Restoring Europe's Rivers

RESTORE Events: Reporting

Sector specific event on hydropower, round 2: Germany–Switzerland

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Event Details

The North Region's sector specific event number 2, round 2 was focused on hydropower and made participants aware of enhancing morphodynamics and about good practices of functioning fish passages, compensative habitats in bypasses and environmental flows. The event was held in Germany and Switzerland in May 2013. The event consisted of lectures, site visits and discussions among key RR persons and hydropower producers. The event is action C3 in the bid. The first part of the event in Munich was organized together with RESTORE West Region.

Key Issues from the Event

Key issue of the event was to see solutions how to enhance ecology of fish and other organism in rivers with intensive hydropower production and regulation against flooding. The main focus was restoration on morphological processes, nature-like bypass channels and environmental flow.

In terms of RESTORE, our key issues were:

- To see restoration cases, where erosion and sedimentation processes can be allowed in rivers with multiple use for recreation
- To discuss with key RR persons and hydropower producers how environmental flow and nature-like bypass channels could be taken more into consideration in regulated rivers.
- To get acquainted key RR persons and hydropower producers for post-RESTORE cooperation.
- To find out more about German and Swiss river restoration cases, with an aim for these to be uploaded on to the River Wiki.
- To promote RESTORE products, such as www-pages and wiki-database.

Key Outcomes

During the event we got a comprehensive picture of how in Germany and Switzerland the contradiction between hydropower production and organisms' pass-through have been resolved. As expected, the selected sites were model examples of how the negative effect of hydropower production can be reduced.

Germany

In River Isar, many river restoration projects have been done mainly with the focus on flood protection. During our excursion in Bavaria we visited 3 sites at the River Isar, Mühltal in the upper Isar, a section in the city of Munich, and Hangenham near Freising. Our guides were Walter Binder, the former leading river restoration expert in the Bavarian environment authorities and Nivedita Mahida and Matthias Junge from the Bavarian State Office for Water Management Munich.

Mühltal is located in the upper part of the River Isar. This is the place where the whole Isar restoration project started. Compared with the section at the city of Munich, the Isar has here had originally a more alpine character because of a bigger gradient. Before the river was regulated, the river had a braided structure with side channels, changing their course during floods, and with wetlands in the drier seasons. Through regulation and leading most of the discharge into power plants, the river course was fixed into one large river bed, without any small side streams. The idea of restoration was to return the natural characteristics of the river. The minimum flow to the old river bed was increased from 5 m^3/s to 12-18 m^3/s (design flow 20 m^3/s). Also bigger floods can affect the morphology, which happened right after the restoration. The bank revetments were partly demolished, to allow natural erosion. Nowadays the river is in this section in a nature-like condition with eroded banks, accumulating gravel bars, ponds in the flood plain. Big tree trunks fall from the banks and are floating and settling down in the river bed and flood plain.

Figures 1 and 2. Mühltal with the flood plain, erosion processes and tree trunks

Isar Plan is a river restoration project in the City of Munich. Even though River Isar flows through the City of Munich, massive restorations have been made successfully to enhance ecological and fluvial processes and to improve fish access. The minimum discharge in the river was raised from 5 m^3/s to 15 m^3/s and they are still trying to increase the amount. The flood plane was lowered to allow more frequent flooding. A new core was installed into the flood embankments to ensure safety of the city against floods. The flood plain is now used for recreation by the residents of Munich city.

Figures 3 and 4. Isar Plan - river restoration project in the city of Munich, with the flood plain restored for recreation

At the Flaucha nature-like bypass channel the old weir was rebuilt so that the fish can go pass them. There is no fixed minimum flow but in practice the discharge does not fall below 4 m^3/s. The discharge is decided mainly based on the needs of the fish species. Sediments like gravel can partly change the flow and create habitats into the bypass.

Figure 5. The Flaucha bypass channel with sediment accumulation

We also visited the Hangenham restoration site in Freising, about 30 km downstream from Munich. Here the River Isar has a more quiet character with lower gradient. The flood plain was partly remodelled even if the floods cannot reform the floodplain as much as in the upper reaches. Through increased minimum flow and partly removed revetments, new diversity in the river bed could be seen.

Figure 6. The restored floodplain of the River Isar at Hangenham

River Rhine along the border of Germany and Switzerland

The second part of the event was organized in the valley of River Rhine in Germany and in Switzerland. The course of the River Rhine between Germany and Switzerland is cut with several power plant dams. There is not yet a free migration route for the Rhine salmon between Strasbourg and Basel but above Basel several fish passes and bypass channels have been accomplished to restore the conditions for local fish. At the main stem of River Rhine we saw hydropower plants Rheinfelden, Wyhlen, Ryburg-Schwörstadt and Albbruck-Dogern. Luckily we were able to get a

lecture and guidance of the power plant sites by Dr. Dipl. Ing. Rolf-Jürgen Gebler, the designer of the fish passes and compensation habitats of these sites.

Albruck/Dogern

The power plant Albruck/Dogern consist of two power plants, a bigger one at a headrace channel diverting water from the main stem (1000 m3/s) and a new smaller one (300 m3/s) at the diversion dam, leading water to the old channel section. Both power plants have a bypass channel with additional fish passes. The new bypass at the diversion dam is designed with a gentle sloped gradient 0,8 % to create compensative habitats. They have been demanded to compenstate the loss of biotopes caused by the powerplants, according to German and Swiss legislation. Compensative habitats are in these countries required with all kinds of construction projects. The bypass had a structure which is used in the design of all reproduction channels we saw: the channel is devided in two parallel sides or separate channels, one mainly of gravel for spawning and one with rock structures, enabling migration of big fish. At the downstream end the water is diverted into two arms. A rock cascade leads further downstream and a vertical slot fish way turns with bends near to the dam.

Figures 7 and 8. The bypass channel with a low gradient and two structure types (rock structure to the left, spawning gravel to the right), is lead through a rock cascade and a diversion to a vertical slot fish way

Rheinfelden

Rheinfelden, accomplished in 2012 is the newest example of comprehensive restoration measures which are nowadays demanded for new power plant permits in Germany and Switzerland. Rheinfelden has the largest fish pass facility of its type in Central Europe (1). In connection with the renewal of the power plant Rheinfelden, a 900 m long and 60 m wide bypass channel is constructed as migration route and a compensative spawning habitat to the German side of the river, in the place of the former power plant headrace channel. A constant discharge of 10 m^3/s is lead to this new river course as environmental flow. Additionally, a discharge up to 25 m^3/s can be lead, in order to provide a dynamic flow regime and effect of flushing of the spawning habitats. A discharge of 10 m^3/s is lead through the flood gates into the main channel, purely for landscape reasons.

To ensure fish to find the bypass channel, which has an entrance far downstream from the dam, an additional pool type rock cascade fish pass, made of natural stone, is lead from the bypass near to the dam. The fish can use the upper section of the bypass channel to swim further upstream or they

can descend to spawn or use in the bypass channel as their habitat. The third migration route for the fish is a vertical slot fish way, made of concrete, at the Swiss bank of the river, near to the new power plant. The bottom of the fish way was covered with natural stone, enabling reduced velocities for weak swimming fish near to the bottom.

Figures 6. and 7. At the Rheinfelden power plant (left in the back) there is a bypass channel with largest compensative spawning areas in Central Europe

Figure 8. A rock-cascade fish pass ensures fish to find the bypass channel

Switzerland

In Switzerland all rivers are regulated. Due to Switzerland is not part of the European Union, Water Framework Directive (WFD) is not binding there, but the legislation is corresponding or even more demanding for measures to reduce impacts of hydropower. The Swiss federal level Water Protection Law (GSchG 1991) demands a minimum flow discharge which has to be maintained in the river when it is used for hydropower production (3).

In Switzerland the Federal Act on River Engineering of 1991 and its associated decree of 1999 have prepared the ground for moving toward preventative and sustainable flood protection. Additionally the Floodplain Decree of 1992 in the conservation of floodplains of national importance stipulates

that remaining floodplain areas must be preserved in an undiminished condition and that natural dynamics of bedload and water regime must be restored (4).

In Switzerland we saw 3 river restoration sites nearby hydropower plants: Ruppoldingen and Ruppereswil at River Aare and Wettingen at River Limmat, which are both tributaries of the River Rhine. Mr. Urs Hoffstetter from the power company Alpiq was our guide in Ruppoldingen and Mr. Bruno Schelbert in Rupperswil.

Ruppoldingen

Ruppoldingen in the River Aare is a good example of a combination of a long bypass channel with reproduction habitats and a fish pass near to the power plant. The bypass was constructed in 2001 during the renewal of the power plant at the place of the old headrace channel. The planning and construction of the bypass at Ruppoldingen served as the first example to gain experience for similar constuctions in other power plants and especially for the large facilities in Rheinfelden.

In Ruppoldingen, the aim was to design a small river create habitats for the fish that are typical for the area. The length of the bypass is 1,2 km and mean gradient 0,5%. 2-5 m^3/s is lead to the bypass channel as environmental flow. A rock cascade fish pass connects the bypass to the power plant. According to monitoring, juveniles of greyling have been found in the bypass channel and big fish species like pike and wells catfish have used it (2).

By the measures at Ruppoldingen the power company Alpiq has got the Naturemade Star - certification which is considered to be the most demanding Green Electricity Certification for hydropower.

Figures 2 and 5. Ruppoldingen bypass channel with several kinds of compensative habitats enables the power plant to have the Naturemade Star certification


Figures 6. and 7. A part of the water is diverted into a rock cascade which leads to the power plant

Rupperswil

Mr. Schelbert presented the river restorations done near power plant Rupperswill in River Aare. The bypass channel at the power plant Rupperswil, downstream from Ruppoldingen, was constructed in 2006 with same principles as Ruppoldingen, to enable migration but also new habitats for fish and invertebrates. The minimum discharge of the bypass is 2 m^3/s, but the structure at the inlet of the bypass rises the discharge automatically up to 4 m^3/s when the flow in the River Aare is bigger. Thus in some extent a natural type of discharge variation can be provided in the bypass channel.

A fish monitoring device can be installed at the upper end of the bypass. A vertical slot fish way with a window viewing possibility diverts a part of the water from the bypass to the dam.

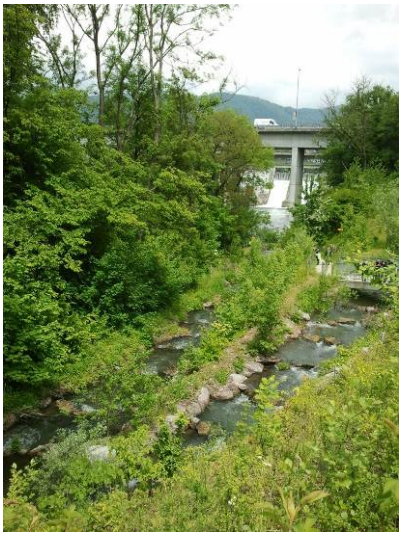
In the river section beneath the power plant we saw a restoration site with a new excavated side channel of River Aare.


Figures 8.and 9. The discharge into the Wettingen bypass can vary between 2 to 4 m3/s according to the discharges in River Aare

Wettingen

Bypass channel at the power plant Wettingen is located at the River Limmat which flows from the lake of Zurich. In Wettingen, total difference of water levels is as high as 18,30 m. It is a great example on how to build functioning bypass channel with the limited space. The channel is terraced in the steep slope partly behind a concrete wall, but the structures are of natural stone. The

entrance is divided to a vertical slot fish way to the dam and to a narrow concrete channel which has a nature-like bottom with natural stone, aimed for weak swimming fish.



Figures 10. and 11. Bypass channel at the Wettingen Power plant, constructed in a steep slope on the River Limmat. The channel is terraced partly with a concrete wall (back in Figure 11) and is divided into two entrances.

Figures 12 an 13. A trout was noticed staying near the bridge in the Wettingen bypass. The upper part of the bypass is designed to be a habitat with low gradient.

Key outcomes for RESTORE:

In Switzerland, the most important thing was to see and hear about the planning principles of reproduction channels, which were constructed to compensate the loss of natural spawning and rearing habitats. Nature-like bypass channels also serve as migration routes and they have many advantages compared to technical fish ways: besides up-migrating fish, they are suitable for bottom fauna, eels and down-migrating fish as well. Nature-like bypass channels are also valuable for landscape. Also the technical fish ways which we saw were constructed for weak swimming species and bottom fauna by covering the bottom with natural stone.

Attendance

There were 30 people attending the event in Germany and 23 people the event in Switzerland. The sectors represented by the participants were: water managers, river basin planners and practitioners (universities, research institutes and NGO's) and stakeholders.

Support for Restoration Practices

We were able to discuss about the common river restoration problems in regulated rivers. The examples in Bavaria showed possibilities for enhancing morphological processes and the importance of environmental flows in a regulated river. At the Rhine the main focus was on hydropower and nature-like bypass channels with compensative reproduction habitats. During the event the participants saw many good river restoration sites where the negative impacts of hydropower production had been.

Building on Network Capacity

During the event river restoration experts from Germany, Norway, Britain, Romania, France, Estonia, Belgium, Sweden, Poland, Switzerland and Finland were able to get acquainted. New connections for further cooperation and knowledge sharing was made possible, to solve similar problems in different countries.

Promoting Effective Knowledge Transfer

The event was a great advertisement of River Wiki, RESTORE Project and the 5th European River Restoration Conference. We gained many good case studies from Germany and Switzerland for the River Wiki.

Dissemination of Event Outcomes

We have written an article about the event focusing on by-pass channels for the RESTORE Bulletin (June) and we will write an article to the Finnish magazine called Suomen Kalastuslehti (Finnish Fishing Magazine) later this year.

All the sites visited during the event were described. Suitable ones will be uploaded into the River Wiki.

Follow Up

A questionnaire of the event was taken during Germany excursion and Switzerland excursion. We received 19 responses. According to the answers all the participants enjoyed the event and the numerous site visits. Each participant learned something new about river restoration and got ideas how to make RR solutions in their own countries as well.

The follow up will be continued via personal contacts. The event was advertised by e-mail to key organisations in all member countries of the North Region before the event and afterwards a description was written to the RESTORE Newsletter.

References

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3. Rohde, S. 2004. River Restoration: Potential and limitations to re-establish riparian landscapes. Assessment & Planning. http://www.rhone-thur.eawag.ch/Diss_Rohde.pdf

4. Schelbert, B. 2008. River restoration in Switzerland, with illustrations from the Canton of Aargau. The 4th International Workshop on River Environment, Seoul, Korea.

Attached

1. Lists of participants
2. Event Program