity is also the possibility of opening new educational fields related to water issues, the development of reskilling and upskilling activities at this level and, last but not least, the development of new job opportunities. The topic of water in the Ústí Region thus has the potential:

1. to become an important part and at the same time one of the drivers of the ongoing restructuring of the region – timely use of all opportunities in various areas of the economy – energy, research and development, transport, tourism and health, can be an important part of the new economic orientation of the region;
2. to enable the application of existing region-specific know-how in the restructuring process to the possibility of efficient use of water as a strategic raw material (for energy, research, chemistry, geology, …).

The gradual phase out of mining activities is a turning point in a number of aspects. From the point of view of water and landscape, a complex, well-thought-out and time-bound sequence of steps is necessary. The overall revitalization of the area needs to be addressed in the affected localities. This revitalization can be defined as follows: landscape revitalization is the restoration of ecological, economic and social functions of the landscape and is carried out not only in reclaimed areas, but also in the area following mining activities in order to achieve the basic principle of revitalization – return to life, namely in the broadest sense – the return of nature and man. Revitalization is therefore understood as a certain superstructure over land reclamation.

With a holistic approach to the topic of water, it is possible to gradually change the image of the Ústí Region, where, as a result, the region will:

- be able to systematically and effectively manage the development processes and respond to new trends;
- have specific know-how and will be able to use it in the new trends defined by the European Green Deal;
- be able to effectively use natural raw materials and resources in connection with sustainable development for further development of the region.

Author

Karel Tichý
Economic and Social Council of the Ústí Region
Most, Czech Republic
tichy@hsr-uk.cz

Aquathermal Energy: Sustainable Heat Source for the Energy Transition in the Netherlands

Aquathermal energy has the potential to meet a large part of the heat demand in the built environment. The article describes its potential as sustainable heat source for the energy transition in the Netherlands.

Marco van Schaik and Henk Looijen

In the Netherlands, the vast majority of buildings is heated with natural gas. Since natural gas was discovered in the Dutch soil, an extensive natural gas network was constructed in the 1960s. After the Paris Climate Agreement (2015), it was agreed that by 2050 all buildings must be heated fossil-free. Aquathermal energy has the potential to meet a large part of the heat demand in the built environment. In this introduction we discuss the potential of aquathermal energy in the Netherlands, configurations of aquathermal energy, the development of aquathermal energy in the Netherlands and challenges for the future.

Potential of aquathermal energy

We distinguish 3 forms of aquathermal heating:

- TEO: Thermal Energy from Surface Water (Oppervlaktewater in Dutch),
- TEA: Thermal Energy from Wastewater or sewage water (Afvalwater in Dutch),
- TED: Thermal Energy from Drinking Water.

The potential of aquathermal energy is very large. With consideration of distance between buildings and the aquathermal source it is calculated that up to 50% of the heat demand could be met [1]. This study does not yet take into account whether other sources might be more suitable. In addition to heat, aquathermal energy can also be used for cooling.

Synopsis

- Aquathermal energy is a sustainable heat source.
- It has been used in the Netherlands since ± 2000. Currently, about 80 projects are in operation.
- Water authorities, municipalities, provinces, the central government, market parties and research institutes are working together to instigate joint fact finding and bring solutions to the aforementioned challenges.

Configurations of aquathermal energy

Aquathermal energy in the Netherlands is usually combined with Aquifer Thermal Energy Storage (ATES) in the subsoil. A common configuration of TEO is shown in **Figure 1**. In most of the Netherlands, the subsoil consists of 100-400 m thick layers of alternating sand and clay. The sandy layers – or aquifers – are very suitable for thermal energy storage.

When using TEA, often no heat storage is used, because the year-round temperature is suitable to extract warmth. For drinking water (TED), the combination with ATES is more common.

The aquathermal source provides warmth from 10-20 °C. In order to be useful for heating buildings, it must be upgraded to a higher temperature (between 40 and 70 °C, depending on the demand of the building) with a heat pump. There can be central heat supply with a large industrial heat pump or a decentralized supply with a heat pump in each building. Heat is mostly distributed with a heat network.

The development of aquathermal energy in the Netherlands

Aquathermal energy has been used in the Netherlands since ± 2000. Currently, about 80 projects are in operation. The largest part of this consists of newly built neighborhoods of 50-500 households. Also a number of swimming pools and schools are provided with aquathermal heating, mostly from sewage water. In the context of the energy transition, more than 60 projects are in preparation in recent years to provide existing residential areas with sustainable heat from aquathermal heating. These initiatives tend to become larger, from 300 to over 10,000 households. In addition, preparations are being made to make some existing heat networks that are heated with fossil fuels more sustainable with aquathermal energy. These projects are carried out by joint ventures of municipalities, water authorities, energy companies and residents who organize themselves in local energy cooperatives. In recent years, many studies have also been carried out to deploy aquathermal energy on a larger scale in the context of the energy transition.

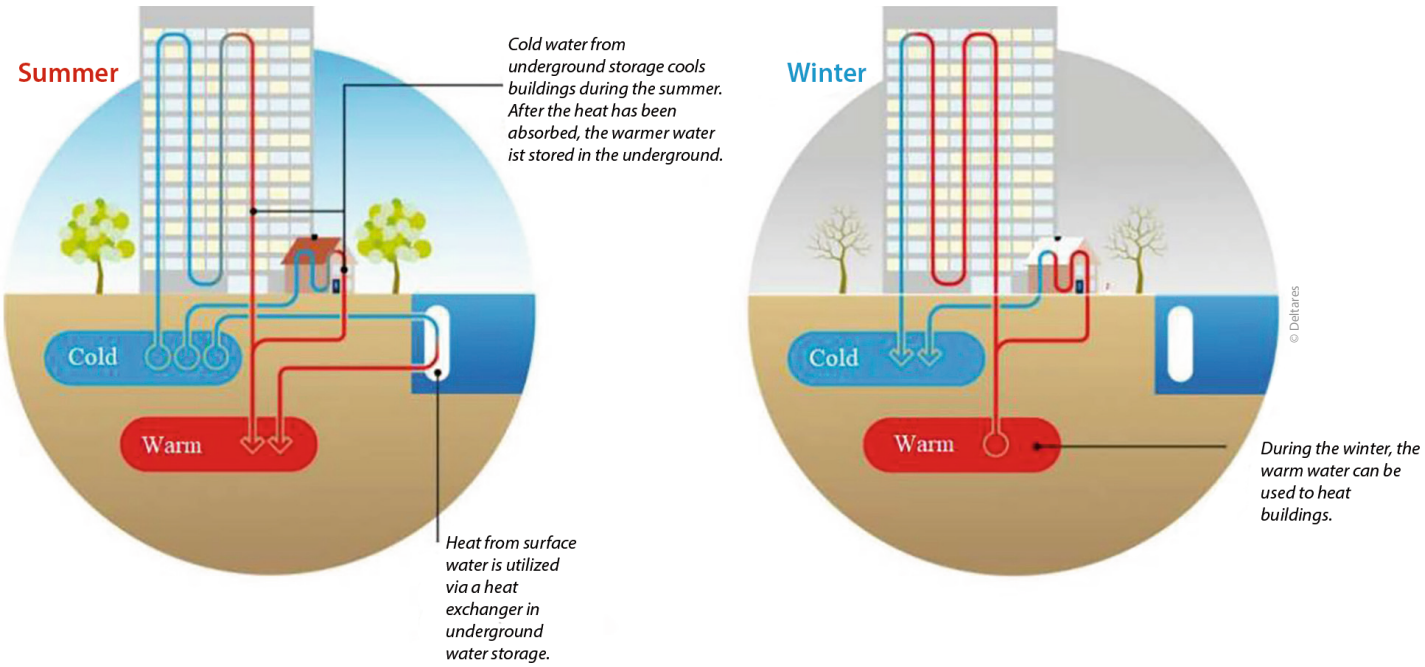


Figure 1: Heat and cold storage (ATES) in combination with TEO

Challenges for the future

So, aquathermal energy has great potential and there is a lot of ambition to use this potential. Actual realization, however, still encounters a number of challenges:

- Financial: The Dutch are used to natural gas. This is a cheap heat source and the infrastructure is ready. Aquathermal energy requires major investments, mostly in new infrastructures. At the moment, to use aquathermal energy in existing buildings can only be realized with subsidies.
- Governance: Municipalities and water authorities are still looking for their role in aquathermal projects. They want influence, but usually do not feel they are the right party to make large investments themselves. Residents do not want to be dependent on one energy company and therefore also ask to have influence. Another issue is that in some city districts the demand for heat exceeds the potential supply from aquathermal heating. Municipalities and water authorities are investigating how they can best distribute the heat in such cases and how they can regulate this by law.
- Ecological: TEO causes surface water to be cooled. Little is known about the effects of this cooling on the development of aquatic plants and animals. That is why water authorities are sometimes reluctant to grant permits for TEO in smaller water bodies. It is a challenge to gain more knowledge about the ecological effects of TEO, because research is expensive.
- Sufficient technical staff: One of the biggest challenges will be that there will not be enough people in the near future who have the technical skills to build the systems needed to reach the goals in 2030.

Finally

The European Union has formulated clear ambitions to reduce greenhouse gas emissions. The Dutch government has adopted the ambitions in its policy. Aquathermal energy can help to achieve the objectives. Therefore, water authorities, municipalities, provinces, the central government, market parties and research institutes are working together in a Network Aquathermia under a Green Deal Aquathermia, to instigate joint fact finding and bring solutions to the aforementioned challenges. International exchange of knowledge and experience can contribute to meet the challenges and contribute to the climate goals.

Authors

ir. Marco van Schaik
Stichting Toegepast Onderzoek Waterbeheer
Amersfoort, The Netherlands
vanschaik@stowa.nl

drs. Henk Looijen
Rijkswaterstaat and Netwerk Aquathermie
Den Haag, The Netherlands
hlooijen@aquathermie.nl

Literature

[1] Kruit, K.; Schepers, B.; Roosjen, R.; Boderie, P.: Nationaal potentieel van aquathermie. Delft, 2018 (https://ce.nl/wp-content/uploads/2021/03/CE_Delft_5S74_Nationaal_potentieel_van_aquathermie_Def.pdf, Access 20.03.2022).

Geomembrane Systems to Restore the Watertightness of Canals in the Dry and Underwater

Canals transport water from the source to users who are often far away, and a large amount of water is lost over their length. Canals must therefore be designed, built and maintained to assure that the maximum possible amount of water is safely conveyed to the final users at the lowest possible costs.

Gabriella Vaschetti and Vanja Verdel

Canals transport water from the source to users who are often far away, and a large amount of water is lost over their length. With the increasing demand of water supply for power generation or for irrigation and human consumption, large losses of water along kilometres of canal are unacceptable. Canals must therefore be designed, built and maintained to assure that the maximum possible amount of water is safely conveyed to the final users at the lowest possible costs.

Synopsis

- To avoid water loss, canals must maintain very low permeability.
- Geomembrane systems can restore watertightness in a very effective way from the technical point of view and can be economically more convenient than traditional linings.
- Since many canals cannot be dewatered, or dewatering entails great inconveniences and high costs, geomembrane systems that can be installed in flowing water have also been developed and installed

Avoid water loss

To avoid water loss, canals must maintain very low permeability. Old unlined canals can experience considerable water losses due to the permeability of the soil, while canals lined with materials such as compacted clay, brick or stone masonry, or concrete, can lose imperviousness because the linings over time deteriorate due to settlements in the natural ground, to the dynamic action of water and of transported sediments, to uplift pressure, to temperature gradients, to growth of vegetation, to animals' hoofs, to action of ice and frost, to chemical attack of water, etc. Cracks form, joints deteriorate, hydraulic roughness increases, aquatic plants grow inside the canal and partially obstruct it. Water flow decreases through water losses and friction losses, and eventually water infiltrating into the ground may cause instability of the natural slopes and lead to landslides affecting the canal structure.

If the entity of water loss and of capacity loss is no longer acceptable, or stability is at stake, the watertightness of the canal must be restored, which generally requires to take the canal out of service. In some cases, local repairs can be sufficient to put back the canal in operation in safe conditions. In other cases, a complete rehabilitation by a new liner is required, which implies a prolonged outage of the canal, hence the choice of a lining system with long-term good performance is very important.

Geomembrane systems, which have been used to restore watertightness in canals since more than half a century, can restore watertightness in a very technically effective way and can be economically more convenient than traditional linings such as concrete, bituminous concrete, shotcrete, resins. A geomembrane with adequate tensile properties will bridge cracks and failing joints and withstand settlements that would destroy other types of liners. With thickness in the order of a few millimetres, a new geomembrane liner practically does not alter the cross section of the canal and can be installed in a shorter time than traditional liners. Additionally, a geomembrane with appropriate anchorage system will maintain over time very low

Figure 1: Fastening system at Larona canal (left), and the Carpi system completed (right)

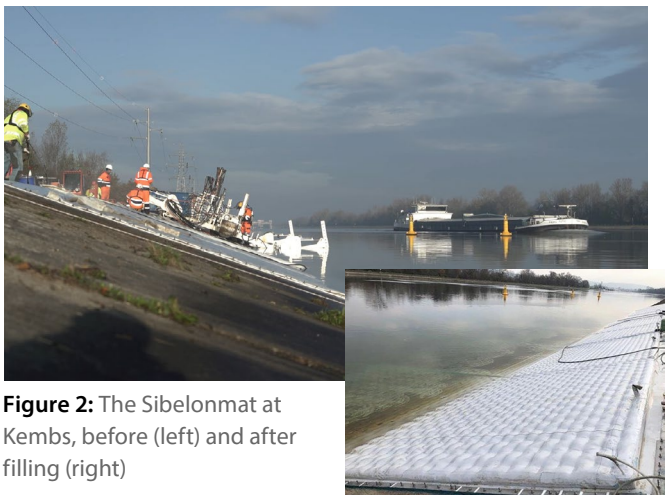


Figure 2: The Sibelonmat at Kembs, before (left) and after filling (right)

hydraulic roughness, thus allowing considerable increase in water flow and hampering vegetation growth.

Over the decades, materials, technology and installation methodologies have evolved. Since many canals cannot be dewatered, or dewatering entails great inconveniences and high costs, geomembrane systems that can be installed in flowing water have also been developed and installed.

The two most recent case histories that follow concern one project made in the dry and one project made underwater in a navigation canal, where the waterproofing works were performed without stopping the flow of water or the heavy fluvial traffic.

Larona Canal in Indonesia, 2019

Larona hydropower canal, owned by PT VALE Indonesia, over a total length of 6,927 m connects the Batu Besi Reservoir to the Larona Power Station. The canal, 14.4 m wide and 5.0 m high, is lined with heavily reinforced concrete, with vertical walls connected to the invert by a sloping section. A construction joint between the vertical and sloping sections, and a hinged joint between the sloping sections and the invert, run longitudinally the full length of the canal. The headpond acting as storage reservoir for turbine start up and automatic shutdown has an inlet structure to the three penstocks in a deeper downstream section, and a labyrinth spillway along one side. The canal is generally operated close to full capacity.

Over the years deterioration of the inner concrete surface and of the joints caused water and friction losses, reduced flow, and foundation failure at some panels. Despite structural and surface repairs, concrete deterioration continued, leakage persisted, a longitudinal crack developed at the invert, hydraulic roughness increased. An exposed 3.0 mm thick PVC composite geomembrane, anchored with a face anchorage system allowing sustaining the design loads with a Safety Factor ≥2, was selected to prevent loss of structural integrity, particularly in case of a seismic event, and to increase of the design flow from 140 to 170 m^3/s.

Carpi, who was awarded the tender, made a hydraulic analysis studying several scenarios with different anchorage lines to optimise design. A special improved tensioning profiles assembly was developed to fasten and tension the geomembrane liner along 9 tensioning lines plus 2 lines of flat profiles in the canal, and along 19 lines of flat profiles in the headpond. Additional fastening lines at the zones of high turbulence, and watertight mechanical perimeter seals at boundaries, complete the anchorage system.

Waterproofing works, in total 159,697 m^2 over 7 km of canal and headpond, had to be carried out within a programmed outage of 10 weeks. A 100 m long, 1:1 scale replica of the canal allowed optimising installation procedures and maximising safety, and training local personnel. Installation of the Carpi system was completed in less than 8 weeks (**Figure 1**). According to the owner all previous joints leakage has ceased and the hydraulic performance of the canal has markedly increased with water levels lower and flow velocities significantly higher and therefore, maximum achievable power output has been increased from 160 MW to 180 MW.

Kembs dike at the Grand canal d'Alsace, France, 2020

To avoid expensive and sometimes impossible dewatering, Carpi developed a system that can be installed in flowing water, the Sibelonmat. It is a flexible mattress prefabricated in the factory and consisting of two watertight geomembranes connected with a connection system allowing free distribution of a ballasting material, such as inexpensive cement grout, which fills the voids between the two geomembranes. The lower geomembrane provides watertightness, the grout provides the ballast to anchor the geomembrane and to protect it against impacts, the upper geomembrane provides containment of the grout, protects the ballast during operation, and improves hydraulic efficiency due to its low roughness. The Sibelonmat panels placed in the canal under full operation are joined underwater by watertight zippers.

After 2-years validation testing and two successful pilot projects in irrigation canals, Sibelonmat was selected by EDF – Electricité de France, for a 50 x 28 m pilot project in the Grand Canal d'Alsace, at Kembs. For Kembs, a system to monitor performance of the Sibelonmat was part of the design and included pressure cells, a pumping system allowing measuring the potential leaks, and an optical fibre leak location system integrated at fabrication in the Sibelonmat. The Kembs project was carried out in October 2020, with the canal in full operating conditions and no disruption in fluvial traffic. The system was installed underwater on the deteriorated concrete of one embankment, from elevation 236.30 to crest, i.e. on about 28 m of slope, in 5 panels, each 10 m wide and 28,4 m long, covering 80 slabs and spanning 26 joints. This totally innovative project will probably mark a milestone in canals' maintenance systems, providing to owners a solution to restore watertightness with no impact on canals' operation (**Figure 2**).

Authors

Gabriella Vaschetti
Vanja Verdel
Carpi Tech BV
Balerna, Switzerland
gabriella.vaschetti@carpitech.com
vanja.verdel@carpitech.com

City Port Leipzig

The interaction of functionality and design ideas runs as a common thread through the planning process of Leipzig's city port. In intensive discussions with the planning teams and the client, the design of the future city harbor crystallized step by step. It will be exciting to see how the port fills with life after completion.

Jens Betcke

Figure 1: Visualization of the future city port

Introduction

The river system of the Weiße Elster, Pleiße and Parthe runs through the Leipzig city area. Since the 1990s, the former mill races have been uncovered again. These water veins shaped the cityscape for centuries before they were filled in, banned to pipes and sacrificed to road traffic in the 20th century. Now the opened canals together with the watercourses form a small-scale network. In addition, there is the lake landscape south of the city as a result of the recultivation of the recultivated opencast mines. In connection with the development of this Leipzig New Lake District, water sports activities are also increasing there. This lake landscape is connected to the Leipzig water network via the waterways and locks. A connection with the city center makes the whole system more attractive in.

With the forthcoming opening of the last section, the opened millrace system is nearing completion. This also makes the construction of a port in the city center possible and sensible.

Synopsis

- An interdisciplinary team of landscape architects, hydraulic and bridge construction engineers plans the functional furnishing and sophisticated design of the city harbor in close cooperation with the client and the users.
- The interaction of functionality and design ideas runs as a common thread through the planning process.

Planning process

The location for the harbor was found on a brownfield site on the western side of the city centre. Then a long planning process began. As a preliminary construction work, the first jetty platforms were erected during the construction of the bank reinforcement for the reopened body of water and temporary facilities for ticket sales, boat rentals, restaurants and beach volleyball were installed on land. This is how the place and term Stadthafen became established in the consciousness of the people of Leipzig.

Around 2010, the first planning steps took shape: the dimensions of the harbor basin and the functional program were determined and the project was brought to approval. For various reasons, including economic ones, it was not realized for the time being.

A good ten years later, the city, represented by the Office for City Green and Water, took up the project again, combined with expanded requirements: a city harbor is more than just a facility for mooring boats. The added value of a harbor atmosphere with jetties, boats and maritime activities should be used to design a place with access and stay on the water for as many people as possible (**Figures 1** and **2**).

The consortium of hydraulic engineering and landscape architects, Fichtner Water & Transportation GmbH, Leipzig location, and häfner jiménez betcke jarosch landschaftsarchitektur, Berlin, were awarded the contract for the conversion and further planning. The third planning team are the engineers from König und Heunisch Planungsgesellschaft mbH Leipzig (KHP), who are responsible for the design and construction of the harbor bridge.

Requirements

The history of the place plays a role: The Julius Blüthner piano factory stood here until it was destroyed in World War II (Blüthner grand pianos are still a world-famous brand today). Reflecting on this historical background, important for Leipzig's musical history, when designing the city harbor represents another challenge. To do this, all functional aspects have to be reconciled: A certain number of berths on the water and in boathouses is defined. Weir and at the lifting crane must be able to be served. Car parking spaces, the rooms for rescue vehicles, fire brigade etc. must be brought into harmony with the movement and rest areas of the boat users, strollers, cyclists. Leisure uses should be taken into account and all attractive places in the port should be accessible without barriers. When organizing all these aspects, the available space turns out to be quite limited. In addition, despite all the desired attractiveness and special features, the economy and the aspects of sustainable planning must not be lost sight of.

Design

The solution to this puzzle of demands was primarily entrusted to the landscape architect as the designer of the visible surface. But this design only works on the basis of well-founded hydraulic engineering. In the planning process, we have fully exploited the advantages of interdisciplinary work. The landscape architects' ideas were checked for feasibility and modified if necessary. The engineers from hydraulic engineering used their wealth of experience to bring ideas into the design that landscape architects tend not to have in their repertoire. This includes, for example, setting up a bypass line. At various points in the harbor basin, the water is drained off via a pipe system and channeled into the mill race using the natural gradient. The water quality is ensured by the permanent flow through the harbor basin.

The largest structure, the bank reinforcement with bored piles, is hidden under the surface of the port area that will be visible in the future. This system of choice continues the construction method already used when excavating the mill races.

Figure 2: Site plan of the port

In addition, there is the infrastructure network of water and electric lines for the organization of port operations.

For the appearance and usability of the port landscape, the transition from water to land is the main design option. A circumferential step system of seats and steps does not allow a vertical bank wall to develop at any point. For barrier-free access to the waterfront, three paths with a 3 percent gradient will be added to this step system. These paths are framed by large islands of plants and form a vegetative triad with grasses and trees within the steps.

The amphitheatrical framing of the harbor basin is entirely intentional. The steps are more than access to the jetties, they are an informal lounge area along with the benches and the edge of the seat near the water. The location can be played on: the audience can take a seat and follow what is happening, like on a grandstand.

The soft curves of the steps are formed by carefully formed artificial stones. From the functional aspect of avoiding the use of the steps by skaters and the associated damage, the rhythm of the large joints arose. In the best case, this appearance is associated with a certain musicality and is reminiscent of the curves and keyboard of a Blüthner grand piano.

A key aspect in the replanning of the port was the idea of making the six large, existing piers for passenger boats on the Elstermühlgraben, on the future outer side of the port, accessible only via stairs, barrier-free. For this purpose, the inner bank path is led to the outside under the bridge over the harbor entrance. To do this, the clear height and the width of the passage must be increased by the width of the path. This more functional thought solution made it possible for the planners at KHP to plan a bridge as an eye-catcher and gateway to the port.

Author

Dipl.-Arch. Landschaftsarchitekt Jens Betcke
häfner jiménez betcke jarosch landschaftsarchitektur gmbh
Berlin, Germany
betcke@haefner-jimenez.de

Scotland's Canals in 2022

The canals of Scotland continue to transform towards a sustainable corridor ensuring their relevance for the 21st Century and beyond.

Catherine Topley and Richard Millar

Since they were first carved through the heart and highlands of the nation more than 250 years ago, Scotland's canals have been home to a unique fusion of art and engineering. During their 19th century heyday as the transport thoroughfares that stoked the fires of the Industrial Revolution, visionary engineers such as Thomas Telford, the Colossus of Roads, ensured they were arteries of artistry as well as commerce. From the art deco flourishes on the iconic bascule bridges of the Forth & Clyde Canal to the sweeping curves of the Crinan Canal's iconic basins, beauty was carved, often literally, into the soul of Scotland's inland waterways.

The glory days of Scotland's canals continued for more than a century before the birth of rail travel instigated their decline. Trains gradually replaced barges as the chosen mode of transport for both passengers and goods, with the clip-clop of heavy horses on the towpaths giving way to the whistle of steam and rhythmic thrum of the new mode of transport. By the 1960s, the canals had fallen into decline and had been transformed from bustling arteries into unloved backwaters. They were an outmoded form of transport, a barrier to development and a danger to local communities. The artistry inherent in their design was lost beneath waves of weeds, graffiti, and the slow, uncaring decay of time.

Europe's first smart canal

Ambition and creativity have delivered The Falkirk Wheel, the world's only rotating boat lift, to The Kelpies, the world's largest equine sculptures, to the development of tourism destinations, holiday cottages, water based experiences and the creation of new communities and housing on the banks. Highlighting the success of the substantial sustainable water management system being built on the canal in North Glasgow and how this is unlocking a large area of the city.

Scotland's canal network has entered a renaissance. Despite the Covid-19 pandemic Scottish Canals have been leading the nations community driven sustainable placemaking across the country. In 2021, Scottish Canals opened an inner-city nature reserve in North Glasgow. The £8m project connected communities and enabled the people of Glasgow to embrace nature within the city. In addition, Scottish Canals redeveloped 19th century infrastructure to transform a disused railway line and open a linear park over the historic Forth & Clyde Canal. The linear park, The Bowline, pays homage to The New York Highline and now enables travel between Edinburgh and Loch Lomond seamlessly along an off- road active travel route (**Figure 1**).

Figure 1: Scottish Canals Bowline Regeneration Project

Scottish Canals is re-imagining 18th century infrastructure to address flood risk, stimulate investment & tackle health inequalities. Through collective investment alongside partners, Scottish Canals has developed Europe's first smart canal, The Glasgow Smart Canal.

The smart canal uses predictive weather management systems to lower the canal by up to 10cm in anticipation for rainfall. The water is passed to pools of water down stream of the canal to make way for an additional 55,000 cubic metres of water or the equivalent to 22 Olympic sized swimming pools. The drainage system has unlocked over 110 hectares of land in North Glasgow to redevelopment and paved the way for 3,000 new houses.

Synopsis

- It would take almost 50 years, and the largest waterway regeneration project ever undertaken in Britain, to bring Scotland's canals back to life and restore them.
- Scottish Canals has developed Europe's first smart canal, the Glasgow Smart Canal.

Authors

Catherine Topley
Richard Millar
Scottish Canals
Glasgow, Scotland
catherine.topley@scottishcanals.co.uk
richard.millar@scottishcanals.co.uk

Publisher
Conference of Regional Parks
and Green Rings
2020, brochure, 80 pages

Landscape to Live In — City-Regional Open Space Strategies

Regional Parks and Green Rings in Germany

Download
www.korg-deutschland.de *or* **www.gruenerring-leipzig.de**

KONFERENZ DER REGIONALPARKS UND GRÜNEN RINGE

Grüner Ring Leipzig

"Even after Disasters and Strokes of Fate, there Must be People who Give Hope"

In this interview, Heidrun Meyer, mayor of the town Seeland near the Concordiasee in Saxony-Anhalt talks about the transformation of the landscape and the economy and the impact of a disaster at the adjacent lake early in her tenure.

WasserWirtschaft: What was your motivation to run for mayor of Seeland?
Heidrun Meyer: After the reunification of Germany, there were great challenges for many people in the east of our country. My job at the time was to manage the municipality's finances. Our plans were already in place in 1994.

After the mining site was abandoned, a concept for its subsequent use had to be drawn up. The tourism project has accompanied us since the very beginning and was part of my work as treasurer. In 2009, the opportunity arose to continue this task as mayor, because I did not want our vision to remain a dream.

What hopes did you have for the project?
It was an uncertain time at that time. In our region, the unemployment rate was 27% because the main employers, the mining industry and the aluminium plant were closed down or wound up. People needed hope and that hope was our lake. Our local tourism development. Small successes in this area were already happening. A pleasure boat was brought in. People felt that something was happening here and were satisfied with it. We developed a master plan „Tourist development on the north and south shores of the lake", in which we recorded what the landscape would look like in 10 - 15 years when the lake had enough water.

Heidrun Meyer
has been in public service since 1984 and has been mayor of the town of Seeland in Saxony-Anhalt since 2009. On 15 July 2009, Seeland was founded as a unified municipality from originally 6 municipalities.

© Stadt Seeland

© Stadt Seeland

Der Concordiasee near Seeland in Saxony-Anhalt

Have you been able to create new jobs and retain people?
Not in the mass that we lost. It was actually the biggest challenge at that time to offer jobs to the local people. On top of that, there was the disaster in 2009: On 18 July, a strip of land measuring 350x150 metres collapsed into the town's nascent lake, a flooded residual open-cast mining hole. A semi-detached house, part of another house and a section of road with a lookout point and information kiosk were swept into the depths, three people died and others were left homeless. It was terrible.

How did this disaster then affect your plans?
That's when we decided in the city council: „We can't go on with tourism, but we have to secure new jobs!" The local aluminium plant was also thinned out from formerly 1,000 employees to 150 to 200. No one knew what was happening to the plant. Fortunately, a Canadian company was given the go-ahead to take over, the plant was rebuilt and many people got industrial jobs, just like before the turnaround. In the meantime, in addition to the main plant, we also have a second plant here on site where aluminium cans are processed for reuse. It is the largest of its kind in the world. This secured the jobs and the future of the young people again. It created conditions for people to stay and not leave their homes.

Another economic factor in our city is biotechnology. Scientists from many countries conduct research at the Institute of Plant Genetics and Crop Plant Research (IPK) Gatersleben. By creating a start-up centre, the city has made it possible for companies and scientists to continue working in this field. The settlement of BASF with a wheat breeding centre is just one example.

What were the biggest obstacles in the development, also due to the disaster?
The disaster was a catastrophe for all of us. The uncertainty about the future of our region was the worst.

After five years there was the final report on the accident. It took another five years before we were able to demand a partial opening of the lake. The challenge was to bring people along and convince them that things could continue.

Looking back, what are you happy about in the time of change from 1990 to 2021?
What excites me about being mayor is that you can shape things together with people. The historical event of the turnaround only happens once in a lifetime. Even in difficult times, you must not lose sight of your goal. I am grateful that I was able to be part of it and then, since 2009, as mayor of our town of Seeland.

Changing the homeland – so that we can feel good here in rural areas, that is a task I would do again in a heartbeat if I were 30 years younger, because together with fellow campaigners you can achieve something you are proud of.

What is your most important message for people from all over the world who visit the WCC?
Even after disasters and strokes of fate, there must be people who give hope. You must not give up pursuing your goal. It also takes many supporters. Especially in difficult times, cohesion is important, taking responsibility for things because our future and that of the next generations is at stake.

What would you recommend to young people who are professionally involved in the development of the administration?
They have it in their hands to shape their environment – with their power and their knowledge. Young people need to get involved in politics to make a difference. It is an exciting task. Seize your chance!

Interview: Benedikt Baikousis

"The Leipzig Neuseenland Was the Largest Landscape Construction Site in Europe"

Until today, Walter Christian Steinbach is considered one of the fathers of the Leipzig Neuseenland, the post-mining landscape in the Leipzig region. In the following interview, he discusses, among other things, his special connection to the area and its current development.

WasserWirtschaft: What connected you professionally to the Leipzig Neuseenland?
Walter Christian Steinbach: Kurt Biedenkopf appointed me as District President in 1991. As a resident of the southern region of Leipzig, I was aware that one of my main challenges would be the transformation of the post-mining landscape. In 1991, this was already one of the main topics of my work. Since the 1950s, there has also been the topic of „Leipzig lake landscape" from GDR times, and I was always laughed at during my first lectures on the topic. The staff in my office recommended holding a regional conference, and we found very good partners for this. We announced an international team competition. The top 10 landscape architects in the world came to Leipzig. For example, Micheal Sorkin from New York, Benjamin Barber (advisor to Bill Clinton) and many more. We met with them in Espenhain in May 1994. Michael Sorkin was 100% convinced of a beautiful lake landscape. It was also a great conference in terms of atmosphere, which inspired and conceived the whole region.

What was your motivation to get involved in the development of the Leipziger Neuseenland in your work as an administrative and licensing authority? Why did you work so hard for the development and not just administer it?
From the very beginning, I saw the task of the Regional Council as a management authority. I have always tried to motivate our staff: We are the engine of Central Germany. When I became District President, there was a reorientation. I received harsh criticism for the fact that we acted as a management authority and not as a regional council.

What hopes did you associate with the area?
The Leipzig Neuseenland was one topic among many. There were several other urgent topics: infrastructure, urban development, development of the surrounding area etc. However, the Leipzig Neuseenland was the largest landscape construction site in Europe, so it was also the most difficult topic. Not only measured by the sheer size but also by the number of partners. All partners could often be united with a similar vision.

What were the biggest challenges and the biggest obstacles?
The biggest obstacles were the approval procedures. The most exciting hurdle for us was to involve all the partners and all the people.

What did you enjoy most during the time of change?
Working together with an unbelievable number of great people. The cooperation was an unbelievable learning effect and success for me.

How do you feel about the development of the Leipziger Neuseenland from your current external perspective?
On the one hand, I am grateful that we had this wonderful time and I was able to work with so many great people. It is a joint project. I like to think back on that. The theme itself is purposeful in that it produces goals itself. But at some point it is completed. It gets slower and slower towards the end, the interest, the commitment wanes. I observe that there are signs of fatigue both in the administration and in the management. I think that is a pity, which is why I welcome such a conference as the WCC. I never felt the loss of power. I was a bit relieved that I can now pursue my hobbies.

As people professionally involved in development, what do you recommend for the future in particular?
The most important thing is to have the courage to make an expert decision. The most important experts are the people concerned, so you have to be able to listen. And you have to put your heart into it.

What is your most important message for the people who visit the WCC?
We are all partners on the path to international understanding.

Interview: Benedikt Baikousis

Walter Christian Steinbach
born in 1944 in Zwenkau, is a German politician. He was a member of the Saxon state parliament from 1990 to 1991 and district president of Leipzig from 1991 to 2010. As a mathematics graduate from Leipzig University, he also worked for several years as a university lecturer and, after studying theology, he was a pastor in Rötha from 1975 to 1985. In 1988, Steinbach collected 100,000 signatures and 100,000 marks with the campaign „One Mark for Espenhain" against the environmental pollution caused by the mining of brown coal in the Leipzig area. This made the protest the largest unauthorised collection of signatures in the GDR. Mr Steinbach is considered one of the fathers of the Leipziger Neuseenland, the post-mining landscape in the Leipzig region.


© Armin Kühne

ATZ live

CONFERENCES FOR VEHICLE AND ENGINE SPECIALISTS

Learn more online now!

www.atzlive.com

If you have any questions we are at your service also by telephone:
Phone: +49 611 7878-131

Spotlight on Powertrain and Vehicle Engineering

Stay at the cutting edge!

- **Highly relevant technical papers presented by renowned speakers**
- **Networking in the international expert community**
- **Innovative products and services**

The automotive community has been regularly meeting at ATZlive events for over 20 years now. The conferences are the ideal platform for going into depth, taking part in discussions and making contacts away from "day-to-day business".

Forward-looking conferences from the fields of

- Internal combustion engines and innovative fuels
- Electrified powertrains
- Complete vehicle
- Chassis technologies
- Vehicle acoustics
- Mobility and vehicle concepts
- Autonomous and automated driving

The Media

ATZ WORLDWIDE MTZ WORLDWIDE ATZ electronics WORLDWIDE ATZ heavyduty WORLDWIDE

Imprint

WasserWirtschaft Extra
Ausgabe S1 | 2022, 112. Jahrgang
ISSN (Print) 0043 0978 | ISSN (Online) 2192-8762
www.springerprofessional.de/wawi

Publishing House:
Springer Vieweg | Springer Fachmedien Wiesbaden GmbH
Abraham-Lincoln-Str. 46 | D-65189 Wiesbaden

Managing Directors:
Stefanie Burgmaier, Andreas Funk, Joachim Krieger

Editorial Staff:
Editor: Florian Bischof (FB) |
E-Mail: florian.bischof@springernature.com

Freelance editor-in-chief (responsible for editorial content):
Prof. Dr.-Ing. Stephan Heimerl (SH)
E-Mail: Stephan@Heimerl.net | Tel +49 (0)163 / 8995737
Meuschenmühle 1 | D-73553 Alfdorf

Freelance Editors:
Benedikt Baikousis (BAI)
E-Mail: wasserwirtschaft@baikousis.de

Contentmanagement:
Carolin Wolfram
E-Mail: carolin.wolfram@springernature.com

Advertising and Production:

Head of Media Sales: Volker Hesedenz

Director Production: Ulrike Drechsler

Sales Management (responsible for advertising):
Ingo Rosenstock
Tel.: +49 611 / 7878-146
E-Mail: ingo.rosenstock@springernature.com

Display Ad Manager: Sandra Reisinger
Tel.: +49 611 / 7878-174
E-Mail: sandra.reisinger@springer.com

Ad Prices: Advertising ratecard from October 2021.

Head of Distribution + Marketing: Jens Fischer

Product Management: Melanie Engelhard-Gökalp (EGH)
Tel.: +49(0)611 / 7878-315
E-Mail: Melanie.Engelhard-Goekalp@springer.com

Production: Anette Reichel

Unless explicitly stated otherwise, all specified persons can be contacted by post at the publisher's address.

Offprint:
Anja Trabusch | E-Mail: anja.trabusch@springer.com
Tel.: +49 (0)611 / 7878-298

Reader Service:
Springer Nature Customer Service Center GmbH
Springer Vieweg Service
Tiergartenstraße 15, 69121 Heidelberg
Tel: +49 6221/345-4303 | Fax: +49 6221/345-4229
Montag - Freitag | 8.00-18.00 Uhr
springervieweg-service@springer.com

Printery:
Wilco B.V., Vanadiumweg 9, 3812 PX Amersfoort, Niederlande

Information for Authors:

Detailed information on a publication in WasserWirtschaft can be found in the author's guidelines at

www.springerprofessional.de/wawi

All manuscripts must be sent to the editorial office. By sending in photographs and drawings, the sender releases the publisher from claims of third parties. Basically only such works will be accepted which have not previously been published in Germany or abroad. The manuscripts may not be offered to other sheets for printing at the same time. Contributions identified by name do not always reflect the opinion of the editorial staff.

The articles of WasserWirtschaft can be found in the following abstract and citation databases and online portals:

Science Citation Index Expanded (SciSearch), Journal Citation Reports / Science Edition, SCOPUS, Google Scholar, CSA, ProQuest, CAB International, ASFA, CAB Abstracts, Geobase, GeoRef, Global Health, INIS Atomindex, International Bibliography of Book Reviews (IBR), International Bibliography of Periodical Literature (IBZ), International Construction Database (ICONDA), OCLC, SCImago, Summon by ProQuest, www.ask-eu.de, www.springerprofessional.de.

Affiliations:

- German Commission On Lage Dams (DTK), www.talsperrenkomitee.de
- Hydropower Interest Group Baden-Wuerttemberg e. V., www.ig-wasserkraft.de
- Hydropower Association of Central Germany e. V., www.wasserkraftverband.de
- Working Committee of Alpine Hydropower (AGAW), www.alpine-wasserkraft.com
- Association for Water Management Baden-Wuerttemberg e. V. (WBW), www.wbw-ev.de
- German Water-historic Community (DWhG), www.dwhg.org
- Ruhrverband, www.ruhrverband.de
- Society for Further Education in Water Management e. V. (GWW), www.wbbau.uni-hannover.de
- Arbeitsgemeinschaft Wasserkraftwerke Nordrhein-Westfalen e. V. (AGW NRW), www.wasserkraftwerke-nrw.de
- Interessengemeinschaft Wassernutzung NRW (IGW NRW),www.igw-nrw.de

Ordering Options: Wasserwirtschaft has 12 issues per year, published as 10 single issues and 2 double issues. In addition, selected special issues are published. Ordering options and details in the subscription conditions can be found at www.mein-fachwissen.de/WAWI

Version of Record:

The printed and the electronic version of a publication may differ. For the actual version of record, please always check the online version at www.springerprofessional.de/wasserwirtschaft/3415344

POLISH YOUR KNOWLEDGE

WITH IST – International Surface Technology

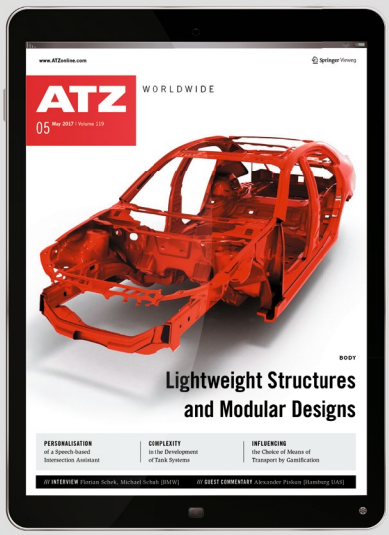
Success requires going beneath the surface. Enhance your industry knowledge with Germany's leading magazine for surface technology. International Surface Technology (IST), the "Best of JOT" in English takes you layer-by-layer, with articles that are practical and user-oriented. Read 4 issues per year and also receive the digital edition, plus free access to the online archive featuring expert articles.

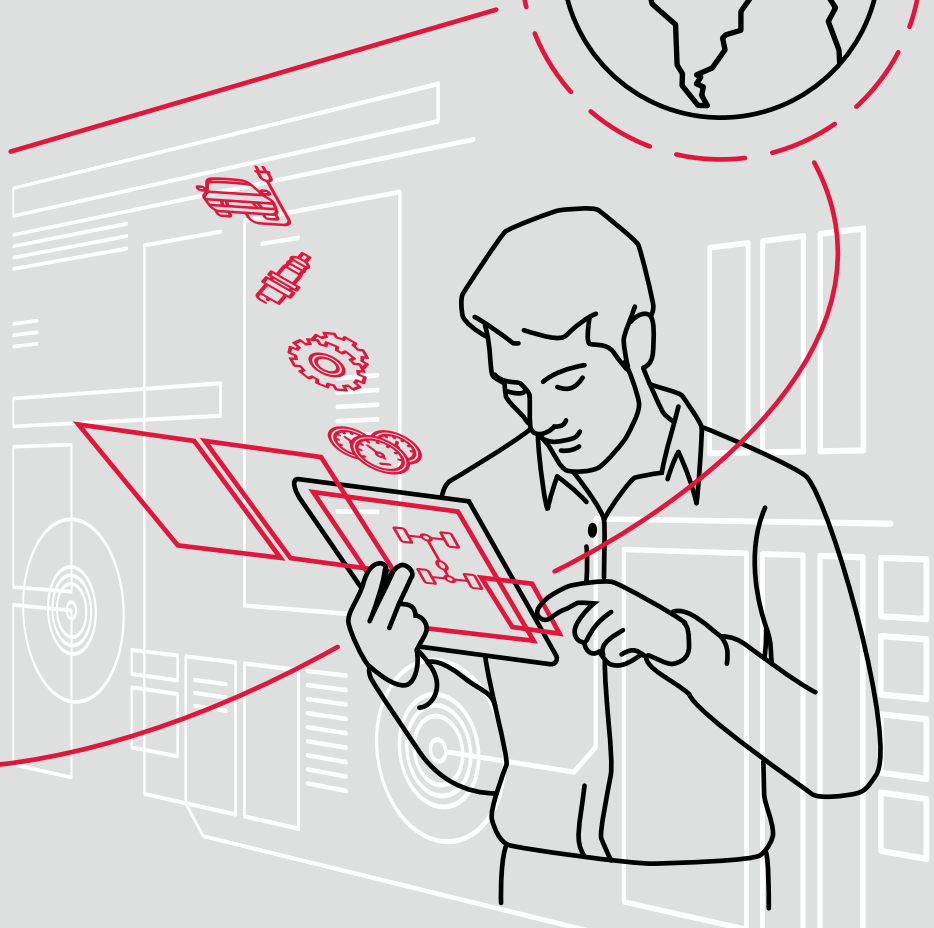
Discover even more at: *www.my-specialized-knowledge.com/ist*

IST

ATZ WORLDWIDE

THE TALK OF THE AUTO INDUSTRY: ATZ eMAGAZINE IN ENGLISH





GO FOR A FREE TEST DRIVE ATZ-MAGAZINE.COM