Restoring urban river habitats. Lessons learned for monitoring, appraisal and management from the River Wandle, South London, UK.

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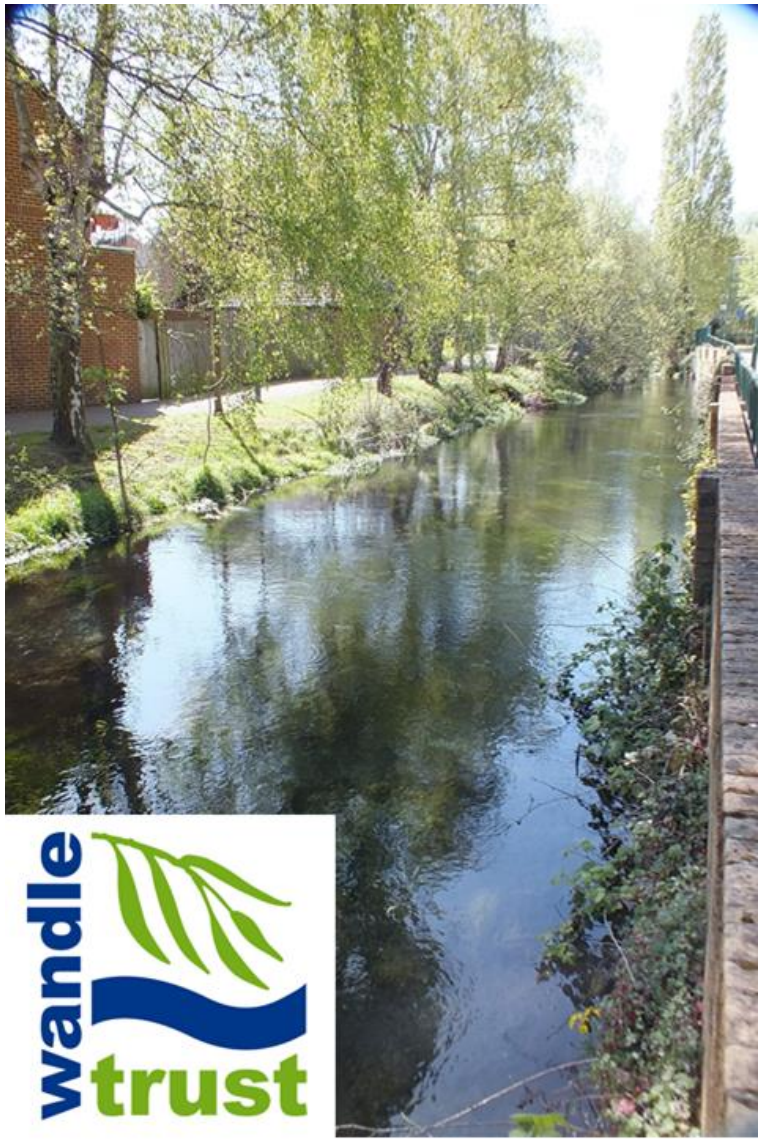
An example of heavily urbanised stream

Pre restoration - 2008



Classified as a distinct and heavily modified water body by the Environment Agency (EA)

Urban River Syndrome (Walsh et al 2005)

- Increase flashy events
- Uniform flow
- Deposition of contaminated sediments from road runoff
- Reduced diversity (invertebrates and fish richness)

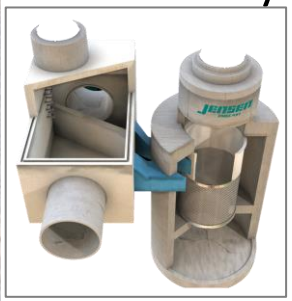
River Restoration Project (2012)

River connectivity

Removal/ modification of concrete structures (weirs, fish pass)

Water quality

Hydrodynamic separators



Flow diversity, river habitats

Geomorphological improvements (large woods, channel narrowing)

River Restoration Project (2013)

River connectivity

Removal/ modification of c

Water quality

Hydrodynamic separators

Flow diversity, river habitats

Geomorphological improve ng)

Good Ecological Potential (GEP) achieved in 2016

Research aim

Evaluate the results of several post-project appraisals carried out between 2013 and 2018 to inform adaptive management and future river restoration.

Post - River Restoration Projects

2008 — Last stocking of trout

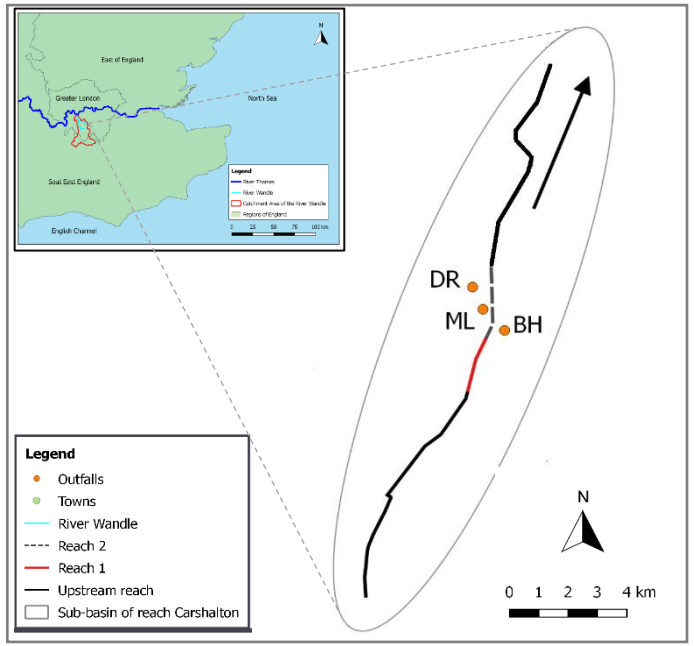
2011 — River restoration started

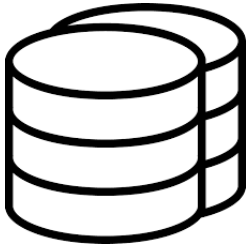
2013 — 1st Data collection (MSc M. Brierley)

2016 (GEP) — 2nd Data collection (MSc G. Corcoran); 3rd Data collection (MSc M. Weston)

2018 — 4th Data collection (MSc N. Bartoletti)

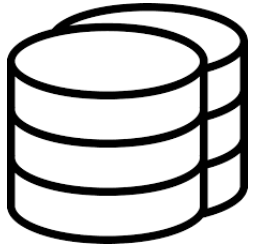
TIME





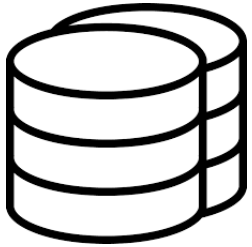
Geomorphology and Sediment characteristics

- Total metal concentrations,
- Organic matter (%) and
- Effective particle size
- Urban River Survey



Water characteristics

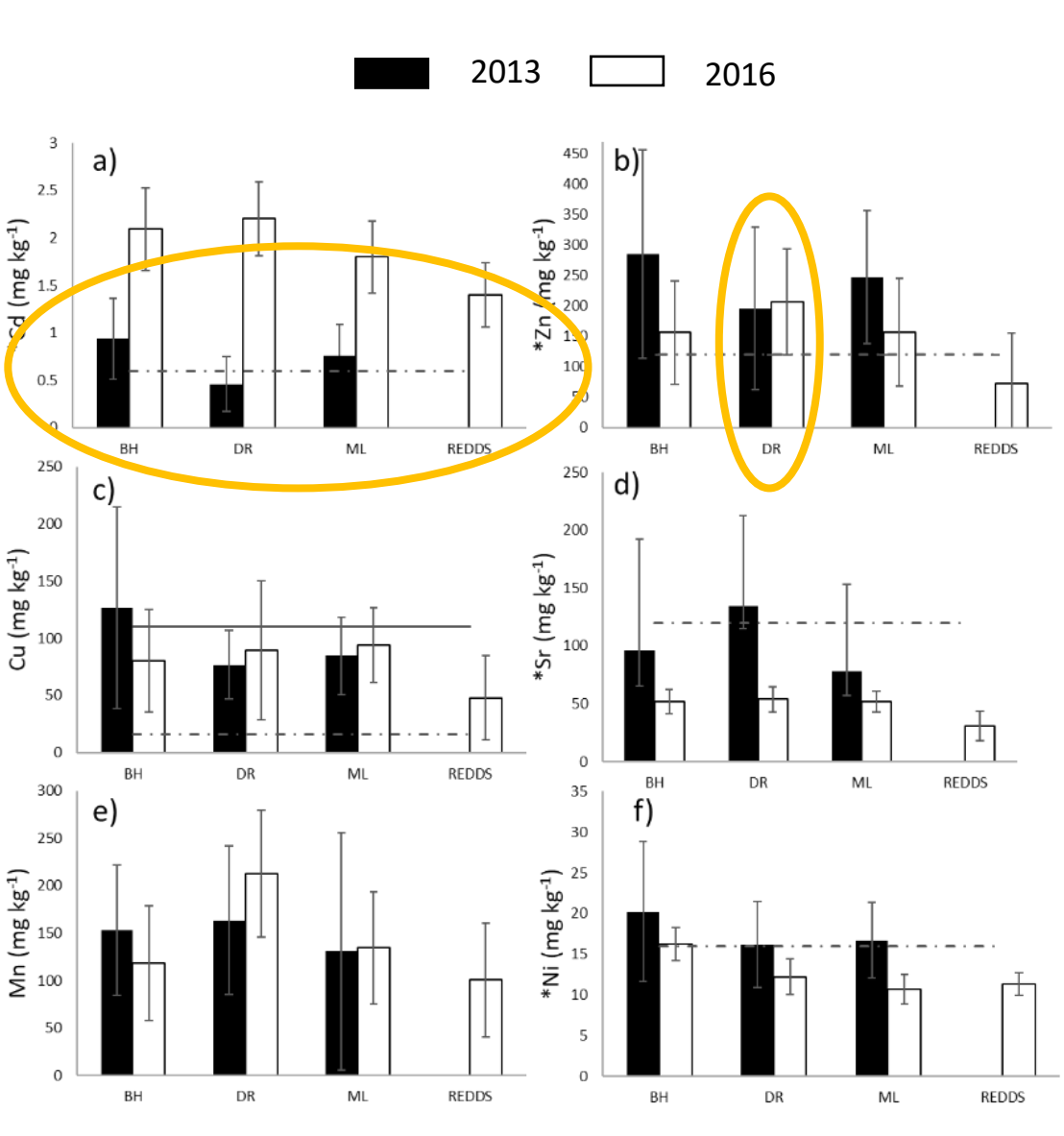
- Water depth,
- Water velocity and TI
- DO, T,
- Water quality



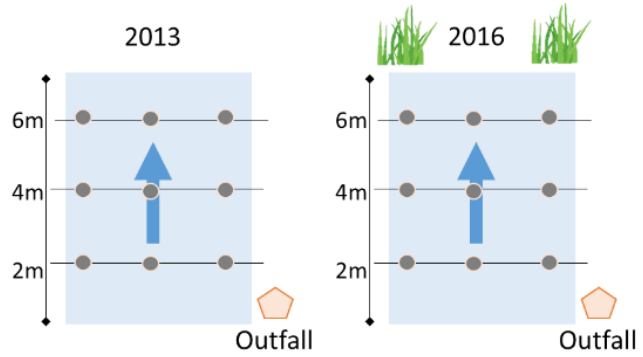
Fish habitat

- Spawning location
- Spawning substrate
- Hydraulic data
- MoRPh (physical features and habitats)

Metal Concentrations of contaminants in riverbed



B.



A.

1) BUTTER HILL OUTFALL

a) Nickel	b) Cadmium	c) Zinc	d) Strontium
= + -	+ = +	- - -	= - +
= - -	+ + +	= - -	- - -
- = +	= + +	= - =	- - -

2) DENMARK ROAD OUTFALL

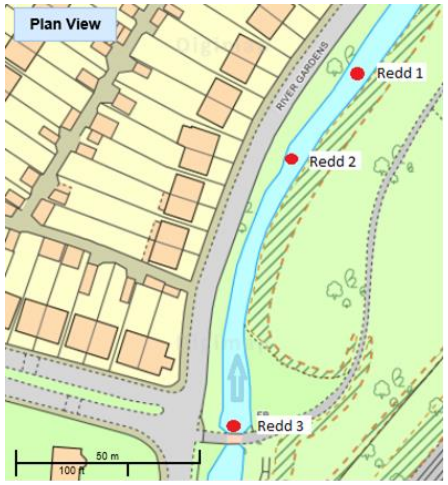
a) Nickel	b) Cadmium	c) Zinc	d) Strontium
- = =	+ + +	= - -	- - -
- - =	+ + +	- - +	- - -
- - -	+ + +	= = -	+ - =

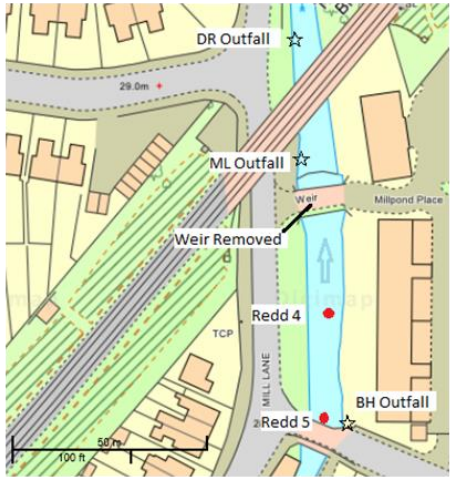
2) MILL LANE OUTFALL

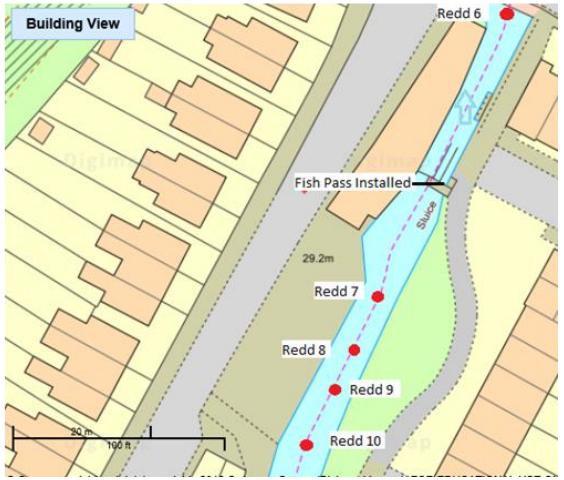
a) Nickel	b) Cadmium	c) Zinc	d) Strontium
- - -	+ + +	- - -	- - -
= - =	+ + +	= - +	= + -
= = -	+ + +	= = -	= = -

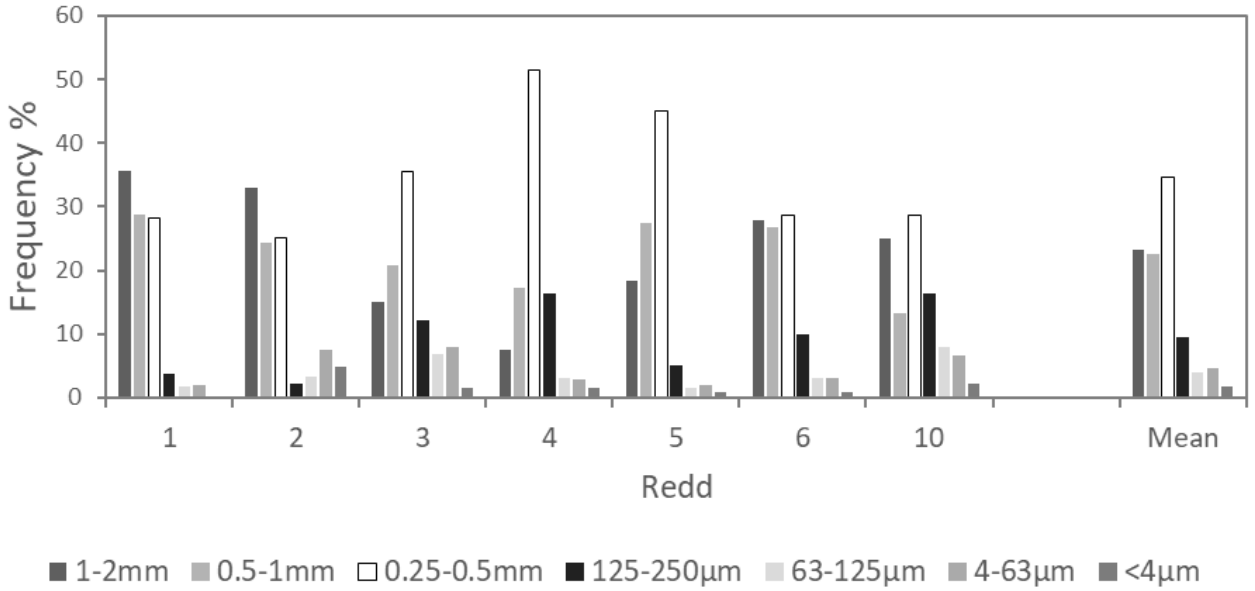
Sediment quality improved between 2013 and 2016 but the **Cd, Pb and Zn exceeded** the Canadian Provincial Sediment Quality Guidelines (PSQGs) lowest effect level (LEL)

Spawning redd sites





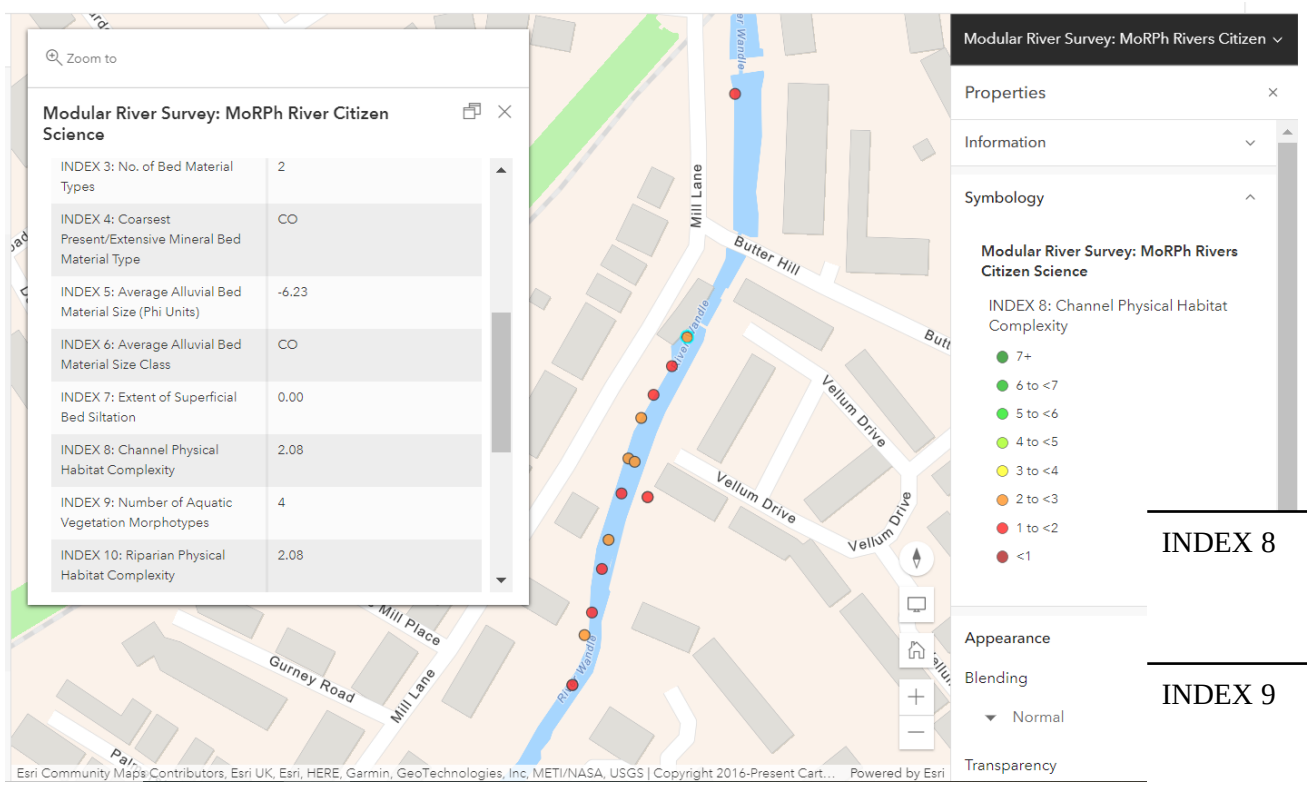




Redds 3-10: dominated by coarser material >0.25mm with medium sand (0.25-0.5mm)

MoRPh - the modular river survey

https://modularriversurvey.org/

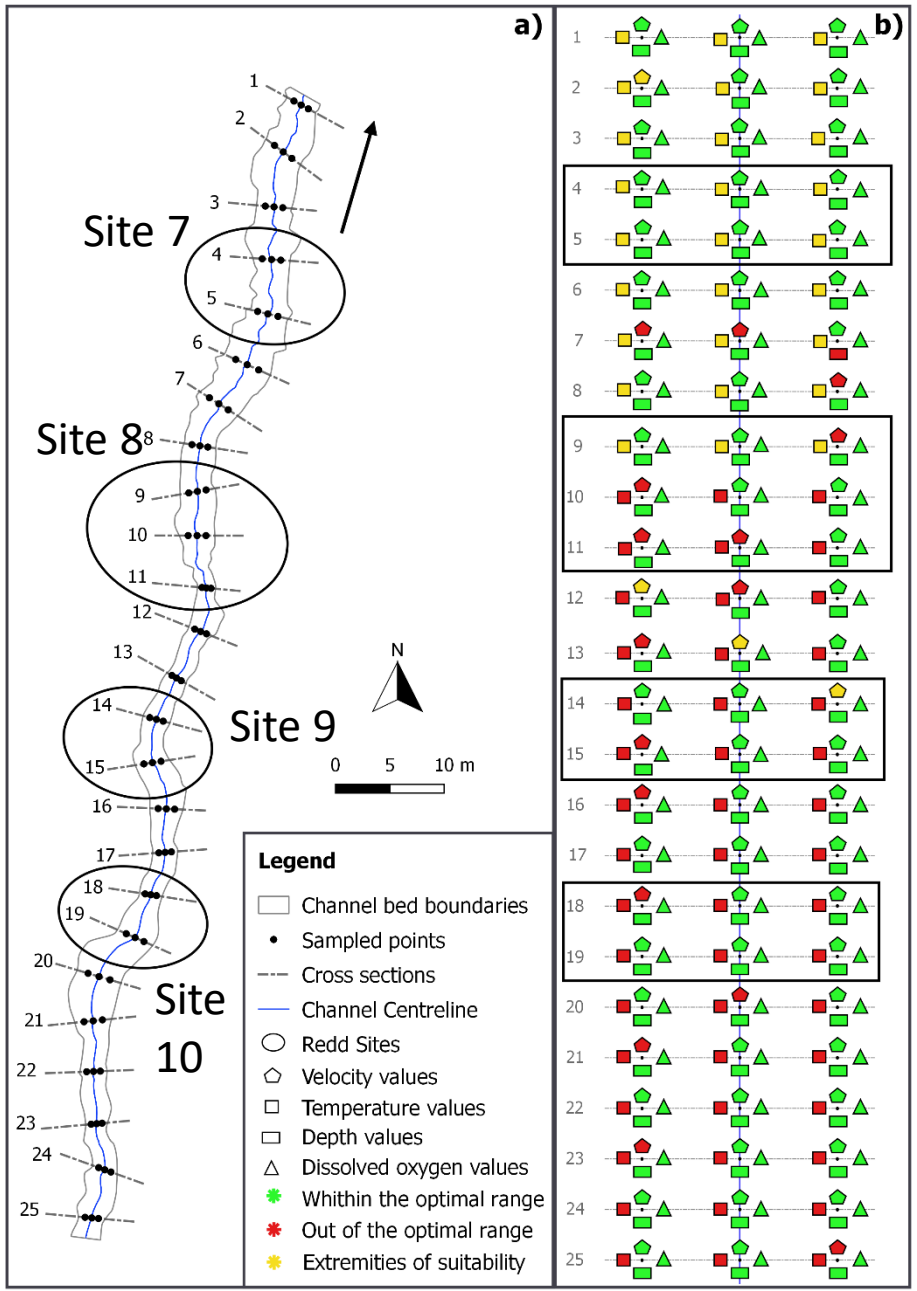


Reach was characterised by extensive **unvegetated**, bare. **Cobbles and gravels** were dominant in the bed channel with no siltation.

INDEX 8	Channel Physical Habitat Complexity	2.5	Index value ranges from 1 to (minimal complexity) to 10 (extremely high complexity)
INDEX 9	Number of Aquatic Vegetation Morphotypes	4	Index value ranges from 0 (no aquatic vegetation) to 10 (all aquatic vegetation morphotypes present)
Riparian Characteristics (Bank Face and Bank Top)			
INDEX 10	Average Riparian Physical Habitat Complexity	2.49	Index value ranges from 0 (extremely low complexity) to 10 (extremely high riparian complexity across both banks)

Identify specific indices that help in providing practical benchmarks to inform river restoration practice

Optimal habitat for Brown Trout



- The four redd sites met the optimal criteria of Water depth and DO in all points
- Three out of four redd sites presented T and water velocity values outside the optimal range

Effect of change in climate?

Lack of riparian vegetation?

Key findings and implications for adaptive management

- ***Riverbed contaminations***:
  - *Improvements* of riverbed quality in the central part of the channel where the faster flows are.
  - BUT metal concentrations remain *high at the margins*.
  - High riverbed contaminants *remain an issue* with further rising of population density in the catchment.

- ***Water temperature:***
  - Rising in water temperature is a *risk for spawning areas.*
  - Restoration need to insure to have enough shade.
  - A symptom of *climate change* can be seen in the rise in temperatures in urban streams, a future problem that cannot be ignored.

THANK YOU FOR THE ATTENTION

Acknowledgements:

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