



**wandle trust**

**RIVER REHAB**

Living Wandle  
Landscape Partnership

Supported by  
**The National Lottery**  
through the Heritage Lottery Fund



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**LIVING WANDLE LANDSCAPE**

Living Wandle  
Landscape Partnership

£2m

Supported by  
**The National Lottery**  
through the Heritage Lottery Fund



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**RIVER REHAB**



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### TODAY'S WORKSHOP



- ECOLOGY AND CONSERVATION
- FRESHWATER CONSERVATION
- THE RIVER
- HOW A RIVER WORKS
- RIVER HABITATS ← LUNCH?
- HUMAN MODIFICATIONS
- THE WANDLE
- RESTORATION ← YOU?

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### BIODIVERSITY



**Biodiversity**  
The variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact

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### ECOSYSTEM



A community of living organisms in conjunction with the non-living components of their environment interacting as a system.



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**WHY CONSERVE BIODIVERSITY?** 

**PROVISIONING** 

**REGULATORY** 

**CULTURAL** 

**SUPPORTING** 

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**CONSERVATION CONCEPTS** 



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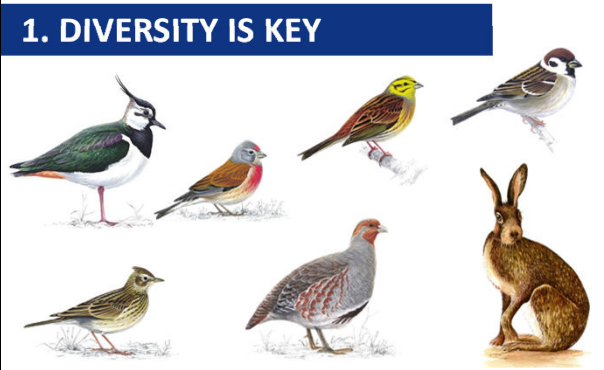
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**CONSERVATION CONCEPTS** 

**1. DIVERSITY IS KEY**



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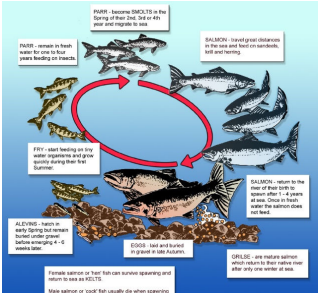
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## CONSERVATION CONCEPTS



### 1. DIVERSITY IS KEY



#### SALMON

Lay eggs in freshwater rivers

Fry live in freshwater rivers

Adults migrate downstream

Some into the Atlantic Ocean

Return to freshwater rivers to breed

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## CONSERVATION CONCEPTS



### 2. CONNECTIVITY IS CRUCIAL

PARENT  
POPULATION

POP 2

POP 3

POP 4

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## CONSERVATION CONCEPTS





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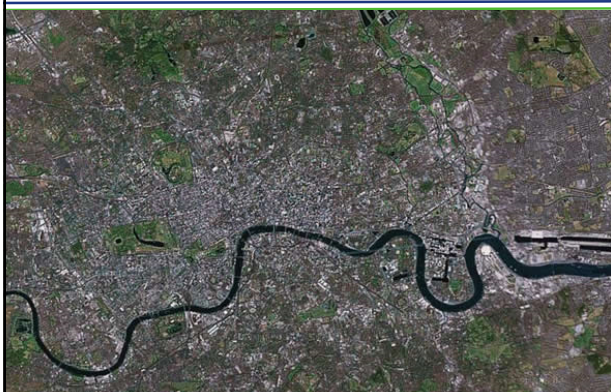
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### CONSERVATION CONCEPTS



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### FRESHWATER ECOSYSTEM



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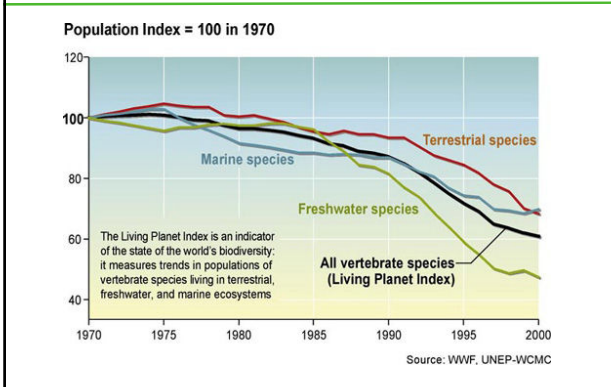
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### FRESHWATER ECOSYSTEM



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### FRESHWATER ECOSYSTEM



**-76%**  
FRESHWATER SPECIES SINCE 1970

**Exploring ponds**  
50% of the UK's ponds were lost in the 20th century  
80% of those that remain are in a poor state

2/3 of all freshwater species are supported by ponds.  
Because they're small it's easy to keep them clean and pristine for the long term



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### THE RIVER



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### THE RIVER



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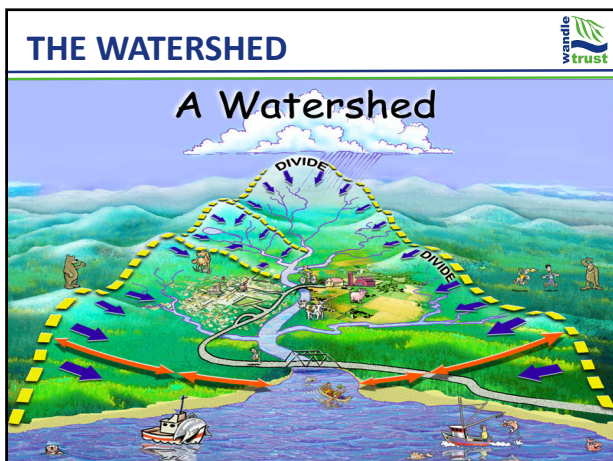
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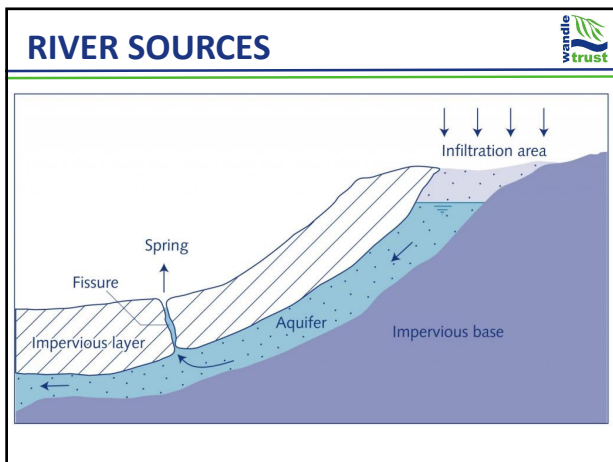
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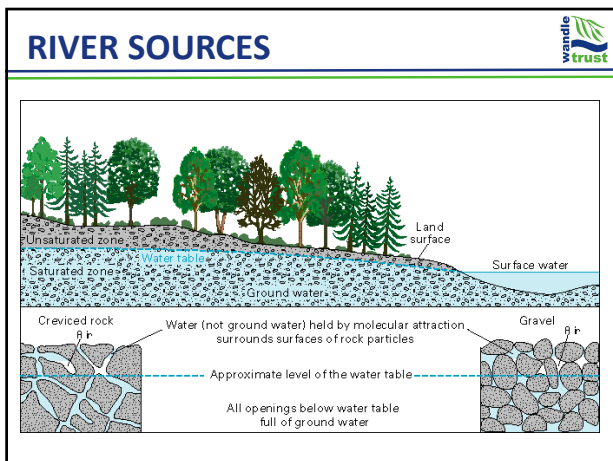
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**RIVER SOURCES**



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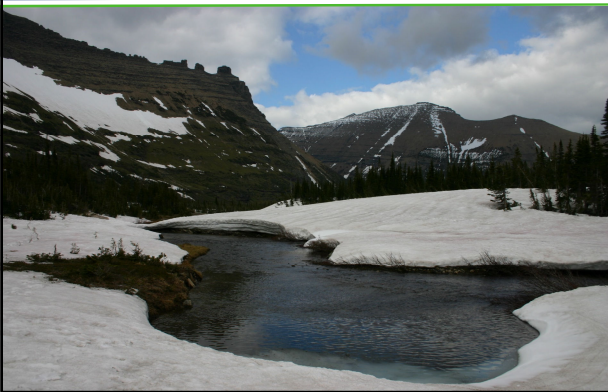
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**RIVER SOURCES**



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**RIVER MOUTHS**



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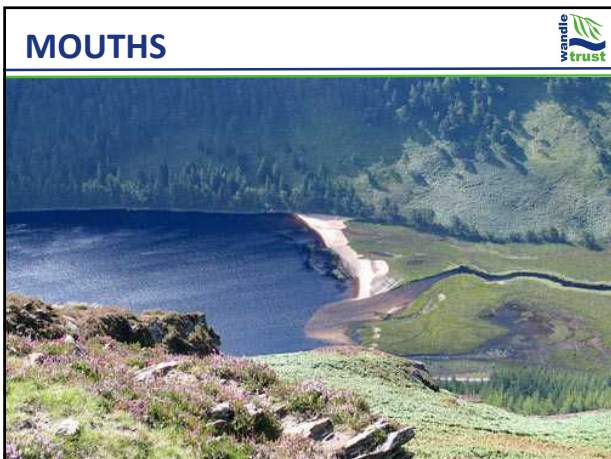
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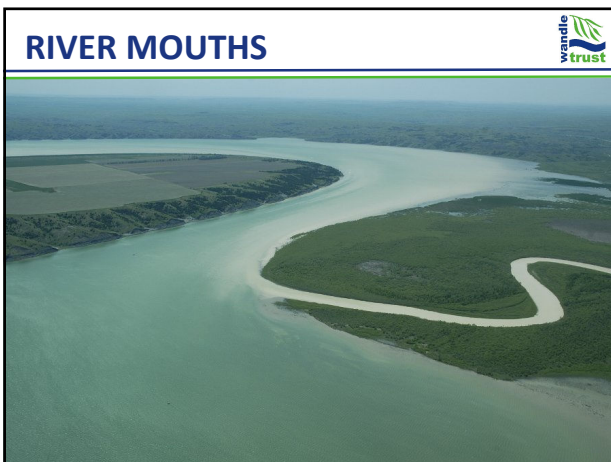
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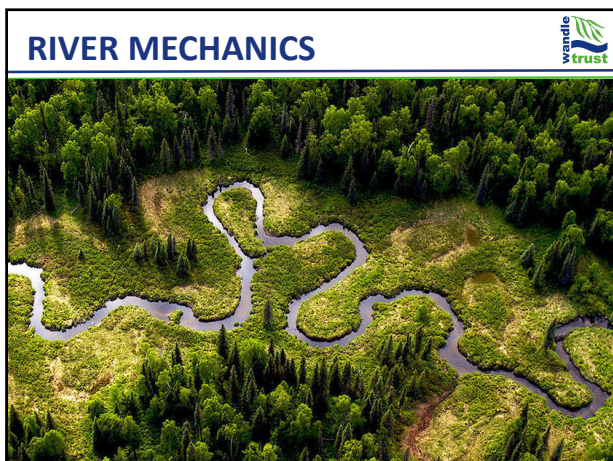
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### RIVER MECHANICS





**Sediment movement**

**Source reach** – reach with net erosion. Supplies sediment to downstream reaches. During high flows sediment will be moved downstream through the river to be deposited at other reaches.

**Transport reach** – reach with generally equal amounts of erosion and deposition. During high flows sediment will be supplied from upstream and the sediment within the reach will be moved downstream.

**Deposition reach** – reach with net deposition. During high flows sediment will be supplied to the reach from upstream and less sediment from the reach will be moved downstream.

**DYNAMIC EQUILIBRIUM**



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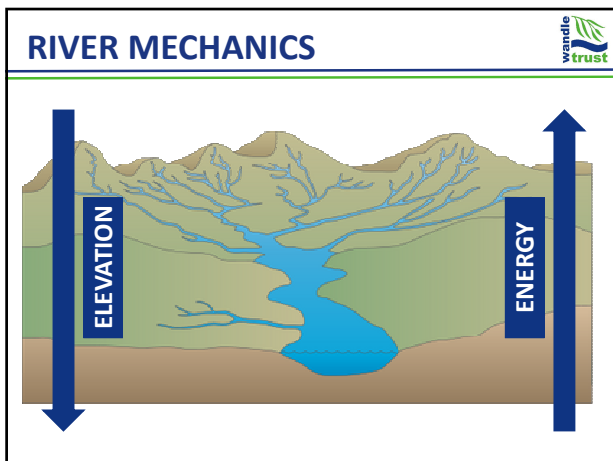
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### RIVER MECHANICS

The diagram illustrates the process of river meandering. On the left, a straight blue river channel flows through a green forest. A cartoon character with a red sword is shown cutting a path through the forest. An arrow with a question mark points to the right, where the river channel has become a meandering blue line with pink and yellow banks, still within the forest.

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### RIVER MECHANICS

**Processes on a meander bend**

Where there is less water on the inside there is more friction and slower flowing water

**Inside of Bend**  
Deposition

**Outside of Bend**  
Erosion

Fast flowing water with lots of energy is directed to the outer bank

*Fastest Current*

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### River Forms & River Habitats

- What is dynamic equilibrium?
- Water follows path of least resistance
- Erodes where sediment is soft
- Deposits when water is slowed down
- Equilibrium is dynamic – responds to environmental factors

The photograph shows a wide, winding river meandering through a valley with steep, rocky mountainsides. The river's path is clearly visible as a series of loops and curves across the landscape.

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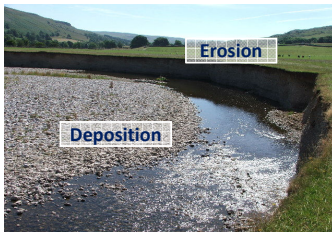
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## Habitat Creation



- Erosion & Deposition = Habitat Formation
- Different processes form different habitat patches
- Lack of equilibrium results in reduced habitat
- Rehabilitation helps conserve freshwater biodiversity



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## Point Bars



- Occurs on inside bend
- Slowed water deposits sediment
- Point bar extends
- Good area of marginal habitat



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## Point Bars



- Become colonised
- Water cress & burr reeds
- Seeds transported in river and by birds
- Roots secure the point bar
- Flies climb up reeds
- Birds nest in the vegetation



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## Mid-channel Bars



- Form during low discharge
- Obstacle to flow - site of deposition
- Colonised by hardy grasses
- Trap sediment
- Home to rich variety insect life
- Good hunting ground for birds



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## Benefits of Plants



- What benefits do plants offer freshwater ecosystems?



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## Pools



- Form in areas of soft riverbed
- Outside bend of meanders + low incline straight sections
- Good fish habitat
- Hunting ground for predators
- Invasive species



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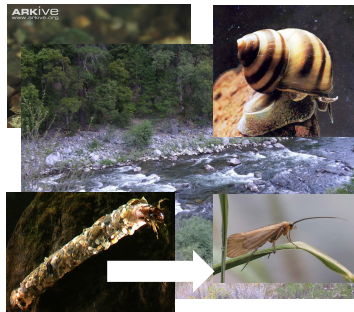
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## Riffles



- Form in areas of hard riverbed
- Where incline is steep
- Wide range of invertebrates
- Small fishes - bullhead



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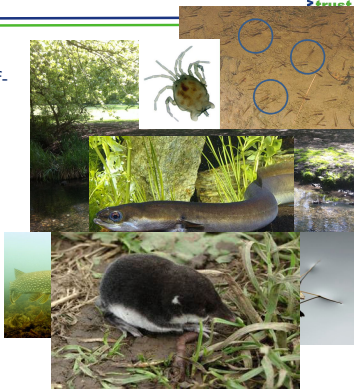
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## Backwaters



- Areas of slack water off-channel
- Old river channels
- Pike spawning habitat
- Nursery ground for fish fry
- Many insect species



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## Diversity is key!



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**RIVER MODIFICATIONS** 

**1. ABSTRACTION**

Rivers are a source of freshwater which we need for drinking, washing, cooking and sewage treatment.

 **ABSTRACTION**       **WATER LEVEL**

Whether from the river directly or groundwater aquifers, over abstraction can cause rivers to “dry up”. This habitat loss has negative effects on freshwater wildlife.

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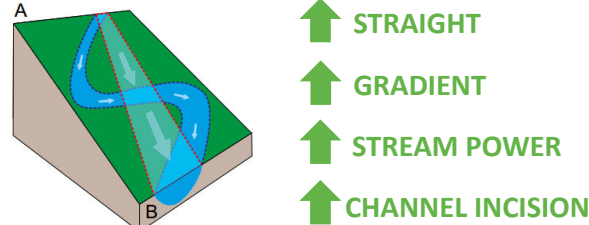
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**RIVER MODIFICATIONS** 

**2. STRAIGHTENING**

Rivers have been straightened in the past to remove a perceived flood risk.



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**RIVER MODIFICATIONS** 

**2. STRAIGHTENING**

Rivers have to be channelized to confine them to an unnatural straight channel.



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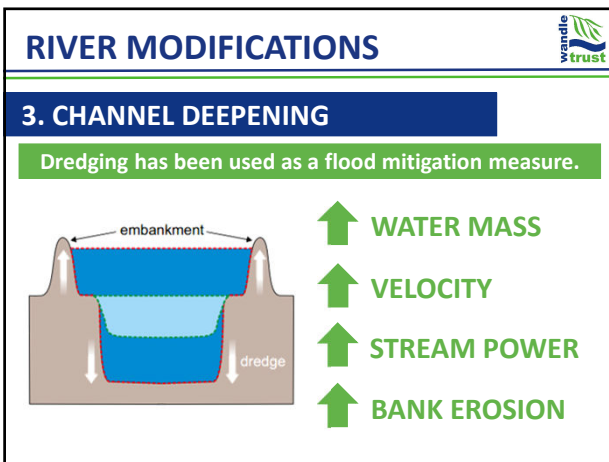
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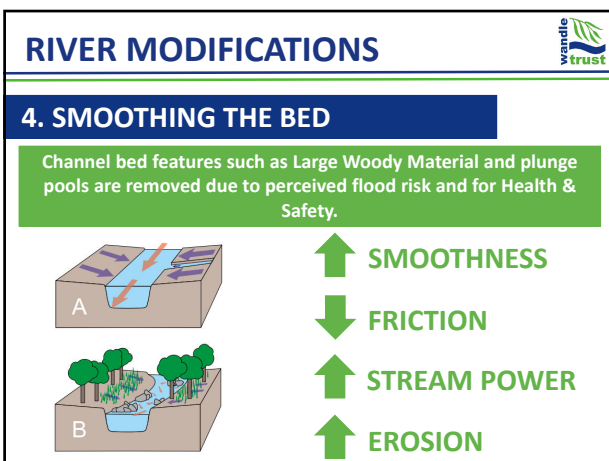
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**RIVER MODIFICATIONS** 

**4. SMOOTHING THE BED**



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**RIVER MODIFICATIONS** 



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**RIVER MODIFICATIONS** 

**5. CULVERTING**

Many urban rivers were forced underground to remove flood risk and make room for development.

- ↑ FLOOD RISK
- ↓ LIGHT
- ↓ HABITAT QUALITY
- ↓ CONNECTIVITY



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**RIVER MODIFICATIONS** 

**6. REINFORCEMENT**

The use of hard engineering to prevent bank erosion and reduce flood risk.



- ↑ SMOOTHNESS
- ↓ FRICTION
- ↑ STREAM POWER
- ↑ EROSION

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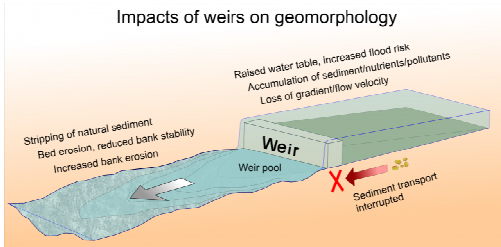
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**RIVER MODIFICATIONS** 

**7. WEIRS**

Weirs were introduced along rivers to control the flow of water for milling.

Impacts of weirs on geomorphology




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**RIVER MODIFICATIONS** 

**7. WEIRS**

Weirs were introduced along rivers to control the flow of water for milling.



- ↓ HABITAT CONNECTIVITY
- ↑ FRAGMENTATION
- ↓ SPECIES DISPERSAL

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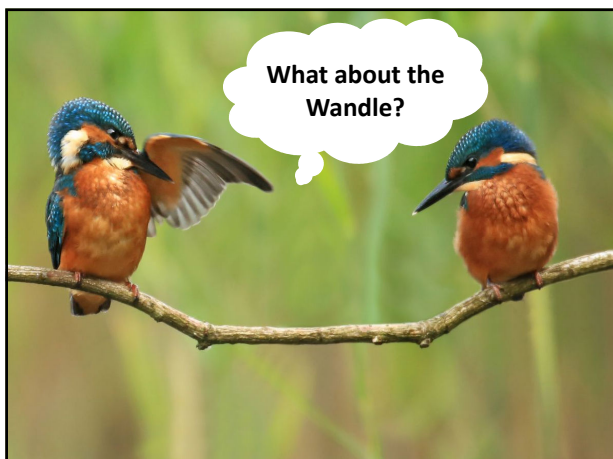
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### THE RIVER WANDLE

The map shows the River Wandle catchment area in London, outlined in red. Key locations are marked with dots and labeled: Wandsworth, Streatham, Carshalton, Claydon, Putney, and Catorham. Callout boxes with green backgrounds and white text point to specific features: "Joins the Thames" (at Wandsworth), "Rises at Carshalton Ponds/Grotto" (at Carshalton), "Rises in Wandle Park" (at Carshalton), and "North Downs" (at Catorham). The Wandle Trust logo is in the top right corner.

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### A CHALK STREAM

A photograph of a chalk stream flowing through a lush green landscape. A blue text box on the right side of the image contains the text: "Only 200 left worldwide 90% of which are found in England". The Wandle Trust logo is in the top right corner.

Three small square images are arranged horizontally at the bottom. The first shows a brown trout in a stream, labeled "BROWN TROUT". The second shows a yellow mayfly nymph, labeled "MAYFLY". The third shows white water crowfoot flowers, labeled "WATER CROWFOOT".

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**CHALLENGES**



**FISH PASSAGE**



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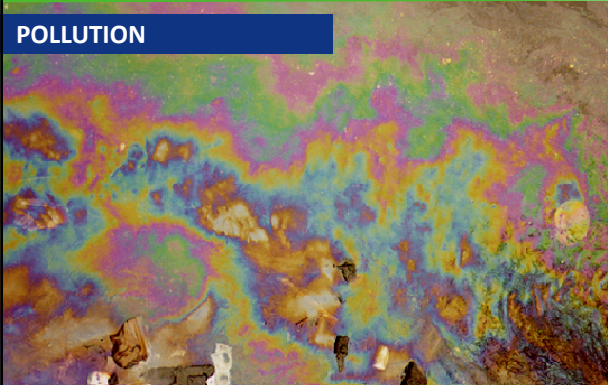
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**CHALLENGES**



**POLLUTION**



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**CHALLENGES**



**LACK OF HABITATS**



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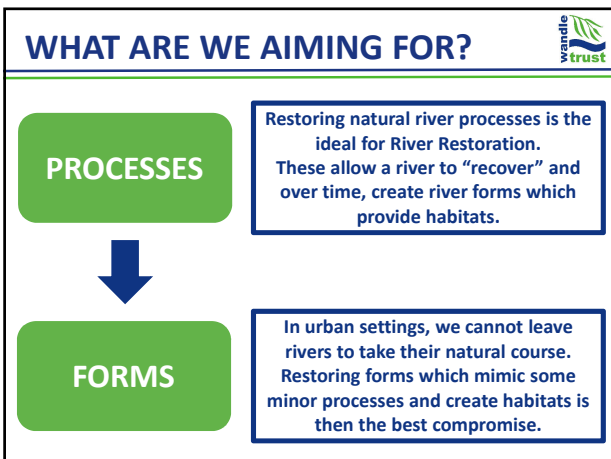
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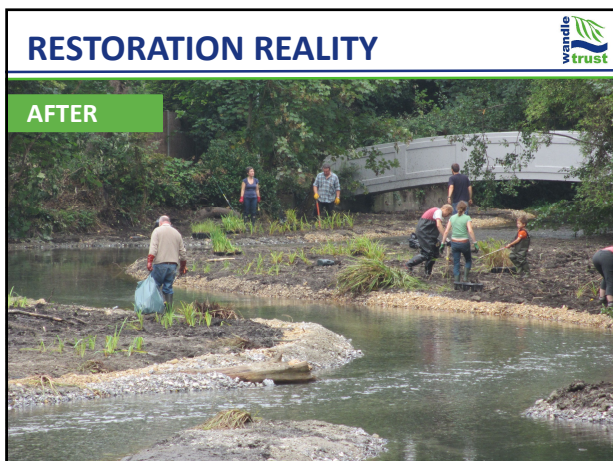
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### RIVER REHAB TECHNIQUES



**CHANNEL NARROWING**

An over-wide channel has a lower stream power, causing sediment to drop out and accumulate, smothering gravel habitats.

- ↓ CHANNEL WIDTH
- ↑ FLOW SPEED
- ↑ STREAM POWER

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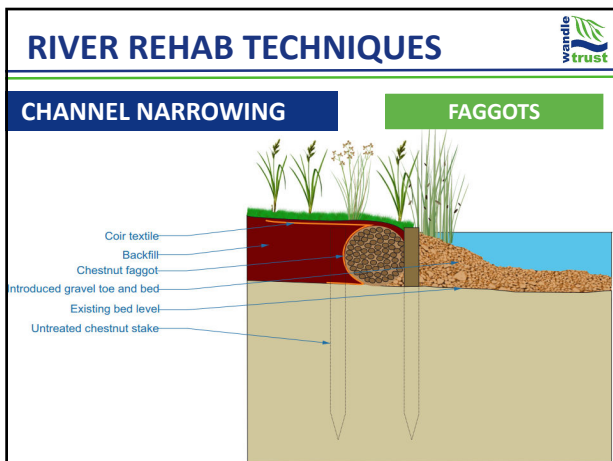
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### RIVER REHAB TECHNIQUES

**CHANNEL NARROWING** **CAUSEWAY**

Infill of mixed granular sub-soil and woody brush

Backwater

Construction retained by untreated wooden stakes

Main channel

Faggot bundles

Slower water velocity promoting silt build-up

Geotextile wrap (optional)

Slow clean bed material (gravel)

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### RIVER REHAB TECHNIQUES

**CHANNEL NARROWING** **MID-CHANNEL**

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### RIVER REHAB TECHNIQUES

**CHANNEL NARROWING** **LWM**

Use a series of Large Woody Deflectors to force the main flow of the channel into a narrower space, increasing speed

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**RIVER REHAB TECHNIQUES** 

**CHANNEL NARROWING** **GRAVELS**



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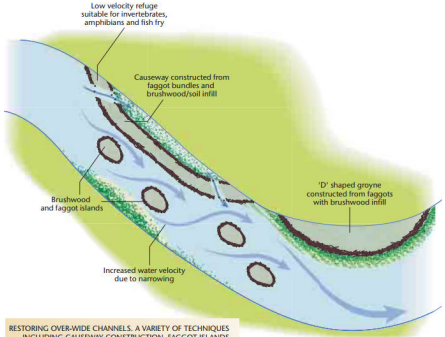
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**RIVER REHAB TECHNIQUES** 



RESTORING OVER-WIDE CHANNELS: A VARIETY OF TECHNIQUES INCLUDING CAUSEWAY CONSTRUCTION, FAGGOT ISLANDS AND 'D' SHAPED GROYNES HAVE BEEN USED TO NARROW THE CHANNEL AND INCREASE WATER VELOCITY.

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**RIVER REHAB TECHNIQUES** 

**CHANNEL NARROWING**



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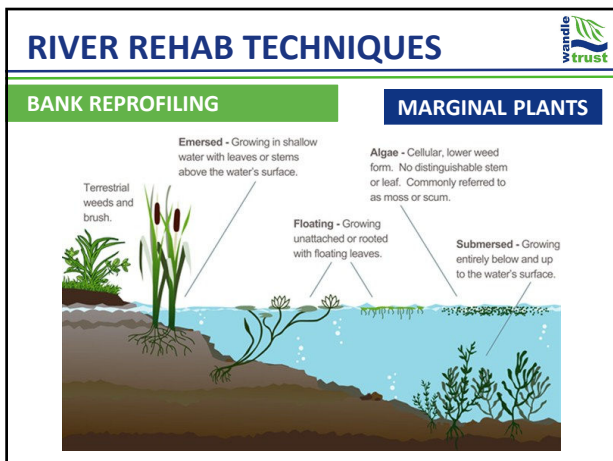
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## RIVER REHAB TECHNIQUES

IN CHANNEL DIVERSITY

BED STRUCTURE

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## RIVER REHAB TECHNIQUES

IN CHANNEL DIVERSITY

LWM

USE OF LARGE WOODY DEBRIS TO INCREASE VARIATION IN DEPTH AND SORTING OF THE SUBSTRATE, CREATING GRAVEL RIFFLES AND SCOUR POOLS.

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## RIVER REHAB TECHNIQUES

IN CHANNEL DIVERSITY

LWM

LWM SHOWING FIXING INTO BANK (PLAN VIEW)

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### RIVER REHAB TECHNIQUES



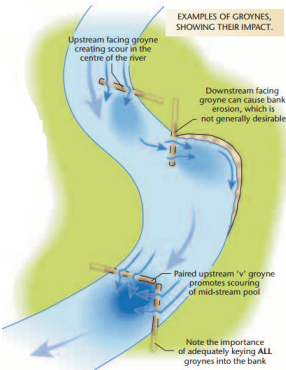

**EXAMPLES OF GROYNES, SHOWING THEIR IMPACT.**

Upstream facing groyne creating scour in the centre of the river

Downstream facing groyne can cause bank erosion, which is not generally desirable

Paired upstream 'v' groyne promotes scouring of mid-stream pool

Note the importance of adequately keying ALL groynes into the bank



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### RIVER REHAB TECHNIQUES



**UPSTREAM AND DOWNSTREAM FACING GROYNES AND THEIR IMPACT.**

LWD providing excellent cover for fish

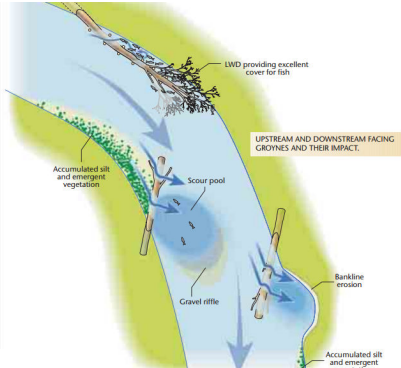
Accumulated silt and emergent vegetation

Scour pool

Gravel riffle

Bankline erosion

Accumulated silt and emergent vegetation



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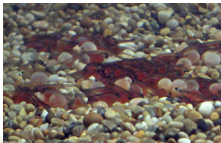
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### RIVER REHAB TECHNIQUES



#### IN CHANNEL DIVERSITY

#### GRAVELS

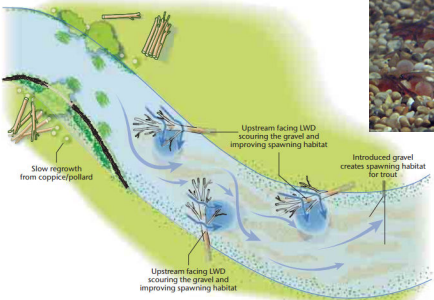


Slow regrowth from coppice/pollard

Upstream facing LWD scouring the gravel and improving spawning habitat

Introduce gravel creates spawning habitat for trout

Upstream facing LWD scouring the gravel and improving spawning habitat



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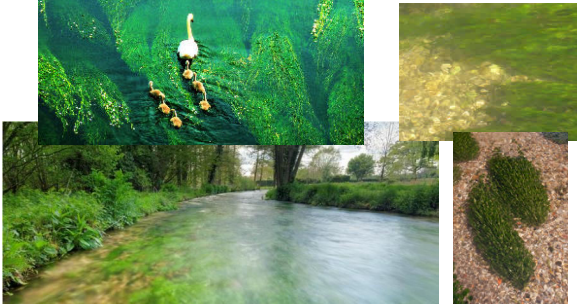
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**RIVER REHAB TECHNIQUES** 

**IN CHANNEL DIVERSITY** **PLANTS**



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Now what..?

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