Georg **Hermannsdorfer**

Restoration
of Running Waters

PRACTICAL HANDBOOK for Natural Construction Methods

PATZER VERLAG
Berlin-Hannover

Synopsis

Prefaces

Preface by Prof. Dr. Florin Florineth

University of Natural Resources and Applied Life Sciences Vienna; **Institute of Soil Bioengineering and Landscape Construction;** Author of the book "Plants instead of Concrete", published by Patzer in 2012.

Georg Hermannsdorfer has dedicated his life's work to the preservation and enhancement of aquatic habitats in flowing water bodies. He has successfully implemented his focus in the restoration of numerous flowing waters, and in this handbook, he provides a detailed account of the necessary steps for their restoration, accompanied by numerous pictures of his successful measures. The text and pictures serve as a comprehensive guide and instructional tool for anyone working on watercourses, simplifying the process of renaturation and watercourse design. This handbook is an invaluable resource for all those interested in water.

Vienna, 30.01.2020
University Professor Dr. Florin Florineth

Foreword by Prof. Dr. Frieder Luz,

Weihenstephan-Triesdorf University of Applied Sciences, Faculty of Landscape Architecture.

The practical handbook by Georg Hermannsdorfer, based on over 30 years of professional experience and daily construction site practice, comes at just the right time! The need to give preference to natural construction and landscaping measures on watercourses over so-called "harsh" construction methods is more current than ever. The keywords "climate change" and "biodiversity" address two fundamental challenges for all those working in landscape construction: the increase in floods already apparent as a result of climate change is placing an increasing burden on the riverbanks and will continue to require numerous securing and restoration measures in the future. The tried-and-tested Water-and Soil Bioengineering construction methods described in the handbook have a clear advantage here. As a result, many flowing waters that are not in their natural state are being transformed into a better ecological condition.

All in all, the spectrum of requirements and measures in living structures has changed and expanded considerably during Hermannsdorfer's professional career: from pure protection to the initiation of dynamics and the creation of structures and habitats. Both of these major areas of work are covered extensively in the handbook – clearly described, illustrated, and explained down to the most calculable detail. And here, another very urgent issue must be addressed, which is why the handbook has come at just the right time: the importance of near-natural biological engineering methods in hydraulic engineering is declining drastically in the region! It seems to be much easier for more and more young engineers to dump tons of stones at water bodies than to work sensitively with willows and geotextiles. Many offices and authorities simply lack the knowledge and courage to create such masterful living structures as those presented to us here.
It is therefore worth recalling here that Hermannsdorfer's first technical publication in 1991 in "Die Flussmeister" had the provocative title " End of the Stone Age", shortly followed by "The Living Construction Returns". It almost seems as if his handbook at the end of his professional career contains the urgent message: "No return to the Stone Age, keep the living construction alive!" The many examples and field reports prove that it really works, especially to secure and enhance the small streams, the ditches and streams without or with few stones. The contents of the book are up-to-date with the latest developments and discussions in the field, as can be seen from the table of contents, but the book also includes examples of stone structures and control structures on larger watercourses. As a true handbook for practitioners, it is written without flourishes or academic headiness and is aimed directly at all those who work on watercourses – they will find numerous suggestions and useful tips here, organized by topic. Experienced experts will be able to clarify detailed questions, and motivated experts will find arguments, courage, support, and answers to many technical questions in order to convince doubters and skeptics.
In the same way, members of environmental associations, waterway neighborhoods, landscape conservation associations, and all those who feel that they are not being looked after enough by the authorities at small streams water bodies will find valuable instructions for sustainable ecological conversion and near-natural protection measures at third-order water bodies. Anyone who has had the privilege of seeing Georg Hermannsdorfer in action, in meetings, on construction sites, or with his waders in the water, working with construction workers, farmers, or lecturing to my students, knows the commitment and enthusiasm with which the examples in this book became reality. Even adverse circumstances, headwinds from many directions and even seemingly irredeemably ill-constructed watercourses without land reserves could not prevent him from restoring them to their natural state. A quote from the book sums up this exemplary philosophy of work and life: "You have to try to get the maximum out of a minimum of margin." There is nothing left to add. He deserves thanks for this valuable farewell gift for the practice, which shall be inspired by it as long as possible. As he transitions to retirement, I wish him many more healthy years full of movement, and I hope his handbook will have a wide distribution.

Freising the 10.01.2020
Prof. Dr. Frieder Luz

2 Streams and ditches

Small watercourses

The following section is covered in great detail to provide practical instructions for those responsible for maintenance, such as communes, water management offices, or nature conservation authorities

Streams and ditches are classified in this book as small streams, followed by the small rivers and the major rivers. Small streams are discussed first because they form a far larger and more extensive network than our large rivers, such as the Danube, Elbe, and Rhine. For example, in the federal state of Bavaria, streams and ditches cover the vast majority of the approximately 100,000 km of running water, totaling approximately 92,000 km (source: website of the Bavarian State Office for Environment). Like the capillary network in our body, streams and ditches run through our landscape.

Maintenance involves reoccurring measures that ensure the seamless functioning of these water bodies. In the past, the communes in Bavaria were intensively supervised by the water management offices, including construction supervision. However, in the meantime, the number of specialized personnel has been reduced. Today, there is only limited consultation available on request. Unfortunately, this is of little help to the communes as most of them lack their own specialist staff and experience for these tasks. This is why ecological and nature conservation maintenance is in a poor state. Even if a watercourse development plan is available, it is of little help as it does not clarify detailed questions for practical implementation, such as how to secure riparian strips in a natural way, how to create riparian strips, how to manage riparian wood strips, and when to intervene and when not to. There is almost no infrastructure for near-natural watercourse maintenance (see Chapter 2.12), which means there is a lack of suitable companies that know how to create near-natural riparian protection. As a rule, these problems are solved by digging and civil engineering companies by securing a bank with a load of stones. However, this does not solve the actual problem, but only shifts it downstream. In the long term, this leads to a complete stoning of the banks, which is far from a natural solution.

2.1

Problems, deficits and conflicts

This book does not address water discharge problems related to hydroelectric power generation or residual water problems. For issues with passability and bottom collapses, please refer to Chapter 3, "small rivers." The problems that have led to the current state of our streams and ditches are diverse, but almost all have two underlying causes: insufficient space and excessive nutrient input. Streams require adequate space for development and clean water. If either of these two fundamentals is missing, the stream deteriorates into a runoff. According to § 39 of the German Water Resources Act (WHG), the maintenance of surface waters is a public obligation. This includes the protection of riparian banks through the maintenance and replanting of appropriate riparian vegetation, the preservation and promotion of the ecological functionality of the watercourse as a habitat for wildlife and plants, the maintenance of natural balance performance and functionality, and the consideration of the water landscape's image and recreational value.
Unfortunately, the reality looks very different to that.

EXAMPLES

Building all the way

to the shore ranks first among the problems, as it creates the worst possible conditions for decades to come. Unfortunately, it's still happening due to planning errors. To prevent this, marginal strips must be designated in the land utilization and development plans, and enforced on all property developers. Without sufficiently wide marginal strips, the ecological requirements of the Water Resources Act § 39 for watercourse maintenance and the watercourse development plan remain wishful thinking, because there is no space for near-natural shoreline design and riparian vegetation. This is particularly problematic if the riverbanks are in private hands. In such cases, communes face serious difficulties, as they must prioritize sustainability and forward thinking instead of short-term profit.

1 **The stream as a hostile element**
Building plots are often filled up to the stream and then protected with armoring stones or wooden planks. Unfortunately, many property owners have little knowledge about the ecology of streams.

2 **Seemingly the riverbanks must look groomed**
The picture is dominated by straight lines and the service road. The stream is lined with stones on both sides, and the slopes are neatly trimmed. Vegetation is only allowed on one side of the upper edge of the bank.

3 **Riverbank protection?**
Apparently every centimeter counts.


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4 **Concrete lined chanel**
The stream and floodplain system is reduced to the removal of water. Biological functions cannot take effect.

5 **Rock-lined channel**
Looks only better, but ecologically no different from the above concrete shell channel.

6 **Cultivation up to the banks**
The stream is only visible from up close. Intensive grassland cultivation up to the foot of the bank. Dung input into the water is guaranteed here.

7 **Pasture up to the bank**
In principle, pasture grazing is positive from the point of view of nature conservation. But this pasture fence is clearly too close to the bank. As a result, the roots of the riparian trees are damaged to the point of death and vegetation sods are trampled off.


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8a **Lack of riparian vegetation**
Up until the 1980s, riparian vegetation was often removed, supported by the state through land consolidation, leaving the banks unprotected and unable to resist the energy of the water. Valuable arable land ends up in the Black Sea.

8b **Remaining trees**
This is not a special type of willow that grows spur-like into the water. The willows indicate the former shoreline. The original shoreline has already been eroded away due to the absence of a closed riparian forest (note the arrows), caused by the removal of trees. The remaining trees that still resist erosion are increasingly being washed away and will fall into the water.

9 **Channelization**
Channelization is causing the stream to gradually disappear from the landscape, along with its habitat functions for plants, animals, and humans.

10 **The theory doesn't hold up**
Piping in the upper reaches facilitates cultivation and creates more production areas, but the cost is paid downstream. During heavy rains, the water shoots out of the pipe unchecked, leading to severe erosion of the streambed in the lower reaches.


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11 **Bank protection with** armoring stones The first step in this process involves clearing the banks of trees and shrubs, followed by the erosion of the banks. In this case, the solution is to use armoring stones as a form of erosion protection which unfortunately is not effective in a ecological sense. This method destroys the riparian strips, which is an armoring network out of tree-, weed- and perennials roots.

FOTOSERIES **Increase in surface runoff**

12 **watersheds/ river basins**
Open, unprotected arable soils (without vegetation in winter) and/or sealing of surfaces due to development in the watershed increase surface runoff

13 **Details**
Soil cannot absorb water during rainfall events.

14 **The stream in the lower section**
Increased surface runoff in erosion-prone gorge ditches can cause severe lateral and deep erosion, affecting the lower sections of the stream.

Nutrient Inputs

The problem of nutrient inputs from wastewater treatment plants, especially phosphate inputs, in Germany is nowadays mostly under control. Our wastewater treatment plants operate according to state-of-the-art standards with a very high degree of purification.

However, the real problem today is the nutrient and topsoil inputs from agriculture, whether through drainage systems or improper management. These inputs can be prevented by addressing issues such as:

- leaky silos
- improperly operated field storage facilities
- silos without collection containers or poor maintenance
- slurry and solid manure or dung spreading right up to the stream bank
- spreading of farm manure on a closed snow cover.

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15 **Topsoil erosion**
Topsoil erosion: Valuable arable soil, including nutrients, is washed away and ends up where it should never be, namely in the stream. Considering that it takes at least 100 years for a layer of soil about 1 cm thick to form from the rock, it would be in the interest of agriculture and all of us to minimize this problem as quickly as possible.

16 **Even with the most modern technology, you can work like yesterday**
Manure spreading right up to the bank – using modern drag hoses won't help either if there is no understanding.

17 **Solid manure**
Solid manure exposed in the open without cover. Nutrients are washed out, reducing the quality of the manure pile and polluting the environment.

18 **Silage effluent**
Leaking silage bales create deep brown effluent – a concentrated nutrient source.

19 **Farming up to the banks of the stream**
Farming up to the edge of the stream is not considered good agricultural practice, yet it remains a common practice. Since August 1 2019 it is prohibited in Bavaria

20 **Drainages**
The subsurface conditions cannot be easily identified on site or from aerial photographs. In some cases, the subsurface is artificially drained (indicated by red lines). Nutrient leakage from silage effluent, solid manure pits, biogas plants, or excessive fertilizer application can end up in the nearest stream via the drainage channels and, depending on the subsurface conditions, may also contaminate groundwater.


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FOTOSERIES

21 **Leaking effluents from the silo system run into the gully.**
(Note: Silo plant not visible in the picture.) The gully does not lead to a catch basin as it should, but into a piped ditch. This results in the dumping of valuable nutrients and the wastage of resources.

22 **From the gully to the drain.**
Nutrient-loaden water flows into the stream at the end of the pipe. The “Sphaerotilus”-bacterium (indicated by the red arrow) signifies a high organic load

23 **From the drainage pipe into the stream.**
In the end, it is always a stream or lake that has to cope with this pollution. For this to change, everyone needs to take responsibility, not just the farmer. Quality of life is not just about the everyday 23-inch cutlet on our plate.

24 **Road drains serve as sources of nutrients.**
Road runoff typically flows into the nearest ditch or stream.

Solutions

In the following chapters, particularly in chapter 2.4 "Natural Protection Methods," solutions will be presented. These solutions refer to the problems highlighted that can be addressed using Water-and Soil Bioengineering methods and with the help of riparian strips, succession, and planting.

The problem of nutrient inputs, as illustrated above, can be improved to a limited extent by riparian strips, and not at all in the case of drainage areas and unauthorized direct discharges. The causes can be traced back to agriculture, agricultural policy, agricultural authorities, the responsible regulatory bodies, and, last but not least, politics. It is upon them to come up with solutions for these problems.

The issue of building right up to the shore can also only be resolved through appropriate political guidelines, modern land use and development planning that takes the Water Resources Act into account, and the strengthening of regulatory bodies.

Laws are only as good as their enforcement.
Laws and regulations without consistent controls with noticeable consequences are worthless pieces of paper.

2.2

To learn from nature

Before beginning any planning, it is advisable to examine a reasonably natural section of a stream or a comparable near-natural stream in the vicinity. This will be more useful than a quick internet search for examples of restoration projects. Nature can provide guidance on how to protect the stream bed and banks from incipient erosion, and what a successful planting should look like. Observations of natural systems can serve as examples for watercourse restoration and engineering-biological measures

1 **Natural streambed with riparian vegetation and gravel bed in balance**
A stable balance has been established between the width of the watercourse, the stress on the riverbed, the gravel bed, and the riparian vegetation in this natural streambed. The size of the river pebbles is sufficient for the riverbed stabilization, and a natural riverbed has formed. Given this, it asks the question of why armoring stones with an edge length of one meter should be used to protect the bank or prevent deepening in comparable sections. This approach would only address the effects rather than the causes, which are typically the result of ill-considered interventions such as gravel extraction in the upper reaches, streambed narrowing, and clearing of riparian woodland.

2a+2b **Willows stabilize the shore**
Who would plant like this? As a landscaper or forestry worker, you learn it differently. But nature does it this way and it works. As the floodwaters recede, if the floodwaters and seed flight of willow trees match, seeds wash up along the shoreline fringe. The willows germinate close together with closely interlocked root systems and push each other upward, shielding each other from weed.