

Inglewood Metal Limited
Quarry Monitoring Programme
Annual Report
2014-2015

Technical Report 2015-08

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Executive summary

Inglewood Metal Limited (the Company) operates a quarry located at Everett Road in the Kurapete catchment. The Company holds a resource consent to allow it to discharge treated washwater, stormwater and groundwater into an unnamed tributary of the Kurapete Stream. The quarry treats washwater and stormwater/groundwater within a series of retention/settlement ponds within the quarry pit and also at normal ground level, and utilises washwater re-circulation as much as possible. This report for the period July 2014-June 2015 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental performance during the period under review, and the results and effects of the Company's activities.

During the monitoring period, the Company has demonstrated an overall high level of environmental performance.

The Company holds one resource consent, which includes a total of fifteen special conditions setting out the requirements that the Company must satisfy. This renewed consent was granted in May 2004 for a period expiring in June 2015. Application for consent renewal has been received.

The Council's monitoring programme included four scheduled inspections (including on-site liaison with management staff), four discharge and three receiving water physicochemical surveys, and one biological survey of receiving waters.

Over the 2014-2015 year the Company has demonstrated a high level of environmental performance and compliance with its resource consent, continuing the trend of improved performance in recent years. There were no incidents recorded during the monitoring year. Monitoring of the site has shown that, under varying receiving water flow conditions, site activities had only very minor impacts on the appearance of the receiving waters of the Kurapete Stream and on all occasions, was compliant with receiving water consent conditions. Good maintenance of the settlement facilities (including regular de-silting of the ponds) resulted in reduced suspended solids loadings and lessened the turbidity impact on the Kurapete Stream at all times during the monitoring year, with effects on the receiving environment of the Kurapete Stream generally found to be insignificant (with minimal re-suspension of fine sediment in the receiving water tributary). Previous reconfiguration of the combined washwater and quarry pit stormwater/groundwater treatment ponds system resulted in compliance with wastewater discharge conditions on all occasions. Minimal impacts on the biological community of the stream were found during a very low flow, mid to late summer period, coincident with minor silt deposition on the streambed and no visual impacts on water quality a short distance downstream of the consented mixing zone.

The construction of larger silt ponds on the quarry lower floor area and better use of their retention capabilities has helped to improve containment of quarry silts, thereby reducing the turbidity effects in the receiving waters, particularly as the active quarry stormwater catchment has increased in area and iron-laden groundwater compounds potential turbidity issues. The containment of the washwater recirculation system has been essential to avoid overloading of the fine silt content of the final wastewater pond discharge. These matters were discussed with the quarry manager at the time of appropriate inspection visits during the period under review. Although some expansion of the active quarry continued during the period, reinstatement of some areas of the quarry pit also commenced.

Fencing and planting of the Department of Conservation reserve on both banks of the Kurapete Stream from downstream of the unnamed tributary to the Everett Road bridge, which was completed in the 2003-2004 year, together with more recent riparian fencing and planting along the remaining bank of the tributary stream, have also mitigated the potential for adverse effects on the Kurapete Stream, and significantly added to the aesthetic value of the lower stream reach. These factors, together with the upstream diversion of the Inglewood municipal wastewater out of the catchment, have contributed to improved biological health in this lower reach of the stream.

This report includes recommendations for the 2015-2016 monitoring year which include the continuation of the modified monitoring programme of the 2014-2015 period (i.e. reduction in the frequency of monitoring inspections) in recognition of the marked improvement in management of the quarry and performance in terms of consent compliance over recent years.

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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 the annual report for the period July 2014-June 2015 by the Taranaki Regional Council (the Council) on the monitoring programme associated with a resource consent held by Inglewood Metal Ltd (the Company). The Company operates a quarry situated at Everett Road, Inglewood.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company that relate to discharges of treated wastes (consent number 1113) within the Kurapete catchment. This is the twentieth annual report to be prepared by the Council to cover the Company's stormwater and washwater discharges and their effects.

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 *Resource Management Act (1991)* (RMA) and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by the Company in the Kurapete catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the lower Kurapete Stream catchment.

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

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

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 socio-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 (e.g. 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

The Company's quarrying operation is located adjacent to the true right of the Kurapete Stream at Everett Road, near Inglewood. Some washing is performed at the site and the machinery includes a dry crusher and a washing and screening plant.

Waste washwater is directed through a series of settling ponds before being either recirculated for use in washing or discharged via a further series of ponds to the head of the unnamed tributary. The quarrying area is contoured and bunded so that groundwater and stormwater are directed back to the settling ponds in the base of the quarry floor (Figure 1) before being pumped to the pond system for washing, or discharging through to the final pond and then to an unnamed tributary of the Kurapete Stream. Over recent years there has been some variability in the configuration of the upper settlement ponds system receiving the quarry floor wastewater prior to discharge to the stream.

Discharge from the final treatment pond is via a steel pipe access culvert to the unnamed tributary of the Kurapete Stream which flows approximately 600 m before joining the Kurapete Stream upstream of the Everett Road Bridge.

Gravel filtered surface runoff from the entrance to the quarry, off Everett Road, and the upstream farm drainage enter the northern boundary drain which discharges into the unnamed tributary (Figure 1).

Quarry management had advised that the quarry face would continue to be excavated and in recent years larger ponds have been constructed on the quarry floor for improved retention and settlement of turbid groundwater and stormwater prior to pumping to the upper ponds' treatment system. The configuration of the quarry floor pond system has remained essentially the same as that illustrated in Figure 1.

1.3 Resource consents

1.3.1 General

In the past, a large percentage of aggregate production came from river-based sites within Taranaki. The Waiwhakaiho River supplied much of New Plymouth's requirements as far back as the 1950s with the Waitara River, Waiongana River, Kapuni Stream and Waingongoro River also providing a valuable source of aggregate. The aggregate source within these rivers was often over-exploited. The protective armouring of the boulders and gravel was removed in places, exposing the underlying erodible ash beds and creating deep narrow channels, which moved progressively upstream with no noticeable recovery. This brought about the need for the Shingle Extraction Bylaw introduced in 1974. Aggregate extraction from rivers was then controlled through the issue of permits accompanied by a set of conditions,

with the removal of river-based aggregate being restricted to that for river control purposes only.

Historically, land-based sites required steady markets to compete with the easily won river-based extraction operations. However, in the early 1980s, due to the restriction placed on river-based aggregate extraction (and the completion of various major river control programmes and 'Think Big' projects) land-based sites became more widespread (Taranaki Regional Council, 1992).

Twenty-nine operating quarries presently supplying aggregate in Taranaki are monitored for consent compliance. These quarries are generally located in reasonable proximity to urban areas, from which the greatest demand for aggregate stems.

Provision of aggregate to meet longer-term demand will continue to be dominated by several large quarry operations. Extra demand on alluvial terraces and laharic deposits has occurred due to the controlled river bed extraction. These resources are of good quality and are relatively plentiful, although Taranaki aggregates are known to have a lower crushing strength [85 kN] than aggregates from most other parts of New Zealand. Importation of various aggregates may need to continue to meet the requirement for aggregate types not available in Taranaki.

Quarrying and shingle extraction in Taranaki is covered by the RMA and, if the minerals in question are Crown owned, by the Crown Minerals Act 1991.

Regional councils have no control over the provision of exclusive rights to minerals. However, they do have control over the environmental effects of aggregate extraction from river and lake beds, and land in certain circumstances, and these controls may act as a constraint or limitation on allocation decisions.

Sections 15 and 30 of the RMA give regional councils responsibility for the discharge of contaminants into the environment. Discharges of water into water, contaminants onto or into land that may result in water contamination, and contaminants from industrial premises into air or onto/into land, may not take place unless expressly allowed by a rule in a regional plan, a resource consent, or regulations.

Aggregate extraction usually involves washing aggregates, and therefore requires the discharge of wastes. Other discharges, such as emissions to air from crushing and processing plants, disposal of spoil and solid wastes, and discharges of stormwater are also the responsibility of regional councils.



Figure 1 Quarry operations, wastewater treatment system

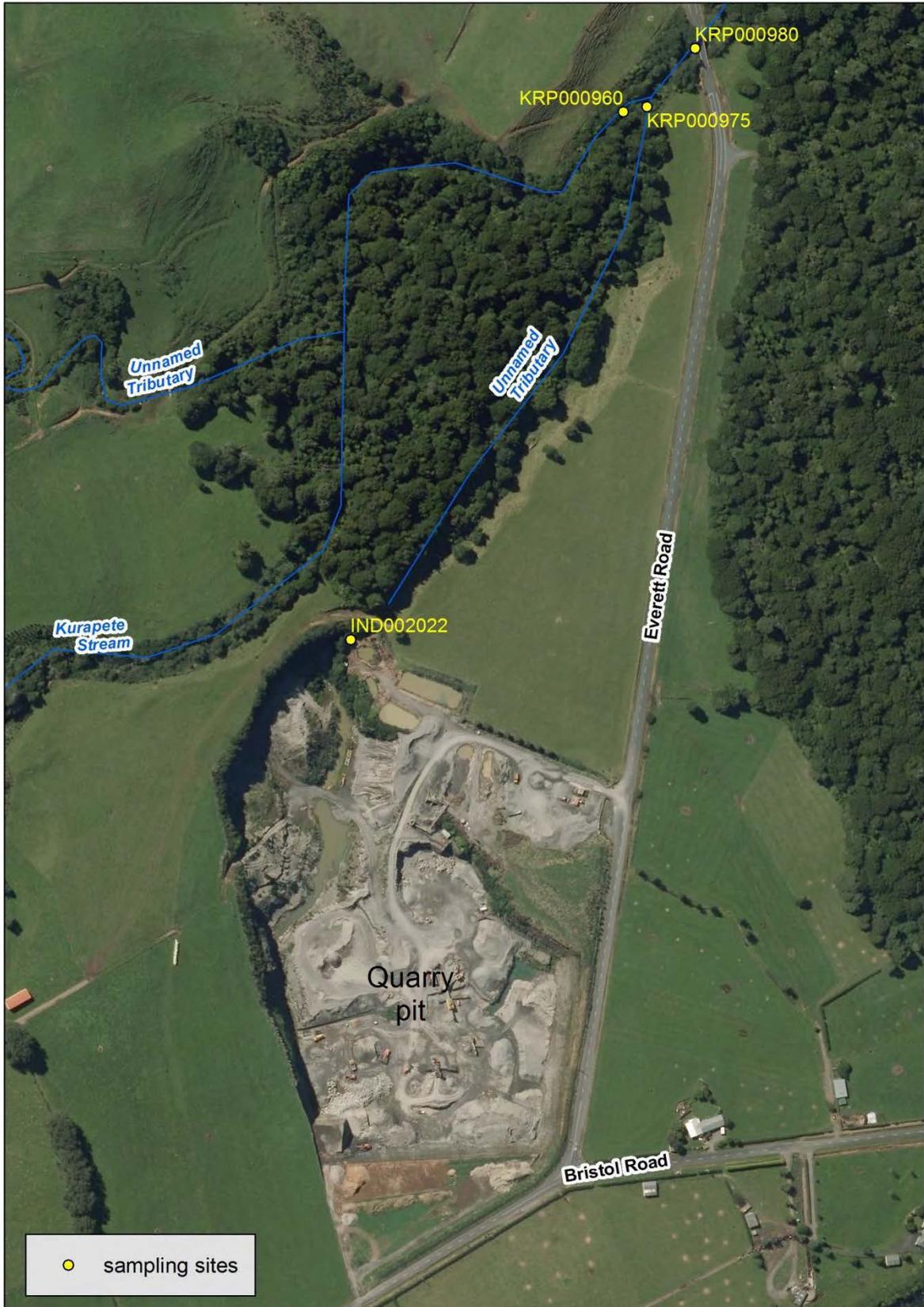


Figure 2 Aerial location map showing sampling sites' locations in relation to the quarry site.

1.3.2 Water abstraction permit

The company previously held a resource consent to abstract surface water for washing metal. Water from the final washwater ponds is now recirculated and used for washing. Therefore a consent was no longer required and the resource consent (1112) was surrendered at the time of its expiry.

1.3.3 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.

Water quality is a primary concern to the Council with regard to aggregate extraction. A quarry can operate as either a 'dry' quarry discharging only stormwater, or a 'washing' quarry, where aggregate washing facilities are in place. Many of the quarries in Taranaki have some form of washing facility and also operate in the vicinity of a water body, or have some form of discharge into a water body.

Waste water from aggregate washing has a high silt concentration. Discharge of this water into a waterbody, particularly to a stream during low flow, can result in smothering of instream life and deterioration in aesthetic conditions and can affect downstream abstractions of water, local fisheries and recreational activity.

Stormwater is generally less contaminated (in terms of silt concentration) and run-off tends to occur when rivers and streams are in higher flow. This means that the effect of silt contamination is reduced due to lower quantities, greater dilution, and increased carrying capacity. The installation of appropriate stormwater diversion structures, together with construction and maintenance of contaminated stormwater and aggregate washing discharge treatment facilities, are most important in maintaining water quality.

The company currently holds discharge consent 1113-4 to cover the discharge of treated stormwater (including groundwater seepage) and treated washwater into an unnamed tributary of the Kurapete Stream. This consent (see Appendix I) was renewed by the Council on 20 May 2004 under Section 87(e) of the RMA. It expires on 1 June 2015 and an application for consent renewal has been received.

There are fifteen special conditions associated with the discharge permit 1113-4. Of these, eight conditions relate to the operation and management of quarrying activities and the treatment system (including recirculation of washwater to minimise this component of the discharge); two conditions are related to reinstatement requirements; one condition requires provision of contingency planning; and three conditions relate to treated wastewater quality and limit effects of the discharge on the receiving water (Kurapete Stream) quality. A further condition provides for review of the consent should this be necessary.

1.4 Monitoring programme: water

1.4.1 Introduction

Section 35 of the RMA sets out an obligation for the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

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 Inglewood Metal Ltd 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, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

The Company's site was visited four times during the monitoring period, a reduction in frequency in 2014-2015 due to marked improvement in compliance over recent years. The main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. The neighbourhood and particularly the receiving waters were surveyed for environmental effects. Changes to the quarry operations contingency plan had included the installation of larger silt traps/settling ponds on the lower quarry floor during the 2006-2007 period.

1.4.4 Physicochemical sampling

The Council undertook sampling of discharges from the site and the water quality upstream and downstream of the discharge point, and the mixing zone in the Kurapete Stream.

The Company's discharge was sampled on four occasions. On three of these occasions samples of the receiving waters were also collected at the end of the unnamed tributary prior to the confluence with the Kurapete Stream, and in the Kurapete Stream upstream of the tributary discharge and downstream beyond the 25 m mixing zone. The samples were analysed for pH, turbidity, conductivity and suspended solids. No discharge was occurring at the time of one inspection occasion and no significant visual impacts were apparent at the time of two other inspections when the stream was in flood and therefore no receiving water surveys were required.

1.4.5 Biological survey

One biological survey of the Kurapete Stream was conducted at two sites, one upstream and one downstream of the confluence with the unnamed tributary. This survey was conducted in January 2015, twenty-two days after the most recent stream fresh and during a mid to late summer very low flow recession period.

2. Results

2.1 Water

2.1.1 Inspections and results of discharge and receiving water monitoring

During the 2014-2015 monitoring period four scheduled inspections of the Company's quarry site were conducted by an officer of the Council. Water samples were collected for physicochemical analysis on four occasions from the discharge and on three of these occasions from the receiving water sites located as shown in Figures 1 and 2 and described in Table 1. There was no noticeable hydrocarbon sheen on the final pond on any inspection occasion and therefore there was no requirement for such analytical measurements for compliance purposes.

Table 1 Location of sampling sites

Site	Location	GPS location	Site code
Kurapete Stream	100 m u/s of Everett Road bridge (upstream of quarry tributary)	1710640E 5668709N	KRP000960
Quarry washwater / stormwater	At discharge outlets (NB sw included after Feb 1998)	1710431E 5668301N	IND002022
Unnamed tributary	5m u/s of the Kurapete Stream confluence (600 m downstream of discharges at quarry)	1710658E 5668713N	KRP000975
Kurapete Stream	At the Everett Road bridge (approximately 100 m d/s of quarry tributary)	1710695E 5668758N	KRP000980

There was a stable period of quarry management continuing after a change in personnel in the 2011-2012 monitoring period (during which there was the appointment of a new manager). Comments associated with the inspections (including meetings with the quarry manager on site) and the results of sampling activities are as follows:

Inspection of 29 August 2014

This inspection was conducted during fine weather conditions and the quarry manager was met on site. No washing was occurring on site but material was being processed in the quarry pit and the site in general was tidy. The initial settlement pond (after the wash area) had been de-sludged recently at the time of the inspection. The property ring drains were clean and sediment free.

Stormwater and groundwater were being pumped from the floor of the quarry to the third pond of the upper ponds settlement system. A high rate of discharge was occurring from the final (sixth) pond to the tributary with no visual oil or grease in the discharge and there were no significant visual impacts of this tributary on the appearance of the Kurapete Stream at the boundary of the mixing zone although stream flow was low and clear upstream. Sampling of the wastewater discharge was performed and sampling of the receiving waters was undertaken. These sampling results are presented in Table 2.

Table 2 Results from Inglewood Metal Ltd quarry monitoring sampled on 29 August 2014

Site location		IND002022 Quarry stormwater	KRP000975 Tributary S downstream	KRP000960 Kurapete S upstream	KRP000980 Kurapete S downstream
Parameter	Unit				
Time	NZST	1110	1125	1130	1120
Suspended Solids	g/m ³	15	16	<2	6
Turbidity	NTU	14	14	1.3	9.9
Conductivity @20°C	mS/m	27.6	26.3	11.1	16.7
pH		7.7	7.6	7.6	7.6
Appearance		slightly turbid, strong flow	turbid, high flow	clear, low flow	v. slightly turbid, low flow

These results indicated that the treated wastewater discharge was in compliance with special condition 10 of the consent. There was minimal visual impact beyond the mixing zone in the receiving waters of the Kurapete Stream (where dilution of the tributary was approximately 2:1). The moderate increase in suspended solids concentration between the upstream and downstream sites in this stream was in compliance with the relevant special conditions 12 (a) despite some increase in turbidity caused by the fine, colloidal particles suspended in the water column.

Inspection of 26 November 2014

The next routine inspection was conducted with the quarry manager during showery, wet weather. The quarry was operating and processing on all plants although there was no pumping of stormwater from the quarry floor occurring. It was noted that washing was occurring at the time. The extraction area was tidy and reinstatement work had begun behind the quarry pit stormwater ponds while the extraction area had been extended back towards Bristol Road. The ring drains were visually clear of contaminants.

The final pond in the system was discharging to the unnamed tributary which was slightly discoloured at the confluence with the Kurapete Stream. However, although the receiving waters of the Kurapete Stream were in flood and turbid in appearance, wastewater and receiving water sampling was undertaken with these results presented in Table 3.

Table 3 Results from Inglewood Metal Ltd quarry monitoring sampled on 26 November 2014

Site location		IND002022 Quarry stormwater	KRP000975 Tributary S downstream	KRP000960 Kurapete S upstream	KRP000980 Kurapete S downstream
Parameter	Unit				
Time	NZST	0750	0805	0810	0800
Suspended Solids	g/m ³	22	15	11	12
Turbidity	NTU	27	18	8.6	8.8
Conductivity @20°C	mS/m	26.6	25.1	11.2	12.8
pH		7.5	7.5	7.5	7.5
Appearance		slightly turbid	slightly turbid	turbid, high flow	turbid, high flow

These results indicated that the treated wastewater discharge was in compliance with special condition 10 of the consent. There was a no visual impact beyond the mixing

zone in the receiving waters of the Kurapete Stream (where dilution of the tributary was approximately 7:1) in compliance with Special Conditions 11(a and b) of the consent. The minor increase in turbidity (2%) between the upstream and downstream sites in this stream was in compliance with the relevant special condition 12 (b) with minimal increase in suspended solids concentrations caused by the fine, colloidal particles suspended in the water column.

Inspection of 10 February 2015



Photos 1 & 2 Recent progress with re-
instatement, February, 2015

This inspection was performed during and following very dry weather conditions. The site was operative at the time of the inspection with processing of product in the quarry pit. The quarry pit area was tidy and no washing was taking place. The washing pond had recently been cleaned out and the second pond was due for de-silting. Re-instatement had begun in the quarry pit (Photos 1 and 2) and the final extraction area adjacent to Bristol Road had been opened up (see Figure 1). Pumping of stormwater and groundwater from the quarry pit to the third upper pond was occurring with a moderate rate of discharge from the final pond to the unnamed tributary. There was minimal discolouration from the tributary within the mixing zone of the Kurapete Stream which was in very low, clear flow upstream and at the Everett Road bridge. Sampling of wastewater and the receiving waters was performed. The sampling results are presented in Table 4.

Table 4 Results from Inglewood Metal Ltd quarry monitoring sampled on 10 February 2015

Site location		IND002022 Quarry stormwater	KRP000975 Tributary S downstream	KRP000960 Kurapete S upstream	KRP000980 Kurapete S downstream
Parameter	Unit				
Time	NZST	0750	0810	0815	0805
Suspended Solids	g/m ³	16	3	<2	<2
Turbidity	NTU	17	3.6	1.7	1.6
Conductivity @20°C	mS/m	27.7	28.8	13.3	14.1
pH		7.5	7.4	7.6	7.6
Appearance		slightly turbid	clear, very low flow	clear, very low flow	clear, very low flow

These results indicated that the treated wastewater discharge was in compliance with special condition 10 of the consent. There was no visual impact beyond the mixing zone in the clear receiving waters of the Kurapete Stream (where dilution of the tributary was approximately 18:1). The absence of any increase in suspended solids (or turbidity) under these very low flow conditions at the downstream site in this stream was in compliance with the relevant special condition 12 (a) and consistent

with the field observations which assessed compliance with Special Conditions 11(a and b) of the consent.

Inspection of 15 May 2015

The final routine inspection was conducted with the quarry manager during very wet weather conditions. The quarry was operating and one crusher was processing. There was pumping of stormwater from the quarry floor occurring after extensive flooding of the quarry pit. It was noted that washing also was occurring at the time. The extraction area was tidy, the second settlement pond had been de-silted recently, and the banks of the other ponds had been tidied. Increased retention in the third settlement pond had been provided by re-location of the inlet pipe from the quarry pit toward the top end of the pond.

The final pond in the system was discharging at a high rate to the unnamed tributary which was in fresh and discoloured at the confluence with the Kurapete Stream. However, as the receiving waters of the Kurapete Stream were in flood and turbid in appearance, only wastewater sampling was undertaken with these results presented in Table 5.

Table 5 Results from Inglewood Metal Ltd quarry monitoring sampled on 15 May 2015

Site location		IND002022 Quarry stormwater	KRP000975 Tributary S downstream	KRP000960 Kurapete S upstream	KRP000980 Kurapete S downstream
Parameter	Unit				
Time	NZST	0845	N/S	N/S	N/S
Suspended Solids	g/m ³	99			
Turbidity	NTU	84			
Conductivity @20°C	mS/m	20.8			
pH		7.6			
Appearance		slightly turbid	turbid, high flow	turbid, high flow	turbid, high flow

These results indicated that the treated wastewater discharge was in compliance with special condition 10 of the consent (although very close to the suspended solids limit under these very wet weather conditions). There was an inspectorial assessment of compliance with relevant special conditions 11(a) and 11(b) of the consent in relation to aesthetic impacts on the receiving waters of the Kurapete Stream (under flood flow conditions).

2.1.2 Freshwater biological monitoring

2.2.1.1 Introduction

One of a number of recommendations contained in the 1995-1996 Annual Report (TRC 96-15c) stated that the monitoring programme should include a summer biomonitoring survey performed in the lower reaches of the Kurapete Stream. This requirement was made in recognition of the fisheries importance of the lower reaches of this stream, and because the consent compliance record at that time indicated a need for a form of monitoring which provided longer-term evaluation of potential siltation effects on receiving water quality.

Some subsequent biomonitoring surveys (see TRC, 2004 , TRC, 2008, and TRC, 2010) have found evidence of macroinvertebrate faunal community deterioration in the Kurapete Stream, beyond the boundary of the mixing zone, 50 metres downstream of the confluence with the small tributary which drained the quarry area. However, other surveys have found limited, but insignificant, impacts on this reach of the Kurapete Stream. Some of these improvements were coincidental with the upgrade to quarry wastewater treatment systems instigated in the 1998-99 monitoring period and improved maintenance of these systems since this time.

From time-to-time, variability in the impacts on the macroinvertebrate communities of the Kurapete Stream may have been related to confounding issues of upstream water quality improvement subsequent to the diversion of the Inglewood oxidation pond systems wastes out of the catchment. Cattle access and lack of riparian vegetation in the proximity of the downstream site, on some occasions may have accentuated the variability of these impacts. An additional site was included in some recent biomonitoring surveys to assess the extent of such effects (TRC, 2004, TRC, 2005, TRC, 2007, TRC, 2008, TRC, 2009, and TRC, 2010) but it was not required for the current survey because of the relative absence of visual impacts on the receiving waters and limited substrate sedimentation noted at the time of the survey during a period of very low flow conditions in late summer.

2.2.1.2 Survey for the 2014-2015 period

One scheduled freshwater biological survey was performed under very low recession flow conditions during the 2014-2015 monitoring period in late summer (23 January 2015). This survey was performed at the two established sites in the Kurapete Stream, one upstream and the other downstream of the confluence of the tributary with the Kurapete Stream (Table 6 and Figure 2).

Table 6 Biomonitoring sites surveys

Site number	Site code	GPS Map reference	Location
I	KRP000960	1710640E 5668709N	Upstream of quarry tributary stream
J	KRP000980	1710695E 5668758N	Everett Road bridge, d/s of tributary stream

The biomonitoring report, which included details of the location of the sampling sites, is attached as Appendix II to this report. The results from this survey are summarised in Table 7 with the specific quarry monitoring historical data to date.

Table 7 Summary of Inglewood Metal Ltd quarry biomonitoring results for the Kurapete Stream performed from March 1997 to February 2015

Site	Taxa numbers				MCI values		
	1996-2014			2014-15 result	1996-2014		2014-15 result
	No. of surveys	Range	Median	Feb 2014	Range	Median	Feb 2014
I	20	19-32	26	27	80-107	95	99
J	20	18-32	25	26	71-101	87	102
K	8	22-35	29	-	87-103	94	-

These results indicated minimal recent impacts on the faunal community over the short reach of the stream, attributable to variability in habitat (rather than quarry discharge impacts) below the small tributary draining the quarry area, downstream at the site a short distance beyond the boundary of the permitted mixing zone. Some subtle but insignificant differences in faunal communities between these sites were found, coincident with minor sedimentation and increased periphyton (mats) substrate cover in the reach of the lower Kurapete Stream below the quarry tributary inflow and no increase in visual turbidity of the main stream, as aesthetic conditions in the stream below the quarry tributary were markedly better than often previously recorded, at the time of the current survey. There was an atypical, but insignificant downstream increase in MCI score (reflective of subtle changes in community structure) under a period of very low flow conditions preceding the survey, coincident with the physical habitat variability noted at this more open site. In general, these results reflected the trend of stream biota improvement recorded over most previous summers coincident with improved management and upgrades to the quarry wastewater treatment system and following upstream water quality improvement subsequent to the diversion of the Inglewood oxidation ponds system wastes out of the stream in mid-catchment. Improvements in the configuration and operation of the quarry wastewater/stormwater settlement ponding system must be maintained in order to reduce the visual, aesthetic impacts of the often turbid quarry tributary on the main Kurapete Stream in the immediate vicinity of Everett Road. More recent riparian vegetation planting in the proximity of the Everett Road site and fencing of the stream and tributary margins preventing stock access has enhanced the stream habitat in this reach, particularly as the plantings have developed. Further catchment riparian initiatives together with re-direction of dairy wastes disposal from surface water onto land could be expected to further enhance stream health in the longer term.

2.2 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 year, there were no incidents recorded by the Council that were associated with the consent holder.

2.3 Contingency plan

An updated contingency plan was received from the consent holder in June 2012 for review by the Council, in compliance with Special Condition 14 of consent 1113. This contingency plan remains operative.

3. Discussion

3.1 Discussion of plant performance

Management of the site during 2014-2015 generally was very good with no complaints received by the Council and no incidents registered in relation to any aspects of the operational performance of the quarry. Additional retention within the quarry floor ponds and operation of a closed washwater re-circulation ponding system, continues to be necessary to provide compliance with treated wastewater standards and minimise impacts upon the receiving waters of the Kurapete Stream. The requirement to maintain a closed washwater re-circulation system (separate from the quarry stormwater) has been re-emphasised with the current management. The provision of additional ponding area within the quarry pit, presence of a silt trap and gravel filter to treat the stormwater from the area near the weighbridge, and frequent de-silting of the treatment ponds, have been effective in achieving compliance with appropriate resource consent conditions over the period under review. Modifications to the treatment ponds may be necessary from time to time (particularly the correct configuration of the upper ponds system) as it has been recognised that greater retention in the groundwater/stormwater treatment pond system has the potential to improve treatment performance, particularly a reduction in the carry through of fine suspended sediment into the Kurapete Stream and re-suspension of fines in the tributary stream. In relation to this, fencing of the tributary stream below the quarry discharge, to prevent stock access to the tributary, had been recently undertaken by Department of Conservation, Taranaki Tree Trust, and Kaimata School. This fencing and planting of the tributary stream has prevented cattle disturbance of the stream bank and bed, allowing riparian benefits to occur and ultimately helping to stabilise and settle fine suspended solids. The performance of the system will continue to be monitored in this respect.

3.2 Environmental effects of exercise of water permit

The main potential environmental effect of quarrying activities on waterways is associated with discharges of washwater and stormwater containing fine silt particles and high suspended solids concentrations. Such discharges may result in discolouration of the receiving waters near the discharge point and smothering of benthic life forms, form a barrier to fish movement, and/or affect fish spawning habitats. This is particularly relevant in the lower reaches of the Kurapete Stream near its confluence with the Manganui River.

The Council monitors for possible effects on stream biota and aesthetic quality by conducting a visual inspection of the stream both up and downstream of the quarry, and measuring physicochemical properties of the wastewater discharge and receiving environment. Biological monitoring surveys have also been undertaken at established sites under low flow conditions to provide longer term assessment of receiving water quality in terms of biological 'health'.

Monitoring of the quarry site during the 2014-2015 year has shown that the Company's site has had minimal impacts on the receiving waters of the Kurapete Stream, limited to occasional small increases in turbidity, particularly under low stream flow conditions. No significant effects on water quality were found by physicochemical monitoring of the receiving waters on three occasions during the period.

In addition, biological monitoring during a very low flow, late summer period found no localised impacts of quarrying activities on the biota of the Kurapete Stream coincidental with no change in visual turbidity in the lower reach of the stream which was in better aesthetic condition than previously recorded.

On occasions in the past, a combination of very fine suspended sediment in the treated wastewater discharged, limited dilution by the receiving waters of the small tributary stream, and possibly some re-suspension of accumulated sediment previously deposited on the tributary stream bed, has contributed to cloudy (turbid) plumes entering the Kurapete Stream. Although increased retention of the wastewater by additional ponding in the quarry pit prior to discharge has been provided, appropriate isolation of the washwater recirculation (from the quarry pit wastewater inflow) must be maintained. Fencing and planting of the tributary's margins have also prevented cattle access which previously caused re-suspension of fine sediment. This may allow aquatic vegetation to establish, providing filtration mechanisms and stabilisation of the silt laden bed, and reduce the effects of fine sediment plumes discharging to the Kurapete Stream.

It has been noted that the quarry stormwater catchment area (as authorised by Special Condition 3 of the consent) has expanded with the potential to overtax the settlement facilities due to increased volumes of stormwater/groundwater generated. Very recent, reinstatement of quarry pit areas to some extent may mitigate these issues. However inflows of iron-laden groundwater seepages onto the quarry floor will continue to add to turbidity issues within the ponding system. This aspect of compliance has been assessed during the 2014-2015 period in conjunction with changes to the management of the settlement ponding facilities both on the floor of the quarry and associated with the washwater recirculation system and will continue to form a component of future monitoring activities.

3.3 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Table 8.

Table 8 Summary of performance for consent 1113-4

Purpose: For discharge of treated quarry groundwater, stormwater and washwater to a tributary of the Kurapete Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Exercise methodology	Inspections of activities and treatment systems	Yes
2. Best practicable options to minimise effects	Liaison and inspections of treatment system and receiving waters	Yes
3. Limit to active quarry site	Inspections	(marginal)
4. No direct discharges	Inspections	Yes
5. Washwater treatment and recirculation requirements	Inspections	Yes
6. Quarry site stormwater treatment provision	Inspections	Yes
7. Minimisation of silt discharged	Inspections and sampling surveys	Yes
8. Minimisation of exposed areas of quarry and reinstatement requirements	Some reinstatement begun (and will continue to be addressed during quarry life)	N/A
9. Silt control operation	Inspections and sampling surveys	Yes
10. Concentration limits on contaminants	Physicochemical sampling	Yes (on all occasions)
11. Limits on effects on receiving waters	Physicochemical and biological sampling	Yes
12. Limits on turbidity effects in receiving waters	Physicochemical sampling	Yes (on all occasions)
13. Reinstatement provision	Scheduled for consideration at end of active quarry life	N/A
14. Maintenance of contingency plan	Liaison with management (plan provided)	Yes
15. Optional review provision re environmental effects	No further reviews ex June 2012	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

During the year, the Company demonstrated a high level of environmental performance and a high level of administrative compliance with the resource consents at its Everett Road quarry site as issues relating to the operation of the wastewater treatment pond system and its configuration were given the necessary close attention coincident with variability in size of the active quarry.

Fencing and planting of the DOC reserve on both banks of the Kurapete Stream downstream of the unnamed tributary and Everett Road (completed eleven years previously), and along the right bank of the tributary stream (completed nine years previously), helped mitigate the effects on the Kurapete Stream and should continue to improve the aesthetic value of this reach of the lower stream.

3.4 Recommendations from the 2013-2014 Annual Report

As a result of the 2013-2014 site specific monitoring programme and in recognition of the compliance performance during the period, the following recommendations were made:

1. THAT monitoring of discharges from Inglewood Metal Ltd, Everett Road quarry in the 2014-2015 year continues at a reduced level of four inspections and wastewater surveys in recognition of the continued improvement in management and resource consent compliance.
2. THAT turbidity and sedimentation effects on receiving waters be minimised by operating and maintaining the sediment pond system in accordance with best quarry management practices.
3. THAT the consent holder and staff of the Council liaise with respect to matters contained in Recommendation 2 (particularly when personnel changes occur amongst these officers).

The first recommendation was implemented and the monitoring programme was performed by the Council. In particular, the issues of turbidity and sedimentation effects on receiving waters had been addressed with management (recommendations 2 and 3) in relation to additional treatment ponds retention capacity and appropriate operation of the system in the 2008-2009 period when a meeting of Council staff and the quarry manager was held to address these and other matters. The improved performance over the 2009-2014 and most recent period have reflected these initiatives. Riparian fencing and planting of the tributary stream, undertaken more recently, have continued to assist with mitigation of these effects.

3.5 Alterations to the monitoring programme for 2015-2016

In designing and implementing the monitoring programmes for 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, the obligations of the Act in terms of monitoring discharges and effects, and subsequently reporting to the regional community, 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 discharging to the environment.

In recognition of the continued good management practices and compliance with resource consent conditions there was a reduction in the site-specific monitoring programme for the 2014-2015 period to four inspections and associated wastewater sampling surveys. As a result of the continuation of a high standard of consent

compliance, this reduced monitoring programme should continue.

A recommendation to this effect is attached to this report.

3.6 Exercise of optional review of consent

Resource Consent 1113 does not provide for any further optional reviews of the consent prior to expiry in June 2015. In June, 2011 it was further noted that, although regular ongoing liaison with quarry management would be necessary to ensure that wastes treatment practices were attuned to the continuing expansion of this active quarry operation, it was not considered necessary to review the consent given that these matters could be considered comprehensively at the time of the expiry date (June, 2015) of the consent.

4. Recommendations

Based on the results of the 2014-2015 site specific monitoring programme and in recognition of the compliance performance during the period, the following recommendations are made:

1. THAT monitoring of discharges from the Company's Everett Road Quarry in the 2015-2016 year continues at the same (reduced) level as in the 2014-2015 period;
2. THAT turbidity and sedimentation effects on receiving waters be minimised by operating and maintaining the settlement ponds system in accordance with best quarry management practices;
3. THAT the consent holder and staff of the Council continue to liaise with respect to matters contained in Recommendation 2 (particularly when personnel changes occur amongst these officers).

5. Acknowledgements

The Job Manager for the programme was Chris Fowles (Scientific Officer) who was the author of this Annual Report and also performed the macroinvertebrate survey. Field inspections and sampling surveys were undertaken by Samantha Bull (Investigating Officer) with physicochemical water and wastewater analyses performed by the Council's ISO-9000 accredited laboratory.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report.

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a structure to contain its contents in the case of leakage.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Fresh g/m ³	Elevated flow in a stream, such as after heavy rainfall. Grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm).
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	Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual.
l/s	Litres per second.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream. It 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.
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).
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Values 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.
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	Resource Management Act 1991 and subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C.
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

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Appendix I

**Resource consent held by
Inglewood Metal Ltd**



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

Name of
Consent Holder: Inglewood Metal Limited
 P O Box 44
 INGLEWOOD

Consent Granted 20 May 2004
Date:

Conditions of Consent

Consent Granted: To discharge treated stormwater, treated groundwater and
 treated shingle washwater from quarry activities into an
 unnamed tributary of the Kurapete Stream a tributary of the
 Manganui River in the Waitara catchment at or about GR:
 Q19:206-299

Expiry Date: 1 June 2015

Review Date(s): June 2009, June 2012

Site Location: Everett Road, Inglewood

Legal Description: Pt Secs 15, 16 & 17 Blk XIII Waitara SD

Catchment: Waitara

Tributary: Manganui
 Kurapete

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

www.trc.govt.nz

Consent 1113-4

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. The exercise of this consent shall be conducted in accordance with the information submitted in support of the application and to ensure that the conditions of this consent are met at all times.
2. At all times the consent holder shall adopt the best practicable option [as defined in Part 2 of the Act] to prevent or minimise any actual or likely adverse effect on the environment associated with the discharges including, but not limited to, the water quality and aquatic habitat of the receiving waters of the Kurapete Stream.
3. The active quarry stormwater catchment shall have a maximum area of no more than 2 hectares.
4. There shall be no direct discharge of untreated stormwater, groundwater or waste washwater from the active quarry site into the unnamed tributary of the Kurapete Stream as a result of the exercise of this consent.
5. The washing and washwater treatment system shall be bunded to prevent the inflow of stormwater and groundwater from other areas of the quarry. In addition the consent holder shall implement appropriate recirculatory systems so as to minimise the volume of washwater required to be discharged.
6. The active quarry site shall be contoured/bunded so that all water generated in this area is directed to silt retention systems for treatment prior to discharge, and to prevent the flow of uncontaminated stormwater into the quarry, as far as is practicable.
7. The consent holder shall undertake measures to minimise the amounts of silt and sediment that could be contained in the discharge licensed by this consent.
8. The consent holder shall operate and progressively reinstate the quarry in a manner that minimises the quarry stormwater catchment area and ensures that the area of exposed unvegetated earth within the quarry stormwater catchment is kept to a minimum at all times.
9. The consent holder shall properly and efficiently maintain and operate the silt control structures in such a manner that any discharge which may occur shall not breach the conditions of this consent. The silt control structures shall be operated, as far as practicable, so as to maximise the treatment of the stormwater and minimise the duration, frequency and rate of the discharge.

Consent 1113-4

10. The following concentrations shall not be exceeded in any discharge:

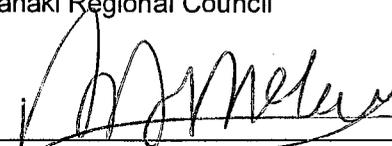
Component	Concentration
pH (range)	6-9
Suspended solids	100gm ⁻³
Total recoverable hydrocarbons	15gm ⁻³

This condition shall apply prior to the entry of any discharge into the receiving waters of the unnamed tributary of the Kurapete Stream, at a designated sampling point approved by the Chief Executive.

11. After allowing for reasonable mixing, within a mixing zone extending 25 metres downstream of the confluence of the unnamed tributary with the Kurapete Stream, the discharge shall not give rise to any of the following effects in the receiving waters of the Kurapete Stream:
- 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.
12. After allowing for reasonable mixing, within a mixing zone extending 25 metres downstream of the confluence of the unnamed tributary with the Kurapete Stream, the discharge shall not give rise to either of the following effects in the receiving waters of the of the Kurapete Stream:
- a) an increase in suspended solids concentration in excess of 10 gm⁻³, when the stream turbidity as measured immediately upstream of the confluence of the unnamed tributary with the Kurapete Stream is equal to or less than 5 NTU [nephelometric turbidity units]; or
 - b) an increase in turbidity of more than 50% when the stream turbidity as measured immediately upstream of the confluence of the unnamed tributary with the Kurapete Stream is greater than 5 NTU [nephelometric turbidity units].
13. On cessation of quarrying operations at the site licensed by this consent, the active quarry area, including the silt control structures, and surrounding areas shall be reinstated satisfactorily, prior to the surrender or lapsing of this consent.
14. The consent holder shall maintain a contingency plan to the satisfaction of the Chief Executive, outlining measures and procedures to be undertaken to prevent the spillage or accidental discharge of contaminants in the stormwater catchment, and measures to avoid, remedy, or mitigate the environmental effects of such a spillage or discharge.
15. 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 2009 and/or June 2012, 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 20 May 2004

For and on behalf of
Taranaki Regional Council



Director Resource Management

Appendix II

Biomonitoring survey of January 2015

To R Phipps, Science Services Manager
From CR Fowles, Scientific Officer
Document 1463203
Report No CF635
Date February 2015

Biomonitoring of the lower reaches of the Kurapete Stream, in relation to Inglewood Metal Ltd Quarry discharges, surveyed in January 2015

General Introduction

A formal consent monitoring programme established for Inglewood Metal Ltd, Everett Road in the lower Kurapete Stream catchment, has been the subject of nineteen TRC Annual Reports to date (e.g. TRC, 2014). Various impacts of the consent holder's quarrying activities have been noted from a programme of regular inspections and physicochemical receiving water sampling. One of the recommendations of these reports required:

"That monitoring be continued with an appropriate programme formulated in accordance with the requirements of existing consents and taking into account matters addressed in these Annual Reports. This programme to include a limited summer biomonitoring survey undertaken at two sites in the lower reach of the Kurapete Stream (upstream and downstream of the confluence of the quarry tributary stream)."

This requirement recognised the biological importance of the lower reaches of the Kurapete Stream and the need for a form of monitoring which provided longer-term indications of receiving water quality.

Therefore, late summer-autumn low flow biomonitoring surveys have been undertaken in the lower reaches of the Kurapete Stream situated upstream and downstream of the small tributary receiving quarry run-off and wastes discharges. In addition to these biomonitoring surveys, other surveys were performed in May 1997, in response to an unauthorised incident report (CF145), and in October 2002 (CF259), as a follow-up to the previous summer biomonitoring survey (March 2002) performed under low recession flow conditions in the lower reaches of the Kurapete Stream which indicated a significant impact on the faunal community of the stream below the small turbid tributary draining the quarry area.

In more recent years, confounding issues of significant upstream water quality improvement (due to removal of the Inglewood oxidation ponds effluent discharge from the Kurapete Stream (TRC, 2014a)), together with cattle access in the proximity of the Everett Road bridge site, necessitated the addition of a third monitoring site (KRP000983) some 150 m downstream of the bridge for effects assessment. However, significant progress in terms of riparian fencing and plantings have improved habitat in the short reach of the stream between the small tributary (receiving quarry stormwater) confluence and the Everett Road Bridge.

The current January 2015 survey continued the summer biomonitoring component of the formal consent monitoring programme but did not require the inclusion of this additional site following an inspection of the quarry tributary together with the substrate and the

acceptable aesthetic appearance of the Kurapete Stream downstream of the confluence with the tributary draining the quarry area.

Method

The standard '400 ml kick sampling' technique was used to collect streambed (benthic) macroinvertebrates from the two established sites (I and J) in the lower reaches of the Kurapete Stream, near Everett Park on 23 January 2015 (Figure 1).

These sites were:

Site No	Site code	GPS Reference	Location
I	KRP000960	1710640E 5668709N	Upstream of quarry tributary stream
J	KRP000980	1710695E 5668758N	Everett Road bridge, d/s of tributary stream

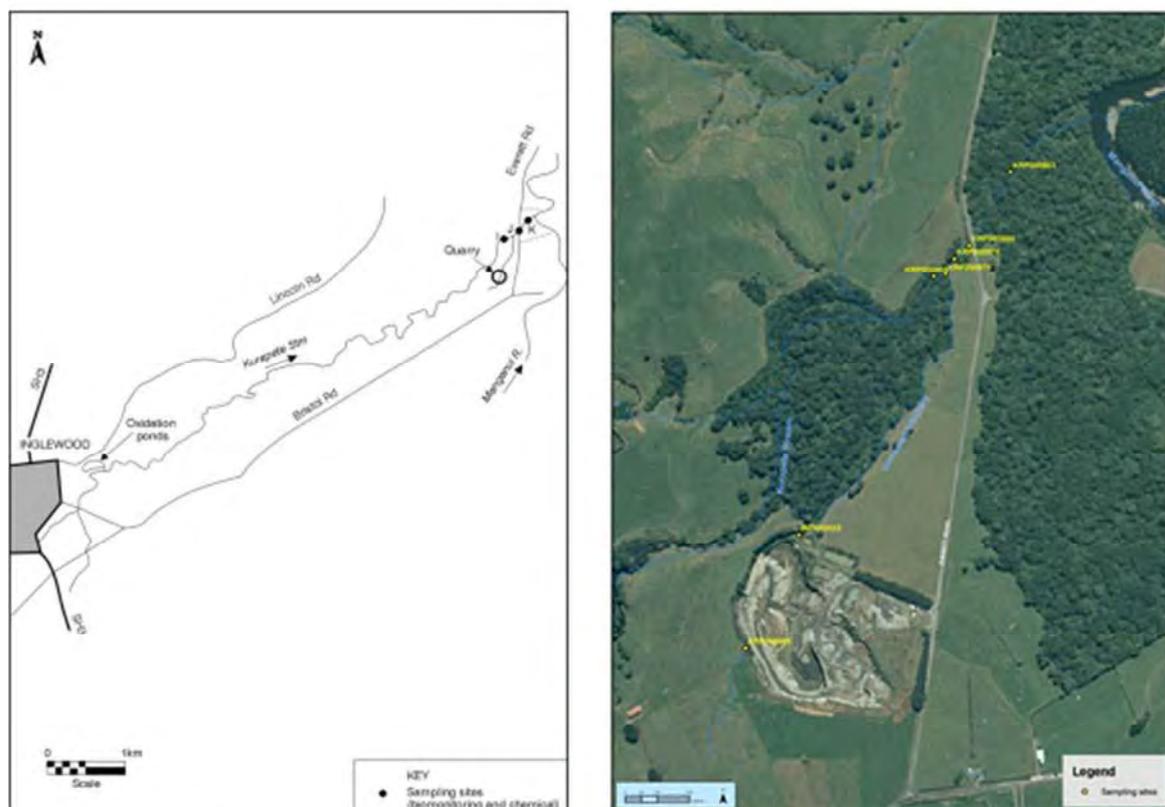


Figure 1 Sampling sites in the Kurapete Stream in relation to Inglewood Metals Ltd, quarry

This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

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)	= 20-99 individuals;
VA (very abundant)	= 100-499 individuals;
XA (extremely abundant)	= 500 or more individuals.

Macroinvertebrate Community Index (MCI) values were calculated for taxa present at each site (Stark 1985) with certain taxa scores modified in accordance with Taranaki experience.

A semi-quantitative MCI value, SQMCI_s (Stark, 1999) 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 scores, and dividing by the sum of the loading factors. 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).

Results and discussion

This summer survey was performed under low recession flow conditions, 22 days after a fresh in excess of three times median flow and 44 days since a fresh in excess of seven times median flow. Water temperatures ranged from 15.2° C to 15.4° C at these sites at the time of this mid morning survey.

The flow at both sites was slightly cloudy and uncoloured in appearance with no apparent visual impact from the quarry tributary, which atypically was clear and in very low (trickle) flow at its confluence with the Kurapete Stream, downstream of the quarry ponds' treated wastewater discharge at the time of the survey. Site I was completely shaded, with thin periphyton mats, patchy and filamentous algae and moss cover, and minimal leaf litter on the substrate. The more open, partially shaded site J, below the quarry tributary, had patchy moss, leaf litter, filamentous algae and widespread periphyton mats covering the substrate which was firmer in composition than on all but the three most previous occasions. The stream banks had been fenced adjacent to this site more than eleven years previously to prevent stock access and riparian growth was extensive on both banks. Some additional silt was apparent at site J, trapped amongst the periphyton and deposited amongst components of the bed of the stream, but less abundant than usual in slower flowing areas toward the stream's right bank. Although significant improvements had been made to waste disposal practices at the quarry over the past eighteen years, fines from the settled quarry stormwater and groundwater discharge, have continued to enter the Kurapete Stream between sites I and J causing increased cloudiness at the downstream site (TRC, 2014) although as noted above, there was no increase in visual turbidity on this occasion. The more open stream margins in the short reach in the vicinity of site J have contributed to the more widespread growth of denser periphyton substrate cover on the bed of this reach of the stream, a consequence of upstream diffuse and point source nutrient inputs within this small and narrow catchment.

Macroinvertebrate communities

Biomonitoring of the impacts of quarrying activities on the Kurapete Stream has been performed previously on twenty occasions and site I had been surveyed as a component of the Inglewood oxidation pond system monitoring programme between early 1989 and March 1993. A summary of all data for this site to date is provided in Table 1.

Table 1 Summary of macroinvertebrate taxa numbers and MCI values for all previous surveys performed at site I (KRP000960), upstream of the quarry

No. of surveys	Taxa Numbers		MCI Values	
	Range	Median	Range	Median
29	12-32	23	70-107	90

A summary of comparative data for all three sites since quarry biomonitoring commenced is presented in Table 2. (Eight surveys have been performed at site K to date).

Table 2 Summary of macroinvertebrate taxa numbers and MCI values for previous surveys performed between January 1997 and February 2014

Site	No. of surveys	Taxa Numbers		MCI Values	
		Range	Median	Range	Median
I	20	19-32	26	80-107	95
J	20	18-32	25	71-101	87
K	8	22-35	29	87-103	94

The results of the recent survey are presented in Table 3.

Site I: upstream of quarry tributary

Historical data for this site are illustrated in Figure 2.

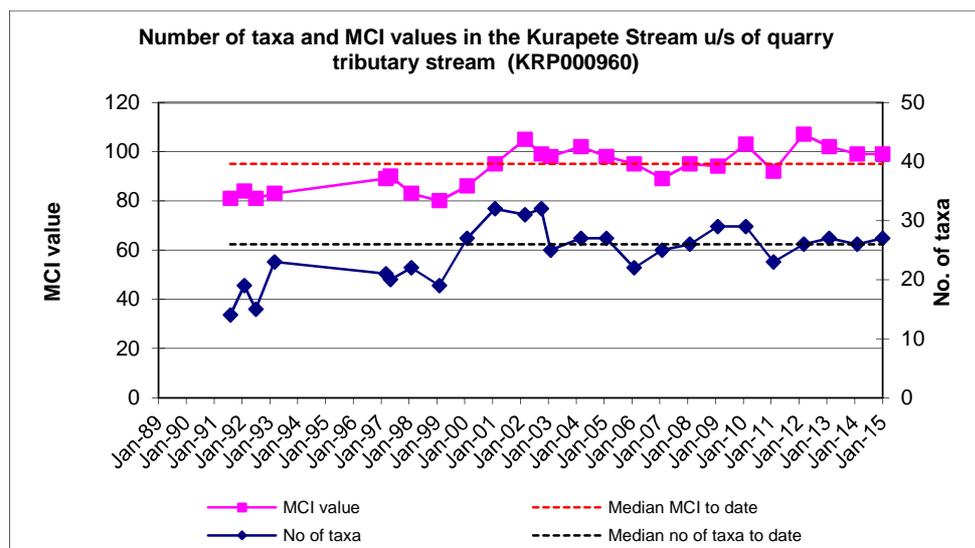


Figure 2 Taxa richness and MCI scores recorded to date at site I

Taxa richness at site I was moderate (27 taxa) for the lower reaches of a small stony ringplain seepage stream rising outside of the National Park, receiving agricultural run-off and point source discharges. It was slightly higher than the median richness recorded for this site to date (Table 1) and very similar to the median richness during the improvement recorded over the last fifteen years as a result of the removal of the municipal ponds' treated wastes discharge from the stream at Inglewood (Table 2 and Figure 2 and TRC, 2014a). The faunal community was dominated by one 'highly sensitive' taxon [very abundant mayfly (*Deleatidium*)]; seven 'moderately sensitive' taxa [(mayflies (*Coloburiscus*, *Austroclima*, and *Zephlebia* group), elmids beetles, dobsonfly (*Archichauliodes*), stony-cased caddisfly (*Pycnocentroides*), and crane fly (*Aphrophila*)]; and four 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), net-building caddisfly (*Aoteapsyche*), and sandfly (*Austrosimulium*)]; some of these 'tolerant' taxa being more typical of slightly enriched streams. The 'highly sensitive' mayfly taxon was one of the more dominant taxa under these low flow conditions, and two

other 'highly sensitive' taxon were recorded at this site although only as rarities. The MCI score (99) reflected the relatively high proportion of 'sensitive' taxa (59% of faunal richness) in the community. This score was an insignificant (Stark, 1998) 9 units above the median of all scores (Table 1) previously recorded at this site and was four units above the median score (Table 2) recorded since quarry biomonitoring commenced. The current MCI score was three units higher than that predicted for a ringplain stream site at an altitude of 110m asl (Stark and Fowles, 2009). Taxa richness and MCI score (Figure 2) continued to reflect the general improvement in stream conditions (physicochemical water quality and physical habitat) consistent with the cessation of the Inglewood oxidation ponds system's discharge (which has been diverted to the New Plymouth Wastewater Treatment Plant) and in the absence of any recent (consented) overflows from the system during wet weather periods (TRC, 2014a and Fowles, 2015).

Table 3 Macroinvertebrate fauna of the Kurapete Stream in relation to Inglewood Metal Ltd's quarry discharge sampled on 23 January 2015

Taxa List	Site Number	MCI score	I	J	
	Site Code		KRP000960	KRP000980	
	Sample Number		FWB15031	FWB15032	
NEMERTEA	Nemertea	3	R	-	
ANNELIDA (WORMS)	Oligochaeta	1	A	A	
	Lumbricidae	5	R	-	
MOLLUSCA	<i>Latia</i>	5	C	C	
	<i>Potamopyrgus</i>	4	VA	VA	
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	VA	VA	
	<i>Coloburiscus</i>	7	VA	A	
	<i>Deleatidium</i>	8	VA	A	
	<i>Ichthybotus</i>	8	R	-	
	<i>Zephlebia group</i>	7	A	A	
PLECOPTERA (STONEFLIES)	<i>Zelandobius</i>	5	R	R	
COLEOPTERA (BEETLES)	Elmidae	6	VA	VA	
	Hydrophilidae	5	-	R	
	Ptilodactylidae	8	R	R	
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	VA	A	
TRICHOPTERA (CADDISFLIES)	<i>Aoteapsyche</i>	4	VA	VA	
	<i>Costachorema</i>	7	C	R	
	<i>Hydrobiosis</i>	5	C	C	
	<i>Neurochorema</i>	6	C	R	
	<i>Pycnocentria</i>	7	-	R	
	<i>Pycnocentroides</i>	5	A	C	
	<i>Triplectides</i>	5	-	R	
		<i>Aphrophila</i>	5	A	A
DIPTERA (TRUE FLIES)	<i>Maoridamesa</i>	3	R	C	
	Orthoclaadiinae	2	R	R	
	<i>Polypedilum</i>	3	R	-	
	Tanytarsini	3	R	R	
	Empididae	3	R	-	
	Muscidae	3	-	R	
	<i>Austrosimulium</i>	3	A	C	
	Tanyderidae	4	R	R	
			No of taxa	27	26
			MCI	99	102
		SQMCI	5.9	5.3	
		EPT (taxa)	11	12	
		%EPT (taxa)	41	46	
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

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

Site J: Everett Road bridge (downstream of quarry tributary)

Historical data for this site are illustrated in Figure 3.

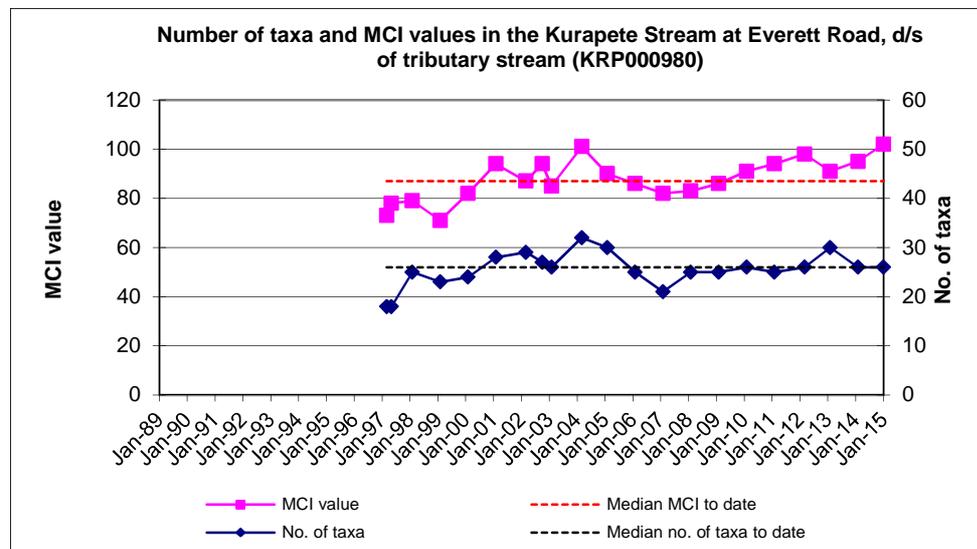


Figure 3 Taxa richness and MCI scores recorded to date at site J

Minimal downstream change in taxa richness (26) was found at the more open site J, downstream of the quarry tributary where slightly siltier, looser substrate conditions continued to be more characteristic of the streambed. More extensive periphyton substrate cover (particularly in the form of widespread mats) was apparent on the finer sedimented, although firmer than usual, substrate. The dominant taxa included all but one of each of the 'sensitive' and 'tolerant' taxa which were abundant at the upstream site but no additional taxa despite the more extensive periphyton substrate cover. There was a slight decrease in the proportion of 'tolerant' taxa (35% of the total taxa) comprising the fauna at this downstream site and a reduction in the abundance of the characteristic 'highly sensitive' taxon recorded.

No significant community composition changes were recorded but the drop in numbers (from very abundant to abundant) within the 'highly sensitive' mayfly, *Deleatidium* and two 'moderately sensitive' taxa resulted in a small decrease in SQMCI_s score (by 0.6 unit) when compared to the score obtained at the upstream site I. The MCI score at site J (102) increased by an insignificant three units from the score at site I upstream indicative of minimal change in community composition. However, this score was a significant (Stark, 1998) 15 units higher than the median of scores recorded at this site to date and one unit above the previous maximum (Figure 3). The difference between the two adjacent sites was statistically insignificant (Stark, 1998) despite the variability in habitat conditions (particularly periphyton substrate cover) between sites.

Conclusions

This late summer biomonitoring survey was performed under a period of very low recession flow conditions in the lower reaches of the Kurapete Stream. The survey indicated minimal impacts on the faunal community over the short reach of the stream, attributable to variability in habitat (rather than quarry discharge impacts) below the small tributary draining the quarry area, downstream at the site a short distance beyond the boundary of the permitted mixing zone. Some subtle but insignificant differences in faunal communities

between these sites were found, coincident with minor sedimentation and increased periphyton (mats) substrate cover in the reach of the lower Kurapete Stream below the quarry tributary inflow and no increase in visual turbidity of the main stream, as aesthetic conditions in the stream below the quarry tributary were markedly better than often previously recorded, at the time of the current survey. There was an atypical, but insignificant downstream increase in MCI score (reflective of subtle changes in community structure) under a period of very low flow conditions preceding the survey, coincident with the physical habitat variability noted at this more open site. In general, these results reflected the recent trend of stream biota improvement recorded over most previous summers coincident with improved management and upgrades to the quarry wastewater treatment system and following upstream water quality improvement subsequent to the diversion of the Inglewood oxidation ponds system wastes out of the stream in mid-catchment. Improvements in the configuration and operation of the quarry wastewater/stormwater settlement ponding system must be maintained in order to reduce the visual, aesthetic impacts of the often turbid quarry tributary receiving waters on the main Kurapete Stream in the immediate vicinity of Everett Road. More recent riparian vegetation planting in the proximity of the Everett Road site and fencing of the stream margins preventing stock access, has enhanced the stream habitat in this reach, particularly as the plantings have developed. Further catchment riparian initiatives together with re-direction of dairy wastes disposal from surface water onto land could be expected to further enhance stream health in the longer term.

Summary

The Council's standard 'kick-sampling' technique was used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Kurapete Stream. Samples were processed to provide number of taxa (richness), MCI score, SQMCI_s score and %EPT taxa for each site.

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. It may also provide more relevant information than the MCI in relation to non-organic impacts. Differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This late summer macroinvertebrate survey indicated that the discharge of treated quarry wastewaters from the Inglewood quarry site had minimal recent detrimental effects on the macroinvertebrate communities of the Kurapete Stream. Minimal changes in the macroinvertebrate communities were noted between the upstream 'control' site and the first site downstream of the discharge, beyond the designated 25 m mixing zone, coincident with no obvious increase in turbidity of the stream at the time of the survey. These were also coincidental with some increase in sedimentation of the streambed and more extensive periphyton substrate cover. These changes included some reduction in 'highly sensitive' and 'sensitive' mayfly numbers but a small decrease in the proportion of 'tolerant' taxa comprising the community coincidental with some increase in periphyton substrate cover at the downstream, more open site.

The macroinvertebrate communities of the Kurapete Stream contained relatively high proportions of 'sensitive' taxa at both sites and the communities were dominated by a

greater proportion of 'sensitive' than 'tolerant' taxa with an atypical small decrease in the proportion of 'tolerant' taxa at the site downstream of the quarry discharge.

MCI scores indicated that the stream communities were of 'fair' to 'good' health (TRC, 2015) in this reach and were relatively typical of conditions recorded in similar Taranaki streams. The 'health' of this lower reach of the stream in general was typical of the trend of recovery in conditions recorded over recent years since the diversion of treated oxidation ponds wastes out of the mid catchment and improvements to quarry management practices. Further longer term improvements could be anticipated as a consequence of future catchment wide riparian and dairy wastes land disposal initiatives.

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