



Enhancing the environment

25

Case studies from Thames Region



April 1999



ENVIRONMENT
AGENCY

Foreword

The Town and Country Planning system enables the Environment Agency to make significant environmental enhancements to development proposals. It gives us the opportunity to work closely with our partners in local planning authorities and the development industry with the objective of achieving sustainable development. The staff working in our local Area offices are dedicated to securing environmental enhancements through the development process.

Often their successes do not receive the full recognition they deserve. I am therefore delighted to present this series of case studies which amply demonstrate their effectiveness. In publishing this document I hope that our partners in this work will be able to recognise the wide scope that exists for building a wide range of enhancements into their development proposals. For our part we will work to make effective partnerships a continuing reality in Thames Region.



Chris Birks

Regional General Manager



ENVIRONMENT AGENCY



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Introduction

The role of the Environment Agency in the Town and Country Planning system is that of a statutory consultee. It has the right to be consulted on a range of categories of planning applications. These are set out in the Agency's 'Liaison with Local Planning Authorities' Manual together with their statutory sources. The Agency is entitled to comment but the local planning authorities take the final decision. Accordingly there is a premium on persuasion and influence to ensure that environmental issues are properly addressed. The Environment Agency takes a proactive approach towards its involvement in the planning system and we see this as an integral part of our work to protect and enhance the environment.

The protection and enhancement of the environment relies on good working relationships between the Environment Agency, local planning authorities and the developers. The Agency is keen to work closely with both of them in promoting its plans and proposals. Cooperation can offer significant benefits to the environment and to the community at large. Developers can likewise benefit from an enhanced environment. Such partnerships can therefore be an efficient and effective method for promoting the interest of all parties.

One of the primary pressures on the Agency will continue to be the environmental impact of new development. It is therefore essential for Agency staff to identify at the planning stages – be it pre-planning or consent enquiries, planning applications, land drainage consent applications or development plans – how the Environment Agency's interests can be protected and furthered through partnerships with external bodies including local authorities, industry and environment groups. This has resulted in the achievement of a wide range of environmental enhancements, that the Environment Agency has secured through the planning and land drainage consenting systems.

The following selection of case studies illustrate all the kinds of enhancements listed opposite. Many of the case studies illustrate more than one category. Our partners are encouraged to look at these examples as an illustration of the range of possibilities for environmental enhancements and to treat individual development proposals as an opportunity for securing better standards of development rather than as a constraint on the development of the site.

The range of enhancements cover the following:

- river restorations and channel enhancements;
- surface water runoff attenuation and source control;
- reed bed treatment for surface water;
- conservation, fisheries and landscape enhancements;
- enhanced recreation and education provisions;
- flood plain compensation schemes;
- river bank enhancement works;
- clean up of contaminated land.

Case studies

Case Study

Development Type
Enhancement Type

- 4**
M40 motorway service area, Oxford
motorway service area
- surface water runoff/source control
 - reed beds for water treatment

- 2**
Fairford Leys, Aylesbury
residential development
- river diversion and enhancements
 - flood storage
 - landscaping

- 3**
Safeways, High Wycombe
supermarket development
- opening of culverted watercourse
 - clean up of contaminated site
 - groundwater protection

- 4**
Soho Mill, Wooburn Green
warehouse/office development
- river diversion and enhancements
 - conservation enhancements (including fish pass)
 - bank works
 - clean up of contaminated land
 - landscaping

- 5**
A34 Newbury Bypass
trunk road
- surface water drainage and storage
 - reedbed treatment of highway runoff

- 4**
The Green, Aspenden
residential development
- surface water runoff/source control
 - conservation enhancement

- 7**
M1 Link Road, Watford
road development
- river enhancements and bankworks
 - conservation enhancements

- 8**
Cowley Business Park, Uxbridge
commercial development
- river enhancement
 - conservation and landscape enhancements

- 7**
Cowley Retail Park, Uxbridge
retail development
- river diversion and enhancement
 - opening up of culverted watercourse

- 10**
Prospect Park and Waterside, Harmondsworth
commercial development
- conservation and landscape enhancements
 - recreation provision
 - river enhancement
 - clean up of contaminated land/containment of waste

- 11**
Two Rivers Retail Park, Staines
retail development
- river diversion and enhancements
 - conservation enhancements
 - clean up of contaminated land

- 12**
Thames Valley Park, Reading
commercial development
- conservation enhancement
 - recreation provision

- 13**
Loddon Mill, Twyford
residential development
- river enhancements
 - conservation enhancement
 - bank works
 - landscaping

- 14**
Tesco, Wokingham
supermarket development
- surface water runoff/source control
 - reed beds for treatment

- 15**
Blackwater Valley Road, near Frimley
road development
- river diversion and enhancements
 - conservation enhancements

- 16**
Teddington Wharf, Teddington
residential development and tidal defences
- enhanced tidal defences
 - conservation enhancements
 - flood storage

- 17**
Barn Elms, South West London
residential development
- conservation enhancement
 - recreation provision

- 19**
Mill Lane, Carshalton
residential development
- river diversion and enhancements (including de-culverting)

- 19**
South Norwood Country Park, Elmers End
light railway system
- river diversion and enhancements
 - conservation enhancements
 - recreation provision



20

Glaxo-Wellcome Site, Beckenham

- commercial and residential development
- river diversion and enhancements
- conservation enhancements
- landscaping

21

Bell Green Gas Works, Sydenham

- retail development
- river diversion and enhancements
- conservation enhancements (including fish pass)
- clean-up of contaminated land

22

Brookmill Park, Lewisham light railway system

- river diversion and enhancements
- conservation and landscape enhancements

23

Bullhead Dock and Bellamy's Wharf, Rotherhithe

- residential development and tidal defences
- enhanced tidal defences
- conservation enhancements
- recreation provision

24

Victoria Wharf, Limehouse

- residential development and tidal defences
- enhanced tidal defences
- conservation enhancements
- recreation provision

25

Millennium site, Greenwich Peninsular

- residential/leisure/commercial development and tidal defences
- enhanced tidal defences
- conservation enhancements
- recreation provision
- clean-up of contaminated land



Project title:
M40 motorway
service area

Location:
Oxford Services,
Wheatley, Oxford

River/catchment:
River Thames (Thames
catchment)

Date completed:
July 1998

**Development
type:**
Motorway service
area

**Types of
enhancement:**

- surface water runoff/source control
- reedbeds for water treatment

Developer:
Welcome Break

Local authority:
South Oxfordshire
District Council

Contact details:
Customer Services
West Area Office
Environment Agency
Isis House
Howbery Park
Wallingford
Oxon
OX10 8BD

The surface water management system at this site incorporates many aspects of best management practice which the environment agency is trying to promote on a wider basis.



Site History

The Welcome Break company has built a new motorway service station at Wheatley, Oxfordshire which opened in summer 1998. The site, adjacent to the existing motorway had been used previously for the dumping of spoil from the construction of the road. The development has standard motorway facilities, including fuel filling area, car and HGV parking areas, an amenity building and a travel lodge. The total site area is 10ha, of which approximately 6ha was being developed, which normally would have incorporated approximately 4.5ha of 'impermeable' surfaces.

**Environment Agency
Interests**

- Promotion of Best Management Practices for surface water management.
- Concerns about the potential

mobilisation of naturally occurring arsenic by increased infiltration.

Description of Scheme

The developer decided to provide Best Management Practices (BMPs) for surface water management on the site and discharge to a local stream rather than, as had been originally proposed, discharging via a requisitioned surface water sewer to the River Thames some distance from the site, which had originally been considered.

Infiltration of water into the subsoil was not permitted by the Environment Agency on the majority of the site because of concerns about the natural levels of arsenic and the possibility of mobilising through increased soakage. The chosen option discharges rainfall runoff at a carefully controlled rate, after treatment, to a small watercourse on the site boundary.

Permeable block surfaces over a stone base on an impermeable membrane were used for the car parks. This achieves a measure of water storage, delays the time of



concentration and enhances water quality through microbial action in the stone layer.

The majority of the rest of the site is positively drained via lined French drains trenched to outfalls that combine with the car park outfalls. These discharge to a 'first flush' pond which has been designed to contain the first 10mm of rainfall for slow release. The discharge from the pond travels via a sub-surface flow reedbed and thence to a final storage pond before release to a small local watercourse.

In conditions of high rainfall, when the 'first flush' pond is full an overspill weir will convey the higher flows down a swale which will bypass the reedbed directly to the main storage pond. The design of these systems raised some interesting issues because



of the differences in the times of concentration. Fortunately there was sufficient flexibility to take a 'belt and braces' approach to the restriction to the final runoff from the site.

Close liaison was essential between the Environment Agency, local authority, site developers and the downstream landowner to ensure that all opportunities were taken to resolve any problems that arose.

Case study

2

Fairford Leys, Aylesbury

This large housing development provided the opportunity to restore the heavily engineered rivers that crossed the site.



Aerial view of site before development.

Site History

The total area of this site is some 217ha in total and is being developed to provide a golf course, sports field, public open space and approximately 70ha of mainly residential development on the edge of the River Thames floodplain. The residential development area is crossed by Bear Brook (the main arterial watercourse taking surface water from Aylesbury) and Southcourt Brook, Stoke Brook and Hartwell Ditch, all of which have associated floodplain.



Site prior to realignment and enhancement.

Environment Agency Interests

- Flood storage compensation for the area lost to the residential development.
- Restoration of the heavily engineered watercourses to

provide ecological, landscape and recreational benefits.

Description of Scheme

In addition to the large flood compensation area to be excavated and landscaped on the edge of the Thames floodplain, considerable work has been carried out to restore the heavily engineered main rivers to a more natural state. This involved reforming the watercourses as multi-staged channels within enhanced river corridors varying in width between 35 and 90 metres. The low-flow channels have been aligned with a restored sinuosity and provided with pools and riffles.

This scheme has been a major milestone for the Agency



as it is the first major river restoration project achieved in cooperation with, and with funding from, private development.

The watercourse corridors have been enhanced by planting of native vegetation including meadow grasslands, trees, reedbeds and marginal aquatic vegetation. The corridors also provide routes for pedestrians, avoiding highways through the development.

The two stage channels allow the transmission of floodwater safely through the development without compromising the degree of flood protection offered to existing residential development upstream.



Site after development completed.

Project title:
Fairford Leys

Location:
Aylesbury, Bucks

River/catchment:
Bear Brook, Southcourt Brook, Stoke Brook and Hartwell Ditch (River Thames catchment)

Date completed:
Ongoing, Phase 1 completed summer 1998

Development type:
Residential (plus golf course, sports fields and public open space)

Types of enhancement:

- river diversion and enhancements
- flood storage
- landscaping

Length of enhancement:
3km

Developer:
Coldharbour Farm Consortium

Local authority:
Aylesbury Vale District Council

Contact details:
Customer Services
West Area Office
Environment Agency
Isis House
Howbery Park
Wallingford
Oxon
OX10 8BD

Case study

3

Safeways, High Wycombe

Project title:
Safeways

Location:
High Wycombe,
Buckinghamshire

River/catchment:
Hughenden Stream
(River Wye
catchment)

Date completed:
April 1998

**Development
type:**
Supermarket

**Types of
enhancement:**

- opening of
culverted
watercourse
- clean up of
contaminated site
- groundwater
protection

**Length of
enhancement:**
150m

Developer:
Safeways

Local authority:
Wycombe District
Council

Contact details:
Customer Services
West Area Office
Environment Agency
Isis House
Howbery Park
Wallingford
Oxon
OX10 8BD



The redevelopment of this site for a supermarket enabled the culverted watercourse to be opened-up and the contaminated land to be remediated.

Site History

This is a new store constructed at the edge of High Wycombe town centre, on a former timber yard and factory site. The store is also located within a sensitive groundwater protection area. The Hughenden Stream, a tributary of the River Wye passed through the site in a culvert and also included a small weir.

Environment Agency Interests

- Culverted section of watercourse with resulting poor habitat and ecology.
- Clean up of contaminated site.
- Protection measures for petrol filling station within groundwater protection zone.

Description of Scheme

Negotiations were carried out between Safeways, the Environment Agency and the Local Authority over redevelopment of this site. Key issues were the future of the Hughenden Stream which passed through the site in a culvert partly under the site of

from the shop building. Contaminated material in the ground was treated in accordance with an agreed programme, including some recycling of materials. Finally the petrol station fuel tanks were fitted with a system of liners and detection systems to ensure that any leakage could not pass into surrounding groundwater and potentially affecting the public supply.

the main building, the clean up of contamination arising from previous industrial use of the site, and protection measures for underground fuel tanks, as the site lies within the protection zone of a major public supply borehole.

The resulting scheme included reopening approximately 70 metres of watercourse, with landscaped banks within concrete 'boxes' to provide structural stability for buildings alongside, and prevent possible contamination.

The Hughenden Stream was diverted off its previous line and the weir was removed to allow a consistent gradient along the stream's route, away



Case study 4 Soho Mill, Wooburn Green

The redevelopment of this former mill site incorporated significant enhancements to the river channel.

Site History

Soho Mill was one of the many mills on River Wye. The buildings at Soho Mill were finally demolished in the 1980s. Speculative development



Site before development.

proposals were put forward in the late 1980s, but were never implemented. The site was acquired by Simon Elvin Ltd (greeting card manufacturers), a local company whose headquarters is next door to the mill site. They put forward a proposal for a warehouse/office development to extend their existing business. All parties involved in the scheme recognised the need to improve the appearance and safety of the mill and the river channel passing through the site.

Environment Agency Interests

- Weir of restricted flood capacity in dangerous condition.
- Blockage to free movement of fish up and down stream caused by height of weir.
- Residual contamination of groundwater on the site from previous industrial use.
- Existing hard bank protection in very poor condition.

Description of Scheme

The agreed scheme comprised separating the existing weir into two smaller drops, and constructing a pool and traverse fish pass around a

wildlife refuge island. The channel works design was influenced by the subsequent discovery of contaminated ground in the building

location. All river works were therefore carried out in a concrete channel sealed against groundwater intrusion, with landscaping inside this. Groundwater contamination was dealt with by localised pumping to the foul sewer, and removal of contaminated soil, however the residual risk was felt to be too great to allow an unlined channel.



Site after development.

Significant to the success of the scheme was the support of Wycombe District Council in agreeing to the landscaping on the site in the river corridor and the commitment to improvement of the site by a sympathetic developer. Both were committed to achieving the best solution to improve the site, recognising the restricted size of the site and the complex technical issues to be resolved.

The success of this scheme also led to the development of ideas first set out in the Local Authority's River Wye Study, and the Environment Agency's Catchment Management Plans and Local Environment Agency Plans. This resulted in production of a joint River Wye Development Advice Note, setting out guidelines for development near the river. A subsequent smaller development at Lower Glory Mill has followed these principles, and further enhancements are expected at other redevelopments.

Project title:
Soho Mill

Location:
Soho Mill Industrial Estate, Wooburn Green, Buckinghamshire

River/catchment:
River Wye (River Wye catchment)

Date completed:
October 1994

Development type:
Warehouse/office development

Types of enhancement:

- river diversion and enhancements
- conservation enhancements (including fish pass)
- bank works
- clean-up of contaminated land
- landscaping

Length of enhancement:
100m

Developer:
Simon Elvin Ltd

Local authority:
Wycombe District Council

Contact details:
Customer Services
West Area Office
Environment Agency
Isis House
Howbery Park
Wallingford
Oxon
OX10 8BD

Case study

5

A34 Newbury Bypass

Project title:
A34 Newbury Bypass

Location:
Newbury, Berkshire

River/catchment:
River Enborne, River Kennet and River Lambourn (Kennet catchment)

Date completed:
Autumn 1998

Development type:
Trunk road

Types of enhancement:

- surface water drainage and storage
- reedbed treatment of highway runoff

Developer:
Highways Agency

Local authority:
West Berkshire

Contact details:
Customer Services
West Area Office
Environment Agency
Isis House
Howbery Park
Wallingford
Oxon
OX10 8BD

The management system for surface water from the bypass adopts best management practices and includes reedbeds to treat runoff which is being monitored as part of an R&D project.

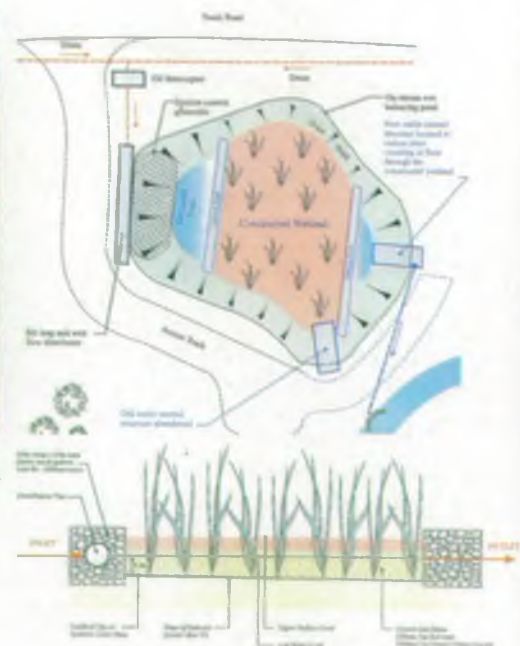
Site History

The Newbury bypass drainage works were finalised in 1992 following the Public Inquiry. Storage ponds were proposed to control rates of runoff from the new road to the local

reedbed as part of an Environment Agency, Thames Region R&D project to investigate the performance of these facilities. The aim of the project was to produce guidelines for the design,

The Environment Agency and the Highways Agency have worked closely in connection with this work and it is likely that design guidance will be reflected in future documents published by both organisations.

From experimental results already available from other studies it is clear that constructed wetlands within storage ponds can significantly



watercourses. They were originally designed as 'wet ponds' planted with a range of aquatic plants working on the 'surface flow' principle to improve water quality and enhance their environmental value.

Environment Agency Interests

- Promotion of Best Management Practices for surface water management.
- Flood Storage compensation for the area of developed land.
- Improvement of the quality of road runoff prior to discharge into watercourses.

Description of Scheme

The design of one of the ponds was modified prior to construction to incorporate a 'sub-surface' flow constructed

construction, operation and maintenance of constructed wetlands for highway runoff, particularly as part of surface water storage ponds.

An interim guidance manual is about to be made generally available, and should be published as a national report from the Environment Agency. Monitoring of the research facility and another pond for comparison purposes commenced when the new bypass opened to traffic in Autumn 1998.

The interim manual will be updated as necessary in light of the Agency's research programme and also with input from associated research being carried out on the sewage drainage provisions at Newbury.

improve water quality prior to the discharge to natural watercourses. However improved guidance is essential if their use is to be extended as part of future surface water drainage management. This R&D study and report should assist this process.



Case study

6

The Green, Aspenden

This case study illustrates how the surface water from a small housing development can be managed in a sustainable manner which deals with runoff as close as possible to where the water falls.

Site History

Aspenden is a small village about ten miles east of Stevenage in Hertfordshire.

Aspenden Brook, a small tributary of the River Rib, flows through the village. This is a typical 'bourne' in the upper part of the Lee catchment and it is not unusual for it to be dry for most of the year.

The site was first brought to the Environment Agency's notice when the developer discussed the disposal of surface water from the development via a pipe running across a field to the Aspenden Brook. However, the location was appropriate for source control via a soakaway system and this option was promoted to the developer.

Environment Agency Interests

- Promotion of Best Practice Management Practices for surface water management.
- Opportunity for habitat creation.

Description of Scheme

The development comprises of five large detached houses. The surface water drainage from the front roof areas is connected via a perforated pipe to a pond. The pond provides a focal point at the front of the site and a new habitat.



Drainage from the road and driveways runs off naturally and is either directed towards the pond or to shingle soakage strips. When the pond is full, it spills into an adjacent hollow which in turn soaks into the underlying gravel sub strata.

The roof water from the rear of the properties is collected in 1000 litre water butts. When these are full the water is diverted into a standard soakaway, French drain or perforated pipe connected to the pond. As the houses are fitted water meters, like most new houses, the use of water butts makes sense both financially and environmentally.



Project title:
The Green

Location:
Aspenden, near
Buntingford,
Hertfordshire

**River and
catchment:**
Aspenden Brook,
River Rib (Upper Lee
catchment)

Date completed:
1998

**Development
type:**
Residential
development

**Types of
enhancement:**

- surface water
runoff/source
control
- conservation
enhancements

Developer:
Leach Homes

Local authority:
East Herts District
Council

Contact details:
Customer Services
North East Area
Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

Case study

7

M1 Link Road, Watford

Project title:
M1 Link Road

Location:
Watford,
Hertfordshire

River and catchment:
River Colne (Colne catchment)

Date completed:
1996

Development type:
Road development

Types of enhancement:

- river enhancements and bank works
- conservation enhancements

Length of enhancement:
approximately 1km

Developer:
Hertfordshire County Council

Local authorities:
Watford District Council and
Hertsmere District Council

Contact details:
Customer Services
North East Area Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

This case study describes how a length of river was restored following its realignment as part of a road scheme and the habitat of lakes designed to store runoff from the road were enhanced.

Site History

The River Colne was realigned between 1989 and 1990 in order to facilitate the construction of the Watford M1



Link Road. As a result the channel became trapezoidal, relatively straight and over wide (by up to 2m) for the predicted minimum flows. The bed (deepened by nearly 1m) was uniform and silty and marginal vegetation was very sparse. This resulted most notably in a drastic reduction in fish numbers (270 recorded in October 1988, 3 recorded in October 1992) following the general loss of habitat diversity. Three balancing ponds were also constructed as part of the road scheme, to store excess river water during high flows.

Environment Agency Interests

- Poor habitat and fishery as a result of heavily engineered watercourse.
- Flood risk due to the size of the catchment and the speed of runoff from the urban/clay catchment.

Description of Scheme

After an assessment of the reach by then National Rivers Authority (NRA), Hertfordshire County Council and the NRA

jointly funded a number of instream measures in 1993, designed to enhance the reach.

Realignment of the river was not possible. These works reversed the effects of the previous works by establishing marginal and aquatic vegetation. They also developed varying flow characteristics absent due to the previous overwidening and deepening. The works carried out included

and prevent them from drying out in hot summers. These were not serving any useful ecological or water quality purpose. This was seen as an opportunity to increase shelter for fish by creating good backwater habitat. Works included reprofiling the banks to form wetland shelves, replacing the inlets with downstream angled inlets to prevent polluted water entering the ponds and planting the backwaters with marginal species.

The scheme has been very successful and the in-channel and marginal habitats have become well established. Fish numbers, biomass and species have all improved beyond that recorded prior to the construction of the road scheme.



placing groynes in the channel, creating riffles and importing gravel for the river bed.

Further works were carried out in 1996 to reprofile and reconnect the adjacent lakes

Case study

8

Cowley Business Park, Uxbridge

The protection and enhancement of a wide buffer zone was realised as a result of the development of this large business park.

Site History

The site is located between the River Frays and the Grand Union Canal and therefore the protection of the river corridor was a high priority for the Environment Agency.

Environment Agency Interests

- Protection of a buffer strip between the watercourse and development.
- Opportunity for habitat and landscape enhancement.

Description of Scheme

This commercial development consisted of over 10,000m² of high tech office and laboratory space. The Environment Agency ensured that a wide buffer strip was maintained between the development and the River Frays. This 20m wide strip provided an opportunity to enhance existing habitats and to create new habitats. The

developer landscaped the strip and planted trees, shrubs and grassland.

The landscaping contribution of the existing trees, scrubs and hedges was identified prior to the commencement of the development. This was supplemented with additional planting to enhance the landscaping.

Attenuation of the site surface water runoff with a controlled rate discharge to the River Frays was a fundamental element of the drainage strategy. This was to ensure the development did not increase the risk of flooding from the River Frays.



Project title:

Cowley Business Park

Location:

High Street, Cowley,
Uxbridge, Middlesex

River/catchment:

River Frays (Colne
catchment)

Date completed:

1998

Development type:

Commercial
development

Types of enhancement:

- river enhancements
- conservation and
landscape
enhancements

Length of enhancement:

390m

Developer:

Kyle Stewart
Properties
Ltd/Cowley Park
Developments Ltd

Local authority:

London Borough of
Hillingdon

Contact details:

Customer Services
North East Area
Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

Case study

9

Cowley Retail Park, Uxbridge

Project title:

Cowley Retail Park

Location:

High Road, Cowley,
Uxbridge, Middlesex

River and catchment:

River Pinn (Colne
catchment)

Date completed:

1997

Development type:

Retail development

Types of enhancement:

- river diversion and enhancements
- opening up of culverted watercourse

Length of enhancement:

130m

Developer:

Lowndes
Queensway/Hadrian
Development Ltd

Local authority:

London Borough of
Hillingdon

Contact details:

Customer Services
North East Area
Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

The redevelopment of this site for a retail park allowed the culverted section of the watercourse to be restored to an open channel to provide an improved environment and a visually attractive solution.

Site History

The River Pinn was in a twin box culvert under most of this site, with short open sections at either end. Downstream of the site the River Pinn is siphoned under the Grand Union Canal before it's confluence with the River Frays.

the culvert under the site and be diverted along the south eastern boundary of the site.

The banks of the new channel were formed as naturally as possible. The design includes: new marginal aquatic planting in localised areas along river banks to

site boundary and trailing plants to grow over and soften hard edges.

In addition, other environmental and landscape improvements were carried out along the frontage of the High Road to enhance the visual appearance of the site and the area generally by providing a continuation of the landscape scheme established by the adjoining development site to the south east.



Watercourse culverted across site before redevelopment.



Watercourse opened up along the edge of the site after redevelopment.

Environment Agency Interests

- Culverted section of watercourse with resulting poor habitat and ecology.
- Opportunity for habitat and landscape improvements.

Description of Scheme

The redevelopment of the site, to include four retail warehouse units, allowed the River Pinn to be removed from

soften edges and to encourage meandering river course; the use of gabion steps to create areas for planting faced with willow

hurdles, including some 'live' willow hurdles; and shrubs used to naturalise the river bank within the limits of the



The reclamation of an area of semi-derelict land adjacent to British Airways' new office complex at Harmondsworth and the building of flood defences provided the opportunity for creating parkland landscape with valuable recreation opportunities.

Site History

The new British Airways headquarters within its parkland setting near Heathrow Airport and is bounded by the M25, M4 and A4. The whole site extends for 108.5ha and is crossed by several rivers, including the River Colne, Wraysbury River, Duke of Northumberland's River. Historically the area, which is in the Green Belt, has been filled with waste. Only a small proportion of the site was developed for the office buildings and in return the surrounding area of parkland was cleaned up, landscaped, habitats created and opened up for public access.

Environment Agency Interests

- Protection of watercourses and groundwater from pollution and disturbance during construction.
- Clean up of contaminated land.
- Need to increase the flood defence standards of service.
- Opportunity for habitat enhancement and creation.
- Opportunity to promote access and education initiatives.

Description of Scheme

The main objective in creating the parkland was to reclaim and reshape the site as an attractive landscape that is safe

soil forming layers and the establishment of vegetation.

Areas for nature conservation were created in various sites within the parkland. Most notably the enhancement of the riverbanks and restoration of the lakes with suitable shoreline and bankside treatments native planting and the formation of islands. Additionally, opportunities to create areas of



and suitable for public access, casual recreation and where appropriate, active recreation. This necessitated substantial earth works, including the excavation of waste and its redistribution in fully engineered

tips conforming to appropriate standards, with the placement of appropriate capping and

interest, such as a small pond, the restoration of flood meadows and woodlands and copses all contribute to the diversity of the site.

The parkland is predominately for casual and informal countryside access and recreation with the creation of a network of footpaths and pedestrian ways throughout the site. Other facilities include picnic areas, new pedestrian bridges and informal cycleways.



Project title:
Prospect Park and Waterside

Location:
Harmondsworth, West London

Rivers/catchment:
River Colne, Wraysbury River, Duke of Northumberland's River (Colne catchment)

Date completed:
1997/9

Development type:
Commercial development

Types of enhancement:

- conservation and landscape enhancements
- recreation provision
- river enhancements
- clean up of contaminated land/containment of waste

Developer:
British Airways

Local authority:
London Borough of Hillingdon

Contact details:
Customer Services
North East Area Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

Project title:

Two Rivers Retail Park
Staines

Location:

Staines, Surrey

River/catchment:

River Colne and
Wraysbury River
(Colne catchment)

Date completed:

1998

Development type:

Retail development

Types of enhancement:

- river diversion and enhancements
- conservation enhancements
- clean up of contaminated land

Length of enhancement:

550m

Developer:

MEPC Developments
Ltd

Local authority:

Spelthorne Borough
Council

Contact details:

Customer Services
North East Area
Office
Environment Agency
Apollo Court
2 Bishop Square
Business Park
St Albans Road West
Hatfield, Herts
AL10 9EX

The redevelopment of this site and the Environment Agency's flood alleviation works have enabled the rivers across this site to be enhanced.

Site History

Redevelopment of the Staines Central Trading Estate and the Environment Agency's Lower Colne Improvement Scheme has provided the opportunity

- Restoration of over engineered watercourse to provide ecological and landscape benefits.

Description of Scheme

The river now forms an attractive setting for the new development. A sinuous channel with marginal shelves has been created with stone surfaces. This has enabled new



Channel before enhancement

for works to be carried out which both improves the local environment and provides enhanced protection from flooding for adjacent properties. The River Colne and Wraysbury River had been straightened and contained within hard, engineered surfaces resulting in shallow flows and a sterile environment of little conservation value.

habitats to be created. Trees and scrubs have been planted along the rivers and walkways and seating provided.



Channel after enhancement

Environment Agency Interests

- Need to increase flood defence standards.



Channel after enhancement

Since the redevelopment of the Two Rivers site and the Environment Agency's works were undertaken in parallel, responsibility for the necessary works to remove obstructions to flood flow were apportioned between the developer and the Agency. The elements undertaken by the Agency included the excavation of a low flow channel, removal of the railway bridge and associated trash screen, installation of a curved weir with fish passes and the removal of Lino Mill.

Case study

12

Thames Valley Park, Reading

The development of this large business park enabled the creation of a country park and nature reserve, improved public access and realise flood defence benefits.

Site History

This site forms a large triangle of land north east of Reading bounded by the River Thames to the north and the London-Bristol railway line to the south. The total area of the application site is 69ha. Part of this site was proposed for development in the relevant local authority development plans.

The site included the former coal fired North Earley Power Station, which was demolished some time ago, and a gas turbine station which was demolished in the mid 1980's. There were several outfalls from the power stations to the River Thames. The rest of the site comprised floodplain meadows adjacent to the river, an area of approximately 16ha which was used as a tip for pulverised fuel ash and an area of other generally dilapidated industrial premises.

Environment Agency Interests

- Provision of flood storage and improved flood routes across the floodplain.
- Opportunity for habitat and landscape improvements.
- Opportunity to promote access and recreation.

Description of Scheme

The Business Park incorporated some 28ha of the site, with

strategic highways incorporating a further 4.6ha. The Business Park provides a low density campus style development with extensive landscaping, including wetland



features, providing corporate premises for companies such as BG plc and Oracle. The Business Park includes in the region of 93,000m² of office space and incorporates essential services for the large number of employees, including shops, sporting and leisure facilities, restaurants, hotel and conference facilities.

The site was prepared for development by removing the original top soil, digging the gravel out and burying the pulverised fuel ash in a cell and then replacing the original soil on top. In the approximate area of the power station a nature reserve was established. This involved creating lakes, islands and wetland areas and then

planting with reedbeds and other appropriate vegetation. The earthworks on the site were also carried out to order to compensate for loss of flood storage and to open up flood flow routes.

The rest of the area adjacent to the river, the country park, was seeded with a wildflower grass seed mix and is managed for a variety of



conservation and low-key recreation purposes. The former cooling water channel has also been enhanced. The footpath along the river is part of the Thames Path. The country park and nature reserve cover an area of 37ha.

Project title:
Thames Valley Park

Location:
North Earley,
Reading, Berkshire

River/catchment:
River Thames

Date completed:
Since completion of business park infrastructure in mid 1990's, companies have been developing different plots within the site.

Development type:
Commercial development

Types of enhancement:

- conservation and landscape enhancement
- recreation provision
- floodplain compensation/storage

Developer:
Speyhawk Land & Estates Ltd/Thames Valley Park Ltd (plus developers of the different plots)

Local authority:
Wokingham District Council

Contact details:
Customer Services
South East Area Office
Environment Agency
Swift House
Frimley Business Park
Frimley
Camberley
Surrey
GU16 5SQ

Case study

13

Loddon Mill, Twyford

Project title:

Loddon Mill

Location:

Twyford, Berkshire

River/catchment:

River Loddon
(Loddon catchment)

Date completed:

1999

Development type:

Residential development

Types of enhancement:

- river enhancements
- conservation enhancements
- bank works
- landscaping

Length of enhancement:

600m

Developer:

Berkeley Homes

Local authority:

Wokingham District Council

Contact details:

Customer Services
South East Area
Office
Environment Agency
Swift House
Frimley Business Park
Frimley
Camberley
Surrey
GU16 5SQ

The redevelopment of this former mill site for housing provided the opportunity to create and manage the bankside habitats.



Before development

Site History

The site occupies land in the north west area of Twyford on the north banks of the River Loddon. The site area is approximately 1.4ha and was occupied by mill buildings, warehouses, offices and hard standing. The Victorian mill buildings had been replaced in the 1960's following a fire. In addition to the River Loddon, the site is also crossed by the mill leat and therefore the site has a considerable length of riverbank.

Environment Agency Interests

- Opportunity for habitat and landscape improvements.
- Opportunity to enhance and restore heavily engineered river banks.

- Opportunity to promote access and recreation.

Description of Scheme

The development consists of a mixture of large detached houses and apartment blocks. The developer, following discussions with the Environment Agency, has made provisions for extensive



vegetation; provision of bat and bird boxes; tree planting; and general landscape maintenance.

Public access is provided to the banks of

the Loddon, where this does not conflict with nature conservation objectives. Existing footpaths have been enhanced, safety provisions installed where appropriate and interpretation signs sympathetically located.

The works to the banks include the creation of a Kingfisher nesting bank, regrading of steep and artificial

banks and the repair of damaged banks. Other works include: tree management, including a programme of pollarding willows and coppicing alders; the creation of new riverside habitats and planting of marginal



Wier Pool Court

Case study

14

Tesco, Wokingham

The surface water management system at this site incorporates many aspects of best management practice which the environment agency is trying to promote on a wider basis.

Site History

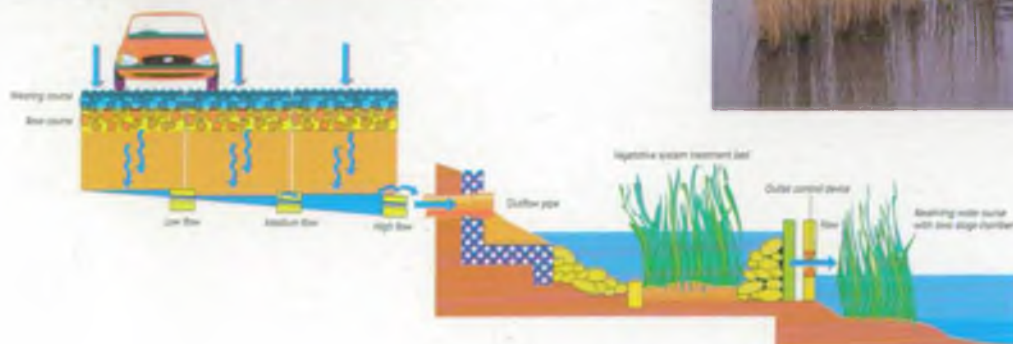
The hard, impermeable areas associated with development can lead to undesirable consequences relating to the rapid runoff of surface water.

source as possible. The car park at this new superstore demonstrates several aspects of this and is an excellent example of a more sustainable approach to development.



This can result in water of poor quality entering watercourses and a risk of flooding. The Environment Agency is therefore promoting a range of measures for dealing with surface water as close to its

The Environment Agency can advise planning authorities and developers about catchment-wide source control measures such as appropriate design and layout of new developments, on-site water attenuation and permeable surfaces. These measures offer a variety of benefits: they can alleviate flood risk, improve water quality and promote groundwater recharge.



Environment Agency Interests

- The control of the quantity and quality of runoff from the site.
- Promotion of Best Management Practices for surface water management.

Description of Scheme

The car park at this superstore demonstrates several aspects of source control. A permeable pavement prevents the rapid runoff of surface water that is collected through pipes in the sub base on top of an impermeable membrane. All water is then directed to an outfall, which discharges via a constructed wetland for filtration through a reed bed. A two-stage channel restricts the rate of discharge into the local stream.

It is also proposed to monitor the quality and quantity of runoff from this site with general research into the effectiveness of these techniques.



Project title:
Tesco

Location:
Wokingham,
Berkshire

River/catchment:
River Loddon
(Loddon Catchment)

Date completed:
1997

Development type:
Supermarket

Types of enhancement:

- surface water runoff/source control
- reed beds for treatment

Developer:
Tesco

Local authority:
Wokingham District
Council

Contact details:
Customer Services
South East Area
Office
Environment Agency
Swift House
Frimley Business Park
Frimley
Camberley
Surrey
GU16 5SQ

Project title:
Blackwater Valley
Road

Location:
Near Frimley,
Hampshire

River/catchment:
Blackwater (Loddon
catchment)

Date completed:
1996

**Development
type:**
Road development

**Types of
enhancement:**

- river diversion and
enhancements
- conservation
enhancements

Developer:
County Highway
Authorities

Local authority:
Hampshire and
Surrey County
Councils

Contact details:
Customer Services
South East Area
Office
Environment Agency
Swift House
Frimley Business Park
Frimley
Camberley
Surrey
GU16 5SQ

This case study describes how a length of river was restored following its realignment and enhanced as part of a road.

Site History

The River Blackwater flows through an area of alluvial gravels and drift deposits, overlain by silts and fine clays.



The gradient is fairly flat, approximately 1:1,000. The hydrology of the river is flashy as a result of the clay soils and the high percentage of urban runoff entering the system. Baseflows are high, due in part to outfalls from sewage treatment works. Urban runoff and effluent discharges also affect river quality.

The river had been degraded by various gravel extraction works and channel diversions. The upstream section had a problem with excessive growth of *Potamogeton natans* (broad-leaf pondweed). In the late 1980s construction of a new road began, joining the A31 to the M3. Due to the heavily urbanised nature of this area,

the road followed the Blackwater valley along the course of the River Blackwater. The road necessitated the diversion of the river at several locations.

Environment Agency Interests

- Minimising and mitigating the impact of the road scheme.
- Opportunity to introduce/increase geomorphological diversity within the channel.
- Opportunity for conservation enhancements.

Description of Scheme

The road and river works were completed in two stages; the northern section and central section. Work was undertaken by both Hampshire and Surrey County Councils, with the obligation to incorporate habitat enhancement in the design of the diverted reaches.



In the Northern Section previous works to the river had left much of this section straight and deepened with little flow or bed diversity.

Some of the original sinuous plan-form remained, though this had been deepened and divorced from the floodplain. In this section a two stage meandering channel was created with a gravel bed and riffles were introduced at various locations. In addition, a new backwater was created.

In the Central Section the Blackwater retained a fairly diverse river corridor, which gave greater impetus to the council to enhance the ecological value of the site. In this section the upstream reach was diverted adjacent to an area of lakes (Spring Lakes), whilst the downstream reach had to be diverted under the new road and through a wooded area. A two stage channel, gravel riffles, secondary channel/backwater and reed bed retention ponds planted with reeds were also incorporated into this section of the scheme.

Case study

16

Teddington Wharf, Teddington

This site illustrates how the Environment Agency is working in partnership with riparian developers along the tidal Thames to achieve environmental enhancements and increased flood protection.

Site History

This site adjacent to the River Thames in Teddington was a famous boatyard for several decades having even built boats for the Normandy landings. A mixed development was proposed on this site. However, part of the development is in the floodplain. In consultation with the Environment Agency it was decided to set the flood defences away from the river frontage and part of the ground floor of one building has been left 'open' to the tide. These measures enable the flood storage on the redevelopment site to be unchanged from the original site.

Environment Agency Interests

- Compensation for loss of flood storage.
- Poor condition of flood defences.

Description of Scheme

Before the redevelopment of the site, there were four floodgate openings on the flood defence walls providing access to a slipway, pontoon and moorings. As part of the redevelopment, three of these floodgates have been closed permanently thereby reducing the flood risk on the site.

A section of river wall which was in poor state of repair was replaced, at no cost to the Environment Agency, and on the same line as the existing river wall. Therefore there was no encroachment of



the foreshore as a result of the new river wall or flood defence walls.

The provision of a riverside walkway and planting between the river edge and the buildings have greatly increased the visual amenity and recreational value of the site. At the same time, new assets (the river wall and flood defence walls) were created and ensuring the flood storage capacity on the site remained unaltered.

Project title:

Teddington Wharf

Location:

Teddington
Middlesex

River/catchment:

Tidal Thames
(Thames tideway
catchment)

Date completed:

Ongoing

Development type:

Residential
development and
tidal defences

Types of

enhancement:

- enhanced tidal defences
- conservation enhancements
- flood storage

Developer:

St. George West
London Ltd

Local authority:

London Borough of
Richmond upon
Thames

Contact:

Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

Project title:
Barn Elms

Location:
South West London

River/catchment:
Tidal Thames
(Thames tideway
catchment)

Date completed:
ongoing

**Development
type:**
Housing
development

**Types of
enhancement:**

- conservation
enhancements
- recreation
provisions

Developer:
Berkeley Homes

Local authority:
London Borough of
Richmond upon
Thames

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

A housing development has provided the opportunity to create a major new wetland habitat on the site of this former water works.



Site History

The new Wildlife and Wetland Trust nature reserve at Barnes is a good example of how the development planning process can lead to habitat enhancement on a significant scale. The site consisted of the reservoir and filter beds that originally supplied South West London and were made redundant by the Thames Water Ring Main. The large expanse of water had attracted flocks of water birds which led to the site being designated a Site of Special Scientific Interest.

Environment Agency Interests

- Opportunity for wetland habitat creation.
- Opportunity for the provision of recreation facilities.

Description of Scheme

The new wetland centre at Barn Elms is a collaborative venture between the Wildfowl and Wetland Trust, Thames Water and Berkeley Homes. The project involves the creation of a 40 hectare complex of wetland habitats and visitor centre funded

by a new housing development of part of the site. In total, 321 residential units are being built.

The main engineering works commenced on site in November 1995 and were completed in 1997. The original concrete and brick-edged reservoirs were broken up and the reservoir banks lowered, separating different soil types into stock piles. Clay cut-off walls and blankets were built to separate each of the hydrological/habitats units, followed by detailed land

forming and planting was complete, various monitoring and surveys projects were carried out. These were jointly funded by the Environment Agency, English Nature and the Wildfowl and Wetland Trust. Experimental work using trial plots on grass seed establishment on soil profiles of various compositions of sub-soil, topsoil and sewage cake were established. Arrangements have also been made to initiate a large programme of collaborative research at Barn Elms between the Wildfowl and Wetland Trust and other academic research institutes.



forming, surface profiling and surface treatment to create the desired landform, including open water lakes, reedbed and seasonally inundated wetlands.



Case study

18

Mill Lane, Carshalton

The redevelopment of this former industrial site for housing incorporated the deculverting, realignment and enhancement of the River Wandle across the site.



- sufficient flood capacity;
- a staged channel design;
- riffles and pools and a rough bed in the low flow channel;
- creation of gently sloping more

Site History

The River Wandle ran in a culvert through a former BP Chemicals site at Carshalton. The site was previously contaminated by heavy metals and Volatile Organic Compounds (VOCs) and therefore remedial work was required.

Environment Agency Interest

- Culverted section of watercourse with resulting poor habitat and ecology.
- Opportunity for habitat and landscape improvements.
- Conveyance of sufficient flood flows.
- Clean up of contaminated land.

Description of Scheme

The redevelopment of the site involved the construction of 121 residential units. Part of the proposals allowed the River Wandle to be restored to a more natural state, enhancing the quality of the new residential development and the environment.

To safeguard against any future river pollution problems, the Wandle was diverted away from the contaminated area. The creation of a new semi-natural channel incorporated:

- natural banks;
 - increased sinuosity; and
 - creation of habitats with appropriate planting.
- A buffer zone was provided along each bank and a riverside walkway.



Project title:
Mill Lane

Location:
Carshalton, Surrey

River/catchment:
River Wandle

Date completed:
mid 1990s

Development type:
Residential development

Types of enhancement:

- river diversion and enhancements (including de-culverting)
- conservation enhancement

Length of enhancement:
approximately 350m

Developer:
Rydon Construction Ltd

Local authority:
London Borough of Sutton

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

Project title:
South Norwood
Country Park

Location:
Elmers End, South
London

River/catchment:
Chaffinch Brook –
West Branch
(Ravensbourne
catchment)

Date completed:
1999

**Development
type:**
Light railway system

**Types of
enhancement:**

- river diversion and
enhancements
- recreation provision
- conservation
enhancements

**Length of
enhancement:**
110m

Developer:
London Borough of
Croydon and London
Underground

Local authority:
London Borough of
Bromley

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

The development of the Croydon Tramlink has enabled a section of over engineered watercourse to be diverted and restored to a semi-natural channel.

Site History

The London Borough of Croydon and London Transport are the joint partners in the operation of Croydon Tramlink, a light rail system covering a total length of 28km which is focused on Croydon Town Centre with three branch lines to Wimbledon, Beckenham and New Addington. The former National Rivers Authority opposed the culverting of the open concrete channel carrying the Chaffinch Brook within the former sewage treatment works at South Norwood Country Park to carry a section of track to Elmers End BR station. The brook was therefore diverted away from the track in a 110m long geomorphologically

Description of Scheme

The new channel is designed for a flood defence standard of a 50-year return period. The design comprises of a main channel with a low flow channel. The low flow channel contains a series of shallow stone groynes extending laterally to the channel mid-section. Flow variability has been encouraged by the introduction of gravel to the low flow channel thus creating a series of shallow riffles and pools. The gravels were selected which approximate those found in semi-naturalised sections downstream. The shallow stone groynes provide a basis for bed stability and prevent the gravels from being

upon the berms will encourage the stability of the gravels. The gravel placement will also benefit channel stability by providing a degree of bed armouring against excessive flows.



The establishment of vegetation is an important component in the stability of the channel. Vegetation will increase bank strength, aid drainage and provide shade to the watercourse. Landscaping will be continuous along the western bank and the bund between the channel and tramway. The eastern bank will be partially vegetated to allow access to the water for maintenance and amenity. Impounding weirs were not used because of their inhibiting effect on fish migration. The value of the diversion is not limited to the enhancement of the geomorphological and ecological integrity of the channel. The aesthetic and educational potential of the diversion can be appreciated from the nearby public footpath.



stable, naturalised channel incorporating diverse native landscaping.

washed out during higher flows. The sedimentation of fines and the establishment of within channel vegetation

Environment Agency Interests

- Opposition to the culverting of an open channel.
- Restoration of a heavily engineered watercourse to provide ecological, landscape and recreational benefits.



Case study

20

Glaxo-Wellcome Site, Beckenham

The redevelopment of the site allowed a culverted watercourse to be opened up and diverted to create, along with other works, wildlife habitats.

Site History

The former culverted East Beck running through the former Glaxo-Wellcome site was diverted in 1990 into an open channel to allow further building works on the site and to act as an overflow via a side weir into a balancing lake. The new course formed part of the Langley Park Nature Trail, which includes wetlands created between the Beck and

Description of Scheme

The diverted channel is designed for a flood defence standard of a 50-year return period. Because of geotechnical considerations the banks had to be constrained by timber boarding and gabions, however, the banks were turfed and landscaped to minimise the impact. An off-line balancing lake was constructed adjacent to the new diversion.

This is fed by a control structure on the diverted East Beck, where a triangular weir causes flood flows to overtop the side weir and pass into storage in the wetlands and lake. In order to maintain the

the lake. The flood defence standard was increased and maintenance access improved. The old culvert continued to take flows from the site. Laing Homes are currently developing the site and the culvert is to be backfilled with all surface water being discharged into sewers or soakaways.

quality of water in the lake and feed the wetlands during low flows, a trickle inlet is provided from the diversion. The spillway of the lake discharges into the main Beck.

The diverted East Beck forms part of the Langley Park Nature Trail, which was created for the benefit of the Wellcome Foundation's employees. This includes woodland,

meadowland, wetland and mounded areas. During a crash tree-planting programme, following the 1987, gale over 3000 trees were planted. These include ash, oak, alder, larch and pine as well as double that number of mainly indigenous hardy shrubs. All have become well established as first generation woodland. Of the two rivers within the site, East Beck supports a far wider range of plant and invertebrate life, due to the varying degrees of water purity governed by off-site conditions. Because of the current redevelopment of the site, the future of the natural trail is uncertain.

The scheme is an early example of engineers working with ecologists in the creation of naturalised channels and the lessons learned were applied to subsequent projects.



Project title:

Glaxo-Wellcome site

Location:

South Eden Park Road, Beckenham, South East London

River/catchment:

The Beck – Main and East branches (Ravensbourne catchment)

Date completed:

1991

Development type:

Commercial and residential development

Types of enhancement:

- river diversion and enhancements
- conservation enhancements
- landscaping

Length of enhancement:

700m

Developer:

Wellcome Foundation Ltd

Local authority:

London Borough of Bromley

Contact details:

Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert Embankment
London
SE1 7TG

Environment Agency Interests

- Need to increase the flood defence standards of service.
- Restoration of culverted watercourse to provide ecological, landscape and recreational benefits.

Project title:
Bell Green Gas Works

Location:
Sydenham, South East
London

River/catchment:
River Pool
(Ravensbourne
catchment)

Date completed:
1995

**Development
type:**
Retail development

**Types of
enhancement:**

- river diversion and enhancements
- conservation enhancements (including fish pass)
- clean-up of contaminated land

**Length of
enhancement:**
500m

Developer:
British Gas

Local authority:
London Borough of
Lewisham

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

The redevelopment of this former gas works provided the opportunity to divert and enhance a previously culverted and heavily engineered watercourse.

Site History

The former Bell Green Gas Works at Sydenham was redeveloped for retail usage in the mid-1990s by British Gas.



Channel before diversion

The former culverted and channelled course of the Pool River was abandoned and backfilled, with flows being diverted into a naturalised channel within a landscaped linear park. The works increased the flood defence standard in the area and created a public landscaped open space with improved maintenance access. Because of existing contamination of the site a benonite cut off barrier was placed around the site.

Environment Agency Interests

- Need to increase the flood defence standards of service.
- Restoration of heavily engineered and culverted watercourse to provide ecological, landscape and recreational benefits.
- Contamination on the site from previous industrial use.

Description of Scheme

The 500m long new 3-stage channel is designed for a flood defence standard of a 50-year return period. The channel was diverted through a 'clean zone' so that it no longer traversed the contaminated gasworks site. The design of the channel was constrained by geotechnical requirements relating to potential bank instability associated with failure planes within the London Clay. Therefore the proposals incorporated the use of piled walls and a reinforced concrete base slab. However, the channel was designed to incorporate such key features as environmentally enhanced

cross-sections including a gravel bed, pool-riffle sequences and in-channel planting. A cascade was introduced at the downstream end to minimise the problems created by the significant level difference between the bottom of the channel and the adjacent ground levels. The channel bed gradient upstream of the cascade is 1 in 800 which reduces the channel velocities during storm events minimising the possibility of flushing out fish stocks through the linear park.



The new channel meanders through a 35m wide linear park landscaped with native species. Footpaths and cycleways traverse the park with bridges crossing over the new channel which also provide maintenance access. A wetland area with restricted access was constructed at the downstream end of the park within a retained part of the old Pool river course. The area incorporates a pond planted with aquatic, emergent and marginal plants.



Case study

22

Brookmill Park, Lewisham

The extension of the Docklands Light Railway has enabled a section of over engineered watercourse to be diverted and restored to a semi-natural channel.

Site History

The concrete flood channel of the River Ravensbourne at Brookmill Park in Lewisham is



Channel before diversion.

to be used as the route of the Docklands Light Railway. This location was chosen to minimise tree loss and reduce the visual impact of the railway on the park and surrounding area. The river has been diverted along a 300 metre meandering course featuring a realistic gravel bed, native landscaping on sloping river terraces and wildlife features. The standard of flood protection has been increased and a waterproof membrane has been laid to prevent pollution of groundwater. An ornamental lake within the park has been reconstructed as a more natural feature.

Environment Agency Interests

- Restoration of a heavily engineered flood channel to provide ecological, landscape and recreational benefits.
- Need to increase flood defence standards of service.
- Potential risk of groundwater contamination.

Description of Scheme

The new channel is designed for a flood defence standard of a 100-year return period. The design comprises of a 3-stage channel providing for habitat diversity, both aquatic and terrestrial. The stages include a low flow notch with a sinuous alignment located within a 7.5m wide gravel/rock channel, which will accommodate normal

river flows. This second stage is bounded by a narrow marginal strip, which will sustain marginal plants and will be subject to frequent flooding due to high flows and the tidal influence. The higher stage widens out to create a flood

notch to provide an acceptable depth of water. Large fish shelters have been provided at the mid-point of each pool. The gravel/rock bed material used will provide the voids necessary to encourage invertebrate and fish life.

Stone deflectors have been provided to enhance habitat diversification by providing a hard substrate for algae and associated invertebrates. The deflectors will also create a cleansing velocity through the pools to protect the banks from erosion.

Native aquatic, emergent and riverside landscaping is being undertaken using species capable of withstanding relatively hostile variable water flows. The steeper slopes will be covered with reeds and vigorous grass species tall enough to obscure the harder engineered aspects of the scheme.



meadow with grassed banks. A polypropylene membrane liner has been laid at least 1m deep to protect the chalk aquifer beneath the river diversion.

Provision has been made to provide sustainable habitats for fish and invertebrates. These include the creation of a series of pools (up to 20m long) and riffles above the low flow



Project title:
Brookmill Park

Location:
Lewisham, South East London

River/catchment:
River Ravensbourne (Ravensbourne catchment)

Date completed:
1998

Development type:
Light railway system

Types of enhancement:

- river diversion and enhancements
- conservation and landscape enhancements

Length of enhancement:
300m

Developer:
DLR Ltd, CGL Rail & LRG Contractors

Local authority:
London Borough of Lewisham

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

Project title:

Bullhead Dock and
Bellamy's Wharf

Location:

Rotherhithe, East
London

River/catchment:

Tidal Thames
(Thames tideway
catchment)

Date completed:

1995

Development type:

Residential
development and
tidal defences

Types of enhancement:

- enhanced tidal defences
- conservation enhancements
- recreation provision

Length of enhancement:

Total frontage 325m

Developer:

Barratts

Local authority:

London Borough of
Southwark

Contact details:

Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG.

This case study illustrates how the Environment Agency works in partnership with developers and local authorities to prevent encroachment by development and promotes environmental and access improvements.

Site History

This site is adjacent to the River Thames in Rotherhithe. Bellamy's Wharf and Bullhead Dock were a sand and gravel unloading facility with a high jetty. Barges were able to moor alongside the jetty, as well as being brought under the jetty through an opening for cranes to unload the ballast.



The initial proposal was to infill not only Bullhead Dock, but also another dock adjacent to Bellamy's Wharf. However, after several meetings between the Environment Agency and the developer's representatives only a small encroachment was allowed to enable the rebuilding of a new river wall at the other dock, at no cost to the Agency, but at Bullhead Dock no encroachment was allowed.

Environment Agency Interests

- Poor condition of the tidal defences.
- Minimisation of encroachment onto the foreshore.
- Improvement of public access.

Description of Scheme

This represents one of the earliest examples of the Environment Agency's successes with development involving 'encroachment', the Agency resists non river related development that encroaches onto the foreshore. As compensation for the small encroachment resulting from rebuilding the river wall, the developer agreed to:

- clean up the existing foreshore;
- create a new shingle beach;
- attach horizontal and vertical timbers to promote algal growth;

- carryout reed planting in Bullhead Dock;
- reduce the size of a large derelict jetty thereby increasing direct light to the foreshore. Consequently increasing the future habitat improvement potential on the new areas of exposed foreshore.

The public walkway to the jetty from the adjacent site over the river and around Bullhead Dock and Bellamy's Wharf greatly improved the amenity and recreation value at this once derelict site. It is proposed that this walkway will become part of the Thames Path National Trail.

The total frontage is 325 metres long and the new residential developments at both sites are now complete.



This case study illustrates how the Environment Agency works in partnership with developers, riparian owners and local authorities to prevent encroachment by development onto the tidal Thames foreshore and promotes environmental and access improvements.

Site History

The site is on the Thames adjacent to the Limehouse Basin entrance at Wapping. The initial proposal for the housing development included an encroachment into the Thames by 7 metres as the foreshore has already been 'purchased' by the developer from the PLA.

When our encroachment policy was explained, the developer withdrew and another developer decided to proceed with the housing development with no encroachment of the foreshore.

Environment Agency Interests

- Poor condition of the tidal defences.
- Avoidance of encroachment onto the foreshore.
- Improvement of public access.

Description of Scheme

The final proposal for the site included a clever design by the Consulting Engineers, in partnership with the Environment Agency, resulting in the retention of an existing jetty. This was refurbished and converted into a public walkway and it is proposed that it will become part of the Thames Path National Trail.

The old river wall was strengthened with additional ties and vertical piles through it to accommodate the

basement car park. The total length of Thames frontage is 130 metres.

Bronze Age timber steps and river wall were found on the site. The engineering works were carried out carefully to ensure no damage occurred to this important archaeological find.



Project title:
Victoria Wharf

Location:
Narrow Street,
Limehouse, East
London

River/catchment:
Tidal Thames
(Thames Tideway
catchment)

Date completed:
July 1996

Development type:
Residential
development and
tidal defences

Types of enhancement:

- enhanced tidal defences
- conservation enhancements
- recreation provision

Length of frontage:
Total frontage 130m

Developer:
Barratts

Local authority:
London Borough of
Tower Hamlets

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Albert
Embankment
London
SE1 7TG

Project title:
Millennium site

Location:
Greenwich
Peninsular, London

River/catchment:
Tidal Thames
(Thames tideway
catchment)

Date completed:
1998 (tidal defences)

Development type:
Residential/leisure/
commercial
development and
tidal defences

Types of enhancement:

- enhanced tidal defences
- conservation enhancements
- recreation provision
- clean-up of contaminated land

Length of enhancement:
Total frontage 1.7 km

Developer:
British Gas/English
Partnerships

Local authority:
London Borough of
Greenwich

Contact details:
Customer Services
South East Area
Office
Environment Agency
Wah Kwong House
10/11 Embankment
London
SE1 7TG

The unique opportunity presented by the Millennium site has enabled the Environment Agency to demonstrate best practice approaches to flood defence works.



Site History

In the year 2000, Greenwich will host the Millennium Exhibition on the Greenwich Peninsular site. Bounded by the River Thames to the north and north east, the highly contaminated and largely derelict site has a total of 2,200 metres of river frontage.

More than 11 million visitors are expected to visit the exhibition, which presents a unique opportunity for the Environment Agency to demonstrate a best practice model in urban flood defence works. The aim is to maximise the recreational and landscape potential of the site whilst preserving and enhancing the conservation options.

Environment Agency Interests

- Contaminated land from previous industrial uses.
- Poor condition of tidal defences and threat of encroachment.
- Opportunity to promote innovative riverbank design.
- Opportunity to promote access and education initiatives.

Description of Scheme

British Gas and English Partnerships have been working closely with the

retreating a 130 m length inland to create an additional 10m of intertidal habitat; boardwalks for public access; viewing points; an area of salt marsh with a series of terraces over a width of 7m between the site and existing flood wall; planting of newly created habitats; and the use of timber fenders to improve the appearance of the wall and



Environment Agency to create the best practice riverbank scheme at the Millennium site. A length of 1.24km of the existing river site frontage was known to be in bad condition with an estimated life expectancy of less than 5 years and would need to be replaced as part of any redevelopment. The Environment Agency encouraged the developer to provide an innovative flood defence wall, incorporating some setting back to create enlarged beaches, an 'ecological sculpture', tidal terraces, timber fendering on vertical flood defence walls, beach replenishment/creation and improved habitats for a potential multitude of wildlife.

As part of the riverside scheme, education signage, riverside paths and cycleways will be a permanent feature of the site.

The design of the tidal defences incorporated

provide some habitat for estuarine animals and plants.

The Millennium site is a unique illustration of the new approach to riverside design that the Environment Agency is striving to promote. Here the competing demands of a large scale commercial riverside development had to be effectively balanced with ecological considerations, providing a site which is both commercially and environmentally beneficial.

The cost of the terrace flood defences are lower than traditional sheet pile walls and the land value of the site has improved as a result of the ecological enhancements.



The Way Forward

These 25 case studies are a selection of examples of the every day work being carried out in the Thames Region and demonstrate the effectiveness of the staff in the three Area offices. They are evidence of the proactive involvement of the Environment Agency in the planning system. The cases described here do not represent the whole picture regarding this work. There are many other schemes where the Agency has had a significant input, several of which are either incomplete or have not yet been implemented.

There are, for example, several major redevelopment sites as yet unimplemented in the Region. These brownfield sites are mainly in urban locations. The Environment Agency has been able to negotiate significant improvements and has provided technical advice to the benefit of the developer, the local planning authority and the Environment Agency alike. Several of these are in the regeneration areas of London, such as the Wandle and Lea Valleys. Elsewhere in the Region, the use of Best Management Practices for surface water management is an important issue that the Environment Agency is now promoting. As illustrated by some of the case studied in this document, this approach can be equally relevant to smaller scale schemes in more rural locations.

This report, *Enhancing the Environment – 25 Case Studies from Thames Region*, has been produced by the Technical Planning Section in Reading.

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— Area Administrative Boundaries

— Regional Boundary

● Area Office

▲ Regional Headquarters

For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

ENVIRONMENT AGENCY GENERAL ENQUIRY LINE

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ENVIRONMENT AGENCY EMERGENCY HOTLINE

0800 80 70 60



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