

Returning the Fontenelle to its original bed at Saint-Wandrille-Rançon

The operation

Category	Restoration
Type of operation	Returning the river to its original bed
Type of environment	Intermediate river zone
Issues at stake (water, biodiversity, climate)	Good state of the habitat, river continuity
Start of operation	August 2010
End of operation	June 2011
Length of river affected by the works	1,200 m

River in the restored sector

Name	La Fontenelle
Distance to source	1.3 km
Mean width	2 m
Mean gradient	3 ‰
Mean flow rate	0.24 m ³ /s

Aim(s) of the project owner

- Flood management.
- Restore the river's natural dynamics.
- Enhance the site from a landscape point of view.

Environment and pressures

Tributary of the left bank of the Rançon and sub-tributary of the Seine, the Fontenelle is a small 3 km long river. Its river catchment measures 30 km². Mainly covered by agricultural land upstream - meadows and cereal crops - and an urban area downstream, this river catchment experiences major run off problems due to the constitution of the soils (clayey-silty soils). Thus, after violent precipitation, the run off



Aerial view of the renatured Fontenelle. Spring 2011

The location

Country	France
River basin	Seine-Normandie
Region(s)	Haute-Normandie
Département(s)	Seine-Maritime
Commune(s)	Saint-Wandrille-Rançon



quickly reach the bottom of valleys together with various discharges (urban, agricultural), causing extensive flooding that could affect the physico-chemical quality of the water.

The Fontenelle was displaced in 1792 to be transformed into a reach allowing the use of the adjacent mill's hydropower. The river is thus perched on half of its length. The Fontenelle has two structures distributed along its course. One of these weirs, 1.3 m high, is situated on the reach downstream of an abbey and was used to raise the water level for the mill. Over time, economic activities linked to the mills have stopped and the latter have lost their initial use.

Despite significant silting of the reach, the Fontenelle offers valuable habitats on parts of its course and, in particular, is a home to eel and brown trout populations. Some marshes are also present on the downstream part of the river catchment, at Saint-Wandrille-Rançon.

Regulatory context	Not applicable
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European directive references:

Water body ref.	FRHR264A - H5111500
Natura 2000 site ref.:	FR2300123



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View of the reach before renaturation works. Autumn 2009



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The filled in former bed of the Fontenelle. Autumn 2009

A Natura 2000 Site, "Boucles de la Seine aval" is present near the Fontenelle, at the level of the Rançon and now borders the new course of the Fontenelle. This site is covered by the Natura 2000 impact assessment document which showed the compatibility of the restoration project with the conservation objectives of the Natura 2000 site.

■ Opportunities to act

Two successive 100 year return period floods (1999 and 2000) which rapidly reached strong flows - average inter-annual flow rising from 0.240 m³/s to 12 m³/s - caused material damage to the abbey and neighbouring farms and caused the banks of the reach to collapse in places. The *syndicat mixte des bassins versants Caux-Seine* (SMBVCS) was created following these events by order of the prefect, with the aim of planning the management of floods across the river catchment.

In 2003, the SMBVCS set up a multi-year maintenance programme. Within this framework, a complementary hydraulic study, commissioned by the *Parc naturel régional (PNR) des Boucles de la Seine Normande* (structure with the jurisdiction to manage the Saint-Wandrille marsh) was launched in 2004 in partnership with the SMBVCS. This study was designed to make proposals for flood management solutions. The results of the study were published in 2007. Originally, the solution sought by the commune was to carry out hydraulic works. The engineering consultant in charge of the project, after consultation with state departments, was asked to give a more "ecological" and hydromorphological" dimension to the project. In addition to the initial solution to rehabilitate the reach by reinforcing the banks, returning the watercourse to the bottom of the valley was also proposed, as the original bed of the Fontenelle was still



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identifiable. At the end of the study and examining the different scenarios and after consultation with the commune and residents, it appeared that returning the Fontenelle to its original bed was the least expensive, most hydraulically viable (overtopping of the river in the event of flooding into neighbouring meadows and marshes) and the most hydrobiologically and hydromorphologically beneficial solution.

■ Works and developments

The river was returned to its original bed for a 1,200 m stretch and the banks gently sloped. The weir on the reach was removed.

Water was returned to the bed in September 2010. In spring 2011, helophyte, shrubs and trees were planted and fences and animal feeders set up along the restored site to protect against trampling by cattle. Foot bridges were also built. A grassy ditch now replaces the perched reach to collect stormwater. Mechanical equipment used on the project site all used biodegradable hydraulic oils which, in the case of an incident, avoided contamination of the aquatic environment.

Fish from the perched reach were caught preventively before works started.

■ Regulatory approach

- Statement of general interest (DIG)
- Declaration of public utility (DUP)
- Authorisation application filed under the "dossier d'autorisation" consent according to the French Water Act

1.2.1.0: *Bypass of the river and its accompanying groundwater*

2.2.1.0: *Discharging into the surface water could alter the water balance*

3.1.1.0: *Installations, structures, embankments and groynes in the low-flow channel, creating an obstacle to continuity*

3.1.2.0: *Modification of the longitudinal or cross profile of a low-flow channel of a river or diversion of a river*

■ Post-restoration Management

The *Syndicat mixte des bassins versants Caux-Seine* proceeds with maintenance of vegetation at the restored site.



Reopening of the former bed and slight remeandering; Summer 2010

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■ Monitoring

Biological surveys were conducted before works via a fish inventory and invertebrates monitoring conducted downstream and upstream of the currently restored area. Monitoring measures after completed work were implemented. These were taken in 2011 and 2012 and covered the physical aspects - flow types, substrate, etc. - on riparian vegetation, as well as the biological aspects - benthic macro-fauna, fish population, insect fauna, amphibians, birds and mammals. All these surveys are to be compiled and included in a map database (GIS). The monitoring will be conducted annually over a five-year period (until 2016).

■ Outcome of the project and outlook

This operation decompartmentalises the Fontenelle over 1.2 km and reopens access to the Rançon and the Seine to biological communities between the confluence and the next upstream weir on the Fontenelle.

Electrofishing analyses in 2011 show a recolonisation of the area by brown trout. Functional spawning grounds have also been observed in the rehabilitated site (observation of brown trout reproduction in 2012). The removal of the structure allowed recolonisation of eels across the whole restored stretch. Upstream of the site, eel density rose from 10.25 individuals / 100 m² in 2005 to 127 individuals / 100 m² in 2011.

Three months after the works, spontaneous aquatic vegetation appeared; callitriche plants, marshwort and common reeds have thus been observed.

Benthic invertebrates quickly recolonised the site. Downstream in particular, groups characteristic of the presence of organic matter - dominance of Gammaridae, Diptera Chironomidae and Ephemeroptera - have been observed, partly due to the significant and rapid development of the herbaceous layer. Analyses in 2011 revealed the presence of Glossosomatidae caddisflies - a group very sensitive to pollution - upstream of the rehabilitated site.

The resumption of river dynamics with the appearance of preferential areas of deposits and erosion is visually apparent in the new bed. Compared to the initial situation, flow types are more diverse, particularly on the upstream part of the sector. The downstream sector



Return of diversified flows on the Fontenelle, 8 months after the restoration.

Cost

In euros ex. VAT

Cost of the preliminary study	90,000 €
Cost of acquisitions	0 €
Cost of works and developments	210,000 €
	VAT per linea metre: 175 €
Cost of promotion: DVD, programme, articles	5,000 €
Total cost of the action	305,000 €

Financial partners (and funding):

Seine-Normandie Water Agency (50%), European Regional Development Fund (40%), General Council of Seine-Maritime (10%)

Technical partners of the project:

National Agency for Water and Aquatic Environments (Onema), regional directorate of the environment, agriculture and housing (DREAL) of Haute Normandie, Departmental fishing and water protection federation of Seine-Maritime - (FDPPMA 76), Parc naturel régional des Boucles de la Seine Normande – Regional natural park of the Seine-Normande Loops.

meanwhile flows through a distribution of rather lenient water flows, owing to its slope, which are ten times lower than upstream.

The risk of flooding is reduced by the presence of flood storage areas covering several hectares along the new course of the Fontenelle. The 10-year flood of 16 December 2011 provided the opportunity to observe this.

Two years after the works, a significant improvement of the biological and morphological environment is observed, with the rapid reestablishment of species and the remobilisation of sediments. However, it is difficult to have real perspective for the time being. The next post-restoration monitoring will confirm or refute this trend.

The success of this project depends in part on the major coordination project set up by SMBVCS. Local residents were involved very early in the project. The declaration of public utility initially taken was not used, as all local residents gave their approval.

With this renovation of the Fontenelle, half of its course has regained its former bed. The river remains perched over the whole 400 m stretch. However, the restitution of the whole stretch into its original river bed does not seem effective in terms of the cost-benefit ratio achieved. The works would only concern a limited potential surface of the spawning grounds and require the end of fish-farming present on this site, which is of local economic interest.

Following this action, the *Syndicat* conducted other operations in favour of aquatic environments. As part of the renovation of the quays of the Seine by the commune of Caudebec-en-Caux, the *Syndicat* took the opportunity to reopen the St. Gertrude river for about thirty metres and installed a fishway on the hydraulic structure present in the sector. The *Syndicat* plans the same type of action on the second river crossing Caudebec-en-Caux.

The SMBVCS also plans the future creation of a bypass channel at the Moulin d'Ansoth on the Sainte Gertrude.

Promotion of the project

Renaturation of the Fontenelle has been strongly promoted. Public meetings were held when the restoration project was completed in November 2010 and for the inauguration of the works in June 2011. The project was widely publicised (publication of articles in the local press, local and national radio coverage, TV reports, etc.). The *Syndicat* has also produced a DVD outlining the renaturation project, in partnership with the Seine-Normandie Water Agency.

Finally, field visits are regularly organised with schools, elected representatives and river agency technicians from neighbouring basins.

The commune of Saint-Wandrille-Rançon is currently building a rambling path along the renatured Fontenelle which would lead to the Abbey of Saint-Wandrille.



Project Owner **Syndicat mixte des bassins versants Caux-Seine (SMBVCS)**



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