Sustainable stormwater management and green infrastructure in Fornebu, Norway

Year of issue

2025

Summary

Fornebu is a brownfield development project with a focus on sustainable stormwater management and green infrastructure. The transformation of Fornebu, a decommissioned airport near Oslo, into a resilient, multifunctional urban landscape exemplifies nature-based stormwater management. Originally abandoned in 1998, the 340 ha brownfield site was redeveloped into a mixed residential and industrial area where stormwater systems were designed not as hidden infrastructure, but as visible, ecological assets. Swales, filter strips, permeable surfaces, detention basins and retention ponds were implemented to handle runoff and purify water, replacing conventional pipe networks. These measures were led and financed by Statsbygg (the Norwegian Directorate of Public Construction and Property), in collaboration with the City of Oslo, Bærum Municipality, and design input from Bjørbekk & Lindheim AS, supported by research from Interconsult ASA and Aalborg University.

From inception, the project aimed to enhance recreational and ecological values while ensuring cost-effective water management. Retention structures were sized to cope with flows from 1- to 20-year return period storms, and water quality improvements were significant—modelled reductions of suspended solids (up to 90 %), phosphorus (≈ 65 %), copper (≈ 65 %), zinc (≈ 45 %) and nitrogen (≈ 40 %) were achieved.

Today, the Fornebu stormwater system is considered complete and serves as a meso-scale model of blue-green infrastructure integration, combining flood protection, water purification, biodiversity enhancement, recreational space and urban development stimulus. Its notable legacy is the shift from traditional stormwater management toward multifunctional, visible, sustainable urban design, resilient in the face of climate change and rooted in cross-government collaboration.

Photo Gallery



Location

59.9019, 10.6229

Project

NWRM

National ID

Norway_01

Sector

Urban

Installation Date

2002-2015

Implementation status

Completed

Contact

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Overview

Location of the project

Fornebu is a 340 ha brownfield redevelopment of the old Olso airport.

Sponge measures implemented in the case study

Swales

Filter Strips

Ponds and scrapes

Basins

Permeable surfaces

Objectives

Regulation of hydrological cycle and water flow

Flood control and flood risk mitigation

Self-regulation of water by filtration / storage / accumulation by ecosystems

Natural assimilation (purification) of effluents through dilution, dispersion, and physicchemical processes

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
National water authority	Statsbygg	Initiation of the measure	Statsbygg is the Norwegian Directorate of Public Construction and Property	Responsible

Authority type	Authority name	Authority role	Comments	Authority responsibility
Other	City of Oslo	Determination of design details of the measure	Also secondary land owner	Responsible
Local water authority	Municipality of Baerun	Determination of design details of the measure	Municipality, typically responsible for infrastructure and green space	Supporting

Site Information

Climate Zone

Cool temperate moist

Precipitation

778.00 mm

Temperature (°C)

6.00 °C

Evapotranspiration

200.00 mm

Imperviousness

40.00 %

Slope range

0-1%

Vegetation class

grass/turf

WFD Ecological status

Bad

WFD Chemical status

Failing to achieve good

Water quality status

Water quality was degraded prior to brownfield redevelopment. There is significant local pollution related to the old airport. Pollutants include oil, PAHs, heavy metals and de-icing chemicals.

Design and Implementation

Project scale

Large

Project scale specifications

Fornebu is a 340 ha brownfield redevelopment

Project area

340

Area subject to Land use change or Management/Practice change (ha)

340.00 ha

Size unit

ha

Basis of design

The measures are deisgned to treat a range of events with return times ranging from 1 to 20 years. Design criteria are based on long-term average summer rainfall.

Principles

Environmental responsibility and a need to balance competing demands were the key guiding principles behind the redevelopment plan. The plan was to develop a functional, multi-use urban area with recreational, residential and industrial areas. The development had to be acceptable to the general Norwegian public as well as area residents and administrators.

Factor constraints

The availability of the entire brownfield site for redevelopment greatly simplified the development of a master plan incorporating sustainable urban drainage features. While there were challenges with communication between different levels of government, these were resolved. The Statsbygg commitment to sustainable urban environments and substantial financial investment allowed this project to be implemented.

Constraints

Winter conditions, snow and ice are a challenge to the implmentation of sustainable urban drainage systems at Fornebu and other northern cities.

Favourable preconditions

Having a brownfield site and a governance environment favorable to sustainable multi use urban landscape were key factors in the success of Fornebu.

Financing

Total cost

2000000.00 €

Total cost information

Total cost is not known

Costs investment information

Total investment cost is not known

Costs land acquisition information

No land acquisition costs as land was already owned by Norwegian government

Administrative annual cost information

Administrative costs are not known

Financing authorities

Type of funding
National funds
Local funds

Compensations

Non

Policy and Governance

Policy description

The old Oslo airport at Fornebu was a brownfield site in need of redevelopment. The urban planning challenge was to redevelop the site in a sustainable manner supporting both residential and industrial uses while encouraging environmental responsibility

Land ownership

Statsbygg (Norwegian Directorate of Public Construction and Property)

Policy targets

Runoff control

Peak-flow reduction

Pollutants Removal

Oher Societal Benefits

Increase Water Storage

Groundwater Recharge

Improved Biodiversity

Policy impact

Directive	Relevant impact
Other non-EU	Storm Overflows
Other non-EU	Community (sustainable built environment)

Policy challenges requirements

Norwegian government commitment to environmental sustainability : The Fornebu development was motivated primarily by national as opposed to European priorities.

Part of a wider plan

Non

Public consultation

Non

Has contractual arrangements

Non

Impacts and Monitoring

Maintenance

Maintenance requirements

A similar level of maintenance as is needed for similar green infrastructure in other cities will be needed.

Socio-economic Impacts

Direct benefits information

The Fornebu brownfield redevelopment has clear direct benefits as it provides space for living, employment and recreation in a crowded urban area. The specific benefits of the measures in Fornebu are harder to quantify as they cannot really be considered in themselves but must be seen as part of the complete redevelopment picture. Water-related ecosystem services include flood protection and security, wastewater services and improved coastal status due to a reduction in polluted runoff.

Ancillary benefits information

Key ancillary benefits include more living space and a sustainable multi use urban environment supporting recreation, residential and industrial land use.

Biophysical impacts: Hydrology

Information on retained water

The total retained volume of water is hard to assess as the Fornebu plan consists of multiple measures.

Increased water storage

230.00

Increased water storage unit

m3/ha

Information on runoff reduction

Large qualitiative reductions in runoff peaks. The entire Fornebu master plan had a goal of runoff attenuation and control. The channels are designed to deal with flows of 1.25 m3 s-1 while the detention ponds are designed to handle a flow of 2.75 m3s-1

Information on peak flow reduction

Large qualitative reductions in peak flow could be expected when compared to the old Fornebu airport

Information on soil moisture

Extensive use of swales and soakaways will lead to improvements in soil moisture status and soil storage capacity compared to traditional impervious urban features. It is hard to make a “before / after” comparison in this case as the data do not exist and the change in land use is too large.

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Information on improved biodiversity

more aquatic habitat and greenspace

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Positive impact-WQ improvement

Information on water quality overall

based on mdeolling results and design criteria

Water quality improvements - Phosphorus (P)

60.00

Water quality improvements - Phosphorus (P) - Unit

% reduction pf pollutant

Water quality improvements - Nitrogen (N)

40.00

Water quality improvements - Nitrogen (N) - Unit

% reduction pf pollutant

Water quality improvements - Total Suspended Solid (TSS)

80.00

Water quality improvements - Total Suspended Solid (TSS) - Unit

% reduction pf pollutant

Water quality improvements - Copper (Cu)

65.00

Water quality improvements - Copper (Cu) - Unit

% reduction pf pollutant

Water quality improvements - Zinc (Zn)

45.00

Water quality improvements - Zinc (Zn) - Unit

% reduction pf pollutant

Soil quality overall improvements

Positive impact-SQ improvement

Information on soil quality overall improvements

Overall soil quality in Fornebu has been improved, primarily due to the removal of approximately 200,000 m3 of contaminated soil .This improvement is not related to green infrastructure, but to brownfield remediation.

Information on soil quality, overall soil pollution

brownfield improvement included removal of contaminated soil, PAH, oil and deicing fluids were all problems

Ecosystem erosion control

Non

Lessons Learned

Key lessons

Success was dependent on communication between different levels of government and a clear vision for a sustainable, multi-use urban environment

Barriers

Barrier type	Barrier role	Comments
Lacking coordination between authorities	Main barrier	Achieving god communication between the different actors and levels of government was one of the key challenges in implementing the Fornebu project.

Drivers

Driver type	Driver role
Organisation committed to it	Main driver

Success factors

Success factor type	Success factor role	Comments
Financing possibilities	—	—

Success factor type	Success factor role	Comments
Attitude of decision makers	Main factor	Commitment of Statsbygg, to a sustainable, multi-use redevelopment of the Fornebu brownfield so as to support recreational, residential and industrial land use.
Attitude of relevant stakeholders	—	—

Flexibility / Adaptability

It is unclear how flexible or adaptable Fornebu is to changing baseline conditions. Climate change may have both negative and positive effects. Warmer temperatures would reduce the problems associated with snow and ice. Changing precipitation patterns could alter the effectiveness of the Green Infrastructure for stormwater management.

Transferability

Fornebu provides a model for brownfield redevelopment and shows that sustainable urban drainage systems can be integrated into a multi-functional urban landscape.

Sources

Sources

Sustainable stormwater management at Fornebu “ from an airport to an industrial and residential area of the city of Oslo, Norway

From airport to sustainable community sustainable Fornebu

The aesthetic performance of urban landscape-based stormwater management systems: a review of twenty projects in northern Europe

Fornebu Stormwater Management System