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TE RAUHITANGA TAIAO

Sources and loads of metals in urban stormwater

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Contents

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1 Executive Summary

Stormwater quality monitoring has identified a large suite of chemical contaminants washing from urban catchments including metals, particularly zinc, copper and lead, and organic compounds including polycyclic aromatic hydrocarbons, herbicides, pesticides, fungicides, plasticisers, hydrocarbons in oil and grease, etc. There is a general assumption that the major sources of these contaminants, particularly the metals, are known although the actual proportions contributed by each source to total catchment stormwater loads are uncertain.

In Auckland we have now reached a situation where three separate studies together provide most of the data required to enable a first attempt to identify and quantify the metal sources in three urban catchments. This report describes a study commissioned by the Auckland Regional Council to combine the data from these studies to produce mass budgets for zinc, copper and lead in the stormwater from the three urban catchments and thereby to determine the contributions of each known metal source to metal loads in urban stormwater.

For all three catchments the mass budgets obtained for zinc are probably as complete as it is possible to achieve using the data presently available. In the commercial (Central Business District) and industrial (Mt Wellington) catchments roof run-off could account for almost all the zinc in the catchment stormwater. Galvanised iron roofing contributed the major part of the roof run-off zinc load. For the residential catchment (Mission Bay) roof run-off contributes about 45% of the catchment load. The zinc budget for this catchment has about 20% of the catchment load unexplained but this could be within the error in the load estimates. Road run-off is a relatively small source of zinc in all catchments.

The mass budgets for copper for all three catchments are far from complete with the copper loads from unidentified sources amounting to about 60% of the total catchment load for the residential catchment, 70% for the commercial catchment and 80% for the industrial catchment. The mass budget does not include run-off from building walls and fittings that drain directly onto impervious surfaces then into the stormwater network. However, the data obtained for soils adjacent to buildings in the residential (Mission Bay) and industrial (Mt Wellington) catchments show that run-off from building walls in these catchments does not carry large amounts of copper. The situation in the commercial (CBD) catchment could be different, however, where possibly more copper is used on buildings. It is also possible that industrial activities deliver copper (and also lead) onto impervious surfaces and thereby provide another source of copper (and lead) that is not accounted for explicitly in the mass budget.

The mass budgets for lead in the commercial and industrial catchments are, like those for copper in these catchments, incomplete. Run-off from building walls and flashings could, however, be the source of some or all of the missing lead. This would appear to be the case in the residential catchment. A realistic assumed average concentration of 500 mg kg^{-1} for lead in 10% of catchment soils (the "near building" soils) completed the lead mass budget for the residential (Mission Bay) catchment.

2 Introduction

Stormwater quality monitoring has identified a large suite of chemical contaminants washing from urban catchments including metals, particularly zinc, copper and lead, and organic compounds including polycyclic aromatic hydrocarbons, herbicides, pesticides, fungicides, plasticisers, hydrocarbons in oil and grease, etc. The large amount of data collected has led to the general assumption that the primary sources of these chemicals are those listed in Table 1, although some of these sources have changed over time, such as lead from petrol and the residential use of chlorinated pesticides.

Table 1 Primary sources of chemical contaminants in urban catchments

Chemical	Primary sources
Zinc	**Vehicle tyres, galvanised building materials (e.g. roofs), paints, industrial activities**
Copper	**Vehicle brake pads, plumbing, industrial activities**
Lead	**Residues from historic paint and petrol, industrial activities**
Polycyclic aromatic hydrocarbons	**Domestic fires, industrial emissions, vehicle exhaust, vehicle lubricating oil.**
Hydrocarbons	**Vehicle lubricating oil, vehicle exhausts**
Plasticisers	**Building materials, plumbing**
Herbicides, pesticides	**Residential and Council (mostly historic) use**
Fungicides	**Paints, residential use**

There have, however, been few attempts to either confirm that the sources listed in Table 1 are the only urban sources of the chemical contaminants or determine the relative contributions from each source. The main reason for this is that such investigations require accurate estimates of the chemical loads contributed by each of the individual sources and of the total loads draining from the catchments containing the sources. (A "load" is the mass of chemical passing a given point in a given time, e.g. an annual load could be kg/annum). These load estimates can be obtained with sufficient accuracy only from intensive monitoring and modelling of stormwater quality and quantity for each individual source as well as for the catchment containing the sources. Monitoring and modelling programmes on this scale are very expensive undertakings.