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1.While this system is helpful in avoiding the collapse of collecting systems which may not be built to collect all runoff rain water – potentially resulting in spills of untreated waste water mixed with rain water – rain water which is not dealt with by the collecting systems – is not regulated by the Urban Waste Water Treatment Directive (as this rain water does not mix with the waste water).

European Commission

Science for Environment Policy

Insights for urban planning — constructed wetlands sited near industry exposed to high levels of pollution

Constructed wetlands serve as a cost-effective and multi-purpose option for storm-water treatment in urban landscapes, offering flood protection as well as wildlife habitat. However, a new study shows that when nearby land use includes industry, wetlands can accumulate high levels of pollution and potentially become toxic to wildlife. This new piece of research offers important insights for the planning and management of wetlands.

Surface-water run-off in urban areas following heavy precipitation (storm water)[1] can be a source of water and soil pollution, as it carries chemical residues from developed land into water bodies. In the EU, storm-water management and the protection of aquatic environments are regulated under the EU Water Framework Directive[2], the, the Groundwater Directive[3] and the Urban Waste Water Treatment Directive[4]. Constructed wetlands are a popular method for treating storm water and have been used for several decades. They slow flows of water, while offering a refuge for wildlife, along with other benefits, such as recreational facilities. They also protect downstream environments from run-off pollutants, acting as biofilters by removing some pollutants from the water. Not all pollutants are removed in wetlands, however; therefore polluted sediment is periodically dredged to clean the wetland. However, according to this new study, the sustainability of wetlands is affected by local land use, which should be considered when designing new sites.

The researchers sampled sediments from 98 constructed wetland sites in the Greater Melbourne metropolitan area, Australia, analysing these for pollutants associated with human activities and focusing on metals and total petroleum hydrocarbons (TPH). The researchers then determined land use in the water catchment areas of each wetland, based on planning map data, in order to identify the factors affecting the generation of pollutants from urban landscapes. Land use was classified into eight broad categories: urban growth, semi-rural, rural, road–rail, residential, open space, industrial and commercial. The age of the wetland and local geology were also assessed to see if these influenced pollutant levels.

Thirteen metals, including zinc and lead, were detected in every sediment sample — a composite sample was taken from each of the 98 sites. Some metals, such as silver (found in 2% of samples) and cadmium (in 12% of samples) were occasionally found. Arsenic occurred in 56.6% of samples, in 19 cases exceeding Australian guideline levels for the protection of aquatic ecosystems. Mercury was found in 28.3% of samples, exceeding guidelines in 12 cases. Petroleum hydrocarbons were present in 94% of samples, exceeding guidelines at two-thirds of sites.

Nine pollutants, including copper, zinc and nickel, exceeded locally prescribed thresholds for disposal in at least one wetland, meaning dredged sediment would need specialist remedial treatment. Petroleum hydrocarbons exceeded waste-disposal levels in at least half of the wetlands. Usually, constructed wetlands are dredged roughly every 20 years; if specialist treatment is required, costs can escalate.

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The relative effects of local land use on pollutant levels were assessed using a technique, which combines single models to analyse complex ecological datasets. The results suggested an increased likelihood of ecological and disposal thresholds being exceeded where industrial activity covers more than 10% of land in the catchment; sediment concentrations of zinc, copper, petroleum hydrocarbons and cadmium were substantially higher near industrial land use — for example, an average 2 500 milligrams per kilogram (mg/kg) of petroleum hydrocarbons were found near industry compared to under 1 000 mg/kg at other sites. High levels of lead, meanwhile, were correlated with commercial activities in the catchment (though no explicit reason is offered for this correlation).

Older wetlands were found to contain more pollutants. The researchers explain that metals and other pollutants can bind to sediment particles, therefore the longer sediment is left to accumulate in wetlands, the more likely that pollutants will also increase. This effect can be magnified by underlying geology; catchments with underlying basalt geology were linked to higher nickel and chromium concentrations, suggesting that wetlands in basalt areas should be managed with more caution. Wetlands near primarily residential or moderately built-up areas were far less likely to be highly polluted.

Wetlands offer an attractive habitat for wildlife, especially in landscapes where other high-value habitat is scarce. If they accumulate dangerous levels of pollution, they pose a risk to local wildlife populations, effectively becoming an 'ecological trap', according to the researchers. In particular, levels of zinc and petroleum hydrocarbons in wetlands near industrial land use were shown to be toxic to marine organisms.

The study suggests that alternative solutions to storm-water management near industry may be more ecologically and economically sustainable; for example, increasing the use of other methods to reduce run-off, such as sediment traps, bio-retention swales and rain gardens. The researchers also propose potential modifications to the design of wetlands that may collect dangerous levels of contaminants, for instance minimising vegetation that may attract wildlife. Increasing the frequency of dredging in industrial wetlands could also mean that pollutants do not reach high concentrations.

The study highlights the need for planners to evaluate landscape activities in a catchment before deciding on storm-water treatment options, which can influence the sustainability of a wetland. Risk management in constructed wetlands could also be informed by further research on the actual impact of contamination on wetland ecosystems.

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2.Directive 2008/105/EC amended by Directive 2013/39/EU. The definition of urban waste water in the Directive is "domestic waste water or the mixture of domestic waste water and/or run off rain water"
3. Directive 2006/118/EC: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006L0118-20140711
4. Directive 91/271/EEC – see Annex I, section A: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271