River habitat scoring: an assessment tool

Evaluating water quality impacts of channel modification and restoration at outfalls

FACTSHEET

Project area: *River Habitats; ecosystem services; water quality*
Intended readership: *Practitioners, academics, interest groups*

Stormwater outfalls discharge pollutants and fine sediment into rivers. Furthermore, associated increased flow volumes result in transport of these pollutants and fine sediment with potentially significant impacts on habitats quality. This factsheet discusses the use of a river habitat scoring method to assess how restoring rivers may improve habitat quality when reaches are impacted by outfalls.

Direct outfall Johnson Creek, Portland USA

Urban environments release a variety of metal pollutants that are transported with/via sediments during rainfall runoff events. These then enter rivers through outfalls. Excess sediment and heavy metal pollutants negatively impact both the chemical composition of the water and the ecology of the river system: where this occurs in heavily engineered areas, the impacts may significantly increase.

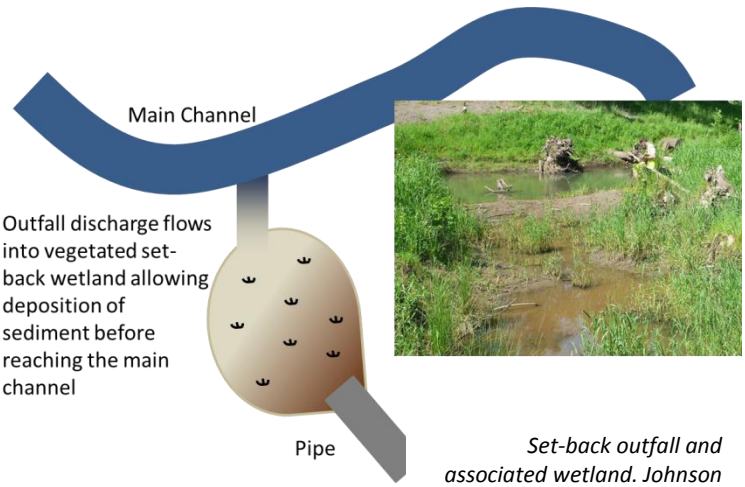
Management and mitigation strategies

Vegetation on channel banks surrounding outfalls reduces sediment generation; vegetation increases resistance to flow, causing flow velocities decrease, reducing channel erosion and scour. Additionally, vegetation traps sediment, reducing sediment concentrations downstream. In urban environments river channels are often heavily modified resulting in the removal of natural vegetation surrounding the channel.

Set-back outfalls indirectly discharge into rivers. Before reaching the main channel much of the energy of the flow from the outfall is lost, resulting in decreased flow velocities and deposition of sediment.

What we did

Sediment samples were taken from stormwater outfalls along Johnson Creek, Portland, Oregon (USA). River habitat quality and the level of modification at each site were assessed using a modified scoring (***River Habitat Survey***) system. An un-natural score was also calculated by including additional land-use data.



Set-back outfall and associated wetland. Johnson Creek, Portland USA

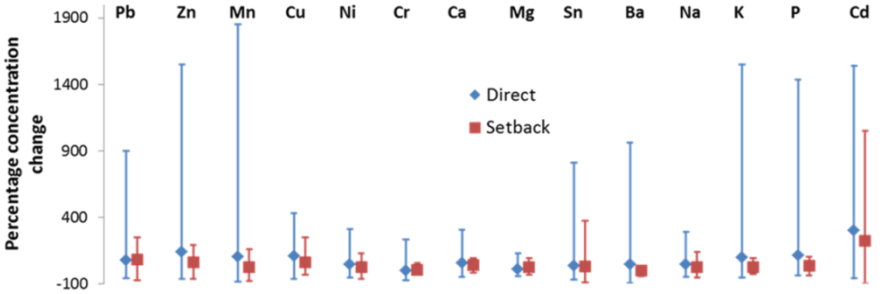
bluegreencities.ac.uk
@BlueGreenCities

EPSRC Engineering and Physical Sciences Research Council
EP/K013661/1

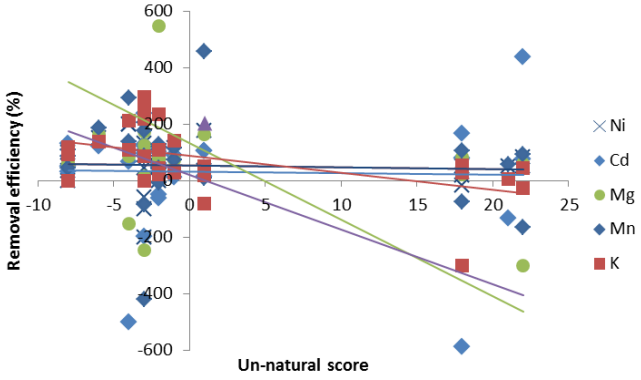
Environment Agency
RIVERS Agency
NATIONAL SCIENCE FOUNDATION

Outfalls and sediment quality

As expected, all pollutants showed an increase in concentration, ranging from +3-275% at outfalls compared to upstream locations. The increase in pollutant concentration at direct outfalls was higher than set-back outfalls for 11 of the 14 pollutants. Additionally the variability of the change in pollutant concentration at direct outfalls was significantly higher than set-back



Percentage pollutant concentration change between upstream and outfall. Points show averages, error bars indicate range of observed values.



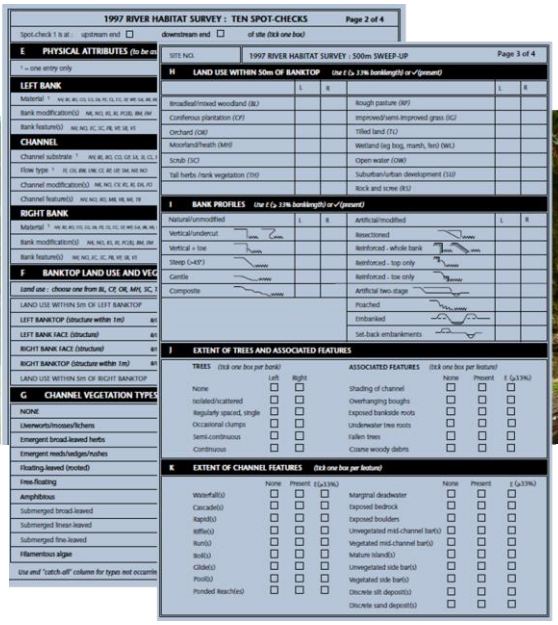
Channel modification and habitat quality

- As un-natural and modification scores increased, the pollutant removal efficiency of the reach decreased.
- As Habitat Quality Assessment (HQA) scores decreased, the pollutant removal efficiency decreased.

This is likely to be a result of the higher density of vegetation in un-modified and restored channels, on channel banks and nearby surrounding land-uses. Vegetation will trap sediment, and hence reduce the pollutant concentration within channel flow.

Heavily modified reach – Habitat Quality Assessment 22, Modification 46, Un-natural 18.

Reinforced banks, lack of in-stream and bank vegetation, singular flow type results in a low HQA score, and high modification and un-natural scores.



Restored reach – Habitat Quality Assessment 53, Modification 4, Un-natural 1.

Vegetated banks and in-stream vegetation, natural channel features such as boulders and woody debris results in a high HQA score, and low modification and un-natural scores.

The results highlight the impact of outfalls on river quality. We provide a preliminary insight into the benefit of channel restoration and the importance of catchment management in this context. The habitat scoring approach has been shown to provide an effective method to assess, compare and evaluate how reach modification influences the behaviour of pollutants deposited within fine sediment transported from outfalls.

Research team:
Cranfield University: *Dr Victoria Janes (v.j.janes@cranfield.ac.uk)* ***River Restoration Centre:*** *Dr Jenny Mant,*
Heriot-Watt University: *Deonie Allen* ***Portland State University:*** *Prof Alan Yeakley, Dr Jennifer Morse*

Blue-Green Cities in an interdisciplinary research consortium made up of partners from UK and international universities, government bodies and practitioners supported by:

bluegreencities.ac.uk
@BlueGreenCities

EPSRC
Engineering and Physical Sciences Research Council
EP/K013661/1

Environment Agency
RIVERS Agency
NATIONAL SCIENCE FOUNDATION