# New Plymouth District Council
# New Plymouth Wastewater Treatment Plant
# Marine Outfall and Sludge Lagoon
# Monitoring Programme Annual Report
# 2015-2016

## Technical Report 2016-43

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Taranaki Regional Council
Private Bag 713
STRATFORD

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# Executive summary

The New Plymouth District Council (NPDC) operates a wastewater treatment plant (NPWWTP) located on Rifle Range Road between New Plymouth and Bell Block. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess NPDC's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of NPDC's activities.

In relation to the operation of the NPWWTP, NPDC holds five resource consents, which include a total of 49 conditions setting out the requirements that NPDC must satisfy. NPDC holds one consent to discharge treated wastewater into the Tasman Sea, one consent to discharge sludge leachate to groundwater, two consents relating to structures and one consent to discharge emissions into the air at the site.

**During the monitoring period, NPDC demonstrated an overall level of environmental performance which required improvement.**

The Council's monitoring programme for the year under review included reviewing data supplied by NPDC, five site inspections, three water samples collected for physicochemical analysis (including inter-laboratory comparison), a marine ecological survey at five sites, norovirus and metal analysis of mussels at three coastal sites and norovirus analysis of treatment plant influent and effluent.

The monitoring showed that elevated concentrations of contaminants were found in the groundwater and surface water drain adjacent to the sludge lagoon. There were no other significant detectable effects in the receiving environment resulting from authorised discharges from the plant.

An improvement in NPDC's environmental performance is required. During the year under review there were a total of 24 incidents which resulted in discharges from the wastewater network to water ways. Four 14 day letters were issued in association with incidents, all associated with unauthorised discharges in the Waitara area. One infringement notice was issued in relation to an overflow from the Waitara Outfall Sewage Pump Station and one abatement notice was issued in relation to a failure of a gasket on the Waitara to New Plymouth pipeline. There were no significant detectable effects in the receiving environment resulting from authorised NPWWTP discharges during the 2015-2016 monitoring period and NPDC performed high against the three remaining consents.

For reference, in the 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents.

In terms of overall environmental and compliance performance by NPDC over the last several years, this report shows that their performance has deteriorated in the year under review. This deterioration in rating is a result of the Council being required to undertake enforcement actions during the 2015-2016 year in relation to unauthorised sewage discharges. In addition, relates to leachate discharges from the sludge lagoon to groundwater at the WWTP, whereby have resulted in elevated levels of contaminants the surface water and groundwater were

found to be contaminated being detected in groundwater and a surface water drain adjacent to the lagoon. NPDC were found to be generally compliant with all other consents.

This report includes recommendations for the 2016-2017 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 2015 to June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held for the New Plymouth Wastewater Treatment Plant (NPWWTP). New Plymouth District Council (NPDC) is the consent holder for the operation which is situated on Rifle Range Road at New Plymouth, in the Waiwhakaiho catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to discharges of air and treated wastewater, a marine outfall structure and a culvert.

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 NPDC's use of water, land and air, and is the 21st combined report by the Council for NPDC's NPWWTP.

### 1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by NPDC for the NPWWTP;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations at the NPWWTP.

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.

Section 4 presents recommendations to be implemented in the 2016-2017 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); and
(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 NPDC, this report also assigns them a rating for their environmental and administrative performance during the period under review.

**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 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents

## 1.2 Process description

The NPWWTP (Photograph 1) treats the municipal wastewater from the New Plymouth urban area, Bell Block, Oakura and Inglewood by a process of extended aeration activated sludge. There is also a substantial industrial load, equivalent to approximately 25% of the total biochemical oxygen demand (BOD) load, treated by the plant. The plant was commissioned in 1984, and has had its capacity expanded several times since.

**Photo 1** The New Plymouth Wastewater Treatment Plant

The wastewater enters the plant at the milliscreening building (Figure 1) to remove plastics and solids from the wastewater, followed by the removal of grit. The solids are collected and removed regularly for land disposal. Following this preliminary treatment, the wastewater enters the aeration basins where micro-organisms, collectively called "activated sludge", breakdown the organic matter in the wastewater. Pathogens and heavy metals stick to the activated sludge, and are removed at a later

stage of the process. The mix of wastewater and activated sludge then overflows into clarifiers, which separate the activated sludge from the water. The clear water overflows into the chlorine contact tank for disinfection prior to discharge through a 450 metre marine outfall offshore of the mouth of the Waiwhakaiho River.

The activated sludge remaining in the clarifiers is returned to the aeration basins to maintain biological levels, while the surplus is diverted to the thermal drying facility (TDF) for sterilisation and disposal by alternative use (soil conditioner).


**Figure 1** Layout of the New Plymouth Wastewater Treatment Plant

Thermal drying of the sludge results in a dry granular solid (biosolid) with a moisture content of 5-10%. The temperatures used in the process are such that there is sterilisation of the micro-organisms and pathogens present in the sludge. The biosolid is registered for sale as *Taranaki Bioboost 6-2-0* fertiliser.

Major construction works were undertaken as part of an upgrade of the NPWWTP between December 2012 and December 2013. The upgrade involved major modification of the plant's two existing aeration basins to make them more efficient.

## 1.3 Resource consents

### 1.3.1 Water discharge permits

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.

NPDC holds coastal permit **0882-4** to cover the discharge of treated municipal wastewater from the NPWWTP through a marine outfall structure into the Tasman Sea.

The recommendations involved with this permit were heard by a panel of independent commissioners, and a decision was reached on 15 November 2011. The permit was issued by the Council on 13 December 2011 under Section 119 of the RMA. It is due to expire on 1 June 2041.

There are 24 special conditions attached to the permit.

Condition 1 requires that the consent holder adopt the best practicable option to minimise adverse environmental effects.

Condition 2 requires that the consent holder maintain a diffuser system to ensure a minimum ratio of dilution of 13:1.

Conditions 3, 4 and 5 stipulate the concentration of various components of the discharge which shall not be exceeded.

Conditions 6 to 9 deal with the eventuality of aeration basins being taken offline.

Condition 10 requires that total available chlorine residual in the effluent is at least 0.3 $g/m^3$.

Condition 11 deals with screen size the effluent must pass through.

Conditions 12 to 18 relates to monitoring requirements.

Condition 19 requires the consent holder to provide a technology report on two occasions, while Condition 20 requires an annual report. Condition 21 states that the consent holder must maintain a contingency plan for the site.

Conditions 22 and 23 require the consent holder to meet with Council, iwi and interested parties regarding the operation and monitoring of the consent.

Condition 24 is a review provision.

NPDC holds discharge permit **2982-4** to cover the discharge of up to 60 $m^3$/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River. This permit was issued by the Council on 17 October 2002 under Section 87(e) of the RMA. It is due to expire on 1 June 2020.

There are five special conditions attached to the permit.

Condition 1 requires that groundwater in the vicinity of the lagoon is monitored.

Condition 2 requires that the unnamed tributary adjacent to the lagoon is monitored.

Condition 3 stipulates that there is to be no direct discharge of contaminants to any surface water body.

Condition 4 requires that there be no adverse impacts on ground or surface waters.

Condition 5 deals with review provisions.

### 1.3.2 Air discharge pemit

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.

On 29 May 2008, NPDC was granted air discharge permit **4740-2** to discharge contaminants into the air from sludge drying and processing activities at the NPWWTP. This permit was issued by the Council under section 87(e) of the RMA and is due to expire on 1 June 2026.

There are seven special conditions attached to the permit.

Condition 1 requires the consent holder to adopt the best practicable option to minimise environmental effects.

Condition 2 requires that the sludge management processes are managed to maintain discharges at a minimum, while condition 3 requires that discharges not give rise to any offensive or objectionable odours beyond the property boundary.

Condition 4 requires the consent holder to supply a statement of how the biofilters are to be maintained and operated.

Condition 5 requires a contingency plan addressing events at the NPWWTP that could give rise to abnormal odour release potential.

Condition 6 deals with removal of sludge from No. 2 lagoon while condition 7 deals with review of the consent.

### 1.3.3 Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC holds coastal permit **4593-2** to erect, place, maintain and use a marine outfall within the coastal marine area as part of the NPWWTP system. This permit was issued by the Council on 24 July 1996 under Section 87(c) of the RMA. It was due to expire on 1 June 2014 and was renewed as consent 4593-3 on 10 September 2014 with a new expiry date of 01 June 2041.

There are five special conditions attached to the permit.

Condition 1 requires that the consent holder maintain the structures authorised by the consent.

Condition 2 requires the consent holder to notify Council prior to undertaking maintenance works.

Condition 3 requires that all practicable measures are undertaken to prevent undue disturbance to reefs and marine life during maintenance works.

Condition 4 stipulates that the structure is removed when no longer needed.

Condition 5 deals with review provisions.

### 1.3.4 Land use consent

Section 13(1)(a) of the RMA stipulates that no person may use, erect, reconstruct, place, alter, extend, remove, or demolish any structure in, on, under, or over the bed of any lake or river, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

NPDC holds land use consent **1826-2** to erect, place and maintain a twin box culvert on the Mangaone Stream for road access purposes. This permit was issued by the Council on 16 January 2002 under Section 87(a) of the RMA. It is due to expire on 1 June 2020.

There are eight special conditions attached to the consent.

Condition 1 requires that the structure is maintained.

Condition 2 stipulates that maintenance be undertaken between November and April inclusive.

Condition 3 requires the consent holder to notify the Council prior to maintenance.

Condition 4 requires the consent holder to adopt the best practicable option to avoid or minimise effects on the streambed or water quality during maintenance.

Condition 5 requires that streambed disturbance is kept to a minimum during maintenance.

Condition 6 stipulates that the structure does not obstruct fish passage.

Condition 7 requires that the structure be removed and the area reinstated if and when no longer required.

Condition 8 deals with review provisions.

Copies of the NPWWTP consents are attached to this report in Appendix I.

## 1.4 Monitoring programme

### 1.4.1 Introduction

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

The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

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 NPWWTP consisted of seven primary components during the 2015-2016 monitoring period.

### 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 NPWWTP was visited five times during the monitoring period. With regard to consents for the abstraction of or discharge 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 NPDC 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 Council effluent monitoring

#### 1.4.4.1 Grab samples

Grab samples were collected from the final effluent on three occasions. Samples were analysed for chlorine (total and free) and faecal indicator bacteria (FIB), specifically; *E. coli*, enterococci and faecal coliforms.

#### 1.4.4.2 Inter-laboratory comparison

Two inter-laboratory comparisons between the Council and NPDC were performed during the 2015-2016 monitoring period using 24 hour composite samples. The comparisons were performed to verify the validity of monitoring results reported by NPDC, and to provide an independent check on compliance with consent conditions. The samples were analysed, by both the Council and NPDC, for cadmium, chromium,

copper, nickel, lead and zinc (all acid soluble), mercury and cyanide (total), and phenolic compounds.

### 1.4.5 Review of NPDC self monitoring data

NPDC monitors the influent and effluent for a number of chemical, biochemical and bacteriological parameters and forwards the results through to the Council on a monthly basis.

#### 1.4.5.1 Composite samples

A number of flow-proportional composite samples were collected from the influent over a 24 hour period and analysed for pH, alkalinity as $CaCO_3$, ammoniacal nitrogen (ammoniacal-N), oxidised nitrogen (oxidised-N), nitrite, nitrate, dissolved reactive phosphorus (DRP), sulphate, biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, and faecal coliforms.

A number of composite samples were collected from the effluent and analysed for various parameters. On a monthly basis, composite samples were collected and analysed for pH, ammoniacal-N, oxidised-N, COD, cyanide, phenols, cadmium, chromium, copper, nickel, lead, zinc, and mercury. Approximately three times a week, samples were collected for the analysis of suspended solids and BOD. Approximately once a week, samples were collected for the analysis of DRP and sulphate. A small number of samples were collected and analysed for alkalinity.

Composite sample results are presented in this report to address Special Conditions 3 and 4 of resource consent 0882-4. A summary of the composite data collected from the influent and effluent is also presented to provide a further indication of plant performance.

#### 1.4.5.2 Grab samples

Grab samples were collected and analysed for total available chlorine twice a day. Grab samples were also collected and analysed for faecal coliform bacteria approximately 3 times each week.

#### 1.4.5.3 Norovirus sampling

Following review of the monitoring programme in 2013, norovirus analysis of mussel flesh and influent and effluent from the NPWWTP was added as a new component of the monitoring programme in accordance with condition 14 (e) of consent 0882-4. One set of influent and effluent samples were analysed for norovirus GI and GII by The Institute of Environmental Science and Research (ESR).

#### 1.4.5.4 Sludge lagoon monitoring

Monitoring of the sludge lagoon is focused on the potential contamination of groundwater and of the drainage channel located next to the lagoon. Three groundwater bores are located around the lagoon. Samples from these bores were collected one a month and analysed for pH, ammoniacal-N, faecal coliform bacteria, DRP, oxidised-N and COD. The drainage channel was also sampled once a month at

two sites, one upstream and the other downstream of the sludge lagoon. The drainage channel samples were analysed for pH, ammoniacal-N and faecal coliform bacteria.

### 1.4.6 Marine ecological surveys

An annual intertidal ecological survey was carried out at three potential impact sites and two control sites during the 2015-2016 monitoring period. The objective of this survey was to indicate any change in intertidal community structure attributable to discharges from the NPWWTP outfall.

### 1.4.7 Shoreline bacteriological surveys

A survey of shoreline bacteriological water quality at four seawater sites in the vicinity of the marine outfall is carried out every second year during the summer months. This survey was last carried out over the 2014-2015 summer period. It is next due to be undertaken in the summer of 2016-2017.

### 1.4.8 Shellfish monitoring

#### 1.4.8.1 Metals

Mussels are collected from three sites around the outfall (Waiwhakaiho Reef, Bell Block and Arakaitai Reef) on a biennial basis and tested for trace metals. This monitoring was undertaken in the period under review.

#### 1.4.8.2 Norovirus

Mussels were collected once from two sites (Waiwhakaiho Reef and Bell Block Reef) and analysed for norovirus GI and GII by ESR.

# 2. Results

## 2.1 Water

### 2.1.1 Inspections

Five scheduled site inspections were performed at the plant during the monitoring period. These inspections involved a visual assessment of the plant effluent and plant processes, a check of the final effluent chlorine data, a brief consultation with operations and/or laboratory staff, and an inspection of the foreshore and seawater adjacent to the outfall.

The plant and surrounds were found to be tidy and well managed during each visit. No issues were noted regarding effluent appearance. Upgrade works were being undertaken in the sludge processing area during the June inspections.

There was no evidence of effluent contamination in the peripheral drains. The coastal effluent plume was either invisible, or visible as a small clear patch above the diffuser. There was no evidence of contamination of the foreshore or shoreline waters during the inspections.

### 2.1.2 Council effluent monitoring

#### 2.1.2.1 Grab samples

Grab samples were collected of the final effluent in conjunction with two of the inspections. The samples were analysed for faecal coliforms, enterococci, total available chlorine, and free available chlorine (Table 1).

**Table 1** Effluent grab samples 2015-2016 (site SWG002002)

| Parameter | Unit | Date | | | Consent Limit |
|---|---|---|---|---|---|
| | | 2 Mar 2016 | 5 May 2016 | 1 Jun 2016 | |
| Free available chlorine | g/m$^3$ | <0.2 | <0.1 | <0.1 | - |
| Total available chlorine | g/m$^3$ | 0.5 | 0.5 | 0.4 | **0.3*** |
| *E. coli* | cfu/100 ml | 27 | 10 | - | **-** |
| Enterococci | cfu/100 ml | 16 | 3 | 1 | **-** |
| Faecal coliforms | cfu/100 ml | 31 | 11 | 4 | **-** |

* The total available chlorine in the effluent, prior to entering the outfall pipe, shall be no less than 0.3 g/m$^3$

The results of these grab samples show that the consent condition was met on all three sampling occasions.

Relatively low levels of FIB were recorded in the final effluent on all sampling occasions.

#### 2.1.2.2 Inter-laboratory comparison

Two 24 hour composite samples of the final effluent were collected and split in order to perform an inter-laboratory comparison. The samples were analysed for cadmium, chromium, copper, nickel, lead and zinc (all acid soluble), cyanide and mercury (total)

and phenols (Table 2). For this comparison, a satisfactory agreement between two samples was reached if they were each within 10% of the resultant mean.

**Table 2** Inter-laboratory effluent composite samples 2015-2016

| Parameter | Unit | 1 March 2016 | | | 4 May 2016 | | | Consent limit |
|---|---|---|---|---|---|---|---|---|
| | | TRC | NPWWTP | Agree | TRC | NPWWTP | Agree | |
| Cadmium | g/m³ | <0.005 | <0.002 | √ | <0.005 | <0.002 | √ | **0.04** |
| Chromium | g/m³ | <0.03 | <0.02 | √ | <0.03 | <0.02 | √ | **0.15** |
| Copper | g/m³ | <0.01 | <0.02 | √ | <0.01 | <0.02 | √ | **0.1** |
| Cyanide | g/m³ | 0.008 | <0.02 | √ | 0.007 | 0.02 | ** | **0.1** |
| Mercury | g/m³ | <0.0002 | <0.001 | √ | <0.0002 | <0.001 | √ | **0.002** |
| Nickel | g/m³ | <0.02 | <0.08 | √ | <0.02 | <0.008 | √ | **0.15** |
| Lead | g/m³ | <0.05 | <0.03 | √ | <0.05 | <0.03 | √ | **0.1** |
| Phenol | g/m³ | 0.03 | 0.15 | ** | <0.02 | 0.05 | ** | **1.0** |
| Zinc | g/m³ | 0.029 | <0.04 | √ | 0.035 | 0.04 | √ | **0.2** |

√ = satisfactory agreement
* = result within 10 -25 % of the mean
** = result > 25 % from mean

The results of the inter-laboratory comparison show that, apart from cyanide and phenols, the results obtained were in good agreement, and all results were within levels prescribed by consent conditions. The majority of metals were below detection limits.

### 2.1.3 NPDC self monitoring data

#### 2.1.3.1 Composite samples

An annual summary of the composite effluent monitoring undertaken by NPDC in relation to Special Condition 3 is presented in Table 3, along with the associated resource consent limits and a summary of previous results.

**Table 3** Summary results of monthly effluent composite samples collected by NPDC (2015-2016)

| Parameter | Unit | Consent limit | 2015-2016 | | | 1990-2015 | | |
|---|---|---|---|---|---|---|---|---|
| | | | Median | Number of samples | % compliant | Min | Max | Number of samples |
| Cyanide | g/m³ | **0.1** | <0.02 | 12 | 100% | <0.01 | 0.1 | 286 |
| Phenols | g/m³ | **1.0** | <0.05 | 12 | 100% | <0.01 | 0.11 | 283 |
| Zinc | g/m³ | **0.2** | <0.04 | 12 | 100% | <0.02 | 0.15 | 291 |
| Copper | g/m³ | **0.1** | <0.02 | 12 | 100% | <0.01 | 0.05 | 291 |
| Chromium | g/m³ | **0.15** | <0.02 | 12 | 100% | <0.011 | 0.05 | 291 |
| Nickel | g/m³ | **0.15** | <0.008 | 12 | 100% | <0.008 | 0.07 | 291 |
| Cadmium | g/m³ | **0.04** | <0.002 | 12 | 100% | <0.0011 | 0.008 | 291 |
| Lead | g/m³ | **0.1** | <0.03 | 12 | 100% | <0.002 | 0.04 | 291 |
| Mercury | g/m³ | **0.002** | <0.001 | 12 | 100% | <0.001 | 0.001 | 279 |

During the 2015-2016 monitoring year, all contaminants were within their consent limits, and all results were comparable those previously recorded. A full table of results

for the period under review can be found in Appendix II. Results from 1990 onwards are also included in Appendix III.

As stated in Special Condition 4, neither BOD nor suspended solids shall exceed a concentration of 25 g/m$^3$ in more than 5% of samples of the final effluent. Results from the effluent composite samples analysed for BOD and suspended solids during the year under review are presented in Figures 2 and 3.

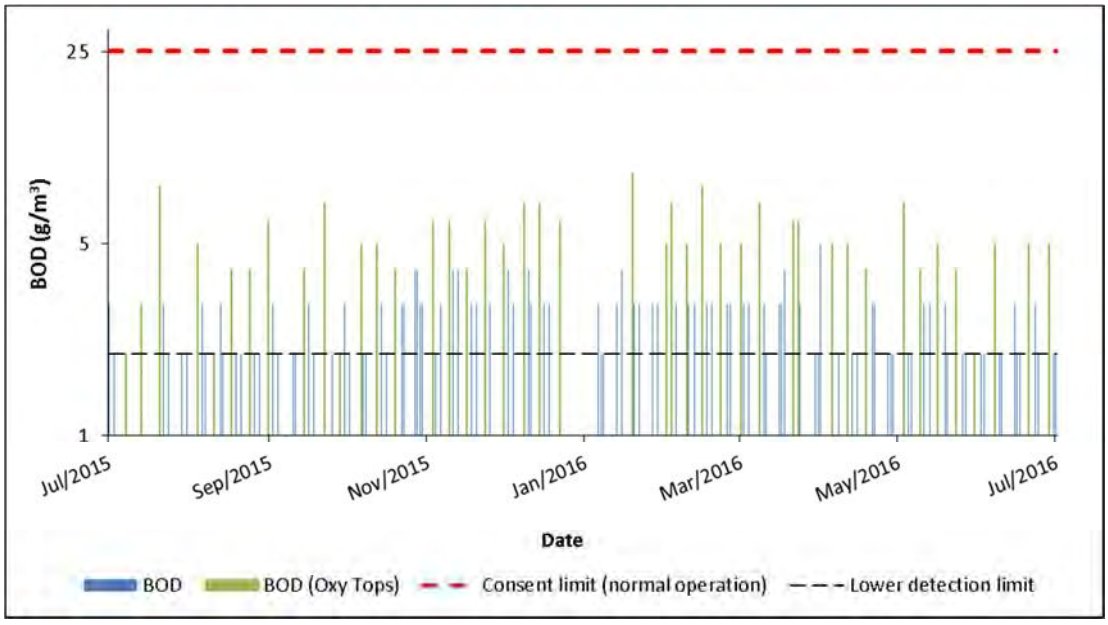


**Figure 2** Biochemical oxygen demand in 24-hour effluent composite samples (presented on a logarithmic scale). Note: the results from two different BOD test methods are presented here.

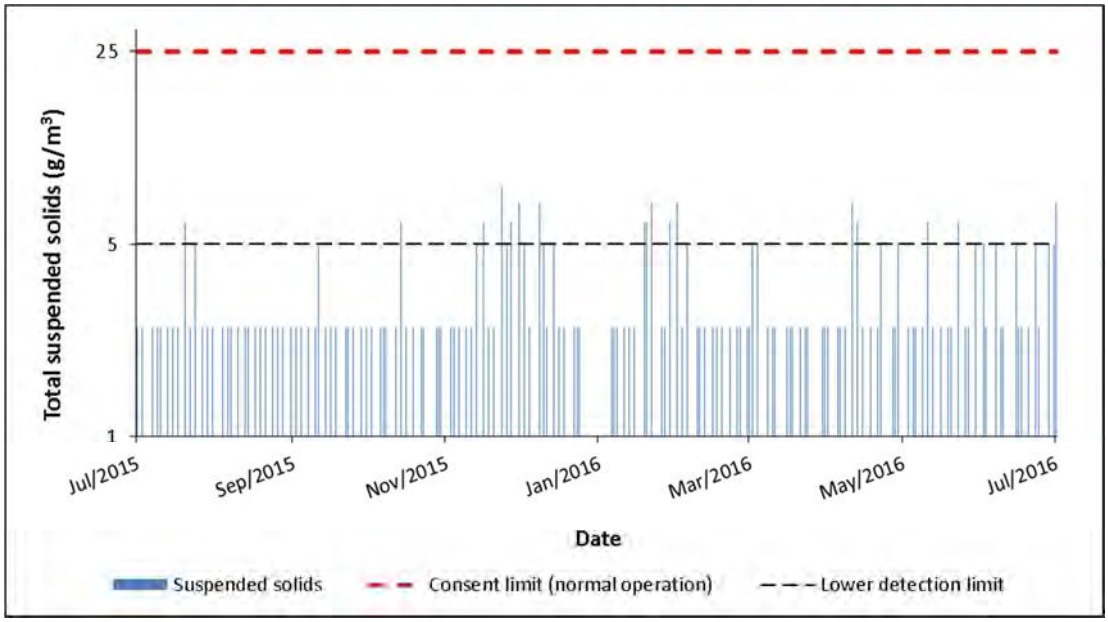


**Figure 3** Concentration of total suspended solids in 24-hour effluent composite samples (presented on a logarithmic scale).

The concentrations of both discharge constituents remained below 25 g/m$^3$ in all samples during this monitoring period[1]. Condition 5 permits greater concentration limits for suspended solids and BOD when plant maintenance is being carried out. There was no work undertaken during the 2015-2016 monitoring year which required these limits to be adopted.

NPDC provided the Council with influent composite data, which, when considered along side the effluent composite data, is indicative of the performance of the plant. A summary of the influent and effluent composite data from the period under review is presented in Table 4.

**Table 4** Summary of composite influent and effluent data from the 2015-2016 monitoring period

| Parameter | Units | Detection limits | Influent | | Effluent | |
|---|---|---|---|---|---|---|
| | | | Median | Number of samples | Median | Number of samples |
| pH | pH units | - | 7.4 | 55 | 7.35 | 12 |
| Alkalinity as $CaCO_3$ | g/m$^3$ | - | 198 | 48 | 70 | 7 |
| Ammoniacal-N | g/m$^3$ | <0.1 | 30 | 78 | <0.1 | 12 |
| Oxidised-N | g/m$^3$ | <0.1 / <0.02 | 0.2 | 52 | 6.75 | 16 |
| Nitrite as N | g/m$^3$ | <0.2 / <0.05 | <0.05 | 52 | - | - |
| Nitrate as N | g/m$^3$ | <0.15 | 0.155 | 52 | - | - |
| DRP as Phosphorus | g/m$^3$ | <0.08 / <0.05 | 3.6 | 52 | 0.125 | 46 |
| Sulphate | g/m$^3$ | - | 36.5 | 52 | 37.95 | 44 |
| BOD | g/m$^3$ | <1 / <2 | 220 | 33 | 3 | 105 |
| BOD (Oxy Tops) | g/m$^3$ | <1 | 212.5 | 18 | 5 | 46 |
| COD | g/m$^3$ | - | 441 | 82 | 23 | 12 |
| Suspended Solids | g/m$^3$ | <5 | 305 | 81 | <5 | 156 |
| Faecal coliforms | No/100ml | <1 | 9,500,000 | 13 | Tested with grab samples – see Section 2.1.3.2 | |

Treatment of influent at the NPWWTP resulted in large reductions in alkalinity, ammoniacal-N, DRP, BOD, COD and suspended solids. Oxidised-N generally increased as the ammonia was converted to nitrate by way of nitrification. Results from the monthly effluent composite samples in the 2015-2016 year are presented in Appendix II. Historical results from the monthly effluent composite samples are presented in Appendix III.

#### 2.1.3.2 Grab samples

Special Condition 10 requires that the concentration of total available chlorine (TAC) in the effluent shall be no less than 0.3 g/m$^3$. NPDC collect regular grab samples of the effluent to assess this condition. The results from the period under review are presented in Figure 5.

[1] NPDC reported a breach of the suspended solids concentration limit outside of their routine monitoring; see Section 2.3.1 for more details.

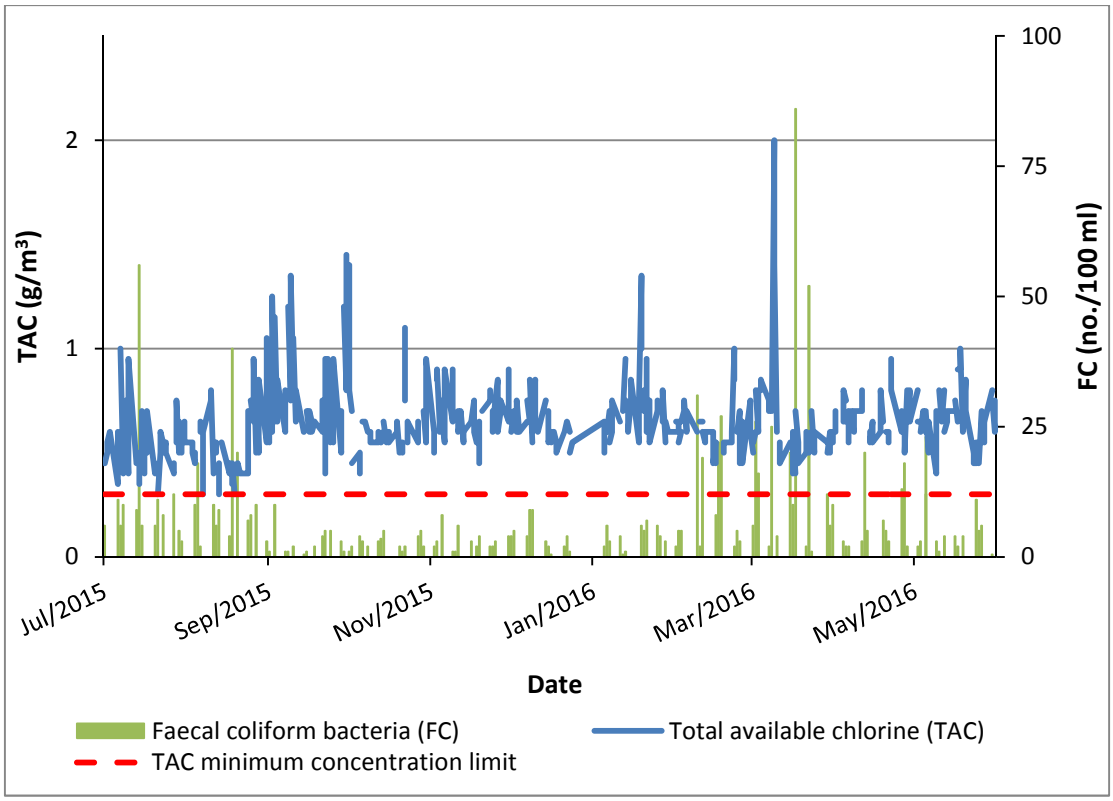


**Figure 4** Levels of total available chlorine (TAC) and faecal indicator bacteria (FC) in effluent grab samples

The concentration of TAC was found to be at or above 0.3 g/m$^3$ in every routine sample collected during the monitoring year[2]. The concentrations of TAC were reflected in the relatively low counts of faecal coliform bacteria present in effluent grab samples throughout the year (Figure 4).

#### 2.1.3.3 Norovirus samples

Condition 14 requires shellfish to be monitored for microbial contamination in relation to the NPWWTP outfall discharge. In conjunction with this, samples of influent and effluent at the NPWWTP are also collected and analysed for norovirus (GI and GII). The results from this monitoring period are presented in Table 5.

[2] NPDC reported two breaches of the minimum chlorine concentration limit outside of their routine monitoring; see Section 2.3.1 for more details.

**Table 5** Norovirus concentration in the effluent and influent at the NPWWTP

| Operation | Date | Norovirus GI (genome copies/L) | | | Norovirus GII (genome copies/L) | | |
|---|---|---|---|---|---|---|---|
| | | Influent | Effluent | Reduction factor | Influent | Effluent | Reduction factor |
| Pre-upgrade | 9 October 2012 | 280,000 | 100 | 2,800 | 470,000 | 13,000 | 36 |
| Pre-upgrade | 16 October 2012 | 37,000 | 180 | 206 | 1,600,000 | 30,000 | 53 |
| Pre-upgrade | 23 October 2012 | 17,000 | 460 | 37 | 28,000,000 | 21,000 | 1,333 |
| Upgrade | 31 July 2013 | 35,000 | 8,200 | 4 | 1,200,000 | 140,000 | 9 |
| Post-upgrade | 9 June 2014 | 67,000 | 200 | 335 | 480,000 | 2,300 | 209 |
| Post-upgrade | 20 April 2015 | 4,300 | 0.5 | 8,600 | 3,000,000 | 1,300 | 2,308 |
| Post-upgrade | 11 April 2016 | 92,000 | 0.5 | 184,000 | 1,900,000 | 770 | 2,468 |

The disinfection rate has continued to improve following the upgrade of the wastewater treatment system. The results from the first samples taken following the upgrade showed that norovirus numbers were being reduced by two orders of magnitude as a result of treatment (Table 5). Results from the previous monitoring period achieved a reduction of three orders of magnitude. This year's results show that the disinfection process is achieving a reduction of four orders of magnitude in norovirus numbers.

### 2.1.3.4 Sludge lagoon monitoring

The results of sludge lagoon groundwater and surface water monitoring, undertaken monthly by NPDC, are summarised in Figures 6 to 13, along with a summary of previous results from 1990 to 2015. All of the results from 2015-2016 are presented in Appendix IV. The locations of the sampling sites in relation to the lagoon are shown in Figure 5.

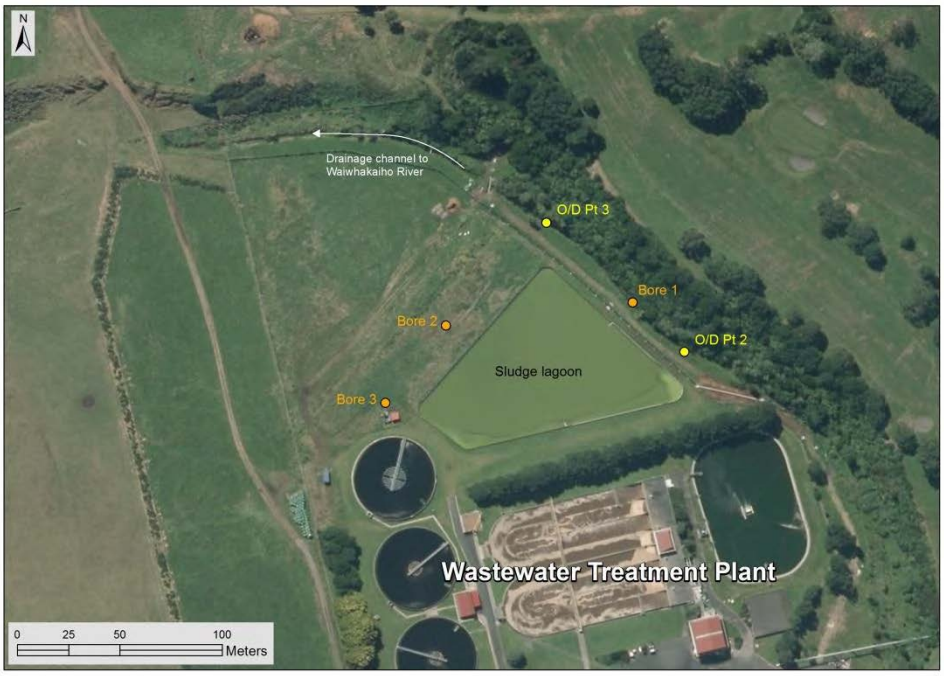


**Figure 5** Sludge lagoon showing location of NPDC's groundwater bore and drain sampling sites

The faecal coliform counts recorded at Bore 1 were low, with a median below the limit of detection (<10 per 100 ml; Figure 6). The median count at Bore 2 was slightly higher (27.5 per 100 ml), although all counts remained within the range of those previously recorded. The median count at Bore 3 was also slightly elevated (21 per 100 ml). This site also recorded the highest max count of all of the bores (5,200 per 100 ml). Median counts were far higher in the drains (427.5 and 980 per 100 ml at the upstream and downstream sites, respectively). It should be noted that at these surface water sites, the variation in faecal coliform numbers is affected to a greater extent by fluctuations in drain flow and access by stock and wildlife.

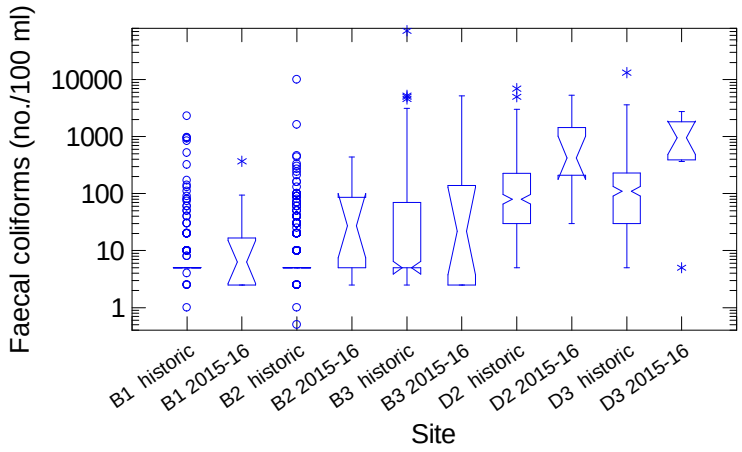


**Figure 6** Boxplots of faecal coliform data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2015 (historic) and the current monitoring period (2015-16) presented on a logarithmic scale

With the exception of those at Bore 3, the pH levels from each site were all comparable with previous results (Figure 7). At Bore 3, the median pH of the groundwater during the year under review was notably lower than the historical median (6 and 6.3, respectively).

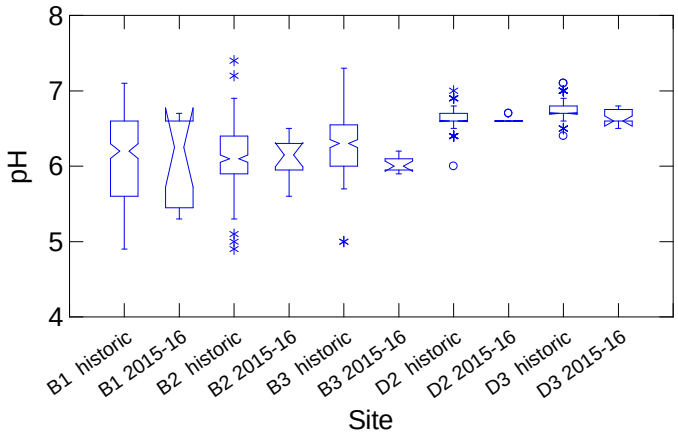


**Figure 7** Boxplots of pH data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2015 (historic) and the current monitoring period (2015-16)

The process of decomposition of nitrogenous fractions within the sludge biomass generates ammoniacal nitrogen. The concentrations of ammoniacal-N at most sites were comparable with historical results (Figure 8, Appendix IV). However, continuing

the previous year's trend, concentrations in Bore 1 were again elevated with a median of 5.6 g/m$^3$, compared with a historical median of 2.6 g/m$^3$.

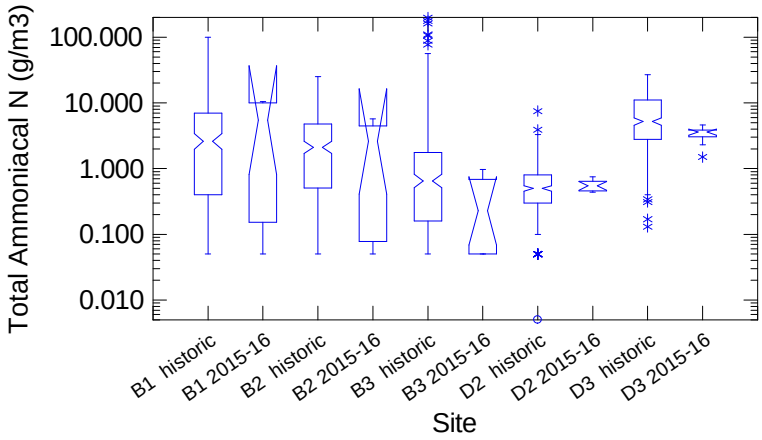


**Figure 8** Boxplots of ammoniacal nitrogen data from the three monitoring bores (B1-3) and two drains (D2-3) from between 1990 and 2015 (historic) and the current monitoring period (2015-16) presented on a logarithmic scale

The median concentrations of oxidised-N were low in all three bores during the year under review and were comparable with historical results (Figure 9, Appendix IV). However, Bore 1 recorded some elevated results over the winter months, including a maximum concentration of 14.9 g/m$^3$.

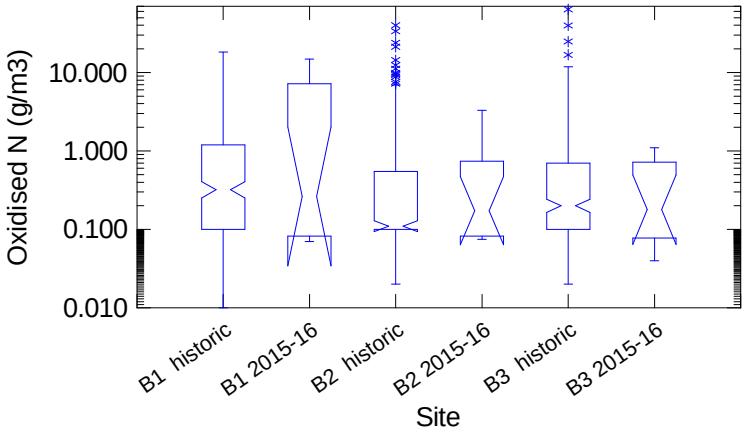


**Figure 9** Boxplots of oxidised nitrogen data from the three monitoring bores (B1-3) between 1990 and 2015 (historic) and the current monitoring period (2015-16) presented on a logarithmic scale

Soluble phosphate is released from the sludge biomass under anaerobic conditions and therefore is the major contributor to dissolved phosphorus levels. The concentration of DRP in the groundwater at all three bores was low, but comparably higher than past results (Figure 9, Appendix IV). Bore 1 recorded the highest median DRP concentration (0.16 g/m$^3$).

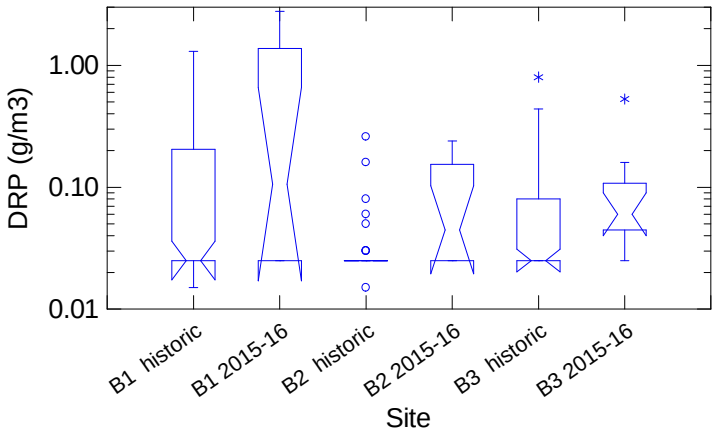


**Figure 10** Boxplots of DRP data from the three monitoring bores (B1-3) between 2008 and 2014 (historic) and the current monitoring period (2014-15)

Finally, levels of COD increased from Bore 1 to Bore 3 with levels in all three bores above the historical median (Figure 11, Appendix IV). These elevated COD levels indicate that seepage from the lagoon was occurring. The construction of the lagoon was so that the sludge would be forced by hydraulic pressure into the fine river silts and ash which underline the lagoon, thus blinding and sealing the bottom of the lagoon. This has in the most part been achieved, although leakage still occurs as indicated by the monitoring results of groundwater and surface waters in the vicinity of the lagoon.

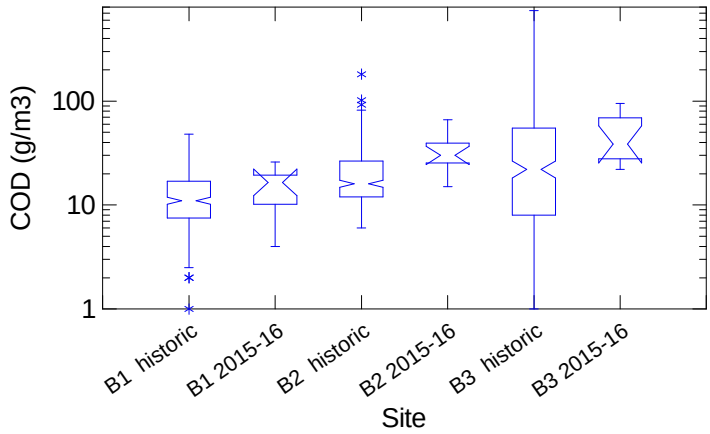


**Figure 11** Boxplots of COD data from the three monitoring bores (B1-3) between 1990 and 2015 (historic) and the current monitoring period (2015-16) presented on a logarithmic scale

The monitoring results indicate that leachate from the sludge lagoon is having an effect on the groundwater in the vicinity of Bore 1, in addition to Bores 2 and 3. Originally, Bore 1 was intended to be used as a control site for groundwater monitoring due to its position in relation to the lagoon and the assumed direction of groundwater flow. However, it is possible that the deposition and subsequent mounding of sludge in this lagoon has altered the localized groundwater gradient, resulting in some of the leachate being forced out of the lagoon in the direction of Bore 1.

Seasonal cycles in concentrations of groundwater contaminants have become particularly apparent in recent years. This trend is most distinct with concentrations of

ammoniacal-N, oxidized-N, and DRP at Bore 1 (Figure 12). The maximum concentrations of these three contaminants are also considerably higher at this Bore compared to Bores 2 and 3. At Bore 1, concentrations of ammoniacal-N are highest in the summer and subside in the winter. Conversely, oxidized-N concentrations are greatest in the winter, and subside during the summer. DRP mirrors the trend of ammoniacal-N, albeit at much lower concentrations.

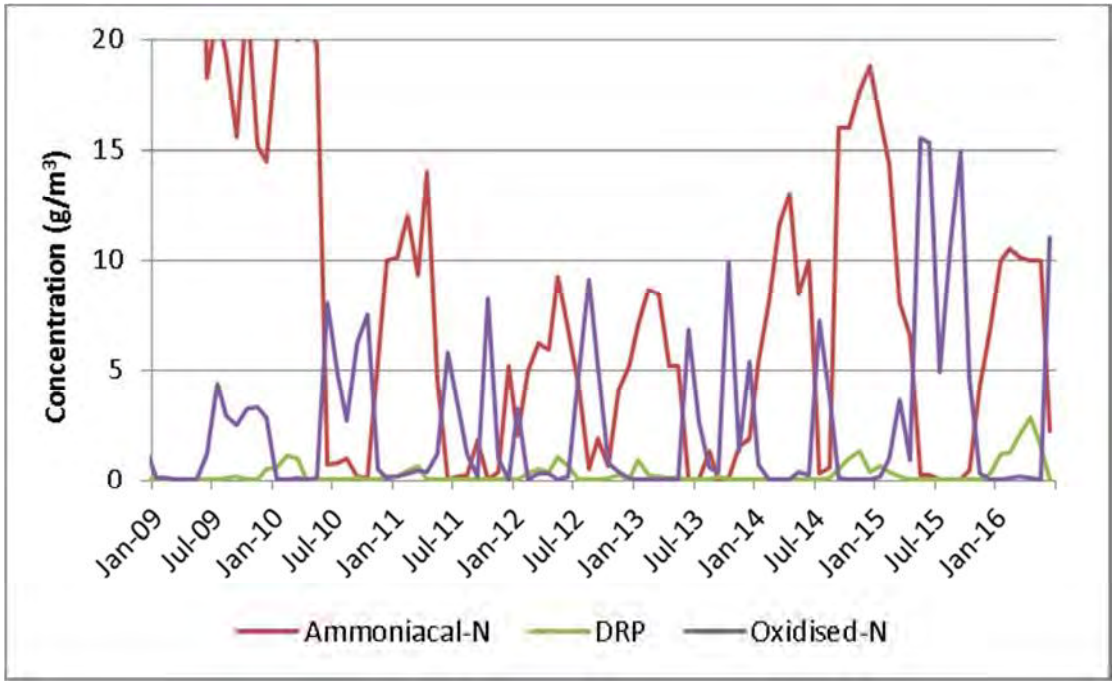


**Figure 12** Concentrations of ammoniacal-N, oxidised-N and DRP in monthly groundwater samples taken from Bore 1 (2009-2016)

There are a number of possible mechanisms driving the seasonal cycle of contaminants in the groundwater adjacent to the lagoon. The first possible mechanism relates to the wastewater treatment process, prior to the lagoon. Sludge would be deposited from the clarifiers into the lagoon in layers with varying ratios of oxidized-N to ammoniacal-N as the treatment process would produce a higher proportion of oxidized-N during the warmer summer months than during the winter. Once the leachate from each layer has reached groundwater, the elapsed time may explain why the concentration of oxidized-N is greatest in the winter months. There may be also be an oxidation-reduction cycle occurring within the lagoon itself, also driven by seasonal conditions, complimenting the first mechanism. Another possible mechanism driving the conversion between ammoniacal-N and oxidized-N could occur within the groundwater surrounding the lagoon. This mechanism assumes that nitrogen is continuously leaching from the lagoon and into the soil in the form of ammoniacal-N. In the summer months, there is typically less rainfall and therefore less oxygenated water entering the soil. The low concentration of dissolved oxygen in the groundwater limits the capacity for the microbial community to respire and convert the ammoniacal-N into oxidized-N. Therefore, the concentration of ammoniacal-N remains high. Conversely, greater rainfall in the winter months increases the concentration of dissolved oxygen in the groundwater as there is more oxygenated water entering the soil. The microbial community is therefore more able to respire and oxidise the available nitrogen. It is hoped that further investigation will indicate the dominant mechanism behind this cycling.

No seasonal cycle is apparent in the concentrations of ammoniacal-N at the two open drain sites. Whilst the concentration of ammoniacal-N has remained consistently low at the upstream site in recent years, the downstream site has shown a slight increase (Figure 13).

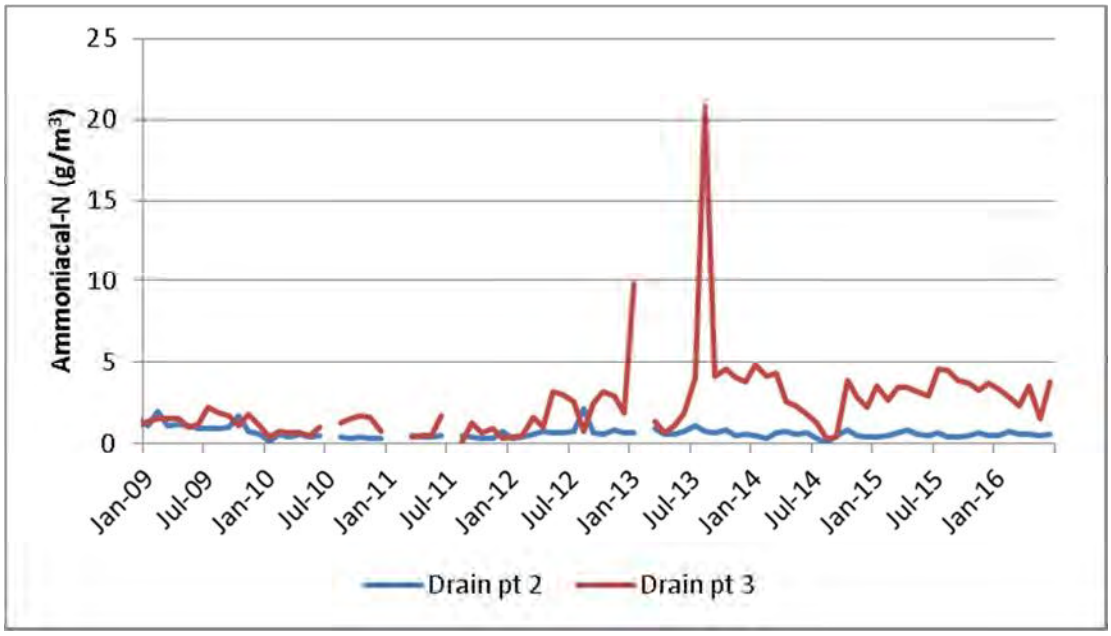


**Figure 13** Concentrations of ammoniacal-N in the monthly drain samples collected upstream and downstream of the sludge lagoon (2009-2016)

### 2.1.4 Marine ecological surveys

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, ecological surveys were conducted in February 2016 at five sites (Figure 13). These surveys included three potential impact sites (SEA902015, SEA902010, SEA902005) and two control sites (SEA903070, SEA901007), north and south of the outfall. Any adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a significant decline in species diversity at the potential impact sites relative to the control sites.

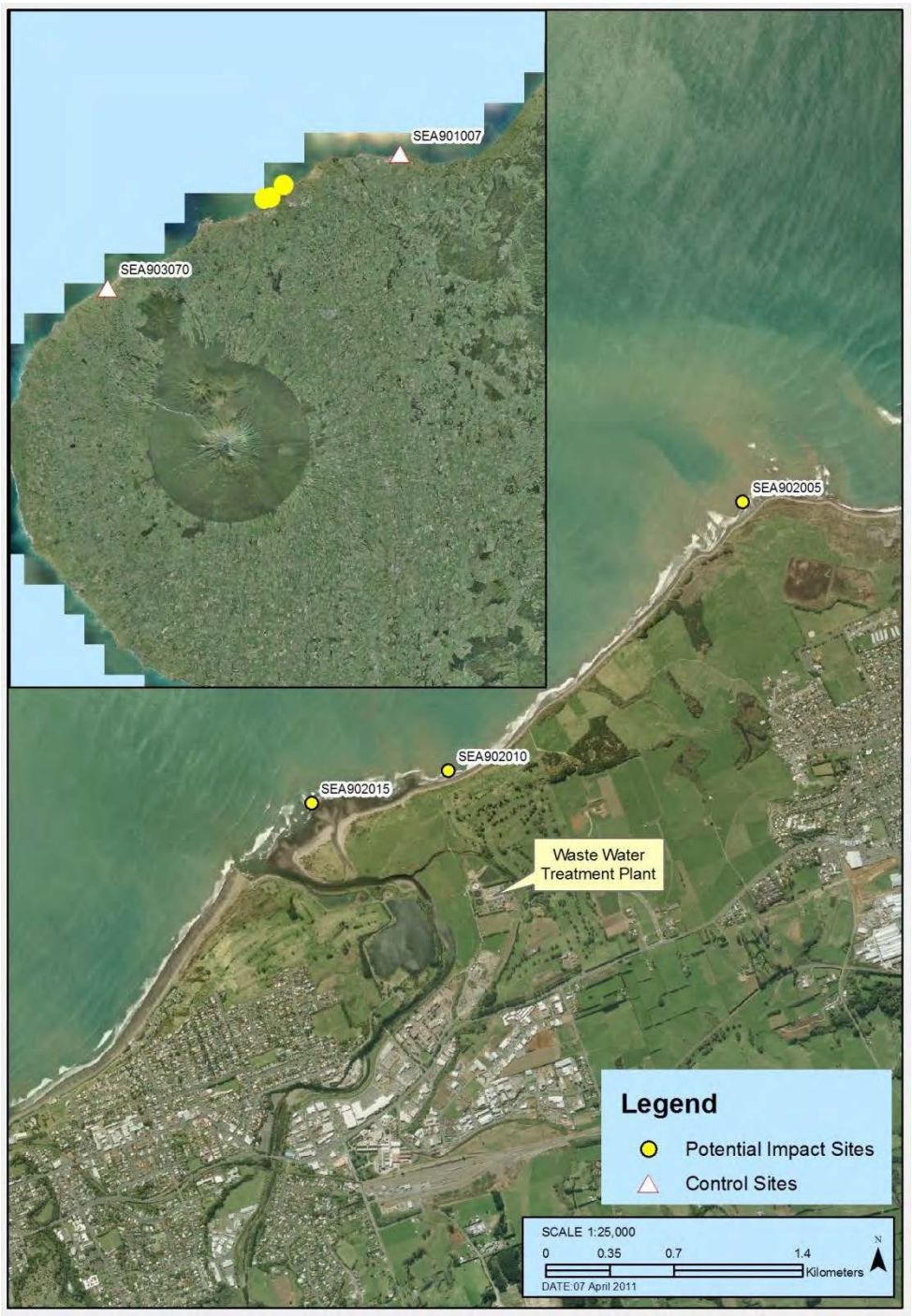


**Figure 14** Marine ecological survey sites for NPWWTP

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2016 survey. All sites showed increases in species number and diversity that were proportionate to decreases in their sand cover from the previous summer (Figures 15, 16 and 17). The one site that was not affected by sand, 500 m SW of the outfall, still showed an increase in species number and diversity from the previous summer. In addition, over the long term record, there has been no obvious decline in species richness or diversity at the potential impact sites relative to the control sites. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appear to remain the dominant drivers of species diversity at the sites surveyed.

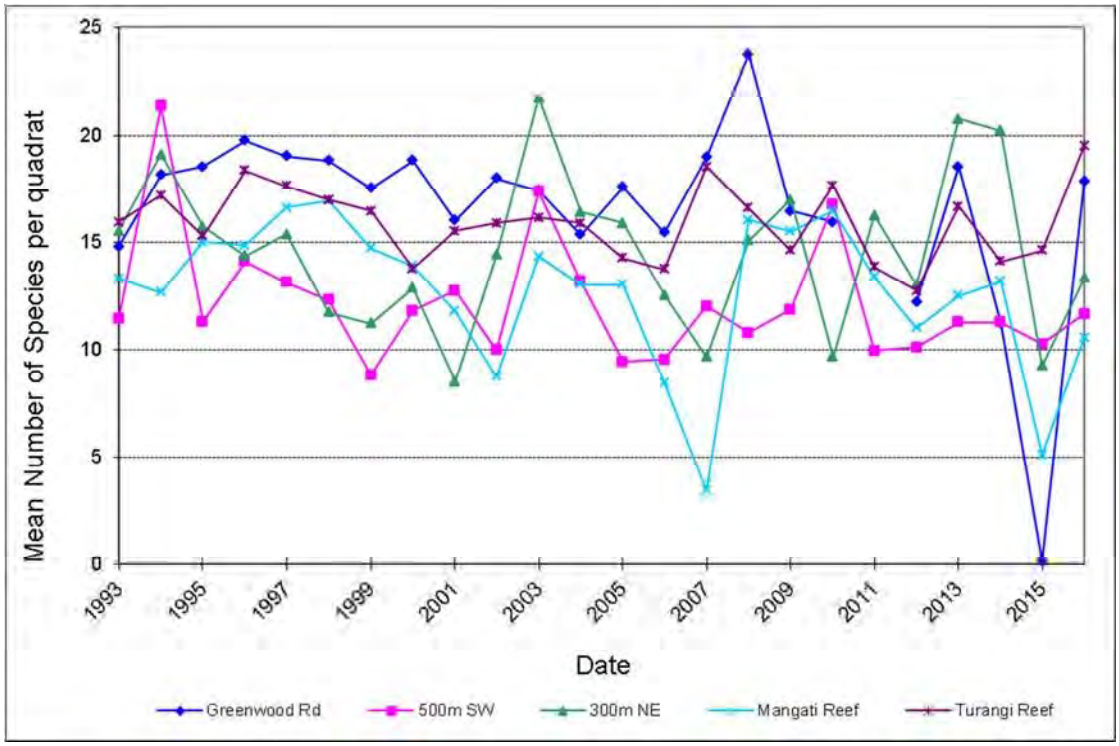


**Figure 15** Mean number of species per quadrat from 1993 to 2016

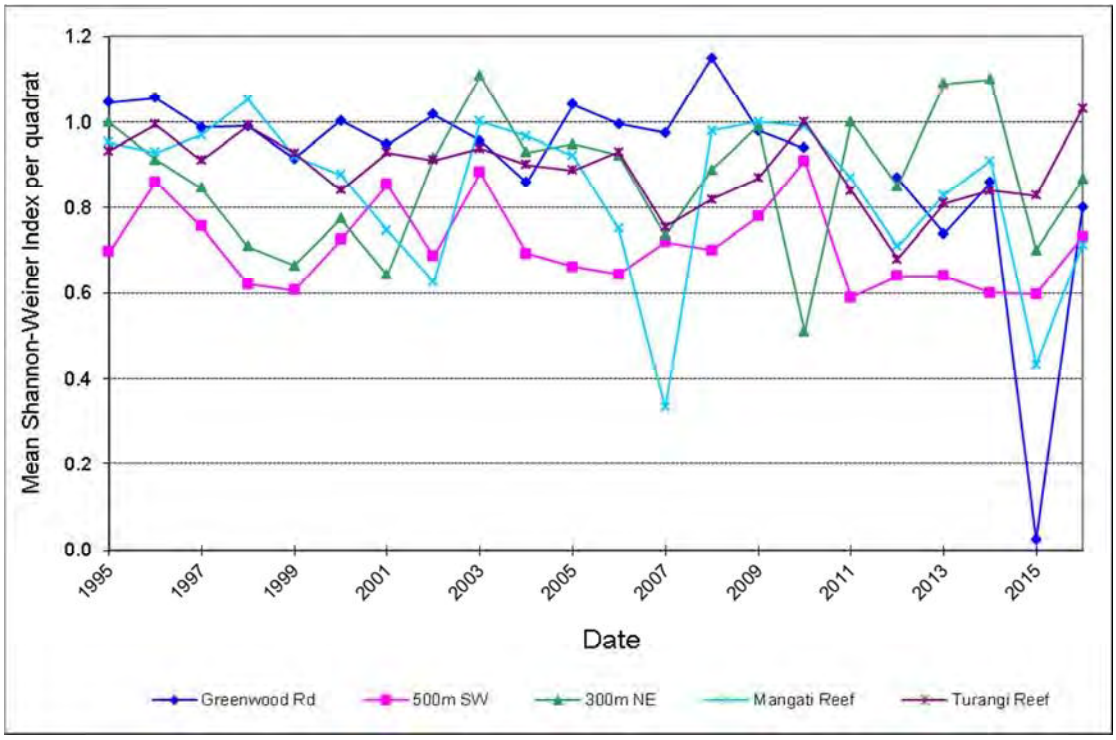


**Figure 16** Mean Shannon-Weiner index per quadrat from 1995 to 2016

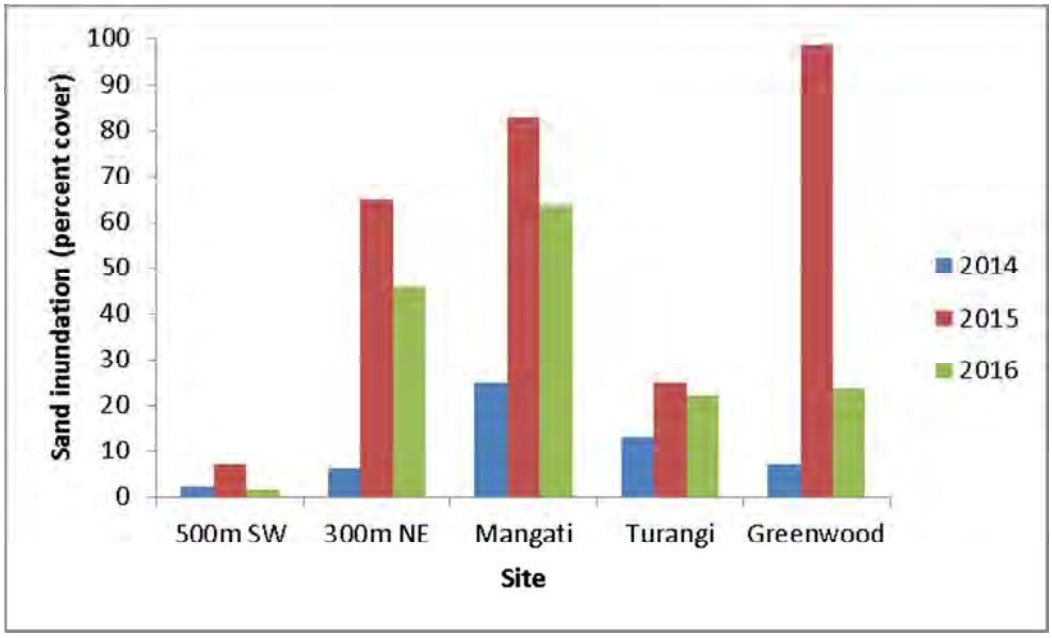


**Figure 17** Mean percentage of sand cover at the five sites in during the last three summer surveys

A full copy of the marine ecological survey report, including a comprehensive analysis and interpretation of results, is provided in Appendix V.

### 2.1.5 Shellfish monitoring

#### 2.1.5.1 Metals in mussel flesh

Mussels can accumulate contaminants in their tissues over time. As a consequence, they can be used as bio-monitors to assess the contaminant load at a particular site. Naturally occurring green lipped mussel were collected from three low shore sites. In order of influence from the NPWWTP outfall discharge the sites sampled were: Waiwhakaiho Reef (SEA902015), Bell Block (SEA902001) and Arakaitai Reef (SEA902040). All sites supported scattered mussel populations.

Each sample was depurated (mussels were placed in filtered seawater for a period of time to allow the elimination of waste products from the gut). The concentrations of heavy metals in the mussel tissue are presented in Table 6.

**Table 6** Heavy metal contaminants in green lipped mussel flesh and guideline maximum limits

| Parameter | Units | Site | | | Shellfish guideline maximum limit* |
|---|---|---|---|---|---|
| | | Arakaitai Reef | Waiwhakaiho Reef | Bell Block | |
| Silver | mg/kg | <0.010 | <0.010 | <0.010 | - |
| Cadmium | mg/kg | 0.023 | 0.025 | 0.028 | **2.0** |
| Chromium | mg/kg | 0.08 | 0.13 | 0.07 | - |
| Copper | mg/kg | 1.1 | 0.94 | 0.79 | - |
| Mercury | mg/kg | <0.010 | <0.010 | <0.010 | **0.5** |
| Nickel | mg/kg | 0.18 | 0.2 | 0.17 | - |
| Lead | mg/kg | 0.047 | 0.043 | 0.047 | **2.0** |
| Zinc | mg/kg | 7.3 | 9.8 | 6.5 | - |

**Australia New Zealand Food Standards Code, 2016*

Mercury, cadmium and lead concentrations in mussel flesh from all three sites (Table 6) were well below Australia New Zealand Food Standards Code guidelines (2016). Although no guidelines exist for the remaining metals, these results are within the range of previous concentrations found during NPWWTP shellfish surveys (Appendix VI). The two metals found in highest concentrations at all three sites were zinc and copper (Figures 16 and 17).

The results collected since 1993 (Appendix VI) indicate that, over the long term, median concentrations of cadmium, copper, nickel, lead and zinc in mussel flesh are the greatest at the site closest to the outfall; Waiwhakaiho Reef. However, the differences in concentrations between sites have typically been minor.

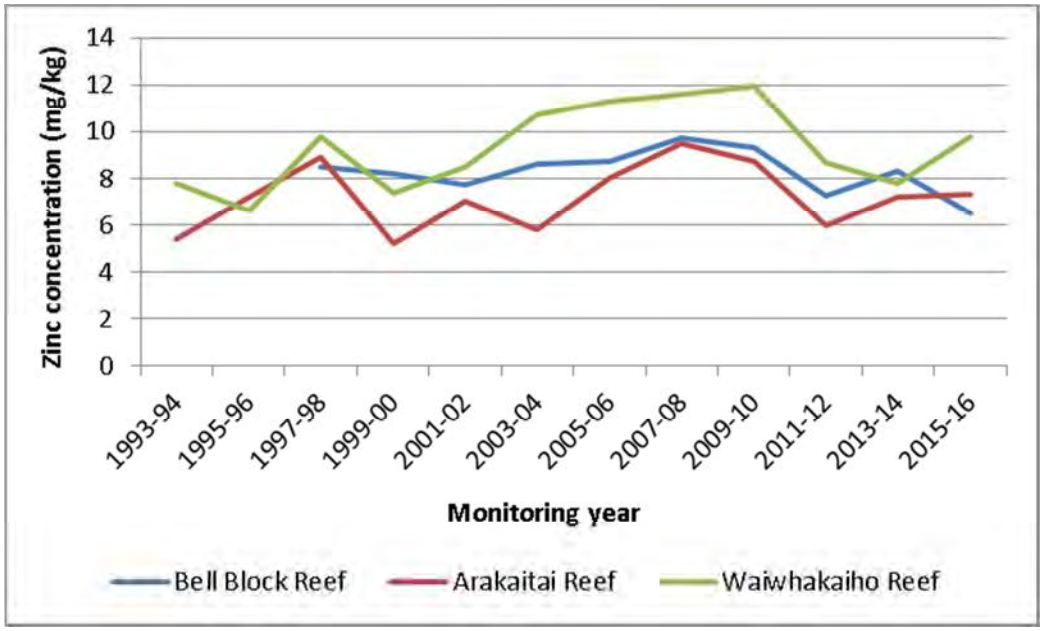


**Figure 18** Concentration of zinc in mussel tissues collected from the three reef sites

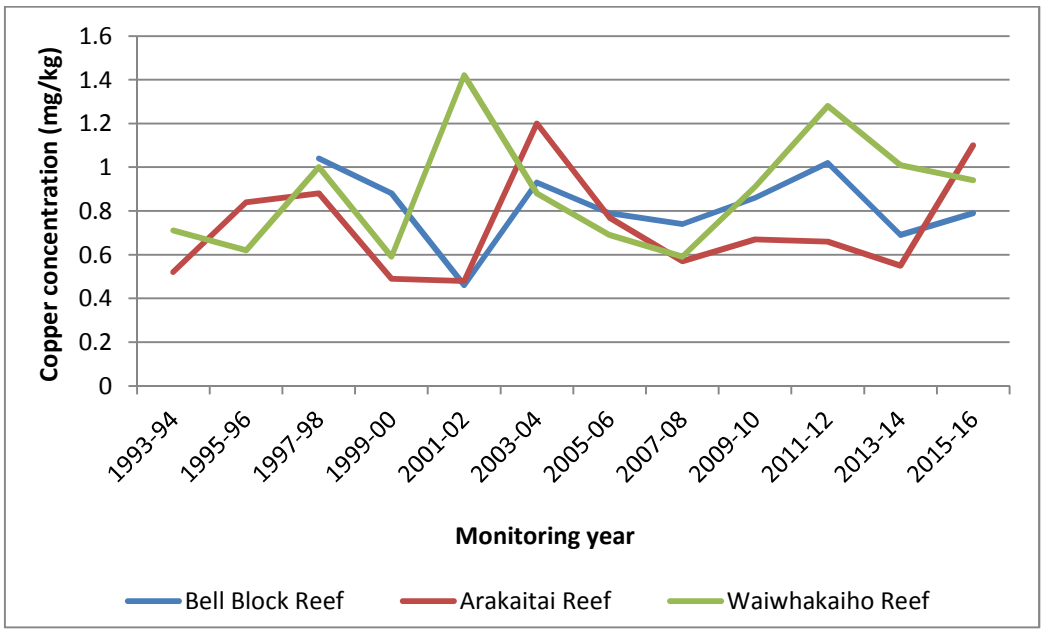


**Figure 19** Concentration of copper in mussel tissues collected from the three reef sites

#### 2.1.5.2 Norovirus in shellfish flesh

In waters affected by discharges from wastewater treatment plants the relationship between indicators and pathogens can be altered by the wastewater treatment process. Currently, it is norovirus that are believed to pose the greatest health risk in seawater containing treated wastewater. Norovirus are the main cause of gastroenteritis associated with shellfish consumption and only low concentrations are required to pose a high risk of infections in humans. Mussels and other filter feeding molluscs are efficient at concentrating norovirus which can be retained in their flesh for up to 8-10 weeks.

As a requirement of condition 13, consent 0882-4, a Quantitative Microbial Risk Assessment (QMRA) was completed which assesses the human health effects associated with norovirus in wastewater discharges from the NPWWTP (McBride, 2012).

In conjunction with the QMRA and as a requirement of condition 14, consent 0882-4, monitoring of microbial contamination within shellfish was implemented within the consent compliance monitoring programme for the NPWWTP. Mussel flesh has been monitored for norovirus (GI and GII) at two potential impact sites (Waiwhakaiho Reef and Bell Block) since October 2012. A control site (Oakura) was also monitored initially; however this has since been discontinued as it was decided that a control site was not required for interpretation of the results. Norovirus (GI and GII) concentrations were also measured within the NPWWTP influent and effluent (see Section 2.1.3.3).

**Table 7** Mussel flesh microbiology results since the NPWWTP upgrade

| Operation | Date | Site | Mussel flesh norovirus | |
|---|---|---|---|---|
| | | | GI | GII |
| Normal: Pre-Upgrade | 5 October 2012 | Waiwhakaiho Reef | Negative | Negative |
| | | Bell Block | Negative | Low |
| | | Oakura | Negative | Negative |
| Upgrade: Bypass | 20 August 2013 | Waiwhakaiho Reef | Moderate | Extremely high |
| | | Bell Block | Low | Moderate |
| | | Oakura | Negative | Low |
| Normal: Post-upgrade | 15 June 2014 | Waiwhakaiho Reef | Low | Negative |
| | | Bell Block | Negative | Low |
| | 20 April 2015 | Waiwhakaiho Reef | Negative | Low |
| | | Bell Block | Negative | Negative |
| | | Oakura | Negative | Negative |
| | 6 April 2016 | Waiwhakaiho Reef | Negative | Negative |
| | | Bell Block | Negative | Negative |

Following the completion of the upgrade, norovirus levels in mussel flesh dropped back to low or below detection levels (on 15 June 2014; Table 6). Results from this monitoring period found that norovirus levels in mussels collected from both sites were below detection limits (6 April 2016). However, due to the highly infectious nature of norovirus, with only low concentrations posing a high risk of illness, shellfish warning signs remain in place at the Waiwhakaiho area and Bell Block (Photograph 3).


**Photograph 1** Shellfish health warning sign at the Waiwhakaiho River mouth

**Photograph 2** Green lipped mussels at Bell Block

## 2.2 Air

### 2.2.1 Inspections

Air inspections were undertaken in conjunction with the five scheduled site inspections. Odours ranging from slight to moderate were often detected downwind of the milliscreening building and sludge processing area. No odours were noted beyond the plant boundary on any occasion.

## 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 NPDC. 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 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 2015-2016 period, the Council was required to undertake significant additional investigations and interventions, record incidents, in association with the Company's conditions in resource consents and provisions in Regional Plans. Over the year in review there were a total of 24 incidents which resulted in discharges from the wastewater network to water ways during the year. Eleven incidents related to pipe blockages/breakages, 6 were related to high rainfall events, two events related to power failure and the remainder results were a result of mechanical failures. Four 14 day letters were issued in association with incidents, all associated with unauthorised discharges in the Waitara area. One infringement notice was issued in relation to an overflow from the Waitara Outfall Sewage Pump Station on 13 February 2016 which occurred during dry weather conditions as a result of human error. One abatement notice was issued in relation to a failure of a gasket on a joining gibault on the Waitara to New Plymouth pipeline which occurred during dry weather conditions on 28 March 2016.

For the purpose of discussion, incidents have been separated into those directly associated with the NPWWTP, sewage pump station incidents and reticulation overflows.

### 2.3.1 New Plymouth Wastewater Treatment Plant incidents

Three incidents were reported from the NPWWTP during the 2015-2016 year (Table 8). Two of these incidents resulted from equipment failures which meant that the

minimum chlorine concentration in the effluent (0.3 g/m$^3$) could not be met. Both incidents were non-compliant with consent 0882-4, however corrective actions were taken by NPDC and therefore the Council was not required to take any further action. The other incident was also due to equipment failure. As a result, the effluent discharge exceeded the limit for suspended solids (25 g/m$^3$). However, this exceedance remained compliant with consent 0882-4 as up to 5% of samples can breach the limit before non-compliance is triggered.

**Table 8** Summary of incidents at the NPWWTP during the 2015-2016 monitoring year

| Date | Incident type | Incident details | Corrective actions taken by NPDC | Council action |
|---|---|---|---|---|
| 29/07/2015 | Unauthorised discharge | Electrical motor fault resulting in equipment failure causing wastewater overflow. | Fault found and process restored to ensure suspended solids levels below the required limits. The motor was replaced and checked. | No further action |
| 30/08/2015 | Non-compliance | A cracked pipe coupling allowed chlorine to leak from storage, resulting in being unable to achieve required dose. This caused the chlorine to fall below required limit in the discharged effluent. | Failed pipe fitting was repaired. Pipes had been renewed within the last five years so condition of pipes to be monitored to ensure no ongoing issues. | No further action |
| 21/09/2015 | Non-compliance | Fault caused by failure of PLC card resulted in the chlorine falling below required limit in the discharged effluent. | Immediate response: manual override of the system was initiated to ensure chlorine level was above required limits.<br>Corrective action: PLC card was replaced. | No further action |

### 2.3.2 Sewage pump station incidents

Sewage pump station discharges reported during the 2015-2016 monitoring year are summarized in Table 9. Of particular concern to the Council were the four unauthorized discharges that occurred in the Waitara area.

The sewage overflow which commenced from the Waitara Sewage Pump Station and discharged from the Waitara Marine Outfall on 13 February 2016 during dry weather conditions did not trigger the alarm system. The Council, the Taranaki District Health Board and the general public did not receive notification of the incident until 15 February; 48 hours after the discharge had first started. Given the late notification no meaningful environmental assessment could be undertaken by the Council. The Council issued two 14 day letters in order to determine the factors which resulted in this discharge. It became apparent the error with the alarm system had resulted from a human error associated with programming. An infringement notice was issued.

On 26 March 2016 the Council received notification from NPDC that a sewage discharge had occurred from the Waitara to New Plymouth wastewater reticulation system at the crossing point of the Waiongana Stream, Waitara. Investigation found that a gasket at a joint in the wastewater reticulation line had failed resulting in untreated effluent discharging onto the bank immediately adjacent to the Waiongana Stream. The discharge was contained and directed into storage and then trucked to the carousal treatment plant. A meeting was held with NPDC staff to discuss the repairs and monitoring of the line. Further information regarding the circumstances that lead to the incident was requested via a 14 day letter. An abatement notice was issued that required NPDC to undertake an investigation of the NPDC waste water reticulation system between the Waitara pump station and the New Plymouth carousel plant to

assess the integrity of the system. NPDC were required to produce a report to the Council confirming that an investigation had been undertaken, outlining any upgrades required to ensure the long term integrity of the system. The report was received from NPDC on 29 June 2016. The Council undertook additional monitoring of the receiving environment which included analysis of *E. coli* concentration in samples taken from seven sites (upstream of the discharge, down stream of the discharge and in connecting tributaries) on three different dates (26 March, 30 March and 29 April 2016). From the *E. coli* results it was not possible to detect human sewage contamination above background counts caused by faecal contamination from other animals. Due to potential health risks associated with sewage contamination signs were erected to warm the public and mussels were tested for norovirus once the signs were taken down (results presented below).

On 31 March 2016 the Council received notification from NPDC that a sewage discharge had occurred from the Waitara Marine Outfall overnight starting on 30 March. No alarms were activated. An explanation was received from New Plymouth District Council (NPDC), which outlined that the discharge occurred because a circuit breaker, which supplies mains power to the uninterruptable power supply, had tripped. Investigations undertaken by NPDC could find no reason why the circuit breaker had tripped. A review of the backup power supplies identified that two circuit supplies are required rather than one. This has been implemented.

Monitoring for norovirus contamination of mussels flesh was undertaken at the Waiongana River mouth, Orapa Reef and Tioma/Airedale Reef on 8 May 2016 after the shellfish signs had been taken down following the three wastewater discharges in the Waitara area. Norovirus (GI and GII) was not detected in mussels collected from all three reef sites.

On 21 May 2016 the Council received notification from NPDC that a sewage overflow had occurred from the Richmond Street Sewage Pump Station into the Waitara River. A letter of explanation was received, outlining that an investigation undertaken by NPDC found that there was no evidence that sewage had entered the Waitara River directly, rather that sewage had likely discharged into a previously redundant soakage field. No further action was taken.

Other overflows that occurred from sewage pump stations during the 2015-2016 year are outlined in Table 9.

**Table 9** Summary of pump station overflows during the 2015-2016 year

| Date | Physical location | Incident details | Corrective actions taken by NPDC | Council action |
|---|---|---|---|---|
| 13/02/2016 | Waitara Outfall SPS | Both milliscreens at the Waitara Transfer Pump Station failed and the monitoring equipment to page the alarms to the Duty Operator also failed, resulting in an overflow to Waitara Outfall SPS and the sea. | Fault was found and equipment replaced/restored. Alarms were reconfigured to ensure Duty Operator would be paged if this fault occurred. Also installed a return pump at Waitara Outfall SPS to enable any overflow to be pumped back into reticulation (not out to sea). | 14 day letter x2; Infringement Notice |
| 18/03/2016 | Ngamotu Beach SPS | High rainfall event causing wastewater overflow. | Checked site and reset pumps. | No further action |
| 28/03/2016 | 217 Brown Road, Waitara (Waiongana | Failure of a gasket on a joining gibault on the Waitara to NP pipeline. | Sewer discharge contained onsite until repairs could be carried out. Parts located overseas and repair | 14 day letter; Abatement Notice |

| Date | Physical location | Incident details | Corrective actions taken by NPDC | Council action |
|---|---|---|---|---|
| | River) | | completed once parts arrived.<br>Report on pipe line integrity as part of abatement notice. | |
| 31/03/2016 | Waitara Outfall SPS | Power outage resulted in Waitara Transfer Pump failure causing wastewater overflow to Waitara Outfall SPS and the sea. | Power restored & pumps reset.<br>Review of IRP to specifically include Waitara Outfall incident response.<br>Review of warning sign locations. | No further action |
| 18/07/2015 | Ngamotu Beach SPS | High rainfall event causing wastewater overflow from the pump station. | Checked site and reset pumps. | No further action |
| 18/07/2015 | East Quay SPS | High rainfall event causing wastewater overflow from the pump station. | Checked site and reset pumps. | No further action |
| 18/01/2016 | Ngamotu Beach SPS | High rainfall event causing wastewater overflow from the pump station. | Checked site and reset pumps. | No further action |
| 21/05/2016 | Richmond Street SPS | High rainfall event causing wastewater overflow. | Checked site and reset pumps and manually drained wet well. The float which generates the overflow alarm was reset and raised to the correct level. Investigate if it is possible to gain more information on the level in the wet above 100%.<br>Investigation of overflow discharge route and updating of as-built information. | 14 day letter |
| 8/06/2016 | Bell Block SPS | Power outage resulted in pump failure causing wastewater overflow from the pump station. | Checked site and reset pumps. Upon investigation it was found it was a planned outage, however PowerCo did not advise retailer who in turn did not advise NPDC.<br>External and internal process for notification of power outages have been reviewed. | No further action |

### 2.3.3 Reticulation overflow incidents

Twelve unauthorised discharges occurred due to blockages or pipe breakage in the reticulation (Table 10). Pipe blockages were usually related to a build-up of fat in the line, or as a result of tree roots. All incidents were responded to as defined in the Incident Response Plan and no further action was required.

**Table 10** Summary of reticulation overflows during the 2015-2016 year

| Date | Physical location | Incident details | Corrective actions taken by NPDC | Council action |
|---|---|---|---|---|
| 18/03/2016 | 17 Brougham St, 3 Carrington Street | High rainfall event causing wastewater overflow from a manhole | Blockage cleared, site cleaned and sanitised. | No further action |
| 14/12/2015 | 32 Coby Sydney Drive, Bell Block | Sewer line blockage from fat caused an overflow of wastewater from a manhole. | Blockage cleared, site cleaned and sanitised. | No further action |
| 25/07/2015 | 20 Nash Street, New Plymouth | Sewer line blockage from fat caused an overflow of wastewater from a manhole | Damage fixed, site cleaned and sanitised | No further action |
| 29/07/2015 | 19 Pembroke Street, New Plymouth | Sewer line blockage from fat caused an overflow of wastewater from a manhole | Damage fixed, site cleaned and sanitised. | No further action |
| 17/08/2015 | 9 Hillside Crescent, New Plymouth | Sewer line blockage from fat caused an overflow of wastewater from a manhole | Blockage cleared, site cleaned and sanitised | No further action |
| 24/08/2015 | 15a Brougham | Sewer line blockage caused an | Blockage cleared, site cleaned and | No further action |

| Date | Physical location | Incident details | Corrective actions taken by NPDC | Council action |
|---|---|---|---|---|
| | Street, New Plymouth | overflow of wastewater from a manhole | sanitised | |
| 25/09/2015 | 48 Dillon Drive, Bell Block | Sewer line blockage from fat caused an overflow of wastewater from a manhole | Blockage cleared, site cleaned and sanitised | No further action |
| 8/09/2015 | 99 Glenpark Avenue | Sewer line blockage from tree roots caused an overflow of wastewater from a manhole | Blockage cleared, site cleaned and sanitised | No further action |
| 9/11/2015 | 42 Connett Road, Bell Block | Damaged pipe caused an overflow of wastewater from a manhole | Damage fixed, site cleaned and sanitised | No further action |
| 20/01/2016 | 5a Tavistock Street, New Plymouth | Third party damage to the sewer line caused an overflow of wastewater from a manhole | Blockage cleared, site cleaned and sanitised | No further action |
| 20/01/2016 | 80 Glenpark Avenue | Sewer line blockage caused an overflow of wastewater from a manhole | Blockage cleared, site cleaned and sanitised | No further action |
| 16/05/2016 | 917 South Road, New Plymouth | Blockage of Air Valve | Fat removed from Air Valve then clean up. No signs put out as overflow was isolated to road swale. Swale cleaned out by sucker truck then disinfected. | No further action |

# 3. Discussion

## 3.1 Discussion of plant performance

Maintenance was carried out on the sludge processing area during the 2015-2016 period. Major works were also undertaken in relation to electrical control systems. During these electrical works, mitigation measures were established to ensure wastewater treatment was maintained. No works required the adoption of the adjusted discharge limits prescribed by Condition 5 of consent 0882-4.

Condition 20 of consent 0882-4 requires that NPDC provide an annual report to the Council by 31 July each year. The report is to detail progress made towards reducing inflow and infiltration reduction; NPDC's target for reduction of inflow and infiltration; and works proposed to meet that target over the coming year. A report addressing these requirements for 2015-2016 was received.

The NPDC Sewer System Emergency Discharge Contingency Plan is incorporated into the Water and Waste Incident Response Plan (IRP). As required by condition 21 of consent 0882-4, the IRP was last reviewed in December 2015, and further updates to the wastewater section were completed in July 2016.

An annual meeting with representatives of the Council, Ngati Tawhirikura Hapu, and interested submitters is required by condition 22 of consent 0882-4. This meeting was held in December 2015. The invitation for the meeting was extended to interested parties (including those specified in consents) for both New Plymouth and Waitara wastewater treatment plant consents. NPDC provided an update on various matters including progress on a land disposal trial. The Council provided results from the first bacteriological water quality survey undertaken since redirecting Waitara's wastewater to the NPWWTP.

## 3.2 Environmental effects of exercise of consents

### 3.2.1 Effluent discharge to Tasman Sea

Two consents cover the discharge of treated wastewater from the plant to the Tasman Sea via the marine outfall. Consent 0882-4 allows the discharge of the wastewater through the marine outfall and consent 4593-2 licenses the presence of the outfall structure in the coastal marine area.

Monitoring of the wastewater discharge to the Tasman Sea during the 2015-2016 monitoring period consisted of both monitoring of the final wastewater composition prior to discharge, and monitoring of the effects of the discharge on the receiving environment.

Monitoring of the final wastewater prior to discharge was primarily undertaken by NPDC in the form of regular grab samples and 24-hour composite samples. Inter-laboratory comparisons and checks of compliance with consent conditions were also undertaken by the Council. NPDC achieved 100% compliance regarding contaminants as per Condition 3 of consent 0882-4. There were no breaches of the BOD limit prescribed by Condition 4. The suspended solids concentration limit was exceeded on one occasion, due to an electrical fault. This exceedance was not considered a breach of consent as the condition allows up to 5% of samples to breach the limit before non-

compliance is triggered. There were two instances during the monitoring period where the chlorine concentration breached the consent limit due to equipment failures. From influent to effluent, norovirus numbers were reduced by four orders of magnitude. Overall, monitoring results indicated that the effluent discharge from the NPWWTP to the Tasman Sea was of a high quality during the 2015-2016 year.

Monitoring of effects on the receiving environment consisted of an intertidal marine ecological survey and the analysis of metals and norovirus in mussel tissue. There were no significant detectable effects in the receiving environment resulting from authorised NPWWTP discharges during the 2015-2016 monitoring period.

### 3.2.2 Sludge lagoon and sludge disposal monitoring

NPDC holds consent 2982-4 which allows the discharge of leachate from the sludge stabilisation lagoon to groundwater.

Monitoring of the sludge lagoon facility during the 2015-2016 monitoring period consisted of monthly testing of groundwater bores and nearby surface water in an open drain by NPDC, and inspections by the Council.

The groundwater results from the three bores, along with the surface water results from the two drain sites indicated that seepage from the lagoon to groundwater and the drainage channel was occurring. In response to the elevated levels of different contaminants found in the groundwater and drain surrounding the lagoon, particularly nitrogen, it has been determined that additional monitoring is required. The following recommendations have been made with the overall intention of better understanding the groundwater flow paths and the potential for wider environmental impact.

The elevations of the sludge lagoon, peripheral drain and all monitoring wells require surveying in order to provide a reference against a common datum (sea level). Once the survey has been carried out, the information will allow for the assessment of hydraulic gradients and groundwater flow directions. Ultimately, these assessments will aid in understanding the movement of leachate from the lagoon.

It is proposed that the current sludge lagoon sampling regime be extended to include an existing two additional monitoring bores, as well as a third drain sampling site and biannual testing for metals in the samples collected at these sites. The two extra bores (located North West of the sludge lagoon) and additional drain site (to be located closer to the confluence with the Waiwhakaiho River) are necessary to sample in order to understand the effect of the leachate in the wider environment. Testing for metals in the surrounding surface water and ground water has been deemed necessary due to the nature of the plant's influent and the demonstrated potential for sludge contaminants to leach from the lagoon.

Finally, in order to better understand the interaction between leachate and groundwater processes, a quarterly sampling regime across all monitoring bores will be undertaken. This regime will employ low-flow sampling methodology with the intention of assessing the potential for attenuation of nitrogen species and microbes along the groundwater flow path. Again, these results will shed further light on the environmental effects caused by the leachate from the sludge lagoon.

The extended monthly sampling programme (including the biannual metals analyses) and additional quarterly sampling regime are to be undertaken as a 12 month investigation. The results from this investigation will be used to determine recommendations for potential work in the future.

### 3.2.3 Air discharge

NPDC holds consent 4740-2 that allows the discharge of contaminants into the air from sludge processing activities. NPDC have provided documentation on the design specifications, operation and maintenance of the biofilter intended for abatement of discharges to air from the sludge management processing facilities.

Assessments of the odour performance of the milliscreen and sludge filter buildings made during inspections at the NPWWTP site noted that odours ranged from slight to moderate. No odours were noted beyond the plant boundary on any occasion.

## 3.3 Evaluation of performance

A summary of NPDC's compliance record for the period under review is provided in Tables 11-15.

**Table 11** Summary of performance for Consent 0882-4

| **Purpose:** ***To discharge wastewater to the Tasman Sea*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Consent holder to adopt best practicable option to minimise environmental effects | Inspections, sampling, ecological surveys | Yes |
| 2. Maintenance of multiport diffuser system | Site inspections, NPDC annual report, operated as per design | Yes |
| 3. Concentration limits upon potential contaminants in discharge | Samples collected by both Council and consent holder: 100% compliance achieved | Yes |
| 4. Concentration limits upon suspended solids (SS) and BOD | Samples collected by both Council and consent holder: 95% compliance required, 99% and 100% compliance achieved for SS and BOD respectively | Yes |
| 5. Concentration limits upon SS and BOD when aeration basins off-line | Samples collected by both Council and consent holder | N/A |
| 6. Public notification prior to taking aeration basin off-line | Not exercised during 2014-2015 | N/A |
| 7. Minimum duration off-line to achieve purpose | Inspections, consultation with consent holder | N/A |
| 8. Notification to Council prior to taking aeration basins off-line | Notification received to take Bioreactor offline 7 May 2015 | N/A |
| 9. Consent holder to erect signage during off-line periods | Signs erected at Fitzroy Beach (two locations), Waiwhakaiho and Bell Block | N/A |

| Purpose: *To discharge wastewater to the Tasman Sea* | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 10. Total available chlorine at least 0.3 $gm^{-3}$ in effluent | Presence of chlorine in samples collected by both Council and consent holder: 99% compliance achieved | **No**<br>2 breaches - 99% compliance achieved |
| 11. Effluent through 3 mm screen | Inspections, consultation with consent holder | Yes |
| 12. Consent holder to undertake monitoring | Monitoring undertaken and results supplied | Yes |
| 13. Consent holder to submit a QMRA | Received December 2012 | Yes |
| 14. Consent holder to submit a monitoring plan | Received June 2013 | Yes |
| 15. Preparation of draft monitoring plan for consultation | Draft issued, consultation undertaken in April and June 2013 | Yes |
| 16. Peer review of monitoring plan | Received May 2013 | Yes |
| 17. Consent holder to provide comments received during consultation and peer review to Council | Received June 2013 | Yes |
| 18. Results of peer review of monitoring programme in 2017, 2022, 2027, 2032 and 2037 | Due March 2017 | N/A |
| 19. Provide Technology Report in March 2027 and 2037 | Due March 2027 | N/A |
| 20. Provide Annual Report by 31 July | Reports received for 2015-2016 | Yes |
| 21. Maintain Contingency Plan | Last comprehensive review of the Incident Response Plan undertaken December 2015, further updates made in July 2016 | Yes |
| 22. Annual meeting with Council, iwi and others | Meeting held on 8 December 2015 | Yes |
| 23. Meeting to include future management of wastewater | Next scheduled in 2027 | N/A |
| 24. Review of consent | Next scheduled in June 2017 | N/A |
| Overall assessment of consent compliance and environmental performance in respect of this consent<br>Overall assessment of administrative performance in respect of this consent | | **Good**<br>**High** |

N/A = not applicable

**Table 12** Summary of performance for Consent 1826-2

| **Purpose:** ***To erect, place and maintain a culvert*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Structure maintained to meet consent conditions | Inspections | Yes |
| 2. Instream maintenance work between November and April | No maintenance required | N/A |
| 3. Notification prior to maintenance work | No maintenance required | N/A |
| 4. Best practicable option during maintenance to avoid adverse effects on environments | No maintenance required | N/A |
| 5. Area and volume of streambed disturbance minimised during maintenance | No maintenance required | N/A |
| 6. No obstruction of fish passage | Inspections | Yes |
| 7. Removal and reinstatement | N/A | N/A |
| 8. Review of consent conditions | No further provision for review | 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

**Table 13** Summary of performance for Consent 2982-4

| **Purpose:** ***To discharge leachate from a sludge stabilisation lagoon to groundwater*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Monitoring of groundwater adjacent to lagoon | Monitoring undertaken by consent holder | Yes |
| 2. Monitoring of unnamed tributary of the Waiwhakaiho River | Monitoring undertaken by consent holder | Yes |
| 3. No direct discharge of contaminants to surface water from sludge lagoons | Inspections and results of monitoring | Yes |
| 4. No adverse effects upon ground or surface waters | Inspections and results of monitoring | **No**<br>Elevated concentrations of contaminants were found in the groundwater and surface water adjacent to the sludge lagoon |
| 5. Review of consent | No further provision for review | N/A |

| **Purpose:** ***To discharge leachate from a sludge stabilisation lagoon to groundwater*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| Overall assessment of consent compliance and environmental performance in respect of this consent<br>Overall assessment of administrative performance in respect of this consent | | **Improvement Required**<br>**High** |

N/A = not applicable

**Table 14** Summary of performance for Consent 4593-2

| **Purpose:** ***To erect, place, maintain and use a marine outfall*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Structures maintained | Inspections | Yes |
| 2. Notification prior to maintenance | No maintenance undertaken | N/A |
| 3. Measures to prevent disturbance | No maintenance undertaken | N/A |
| 4. Removal of structures when no longer required | N/A | N/A |
| 5. Review of consent conditions | No further provision for review | N/A |
| Overall assessment of consent compliance and environmental performance in respect of this consent<br>Overall assessment of administrative performance in respect of this consent | | **High**<br>**High** |

N/A = not applicable

**Table 15** Summary of performance for Consent 4740-2

| **Purpose:** ***To discharge contaminants to air*** | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 1. Best practicable option to prevent or minimise adverse effects | Inspections | Yes |
| 2. Operation and maintenance of sludge management processes | Inspections | Yes |
| 3. No odours beyond property boundary | Inspections | Yes |
| 4. Statement of how biofilters are maintained | Information received | Yes |
| 5. Preparation of contingency plan | Information received | Yes |
| 6. Plan and notification prior to removal of sludge from No. 2 lagoon | Not yet undertaken | N/A |

| Purpose: *To discharge contaminants to air* | | |
|---|---|---|
| **Condition requirement** | **Means of monitoring during period under review** | **Compliance achieved?** |
| 7. Review of consent | Next scheduled for June 2020 if required | 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

Over the year in review there were a total of 24 incidents which resulted in discharges from the wastewater network to water ways during the year. Four 14 day letters were issued in association with incidents, all associated with unauthorised discharges in the Waitara area. One infringement notice was issued in relation to an overflow from the Waitara Outfall Sewage Pump Station and one abatement notice was issued in relation to a failure of a gasket on the Waitara to New Plymouth pipeline.

Elevated concentrations of contaminants were found in the groundwater and surface water adjacent to the sludge lagoon. There were no other significant detectable effects in the receiving environment resulting from discharges from the plant.

During the year, NPDC demonstrated a level of environmental performance which required improvement and a high level of administrative performance with the resource consents as defined in Section 1.1.4.

## 3.4 Recommendations from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

1. THAT the monitoring programme for the NPWWTP in the 2015-2016 year remains unchanged from that of 2014-2015.

2. THAT monitoring of metals in mussel tissue at three sites will be included in the 2015-2016 monitoring programme.

These recommendations were implemented.

## 3.5 Alterations to monitoring programmes for 2016-2017

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
- to 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.

For the 2016-2017 year, monitoring of bacteriological shoreline water quality at five sites will be included in the monitoring programme. A survey is to be undertaken to determine the elevations of the sludge lagoon, peripheral drain and all monitoring wells. The monthly sludge lagoon monitoring regime is to be extended to include an additional two monitoring wells, an additional drain sampling site and biannual metals analyses. The Council is to collect samples from all monitoring wells on a quarterly basis using 'low-flow' methodology. Monitoring of metals in mussel tissue will not be included in the 2016-2017 programme. Recommendations to this effect are attached to this report.

## 3.6 Exercise of optional review of consent

Resource consent 0882-4 provides for an optional review of the consent in June 2017.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued.

# 4. Recommendations

1. THAT aside from monitoring related to the sludge lagoon, shoreline water quality and shellfish metals content, the monitoring programme for the NPWWTP in the 2016-2017 year remains unchanged from that of 2015-2016.

2. THAT a survey is undertaken to determine the elevations of the sludge lagoon, peripheral drain and all monitoring wells.

3. THAT the monthly sludge lagoon monitoring regime is extended to include an additional two monitoring wells, an additional drain sampling site and biannual metals analyses.

4. THAT all monitoring wells are sampled on a quarterly basis using 'low-flow' methodology.

5. THAT bacteriological shoreline water quality monitoring at five sites is included in the 2016-2017 monitoring programme.

6. THAT monitoring of metals in mussel tissue is next undertaken in the 2017-2018 year.

7. THAT the optional review of resource consent 0882-4 is not exercised in 2017.

# Glossary of common terms and abbreviations

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

| | |
|---|---|
| Ammoniacal-N | Both forms of ammonia; unionised and ionised ($NH_3$ and $NH_4$). |
| BOD | Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate. |
| Bund | A wall around a tank to contain its contents in the case of a leak. |
| COD | Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction. |
| DRP | Dissolved reactive phosphorous. |
| Enterococci | An indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units (CFU) per 100 millilitre of sample. |
| FAC | Free available chlorine. |
| Faecal coliforms | An indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units (CFU) per 100 millilitre sample. |
| g/m3 | 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. |
| Incident Register | 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. |
| 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. |
| L/s | Litres per second. |
| Oxidised-N | Total oxidised nitrogen; nitrite and nitrate ($NO_2$ and $NO_3$). |
| 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. |
| 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 including all subsequent amendments. |

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

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# Appendix I

# Resource consents held by NPDC

(For a copy of the signed resource consent
please contact the TRC Consents department)

# Coastal Permit

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

| | |
|---|---|
| Name of Consent Holder: | New Plymouth District Council<br>Private Bag 2025<br>NEW PLYMOUTH 4342 |
| Decision Date: | 15 November 2011 |
| Commencement Date: | 13 December 2011 |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge treated municipal wastewater from the New Plymouth wastewater treatment plant through a marine outfall structure into the Tasman Sea at or about (NZTM) 1696211E-5679248N |
| Expiry Date: | 1 June 2041 |
| Review Date(s): | June 2017, June 2022, June 2027, June 2032, June 2037 and/or within three months of the receipt of the Quantitative Microbial Risk Assessment required by condition 13 |
| Site Location: | Waiwhakaiho Marine Outfall, [approximate 450 metres offshore] |
| Catchment: | Tasman Sea<br>Waiwhakaiho |

## 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 to 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 discharge shall occur through a multiport diffuser system that ensures a minimum dilution of 13:1 at the sea surface at chart datum under dry weather discharge flow and calm sea conditions.

3. Constituents in the effluent discharged shall meet the standards shown in the table below.

| **Constituent** | **Standard** |
|---|---|
| Zinc | Concentration not greater than 0.2 $gm^{-3}$ |
| Chromium | Concentration not greater than 0.15 $gm^{-3}$ |
| Cadmium | Concentration not greater than 0.04 $gm^{-3}$ |
| Lead | Concentration not greater than 0.1 $gm^{-3}$ |
| Nickel | Concentration not greater than 0.15 $gm^{-3}$ |
| Copper | Concentration not greater than 0.1 $gm^{-3}$ |
| Mercury | Concentration not greater than 0.002 $gm^{-3}$ |
| Cyanide | Concentration not greater than 0.1 $gm^{-3}$ |
| Phenols[including chlorinated phenols] | Concentration not greater than 1.0 $gm^{-3}$ |

4. Subject to condition 5 below, at least 95% of effluent discharge samples shall meet the standards shown in the table below.

| **Constituent** | **Standard** |
|---|---|
| Suspended solids | Concentration not greater than 25 $gm^{-3}$ |
| 5-day Biochemical oxygen demand | Concentration not greater than 25 $gm^{-3}$ |

5. During:

   (a) two periods, occurring before 30 June 2015, during which one of the aeration basins is off-line while being upgraded; and

   (b) periods not exceeding 14 days, occurring no more than once per year, when one of the aeration basins is off-line for planned maintenance purposes;

Condition 4 shall not apply and samples shall instead meet the following standards:

| **Constituent** | **Standard** |
|---|---|
| Suspended solids | Concentration not greater than 110 $gm^{-3}$ |
| 5-day Biochemical oxygen demand | Concentration not greater than 130 $gm^{-3}$ |

6. The consent holder shall publicly notify its intention to exercise condition 5(a) at least five working days prior to taking an aeration basin off-line. The public notice shall detail the health and safety risks, reasons why the basin is being taken off line, and associated potential effects.

7. Notwithstanding any duration specified in condition 5 above, the periods when aeration basins are off-line shall be of the minimum duration necessary to achieve the purpose.

8. The consent holder shall give at least 30 working days notice to the Chief Executive, Taranaki Regional Council of the intention to take an aeration basin off-line. Notice shall be given by email to worknotification@trc.govt.nz and shall include:

   (a) The intended dates that the aeration basin will be offline; and

   (b) Documentation demonstrating the off-line period complies with the requirement to be the minimum necessary.

9. The consent holder shall erect and maintain signs for a period beginning on the date that an aeration basin goes off-line, as described in condition 5(a), and ending 14 days after the date that the off-line period ends. The signs shall advise the public of the discharge of sewage that has not been fully treated and inform them of the potential health risks, and are to be placed in a prominent location at:

   - Fitzroy Beach; and
   - Bell Block Beach.

10. The total available chlorine in the effluent, prior to entering the outfall pipe, shall be no less than 0.3 $gm^{-3}$.

11. All effluent discharged shall have passed through a screen with an aperture no more than 3 mm, except that during periods when the milli-screen is non-operational for maintenance purposes, effluent may pass through a screen with an aperture no more than 6 mm.

12. The consent holder shall undertake sampling and testing necessary to:

   (a) Determine compliance with the conditions of this consent; and

   (b) Characterise the effluent to the extent necessary to identify the nature and scale of its effects on the environment, during normal operation and at times when all the effluent is not being fully treated. In particular, monitoring must occur at times when an aeration basin is off-line, and be discussed at the annual meeting required by special condition 22.

Until the Monitoring Plan required by condition 14 is submitted to Taranaki Regional Council, monitoring will continue in accordance with the existing monitoring plan prepared under consent 0882-3.

13. Within one year of the commencement of this consent, the consent holder shall submit to the Chief Executive, Taranaki Regional Council a Quantitative Microbial Risk Assessment (QMRA) of the discharge under this consent (focusing primarily on bypass discharges).

14. Within six months of the provision of the QMRA under condition 13, the consent holder shall prepare, and submit to the Chief Executive, Taranaki Regional Council for certification, a 'Monitoring Plan' detailing the sampling, testing and measuring that will be undertaken to achieve compliance with condition 12. The Plan shall include, but not necessarily be limited to:

    (a) Details of the measuring and sampling to be undertaken including: sampling location, frequency and methodology; and

    (b) Documentation of how the measuring and sampling described in 14(a) above, adequately characterises the effluent at all times.

    As a minimum, the Monitoring Plan will require:

    (c) Monitoring of the effluent to determine compliance with conditions 3, 4 and 5;

    (d) Monitoring of ecology in the intertidal zone approximately adjacent to the point of discharge, with appropriate control sites; and

    (e) Monitoring of microbiological contamination within shellfish.

15. In preparing the Monitoring Plan, the consent holder shall issue a draft Monitoring Plan and then carry out reasonable consultation with the Department of Conservation, Ngati Tawhirikura Hapu and interested community groups, allowing at least one month for a response from those groups on the draft Plan.

16. Before submitting the Monitoring Plan to Taranaki Regional Council for certification, the consent holder shall have the Monitoring Plan peer reviewed by an independent, suitably qualified expert.

17. The consent holder shall provide any comments received from the Department of Conservation, Ngati Tawhirikura Hapu and interested community groups under condition 15, and the peer review under condition 16, to the Chief Executive, Taranaki Regional Council, at the time the final Monitoring Plan is submitted for certification under condition 14. In the event that the consent holder declines to adopt any recommendations provided by the peer reviewer under condition 16, the consent holder shall also provide, at the same time, its written reasons for declining to follow those recommendations.

18. By 31 March in the years 2017, 2022, 2027, 2032 and 2037, the consent holder shall provide to the Chief Executive, Taranaki Regional Council the results of a peer review of the Monitoring Plan by an independent, suitably qualified expert to ensure that the monitoring programme is still appropriate. The results of the peer review shall also be made publicly available. In the event that the consent holder declines to adopt any recommendations provided by the peer reviewer under this condition, the consent holder shall also provide, at the same time, its written reasons for declining to follow those recommendations.

19. By 31 March in the years 2027 and 2037, the consent holder shall provide to the Chief Executive, Taranaki Regional Council a Technology Report covering:

    (a) A summary of any improvements made to the reticulation, treatment or disposal system since the granting of this consent;

    (b) An outline of technological changes and advances in relation to wastewater management, treatment, disposal and technologies which may be available to address any residual adverse effects; and

    (c) An assessment of whether any such options or combination of options represent the Best Practicable Option to minimise the effects of the discharge and whether the consent holder intends to incorporate such changes.

    The Technology Report shall also be made publicly available. The Regional Council may obtain an independent peer review of the Technology Report, and may charge the consent holder for the actual and reasonable cost of obtaining this peer review.

20. By 31 July each year, the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report covering:

    (a) details of the progress made towards reducing inflow and infiltration reduction over the past year;

    (b) the consent holder's target for reduction of inflow and infiltration in the coming year; and

    (c) details of the works proposed in order to meet that target.

21. The consent holder shall maintain a Contingency Plan for the wastewater treatment plant site that shall be adhered to in the event of a spill or emergency. The Plan shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity and shall detail measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

22. At least once every year, the consent holder shall convene a meeting with representatives of the Taranaki Regional Council, Ngati Tawhirikura Hapu, and interested submitters on application 6803, to discuss any matter relating to the operation or monitoring of this consent.[1]

23. In the years 2027 and 2037, the consent holder shall use the meeting required by condition 22 as a means of collaborating with the community and stakeholders about the strategy for the future management of wastewater in New Plymouth district.

24. 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 within three months of the receipt of the QMRA required by condition 13 and/or during the month of June 2017 and/or June 2022 and/or June 2027 and/or June 2032 and/or June 2037 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. Reviews may also be undertaken at the dates listed above to enable the Taranaki Regional Council to deal with the consequences of the consent holder declining to accept the Peer Reviewer's recommendations under condition 18.

    **Advice note:** The consent holder intends to establish a collaborative approach with Maori to investigate a trial of land-based disposal of treated wastewater. The commencement of such a trial will be subject to the consent holder being satisfied that:

    (a) the owner(s) of land which has been offered for that purpose consent to its use for effluent disposal over the period of the trial and appropriate arrangements for its use are able to be satisfactorily resolved; and

    (b) the disposal is technically, economically and environmentally feasible (including addressing relevant RMA requirements).

Signed at Stratford on 13 December 2011

For and on behalf of
Taranaki Regional Council

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**Director-Resource Management**

[1] For the avoidance of doubt, this meeting can be combined with the annual meetings required under consents 7861-1 and 3397-2.

Consent 2982-4

# Discharge Permit

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

| | |
|---|---|
| Name of Consent Holder: | New Plymouth District Council<br>Private Bag 2025<br>NEW PLYMOUTH |
| Consent Granted Date: | 17 October 2002 |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge up to 60 cubic metres/day of leachate from a sludge stabilisation lagoon to groundwater in the vicinity of the Waiwhakaiho River at or about GR: P19:070-402 |
| Expiry Date: | 1 June 2020 |
| Review Date(s): | June 2008, June 2014 |
| Site Location: | New Plymouth Wastewater Treatment Plant, Rifle Range Road, New Plymouth |
| Legal Description: | Pt Sec 224 SO 11937 Hua Dist Blk II Paritiutu SD |
| Catchment: | Waiwhakaiho |

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

**General conditions**

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), 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 consent holder, in conjunction with the Taranaki Regional Council, shall monitor the groundwater adjacent to the lagoon. The number of monitoring sites, the parameters to be monitored and the frequency of the monitoring shall be to the satisfaction of the Chief Executive, Taranaki Regional Council.

2. The consent holder, in conjunction with the Taranaki Regional Council, shall monitor the surface water in the small open drain [an unnamed tributary of the Waiwhakaiho River] located adjacent to the northern and eastern boundary of the lagoon. The number of sites, the parameters to be monitored and the frequency of the monitoring shall be to the satisfaction of the Chief executive, Taranaki Regional Council.

3. The exercise of this consent shall not lead to a direct discharge of contaminants from the sludge stabilisation lagoon to any other surface water body.

4. That the exercise of this consent shall not result in any adverse impacts to groundwaters and surface waters such that the suitability of those waters for any use is changed as determined by the Chief Executive, Taranaki Regional Council.

5. 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 2008 and/or June 2014, 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 17 October 2002

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: | New Plymouth District Council<br>Private Bag 2025<br>NEW PLYMOUTH 4342 |
| Consent Granted Date: | 29 May 2008 |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To discharge contaminants into the air from sludge drying and processing activities at the New Plymouth Wastewater Treatment Plant at or about (NZTM) 1697041E-5678313N |
| Expiry Date: | 1 June 2026 |
| Review Date(s): | June 2014, June 2020 |
| Site Location: | Rifle Range Road, New Plymouth |
| Legal Description: | Secs 5-6 So 314271 Pt Sec 224 Hua Dist Blk II Paritutu SD |

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

## 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 condition 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 actual or likely adverse effect on the environment associated with the discharges into air from sludge management processing activities and facilities on the site.

2. That the consent holder shall at all times operate, maintain, supervise, monitor and control all sludge management processes (including but not limited to associated emission treatment processes) so that discharges authorised by this consent are maintained at a practicable minimum.

3. That the discharges authorised by this consent shall not give rise to any odours that are offensive or objectionable at or beyond any boundaries of the property.

4. Without restricting the generality of condition 1, the consent holder shall supply a statement of how the biofilters are maintained, operated, and monitored, to give effect to condition 1. This statement shall be provided to the Chief Executive, Taranaki Regional Council, within six months of the granting of the consent.

5. The consent holder shall prepare a contingency plan addressing events at the New Plymouth Waste Water Treatment Plant that could give rise to abnormal odour release potential, and the procedures the consent holder would adopt to deal with any such event. This contingency plan shall be provided to the Chief Executive, Taranaki Regional Council, within six months of the granting of the consent. The contingency plan shall subsequently be reviewed at intervals not exceeding two years.

6. Prior to undertaking processing of, including removal of, sludge from No. 2 lagoon, the consent holder shall submit a plan, for approval by the Chief Executive, Taranaki Regional Council [such approval not to be unreasonably withheld], describing the methodology proposed for sludge recovery from the lagoon and measures proposed for mitigation of odours and any off-site effects of odours, during the recovery activity, demonstrating the capability to satisfy the conditions of this consent. The consent holder shall notify the Council at least 72 hours prior to any processing/removal activity, including associated recovery of sludge, before undertaking removal. Notification shall be emailed to worknotification@trc.govt.nz.

7. 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.

Signed at Stratford on 29 May 2008

For and on behalf of
Taranaki Regional Council

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**Director-Resource Management**

TRK964593

# COASTAL PERMIT

**Pursuant to the RESOURCE MANAGEMENT ACT 1991
a resource consent is hereby granted by the
Taranaki Regional Council**

Name of Consent Holder: NEW PLYMOUTH DISTRICT COUNCIL
PRIVATE BAG 2025 NEW PLYMOUTH

Renewal
Granted Date: 24 July 1996

## CONDITIONS OF CONSENT

Consent Granted: TO ERECT, PLACE, MAINTAIN AND USE A MARINE OUTFALL WITHIN THE COASTAL MARINE AREA AS PART OF THE NEW PLYMOUTH WASTEWATER TREATMENT SYSTEM AT OR ABOUT GR: P19:063-410

Expiry Date: 1 June 2014

Review Date[s]: June 2002 and June 2008

Site Location: 450 METRES OFFSHORE FROM THE WAIWHAKAIHO RIVER MOUTH

Legal Description: 450 METRES OFFSHORE FROM THE WAIWHAKAIHO RIVER MOUTH

Catchment: TASMAN SEA 902.000

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

TRK964593

**GENERAL CONDITIONS**

(a)That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

(b)That 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)That 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;
(ii)charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii)charges authorised by regulations.

SPECIAL CONDITIONS

1.THAT the consent holder shall maintain the structures to the satisfaction of the General Manager, Taranaki Regional Council.

2.THAT the consent holder shall notify the Taranaki Regional Council at least seven days prior to undertaking any programmed maintenance works.

3.THAT the consent holder shall ensure that all practicable measures are undertaken to prevent undue disturbance of intertidal reefs and marine life in the area during maintenance of the structures licensed by this consent, to the satisfaction of the General Manager, Taranaki Regional Council.

4.THAT the consent holder shall remove structures licensed by this consent, to the satisfaction of the General Manager, Taranaki Regional Council, when these structures become no longer necessary.

5.THAT the Taranaki Regional Council may review any or all of the conditions of this consent, by giving notice of review during June 2002 and/or June 2008 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 consent.

Signed at Stratford on 24 July 1996

For and on behalf of
TARANAKI REGIONAL COUNCIL

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OPERATIONS MANAGER

Consent 1826-2

# Land Use Consent

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

| | |
|---|---|
| Name of Consent Holder: | New Plymouth District Council<br>Private Bag 2025<br>NEW PLYMOUTH |
| Consent Granted Date: | 16 January 2002 |

## Conditions of Consent

| | |
|---|---|
| Consent Granted: | To erect, place, use and maintain a twin box culvert on the Mangaone Stream for road access purposes at or about GR: P19:069-400 |
| Expiry Date: | 1 June 2020 |
| Review Date(s): | June 2008, June 2014 |
| Site Location: | Mangaone Stream, Rifle Range Road, New Plymouth |
| Legal Description: | Pt Sec 161,138 & Lot 1 DP 12331 Hua Dist |
| Catchment: | Waiwhakaiho |
| Tributary: | Mangaone |

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

**General conditions**

a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) That 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) That 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 structure[s] authorised by this consent shall be maintained to ensure the conditions of this consent are met.

2. Any instream maintenance works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

3. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to and upon completion of any maintenance works which would involve disturbance of or deposition to the streambed or discharges to water.

4. During any maintenance of the structure[s] authorised by this consent, the consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the streambed and to avoid or minimise the disturbance of the streambed and any adverse effects on water quality.

5. During any maintenance of the structure[s] authorised by this consent, the consent holder shall ensure that the area and volume of streambed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

6. The structure[s], which are the subject of this consent, shall not obstruct fish passage.

7. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.

8. 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 2008 and/or June 2014, 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 16 January 2002

For and on behalf of
Taranaki Regional Council

_____

**Director-Resource Management**

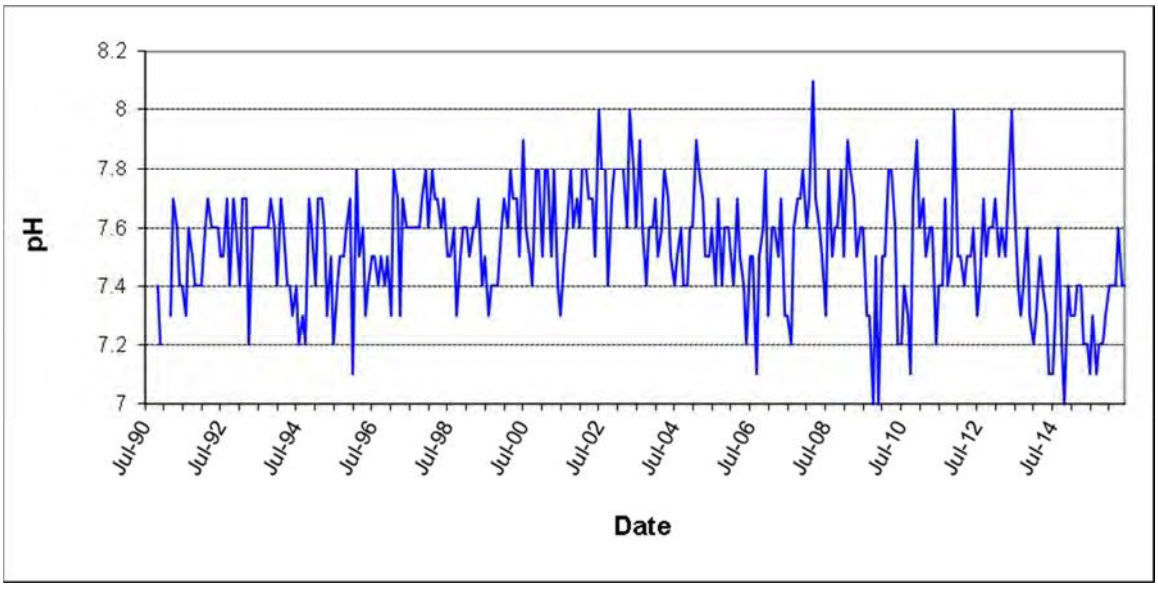
# Appendix II

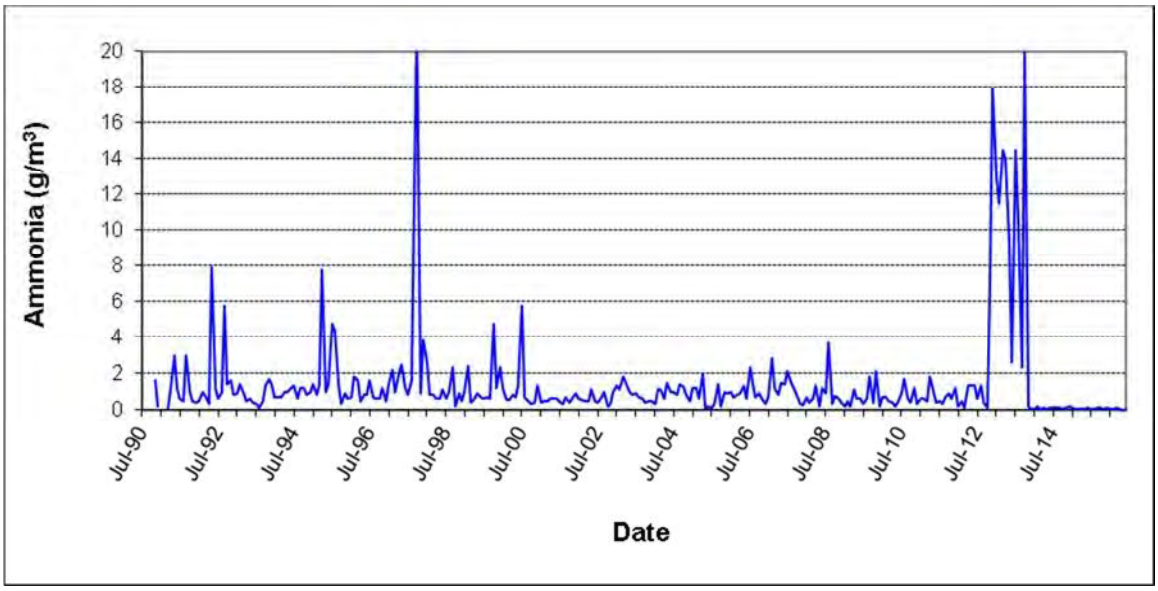
# Results of monthly composite effluent monitoring 2015-2016

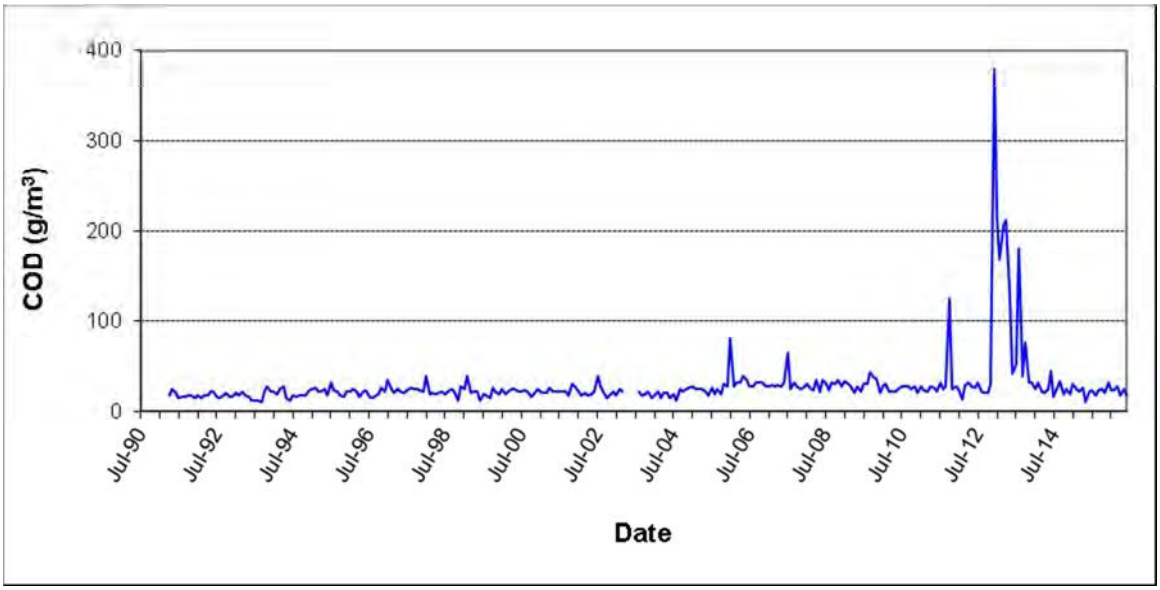
| Results from monthly effluent composite samples (2015-2016) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **pH** | **Ammoniacal - N** ($g/m^3$) | **COD** ($g/m^3$) | **NOx** ($g/m^3$) | **RDP** ($g/m^3$) | **Cyanide** ($g/m^3$) | **Phenols** ($g/m^3$) | **Zinc** ($g/m^3$) | **Copper** ($g/m^3$) | **Chromium** ($g/m^3$) | **Nickel** ($g/m^3$) | **Cadmium** ($g/m^3$) | **Lead** ($g/m^3$) | **Mercury** ($g/m^3$) |
| **Jul** | 7.1 | <0.1 | 23 | 7.5 | <0.05 | <0.02 | <0.05 | <0.021 | <0.011 | <0.011 | <0.011 | <0.0011 | <0.0021 | <0.0021 |
| **Aug** | 7.3 | <0.1 | 17 | 7.9 | 0.14 | <0.02 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Sep** | 7.1 | 0.1 | 23 | 6.8 | 0.12 | <0.02 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Oct** | 7.2 | 0.1 | 24 | 6.7 | 0.09 | 0.024 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Nov** | 7.2 | <0.1 | 20 | 7.7 | 1.5 | <0.02 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Dec** | 7.3 | 0.12 | 31 | 7 | 1.5 | 0.03 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Jan** | 7.4 | <0.1 | 23 | 6.2 | 0.1 | <0.02 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Feb** | 7.4 | <0.1 | 23 | 6.2 | 0.12 | <0.02 | <0.05 | 0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Mar** | 7.4 | 0.1 | 28 | 6.5 | 0.51 | <0.02 | 0.15 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Apr** | 7.6 | <0.1 | 17 | 6.4 | 0.12 | 0.02 | <0.05 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **May** | 7.4 | 0.083 | 25 | 8.6 | 0.09 | 0.02 | 0.05 | 0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |
| **Jun** | 7.4 | <0.1 | 18 | 7.2 | 0.13 | <0.02 | 0.17 | <0.04 | <0.02 | <0.02 | <0.008 | <0.002 | <0.03 | <0.001 |

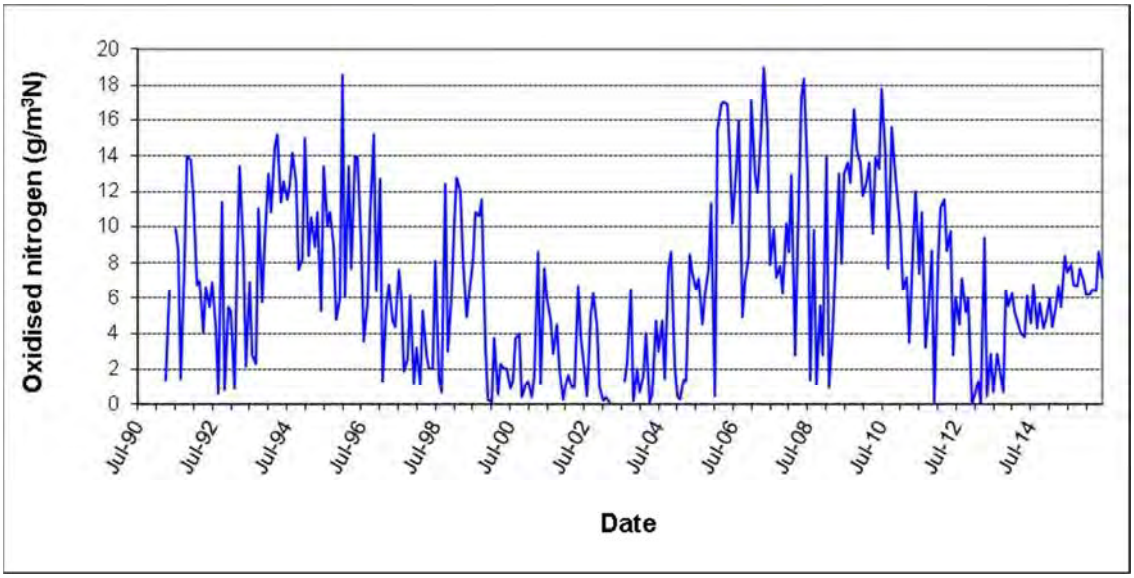
# Appendix III

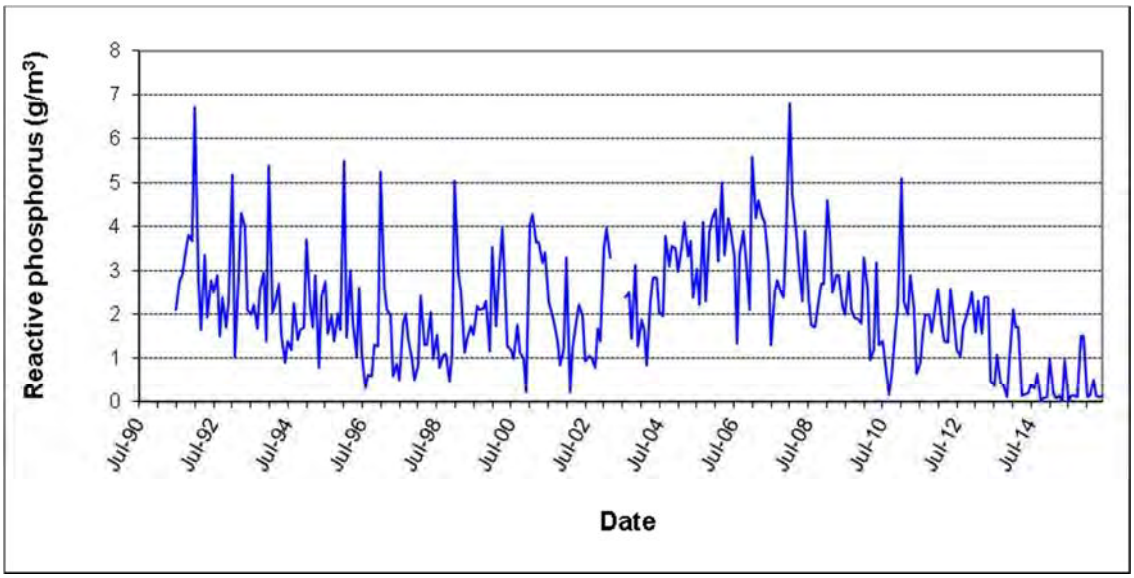
# Graphical results of monthly composite effluent monitoring 1990-2016

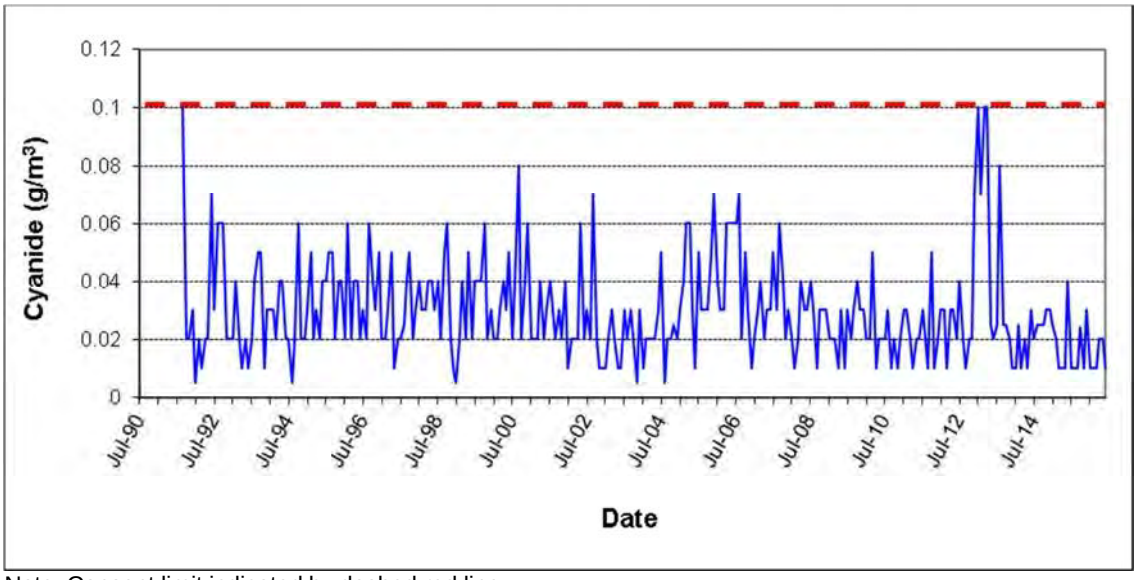

pH
8.2
8
7.8
7.6
7.4
7.2
7
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Date


Ammonia (g/m³)
20
18
16
14
12
10
8
6
4
2
0
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Date

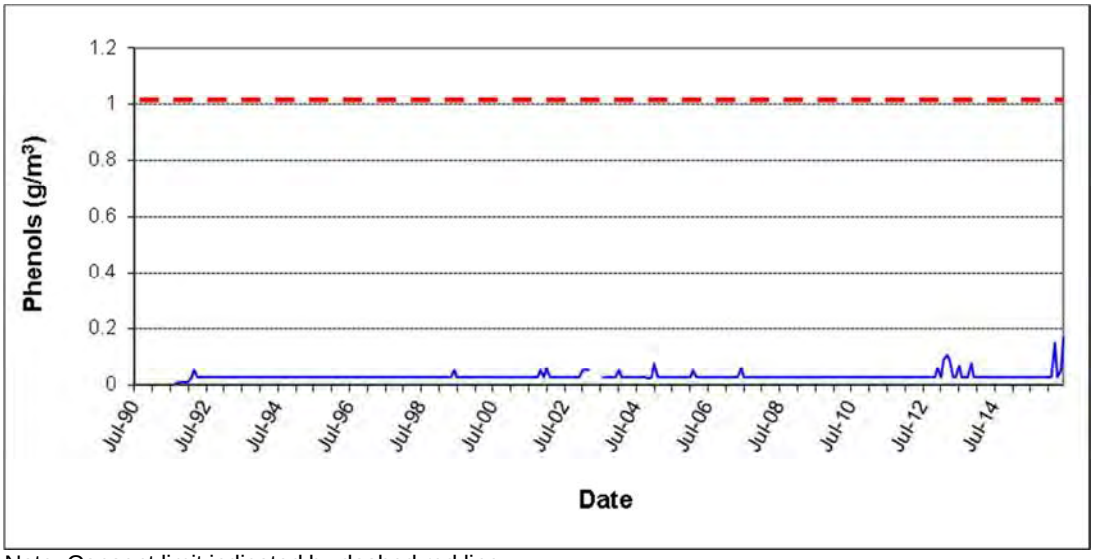

COD (g/m³)
400
300
200
100
0
Jul-90
Jul-92
Jul-94
Jul-96
Jul-98
Jul-00
Jul-02
Jul-04
Jul-06
Jul-08
Jul-10
Jul-12
Jul-14
Date



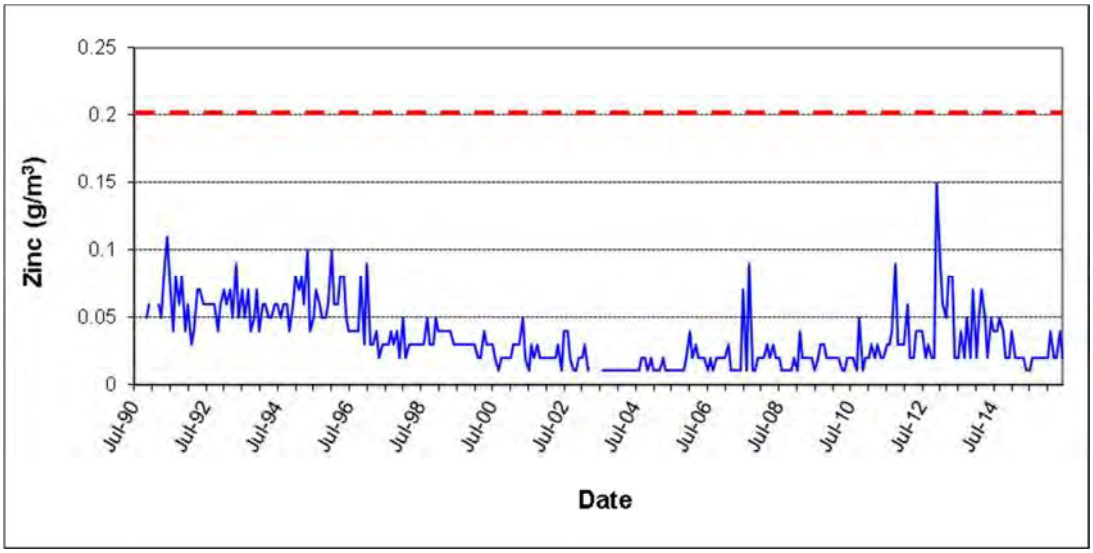



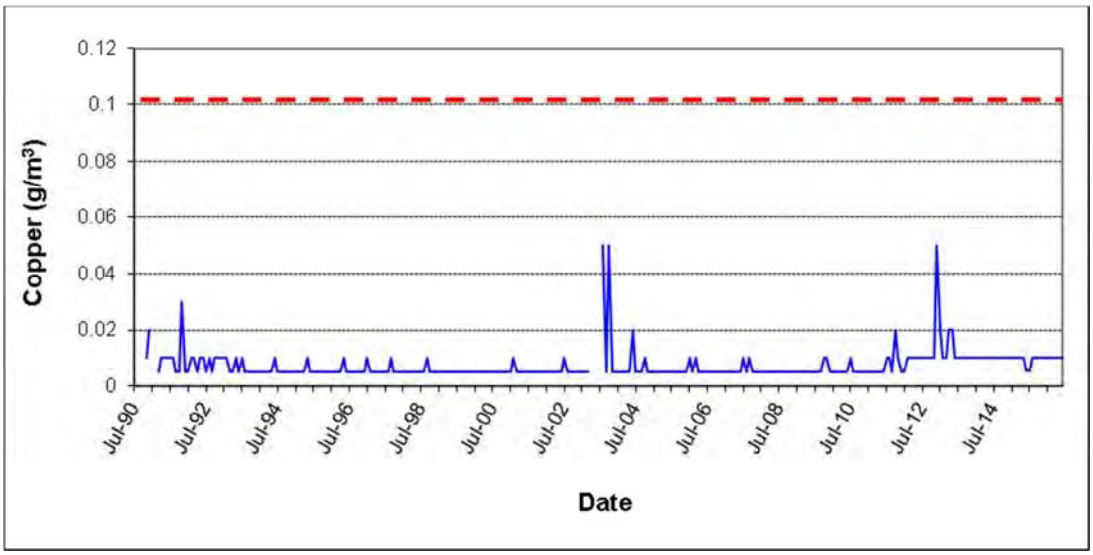

Note: Consent limit indicated by dashed red line
Detection limit = 0.02 g/m$^3$



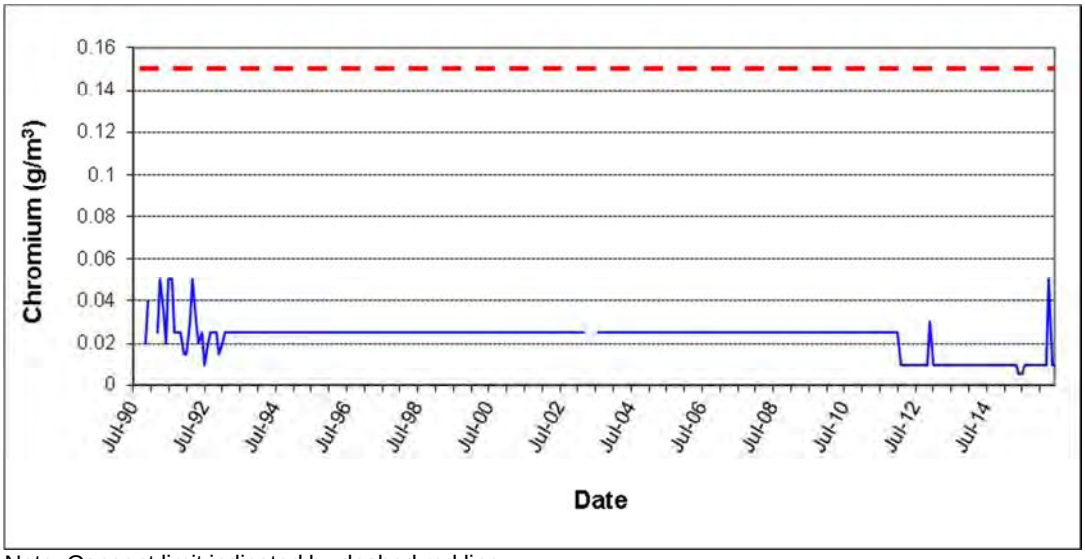

Note: Consent limit indicated by dashed red line
Detection limit = 0.05 g/m$^3$



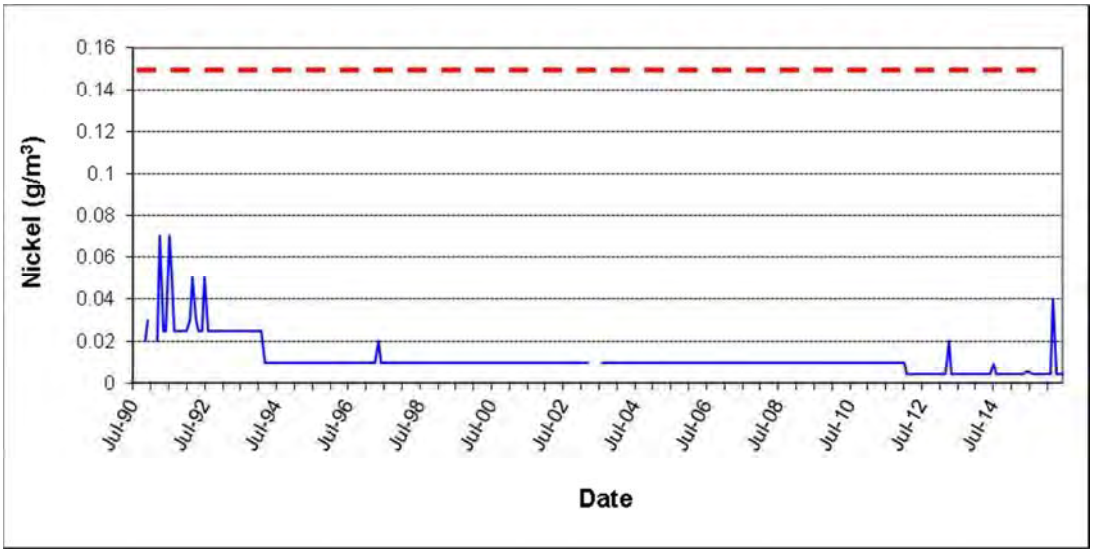

Note: Consent limit indicated by dashed red line
Detection limit between 0.04 - 0.021g/m$^3$



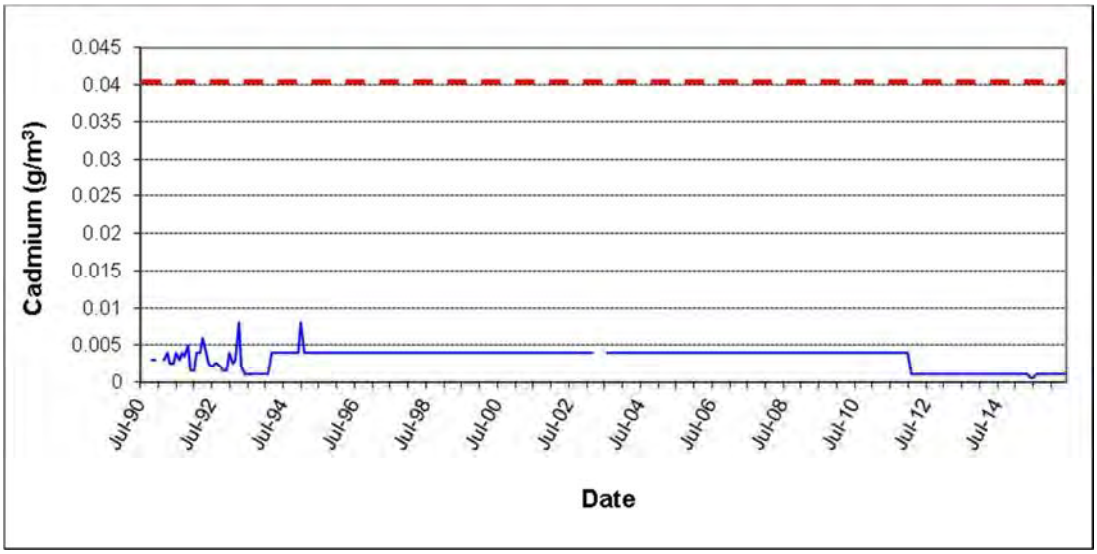

Note: Consent limit indicated by dashed red line
Detection limit between 0.01 - 0.02 g/m$^3$



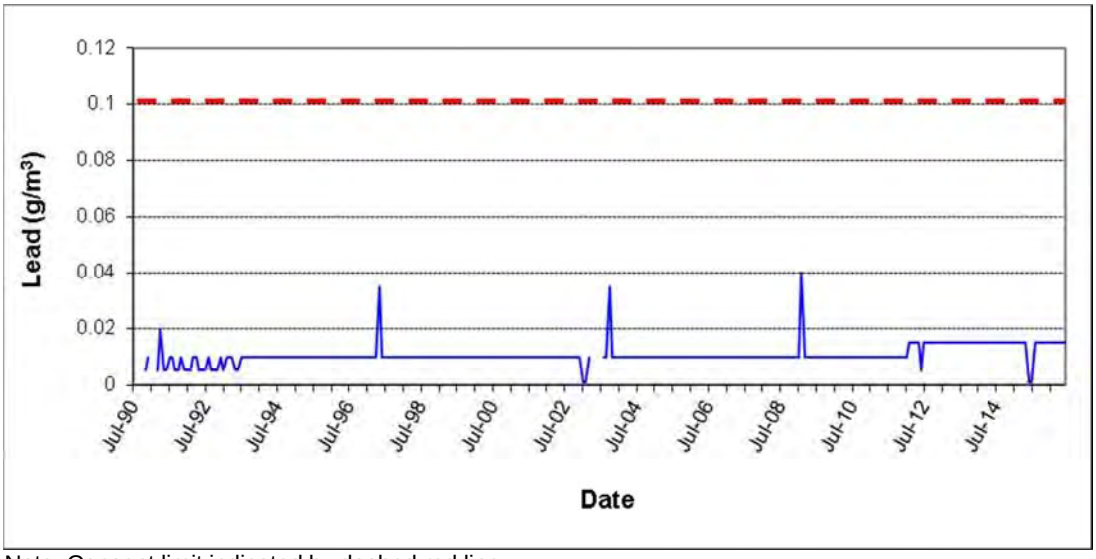

Note: Consent limit indicated by dashed red line
Detection limit between 0.011 - 0.05 g/m$^3$



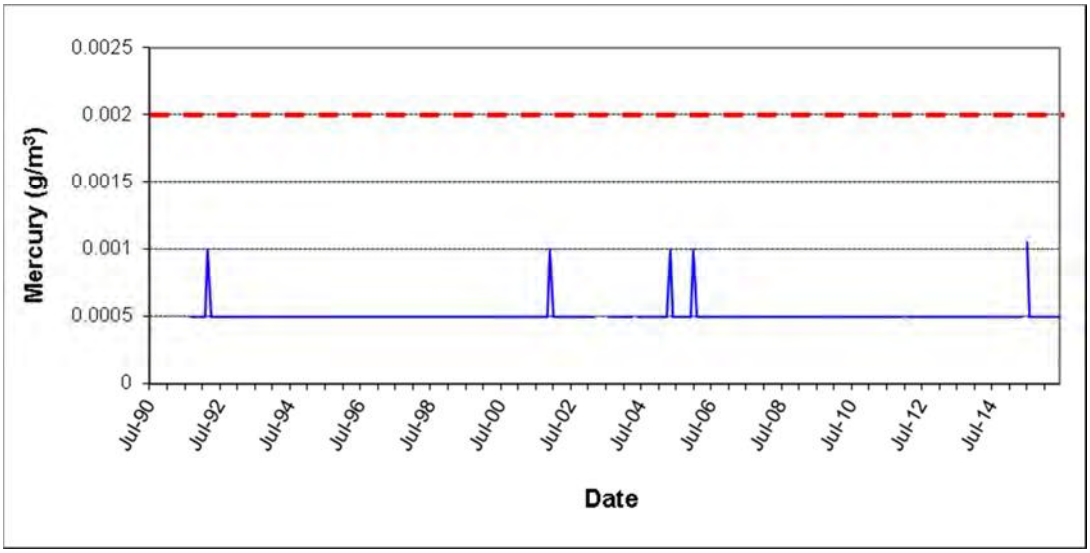

Note: Consent limit indicated by dashed red line
Detection limit between 0.008 - 0.02 g/m$^3$




Note: Consent limit indicated by dashed red line
Detection limit between 0.0011 - 0.008 g/m$^3$




Note: Consent limit indicated by dashed red line
Detection limit between 0.0021 - 0.03 g/m$^3$




Note: Consent limit indicated by dashed red line
Detection limit between 0.001 - 0.0021 g/m3

# Appendix IV

# Results of sludge lagoon monitoring 2015-2016

| Bore 1 | Parameter | | | | | |
|---|---|---|---|---|---|---|
| | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml | RDP g/m³ | NOx g/m³ | COD g/m³ |
| Jul-15 | 5.4 | 0.05 | 10 | 0.025 | 4.9 | 16 |
| Aug-15 | 5.4 | 0.05 | 5 | 0.025 | 10.6 | 18 |
| Sep-15 | 5.3 | 0.05 | 8 | 0.025 | 14.9 | 4 |
| Oct-15 | 5.5 | 0.47 | 2.5 | 0.025 | 4.6 | 8 |
| Nov-15 | 6.1 | 4.3 | 2.5 | 0.025 | 0.33 | 13 |
| Dec-15 | 6.4 | 6.9 | 370 | 0.28 | 0.075 | 26 |
| Jan-16 | 6.6 | 10 | 10 | 1.2 | 0.075 | 21 |
| Feb-16 | 6.6 | 10.5 | 2.5 | 1.24 | 0.1 | 16 |
| Mar-16 | 6.5 | 10.1 | 2.5 | 2.1 | 0.21 | 23 |
| Apr-16 | 6.7 | 10 | 95 | 2.78 | 0.09 | 17 |
| May-16 | 6.6 | 10 | 28 | 1.52 | 0.07 | 17 |
| Jun-16 | 5.8 | 2.2 | 2.5 | 0.04 | 11 | 4 |
| **Summary of 2015-2016 results** | | | | | | |
| **Minimum** | 5.3 | 0.05 | 2.5 | 0.025 | 0.07 | 4 |
| **Maximum** | 6.7 | 10.5 | 370 | 2.78 | 14.9 | 26 |
| **Median** | 6.25 | 5.6 | 6.5 | 0.16 | 0.27 | 16.5 |
| **Results until July 2015** | | | | | | |
| **Number** | 273 | 273 | 270 | 272 | 273 | 272 |
| **Minimum** | 4.9 | 0.05 | 1 | 0.005 | 0.01 | 1 |
| **Maximum** | 7.1 | 100 | 2300 | 3.3 | 18.3 | 48 |
| **Median** | 6.2 | 2.6 | 5 | 0.02 | 0.32 | 11 |

**Note:** Figures in red indicate that the result was below detection limit (the lower limit being twice the value of the red figure). Data has been expressed this way for statistical purposes.

| Bore 2 | Parameter | | | | | |
|---|---|---|---|---|---|---|
| | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml | RDP g/m³ | NOx g/m³ | COD g/m³ |
| Jul-15 | 5.7 | 0.05 | 8 | 0.025 | 1.7 | 23 |
| Aug-15 | 6 | 0.12 | 110 | 0.05 | 0.075 | 52 |
| Sep-15 | 5.9 | 0.05 | 32 | 0.025 | 0.15 | 47 |
| Oct-15 | 6 | 0.18 | 5 | 0.025 | 0.2 | 29 |
| Nov-15 | 6.2 | 2.7 | 2.5 | 0.06 | 0.1 | 33 |
| Dec-15 | 6.3 | 3.4 | 440 | 0.025 | 0.075 | 66 |
| Jan-16 | 6.5 | 4.5 | 5 | 0.14 | 0.075 | 32 |
| Feb-16 | 6.3 | 5.7 | 68 | 0.21 | 0.2 | 28 |
| Mar-16 | 6.2 | 5 | 25 | 0.17 | 1.6 | 28 |
| Apr-16 | 6.1 | 2.5 | 5 | 0.04 | 3.3 | 17 |
| May-16 | 6.3 | 4.4 | 30 | 0.24 | 0.09 | 31 |
| Jun-16 | 5.6 | 0.05 | 305 | 0.04 | 0.34 | 15 |
| **Summary of 2015-2016 results** | | | | | | |
| **Minimum** | 5.6 | 0.05 | 2.5 | 0.025 | 0.075 | 15 |
| **Maximum** | 6.5 | 5.7 | 440 | 0.24 | 3.3 | 66 |
| **Median** | 6.15 | 2.6 | 27.5 | 0.045 | 0.175 | 30 |

| Bore 2 | Parameter | | | | | |
|---|---|---|---|---|---|---|
| | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml | RDP g/m³ | NOx g/m³ | COD g/m³ |
| **Results until July 2015** | | | | | | |
| **Number** | 273 | 272 | 271 | 272 | 273 | 272 |
| **Minimum** | 4.9 | 0.05 | 0.5 | 0.005 | 0.02 | 6 |
| **Maximum** | 7.4 | 25 | 10000 | 0.36 | 40 | 181 |
| **Median** | 6.1 | 2.1 | 5 | 0.02 | 0.11 | 16 |

| Bore 3 | Parameter | | | | | |
|---|---|---|---|---|---|---|
| | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml | RDP g/m³ | NOx g/m³ | COD g/m³ |
| Jul-15 | 6 | 0.05 | 22 | 0.05 | 0.2 | 95 |
| Aug-15 | 6 | 0.05 | 20 | 0.06 | 1.1 | 91 |
| Sep-15 | 5.9 | 0.05 | 350 | 0.08 | 1 | 36 |
| Oct-15 | 5.9 | 0.05 | 2.5 | 0.06 | 0.2 | 41 |
| Nov-15 | 6 | 0.2 | 2.5 | 0.53 | 0.16 | 26 |
| Dec-15 | 6 | 0.26 | 42 | 0.025 | 0.075 | 30 |
| Jan-16 | 6.2 | 0.56 | 5 | 0.06 | 0.075 | 22 |
| Feb-16 | 6.2 | 0.88 | 23 | 0.09 | 0.04 | 53 |
| Mar-16 | 6.1 | 0.97 | 2.5 | 0.16 | 0.1 | 80 |
| Apr-16 | 6 | 0.61 | 140 | 0.13 | 0.98 | 26 |
| May-16 | 6.1 | 0.78 | 2.5 | 0.04 | 0.08 | 59 |
| Jun-16 | 5.9 | 0.05 | 5200 | 0.04 | 0.53 | 35 |
| **Summary of 2015-2016 results** | | | | | | |
| **Minimum** | 5.9 | 0.05 | 2.5 | 0.025 | 0.04 | 22 |
| **Maximum** | 6.2 | 0.97 | 5200 | 0.53 | 1.1 | 95 |
| **Median** | 6 | 0.23 | 21 | 0.06 | 0.18 | 38.5 |
| **Results until July 2015** | | | | | | |
| **Number** | 264 | 264 | 264 | 261 | 262 | 263 |
| **Minimum** | 5 | 0.05 | 2.5 | 0.005 | 0.02 | 1 |
| **Maximum** | 7.3 | 198 | 72000 | 1 | 64 | 740 |
| **Median** | 6.3 | 0.65 | 5 | 0.025 | 0.2 | 22 |

| Open Drain | Point 2 | | | Point 3 | | |
|---|---|---|---|---|---|---|
| | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml | pH | Ammoniacal nitrogen g/m³ | Faecal coliforms No./100ml |
| Jul-15 | 6.6 | 0.68 | 30 | 6.7 | 4.6 | 365 |
| Aug-15 | 6.6 | 0.44 | 600 | 6.7 | 4.5 | 1000 |
| Sep-15 | 6.6 | 0.45 | 1700 | 6.6 | 3.9 | 390 |
| Oct-15 | 6.6 | 0.46 | 260 | 6.6 | 3.7 | 393 |
| Nov-15 | 6.6 | 0.66 | 1223 | 6.5 | 3.3 | 957 |
| Dec-15 | 6.6 | 0.47 | 1900 | 6.6 | 3.7 | 2700 |
| Jan-16 | 6.7 | 0.5 | 5300 | 6.8 | 3.35 | 1800 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Feb-16 | 6.6 | 0.75 | 390 | 6.6 | 2.8 | 2750 |
| Mar-16 | 6.6 | 0.6 | 465 | 6.6 | 2.3 | 960 |
| Apr-16 | 6.6 | 0.62 | 360 | 6.8 | 3.5 | 2300 |
| May-16 | 6.6 | 0.46 | 125 | 6.6 | 1.5 | 1827 |
| Jun-16 | 6.7 | 0.61 | 170 | 6.8 | 3.8 | 710 |
| **Summary of 2015-2016 results** | | | | | | |
| **Minimum** | 6.6 | 0.44 | 30 | 6.5 | 1.5 | 365 |
| **Maximum** | 6.7 | 0.75 | 5300 | 6.8 | 4.6 | 2750 |
| **Median** | 6.6 | 0.55 | 427.5 | 6.6 | 3.6 | 980 |
| **Results until July 2015** | | | | | | |
| **Number** | 268 | 268 | 267 | 267 | 268 | 267 |
| **Minimum** | 6 | 0.005 | 5 | 6.4 | 0.13 | 5 |
| **Maximum** | 7 | 7.5 | 6960 | 7.1 | 27 | 13280 |
| **Median** | 6.6 | 0.5 | 80 | 6.7 | 5.2 | 110 |

# Appendix V

# Marine ecological survey
# 2015-2016

**Memorandum**

**To:** Science Manager – Hydrology/Biology, Regan Phipps
**From:** Scientific Officer, Emily Roberts and Technical Officer, Thomas McElroy
**File:** #1650512
**Date:** 4 March 2016

# New Plymouth Wastewater Treatment Plant Marine Outfall - Marine Ecological Survey February 2016

## 1. Introduction

The New Plymouth District Council (NPDC) operates the New Plymouth Wastewater Treatment Plant. The plant receives and treats the municipal wastewater from a large proportion of North Taranaki; the major inputs are New Plymouth, Inglewood, Bell Block, Waitara and Oakura. The treated wastewater then discharges through a 450 m long marine outfall offshore of the Waiwhakaiho River mouth. NPDC hold coastal permit 0882-4 to discharge treated effluent into the Tasman Sea. Special condition 1 of the consent requires that the consent holder prevents or minimises any adverse environmental effects. Accordingly, a survey at coastal sites in the vicinity of the outfall is undertaken each year to assess any adverse effects on intertidal communities.

The survey was carried out at five sites between 9 and 22 February 2016 as part of the 2015-2016 monitoring programme. The objective of the survey was to assess any change in intertidal diversity attributable to the wastewater discharge.

## 2. Methods

### 2.1 Field Work

The survey was conducted at five sites: 500 m south west of the outfall on the Waiwhakaiho Reef (SEA902015), 300 m north east of the outfall on the Waiwhakaiho Reef (SEA902010), the Mangati Reef (SEA902005) approximately 2.2 km north east of the outfall and the two control sites at Turangi Reef (SEA900095) approximately 16 km north east of the outfall, and Greenwood Road (SEA903070) approximately 22 km south west of the outfall (Photographs 1-5).

**Photograph 1** Potential impact site at 500 m south west of the outfall (SEA902015) 10 Feb 2016

**Photograph 2** Potential impact site at 300 m north east of the outfall (SEA902010) 11 Feb 2016

**Photograph 3** Potential impact site at the Mangati Reef (SEA 902005) 09 Feb 2016

**Photograph 4** Control site at Greenwood Road (SEA903070) 12 Feb 2016

**Photograph 5** Control site at Turangi Reef (SEA900095) 22 Feb 2016

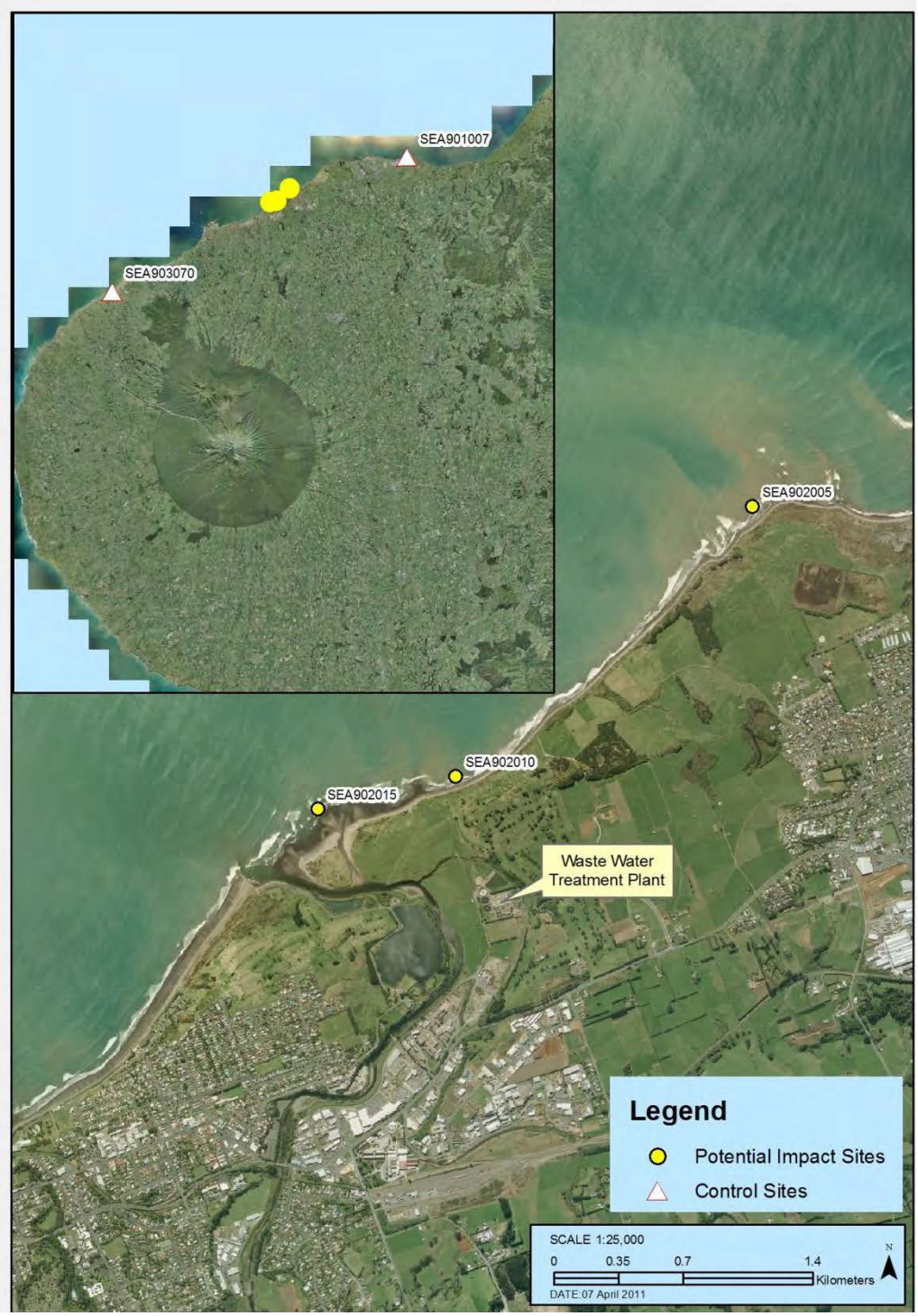



**Figure 1** Location of the intertidal survey sites

At each site, a 50 m transect was laid parallel to the shore, approximately 0.6 metres above chart datum. This transect was used to establish five 5 m x 3 m blocks. Within each block, 5 random 0.25 m² quadrats were laid giving a total of 25 random quadrats. For each quadrat the percentage cover of algae and encrusting animal species was estimated using a grid. For all other animal species, individuals larger than 3 mm were counted. Under boulder biota was counted where rocks and cobbles were easily overturned.

# 3. Results

Summary statistics, including the number of species per quadrat and Shannon Weiner indices are presented in Table 1.

**Table 1** Summary statistics – February 2016

| Site | Number of quadrats | Mean number of species per quadrat | | | Mean Shannon-Weiner index per quadrat | | |
|---|---|---|---|---|---|---|---|
| | | Algae | Animals | Total Species | Algae | Animals | Total Species |
| 500 m SW | 25 | 1.08 | 10.60 | 11.68 | 0.132 | 0.701 | 0.731 |
| 300 m NE | 25 | 4.24 | 9.12 | 13.36 | 0.577 | 0.707 | 0.868 |
| Mangati Reef | 25 | 3.76 | 6.84 | 10.60 | 0.466 | 0.545 | 0.714 |
| Turangi Reef | 25 | 5.48 | 14.04 | 19.52 | 0.641 | 0.879 | 1.032 |
| Greenwood Road | 25 | 9.80 | 8.08 | 17.88 | 0.913 | 0.558 | 0.802 |

## 3.1 Number of Species per Quadrat Data

Figure 2 shows the total number of species per quadrat at each site as a box and whisker plot. The notched area of the box represents the median plus and minus the 95% confidence interval. This form of graphical representation allows a quick comparison to be made between sites. Generally, if the notched areas of the boxes do not overlap you would expect to obtain a significantly different result with ANOVA.

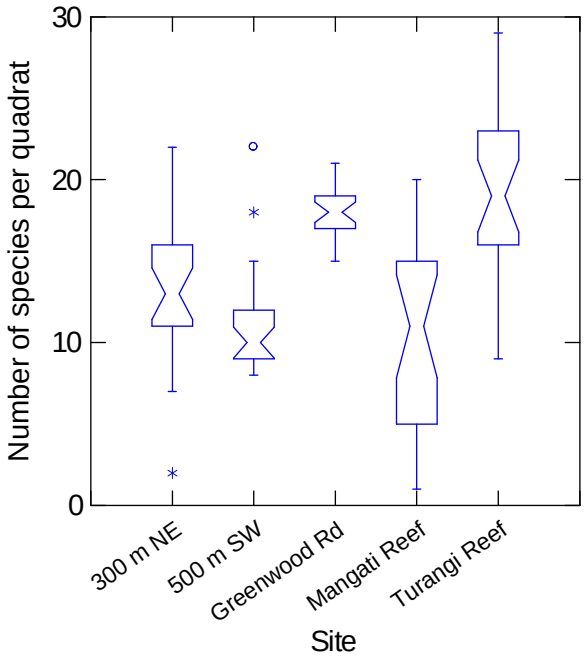



**Figure 2** Box and whisker plot of total number of species per quadrat

Only one site (500 m SW of the outfall) showed a significant deviation from normal distribution at the 95% confidence level (Lilliefors test, n=25, P <0.001).

The ANOVA assumptions of even variance and normal distribution were not met following a natural log transformation of the data. Accordingly, further analyses were performed with the raw data using non-parametric tests.

There was a significant difference in the mean number of species per quadrat between sites (Kruskal-Wallis, H = 51.171, Degrees of freedom (df) = 4, P < 0.001).

Significant differences between sites were determined using the Wilcoxon signed-ranks test (Table 2). The mean number of species per quadrat at each site increased in the following order: Mangati Reef, 500 m SW, 300 m NE, Greenwood Road, Turangi Reef. The mean number of species was significantly higher at both control sites when compared with the three potential impact sites. The scores were not significantly different between the potential impact sites or between the control sites, respectively.

**Table 2** Wilcoxon signed ranks test of number of species per quadrat

| Site | Greenwood Road | 500 m SW | 300 m NE | Mangati Reef |
|---|---|---|---|---|
| 500 m SW | SIG | | | |
| 300 m NE | SIG | NS | | |
| Mangati Reef | SIG | NS | NS | |
| Turangi Reef | NS | SIG | SIG | SIG |

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

## 3.2 Shannon-Weiner Diversity Index Data

Figure 4 shows the Shannon-Weiner index (SW index) per quadrat at each site as a box and whisker plot.

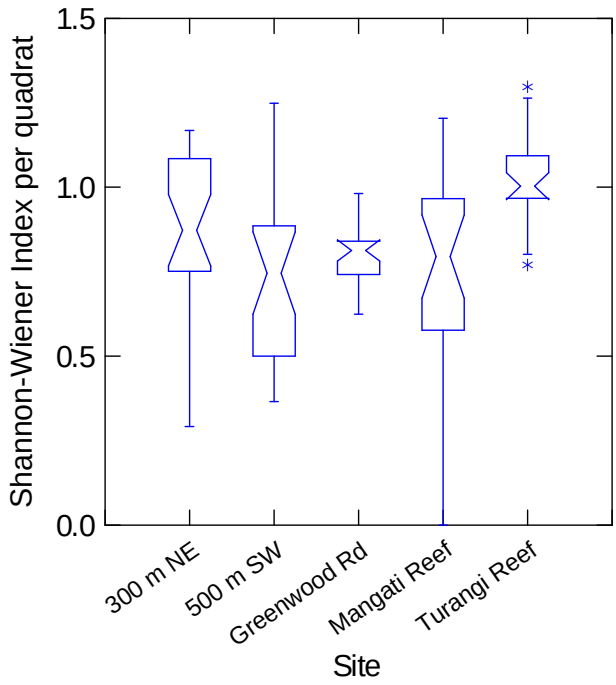



**Figure 3** Box and whisker plot of Shannon-Wiener index per quadrat

None of the sites showed a significant deviation from normal distribution at the 95% confidence level (Lilliefors test, n=25, P > 0.05). However, based on the boxplots, variation in the data was not homogenous between all sites (namely, variance was far greater at the potential impact sites when compared with the control sites; Figure 4).

The ANOVA assumption of even variance was not met following a natural log transformation of the data. Accordingly, further analyses were performed with the raw data using non-parametric tests.

There was a significant difference in the mean SW index per quadrat between sites (Kruskal-Wallis, H = 30.971, df = 4, P < 0.001).

Significant differences between sites were determined using the Wilcoxon signed-ranks test (Table 3). Mean Shannon-Wiener Index increased across the sites from lowest to highest in the following order: Mangati Reef, 500 m SW, Greenwood Road, 300 m NE, Turangi Reef. The mean Shannon-Wiener Index was significantly greater at Turangi Reef than at any other site. The mean Shannon-Wiener Index at the site 300 m NE of the outfall was significantly higher than at the other two potential impact sites. There were no further significant differences between the sites.

**Table 3** Wilcoxon signed ranks test of Shannon-Weiner diversity indices

| Site | Greenwood Road | 500 m SW | 300 m NE | Mangati Reef |
|---|---|---|---|---|
| **500 m SW** | NS | | | |

| | | | | |
|---|---|---|---|---|
| **300 m NE** | NS | SIG | | |
| **Mangati Reef** | NS | NS | SIG | |
| **Turangi Reef** | SIG | SIG | SIG | SIG |

Key: SIG = significant difference at 95% confidence level
NS = no significant difference

## 3.3 Sand and silt/mud cover

The percentage cover of sand was recorded (Table 4) because high sand levels can significantly impact marine communities.

**Table 4** Mean percentage cover of sand and silt/mud per quadrat at each site

| Site | Sand (%) | Silt/mud (%) | Total (%) |
|---|---|---|---|
| 500 m SW | 1.60 | 0.00 | 1.60 |
| 300 m NE | 45.80 | 0.00 | 45.80 |
| Mangati Reef | 63.60 | 0.00 | 63.60 |
| Turangi Reef | 22.28 | 0.20 | 22.48 |
| Greenwood Road | 23.60 | 10.52 | 34.12 |

There was moderate to high sand cover at all sites surveyed this summer, with the exception of the site 500 m SW of the outfall, which remained low. At all sites, the results from this survey revealed a decrease in sand cover from the previous summer. Most notably, Greenwood Road coverage had dropped from nearly 100% to 34% (including 10% silt). Previous studies on intertidal reefs in Taranaki have demonstrated that at 30% cover, sand begins to negatively influence hard shore communities.

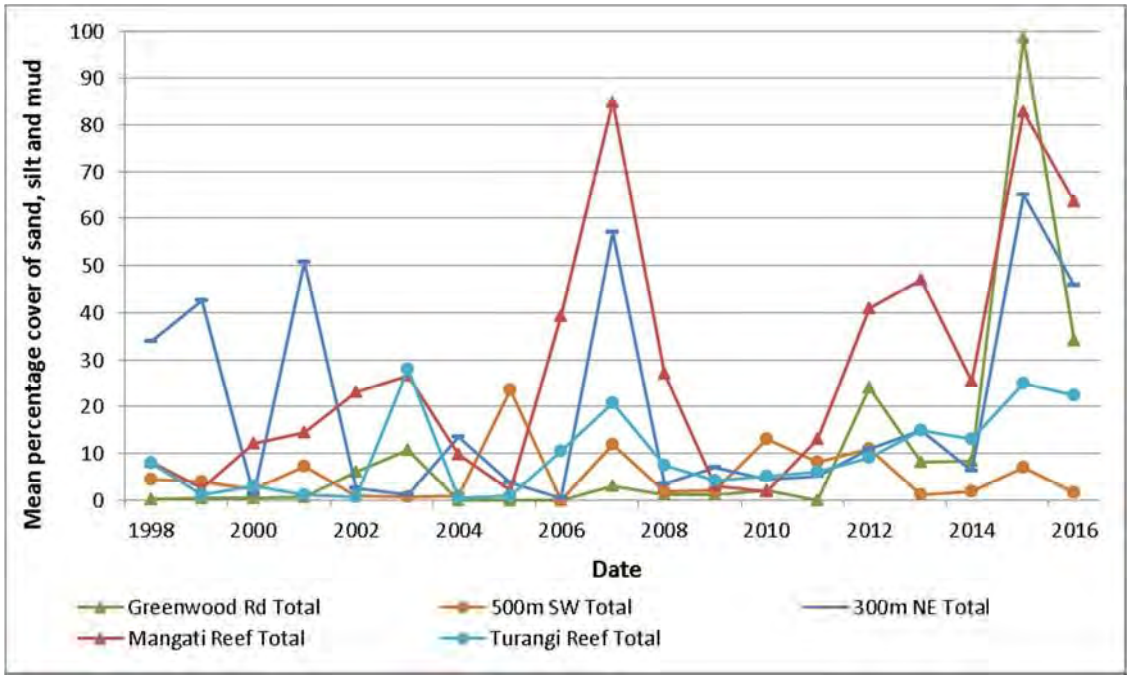



**Figure 4** Mean percentage cover of sand, silt and mud at the five reef sites from 1998 to 2016

## 3.4 Trends over time

Comparisons of the mean number of species per quadrat and the mean Shannon-Weiner index at the five sites surveyed from 1993 to 2016 are shown in Figures 7 and 8, respectively. Species richness and diversity show high interannual variability, with no obvious long term trends in diversity evident at the three impact sites over time (Figures 7 and 8). The mean number of species increased at all sites from the previous summer. This trend was mirrored with diversity scores, with the mean Shannon-Wiener Index at each site increasing from the previous year. It is difficult to determine differential trends between sites, as much of the variation over time appears to be driven by stochastic events (i.e. sand inundation). The increase in both ecological parameters at all sites revealed by this year's survey highlights the acute nature of such events.

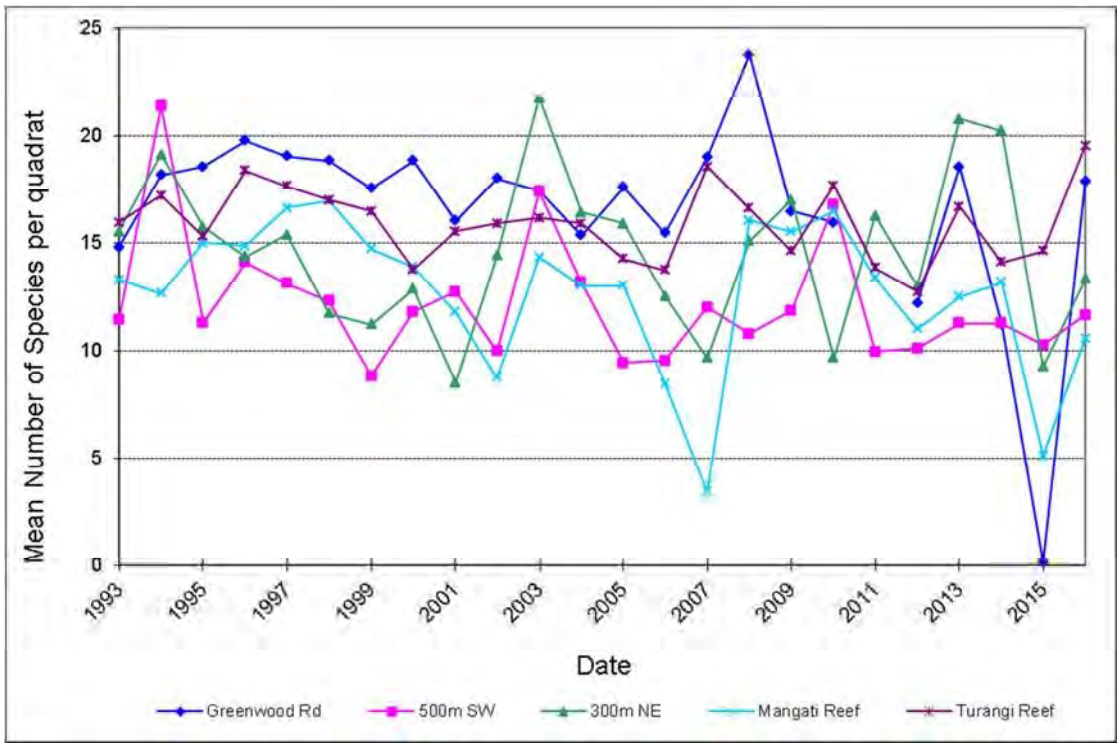



**Figure 5** Mean number of species per quadrat in summer surveys from 1993 to 2016

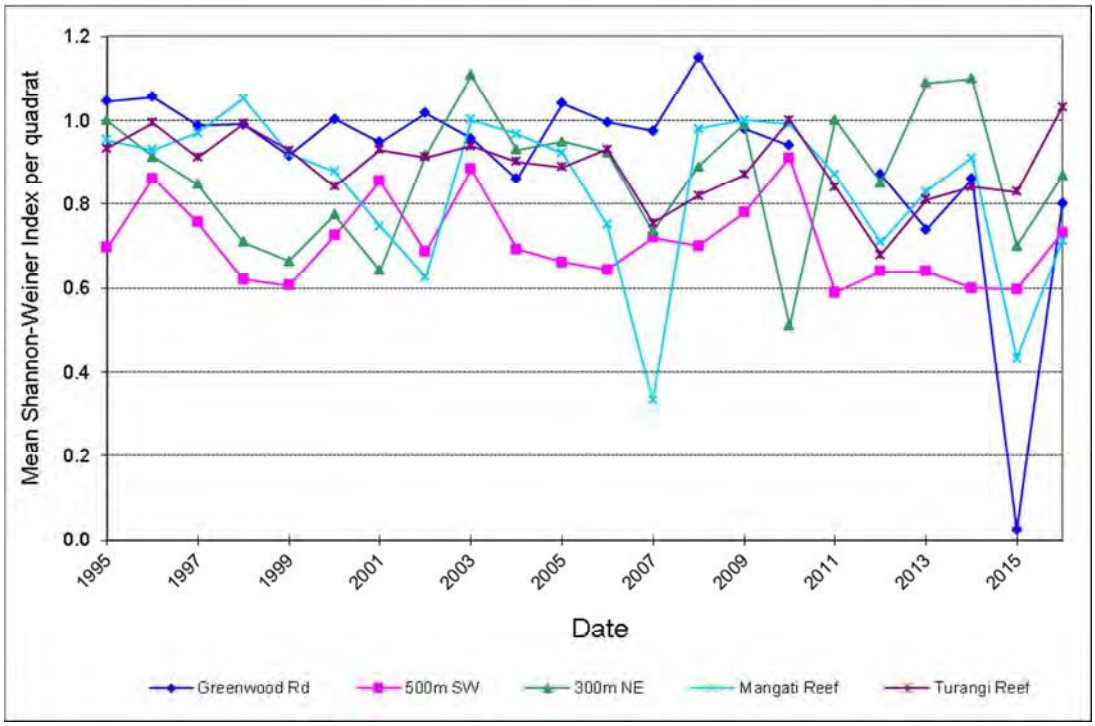



**Figure 6** Mean Shannon-Weiner index per quadrat in summer surveys from 1995 to 2016

# 4. Discussion

An intertidal survey was conducted at five sites between 9 and 22 of February 2016 as part of the 2015-2016 NPWWTP monitoring programme. Potential impact of the NPWWTP outfall discharge on the intertidal community was assessed through comparison of results from potential impact sites and control sites within the same year in addition to the analysis of trends over time. The data analysed in this report covers over a twenty year record of species diversity from January 1993 to January 2016.

Impacts of the NPWWTP outfall discharge on the local intertidal community were not evident from the 2016 survey. All sites showed increases in species number and diversity that were proportionate to decreases in their sand cover from the previous summer. The one site that was not affected by sand, 500 m SW of the outfall, still showed an increase in species number and diversity from the previous summer. In addition, over the long term record, there has been no obvious decline in species richness or diversity at the potential impact sites relative to the control sites.

Spatial and temporal variability in the intertidal communities surveyed could be largely attributed to natural changes in physical characteristics of the habitats. In particular sand cover, substrate type and substrate mobility have typically been classified as major drivers of diversity. In Taranaki, mid to high shore sand indundation can be the product of a series of factors. Erosion events on Mt. Taranaki are considered to be the source of much of the sandy material that is deposited around Taranaki's coast. The material is carried down the Stony River and into the

coastal waters, where it is then naturally transported around the coastline. Sustained calm weather conditions in conjunction with high period swell can cause sand to be pushed upshore and onto the intertidal zone (Mr P McComb 2015, pers. comm.). Historically, the Mangati Reef site has been prone to sand accumulation. Years of high sand accumulation at this site have resulted in reduced diversity within the intertidal community (e.g. 2006, 2007, 2012 2013 and 2015). This response is not surprising given that sand deposition has been shown to have a profound effect on under-rock colonisation on intertidal hard-shore environments in Taranaki (Walsby, 1982). Sand cover can also result in reduced diversity due to sand scour of the biota, reduced water movement between rocks and temporary burial. Results from this year's survey demonstrated two important aspects of intertidal sand inundation. Firstly, the sand is not static; it continues to shift. Reefs that were inundated in the summer of 2015 had a decreased sand cover in the summer of 2016 (Figure 10, Photgraphs 6, 7, 8). Secondly, reef communities have the innate capacity to recover from sand inundation events. This was demonstrated particularly well at the Greenwood Road site, where algal diversity had already recovered to become the highest of all of the sites (Table 1).

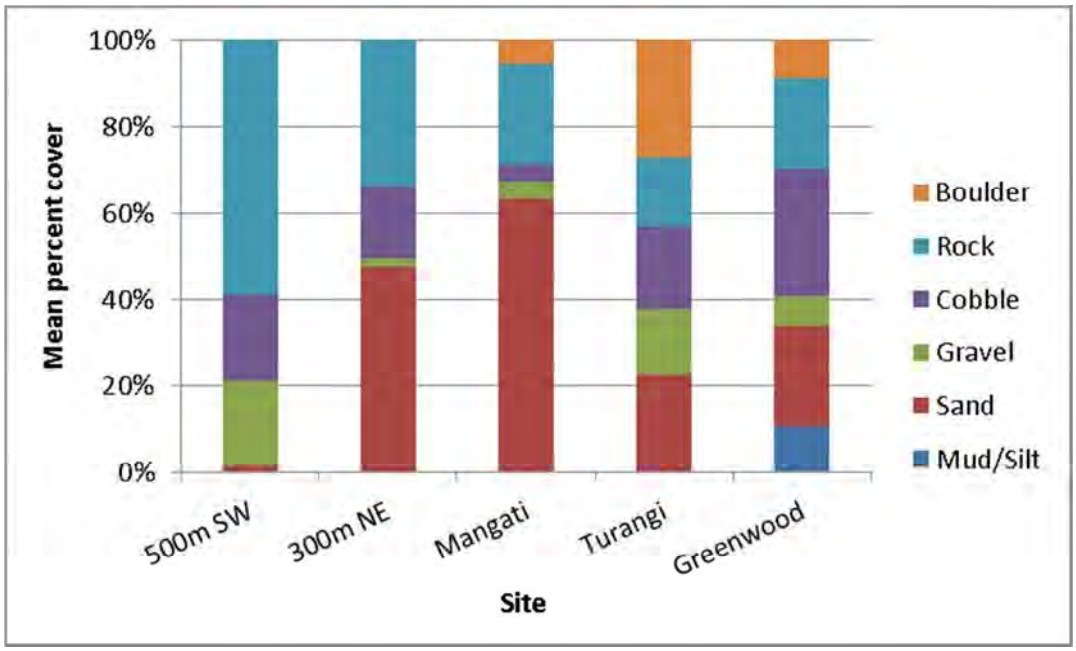



**Figure 7** Mean percentage cover of different substrate types at the five sites during the February 2016 survey

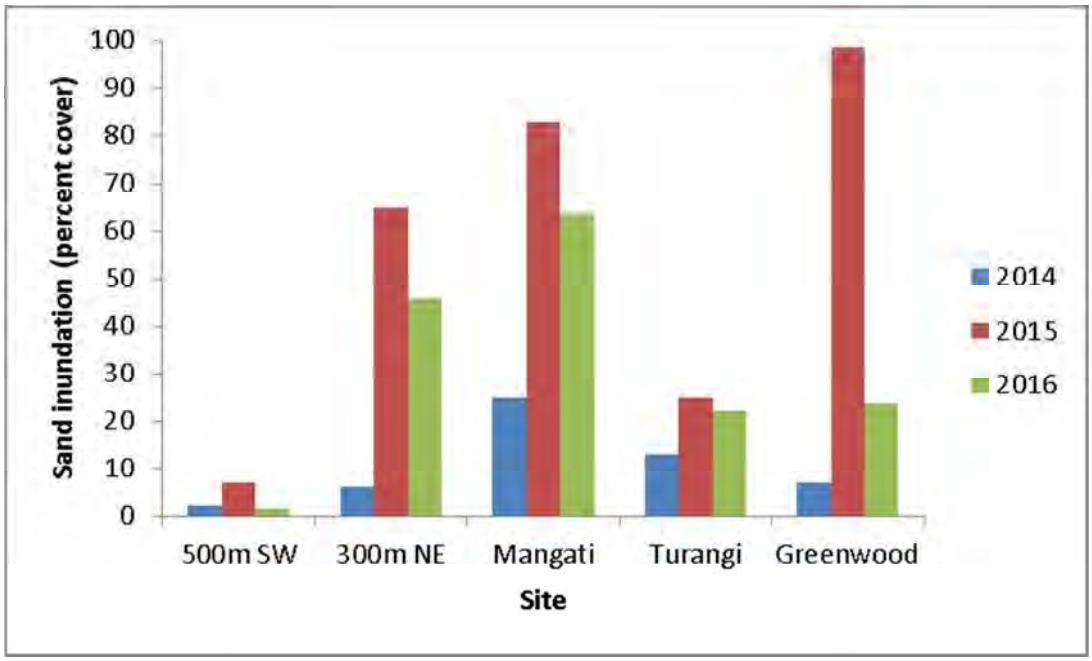
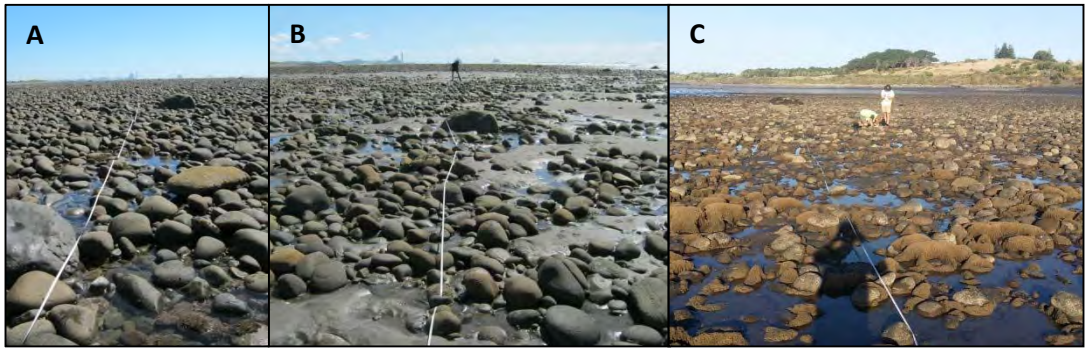



**Figure 8** Mean percentage sand cover at the five sites in during the last three summer surveys


**Photograph 6** Greenwood Road site. A) February 2014, B) January 2015, C) February 2016


**Photograph 7** Mangati Reef site. A) February 2014, B) January 2015, C) February 2016




**Photograph 8** 300 m NE site. A) 21 January 2014, facing SW, B) 19 January 2015, facing SW, C) February 2016, facing NE

Historically, Mangati Reef has supported the growth of coralline turf algae more so than the other two impact sites (Figure 11). Although this reef has been periodically inundated with sand, the sheltered conditions have proved more favourable for coralline algae growth. In turn, the relatively high percentage cover of coralline turf can provide an ideal habitat for juvenile cat's-eyes *Turbo smaragdus* (Figure 12), which are known to feed on the small epiphytes present on the calcified surface of the coralline algae (Morton, 2004). However, in 2015, the extent of sand inundation at

the Mangati Reef resulted in extremely low coralline turf cover and *T.smaragdus* densities at the site. A similar result, albeit at a smaller scale, was observed at the 300 m NE site (Figure 11 and 12). There was a slight increase in turf cover observed at the Mangati Reef site in the most recent survey. As the sand cover decreases at these sites it would be expected that the coralline turf cover, and subsequently *T.smaragdus* abundance, would continue to increase.

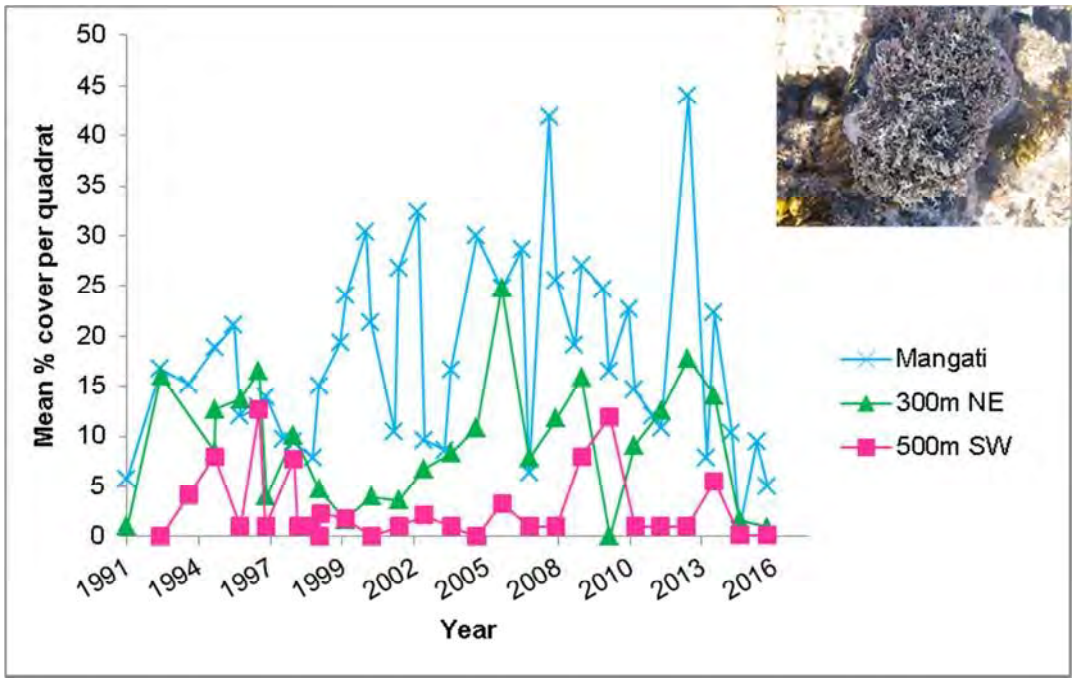



**Figure 9** Percentage cover of coralline turf *Corallina officinalis* at the three potential impact sites from 1991 to 2016

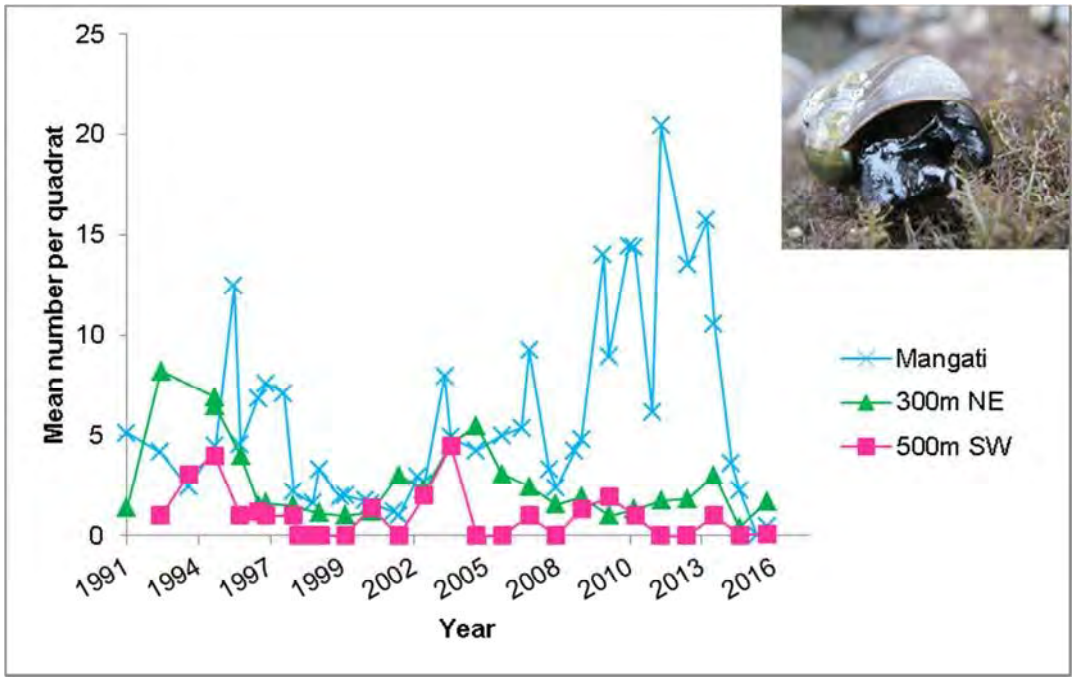



**Figure 10** Abundance of cat's-eye *Turbo smaragdus* at the three potential impact sites from 1991 to 2016

The site 500 m SW of the outfall is a unique in its substrate composition, whilst also a characteristic example of Taranaki's dynamic coastline. The reef is predominantly composed of relatively uniform, small, rounded rocks/cobbles (Photograph 1). It has been previously noted that the movement of these rocks/cobbles is influenced by the close proximity of the Waiwhakaiho River, with the formation of cobble banks which regularly shift and vary in height. The mobile nature of the substrate prevents many species, in particular macroalgae, from establishing (Table 1). This may explain the low cover of coralline turf relative to the other two impact sites over the past 20 years (Figure 11). The porcelain crab *Petrolisthes elongates* is one of the few animals able to thrive at this site (Figure 13). This highly mobile, small species of crab is well adapted to such harsh, transient environments, being able to scuttle and filter feed between the rounded rocks (Morton, 2004). Over recent years, high densities of *P. elongatesis* have been recorded at this site. However, densities recorded during the 2016 survey were much lower, for reasons which are not immediately obvious. A possible explanation could be the observed shift in substrate composition from previous years. This year's survey found a greater proportion of rocks than cobbles; the former being larger than the later. This shift in substrate composition may have lead to a reduction in the interstitial spaces in which *P. elongates* prefer to reside within.

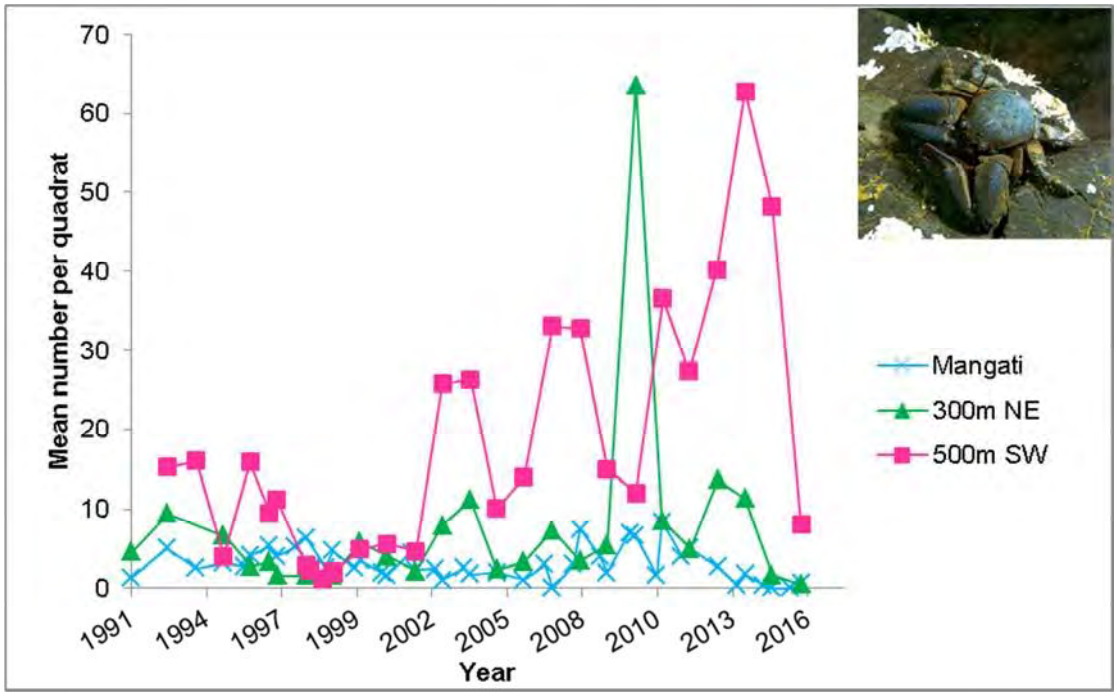



**Figure 11** Abundance of Porcelain crab *Petrolisthes elongates* at the three potential impact sites from 1991 to 2016

The site 300 m NE of the outfall provides an intermediate substrate composition relative to the two other potential impact sites (Figure 9), offering more shelter/stability than 500 m SW and less sand accumulation than Mangati Reef. The substrate complexity provides a range of habitats/ecological niches. Of all sites covered in this survey this summer, sand cover was second highest at this site,

although it had decreased since the 2015. Nevertheless, 300 m NE had both the highest mean number of species and Shannon Weiner Index of the impact sites in this survey. However, this year's survey also revealed that *Neosabellaria kaiparaensis* was becoming a dominant species at the 300 m NE site (Photograph 2). As this tubeworm can be a strong competitor for hard substrate (suitable habitat) in the intertidal zone, its presence could limit the ecological diversity of the reef in the future.

The control sites at Turangi Reef and Greenwood Road have typically had a high level of species abundance and diversity. Variation at these sites (lower abundance and diversity) has previously been attributed to sand inundation. Species number and diversity have tended to recover quickly once the sand has been removed. Sand inundation at Greenwood Road was unprecedented during the January 2015 survey; however the 2016 survey revealed that the reef was already recovering, with rich algal assemblages beginning to establish (Figure 7, 8, Table 1). The moderate level of sand cover at Turangi Reef had not changed notably since the 2015 summer survey; however the site remained the most diverse and supported the greatest mean number of species (Figures 7, 8).

Finally, it must be noted that the high energy receiving environment combined with the effects of suspended sediments from rivers and streams prevent the development of stable biological communities along the Taranaki coastline (Clark et al., 2012). Such conditions could potentially mask any subtle ecological effects from the NPWWTP outfall discharge. However, in spite of these limitations, intertidal surveys are useful in detecting more noticeable effects from wastewater, as clearly identified in the TRC Fonterra Whareroa Annual Report 2012-2013 (13-24).

# 5. Conclusions

In order to assess the effects of the NPWWTP outfall discharge on the nearby intertidal communities, surveys were conducted in February 2016 at five sites. These surveys included three potential impact sites and two control sites, north and south of the outfall. It was expected that adverse effects of the NPWWTP outfall discharge on the intertidal communities would have been evident as a significant decline in species diversity at the potential impact sites relative to the control sites.

There was no distinguishable shift in species richness or diversity at the potential impact sites compared with the control sites in this year's survey. In addition, over the long term record, there has been no obvious decline in species number and Shannon-Weiner index at the potential impact sites relative to the control sites. The results indicate that the outfall discharge was not having detectable adverse effects on the intertidal reef communities of North Taranaki. Natural environmental factors, in particular sand cover, substrate type and substrate mobility, appeared to be the dominant drivers of species diversity at the sites surveyed.

Emily Roberts
**Scientific Officer – Marine Ecologist**

Thomas McElroy
**Technical Officer**

## References

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Morton, J. (2004) Seashore ecology of New Zealand and the Pacific.

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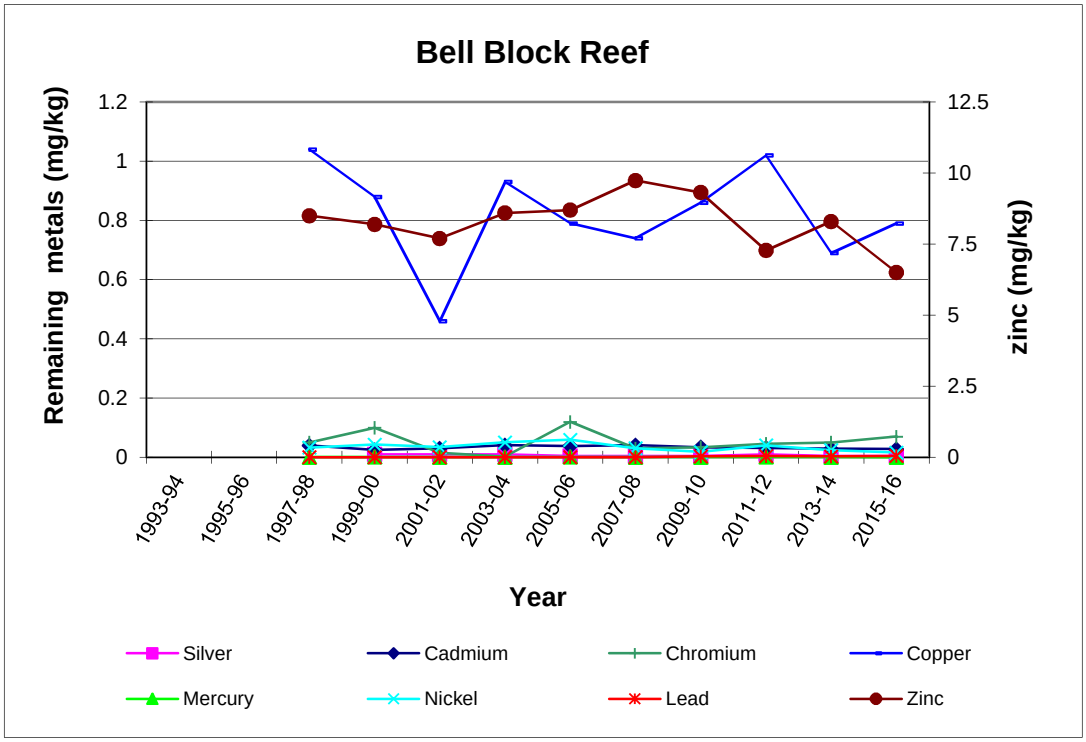
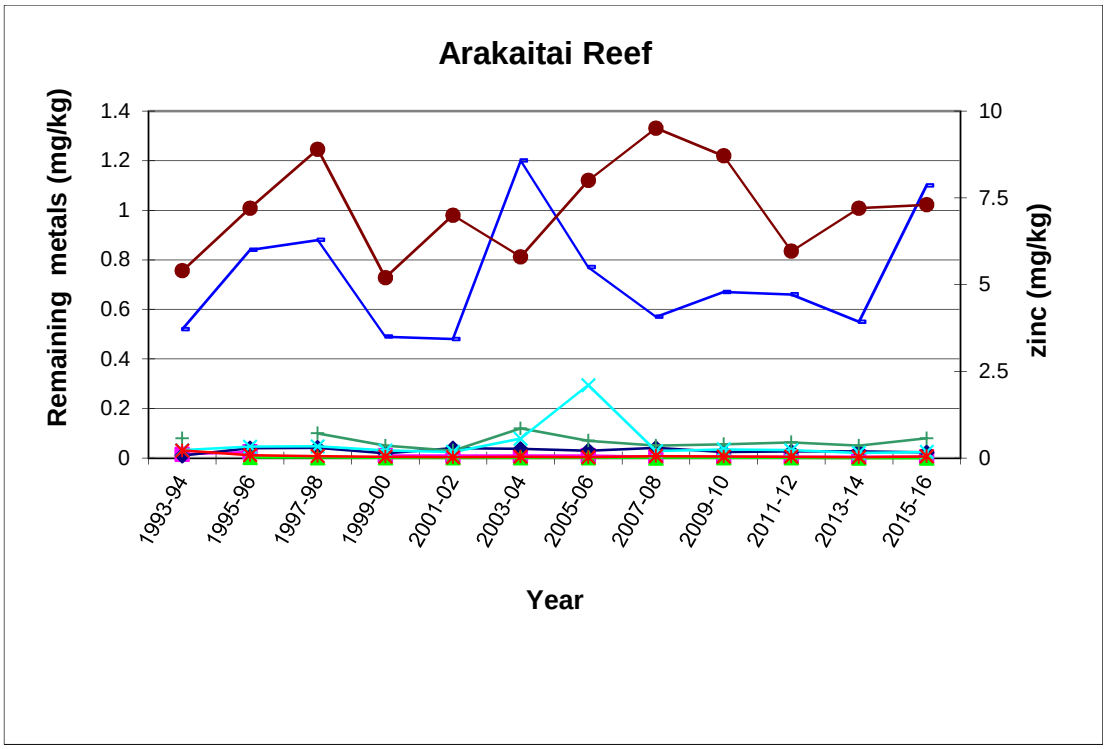
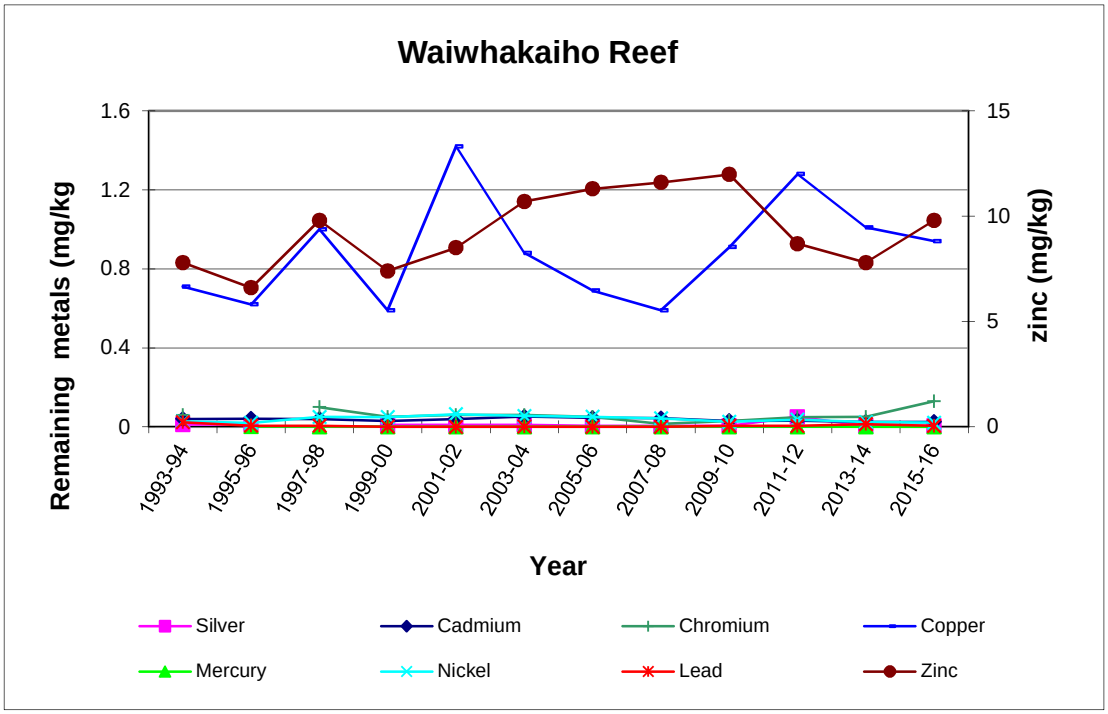
# Appendix VI

# Shellfish monitoring: Summary of metals results 1993-2015

| Parameter | Unit | Bell Block Reef | | | | Arakaitai Reef | | | | Waiwhakaiho Reef | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Median | No. | Min | Max | Median | No. | Min | Max | Median | No. |
| Silver | mg/kg | <0.01 | 0.01 | <0.01 | 9 | <0.01 | 0.025 | <0.02 | 11 | <0.01 | 0.05 | <0.02 | 11 |
| Cadmium | mg/kg | 0.025 | 0.041 | 0.034 | 10 | 0.01 | 0.042 | 0.030 | 12 | 0.025 | 0.052 | 0.040 | 12 |
| Chromium | mg/kg | <0.03 | 0.12 | 0.046 | 10 | 0.03 | 0.12 | 0.060 | 11 | <0.03 | 0.1 | 0.050 | 11 |
| Copper | mg/kg | 0.46 | 1.04 | 0.860 | 10 | 0.48 | 1.2 | 0.660 | 12 | 0.59 | 1.42 | 0.880 | 12 |
| Mercury | mg/kg | <0.01 | 0.016 | 0.011 | 10 | <0.01 | 0.02 | 0.014 | 11 | <0.01 | 0.02 | 0.013 | 11 |
| Nickel | mg/kg | 0.19 | 0.62 | 0.360 | 10 | 0.15 | 2.1 | 0.230 | 12 | 0.19 | 0.6 | 0.400 | 12 |
| Lead | mg/kg | <0.005 | 0.046 | 0.004 | 10 | <0.05 | 0.22 | 0.041 | 12 | <0.005 | 0.22 | 0.044 | 12 |
| Zinc | mg/kg | 7.28 | 9.74 | 8.500 | 10 | 5.2 | 9.51 | 7.200 | 12 | 6.6 | 11.98 | 8.690 | 12 |




Arakaitai Reef
Remaining metals (mg/kg)
zinc (mg/kg)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10
7.5
5
2.5
0
1993-94
1995-96
1997-98
1999-00
2001-02
2003-04
2005-06
2007-08
2009-10
2011-12
2013-14
2015-16
Year


Waiwhakaiho Reef
Remaining metals (mg/kg
zinc (mg/kg)
1.6
1.2
0.8
0.4
0
15
10
5
0
1993-94
1995-96
1997-98
1999-00
2001-02
2003-04
2005-06
2007-08
2009-10
2011-12
2013-14
2015-16
Year
Silver
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc