

# Bio-engineering techniques for bank protection on the Moselle River in Villey-le-Sec

## The operation

Project owner	Voies navigables de France (VNF) (French waterways)
Category	Improvement of waterways
Type of operation	Bio-engineering techniques for river-bank protection
Type of environment	Lowland rivers
Issues at stake (water, biodiversity, climate)	Good status of habitats

Start of operationx	September 2011
End of operation	December 2011
Length of river affected by the works	1,000 m

## River in the restored sector

Name	Moselle River
Distance to source	150 km
Mean width	130 m
Mean flow rate	63.40 m <sup>3</sup> /s

## Aims of the project owner

- Restore lateral continuity to enable the passage of aquatic and terrestrial species.
- Participate in achieving good ecological potential of the water body by implementing the programme of measures prescribed by the Rhin-Meuse RBMP (river-basin management plan).

## Environment and pressures

The Moselle River is almost 650 kilometres long and has its source at the Bussang pass in the Vosges mountains. From the source to the Luxembourg border, it covers 314 km and then continues to the Rhine at Koblenz in Germany.

In the 1800s, groynes were installed and the Moselle was already used for navigation by small ships. In the upstream section, sand and gravel mining in the riverbed took place during the 1900s.

Then in the 1960s and 1970s, certain sections were modified and channelised for large ships. Today, ships up to 3,000 metric tons can travel up the river as far as Neuves-Maisons, near Nancy. At the time, the purpose of this

## The location

Country	France
River basin	Rhin-Meuse
Region(s)	Lorraine
Département(s)	Meurthe-et-Moselle
Commune(s)	Villey-le-Sec



Collapse of sheet piles along 80 metres of the Moselle River. August 2008.

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Regulatory context	Not applicable
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## European directive references

Water-body ref.:	CR212
Natura 2000 site ref.:	FR4100178

work was to increase trade in steel and coal between France, Luxembourg and Germany.

Approximately 800 large merchant ships and 700 pleasure craft navigate on the river each year.

In the sector near Villey-le-Sec are a sensitive natural zone and a Type-1 ZNIEFF (high-value ecological zone) that were factors in the establishment of the "Moselle valley from Fond de Monvaux to the Deuille valley" Natura 2000 zone. The presence of beaver in the area has been confirmed.

In addition, the sector has been listed as a priority in the Rhin-Meuse RBMP for the hydromorphological programme of measures. The RBMP recommends improving the ecological parameters, notably by restoring connections with side channels and improving lateral exchanges.

The river flows in a valley that has fairly steep sides and is heavily wooded. There are few connected wetlands and few opportunities for the river to overflow. The lateral obstacles and the fixed position of the riverbed are reinforced by the civil works carried out, namely channelisation and bank protection.

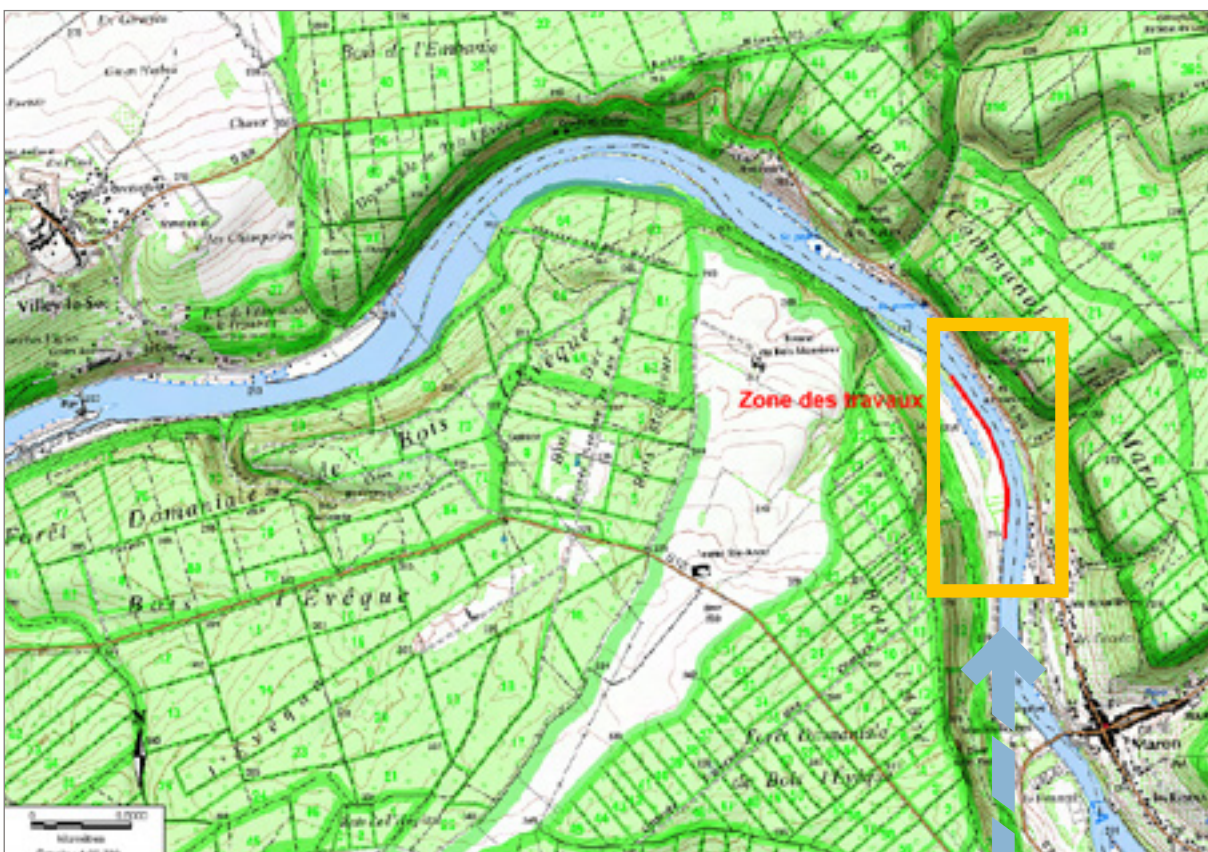
### ■ **Opportunities to act**

Following the 20-year flood in 2006, 80 metres of metal sheet piles, dating back to the work to open the Moselle to large ships, collapsed. The bank became unstable and erosion occurred at points along a 300-metre linear distance.

In light of the damage, an assessment of the banks was carried out by an engineering firm in 2009. The results made clear the seriousness of the situation and the risks incurred by the notches in the banks caused by the erosion. The danger was that the eroded material could be deposited in the navigation channel and the service road damaged.

The VNF technical department wanted a technical solution for both river navigation and the ecological issues in the area, namely an improvement in lateral continuity. The poor condition of the sheet piles and the available funding both contributed to the decision to proceed with the operation.

The obtention of sufficient funding made it possible to increase the scope of the operation and to restore a greater length of river bank than was initially planned.





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Eroded sections appeared in the banks following the collapse of metal sheet piles along the Moselle River. August 2008.



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Installation of geotextiles and planting of helophytes on the banks of the Moselle River. Fall 2011.



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Signs of beaver activity and passage on the banks. Fall 2012.

### ■ Works and developments

The sheet piles along the work site were removed. The banks were reworked over a distance of 1,000 metres and a coconut geotextile was laid. Local plant species were then planted along the banks, including helophytes (three to four plants per linear metre), willow cuttings, etc.

The work, during which the bicycle path was cut, was scheduled in the fall in order to impact as little as possible the use of the path.

### ■ Regulatory approach

The use of bio-engineering techniques to protect river banks does not require preparation of a Water-law filing. The water police and the manager of the Natura 2000 site were simply informed of work in advance.

### ■ Post-restoration management

The banks are simply mowed by the departmental council along the bicycle path.

### ■ Monitoring

The study on the initial status condition and post-work monitoring were carried out in the framework of the ISO 14001 certification, i.e. to determine compliance with the ISO 14001 standard.

The study on the initial status condition was carried out in the summer of 2011 and addressed the fish and hydrobiological compartments. Electrofishing was done in the main channel. Hydrobiological monitoring implemented a protocol derived from the IBGN (standardised biological index), without a final score. Visual monitoring of changes on the site was regularly carried out.

Post-work monitoring on the same compartments was done in July 2012 and 2013, i.e. 6 months and 18 months respectively after the work.

## Costs

In euros ex. VAT

Preliminary studies and monitoring <i>*preliminary study run in-house</i>	2,000 €*
Purchase of land	-
Works and developments	253,000 €, i.e. 253 € per linear metre
Promotion	-
<b>Total cost of project</b>	<b>255,000 €</b>

### Financial partners and funding:

*Rhin-Meuse water agency (50%), Voies navigables de France (50%)*

### Technical partner:

*Meurthe-et-Moselle (54) departmental council*

### Bibliography:

*Hydrosphère, 2012. Suivi écologique faune flore de restauration de berges par techniques végétales des canaux et rivières navigables. Voies navigables de France*



*Development of grass and bushes on the banks of the section where the work took place. June 2013.*

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Ecological monitoring will be pursued 2, 3, 5 and 10 years after the work to protect the river banks.

## Outcome of the project and outlook

Analysis of the fish-monitoring data focusses on alevin composition and structure.

The results of the fishing campaign in 2012, one year after the work, revealed a relatively low level of hydrobiological quality and overall quality in terms of fish. This may have been due to the recentness of the work because the helophytes had not had enough time to form sufficient cover and enable the various organisms to colonise the site.

The monitoring in July 2013 showed improved results. A greater number of alevins were present, signalling progressive colonisation of the bank habitats. The vegetation is now firmly implanted and growing satisfactorily. Future monitoring work will indicate whether this positive trend has continued.

In addition, significant colonisation by alder trees at the foot of the bank was observed, which will require monitoring to track the future development.

The objective of the work was not to restore significant hydromorphological functioning, but to re-establish the lateral continuity that had been lost due to the presence of the metal sheet piles. During the monitoring visits, signs of several passages by beavers were noted, confirming the significant improvement in transverse continuity.

*Voies navigables de France* plans to return to the site to make minor repairs on the geotextile and to replant helophytes where they did not develop well.

The VNF technical department is satisfied with the overall results of the operation. The work done on the site did not affect navigation. Bio-engineering techniques for river-bank protection cost less than standard, civil-works techniques. However, their use requires correct identification of the pressures weighing on the work site and adaptation of the selected solution to those pressures. The subsequent maintenance work must also be adapted to the selected vegetation.

VNF now plans to continue replacing certain civil works with bio-engineering techniques in the sectors where it is possible.

## Promotion of the project

The operation was presented during a meeting to exchange scientific and technical information on waterways in December 2012.

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