



Restoring Meanders to Straightened Rivers

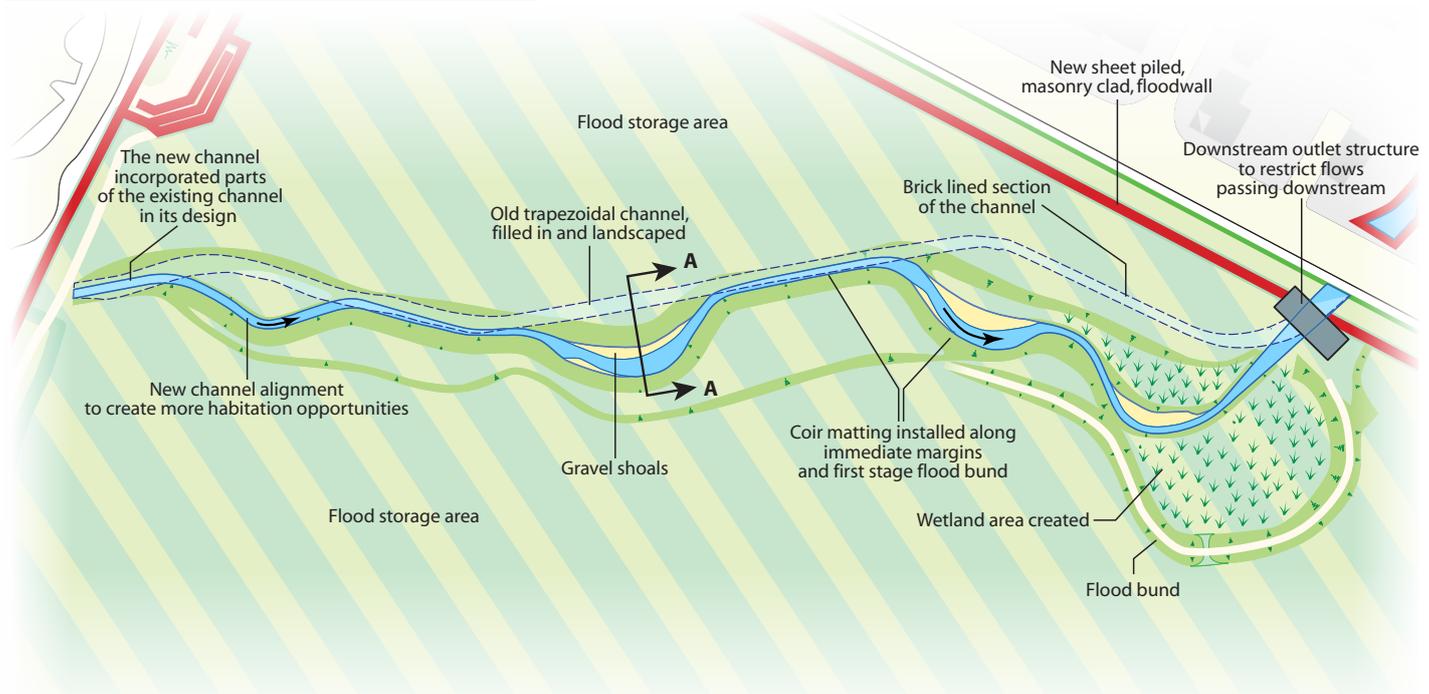
1.10 New meanders replacing a lined urban channel

BRAID BURN

LOCATION - INCH PARK, EDINBURGH NT277711
 DATE OF CONSTRUCTION - LATE 2008 – MID 2009
 LENGTH - 310M
 COST - £110,000

Braid Burn	Medium energy, gravel
WFD Mitigation measure	
Waterbody ID	3500
Designation	UWS
Project specific	BAP species (pre-only)

Figure 1.10.1
 PLANFORM OF THE BRAID BURN THROUGH INCH PARK



Description

The re-meandering of the Braid Burn at Inch Park was a small component of a wider flood alleviation scheme promoted by the City of Edinburgh Council, designed to protect against a 1 in 200 year flood, with additional allowance for climate change. The scheme utilised the flood storage capacity within Inch Park and so provided an opportunity to promote biodiversity and create habitat along the river corridor. The site is an Urban Wildlife Site (UWS) within the Edinburgh Urban Nature Conservation Strategy and delivers parts of Edinburgh’s Local Biodiversity Action Plan (BAP) 2010-2015.

Inch Park is a well used recreational resource within the city, adjacent to a large shopping centre, residential properties and a primary school. The park has a mix of mature woodland and individual trees along with amenity grassland and is maintained

by the City of Edinburgh Council. Prior to the works Himalayan balsam (*Impatiens glandulifera*) was widespread along the margins of the burn where it flows through the park. The council carried out an eradication programme during the few years prior to the flood prevention work starting on site.

The aim was to reintroduce diversity in the width, depth, flow rates and appearance of the burn, to allow natural morphological and ecological processes to take place following initial construction. This was achieved by replacing the brick and concrete channels with sinuous meanders, runs, riffles, shoals and gently sloping banks. A new wetland habitat was also created at the downstream end of the burn.

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Design

Approximately 80% of the restored course was newly dug and 20% was made up of the retained channel, the banks of which were reprofiled.

None of the brick and concrete sections of the existing channel were incorporated into the new design. These were all broken down and in-filled. Densely graded rock (lumpstone) of 0.075m to 0.3m was imported and used to form the riffles and shoals. Gravels for the new channel were recovered and re-used from the sections of the old course which were to be in-filled. It was deemed that over time natural processes would transport substrate, invertebrates and flora to the new sections of the burn. The hydraulic conveyance of the new naturalised course is at least as great as that of the lined channel, ensuring no increase in flood risk upstream.

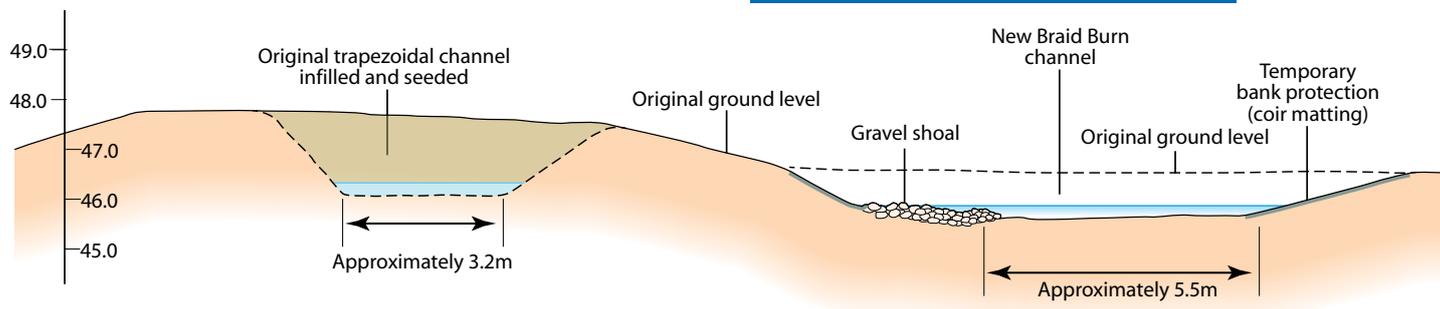
As a precautionary measure coir matting was pinned in place along the channel margins and the first stage flood bund, to help protect the clay and soil banks until vegetation established.



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Prior to works part of the channel through Inch Park was brick lined – April 2006

Figure 1.10.2
NEW BRAID BURN CHANNEL AND REPROFILED BANKS
SECTION A–A (SEE FIGURE 1.10.1)



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New meander channel cut off-line. 0.075 – 0.3m lumpstone was used to create the riffle and shoal base to prevent excessive bed scour – January 2009



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The gently sloped banks provide additional capacity and promote the natural processes of sediment transport and vegetation colonisation – February 2009

The new meanders were created off-line and, once complete, were connected to the existing channel. Overpumping of some sections of the burn was necessary to maintain flow whilst works were carried out. The downstream end of each meander was opened up first and allowed to fill with water. Each meander was then left for a period to allow sediment to settle and reduce the potential for dirty water to pass downstream. The upstream end was then opened very slowly to control the initial flow through the new meander in order to prevent scouring of loose materials. During construction settlement ponds were created to control and retain muddy water draining from the site.

A debris screen was installed at the downstream outlet structure as part of the flood protection scheme to intercept floating debris and help prevent blockage of downstream culverts. A wetland has been created in a low-lying area adjacent to the outlet. The wetland is covered during higher flows enabling fine sediment and nutrients to be retained.



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Eroded clay forming a stable cascade and adding to the diversity of features within the channel – May 2011



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Wetland area at low flows. The height of the floodwall demonstrates the flood storage capacity within the park – March 2010

Subsequent performance

Following the works the river corridor is significantly wider, with a sinuous channel and more natural appearance. Riparian vegetation has colonised the banks and wider corridor, which now has a diversity of height, form and texture that was not present prior to the works.

The meanders have increased variability in the width and depth of the channel and have provided flow diversity. As a result a mosaic of habitats has been created for birds, mammals and invertebrates, increasing the overall biodiversity of the immediate area. Of particular note is the presence of otters (*Lutra lutra*) in the watercourse, previously absent from this section of the Braid Burn.

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The shoals around the meanders have trapped significant quantities of fine silt during high water events and vegetation has begun to colonise the sediment, disguising the lumpstone structures. Gravel has been transported out of some parts of the new meanders and replacement with gravel transported from upstream has been slow. At one location a less dense lens of sandy clay within the channel has eroded to form a small cascade and pool.

Informal footpaths have developed along both banks of the burn and are well used. Following the works the burn has become an integral part of Inch Park that brings ecological, aesthetic and recreational benefits to the area. In 2011 the scheme won a commendation for environmentally sustainable construction in the Saltire Society's Civil Engineering Awards.

The coir used to protect the first stage bund from erosion was a fairly dense weave matting which prevented all but the most vigorous species from penetrating. Natural colonisation of the

bund was therefore slow. Coir matting with a more open weave would have allowed more rapid colonisation by a wider range of species. The coir matting used along the immediate margins of the burn worked as designed, quickly becoming covered by sediment.

Environmental Impact Assessment (EIA) ecological surveys (including bat, otter, badger and tree) were carried out before works commenced in order to establish the potential impacts. Routine inspection is carried out by the City of Edinburgh Council to monitor on-going morphological processes and to assess stability. This indicated that the new pool and cascade were stable and as a result this feature was retained. Planting within the meanders captures litter and other debris which passes downstream during high flow events. It is periodically necessary to clear this. Himalayan balsam has been noted following the works and continued invasive species management is being carried out.



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The new course of the Braid Burn through Inch Park after two years. Marginal vegetation has established well and natural processes have enhanced the in-channel morphological features that were created – May 2011

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