Constructed wetland with reed bed filters near Reims, France

Year of issue

2015

Summary

The intensive urban development of the Bezannes joint development zone (ZAC), near Reims, has led to the artificialization of 172 hectares of land, along with a growing need for stormwater management. Vegetated swales were implemented in the southern part of the area, while in the north, stormwater is collected and directed to a facility that includes an artificial wetland, an artificial lagoon, and a reed bed filter.

The construction of this facility, initiated by the Greater Reims Urban Community (project owner) and Sinbio (project manager), aimed to incorporate a nature-based solution to manage stormwater inflows upstream of the Muire River, improve the quality of discharged water, and create a 5-hectare natural space that would benefit both local residents and biodiversity called Parc de la Roselière.

This project illustrates a shift from traditional civil engineering to ecological engineering, combining water regulation, pollution control, biodiversity enhancement, and public amenities.

Photo Gallery



Location

49.222, 3.989

Project

NWRM

National ID

France_02

Sector

Hydromorphology

Installation Date

2009-2010, public opening in 2013

Implementation status

Completed

Contact

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Overview

Location of the project

This project is located at the northern boundary of the commune of Bezannes, adjacent to the city of Reims. It is an area that has become highly urbanized, as fields have given way to residential developments and a joint development zone (ZAC) since the 2000s. The project is located within the catchment area of the Muire River, which flows downstream into the Vesle River, in a densely urbanized area.

Country

France

NUTS2 Code

Champagne-Ardenne

Sponge measures implemented in the case study

Basins

Wetland restoration and management

Swales

Objectives

Regulate runoff from 34.9 ha of impervious surfaces
Prevent downstream flooding and pollution (Muire stream and Vesle river)
Improve stormwater quality through natural filtration
Enhance biodiversity and landscape integration
Provide recreational and educational value via public access

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Local water authority	Greater Reims Urban Community	Initiation of the measure	Project owner, financing, management. Operates the site.	Responsible
Architects / Engineers	SINBIO	Determination of design details of the measure	Led design evolution to natural wetland	Supporting
Architects / Engineers	GUINTOLI	Implementation	Implemented wetland, paths and gabions	Supporting

Authority type	Authority name	Authority role	Comments	Authority responsibility
Architects / Engineers	ISS Espaces Verts – Reims branch	Implementation	Basin planting	Supporting
Architects / Engineers	EDIVERT	Implementation	Park landscaping	—
Architects / Engineers	SCEE	Implementation	Lighting	Supporting
Architects / Engineers	ANTEA	Determination of design details of the measure	Contributed to early scenario assessment, initial hydraulic study	Supporting

Site Information

Climate Zone

Cool temperate moist

Precipitation

596.00 mm

Temperature (°C)

11.50 °C

Elevation range

81.7 m

Vegetation class

species of wetlands and aquatic environments, great diversity: 26 varieties

WFD Ecological status

Moderate

WFD Chemical status

Failing to achieve good

Water quality status

Chronic rainwater pollution, road runoff. Nitrate-sensitive groundwater.

Design and Implementation

Project scale

Micro

Project scale specifications

Urban site-level intervention (stormwater management for 34.9 ha)

Located in the downstream section of the 172 ha ZAC de Bezannes

Project area

35

Project area specifications

Northern part of the 174-hectare joint development zone of Bezannes. Approx. 35 ha of drainage area.

Lagoon and filter: ~1.2 ha

Total landscaped park: >1 ha

Size

4.70

Size unit

ha

Design capacity

15000 m3

Principles

Transition from technical to ecological solution

Passive, gravity-based water routing (no pumping)

Multi-functionality: hydraulic retention, filtration, biodiversity, recreation

Design for 1-year to 100-year stormsIntegration of various depths and habitats (open water, wetlands, dry areas)

Public access with wooden footbridges and interpretive panels

Constraints

Very high groundwater table, no infiltration possible.

Need to avoid adding pressure to downstream sewer network (limited to 85 L/s).

Favourable preconditions

The idea to change from concrete to natural water retention was supported by WFD conditions and the city management. Large available space. Landscape integration supported by the urban project vision

Financing

Total cost

5480000.00 €

Total cost information

Basin works: 4,310,000 €

Park works: 520,000 €

Fence: 370,000 €

Project management : 280,000 €

All values are without VAT.

Financing authorities

Authority name	Type of funding	Comments	Financing share
Région Champagne Ardenne	Sub-national funds	709,815.26 €	~ 25 %
Reims Métropole	Local funds	Additional budget dedicated to the joint development zone.	~ 75 %
Conseil Général de la Marne	Sub-national funds	139,332.00 €	small share

Compensations

No

Policy and Governance

Policy description

The creation of a 174-hectare joint development zone (ZAC) in the commune of Bezannes led to the need for stormwater management. The Greater Reims Urban Community sought to minimize reliance on civil engineering solutions for managing these waters. To protect the downstream urban areas, it is essential to store and infiltrate the water as much as possible, especially as the water table is shallow in the area. To maintain water quality, the use of the biological purification functions of wetlands and reed bed filters was chosen.

Land ownership

Public – Owned by Communauté Urbaine du Grand Reims (Project owner and operator)

Policy targets

Increase Water Storage

Runoff control

Improved Biodiversity

Oher Societal Benefits

Target remarks

Manage runoff from 34.9 ha of urban surfaces

Limit discharge to 85 L/s

Prevent flooding and protect groundwaterImprove water quality and create a recreational space

Pressure remarks

Sealed soils and urbanization

High groundwater level

Downstream flood risk (Muire & Vesle)

Chronic urban water pollution (hydrocarbons, heavy metals, road runoff)

Impact remarks

Hydrological regulation

Reduction of pollutants via reed bed filtration

Public access and landscape integration

Biodiversity creation and spontaneous species colonisation

Requirement directive remarks

Regulatory authorisation under the Loi sur l’Eau (2006)

Strict pollutant discharge thresholds (e.g. 25 mg/L MES, 5 mg/L hydrocarbons)

Policy challenges requirements

Limit algae growth and the need for dredging operations.

Landscaping includes three wooden footbridges and a path along the embankment, allowing for a walk around the basin.

Part of a wider plan

No

Public consultation

Yes

Consultation activities

Activity stage	Activity type	Comments
Other	Informative signage & bird panels	Explains system & biodiversity

Has contractual arrangements

No

Impacts and Monitoring

Monitoring System

Presence of formal monitoring system

No formal long-term ecological or hydrological monitoring in place

Maintenance

Maintenance requirements

Includes green space maintenance, reed cutting, decantation chamber cleaning. Footbridge repairs handled separately. Some early issues due to insufficient maintenance.

Impact Assessment Methodology

Performance impact assessment method

Unknown

Socio-economic Impacts

Benefits and co-benefits

Integrated into a public park frequented by local residents (recreation, education)
Increased land value and public satisfaction.

Direct benefits

Earlier estimate for conventional concrete basin was 8,000,000 €. The natural alternative saved ~3.2 M€

Biophysical impacts: Hydrology

Information on retained water

Storage of up to 15,000 m³ for 100-year storms
Discharge regulated at 85 L/s
Passive gravity-based outflow prevents downstream network saturation
Early limitation: underperformance at start due to incomplete roadworks and insufficient inflow

Biophysical impacts: Biodiversity

Improved biodiversity

Yes

Information on improved biodiversity

Development of a diversified wetland habitat. The site functions as an attractive refuge and offers a variety of habitats.
Spontaneous colonisation by frogs, fish, and unexpected willow species. Notably, the house martin and the common kestrel - both species in significant decline in recent years - have been observed. Bats (common pipistrelle and the serotine bat), odonates (such as hawker dragonflies and damselflies), orthopterans including the ebony black grasshopper - listed as a regional red list species - and common butterflies like the common blue, marbled white, and cabbage white.
Plantation of 26 wetland plant varieties

Artificial river section: This area hosts the richest biodiversity on the site.
Lagoon section: Ecological diversity and richness are satisfactory, but the planted species are underrepresented. The presence of filamentous algae suggests a meso-eutrophic environment, water renewal is lower than expected.
Reed bed filter section: The plants appear stunted due to insufficient water and nutrients. Eight additional species have colonized the area spontaneously, requiring differentiated mowing management.
Wetland section: Water levels are too low; the planted species are in the minority and have been replaced by plants not typical of wetland environments.

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Positive impact-WQ improvement

Information on water quality overall

Filtration of stormwater via reed bed filter

Treatment of suspended solids, hydrocarbons, and metals

Pollution control compliant with thresholds (e.g. MES < 25 mg/L)

Occasional pollution episodes observed (e.g. sewage backflow, dewatering discharge)

Soil quality overall improvements

N/A info

Biophysical impacts: Others

Ecosystem impact climate regulation

No specific impact

Information on ecosystem impact climate regulation

Not mentioned

Lessons Learned

Key lessons

This project demonstrates how a purely technical stormwater management facility can be transformed into a project that delivers significant ecological and landscape value, particularly as it is located along one of the identified ecological corridors of the urban area.

Passive, nature-based solutions can replace costly engineered alternatives

Early stakeholder engagement (e.g. landscape architects, ecologists) improves project outcomes

Public accessibility increases acceptance, but requires robust infrastructure

Design flexibility is key to adapting to site constraints (e.g. groundwater)

Anticipating inflow timing and maintenance needs is essential for early functionality

Barriers

Barrier type	Barrier role	Comments
Legal obligations / restrictions	Main barrier	Required environmental authorisation due to proximity to groundwater
Other	Main barrier	High groundwater table, imposed full waterproofing and prevented infiltration.

Barrier type	Barrier role	Comments
Other	Secondary barrier	The first years, low inflows. Roads not yet completed, limited water entering the basin initially.

Drivers

Driver type	Driver role	Comments
Organisation committed to it	Main driver	Project director to replace a concrete basin with a natural solution
Other	Main driver	Need to manage runoff from a large new urban zone.
Legal obligations	Secondary driver	Sustainability ambition embedded in Reims Métropole’s planning policies

Success factors

Success factor type	Success factor role	Comments
Other	Main factor	Large space available enabled ecological and public integration
Existing staff and consultant knowledge	Main factor	Interdisciplinary design team. Combined hydrology, landscape, ecology, and urban design
Other	Secondary factor	Public ownership and long-term vision. Enabled consistent management and public park development.

Cost effectiveness

The initial solution cost of €8 million. The sustainable development approach reduced to €4.8 million, representing a saving of €3.2 million.

Sources

Sources

Green potential of a constructed wetland with reed bed filters on a 172 ha urban project near Reims (France). Project evolution analysis

Potentiel écologique d’un ouvrage de rétention et de filtration des eaux pluviales sur une opération de 172 hectares (Reims) ; analyse de la genèse du projet

Ingénierie écologique : évolution de la biodiversité et entretien d’un milieu aquatique artificiel finalisé en 2010, destiné à la gestion d’eaux pluviales urbaines

Dispositif de rétention et de traitement des eaux pluviales de la Zone d’activités de BEZANNES (51)

Le parc de la Roselière

Press file – Parc de la Roselière stormwater basin (ZAC Bezannes)

Summary sheet – Roselière basin, ZAC Bezannes

Engineering ecology applied to aquatic environments