

McKechnie Aluminium Solutions Limited
Monitoring Programme
Annual Report
2014-2015

Technical Report 2015-88

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Taranaki Regional Council
Private Bag 713
STRATFORD

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Executive summary

McKechnie Aluminium Solutions Limited (the Company) operates an aluminium melting and extrusion plant located at Bell Block, in the Mangaone and Mangati catchments. Processing of copper and brass (copper/zinc) at the metal melting and extrusion plant ceased in June 2002 and January 2003, respectively. The Company holds resource consents to allow it to discharge into the Mangaone and Mangati streams, and to discharge emissions into the air. This report for the period July 2014-June 2015 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of their activities.

McKechnie Aluminium Solutions Ltd holds a total of two resource consents that are covered within this particular report: consent 1857 to discharge stormwater into an unnamed tributary of the Mangaone Stream, and consent 4034 to discharge emissions into the air, which together include a total of 22 conditions setting out the requirements that they must satisfy.

During the 2014-2015 year, McKechnie Aluminium Solutions Ltd demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included four site inspections, 21 water samples collected for physicochemical analysis, two biomonitoring surveys of receiving waters, and one deposition gauge survey in the vicinity of the foundry site.

As in the previous monitoring period, sampling showed slight improvements in water quality in relation to dissolved copper and dissolved zinc concentrations. This supports the trend from previous sampling of an improvement in water quality within the receiving environment. Biomonitoring results have also continued to indicate a slight improvement in water quality and ecological conditions in the stream over the last few years. MCI and SQMCI₅ scores indicate that treated stormwater discharged from the site is not having a detrimental effect on the macroinvertebrate communities of the unnamed tributary of the Mangaone Stream.

The results from deposition gauging indicate that there was an environmentally acceptable level of particulate deposition in the vicinity of the foundry site. No visible emissions or odour issues were noted during inspections and no complaints were received during the period under review.

During the year, McKechnie Aluminium Solutions Ltd demonstrated a high level of environmental performance and a high level of administrative compliance with the resource consents. There were no unauthorised incidents recorded by the Council in relation to the Company's activities. The foundry site was well managed and maintained.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

This report includes a recommendation for the 2015-2016 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2014-June 2015 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by McKechnie Aluminium Solutions Limited (MASL). The Company operates an aluminium foundry and extrusion process situated at Paraite Road, in the Mangaone and Mangati catchments. The location of the site is shown in Figures 1 and 2.

Copper and brass foundries and extrusion processes had previously been operated at the site. Copper processing ceased in June 2002 and brass processing ceased in January 2003. MASL also previously operated a separate powdercoating facility on Connett Rd in the Mangati catchment. This operation was shifted to the main Paraite Rd site during the 2008-2009 year and is now monitored under the existing consents for this site.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company that relates to discharges of water within the Mangaone catchment¹, and the air discharge permit held by MASL to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water and air, and is the twenty second combined annual report by the Council for the foundry site.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by the Company in the Mangaone and Mangati catchments, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the Company's site.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretations, and their significance for the environment.

¹ Two stormwater discharge permits are held for the MASL site, consents 1857 and 3139. Consent 3139 (for the discharge of cooling water and stormwater from the MASL site to the Mangati Stream) is reported separately by the Taranaki Regional Council in a joint report covering discharges within the Mangati catchment.

Section 4 presents recommendations to be implemented in the 2015-2016 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.1.3 The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- (a) the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- (b) physical effects on the locality, including landscape, amenity and visual effects;
- (c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- (d) natural and physical resources having special significance (for example recreational, cultural, or aesthetic);
- (e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns a rating as to each Company's environmental and administrative performance.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.
- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.
- **Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.
- **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.
- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.
- **Poor:** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

1.2.1 Discharges to stormwater

The MASL manufacturing plant extends across the boundary between two stormwater catchments (Figure 1). Drainage from the western side (3.9 hectares) is to the eastern headwaters of the Mangaone Stream, about four kilometres from where the stream enters the Waiwhakaiho River. Drainage from the eastern side (4.9 hectares) is to the Mangati Stream. There are separate consents for stormwater discharges to the two catchments. This report relates to the western stormwater discharge. The eastern stormwater discharge, consent 3139, is monitored under the Mangati Stream Catchment Monitoring Programme.

The area which drains to the Mangaone catchment is bounded by the Marton - New Plymouth railway, Henwood Road, and the main building. Significant changes have occurred at the site during the last twenty years with respect to both processing activities undertaken at the site and improvements to control the effects of historical activities. An outline of the historical activities and their potential impacts on current stormwater quality is given below. More detailed discussions are contained in previous monitoring reports, which are listed in the bibliography.

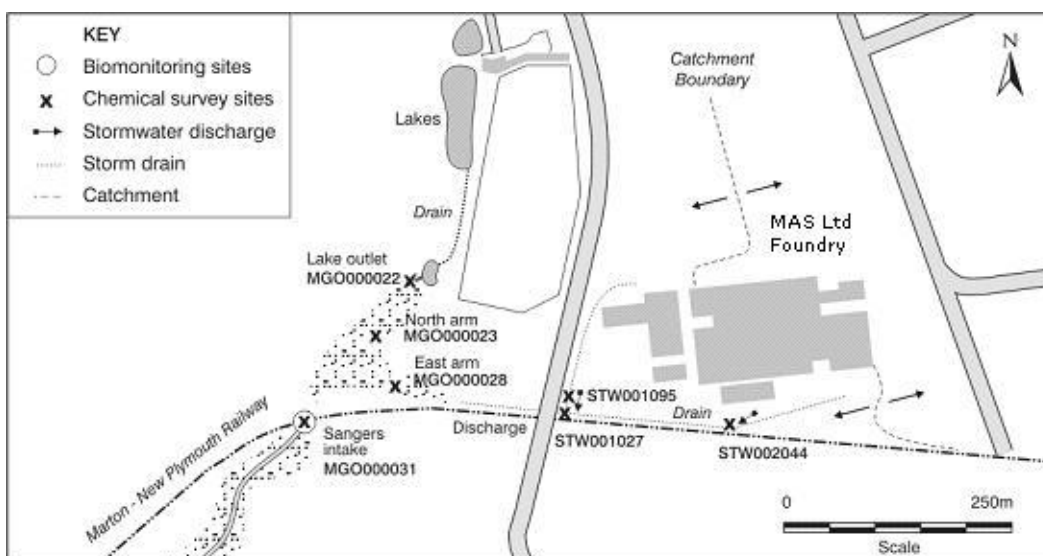


Figure 1 MASL foundry site, showing the boundary between Mangaone and Mangati stream catchments and water monitoring sites

Approximately 40% of the site draining to the Mangaone catchment is planted, 16% roofed, 41% tar seal or concrete, and 3% bare gravel.

The estimated storm flow to the Mangaone system, for a 10-minute duration event of 5 year return period, is 670 litres per second. Currently, for consent compliance purposes, the discharge point is at Henwood Road railway crossing. Monitoring is also undertaken at the points of exit from the site.

Aerial emissions from the now defunct brass and copper foundry and swarf drying plant prior to the installation of the baghouse in 1996, have contributed to the significant concentrations of metals, particularly copper, zinc and lead, now found in the surface soils at the site. Historical practices relating to the handling and storage of scrap, dross and baghouse dust have also resulted in particular areas having elevated metals concentrations.

Included in the Mangaone catchment are a tool room, fabrication shops, an aluminium anodising plant, an anodising effluent treatment plant, and a powdercoating facility. Also in this catchment are areas previously used in relation to the copper and brass re-melting and extrusion activities, which are now used for aluminium scrap sorting, finishing and warehousing.

A Stormwater Management Plan developed by the Company identifies actions that MASL has already carried out and is continuing to undertake to minimise the potential for contaminants to enter the stormwater from current operating practices and historical contamination.

There are two main stormwater drains westward from the site, which converge immediately above the railway crossing.

The southern drainage ditch runs approximately parallel with the railway, starting outside the former swarf drying plant and brass foundry. Its catchment includes a bunded holding area for drummed waste substances. The drainage from this area is discharged via a piped system which incorporates a baffled sediment and oil trap. A

stop valve is fitted just downstream of the trap allowing isolation of the discharge in the event of a spillage in this catchment.

The western drain services the area around the aluminium anodising plant and fabrication building. The anodising effluent treatment plant is contained within a bunded area. The stormwater discharges to a small swamp in the eastern headwaters of the Mangaone Stream, about four kilometres from where the stream enters the Waiwhakaiho River further west. The swamp is fed from groundwater seeps and from a small lake on the property of the Pacific International Hotel Management School on Henwood Road. This area was redeveloped during the creation of the SH3 Bell Block bypass. Transit NZ holds consents for the reclamation of part of the northern end of the lake (5801) and to discharge stormwater from road surface drainage into the lakes (5803).

1.2.2 Discharges to air

In January 2008, a reconditioned gas fired furnace was installed which replaced the previous gas fired melting and holding furnaces. Only clean scrap is loaded into the new gas furnace, which discharges directly to atmosphere through a separate stack.

The Company receives clean in-house production and purchased scrap aluminum extrusions and ingots for re-melting and casting into extrusion log. A small amount of fumeless cleaning flux is used during the melting process. Small additions of silicon and magnesium are made to the aluminum in the gas fired furnace after it is melted for alloying purposes. The furnace burners are turned to low during dross removal, which combined with the fumeless flux, means that there are no emissions generated. No toxic metals are used during the melting process.



Photo 1 MASL Baghouse

Before the aluminum is cast, further fumeless cleaning flux is used, along with casting table and launder coating applications. Continuous lubricant is injected into molds during the casting process.

Anodised and powdercoated scrap is chopped for loading into a separate induction furnace where emissions are routed to the aluminum baghouse. A fumeless cleaning flux is used after melting, followed by dross removal with the melt then being transferred to the gas fired furnace.

Discharges to air from the powdercoating facility are monitored under the foundry site consent. The potential effects from powdercoating are emissions of powder and odours into the air from the process. If solvents are used in the process there is also potential for air emissions to contain a toxic component. These effects can all be avoided by appropriate technology; and in this case an exhaust fan followed by a baghouse is used. This technology is simple, robust and effective.

During past monitoring periods, there were frequent, but intermittent, plume discharges from the various sources to air. These varied in their impact offsite, depending on processing and weather conditions at the time of emission. Fugitive emissions have not been noted from vents on the aluminium building roof in recent monitoring periods. The baghouse controls have pre-set temperature limits, which will divert the exhaust gases directly to the stacks if the incoming gases exceed the limits set. This avoids the superheated gases damaging the baghouse or its components. This type of discharge is still subject to conditions 1 and 2 of consent 4034-3, which require the consent holder to adopt the 'best practicable option' to minimise adverse effects upon the receiving environment from the discharges.

1.3 Resource consents

1.3.1 Water discharge permit

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

McKechnie Aluminium Solutions Limited holds water permit **1857-6** to discharge treated stormwater from an industrial premise that includes a metal extrusion plant into an unnamed tributary of the Mangaone Stream. This permit was issued by the Council on 4 December 2012 under Section 87(e) of the RMA. It is due to expire on 1 June 2026.

There are nine special conditions imposed on consent 1857-6.

Condition 1 requires that the consent holder adopts the best practicable option to prevent or minimise any adverse effects on the environment.

Condition 2 limits the catchment area of the discharge to 4 hectares.

Condition 3 requires that hazardous substance storage areas are isolated from the stormwater catchment.

Condition 4 specifies limits for the components within the discharge immediately downstream of the railway crossing culvert.

Condition 5 establishes a mixing zone of 150 metres extending from below the railway crossing culvert, beyond which compliance with section 107 of the RMA is required.

Condition 6 requires that MASL maintain a contingency plan for action to be taken in the event of accidental discharge or spillage of contaminants.

Condition 7 requires the maintenance of a stormwater management plan to the satisfaction of the Council.

Condition 8 requires the consent holder to notify the Council prior to making changes at the site which may alter the nature of the discharge.

Condition 9 provides for review of the consent.

The permit is attached to this report in Appendix I.

1.3.2 Air discharge permit

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

McKechnie Aluminium Solutions Limited holds air discharge permit **4034-3** to discharge emissions into the air from extrusion and remelting of aluminium and associated activities. This permit was first issued by the Council on 8 September 1993 as a resource consent under Section 87(e) of the RMA. It was most recently renewed on 15 August 2008 and is due to expire on 1 June 2026.

There are thirteen special conditions imposed on consent 4034-3.

Conditions 1 and 2 require that the consent holder adopts the best practicable option to prevent or minimise any adverse effects on the environment.

Condition 3 stipulates that any discharge to air shall not give rise to offensive or toxic levels of smoke, dust or odour at or beyond the site boundary.

Conditions 4, 5 and 6 limit the dust deposition rate beyond the site boundary; the total particulate matter concentration of ventilated gas streams; and the effect of discharges on the ambient suspended particulate concentration at the site boundary.

Condition 7 requires the consent to be exercised in accordance with the consent holder's Environmental Management Manual.

Condition 8 requires the consent holder to notify the Council prior to making any changes at the site which may alter the nature of the discharge.

Conditions 9, 10 and 11 stipulate limits on the opacity of any discharge; the increase in the ground level PM₁₀ concentration beyond the boundary due to site discharges; and

the concentration of any other contaminants in the discharge not specifically named in this consent.

Condition 12 requires the consent holder to immediately notify the Council of any incident or situation that does not comply with this consent, and to supply a written report on the incident to the Council within one week.

Condition 13 provides for review of the consent.

The permit is attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.

The monitoring programme for the MASL site consisted of four primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The MASL site was visited four times during the monitoring period. With regard to consents for discharges to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Council undertook sampling of the discharges from the site for the purpose of compliance monitoring, and surveyed the water quality upstream and downstream of the discharge point and mixing zone to determine the impact on the receiving water.

There are eight permanent chemical monitoring sites (as shown in Figures 1 and 2). These are the western and eastern discharge points; the discharge drain at Henwood Rd; the lake outlet upstream of the stormwater discharge; the northern arm of the swamp upstream of the discharge; the eastern arm of the swamp which receives the discharge (just inside the mixing zone); the receiving water in the unnamed tributary; and the receiving water in the Mangaone Stream at Egmont Rd.

One monitoring run is carried out annually in wet weather, for compliance monitoring of the stormwater discharge, and one run is carried out annually in dry weather, to determine long term trends in the quality of the receiving water. Samples are analysed for pH, conductivity, suspended solids and concentrations of total and dissolved copper and zinc. The results of this monitoring are presented in Table 1.

In addition, two reduced wet weather sampling runs and four dry weather receiving water samples were taken to assess the relative levels of dissolved copper and zinc in the combined discharge and the receiving water below the mixing zone. The results are included in Tables 2 and 3.

To assess levels of particulate emissions to air, deposition gauges were placed in the vicinity of the site on one occasion during the period under review and the collected samples were analysed for deposited particulates and selected metals.

1.4.5 Biomonitoring surveys

Biological surveys were performed in October 2014 and February 2015 in an unnamed tributary of the Mangaone Stream to determine whether or not the discharge of stormwater from the site had had a detrimental effect upon the communities of the stream.

2. Results

2.1 Water

2.1.1 Inspections

Four inspections were undertaken at the MASL site during the period under review. The following was found during the inspections:

19 August 2014

An inspection was carried out with the MASL Environmental Manager, including a circuit of the perimeter of the site. It was noted that the new acid-etch bund had been leaking. One of the open drains leading into the Mangaone Stream appeared to have dead grasses, possibly from a discharge. The Company was to identify what was discharged from the drain. It was requested that they ensure the bund was repaired that all discharges into the open drains would not contaminate the waterway. No air or dust emissions were observed at the time of inspection.

7 November 2014

An inspection was carried out with the Environmental Manager. The site was clean and tidy. New petrol and diesel tanks had been installed. The bund below the acid-etch filter press had been re-contoured so that the water would flow back into the building. More works were required to increase the volume of the bund. The open drain opposite the filter press still had what appeared to be a dead patch of grass within the open drain. The Company advised that the pH of the discharge into the drain would be monitored to ensure that there was no ongoing discharge of contaminants.

4 May 2015

An inspection was carried out with the Environmental Manager. It was noted that the new diesel and petrol tanks had been bunded. A minor problem had arisen with one of the pump nozzles not having an automatic shut off system. This had been addressed. The stormwater drain by the workshop was still dark in colour, however the water itself appeared clean. The drain by the acid-etch bund may have been sprayed by contractors, causing any vegetation in the drain to die. This was one possible explanation for the lack of growth in the drain. The Company advised that some spills had occurred in the area where the sulphuric acid is stored. One incident was from a burst hose and the other from the removal of sludges from an old tank. It appeared that some of the acid had entered a stormwater drain that was believed to be a sump. An inspection of the sump found that an exit pipe existed. The Company was to investigate where the drain led and what options may be available to prevent sulphuric acid from discharging offsite or into groundwater.

22 May 2015

A monitoring inspection was carried out with the Environmental Manager to check for compliance with resource consent conditions. It was observed that a new splash curtain had been installed in the acid-etch filter press bund. The Company advised that the drain which was believed to be a sump on the previous inspection was in fact a drain that discharges to a soak hole. The site spill kits had been modified to include chemical absorption pads. There were no visible discharges to air and no odours were detected that would be associated with emissions from the extrusion and remelting of aluminium.

2.1.2 Results of discharge and receiving water monitoring

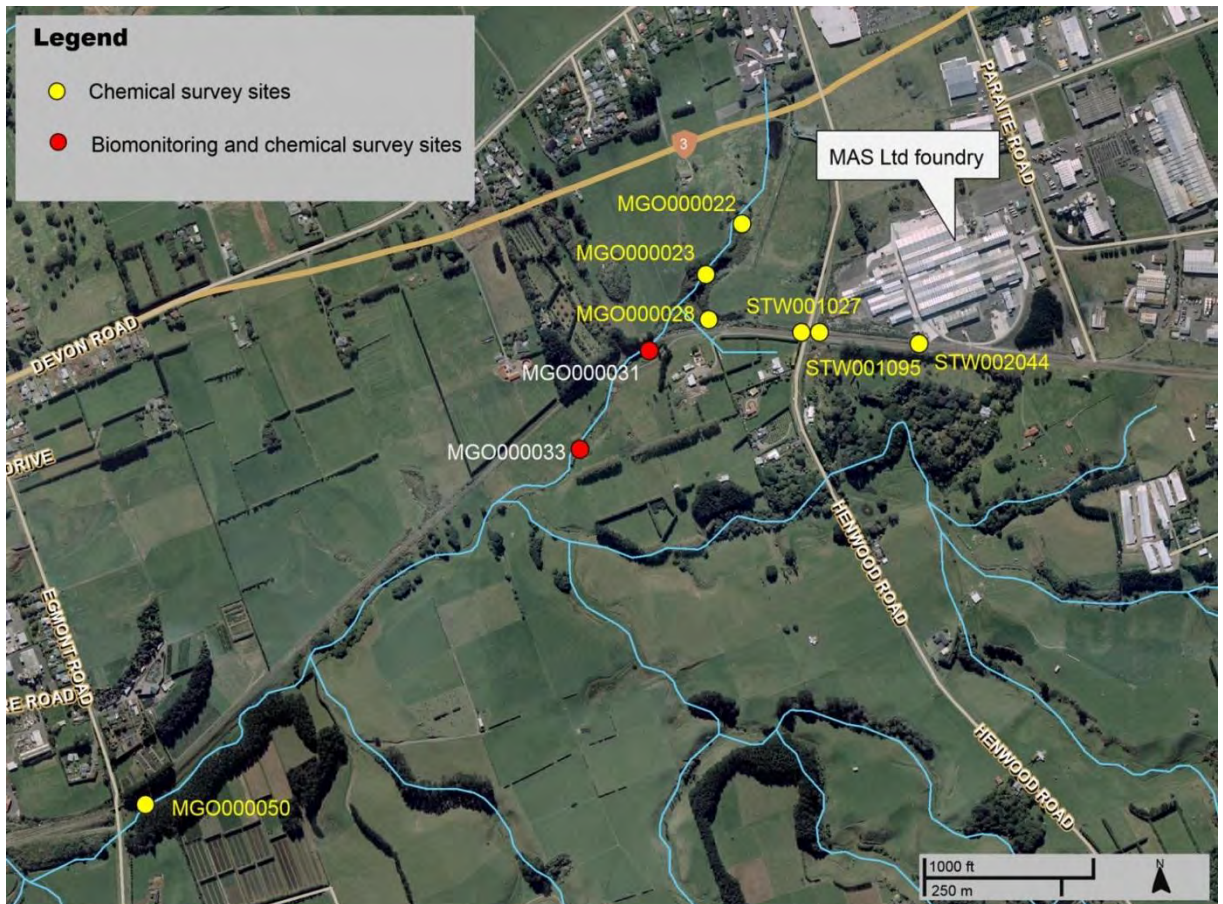


Figure 2 Location of the MASL plant at Bell Block and related water quality monitoring sites

Samples were taken by the Council from several permanent sampling points under dry conditions on 28 May 2015 and in wet weather conditions on 6 August 2015 (delayed due to unsuitable weather conditions and lab availability). The results are presented in Table 1. Two reduced wet weather runs were conducted on 12 May 2015 and 3 June 2015. A summary of these combined discharge and receiving water results is given in Table 2. Four dry weather samples of the tributary of the Mangaone Stream below the mixing zone were also taken during the year. The results from these samples are presented in Table 3.

Dry weather runs are intended to determine long term trends in the quality of the receiving water. Historical metals concentration data available for dry weather runs was limited prior to the introduction of regular sampling at the start of the 1999-2000 monitoring period.

Wet weather runs enable the Council to determine whether compliance with the discharge conditions on consent 1857-6 is being achieved, and what effects the discharge is having on the receiving waters.

Up until a consent renewal in September 2003 there were six prescribed control limits imposed upon the MASL stormwater discharge. These limits applied to the pH, suspended solids, oil and grease, and copper, lead and zinc concentrations. From September 2003 to the end of the 2012 monitoring period the three prescribed control

limits imposed on contaminants were for pH, oil and grease, and suspended solids. The current version of the consent also includes a limit of 0.05 g/m³ on dissolved copper in the combined discharge and 1 g/m³ for dissolved zinc.

The consent also limits the effects that the discharge may have on the receiving water beyond a mixing zone extending 150 m from where the discharge enters the swampy area. Site MGO000028 is within this mixing zone.

Traditionally, the establishment of water quality criteria has been based upon the use of measures such as “total recoverable metals” for determining acceptable limits for metal concentrations in discharges. However, in recent years a number of countries including the United States (under the aegis of the USEPA) have revised their toxicant criteria towards the protection of freshwater aquatic ecosystems in the receiving environment, and as such dissolved metal concentrations are considered more representative of the bioavailable fraction of metals in the water column.

The receiving water quality criteria for dissolved copper and zinc, in water with hardness of 50 g/m³ CaCO₃, are 0.0062 g/m³ Cu and 0.058 g/m³ Zn for chronic (long-term) exposure. The corresponding criteria for acute (1-hour) exposure are 0.0088 g/m³ Cu and 0.064 g/m³ Zn. Chronic exposure criteria are best related to dry weather sampling results, whilst acute exposure criteria are best related to wet weather sampling conditions.

Aside from the dissolved metal concentrations within the mixing zone in the Eastern Arm (MGO000028), none of the samples collected from the tributary of the Mangaone Stream exceeded the relevant USEPA receiving water criteria for the protection of aquatic ecosystems.

The levels of dissolved copper found within the mixing zone of the Eastern Arm were significantly lower than the median of previous sampling (0.040 g/m³), being 0.008 g/m³ during the dry run and 0.014 g/m³ during the wet run. Levels of dissolved zinc were also well below the median of previous results of 0.410 g/m³ Zn. In general, there is continuing evidence of an improvement in the water quality of the tributary of the Mangaone Stream in relation to both dissolved copper and dissolved zinc.

The results for all other parameters indicated that the discharge was not having an adverse effect on the receiving waters. Levels of aluminium, lead, oil and grease, and suspended solids in the discharge were low and in compliance with applicable consent conditions.

Table 1 Results of comprehensive discharge and receiving environment monitoring

Parameter	Discharge			Downstream			Upstream	
	Western Drain	Eastern Drain	Combined Discharge	East Arm	Sanger's Intake*	Egmont Road	North Arm	Lake Outlet
Site code	STW001095	STW002044	STW001027	MGO000028	MGO000031	MGO000050	MGO000023	MGO000022
Dry Run – 28 May 2015								
Temperature (degC)	-	-	-	13.3	10.8	10.4	11.1	10.8
Conductivity (mS/m)	-	-	-	19.1	18.7	17.9	18.8	15.2
pH	-	-	-	6.5	6.9	7.0	6.7	6.4
Suspended Solids (g/m ³)	-	-	-	< 2	3	9	< 2	< 2
Cu Acid Soluble (g/m ³)	-	-	-	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Cu Dissolved (g/m ³)*	-	-	-	0.008	0.001	< 0.001	0.003	< 0.001
Zn Acid Soluble (g/m ³)	-	-	-	0.134	0.018	< 0.005	0.013	0.021
Zn Dissolved (g/m ³)*	-	-	-	0.126	0.017	< 0.005	0.012	0.020
Wet Run – 6 August 2015								
Temperature (degC)	12.2	11.9	12.0	14.2	12.8	13.1	12.9	12.8
Conductivity (mS/m)	3.6	3.0	3.8	14.0	9.5	14.1	8.2	5.8
pH	6.6	6.8	7.0	6.5	6.9	6.9	6.9	6.6
Suspended Solids (g/m ³)	< 2	2	3	3	2	24	4	7
Cu Acid Soluble (g/m ³)	0.01	0.08	0.05	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Cu Dissolved (g/m ³)*	0.013	0.059	0.022	0.014	0.003	0.002	0.001	0.003
Zn Acid Soluble (g/m ³)	0.922	0.200	0.531	0.260	0.022	< 0.005	0.022	0.046
Zn Dissolved (g/m ³)*	0.884	0.193	0.500	0.231	0.013	< 0.005	0.022	0.038
Al Acid Soluble (g/m ³)	0.38	0.34	0.69	-	-	-	-	-
Pb Acid Soluble (g/m ³)	< 0.05	< 0.05	< 0.05	-	-	-	-	-
Oil and Grease (g/m ³)	< 0.5	< 0.5	< 0.5	-	-	-	-	-
*USEPA acute criteria for dissolved metals: Cu 0.0088 g/m ³ and Zn 0.064 g/m ³ [at hardness of 50 g/m ³ CaCO ₃]								

The results of combined discharge and receiving water monitoring for the 2014-2015 monitoring period are summarised in Table 2. The monitoring points are the stormwater culvert at the Henwood Road railway crossing (STW001027), which is representative of the total stormwater discharge from the foundry site to the Mangaone catchment, and the unnamed tributary of the Mangaone Stream that is located downstream of the MASL stormwater discharge point. The second location is shown in Figure 1 and Figure 2 and is referred to as Sanger's Intake (MGO000031)². Two sets of samples were taken during the period under review. All results for dissolved metals in the tributary below the mixing zone were below the USEPA acute receiving water criteria. The discharge was in compliance with consent 1857-6.

Table 2 Results of combined discharge (STW001027) and receiving water (MGO000031) monitoring

Date	Sampling point	Temp (°C)	pH	Conductivity (mS/m)	Suspended Solids (g/m ³)	Dissolved Copper* (g/m ³)	Dissolved Zinc* (g/m ³)
12.5.15	STW001027	15.5	6.9	5.4	2	0.025	0.371
	MGO000031*	15.4	6.8	10.7	3	0.003	0.017
3.6.15	STW001027	13.6	6.8	4.0	4	0.011	0.259
	MGO000031*	13.2	6.8	11.9	14	0.003	0.025

*USEPA acute criteria for dissolved metals: Cu 0.0088 g/m³ and Zn 0.064 g/m³ [at hardness of 50 g/m³ CaCO₃]

The aim of this monitoring was to examine any potential correlation between the levels of dissolved metals in the MASL discharge and in the tributary of the Mangaone Stream below the mixing zone. This monitoring was instigated during the previous monitoring periods for the purpose of gathering data to assist in setting practical metals content limits in the Company's renewed stormwater discharge consent.

Table 3 Dry weather Sanger's Intake (MGO000031) monitoring results

Date	Temp (°C)	pH	Conductivity (mS/m)	Dissolved Copper* (g/m ³)	Dissolved Zinc* (g/m ³)
13.10.14	13.5	7.2	19.1	0.002	0.018
29.1.15	17.4	7.0	22.0	< 0.001	< 0.005
19.2.15	15.7	7.2	21.0	< 0.001	< 0.005
15.6.15	12.9	7.1	17.9	0.001	0.010

*USEPA chronic criteria for dissolved metals: Cu 0.0062 g/m³ and Zn 0.058 g/m³ [at hardness of 50 g/m³ CaCO₃]

² Sanger's Intake sampling location is downstream of the stormwater mixing zone. It also provides a useful indication of the overall quality of the receiving water within the unnamed tributary because this particular sampling location is representative of all contributing sources of heavy metals, including several other sources of contaminants that are not directly associated with the stormwater discharge itself.

Four samples of the tributary of the Mangaone Stream at Sanger's Intake during dry weather were also collected during the year. The results are shown in Table 3.

In interpreting the impact of the discharge on the receiving water at Sanger's intake, a number of other sources of metals not directly associated with the discharge itself that also affect the receiving water must be considered. For example, other sources may include: leaching related to historical aerial contamination from the MASL site; stormwater run-off from the Bell Block shopping complex and State Highway; earthworks associated with the bypass and industrial area development; and release of metals from the eastern arm associated with historical stormwater discharge activities.

The results of sampling from Sanger's Intake under dry weather conditions are similar to those found when stormwater was discharging from the MASL site. This indicates that the discharge is not significantly increasing copper and zinc concentrations within the tributary of the Mangaone.

2.1.3 Biological monitoring of receiving waters

The Council's standard 'sweep sampling' technique was used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 16 October 2014 and 12 February 2015. Samples were sorted and identified to provide number of taxa (richness) and MCI and SQMCI_s scores.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring, and may be more useful in soft-bottomed streams. Significant differences in either the MCI or the SQMCI_s between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

16 October 2014

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was moderate, equal to the historical median for this site. The community 400 metres further downstream was also in average condition, also having a macroinvertebrate richness equal to the historical median. The upstream richness does not indicate an impact from the MASL discharge, but reflected the limited potential for recruitment from upstream, which has poor invertebrate habitat. The MCI value at site 3 was five units higher than the median for this site, but well within the scores previously recorded. This result is similar to most recent scores, including that recorded in the previous summer survey. However, it appears that there may be a seasonal pattern emerging, with higher MCI scores recorded in spring, and lower MCI scores recorded in summer. The MCI score at site 4 was insignificantly higher than the median, and only one unit less than that recorded at site 3.

It is considered that the macroinvertebrate communities at sites 3 and 4 did not indicate any impacts from the stormwater discharge, as an above average MCI score was recorded at both sites. This conclusion is also supported by a comparison with

historical survey results, and overall, the current survey results were indicative of no recent impacts of discharges on the macroinvertebrate communities of either site.

12 February 2015

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was moderately low, three taxa less than the historical median for this site. The community 400 metres further downstream was in average condition, having a macroinvertebrate richness equal to the historical median. The upstream richness does not indicate an impact from the MASL discharge, but reflected the limited potential for recruitment from upstream, which had poor invertebrate habitat. The MCI value at site 3 was five units higher than the median for this site, but well within the scores previously recorded. This result was similar to most recent scores, including that recorded in the previous spring survey. However, it did not follow the seasonal pattern that appeared to be emerging over the last two years, which recorded higher MCI scores recorded in spring, and lower MCI scores recorded in summer. During the current survey, the MCI score was relatively high, being similar to that recorded in the previous spring survey. The MCI score at site 4 was insignificantly higher than the median, and two units higher than that recorded at site 3.

It is considered that the macroinvertebrate communities at sites 3 and 4 did not indicate any impacts from the stormwater discharge, as an above average MCI score was recorded at both sites. This conclusion is also supported by a comparison with historical survey results, and overall, the current survey results were indicative of no recent impacts of discharges on the macroinvertebrate communities of either site.

With the exception of the February 2006 and April 2007 surveys, the SQMCI_S values have been relatively high in the last 25 surveys. This was due mainly to the high abundances of medium-scoring taxa, particularly 'sensitive' amphipods. This trend was continued in the present survey at both sites, with both scores recording above average scores. The generally higher SQMCI_S values in recent surveys may have indicated subtle improvements in the community from that recorded in the late 1990's. Although it is unlikely to be a significant change, it correlates with the improvement shown in the physicochemical water quality monitoring data over this time.

These macroinvertebrate surveys indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate community of this unnamed tributary.

The full biomonitoring reports are attached to this report in Appendix II.

2.2 Air

2.2.1 Inspections

Inspection notes are included in section 2.1.1 above. No issues regarding air quality were noted during the monitoring period.

2.2.2 Deposition dust gauging

Many industries emit dust from various sources during operational periods. In order to assess the effects of the emitted dust, industries have been monitored using deposition gauges. Deposition gauges are buckets elevated on a stand to about 1.6 metres. The buckets have a solution in them to ensure that any dust that settles out of the air is not resuspended by wind.

The rate of dust-fall is calculated by dividing the weight of insoluble material (grams) collected by the cross-sectional area of the gauge (m^2) and the number of days over which the sample was taken. The units of measurement are grams/metre²/day.

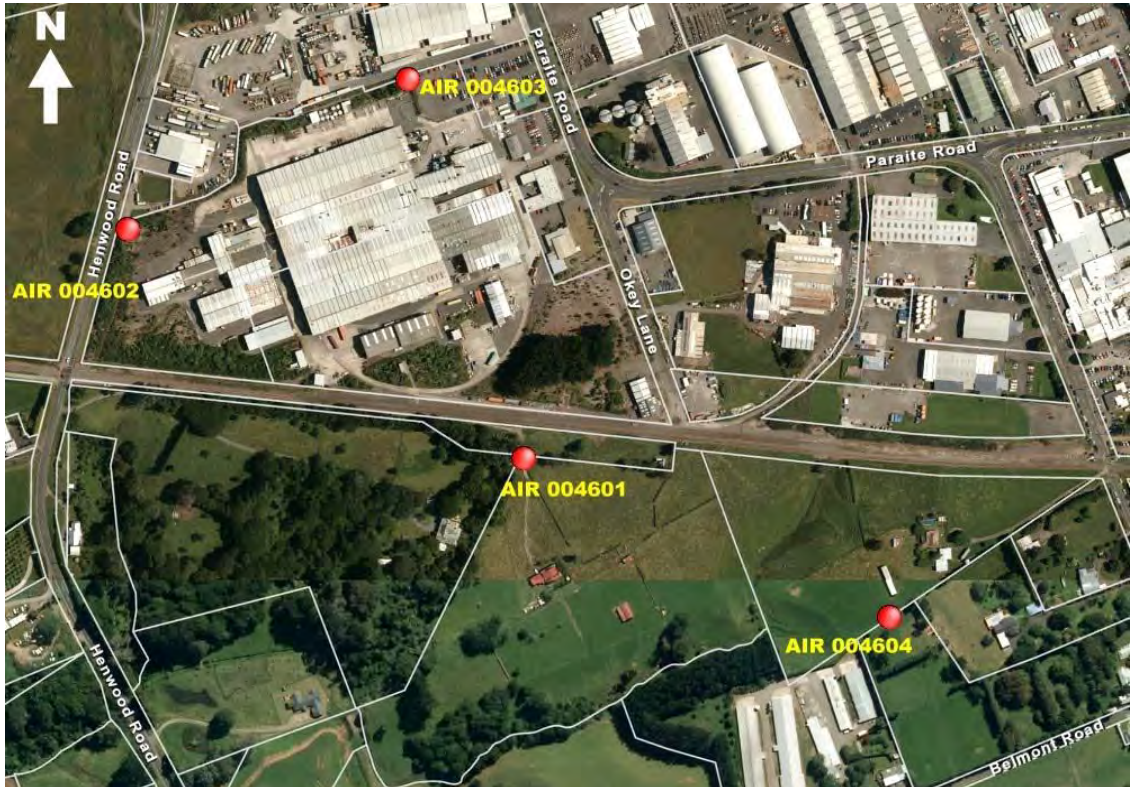


Figure 3 Locations of dust deposition monitoring sites in relation to the MASL site.

Guideline values used by the Council for dust deposition are 4 g/m²/30 days or 130 mg/m²/day deposited matter. Consideration is given to the location of the industry and the sensitivity of the surrounding community when assessing results against these values. Material from the gauges was analysed both for solid particulates and for constituents associated with pollution, including selected metals.

In the 2014-2015 period, gauges were deployed on one occasion at four locations in the vicinity of the foundry site for a period of 21 days from 14 October to 4 November. The locations of the monitoring sites around the foundry are shown in Figure 3 above.

Material from the gauges was analysed for particulates, aluminium, copper, lead, zinc and conductivity. For comparison, the median values of data obtained from an urban 'state of the environment' deposition gauge site located on the corner of Mangorei Road and Devon Road (site AIR000012) have been included in Table 4.

Table 4 Foundry deposition gauge results for the 14 Oct – 4 Nov 2014 survey

Site		AIR004601	AIR004602	AIR004603	AIR004604	AIR000012 (median 2000-2003) comparison site
Total particulate mg/m ² /day		30	40	100	120	50
Total particulate mg/m ² /day June 1996-June 2014 median		40	40	100	50	-
Aluminium mg/m ² /day	Dissolved	0.47	0.39	0.49	0.49	-
	Particulate	0.24	0.80	0.99	2.21	-
Copper mg/m ² /day	Dissolved	0.05	0.04	0.05	0.05	0.021
Lead mg/m ² /day	Dissolved	0.24	0.20	0.24	0.24	-
Zinc mg/m ² /day	Dissolved	0.09	0.11	0.35	0.16	0.284
Conductivity @ 20°C mS/m/day		0.49	0.45	0.47	1.58	0.28

Particulates

The rates of particulate deposition were below the 130 mg/m²/day guideline value at all monitoring sites, and were similar to the medians of previous sampling results except for at the control site AIR004604 where it was unusually high. This is discussed below. The consistently elevated deposition rate at site AIR004603 may be explained by its proximity to both the MASL site and surrounding industrial sites, including a large truck depot.

Metals deposition

The ratio between the particulate and dissolved fractions varies according to the individual metal and the pH of the liquid in the deposition gauge. As much as 99% of the total zinc has been found to be in the dissolved (bio-available) form. This is likely to be higher than the proportion bio-available in the soil, as historically the pH of the liquid in the gauge has been quite acidic (favouring metal solubility) relative to the soil. Because of this, combined with the closure of the copper and brass activities at the site, particulate metal analysis of the filters for copper, lead and zinc has been ceased.

The Department of Health (1992) has set guidelines for maximum annual application to agricultural land of heavy metals (in sewage sludge). These guidelines may be used for assessing the impact of metals deposited on land in the vicinity of the MASL site. The guidelines for copper, lead and zinc are 12, 15 and 30 kilograms per hectare per year, respectively. This equates to 3.3, 4.1 and 8.2 mg/m²/day for copper, lead and zinc respectively. There is no guideline for aluminium.

The highest values recorded for the dissolved metals deposited in the 2014-2015 monitoring year were 1.5%, 5.9%, and 4.3% of the respective guidelines for copper, lead, and zinc. The levels of dissolved aluminium were slightly elevated above historical medians for all sites, while particulate aluminium levels were generally below the median values.

The highest total deposition rate, conductivity and particulate aluminium level were found at the control site AIR004604, which is the farthest site from the foundry and downwind of site AIR004601. This indicates that main source of deposited materials at the control site was from the vicinity of the gauge rather than the MASL site.

In comparison to the median values found at the urban 'state of the environment' monitoring site, during the year under review the MASL deposition gauge sites showed copper and zinc deposition rates that were similar to those in an urban area close to a main road.

Other parameters

These results are consistent for those parameters which are predominantly affected by the proximity of a monitoring site to the sea, i.e. total dissolved salts (indicated by conductivity). Activities at the MASL site do not lead to significant emissions of these compounds, and there is no evidence from the monitoring of site-specific effects related to total dissolved salts.

2.3 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified company is indeed the source of the incident (or that the allegation cannot be proven).

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

MASL has markedly reduced the discharge of contaminants from its foundry site in recent years. The Company achieved compliance with the prescribed consent limits imposed on its discharge permits for the site in the period under review. Good control of emissions from the aluminium foundry was also achieved. There were no air related complaints received by Council.

The Company has implemented the improvements relating to consent 1857 and the stormwater management programme developed in conjunction with the Council.

3.2 Environmental effects of exercise of consents

3.2.1 Environmental effects of exercise of water discharge permit

Stormwater from the MASL site has discharged to a small swamp in the headwaters of the Mangaone Stream for a period of over 30 years. The Council has monitored the effects of the discharge and the receiving water since 1982 through both chemical and biological surveys.

Continued improvements in effluent management and housekeeping practices by MASL have assisted in reducing the concentrations of contaminants within the stormwater discharged from the site. Sample results during the period under review support the trend of reductions in the levels of contaminants in the receiving water at Sanger's Intake seen during recent years. No samples outside of the mixing zone exceeded the relevant USEPA receiving water criteria for the protection of aquatic ecosystems.

The two biological surveys undertaken during the period under review indicated that the discharge of treated stormwater from the MASL site had not had any recent detrimental effect on the macroinvertebrate communities of the unnamed tributary of the Mangaone Stream. This provides further evidence that there has been an improvement in physicochemical water quality in recent monitoring years, consistent with the water quality monitoring data.

3.2.2 Environmental effects of exercise of air discharge permit

Atmospheric particulate matter can arise from a number of sources, both natural and from human activity eg, vegetation pollens, smoke and ash, sea spray, dust from soils and paved surfaces, and manufacturing processes. While extremely fine particles may remain floating in the atmosphere for weeks or months, coarser dusts may settle out within timeframes ranging from a few seconds to minutes.

The environmental effects of dusts include loss of visibility, loss of the amenity and aesthetic values of a 'clear sky', irritation to breathing, and soiling of surfaces. It has been found that background rates of dust deposition in rural areas of New Zealand are typically 0.1-1.5 g/m²/30 days, while in urban areas rates are generally higher, in the range of 0.6-3.0 g/m²/30 days. From experience, rates above 3-4 g/m²/30 days tend to lead to complaints by neighbours over the objectionable or offensive nature of dust emissions from particular sources.

Deposition gauging was conducted for the 20th time during the 2014-2015 monitoring period around the foundry site. The results from the gauging indicate that there was an environmentally acceptable level of particulate deposition in the vicinity of the foundry site. The results of the gauging also showed that the levels of deposited metals were much lower than allowed by the Department of Health (1992) guidelines for maximum annual application to agricultural land of heavy metals (in sewage sludge).

The incidence of conspicuously visible emissions has reduced greatly at the foundry site since the installation of the aluminium baghouse. No visible emissions or odour issues were noted during inspections and no complaints were received during the period under review.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 5 and 6.

Table 5 Summary of performance for Consent 1857-6

Purpose: To discharge treated stormwater from an industrial premise that includes a metal extrusion plant into an unnamed tributary of the Mangaone Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise effects on the environment	Inspections and liaison with consent holder	Yes
2. Maximum catchment size	Site inspections	Yes
3. Appropriate hazardous substance storage	Site inspections	Yes
4. Limits on chemical composition of discharge	Sampling	Yes
5. Discharge shall not cause specified adverse effects beyond mixing zone	Sampling and biomonitoring surveys of the receiving water	Yes
6. Implementation and review of a contingency plan	Reviewed plan submitted as part of the MASL Environmental Management Manual	Yes
7. Maintenance of a stormwater management plan	Reviewed plan submitted as part of the MASL Environmental Management Manual	Yes
8. Notification prior to making changes at the site which may alter the nature of the discharge	Notifications and site inspections	Yes
9. Optional review provision	Next option for review in June 2020	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 6 Summary of performance for Consent 4034-3

Purpose: To discharge emissions into the air from extrusion and remelting of aluminium and associated activities		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise effects on the environment	Site inspections	Yes
2. Selection of best practicable equipment and processes	Site inspections	Yes
3. Discharge shall not give rise to offensive or toxic levels of contaminants at the site boundary	Site inspections and discharge monitoring	Yes
4. Limit on dust deposition rate beyond the site boundary	Deposition gauge monitoring	Yes
5. Maximum particulate concentration of discharges	Testing not undertaken during year under review	N/A
6. Limit on elevation of ambient suspended particulate matter concentration	Deposition gauge monitoring	Yes
7. Compliance with the MASL Environmental Management Manual	Site inspections and liaison with consent holder	Yes
8. Notification prior to making changes at the site which may alter the nature of the discharge	Notifications and site inspections	Yes
9. Limit on opacity of any discharge	Testing not undertaken during year under review	N/A
10. Limit on effect of emissions on PM10 concentration at the boundary	Testing not undertaken during year under review	N/A
11. Limits on other contaminants beyond site boundary	Testing not undertaken during year under review	N/A
12. Notification in the event of unauthorised discharge	No unauthorised incidents logged during the year	N/A
13. Optional review provision	Next option for review in June 2020	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

During the year, MASL demonstrated a high level of environmental performance and a high level of administrative compliance with the resource consents as defined in Section 1.1.4. There were no unauthorised incidents recorded by the Council in relation to the Company's activities. The MASL site was well managed and maintained.

3.4 Recommendations from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

1. THAT monitoring of consented activities at the MASL site in the 2014-2015 year be amended from that undertaken in 2013-2014 to reflect the Council's changes to the structure of all monitoring programmes.

This recommendation was implemented.

3.5 Alterations to monitoring programmes for 2015-2016

In designing and implementing the monitoring programmes for air/ water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, its obligations to monitor emissions/ discharges and effects under the RMA, and report to the regional community. The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/ discharging to the environment.

It is proposed that monitoring of consented activities at the MASL site in the 2015-2016 year continue at the same level as in 2014-2015. A recommendation to this effect is attached to this report.

4. Recommendations

1. THAT monitoring of consented activities at the McKechnie Aluminium Solutions Limited site in the 2015-2016 year continue at the same level as in 2014-2015.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

Al*	Aluminium.
As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
F	Fluoride.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ² /day	grams/metre ² /day.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.

Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m ²	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH ₄	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH ₃	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM ₁₀	Relatively fine airborne particles (less than 10 micrometre diameter).
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

Zn*

Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact the Council's laboratory.

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Appendix I

**Resource consents held by
McKechnie Aluminium Solutions Limited**
(For a copy of the resource consent
please contact the TRC consent department)

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: McKechnie Aluminium Solutions Limited
Private Bag 2007
NEW PLYMOUTH 4342

Decision Date: 4 December 2012

Commencement
Date: 4 December 2012

Conditions of Consent

Consent Granted: To discharge treated stormwater from an industrial premise
that includes a metal extrusion plant into an unnamed
tributary of the Mangaone Stream at or about (NZTM)
1698859E-5677985N

Expiry Date: 1 June 2026

Review Date(s): June 2014, June 2020 and in accordance with special
condition 9

Site Location: 36 Paraitē Road, Bell Block, New Plymouth

Legal Description: Lot 1 DP 10008 Lot 1 DP 9212 Lot 2 DP 330342
[discharge source]

Catchment: Waiwhakaiho

Tributary: Mangaone

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
2. The stormwater discharged shall be from a catchment area not exceeding 4 hectares.
3. Any significant volumes of hazardous substances on site shall be stored in a dedicated bunded area with drainage to sumps, or to other appropriate recovery systems, and not directly to the site stormwater system.
4. Constituents of the discharge shall meet the standards shown in the following table.

<u>Constituent</u>	<u>Standard</u>
pH	within the range 6.0 to 9.0
Suspended solids	concentration not greater than 100 gm ⁻³
Oil and grease	concentration not greater than 15 gm ⁻³
Dissolved copper	concentration not greater than 0.05 gm ⁻³
Dissolved zinc	concentration not greater than 1 gm ⁻³

This condition shall apply in the receiving waters at a designated sampling point immediately downstream of the railway crossing culvert at or about [1698859E-5677985N].

5. After allowing for reasonable mixing, within a mixing zone extending 150 metres downstream of the discharge point, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the receiving water:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
6. The consent holder shall maintain a contingency plan that details measures and procedures to be undertaken to prevent spillage or any discharge of contaminants not authorised by this consent. The contingency plan shall be followed in the event of a spill or unauthorised discharge and shall be certified by the Chief Executive, Taranaki Regional Council as being adequate to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

Consent 1857-6

7. The consent holder shall maintain a stormwater management plan that documents how the site is to be managed to minimise the contaminants that become entrained in the stormwater. This plan shall be followed at all times, shall be certified by the Chief Executive, Taranaki Regional Council, and shall include but not necessarily be limited to:
 - a) the loading and unloading of materials;
 - b) maintenance of conveyance systems;
 - c) general housekeeping; and
 - d) management of the interceptor system.
8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site, or any disturbance of soil on site that could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and be emailed to consents@trc.govt.nz.
9. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review:
 - a) during the month of June 2014 and/or June 2020; and/or
 - b) within 3 months of receiving a notification under special condition 8 above;for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 4 December 2012

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: McKechnie Aluminium Solutions Limited
Private Bag 2007
NEW PLYMOUTH 4342

Consent Granted
Date: 15 August 2008

Conditions of Consent

Consent Granted: To discharge emissions into the air from extrusion and
remelting of aluminium and associated activities at or about
(NZTM) 1699193E-5678120N

Expiry Date: 1 June 2026

Review Date(s): June 2014, June 2020

Site Location: Paraita Road, Bell Block, New Plymouth

Legal Description: Lot 1 DP 9212, Lot 1 DP 10008 & Lot 2 DP 330342

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. Notwithstanding any other conditions of this consent the consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
2. The consent holder shall minimise the emission and effects of contaminants discharged to air from the property, by the selection of the best practicable process equipment, process control equipment, contaminant abatement equipment, and methods of control, supervision and operation, and the proper and effective operation, supervision, control and maintenance of all equipment and processes at all times.
3. Any discharge to air from the exercise of this consent shall not give rise to any offensive, objectionable or toxic levels of smoke or dust or odour at or beyond the boundary of the property on which the extrusion and remelting of aluminium and associated activities are occurring.
4. The dust deposition rate beyond the property boundary of the MCK Metals Pacific Ltd Plant, arising from the discharge, shall be less than 4.0 g/m²/30 days or 0.13 g/m²/day.
5. All gas streams ventilated or otherwise discharged from the plant shall be treated to reduce the concentration of total particulate matter to less than 125 milligrams per cubic metre, normal temperature and pressure, at any time.

Consent 4034-3

6. The discharge of suspended particulate matter from the site shall not increase the ambient concentration of suspended particulate matter by more than 3 milligrams per cubic metre (measured under ambient conditions), determined by measurements at the upwind and downwind boundaries of the property.
7. The consent will be exercised in accordance with the procedures set out in the consent holder's Environmental Management Manual (August 2007) and subsequent revisions, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the Environmental Management Manual (August 2007), except by specific agreement of the Chief Executive, Taranaki Regional Council. In the case of any contradiction between the Environmental Management Manual (August 2007) and the conditions of this resource consent, the conditions of this resource consent shall prevail.
8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site, which could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and to be emailed to worknotification@trc.govt.nz.
9. The opacity of any discharge to air when measured by photoelectric means shall not equal or exceed a value of 20% opacity.
10. The emissions to the air from the Consent Holder's premises shall not significantly contribute to, nor cause the monitored ground level concentrations of particulate material less than 10 microns in aerodynamic diameter to exceed 50 micrograms per cubic metre of air expressed as a 24 hour average at or beyond the boundary of Consent Holder's premises.
11. That the discharge to atmosphere of any contaminants other than those specified above shall not cause the concentration within the air space beyond the boundary of the Consent Holder's property of that contaminant to exceed 1/30th [one-thirtieth] of the relevant Workplace Exposure Standard Time-weighted average [Workplace Exposure Standards Effective from 2002].
12. The Consent Holder shall, for the purposes of adequately monitoring the consent as required under Section 35 of the Act, on becoming aware of any incident or situation that does not comply with this consent, immediately advise the Council on the incident. The Consent Holder shall then supply a written report to the Council on the cause, effects and the actions taken to mitigate the effects on the environment and to prevent recurrence. The written report shall be submitted to the Council within one week of the incident occurring.

Consent 4034-3

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2014 and/or June 2020, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 4 March 2010

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Biomonitoring reports

To Job Manager, C MacKenzie
 From Scientific Officer, B Jansma
 File 03-02-005-07/01; 1857
 Report No BJ263
 Document No. 1549203
 Date 3 August 2015

Biomonitoring of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd plant, October 2014.

Introduction

The macroinvertebrate communities of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd [MASL] plant have been monitored annually or biannually since November 1983. This biological survey was the first of two surveys scheduled in the 2014-2015 monitoring year. The results of surveys performed since the 1998-99 monitoring year are discussed in various Taranaki Regional Council reports (refer to the references).

Methods

The standard '400 ml sweep-net-sampling' technique was used to collect streambed macroinvertebrates from two established sites in the Mangaone Stream (Table 1, Figure 1) on 16 October 2014. The 'sweep-net sampling' technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 Biomonitoring sites in the tributary of the Mangaone Stream that receives stormwater discharges from MASL

Site No.	Site code	Map reference	Location
3	MGO 000031	P19: 086397	Below swamp (Sanger's intake)
4	MGO 000033	P19: 086395	400 metres downstream of site 3

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores assigned to the taxa found at a site, and multiplying the average by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways. The use of this index in non-stony streams is possible if results are related to physical habitat (muddy or weedy streams tend to produce lower MCI values than stony streams).

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Results and discussion

The stormwater discharge from the MASL plant flows into a small drain which itself flows into the eastern arm of a swampy area. The swamp forms the headwater of a small stream in which sites 3 and 4 are located. A long culvert was laid in the stream between sites 3 and 4 prior to the November 2000 survey (Figure 1). The culvert begins a few metres downstream of site 3 and ends at the point where site 4 was previously located. Site 4 was subsequently moved several metres downstream. The habitat at this location was similar to the habitat at the original site. There have also been changes in the headwaters of this unnamed tributary in relation to the construction of the bell block bypass.

It should be noted that the stream was culverted between sites 3 and 4 to allow the landowner to discharge cleanfill, in doing so, slowly filling in the gully. This site holds a consent to discharge this cleanfill, and is monitored under a separate monitoring programme. However, activities at this cleanfill site have the potential to impact on the communities of this stream.

During the current survey, flows were moderate with both sites having a clear, uncoloured and slow flow. The survey was performed in the early morning, and the water temperature had a narrow range (13.2 – 13.5°C). Substrate comprised predominantly silt at both sites.

Both sampling sites supported aquatic macrophytes, as is often typical of softer-bedded, slower-flowing habitats, although they were only present on the edges at site 4. Site 3 was partially shaded by riparian vegetation, but site 4 was unshaded. There was no obvious algal growth at either site during this survey, but iron oxide sediment as noted at site 4.

Macroinvertebrate communities

The results of the previous macroinvertebrate surveys performed at sites 3 and 4 in the Mangaone tributary that receives stormwater discharges from MASL are summarised in Table 2, together with the results of the current survey.

Table 2 Numbers of taxa and MCI values recorded in the unnamed tributary of the Mangaone Stream downstream of MASL, from November 1983 to the current survey

Site	Number of previous surveys	Numbers of taxa			MCI values			SQMCI _s values			
		Range	Median	Current	Range	Median	Current	No.	Range	Median	Current
3	55	6-26	17	17	52-94	77	82	30	1.7-4.8	4.2	4.5
4	46	6-27	19	19	70-90	78	81	30	1.5-4.9	4.2	4.4

Table 3 Macroinvertebrate fauna of a tributary of Mangaone Stream in relation to MASL sampled on 16 October 2014

Taxa List	Site Number	MCI score	3	4
	Site Code		MGO000031	MGO000033
	Sample Number		FWB14304	FWB14305
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	-
ANNELIDA (WORMS)	<i>Oligochaeta</i>	1	C	R
	Lumbricidae	5	-	R
MOLLUSCA	<i>Physa</i>	3	-	R
	<i>Potamopyrgus</i>	4	XA	XA
CRUSTACEA	Ostracoda	1	R	-
	Isopoda	5	-	C
	<i>Paracalliope</i>	5	A	XA
	Paraleptamphopidae	5	XA	VA
	Talitridae	5	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Zephlebia group</i>	7	C	-
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	-	R
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	-	VA
COLEOPTERA (BEETLES)	Dytiscidae	5	-	R
	Hydrophilidae	5	-	R
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>	4	R	-
	<i>Polypsectopus</i>	6	C	C
	<i>Triplectides</i>	5	C	R
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	R	-
	<i>Zelandotipula</i>	6	R	-
	Orthoclaadiinae	2	C	C
	<i>Polypedilum</i>	3	C	A
	Tanypodinae	5	R	-
	<i>Paradixa</i>	4	R	-
	Empididae	3	-	R
	<i>Austrosimulium</i>	3	A	R
ACARINA (MITES)	Acarina	5	-	C
No of taxa			17	19
MCI			82	81
SQMCI _s			4.5	4.4
EPT (taxa)			4	2
%EPT (taxa)			24	11
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

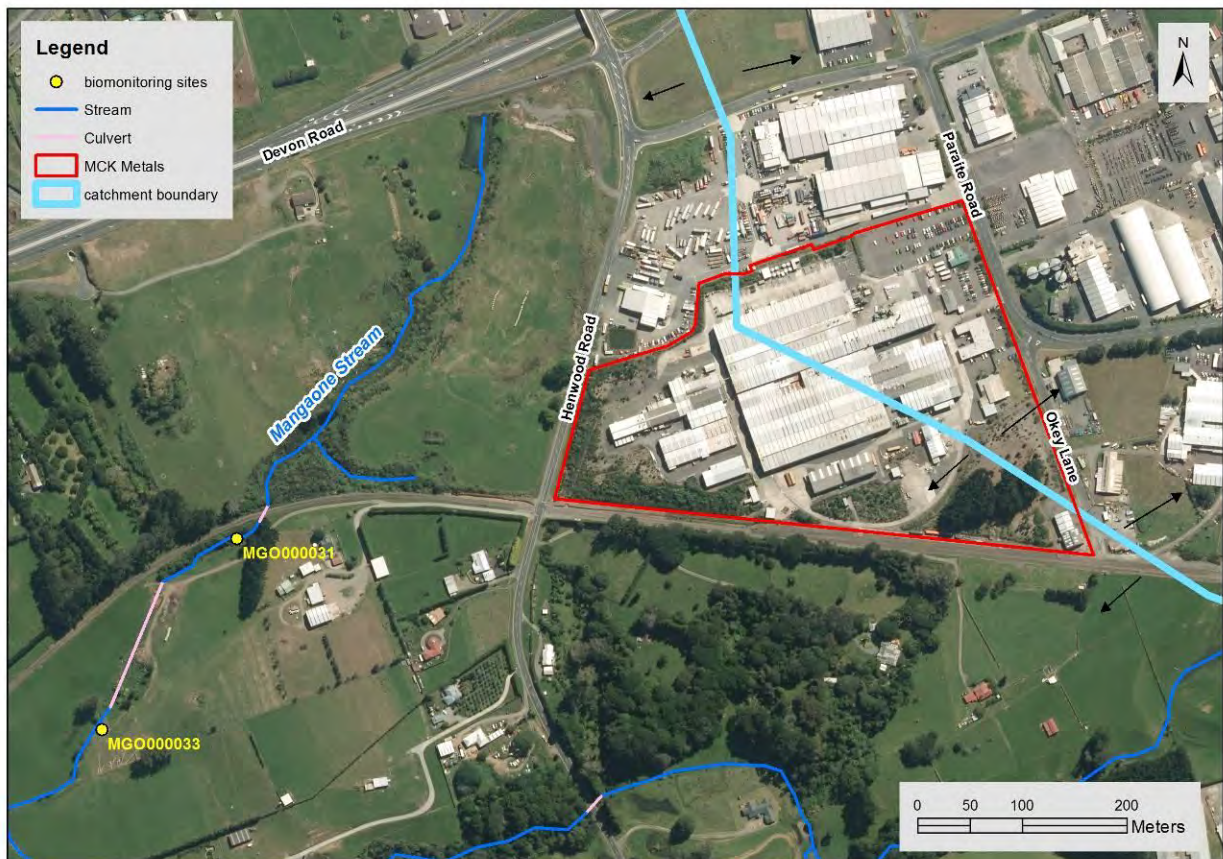


Figure 1 Biomonitoring sites in a tributary of the Manganone Stream related to the stormwater discharge from MASL

Site 3 (MGO000031)

A moderate richness of 17 taxa was found at site 3, equal to the median richness found by previous surveys (Table 2). The community was dominated by a typical weedbed fauna including two ‘moderately sensitive’ taxa (amphipods (abundant *Paracalliope* and very abundant *Paraleptamphipods*)); and two ‘tolerant’ taxa (extremely abundant snail (*Potamopyrgus*), and abundant sandfly larvae (*Austrosimulium*)) (Table 3).

The moderate proportion of ‘tolerant’ taxa in the community (53% of richness) was reflected in the MCI score of 82 units which was five units higher than the median of previously recorded scores, a statistically insignificant difference (Table 2 and Figure 2), and a score typical of weedy habitats that are in good condition. MCI scores have consistently been near to or above the median since 2000, and the current result follows this pattern, although a seasonal pattern appears to be emerging also. It appears that higher MCI scores are being recorded in spring, with lower scores recorded in summer (Figure 2). The current scores indicates improvement from the previous summer survey, although the SQMCI_s score of 4.5 was equal to that recorded in the previous survey, and was also typical of weedy habitats, and slightly higher than the long term median for this site due principally to the numerical dominance of two ‘moderately sensitive’ amphipod taxa.

The change in MCI score is likely related to improved flow and habitat conditions, as summer flow conditions are generally less favourable to ‘sensitive’ taxa, due to warmer waters and lower dissolved oxygen concentrations, especially in weedy streams. Overall, this indicates that the community was in average condition, and there is no indication that the stormwater discharge from the MASL site had had any impact on this community.

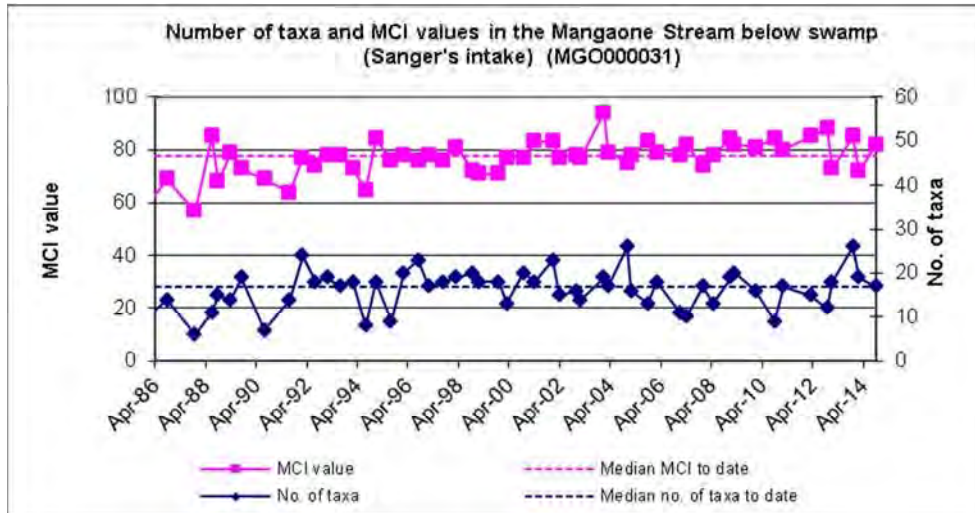


Figure 2 Taxa numbers and MCI scores recorded to date at site 3

Site 4 (MGO000033)

Community richness at site 4 (19 taxa) was equal to the median richness found by all previous surveys (Table 2, Figure 3), and slightly more than that recorded upstream in the current survey.

The absence of impacts from the MASL stormwater discharge was also recorded at site 4, with the MCI score (81) being three units higher than the median, and only one unit less than that recorded at site 3, reflecting the similar proportion of ‘tolerant’ taxa present (47% of richness) in the community. The variability in numbers of taxa recorded at sites 3 and 4 in the Mangaone tributary to date is illustrated in Figure 4.

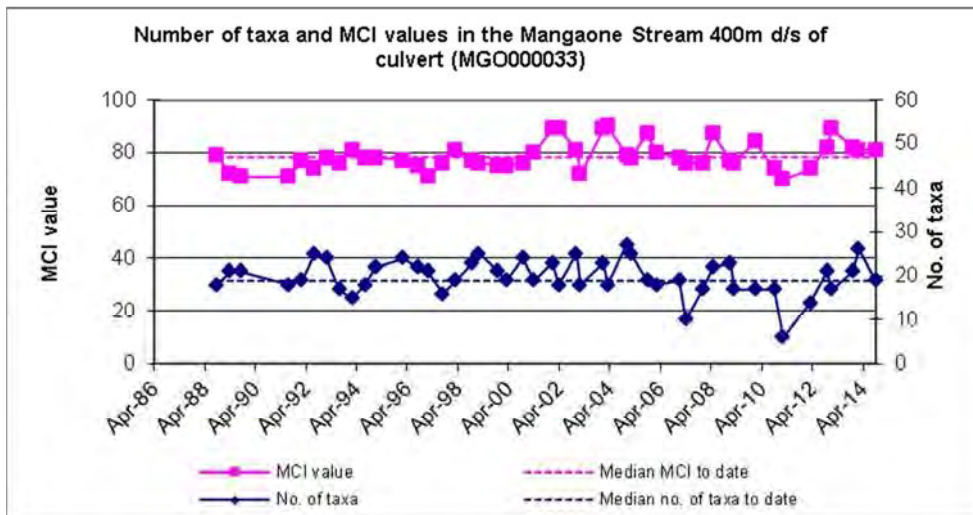


Figure 3 Taxa numbers and MCI scores recorded to date at site 4

Macroinvertebrate communities at site 3 (closer to the swampy headwaters and MASL stormwater discharge) have generally contained lower numbers of taxa than the communities at site 4 (see medians and ranges in Table 2), and this result was repeated in the current survey. The lower numbers of taxa at site 3 may be explained by the close proximity of this site to the upstream swamp. The swampy habitat may not be a significant source of colonisation of stream invertebrates by means of downstream drift. In the current survey, community richness at both sites 3 and 4 were equal to their respective historical median values.

The site 4 community was dominated by the same taxa as those recorded upstream (Table 3), with the exception of *Austrosimulium* sandfly, and the addition of 'tolerant' water striders (*Microvelia*) and *Polypedilum* midge larvae. There were six significant differences in individual taxon abundances between sites, reflecting the subtle differences in habitat between the sites. These changes had little effect on the SQMCI_s scores, which differed by only 0.1 unit between sites.

SQMCI_s values from both sites have generally varied between 4 and 5 units (particularly at site 4) in more recent surveys and this trend has continued in this survey. Slow-flowing, muddy-bedded and weedy stream macroinvertebrate communities most commonly produce SQMCI_s values in the range of 2 to 4 units. The abundances of 'moderately sensitive' taxa (e.g. amphipods) in this weedy stream increased these values toward the upper range found in most streams of this type. The recent increased abundances of such 'moderately sensitive' taxa suggest that water quality or habitat quality may have improved slightly during the past eight years (Figure 5), particularly at site 3.

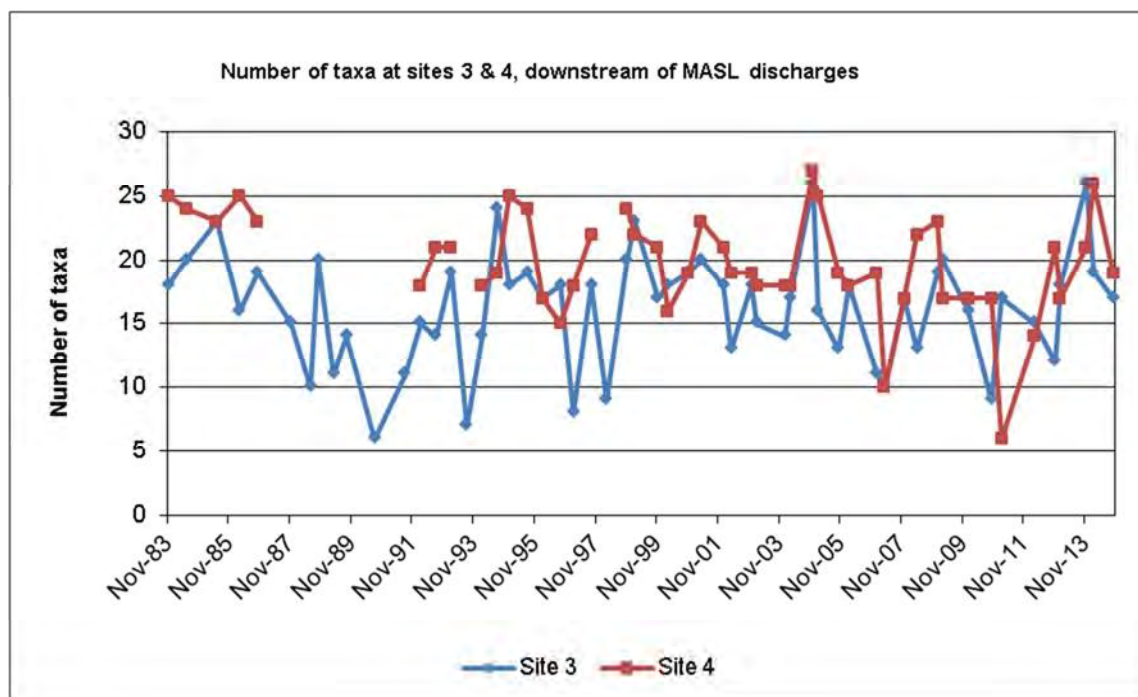


Figure 4 Number of taxa at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

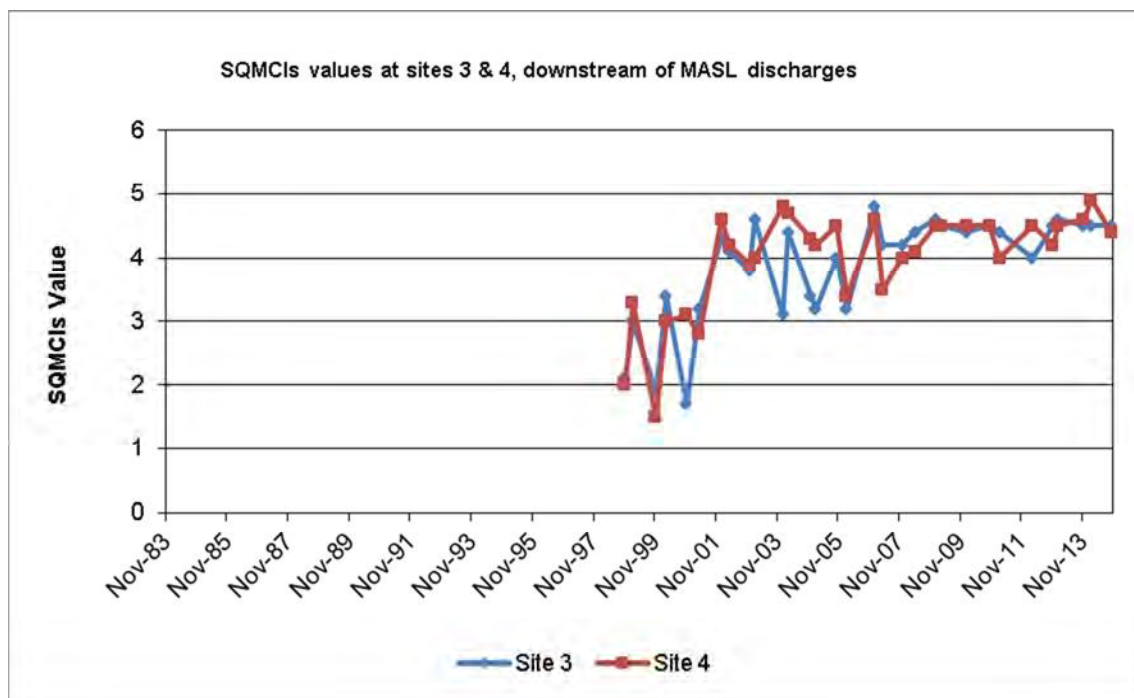


Figure 5 SQMCI₅ values at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Summary and Conclusions

The Council's standard 'sweep sampling' technique was used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 16 October 2014. Samples were sorted and identified to provide number of taxa (richness) and MCI and SQMCI₅ scores.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI₅ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring, and may be more useful in soft-bottomed streams. Significant differences in either the MCI or the SQMCI₅ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was moderate, equal to the historical median for this site. The community 400 metres further downstream was also in average condition, also having a macroinvertebrate richness equal to the historical median. The upstream richness does not indicate an impact from the MASL discharge, but reflected the limited potential for recruitment from upstream, which has poor invertebrate habitat. The MCI value at site 3 was five units higher than the median for this site, but well within the scores previously recorded. This result is similar to most recent scores, including that recorded in the previous summer survey. However, it appears that there may be a seasonal pattern emerging, with higher MCI scores recorded in spring, and lower MCI scores recorded in summer. The MCI score at site 4 was insignificantly higher than the median, and only one unit less than that recorded at site 3.

It is considered that the macroinvertebrate communities at sites 3 and 4 did not indicate any impacts from the stormwater discharge, as an above average MCI score was recorded at both sites. This conclusion is also supported by a comparison with historical survey results,

and overall, the current survey results were indicative of no recent impacts of discharges on the macroinvertebrate communities of either site.

With the exception of the February 2006 and April 2007 surveys, the SQMCI_s values have been relatively high in the last 25 surveys. This was due mainly to the high abundances of medium-scoring taxa, particularly 'sensitive' amphipods. This trend was continued in the present survey at both sites, with both scores recording above average scores. The generally higher SQMCI_s values in recent surveys may have indicated subtle improvements in the community from that recorded in the late 1990's. Although it is unlikely to be a significant change, it correlates with the improvement shown in the physicochemical water quality monitoring data over this time.

This macroinvertebrate survey indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate community of this unnamed tributary.

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To Job Manager, C MacKenzie
From Scientific Officer, B Jansma
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Biomonitoring of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd plant, February 2015.

Introduction

The macroinvertebrate communities of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd [MASL] plant have been monitored annually or biannually since November 1983. This biological survey was the second of two surveys scheduled in the 2014-2015 monitoring year. The results of surveys performed since the 1998-99 monitoring year are discussed in various Taranaki Regional Council reports (refer to the references).

Methods

The standard '400 ml sweep-net-sampling' technique was used to collect streambed macroinvertebrates from two established sites in the Mangaone Stream (Table 1, Figure 1) on 12 February 2015. The 'sweep-net sampling' technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 Biomonitoring sites in the tributary of the Mangaone Stream that receives stormwater discharges from MASL

Site No.	Site code	Map reference	Location
3	MGO 000031	P19: 086397	Below swamp (Sanger's intake)
4	MGO 000033	P19: 086395	400 metres downstream of site 3

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores assigned to the taxa found at a site, and multiplying the average by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways. The use of this index in non-stony streams is possible if results are related to physical habitat (muddy or weedy streams tend to produce lower MCI values than stony streams).

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Results and discussion

The stormwater discharge from the MASL plant flows into a small drain which itself flows into the eastern arm of a swampy area. The swamp forms the headwater of a small stream in which sites 3 and 4 are located. A long culvert was laid in the stream between sites 3 and 4 prior to the November 2000 survey (Figure 1). The culvert begins a few metres downstream of site 3 and ends at the point where site 4 was previously located. Site 4 was subsequently moved several metres downstream. The habitat at this location was similar to the habitat at the original site. There have also been changes in the headwaters of this unnamed tributary in relation to the construction of the bell block bypass.

It should be noted that the stream was culverted between sites 3 and 4 to allow the landowner to discharge cleanfill, in doing so, slowly filling in the gully. This site holds a consent to discharge this cleanfill, and is monitored under a separate monitoring programme. However, activities at this cleanfill site have the potential to impact on the communities of this stream.

During the current survey, flows were low with both sites having a clear, uncoloured and slow flow. The survey was performed in the late morning, and the water temperature had a narrow range (16.5°C at both sites). Substrate comprised predominantly silt at both sites.

Both sampling sites supported aquatic macrophytes, as is often typical of softer-bedded, slower-flowing habitats, although they were only present on the edges at site 4. Both sites were unshaded and no obvious algal growth was noted at either site during this survey. However, it was noted that site 4 was severely impacted by iron oxide sedimentation, most likely due to the upstream piping activities.

Macroinvertebrate communities

The results of the previous macroinvertebrate surveys performed at sites 3 and 4 in the Mangaone tributary that receives stormwater discharges from MASL are summarised in Table 2, together with the results of the current survey.

Table 2 Numbers of taxa and MCI values recorded in the unnamed tributary of the Mangaone Stream downstream of MASL, from November 1983 to the current survey

Site	Number of previous surveys	Numbers of taxa			MCI values			SQMCI _s values			
		Range	Median	Current	Range	Median	Current	No.	Range	Median	Current
3	56	6-26	17	14	52-94	78	83	31	1.7-4.8	4.2	4.5
4	47	6-27	19	19	70-90	78	85	31	1.5-4.9	4.2	4.8

Table 3 Macroinvertebrate fauna of a tributary of Mangaone Stream in relation to MASL sampled on 12 February 2015

Taxa List	Site Number	MCI score	3	4
	Site Code		MGO000031	MGO000033
	Sample Number		FWB15103	FWB15104
NEMERTEA	Nemertea	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	C	-
MOLLUSCA	Lymnaeidae	3	-	R
	<i>Physa</i>	3	-	R
	<i>Polamopyrgus</i>	4	XA	VA
CRUSTACEA	Ostracoda	1	R	-
	<i>Paracalliope</i>	5	VA	XA
	Paraleptamphopidae	5	XA	VA
EPHEMEROPTERA (MAYFLIES)	<i>Zephlebia group</i>	7	R	-
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	-	R
COLEOPTERA (BEETLES)	Dytiscidae	5	-	R
	Hydrophilidae	5	-	R
TRICHOPTERA (CADDISFLIES)	<i>Polypsectropus</i>	6	A	A
	<i>Psilochorema</i>	6	-	R
	Oeconesidae	5	R	-
	<i>Triplectides</i>	5	R	C
DIPTERA (TRUE FLIES)	Hexatomini	5	-	R
	<i>Corynoneura</i>	3	-	R
	<i>Polypedilum</i>	3	C	A
	Tanypodinae	5	C	C
	Culicidae	3	-	R
	<i>Paradixa</i>	4	R	R
	Ephydriidae	4	R	-
<i>Austrosimulium</i>	3	C	-	
ACARINA (MITES)	Acarina	5	-	R
		No of taxa	14	19
		MCI	83	85
		SQMCI _s	4.5	4.8
		EPT (taxa)	4	3
		%EPT (taxa)	29	16
		'Tolerant' taxa	'Highly sensitive' taxa	

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

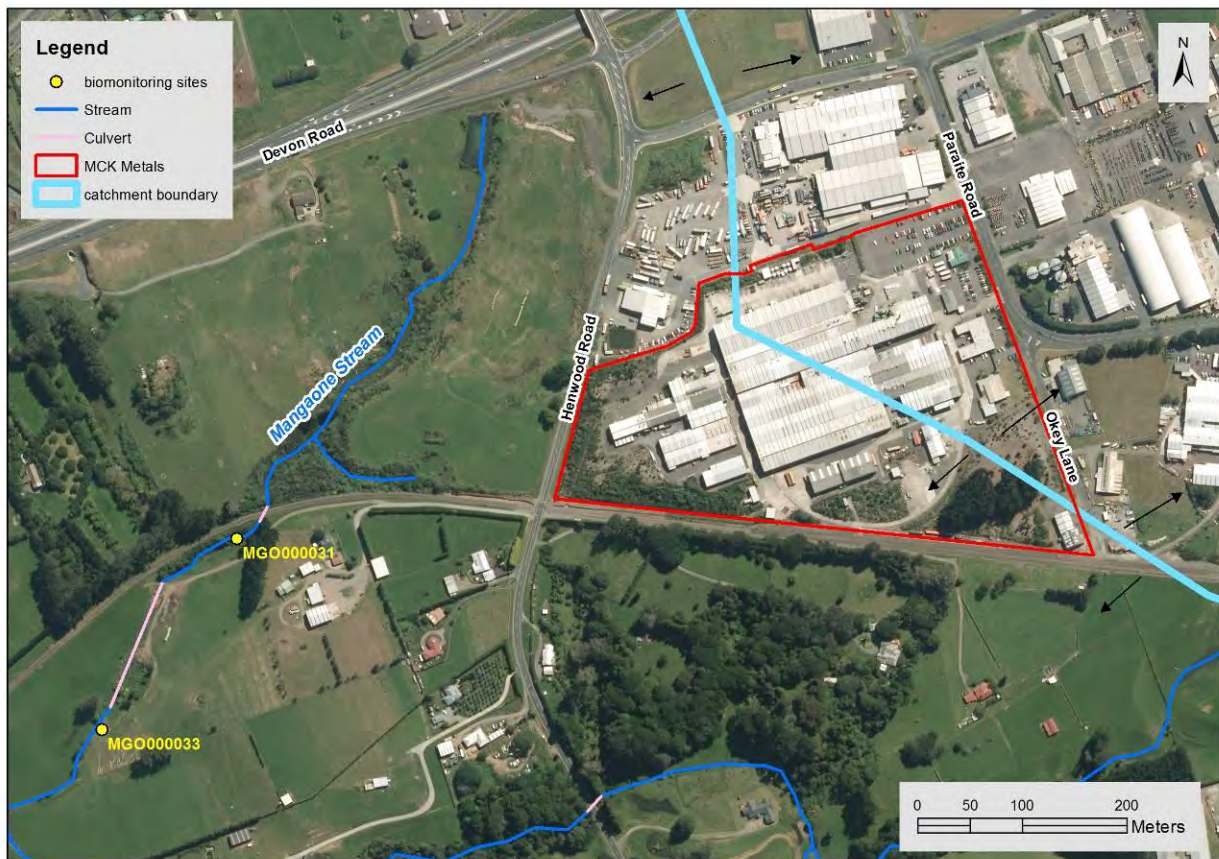


Figure 1 Biomonitors sites in a tributary of the Mangaone Stream related to the stormwater discharge from MASL

Site 3 (MGO000031)

A moderately low richness of 14 taxa was found at site 3, three taxa less than the median richness found by previous surveys (Table 2). The community was dominated by a typical weedbed fauna including three ‘moderately sensitive’ taxa (amphipods (abundant *Paracalliope* and extremely abundant paleoptamphipods) and free-living caddisfly (*Polypsectropus*)); and one ‘tolerant’ taxon (extremely abundant snail (*Potamopyrgus*)) (Table 3).

The moderate proportion of ‘tolerant’ taxa in the community (50% of richness) was reflected in the MCI score of 83 units which was five units higher than the median of previously recorded scores, a statistically insignificant difference (Table 2 and Figure 2), and a score typical of weedy habitats that are in good condition. MCI scores have consistently been near to or above the median since 2000, and the current result follows this pattern. The current summer score does not reflect the seasonal pattern that appeared to be emerging over the last five surveys, being slightly higher than that recorded in the previous spring survey (Figure 2). The current MCI score indicates improvement from the previous summer survey, although the SQMCI_s score of 4.5 was equal to that recorded in the last three surveys, and was also typical of weedy habitats, and slightly higher than the long term median for this site due principally to the numerical dominance of two ‘moderately sensitive’ amphipod taxa.

The lack of change in MCI score does not reflect the reduced flow and poorer habitat conditions typical of a summer survey, as such summer flow conditions are generally less favourable to ‘sensitive’ taxa, due to warmer waters and lower dissolved oxygen concentrations, especially in weedy streams. Overall, this indicates that the community was in

relatively good condition, and there is no indication that the stormwater discharge from the MASL site had had any impact on this community.

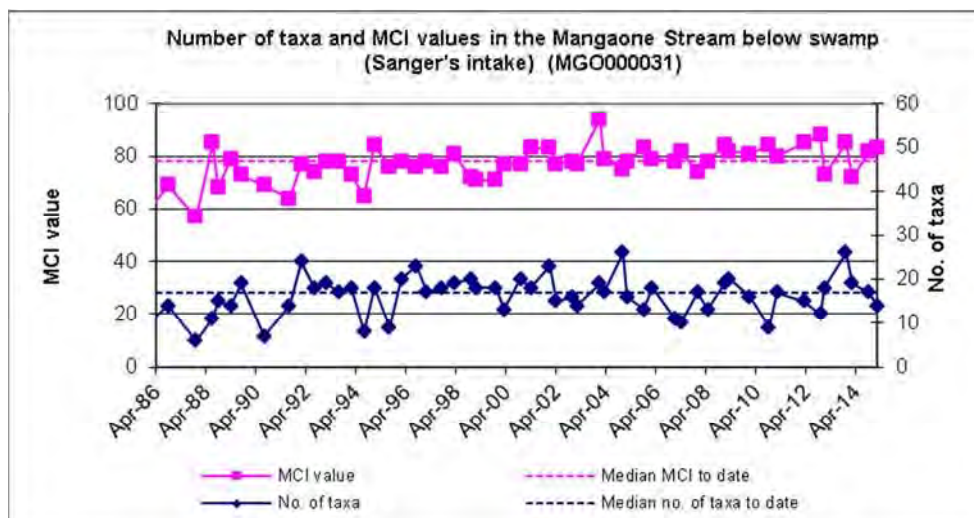


Figure 2 Taxa numbers and MCI scores recorded to date at site 3

Site 4 (MGO000033)

Community richness at site 4 (19 taxa) was equal to the median richness found by all previous surveys (Table 2, Figure 3), and five taxa more than that recorded upstream in the current survey.

The absence of impacts from the MASL stormwater discharge was also recorded at site 4, with the MCI score (85) being seven units higher than the median, and only two units higher than that recorded at site 3 reflecting the similar proportion of 'tolerant' taxa present (47% of richness) in the community. The variability in numbers of taxa recorded at sites 3 and 4 in the Mangaone tributary to date is illustrated in Figure 4.

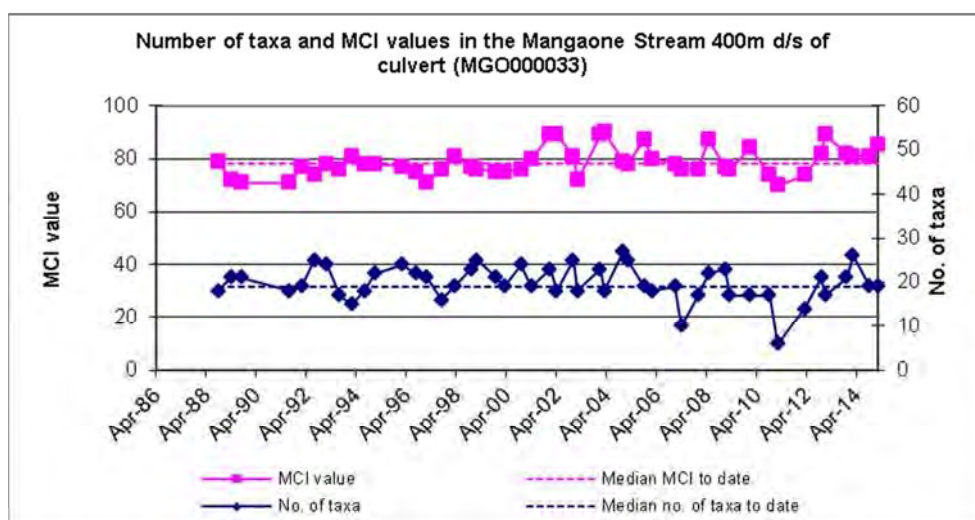


Figure 3 Taxa numbers and MCI scores recorded to date at site 4

Macroinvertebrate communities at site 3 (closer to the swampy headwaters and MASL stormwater discharge) have generally contained lower numbers of taxa than the communities at site 4 (see medians and ranges in Table 2), and this result was repeated in the current survey. The lower numbers of taxa at site 3 may be explained by the close proximity of this site to the upstream swamp. The swampy habitat may not be a significant source of

colonisation of stream invertebrates by means of downstream drift. In the current survey, community richness at site 3 was three taxa less than, but at site 4 equal to, their respective historical median values.

The site 4 community was dominated by the same taxa as those recorded upstream (Table 3), with the addition of 'tolerant' *Polypedilum* midge larvae. There were only two significant differences in individual taxon abundances between sites, reflecting the subtle differences in habitat between the sites. These changes had little effect on the SQMCI_s scores, which differed by only 0.3 unit between sites.

SQMCI_s values from both sites have generally varied between 4 and 5 units (particularly at site 4) in more recent surveys and this trend has continued in this survey. Slow-flowing, muddy-bedded and weedy stream macroinvertebrate communities most commonly produce SQMCI_s values in the range of 2 to 4 units. The abundances of 'moderately sensitive' taxa (e.g. amphipods) in this weedy stream increased these values toward the upper range found in most streams of this type. The recent increased abundances of such 'moderately sensitive' taxa suggest that water quality or habitat quality may have improved slightly during the past eight years (Figure 5), particularly at site 3.

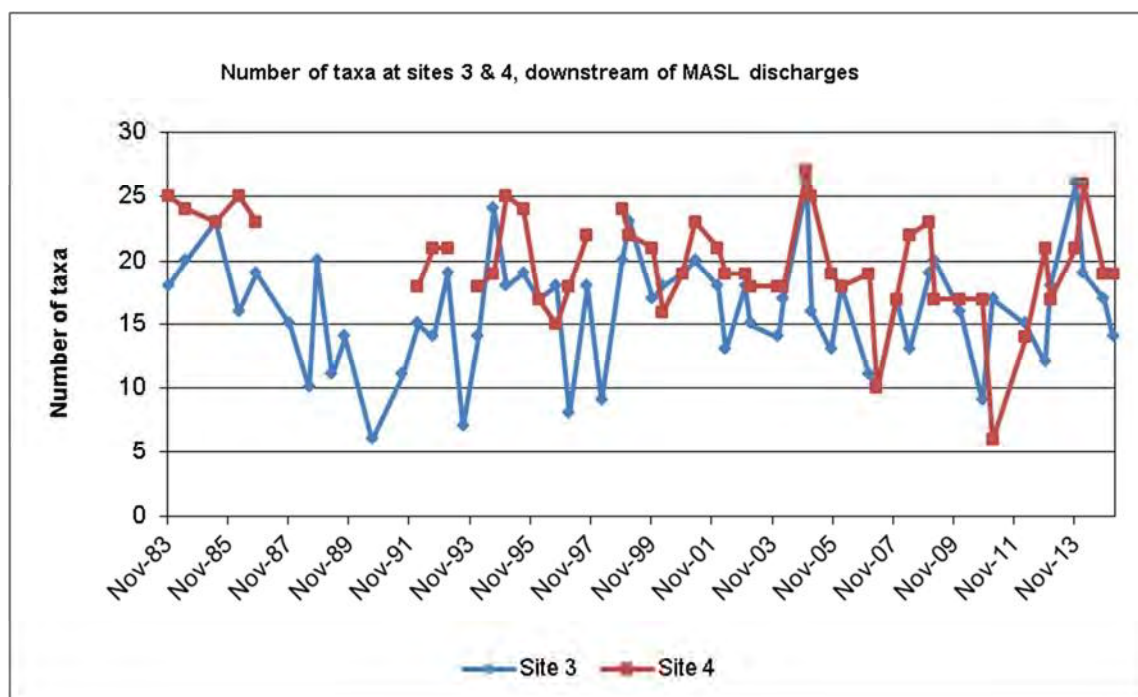


Figure 4 Number of taxa at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

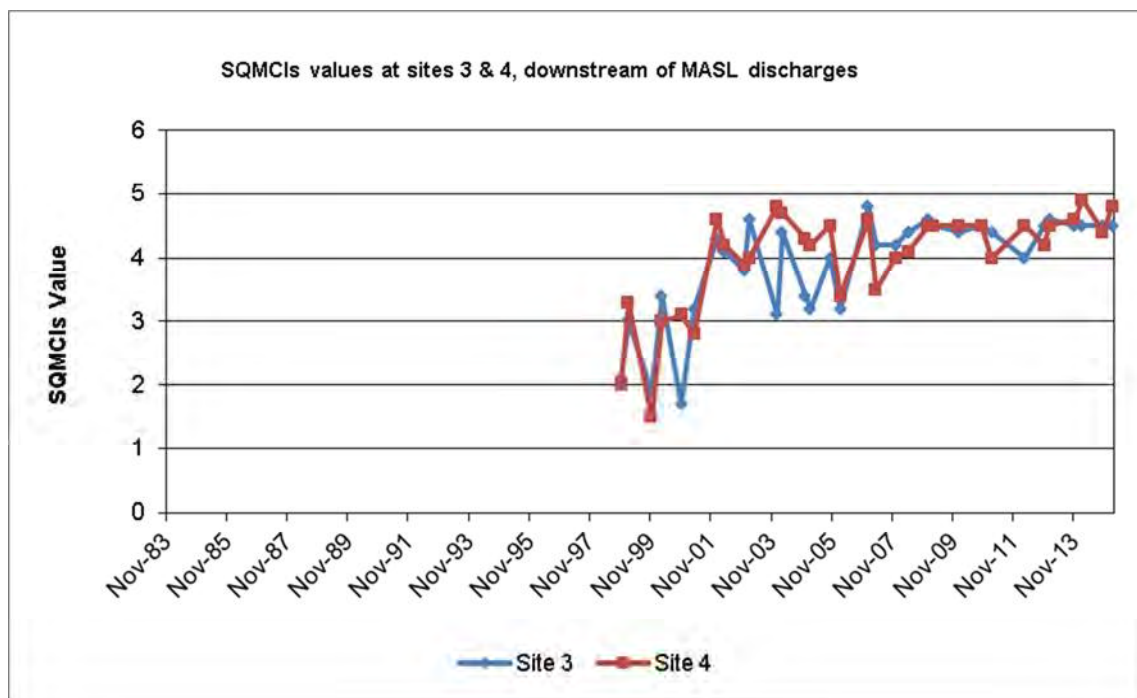


Figure 5 SQMCI₅ values at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Summary and Conclusions

The Council’s standard ‘sweep sampling’ technique was used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 12 February 2015. Samples were sorted and identified to provide number of taxa (richness) and MCI and SQMCI₅ scores.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI₅ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring, and may be more useful in soft-bottomed streams. Significant differences in either the MCI or the SQMCI₅ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was moderately low, three taxa less than the historical median for this site. The community 400 metres further downstream was in average condition, having a macroinvertebrate richness equal to the historical median. The upstream richness does not indicate an impact from the MASL discharge, but reflected the limited potential for recruitment from upstream, which had poor invertebrate habitat. The MCI value at site 3 was five units higher than the median for this site, but well within the scores previously recorded. This result was similar to most recent scores, including that recorded in the previous spring survey. However, it did not follow the seasonal pattern that appeared to be emerging over the last two years, which recorded higher MCI scores recorded in spring, and lower MCI scores recorded in summer. During the current survey, the MCI score was relatively high, being similar to that recorded in the previous spring survey. The MCI score at site 4 was insignificantly higher than the median, and two units higher than that recorded at site 3.

It is considered that the macroinvertebrate communities at sites 3 and 4 did not indicate any impacts from the stormwater discharge, as an above average MCI score was recorded at both sites. This conclusion is also supported by a comparison with historical survey results, and overall, the current survey results were indicative of no recent impacts of discharges on the macroinvertebrate communities of either site.

With the exception of the February 2006 and April 2007 surveys, the SQMCI_s values have been relatively high in the last 25 surveys. This was due mainly to the high abundances of medium-scoring taxa, particularly 'sensitive' amphipods. This trend was continued in the present survey at both sites, with both scores recording above average scores. The generally higher SQMCI_s values in recent surveys may have indicated subtle improvements in the community from that recorded in the late 1990's. Although it is unlikely to be a significant change, it correlates with the improvement shown in the physicochemical water quality monitoring data over this time.

This macroinvertebrate survey indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate community of this unnamed tributary.

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