Te Awarua-o-Porirua Whaitua Committee

Options for managing contaminants in Te Awarua-o-Porirua Whaitua
ZINC AND COPPER
4 October 2018 Committee Workshop

Contents

Background and Context

1. What is the problem?

This memo lays out the most recent information on the sources of zinc and copper and which catchment within the whaitua they are coming from. Further refinement of the draft objectives is proposed and key options for managing heavy metals (policy approaches) are outlined. These will all ultimately inform the draft Whaitua Implementation Programme (WIP).

<u>The issue in the water</u>

Zinc and copper are two of the heavy metals which are common in urban runoff. Other metals and urban contaminants exist, but management methods for zinc and copper generally deal with these. Metals can occur in the water in a dissolved state and also attached to sediment particles. Both of these are an issue. Zinc and copper contamination can impact on a range of values, including ecosystem health and the way people use water for spiritual, cultural and recreational purposes. Heavy metals have both acute and chronic effects on aquatic life. Metals can be directly toxic to animals that absorb/ingest them from the sediments and they can also bio-accumulate as larger species eat smaller ones. Instream concentrations of copper and zinc can have toxicity effects on aquatic life in freshwater environments. Copper is approximately 5 to 10 times more toxic to aquatic life than zinc but occurs in lower concentrations than zinc.

Heavy metals are recognised as an issue in both the freshwater and coastal environments. There are elevated levels of metals and other toxic contaminants in urban stream water and bed sediment. For example, Porirua Stream at Wall Park has elevated levels of dissolved copper and zinc (Perrie et al. 2012, Heath et al. 2014) while Kenepuru Stream has high levels of heavy metals (Milne & Watts 2008).

Preliminary analysis of water quality data between July 2006 and June 2015 from the four GWRC monitoring sites shows stable but elevated median levels of dissolved copper and zinc at both Porirua Stream sites.

In regards to the harbour, it is considered to be in 'moderate' health for metals although there is localised contamination of sediments in the Harbour, particularly at the southern end of Onepoto Arm (Sorensen & Milne 2009, Oliver & Milne 2012). The overall ecological health is worse in the Onepoto Arm compared with the Pauatahanui Arm. This reflects the combined influence of higher mud content, nutrients, and input of stormwater contaminants. Subtidal sediments show levels of heavy metals above Australia and New Zealand Environment and Conservation Council (ANZECC) and Auckland Regional Council (ARC) 'early warning' guidelines (Oliver & Milne 2012).

Impact on Te Awarua- o-Porirua Whaitua Committee values

Te Awarua- o-Porirua Whaitua Committee values that are the most relevant to zinc and copper are:

- Kai kete – the harbour, streams and coast can be used to gather and catch kaimoana and mahinga kai for food
- Hauora kaiao – the harbour, streams and coast are clean and brimming with life and have diverse and healthy ecosystems
- Ka taea e te tangata – the harbour, streams and coast flow naturally with energy, attracting people to connect with them
- Whanaketanga tauwhiro o te whenua – land is developed, used and managed sustainably, recognising its effect on water quality and quantity.
- Ko Te Awarua-o-Porirua he taonga tuku iho a Ngāti Toa Rangatira – Te Awarua-o-Porirua is an ancestral treasure of Ngāti Toa Rangatira

Challenges in respect of zinc and copper management

- There is an absence of regulation for managing contaminants (including metals) from new development currently under either regional or district planning processes
- There is little familiarity or industry best practice around stormwater management techniques and design in new subdivision that are needed to deliver improved water quality and habitat outcomes
- Water quality in receiving environments is not top of mind for developers
- There are pressures to increase housing, especially though greenfield development

- Developers incur financial risk in the development of new subdivision and/or infill activities therefore regulatory frameworks need to be clear and certain
- Connectivity between planning and delivery is poor (e.g. regional plan to district plan to structure plan to construction), including because objectives of the regional plan are not clearly enough stated and there is a lack of a regulatory framework.
- RMA planning in the region at present lacks clear objectives and water quality limits for new development to meet
- Greenfields development does not contribute to a load reduction which is required in most urban catchments
- The only place load reductions can come from is brownfield development and the utilisation of public open space (causing some tensions in the community)
- It is generally low awareness by people undertaking land uses that are of high risk of contaminating stormwater of the potential impact of their activities
- Many land uses at high risk of generating stormwater contaminants are likely also regulated for trade waste and hazardous substances. This presents both a challenge in terms of confusion around what the rules are but also an opportunity to use existing avenues for connecting with water quality management policy options

2. Where is the zinc and copper coming from?

Zinc and copper are heavy metals that occur naturally within our environment but elevated levels of these metals tend to indicate contamination from another source. Metals tend to be generated in the urban environment (copper primarily from car tyres and vehicle brake pads and zinc from roofing/cladding) and bind to sediment which is then transported to waterways, accumulating in estuarine and coastal sediments.

High concentrations of zinc and copper in the harbour are localised and are generally known to originate from certain stormwater-borne sources. International and NZ experience is that the main sources of copper are vehicle brake pads and zinc car tyres and roofing/cladding. Generally speaking the main source of contaminants in stormwater is from impervious surfaces on which vehicles move (roads and car parks)

Table 1 shows the estimated concentrations of dissolved zinc and copper coming from the highest yielding sources during rainfall to give some insights into the relative contributions from different sources in the catchment.

Table 1: Estimated metal concentrations and areas from sources for Whaitua

	Roads		Industrial		Commercial		Residential	
	Local	Major	Roof area	Paved area	Roof area	Paved area	Roof area	Paved area
Estimated area (Ha)	330	30	40	70	30	40	360	760
Estimated mean dissolved zinc concentration during rainfall (mg/l)	0.0004-0.013	0.03-0.05	1.5	0.06	0.6	0.02	0.05	0.02
Estimated mean dissolved copper concentration during rainfall (mg/l)	0.0003-0.008	0.02-0.3	0.001	0.03	0.03	0.01	0.0005	0.01

Table 2 shows the objectives for these metals and the modelled existing states (medians and 95th percentiles). This also illustrates the spatial distributions of higher and lower levels of dissolved zinc and copper throughout the whaitua. This clearly shows the impact of urban catchments.

Table 2: Estimated instream dissolved metal concentrations and draft objective per WMU

		Dissolved Zinc			Dissolved copper		
		Objective	Median (µg/L)	95th percentile (µg/L)	Objective	Median (µg/L)	95th percentile (µg/L)
Hongoeka to Pukerua	Hongoeka to Pukerua	A	A 0.8	A 7.2	A	A 0.3	C 2.2
Taupo Stream	Wetland	A	A 1.2	B 12.8	A	A 0.3	C 2.7
	Camborne case study	A	C 9.3	D 84.2	A	A 0.8	D 6.6
	Mouth	A	B 3.9	C 32.3	B	A 0.6	D 4.7
Horokiri Stream	Horokiri Battle Hill	A	A 0.1	A 0.2	A	A 0	A 0.1
	Horokiri @ Golf Club	A	A 0.1	A 0.2	A	A 0	A 0.1
	Horokiri Mouth	A	A 0.1	A 0.3	A	A 0	A 0.1
Kakaho Stream	Kakaho Stream	A	A 0.1	A 0.3	A	A 0	A 0.1
Ration Creek	Ration Creek	A	A 0.1	A 0.4	A	A 0	A 0.1
Pauatahanui Stream	Judgeford Stream	A	A 0.1	A 0.3	A	A 0	A 0.1
	Pauatahanui Stream - mid	A	A 0.1	A 0.5	A	A 0.1	A 0.3
	Pauatahanui Mouth	A	A 0.3	A 2.6	A	A 0.1	A 0.9
Duck Creek	Upper Duck Creek	A	A 0.1	A 0.3	A	A 0	A 0.1
	Lower Duck Creek	A	A 2	B 13	B	A 0.5	C 2.9
Whitireia	Whitireia	A	A 1.3	B 10.8	A	A 0.4	C 2.6
Hukarito Stream	Hukarito Stream	A	B 2.6	B 13	B	A 0.8	C 3.8
Mahinawa Stream	Mahinawa Stream	A	A 0.9	B 8.2	B	A 0.3	C 2.2
Elsdon	Elsdon	B/A	D 42.7	D 249.1	C	C 1.8	D 10.3
Upper Porirua	Belmont Stream	C	B 5	C 33	C	A 0.7	C 3.5
	Stebbings Stream	A	A 0.2	A 0.5	A	A 0.1	A 0.3
	Takapu Stream	C	A 2.2	C 29.8	C	A 0.1	A 1.4
	Grenada North	C	D	D	C	C	D

	industrial		50.6	248.2		1.9	9.3
	Willowbank	C	B 6.2	C 36.2	C	A 0.8	D 4.5
Lower Porirua	Rangituhi Stream	A	A 0.1	A 0.2	A	A 0	A 0.1
	Mitchell Stream	C	C 8.7	D 78.9	C	A 0.6	D 5.5
	Kenepuru Drive	C	B 7.6	C 40.6	C	A 0.9	D 4.7
Kenepuru	Upper Kenepuru	A	A 0.4	A 3.7	A	A 0.1	A 1
	Infill case study	-	B 6.1	C 22.1	-	B 1.4	D 5
	Kenepuru	B	B 5.2	C 19.8	C	B 1.3	D 4.7
Porirua	Porirua Mouth	C	C 8.1	C 36.2	C	B 1.1	D 4.8

The modelling shows that around 80% of total zinc load entering the harbour is entering the Onepoto Arm. Of that load entering Onepoto Arm, 80% of the total load enters through Porirua Stream, with Elsdon being the next largest contributor. From the remaining streams direct to Onepoto Arm, streams draining residential areas such as Mahinawa Stream contribute notable loads along with the small streams under State Highway 1.

In regards to copper 80% of the load enters the Onepoto Arm. Of that 75% is entering the Onepoto Arm through the Porirua Stream mouth with the remainder largely coming through the Elsdon WMU and the small streams under State Highway 1.

Table 3: Estimated zinc loads to Te Awarua-o-Porirua Harbour

		Total zinc loads (kg/yr)		Total copper loads (kg/yr)	
Onepoto	Porirua	2130	2650	190	240
	Elsdon	190		10	
	The rest	330		30	
Pauatahanui	Pauatahanui	160	580	20	70
	Horokiri	70		10	
	Duck	190		20	
	Browns	80		10	
	The rest	80		10	

3. What have we learnt from the scenario modelling?

As part of the scenario modelling, a series of mitigations (including source reduction) were applied across the whaitua to explore the likely instream outcomes of reduced zinc and copper contamination.

The BAU scenario sees development occurring to the extent and density anticipated in the WCC and PCC district plans' rules and the rules of the regional. Practice around the mitigation of the effects of new development is assumed to be as it is today (i.e. little stormwater quality management). It also assumes that identified and/or likely development areas not currently within a district plans, but described in other documents such as structure plans and/or growth strategy (e.g. the PCC Northern Growth Area Structure Plan), will go ahead. There are four main catchments (Pauatahanui, Belmont, Stebbings and Taupo) where new urban development has been modelled. The BAU scenario also includes the construction and operational impacts of the Transmission Gully state highway. The total additional urban area (includes roading) modelled in the scenarios is around 400 ha.

Table 4: Mitigation measures modelled for each of the scenarios

Improved Scenario	Water sensitive Scenario
Runoff from 100% of local roads in infill and greenfield is treated (74% treatment performance)	Runoff from 100% of local roads in infill and greenfield is treated (79% treatment performance)
Runoff from 50% of major roads is treated (70% treatment performance)	Runoff from 100% of major roads is treated (70% treatment performance)
50% of high Zn roofs are treated and have low Zn yield in industrial and commercial areas	100% of high Zn roofs are treated and have low Zn yield in industrial and commercial areas
Runoff from 50% of paved surfaces in industrial and commercial areas is treated (50% treatment performance)	Runoff from 100% of paved surfaces in industrial and commercial areas is treated (50% and 80% treatment performance respectively)
50% of existing high Zn roofs are treated/replaced and have low Zn yield in residential areas and 100% of new roofs in infill and greenfield roofs are low Zn yield in residential areas	100% of existing high Zn roofs are treated/replaced and have low Zn yield in residential areas and 100% of new roofs in infill and greenfield roofs are low Zn yield in residential areas and there is a smaller roof footprint in the development
Runoff from 100% of infill and greenfield paved and roof surfaces in residential areas are treated (70% treatment performance)	Runoff from 100% of infill and greenfield paved and roof surfaces in residential areas are treated and there is a smaller paved footprint in the development (70% treatment performance)
Runoff from 100% of construction treated (90% treatment performance)	Runoff from 100% of construction treated (90% treatment performance)

Three case studies were also modelled to provide a greater illustration of the influence of the mitigation scenarios in respect of different land use (industrial, new greenfield and infill redevelopment).

3.1 What have we learnt from scenario modelling - zinc?[1]

Water management units (WMUs) under current state are generally very good in rural areas, although Taupo Stream is perhaps affected by the main highway (SH1) and the commercial and industrial area downstream of the wetland. Zinc concentration in urban areas was poor/fair, with major sources coming from commercial and industrial areas, roads and roofs.

[1] Source document – Memo: Key messages from scenario modelling for *E.coli* and toxicity attributes – dated May 2018

Most rural areas likely to maintain A band under all scenarios (exception Taupo), though Transmission Gully (TG) and the connecting roads around the interchange areas (Whitby/Waitangirua & SH58) may bring some new sources of zinc into those areas.

Modelling suggests it may be possible to achieve an A band in the urban WMUs with the water sensitive scenario, however, uncertainty around the estimated reductions from roof painting and replacement mean that results may more likely be B band than A from the water sensitive efforts.

Major drivers of change in the water sensitive scenario include treatment of:

- runoff from roofs and paved surfaces in infill and greenfield development, roofs and paved surfaces in commercial and industrial areas and high traffic roads, which reduce zinc by around 70-85%,
- the replacement and/or painting of all existing roofs, which reduces zinc by around 95% from those sources.

3.2 What have we learnt from scenario modelling - copper?[2]

WMUs under current state are generally very good in the rural areas except for the small coastal catchments (Pukerua, Hongoeka and Whitireia), though the model results may be influenced by low flows in these areas. Urban results were typically poor/fair, with major contributions from roads and paved surfaces.

Most rural areas will be likely to maintain A band under all scenarios, though Transmission Gully completion may bring some new sources into those areas, particularly in Upper Duck Creek. Changes in traffic load off SH1 onto Transmission Gully may help improve copper concentrations in the Taupo Stream catchment.

Treatment of new development and high risk areas (i.e. high traffic roads and commercial and industrial paved surfaces) is effective for copper from those surfaces, but it becomes more challenging to treat other relatively high yielding and extensive sources such as residential roads and paved surfaces.

Committee decisions

4. Objectives

The Committee have produced high level objectives, narrative objectives for urban contaminants, specific harbour objectives based on ANZEEC guidelines and instream concentration objectives for freshwater.

See **Appendix 1.**

At the August meeting the Committee did not reach agreement in respect of the specific harbour objectives. Concerns were raised as to whether it was achievable to reduce contamination levels in the sediment in the hot spot areas. Further work is underway to determine what sources are contributing to the contamination in the hot spot areas and the feasibility of reducing contaminant loads. This work will inform further consideration of the harbour specific objectives.

[2] Source document – Memo: Key messages from scenario modelling for E.coli and toxicity attributes – dated May 2018

5. What limits and targets are on the table?

Zinc and copper limits and targets (contaminant loads and load reductions) to achieve freshwater objectives will be calculated.

The project team is undertaking further work to determine how it is most appropriate to use dissolved and total loads as limits and whether the load limit into the harbour should be total zinc and copper or dissolved zinc and copper.

It is proposed to set a load limit for each harbour arm as well as certain high contributing WMUs. The objectives shown in Table 2 indicate that considerable load reductions will be required inputting into the Onepoto Arm.

The project team is undertaking further work to determine an approach to the management of the harbour hot spot areas. This work will seek to identify certain WMUs as primary sources of the contamination. If this is the case then work will continue to determine if these WMUs should have a target load (or relative reduction target) in order to achieve a harbour objective to reduce the contamination in hot spot areas.

6. To allocate or not to allocate?

There are two key questions in consideration of allocation approach for discharges. These are:

1. Can you allocate the contaminant? Are there conditions which mean you can't allocate?
2. Should you allocate the contaminant? I.e. What are the pros and cons of using an allocation approach vs a non-allocation approach?

Point source discharges of zinc and copper can be attributed to an individual property (or to the owner of a road) and the loss could be measured or estimated. However, zinc and copper tend to be diffuse discharges originating from multiple sources and ultimately discharging through the stormwater network. This makes it difficult to attribute diffuse discharges to individuals and accurately measure or estimate individual losses. Therefore, in reality our ability to attribute discharges to individuals is not good enough to enable an allocation framework to be developed at a property scale.

7. Policy decisions

Greenfield development will occur in the Whaitua. The tension is that greenfield development will not reduce stormwater contaminant loads. The approach suggested is:

- Minimise the contaminant loads from new greenfield development and control this vigorously. National best practice in water sensitive urban design is a bottom line. To achieve this regulation of new development is required (this is a new requirement in this region)
- Limit greenfield development in the Onepoto Arm catchments to that presently envisaged in District Plans or is already earmarked for development through a plan change process i.e. no more
- Allow for small increases in load in some sub-catchments (to allow for development) while requiring an overall reduction into a harbour arm
- Incentivise brownfields development and infill over greenfields

Brownfield development and infill are important in meeting a number of community objectives. In the water quality space these developments provide the opportunity to reduce overall contaminant loads in the harbour arms. The challenge is to incentivise this type of development and capture the opportunity it provides. A number of opportunities in the Porirua catchment are likely to occur in the near to medium term.

8. Other Policy options

Education/change programme

- Promoting water sensitive urban design including programmes that improve industry and council capability and capacity.
- Improvement of high risk land uses and other urban critical source areas that contribute a higher portion of contamination in line with good management practice. This could include an urban water advisory programme that is an expansion of the Take Charge programme formally run by Greater Wellington
- Greater Wellington to advocate to central government for the replacement of copper brake pad with copper-free brake pads. This could involve co-ordinating a combined regional council response on the issue. It should be noted that copper-free brake pads cost approximately 50% more than copper brake pad
- Development and/or communication of industry good practice e.g. stormwater management, industrial sites.

Integrated planning

- Greater Wellington to work with WCC, PCC and Wellington Water to provide a cohesive approach to instigating changes in land development practice within urban areas. This may include:
  - Alignment of regional and district plans, and water asset plans
  - Development of water sensitive urban design guidelines for new greenfield subdivisions
  - Joint resource consent processing
  - Clear distinction in respect of any jurisdictional overlap
  - develop an agreed understanding in respect of land use controls
  - identify the opportunities in brownfield development
  - identify the opportunities for stormwater retrofitting in existing urban footprint

- Reduce the footprint of high zinc yield roofs and cladding within residential, commercial and industrial areas. Methods to achieve this could include:
  - Investigate the existing replacement rate of roofs
  - Potential for incentive schemes
  - Role of the district plan or bylaws to increase the rate of change
  - Changes to the Building Act

- Greater Wellington to work with NZTA to gain a better understanding of the heavy metals generated from the operation of the state highways and the rate of accumulation/concentration in the harbour sediments and any mitigation measures

Appendix 1: Draft objectives for heavy metals in freshwater and the harbour

High level objectives[3]

The high level objectives relevant to zinc and copper are:

Restore ecological health and water quality	Improve water quality for human health	Sustainable urban development	Sustainable rural land use	Te mana o Te Awarua-o-Porirua
Reduce sedimentation rates Reduce pollutant inputs: - reduce toxicant inputs - cap nutrient inputs Restore habitats: - estuary re-vegetation - riparian and habitat enhancement Reduce impacts from altered hydrology	Achieve water quality suitable for swimming – reduce faecal inputs Improve access Improve amenity	Achieve sustainable urban development: - maintain and improving water quality - provide housing stock and built environment that meets the communities needs Provide sustainable and resilient water infrastructure	Achieve sustainable land management and land use practice	Provide for Māori use including mahinga kai Restore the mana of Te Awarua-o-Porirua

Summary of draft objectives[4]

Draft objectives

Prevent the impact of urban contaminants (particularly zinc and copper) in streams and the harbour from getting worse.

In particular, improve the 'hot spot' areas of contaminated sediments in the harbour (e.g. southwestern end of the Onepoto Arm) and improve impacts on stream ecosystem health in urban areas.

[3] Committee meeting minutes 19 May and 16 June 2016
[4] ENPL-6-2812 confirmed with committee on 23 August 2018

What is driving this and what might it mean?

Zinc and copper are heavy metals and cumulative ecotoxins.

Reduce zinc and copper impacts on stream and harbour ecosystems across the whaitua.

The way new development and new roads are constructed should avoid, as far as possible, urban contaminants reaching waterways. Economic analysis has shown that treatment of stormwater contaminants is most cost-effective when undertaken at the time of construction.

Recognise the moment of land use change and redevelopment (e.g. infill housing) as the opportunity when cost-effective mitigation options can be best realised.

Protect significant biodiversity, mana whenua and recreational values in streams and other water bodies that will be subject to urban development.

Harbour objectives[5]

The Committee considered these draft objectives for zinc and copper sediment concentrations in the harbour at the August 2018 committee meeting.

Concentration of metals in sediment should be no more than 0.5 of ANZECC guideline values (ISQG) – low guidelines in intertidal areas, including reducing contamination in known intertidal hot spot areas
Concentration of metals in subtidal area sediments to reduce below ANZECC guidelines

Draft objectives for dissolved zinc and copper concentrations in freshwater

Drains to	WMU group	WMU name	Dissolved zinc toxicity		Dissolved copper toxicity	
			Current State	Objective 19.4.18	Current State	Objective 19.4.18
Open coast	Coastal catchments	Pukerua	A	A	C	B
		Hongoeka to Pukerua	A	A	C	A
		Whitireia	B	A	C	A
Taupo	Taupo Stream and Swamp	Taupo Stream	C	A	D	B
			B	A	C	A
Pauatahanui Inlet	Pauatahanui steep rural streams	Horokiri and Motukaraka	A	A	A	*A**
			A	A	A	*A**
		Kakaho Stream	A	A	A	*A**

5 Memo – Recommendations for draft harbour objectives and key messages from harbour modelling results dated 17 August 2018

		Judgeford Stream	A	*A**	A	*A**
		Upper Duck Creek	A	A	A	*A**
	Pauatahanui rural streams	Pauatahanui Stream	A	A	A	*A**
		Ration Creek	A	A	A	*A**
	Pauatahanui urban streams	Lower Duck Creek	B	A	C	B
		Pauatahanui fringe streams	C	A	D	B
Onepoto inlet	Onepoto steep rural streams	Rangituhi Stream	A	A	A	A
		Takapu Stream	C	C	A	A
		Upper Kenepuru	A	A	A	A
	Onepoto rural streams	Belmont Stream	C	C	C	C
		Stebbings Stream	A	A	A	A
	Onepoto small urban streams	Hukarito Stream	B	A	C	B
		Mahinawa Stream	B	A	C	B
		Onepoto Fringe	D	A-B	D	C
		Titahi	C	A	D	C
	Kenepuru Stream	Kenepuru	C	B	D	C
	Porirua Stream	Porirua	D	C	D	C
			D	C	D	C
			C	C	D	C
			C	C	D	C