AGENDA

Wastewater Management Review Committee meeting

Wednesday, 22 November 2023

I hereby give notice that a Wastewater Management Review Committee meeting will be held on:

Date:	**Wednesday, 22 November 2023**
Time:	**To start at the conclusion of the Wastewater Management Review Committee Public Excluded Workshop, but not before 1:30pm.**
Location:	**Ground Floor Meeting Room 1 306 Cameron Road Tauranga**

Please note that this meeting will be livestreamed and the recording will be publicly available on Tauranga City Council's website: www.tauranga.govt.nz.

Marty Grenfell

Chief Executive

Terms of reference – Wastewater Management Review Committee

Membership

Chairperson	Ms Lara Burkhardt – Ngā Pōtiki
Deputy chairperson	Commissioner Bill Wasley – Tauranga City Council
Members	Commissioner Stephen Selwood – Tauranga City Council Commissioner Bill Wasley – Tauranga City Council Commissioner Shadrach Rolleston – Tauranga City Council (*alternate member)* Mr Spencer Webster – Ngā Pōtiki Mr Whitiora McLeod - Ngāi Te Rangi Mr Des Heke - Ngāti Ranginui Ms Destiny Leaf – Ngāti Ranginui *(alternate member)*
Quorum	Four members with at least one member representing Tauranga City Council and one member representing Ngā Pōtiki
Decision-making	By consensus where possible. If consensus cannot be reached, by majority vote. If there is an equal number of votes, the member who is chairing the meeting has a casting vote.
Meeting frequency	A minimum of twice yearly
Meeting venue	To alternate between marae and council venues; or as appropriate to a meeting agreed by the Chairperson and the Deputy Chairperson.

The Committee previously had a membership of eight, four elected members from Tauranga City Council (TCC) and four iwi. Currently the membership will be reduced to six, two Commissioners appointed to represent the TCC and four who are appointed as representatives of iwi, with one member each from Ngāti Ranginui and Te Runanga o Ngāi Te Rangi Iwi Trust and two members representing Ngā Pōtiki ā Tamapahore Trust Board.

The Wastewater Management Review Committee is established as a committee of Council under the Local Government Act 2002 and conditions imposed on Bay of Plenty Regional Council Coastal Permit # 62878.

Role

- To ensure Wastewater operations are in accordance with the Wastewater Management Review Committee Management Plan.

Scope

(a) To receive reports on the operation of the Wastewater Scheme, including reports in relation to monitoring and permit compliance, and to make recommendations to the Permit Holder on the development of Tauranga City Council's policies in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies and standards addressed in the Monitoring, Upgrade and Technology Review Report required by Condition 20 of Coastal Permit N^0 62878.

(b) To make decisions about the application of the Environmental Mitigation and Enhancement Fund established in accordance with Condition 19 of Coastal Permit N^0 62878.

(c) To make recommendations to the Permit Holder as to physical measures and initiatives to address or compensate for actual or potential effects of the Tauranga City Wastewater Scheme (in the broadest environmental sense).

(d) Without limiting the generality of function (c) above, to make recommendations to the Permit Holder as to the implementation of the works to be undertaken in accordance with Permit N^0 62881, namely:

- (i) Decommissioning of the Te Maunga Sludge Pond and the future use of the pond.
- (ii) Conversion of the Te Maunga Oxidation Ponds to wetlands.

(e) To make recommendations to the Permit Holder in relation to the independent consultant to be appointed to undertake the Monitoring, Upgrade and Technology Review Report required by Condition 20 of Coastal Permit N^0 62878.

(f) To make recommendations to the Permit Holder as to enhancing the involvement of tangata whenua in sampling, testing and monitoring.

(g) Assessment of the scope and adequacy of sampling and monitoring.

(h) Notification to appropriate parties of activities that may have adverse effects.

(i) To receive, review and recommend action following receipt of wastewater reports.

(j) To recommend the commissioning of reports and future Tauranga City Council actions on wastewater management, treatment and disposal issues and options, including:

- (i) Development of alternatives to waterborne wastewater systems;
- (ii) Options for further treatments;
- (iii) Options for methods of disposal;
- (iv) Monitoring effects on the environment.

(k) To co-ordinate and oversee education of the community on wastewater management, treatment and disposal issues.

(l) To identify and make recommendations to the Permit Holder as to sources of funding which may be available to supplement the Environmental Mitigation and Enhancement Fund established pursuant to Condition 19 of Coastal Permit N^0 62878 hereof and to be applied for the purposes specified in that condition.

(m) To make recommendations to the Permit Holder as to changes to conditions of these permits pursuant to section 127 of the Resource Management Act 1991, in light of the exercise of the Review Committee's functions, including reports received and information received as a result of monitoring, etc. or to avoid, remedy or mitigate actual or potential adverse effects associated with the operation of the Wastewater Scheme.

(n) To foster robust relationships and dialogue between the Review Committee, the Permit Holder, the Western Bay of Plenty District Council and Bay of Plenty Regional Council in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies.

(o) To make recommendations to Bay of Plenty Regional Council as to amendments to the conditions of these permits which could be implemented via a review under section 128 of the Act in accordance with Condition 22 of Coastal Permit N^0 62878.

(p) Prior to making any:

- (i) Decisions as to the allocation of the Environmental Mitigation and Enhancement Fund in accordance with Condition 18.3(b) of Coastal Permit N^0 62878 hereof or,
- (ii) Recommendations to the Permit Holder in relation to physical environmental mitigation or enhancement or mitigation works in accordance with Condition 18.3(c) of Coastal Permit N^0 62878 hereof; -

the Review Committee will exercise its best endeavours to ascertain the existence of any persons or bodies who may have a particular interest or stake in the ecological health of the

Tauranga Harbour (particularly the Upper Harbour/Rangataua Bay area) and to consult with those bodies or persons as to appropriate initiatives and measures to be so recommended (in accordance with Condition 18.3(b)of Coastal Permit N^0 62878) or undertaken (in accordance with Condition 18.3(c)of Coastal Permit N^0 62878). As a minimum, the Review Committee shall consult with

- Nga Potiki Kaitiaki Resource Management Unit hapu and iwi of Te Runanga o Ngaiterangi Iwi Trust, Ngati Ranginui and Ngati Pukenga and Te Arawa and their respective hapu which hold kaitiaki status over the wider Tauranga Moana district, including any Working Group established by those hapu or iwi;
- Bay of Plenty Regional Council and the Western Bay of Plenty District Council in relation to issues which may affect those councils in accordance with their function under Condition 18.3(m) of Coastal Permit N^0 62878 hereof.

(q) Not later than one month following the first anniversary of the commencement of these permits and on each anniversary thereafter, the Wastewater Management Review Committee shall forward to the General Manager, Bay of Plenty Regional Council, a report on the exercise of its activities and functions, including where appropriate a report on the effectiveness of measures undertaken pursuant to the Environmental Mitigation and Enhancement Fund.

(r) Not less than six months following the first anniversary of this permit and each fifth anniversary thereafter, the Wastewater Management Review Committee's annual report shall contain a review of its activities over the previous five-year period and recommendations for appropriate initiatives over the next five-year period, including any recommendations for changes to conditions of these permits which may be considered necessary or desirable. This report shall be available at least three months prior to the date on which Bay of Plenty Regional Council is entitled to review the conditions of these permits in accordance with Condition 22 of Coastal Permit N^0 62878 hereof.

(s) A copy of this report shall also be provided to the Chief Executive, Tauranga City Council.

(t) As set out in Condition 18.1.3 of Coastal Permit N^0 62878, the Wastewater Management Review Committee Management Plan may be amended with the written approval of the Chief Executive of Bay of Plenty Regional Council or delegate.

(u) Confirmation of Committee minutes.

Reporting

The Wastewater Management Review Committee reports to Council and the Chief Executive of the Bay of Plenty Regional Council.

Chairperson and Deputy Chairperson acting as Co-Chairs

The Chairperson and Deputy Chairperson of the Wastewater Management Review Committee (WWMRC) have a governance role to ensure that the WWMRC meets regularly and undertakes its role to monitor and provide advice to Tauranga City Council as the consent holder of Bay of Plenty Regional Council Coastal Permit # 62878 and ensure wastewater operations are in accordance with the Wastewater Management Plan.

- The Chairperson will be appointed by the Tauranga City Council following a recommendation of the Wastewater Management Review Committee.
- The Deputy Chairperson will be appointed by the Wastewater Management Review Committee.
- While these roles are separately appointed it is the intention that they act as co-chairs.
  - Only one person can chair a meeting at any one time. The person chairing the meeting has the powers of the chairperson as set out in standing orders and has the option to use the casting vote in the case of an equality of votes.

- The rotation of the meeting chairs is at the discretion of the Chairperson and Deputy Chairperson and subject to their availability, however it is expected that they will alternate chairing meetings when possible.
- When the Deputy Chairperson is chairing the meeting, the Chairperson will vacate the chair and enable the Deputy Chairperson to chair the meeting. The Chairperson will be able stay and participate in the meeting unless they declare a conflict of interest in an item, in which case they will not participate or vote on that item.
- The Chairperson and Deputy Chairperson will attend pre-agenda briefings and split any other duties outside of meetings, e.g. spokesperson for WWMRC.
- The Chairperson and Deputy Chairperson will jointly oversee and co-ordinate all activities of the WWMRC within their specific terms of reference and delegated authority, providing guidance and direction to all members and liaising with Council staff in setting the content and priorities of meeting agendas.
- The Chairperson and Deputy Chairperson will be accountable for ensuring that any recommendations from the WWMRC are considered by the Tauranga City Council.

Refer to the position description for the Chairperson and Deputy Chairperson for more details.

Order of Business

1 OPENING KARAKIA

2 APOLOGIES

3 PUBLIC FORUM

4 ACCEPTANCE OF LATE ITEMS

5 CONFIDENTIAL BUSINESS TO BE TRANSFERRED INTO THE OPEN

6 CHANGE TO ORDER OF BUSINESS

7 CONFIRMATION OF MINUTES

7.1 Minutes of the Wastewater Management Review Committee meeting held on 11 October 2023

File Number: A15302656

Author: Anahera Dinsdale, Governance Advisor

Authoriser: Anahera Dinsdale, Governance Advisor

RECOMMENDATIONS

That the Minutes of the Wastewater Management Review Committee meeting held on 11 October 2023 be confirmed as a true and correct record.

ATTACHMENTS

1. **Minutes of the Wastewater Management Review Committee meeting held on 11 October 2023**

MINUTES

Wastewater Management Review Committee meeting

Wednesday, 11 October 2023

Order of Business

MINUTES OF TAURANGA CITY COUNCIL
WASTEWATER MANAGEMENT REVIEW COMMITTEE MEETING
HELD AT THE GROUND FLOOR MEETING ROOM 1, 306 CAMERON ROAD, TAURANGA
ON WEDNESDAY, 11 OCTOBER 2023 AT 1PM

PRESENT: Commissioner Bill Wasley (Chairperson), Mr Whitiora McLeod, Mr Spencer Webster and Mr Des Heke.

VIA AUDIO VISUAL LINK: Commissioner Stephen Selwood, Ms Destiny Leaf and Ms Lara Burkhardt

IN ATTENDANCE: Commissioner Shadrach Rolleston, Wally Potts (Director, Waters), Jane Groves (Stormwater Programme Leader), Jim Summers (Consents Officer), Shaleen Narayan (Team Leader: Governance Services), Anahera Dinsdale (Governance Advisor)

1 OPENING KARAKIA

Commissioner Shadrach Rolleston opened the meeting with a karakia.

It was noted that Commissioner Shadrach Rolleston was in attendance as an alternate for Tauranga City Council but due to both Commissioners Wasley and Selwood both being present, he was in attendance to hear discussion. The Chair afforded Commissioner Shadrach Rolleston rights to speak but he could not vote in the meeting.

2 APOLOGIES

APOLOGY

COMMITTEE RESOLUTION WW2/23/1

Moved: Commissioner Bill Wasley
Seconded: Mr Spencer Webster

That the apology for lateness received from Mr Des Heke be accepted.

It was noted that Nic Johanson was also an apology for absence.

CARRIED

3 PUBLIC FORUM

None

4 ACCEPTANCE OF LATE ITEMS

None

5 CONFIDENTIAL BUSINESS TO BE TRANSFERRED INTO THE OPEN

None

6 CHANGE TO ORDER OF BUSINESS

None

7 CONFIRMATION OF MINUTES

7.1 Minutes of the Wastewater Management Review Committee meeting held on 31 May 2023

COMMITTEE RESOLUTION WW2/23/2

Moved: Mr Whitiora McLeod
Seconded: Commissioner Bill Wasley

That the minutes of the Wastewater Management Review Committee meeting held on 31 May 2023 be confirmed as a true and correct record.

CARRIED

8 DECLARATION OF CONFLICTS OF INTEREST

None

9 BUSINESS

9.1 Wastewater Programme Business Case

Staff Nic Johansson, General Manager: Infrastructure Services
Jane Groves, Stormwater Programme Leader

Key points
- The report provided an update of progress of the Programme Business Case (PBC) since the meeting held on 31 May 2023. At this meeting, the Recommendations were not endorsed by the Committee.
- The Project Working Group met multiple times to discuss and agree on a range of matters raised by Tangata Whenua.
- All project reporting for the PBC to the Committee would be joint representation of tangata whenua and staff.

Key Service Requirements 8
- The Tangata Whenua report stated that "Cultural Redress" was an inappropriate term and the paper indicated that the PBC would not mean that tangata whenua could not pursue aspirations in terms of tangata whenua vision for land at Te Maunga to be returned. The amended wording was "Promotes opportunities for strong and enduring partnerships with tangata whenua" and should incorporate KSR 8.

Key Service Requirements 11
- The project working group agreed to wording amendment. The wording change was reflected in the Recommendations below.
- The level and metric were also amended to reflect the change of the amended wording and the scope levels remain unchanged.

Critical Success Factor (CSF) 17 – Must not disturb additional urupā or wāhi tapu sites
- Discussion regarding the phrase "Must not disturb additional urupā or wāhi tapu sites".
- It was noted that tangata whenua and staff were still debating what this meant to each party.

- Iwi Members noted that there was existing pipe work in urupā and wāhi tapu sites and recognised that these would need to be regularly inspected and remedial work undertaken when required, however they did not expect upgrades or additions to occur at the sites.
- There was agreement in principal that a new CFS should be added, however staff would still seek further clarification from tangata whenua before the word “additional” was included in the final PBC.

Long List Assessment Criteria on Hapu and Iwi Management Plans

- General agreement to include long list assessment criteria on hapu and iwi management plans and staff recommended for inclusion to PBC.

Critical Success Factor 10 – Must not discharge treated wastewater directly to natural wetlands, groundwater, rivers, lakes and streams.

- Wording changed to “must not discharge to natural fresh water receiving environments”.
- The project working groups discussed the sea water receiving environments. It was noted that tangata whenua had a desire to phase this out.

Key Service Requirement 12

- The metric and scope levels would be confirmed by project working group.
- The word ‘coast’ would be replaced with ‘seawater’.

Mortuary Waste

- Desire in PBC to look at separation of mortuary waste in wastewater stream.
- Wastewater Management Review Committee within the scope of the terms of reference should request that staff undertake an investigation and provide a feasibility and possibility report to the next Wastewater Management Review Committee.

Geographical Scope

- It was noted that tangata whenua do not support increasing the geographical scope beyond where the Te Maunga Wastewater Treatment Plant. The staff clarified the scope level set out in PBC related to service and not how the service took place.

Draft Terms of Reference for Wastewater Programme Business Case

- Terms Of Reference was prepared for Wastewater PBC and was circulated to members in June 2023.
- It was recognised that the Terms of Reference (TOR) was not discussed in any length by the Project Working Group. There was an indicative signal that an agreed TOR would be done in November 2023 by the Project Working Group.

Discussion points raised

- Chair acknowledged the members of the Project Working Group for the work ethic on the PBC.

Key Service Requirement 6

- Expressed difficulty in understanding minimum and maximum aspirational scope levels. Iwi member expressed the desire for a word change to specify practicality of the visions and cover off all issues.
- Members agreed on the need of further discussion regarding the matters in KSR 6 by the Project Working Group.
- It was noted that the land that was to be decommissioned for pond 1 was originally taken under the Public Works Act, Iwi Members considered that as the land was no longer needed for the purpose in which it was taken, it should be returned. It was suggested that KSR 6 in relation to the land, was changed from maximum scope to intermediate scope.
- Discussion ensued on the return of the land as it was no longer

Key Service Requirement 11

- Ultimately to protect and look after cultural heritage sites.
- Amendment of wording – 'take practicable steps to not disturbing urupa and waahi tapu sites where they are known'.
- It was expressed that the potential need for Council to interpretate from a holistic point of view rather than a wastewater scientific point of view.

Critical Success Factor 10

- There were currently two constructed habitat wetlands at the Te Maunga Treatment Plant which the discharge flowed through before reaching the outfall.

COMMITTEE RESOLUTION WW2/23/3

Moved: Commissioner Bill Wasley
Seconded: Mr Spencer Webster

That the Wastewater Management Review Committee:

(a) Receives the report "Wastewater Programme Business Case".

(b) Endorse the PBC outputs (as set out below and in **Attachment 1** which were presented at the 31st May WWMRC meeting for endorsement). Those items coloured green in the attachment are not confirmed and are addressed separately in c) below.

- Investment Logic Map: confirms problem statements and define benefits from investment
- Benefits, KPIs and Measures: baseline and target values to be confirmed
- Investment Objectives
- Key Service Requirements (KSRs): describe a change sought, and the degree of change (minimum, intermediate, maximum) the programme investment is expected to deliver. Subsequent steps of the PBC will identify responses capable of delivering the respective levels of change for each KSR. The KSRs are broad, and include growth and geographical coverage, tangata whenua partnership and values, environmental considerations and resilience requirements.
- Scope parameters: the scope boundaries for the investment (based on the KSRs). Only options within the range of minimum, intermediate and maximum will be assessed.

(c) Endorse actions as agreed at the 13th September hui:

i. All reporting to the WWMRC in relation to the PBC will be joint, and as such, represent the views of the PBC project team as a whole.

ii. Amend wording for KSR 11 to ***'Actively seeks practicable alternative options to the two consented overflows from the WWTPs'***. The level/metric has also been amended to reflect this change. The scope levels remain unchanged.

	KSR	Level/ metric	Minimum (Critical)	Intermediate (Desirable)	Maximum (Aspirational)
11	~~Seeks to avoid direct wet weather wastewater overflows to wai receiving environments~~	~~Extent of direct wet weather wastewater overflows to wai receiving environments~~	No increase in extent of direct wet weather wastewater overflows to wai receiving environments	Reduction in extent of direct wet weather wastewater overflows to wai receiving environments	Minimise direct wet weather wastewater overflows to wai receiving environments

NEW KSR NAME: **Actively seek practicable alternative options to the two consented overflows from the WWTPs**

***NEW KSR LEVEL/METRIC*:** **Extent of direct wet weather wastewater overflows to wai receiving environments from 2 consented overflows from the WWTPs**

iii. Add long list assessment criteria on ***'Hapū and Iwi Management Plans'***

iv. Amend KSR 12 to ***'Actively seek practicable alternative options to the discharge of wastewater to seawater'***. The metric and scope levels for this KSR will need to be confirmed with the project team.

v. Request that the WWMRC ask staff to investigate the separation of mortuary waste from the wastewater stream for report back at future WWMRC meetings.

vi. Continue to work together on the 'Terms of Reference', paying particular attention to setting out PBC purpose, decision-making and PBC approval, with a view to finalising within one month of this meeting.

CARRIED

9.2 WWMRC Activity Report

Staff Jim Summers, Consents Officer and Acting Manager: Drainage Services
Bryan Everitt, Team Leader: Engineer Services

Power point Presentation

Key points

- The Te Maunga Pond 1 outfall discharge seepage rate was well within the consents conditions.
- There were no new odour complaints for Chapel Street or Te Maunga.
- There were no new overflow emergency discharges since the June 2023 Wastewater Management Review Committee.
- Since the previous June 2023 Committee meeting, there had been 23 blockage reports notified to Council. 18 did not leave the network, two discharged into the stormwater system and three potentially made the receiving environment.
- The contractor desludging Pond one (1) was working a 24 hour operation and tracking on schedule.
- Over 6,000 dry tonnes had been removed since the desludging begun. The Consent expire March 2024.
- Bay of Plenty Regional Council undertook a site inspection July 2023 and were satisfied with the compliance with the consent.
- The construction contract for Clarifier 3 was awarded to HEB and construction had begun. Excavation was due to commence late September 2023. Nga Pōtiki had been commissioned to provide cultural monitoring during the excavation.
- Construction of the internal grid piles for Bioreactor Two was complete and were currently being tested and checked for compliance with specifications.
- The Landward Section of Outfall was now complete
- Marine Section outfall had been cleared of debris. The CCTV inspection data was being review by a consultant and results were expect six to nine weeks from this meeting.
- New Inlet Works had commenced and would be completed in the third quarter of 2024.
- A number of ground site investigations would commence late 2023 for Bioreactor three and Picket Fence Thickener three
- The Interviews of candidates for Environmental Mitigation and Enhancement Fund (EMEF) had already taken place. TCC to provide and recommend candidates and the EMEF Panel made final decision.

Discussion points raised

- The Committee encouraged the Panel to finalise the EMEF candidate and progress it forward.

Inflow & Infiltration Strategy

Power point presentation

- A new strategy put together in 2022 to prevent rainwater and ground water entering the Wastewater system.
- Consequences of this included increased operations costs, reduced capacity in the waste water system, increased Capital costs and wet weather over flows.
- It was noted that almost all the main sources for infiltration were faults like cracked pipes or gully traps in both private and public infrastructure.
- Tauranga currently had a low level of inflow and infiltration with a 1.2% average. It was noted

that other New Zealand cities and towns typically reported five to ten percent, sometimes more.
- The Tauranga wet weather inflows were below average compared to others in New Zealand.
- There had been a lot of work completed between 2008 and 2020 before Covid. There were 45 catchment investigations which included smoke testing and manhole and property gully trap inspections. These areas were selected based off the trends record.
- The Inflow and Infiltration strategy pillars included prevention, issue identification, implantation and annual and three yearly review.
- The key deliverables from the 2023 Annual Report and programme review included the graphical inflow and infiltration database that had been developed and a list of prioritised catchments and a list of improvements.
- It was noted that the main objective of the Inflow and infiltration strategy was to maintain and pertain standards.

Discussion points raised
- Staff were acknowledged for their work.

COMMITTEE RESOLUTION WW2/23/4

Moved: Commissioner Stephen Selwood
Seconded: Mr Whitiora McLeod

That the Wastewater Management Review Committee:

(a) Receives the report "WWMRC Activity Report".

CARRIED

Attachments

1 WWMRC Meeting Power point October 2023 - Activity Report (A15174492)
2 WWMRC Meeting Power point October 2023 - I&I Update (A15182039)

9.3 Treated Wastewater for Street Tree/Garden Irrigation

Staff Jim Summers, Consents Officer

Key points
- Noted the climate change and extreme weather events in 2023 and TCC were committed to maintaining and enhancing the health of our source water streams.
- The Oct to Dec 2023 predictions showed that the soil moisture levels were below average (45% chance)
- TCC staff were investigating and trial the reuse of treated wastewater to irrigate urban open spaces along Maunganui Road and Papamoa, which was a practical solution to address water resource scarcity. It was noted that this was already being practiced in other parts of New Zealand and the world. TCC had used irrigated wastewater at the Omanu Golf Course.
- The TCC Water watchers plan was focussed on establishing good water practices, whatever the weather may be. The aim was to have a plan in place before the demand for water occurs
- It was noted that any water use which falls outside the standard approval system were required to have a smart water plan.
- The Environmental Strategy and Nature and Biodiversity Action Plan included more street trees and plants across city in near future. These trees would support climate change mitigation, provide amenity and ensure Council meets the target to increase tree canopy and indigenous vegetation. In short term, this would likely increase the demand for water.

In response to questions

- The feedback from Tangata whenua was that they were ok with progressing study and investigation regarding use of highly treated water but interested in how the feedback from tangata whenua to staff would happen.
- The water effluent would go through full system, wetland and UV disinfection plant before the water was used to irrigate.
- Staff expect that the start of this trial and investigation would be in small quantities.
- It was noted that the Committee supported the trial and investigation.

Discussion points raised

- Staff noted that there was no residual disinfectant in the treated water after the water filtered through the UV plant.
- Staff noted that the trial couldn't progress without resource consents. Staff would investigate first and foremost and report back to Committee before progressing with the trial.
- It was suggested that staff meet with Te Rangapu Mana Whenua o Tauranga Moana regarding the trial and investigation on reuse of treated water.

COMMITTEE RESOLUTION WW2/23/5

Moved: Commissioner Bill Wasley
Seconded: Commissioner Stephen Selwood

That the Wastewater Management Review Committee:

(a) Receives the report "Treated Wastewater for Street Tree/Garden Irrigation".

(b) Supports the investigation for the reuse of treated water for watering street trees.

(c) Staff to provide report on findings of investigation and process moving forward.

(d) Provide feedback on the reuse of treated wastewater for watering street trees and potentially other locations

CARRIED

Attachments

1 WWMRC Meeting Power point October 2023 - Treated Wastewater (A15175786)

10 DISCUSSION OF LATE ITEMS

None

11 CLOSING KARAKIA

Commissioner Shadrach Rolleston closed the meeting with a karakia.

The meeting closed at 3:33pm.

The minutes of this meeting were confirmed as a true and correct record at the Wastewater Management Review Committee meeting held on 22 November 2023.

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CHAIRPERSON

8 DECLARATION OF CONFLICTS OF INTEREST

9 BUSINESS

9.1 Appointment of Chairperson of Wastewater Management Review Committee

File Number: **A15297214**

Author: **Coral Hair, Manager: Democracy and Governance Services**

Authoriser: **Christine Jones, General Manager: Strategy, Growth & Governance**

PURPOSE OF THE REPORT

1. This report recommends that Spencer Webster be appointed Chairperson of the Wastewater Management Review Committee (WWMRC) as requested by Ngā Potiki ā Tamapahore Trust Board representatives.

RECOMMENDATIONS

That the Wastewater Management Review Committee:

(a) Receives the report "Appointment of Chairperson of Wastewater Management Review Committee".

(b) Recommends to Council that Spencer Webster (Ngā Potiki) is appointed as the Chairperson of the Wastewater Management Review Committee.

(c) Thanks Lara Burkhardt for her services as Chairperson of the Wastewater Management Review Committee.

BACKGROUND

2. Lara Burkhardt was appointed Chairperson of the WWMRC by Council on 5 September 2022 following a recommendation from the WWMRC. At the same time Commissioner Bill Wasley was appointed as Deputy Chairperson and the terms of reference were amended to enable alternate presiding of meetings between the Chair and Deputy Chair. The revised governance arrangements for the WWMRC and appointments were the result of a thorough discussion by the members.
3. Spencer Webster was endorsed and appointed by Council on 29 May 2023 as the Ngā Potiki ā Tamapahore Trust Board representative to the WWMRC in place of Te Rangimārie Williams.
4. A request has been received from Lara Burkhardt and Spencer Webster to enable Spencer Webster to step into the Chairperson's role.

STRATEGIC / STATUTORY CONTEXT

5. The WWMRC is a special committee established both by the Council (under the Local Government Act 2002) and the management plan approved by the Bay of Plenty Regional Council that sets out how the WWMRC is to operate under the conditions of resource consent 62878 and the iwi membership of this is set by the consent. The management plan is silent on the arrangements for chairing the meetings. This is not a matter that would be addressed under this plan and there is no requirement to amend this plan to spell out chairing arrangements. The Local Government Act 2002 requirements relating to chairing of meetings, and the appointments of a Chair and Deputy Chair apply.
6. The Mayor has the power under section 41A (3)(c) to appoint the chairperson of each committee and Council has the power to discharge a chairperson appointed by the Mayor

(section 41A(4) (d)). The Commission Chair does not have the powers of the Mayor and therefore Clauses 25[1] and 26(3) of Schedule 7 of the Local Government Act 2002 (LGA) apply. Sub-clauses 26(3) and (4) state:

(3) The local authority may appoint a member of a committee to be the chairperson of that committee and, if the local authority, on the appointment of the committee, does not appoint a chairperson, that power may be exercised by the committee.

(4) The local authority or the committee may appoint a deputy chairperson to act in the absence of the chairperson.

OPTIONS ANALYSIS

7. The WWMRC has the following options:

   (a) Agree to the recommendation to appoint Spencer Webster as chair

   (b) Continue with the appointment of Lara Burkhardt as chair

   (c) Recommend another person be appointed as chair

8. Given that this change has been requested by Ngā Potiki ā Tamapahore Trust Board members, and that the previous decision of the WWMRC was to appoint a member of Ngā Potiki as the Chairperson, option (a) is considered the preferred option.

FINANCIAL CONSIDERATIONS

9. There are no financial considerations.

LEGAL IMPLICATIONS / RISKS

10. The current chairperson can remain in the position until replaced and WWMRC can continue to meet and be chaired alternatively by the chairperson or deputy chairperson.

SIGNIFICANCE

11. The Local Government Act 2002 requires an assessment of the significance of matters, issues, proposals and decisions in this report against Council's Significance and Engagement Policy. Council acknowledges that in some instances a matter, issue, proposal or decision may have a high degree of importance to individuals, groups, or agencies affected by the report.

12. In making this assessment, consideration has been given to the likely impact, and likely consequences for:

    (a) the current and future social, economic, environmental, or cultural well-being of the district or region

    (b) any persons who are likely to be particularly affected by, or interested in, the decision.

    (c) the capacity of the local authority to perform its role, and the financial and other costs of doing so.

13. In accordance with the considerations above, criteria and thresholds in the policy, it is considered that the decision is of low significance.

ENGAGEMENT

14. Taking into consideration the above assessment, that the decision is of low significance, officers are of the opinion that no further engagement is required prior to the Committee making a decision.

[1] Clause 25 relates to the voting systems for certain appointments, including for the chairperson and deputy chairperson of a committee.

NEXT STEPS

15. The Council approves the WWMRC’s recommendation and appoints the Chairperson of WWMRC.

ATTACHMENTS

Nil

9.2 Wastewater Activities Report

File Number: **A15295542**

Author: **Radleigh Cairns, Manager: Drainage Services**

Authoriser: **Nic Johansson, General Manager: Infrastructure**

PURPOSE OF THE REPORT

1. To provide information to the Wastewater Management Review Committee on the status of wastewater network and associated projects.

RECOMMENDATIONS

That the Wastewater Management Review Committee:

(a) Receives the report "Wastewater Activities Report".

DISCUSSION

Wastewater Consents

2. Results of sample monitoring associated with Council's wastewater consents are all within consent limits.
3. RC 62878 (Te Maunga Discharge Consent) requires Council to undertake, in 2024, a broad spatial study of benthic biota and sediments in the vicinity of the outfall comparable to that carried out originally as part of the consent application process. Staff are working to appoint a contractor for this study The previous study was conducted in 2014 (**attachment 1**).
4. In 2024, RC 62878 also requires Council to commission a comprehensive assessment of the wastewater discharge and the operation and effects of the wastewater scheme and technological developments in relation to wastewater treatment and disposal and re-use systems and techniques. Based on this work a Monitoring, Upgrade and Technology Review Report (MUTR) will then be prepared. The previous report was undertaken in 2019 (**attachment 2**).
5. The assessment shall be undertaken by a suitably qualified independent New Zealand specialist(s) in wastewater systems. The WWMRC, as set out in its terms of reference, is to make recommendations to Council in relation to the independent consultant appointed.
6. Previously Beca have been the technical lead for this review with other specialists recruited as required (including those specified by the tangata whenua committee members for the cultural report, refer item 8 below).
7. Staff's recommendation will be for Beca to once again perform this role. Staff also propose that the committee be provided with an opportunity to ask questions and assess Beca's approach to the assessment at the upcoming WWMRC meeting.
8. RC 62878 anticipates that tangata whenua will prepare a report as part of the review, and Council resource this requirement appropriately so that any conclusions and outcomes are incorporated into the final MUTR report.

Pond 1 desludging

9. The contractor has now removed 7500 dry tonnes of sludge since desludging began in October 2022. Seepages have remained well within consented limits throughout the process, even with contractors working on the harbour face of the pond over the last two months. Contractors are currently working 24 hrs a day with completion currently anticipated to be in line with the disposal consent requirement of March 2024.

Te Maunga Capex Projects

10. Construction continues to be on remediation of piles for Bioreactor two. Remediation could take between 4 and 6 months with completion of ground improvement works pushed out to April 2024. Above ground works will commence thereafter and take approximately 15 months.
11. Construction of Clarifier three has progressed well, with sheet piles and a dewatering system installed. Excavation for piling has been completed and pile installation underway. This project is currently ahead of schedule.
12. The existing inlet works odour bed is to be decommissioned and replaced with new technology requiring a smaller footprint with works to begin towards the end of 2024. A preferred concept option for the new inlet works is expected prior to Christmas with preliminary design to commence around September 2024.
13. A preliminary site assessment for Bioreactor three is underway with geotechnical and groundwater investigations to commence at the beginning of 2024.
14. Dye testing of the marine outfall requires very favourable conditions and so is scheduled for the beginning of 2024. This will complete the condition assessment investigations and enabling progress on what if any remediation is required.

Biosolids Strategy

15. In 2016 Council began work on a Biosolids strategy as a response to the consent requirement to decommission Pond 1 as a sludge pond. Stage 1 of the strategy was completed with the commissioning of Te Maunga's thickening and dewatering plant in April 2019 which enabled Council to remove the need to dispose of the waste activated sludge into Pond 1.
16. Stage 2 of the biosolids strategy included looking at the long-term approach to biosolids management. This included both the current disposal option (a mixture of Vermi-composting and landfill disposal moving towards 90%+ vermi-composting) and the current longer-term option of solar drying (which is included in both the 2021-31 and draft 2024-34 Long Term Plans).
17. Stage 3, underway, includes staff and the WWMRC considering the long-term future of Pond 1 (this matter is identified within the suite of wastewater consents as a function of the committee). Consideration of pond 1's future will also be through the Wastewater Programme Business Case (PBC) which is described further below.
18. A review of the biosolids strategy is timely given the work underway with the wastewater PBC, the upcoming 5 yearly MUTR report, and the nearing completion of the desludging of Pond 1.
19. An opportunity for staff to visit a number of North American treatment plants with varying solutions to the disposal of biosolids along with energy neutrality and wastewater reuse presented itself as part of a trip to the Water Environment Federations Technical Exhibition and Conference (WEFTEC) in October.
20. Staff and Beca will present an overview of the study tour and the types of existing and new technologies currently utilised as an introduction to this topic to current WWMRC members.

Wastewater Programme Business Case

21. The PBC will define a 'preferred way forward' and roadmap for future investment in the wastewater scheme and broader initiatives to improve environmental performance, strengthen partnerships with tangata whenua and improve system resilience. The PBC process involves defining key issues with the wastewater scheme, the development of objectives and service requirements for future investment and proposes possible options or responses which could be implemented to meet service requirements. These responses may include both infrastructure and non-infrastructure options (e.g. educational and policy setting/coverage changes). The PBC will include consideration of, and provide direction for, the future of the marine outfall, the biosolids strategy and the future of Pond 1 in addition to a wide range of other matters.

22. At its last meeting on 11 October, the WWMRC endorsed all outputs of the PBC to date with the exception of two outstanding matters as follows:

- A new or amended KSR 8 *Enables strong, enduring partnerships with tangata Whenua (enabling active protection and informed decision-making)*; and,
- Add a new CSF17 *'Must not disturb additional urupā or wāhi tapu sites' (or similar wording).*

23. It was noted by the WWMRC that the KSR 8, as proposed, was considered to be outside the scope of the PBC as it addressed matters relating to the restoration and return of land, and for CSF17, that further clarification on the wording 'disturb' and 'additional was required.

24. The project team are currently looking to clarify the intent of the above matters and exploring possible alternative wording for consideration by the WWMRC at the next meeting?

ATTACHMENTS

1. **Outfall Ecologocal Study 2014 - A9226873** ⇩
2. **FINAL MUTR Report August 2020 inc_Appendices - A15298068** ⇩

Survey of Benthic Ecology and Sediments around the Ocean Outfall, 2014

Prepared for Tauranga City Council

22 September 2014

Boffa Miskell

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CONTENTS

Appendices

1.0 Introduction

Tauranga City Council holds a resource consent to discharge treated effluent from its Chapel Street and Te Maunga Wastewater Treatment Plants into the Bay of Plenty. The discharge is via a subtidal marine outfall at Omanu Beach, Mount Maunganui, hereafter called the Ocean Outfall (Figure 1).

A baseline survey of benthic biota in the vicinity of the outfall was undertaken by Bioresearches Ltd in 1986, with a second more detailed study of biological resources around the outfall conducted by Beca in 1991 as part of a Receiving Waters Study. Cawthron conducted an assessment of the effects of the existing outfall discharge on marine sediment quality, the benthic fauna community, and edible shellfish resources in the vicinity of the outfall in 2013.

As a condition of consent the survey conducted in 2003 was to be repeated in 2014. This report summarises the findings of the 2014 survey.

2.0 Project Description

2.1 Nature of the Discharge

Effluent from the ocean outfall is comprised of combined effluent from two wastewater treatment plants (WWTP): Chapel Street WWTP and Te Maunga WWTP. The Chapel Street facility uses contact stabilisation/activated sludge secondary treatment followed by tertiary ultraviolet disinfection[1]. The Te Maunga plant uses extended aeration/clarification followed by waste stabilisation ponds. Effluent from both facilities is discharged to treatment wetlands. Wetland effluent is combined and pumped through a tertiary ultraviolet disinfection plant[2] prior to being discharged at the ocean outfall.

Cawthron (2003) noted that both these treatment processes produce high quality, low concentration effluent which is typical of waste stabilisation pond effluent (Hickey et al., 1989) or standard secondary treatment i.e. a near neutral pH, low biological oxygen demand (BOD) and total suspended solids (TSS), but less efficient nutrient removal.

Effluent flow rates through the outfall vary seasonally and diurnally. The current resource consent allows a discharge of up to 37,000 m^3 per day, but the average daily discharge is estimated to be approximately 25,000m^3.

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[1] *Tertiary ultraviolet disinfection is only utilised if the treated effluent is to be used for irrigation purpose, or in the event of an emergency discharge to the harbour.*

[2] *The new tertiary ultraviolet disinfection plant is to be commissioned by April 2015*

2.2 Receiving Environment

The outfall pipeline was constructed in 1977 and extends approximately 950m off Omanu Beach. Effluent is discharged through approximately nine 100mm diameter diffuser ports in approximately 12m of water. Beca (1991) showed that the predominant currents are alongshore and are up-coast 50% of the time and down-coast 50% of the time. Dilution at the diffuser is estimated at 25:1 at the maximum flow rate of 37,000m^3/day. Beca (1991) stated that it was unlikely effluent would reach the shoreline within three hours of release with the outfall extending 950m from the beach.

Previous surveys by Bioresearches (1991) and Cawthron (2003) indicated that benthic sediment around the diffuser is dominated by sand grain sizes with shell material. These surveys also indicated that the dominant benthic invertebrates present subtidally were large filter feeding bivalves such as *Dosinia* sp., frilled venus shell (*Circomphalus yatei*[3]) and morning star shell (*Tawera spissa)*. It was noted that gastropods such as large ostrich foot (*Struthiolaria papulosa*) and speckled whelk (*Cominella adspersa*) were common, as were tuatua (*Paphies subtriangulata*), sand dollar (*Fellaster zelandiae*), paua (*Haliotis iris*), green lipped mussel (*Perna canaliculatus*), crayfish (*Jasus edwardsii*) and paddle crabs (*Ovalipes catharus*).

The main fish species caught offshore from Mount Maunganui were snapper (*Chrysophrys auratus*), flounder (*Rhombosolea plebeia*), terakihi (*Nemadactylus macropterus*), trevally (*Caranx georgianus*) and kingfish (*Seriola lalandi*), guarnard (*Chelidonichthys kumu*), John Dory (*Zeus faber*) and hapuku (*Polyprion oxygeneios* and *Polyprion moene*) (Bioresearches 1991, Cawthron 2003).

Omanu Beach and Mount Maunganui main beach are popular recreational areas that are used for a wide variety of water-based recreation, boating, fishing and shellfish gathering.

3.0 Methods

3.1 Study Design

This survey adopts the same methods that were used by Cawthron (2003). In summary, the approach focuses on describing the composition of the subtidal benthic communities (infauna and epifauna), the biochemical state of key subtidal and intertidal bivalves, and the physical and chemical sediment properties at various distances from the outfall. Subtidal communities are described on two spatial scales, one designed to sample small macrofauna and the other to describe larger, more sparsely distributed, bivalves and large invertebrates. Intertidal sampling targeted tuatua (*Paphies subtriangulata*) which is the dominant large bivalve found within the intertidal and surf zone (Bioresearches 1991).

Spatial changes were assessed along transects radiating away from the outfall at approximately north and south orientations (shown in Figure 1), following the local bathymetry and predominant current directions (i.e. parallel to shore). Survey effort focussed on the primary transect which was sampled for sediment chemistry, subtidal shellfish, infauna, and shellfish health at 20, 100,

[3] Previously known as *Bassina yatei*

1000 and 2000 m intervals. The primary transect extended from the outfall diffuser at a depth of approximately 12m. The two secondary transects were located respectively at 5m and 20m depth. Intertidal bivalves were sampled at 0, 100, 200, 400, 800, 1600 and 2000m from the outfall alignment in both a northerly and southerly direction. The 20m transect was only sampled in alignment with the outfall and at 2000m north and south. Sites greater than *ca.* 1000m away served as reference sites. Additionally, dredge samples were collected at various points near the outfall between the 15 and 20 m isobaths to better describe the sparse large epifaunal and to collect scallops for health analyses. Survey methodologies are provided in section 3 below.

Table 1: Omanu Beach ocean outfall station locations and sample types collected during the current study.

Site	NZMG E (m)	NZMG N m)	Shellfish Size/Counts x 1 composite sample	Benthic Infauna x 3 reps	Sediment Chemistry 3 reps	Shellfish Chemistry
Diffuser-12	2796913	6387099		✓	✓	
20N-12	2796892	6387109	✓	✓	✓	✓
100N-12	2796932	6387085	✓	✓	✓	✓
100S-12	2796828	6387154	✓	✓	✓	✓
1000N-12	2796997	6387039	✓	✓	✓	✓
1000S-12	2796218	6387699	✓	✓	✓	✓
2000N-12	2797846	6386600	✓	✓	✓	✓
2000S-12	2798699	6386022	✓	✓	✓	✓
0-INT	2795430	6388363	✓			✓
200N-INT	2796468	6386531	✓			
400N-INT	2796409	6386556	✓			
600N-INT	2796264	6386690	✓			
800N-INT	2795929	6386912	✓			✓
1200N-INT	2795619	6387165	✓			
1600N-INT	2795304	6387418	✓			
2000N-INT	2794984	6387651	✓			✓
200S-INT	2796729	6386329	✓			
400S-INT	2796905	6386220	✓			
800S-INT	2797230	6385988	✓			✓
1200S-INT	2797555	6385761	✓			
1600S-INT	2797880	6385534	✓			
2000S-INT	2798216	6385317	✓			✓
0-05	2796729	6386809	✓			
2000N-05	2795252	6388105	✓			
2000S-05	2798484	6385720	✓			
1000N-05	2797620	6386263	✓			
1000S-05	2795992	6387408	✓			
0-20	2797283	6387927	✓	✓	✓	✓
2000S-20	2799362	6387072	✓			
2000N-20	2796140	6389453	✓			

3.2 Subtidal Sediment Characteristics

Sediment grain size is an important variable when studying benthic chemistry and ecology. It indicates the chemical makeup of sediment (e.g. muddy sediments tend to have relatively high organic and nutrient contents) and the range of organisms that may live in it (e.g. the types of species encountered in sandy sediments are generally different to those in muddy sediments). Sediment grain size therefore provides a measure of the physical characteristics of a site that can be used to examine differences between sites for other environmental parameters.

Three replicate sediment chemistry cores were collected by SCUBA at each of the 9 sites positioned along the primary 12m transects (Fig.1) plus the 20m site in line with the outfall (0-20). At each site the sediment chemistry cores were manually driven into the sediments to a depth of approximately 10cm. Prior to subsampling for chemical analysis, cores were examined to determine texture, colour (black anoxic layer) and odour (“rotten egg” smell indicating anaerobic conditions). Digital photographs were then taken of each core to document the appearance of the sediment profile (Appendix A).

The top 3cm of each replicate core was combined and placed in sample jars, stored on ice, and transported to the analytical laboratories (Hill Laboratories and the University of Waikato). Samples were analysed for trace metals, grain size distribution, and organic content (AFDW). Trace metal analysis included arsenic, aluminium, cadmium, copper, chromium, lead, nickel, mercury and zinc. The inert reference metal Al was included to help account for the natural variability that occurs in sediment. Metals samples were acid digested (ASTM 3974) and analysed via flame atomic absorption spectrometry (AAS).

Particle size distribution analysis was conducted to closely match the size classes previously analysed [i.e. gravel (<2mm); very coarse sand (2mm – 1mm); coarse sand (1mm – 500µm); medium sand 250µm – 500µm), fine sand 125µm - 250µm), very fine sand 63µm -125µm) and silt and clay (<63µm)]. These divisions are consistent with the standard Udden-Wentworth size classifications. Sediment particle size analysed using a laser particle analyser and wet sieving of grain sizes > 2mm.

Sediment organic content involves ashing sediment at 550°C to determine the loss of weight on ignition (APHA 2540 method).

3.3 Subtidal Communities

The approach for sampling the subtidal communities was to locate and mark each of the subtidal stations prior to beginning the dive on each site. The sites were located in the field using a vessel-mounted global positioning system (GPS) and marked from the surface using a shot line (i.e. a small surface buoy attached to an anchored line). The survey was conducted using standard SCUBA.

3.3.1 Infauna

The infauna communities were sampled 0, 20, 100, 1000 and 2000m to the north and south of the outfall along the 12m transect. Three replicate benthic infauna core samples were collected concurrently with the sediment chemistry cores described above. The infauna cores consisted of 130mm PVC tubes with a 0.5mm nylon mesh bag affixed to the top of each core to act as a sieve. Cores were manually driven approximately 10cm into the benthic sediment. The contents of the core were emptied into the mesh bag and sieved by gently rinsing the contents of the bag in clean seawater. The contents were transferred to a jar for preservation. An aqueous solution of 60%

ethanol (ETOH) and seawater was used to fix macrofaunal samples prior to transport to the laboratory.

At the laboratory, individual organisms within the macrofaunal samples were identified and counted with the aid of a binocular microscope. Identifications were made to the lowest practicable taxonomic level (ideally genus and species).

3.3.2 Shellfish and other large Invertebrates

Shellfish samples were collected using a slider sampler at the 17 subtidal sites indicated on Figure 1 by combining the sediments from two 0.125m^2 slide samples to produce four replicate 0.125m^2 x 0.1m deep samples. That is, two individual slide samples were emptied into each bag to produce one of the four replicates. A slide sampler is a stainless steel box frame (250mm x 500mm) with detachable doors on the ends and an adjustable depth gauge (set to 100mm) so that it could be manually driven across and through the sediment at a consistent depth.

Upon collection of the sample the contents were transferred into large 2mm mesh bags. Contents were sieved onboard the vessel before being preserved in 60% ethanol (ETOH) and seawater prior to transportation to the laboratory. In the laboratory all large (*c.* > 5mm) shellfish and invertebrates were picked out, identified, counted and measured.

3.3.3 Shellfish Health

The dominant shellfish species found along the primary 12m deep transect (see Figure 1) (*Dosinia* sp.) was tested for:

- the most common contamination-indicating metals and metalloids (Al, As, Cd, Cr, Cu, Hg, Ni, Pb, Sn),
- $\delta^{13}C$ and $\delta^{15}N$ stable isotope ratios (which indicate the degree to which the shellfish derive food from outfall derived organics) and
- indicator bacteria (Faecal coliforms and *Enterococci*) to check safety for human consumption.

The stable isotope analysis involves comparing the ratio of the stable isotopes of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) against the parent forms of each atom ($\delta^{12}C$ and $\delta^{14}N$). Marine organisms and sediments tend to have different sources of carbon and nitrogen than their terrestrial counterparts and therefore have been shown to have markedly different isotopic signatures. However, marine organisms and sediments in the vicinity of wastewater outfalls are subjected to terrestrial sources of carbon and nitrogen from the effluent and tend to show an isotopic shift towards this terrestrial signature. Isotope results were based on whole homogenised animals, and not solely the gut or tissue portions. This approach works well for distinguishing total body burdens based on chronic long-term exposure (i.e. months to years) but is less sensitive to acute changes or recent impacts (i.e. days to weeks) where analysis of gut content alone is the preferred approach. Given that assessment of cumulative impacts from the ocean outfall was the primary objective, the whole body burden approach was used.

Dosinia anus was the preferred species and was used for all of the trace metals and stable isotope analyses because of the biomass required. Approximately a dozen specimens were removed from the shellfish samples prior to preservation, measured (for inclusion in the shellfish statistics), bagged and held on ice until processed by the laboratories.

The seabed between the outfall and the 20m isobaths was also dredged for scallops and other large epifauna. Scallops caught in these dredge surveys were also tested for shellfish health in the same manner to that described above.

3.4 Intertidal Shellfish (tuatua)

Tuatua (*Paphies subtriangulata*) were sampled at 13 intertidal sites along Omanu Beach in the vicinity of the outfall (see section 2.3.1 and Figure 1). At each site, the main "tuatua bed" was located by moving progressively down the profile digging with bare feet until tuatua were found. Digging then continued further down the profile to ensure that the densest part of the bed had been located. Five replicate 0.25m^2 quadrats were then placed haphazardly within the roughly defined bed and each quadrat was searched for tuatua down to a depth of approximately 15cm. All tuatua were removed, counted and measured (longest axis ±0.5mm). After measuring, 10-15 tuatua from five sites (in alignment with the outfall, 800m north and south and 2000m north and south) were held on ice until processed by the laboratories for shellfish health analyses (see 2.3.2 for analyses and treatment). The remaining shellfish were released back into the surf zone. Density estimates and size-frequency plots were carried out for tuatua in the intertidal zone in a similar manner to that employed by the 1991 and 2003 surveys.

3.5 Comparison against Guidelines

In accordance with Cawthron (2003), certain sediment and tissue samples were compared against relevant guideline criteria. The assessment, however, has not been based on the criteria value alone and is merely part of the decision framework. The guideline values adopted as part of this assessment and their application is as follows:

- **ANZECC (2000):** Aquatic ecosystem guidelines for sediments. The ANZECC Interim Sediment Quality Guideline criteria were used for the two distinct threshold levels under which biological effects are predicted. The lower threshold (ISQG-low) indicates a possible biological effect while the upper threshold (ISQG-high) indicates a probable biological effect.
- **Ministry for the Environment, 2003**. Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas. Ministry for the Environment, Wellington.
- **Food Standards Australia and New Zealand, 2008.** Australia New Zealand Food Standards Code, Anstat Pty Ltd, Melbourne.

A range of univariate and multivariate statistical procedures were undertaken to examine the differences between the range of biotic, chemical and physical variables at the various sites. Analyses were primarily carried out using PRIMER v6 with Permanova.

3.5.1 Subtidal Communities

Permanova was used to examine species assemblage by distance, direction and depth. This was done first with just one factor (location) and subsequently with all the data. Location was a combination of distance, direction and depth. Next, a three factor model was used (distance, direction and depth) using all of the data, and finally only the data collected on the 12m transect.

One way ANOVAs were constructed. Where appropriate, data were subjected to tests for normality and homogeneity of variances, and transformed as required. If differences did exist, the data were subjected to Tukey Post Hoc analysis, so significant differences could be examined on a site by site basis.

Following that, the infauna assemblages recorded at each site were contrasted in a non-metric multidimensional scaling (MDS) ordination and presented graphically in a cluster diagram using Bray-Curtis similarities between samples. Abundance data were fourth-root transformed to de-emphasise the influence of the most abundant species. Groups of sites were formed from the cluster diagram at an arbitrarily assigned level of similarity. The statistical significance of the differences between the groups was calculated using a permutation-randomisation test based on Bray-Curtis similarity. The major contributing taxa of each group were then summarised by calculating the average contribution of each species to the similarity of the group.

4.0 Results and Discussion

4.1 Subtidal Sediment

4.1.1 Physico-chemical

Grain size results indicate a similar pattern to that detected in 2003 (Cawthron, 2003), with an increase in fine sediments with proximity to the outfall. This indicates a deposition zone around the diffuser. Very fine sand dominates sites around the diffuser out to sites 100m north and south. Beyond 100m there is a greater proportion of fine sand and medium sand. Silt and clay was not detected at any of the sites. Gravel formed a very small proportion of sediment at some sites.

In 2003, benthic sediment from these sites was dominated by fine sand, with a greater proportion of medium sand with increasing distance from the diffuser. In the 2003 survey small proportions of silt and clay were detected at all sites. Gravel (most likely shell hash) formed a greater proportion in the sites close to the diffuser.

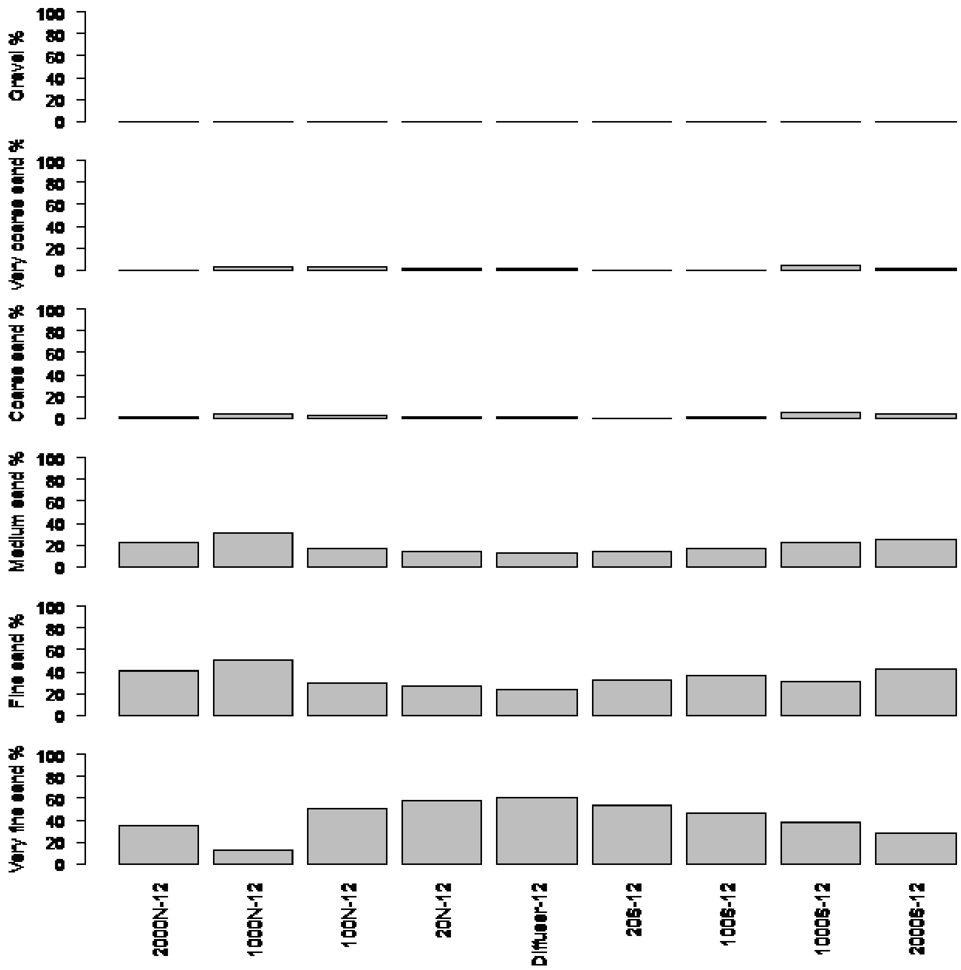


Figure 4: Particle size distribution from composite samples collected from subtidal sites.

4.1.2 Contaminants

Contaminant concentrations were low at all sites and significantly below ANZECC (2000) sediment quality guidelines. There is no difference in contaminant concentrations between sites 2000m from the outfall and those closer to the outfall. This indicates the outfall discharge is having no measureable effect on contaminant concentrations in benthic sediment. Concentrations of metals are generally lower than those detected in 2003.

Table 4: Sediment organic content and trace metals from stations in the vicinity of the ocean outfall (metals are in mg/kg).

Site	% Organic	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
2000N-12	< 0.04	4	< 0.10	4	< 2	< 0.10	< 2	2.5	17
1000N-12	< 0.04	4	< 0.10	4	< 2	< 0.10	< 2	2.3	16
100N-12	< 0.04	4	< 0.10	5	< 2	< 0.10	< 2	2.5	18
20N-12	< 0.04	3	< 0.10	4	< 2	< 0.10	< 2	2.2	16
Diffuser	0.04	4	< 0.10	5	< 2	< 0.10	< 2	2.6	21
20S-12	< 0.04	4	< 0.10	4	< 2	< 0.10	< 2	2.3	16
100S-12	< 0.04	4	< 0.10	5	< 2	< 0.10	< 2	2.7	19
1000S-12	< 0.04	3	< 0.10	5	< 2	< 0.10	< 2	3.8	26
2000S-12	< 0.04	4	< 0.10	4	< 2	< 0.10	< 2	2.5	16
0-20	0.09	7	< 0.10	8	< 2	< 0.10	< 2	5	22
ISQG-Low		**20**	**1.5**	**80**	**65**	**0.15**	**21**	**50**	**200**
ISQG-High		70	10	370	270	1	52	220	410

4.2 Subtidal Communities

4.2.1 Infauna

Generally infauna was dominated by polychaete worms (*Spiophanes modestus*, *Heteromastus filiformis*, *Euchone pallida*, Cirratulidae, *Magelona dakini*), amphipods (Haustoridae, Phoxocephalidae, unidentified amphipod taxa), bivalves (*Tawera spissa* and *Myllitella vivens vivens*), and cumacea (Table 5). Each of the remaining species comprised less than 2% of the total. A complete infauna species list is provided in Appendix B.

Infauna abundance was significantly higher (ANOVA, $P<0.01$, Appendix C) in samples collected in 20m water depth adjacent to the outfall (0-20) compared to the other sites surveyed. The higher abundance of organisms at this site was due to the presence of large numbers of juvenile *Tawera spissa* at this site. The core samples collected at 0-20 contained 60, 107 and 120 juvenile *Tawera spissa*. A single individual of this species was detected at one of the other sites, but was absent from all other sites (Figure 5).

The average number of individuals collected at 12m depth ranged from 30.67 (at 2000S-12) to 64.0 at 100N -12. These appear higher than those observed in 2003 (between 4 and 16).

The average number of taxa ranged from 12 (at 2000S-12) to 17.33 (at 100N-12). However, there was no significant difference in number of taxa among locations (Figure 5).

The patterns of abundance and diversity detected in the 2014 survey are different to those detected in 2003. Cawthron (2003) report a lower diversity and abundance of infauna at the diffuser and at sites 20m and 100m N and S of the diffuser compared to sites located 1000m and 2000m from the diffuser. No significant difference was detected in abundance or diversity among sites in the 2014 survey.

Table 5: Infauna counts of species which occupy >2% of the total number of individuals collected from sites around the ocean outfall.

Taxa	FEEDING	0-20	2000N-12	1000N-12	100N-12	20N-12	Diffuser-12	20S-12	100S-12	1000S-12	2000S-12	Sum	% of total
Haustoridae	Deposit feeder	-	28	39	79	64	35	50	16	11	12	334	20.4
Tawera spissa	Filter feeder	287	-	-	-	-	-	-	-	-	-	287	17.5
Spiophanes modestus	Surface deposit feeder	-	6	16	14	13	18	24	12	-	-	103	6.3
Myllitella vivens vivens	Filter feeder	-	14	11	-	23	5	20	12	-	-	85	5.2
Cumacea	Infaunal filter or deposit feeder	28	4	6	6	5	5	6	3	14	8	85	5.2
Heteromastus filiformis	Sub-surface deposit feeder	-	13	17	10	6	-	-	9	11	17	83	5.1
Euchone pallida	Sessile filter-feeder	-	6	12	14	11	9	11	9	7	3	82	5.0
Amphipoda Unid.	Epifaunal mobile scavenger	9	4	-	10	12	5	-	11	9	6	66	4.0
Cirratulidae	Deposit or suspension feeder	-	4	9	5	9	-	7	4	5	-	43	2.6
Magelona dakini	Surface deposit feeder	-	6	4	5	9	5	-	4	-	-	33	2.0
Phoxocephalidae	Deposit feeder	-	8	14	6	-	-	-	-	-	5	33	2.0

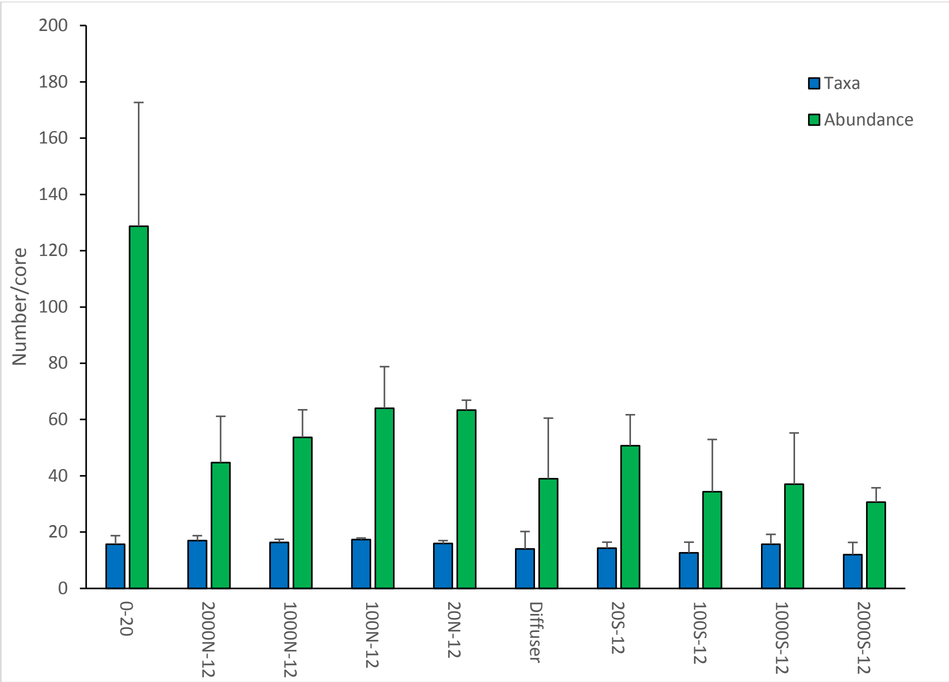


Figure 5: Average abundance and average taxa counts per core collected in the vicinity of the ocean outfall (+/- s.e.).

An MDS plot arranges the community composition of the samples into 2-dimensional space according to their relative similarities based on relative abundance of all species. Site 0-20m is clearly different to all other sites. Sites to the south of the diffuser at 1000m and 2000m have different composition to the 0-20m site and all other sites. The MDS indicates similarities in community composition at the diffuser site (0-12m), 20m north and south, 100m north and south and 1000 north and 2000 north (Figure 6).

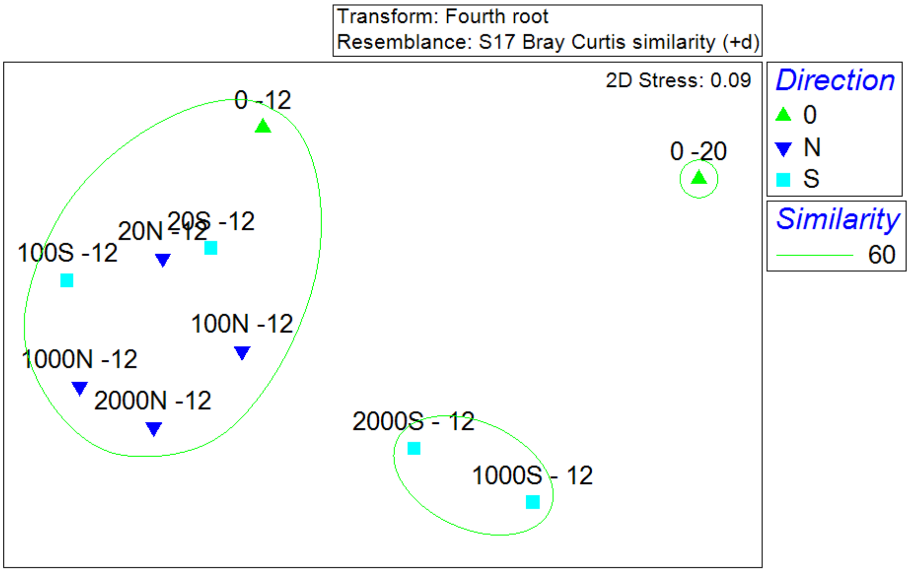


Figure 6: MDS plot of site averaged fourth-root transformed infauna data.

The corresponding cluster diagram (Figure 7) places the sites into the same groups as the MDS plot.

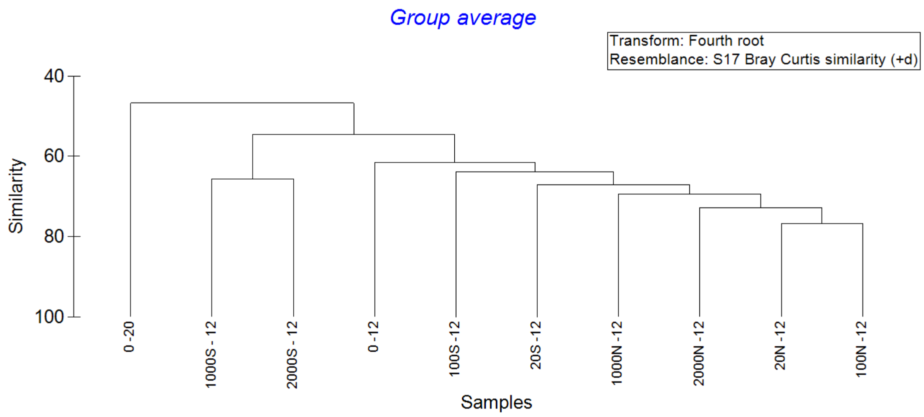


Figure 7: Cluster diagram of site averaged fourth-root transformed infauna data.

Analysis of similarities indicated a range of average similarities at each location ranged from 34.41% for 0-12 to 68.95% for 1000N – 12 (see similarity statistic tables in Appendix C). Greatest similarity was at site 1000N-12 (68.95%), where the infaunal assemblage was characterised by

Haustoridae and Phoxocephalidae amphipods and polychaete worms (*Spiophanes modestus*, *Heteromastus filiformis*, and *Euchone pallida*). The infaunal assemblage at all of the other sites (excluding 0-12) had between 64% and 53% similarity, with the most abundant organisms being fairly similar across sites. The assemblage at 0-20, however, was different to the other sites as mentioned above, due to the dominance of juvenile *Tawera spissa* at this site. The assemblage at 0-12 only had 34.41% similarity and there were two main species contributing to the similarity measure; namely Haustoridae amphipods and the polychaete *Euchone pallida*.

The assemblages detected in 2014 appear to be somewhat different to those reported by Cawthron in 2003. It is interesting to note that the infaunal assemblage detected in 2003 was different to that reported by Bioreasearches in 1991. The assemblage in 1991 included large numbers of conspicuous species, such as heart urchin (*Echinocardium cordatum*), which was absent in 2003 and 2014 surveys (Cawthron, 2003).

The potential causes for the changes in infaunal assemblage could include natural environmental perturbations (e.g. long term weather patterns) or progressive enrichment and contaminant accumulation in sediments from the outfall. It is not possible to determine whether natural environmental change has occurred, as multi-year sampling would be required as well as within-year sampling.

It is unlikely that the outfall has caused the environmental change because there appears to be little difference in the abundance and diversity of infauna at the outfall compared to sites distant from the outfall, including at 2000m which represents background conditions.

4.2.2 Shellfish and Other Large Invertebrates

The communities detected at each site comprised typical species for open coast soft sediment habitats on the east coast of the central North Island. There were no significant trends in abundance of organisms or *D. anus* relating to the outfall. The lower abundances at sites 20N, 1000N, 1000S and 2000S could be due to localised differences in habitat type or natural spatial variability.

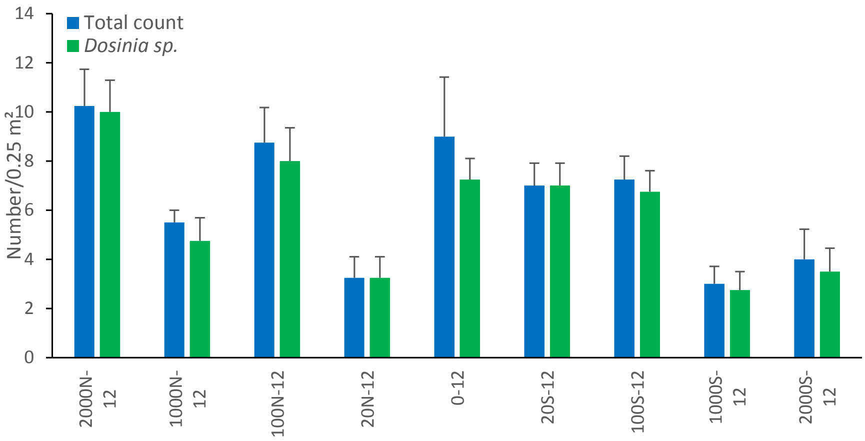


Figure 8: Total abundance and abundance of *Dosinia anus* per 0.25m2 along the 12m isobaths (+/- s.e.)

Table 7 below shows that ten most abundant shellfish and large invertebrates collected in the subtidal slider samples. The most abundant organism is the bivalve *Dosinia* sp., followed by sand dollar (*Fellaster zealandiae*), and the anemone *Edwardsia* sp. Of the top ten species, only three were present in the top ten in 2003, that being *Dosinia* sp., *F. zealandiae* and olive shell (*Amalda* sp.). The top ten taxa in 2003 did not include any polychaete worms, whereas in 2014 two large polychaete worms (>5mm) were in the top ten (*Travisia olens* and Sigalionidae).

The ten most abundant organisms includes several species that are sensitive to organic enrichment and intolerant of fine sediment grain sizes. This indicates that the subtidal habitat surveyed is relatively sandy and not enriched. The anthozoa, *Edwardsia* sp., is fairly common throughout New Zealand. This species prefers sandy sediments with low-moderate mud content and is intolerant of anoxic conditions. The polychaete worm *Travisia olens* is sensitive to organic enrichment and prefers sandy sediments with low mud content. The sea cucumber, *Trochodota dendyi* is also intolerant of organic enrichment and prefers sandy sediment. Other taxa known to prefer sandy sediment include the bivalve *Dosinia* sp. and sand dollar (*F. zelandiae*).

Dense scallop beds were not detected in the 2014 survey. Scallops were detected in the dredge survey at 2000S only. Sufficient scallops were collected to enable testing for metals.

Table 7: Total counts per site of 10 most abundant shellfish and large invertebrate species recorded in each of the three depth zones around the ocean outfall. "-" indicates zero count, blank space indicates not sampled.

Taxa	Total per site	Rank	Depth isobath	2000N	1000N	100N	20N	Outfall alignment	20S	100S	1000S	2000S
Dosinia sp.	278	1	20 m	-				-				-
(Bivalve)			12 m	14	19	32	13	29	28	27	11	40
			5 m	18	17			6			18	6
Fellaster zelandiae	54	2	20 m	-				-				-
(Sand dollar, Echinoderm)			12 m	-	-	-	-	-	-	-	-	-
			5 m	2	18			12			11	11
Edwardsia sp.	50	3	20 m	-				-				-
(Burrowing anemone, Anthozoa)			12 m	-	8	1	1	11	4	15	-	8
			5 m	-	-			-			2	-
Ophiuroidea	38	4	20 m	-				-				-
(Brittle star)			12 m	-	6	1	3	4	3	5	-	2
			5 m	2	6			1			1	4
Zethalia zelandica	37	5	20 m	-				-				-
(Wheel shell, Gastropod)			12 m	-	-	-	-	-	-	-	-	-
			5 m	-	-			37			-	-

Nemertea	36	6	20 m	-				-				-
(Proboscis worm)			12 m	-	6	2	1	4	3	8	-	3
			5 m	1	2			2			2	2
Travisia olens	29	7	20 m	-				-				-
(Polychaete worm)			12 m	-	3	2	3	2	4	8	1	4
			5 m	-	2			-			-	-
Sigalionidae	17	8	20 m	-				-				-
(Polychaete worm)			12 m	-	1	-	-	-	-	1	-	1
			5 m	2	-			4			1	7
Amalda depressa	16	9	20 m	-				-				-
(Olive shell, Gastropod)			12 m	-	5	1	-	4	1	-	-	-
			5 m	-	3			1			1	-
Trochodota dendyi	15	10	20 m	-				-				-
(Sea cucumber, Echinoderm)			12 m	-	3	1	0	1	2	4	0	1
			5 m	2	-			-			1	-

4.2.3 Shellfish Health

Microbiological Quality

Dosinia sp. were analysed for microbiological pathogens and metals. All shellfish samples analysed for faecal indicator bacteria had concentrations that were below the detection limit. Recreational shellfish gathering guidelines (MfE, 2003) advise that median faecal coliform content of samples collected over a shellfish gathering season shall not exceed 14 MPN/100ml and no more than 10% of samples should exceed 43 MPN/100ml[4]. As the current survey involved collection of samples at one point in time only these guidelines cannot directly be applied. However, as indicator bacteria were not detected in the current survey at any site, it is unlikely that the discharge of treated effluent causes accumulation of bacterial pathogens in shellfish.

Table 8: Faecal coliform and Enterococci concentrations in *Dosinia* sp. collected in the vicinity of the outfall (MPN/100ml).

	2000N-12	1000N-12	100N-12	20N-12	Diffuser-12	20S-12	100S-12	1000S-12	2000S-12
Faecal coliforms	< 18	< 18	< 18	< 18	< 18	< 18	< 18	< 18	< 18
Enterococci	<10	<10	<10	<10	<10	<10	<10	<10	<10

[4] Note that the detection limit is higher than 14 MPN/100ml.

Contaminants

The Food Standards Code for Australia and New Zealand (FSANZ, 2008) has set maximum levels for the heavy metals mercury, lead, cadmium and arsenic in shellfish. Guideline values for these metals have been developed as they present a risk to human health. There are no published guidelines for acceptable concentrations of chromium, copper, nickel or zinc in shellfish tissue, although the previous food standards, revoked in 2002, prescribed a copper guideline of 30 mg/kg.

Mercury occurs naturally in the environment and can also be discharged to the environment through industrial pollution. Mercury can accumulate in the environment and bioaccumulates in the food chain. Ingestion of high concentrations of mercury can damage kidneys and nervous system in humans.

Cadmium occurs naturally in the environment and is also used in batteries, pigments and metal coatings. Long term exposure to high doses of cadmium can cause kidney failure and softening of bones.

Lead is used in batteries, solder, ammunition, devices to shield x-rays, and electronic items. Most exposure in humans is due to lead-based paint and leaded fuel. Lead can build up in the body and affect the nervous system reproductive system and kidneys.

Arsenic is naturally occurring in soils, water and living organisms. In New Zealand arsenic levels in the environment can increase due to mining, geothermal productions, treated timbers and land erosion. Fish and seafood can accumulate organic arsenic from the environment, but most foods contain very low levels of arsenic which do not cause human health issues. Acute exposure to high levels of arsenic can cause vomiting, diarrhoea, anaemia, liver damage and death.

The concentration of mercury and lead in shellfish collected in 2014 was below guideline values. The concentration of cadmium exceeded the guideline value for dredge samples (the only scallop sample) collected at 20-15m depth only (Table 9). The source or extent of the cadmium contamination is not clear, but given the distance from the outfall and the low concentration of cadmium detected at all other sites surveyed, it is unlikely to be due to the effluent discharge. Cawthron (2003) also detected elevated cadmium in scallops and concluded that as the specimens were collected from sites distant from the outfall, it was likely to be a result of species-specific traits or reflective of the natural environment.

The concentration of total arsenic in shellfish exceeded the guideline value (for inorganic arsenic) at all sites. The United States Food and Drug Administration state that inorganic arsenic is estimated to be 10% of total arsenic. Therefore, when considering only 10% of the total arsenic detected is likely to be inorganic arsenic, then the guideline value is not exceeded at any site.

Cawthron (2003) reported that Zinzan (2002) detected elevated arsenic at sites in 20-25m of water but they concluded that inter-site and inter-year comparisons in concentrations were confounded by potential differences in marine habitat and species tested. Cawthron (2003) also concluded that the spatially consistent concentration of arsenic in sediment and the concentrations detected in shellfish indicate a broadscale distribution of arsenic.

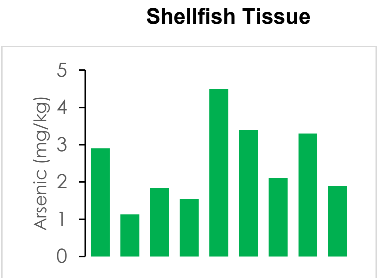
Table 9: Average trace metal concentrations in shellfish collected in the vicinity of the ocean outfall (mg/kg). Cells highlighted in light blue exceed the FSANZ guideline.

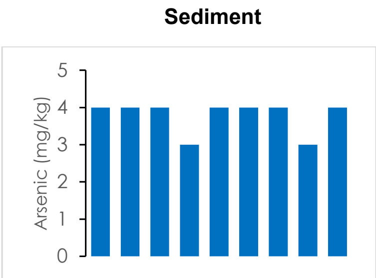
					12 m					20 m	20-25 m	
	2000N	1000N	100N	20N	0	20S	100S	1000S	2000S	0	Dredge	MIS
Ar	**2.9**	1.13	**1.84**	**1.55**	**4.5**	**3.4**	**2.1**	**3.3**	**1.9**	**2.9**	**1.24**	**1.4**
Cd	0.69	0.143	0.3	0.187	0.6	0.64	0.58	0.75	0.36	0.54	**2.7**	**1**
Cr	0.18	< 0.1	0.12	0.52	0.16	0.19	0.13	0.17	0.11	0.19	0.18	**1**
Cu	0.58	0.58	0.61	0.71	0.55	0.6	0.67	0.42	0.63	0.32	0.63	**20**
Hg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.031	< 0.01	**0.5**
Ni	**2.9**	1.54	1.29	1.5	**2.6**	**3.7**	**2.6**	1.71	1.57	0.23	0.19	**2**
Pb	0.143	< 0.01	0.176	0.021	0.129	0.27	0.175	0.22	< 0.01	0.038	< 0.01	**2**
Zn	14.5	10.5	11.3	11.3	13.5	20	12.8	10.8	12.1	7.5	13.8	**70**
Al	5.6	3.5	5	5.2	3.5	4.5	3.2	3.3	1.8	8.8	38	-

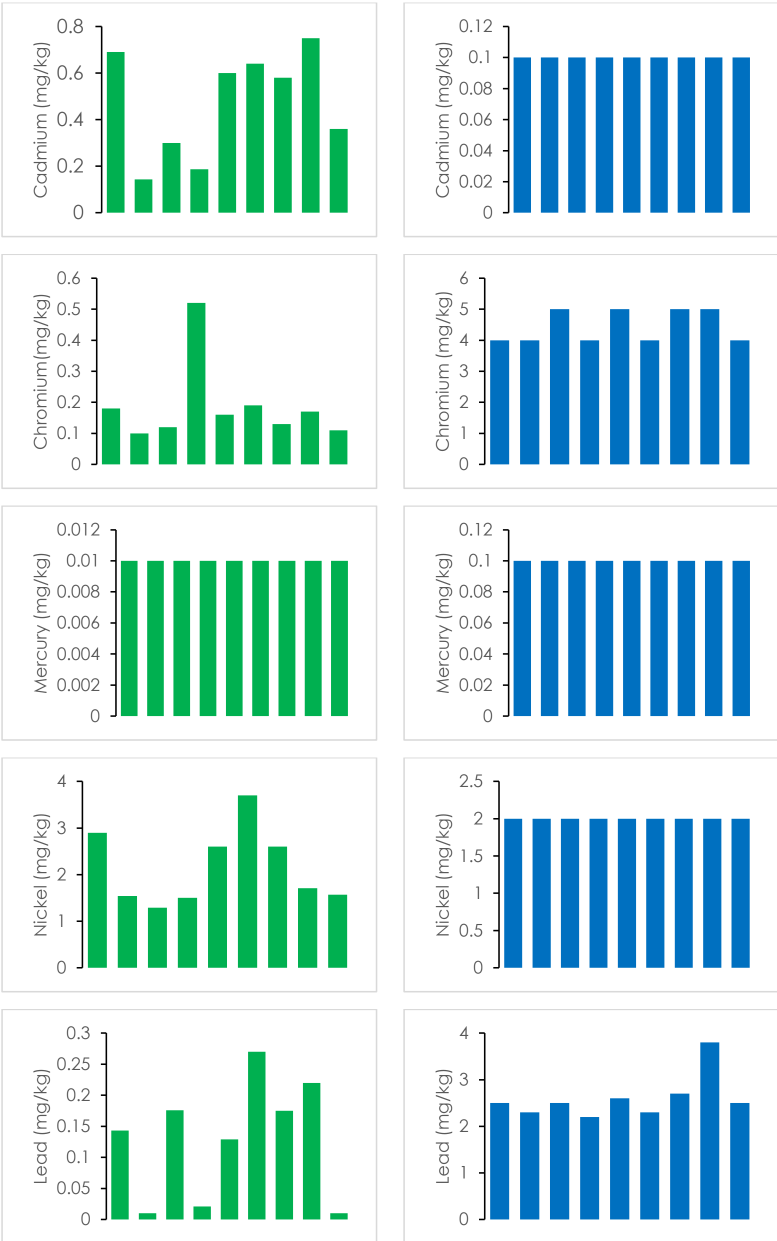
* The guideline is for inorganic arsenic, whereas the analysis is for total arsenic. Inorganic arsenic is estimated to be 10% of total arsenic (USFDA 2003).

Note: Apart from 20-25m dredge sample, all other samples were *Dosinia* sp. The dredge sample comprised scallops.

Contaminant concentrations in sediment were below ANZECC Interim Sediment Quality Guideline Low threshold (Figure 9). The concentrations of arsenic and cadmium detected in 2014 were approximately half that detected in 2003 (Cawthron, 2003). The concentration of chromium was lower in the 2014 survey. All other metals were detected at similar concentrations in both surveys.






Cadmium (mg/kg)
0.8
0.6
0.4
0.2
0
Cadmium (mg/kg)
0.12
0.1
0.08
0.06
0.04
0.02
0
Chromium (mg/kg)
0.6
0.5
0.4
0.3
0.2
0.1
0
Chromium (mg/kg)
6
5
4
3
2
1
0
Mercury (mg/kg)
0.012
0.01
0.008
0.006
0.004
0.002
0
Mercury (mg/kg)
0.12
0.1
0.08
0.06
0.04
0.02
0
Nickel (mg/kg)
4
3
2
1
0
Nickel (mg/kg)
2.5
2
1.5
1
0.5
0
Lead (mg/kg)
0.3
0.25
0.2
0.15
0.1
0.05
0
Lead (mg/kg)
4
3
2
1
0

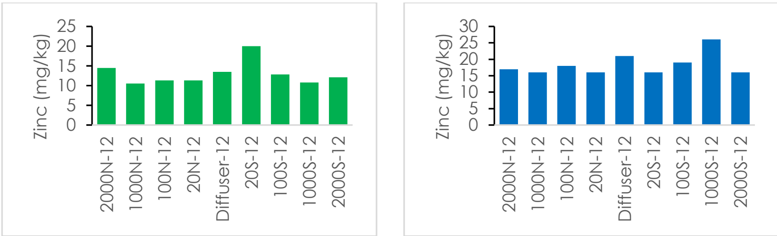


Figure 9: Concentration of arsenic and trace metals in Dosinia sp. and subtidal sediments (mg/kg). Note scales may be different for each contaminant.

Stable Isotopes

Very minor isotopic variations were observed between survey sites, which is a similar result to that detected in 2003 (Cawthron, 2003). Typical sewage has a δ15N value of approximately 2.3, and a δ13C value of around -26.5. Similar to the 2003 survey, the values detected in shellfish in the 2014 survey are not similar to typical sewage values.

Table 10: Average percentage of nitrogen and carbon and isotopic ratios in Dosinia sp.

Location	Total N %	δ15NValue	Total C %	δ13CValue	C:N Ratio
20S - 12	9.7	9.4	39.4	-17.8	4.07
100N - 12	9.6	9.1	40.4	-18.3	4.21
100S - 12	10.3	10.0	40.9	-17.5	3.98
1000N - 12	9.3	9.2	39.0	-18.1	4.22
2000N - 12	10.2	10.3	41.8	-17.2	4.10
2000S - 12	9.4	9.3	39.8	-17.7	4.25
0 -12	9.8	9.8	40.2	-17.6	4.10

4.3 Intertidal Shellfish (tuatua)

4.3.1 Tuatua Size and Abundance

Tuatua (*Paphies subtriangulata*) beds were detected at all 13 intertidal survey sites. Densities ranged between 7 and 89 per quadrat (Table 11) and average length varied between approximately 47 and 52 mm (Table 12).

Tuatua were detected at a greater density at site 200N, 200S (40-50 per quadrat) and adjacent to the diffuser, and also at 1600S (approximately 90 per quadrat) compared to the remaining sites (10-15 per quadrat) (Figure 10). Apart from the dense tuatua beds at 1600S, there would appear to be a potential effect of the effluent discharge on density of tuatua. Cawthron (2003) did not detect greater density of tuatua close to the outfall.

Tuatua are spatially and temporally variable and therefore further surveys along the intertidal zone of Omanu Beach would be required to confirm that the outfall has had an effect on tuatua density.

Table 11: Average number of tuatua per quadrat (0.25m^2)

Group	Mean	N	Std. Deviation	Std. Error of Mean
2000N	15.40	5	9.044	4.045
1600N	8.00	5	4.062	1.817
1200N	15.20	5	7.497	3.353
800N	10.20	5	7.463	3.338
400N	7.00	5	4.899	2.191
200N	47.40	5	23.201	10.376
Outfall Alignment	33.40	5	16.832	7.527
200S	39.20	5	35.822	16.020
400S	15.20	5	11.946	5.342
800S	15.60	5	7.701	3.444
1200S	9.20	5	4.817	2.154
1600S	89.00	5	74.206	33.186
2000S	10.80	5	4.324	1.934
Total	24.28	65	31.857	3.951

Table 12: Average length of tuatua (mm)

Group	Mean	N	Std. Deviation	Std. Error of Mean
2000N	50.51	77	5.817	0.663
1600N	47.38	40	9.831	1.554
1200N	47.20	76	7.854	0.901
800N	50.55	51	7.357	1.030
400N	52.03	35	7.935	1.341
200N	53.01	237	7.107	0.462
Outfall Alignment	51.44	167	7.105	0.550
200S	52.27	196	7.152	0.511
400S	50.45	76	7.123	0.817
800S	50.82	78	7.777	0.881
1200S	50.48	46	7.800	1.150
1600S	49.07	445	8.474	0.402
2000S	50.26	54	6.696	0.911
Total	50.60	1578	7.803	0.196

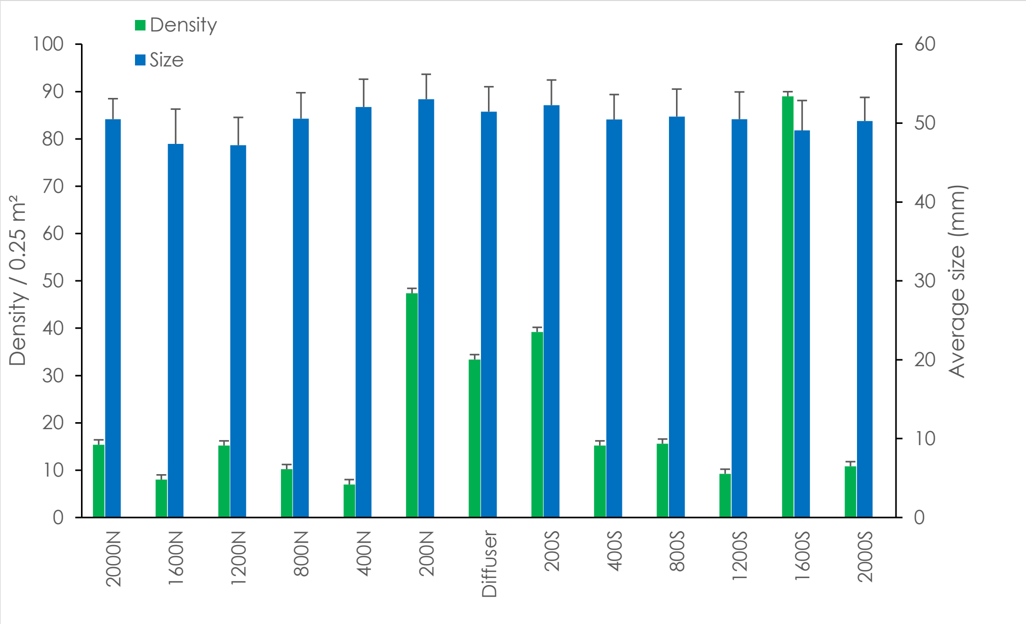


Figure 10: Average tuatua size and density at intertidal survey sites (+/- s.e.)

ANOVA revealed statistically significant differences in tuatua size/length by distance, but not by direction. Pairwise tests (Tukey) indicated statistically significant differences between tuatua at the diffuser and 1200m and1600m, and between 200m and 1200m, 1600m, and 2000m.

The size-frequency plots in Figure 11 below indicate a single cohort of adult tuatua across all sites.

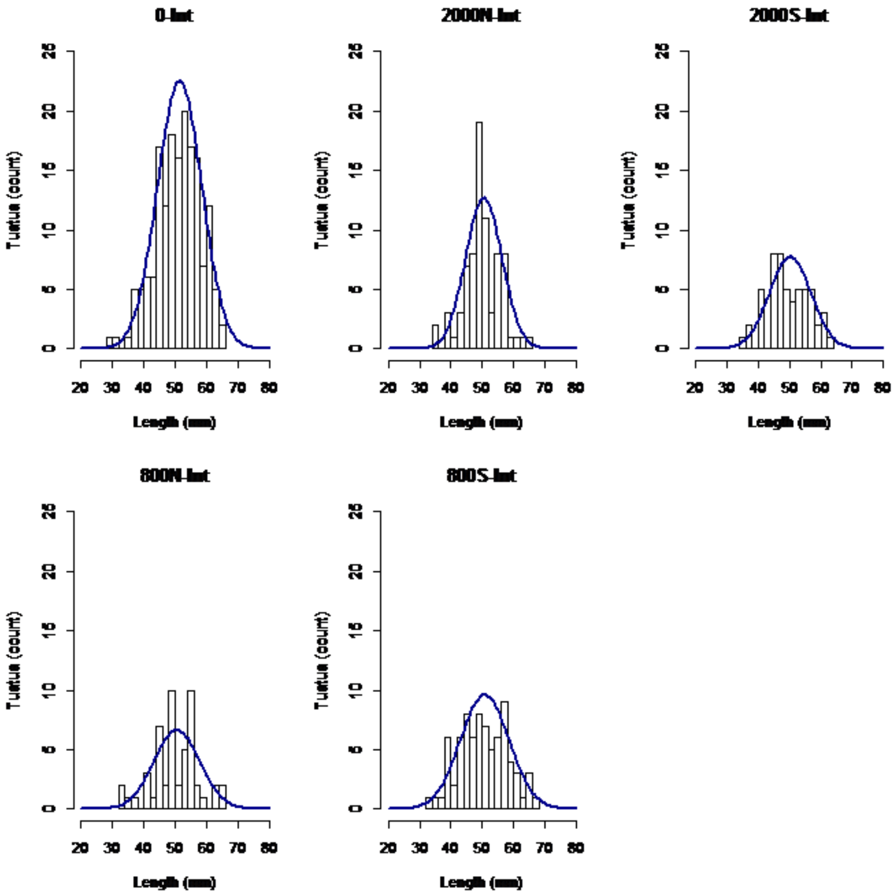


Figure 11: Size frequency histograms and normal frequency curves for tuatua collected at the five intertidal chemistry sites. Normal curves are calculated as the theoretical normal distribution with the same mean and standard deviation as observed in the data.

4.3.2 Tuatua Health

Microbiological Quality

Indicator bacteria were below detection limits at all sites, indicating that the outfall is not having an effect on the microbiological quality of shellfish in intertidal and shallow subtidal habitats. This result is similar to that detected by Cawthron in 2003.

Table 13: **Faecal coliform and Enterococci concentrations in tuatua (MPN/100ml).**

Coliforms	2000N-INT	800N-INT	0-INT	800S-INT	2000S-INT
Faecal	< 18	< 18	< 18	< 18	< 18
Enterococci	< 10	< 10	< 10	< 10	< 10

Contaminants

The concentration of contaminants in tuatua at all sites were low with the exception of arsenic, which exceeded the FSANZ guideline value at all sites (Table 14). As discussed above, the guideline value is for inorganic arsenic only, whereas the analysis of shellfish flesh was for total arsenic. Since approximately 10% of total arsenic is inorganic arsenic, on that basis all samples are below the guideline value.

Table 14: Concentration of contaminants in tuatua

*guideline is for inorganic arsenic.

Note: cells highlighted in blue exceed the FSANZ guideline

Analysis of trace metal concentrations by distance and direction was carried out (ANOVA). No statistically significant difference was detected for distance or direction (Appendix C).

Similar to the subtidal isotope results, the percentage of nitrogen and carbon, and the isotopic signatures, do not indicate wastewater effects (Table 15).

Table 15: Average carbon and nitrogen percentage and isotopic ratios in tuatua

Location	Total N %	δ15N Value	Total C %	δ13C Value	C:N Ratio
0	9.56	7.85	34.97	-18.38	3.66
800N	9.56	7.95	35.12	-18.31	3.67
800S	8.81	8.10	32.02	-18.21	3.63
2000N	9.83	7.93	36.85	-18.53	3.75
2000S	10.07	7.92	37.35	-18.32	3.71

5.0 Summary

This survey found that the ocean outfall and discharges are not currently having discernable adverse effects on benthic biota, sediment or shellfish quality (Table 16).

Table 16: Summary of survey results:

Habitat	Test	Severe effect	Discernable effect	Possible effect	No discernable effect
Subtidal	Sediment grain size			✓[a]	
	Sediment organic content				✓
	Sediment trace metals				✓
	Visual observations				✓
	Infauna				✓
	Shellfish community				✓
	Shellfish trace metals				✓
	Shellfish isotopes				✓
	Shellfish microbiology				✓
Intertidal	Tuatua community			✓[b]	
	Tuatua trace metals				✓
	Tuatua isotopes				✓
	Tuatua microbiology				✓

a – a greater proportion of finer grained sediment around the outfall

b – larger tuatua were detected closer to the outfall

5.1 Subtidal

A summary of the subtidal parameters is as follows:

- Very fine sand dominates sites around the diffuser to a distance of 100m north and south. Beyond 100m there is a greater proportion of fine sand and medium sand. Silt and clay was not detected at any of the sites and gravel formed a very small proportion of sediment at some sites.
- Sediment trace metals were all below ISQG-low concentrations which suggests that adverse effects on organisms is highly unlikely. Spatial trends were not evident.

- Infauna abundance and diversity was higher than the 2003 survey. Cawthron (2003) reported a lower diversity and abundance of infauna at the diffuser and at sites 20m and 100m N and S of the diffuser compared to sites located 1000m and 2000m from the diffuser. No significant difference was detected in abundance or diversity among sites in the 2014 survey.

- Site 0-20m has a different community composition to all other sites, and sites to the south of the diffuser at 1000m and 2000m have different composition to the 0-20m site and all other sites. There are similarities in community composition at the diffuser site (0-12m), 20m north and south, 100m north and south and 1000N and 2000N. Differences in community composition do not appear to be related to the outfall.

- The invertebrate assemblages detected in 2014 appear to be somewhat different to that reported by Cawthron in 2003. Invertebrate assemblages detected in 2003 were also different to that reported by Bioreasearches in 1991. The potential causes for the changes in infaunal assemblage detected could include natural environmental perturbations (e.g. long term weather patterns) or progressive enrichment and contaminant accumulation in sediments from the outfall. It is unlikely that the outfall has caused the environmental change because there appears to be little difference in the abundance and diversity of infauna at the outfall compared to sites distant from the outfall, including at 2000m which represents background conditions.

- The most abundant organism within the large shellfish and invertebrate group was the bivalve *Dosinia* sp., followed by sand dollar (*Fellaster zealandiae*), and the anemone *Edwardsia* sp. Of the top ten species, only three were present in the top ten in 2003, that being *Dosinia* sp., *F. zealandiae* and olive shell (*Amalda* sp.). The ten most abundant organisms detected include several species that are known to be sensitive to organic enrichment and intolerant of fine sediment grain sizes, which indicates that the subtidal habitat surveyed is relatively sandy and not enriched.

- All subtidal shellfish samples analysed for faecal indicator bacteria had concentrations that were below the detection limit. No effect from the outfall was detected.

- Contaminant concentrations detected in shellfish did not show any relationship to the outfall. Contaminants in shellfish collected in 2014 were below guideline values for mercury and lead. The concentration of cadmium exceeded the guideline value in scallops collected at the 20-15m isobath only. Given the distance from the outfall and the low concentration of cadmium detected at all other sites surveyed, the cadmium detected in scallops is unlikely to be due to the effluent discharge.

- The concentration of total arsenic in shellfish exceeded the guideline value (for inorganic arsenic) at all sites. Given that only 10% of the total arsenic detected is likely to be inorganic arsenic, then the guideline value is not exceeded at any site.

- Contaminant concentrations in sediment were below ANZECC Interim Sediment Quality Guideline Low threshold. The concentrations of arsenic and cadmium detected in 2014 were approximately half that detected in 2003. The concentration of chromium was lower in the 2014 survey. All other metals were detected at similar concentrations in both surveys.

- Very minor isotopic variations were observed between survey sites, which is a similar result to that detected in 2003. Similar to the 2003 survey, the values detected in shellfish in the current survey are not similar to typical sewage values.

5.2 Intertidal

- Tuatua were detected at a greater density adjacent to the diffuser and also at 1600S. Apart from the dense tuatua beds at 1600S, there may be a potential effect of the effluent discharge on density of tuatua. However, tuatua are spatially and temporally variable. A wider survey of Omanu Beach would be required to determine whether the increased density is due to the outfall.
- Indicator bacteria were below detection limits at all sites survey, indicating that the outfall is not having an effect on the microbiological quality of shellfish in intertidal and shallow subtidal habitats.
- The concentration of contaminants in tuatua at all sites were low with the exception of arsenic, which exceeded the FSANZ guidelines value at all sites. As discussed above, the guideline value is for inorganic arsenic only, whereas the analysis of shellfish flesh was for total arsenic. Approximately 10% of total arsenic is inorganic arsenic. On that basis all samples are below the guideline value.
- Similar to the subtidal isotope results, the percentage of nitrogen and carbon and the isotopic signatures do not indicate wastewater effects.

5.3 Recommendations

The current survey does not indicate discernable effects from the outfall on benthic ecology nor sediments in subtidal and intertidal marine habitats adjacent to the outfall. The survey is to be repeated in 2024, which will provide data over three sampling periods. At that point a detailed statistical analysis of differences among surveys periods would be appropriate.

6.0 References

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Appendix A: Sediment Cores

Sediment Characteristics:

Site		Description
0 - 12		Fine sand, no odour, no anoxic layer, evenly mixed
20N -12		Fine sand, no odour, no anoxic layer, evenly mixed

20S -12		Fine sand, no odour, no anoxic layer, evenly mixed
100N -12		Fine sand, shell fragments, no odour, no anoxic layer, evenly mixed
100S - 12		Fine sand, no odour, no anoxic layer, well sorted

1000N - 12

Fine sand with some shell debris, no odour, no anoxic layer, evenly mixed

1000S - 12

Coarser sand, shell fragments, no odour, dark layers

2000N - 12

Fine sand, no odour, no anoxic layer, evenly mixed

Appendix A: Sediment Cores

Boffa Miskell Ltd | Survey of Benthic Ecology and Sediments around the Ocean Outfall, 2014 | [Subject]

2000S - 12		Fine sand, no odour, no anoxic layer, evenly mixed
0 - 20		Fine sand, shell hash, no odour, no anoxic layer, evenly mixed

Appendix B: Biological Data

Omanu Beach core samples, collected 17 May 2014. Client Ref A14046										
			0-12 Diffuser A	**0-12 Diffuser B**	**0-12 Diffuser C**	**0-20 A**	**0-20 B**	**0-20 C**	**20N-12 A**	**20N-12 B**
General Group	**Taxa**	**Common Name**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**
Hydrozoa	Hydromedusae	Hydroid and jellyfish larvae								
Anthozoa	Edwardsia sp.	Burrowing anemone			1					1
Nemertea	Nemertea	Proboscis worms			1				1	
Gastropoda	Gastropoda (micro Snails)	Unidentified gastropod	1							
Gastropoda	Amalda mucronata	Olive Shell								
Gastropoda	Austrofusus glans	Kobbed whelk	1		1					
Gastropoda	Neoguraleus sp.	Whelk								
Bivalvia	Dosinia anus	Coarse biscuit shell								
Bivalvia	Dosinia subrosea	Fine biscuit shell								
Bivalvia	Myadora antipodum	Box shell		1						
Bivalvia	Myllitella vivens vivens	Small bivalve	2		3				11	11
Bivalvia	Nucula nitidula	Nut shell						1		
Bivalvia	Soletellina sp.	Golden sunset shell						1		
Bivalvia	Tawera spissa (Juveniles) <1mm	Morning Star				60	107	120		
Oligochaeta	Oligochaeta	Oligochaete worms	1							
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm								
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm								
Polychaeta: Paraonidae	Paraonidae	Polychaete worm		1			1	1		
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm							1	
Polychaeta: Spionidae	Prionospio sp.	Polychaete worm	2		1		1	2	1	1
Polychaeta: Spionidae	Prionospio yuriel	Polychaete worm				2			3	2
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm	3		15				1	6
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm	3		2	1	1		3	3
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	1		1	1	1	1	3	
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms	1			1	4	1		
Polychaeta: Opheliidae	Armandia maculata	Polychaete worm								
Polychaeta: Opheliidae	Travisia olens	Polychaete worm								
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm					1			1
Polychaeta: Hesionidae	Hesionidae	Polychaete Worm								
Polychaeta: Syllidae	Syllidae	Polychaete worm								
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm						1		
Polychaeta: Glyceridae	Glyceridae	Polychaete worm								
Polychaeta: Goniadidae	Goniada sp.	Polychaete worm					1			
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm			1	1	1			
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm								
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm								
Polychaeta: Ampharetidae	Ampharetidae	Polychaete worm				1				
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm			2		4		4	4
Polychaeta: Terebellidae	Terebellidae	Polychaete worm								
Polychaeta: Sabellidae	Euchone pallida	Fan worm	5	1	3	1			3	6
Crustacea	Nebalia sp.	Small crustacea			2					4
Mysidacea	Mysidae	Misid shrimp		1						
Cumacea	Cumacea	Cumaceans		1	4	2	24	2	3	
Isopoda	Anthuridea	Isopod					1		1	
Isopoda	Munna schauinslandii	Isopod								
Amphipoda	Haustoridae	Amphipod (family)	8	12	15		1	4	20	18
Amphipoda	Lysianassidae	Amphipod (family)	2							

			0-12 Diffuser A	0-12 Diffuser B	0-12 Diffuser C	0-20 A	0-20 B	0-20 C	20N-12 A	20N-12 B
General Group	**Taxa**	**Common Name**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**
Amphipoda	Oedicerotidae	Amphipod (family)	1		1					1
Amphipoda	Phoxocephalidae	Amphipod (family)			1		1	1		1
Amphipoda	Amphipoda Unid.	Amphipod	5			3	4	2	3	6
Decapoda	Paguridae	Hermit Crab Unid.					3			
Decapoda	Betaeus sp.	Shrimp		1	3	1			1	
Decapoda	Halicarcinus sp.	Pill-box Crab								
Decapoda	Ogyrides sp	Shrimp (long eyes)	1							1
Decapoda	Pontophilus sp.	Shrimp								
Decapoda	Decapoda (larvae Unid.)	Unidentified Crab Larvae					2			
Ostracoda	Diasterope grisea	Ostracod	1		1				1	
Ostracoda	Leuroleberis zealandica	Ostracod (Large)			1					
Ostracoda	Neonesidea	Ostracod				4	4	5		1
Ostracoda	Parasterope quadrata	Ostracod			1	1		1		
Ostracoda	Propontocypris sp.	Ostracod								
Copepoda	Copepoda	Copepods					1			
Pycnogonida	Pycnogonidae	Sea spiders								
Phoronida	Phoronus sp.	Horseshoe worms						1	1	
Echinoidea	Echinocardium spat	Heart Urchin								
Ophiuroidea	Ophiuroidea	Brittle stars			1				2	
Holothuroidea	Trochodota dendyi	Sea cucumber								
Chaetognatha	Chaetognatha	Arrow Worm								
Tunicata	Salpa sp.	Barrel salp								
Cephalocordata	Epigonichthys hectori	Lancelet								
	Count: No of Individuals		**38**	**18**	**61**	**79**	**163**	**144**	**63**	**67**
	Count: No of Taxa		**16**	**7**	**21**	**13**	**19**	**15**	**18**	**16**
	SW_Diversity		**2.4934**	**1.2338**	**2.4579**	**1.1128**	**1.3936**	**0.8570**	**2.3495**	**2.3177**
	SW_Evenness		**0.8993**	**0.6340**	**0.8073**	**0.4339**	**0.4733**	**0.3165**	**0.8129**	**0.8359**

			20N-12 C	20S-12 A	20S-12 B	20S-12 C	100N-12 A	100N-12 B	100N-12 C	100S-12 A	100S-12 B
General Group	**Taxa**	**Common Name**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**
Hydrozoa	Hydromedusae	Hydroid and jellyfish larvae									
Anthozoa	Edwardsia sp.	Burrowing anemone					2	2			1
Nemertea	Nemertea	Proboscis worms	2		1			2			
Gastropoda	Gastropoda (micro Snails)	Unidentified gastropod									
Gastropoda	Amalda mucronata	Olive Shell	1								1
Gastropoda	Austrofusus glans	Kobbed whelk									
Gastropoda	Neoguraleus sp.	Whelk	1						1		
Bivalvia	Dosinia anus	Coarse biscuit shell							1		
Bivalvia	Dosinia subrosea	Fine biscuit shell					1				
Bivalvia	Myadora antipodum	Box shell		2							
Bivalvia	Myllitella vivens vivens	Small bivalve	1	6	5	9		1	2	7	3
Bivalvia	Nucula nitidula	Nut shell									
Bivalvia	Soletellina sp.	Golden sunset shell		1							
Bivalvia	Tawera spissa (Juveniles) <1mm	Morning Star				1					
Oligochaeta	Oligochaeta	Oligochaete worms									
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm									
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm									
Polychaeta: Paraonidae	Paraonidae	Polychaete worm									
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm			1						
Polychaeta: Spionidae	Prionospio sp.	Polychaete worm						1		1	
Polychaeta: Spionidae	Prionospio yuriel	Polychaete worm		1			1	1	2	2	
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm	6	8	13	3	4	7	3	8	1
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm	3	1	1		2	3		1	2
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	3	1		2	3	3	4	4	2
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms				1					
Polychaeta: Opheliidae	Armandia maculata	Polychaete worm							1		
Polychaeta: Opheliidae	Travisia olens	Polychaete worm									
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm									
Polychaeta: Hesionidae	Hesionidae	Polychaete Worm					1		1		
Polychaeta: Syllidae	Syllidae	Polychaete worm			1		1			5	
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm									
Polychaeta: Glyceridae	Glyceridae	Polychaete worm									
Polychaeta: Goniadidae	Goniada sp.	Polychaete worm									
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm							1		
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm									
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm									
Polychaeta: Ampharetidae	Ampharetidae	Polychaete worm									
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm	1	5	1	1	4	1		3	
Polychaeta: Terebellidae	Terebellidae	Polychaete worm								1	
Polychaeta: Sabellidae	Euchone pallida	Fan worm	2	6	2	3	10	1	3	4	1
Crustacea	Nebalia sp.	Small crustacea	3	1	1		1	2	1		1
Mysidacea	Mysidae	Misid shrimp	2							1	
Cumacea	Cumacea	Cumaceans	2	3	1	2	5	1		1	2
Isopoda	Anthuridea	Isopod		1				1	1		
Isopoda	Munna schauinslandii	Isopod									1
Amphipoda	Haustoridae	Amphipod (family)	26	18	21	11	33	31	15	7	4
Amphipoda	Lysianassidae	Amphipod (family)									

			20N-12 C	20S-12 A	20S-12 B	20S-12 C	100N-12 A	100N-12 B	100N-12 C	100S-12 A	100S-12 B
General Group	**Taxa**	**Common Name**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**
Amphipoda	Oedicerotidae	Amphipod (family)									
Amphipoda	Phoxocephalidae	Amphipod (family)	2		3		1	3	2		
Amphipoda	Amphipoda Unid.	Amphipod	3	2	2	3	1	4	5	6	
Decapoda	Paguridae	Hermit Crab Unid.									
Decapoda	Betaeus sp.	Shrimp	1				1				
Decapoda	Halicarcinus sp.	Pill-box Crab			1						
Decapoda	Ogyrides sp	Shrimp (long eyes)		1	1				2		
Decapoda	Pontophilus sp.	Shrimp									
Decapoda	Decapoda (larvae Unid.)	Unidentified Crab Larvae				1					
Ostracoda	Diasterope grisea	Ostracod	1	1	1	1	2	5	1	2	
Ostracoda	Leuroleberis zealandica	Ostracod (Large)									
Ostracoda	Neonesidea	Ostracod									
Ostracoda	Parasterope quadrata	Ostracod									
Ostracoda	Propontocypris sp.	Ostracod								1	
Copepoda	Copepoda	Copepods					1				
Pycnogonida	Pycnogonidae	Sea spiders									
Phoronida	Phoronus sp.	Horseshoe worms						1			
Echinoidea	Echinocardium spat	Heart Urchin									
Ophiuroidea	Ophiuroidea	Brittle stars						1	1	1	
Holothuroidea	Trochodota dendyi	Sea cucumber									
Chaetognatha	Chaetognatha	Arrow Worm									
Tunicata	Salpa sp.	Barrel salp									
Cephalocordata	Epigonichthys hectori	Lancelet									
	Count: No of Individuals		**60**	**58**	**56**	**38**	**74**	**71**	**47**	**55**	**19**
	Count: No of Taxa		**17**	**16**	**16**	**12**	**18**	**19**	**18**	**17**	**11**
	SW_Diversity		**2.1681**	**2.2625**	**2.0362**	**2.0899**	**2.0743**	**2.1822**	**2.4384**	**2.5558**	**2.2602**
	SW_Evenness		**0.7652**	**0.8160**	**0.7344**	**0.8410**	**0.7177**	**0.7411**	**0.8436**	**0.9021**	**0.9426**

			100S-12 C	1000N-12 A	1000N-12 B	1000N-12 C	1000S-12 A	1000S-12 B	1000S-12C	2000N-12 A	2000N-12 B	2000N-12 C
General Group	**Taxa**	**Common Name**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Hydrozoa	Hydromedusae	Hydroid and jellyfish larvae	1									
Anthozoa	Edwardsia sp.	Burrowing anemone									2	
Nemertea	Nemertea	Proboscis worms	1	1		1						1
Gastropoda	Gastropoda (micro Snails)	Unidentified gastropod										
Gastropoda	Amalda mucronata	Olive Shell		1								
Gastropoda	Austrofusus glans	Kobbed whelk										
Gastropoda	Neoguraleus sp.	Whelk										
Bivalvia	Dosinia anus	Coarse biscuit shell										1
Bivalvia	Dosinia subrosea	Fine biscuit shell										
Bivalvia	Myadora antipodum	Box shell							1			
Bivalvia	Myllitella vivens vivens	Small bivalve	2	1	3	7				1	12	1
Bivalvia	Nucula nitidula	Nut shell										
Bivalvia	Soletellina sp.	Golden sunset shell										
Bivalvia	Tawera spissa (Juveniles) <1mm	Morning Star										
Oligochaeta	Oligochaeta	Oligochaete worms										
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm		1								
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm				1						
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					4	2	1			
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm							1			
Polychaeta: Spionidae	Prionospio sp.	Polychaete worm					2					
Polychaeta: Spionidae	Prionospio yuriel	Polychaete worm	1		1	3				1	9	2
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm	3	3	5	8	1			1	3	2
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm	1	1	1	2	1		1		5	1
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	3	6	2	9	6	4	1	6	4	3
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms			1							
Polychaeta: Opheliidae	Armandia maculata	Polychaete worm		1			4		1			1
Polychaeta: Opheliidae	Travisia olens	Polychaete worm				3						1
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm									1	
Polychaeta: Hesionidae	Hesionidae	Polychaete Worm					1			2		
Polychaeta: Syllidae	Syllidae	Polychaete worm	1				7	1	1	1		1
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm										
Polychaeta: Glyceridae	Glyceridae	Polychaete worm		1						1	1	
Polychaeta: Goniadidae	Goniada sp.	Polychaete worm										
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					1		1			
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm	1									
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm					1	1	2		1	1
Polychaeta: Ampharetidae	Ampharetidae	Polychaete worm										
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm	1	3	1	5	3		2	3	1	
Polychaeta: Terebellidae	Terebellidae	Polychaete worm										
Polychaeta: Sabellidae	Euchone pallida	Fan worm	4	6	2	4	3	4		3	2	1
Crustacea	Nebalia sp.	Small crustacea			2					1	3	
Mysidacea	Mysidae	Misid shrimp										
Cumacea	Cumacea	Cumaceans		2	2	2	7	5	2	1	2	1
Isopoda	Anthuridea	Isopod									1	
Isopoda	Munna schauinslandii	Isopod										
Amphipoda	Haustoridae	Amphipod (family)	5	10	20	9	6		5	13	4	11
Amphipoda	Lysianassidae	Amphipod (family)										

			100S-12 C	1000N-12 A	1000N-12 B	1000N-12 C	1000S-12 A	1000S-12 B	1000S-12C	2000N-12 A	2000N-12 B	2000N-12 C
General Group	**Taxa**	**Common Name**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Amphipoda	Oedicerotidae	Amphipod (family)										
Amphipoda	Phoxocephalidae	Amphipod (family)		6	5	3	1		1	2	6	
Amphipoda	Amphipoda Unid.	Amphipod	5	1		2	6	3			3	1
Decapoda	Paguridae	Hermit Crab Unid.							1			
Decapoda	Betaeus sp.	Shrimp			1		1	1	4			1
Decapoda	Halicarcinus sp.	Pill-box Crab										
Decapoda	Ogyrides sp	Shrimp (long eyes)		1	1	1						
Decapoda	Pontophilus sp.	Shrimp						1				
Decapoda	Decapoda (larvae Unid.)	Unidentified Crab Larvae						1				
Ostracoda	Diasterope grisea	Ostracod		2	1	3				2		
Ostracoda	Leuroleberis zealandica	Ostracod (Large)										
Ostracoda	Neonesidea	Ostracod										
Ostracoda	Parasterope quadrata	Ostracod										
Ostracoda	Propontocypris sp.	Ostracod					2	2	2			
Copepoda	Copepoda	Copepods										
Pycnogonida	Pycnogonidae	Sea spiders									1	
Phoronida	Phoronus sp.	Horseshoe worms								1		
Echinoidea	Echinocardium spat	Heart Urchin						1				
Ophiuroidea	Ophiuroidea	Brittle stars		1						1	1	
Holothuroidea	Trochodota dendyi	Sea cucumber				1					1	
Chaetognatha	Chaetognatha	Arrow Worm					1					
Tunicata	Salpa sp.	Barrel salp				1						
Cephalocordata	Epigonichthys hectori	Lancelet										1
	Count: No of Individuals		**29**	**48**	**48**	**65**	**58**	**26**	**27**	**40**	**63**	**31**
	Count: No of Taxa		**13**	**18**	**15**	**18**	**19**	**12**	**16**	**16**	**20**	**17**
	SW_Diversity		**2.3460**	**2.5245**	**2.1035**	**2.6245**	**2.6820**	**2.2886**	**2.5870**	**2.3177**	**2.6586**	**2.3874**
	SW_Evenness		**0.9146**	**0.8734**	**0.7768**	**0.9080**	**0.9109**	**0.9210**	**0.9331**	**0.8359**	**0.8874**	**0.8426**

			2000S-12 A	2000S-12 B	2000S-12 C
General Group	**Taxa**	**Common Name**	**A**	**B**	**C**
Hydrozoa	Hydromedusae	Hydroid and jellyfish larvae			
Anthozoa	Edwardsia sp.	Burrowing anemone			
Nemertea	Nemertea	Proboscis worms	2		1
Gastropoda	Gastropoda (micro Snails)	Unidentified gastropod			
Gastropoda	Amalda mucronata	Olive Shell			
Gastropoda	Austrofusus glans	Kobbed whelk			
Gastropoda	Neoguraleus sp.	Whelk			
Bivalvia	Dosinia anus	Coarse biscuit shell			
Bivalvia	Dosinia subrosea	Fine biscuit shell		1	
Bivalvia	Myadora antipodum	Box shell			
Bivalvia	Myllitella vivens vivens	Small bivalve		1	
Bivalvia	Nucula nitidula	Nut shell			
Bivalvia	Soletellina sp.	Golden sunset shell			
Bivalvia	Tawera spissa (Juveniles) <1mm	Morning Star			
Oligochaeta	Oligochaeta	Oligochaete worms			
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm			
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm			
Polychaeta: Paraonidae	Paraonidae	Polychaete worm			
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm		1	
Polychaeta: Spionidae	Prionospio sp.	Polychaete worm		1	
Polychaeta: Spionidae	Prionospio yuriel	Polychaete worm			1
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm			
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm	1		
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	6	5	6
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms			
Polychaeta: Opheliidae	Armandia maculata	Polychaete worm	1	1	
Polychaeta: Opheliidae	Travisia olens	Polychaete worm			
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm		1	
Polychaeta: Hesionidae	Hesionidae	Polychaete Worm			
Polychaeta: Syllidae	Syllidae	Polychaete worm	5	3	7
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm			
Polychaeta: Glyceridae	Glyceridae	Polychaete worm			
Polychaeta: Goniadidae	Goniada sp.	Polychaete worm	1	2	
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm		1	
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm			
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm	1		
Polychaeta: Ampharetidae	Ampharetidae	Polychaete worm			
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm		1	
Polychaeta: Terebellidae	Terebellidae	Polychaete worm			
Polychaeta: Sabellidae	Euchone pallida	Fan worm		1	2
Crustacea	Nebalia sp.	Small crustacea			
Mysidacea	Mysidae	Misid shrimp			
Cumacea	Cumacea	Cumaceans	2	2	4
Isopoda	Anthuridea	Isopod			
Isopoda	Munna schauinslandii	Isopod			
Amphipoda	Haustoridae	Amphipod (family)	2	7	3
Amphipoda	Lysianassidae	Amphipod (family)			

			2000S-12 A	2000S-12 B	2000S-12 C
General Group	**Taxa**	**Common Name**	**A**	**B**	**C**
Amphipoda	Oedicerotidae	Amphipod (family)			
Amphipoda	Phoxocephalidae	Amphipod (family)	3		2
Amphipoda	Amphipoda Unid.	Amphipod		6	
Decapoda	Paguridae	Hermit Crab Unid.			
Decapoda	Betaeus sp.	Shrimp	2	1	3
Decapoda	Halicarcinus sp.	Pill-box Crab			
Decapoda	Ogyrides sp	Shrimp (long eyes)			
Decapoda	Pontophilus sp.	Shrimp			
Decapoda	Decapoda (larvae Unid.)	Unidentified Crab Larvae			
Ostracoda	Diasterope grisea	Ostracod		1	
Ostracoda	Leuroleberis zealandica	Ostracod (Large)			
Ostracoda	Neonesidea	Ostracod			
Ostracoda	Parasterope quadrata	Ostracod			
Ostracoda	Propontocypris sp.	Ostracod			
Copepoda	Copepoda	Copepods			1
Pycnogonida	Pycnogonidae	Sea spiders			
Phoronida	Phoronus sp.	Horseshoe worms			
Echinoidea	Echinocardium spat	Heart Urchin			
Ophiuroidea	Ophiuroidea	Brittle stars			
Holothuroidea	Trochodota dendyi	Sea cucumber			
Chaetognatha	Chaetognatha	Arrow Worm			
Tunicata	Salpa sp.	Barrel salp			
Cephalocordata	Epigonichthys hectori	Lancelet			
	Count: No of Individuals		**26**	**36**	**30**
	Count: No of Taxa		**11**	**17**	**10**
	SW_Diversity		**2.1951**	**2.5144**	**2.0918**
	SW_Evenness		**0.9154**	**0.8875**	**0.9085**

Boffa Miskell. Sharon De Luca																								
Macrofauna Identification and Counts for Omanu Beach >5mm samples, collected 17 May 2014. Client Ref T14036																								
General Group	**Taxa**	**Common Name**	**0-5 A**	**0-5 B**	**0-5 C**	**0-5 D**	**0-12 A**	**0-12 B**	**0-12 C**	**0-12 D**	**0-20 A**	**0-20 B**	**0-20 C**	**0-20 D**	**20N-12 A**	**20N-12 B**	**20N-12 C**	**20N-12 D**	**20S-12 A**	**20S-12 B**	**20S-12 C**	**20S-12 D**	**100N-12 A**	**100N-12 B**
	NS No sample supplied				**Empty**		**Empty**				**Empty**			**Empty**	**Empty**							**Empty**		
Anthozoa	Edwardsia sp.	Burrowing anemone						9	2							1					4			
Anthozoa	Arachnanthus sp.	Tube anemone																						
Nemertea	Nemertea	Proboscis worms	1			1		1	3							1				2	1			
Gastropoda	Amalda depressa	Olive Shell				1		2	2											1				1
Gastropoda	Amalda australis	Olive Shell														1							1	
Gastropoda	Zethalia zelandica	Sundial shell				37																		
Gastropoda	Austrofusus glans	Kobbed whelk						2	1								1							
Gastropoda	Struthiolaria papulosa	Ostrich foot						1															1	
Gastropoda	Dicathais orbita (Juvenile)	White rock shell						1																
Gastropoda	Cominella adspersa	Speckled whelk								1													1	
Gastropoda	Neoguraleus sp.	Spired shell																						
Gastropoda	Zeacolpus sp.	Turret shell																						
Opisthobranchia	Opisthobranchia Unid.	Slugs Marine																						
Bivalva	Mactra discors	Large trough shell	1	1																				
Bivalvia	Dosinia anus	Coarse biscuit shell				2																		
Bivalvia	Dosinia subrosea	Fine biscuit shell				1		1																
Bivalvia	Soletellina nitida	Golden sunset shell						3																
Bivalvia	Myadora antipodum	Box shell						3																
Bivalvia	Myadora striata	Box shell																						1
Bivalvia	Pecten novaezelandiae	Scallop																						
Bivalvia	Tellinota edgari	Wedge shell																						
Bivalvia	Myllitella vivens vivens	Small bivalve																						
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm						1																
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm						1																
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm						1																
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms						2	2				2			1					1			
Polychaeta: Opheliidae	Travisia olens	Polychaete worm						2								1	2		4					
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm	1	2		1																		
Polychaeta: Glyceridae	Glyceridae	Polychaete worm											1						1					1
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm						1					1											
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm						1																
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm						3																
Polychaeta: Phyllodocidae	Phyllodocidae	Paddle worm																						
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm						1																
Polychaeta: Terebellidae	Terebellidae	Polychaete worm	1													1								
Polychaeta: Sabellidae	Euchone pallida	Fan worm						2											1					
Polychaeta: Sabellariidae	Sabellariidae	Polychaete worm																		1				
Amphipoda	Ampelisca sp.	Amphipod (large)						1	1							1								
Decapoda	Pinnotheres novaezelandiae	Mussel Pea Crab																						
Decapoda	Paguridae	Hermit Crab Unid.				1						1												
Decapoda	Neommatocarcinus huttoni	Policeman Crab											1											
Decapoda	Ovalipes catharus	Common Swimming - Paddle Crab																						

General Group	Taxa	Common Name	0-5 A	0-5 B	0-5 C	0-5 D	0-12 A	0-12 B	0-12 C	0-12 D	0-20 A	0-20 B	0-20 C	0-20 D	20N-12 A	20N-12 B	20N-12 C	20N-12 D	20S-12 A	20S-12 B	20S-12 C	20S-12 D	100N-12 A	100N-12 B
Decapoda	Ogyrides sp	Shrimp (long eyes)															1							
Decapoda	Pariliacantha georgeorum	Mantis shrimp																						1
Asteroidea	Fellaster zelandiae	Sand Dollar																						
Ophiuroidea	Ophiuroidea	Brittle stars		1				3	1							1	1	1	1	1	1			
Holothuroidea	Trochodota dendyi	Sea cucumber							1											2				
Holothuroidea	Heteromolpadia marenzelleri	Sea cucumber																1						
Holothuroidea	Paracaudina chilensis	Sea cucumber																						1
Phoronida	Phoronus sp.	Horseshoe worms																						

General Group	**Taxa**	**Common Name**	**100N-12 C**	**100N-12 D**	**100S-12 A**	**100S-12 B**	**100S-12 C**	**100S-12 D**	**1000N-05 A**	**1000N-05 B**	**1000N-05 C**	**1000N-05 D**	**1000S-05 A**	**1000S-05 B**	**1000S-05 C**	**1000S-05 D**	**1000N-12 A**	**1000N-12 B**	**1000N-12 C**	**1000N-12 D**	**1000S-12 A**	**1000S-12 B**	**1000S-12 C**	**1000S-12 D**
									*	*	*	*	*	*	*	*								
	NS No sample supplied																					**Empty**	**Empty**	
Anthozoa	Edwardsia sp.	Burrowing anemone		1	2	8	3	2					1		1		2	2	1	3				
Anthozoa	Arachnanthus sp.	Tube anemone				1	1																	
Nemertea	Nemertea	Proboscis worms	1	1	1	7				1		1	1		1			2	2	2				
Gastropoda	Amalda depressa	Olive Shell							1	1		1		1			1	1	1	2				
Gastropoda	Amalda australis	Olive Shell	2		1	1																		
Gastropoda	Zethalia zelandica	Sundial shell																						
Gastropoda	Austrofusus glans	Kobbed whelk	1		2	1											1							2
Gastropoda	Struthiolaria papulosa	Ostrich foot								2							1							
Gastropoda	Dicathais orbita (Juvenile)	White rock shell																						
Gastropoda	Cominella adspersa	Speckled whelk						1										1			1			
Gastropoda	Neoguraleus sp.	Spired shell			1	1	1																	
Gastropoda	Zeacolpus sp.	Turret shell					1																	
Opisthobranchia	Opisthobranchia Unid.	Slugs Marine					1											1						
Bivalva	Mactra discors	Large trough shell										1	2											
Bivalvia	Dosinia anus	Coarse biscuit shell					1		2	1		2	2	2	2	4								
Bivalvia	Dosinia subrosea	Fine biscuit shell				2	1					1		1	1									
Bivalvia	Soletellina nitida	Golden sunset shell															1		1					
Bivalvia	Myadora antipodum	Box shell																						
Bivalvia	Myadora striata	Box shell								1				1										
Bivalvia	Pecten novaezelandiae	Scallop																						
Bivalvia	Tellinota edgari	Wedge shell																						
Bivalvia	Myllitella vivens vivens	Small bivalve																	1					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm																						
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm																						
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm					1																	
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms		1		1																		
Polychaeta: Opheliidae	Travisia olens	Polychaete worm	1	1		5	1	2		2									3		1			
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm					1								1					1				
Polychaeta: Glyceridae	Glyceridae	Polychaete worm				1							1											
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					1		1		1	1				1				1				1
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm																						
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm					1											2	2	1				
Polychaeta: Phyllodocidae	Phyllodocidae	Paddle worm														1								
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm					1																	
Polychaeta: Terebellidae	Terebellidae	Polychaete worm												1					1					
Polychaeta: Sabellidae	Euchone pallida	Fan worm				1												1	1					
Polychaeta: Sabellariidae	Sabellariidae	Polychaete worm																						
Amphipoda	Ampelisca sp.	Amphipod (large)		1														2						
Decapoda	Pinnotheres novaezelandiae	Mussel Pea Crab											1											
Decapoda	Paguridae	Hermit Crab Unid.		1			1						1						1					
Decapoda	Neommatocarcinus huttoni	Policeman Crab																						
Decapoda	Ovalipes catharus	Common Swimming - Paddle Crab																						

General Group	Taxa	Common Name	100N-12 C	100N-12 D	100S-12 A	100S-12 B	100S-12 C	100S-12 D	1000N-05 A	1000N-05 B	1000N-05 C	1000N-05 D	1000S-05 A	1000S-05 B	1000S-05 C	1000S-05 D	1000N-12 A	1000N-12 B	1000N-12 C	1000N-12 D	1000S-12 A	1000S-12 B	1000S-12 C	1000S-12 D
Decapoda	Ogyrides sp	Shrimp (long eyes)	1			2		1		1														
Decapoda	Pariliacantha georgeorum	Mantis shrimp																						
Asteroidea	Fellaster zelandiae	Sand Dollar											6			1								
Ophiuroidea	Ophiuroidea	Brittle stars		1	1	1	1	2	1	3	1	1			1		1	1	2	2				
Holothuroidea	Trochodota dendyi	Sea cucumber		1		1	2	1					1					1	1	1				
Holothuroidea	Heteromolpadia marenzelleri	Sea cucumber																						
Holothuroidea	Paracaudina chilensis	Sea cucumber																						
Phoronida	Phoronus sp.	Horseshoe worms																						
			* 1000N-05 crossed out on bottle and replaced by 1000S-05 BUT internal label still 1000N-05																					
			* 1000S-05 crossed out on bottle and replaced by 1000N-05 BUT internal label still 1000S-05																					

NB I have recorded as if the INTERNAL label is correct

General Group	Taxa	Common Name	2000N-05 A	2000N-05 B	2000N-05 C	2000N-05 D	2000S-05 A	2000S-05 B	2000S-05 C	2000S-05 D	2000N-12 A	2000N-12 B	2000N-12 C	2000N-12 D
	NS No sample supplied													**Empty**
Anthozoa	Edwardsia sp.	Burrowing anemone									8			
Anthozoa	Arachnanthus sp.	Tube anemone												
Nemertea	Nemertea	Proboscis worms			1				2		2		1	
Gastropoda	Amalda depressa	Olive Shell												
Gastropoda	Amalda australis	Olive Shell												
Gastropoda	Zethalia zelandica	Sundial shell												
Gastropoda	Austrofusus glans	Kobbed whelk												
Gastropoda	Struthiolaria papulosa	Ostrich foot												
Gastropoda	Dicathais orbita (Juvenile)	White rock shell												
Gastropoda	Cominella adspersa	Speckled whelk									1			
Gastropoda	Neoguraleus sp.	Spired shell												
Gastropoda	Zeacolpus sp.	Turret shell												
Opisthobranchia	Opisthobranchia Unid.	Slugs Marine												
Bivalva	Mactra discors	Large trough shell						1		1				
Bivalvia	Dosinia anus	Coarse biscuit shell	3	3	2	1	2			1				
Bivalvia	Dosinia subrosea	Fine biscuit shell												
Bivalvia	Soletellina nitida	Golden sunset shell												
Bivalvia	Myadora antipodum	Box shell												
Bivalvia	Myadora striata	Box shell					1			2				
Bivalvia	Pecten novaezelandiae	Scallop												
Bivalvia	Tellinota edgari	Wedge shell		1										
Bivalvia	Myllitella vivens vivens	Small bivalve												
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm												
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm												
Polychaeta: Spionidae	Spiophanes modestus	Polychaete worm												
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms												
Polychaeta: Opheliidae	Travisia olens	Polychaete worm									1	1	2	
Polychaeta: Sigalionidae	Sigalionidae	Polychaete worm		1		1	1		4	2			1	
Polychaeta: Glyceridae	Glyceridae	Polychaete worm										1		
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm				2								
Polychaeta: Onuphidae	Onuphis aucklandensis	Polychaete worm												
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm		2										
Polychaeta: Phyllodocidae	Phyllodocidae	Paddle worm												
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm												
Polychaeta: Terebellidae	Terebellidae	Polychaete worm		1	2						1			
Polychaeta: Sabellidae	Euchone pallida	Fan worm												
Polychaeta: Sabellariidae	Sabellariidae	Polychaete worm												
Amphipoda	Ampelisca sp.	Amphipod (large)											1	
Decapoda	Pinnotheres novaezelandiae	Mussel Pea Crab												
Decapoda	Paguridae	Hermit Crab Unid.				1	1							
Decapoda	Neommatocarcinus huttoni	Policeman Crab												
Decapoda	Ovalipes catharus	Common Swimming - Paddle Crab			1		1							

General Group	Taxa	Common Name	2000N-05 A	2000N-05 B	2000N-05 C	2000N-05 D	2000S-05 A	2000S-05 B	2000S-05 C	2000S-05 D	2000N-12 A	2000N-12 B	2000N-12 C	2000N-12 D
Decapoda	Ogyrides sp	Shrimp (long eyes)						1						
Decapoda	Pariliacantha georgeorum	Mantis shrimp												
Asteroidea	Fellaster zelandiae	Sand Dollar				1								
Ophiuroidea	Ophiuroidea	Brittle stars		1		1	1	1	1	1	2			
Holothuroidea	Trochodota dendyi	Sea cucumber		1		1					1			
Holothuroidea	Heteromolpadia marenzelleri	Sea cucumber												
Holothuroidea	Paracaudina chilensis	Sea cucumber												
Phoronida	Phoronus sp.	Horseshoe worms									1			

Table 5: Infauna - counts of all species by location

	Location											
	0 - 12	0 - 20	1000N - 12	1000S - 12	100N - 12	100S - 12	2000N - 12	2000S - 12	20N - 12	20S - 12	Total	% of total
Haustoridae	35	5	39	11	79	16	28	12	64	50	339	20.7%
Tawera spissa (Juveniles) <1mm	0	287	0	0	0	0	0	0	0	1	288	17.6%
Spiophanes modestus	18	0	16	1	14	12	6	0	13	24	104	6.3%
Heteromastus filiformis	2	3	17	11	10	9	13	17	6	3	91	5.6%
Myllitella vivens vivens	5	0	11	0	3	12	14	1	23	20	89	5.4%
Cumacea	5	28	6	14	6	3	4	8	5	6	85	5.2%
Euchone pallida	9	1	12	7	14	9	6	3	11	11	83	5.1%
Amphipoda Unid.	5	9	3	9	10	11	4	6	12	7	76	4.6%
Cirratulidae	2	4	9	5	5	4	4	1	9	7	50	3.1%
Phoxocephalidae	1	2	14	2	6	0	8	5	3	3	44	2.7%
Magelona dakini	5	2	4	2	5	4	6	1	9	2	40	2.4%
Syllidae	0	0	0	9	1	6	2	15	0	1	34	2.1%
Prionospio yuriel	0	2	4	0	4	3	12	1	5	1	32	2.0%
Diasterope grisea	2	0	6	0	8	2	2	1	2	3	26	1.6%
Nebalia sp.	2	0	2	0	4	1	4	0	7	2	22	1.3%
Betaeus sp.	4	1	1	6	1	0	1	6	2	0	22	1.3%
Nemertea	1	0	2	0	2	1	1	3	3	1	14	0.9%
Neonesidea	0	13	0	0	0	0	0	0	1	0	14	0.9%
Prionospio sp.	3	3	0	2	1	1	0	1	2	0	13	0.8%
Armandia maculata	0	0	1	5	1	0	1	2	0	0	10	0.6%
Paraonidae	1	2	0	7	0	0	0	0	0	0	10	0.6%
Edwardsia sp.	1	0	0	0	4	1	2	0	1	0	9	0.5%
Maldanidae	1	6	1	0	0	0	0	0	0	1	9	0.5%
Ogyrides sp	1	0	3	0	2	0	0	0	1	2	9	0.5%
Ophiuroidea	1	0	1	0	2	1	2	0	2	0	9	0.5%
Aglaophamus sp.	1	2	0	2	1	0	0	1	0	0	7	0.4%
Lumbrineridae	0	0	0	4	0	0	2	1	0	0	7	0.4%
Propontocypris sp.	0	0	0	6	0	1	0	0	0	0	7	0.4%

Anthuridea	0	1	0	0	2	0	1	0	1	1	6	0.4%
Hesionidae	0	0	0	1	2	0	2	0	0	0	5	0.3%
Myadora antipodum	1	0	0	1	0	0	0	0	0	2	4	0.2%
Aricidea sp.	0	0	0	1	0	0	0	1	1	1	4	0.2%
Travisia olens	0	0	3	0	0	0	1	0	0	0	4	0.2%
Sigalionidae	0	1	0	0	0	0	1	1	1	0	4	0.2%
Goniada sp.	0	1	0	0	0	0	0	3	0	0	4	0.2%
Mysidae	1	0	0	0	0	1	0	0	2	0	4	0.2%
Paguridae	0	3	0	1	0	0	0	0	0	0	4	0.2%
Decapoda (larvae Unid.)	0	2	0	1	0	0	0	0	0	1	4	0.2%
Phoronus sp.	0	1	0	0	1	0	1	0	1	0	4	0.2%
Amalda mucronata	0	0	1	0	0	1	0	0	1	0	3	0.2%
Glyceridae	0	0	1	0	0	0	2	0	0	0	3	0.2%
Oedicerotidae	2	0	0	0	0	0	0	0	1	0	3	0.2%
Parasterope quadrata	1	2	0	0	0	0	0	0	0	0	3	0.2%
Copepoda	0	1	0	0	1	0	0	1	0	0	3	0.2%
Austrofusus glans	2	0	0	0	0	0	0	0	0	0	2	0.1%
Neoguraleus sp.	0	0	0	0	1	0	0	0	1	0	2	0.1%
Dosinia anus	0	0	0	0	1	0	1	0	0	0	2	0.1%
Dosinia subrosea	0	0	0	0	1	0	0	1	0	0	2	0.1%
Soletellina sp.	0	1	0	0	0	0	0	0	0	1	2	0.1%
Lysianassidae	2	0	0	0	0	0	0	0	0	0	2	0.1%
Trochodota dendyi	0	0	1	0	0	0	1	0	0	0	2	0.1%
Hydromedusae	0	0	0	0	0	1	0	0	0	0	1	0.06%
Gastropoda (micro Snails)	1	0	0	0	0	0	0	0	0	0	1	0.06%
Nucula nitidula	0	1	0	0	0	0	0	0	0	0	1	0.06%
Oligochaeta	1	0	0	0	0	0	0	0	0	0	1	0.06%
Orbinia papillosa	0	0	1	0	0	0	0	0	0	0	1	0.06%
Scoloplos cylindrifer	0	0	1	0	0	0	0	0	0	0	1	0.06%
Sphaerosyllis sp.	0	1	0	0	0	0	0	0	0	0	1	0.06%
Onuphis aucklandensis	0	0	0	0	0	1	0	0	0	0	1	0.06%
Ampharetidae	0	1	0	0	0	0	0	0	0	0	1	0.06%

Terebellidae	0	0	0	0	0	1	0	0	0	0	1	0.06%
Munna schauinslandii	0	0	0	0	0	1	0	0	0	0	1	0.06%
Halicarcinus sp.	0	0	0	0	0	0	0	0	0	1	1	0.06%
Pontophilus sp.	0	0	0	1	0	0	0	0	0	0	1	0.06%
Leuroleberis zealandica	1	0	0	0	0	0	0	0	0	0	1	0.06%
Pycnogonidae	0	0	0	0	0	0	1	0	0	0	1	0.06%
Echinocardium spat	0	0	0	1	0	0	0	0	0	0	1	0.06%
Chaetognatha	0	0	0	1	0	0	0	0	0	0	1	0.06%
Salpa sp.	0	0	1	0	0	0	0	0	0	0	1	0.06%
Epigonichthys hectori	0	0	0	0	0	0	1	0	0	0	1	0.06%
Total	117	386	161	111	192	103	134	92	190	152	1638	

We next did Permanova to examine the species assemblage by Distance, Direction and Depth.

We did this two ways: first, we had just one factor, location, and all the data. Location was a combination of distance, direction and depth, as defined in the above table 5. There were 10 locations, each with 3 subtidal cores.

Overall, there was a statistically significant difference by Location, pseudo-F = 2.615, 9 and 20df, p = 0.0001.

PERMANOVA table of results

```
                                          Unique
Source df     SS      MS  Pseudo-F P(perm)  perms
Lo      9  21245  2360.5     2.615  0.0001   9857
Res    20  18054   902.7
Total  29    39299
```

However, when we examined the pairwise differences between locations, none were statistically significant (all p-values were > 0.09). This can only be because of the small sample sizes at each location.

We next looked at a 3 factor model: Distance, Direction and Depth. All factors were statistically significant. The only interaction that could be examined was Distance x Direction, which was also significant.

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Dis	3	5133.1	1711	1.8954	0.0083	9885
Dir	1	3051.6	3051.6	3.3805	0.0024	9935
De	1	3935.8	3935.8	4.36	0.0002	9947
DisxDir**	3	4549	1516.3	1.6798	0.0157	9880
DisxDe**	0	0		No test		
DirxDe**	0	0		No test		
DisxDirxDe**	0	0		No test		
Res	20	18054	902.7			
Total	29	39299				

Note that the other interaction terms could not be tested, because of empty cells (not all combinations had 3 samples).

However, again, none of the pairwise differences were statistically significant, neither between difference distances within direction, nor between directions within distance (all $p > 0.09$).

We next looked only at the 12m data, so had 27 samples at 9 locations.

By location only, the results were:

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Lo	8	14516	1814.4	2.0041	0.0002	9862
Res	18	16297	905.37			
Total	26	30812				

But, as above, no pairwise differences were significant (all $p > 0.09$).

The results by Distance and Direction were:

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Dis	3	5133.1	1711	1.8899	0.0141	9906
Dir	1	3051.6	3051.6	3.3706	0.0029	9924
DisxDir**	3	4549	1516.3	1.6748	0.0184	9887
Res	18	16297	905.37			
Total	26	30812				

** Term has one or more empty cells

And, as above there were no pairwise significant differences.

The results of the SIMPER analysis by Location were (Table 6):

Group 0 - 12
Average similarity: 34.41

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.84	10.55	4.14	30.65	30.65

Euchonepallida	1.27	6.54	7.98	19.00	49.65
Cumacea	0.80	2.04	0.58	5.92	55.57
Betaeussp	0.77	2.04	0.58	5.92	61.49
Spiophanesmodestus	1.09	2.01	0.58	5.83	67.32
Myllitellavivensvivens	0.84	1.81	0.58	5.27	72.59
Magelonadakini	0.84	1.81	0.58	5.27	77.85
Austrofususglans	0.67	1.52	0.58	4.43	82.28
Prionospiosp	0.73	1.52	0.58	4.43	86.71
Heteromastusfiliformis	0.67	1.52	0.58	4.43	91.14

Group 0 - 20
Average similarity: 56.03

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
TaweraspissaJuvenileslt1mm	3.10	14.88	12.92	26.55	26.55
Neonesidea	1.44	7.22	8.57	12.89	39.44
AmphipodaUnid	1.31	6.28	8.80	11.21	50.65
Cumacea	1.53	6.07	8.57	10.84	61.49
Heteromastusfiliformis	1.00	5.11	8.57	9.11	70.60
Maldanidae	1.14	5.11	8.57	9.11	79.72
Parasteropequadrata	0.67	1.92	0.58	3.43	83.15
Magelonadakini	0.67	1.65	0.58	2.94	86.09
Aglaophamussp	0.67	1.65	0.58	2.94	89.03
Paraonidae	0.67	1.54	0.58	2.74	91.77

Group 20N - 12
Average similarity: 59.97

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.14	9.69	59.23	16.15	16.15
Magelonadakini	1.32	6.13	50.08	10.23	26.38
AmphipodaUnid	1.40	6.13	50.08	10.23	36.61
Myllitellavivensvivens	1.55	5.92	2.76	9.88	46.49
Euchonepallida	1.36	5.74	18.74	9.57	56.06
Spiophanesmodestus	1.38	5.56	3.37	9.27	65.33
Cirratulidae	1.28	5.30	4.97	8.84	74.17
Nebaliasp	0.91	2.09	0.58	3.49	77.65
Heteromastusfiliformis	0.88	2.02	0.58	3.37	81.02
Prionospioyuriel	0.84	1.83	0.58	3.05	84.07
Cumacea	0.84	1.82	0.58	3.04	87.11
Phoxocephalidae	0.73	1.59	0.58	2.65	89.76
Prionospiosp	0.67	1.54	0.58	2.56	92.33

Group 100N - 12
Average similarity: 62.19

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.24	9.38	11.57	15.08	15.08
Spiophanesmodestus	1.45	6.03	42.32	9.70	24.78
Heteromastusfiliformis	1.35	5.89	41.70	9.47	34.25
AmphipodaUnid	1.30	5.09	4.73	8.19	42.44
Euchonepallida	1.36	4.96	5.33	7.97	50.41
Phoxocephalidae	1.17	4.76	9.48	7.65	58.06
Diasteropegrisea	1.23	4.75	12.27	7.64	65.70
Prionospioyuriel	1.06	4.48	41.70	7.20	72.90
Nebaliasp	1.06	4.48	41.70	7.20	80.10
Edwardsiasp	0.79	1.73	0.58	2.78	82.88
Magelonadakini	0.84	1.73	0.58	2.78	85.66

Hesionidae	0.67	1.53	0.58	2.46	88.12
Myllitellavivensvivens	0.73	1.49	0.58	2.40	90.52

Group 1000N - 12
Average similarity: 68.95

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.88	8.32	13.12	12.07	12.07
Phoxocephalidae	1.46	6.57	7.52	9.53	21.60
Spiophanesmodestus	1.50	6.55	9.84	9.50	31.10
Heteromastusfiliformis	1.50	6.22	9.50	9.02	40.13
Euchonepallida	1.39	6.00	20.64	8.70	48.82
Cumacea	1.19	5.66	15.84	8.21	57.03
Myllitellavivensvivens	1.31	5.27	5.52	7.64	64.67
Cirratulidae	1.27	5.23	9.50	7.59	72.26
Diasteropegrisea	1.17	5.04	20.64	7.31	79.57
Magelonadakini	1.06	4.76	15.84	6.91	86.48
Ogyridessp	1.00	4.76	15.84	6.91	93.38

Group 2000N - 12
Average similarity: 53.57

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.71	7.59	3.98	14.17	14.17
Heteromastusfiliformis	1.43	6.54	12.62	12.20	26.37
Prionospioyuriel	1.31	5.14	10.54	9.60	35.97
Spiophanesmodestus	1.17	5.14	10.54	9.60	45.57
Euchonepallida	1.17	5.14	10.87	9.60	55.17
Myllitellavivensvivens	1.29	4.85	10.62	9.06	64.22
Cumacea	1.06	4.85	10.62	9.06	73.28
Phoxocephalidae	0.92	1.82	0.58	3.39	76.67
Syllidae	0.67	1.79	0.58	3.35	80.02
Magelonadakini	0.83	1.53	0.58	2.86	82.88
Lumbrineridae	0.67	1.53	0.58	2.86	85.74
AmphipodaUnid	0.77	1.53	0.58	2.86	88.60
Glyceridae	0.67	1.53	0.58	2.85	91.45

Group 20S - 12
Average similarity: 64.41

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.01	10.53	79.26	16.35	16.35
Myllitellavivensvivens	1.60	8.45	11.59	13.11	29.46
Spiophanesmodestus	1.63	7.94	14.48	12.32	41.78
Euchonepallida	1.36	6.85	9.17	10.64	52.42
AmphipodaUnid	1.23	6.61	13.49	10.26	62.68
Cumacea	1.17	5.92	6.89	9.19	71.87
Cirratulidae	1.17	5.56	13.49	8.63	80.50
Diasteropegrisea	1.00	5.56	13.49	8.63	89.14
Heteromastusfiliformis	0.73	1.91	0.58	2.96	92.10

Group 100S - 12
Average similarity: 54.25

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.51	8.93	7.60	16.46	16.46
Myllitellavivensvivens	1.38	7.63	6.99	14.07	30.52
Heteromastusfiliformis	1.31	7.61	8.52	14.03	44.56

Euchonepallida	1.28	6.96	7.48	12.83	57.39
Spiophanesmodestus	1.33	6.78	9.01	12.50	69.89
Magelonadakini	1.06	6.21	6.56	11.44	81.33
AmphipodaUnid	1.02	2.71	0.58	5.00	86.33
Cumacea	0.73	1.97	0.58	3.63	89.97
Prionospioyuriel	0.73	1.81	0.58	3.34	93.31

Group 1000S - 12
Average similarity: 57.40

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Cumacea	1.44	7.05	6.10	12.29	12.29
Propontocyprissp	1.19	6.51	7.20	11.34	23.63
Heteromastusfiliformis	1.33	6.21	4.66	10.81	34.44
Paraonidae	1.20	5.81	6.81	10.12	44.56
Syllidae	1.21	5.48	7.20	9.54	54.10
Lumbrineridae	1.06	5.48	7.20	9.54	63.64
Betaeussp	1.14	5.48	7.20	9.54	73.18
Haustoridae	1.02	2.40	0.58	4.19	77.37
Euchonepallida	0.91	2.32	0.58	4.04	81.42
AmphipodaUnid	0.96	2.32	0.58	4.04	85.46
Cirratulidae	0.84	1.91	0.58	3.33	88.79
Magelonadakini	0.67	1.61	0.58	2.80	91.59

Group 2000S - 12
Average similarity: 54.86

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Heteromastusfiliformis	1.54	10.23	6.14	18.65	18.65
Syllidae	1.48	9.31	4.67	16.97	35.63
Haustoridae	1.38	8.26	8.59	15.05	50.68
Cumacea	1.26	7.99	7.42	14.57	65.25
Betaeussp	1.17	7.21	4.11	13.15	78.40
Phoxocephalidae	0.84	3.08	0.58	5.61	84.01
Nemertea	0.73	2.59	0.58	4.72	88.73
Euchonepallida	0.73	2.08	0.58	3.80	92.53

Appendix C: Statistical Results

Infaunal Cores

Permanova to examine the species assemblage by Distance, Direction and Depth.

We did this two ways: first, we had just one factor, location, and all the data. Location was a combination of distance, direction and depth, as defined in the above table 5. There were 10 locations, each with 3 subtidal cores.

Overall, there was a statistically significant difference by Location, pseudo-F = 2.615, 9 and 20df, p = 0.0001.

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Lo	9	21245	2360.5	2.615	0.0001	9857
Res	20	18054	902.7			
Total	29	39299				

However, when we examined the pairwise differences between locations, none were statistically significant (all p-values were > 0.09). This can only be because of the small sample sizes at each location.

We next looked at a 3 factor model: Distance, Direction and Depth. All factors were statistically significant. The only interaction that could be examined was Distance x Direction, which was also significant.

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Dis	3	5133.1	1711	1.8954	0.0083	9885
Dir	1	3051.6	3051.6	3.3805	0.0024	9935
De	1	3935.8	3935.8	4.36	0.0002	9947
DisxDir**	3	4549	1516.3	1.6798	0.0157	9880
DisxDe**	0	0		No test		
DirxDe**	0	0		No test		
DisxDirxDe**	0	0		No test		
Res	20	18054	902.7			
Total	29	39299				

Note that the other interaction terms could not be tested, because of empty cells (not all combinations had 3 samples).

However, again, none of the pairwise differences were statistically significant, neither between difference distances within direction, nor between directions within distance (all p > 0.09).

We next looked only at the 12m data, so had 27 samples at 9 locations.

By location only, the results were:

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Lo	8	14516	1814.4	2.0041	0.0002	9862
Res	18	16297	905.37			
Total	26	30812				

But, as above, no pairwise differences were significant (all $p > 0.09$).

The results by Distance and Direction were:

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Dis	3	5133.1	1711	1.8899	0.0141	9906
Dir	1	3051.6	3051.6	3.3706	0.0029	9924
DisxDir**	3	4549	1516.3	1.6748	0.0184	9887
Res	18	16297	905.37			
Total	26	30812				

** Term has one or more empty cells

And, as above there were no pairwise significant differences.

The results of the SIMPER analysis by Location were (Table 6):

Group 0 - 12
Average similarity: 34.41

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.84	10.55	4.14	30.65	30.65
Euchonepallida	1.27	6.54	7.98	19.00	49.65
Cumacea	0.80	2.04	0.58	5.92	55.57
Betaeussp	0.77	2.04	0.58	5.92	61.49
Spiophanesmodestus	1.09	2.01	0.58	5.83	67.32
Myllitellavivensvivens	0.84	1.81	0.58	5.27	72.59
Magelonadakini	0.84	1.81	0.58	5.27	77.85
Austrofususglans	0.67	1.52	0.58	4.43	82.28
Prionospiosp	0.73	1.52	0.58	4.43	86.71
Heteromastusfiliformis	0.67	1.52	0.58	4.43	91.14

Group 0 - 20
Average similarity: 56.03

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
TaweraspissaJuvenileslt1mm	3.10	14.88	12.92	26.55	26.55
Neonesidea	1.44	7.22	8.57	12.89	39.44
AmphipodaUnid	1.31	6.28	8.80	11.21	50.65
Cumacea	1.53	6.07	8.57	10.84	61.49
Heteromastusfiliformis	1.00	5.11	8.57	9.11	70.60
Maldanidae	1.14	5.11	8.57	9.11	79.72
Parasteropequadrata	0.67	1.92	0.58	3.43	83.15
Magelonadakini	0.67	1.65	0.58	2.94	86.09
Aglaophamussp	0.67	1.65	0.58	2.94	89.03

Paraonidae	0.67	1.54	0.58	2.74	91.77

Group 20N - 12
Average similarity: 59.97

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.14	9.69	59.23	16.15	16.15
Magelonadakini	1.32	6.13	50.08	10.23	26.38
AmphipodaUnid	1.40	6.13	50.08	10.23	36.61
Myllitellavivensvivens	1.55	5.92	2.76	9.88	46.49
Euchonepallida	1.36	5.74	18.74	9.57	56.06
Spiophanesmodestus	1.38	5.56	3.37	9.27	65.33
Cirratulidae	1.28	5.30	4.97	8.84	74.17
Nebaliasp	0.91	2.09	0.58	3.49	77.65
Heteromastusfiliformis	0.88	2.02	0.58	3.37	81.02
Prionospioyuriel	0.84	1.83	0.58	3.05	84.07
Cumacea	0.84	1.82	0.58	3.04	87.11
Phoxocephalidae	0.73	1.59	0.58	2.65	89.76
Prionospiosp	0.67	1.54	0.58	2.56	92.33

Group 100N - 12
Average similarity: 62.19

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.24	9.38	11.57	15.08	15.08
Spiophanesmodestus	1.45	6.03	42.32	9.70	24.78
Heteromastusfiliformis	1.35	5.89	41.70	9.47	34.25
AmphipodaUnid	1.30	5.09	4.73	8.19	42.44
Euchonepallida	1.36	4.96	5.33	7.97	50.41
Phoxocephalidae	1.17	4.76	9.48	7.65	58.06
Diasteropegrisea	1.23	4.75	12.27	7.64	65.70
Prionospioyuriel	1.06	4.48	41.70	7.20	72.90
Nebaliasp	1.06	4.48	41.70	7.20	80.10
Edwardsiasp	0.79	1.73	0.58	2.78	82.88
Magelonadakini	0.84	1.73	0.58	2.78	85.66
Hesionidae	0.67	1.53	0.58	2.46	88.12
Myllitellavivensvivens	0.73	1.49	0.58	2.40	90.52

Group 1000N - 12
Average similarity: 68.95

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.88	8.32	13.12	12.07	12.07
Phoxocephalidae	1.46	6.57	7.52	9.53	21.60
Spiophanesmodestus	1.50	6.55	9.84	9.50	31.10
Heteromastusfiliformis	1.50	6.22	9.50	9.02	40.13
Euchonepallida	1.39	6.00	20.64	8.70	48.82
Cumacea	1.19	5.66	15.84	8.21	57.03
Myllitellavivensvivens	1.31	5.27	5.52	7.64	64.67
Cirratulidae	1.27	5.23	9.50	7.59	72.26
Diasteropegrisea	1.17	5.04	20.64	7.31	79.57
Magelonadakini	1.06	4.76	15.84	6.91	86.48
Ogyridessp	1.00	4.76	15.84	6.91	93.38

Group 2000N - 12
Average similarity: 53.57

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%

Haustoridae	1.71	7.59	3.98	14.17	14.17
Heteromastusfiliformis	1.43	6.54	12.62	12.20	26.37
Prionospioyuriel	1.31	5.14	10.54	9.60	35.97
Spiophanesmodestus	1.17	5.14	10.54	9.60	45.57
Euchonepallida	1.17	5.14	10.87	9.60	55.17
Myllitellavivensvivens	1.29	4.85	10.62	9.06	64.22
Cumacea	1.06	4.85	10.62	9.06	73.28
Phoxocephalidae	0.92	1.82	0.58	3.39	76.67
Syllidae	0.67	1.79	0.58	3.35	80.02
Magelonadakini	0.83	1.53	0.58	2.86	82.88
Lumbrineridae	0.67	1.53	0.58	2.86	85.74
AmphipodaUnid	0.77	1.53	0.58	2.86	88.60
Glyceridae	0.67	1.53	0.58	2.85	91.45

Group 20S - 12
Average similarity: 64.41

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	2.01	10.53	79.26	16.35	16.35
Myllitellavivensvivens	1.60	8.45	11.59	13.11	29.46
Spiophanesmodestus	1.63	7.94	14.48	12.32	41.78
Euchonepallida	1.36	6.85	9.17	10.64	52.42
AmphipodaUnid	1.23	6.61	13.49	10.26	62.68
Cumacea	1.17	5.92	6.89	9.19	71.87
Cirratulidae	1.17	5.56	13.49	8.63	80.50
Diasteropegrisea	1.00	5.56	13.49	8.63	89.14
Heteromastusfiliformis	0.73	1.91	0.58	2.96	92.10

Group 100S - 12
Average similarity: 54.25

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Haustoridae	1.51	8.93	7.60	16.46	16.46
Myllitellavivensvivens	1.38	7.63	6.99	14.07	30.52
Heteromastusfiliformis	1.31	7.61	8.52	14.03	44.56
Euchonepallida	1.28	6.96	7.48	12.83	57.39
Spiophanesmodestus	1.33	6.78	9.01	12.50	69.89
Magelonadakini	1.06	6.21	6.56	11.44	81.33
AmphipodaUnid	1.02	2.71	0.58	5.00	86.33
Cumacea	0.73	1.97	0.58	3.63	89.97
Prionospioyuriel	0.73	1.81	0.58	3.34	93.31

Group 1000S - 12
Average similarity: 57.40

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Cumacea	1.44	7.05	6.10	12.29	12.29
Propontocyprissp	1.19	6.51	7.20	11.34	23.63
Heteromastusfiliformis	1.33	6.21	4.66	10.81	34.44
Paraonidae	1.20	5.81	6.81	10.12	44.56
Syllidae	1.21	5.48	7.20	9.54	54.10
Lumbrineridae	1.06	5.48	7.20	9.54	63.64
Betaeussp	1.14	5.48	7.20	9.54	73.18
Haustoridae	1.02	2.40	0.58	4.19	77.37
Euchonepallida	0.91	2.32	0.58	4.04	81.42
AmphipodaUnid	0.96	2.32	0.58	4.04	85.46
Cirratulidae	0.84	1.91	0.58	3.33	88.79
Magelonadakini	0.67	1.61	0.58	2.80	91.59

Group 2000S - 12
Average similarity: 54.86

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Heteromastusfiliformis	1.54	10.23	6.14	18.65	18.65
Syllidae	1.48	9.31	4.67	16.97	35.63
Haustoridae	1.38	8.26	8.59	15.05	50.68
Cumacea	1.26	7.99	7.42	14.57	65.25
Betaeussp	1.17	7.21	4.11	13.15	78.40
Phoxocephalidae	0.84	3.08	0.58	5.61	84.01
Nemertea	0.73	2.59	0.58	4.72	88.73
Euchonepallida	0.73	2.08	0.58	3.80	92.53

Table A1: ANOVA and Tukey Post Hoc results from the infauna abundance data.

ANOVA

Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21906.533	9	2434.059	6.361	.000
Within Groups	7652.667	20	382.633		
Total	29559.200	29			

There was a significant difference in the mean abundance by location, $F(9, 20) = 6.361$, $p < 0.0005$).

Tukey- adjusted p-values comparing locations.

	0-12	0-20	20N-12	100N-12	1000N-12	2000N-12	20S-12	100S-12	1000S-12	2000S-12
0-12	1	0.001	0.867	0.849	0.994	1	0.999	1	1	1
0-20		1	0.016	0.017	0.004	0.001	0.003	0.000	0.000	0.000
20N-12			1	1	1	0.969	0.998	0.719	0.810	0.581
100N-12				1	1	0.962	0.997	0.695	0.788	0.555
1000N-12					1	1	1	0.962	0.985	0.900
2000N-12						1	1	1	1	0.996
20S-12							1	0.987	0.996	0.953
100S-12								1	1	1
1000S-12									1	1
2000S-12										1

In summary, the only significant differences between the locations were that 0-20 was significantly different from all other locations.

Table A2: Comparison of taxa by location.

ANOVA

NTaxa

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	76.533	9	8.504	.880	.559
Within Groups	193.333	20	9.667		

Total	269.867	29				

There was no significant difference in number of Taxa present by location.

Table A3: Results of PERMANOVA pairwise tests by location:

PERMANOVA
Permutational MANOVA

```
Resemblance worksheet
Name: Resem1
Data type: Similarity
Selection: All
Transform: Fourth root
Resemblance: S17 Bray Curtis similarity (+d)

Sums of squares type: Type III (partial)
Fixed effects sum to zero for mixed terms
Permutation method: Unrestricted permutation of raw data
Number of permutations: 9999

Factors
Name     Abbrev. Type  Levels
Location Lo      Fixed     10

PAIR-WISE TESTS

Term 'Lo'

                                            Unique
Groups                        t  P(perm)   perms
0 - 12, 0 - 20         1.6584   0.0957      10
0 - 12, 20N - 12      0.86176   0.7979      10
0 - 12, 100N - 12       1.161   0.2019      10
0 - 12, 1000N - 12      1.115   0.1987      10
0 - 12, 2000N - 12     1.1408    0.306      10
0 - 12, 20S - 12      0.98398   0.7966      10
0 - 12, 100S - 12     0.96335   0.6966      10
0 - 12, 1000S - 12     1.4431   0.2001      10
0 - 12, 2000S - 12     1.3315   0.2043      10
0 - 20, 20N - 12       2.3164   0.1011      10
0 - 20, 100N - 12       2.477   0.1002      10
0 - 20, 1000N - 12     2.7574   0.1028      10
0 - 20, 2000N - 12     2.3145   0.1003      10
0 - 20, 20S - 12       2.5055   0.1014      10
0 - 20, 100S - 12       2.358   0.1045      10
0 - 20, 1000S - 12     2.1264   0.1007      10
0 - 20, 2000S - 12      2.167   0.0979      10
20N - 12, 100N - 12   0.82511   0.8986      10
20N - 12, 1000N - 12   1.0192   0.4952      10
20N - 12, 2000N - 12  0.98457   0.4917      10
20N - 12, 20S - 12    0.96101   0.6047      10
20N - 12, 100S - 12   0.94084   0.5993      10
20N - 12, 1000S - 12   2.2222   0.1008      10
20N - 12, 2000S - 12   1.9008   0.0992      10
```

```
100N - 12, 1000N - 12    1.1914  0.2007     10
100N - 12, 2000N - 12   0.74144   0.899     10
100N - 12, 20S - 12      1.2716  0.1046     10
100N - 12, 100S - 12     1.2026  0.0966     10
100N - 12, 1000S - 12    2.2361  0.1046     10
100N - 12, 2000S - 12    1.8369  0.0985     10
1000N - 12, 2000N - 12  0.96921  0.5962     10
1000N - 12, 20S - 12     1.0013  0.5983     10
1000N - 12, 100S - 12    1.2222  0.2016     10
1000N - 12, 1000S - 12   2.4619  0.1023     10
1000N - 12, 2000S - 12   1.9064   0.098     10
2000N - 12, 20S - 12     1.2289  0.0933     10
2000N - 12, 100S - 12   0.83892  0.7968     10
2000N - 12, 1000S - 12   1.7488  0.1016     10
2000N - 12, 2000S - 12   1.4079  0.1974     10
20S - 12, 100S - 12      1.0363  0.4015     10
20S - 12, 1000S - 12     2.3417  0.1045     10
20S - 12, 2000S - 12     2.1326  0.1021     10
100S - 12, 1000S - 12    1.9054  0.0999     10
100S - 12, 2000S - 12    1.6298  0.1017     10
1000S - 12, 2000S - 12   1.3122  0.1003     10
```

Table A4: Pearson correlations of the trace metals in *Dosinia anus*.

Correlations

		Aluminium	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Aluminium	Correlation	1								
	Sig. (2-tailed)									
Arsenic	Correlation	.099	1							
	Sig. (2-tailed)	.786								
Cadmium	Correlation	.076	.805**	1						
	Sig. (2-tailed)	.835	.005							
Chromium	Correlation	.307	-.068	-.181	1					
	Sig. (2-tailed)	.388	.852	.616						
Copper	Correlation	-.526	-.445	-.444	.261	1				

	Sig. (2-tailed)	.118	.198	.199	.467					
Lead	Correlation	-.088	.535	.697*	-.158	-.042	1			
	Sig. (2-tailed)	.809	.111	.025	.662	.909				
Mercury	Correlation	.802**	.119	.100	.022	-.748*	-.295	1		
	Sig. (2-tailed)	.005	.743	.784	.951	.013	.408			
Nickel	Correlation	-.398	.412	.465	-.068	.450	.638*	-.617	1	
	Sig. (2-tailed)	.254	.236	.176	.852	.192	.047	.057		
Zinc	Correlation	-.303	.365	.363	-.011	.439	.627	-.530	.936**	1
	Sig. (2-tailed)	.394	.300	.302	.977	.205	.052	.115	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Large Invertebrates

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
total	Between Groups	1613.000	8	201.625	2.626	.029
	Within Groups	2073.000	27	76.778		
	Total	3686.000	35			
NTaxa	Between Groups	369.889	8	46.236	2.774	.022
	Within Groups	450.000	27	16.667		
	Total	819.889	35			
Dosinia sp.	Between Groups	196.000	8	24.500	6.197	.000
	Within Groups	106.750	27	3.954		
	Total	302.750	35			

The mean number of individuals, of Taxa and of Dosinia sp were significantly different by location. However, for mean total number of individuals, none of the pairwise differences were significant (Tukey's method), possibly because of inhomogeneity of variances between groups.

For the Number of Taxa, 2000S – 12 was significantly lower than 100S – 12 (p = 0.049), but none of the other groups were statistically different. For Dosinia, 2000N-12 was significantly higher than 1000S-12 (p = 0.001), 20N-12(p = 0.001), 2000S-12 (p = 0.002), and 1000N-12 (p = 0.021), and both 1000S -12 (p = 0.021, p = 0.001) and 20N-12 (p = 0.048, p = 0.001) were significantly lower than 100N – 12, and 2000N – 12.

We ran a **PERMANOVA** analysis, using a fourth root transformation and the Bray-Curtis metric (with dummy added).

Permanova Analysis established that, overall, the species assemblage differed by Distance, but not by Direction.

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Dis	3	6222	2074	2.0506	0.013	999
Dir	1	1494.7	1494.7	1.4778	0.185	999
DisxDir**	3	10139	3379.5	3.3413	0.002	998
Res	27	27308	1011.4			
Total	35	45779				

Hence, there was a significant effect of Distance (Pseudo-F = 2.051, with 3 and 27 df, p = 0.013), but no significant effect of Direction (pseudo-F = 1.478, df = 1, 27, p = 0.185). The interaction between Distance and Direction was also significant (Pseudo-F = 3.341, df = 3, 27, p = 0.002), indicating the pattern of change over the distances was different in N versus S directions. To investigate this further, we did pairwise tests, again in Permanova:

Within level 'N' of factor 'Direction'

Groups	t	P(perm)	Unique perms
20, 100	1.11	0.265	35
20, 1000	1.9221	0.052	35
20, 2000	1.1847	0.192	35
100, 1000	1.696	0.052	35
100, 2000	0.60197	0.894	35
1000, 2000	2.0117	0.069	35

Within level 'S' of factor 'Direction'

Groups	t	P(perm)	Unique perms
20, 100	1.4591	0.054	35
20, 1000	1.7044	0.019	35
20, 2000	1.977	0.031	25
100, 1000	2.504	0.029	35
100, 2000	3.1587	0.026	25
1000, 2000	0.27274	1	25

In the N direction, no distances were actually statistically different from each other, although 20 and 1000; 100 and 1000; and 1000 and 2000 all showed a trend towards statistical significance (p < 0.1). However, in the S direction, 20 and 1000; 20 and 2000; and 100 and 2000 were all significantly different from each other, and 20 and 100 showed a trend towards statistical significance. The only pair which showed no indication of a statistically significant difference was 1000 and 2000.

To examine which species were driving the dissimilarities between distances, we used SIMPER, which gives the contribution of each species to the similarities within distance groups (equivalent to Table 6, p 21). The results were:

Distance groups
(across all Direction groups)
Group 0
Average similarity: 37.34

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	2.09	31.19	1.25	83.54	83.54
Edwardsia sp.	0.85	1.11	0.41	2.98	86.52
Amalda depressa	0.55	1.11	0.41	2.98	89.50
Maldanidae	0.55	1.11	0.41	2.98	92.48

Group 20
Average similarity: 42.81

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.71	34.31	3.20	80.15	80.15
Ophiuroidea	0.52	6.54	0.93	15.28	95.43

Group 100
Average similarity: 44.75

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	2.10	25.10	3.05	56.10	56.10
Edwardsia sp.	0.81	5.37	0.93	12.00	68.10
Ophiuroidea	0.48	3.28	0.92	7.34	75.44
Travisia olens	0.62	2.52	0.65	5.63	81.07
Neoguraleus sp.	0.26	1.47	0.54	3.29	84.36
Amalda australis	0.40	1.46	0.40	3.26	87.62
Bassina sp.	0.35	1.44	0.40	3.22	90.84

Group 1000
Average similarity: 51.02

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.47	30.84	1.68	60.44	60.44
Edwardsia sp.	0.53	4.91	0.88	9.62	70.06
Ophiuroidea	0.45	4.07	0.93	7.97	78.03
Amalda depressa	0.40	3.74	0.94	7.33	85.36
Nemertea	0.41	2.64	0.55	5.18	90.54

Group 2000
Average similarity: 61.66

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.91	55.73	2.79	90.39	90.39

At all distances, Dosinia sp. was the species which contributed the most to the similarities within the group. It contributed between 50.6% to 90.39% to the similarity. Edwardsia and Ophiuroidea were the second and third highest contributors to the similarity respectively.

There was a significant difference in the mean number of Dosinia sp by location, $F(5, 18) = 4.372$, $p = 0.009$. The mean number of Dosinia at 0 – 20 was significantly different from those at 2000N -5 ($p = 0.032$), 1000N -5 ($p = 0.046$) and 1000S – 5 ($p = 0.032$).

There was a significantly different mean number of Taxa by location, $F(5, 18) = 2.970$, $p = 0.040$. The number of taxa at 0 -20 was significantly lower than for 1000N-5 ($p = 0.049$) and for 1000S -5($p = 0.036$).

PERMANOVA analysis established that there was a significant difference in species assemblage by location:

PERMANOVA table of results

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
De	5	19814	3962.8	3.1446	0.001	997
Res	18	22683	1260.2			
Total	23	42497				

The pairwise tests revealed:

Groups	t	P(perm)	perms
0 - 5, 0 - 20	1.9737	0.058	25
0 - 5, 1000N - 5	1.7588	0.023	35
0 - 5, 1000S - 5	1.1826	0.323	35
0 - 5, 2000N - 5	1.5088	0.051	35
0 - 5, 2000S - 5	1.0917	0.384	35
0 - 20, 1000N - 5	2.9444	0.033	25
0 - 20, 1000S - 5	2.2263	0.035	25
0 - 20, 2000N - 5	2.147	0.022	25
0 - 20, 2000S - 5	2.7228	0.029	25
1000N - 5, 1000S - 5	1.0397	0.462	35
1000N - 5, 2000N - 5	1.5192	0.027	35
1000N - 5, 2000S - 5	1.6628	0.034	35
1000S - 5, 2000N - 5	0.75295	0.831	35
1000S - 5, 2000S - 5	1.4303	0.115	35
2000N - 5, 2000S - 5	1.5502	0.049	35

SIMPER analysis gave the following in terms of similarities:

Group 0 - 5
Average similarity: 35.06

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Mactra discors	0.80	14.37	0.87	40.99	40.99
Evechinus chloroticus	1.06	10.59	0.89	30.22	71.21

Sigalionidae	0.80	7.87	0.88	22.46	93.67

Group 0 - 20
All the similarities are zero

Group 1000N - 5
Average similarity: 61.25

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.43	19.15	5.75	31.27	31.27
Ophiuroidea	1.08	14.10	4.99	23.02	54.29
Evechinus chloroticus	1.14	8.96	0.90	14.63	68.92
Aglaophamus sp.	0.75	8.18	0.91	13.36	82.28
Amalda depressa	0.75	6.12	0.90	10.00	92.28

Group 1000S - 5
Average similarity: 35.30

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.44	19.04	4.90	53.96	53.96
Evechinus chloroticus	1.04	8.70	0.88	24.64	78.59
Fellaster zelandiae	0.64	1.95	0.41	5.52	84.11
Mactra discors	0.55	1.95	0.41	5.52	89.63
Edwardsia sp.	0.50	1.83	0.41	5.18	94.82

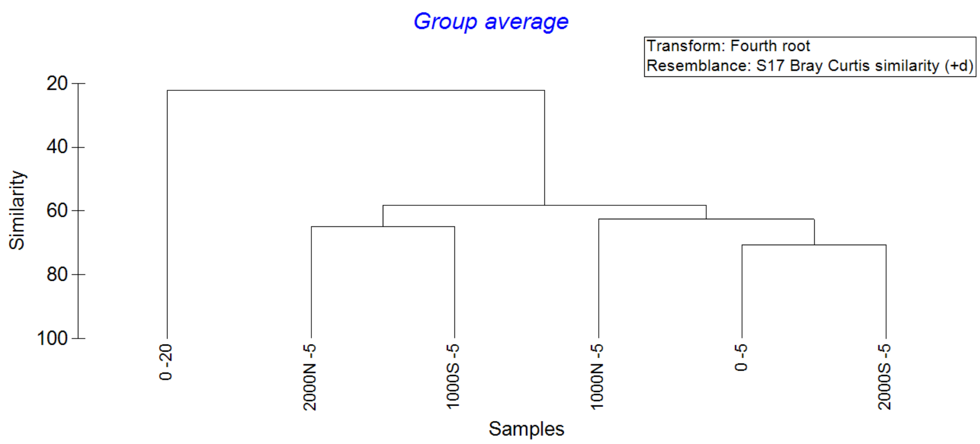
Group 2000N - 5
Average similarity: 36.52

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Dosinia sp.	1.43	24.58	2.74	67.30	67.30
Evechinus chloroticus	0.50	3.05	0.41	8.34	75.64
Terebellidae	0.55	2.70	0.41	7.39	83.03
Sigalionidae	0.50	2.07	0.41	5.66	88.68
Ophiuroidea	0.50	2.07	0.41	5.66	94.34

Group 2000S - 5
Average similarity: 53.00

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Evechinus chloroticus	1.26	19.68	6.44	37.13	37.13
Ophiuroidea	1.00	17.18	5.83	32.42	69.55
Sigalionidae	0.90	8.31	0.89	15.69	85.24
Mactra discors	0.55	2.93	0.41	5.52	90.76

Averaging across sites, we did a cluster analysis:



Appendix C: Statistical Results

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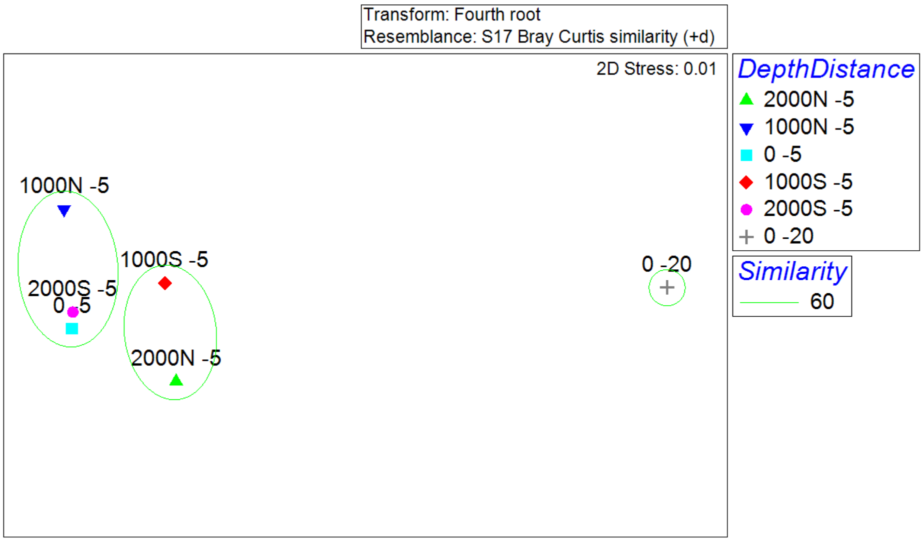
This clustering gave the following grouping on the MDS plot:



Intertidal Data

Tuatua counts: ANOVA (by location along the shore)

Tests of Model Effects

Source	Type III		
	Wald Chi-Square	df	Sig.
(Intercept)	7636.661	1	.000
Location	1031.066	12	.000

Dependent Variable: Ntuatua
Model: (Intercept), Location

We did a Generalized Linear model on Tuatua counts by quadrat. Mean Tuatua count was highly statistically significantly different by Location, Wald $X^2 = 1031.066$, $p < 0.0005$.

We used the sequential Bonferroni test to determine which locations were different. The following table gives the sequential Bonferroni p-values ("adj p-value") for the differences between locations (note "0" means p < 0.00005)

Paired tests
Used sequential Bonferroni adjustment for multiple comparisons

Site 1	Site 2	p value	Adj p value
0	200N	4.80E-004	0.0163
0	400N	3.53E-022	0
0	800N	7.38E-016	0
0	1200N	3.43E-009	0
0	1600N	5.65E-020	0
0	2000N	5.53E-009	0
0	200S	1.28E-001	1
0	400S	3.43E-009	0
0	800S	8.83E-009	0
0	1200S	1.29E-017	0
0	1600S	2.44E-030	0
0	2000S	6.98E-015	0
200N	400N	1.78E-038	0
200N	800N	3.53E-030	0
200N	1200N	1.13E-020	0
200N	1600N	1.22E-035	0
200N	2000N	2.34E-020	0
200N	200S	4.86E-002	0.9240
200N	400S	1.13E-020	0
200N	800S	4.78E-020	0
200N	1200S	1.53E-032	0
200N	1600S	9.86E-016	0

200N	2000S	7.58E-029	0
400N	800N	8.36E-002	1
400N	1200N	8.21E-005	0.0030
400N	1600N	5.64E-001	1
400N	2000N	5.88E-005	0.0022
400N	200S	9.64E-029	0
400N	400S	8.21E-005	0.0030
400N	800S	4.19E-005	0.0016
400N	1200S	2.21E-001	1
400N	1600S	3.39E-092	0
400N	2000S	4.32E-002	0.9072
800N	1200N	2.60E-002	0.6249
800N	1600N	2.48E-001	1
800N	2000N	2.11E-002	0.5276
800N	200S	1.55E-021	0
800N	400S	2.60E-002	0.5989
800N	800S	1.70E-002	0.4428
800N	1200S	6.12E-001	1
800N	1600S	4.62E-080	0
800N	2000S	7.70E-001	1
1200N	1600N	7.51E-004	0.0240
1200N	2000N	9.36E-001	1
1200N	200S	1.33E-013	0
1200N	400S	1.00E+000	1
1200N	800S	8.72E-001	1
1200N	1200S	6.33E-003	0.1773
1200N	1600S	6.98E-065	0
1200N	2000S	5.31E-002	0.9025
1600N	2000N	5.60E-004	0.0185
1600N	200S	2.97E-026	0
1600N	400S	7.51E-004	0.0233
1600N	800S	4.16E-004	0.0146
1600N	1200S	5.17E-001	1
1600N	1600S	3.84E-088	0
1600N	2000S	1.48E-001	1
2000N	200S	2.39E-013	0
2000N	400S	9.36E-001	1
2000N	800S	9.36E-001	1
2000N	1200S	4.95E-003	0.1435
2000N	1600S	2.39E-064	0
2000N	2000S	4.39E-002	0.8786
200S	400S	1.33E-013	0
200S	800S	4.26E-013	0
200S	1200S	1.45E-023	0
200S	1600S	2.15E-023	0
200S	2000S	2.12E-020	0
400S	800S	8.72E-001	1
400S	1200S	6.33E-003	0.1710
400S	1600S	6.98E-065	0
400S	2000S	5.31E-002	0.9556
800S	1200S	3.85E-003	0.1156

800S	1600S	8.08E-064	0
800S	2000S	3.62E-002	0.7962
1200S	1600S	1.32E-083	0
1200S	2000S	4.23E-001	1
1600S	2000S	4.98E-078	0

Tuatua mean size: ANOVA

Tuatua mean size by
Distance and Direction

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	6	3923	653.9	11.178	3.03E-012
Direction	1	6	5.8	0.099	0.753
Distance:Direction	5	532	106.5	1.82	0.106
Residuals	1565	91550	58.5		

Tuatua mean size/ length was highly significantly by Distance ($F(5, 1565) = 11.178$, $p < 0.0005$) from the outfall, but not by direction ($F(1, 1565) = 0.099$, $p = 0.753$). The interaction between distance and direction was not significant.

Pairwise tests were performed using the Tukey adjustment:

Tukey Test

	p adj
200-0	0.5705284
400-0	0.9984
800-0	0.9835756
1200-0	0.0169569
1600-0	0.0048654
2000-0	0.9076898
400-200	0.3387969
800-200	0.1403944
1200-200	0.0000015
1600-200	0
2000-200	0.0466651
800-400	0.9999861
1200-400	0.1586329
1600-400	0.1589114
2000-400	0.998072
1200-800	0.2168872
1600-800	0.2206431
2000-800	0.9999052
1600-1200	0.995376
2000-1200	0.3851515
2000-1600	0.4438624

Anovas on the Trace metals by Distance and Direction:

We did these ANOVAs by Distance and Direction rather than Location, because there was only one observation by Location, and so we couldn't do and ANOVA on that data. However, using Distance and Direction (but not their interaction), we had 2 observations at each Distance and 5 observations for each direction, and so could calculate standard deviations.

Note that no ANOVA was done for Mercury, since all values were the same

Aluminium

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	2.597	0.649	0.509	0.738
Direction	1	5.281	5.281	4.144	0.135
Residuals	3	3.824	1.275		

Arsenic

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	4.744	1.186	1.093	0.49
Direction	1	1.345	1.345	1.24	0.347
Residuals	3	3.255	1.085		

Cadmium

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	0.03219	0.00805	0.095	0.977
Direction	1	0.12751	0.12751	1.512	0.306
Residuals	3	0.25297	0.08432		

Chromium

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	0.07994	0.019985	1.089	0.492
Direction	1	0.00911	0.009112	0.497	0.532
Residuals	3	0.05504	0.018346		

Copper

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	0.03152	0.007881	1.264	0.441
Direction	1	0.0032	0.0032	0.513	0.525
Residuals	3	0.0187	0.006233		

Lead

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	0.01143	0.002858	0.17	0.94
Direction	1	0.0132	0.013203	0.785	0.441
Residuals	3	0.05043	0.016811		

Nickel

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	1.257	0.3142	0.27	0.881
Direction	1	0.69	0.6903	0.594	0.497
Residuals	3	3.487	1.1622		

Zinc

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Distance	4	27.32	6.83	0.608	0.686
Direction	1	8.2	8.201	0.73	0.456
Residuals	3	33.69	11.231		

Therefore, for all the metals there was no significant relationship by Distance nor by direction. Because of small sample sizes, this could be due to lack of power to detect differences.

Wastewater Treatment Plant Monitoring Upgrade and Technology Review Report (2014-2019)

Prepared for Tauranga City Council
Prepared by CH2M Beca Ltd

4 August 2020

Creative people together transforming our world

Sensitivity: General

Revision History

Revision Nº	Prepared By	Description	Date
1	Diego Valenzuela/Kristina Hermens	Draft for client comment	9 August 2019
2	Diego Valenzuela/Kristina Hermens	Updated with initial client comments	23 August 2019
3	Kristina Hermens	Updated with cultural report, section 10 and client comments	4 August 2020

Technical Input

Section	Section Name	Prepared By	Reviewed By
1	Introduction	Kristina Hermens	Garry Macdonald
2	Background	Kristina Hermens	Garry Macdonald
3	Performance Review	Diego Valenzuela / Sharon De Luca / Garrett Hall	Garrett Hall
4	Consent Compliance Assessment	Diego Valenzuela / Sharon De Luca / Garrett Hall	Garrett Hall
5	Technological Advances and Alternatives	John Crawford	Garry Macdonald
6	Progress Towards Zero Waste	Kristina Hermens	Garry Macdonald
7	Progress Towards SmartGrowth Stretch Targets	Kristina Hermens	Garry Macdonald
8	Additional Factors	Sarah Burgess	Garry Macdonald
9	Consultation	Kristina Hermens	Garry Macdonald
10	Implications of Changes in Legislation and Policy	Garrett Hall	Garry Macdonald
11	Conclusions and Recommendations	Kristina Hermens	Garry Macdonald

Document Acceptance

Action	Name	Signed	Date
Prepared by	Diego Valenzuela		4 August 2020
Reviewed by	Kristina Hermens		4 August 2020
Approved by	Garry Macdonald		4 August 2020
on behalf of	CH2M Beca Ltd		

Sensitivity: General

Executive Summary

Introduction

This Monitoring, Upgrade and Technology Review (MUTR) report is required under consent condition 20 of consent 62878 issued by Bay of Plenty Regional Council (BOPRC) for the Tauranga City Council (TCC) wastewater scheme. A MUTR report is prepared by an independent consultant every 5 years which considers TCC's progress towards zero waste; adoption and promotion of SmartGrowth Stretch Targets; technological changes and advances in relation to wastewater management; an assessment of sampling and monitoring and consent compliance; any relevant changes in legislation or policy; and potential technological changes.

CH2M Beca and Boffa Miskell have undertaken an independent review of the performance and level of consent compliance of the Chapel Street and Te Maunga Wastewater Treatment Plants (WWTPs). Boffa Miskell has provided marine ecological advice which has been incorporated into this report.

This revision of the MUTR report incorporates feedback from TCC, the Wastewater Management Review Committee (WMRC) and a cultural report prepared by tangata whenua representatives of the WMRC.

Background

Tauranga is served by two wastewater treatment plants (WWTPs), Chapel St and Te Maunga. Chapel St WWTP receives wastewater from the western side of Tauranga and the townships of Omokoroa and Te Puna. Te Maunga WWTP receives wastewater from the southern and eastern suburbs of Tauranga and the coastal strip from Mount Maunganui to Papamoa. Secondary treated effluent from Chapel Street is pumped to Te Maunga WWTP for tertiary treatment and the final treated effluent from both WWTPs is discharged via an ocean outfall at Omanu. Several upgrade works have occurred at both WWTPs in the last 5 years. There has been one update to the main wastewater discharge consent 62878. The remainder of consents have remained unchanged since the previous MUTR in 2014.

Performance Review

The overall performance of the wastewater scheme, as measured by the treated wastewater quality at the point of compliance and with respect to the various environmental monitoring requirements of this resource consent, has been consistently good.

Flow records show that the average and maximum daily discharges have increased every year from 2015 to 2018, which is expected due to population growth, but have remained well within the consented limits.

Monitoring results at the outfall pump station show that the plants and wetlands system consistently produce a high quality treated wastewater. The levels of BOD_5 and TSS are within the range of values expected for secondary treated wastewater. There have been no breaches in consent 62878 during the current review period. Microbiological quality during 2016 was of a lesser quality than the other years but was still within consent limits. No other significant changes in the treated wastewater quality during the review period are noticeable.

There are no consent limits for nutrient concentrations, and the plants are not specifically designed to remove nutrients. The year 2016 showed the highest concentrations of ammonia and TKN, which coincides with the lesser quality of the treated wastewater in terms of BOD_5 and bacteria. Nitrate-N increased slightly after 2016 and it has remained relatively stable ever since. Total phosphorus, dissolved reactive phosphorus, pH and conductivity have not shown significant variations throughout the review period.

Consent RC 62881 requires annual monitoring of seepages from the Te Maunga oxidation ponds and annual surveys of titiko within the inter-tidal zone adjacent to the ponds. In 2016, in response to planned desludging work, the seepage and titiko monitoring programme was increased from annual to quarterly. This revised plan exceeds the compliance monitoring obligations specified in the existing consent.

Samples of the seepages are taken and analysed for faecal coliforms, ammonia, nitrate and dissolved reactive phosphorus. Results of the monitoring have shown that the seepages are not anticipated to have any significant adverse effect on estuarine water quality.

Monitoring of odour comprises biennial community surveys, annual odour monitoring and monthly walkover inspections by Operations staff of Chapel St and Te Maunga. In 2015, a higher than usual number of odour complaints were received at Chapel St. Following this, the potential cause of these complaints was investigated and determined to be from decaying sea lettuce rather than treatment plant operation.

Consent Compliance Assessment

Overall, consent compliance has been high. The UV plant was installed and commissioned in late 2015. However, on occasion, the UV plant has been shut down due to operational issues. Notwithstanding these instances, the treated wastewater discharges have all been compliant with consent conditions on bacteria due to the detention in the storage ponds and wetlands and exposure to solar radiation.

Marine receiving environment water quality was generally high (with a single 2015 sample event exceeding the consent limits at two sites). Additionally, non-compliant shellfish (tuatua) E. coli exceedances were recorded in 2015 during one sampling event. The 2015 exceedances were one-off events and thought to be related to either sample contamination or related to rainfall that occurred on the day of and two days prior to sampling. Subsequent repeated sampling events showed no exceedances of the consent limits. BOPRC was advised of these exceedances but is it recommended that Toi Te Ora is also notified for completeness in reporting.

In addition, mussels collected from the outfall and tuatua collected from the adjacent intertidal beach had low body burden concentrations of contaminants.

Review of titiko monitoring data (adjacent to ponds 1 and 2 and wetland C (and at a control site)) resulted in a re-analysis of data and consideration of the efficacy of the monitoring programme against monitoring objectives. Re-analysis of the 2017-2019 abundance data revealed statistically significantly higher abundance of titiko at control sites compared to impact sites. However, abundance was highly variable across the impact sites, with higher abundance of titiko at both the western and eastern ends of the ponds where there is freshwater input and sparse mangrove cover. Analysis also indicated that titiko abundance adjacent to seepage sites W6 and W6a was not different to abundance at neighbouring sites along the face of the ponds where there are no seepages. In addition, abundance was highly variable across the years. Due to this high spatial and temporal variability in titiko abundance and differences in habitat characteristics, we do not consider the statistically higher abundance at the control sites is due to pond seepages. The most likely explanation for differences in abundance detected both within the impact transects and between impact and control transects is differences in habitat characteristics. Ongoing monitoring of abundance of titiko, relative to seepages, is unlikely to provide meaningful data to inform whether there is a causal relationship. We recommend that size/abundance titiko monitoring is refocussed on titiko health rather than titiko abundance (e.g. monitoring of body burden of contaminants and indicator bacteria).

Pond 1 stopped receiving sludge in April 2019 after the commissioning of a new biosolids thickening and dewatering facility. Future use of this pond is yet to be agreed with the Wastewater Management Review Committee and Bay of Plenty Regional Council. Sludge currently in this pond (from before April 2019) is stabilising and it is recommended to remain for a minimum of 12 months before removal and disposal.

Technological Advances and Alternatives

The previous MUTR report provided an updated and comprehensive review of wastewater treatment in New Zealand, treatment technologies, sludge treatment and progress towards zero waste. To avoid repetition, this section of the report was updated with recent advances and processes that are of particular relevance and current interest to TCC. Technological developments that are being considered at the WWTPs are summarised below.

- Optimising utilisation of existing treatment assets and unit processes in an integrated, regional manner:
  - Tauranga is unusual in having two relatively modern treatment plants and a wastewater system that allows rebalancing of the flows and loads between them through the completed Southern Pipeline.
  - TCC is already accepting wastewater from outside its boundary (Omokoroa and Te Puna) just as many other wastewater utilities are doing in New Zealand and around the world to achieve “economies of scale” and a pan-regional approach to wastewater management.

- Resource recovery from wastewater systems and treatment plants – not seeing wastewater as “waste” but a source of water (to reuse), bioenergy, heat and nutrients:
  - Chapel Street WWTP recovers biogas from the combined primary and waste activated sludge and TCC has investigated adding recuperative thickening process to maximise biogas production and power generation, while producing a drier sludge end-product.
  - Greater energy (heat and power) can be produced from digesters if they are also directly fed high-strength organic wastes (such as fats, oils and greases or FOG) in a process termed “co-digestion”;
  - Both treatment plants provide a high-quality effluent stream which complies with consent discharge standards, however for any of the effluent to be suitable for “reuse” additional treatment processes would need to be added.
  - Tauranga has an extensive network of gravity and trunk sewers, some of the latter being large diameter and high flow pipes from which low-grade heat energy could be captured and used for heating pools or heating/cooling adjacent buildings – this technology is being increasingly seen as replacing fossil fuels for heating and cooling as the low-grade heat source is available 24/7 year round. To date, uptake has mainly been in cold climate regions.

- Sludge/solids processing at both plants is intended to reduce the net cost of stabilisation and disposal, with the ultimate goal of beneficial reuse for the organic and nutrients in the biosolids:
  - The beneficial reuse of biosolids in NZ is very low in comparison with countries such as USA and Australia. The guidelines for this enduse are currently being revised and may change the outcomes.
  - As with many other water utilities, TCC disposes all of its dewatered biosolids to landfill, although the long-term plan includes for further processing of biosolids through a new solar drying facility at Te Maunga WWTP that would produce a usable dry fertiliser product. A review of the biosolids strategy should be conducted prior to any decision being made.

Progress Towards Zero Waste

Since the last review, TCC has updated its Waste Management and Minimisation Plan and Wastewater Overflow and Mitigation Response Plan. TCC has also joined the Regional Wastewater Management Group which is drafting a Regional Best Practice Guide for Managing Wastewater Overflows. TCC has continued to develop its various programmes to reduce wastewater blockages and stormwater and groundwater from entering the wastewater network. In 2018, TCC launched a media campaign called Save our Pipes from Wipes which gained a lot of attention from the local community and nationwide.

In 2017, TCC also updated its 30 Year Wastewater Management Plan which identifies capital projects required to meet levels of service and growth requirements. This is due to be updated in 2020.

Progress Towards SmartGrowth Stretch Targets

Since 2014, the SmartGrowth Strategy was updated in the form of the Proposed SmartGrowth Future Development Strategy. Submissions on the proposed strategy closed in late 2018 and it is currently on hold while the Urban Form and Transport Initiative (UFTI) is completed. UFTI is a joint initiative between SmartGrowth and the NZ Transport Agency designed to provide a coordinated and aligned approach across the sub-region on key issues, such as housing, transport and urban development. A draft report is due in August 2019 and a final report in December 2019.

The 2004 SmartGrowth Strategy had six stretch targets. TCC has implemented the actions required under these targets.

Additional Factors

There is a global trend focusing on recovery of resources from wastewater systems. This includes initiatives such as: extracting heat energy from sewer systems; nutrients such as nitrogen and phosphorus; increasing biogas yield from digesting biosolids; hydrogen from treated effluent and, of course, water. As well as these new areas of research and application, water utilities are continuing their sustainability efforts by making treatment facilities more energy efficient, safer to operate and more cost-effective.

TCC carried out an energy and carbon efficiency study on the wastewater system in 2018/2019 which identified options for recuperative thickening at Chapel St WWTP and for primary solids filtration at Te Maunga WWTP. As part of the project scope TCC also looked at potential efficiency improvements for the Chapel Street secondary treatment system, due to the age of the current aeration system. The scope of this investigation included the process configuration, diffuser replacement options, and blower replacement options.

New Zealand’s water and wastewater systems have always been vulnerable to natural hazards such as earthquakes, severe meteorological events and flooding in wet weather events. Climate change risks are now being added to this list of natural hazards when assessing the resilience of wastewater systems, which must be considered as a whole system when determining the operability of the system following any particularly severe event, or over a longer period of time.

The two Tauranga WWTPs are potentially vulnerable to these risks due to their proximity to the harbour and ocean, and their low-lying ground levels. TCC has undertaken a “Resiliency Study” in order to determine the “Importance Level” for new and existing structures and buildings. The impacts on the plant and the wastewater conveyance system from a range of different natural hazards and long-term climate change-induced scenarios were assessed, so that the appropriate design standards could be set for each plant component. This should be supplemented with a similar assessment for the Chapel Street plant, even though very few new works are planned for this facility.

As part of a recent emissions study, TCC identified improvements which could be made in three areas:

- Reduce the mass of wet sludge transported by bringing forward installation/sludge treatment capacity of a solar (or equivalent) sludge dryer, which would reduce considerably the weight of water transported to landfill and paid for as a waste accepted in by the landfill
- Reduce distance travelled for sludge disposal
- Use alternative transportation fuel (biogas or electric vehicles instead of diesel)

Consultation

Tāngata whenua representatives (Ngā tāngata whenua o Te Tahuna o Rangataua) commissioned a cultural review of the wastewater scheme (Cultural Review for the Te Maunga Wastewater Treatment Plant Resource Consent, Conroy and Donald Consultants Limited, July 2020). This report made recommendations with regard to:

- Acknowledgement to Iwi Planning Documents, Treaty Settlements, Tauranga Harbour Advisory Group and the new Wāhi Tapu Status for Te Tahuna o Rangataua in the MUTR report (completed)
- Operation of the WMRC
- Pond 1 decommissioning
- Operation of the WWTP
- Environmental Mitigation and Enhancement Fund
- Cultural Monitoring
- Considering innovative approaches to restoring mauri to Te Tahuna a Rangataua and/or ocean outfall site
- Review and development of the Wastewater Management Plan
- Review of treatment technologies, including an assessment in relation to cultural values and customary resources, including high rate algal ponds
- Awareness of the implications of coastal statutory acknowledgements, iwi planning documents and the waahi tapu status of Te Tahuna o Rangataua on resource consent processes (both renewals and variations)
- BOPRC to consider representation of Ngā Pōtiki ā Tamapahore Trust on the Tauranga Harbour Advisory Group given the significance of Te Tāhuna o Rangataua to Ngā Pōtiki

Implications of Changes in Legislation and Policy

The Climate Change Response (Zero Carbon) Amendment Act was enacted in November 2019. The Act will impact local authorities in terms of their climate change mitigation and adaptation obligations. The Three Waters Review is also progressing with changes flagged in water, wastewater and stormwater regulation. We recommend TCC maintain a close watching brief on these developments and implications on the future wastewater scheme.

Since 2015 a number of changes have become operative to the Regional Policy Statement. None of these plan changes have direct implications for the wastewater scheme.

In 2018, the BOPRC adopted the Proposed Regional Coastal Environment Plan and agreed for it to be referred to the Minister of Conservation for her approval. Schedule 10 (Water Quality Classifications) is the most relevant to the MUTR as this relates to 'standards relevant to receiving environments affected by the wastewater scheme'. The standards apply after reasonable mixing of any contaminant or water with the receiving water and disregarding the effect of any natural perturbations that may affect the water body.

Whilst the standards would need to be considered fully in any new consent application for the discharge of treated wastewater to the coastal marine area, an assessment is provided in this report. Based on monitoring undertaken as part of consent requirements, no observations have been made to suggest these standards are not currently being complied with. Further assessment will be required leading up to the expiry of the existing discharge consent and further detailed assessments against these standards should form part of future MUTR reports.

Conclusion and Recommendations

The following provides comments on the adequacy and scope of monitoring and sampling as required by condition 20d of consent 62878.

Titiko monitoring – condition 6.4 consent 62881 - The current titiko monitoring programme is providing limited benefit due to the naturally high variability in abundance, distribution being affected by natural environmental variables and no relationship being detected between size/abundance and seepage location. The titiko monitoring programme could be refocussed to other aspects of titiko health, such as body burden of contaminants and indicator bacteria at a range of sites where titiko are present (and potentially harvested) within Rangataua Bay.

Establishing a carbon baseline - Diffuse and point emission sources of CO_2 and CH_4 at the two treatment plants could be identified and annually measured and reported as CO_2e emissions on an annualised basis to establish a carbon footprint for the wastewater scheme.

Emerging contaminants - Sampling of the treated wastewater for a typical suite of emerging contaminants (e.g. contaminants from personal care products etc.) could be undertaken on an annual basis to provide a trend of these contaminants to inform the future MTUR reports and consents. These contaminants are routinely tested for as requirements of new consents. This information would be useful to inform future consent processes where in other projects tāngata whenua and other stakeholders routinely enquire with regards to the effects of these contaminants.

Overflow volume and discharge rates - TCC currently estimates overflow volume and discharge rates when these events occur. It is recommended that TCC investigates ways to improve the accuracy of these records.

Toi Te Ora - TCC notifies BOPRC of any non-compliances in marine bacterial and shellfish monitoring. It is recommended this is extended to Toi Te Ora Pubic Health as required in conditions 11.3 and 12.2 of consent 62878.

The following provides our overall conclusions and recommendations in accordance with condition 20 of consent 62878.

Progress towards TCC's objective of "towards zero waste" - Since the last review TCC has progressed its objective of "towards zero waste" by updating plans associated with waste minimisation and responding to and mitigating wastewater overflows. TCC has also participated in drafting a regional best practice guide for managing wastewater overflows. TCC has continued to develop its various programmes to reduce wastewater blockages and stormwater and groundwater from entering the wastewater network. It is recommended that TCC continues with its development of current programmes and reviews them regularly to achieve and maintain best industry practice.

Progress in adoption or promotion of SmartGrowth Stretch Targets - The 2004 SmartGrowth Strategy had six stretch targets. TCC has implemented the actions required under these targets. It is recommended that TCC continues to participate in the implementation of SmartGrowth initiatives and sets further targets to improve its wastewater management as set out in a. above.

Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems - TCC recovers biogas from processes at Chapel St WWTP and is investigating further options for improving energy efficiency. TCC has also conducted an energy and carbon efficiency review of both WWTPs. Options investigated over the past five years to improve processes have been summarised in this report. There has been a focus on improving processing of biosolids. TCC is also looking options for end use of biosolids. It is recommended that TCC continues to review options to increase capacity due to growth and to improve treatment processes in line with technological changes and advances.

The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling - the overall performance of the wastewater scheme, as measured by the treated wastewater quality at the point of compliance and with respect to the various environmental monitoring requirements of this resource consent, has been consistently good.

Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions - overall, consent compliance has been high. The UV plant was installed and commissioned in late 2015. However, the plant has been shut down due to operational issues on occasion, notwithstanding the treated wastewater discharges have all been compliant with consent conditions. Pond 1 stopped receiving sludge in April 2019 after the commissioning of a new thickening and dewatering facility. Future use of this pond is yet to be agreed with the Wastewater Management Review Committee and Bay of Plenty Regional Council.

The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme - Upcoming legislation on climate change and how wastewater is managed in New Zealand will affect the TCC wastewater scheme. The Regional Coastal Environment Plan sets water quality classification standards relevant to new consent applications. Based on monitoring information provided by TCC, no observations have been made to suggest these standards are not currently being complied with. It is recommended that TCC maintains a close watching brief on these developments and implications on the future wastewater scheme.

The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue - The costs of any potential technological changes have been assessed in the various options studies out to increase capacity due to growth and to improve treatment processes. This is summarised in TCC's 30 Year Wastewater Management Plan which describes wastewater treatment needs to meet levels of service and growth requirements. Capital works projects from this Plan are input to the Long Term Plan and Infrastructure Strategy. The Plan was last updated in 2017 and is due for review in 2020. It is recommended that TCC continues to carry out multi-criteria analysis (which consider the social, cultural, environmental and economic effects) in determining the best practicable option for delivering its wastewater services.

Consultation - it was recommended that TCC and the WMRC review and agree actions from the recommendations made in the Cultural Review report. Progress on these actions should be reported regularly to the WMRC.

Climate Change Response (Zero Carbon) Amendment Act 2019 – it was recommended that TCC maintains a watching brief on implications from this legislation.

Three Waters Review - It was recommended that TCC take a proactive role in the Three Waters Review and monitoring its implications for the Tauranga wastewater scheme.

Sensitivity: General

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List of Abbreviations

Abbreviation	Definition
ADF	Average Daily Flow
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
As	Arsenic
BOD_5	Biochemical Oxygen Demand over 5 Days
BOPRC	Bay of Plenty Regional Council
CCTV	Closed-Circuit Television
Cd	Cadmium
cfu	Colony Forming Units
CH_4	Methane
COD	Chemical Oxygen Demand
Cr	Chromium
Cu	Copper
DO	Dissolved Oxygen
DRP	Dissolved Reactive Phosphorus
Ent	Enterococci
F/M ratio	Food to Microorganism Ratio - Degree of Starvation of The Microorganisms
FTW	Floating Treatment Wetland
Hg	Mercury
HST Blower	High Speed Turbo Blower
I/I	inflow and infiltration
KPI	Key Performance Indicators
LTP	Long Term Plan
MfE	Ministry for Environment
MPN/100ml	Most Probable Number per 100 millilitres
$N0_3$-N	Nitrogen Nitrate, Nitrate Nitrogen
NES	The National Environmental Standards for Air Quality
NH_4-N	Ammonium-N, Total Ammoniacal Nitrogen
Ni	Nickel
NIWA	National Institute of Water and Atmospheric Research
NPS-FM	National Policy Statement for Freshwater Management 2014
OM_{feed}	Organic Matter
Pb	Lead
PS	Pump Station
RAS	Return Activated Sludge
RC	Resource Consent
RMA	Resource Management Act
SCADA	Supervisory Control And Data Acquisition
SS	Suspended Solids
SVI	Sludge Volume Index
TCC	Tauranga City Council
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids

Abbreviation	Definition
UV	Ultra Violet
VS	Volatile Solids
WAS	Waste Activated Sludge
WMMP	Waste Management and Minimisation Plan
WRRF	Wastewater Resource Recovery Facilities
WRRP	Wastewater Resource Recovery Plants
WWTP	Wastewater Treatment Plant
Zn	Zinc

1 Introduction

Tauranga City Council (TCC) has commissioned CH2M Beca to undertake an independent review of the performance and level of consent compliance of the Chapel Street and Te Maunga Wastewater Treatment Plants (WWTPs). Boffa Miskell has been engaged by TCC to assess marine ecological aspects. This assessment has been incorporated into this report.

1.1 Purpose

The purpose of this Monitoring, Upgrade and Technology Review (MUTR) report is to review the TCC's performance and compliance with its wastewater consents from 2015 to 2019. This MUTR report is required under consent condition 20 of consent 62878 issued by Bay of Plenty Regional Council (BOPRC). This consent condition requires that a MUTR report is prepared every 5 years which considers the following:

a) Progress towards TCC's objective of "towards zero waste"

b) Progress in adoption or promotion of SmartGrowth Stretch Targets

c) Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems

d) The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling.

e) Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions.

f) The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme

g) The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue

The consent also states that the:

- Wastewater Management Review Committee (WMRC) should make recommendations to TCC in relation to the independent consultant to be appointed to undertake the MUTR report.
- MUTR be prepared in consultation with the WMRC, BOPRC and any key stakeholders or iwi groups identified by the WMRC
- Tangata whenua may prepare a paper for submission to the independent consultant on the outcomes of any cultural monitoring or any other issue relevant to the operation of the permits

CH2M Beca and Boffa Miskell presented a proposal to the WMRC on 29 May 2019. The WMRC accepted this proposal, which included the following proposed timeline for consultation with key stakeholders and preparation of the cultural paper (by members of the WMRC):

- August 2019 – draft MUTR report presented to WMRC during workshop 1
- September to December 2019 – cultural paper prepared by tangata whenua; update MUTR with any feedback from workshop 1
- February 2020 – cultural paper presentation at workshop 2. Update MUTR to include cultural paper and with any feedback from workshop 2
- March 2020 – submit final MUTR report to committee for approval prior to sending to BOPRC

Sensitivity: General

1.2 Additional factors

Since the wastewater consents were granted by BOPRC to TCC in 2006, there has been an increased focus in New Zealand on the following factors which influence the successful performance of key infrastructure:

- Sustainability and resource recovery
- Resilience to natural hazards and climate change
- Environmental emissions and natural water quality

This report also reviews TCC’s progress in considering these factors in the planning and operation of its wastewater treatment plants. This would provide a higher level of scrutiny against national infrastructure planning guidelines and greater assurance to the WMRC and BOPRC that TCC is acting and planning in accordance with these factors and trends.

1.3 Previous reports

Previous MUTR reports prepared under condition 20 of consent 62878 and submitted to BOPRC are.

- Tauranga City Council Wastewater Treatment Plant Monitoring Upgrade and Technology Review Report (2011-2014), CH2M Beca, March 2016
- Wastewater Monitoring, Upgrade and Technology Review. Tauranga City, Andrew.Stewart. February 2011

Figure 1 provides an overview of the existing wastewater network.

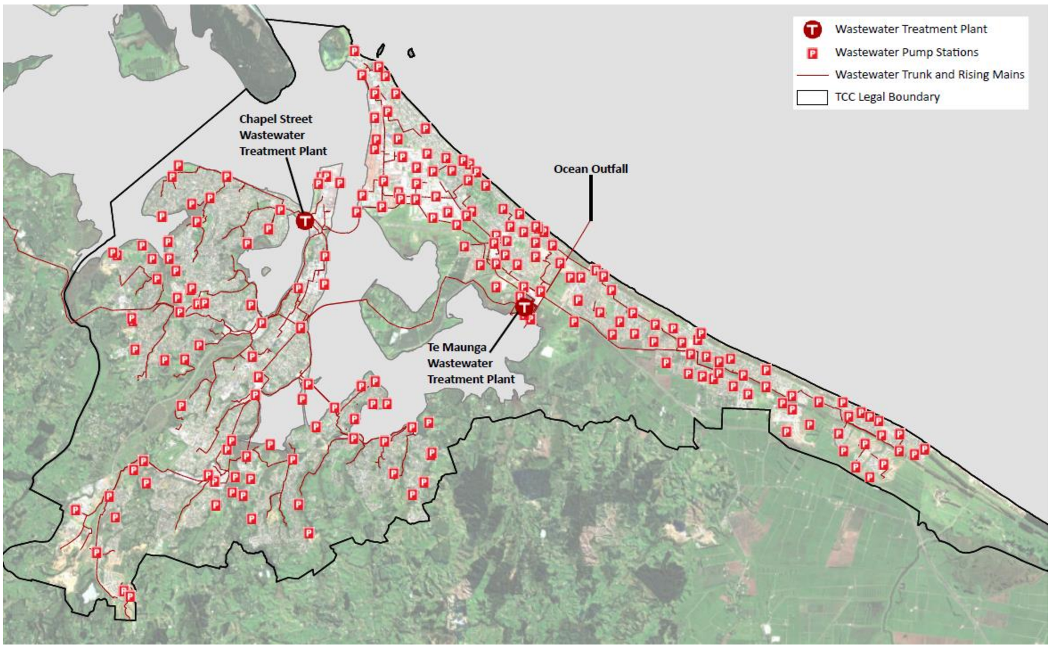

Figure 1: Overview of Tauranga's wastewater network

Sensitivity: General

1.4 Outline of Report

The figure shown below outlines the sections contained within this report and gives an overview of their content.

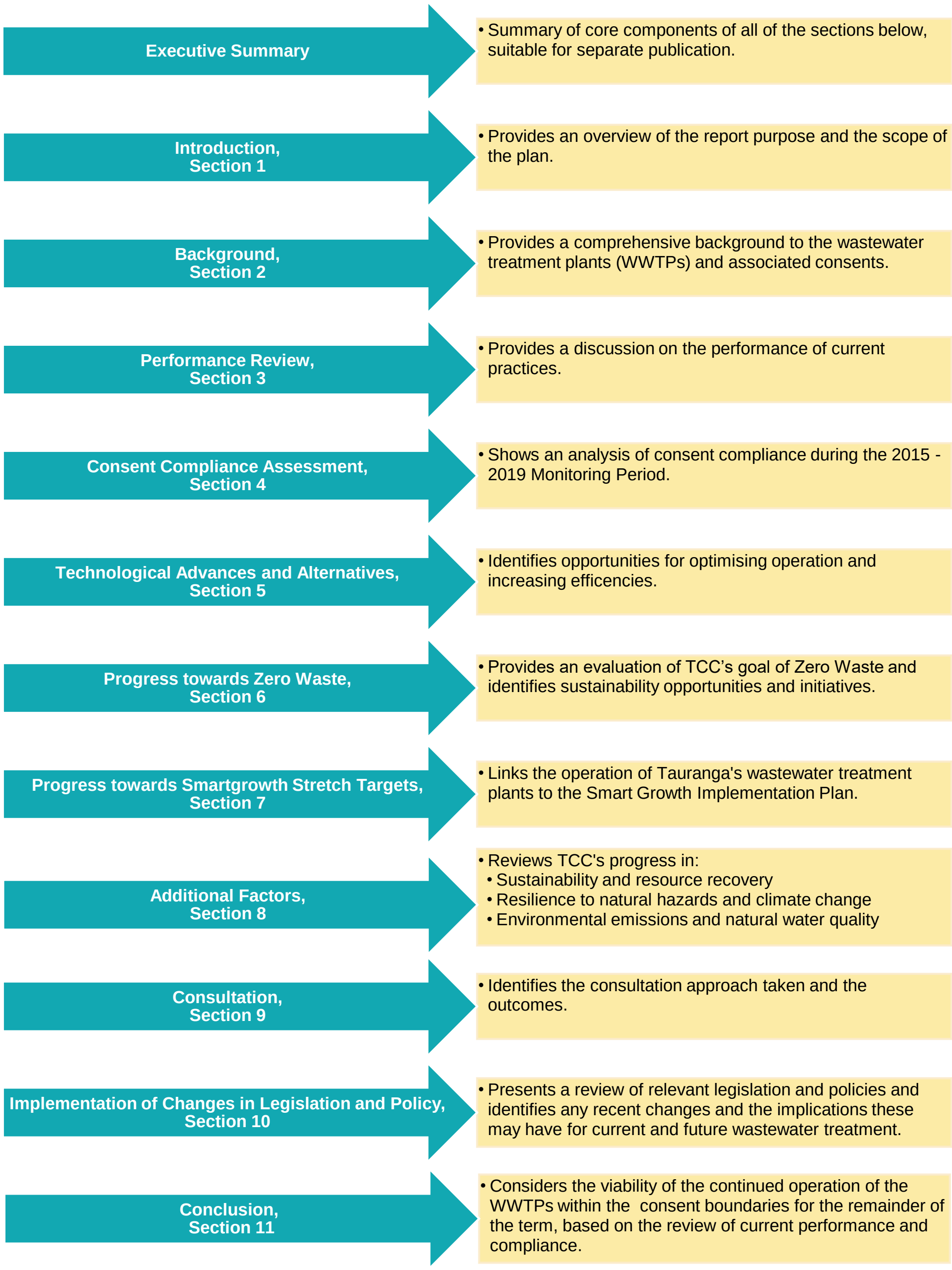

Figure 2: Report Outline Graph

2 Background

The Tauranga City wastewater network was constructed from the mid-sixties and has gradually evolved with the development of the city. Figure 1 in Section 1.4 shows the most significant components of Tauranga's wastewater system, including pipes of diameter 225mm and above, rising mains, wastewater pump stations, the two wastewater treatment plants (WWTPs) and the ocean outfall.

Figure 3 below shows the main components of TCC's wastewater network.

Tauranga Trunk Wastewater Network (August 2019)

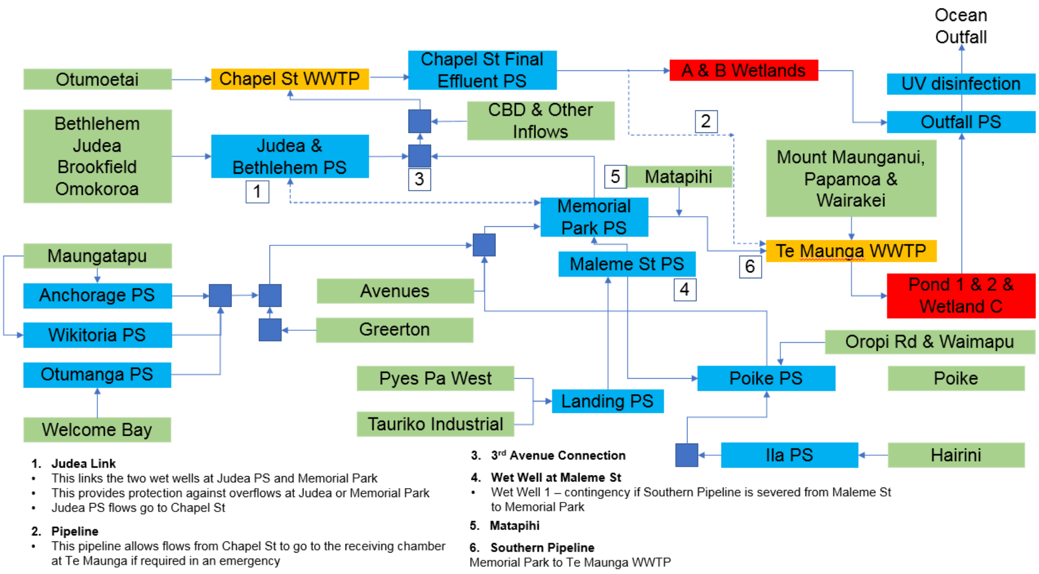

Figure 3: Schematic Diagram of Tauranga's Wastewater Network (August 2019)

Chapel Street and Te Maunga WWTPs are separated by the Tauranga Harbour. Wastewater flows from the western areas of Tauranga City, Omokoroa and Te Puna are treated at the Chapel Street WWTP. The balance of the city's wastewater is treated at the Te Maunga WWTP.

Treated wastewater from the Chapel Street WWTP is pumped to Te Maunga where it passes through two wetlands (Wetland A + Wetland B). Treated wastewater from the Te Maunga WWTP also passes through a series of storage ponds and wetlands (Pond1 + Pond 2 + Wetland C) as shown in Figure 3 above. Finally, it is tertiary treated via ultra violet (UV) disinfection after the outfall pump station which pumps treated flows to the Pacific Ocean through a 950m long marine outfall off Papamoa Beach.

In late 2018, the Southern Pipeline was commissioned. This wastewater interceptor is installed from the southern growth areas of Tauranga (The Lakes and Pyes Pa) to Te Maunga WWTP. A new pump station at Memorial Park allows flows to be diverted between Chapel St and Te Maunga WWTPs providing for greater operational flexibility in the wastewater network.

In 2019, approximately 50 residential properties, two marae and a kura and kohanga reo in Matapihi were connected to TCC's wastewater network.

The transfer pipeline that takes the treated wastewater from the Chapel Street WWTP to the Te Maunga wetlands in a pipeline in the original harbour bridge crosses an area used for heavy industry and petroleum storage. High flow fire hydrants have been installed on the transfer main to help meet local firefighting requirements. The system also allows for the utilisation of treated wastewater for irrigation at eight locations. However, no irrigation has taken place since 2010.

TCC's wastewater collection, treatment and disposal systems serve all properties in commercial/industrial zones and almost 100% of all properties in residential zones. The percentage of dwellings within Tauranga City not serviced by TCC's wastewater system is estimated to be around 3%, being rural and rural/residential.

2.1 Chapel Street WWTP

Chapel Street WWTP (Figure 4) consists of pre-treatment, primary clarification, flow balancing, secondary treatment utilising contact stabilisation and clarification and sludge digestion followed by ultraviolet treatment.

Figure 4: Aerial Photo of Chapel Street WWTP

The average dry weather capacity of Chapel Street WWTP is 16,300m^3/day which corresponds to a load capacity of 4,900kg/d for biochemical oxygen demand (BOD) and 6,100 kg/d for total suspended solids (TSS) and further capacity upgrades are planned at this site for enhanced sludge digestion.

2.2 Te Maunga WWTP

The Te Maunga WWTP (Figure 5) consists of pre-treatment and secondary treatment comprising extended aeration, secondary clarification and sludge thickening and dewatering. The dewatered biosolids are transported to a consented landfill in the Waikato. The final effluent then gravitates to two flow balancing ponds from where it flows through Wetland C before being pumped through the UV plant and out to sea via the ocean outfall.

Figure 5: Aerial Photo of Te Maunga WWTP

2.2.1 Te Maunga Wetlands, Ponds and UV Disinfection

A series of storage ponds and wetlands balance effluent flows to final disinfection through a UV disinfection system process prior to discharge into the ocean. The main function of the wetlands is to reduce nutrient levels and biological oxygen demand of the treated wastewater prior to its discharge and to manage flows before the outfall (provide storage and preventing overflows).

Sensitivity: General

Figure 6: Aerial Photo of Wetlands and Ponds at Te Maunga

2.3 Ocean Outfall

The ocean outfall consists of an ocean outfall pump station and a 600mm diameter post tensioned concrete pipeline extending approximately 950 metres offshore from Papamoa Beach.

Downstream of the outfall pump station the UV disinfection facility treats the combined treated effluent discharge.

Figure 7: Aerial view of Te Maunga WWTP

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2.4 Upgrade Works since 2015

The following upgrade works have been completed at Chapel St and Te Maunga WWTPs since the last MUTR report in 2015.

2.4.1 Chapel St WWTP

Various minor works have been carried out in the last five years at Chapel St WWTP, mainly to improve odour control and increase process efficiencies.

2.4.2 Te Maunga WWTP

The following construction works have been completed or are underway to improve operation or increase capacity at Te Maunga WWTP:

- Aeration upgrade – upgrade to maximise aeration capacity of the existing bioreactor
- Receiving chamber – construction of a new raw sewage chamber due to increased capacity
- Emergency generator – installation of a larger standby power generator
- Pond 1 – sludge has been removed twice from this pond, dewatered and placed in cells on the old landfill in Tip Lane
- Thickening & dewatering plant– construction of a new sludge thickening and dewatering plant to allow pond 1 to be decommissioned as a sludge pond (no longer receives sludge from the treatment plant)
- Final Effluent Line and Ponds bypass design – construction (underway in 2019) to replace the bypass pipeline to improve seismic resilience; accommodate increased future flows and align with proposed works
- Grit upgrade – construction (underway in 2019) of a new system to improve the removal of grit from incoming wastewater

2.5 Future Flows

Table 1 below shows the predicted average daily flows to Chapel St and Te Maunga WWTPs to 2053. With the commissioning of the Southern Pipeline in 2018, additional wastewater flows are able to be diverted from away from Chapel St WWTP to Te Maunga WWTP. Flows and loads to Chapel St WWTP will be capped and additional flows due to city growth will be accommodated at Te Maunga WWTP.

Table 1: Future WWTP average daily flows predicted to 2053 (Te Maunga WWTP Design Flows to 2103, CH2M Beca, 2019)

Year	Te Maunga WWTP (m^3/d)	Chapel Street WWTP (m^3/d)
2018	13,472	16,300
2023	17,366	16,300
2033	22,205	16,300
2043	26,698	16,300
2053	28,858	16,300

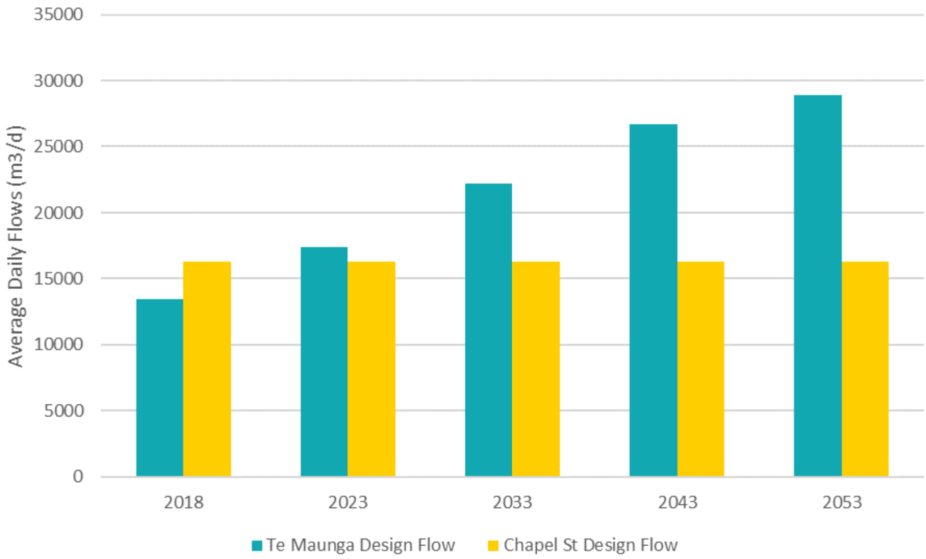

Figure 8: Te Maunga and Chapel St WWTP design flow projections to 2053

2.6 Resource Consents

Most resource consents governing the activities of the Chapel St and Te Maunga WWTPs and their discharges were granted by the BOPRC in 2005/06 and have a duration of 35 years.

At the time these wastewater consents allowed for the following changes to the system:

- An increase in the average daily discharge of treated wastewater via the ocean outfall from 23,000m^3/day to 50,000m^3/day
- Further development of the Chapel Street WWTP and the Te Maunga WWTP
- Implementation of further odour management measures at the Chapel Street WWTP
- UV disinfection at the Te Maunga WWTP
- Conversion of the Te Maunga oxidation pond to a wetland
- Introduction of a new process for managing sludge at the Te Maunga site
- Decommissioning of the Te Maunga sludge pond
- Improvements to the storage capacity at the Te Maunga site to prevent overflows of treated wastewater into the Tauranga Harbour.
- Upgrading the ocean outfall pipeline by relaying a new pipe in the landward section from the Te Maunga site to Maranui Street, and retrofitting (relining) the beach and marine sections from Maranui Street out into the ocean
- Increasing the number of sites for the irrigation of reclaimed water.

On 27 May 2009 an additional discharge permit (RC 65623) was approved by BOPRC for the discharge of stabilised sludge from the Chapel Street WWTP and anaerobically digested sludge from Te Maunga WWTP (Pond 1). A general consent allowing TCC to continue to occupy space in the coastal marine area was granted in September 2009. This consent allows for existing infrastructure to occupy the area and to be maintained.

Sensitivity: General

A further discharge consent (RC 66510) was approved by BOPRC on 8 December 2010 (replacing RC 65623), which covered the discharge of anaerobically digested sludge from Te Maunga plant (Pond 1 and Pond 2) and expired on 1 December 2011. A further consent (RC 67894) was granted on 9 July 2014 covering the discharge of contaminants (dewatered sludge) to land to allow dewatered sludge to be disposed to the old landfill at Te Maunga.

There have also been various consents granted over the last five years specifically for the duration of construction works at Te Maunga WWTP.

Figure 9 below provides an overview of the existing resource consents for activities associated with the operation of the WWTPs.

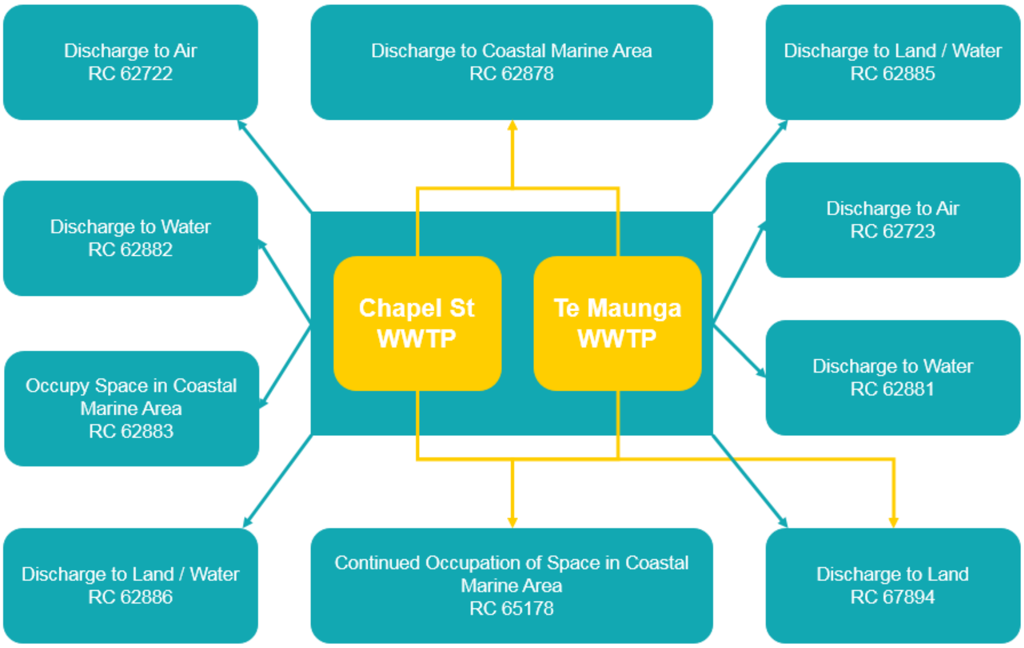

Figure 9: Overview of TCC Wastewater Resource Consents

The wastewater resource consents granted are presented in Table 2 below, with copies provided in Appendix A.

Sensitivity: General

Table 2: TCC Wastewater Resource Consents

Consent No.	Date Granted	Facility	Consent Purpose	Expiry Date
62722	17 October 2005	Chapel St WWTP	To Discharge Odorous gases from Chapel Street Wastewater Treatment Plant to the Air.	30 April 2040
62723	17 October 2005	Te Maunga WWTP	To Discharge Odorous Gases from Te Maunga Wastewater Treatment Plant to the Air.	30 April 2040
62878	Granted: 9 September 2005 Updated: 21 February 2013, 14 November 2017	Chapel St WWTP & Te Maunga WWTP	To Discharge Treated Wastewater from Chapel Street WWTP and Te Maunga WWTP to the Coastal Marine Area (Ocean).	30 April 2040
62881	17 October 2005	Te Maunga WWTP	To Discharge Contaminants to Land where it may Enter Water (Oxidation Ponds into Rangataua Bay).	30 April 2040
62882	7 November 2005	Chapel St WWTP	To Discharge Treated Wastewater into Coastal Marine Area (Chapel Street Extreme Wet Weather Overflow).	30 April 2040
62883	17 October 2005	Chapel St WWTP	To Occupy Space in the Coastal Marine Area and to Use a Harbour Overflow Structure in, on, under, or over the Foreshore of Tauranga Harbour (Chapel Street harbour overflow structure).	30 April 2040
62884			*To Abandon the Existing Harbour Outfall (Otumoetai Channel)*	*30 April 2010 (expired)*
62885	17 October 2005	Te Maunga WWTP	To Discharge Secondary Treated Wastewater to Land then to Water (Te Maunga Wetland Extreme Wet Weather Overflow).	30 April 2040
62886	9 September 2005	Chapel St WWTP	To Discharge Reclaimed Water from the Chapel Street Wastewater Treatment Plant on to Land at Various Sites in Tauranga City.	30 April 2040
65178	1 September 2009 Updated 2011	Chapel St WWTP & Te Maunga WWTP	Continued occupation of space in the coastal marine area (Tauranga Harbour) by existing wastewater infrastructure.	31 July 2044
65623			*To Discharge of stabilised sludge from the Chapel Street and anaerobically digested sludge from Te Maunga plant (Pond 1).*	*31 January 2011 (expired)*
66510			*To Discharge of anaerobically digested sludge from Te Maunga plant Pond 1and Pond 2.*	*1 December 2011 (expired)*
67894	9 July 2014	Chapel St WWTP & Te Maunga WWTP	Discharge a Contaminant (dewatered sludge) to Land.	31 July 2024

Consent 62878 is the discharge consent for the combined wastewater flows from both of Tauranga's wastewater treatment plants into the sea via the ocean outfall 950m off Papamoa Beach. It allows for the discharge of an average of 50,000m^3/day and a maximum wet weather flow of 900 l/s. The consent requires the flow rate and volume of the discharge to be continuously monitored, and for wastewater samples to be checked for BOD_5, suspended solids and Enterococci twice weekly.

Sampling and testing is also required for the receiving waters as well as shellfish over summer. In addition, it sets out deadlines for process improvements and asset upgrades, such as UV disinfection prior to discharge and modification of the diffuser on the ocean outfall to allow for maximum dilution. Some changes have been approved by BOPRC to 62878 consent conditions since it was first granted with regards to the timing of installing and maintenance of the UV treatment facility.

It also sets timeframes for the completion of an independent Monitoring, Upgrade and Technology Review Report to assess the operation and discharge effects of the Wastewater Treatment plants in Tauranga, which is the basis for the preparation of this report.

2.6.1 BOPRC Compliance

In its report An Overview of Wastewater in the Bay of Plenty Region (BOPRC, 2018), BOPRC found TCC to be fully compliant with its consent conditions in the 2018 calendar year. This was based on a total of 35 inspections comprised of 15 performance monitoring returns and 20 site audits.

The report also noted that the UV facility had been shut down several times in 2018 due to operational issues. However, treated wastewater quality was compliant with consent conditions prior to entering the UV facility.

No other compliance reports from BOPRC were available for review at the time of preparing this report.

Sensitivity: General

3 Performance Review

This section reviews the performance of both Chapel Street and Te Maunga WWTPs against resource consent conditions since the last review report was written in 2014. The performance review is not necessarily a compliance assessment of consent clauses, which is covered in detail in Section 4, but provides an overview of the plant performance based on the data collected through the monitoring programme as required by the different resource consents.

NOTE: Although the date of this final report is August 2020, the data within section 3 and 4 covers the five year period from 2015 to mid 2019 as per consent conditions.

3.1 Required Information / Data

Table 3: Required information

Consent	Clause	Information Required
62878 - To Discharge Treated Wastewater from Chapel Street WWTP and Te Maunga WWTP to the Coastal Marine Area (Ocean)	5 & 9.1	• Outfall discharge records
	7.3	• Outfall annual inspection reports
	9.2 & 10	• Te Maunga treated wastewater quality: – BOD_5, TSS, Enterococci, E. coli (twice weekly) – Nutrients (monthly) – Metals (quarterly) – Organics (annually)
	11.1 & 11.2	• Ocean water Enterococci counts (nine locations, five samples/station/month, Dec to Mar)
	12.1 & 12.2	• Tuatua on beach (five locations, five replicate samples per station in Feb) – Bacterial counts: E. coli – Trace metals: As, Cu, Pb, Hg, Ni, Zn
	12.3	• Mussels at outfall diffuser (three samples in February): – As, Cd, Cr, Cu, Hg, Pb, Ni, Zn
62881 - Discharge from Oxidation Ponds to Rangataua Bay	2 & 6.3	• Seepage rates
	6.1 & 6.2	• Groundwater monitoring (annual in Feb): One up-gradient and three down-gradient shallow bores (pH, Conductivity, COD, BOD_5, DRP, Nitrate, Ammonia, Sulphate, Chloride, Faecal coliforms)
	6.3	• Intertidal sandflats for seepages (annual in Feb). Where leakage is suspected: – Estimated seepage flow rate, T°, DO, Salinity, Faecal coliforms, Ammonia, Nitrate, DRP
	6.4	• Titiko (mud snails): Six locations adjacent to ponds – Annual survey in Feb during low tide
67894 - Discharge Dewatered Sludge to Land	10.2	• % of solids in sludge and volumes of sludge disposed to trenches
	13.3	• Integrity of the cap of trenches inspection results (annual)
	14.4 & 14.6	• Groundwater monitoring (bi-annually in Mar and Sep): At three bores (TMG1, TMG3 and TMG4) for As, Cd, Cr, Cu, Pb, Hg, Ni, Zn
	14.9	• Annual monitoring reports
62722 – Discharge of Odorous gases from Chapel Street	7.1	• Community survey results (2016 & 2018)
	8.1	• Odour monitoring (annual)
	8.3	• Walkover inspections (monthly)

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Consent	Clause	Information Required
WWTP to Air 62723 - Discharge of Odorous Gases from Te Maunga WWTP to Air	9.3	• Odour complaints register
62885 - Discharge to Land then to Water at Te Maunga	2	• Overflow discharge daily quantity and rates
65178 – Occupy the Coastal Marine Area with WW Infrastructure	6.4	• 5-yearly maintenance reports

The following resource consents do not have any monitoring and performance reporting requirements:

- RC **62882** – Chapel Street Emergency Discharges to the Harbour.
- RC **62883** – Occupy Space in the Coastal Marine area (Harbour Outfall - Chapel Street overflow structure).
- RC **62886** – Irrigation of Reclaimed Water from Chapel Street[1]

3.2 Methodology

TCC keeps records of all the data related to consents compliance in an online platform called Infrastructure Data (ID), which has been the primary source of information for evaluating the performance of the plants. ID only contains data from 1 September 2017, as a different platform was previously used (CS-VUE) and the historical data was not migrated to the new system. The information for the period not covered by ID has been provided by TCC in different formats (Excel, pdf, Word, etc.) and compiled to produce a database for the performance review.

While the data is mainly the source for identifying any resource compliance issues, it has also been used to analyse the plant performance and recognise any opportunities to optimise and improve the operation of the plants.

Figure 10 identifies the location of the monitoring points associated with the consent conditions.

[1] No monitoring requirements if no reclaimed water for irrigation

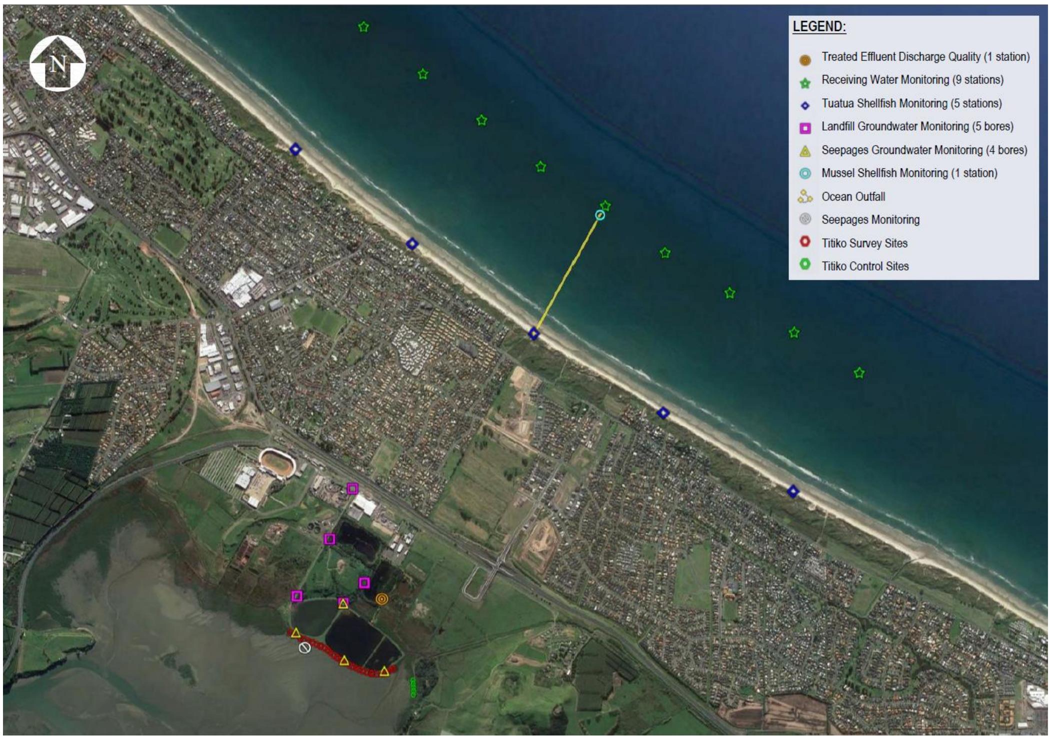

Figure 10: Approximate location of sampling points

3.3 Consent 62878 – Ocean Outfall Discharges

3.3.1 Treated Wastewater Quantity Ocean Outfall (Clause 5)

"5. The average daily quantity of treated wastewater to be discharged shall not exceed 50,000 cubic metres per day, with a maximum wet weather discharge of 900 litres per second. (see advice note 1).

Advice Note 1: For the purpose of condition 5, the average daily quantity of treated wastewater discharges shall be determined for each year"

The treated wastewater is discharged into the ocean at approximate 950m from the coast at Omanu beach. The flow is continuously monitored at the Te Maunga outfall pumping station. Summarised records of the daily and annual discharges are presented in Table 4 and Figure 11.

Table 4: Discharge flows at the ocean outfall between 2015 and May 2019

Year	Average daily discharge (m^3/day)	Max. daily discharge (m^3/d)	Total recorded annual discharge (m^3)
2015	25,678	34,576	9,321,240
2016	28,907	39,004	10,493,188
2017	33,050	49,620	12,030,180
2018	34,198	50,622	12,447,970
2019[2]	29,739	46,385	4,490,650

[2] Up to 31 May 2019

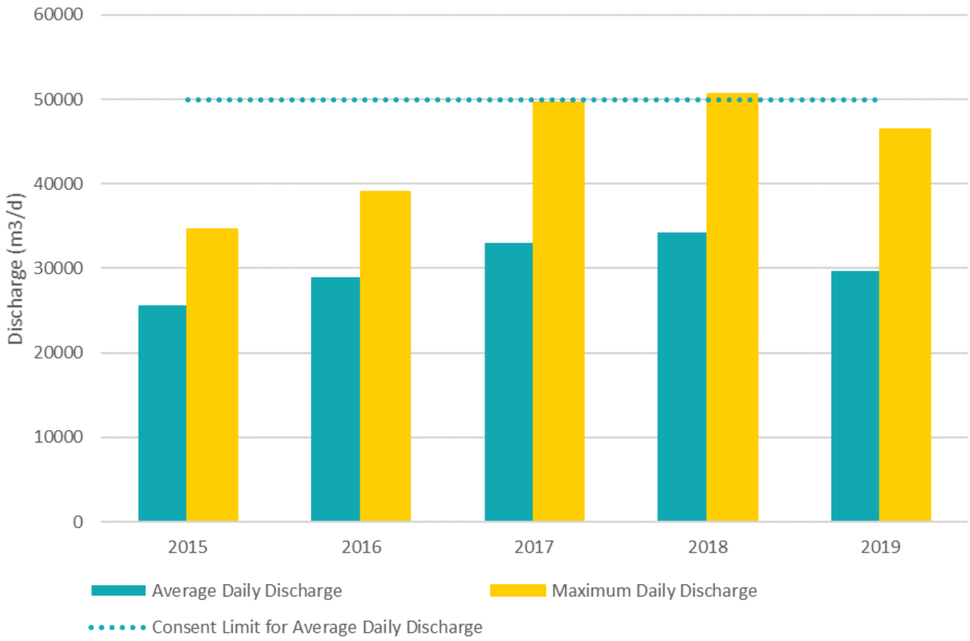

Figure 11: Average and maximum daily discharge flows at the outfall between 2015 and May 2019

The records show that the average and maximum daily discharges have increased every year from 2015 to 2018, which is expected due to population growth. The average values for 2019, which include only up to 31 May, show a decrease in the volumes discharged to the ocean, however it is common that infiltration into the reticulation network during winter months causes higher volumes of wastewater to be treated. As winter months are not included for 2019, it is expected that the 2019 averages will increase once the records for the full year are used.

Note that during 2018, there were three days where the daily discharge was slightly over 50,000m^3/d. Nevertheless, the consent limit compliance is to be calculated using the annual average and not the maximum daily discharges as stated in advice note 1 to the consent.

The maximum wet weather discharge limit at the outfall is 900 L/s, which has never been exceeded during the monitoring period, as shown in Figure 12. The maximum recorded instantaneous flow was 585.9 L/s on 13 June 2018.

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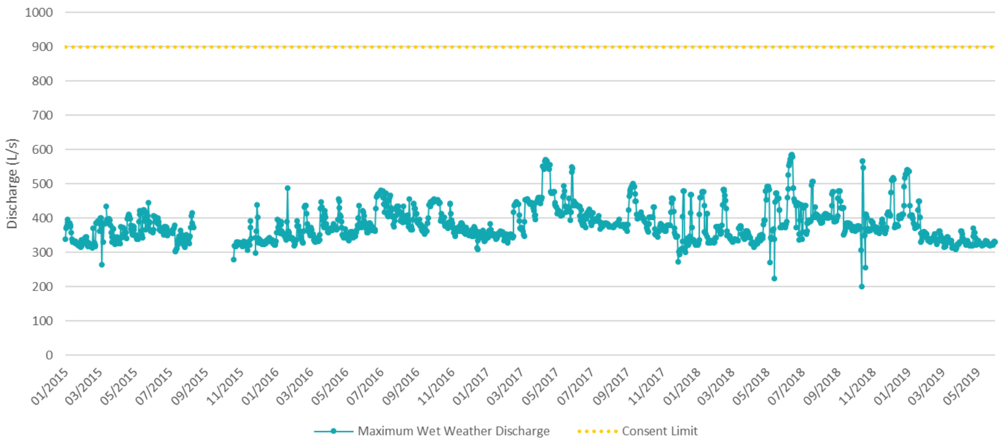


Figure 12: Maximum wet weather flows at the outfall between 2011 and May 2015

The existing condition of the outfall, which was commissioned around 1976, cannot physically withstand the pressures required to deliver the consented maximum rate of 900 L/s. Under normal operation, the landward section is subjected to pressures that, if not managed properly, are likely to cause a failure. Previous tests have caused a failure of this section at the beach manhole at a pressure of 20m. Consequently, the outfall pump station has been limited to pump at a head of 18m, which is equivalent to a flow rate of approximately 600 L/s.

3.3.2 Ocean Outfall Inspections (Clause 7.3)

"7.3 The outfall diffuser shall be inspected at least once per annum. A report on the results of the inspection shall be sent to the Regional Council within one month of inspection."

In accordance with Condition 7.3 of consent 62878 to discharge treated wastewater from Te Maunga to the ocean, the outfall is to be inspected on an annual basis. The objective is to check that the diffuser is operating correctly, with the ports open and free of internal debris. Observations are made as to sand levels, marine growth, artificial fouling (fishing line, plastic bags etc.) and damage. Maintenance work is carried out as required.

The outfall has been inspected on an annual basis since 2015 and the corresponding reports indicate that the pipeline end manifold is in good serviceable condition and operating correctly. During the 2015 and 2016 inspections, divers replaced the end plate anode and mussels were removed from all ports. In 2017, mussels were quite abundant, all ports were cleared of marine fouling and the anode was replaced again. No ports were blocked with any kind of debris as seen in previous years. During the 2018 annual inspection, the anode was 70% depleted and consequently replaced. The diffuser ports were fouled with marine growth, mainly mussels, which were removed and the ports were observed to subsequently be flowing freely. The level of sand build-up along the length of the diffuser has been consistent over the last five years, not requiring any extra maintenance works. (*Pacific Diving, Omanu Outfall Diffuser Inspection Report and Mussel Sample Collection, 2015, 2016, 2017 and 2018*).

3.3.3 Outfall Flow Rate Records (Clause 9.1)

"9.1 The permit holder shall continuously monitor and record the flow rate and volume of treated wastewater entering the outfall pipeline."

The flow rate of the combined treated wastewater at the Te Maunga outfall pumping station is continuously monitored. The average daily flow and maximum instantaneous flow per day is recorded through SCADA.

The following figure shows the percentage of days where the flow has not been recorded for the period from January 2015 to May 2019.

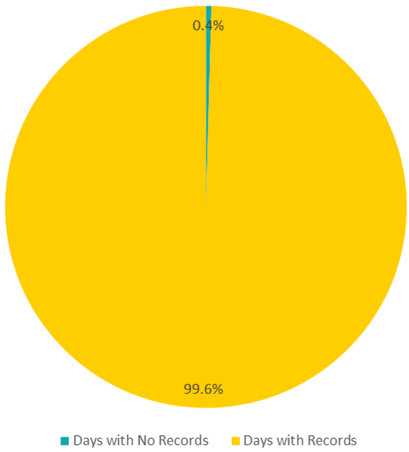


Figure 13: Outfall discharge records from Jan 2015 to May 2019

Most of days with no available records are scattered throughout the years. It is not unusual for continuous monitoring devices to have some gaps in a 5-year period, which may be caused by instrument malfunction, instruments or pump station maintenance, etc.

3.3.4 Treated Wastewater Quality Ocean Outfall (Clauses 9.2, 10.1 & 10.2)

"9.2 The permit holder shall take grab samples and 24-hour flow proportioned samples of treated wastewater discharged twice each week. The samples shall be analysed for the constituents and at the frequency listed in Schedule 1 below.

10.1 Based on twice-weekly sampling, as required by condition 9.2 of this permit, and take over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year during the term of this permit, all wastewater discharged through the ocean outfall shall meet the following BOD_5 and total suspended solids standards:

Analyte	*Sample Type*	*No more than 16 values shall exceed*	*No more than 3 values shall exceed*
BOD_5 (mg/L)	*Composite*	*25*	*30*
Total suspended solids (mg/L)	*Composite*	*50*	*80*

10.2 The following enterococci standard shall apply to all wastewater discharged through the ocean outfall:

- *Based on twice-weekly sampling as required by condition 9.2 of this permit, and taken over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year, no more than 16 enterococci values shall exceed 3,500 cfu/100mL."*

The quality of treated wastewater discharged to the ocean is monitored comprehensively at the outfall pumping station at Te Maunga at a range of frequencies and for a range of parameters, in accordance with Schedule 1 of the consent. The results reflect the quality of the combined treated wastewater from both the Te Maunga and Chapel Street WWTPs, after it has passed through the Te Maunga wetlands A, B and C.

BOD_5, Suspended Solids and Microbiology (twice-weekly monitoring)

The consent does not specify if the type of BOD_5 to be monitored is Carbonaceous BOD_5 ($cBOD_5$) or BOD_5 (including nitrogenous oxygen demand). TCC has confirmed that $cBOD_5$ has been monitored since the commencement of the consent and this is deemed appropriate by Beca.

The consent requires the Enterococci results to be in cfu/100mL (colony forming units), which are based on actual colony counts. The laboratory results show that the method used for determination of Enterococci concentration is based on MPN/100mL (most probable number), which is a statistical probability of the number of organisms. The method used by the laboratory is the APHA 9230 D Enterolert™, which provides results in MPN/100mL. According to the MfE Microbiological Water Quality for Marine and Freshwater Recreational Areas, either the Enterolert™ test (MPN/100mL) or the EPA Method 1600 (cfu/100mL) are recommended to enumerate Enterococci. Based on this recommendation, the monitoring of Enterococci by MPN/100mL is still considered appropriate for the treated wastewater quality, even though it is not specified in the consent.

A summary of the data collected twice-weekly is presented in Table 5 and Figure 14 below.

Table 5: Twice-weekly monitoring treated wastewater quality summary

Parameter	Year	Median	Max	Min	95%ile
Biochemical Oxygen Demand over 5 days (BOD_5) (mg/L)	2015	13.5	26	6	22.0
	2016	14.0	38	4	30.0
	2017	11.0	31	6	19.9
	2018	11.0	25	5	21.8
	2019	12.0	23	5	19.4
Total Suspended Solids (mg/L)	2015	26.5	66	5	58.9
	2016	23.0	91	6	48.0
	2017	21.0	55	3	42.0
	2018	23.0	73	6	53.2
	2019	29.0	68	9	60.8
Enterococci (MPN/100ml)	2015	480	19,000	29	7,100
	2016	1750	69,000	100	18,500
	2017	505	24,000	10	5,425
	2018	80	12,000	10	3,950
	2019	580	10,000	110	4,695
E. coli (MPN/100ml)	2015	2300	170,000	25	77,750
	2016	13500	870,000	200	147,500
	2017	3250	240,000	9	88,550
	2018	200	160,000	10	37,100
	2019	3800	87,000	63	38,400

Sensitivity: General

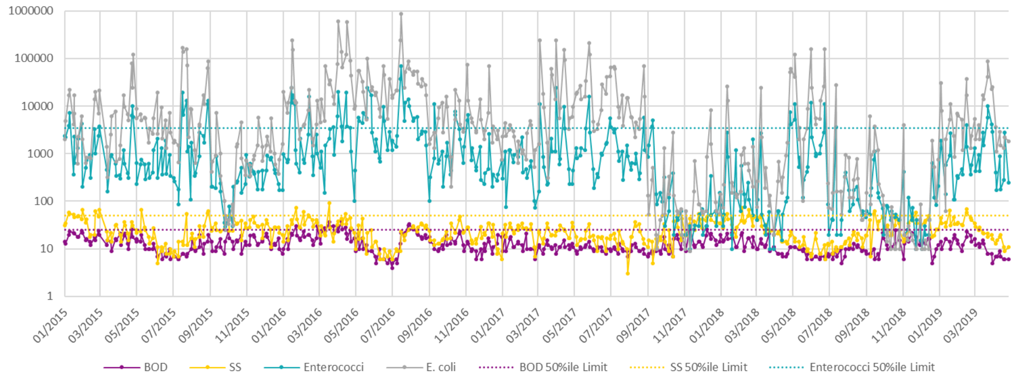


Figure 14: BOD_5, SS, Enterococci and E. coli concentration in the treated wastewater

Monitoring results at the outfall pump station show that the plants and wetlands system consistently produce a high quality effluent. The levels of BOD_5 and TSS are within the range of values expected for secondary treated wastewater. There have been no breaches in consent during the review period (refer to Section 4 for full review of compliance). Microbiological quality during 2016 was of a lesser quality than the other years, however still within consent limits. No other significant changes in the treated wastewater quality during the review period are noticeable.

The graphs below show a summary of the 50%ile and 95%ile annual results for BOD_5, TSS and Enterococci.

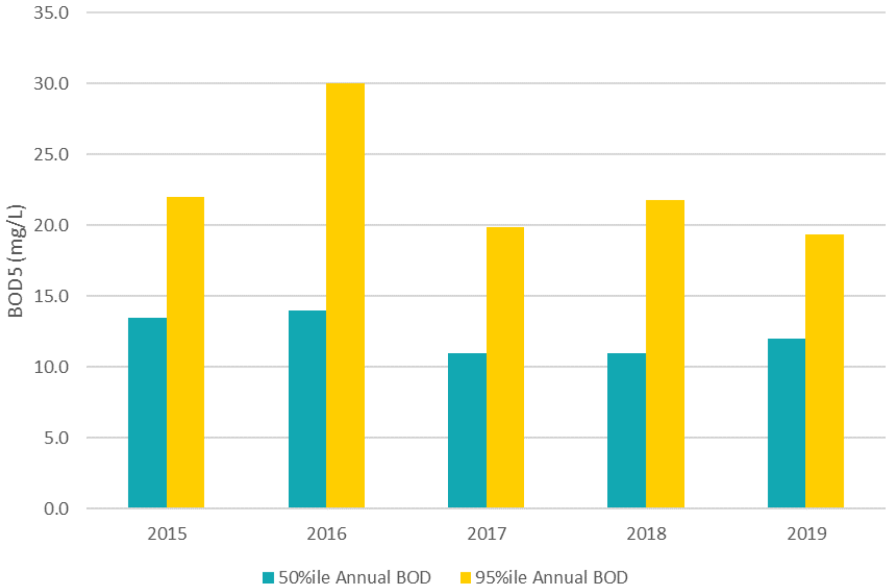


Figure 15: BOD_5 concentration in the treated wastewater

Sensitivity: General

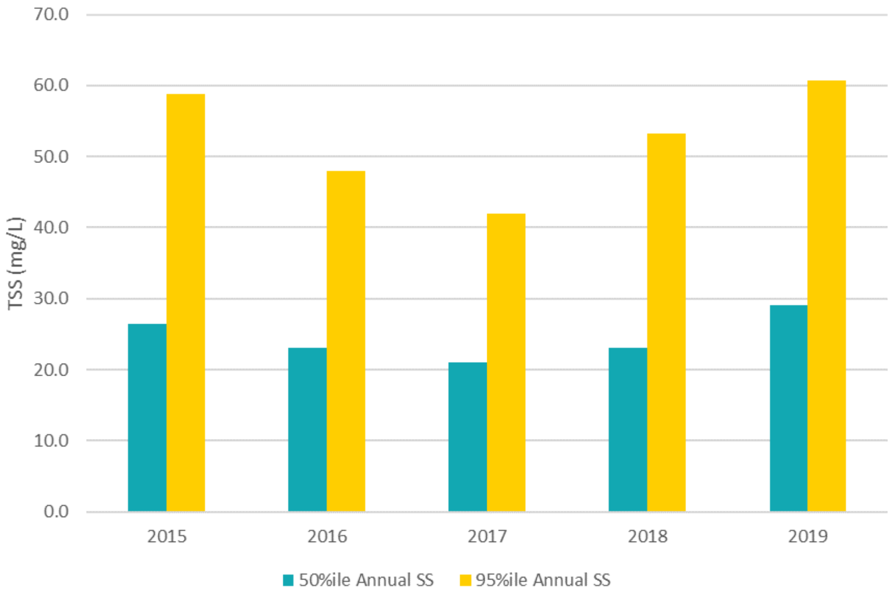


Figure 16: TSS concentration in the treated wastewater

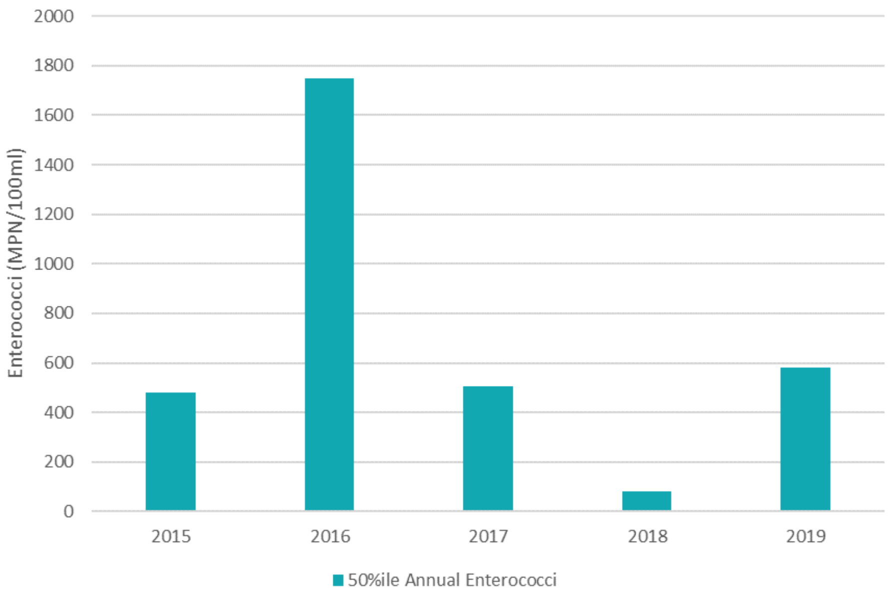


Figure 17: Enterococci concentration in the treated wastewater

Nutrients (monthly monitoring)

There are no consent limits for nutrient concentrations, and the plants are not specifically designed to remove nutrients. 2016 showed the highest concentrations of ammonia and TKN, which coincides with the lowest quality of the treated wastewater in terms of BOD_5 and bacteria. Nitrate-N increased slightly after 2016 and it has remained relatively stable ever since. Total phosphorus, dissolved reactive phosphorus, pH and conductivity have not shown significant variations throughout the review period.

Table 6: Monthly monitoring treated wastewater quality summary

Parameter	Year	Median	Max	Min
Ammonia-N (mg/L)	2015	30.5	39.0	13.4
	2016	38.5	44.0	32.0
	2017	27.5	39.0	21.0
	2018	29.5	44.0	19.0
	2019	17.0	30.0	4.0
Total Kjeldahl Nitrogen (TKN) (mg/L)	2015	33.5	42.0	16.3
	2016	42.0	72.0	33.0
	2017	32.5	46.0	23.0
	2018	31.5	47.0	23.0
	2019	20.3	32.0	5.8
Nitrate-N (mg/L)	2015	0.2	0.9	0.1
	2016	0.1	0.6	0.1
	2017	0.4	2.0	0.1
	2018	0.4	2.7	0.2
	2019	0.4	4.6	0.1
Total Phosphorus (mg/L)	2015	7.8	9.7	6.6
	2016	7.4	9.7	5.3
	2017	6.4	10.4	4.6
	2018	7.0	8.0	4.4
	2019	7.5	8.9	0.7
Dissolved Reactive Phosphorus (DRP) (mg/L)	2015	7.9	9.6	6.2
	2016	6.8	8.6	5.3
	2017	6.1	10.0	4.4
	2018	6.7	8.1	3.9
	2019	7.0	8.2	0.1
pH	2015	7.6	7.7	7.4
	2016	7.5	7.8	7.4
	2017	7.5	7.8	7.3
	2018	7.5	7.6	7.3
	2019	7.6	7.9	6.9
Conductivity (mS/m)	2015	89.9	116.7	71.3
	2016	89.5	96.4	75.9
	2017	82.3	97.8	64.5
	2018	85.7	112.6	62.7
	2019	79.4	92.6	60.6

Metals (quarterly monitoring)

There is no consent limit for metal concentrations at the outfall. Metal concentrations for the period 2015-2019 have remained relatively low and constant.

Table 7: Quarterly monitoring treated wastewater quality summary

Parameter	Year	Average	Max	Min
Arsenic (mg/L)	2015	0.0013	0.0015	0.0011
	2016	0.0013	0.0013	0.0012
	2017	0.0017	0.0020	0.0013
	2018	0.0016	0.0017	0.0014
	2019	0.0015	0.0015	0.0015
Cadmium (mg/L)	2015	<0.000053	<0.000053	<0.000053
	2016	<0.000053	<0.000053	<0.000053
	2017	<0.000053	0.000054	<0.000053
	2018	<0.000053	<0.000053	<0.000053
	2019	<0.000053	<0.000053	<0.000053
Chromium (mg/L)	2015	0.0018	0.0022	0.0015
	2016	0.0018	0.0025	0.0014
	2017	0.0030	0.0044	0.0023
	2018	0.0020	0.0026	0.0013
	2019	0.0019	0.0019	0.0019
Copper (mg/L)	2015	0.0063	0.0085	0.0048
	2016	0.0064	0.0109	0.0031
	2017	0.0093	0.0155	0.0028
	2018	0.0069	0.0112	0.0032
	2019	0.0148	0.0148	0.0148
Lead (mg/L)	2015	0.0008	0.0010	0.0006
	2016	0.0008	0.0010	0.0006
	2017	0.0008	0.0013	0.0005
	2018	0.0007	0.0008	0.0005
	2019	0.0005	0.0005	0.0005
Mercury (mg/L)	2015	<0.00008	<0.00008	<0.00008
	2016	<0.00008	<0.00008	<0.00008
	2017	<0.00008	<0.00008	<0.00008
	2018	<0.00008	<0.00008	<0.00008
	2019	<0.00008	<0.00008	<0.00008
Nickel (mg/L)	2015	0.0027	0.0032	0.0024
	2016	0.0019	0.0021	0.0016
	2017	0.0019	0.0022	0.0015
	2018	0.0017	0.0022	0.0014
	2019	0.0020	0.0020	0.0020
Zinc (mg/L)	2015	0.054	0.073	0.034
	2016	0.042	0.051	0.034
	2017	0.049	0.083	0.024
	2018	0.094	0.210	0.033
	2019	0.035	0.035	0.035

Sensitivity: General

Organics (annual monitoring)

There is no consent limit for organic compounds concentration at the outfall. All concentrations for the period 2015-2018 have remained below detection limits.

Table 8: Annually monitoring treated wastewater quality summary

Year	VOC (mg/L)	SVOC (mg/L)
2015	<0.5	<0.10
2016	<0.10	<0.10
2017	<0.5	<0.10
2018	<0.5	<0.10

3.3.5 Receiving Water Monitoring (Clauses 11.1 & 11.2)

"11.1 The permit holder shall monitor the enterococci concentration on the receiving water at nine locations offshore of the beach adjacent to the outfall. Five water samples are to be collected per station per month during December, January, February and March to give a total of 20 samples per station per year. The monitoring stations shall be situated approximately 400 metres offshore of the beach at the following locations:

a) 2000 metres northwest of the outfall
b) 1500 metres northwest of the outfall
c) 1000 metres northwest of the outfall
d) 500 metres northwest of the outfall
e) On the outfall alignment
f) 500 metres southeast of the outfall
g) 1000 metres southeast of the outfall
h) 1500 metres southeast of the outfall
i) 2000 metres southeast of the outfall

11.2 Based on 20 coastal water samples collected each year in accordance with condition 11.1, the treated wastewater discharge shall not cause more than 13 enterococci values to exceed 35 enterococci per 100 mL, or cause any single sample to exceed 104 enterococci per 100 mL (see advice note 5)."

Enterococci concentration on the receiving water is monitored at nine locations offshore of the beach adjacent to the outfall. Five water samples are collected per station per month for the period from December to March. A summary of the monitoring results is shown in Table 9 below.

Table 9: Summary of Enterococci results from all 9 monitoring stations

Year	Median	Max	Min	Standard Deviation
2015	9	2500	9	239.4
2016	9	31	9	1.8
2017	9	20	9	1.2
2018	9	20	9	1.2
2019	10	41	10	2.8

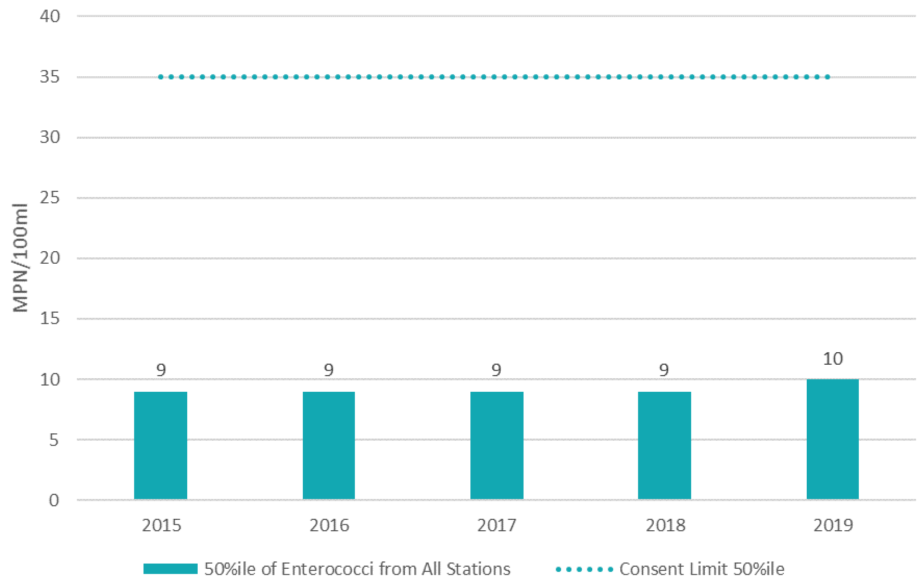


Figure 18: Summary of Enterococci results from all 9 monitoring stations

The results show that the Enterococci counts in the receiving environment (ocean) have been consistently below 10 MPN/100ml, except for the samples taken in March 2015, where several samples exceeded the 35 and 104 enterococci per 100ml limits at the ocean outfall monitoring point and the stations towards Papamoa. A maximum of 2500 enterococci/100ml was found at the ocean outfall location. Resampling was carried out two weeks later and all results were below 10 MPN/100ml.

A single sample taken in 13 February 2019 was over the 35 enterococci per 100ml limit, however still within the tolerance range set by the consent.

3.3.6 Shellfish (Tuatua) on Beach (Clauses 12.1 & 12.2)

"12.1 The permit holder shall monitor the Escherichia coli, arsenic, and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content in the soft tissue of inter-tidal shellfish (tuatua) collected from five stations off the beach adjacent to the outfall. Five replicate shellfish samples shall be collected per station during February of each year. The monitoring stations shall be within the intertidal zone at approximately the following locations:

- *a) 2000 metres northwest of the outfall*
- *b) 1000 metres northwest of the outfall*
- *c) On the outfall alignment*
- *d) 1000 metres southeast of the outfall*
- *e) 2000 metres southeast of the outfall*

12.2 For shellfish samples collected in accordance with condition 12.1 the following shall apply:

- *a) No more than 1 out of 5 replicate shellfish samples shall exceed 230 E. coli per 100g and none of the 5 replicate samples shall exceed 700 E. coli per 100g.*
- *b) None of the 5 replicates shall exceed the following trace metal concentrations (all values mg/kg):*
  - *Arsenic (inorganic) 2 (see advice note 6)*
  - *Copper 30*

Sensitivity: General

- *Lead 0.5*
- *Mercury 0.5*
- *Nickel 2*
- *Zinc 40"*

E. coli and metals were present at low concentrations from 2015 to 2019 (Table 10), except for one instance on 13 May 2015 where E. coli was higher than typically recorded (940 MPN/100g at site 2000m south east of the outfall, and 2400 MPN/100g in one sample 1000m south east of the outfall).

Table 10: Average results for Tuatua monitoring

Parameter (Average)	Monitoring Station	2015	2016	2017	2018	2019
E. coli (MPN/100g)	2000 m NW outfall	33.2	43.0	30.4	32.0	80.4
	1000 m NW outfall	31.8	30.4	31.8	41.6	28.0
	On outfall alignment	44.4	30.4	31.8	29.0	35.8
	1000 m SE outfall	408.4	29.0	67.2	31.8	19.0
	2000 m SE outfall	410.2	30.4	31.8	29.0	47.2
Arsenic (mg/kg)	2000 m NW outfall	2.4	1.7	2.4	2.1	1.8
	1000 m NW outfall	2.4	2.0	2.3	2.4	1.9
	On outfall alignment	2.5	1.7	2.3	2.0	1.7
	1000 m SE outfall	2.2	1.8	2.2	2.3	1.7
	2000 m SE outfall	2.3	1.6	2.2	1.8	1.8
Cadmium (mg/kg)	2000 m NW outfall	0.20	0.26	0.34	0.34	0.20
	1000 m NW outfall	0.27	0.22	0.33	0.26	0.23
	On outfall alignment	0.25	0.20	0.41	0.20	0.19
	1000 m SE outfall	0.18	0.21	0.32	0.36	0.13
	2000 m SE outfall	0.19	0.19	0.33	0.18	0.20
Chromium (mg/kg)	2000 m NW outfall	0.09	0.11	0.10	0.07	0.05
	1000 m NW outfall	0.12	0.07	0.12	0.07	0.07
	On outfall alignment	0.09	0.07	0.12	0.05	0.05
	1000 m SE outfall	0.10	0.06	0.14	0.10	0.04
	2000 m SE outfall	0.09	0.08	0.26	0.05	0.09
Copper (mg/kg)	2000 m NW outfall	1.6	1.3	1.9	1.4	1.5
	1000 m NW outfall	1.4	1.7	1.7	2.0	1.4
	On outfall alignment	2.0	1.3	1.4	1.6	1.4
	1000 m SE outfall	1.9	1.3	1.7	1.5	1.4
	2000 m SE outfall	1.6	1.2	1.4	1.4	1.3
Mercury (mg/kg)	2000 m NW outfall	0.013	0.016	0.011	0.013	0.013
	1000 m NW outfall	0.014	0.015	0.011	0.014	0.014
	On outfall alignment	0.014	0.014	0.012	0.011	0.012
	1000 m SE outfall	0.013	0.013	0.011	0.015	0.011
	2000 m SE outfall	0.014	0.011	0.011	0.011	0.011
Lead (mg/kg)	2000 m NW outfall	0.01	0.02	0.03	0.01	0.01
	1000 m NW outfall	0.02	0.02	0.02	0.02	0.03
	On outfall alignment	0.02	0.01	0.03	0.01	0.02
	1000 m SE outfall	0.02	0.02	0.04	0.05	0.02
	2000 m SE outfall	0.03	0.02	0.03	0.01	0.03
Nickel (mg/kg)	2000 m NW outfall	0.08	0.10	0.31	0.09	0.10

Parameter (Average)	Monitoring Station	2015	2016	2017	2018	2019
	1000 m NW outfall	0.09	0.12	0.26	0.10	0.10
	On outfall alignment	0.10	0.10	0.29	0.11	0.10
	1000 m SE outfall	0.09	0.10	0.29	0.09	0.11
	2000 m SE outfall	0.10	0.09	0.28	0.09	0.11
Zinc (mg/kg)	2000 m NW outfall	11.3	9.9	13.8	11.7	9.1
	1000 m NW outfall	10.4	12.1	13.3	12.3	9.8
	On outfall alignment	13.3	11.0	12.8	11.6	9.0
	1000 m SE outfall	11.7	11.3	12.9	11.8	8.9
	2000 m SE outfall	11.7	9.4	12.0	11.0	9.4

3.3.7 Shellfish (Mussel) at Outfall Pipeline Diffuser (Clause 12.3)

"12.3 The permit holder shall monitor the arsenic and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content of the three replicate mussel samples collected from the outfall pipeline diffuser to provide a worst-case measure of trace metal accumulation. The three replicate shellfish samples shall be collected from the diffuser section of the pipeline during February of each year."

Annual survey of metal concentrations in mussel (*Perna canaliculus*) from the outfall pipe indicate low and relatively consistent levels of metals over time (Table 11). The concentrations detected in mussels at the diffuser are comparable to that detected in tuatua at the outfall and at various distances from the outfall (Table 10).

Table 11: Average results for Mussels monitoring

Parameter (Average)	2015	2016	2017	2018	2019
Total Arsenic (mg/kg)	1.34	1.36	1.56	2.13	1.92
Cadmium (mg/kg)	0.23	0.23	0.40	0.19	0.30
Chromium (mg/kg)	0.09	0.07	0.06	0.06	0.08
Copper (mg/kg)	0.47	0.39	0.59	0.74	0.62
Lead (mg/kg)	0.029	0.031	0.024	0.031	0.035
Mercury (mg/kg)	0.019	0.012	0.011	0.014	0.011
Nickel (mg/kg)	0.17	0.17	0.27	0.18	0.27
Zinc (mg/kg)	8.27	7.83	10.27	11.70	9.60

3.3.8 Comprehensive Ecological Survey (Clause 13)

"13 The permit holder shall undertake a broad spatial study of the benthic biota and sediments in the vicinity of the outfall (comparable to that carried out by Cawthron Institute in 2003) in the years 2014 and 2024. The results of such studies are to be provided to the Regional Council within three months of each survey being undertaken."

Monitoring of the benthic ecology and sediments around the ocean outfall was undertaken in 2014, based on the methodology developed by Cawthron in 2003. Consent conditions require a repeat of the survey to be carried out in 2024. As part of this review, we have considered the methodology, data analysis approach and frequency of survey.

The survey approach focuses on describing the composition of the subtidal benthic communities (infauna and epifauna), the biochemical state (body burden of metals, indicator bacteria and $\delta^{13}C$ and $\delta^{15}N$ stable isotope ratios[3]) of key subtidal and intertidal bivalves, and the physical and chemical sediment properties at various distances from the outfall. Subtidal communities are described on two spatial scales, one designed to sample small macrofauna and the other to describe larger, more sparsely distributed, bivalves and large invertebrates. Intertidal sampling targeted tuatua (*Paphies subtriangulata*) which is the dominant large bivalve found within the intertidal and surf zone.

Spatial changes are assessed along transects radiating away from the outfall at approximately north and south orientations, following the local bathymetry and predominant current directions (i.e. parallel to shore). Survey effort focusses on the primary transect (extending from the diffuser at a depth of approximately 12m) sampled for sediment chemistry, subtidal shellfish, infauna, and shellfish health at 20, 100, 1000 and 2000m intervals. The two secondary transects are located respectively at 5m and 20m depth. Intertidal bivalves are sampled at 0, 100, 200, 400, 800, 1600 and 2000m from the outfall alignment in both a northerly and southerly direction. The 20m transect is only sampled in alignment with the outfall and at 2000m north and south. Sites greater than *ca.* 1000m away served as reference sites. Additionally, dredge samples were collected at various points near the outfall between the 15 and 20m isobaths to better describe the sparse large epifaunal and to collect scallops for health analyses.

The methodology and data analyses developed by Cawthron in 2003 are appropriate and scientifically robust. The 2014 survey results did not indicate significant adverse effects from the discharge of treated wastewater at the outfall on benthic ecology nor on sediment quality and grain size in the subtidal and intertidal marine habitats adjacent to the outfall. The survey is to be repeated in 2024, which constitutes quite a long interval between surveys. We considered whether a five-year interval would be more appropriate. However, given that the discharge quality is within consent parameters, annual sediment and shellfish monitoring at and adjacent to the outfall and the ten yearly ecology survey do not indicate adverse effects, we agree that a ten-yearly interval is adequate. Once the 2024 survey has been carried out, it would be appropriate to do a detailed analysis of surveyed parameters over the three survey periods (2004, 2014 and 2024).

3.4 Consent 62881 – Seepages from Te Maunga Oxidation Ponds

3.4.1 Seepage Rates (Clauses 2 & 6.3)

"2 The daily quantity discharged shall not exceed 43.2m^3/day. The rate of discharge shall not exceed 1.0 litres per second."

As required by the consent, the inter-tidal zone is inspected annually for seepages. In 2016, in response to planned desludging work, the seepage and titiko monitoring programme was increased from annual to quarterly. This revised plan exceeds the compliance monitoring obligations specified in the existing consent.

The identification of seepages is undertaken by walkovers at low tide. Seepages are generally characterised by discolouration on the sand surface, increased wetness of the sand, an absence of mud, crab burrows and/or other indicators of living organisms or unusual biological features.

[3] The stable isotope analysis involves comparing the ratio of the stable isotopes of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) against the parent forms of each atom ($\delta^{12}C$ and $\delta^{14}N$). Marine organisms and sediments tend to have different sources of carbon and nitrogen than their terrestrial counterparts and therefore have been shown to have markedly different isotopic signatures. However, marine organisms and sediments in the vicinity of wastewater outfalls are subjected to terrestrial sources of carbon and nitrogen from the effluent and tend to show an isotopic shift towards this terrestrial signature.

There have been a number of historic seepages located around the oxidation ponds, but most recently there are two seepages that have remained active, W6 and W6a (Figure 19).

Figure 19: Active seepage inspection locations

A number of multiple small seeps have also been identified around seepage W6a. Clusters of individual small seeps are grouped as seepage areas (W6b & W6c). These combined groups produce enough flow for seepage rate measurements. The total seepage rate is calculated as the sum of seepages through active sites (W6 & W6a) and individual seeps if any (W6b & W6c). Table 12 shows annual average seepage rates from the quarterly monitoring.

Table 12: Average seepage flows from Te Maunga oxidation ponds

Year	Average Seepage Rate (L/s)	Average Daily Seepage (m^3/d)
2015	0.03	2.80
2016	0.25	21.96
2017	0.12	10.20
2018	0.25	21.77
2019	0.32	27.22

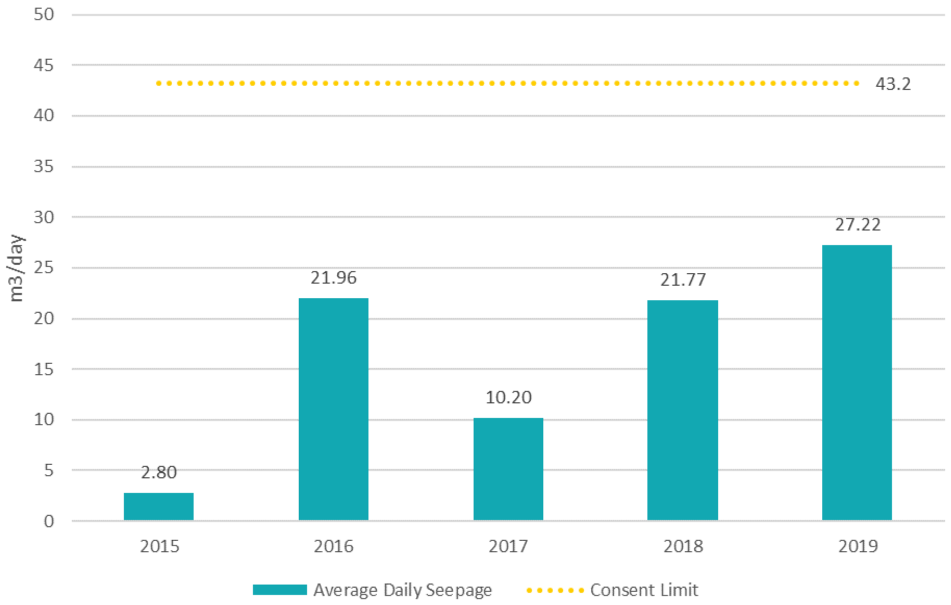


Figure 20: Average daily seepages from Te Maunga oxidation ponds

Between July 2018 and March 2019 monitoring was increased from quarterly to monthly whilst desludging works at Pond 1 were conducted. The increased monitoring was designed to detect any changes to seepage activity during the desludging works. Higher seepage rates were recorded whilst the desludging works were in operation, however seepage flow rates have remained below the consent limits for all the monitoring period. A significant reduction in seepage rates was recorded during March 2019 when the desludging works finished.

3.4.2 Seepage Quality (Clause 6.3)

"6.3 In the month of February each year, at or near low tide, the permit holder shall undertake an inspection of the intertidal sand flats in a band extending 100m seaward of the ponds. The aim of the inspection is to identify any indicator organisms or unusual biological features that could indicate the presence of leakage from the ponds.

6.3.1 At each location where leakage is suspected, water samples shall be collected by excavation of a depression in the sand at the base of a seep and allowing the depression to fill.

6.3.2 At each location where leakage is suspected, the following field measurements of the water shall be made:

- *Estimate of flow rate from seepage*
- *Temperature*
- *Dissolved oxygen*
- *Salinity*

6.3.3 At each location water samples shall be collected and analysed for:

- *Faecal coliform bacteria*
- *Ammonia-N*
- *Nitrate-N*
- *Dissolved Reactive Phosphorus"*

The consent requires the flow rate of seepages to be recorded and field measurements of temperature, dissolved oxygen and salinity to be collected at each location. Samples of the seepages are taken and analysed for faecal coliform, ammonia, nitrate and dissolved reactive phosphorus. Table 13 shows the annual averages for the seepage quality per sample site.

Table 13: Average water quality of surface flows and leakages

Values	Sample Site	2015	2016	2017	2018	2019
Temperature (°C)	W6	27.8	22.6		23.5	
	W6a	25.9	23.3		22.2	
	W6b		20.9		21.8	
	W6c		22.1		14.8	
Dissolved Oxygen (mg/L)	W6	10.01	9.00	10.06	10.67	10.59
	W6a	6.94	10.55	6.85	9.89	8.00
	W6b		7.91	7.10	8.55	9.12
	W6c		8.39		8.12	
Salinity (ppt)	W6	6.9	6.7	5.0	5.8	6.0
	W6a	9.1	6.4	6.0	5.6	5.7
	W6b		10.9	6.8	6.8	11.5
	W6c		11.0		12.3	
Faecal coliforms (cfu/100ml)	W6	78	40	110	1307	3727
	W6a	20	31	5	72	103
	W6b		169	6	47	47
	W6c		76		11	
Ammonia-N (mg/L)	W6	133.0	78.0	162.0	164.6	156.3
	W6a	230.0	140.5	198.0	209.0	230.0
	W6b		85.3	160.0	198.8	181.3
	W6c		72.0		93.0	
Nitrate-N (mg/L)	W6	0.01	0.36	0.32	0.78	4.00
	W6a	0.01	0.49	0.55	0.66	0.70
	W6b		0.19	0.85	0.55	0.70
	W6c		0.89		3.20	
Dissolved Reactive Phosphorus (mg/L)	W6	32.0	25.6	33.0	23.5	20.6
	W6a	43.0	32.3	33.0	25.9	20.7
	W6b		24.7	31.0	29.7	23.3
	W6c		21.0		20.0	
Enterococci (cfu/100ml)	W6		47	10	105	471
	W6a		24	9	10	39
	W6b		86	10	46	25
	W6c		40		30	

The presence of faecal coliforms is likely an indication of pond seepage, and it has been identified in most samples collected since 2015. The consent does not set a limit, but using the Ministry for the Environment Guidelines for Recreational Water Quality (MfE, 2003) an indication of public health risks from bacteria concentrations in marine recreational water can be assessed. Enterococci has been consistently monitored on seepages since 2016 (not required by the consent), to provide an indication against the guidelines.

Higher concentrations of faecal coliforms were obtained during 2018 and 2019 from seepage site W6, which historically has had higher values when compared to W6a. Nitrate has also showed an increase over the last two years. These results may be influenced by the desludging works that started mid-2018.

Enterococci concentrations have remained in most cases below MfE guideline value (<140 enterococci/100ml), with a few exceptions on March 2018, October 2018, February and March 2019, all obtained from W6. The highest recorded value was 800 cfu/100ml on March 2019. Due to seepage low flow rates and dilution with estuarine water, there is unlikely to be any significant risk for those coming into contact with the water. The seepages are not anticipated to have any significant adverse effect on estuarine water quality.

3.4.3 Groundwater Quality Associated with Sludge Ponds (Clauses 6.1 & 6.2)

6.1 In the month of February each year the permit holder shall take samples from:

a) One up-gradient shallow groundwater bore and;
b) Three down-gradient shallow groundwater bores.

The bores shall penetrate at least 2 meters below the lowest summer groundwater level. The exact location of the groundwater bores shall be determined in consultation with the Chief Executive of the Regional Council or delegate.

6.2 The samples shall be analysed for:

- *pH*
- *Conductivity*
- *COD*
- *BOD5*
- *Dissolved Reactive Phosphorus*
- *Nitrate-N*
- *Ammonia-N*
- *Sulphate*
- *Chloride*
- *Faecal coliforms"*

Groundwater quality is to be monitored annually during February for three perimeter bund bores at sludge ponds 1 and 2 and one up-gradient bore (TMG3), for the discharge from the ponds to Rangataua Bay. The approximate locations of the bores associated with the ponds are shown on Figure 21 below.

Sensitivity: General

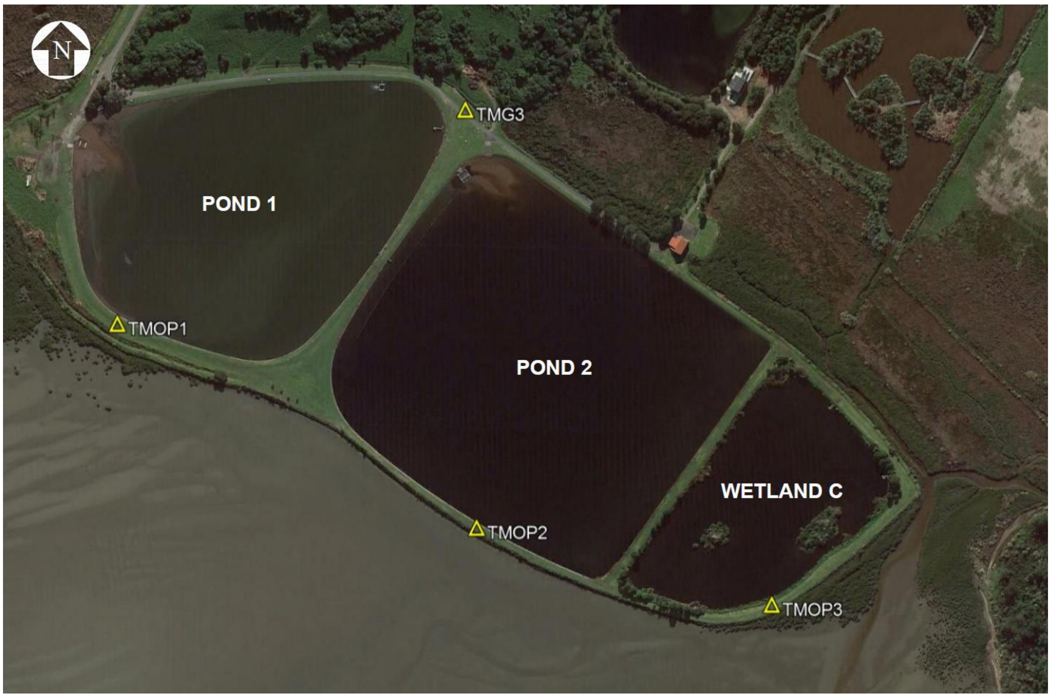


Figure 21: Groundwater monitoring locations for discharges to Rangataua Bay

Since 2016, the groundwater monitoring frequency was increased to a quarterly basis, to be aligned with the seepages and Titiko survey frequency. In January 2018, a new bore TMUG was installed to provide background groundwater chemistry upgradient of Te Maunga landfill and sludge ponds. The location of the new bore is shown in Figure 25.

A summary of the quarterly groundwater monitoring is shown on Table 14 below.

Table 14: Average groundwater quality at Te Maunga ponds monitoring bores

Values	Bore sample site	2015	2016	2017	2018	2019
pH	TM0P1 (West)	7.1	7.2	7.0	7.2	6.9
	TM0P2 (Middle)	7.4	7.2	7.3	7.4	7.2
	TM0P3 (East)	7.3	7.3	7.4	7.5	7.1
	TMG3	7.1	7.1	7.1	7.2	6.8
	TMUG				7.0	6.9
Conductivity (uS/cm)	TM0P1 (West)	154	146	151	549	823
	TM0P2 (Middle)	116	128	123	336	112
	TM0P3 (East)	397	330	198	736	253
	TMG3	195	188	251	576	178
	TMUG				84	20
COD (mg/L)	TM0P1 (West)	17	37	32	55	42
	TM0P2 (Middle)	41	50	36	59	36
	TM0P3 (East)	31	25	42	38	36
	TMG3	44	38	61	42	30
	TMUG				6	6

Sensitivity: General

Values	Bore sample site	2015	2016	2017	2018	2019
BOD_5 (mg/L)	TM0P1 (West)	5	7	5	8	5
	TM0P2 (Middle)	10	12	10	8	6
	TM0P3 (East)	1	1	1	2	5
	TMG3	1	2	1	3	5
	TMUG				4	5
Nitrate-N (mg/L)	TM0P1 (West)	0.002	0.026	0.002	0.027	0.100
	TM0P2 (Middle)	0.002	0.010	0.005	0.111	0.100
	TM0P3 (East)	0.002	0.002	0.002	0.005	0.100
	TMG3	0.002	0.002	0.004	0.002	0.100
	TMUG				1.520	0.940
Ammonia-N (mg/L)	TM0P1 (West)	64.0	63.8	58.8	122.5	96.0
	TM0P2 (Middle)	38.0	46.0	38.8	40.5	35.0
	TM0P3 (East)	2.5	3.0	3.3	4.9	5.0
	TMG3	21.0	20.7	27.3	39.5	110.0
	TMUG				0.1	0.5
Sulphate (mg/L)	TM0P1 (West)	0.4	1.4	1.0	2.3	1.8
	TM0P2 (Middle)	1.4	3.0	2.5	1.9	1.2
	TM0P3 (East)	69.0	55.5	8.0	11.1	21.0
	TMG3	37.0	24.8	27.2	55.9	9.6
	TMUG				9.7	8.9
Chloride (mg/L)	TM0P1 (West)	86.0	68.5	65.3	79.5	80.0
	TM0P2 (Middle)	83.0	89.8	92.5	87.3	91.0
	TM0P3 (East)	690.0	550.0	200.3	245.3	350.0
	TMG3	113.0	122.8	211.0	116.3	71.0
	TMUG				8.5	8.0
Faecal coliforms (cfu/100ml)	TM0P1 (West)	1	10	138	98	2
	TM0P2 (Middle)	0	0	22	1126	3
	TM0P3 (East)	0	1	363	17	7
	TMG3	0	3	41	186	8
	TMUG				2	1
Dissolved Reactive Phosphorus (mg/L)	TM0P1 (West)	30.0	26.8	26.8	27.0	29.0
	TM0P2 (Middle)	14.2	16.5	15.0	15.9	13.7
	TM0P3 (East)	0.0	0.0	0.1	0.0	0.2
	TMG3	1.9	3.8	1.2	0.8	39.0
	TMUG					0.1

From a microbiological perspective, faecal coliforms have not been observed at significant levels except for November 2017 at TMP03 (1100 MPN/100ml) and February 2018 at TMP02 (4500 MPN/100ml). These elevated concentrations significantly reduced on the following monitoring round and all sites remained low for the review period.

Higher values of Chemical Oxygen Demand (COD) and ammonia are observed at the bores around the ponds when compared to the upstream landfill bore TMUG, however no significant changes are noticeable for BOD_5. Conversely, nitrate levels appear to decrease from the upstream landfill bore once it gets to the sludge ponds area.

Sensitivity: General

TMP03 has shown consistently the lowest ammonia levels, whilst the highest values where recorded for TMP01 (2018) and TMG3 (2019). TMP01 is located downgradient of the ponds and TMG3 is located upgradient, so no conclusions can be drawn from this.

Dissolved reactive phosphorus remains higher in downgradient bores TMP01 and TMP02, indicating phosphorus enrichment in the groundwater, likely to be from sludge pond contribution. However, the effect seems to be localised south from the ponds, as bore TMP03 shows low phosphorus levels.

Conductivity and chloride values are significantly lower at TMUG bore, which suggest that the impact of saline intrusion is not as significant as the bores closer to Rangataua Bay. TMG0P3 shows generally the highest levels of chloride, sulphate and conductivity, likely to be the most affected by saline water.

3.4.4 Titiko (Mud Snail) Survey (Clause 6.4)

"6.4 In the month of February each year, at or near low tide, the permit holder shall undertake a survey of titiko (Amphibola crenata) abundance at six locations. The methodology and location of sampling stations shall be consistent with that described by Bioresearches (1996) and MWH (2002)."

Surveys of titiko were carried out annually between 2015 and 2019. In 2015 and 2016 annual surveys in February were undertaken in February at low tide (Figure 22). In 2017, in response to desludging of Pond 1 in 2016, the number of sites monitored and the frequency of monitoring increased to 23 impact sites and five control sites, all monitored quarterly at low tide (Figure 23). De-sludging work also occurred in mid-2018.

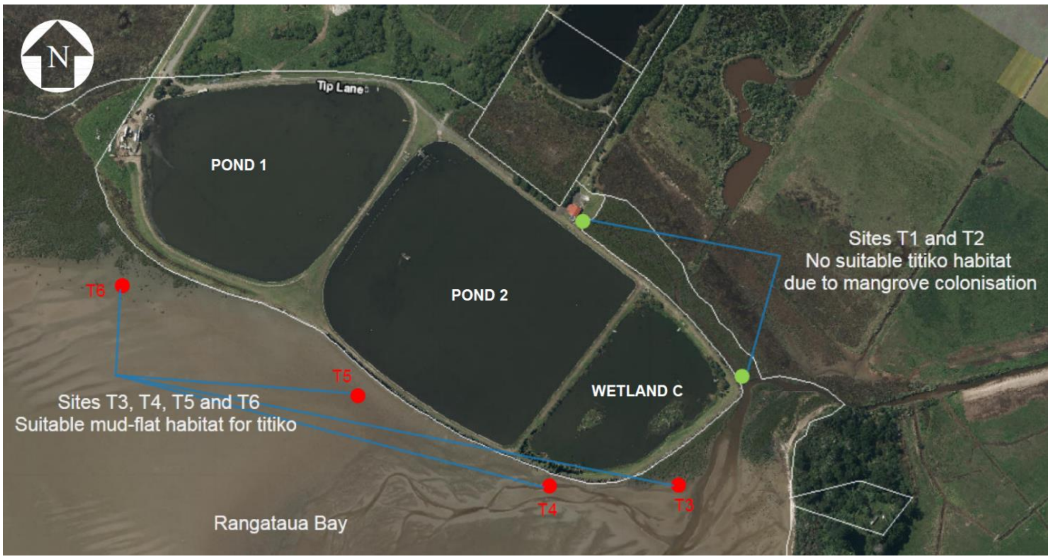


Figure 22: Titiko survey locations in 2015 and 2016 (Aquatek, 2016)

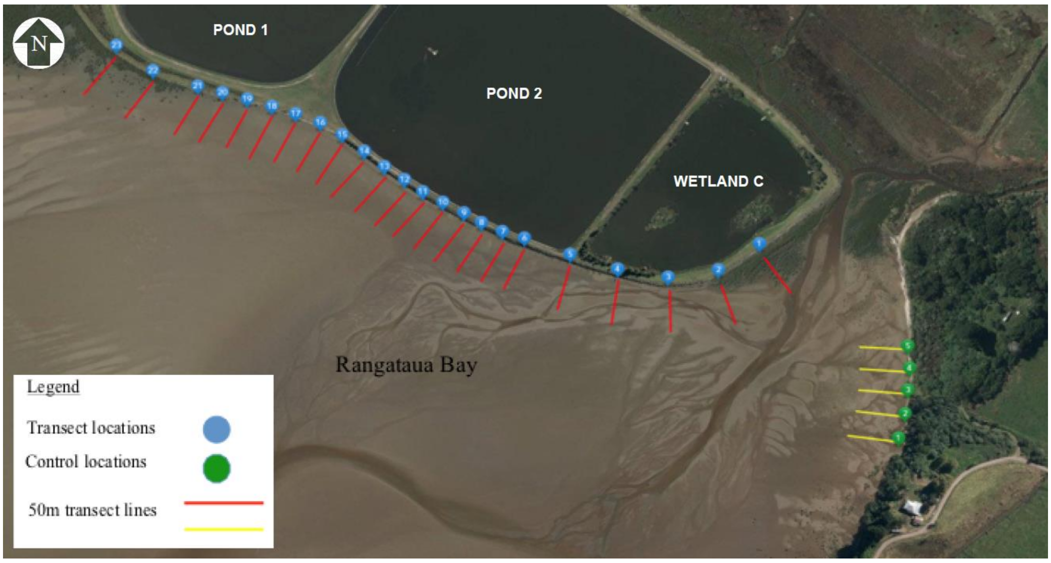


Figure 23: Titiko survey locations 2017-2019 (Aquatek, 2017)

Review of the methodology, data collected, data analysis and interpretation of results raised a number of potential issues:

1. The objective of the monitoring is to determine whether the seepages are having an adverse effect on the abundance of harvestable and non-harvestable sized titiko. However, titiko distribution (similar to many other benthic invertebrates) is naturally highly variable in space and time, which makes it difficult to detect trends in abundance over time within sites and difficult to detect significant differences in abundance between sites. In addition, titiko distribution is also driven by natural environmental factors such as freshwater input, sediment grain size and mangrove density. Those environmental factors confound analysis of abundance along the face of ponds 1 and 2, as there are freshwater inputs and mangroves present at the eastern and western ends of the survey sites, but those factors are absent along the face of the ponds.
2. The data collected shows high spatial heterogeneity, with a high proportion of zero counts in the data set. This lack of equal variance across the data makes it difficult to satisfy the assumptions of many univariate statistical analyses. It is not clear from the existing reports what statistical analyses were carried out. Use of a permutational analysis of variance approach (Permanova) is recommended which avoids many of the assumptions in univariate analyses.
3. Scaling up of the raw data from a 0.25m^2 quadrat to per 1 m^2, as has been reported, may not be appropriate when the data is highly variable, with a large proportion of zero counts.
4. Due to the identified issues with the monitoring design and analysis of the titiko data, the conclusions drawn may not be accurate

Re-analysis of the 2017-2019 abundance data revealed statistically significantly higher abundance of titiko at control sites compared to impact sites. However, abundance was highly variable across the impact sites, with higher abundance of titiko at both the western and eastern ends of the ponds where there is freshwater input and sparse mangrove cover. Analysis also indicated that titiko abundance adjacent to seepage sites W6 and W6a was not different to abundance at neighbouring sites along the face of the ponds where there are no seepages. In addition, abundance was highly variable among years. Due to this high spatial and temporal variability in titiko abundance and differences in habitat characteristics, we do not consider the statistically higher abundance at the control sites is due to pond seepages. The most likely explanation for differences in abundance detected both within the impact transects and between impact and control transects is differences in habitat characteristics. Ongoing monitoring of abundance of titiko, relative to seepages, is unlikely to provide meaningful data to inform whether there is a causal relationship. We recommend that size/abundance titiko monitoring is refocussed on titiko health rather than titiko abundance (e.g. monitoring of body burden of contaminants and indicator bacteria).

Aside from the abundance surveys carried out as required by conditions of consent, other research has been undertaken in Rangataua Bay in relation to the WWTP. These research projects also provide important background information about the effect of WWTP discharges/seepages on titiko. Contaminants were measured in titiko by Taikato et al. (2016) with no obvious trend evident in metal concentrations with proximity to the WWTP ponds. Huteau (2015) surveyed isotopic signatures of faecal contaminants in the WWTP discharges and the Mangatawa drain (Rocky Stream) concluded that the Mangatawa drain had a similar signature to the wastewater with the potential for septic tank leachate to be entering that waterway. Taikato et al. (2016) also concluded with respect to faecal indicator bacteria survey that titiko are fit for consumption most of the time. E. coli concentrations in titiko in Rangataua Bay were similar to those detected in shellfish in other parts of Tauranga Harbour (Scholes et al., 2009). These surveys indicate that faecal contaminants in Rangataua Bay are sourced from the WWTP and Mangatawa drain and titiko in Rangataua Bay do not have elevated metal concentrations and their E. coli concentrations are similar to elsewhere in Tauranga Harbour.

3.5 Consent 67894 – Sludge Disposal at Te Maunga Landfill

3.5.1 Sludge Disposal (Clause 10.2)

"10.2 The sludge disposed of in the trenches shall contain no less than 16% solids by weight to be verified by a laboratory analysis taken from no less than one composite sample per 500 cubic metres of dewatered sludge discharged."

As stated in the consent, the percentage of solids in dewatered sludge to be disposed in the Te Maunga landfill trenches has to be no less than 16% solids by weight. The solids concentration is measured during each of the desludging campaigns undertaken at Te Maunga. Table 15 shows the average and minimum solids concentrations recorded since 2015.

Table 15: Solids concentration in sludge to Te Maunga landfill

Year	Average of Solids in Sludge (% by weight)	Minimum of Solids in Sludge (% by weight)
2015	32.26	14.40
2016	38.47	26.30
2017	26.56	19.67
2018	27.39	14.36
2019	32.12	30.68

The results show that the average concentrations are in the range expected for dewatered sludge. Figure 24 below shows that for all measurements taken since 2015, only 4% of them were below the consent limit (<16%). All the samples below the limit were taken between March and May 2015, plus another sample taken on September 2018.

Sensitivity: General

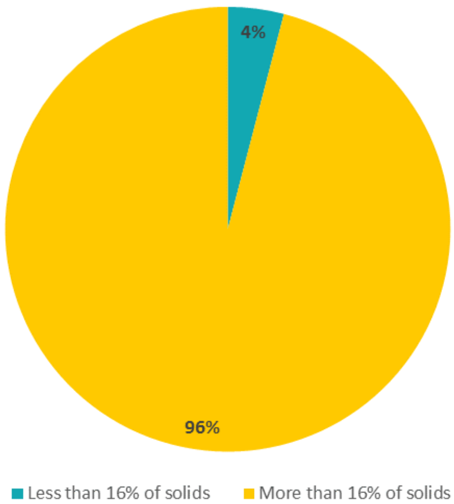


Figure 24: Percentage of samples below consent limit for solids in sludge

3.5.2 Trench Inspections (Clause 13.3)

"13.3 The integrity of the cap of the trenches shall be inspected annually and repaired within 3 months if required."

The TCC Wastewater Operations team regularly inspects the condition of the trenches and leachate collection system of the landfill, to ensure that the erosion and sediment controls, spillways, erosion protection devices and dust controls are maintained in an effective capacity at all times. Following a desludging campaign in 2016 and requested by the desludging contractor Conhur, a geotechnical assessment of the sludge disposal was undertaken by Terrane Geotechnical Solutions (Terrane, 2016). A detailed walkover inspection and penetrometer testing was conducted to confirm the extents of the sludge beds. The results of the inspection showed that the disposal beds appeared to be satisfactory in terms of the geotechnical aspects of the consent. An additional inspection was undertaken in October 2017 for disposal beds 15 and 16, which confirmed the good condition of the new disposal beds. Further inspections have been undertaken during 2018 and 2019 to identify possible health and safety issues with the trenches. During 2019, TCC fenced off the landfill soft areas and a security fence was installed to restrict the access to the trenches area.

The monitoring controls undertaken by TCC appear to be adequate for ensuring a satisfactory maintenance of the landfill. However, it is recommended that TCC formally documents the annual inspections of the trenches and repairs made to the cap of the trenches (if any) as required by the consent.

3.5.3 Groundwater Monitoring (Clauses 14.4 & 14.6)

4.4 The consent holder shall undertake groundwater monitoring, as follows:

- *a) Groundwater samples will be taken from onsite monitoring bores TMG1, TMG3 and TMG4 within the four weeks prior to the commencement of sludge disposal under this permit.*
- *b) Once sludge disposal commences, groundwater samples shall be taken from onsite monitoring bores TMG1, TMG3 and TMG4, bi-annually in the months of March and September, for the duration of the consent.*
- *c) The water samples taken in condition 14.4(a) and (b) shall be analysed for the following constituents:*

Sensitivity: General

- *Arsenic*
- *Cadmium*
- *Chromium*
- *Copper*
- *Lead*
- *Mercury*
- *Nickel*
- *Zinc*

14.6 The consent holder shall repeat the sampling and analysis within one month if the results obtained under condition 14.4 (c) exceed the Australia New Zealand Environmental Conservation Council Guidelines for Fresh and Marine Water Quality (ANZECC, 2000 Guidelines), 80% trigger value for marine water."

Groundwater is to be monitored twice a year (March and September) from bores TMG1, TMG3 and TMG4. TCC included the existing bore TMG2 to their monitoring programme, and in January 2018 installed a new bore TMUG to provide background groundwater chemistry upgradient of the landfill. The approximate location of the monitoring bores is shown in Figure 25.

Figure 25: Groundwater monitoring locations for sludge disposal at Te Maunga Landfill

The average results of the groundwater monitoring programme are shown in Table 16 below.

Table 16: Average groundwater quality at Te Maunga landfill monitoring bores

Values	Sample Site	2016	2017	2018	2019
Arsenic (mg/L)	Bore TMG1	0.0010	0.0010	0.0010	0.0010
	Bore TMG2	0.0031	0.0041	0.0031	0.0041
	Bore TMG3	0.0026	0.0010	0.0010	0.0010
	Bore TMG4	0.0043	0.0010	0.0032	0.0010

Sensitivity: General

Values	Sample Site	2016	2017	2018	2019
	Bore TMUG			0.0010	0.0010
Cadmium (mg/L)	Bore TMG1	0.000053	0.000053	0.000053	0.000083
	Bore TMG2	0.000132	0.000210	0.000066	0.000210
	Bore TMG3	0.000132	0.000053	0.000053	0.000053
	Bore TMG4	0.000132	0.000053	0.000162	0.000053
	Bore TMUG			0.000053	0.000053
Chromium (mg/L)	Bore TMG1	0.00053	0.00060	0.00075	0.00053
	Bore TMG2	0.00515	0.00270	0.00230	0.00330
	Bore TMG3	0.00082	0.00063	0.00106	0.00143
	Bore TMG4	0.00141	0.00104	0.00255	0.00065
	Bore TMUG			0.00093	0.00053
Copper (mg/L)	Bore TMG1	0.00110	0.00490	0.00053	0.00055
	Bore TMG2	0.00106	0.00110	0.00110	0.00110
	Bore TMG3	0.00082	0.00053	0.06027	0.00053
	Bore TMG4	0.00127	0.00053	0.00342	0.00126
	Bore TMUG			0.00101	0.00102
Lead (mg/L)	Bore TMG1	0.00020	0.00048	0.00011	0.00011
	Bore TMG2	0.00071	0.00110	0.00066	0.00110
	Bore TMG3	0.00061	0.00011	0.00089	0.00011
	Bore TMG4	0.00061	0.00011	0.00032	0.00018
	Bore TMUG			0.00011	0.00011
Mercury (mg/L)	Bore TMG1	0.00008	0.00008	0.00008	0.00008
	Bore TMG2	0.00008	0.00008	0.00008	0.00008
	Bore TMG3	0.00008	0.00008	0.00008	0.00008
	Bore TMG4	0.00008	0.00008	0.00010	0.00008
	Bore TMUG			0.00008	0.00008
Nickel (mg/L)	Bore TMG1	0.00053	0.00185	0.00053	0.00330
	Bore TMG2	0.00405	0.00500	0.00420	0.00700
	Bore TMG3	0.00405	0.00062	0.00197	0.00107
	Bore TMG4	0.00405	0.00055	0.00243	0.00085
	Bore TMUG			0.00085	0.00053
Zinc (mg/L)	Bore TMG1	0.0800	0.6300	0.0905	0.1230
	Bore TMG2	0.0059	0.0138	0.0053	0.0057
	Bore TMG3	0.0027	0.0011	0.0391	0.0011
	Bore TMG4	0.0100	0.0127	0.0128	0.0091
	Bore TMUG			0.0014	0.0013

Arsenic, cadmium, chromium, nickel and lead have remained below the 80% trigger value for marine water as set by the consent. A sample taken from TMG3 on May 2018 showed concentrations of copper and zinc above the trigger level, however it is suspected that the cause was an anomaly during the testing as this was a one-off result. Resampling undertaken as required by the consent indicated that all levels were below the 80% trigger values and it has remained compliant since then.

Zinc concentrations in TMG1 regularly exceed the 80% trigger value of 0.043 mg/L. TCC has undertaken a series of actions to understand the source of zinc levels in this bore, including the development of a groundwater model, construction of a new monitoring bore upstream of the landfill and zinc testing at the ponds. The results indicate that most likely a different source of zinc is reporting at TMG than from the landfill (CH2M Beca: Te Maunga RC67894 – Condition 14 Monitoring and Reporting Requirements 2017-2018, 2018)

The leachate from the landfill is collected through a drainage system and pumped back to the treatment plant, so any potential zinc. from the landfill is being recycled through the treatment plant processes. Zinc was also tested at the oxidation pond that receives the treated wastewater from the treatment plant and the results were all below the trigger values.

3.6 Consent 62722 – Air Discharges at Chapel Street

3.6.1 Biennial Community Survey (Clause 7.1)

"7.1 The permit holder shall undertake a community-based odour survey within six months of the commencement of the permit and every two years thereafter for the term of the permit, for the purpose of assessing the effectiveness of odour control at the plant and the levels of off-site odour. The survey shall be carried out in accordance with procedures set out in the Odour Management Plan."

Community telephone odour surveys have been carried out in 2016 and 2018 by Key Research Group. The study and control areas used for the survey are shown in Figure 26 below.

Figure 26: Biennial telephone odour survey areas for Chapel Street

Levels of odour annoyance from the questionnaire were recorded and categorised to determine a "percent of at least annoyed" as a key statistic. The results from both the study and control groups show that the "at least annoyed" levels have remained well below the Ministry for Environment (MfE) guidelines of 20% for the 2016 and 2018 surveys, indicating a community not affected by odour from Chapel Street WWTP.

Sensitivity: General

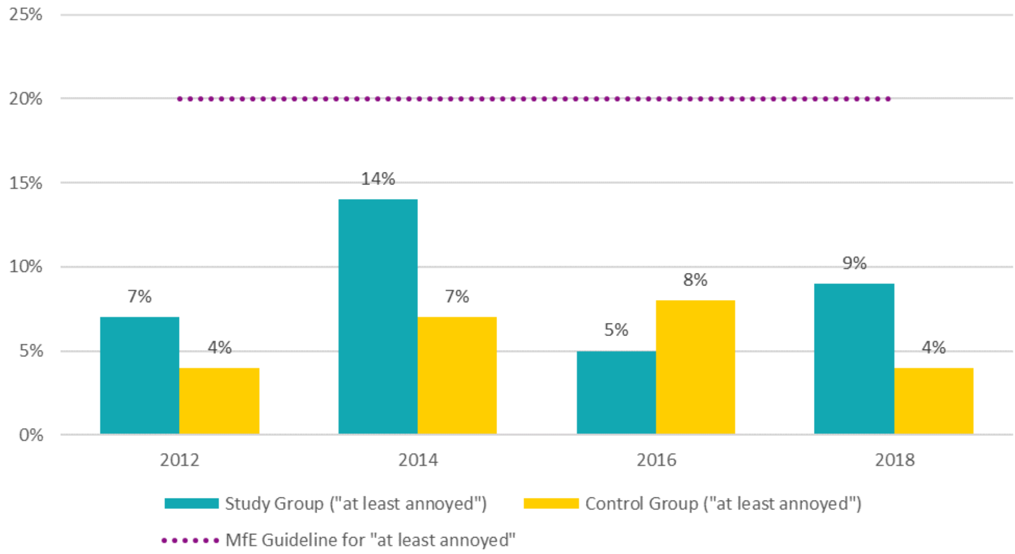


Figure 27: Biennial odour survey results for Chapel Street WWTP

3.6.2 Annual Odour Monitoring (Clause 8.1)

"8.1 The permit holder shall undertake monitoring of odour discharge rates at least once every twelve months. The monitoring shall be on:

a) All biofilters, unless agreed otherwise in writing; and
b) A secondary sedimentation tank; and
c) The contact stabilisation tank; and
d) One representative primary sedimentation tank if uncovered."

Odour flux monitoring has been carried out annually by an independent external contractor at all the locations required by the consent. Results show that odours at the stabilisation tank and secondary sedimentation tank have remained light to moderate, with a peak during the 2017 inspection where odours where described as moderate sewage. At the biofilters outlet, odour has consistently been described as light vegetation/indiscernible.

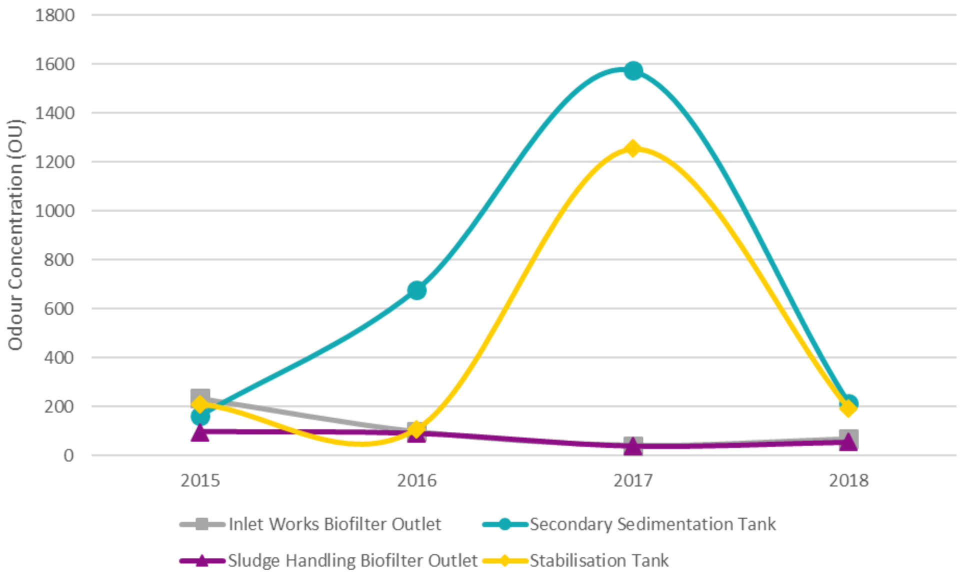


Figure 28: Odour flux monitoring at Chapel Street WWTP

Odour is monitored at the biofilters inlet/outlet to estimate the odour removal efficiency. The odour at the inlet to the biofilters has been described as strong sewage during all monitoring rounds, however it has not been very noticeable at the biofilters outlet. The efficiency in odour removal has remained over 96% since 2015 as shown in Figure 29, which is within the expected range for biofilters efficiency.

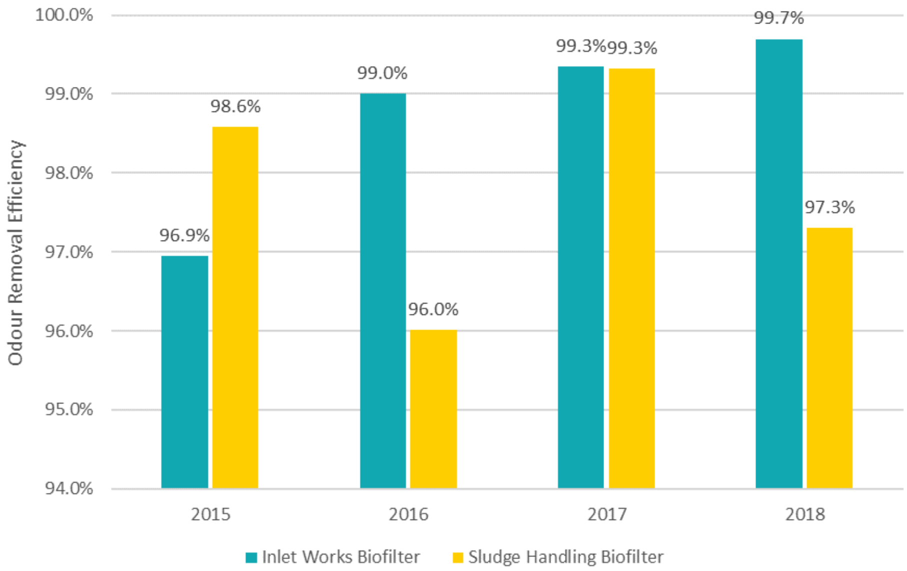


Figure 29: Chapel Street biofilters odour removal efficiency

3.6.3 Monthly Walkover Inspections (Clause 8.3)

"8.3 That the permit holder shall undertake a walkover inspection of the treatment plant and surrounding neighbourhood on at least a monthly basis. Any evidence of actual odour shall be recorded and investigated. Where necessary remedial action shall be undertaken as soon as practicable. The procedures for the walkover, recording of the results and remedial actions shall be detailed in the Odour Management Plan."

The review of the monthly reports indicates that some odour is usually noted with the plant during the walkover inspections, generally described as musty/earthy/mouldy with intensities going from barely noticeable to mild. The odours detected inside the plant have not been noticeable beyond the plant boundary, except for the inspection carried out on January 2016 where moderate odours where detected around clarifiers and humid weather caused odour beyond plant boundary.

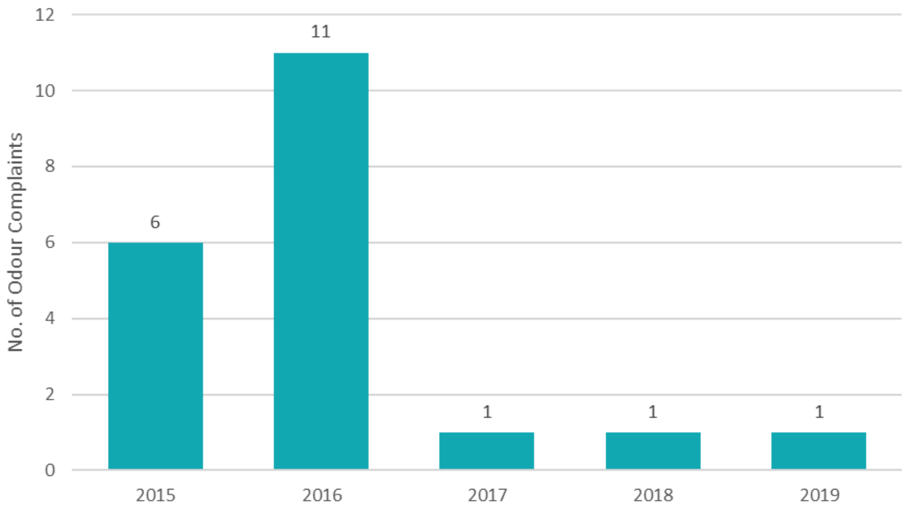
3.6.4 Complaints (Clause 9.3)

"9.3 That the permit holder shall log all air quality complaints received. The complaint details shall include:

a) The date, time, position and nature of the complaint; and
b) The name, phone number and address of the complainant, unless the complainant refuses to supply these details: and
c) Any remedial actions undertaken."

TCC has an odour complaint register which has been the primary source of information for this section. The complaint register indicates that on average only one or two complaints are received every year, which is considered to be relatively low given the vicinity of high sensitivity receptors and the scale of the operations. However, some events have been recorded showing high odour levels which led to an unusual number of complaints:

- Four of the six complaints in 2015 were received between the 2nd and 16th December. The high frequency of complaints received during this period suggests that the odours emitted from the site were higher than usual. Causes of odour were investigated following complaints and sea lettuce was identified as a contributing factor to the odours, rather than plant operation.
- A total of eight complaints during 2016 refer to a single odour event which occurred on 6 Jan. The event appears to have been due to a contaminant upsetting the treatment process.



Sensitivity: General

Figure 30: No. of odour complaints related to Chapel Street WWTP

Most of the complaints were reported from staff working at the adjacent shopping centre or people visiting the shopping centre. Only a comparatively small number of complaints have been received from residents.

3.7 Consent 62723 – Air Discharges at Te Maunga

3.7.1 Biennial Community Survey (Clause 7.1)

"7.1 The permit holder shall undertake a community-based odour survey within six months of the commencement of the permit and every two years thereafter for the term of the permit, for the purpose of assessing the effectiveness of odour control at the plant and the levels of off-site odour. The survey shall be undertaken in accordance with procedures set out in the Odour Management Plan."

Community telephone odour surveys have been carried out in 2016 and 2018 by Key Research Group. The study and control areas used for the survey are shown in Figure 31 below.

Figure 31: Biennial telephone odour survey areas for Te Maunga

Levels of odour annoyance from the questionnaire were recorded and categorised to determine a "percent of at least annoyed" as key statistic. The results from both the study and control groups show that the "at least annoyed" levels have remained below the MfE guidelines of 20% for the 2016 and 2018 surveys, indicating a community not affected by odour from Te Maunga WWTP. There is an increasing trend in the control group reporting odour annoyance since 2012. Given the distance from the treatment plant and the location of the control zone, upstream of the prevailing winds, it is very unlikely that the source of unpleasant odours is the plant itself. The results from the study group, which are most likely affected by odours from the treatment plant, suggest that the majority of residents in the vicinity of Te Maunga WWTP consider the odour level emitted from the plant as acceptable.

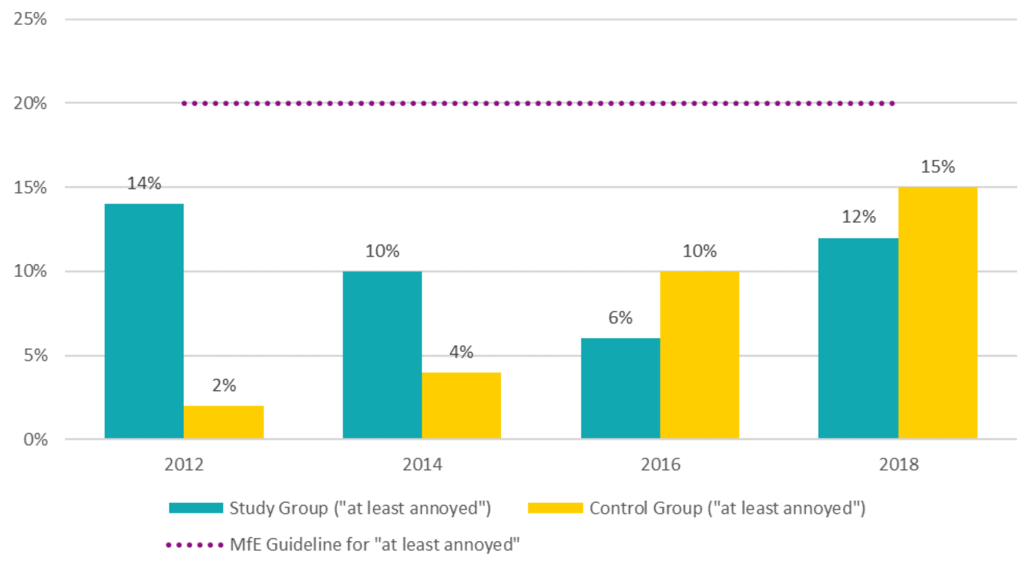


Figure 32: Biennial odour survey results for Te Maunga WWTP

3.7.2 Annual Odour Monitoring (Clause 8.1)

"8.1 The permit holder shall undertake monitoring of odour discharge rates once every twelve months. The monitoring shall be on:

a) All biofilters, unless agreed otherwise in writing; and
b) A secondary sedimentation tank; and
c) At least two locations within the aeration ditch."

Odour flux monitoring has been carried out annually by an independent external contractor at all the locations required by the consent. Results show that odours at the aeration tanks and clarifier are generally described as light/moderate with a chemical/mould/earthy smell. At the biofilter outlet, odour has consistently been described as light vegetation/indiscernible.

Sensitivity: General

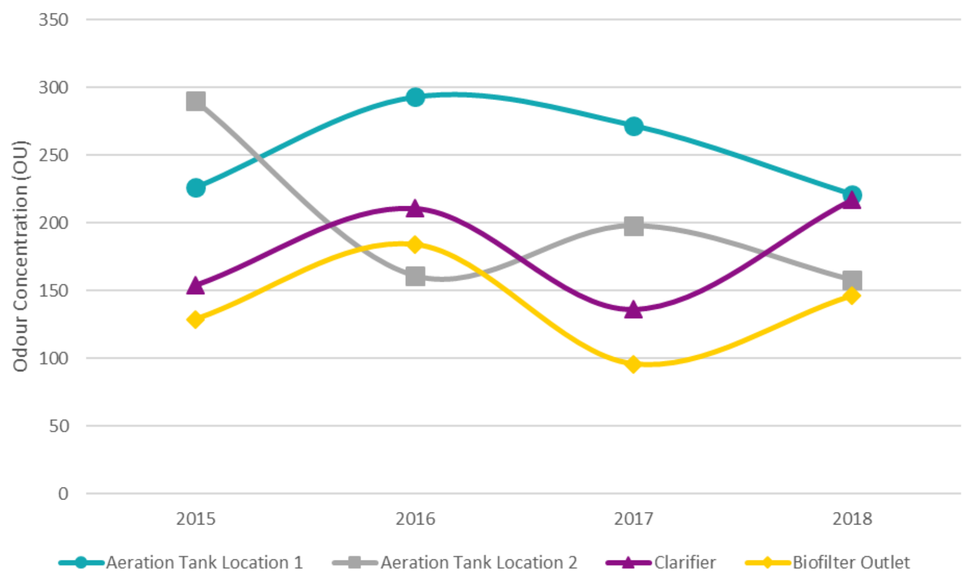


Figure 33: Odour flux monitoring at Te Maunga WWTP

Odour is monitored at the biofilter inlet/outlet to estimate the odour removal efficiency. The odour at the inlet to the biofilter has been described as strong sewage during all monitoring rounds, however it has not been very noticeable at the biofilter outlet. The efficiency in odour removal has remained over 97% since 2015 as shown in Figure 34, which is within the expected range for the biofilters efficiency.

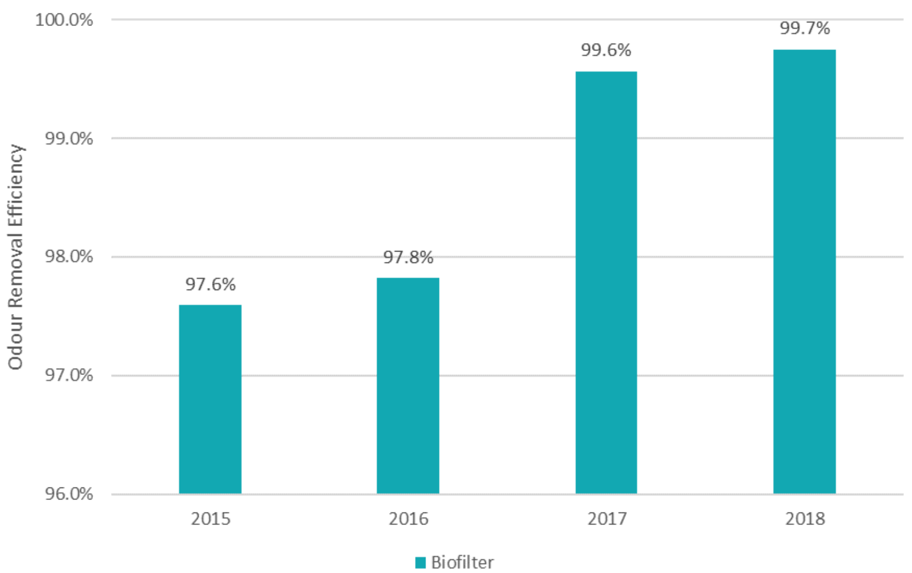


Figure 34: Te Maunga biofilter odour removal efficiency

3.7.3 Monthly Walkover Inspections (Clause 8.3)

"8.3 The permit holder shall undertake a walkover inspection of the treatment plant and surrounding neighbourhood on at least a monthly basis. Any evidence of actual odour shall be recorded and investigated. Where necessary remedial action shall be undertaken as soon as practicable."

The review of the monthly reports indicates that some odour is usually noted with the plant during the walkover inspections, generally described as musty/earthy/mouldy with intensities going from barely noticeable to moderate. The odours detected inside the plant have not been noticeable beyond the plant boundary, except for the inspection carried out on April 2015 where strong odour around the clarifier tank was caused by a clarifier pump failure.

3.7.4 Complaints (Clause 9.3)

"9.3 The permit holder shall log all air quality complaints received. The complaint details shall include:

a) The date, time, position and nature of the complaint; and
b) The name, phone number and address of the complainant, unless the complainant refuses to supply these details: and
c) Any remedial actions undertaken."

TCC has an odour complaint register which has been the primary source of information for this section. The complaint register indicates that no more than six complaints are received every year, which is considered to be relatively low given the scale of the operations. Investigations following the complaints have identified that in most cases the plant was not the source of odour.

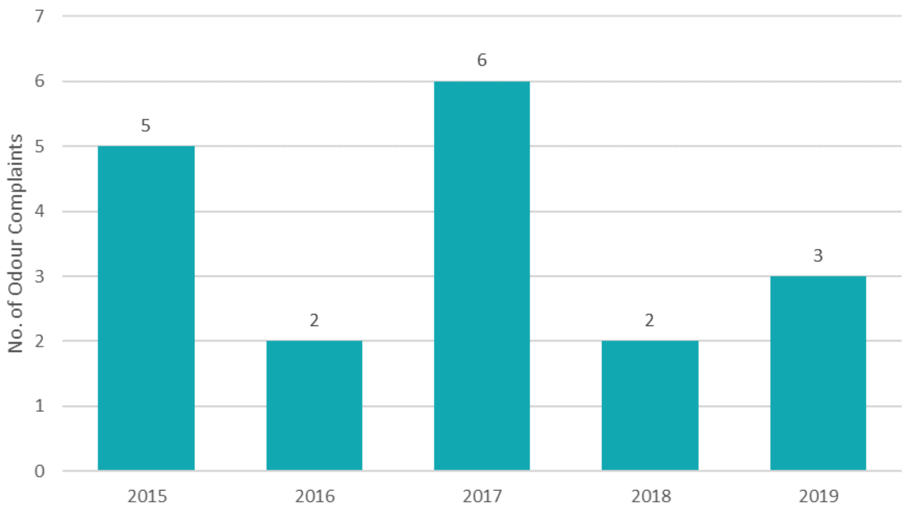


Figure 35: No. of odour complaints related to Te Maunga WWTP

4 Consent Compliance Assessment

An analysis of consent compliance has been undertaken for each of the current consents, as per the relevant conditions of that consent. This is in accordance with condition 20.1(e) of permit 62878 which states that the scope of the assessment should address:

“On-going compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions”.

The approach taken to this assessment includes a review of compliance with operational conditions (such as sampling, monitoring and compliance) for each consent. This provides a level of day-to-day compliance of the WWTP with the respective consents.

4.1 Consent 62878 – Ocean Outfall Discharges

The on-going operational conditions of this consent and associated compliance summary are presented in Table 17 below.

Table 17: Consent 62878 operational consent compliance

Clause	Description	Summary of Compliance
5	Outfall discharge – Limits: 50,000m^3/d and 900 L/s	• Average daily discharge below limit: – 2015: 25,115 m^3/d – 2016: 28,907 m^3/d – 2017: 33,050 m^3/d – 2018: 34,198 m^3/d – 2019: 29,739 m^3/d • Highest flow rate recorded over the past five years was 586 L/s on 13 June 2018
6	UV Disinfection to be operational nine years after the issue of consent (23 January 2015)	• Non-compliant. UV plant was installed and commissioned in late 2015. UV plant has shut down due to operational issues on occasions, however the discharges had all been within consent conditions. (BOPRC, 2019)
7.3	Outfall diffuser inspection - Annual	• Compliant, outfall inspected every year and report prepared
9.1	Rate and volume of treated wastewater entering outfall pipeline – Continuous.	• Compliant, discharge rate recorded continuously
9.2	Monitoring to be undertaken as per Schedule 1	• All monitoring of the twice-weekly, monthly, quarterly and annually parameters was undertaken as required. Missing data for twice-weekly parameters corresponding to the second week of March 2015.
10.1 & 10.2	Combined treated wastewater quality – BOD_5, TSS, Enterococci	• All results compliant. The number of exceedances per quarter is all within consent limits.
11.1	Receiving water monitoring – Frequency and location	• A minimum of five samples per month (December to March) on each of the nine locations have been collected since 2015, except for January 2016 where no samples were taken due to poor sea conditions. On the following month (February 2016) ten samples were collected from each station, giving a total of twenty samples per station per year

Clause	Description	Summary of Compliance
11.2	Receiving water monitoring – Enterococci levels	• 2015: Non-compliant (six samples exceeded 104 enterococci per 100ml in March). Resampling was undertaken three weeks later (still in March) and no exceedances were observed. It was thought that the non-compliant results were not representative and there was a small amount of rain on the day of sampling and two days prior that may have affected the results. • 2016 - 2019: All compliant
11.3	Receiving water monitoring – Notify BOPRC and Toi Te Ora following non-compliances	• Partially-compliant: The exceedances in the 2015 receiving water monitoring were discussed with BOPRC at the two monthly meetings. Although Toi Te Ora was not notified. Repeated sampling showed no exceedance.
12.1	Shellfish (Tuatua) monitoring on beach – Frequency: Five replicate samples per station	• 2015: Samples collected during March instead of February (due to a cyclone in February) • 2016 - 2018: All compliant • 2019: In February, four samples were collected at the station located 1km SE of the outfall. The fifth sample was unavailable due to lack of shellfish.
12.2	a) Shellfish (Tuatua) monitoring on beach – Limits: 1/5 replicates >230 E. coli/100mg b) Metals – Arsenic, copper, lead, mercury, nickel, zinc c) Notify BOPRC and Pacific Health following non-compliances	• 2015: Non-compliant – One sample over 700 E. coli at 1000m SE of outfall – Four samples over 700 E. coli at 2000m SE of outfall The exceedances in the 2015 shellfish (tuatua) monitoring were discussed with BOPRC at the two monthly meetings. Although Toi Te Ora was not notified. Repeated sampling showed no exceedance. • 2016 - 2019: All compliant
12.3	Outfall mussel testing – (Three replicates) Arsenic, cadmium, chromium, copper, mercury, lead, nickel, zinc	• All monitoring undertaken in reporting period - compliant
20.1	Monitoring, upgrade and technology review report	• This report is due March 2020

Treated Wastewater Quality (Clauses 9.2, 10.1 & 10.2)

Table 18 summarises the limits set by the consent regarding the twice-weekly parameters at the effluent pump station. The consent allows for a certain number of samples to be over the limits, and defines the number of exceedances allowed for the 50%ile and 95%ile.

Table 18: Treated wastewater quality consent condition limits

Twice-Weekly Samples	Sample Type	No more than 16 samples may exceed these limits out of 26 samples (50%ile)	No more than 3 samples may exceed these limits out of 26 samples (95%ile)
BOD_5 (mg/L)	Composite	25	30
TSS (mg/L)	Composite	50	80
Enterococci (cfu/100mL)	Grab	3500	-

An assessment per quarter was undertaken to determine the number of exceedances based on the tolerances presented in Table 18. There have been no breaches to the consent conditions in the review period in terms of concentrations. For the monitoring frequency, there was a sample missing for the second week of March 2015.

Table 19: Number of exceedances of discharge standards summary

Quarter[4]	BOD_5>25mg/L	BOD_5>30mg/l	TSS>50mg/l	TSS>80mg/l	Enterococci>3500
2015-Q1	1	0	3	0	5
2015-Q2	0	0	2	0	3
2015-Q3	0	0	2	0	2
2015-Q4	1	0	1	0	4
2016-Q1	9	2	4	1	7
2016-Q2	0	0	0	0	13
2016-Q3	4	2	0	0	8
2016-Q4	0	0	0	0	2
2017-Q1	0	0	0	0	3
2017-Q2	0	0	0	0	3
2017-Q3	0	0	0	0	3
2017-Q4	3	1	3	0	0
2018-Q1	0	0	2	0	0
2018-Q2	0	0	0	0	7
2018-Q3	0	0	2	0	0
2018-Q4	0	0	2	0	0
2019-Q1	0	0	2	0	4
Green: Compliant			Red: Non-compliant		

4.1.1 Receiving Water Monitoring (Clauses 11.1 & 11.2)

Table 20 provides a summary of the consent limits for the receiving water monitoring in terms of the number of exceedances allowed for Enterococci.

Table 20: Enterococci consent conditions regarding ocean water quality

Item	Consent Limit 1	Consent Limit 2
Enterococci	No more than 13 samples per station out of 20 samples (50%ile) may exceed 35 Enterococci per 100ml	No sample to exceed 104 Enterococci per 100ml

An assessment on the number of exceedances per station for each year was undertaken based on the available data. A total of six samples taken on 4 March 2015 were non-compliant, beyond the consent limit of 104 Enterococci/100mL. The maximum concentration (2,500 MPN/100mL) was obtained at the outfall location. Resampling was carried out two weeks later and all results were below 10 MPN/100mL. It was thought that the non-compliant results were not representative and there was a small amount of rain on the day of sampling and two days prior that may have affected the results. Table 21 summarises the number of exceedances since 2015.

Table 21: Exceedance of receiving water quality summary

Years	Stations	Enterococci>35	Enterococci>104
2015	2.0 Km Mount Side	0	0
	1.5 Km Mount Side	1	0
	1.0 Km Mount Side	2	0

[4] Q1 starting on 1 February, Q2 on 1 May, Q3 on 1 August, Q4 on 1 November

Sensitivity: General

Years	Stations	Enterococci>35	Enterococci>104
	0.5 Km Mount Side	0	0
	Outfall	2	2
	0.5 KM Papamoa Side	1	1
	1.0 KM Papamoa Side	3	2
	1.5 KM Papamoa Side	0	0
	2.0 KM Papamoa Side	3	1
2016	2.0 Km Mount Side	0	0
	1.5 Km Mount Side	0	0
	1.0 Km Mount Side	0	0
	0.5 Km Mount Side	0	0
	Outfall	0	0
	0.5 KM Papamoa Side	0	0
	1.0 KM Papamoa Side	0	0
	1.5 KM Papamoa Side	0	0
	2.0 KM Papamoa Side	0	0
2017	2.0 Km Mount Side	0	0
	1.5 Km Mount Side	0	0
	1.0 Km Mount Side	0	0
	0.5 Km Mount Side	0	0
	Outfall	0	0
	0.5 KM Papamoa Side	0	0
	1.0 KM Papamoa Side	0	0
	1.5 KM Papamoa Side	0	0
	2.0 KM Papamoa Side	0	0
2018	2.0 Km Mount Side	0	0
	1.5 Km Mount Side	0	0
	1.0 Km Mount Side	0	0
	0.5 Km Mount Side	0	0
	Outfall	0	0
	0.5 KM Papamoa Side	0	0
	1.0 KM Papamoa Side	0	0
	1.5 KM Papamoa Side	0	0
	2.0 KM Papamoa Side	0	0
2019	2.0 Km Mount Side	0	0
	1.5 Km Mount Side	1	0
	1.0 Km Mount Side	0	0
	0.5 Km Mount Side	0	0
	Outfall	0	0
	0.5 KM Papamoa Side	0	0
	1.0 KM Papamoa Side	0	0
	1.5 KM Papamoa Side	0	0
	2.0 KM Papamoa Side	0	0
Green: Compliant		Red: Non-compliant	

4.1.2 Shellfish (Tuatua) Monitoring (Clauses 12.1 & 12.2)

Table 22 summarises the consent limits for the shellfish monitoring at the beach adjacent to the outfall.

Table 22: Shellfish sampling consent limits

Item	Consent Limit
E. coli (MPN/100g)	No more than 1 sample to exceed 230 E. coli/100g and no sample to exceed 700 E. coli/100g
Arsenic (organic) (mg/kg)	2 (equivalent to 20 mg/kg total arsenic)
Copper (mg/kg)	30
Lead (mg/kg)	0.5
Mercury (mg/kg)	0.5
Nickel (mg/kg)	2
Zinc (mg/kg)	40

An assessment on the number of exceedances per station for each year was undertaken based on the available data. During 2015, four samples taken at 2000m SE from the outfall were above the consent limit, with concentrations of 930 E. coli/100g. A sample collected from the station 1000m SE from the outfall was also exceeded, with 2400 E. coli/100g. Resampling for *E. coli* was undertaken a month later following the exceedances registered during 2015 monitoring and no further exceedances were observed. All other results were below the consent limits. Table 23 summarises the number of exceedances since 2015.

Table 23: Shellfish samples number of exceedances summary

Year	Monitoring station	E.coli >230	E.coli >700	Arsenic>2	Copper>30	Lead> 0.5	Mercury>0.5	Nickel >2	Zinc> 40
2015	2000 m NW of outfall	0	0	0	0	0	0	0	0
	1000 m NW outfall	0	0	0	0	0	0	0	0
	On outfall alignment	0	0	0	0	0	0	0	0
	1000 m SE outfall	1	1	0	0	0	0	0	0
	2000 m SE outfall	4	4	0	0	0	0	0	0
2016	2000 m NW of outfall	0	0	0	0	0	0	0	0
	1000 m NW outfall	0	0	0	0	0	0	0	0
	On outfall alignment	0	0	0	0	0	0	0	0
	1000 m SE outfall	0	0	0	0	0	0	0	0
	2000 m SE outfall	0	0	0	0	0	0	0	0
2017	2000 m NW of outfall	0	0	0	0	0	0	0	0
	1000 m NW outfall	0	0	0	0	0	0	0	0
	On outfall alignment	0	0	0	0	0	0	0	0
	1000 m SE outfall	0	0	0	0	0	0	0	0
	2000 m SE outfall	0	0	0	0	0	0	0	0
2018	2000 m NW of outfall	0	0	0	0	0	0	0	0
	1000 m NW outfall	0	0	0	0	0	0	0	0
	On outfall alignment	0	0	0	0	0	0	0	0
	1000 m SE outfall	0	0	0	0	0	0	0	0
	2000 m SE outfall	0	0	0	0	0	0	0	0
2019	2000 m NW of outfall	0	0	0	0	0	0	0	0
	1000 m NW outfall	0	0	0	0	0	0	0	0
	On outfall alignment	0	0	0	0	0	0	0	0
	1000 m SE outfall	0	0	0	0	0	0	0	0

Year	Monitoring station	E.coli >230	E.coli >700	Arsenic>2	Copper>30	Lead>0.5	Mercury>0.5	Nickel >2	Zinc>40
	2000 m SE outfall	0	0	0	0	0	0	0	0
Green: Compliant					Red: Non-compliant				

4.2 Consent 62881 – Seepages from Te Maunga Oxidation Ponds

The ongoing operational conditions of this consent and associated compliance summary are presented in Table 24 below.

Table 24: Consent 62881 operational consent compliance

Clause	Description	Summary of Compliance
2	Seepage rates – Limits: 43.2 m^3/d, 1 L/s	• All measurements below consent limits.
6.1 & 6.2	Annual sampling from groundwater bores in February	• All groundwater samples collected and analysed in accordance to consent requirements – compliant • A new bore (TMUG) was added to the monitoring programme in 2018
6.3	Inter-tidal inspection of Rangataua Bay for indications of the presence of leakage from the ponds – yearly in February	• Seepages inspected at least once per year and samples analysed for the required parameters, except for the following: – Temperature has not been consistently monitored on seepage samples
6.4	Titiko (mud snail) survey in Rangataua Bay – yearly in February	• Titiko survey undertaken in February of each year and annual reports have been prepared

There is a high level of compliance with the operational conditions of this consent. All required seepage quality parameters have been monitored at least once per year except for temperature, which was omitted during the 2017 and 2019 monitoring.

Whilst titiko surveys have been carried out annually in Rangataua Bay in February as required by the condition of consent, as discussed in Section 3.4.4, it is recommended that the titiko monitoring programme is refocussed.

Sensitivity: General

4.3 Consent 67894 – Sludge Disposal at Te Maunga Landfill

The on-going operational conditions of this consent and associated compliance summary are presented in Table 25 below.

Table 25: Consent 67894 operational consent compliance

Clause	Description	Summary of Compliance
10.2	Sludge disposed in trenches not to contain less than 16% solids by weight	• 2015: Non-compliant (seven samples taken between March and May were below 16% solids) • 2016-2017: All compliant • 2018: Non-compliant (one sample taken on September was below 16% solids) • 2019: All compliant
13.3	Integrity of the cap of the trenches inspected annually	• Inspections carried out regularly, but not formal records of the inspection results are held by TCC. Inspection reports available only for 2016 and 2017, undertaken by request of the desludging contractor.
14.4	Groundwater samples to be taken from three bores in March and September. Testing for Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc	• 2015: No data available • 2016: September samples taken in October • 2017: September samples missed (note change in sampling contractor which resulted in sampling being missed in September and March, therefore the March sampling was undertaken in May) • 2018: March samples taken in May • 2019: Compliant
14.6	Groundwater samples to be repeated within one month if the results exceed 80% ANZECC marine water trigger values	• Bore TMG1 exceeded trigger value for Zinc since 2015. No resampling has been undertaken • Bore TMG3 exceeded trigger value for Zinc and Copper in 16 May 2018. Resampling undertaken in 25 July 2018 (more than a month later). Resampling results not exceeding trigger values.
14.9	Compile an annual monitoring report	• 2015 – 2016: No reports were prepared • 2017: Annual report prepared and covered information since 2015 • 2018: Annual report prepared

In general, there is a high level of compliance with the operational conditions of this consent. Only a few samples show that the solids concentration in sludge has been below the limit, and they represent only 4% of all measurement taken during the review period.

The annual reports were not prepared during 2015 and 2016, but the 2017 report included the review of the previous years. The reports contained all the information required by the consent, including the following:

- The results of all monitoring undertaken during the year;
- An interpretation of these results;
- An assessment of any potential environmental impacts of the sludge disposal on the environment;
- A summary of the soil disturbance activities undertaken;
- The volume of sludge disposed of in the trenches;
- The monitoring results (groundwater, sludge moisture);
- Disposal records;
- The origin, quantity, and source of imported soil;
- Updated maps indicating where new trenches have been placed.

4.3.1 Groundwater Monitoring (Clauses 14.4 & 14.6)

Table 26 below shows the 80% trigger values for marine water according to the ANZECC 2000 Guidelines.

Table 26: Consent limits for groundwater samples

Parameter	80% Trigger Value for Marine Water[5]
Arsenic (mg/L)	0.14
Cadmium (mg/L)	0.036
Chromium (mg/L)	0.085
Copper (mg/L)	0.008
Lead (mg/L)	0.012
Mercury (mg/L)	0.0014
Nickel (mg/L)	0.56
Zinc (mg/L)	0.043

A summary of the number of exceedances per bore per year is presented below, based on the bi-annual monitoring.

Table 27: Number of groundwater quality exceedances

Years	Sample Site	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
2016	Bore TMG1	0	0	0	0	0	0	0	2
	Bore TMG2	0	0	0	0	0	0	0	0
	Bore TMG3	0	0	0	0	0	0	0	0
	Bore TMG4	0	0	0	0	0	0	0	0
2017	Bore TMG1	0	0	0	0	0	0	0	1
	Bore TMG2	0	0	0	0	0	0	0	0
	Bore TMG3	0	0	0	0	0	0	0	0
	Bore TMG4	0	0	0	0	0	0	0	0
2018	Bore TMG1	0	0	0	0	0	0	0	2
	Bore TMG2	0	0	0	0	0	0	0	0
	Bore TMG3	0	0	0	1	0	0	0	1
	Bore TMG4	0	0	0	0	0	0	0	0
	Bore TMUG	0	0	0	0	0	0	0	0
2019	Bore TMG1	0	0	0	0	0	0	0	1
	Bore TMG2	0	0	0	0	0	0	0	0
	Bore TMG3	0	0	0	0	0	0	0	0
	Bore TMG4	0	0	0	0	0	0	0	0
	Bore TMUG	0	0	0	0	0	0	0	0
Green: Compliant					Red: Non-compliant				

A few non-compliances were observed regarding the groundwater quality monitoring, where samples were not taken on the month required. The monitoring was completely missed during September 2017, however in terms of quality most parameters have been within consent limits. The exception is zinc on bore TMG1, which have been consistently over the trigger values since 2000. Repeat sampling and analysis within one month was not performed and is an oversight in complying with the conditions of the consent. However, a leachate collection system is in place around the perimeter of the landfill, which conveys the leachate to a sump well and is pumped to the WWTP, ultimately reporting to oxidation pond 1 where the effluent from the

[5] ANZECC, 2000 Guidelines

bioreactors is discharged. The zinc content on pond 1 has been measured and is below the trigger concentration. The direction of the regional groundwater is such that is unlikely the source of zinc is from the landfill, but from another up-gradient location.

The sample taken during May 2018 in bore TMG3 was above the trigger levels for copper and zinc. Resampling was carried out in July, which is slightly over the consent limit of a month for the resampling. The repeated results were all below the consent limits.

4.4 Consent 62722 – Air Discharges at Chapel Street

The ongoing operational conditions of this consent and associated compliance summary are presented in Table 28 below. There is a high level of compliance with the odour monitoring consent conditions.

Table 28: Consent 62722 operational consent compliance

Clause	Description	Summary of Compliance
7.1	Biennial odour community survey	• 2016 and 2018 surveys undertaken - compliant
8.1	Yearly odour monitoring and discharge rates at designated treatment units on-site	• All locations monitored, and discharge rates estimated yearly since 2015 - compliant
8.3	Monthly plant odour walkover inspection	• All monthly inspections undertaken for the monitoring period. No odour detected during inspections outside of plant area, except for January 2016 where odour was detected outside boundary due to humidity in the air - compliant
9.3	Odour complaints log	• Odour complaints recorded. Total of 20 complaints regarding odour from Chapel Street WWTP. Complaint details were registered and investigations following the complaints were made to identify the odour source. TCC operational staff were also alerted when a complaint was registered and a response was prepared to the complainant - compliant

4.5 Consent 62723 – Air Discharges at Te Maunga

The ongoing operational conditions of this consent and associated compliance summary are presented in Table 29 below.

Table 29: Consent 62723 operational consent compliance

Clause	Description	Summary of Compliance
5.2 (b)	Decommission of the sludge lagoon pond by September 2012	• Sludge pond– Pond 1 stopped receiving sludge in April 2019 after the commissioning of a new thickening and dewatering facility. Future use of this pond is yet to be agreed with the Wastewater Management Review Committee and Bay of Plenty Regional Council.
7.1	Biennial odour community survey	• 2016 and 2018 surveys undertaken - compliant
8.1	Yearly odour monitoring and discharge rates at designated treatment units on-site	• All locations monitored, and discharge rates estimated yearly since 2015 - compliant

Clause	Description	Summary of Compliance
8.3	Monthly plant odour walkover inspection	• All monthly inspections undertaken for the monitoring period. No odour detected during inspections outside of plant area, except for April 2015 where odour was detected outside boundary due to failure of clarifier pump - compliant
9.3	Odour complaints log	• Odour complaints recorded. Total of 18 complaints regarding odour from Te Maunga WWTP. Complaint details were registered and investigations following the complaints were made to identify the odour source. TCC operational staff were also alerted when a complaint was registered and a response was prepared to the complainant - compliant

4.6 Consent 62882 – Chapel Street Emergency Discharges to the Harbour

There are no operational conditions in this consent that require any specific sampling, monitoring or reporting. Should a flood event occur, which results in a discharge to the Tauranga Harbour from the Chapel Street WWTP, then reporting of the event and any remedial works is required.

The consent requires that following a discharge event, the Regional Council and the Director, Toi Te Ora Public Health are notified within 24 hours after the discharge ceases. TCC notifies BOPRC, Toi Te Ora, and tangata whenua groups via email within 24 hrs of any wastewater overflow. TCC also provides reports to BOPRC which provides the timing of the discharges and estimate the volume based on WWTP influent and effluent discharge volumes. It is recommended that TCC investigates ways to improving the accuracy of these records.

4.7 Consent 62883 – Occupy Space in the Coastal Marine Area (Chapel St)

There are no operational conditions in this consent that require any specific sampling, monitoring or reporting. Maintenance of the harbour overflow structures is required to ensure effective capacity at all times and any maintenance works are to be carried out immediately.

4.8 Consent 62885 – Discharge to Land then to Water at Te Maunga

The consent requires that following a discharge event, the Regional Council and the Director, Toi Te Ora Public Health are notified within 24 hours after the discharge ceases. Overflows from the wetlands in the two 2017 cyclone events which were extreme wet weather events.

Table 30: Consent 62885 operational consent compliance

Clause	Description	Summary of Compliance
2	Overflow daily quantity not to exceed 12,000m^3. Rate of discharge not to exceed 343 L/s	• TCC notifies BOPRC, Toi Te Ora, and tangata whenua groups via email within 24 hrs of any wastewater overflow. BOPRC advised in writing of discharge occurrence, however given the overflow is from the wetlands, no flow records are captured. It is recommended that TCC investigates ways to improving the accuracy of these records.

4.9 Consent 62886 – Irrigation of Reclaimed Water from Chapel Street

There are no operational conditions in this consent that require any specific sampling, monitoring or reporting as long as there is no reclaimed water for irrigation.

Originally, this consent was intended to allow for irrigation of two reserves and the Omanu Golf Course with treated water from Chapel Street WWTP. Feedback from the users is that the consent conditions were too restrictive, encouraging them to find alternative irrigation water sources. No reclaimed wastewater was used for irrigation during the 2015-2019 period.

4.10 Consent 65178 – Occupy the Coastal Marine Area with WW Infrastructure

Table 31 shows the compliance monitoring conditions required by consent 65178.

Table 31: Consent 65178 operational consent compliance

Clause	Description	Summary of Compliance
6.4	Prepare report every five years on the maintenance works, summary of discharges, inspections and complaints related to the wastewater structures covered by the consent	• Compliant, report prepared in 2016. Next report due in 2021

A comprehensive “Wastewater Coastal Structures Asset Management Summary Report 2009-2016” was prepared in 2016 to cover all the details required by Clause 6.4 of the consent. A detailed review on the maintenance works, summary of discharges, inspections and complaints was included. The report also provided proposed amendments to the consent conditions, with the main intent of encompass into one set of conditions all the additional structures that were built after the consent was granted.

5 Technological Advances and Alternatives

This section of the report responds to condition 20: Monitoring, Upgrade and Technology Review Report for permit 62878. The previous report prepared by CH2M Beca Ltd for TCC in March 2015 provided an updated and comprehensive review of wastewater treatment in New Zealand, treatment technologies, sludge treatment and progress towards zero waste.

To avoid repetition, the following sections update recent advances and processes that are of particular relevance and current interest to TCC. Technological developments that are being considered at the two Tauranga wastewater treatment plants are summarised below. Further commentary is provided on these and other technological advances in this section.

- Optimising utilisation of existing treatment assets and unit processes in an integrated, regional manner:
  - Tauranga is unusual in having two relatively modern treatment plants and a wastewater system that allows rebalancing for the flows and loads between them through the completed Southern Pipeline.
  - TCC is already accepting wastewater from outside its boundary (Omokoroa and Te Puna) just as many more other wastewater utilities are doing in New Zealand and around the world to achieve “economies of scale” and a pan-regional approach to wastewater management.

- Resource recovery from wastewater systems and treatment plants – not seeing wastewater as “waste” but a source of water (to reuse), bioenergy, heat and nutrients:
  - Chapel Street WWTP recovers biogas from the combined primary and waste activated sludge and Council has investigated adding recuperative thickening process to maximise biogas production and power generation, while producing a drier sludge end-product.
  - Greater energy (heat and power) can be produced from digesters if they are also directly fed high-strength organic wastes (such as fats, oils and greases or FOG) in a process termed “co-digestion”;
  - Both treatment plants provide a high-quality effluent stream which complies with consent discharge standards, however for any of the effluent to be suitable for “reuse” additional treatment processes would need to be added.
  - Tauranga has an extensive network of gravity and trunk sewers, some of the latter being large diameter and high flow pipes from which low-grade heat energy could be captured and used for heating pools or heating/cooling adjacent buildings – this technology is being increasingly seen as replacing fossil fuels for heating and cooling as the low-grade heat source is available 24/7 year round.

- Sludge/solids processing at both plants is intended to reduce the net cost of stabilisation and disposal, with the ultimate goal of beneficial reuse for the organic and nutrients in the biosolids:
  - The beneficial reuse of biosolids in NZ is very low in comparison with countries such as USA and Australia, as shown in Figure 36.
  - As with many other water utilities, TCC transports all of its dewatered biosolids to the Hampton Downs Landfill site where it is reused, although the long-term plan includes for further processing of biosolids through a new solar drying facility at Te Maunga WWTP that would produce a usable dry fertiliser product.

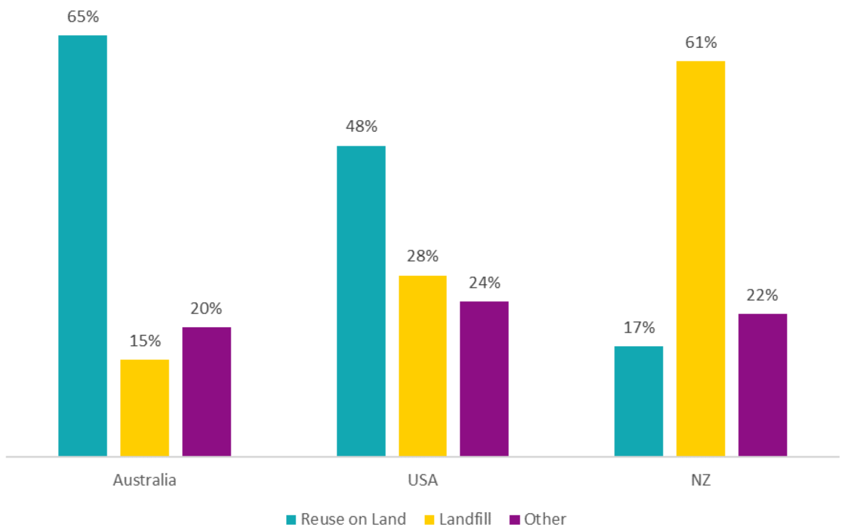


Figure 36: End use/disposal of biosolids in NZ, Australia and USA

5.1 Total System Approach

With the completion and commissioning of the Southern Pipeline Harbour Crossing in early 2019, TCC is now able to split flows and loads between the Chapel Street and Te Maunga WWTPs. Most of the growth areas and some of the industrial waste will be directed to the Te Maunga WWTP, with other catchment areas diverted from Chapel Street to keep this plant below its load capacity of 4,700 kg BOD/day.

The Chapel Street WWTP site is constrained with the harbour to the north and east and bulk retail premises to the south and east. There is some scope to develop the capacity of the plant further, for example with the introduction of recuperative thickening on the digesters, but the proximity of the adjacent retail areas limits expansion of the plant. TCC does not therefore propose to increase the overall capacity of the Chapel Street WWTP.

Regionalisation of wastewater schemes provides a number of benefits with economies of scale and lower construction and operating costs. It is proposed that sewage from Te Puna, just outside the city's western boundary, will be collected and transferred into the Tauranga network, to be treated at the Chapel Street plant, and ultimately discharged through the ocean outfall.

Economies of scale would also be provided with a regional biosolids treatment scheme and options for this are being considered currently. TCC has a long-term plan to dry dewatered solids from both plants in a solar drying facility at Te Maunga adjacent to the new thickening and dewatering plant, but without a beneficial reuse identified, the dried cake would still be disposed to landfill, albeit with much lower transportation costs and gate fees.

Consideration has been given to a regional treatment scheme whereby the Chapel Street WWTP is converted to a primary treatment/digestion only plant (enabling a higher load cap) and the Te Maunga WWTP provides all the secondary treatment and final effluent polishing and UV disinfection before discharge. The revised (2020) 30-year masterplan for the whole wastewater system will revisit this option.

5.2 Resource Recovery and Renewable Energy

Resource recovery, including energy, heat and biosolids, are coming under increasing focus as wastewater utility operators recognise the significant economic and environmental benefits that result from the recovery of resources from the wastewater and the solids stream.

Many water utilities are also installing solar photovoltaic (PV) arrays in buffer zones around their plants or on treatment tanks and buildings which produce "green energy" to provide some of their power needs, and reduce their carbon footprints.

Some examples are given below:

- In Amersfoort, Netherlands, the Dutch Water Board plans to recover energy and nutrients at its treatment plant. The facility which treats wastewater from a 150,000 population will provide enough power for the whole treatment plant plus an estimated two million kWh, supplied to the national grid.
- In the USA, many wastewater utilities are rebranding their treatment plants as "wastewater resource recovery facilities" (or plants – WRRF or WRRP) and are achieving energy neutrality or even energy "positivity". Notable examples are AlexRenew (Alexandria, Washington), the East Bay Metropolitan Utility District (EBMUD) WTP in Oakland, California and the City of Gresham WWTP, Oregon.
- Aarhus Water in Denmark are implementing an energy neutrality policy at its Marselisborg Wastewater Treatment Plant where they have installed energy-saving technologies such as an advanced SCADA control system, turbo blowers, sludge liquor treatment based on the anammox process, as well as optimised the fine bubble aeration system. Energy efficiency gains, combined with enhanced energy production from sludge have led to (by 2016) the site producing 40 to 50% more energy than is required to run it, with the excess energy being exported to the national grid.
- Watercare Services in Auckland has adopted an ambitious plan to achieve energy neutrality at its two major plants, Mangere WWTP and Rosedale WWTP, and are currently installing the Cambi Thermal Hydrolysis process (THP) at the latter plant to increase biogas yield as well as introducing energy savings across both plants. Once the THP process is proven at Rosedale, Watercare is proposing to install an even larger THP system at Mangere.
- DC Water (Washington DC) has plans to install very large PV solar arrays at their Blue Plains WWTP, the largest advanced wastewater facility in the world, bounded by the Potomac River on one side and busy freeways on the other. The utility is also looking into installing PV panels on some of their reservoir roofs (see Figure 37 and Figure 38). Gresham WWTP has installed PV arrays right at the entrance to their facility able to generate 419 kW of renewable solar power (Figure 39).

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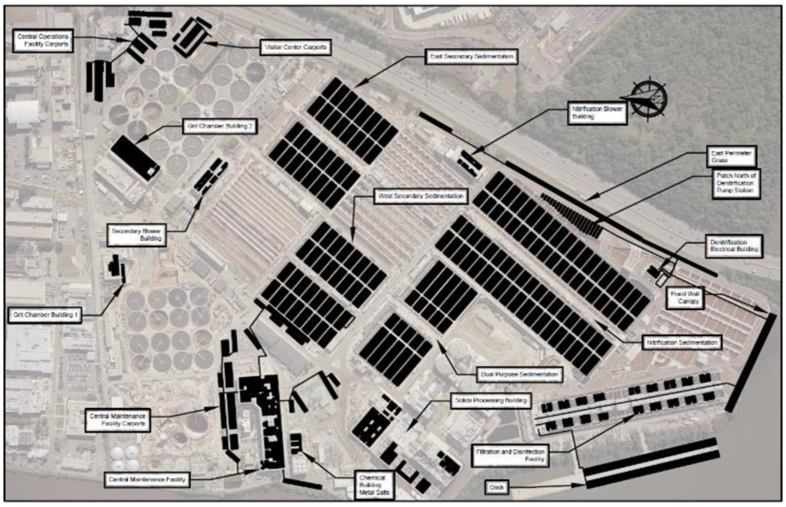

Figure 37: DC Water’s Blue Plains WWTP planned installation of PV panels, Washington DC

Figure 38: DC Water’s Brentwood Reservoir, 2.0-2.75 acres (500kW+), Washington DC

Figure 39: Gresham WWTP PV arrays

The following provides a brief discussion of some of the opportunities in this area.

5.2.1 Biogas and Enhanced Digestion

Biogas production is a result of anaerobic digestion where the volatile solids are converted to methane and carbon dioxide gas. Biogas which is typically 65% methane produces 35 MJoules of energy per m^3 of gas. Methane recovery has been common in anaerobic digesters at wastewater treatment plants and was typically used with boilers to provide heat. In the last few decades, cogeneration plants are being used with biogas which provides the benefit of not only the power generation, but also the heat from the engine cooling. The heat can be used for heating buildings, drying biosolids (thermal driers or auxiliary heat for a solar dryer), and heating the digester.

In the case of the Chapel Street WWTP, the more recently installed (2006) cogeneration plant provides both power and waste heat to heat the digesters to 37°C. The power recovery estimated is equal to up to 33% of the plant need. The current gas loadings to the cogen plant are insufficient to keep it operating continuously. Currently primary and co-settled waste activated sludge (WAS) is digested. Primary sludges are known to provide higher methane production of 300 to 350 L CH_4/kg feed organic matter (OM_{feed}) compared to 140 to 210 L CH_4/kg OM_{feed} for WAS. The WAS feed is therefore of lesser "value" in terms of biogas generation and the digesters could be better utilised and gas production increased if the feed was primary sludge only. With future consideration being given to the Chapel Street plant being a primary only plant, the digesters at the plant could be optimised for the generation of power and heat with the plant being used for energy recovery. There were some issues with the digestion of WAS due to foaming and inconsistent/unstable digestion conditions prior to commissioning the Southern Pipeline. TCC has prepared a programme of works to overcome these issues, and is also considering the installation of recuperative thickening which would increase he solids retention time in the two digesters and therefore increase the gas yield.

If the Chapel Street WWTP was to continue in its present configuration of digesting thickened WAS, other digester enhancements could include supplementing them with fatty wastes which have been shown to increase biogas generation from WAS digesters. Co-digestion can include trade wastes such as septage, grease trap waste, animal manures, cheese/milk wastes added with the sludge stream. There are also options currently widely adopted around the world that are configured with different load in, mixing and recirculation systems that allow for a more solids based digester substrate such as supermarket green waste. Liquid sludge can also be processed in these digesters. Providing a well-mixed digester (10 – 20 $W/m^3_{digester}.day^{-1}$) with high volatile solids loading rates (4 – 5 kg $VS/m^3_{digester}.day^{-1}$) with high biogas productivities (2 – 3 $m^3biogas/m^3_{digester}.day^{-1}$) and short residence times (10 – 15 days) is possible with co-digestion facilities. This compares to conventional mesophilic digesters for primary sludge and WAS which operate at volatile solids loading rates (1.5 kg $VS/m^3_{digester}.day^{-1}$) with low biogas productivities (0.7 $m^3biogas/m^3_{digester}.day^{-1}$) and longer residence times (15 – 20 days). One study showed that with the addition of fatty wastewater to the WAS, the methane production increased from 190 L CH_4/kg OM_{feed} for the WAS only, to in the range of 300 to 600 L CH_4/kg OM_{feed} (Carrere 2010).

A potential enhancement for digesters is the thermal hydrolysis process (THP). Hydrolysis is the separation (*lysis*) of chemical bonds by the addition of water. The process is carried out under heat at 165°C and a pressure of 11 bar. Cambi has a patented proprietary process that has been installed at a number of treatment plants around the world, and is currently (2019) being installed at Watercare's Rosedale WWTP in Auckland – a first for NZ. There are now over 60 Cambi THP plants worldwide with one of the largest at DC Water's Blue Plains plant, Washington DC (see Figure 40).

Sensitivity: General

Figure 40: Thermal Hydrolysis Process plant at DC Water's Blue Plains WWTP, Washington DC

The process provides a number of benefits including:

- A more fluid sludge allowing 2 to 3 times the digester solids loading.
- Increasing biogas production.
- Improved dewaterability after digestion (up to 40% DS).
- Thermal treatment (165° C for 30 minutes) provides a Grade A stabilised biosolids.

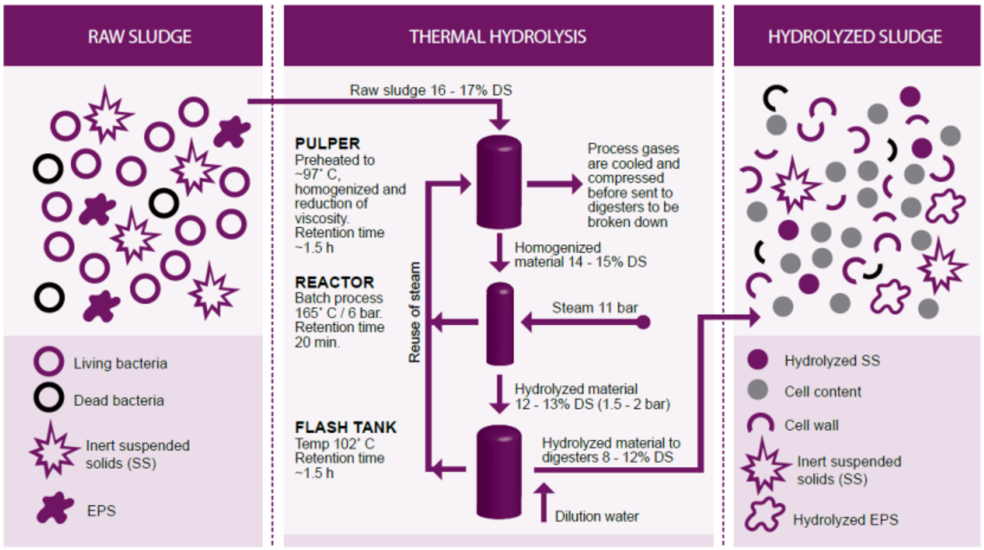

Figure 41: Thermal Hydrolysis Process

Sensitivity: General

5.2.2 Combustion

Combustion is the oxidation or burning of sludge with an oxygen source. Combustion takes place in two phases: firstly, drying to evaporate the water, and secondly the combustion of the volatile fraction of the solids. The combustion process converts the solids into an inert ash. Up to 75% of the solids are combustible so the volume of the ash is significantly lower than that of the original biosolids. Dewatering the solids to at least 30% allows the combustion process to be self-sustaining due to the calorific value of the solids. Supplementary fuel is always necessary for the initial start-up and to allow for the fluctuation in feed solids characteristics. Pre-drying can be achieved in a dryer using the steam generated from the recovered energy of the flue gases.

The combustion process produces particulates and combustion gases such as; nitrogen oxides, sulphur oxides and carbon monoxide. Air pollution control is an integral part of a combustion operation and would need to include wet scrubbers or electrostatic precipitators to remove; particulates, sulphur oxides and water soluble contaminants.

The combustion process is not common in New Zealand, however the existing Tahuna (Dunedin) WWTP fluidised-bed incinerator was recently refurbished and brought back into operation. The option of upgrading the existing incinerator was selected as it provided a lower NPV cost than the alternatives considered; drying, wet air oxidation, and super critical air oxidation.

Combustion reduces wastewater solids by up to 95%. The ash can then be disposed of more readily, with reduced transport and landfilling costs. The technology is most applicable when transport and landfill costs are high and distances to sites for beneficial reuse at farms are long, or beneficial reuse options are not appropriate. Combustion technology has a high capital cost, however, there is potential for energy recovery from the flue gases being cooled to approximately 200°C by the recovery boiler which can generate temperatures at 400°C. For the Tahuna WWTP there is still approximately 1400 kW/hour of thermal energy available after the energy use from the drying and preheating processes.

Andritz, a leading supplier of biosolids drying plant, has developed a design for a biosolids drying/incineration plant known as “EcoDry” as shown in Figure 42.

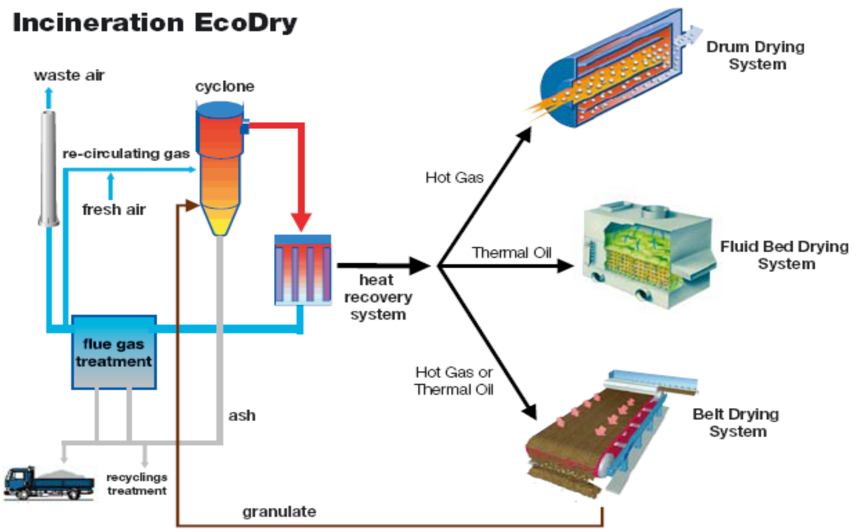

Figure 42: Andritz EcoDry Incineration Process (Andritz, 2014)

The EcoDry process employs a sophisticated cyclone furnace operating at very high temperature and with a two second residence time, so that all hazardous contaminants are reduced to low levels. The final product of the process is an inert ash that can be disposed to landfill. Capital costs for incinerators are approximately twice the cost of any other biosolids drying options.

5.2.3 Low Grade Heat

Heat can be recovered from raw wastewater and effluent and is described as low-grade heat. Low-grade heat extracted from wastewater can be used for water heating using heat pump technology. The heat recovery occurs via a heat exchanger to transfer the heat from the wastewater to the refrigerant. Heat exchanger technologies typically include pumped, in-tank, in-pipe or in-trench exchangers.

Figure 43 shows a typical heat exchanger installed in a concrete sewer pipe. Because sewage maintains a relatively consistent temperature throughout the year the low grade heat captured from the sewage can be used for area heating during colder months.

Figure 43: Heat Exchanger in a Concrete Sewer (BauLinks, 2003)

Heat recovery from raw wastewater presents more difficulties than recovery from effluent as it requires pre-treatment to solids that could cause clogging of the heat exchanger.

Heat recovery from the effluent has the advantage that it is of better quality and the potential for clogging is reduced. The disadvantage however is that the effluent discharges are often located at a greater distance from the potential users of the heat, and treated effluent is generally cooler than the incoming raw sewage.

The recovery of heat from sewers lowers the wastewater temperatures which can present some issues. The lower temperatures of wastewater can increase the congealing of fats, oils and grease in the sewer lines. A further issue is the lower temperature of the wastewater coming into the treatment plant and the impact this may have of biological processes, although cooler wastewater has a higher oxygen solubility which can reduce aeration capacity for secondary treatment. Other issues for the effluent are on the discharge environment and the temperature effects on the plume density which impacts on the initial dilution and dispersion of the discharge (Bush et al 2008).

The heat available from wastewater from a town of 10,000 population, for a change in temperature of 5°C, is estimated to be 700 kW (annual average). This represents a small proportion of the total power consumed of 9,000 kW (annual average) for the town (Homenuke, 2013).

Proprietary sewer heat recovery units have been developed and HUBER market the ThermWin® system. A portion of the wastewater flows from the sewer into a screening chamber where the screenings are separated to prevent clogging of the heat exchangers. After passing through the heat exchanger the wastewater is returned to the sewer via a pipeline with an integrated launder channel to return the screenings to the sewer. For this system the dry weather flow in the sewer must be at least 10 l/sec and the average temperature in winter should not fall below 10 °C. The use of the heat source must be a short distance from the sewer. Suitable applications for this system are typically larger buildings and industries. Figure 44 shows the HUBER sewer heat recovery system.

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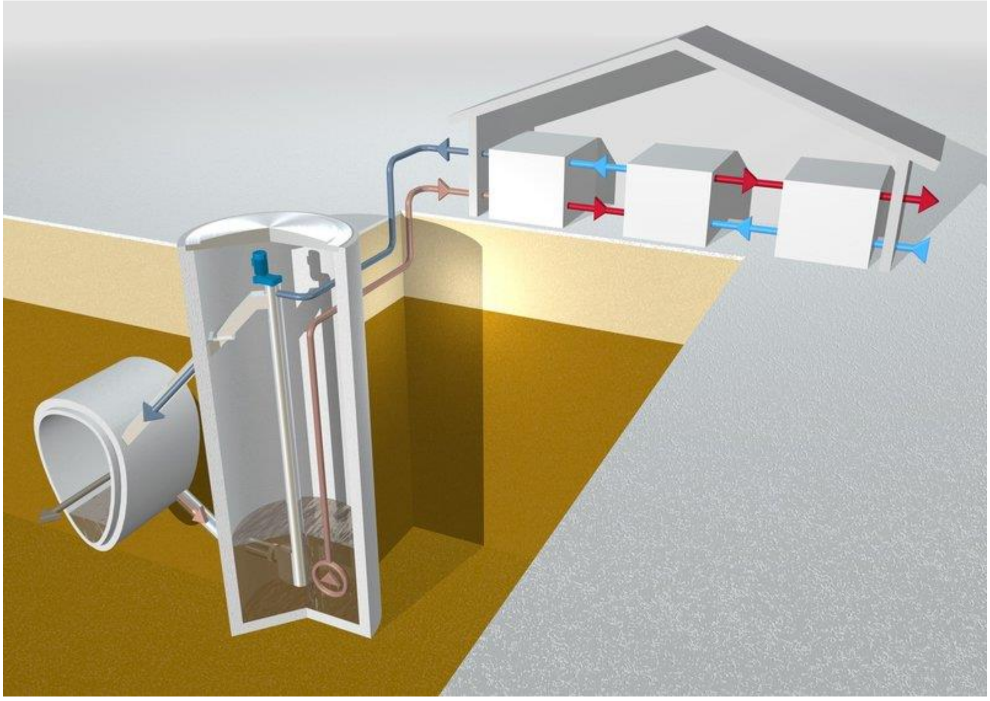

Figure 44: The HUBER ThermWin® sewer heat recovery system (Huber, 2014)

5.3 Biosolids

5.3.1 Current Operations

Since 2014, TCC has transported digested and dewatered biosolids to Hampton Downs Landfill site where they are stored and then applied to land. The farmland at Hampton Downs and neighbouring properties have resource consents that allow for the beneficial reuse for crops and other non-dairy activity.

For the Te Maunga WWTP, TCC commissioned a new biosolids thickening and dewatering plant in 2019 that has resulted in permanent diversion of the WAS from the previous method of storage and stabilisation in Pond 1. Dewatered cake from Te Maunga is also taken to Hampton Downs. A biosolids solar drying facility is shown in TCC's long-term plan, adjacent to the dewatering plant, with the drying halls to be built in stages to eventually take solids cake from both treatment plants.

Solids in Pond 1 were again dredged and dewatering and carted to the adjacent TCC landfill in the 2014-19 period. A final dredging and dewatering operation for the remaining stabilised solids is planned once a decision is reached on the future of Pond 1. In the meantime, it continues to provide flow-balancing of final effluent before pumping to the outfall.

Landfill levies are proposed to significantly increase in New Zealand. This will provide further incentive to reduce or eliminate volumes to landfill and seek alternative end uses for biosolids. Recently some councils in New Zealand have had success in vermicomposting of biosolids with specialist vermicomposting companies. This depends on a number of factors, including ability to handle continuous large volumes, variable environmental conditions and demand for end product.

Sensitivity: General

5.3.2 New Technologies

Technologies that were discussed in the previous Technology Review Report included:

- Digestion for generation of heat and power using cogeneration, microturbines or fuel cells
- Enhancing digestion with thermal hydrolysis, High Voltage electric pulses, mechanical lysis, and ultrasonic destruction
- Thermal drying
- Solar drying (see above)

Figure 45: New Technology Examples

Moxiepel - is a low energy (non-thermal, non-solar) biosolids drying and pelletizing process. The first full scale trial plant has recently been put into operation at Luggage Point WWTP in Brisbane. The key objectives are to reduce biosolids haulage and landfill costs. The product can be used as a thermal fuel (in boilers, furnaces and the like) or as a fertilizer (with appropriate permissions). The product is in pellet form, much the same size and shape as the New Plymouth BioBoost or the dried Hutt City sludge granules. Beca has recently visited the facility at Luggage Point which is currently awaiting completion of commissioning of the new Luggage Point centrifuges before going in to full scale operation. https://moxiepel.com/

5.3.3 Nutrient Recovery Technologies

Nutrient pollution is a significant environmental problem and the recovery of nutrients is gaining interest with America and Europe with full scale recovery plants recently being commissioned. In New Zealand, a hydrothermal deconstruction process was developed by Scion (previously the Forest Research Institute) in partnership with the Rotorua District Council (RDC). This plant is now patented by TERAX™. This process was developed for the treatment of municipal wastewater sludge, and the production of an organic fertiliser. The first full scale demonstration of the technology was completed in 2015 and the process was run for a short time but was then shut down. The company formed to commercialise the product has been dissolved and Rotorua DC is no longer proceeding with this option.

5.4 Optimising Operations and Treatment Effectiveness

A number of opportunities exist for optimising the operation of the existing WWTP through process changes or new equipment. TCC has (in 2019) reviewed the energy efficiency of the two plants (refer to Section 8) and has considered more energy efficient technologies, as well as the increased production of biogas and higher generation of bioenergy (refer above).

5.4.1 Direct Drive Blower Technologies

TCC has already implemented high efficiency direct drive blower technology with the installation of the HST blowers at the Te Maunga WWTP in 2008. Direct drive technology should be considered for all new

Sensitivity: General

installations with the capital and the operating and maintenance costs being assessed over the life of the equipment.

5.4.2 Optimising the Aeration

Given that the aeration energy for an activated sludge treatment plant is the largest user of power for the plant, there needs to be a continual focus on maintaining the aeration system at its optimum efficiency.

Diffuser Maintenance: Maintenance of diffusers is important for energy efficiency. Diffusers will foul over time which will increase their headloss and result in greater energy consumption. Typically, the air flow through diffusers should be 'bumped' i.e. increasing the air flow to open up the pores in the membrane. In addition, typically diffusers should be cleaned annually. The diffuser O & M Manual should be consulted for the exact maintenance regime.

Dissolved Oxygen (DO) Set Points: DO control is important in order to prevent wasting of energy. In general, the rate of BOD5 removal is near maximum at 1.0 mg/L DO and the rate of nitrification at 2.0 mg/L. Therefore, DO set points should be managed depending on whether the plant is configured for BOD_5 removal or nitrification.

Figure 46: Optimising Aeration Examples

DO concentrations may need to be varied from the above guidelines to control the growth of filamentous bacteria which can cause poor solids settling (high SVI's) or foaming problems. At the Chapel Street WWTP, temporary problems have been experienced with poor solids settling with the higher plant loads during the mussel processing season. At higher F/M ratios (>0.5) a DO value of 2.0 mg/L may be needed. This is to keep the floc interiors aerobic and this is more difficult at higher F/M ratios where the oxygen uptake rate of the solids is high.

Ammonia Based Control: The DO guidelines discussed above are aimed at providing a safe and stable process operation without having to specifically monitor the target pollutants 'real time'. However, reliable monitoring systems are now available that realistically do allow this real time monitoring. As such, it is now feasible, to operate the blowers and control air flow to individual zones based on measurement of residual ammonia in the process. This allows reliable nitrification to take place with DO levels down to 0.5mg/l and sometimes less. However, this must be done within the bounds of sludge settleability requirements (discussed above). The added benefit of this approach is that the aeration can be tapered through the reactor, effectively increasing the anoxic fraction and improving denitrification.

5.4.3 Improving Biosolids quality - microplastics and fine inorganic solids

At both treatment plants, the incoming sewage is screened though milliscreens – currently 3mm slots at Chapel Street and now (previously 3mm) 5mm perforated screens at Te Maunga. In theory, these screens should remove all nuisance plastics and gross solids which would otherwise end up in the solids streams. However, there are increasing amounts of plastics and non-soluble/nondigestible materials less than these dimensions, which pass through the liquid stream unit processes and can contaminate the biosolids cake.

For the new thickening and dewatering facility, two sets of macerators have been installed to make the cake more homogenous, reducing the size (and visibility) of such micro-solids but any potential reuse options need to consider the presence and impact of this small percentage of non-organic contamination.

5.4.4 Mainstream Anammox - Improving Nitrogen Reduction

Should there be a new consent or national statutory requirement to reduce nitrogen in the effluent, TCC could consider the potential use of Anammox as a side-stream or mainstream process. Anammox offers the potential to achieve nitrogen removal with significantly lower aeration requirements, and hence energy costs, than conventional two stage nitrification-denitrification processes. The key objective of Anammox is the removal of ammonia, direct to nitrogen gas in order to reduce the energy needs of the more conventional nitrification process and the rbCOD needs of the conventional denitrification process.

The use of Anammox has increased rapidly in recent years, particularly for discharge to nutrient-sensitive receiving waters, and principally as a side-stream process treating high strength digester/dewatering supernatant. Anammox is a very slow growing bacteria and it requires very controlled conditions in which to develop. It can be developed as a granular sludge or on fixed media. In New Zealand, Watercare are currently developing an Anammox supply for their own use.

Similar developments are also happening in Australia where both Veolia and Aquatech Maxcon have entered the market as technology suppliers. At Tauranga, the most probable application would be on the digested sludge, dewatering centrate recycle stream at Chapel Street.

5.4.5 Aerobic Granular Processes - Increased treatment capacity

Granular sludge has been widely used in anaerobic processes, particularly for industrial wastes. Recent developments have identified process conditions which enable an aerobic granular sludge to form. The granular sludge settles very quickly, allowing high biomass concentrations to be retained within the reactor tank. This results in smaller footprints than conventional activated sludge processes and could be applied at Chapel Street to increase treatment capacity within the same plant area or at Te Maunga to postpone the need for a third bioreactor. Aerobic granular sludge technology is currently a proprietary process, e.g. Nereda® which is marketed by Aquatec Maxcon in Australia and New Zealand.

5.5 Alternative Treatment in "Natural Systems”

5.5.1 Floating Wetlands

Floating treatment wetlands (FTWs) were reported on in 2014 as an emerging technology with potential as an additional treatment step for municipal wastewater polishing, particularly on the end of pond systems. A considerable number were installed in that period. While the microbiological science is probably reasonably sound (Dr Tanner of NIWA is a world expert in this regard), the implementation by the proprietary supplier was poor and most of the systems have failed in one form or another. That is, they have either failed physically or they have failed to deliver the process outcomes that the supplier was promising. The one successful installation seems to have been in Hunterville.

5.5.2 High Rate Algal Ponds

NIWA have been researching and trialling hybrid forms of wetland including ‘High Rate Algal Ponds’ (HRAPs) which aim to provide a high level of treatment to wastewater but also harvest nutrients in the form of algae grown under specific conditions that encourage rapid and prolific growth of algae which can subsequently be settled out, thickened, dried and sold as a fertilizer. The technology is used on some farms. A full scale trial unit was installed at Cambridge and run for nearly 3 years. This has recently been shut down pending upgrading of the Cambridge WWTP using conventional biological treatment processes.

5.6 Summary of Emerging and Alternative Technologies

Table 32 summarises the status of various new and alternative technologies, globally and within NZ, and rates their applicability at either of the two Tauranga WWTPs.

Table 32: New Wastewater Technology 'Trending-Now' Summary

Technology	Adoption Trend	NZ Uptake	Applicability at Chapel St or Te Maunga WWTPs
Thermal Hydrolysis	Increasing	First underway	Chapel Street to increase biogas yield and improve dewatering performance and biosolids quality (Class A)
Anammox	Rapid increase	First in planning	Possibly at Chapel Street but N treatment not required
Floating Wetlands	Rapid decline	Numerous	No – current wetlands adequate for purpose and consents
High Rate Algal Ponds (HRAP)	Being adopted slowly in some countries overseas	Pilot scale schemes undertaken but no full scale plants – scaling up to full size shown to be costly at two NZ sites	Not really - needs very large surface area because algal ponds are very shallow
Sludge Solar Drying	Increasing due to low energy	One full scale	Yes – preferred for Te Maunga although other drying technologies also available
Terax	Dead	One. Failed	No
Moxiepel	Too new to tell	One in Australia	Possible alternative to solar drying for Te Maunga
Turbo Blowers	Rapid Increase	Multiple	Te Maunga – in use
Advanced Aeration Control	Increasing	Unknown	Te Maunga
Sewer heat mining	Unknown	Uptake has mainly been in cold climate countries – Canada, northern Europe.	Not recommended
Incineration	Flat	Increasing in western Europe. Only Dunedin in NZ.	Possible regional energy centre in combination with other non-recyclable solid wastes. Could be used with Moxiepel.
Co-Digestion	Increasing	Several trials and smaller scale in NZ. Watercare preparing to use 1 full digester as trail.	Chapel Street to increase digester capacity and biogas yield after recuperative thickening is introduced
Scrubbed Biogas	Appears flat.	Last used in NZ in CHCH City in 1990s. No reason why it should not be used again if efficient. Return as a diesel replacement is likely to be better than return as an electricity replacement.	Chapel Street if CBG use in vehicles is adopted to reduce diesel use and CO_2 footprint
Carbon Accounting	Increasing	Common use in NZ	Both WWTPs as part of TCC carbon reduction strategy

6 Progress Towards Zero Waste

Tauranga City Council's Waste Management and Minimisation Plan (WMMP) was first developed in 2010 and updated in 2016 as required by the Waste Minimisation Act 2008. The purpose of the WMMP is to provide a set of priorities for promoting efficient and effective waste management and waste minimisation activities. The waste types considered under this plan include biosolids but exclude wastewater from the sewage treatment process and gaseous wastes. The WMMP states a vision that is; "Minimising waste to landfill."

TCC has developed a corporate Sustainability Strategy called "Sustainable Steps" aimed to help and guide TCC staff to embed sustainability into the way they do things. As part of the development of this strategy, each Council Activity Area developed an activity specific sustainability action plan highlighting sustainability initiatives to be undertaken and reported against throughout the strategy timeframe.

TCC wishes to increase efficiency in the use of resources (e.g. water, energy) and have developed a number of plans showing this commitment (e.g. water efficiency plan).

6.1 Wastewater Issues

The sources of wastewater are: potable water use (by households, businesses and other users of the reticulated water system), and inflow and infiltration (I/I) into the sewerage system, especially during extreme wet weather events. The main risk to public health from the wastewater activity is the overflow of wastewater into waterways or the general environment. Overflows of untreated wastewater from the wastewater network occur due to:

- Blockages
- Pump station or other plant malfunction
- Excessive inflow/infiltration of stormwater into the wastewater system
- Insufficient capacity

Overflows occur most frequently from blockages or excessive inflow/infiltration rather than plant malfunction or insufficient network capacity. TCC has online telemetry systems which continuously monitor pump stations to ensure they are functioning correctly.

6.1.1 Reducing Wastewater Overflows

In comparison with other local authorities around New Zealand, TCC has a lower blockage rate than average (Water NZ, 2018). TCC has a KPI where 98% of wastewater overflows must be attended within an hour of reporting the incident. TCC currently meets this KPI. TCC has active programmes in place to manage the flows from these sources, and therefore the load on the wastewater system.

However, there has been some concern with regard to wastewater overflows affecting recreational activities such as swimming and shellfish gathering. TCC reports the number of "No Bathing" notices and shellfish collection bans each year that are due to wastewater system overflows, with a goal to reduce these.

In 2018, TCC launched a media campaign called Save our Pipes from Wipes. The purpose is to educate the public about the flushing of wet wipes which cause blockages and subsequently overflows from the wastewater network. This included social and traditional media advertising and gained national attention. This education programme is ongoing.

6.1.2 Regional Wastewater Management Group

TCC is a member of the Regional Wastewater Management Group comprising BOPRC, Te Toi Ora Public Health and other local authorities in the Bay of Plenty region.

The purpose of the group is (BOPRC, 2018):

- To promote and document Bay of Plenty-wide best practice in responding to wastewater overflows.
- To establish and standardise regional best practice for the response and reporting of wastewater overflow events.
- To work towards best practice for managing overflow events.
- To create a non-statutory forum that fosters cooperation and a unified strategic approach to the long term management of wastewater overflows.

The group meets every second month and is drafting a Regional Best Practice Guide for Managing Wastewater Overflows which is due at the end of 2019. BOPRC specifically noted that TCC practised consistently good reporting on network overflows.

6.1.3 Wastewater Overflow and Mitigation Response Plan (TCC, 2017)

TCC reviews its Wastewater Overflow and Mitigation Response Plan on a five yearly basis in alignment with compliance reviews of its wastewater consents. The last review was carried out in 2017 (TCC, 2017) and provided:

- An overview of TCC’s wastewater network, including an updated inventory of assets
- A breakdown by cause of overflows
- A description of overflow mitigation procedures
- A description of overflow response procedures
- Information about the public health communication plan (utilised in response to overflows)
- A summary of future actions required to improve current practice

In this review period it was found that over 50% of overflows resulted from external parties and activities rather than network constraints. This influenced TCC to focus on community education such as the Save our pipes from wipes media campaign.

Recommended actions were for TCC to:

- Continue to be involved in the regional wastewater overflow forum which develops best management practice for preventing and managing wastewater overflows
- Work to improve the accuracy of recording the cause of blockages across the wastewater network
- Continue to focus on a long-term programme of targeted proactive maintenance

6.2 Wastewater Asset Management

TCC’s key asset management challenges include:

- Chapel Street and Te Maunga WWTPs will continue to require ongoing maintenance. These works are funded from maintenance and renewal budgets. Additionally, the minor capital works budget is intended to enhance this budget to incorporate minor asset upgrades over time.
- As for most wastewater service providers TCC’s system is subject to I/I challenges including a reduced infrastructure capacity to convey wastewater and the need to prematurely upgrade infrastructure, wastage of power in conveying and treating stormwater and groundwater and spillages during storm events with may result in environmental impact, health hazards, potential violation of consents and customer concerns. A strategic model will be developed in the next 12 months to target and refine future investment in reducing inflow and infiltration.

TCC considered a longer term, sustainable approach, based on best practices as important. As such several initiatives have been undertaken to reduce waste including:

- **ISO14001:2004 Environmental Certification**
  TCC has gained ISO14001:2004 certification for both WWTPs in 2011. ISO 14001:2004 sets out the criteria for an environmental management system providing assurance to management and employees that environmental impacts are being measured and improved.
  As a function of that certification TCC aims to minimise the impact on the environment through;
  - Recycling of all waste oil.
  - Recycling of all scrap metal and batteries.
  - Recycling of paper and plastic where possible.
  - Staff training in the use of spill containment kits to minimise the risk of hazardous substance entering the environment.
  - Providing containment for hazards substance, bunded fuel tanks, dangerous goods store.

  As part of the certification, TCC has regular management meetings that discuss continuous improvements, site audits, compliance issues, health and safety, staff training, review operational procedures and impacts.

- **Inflow and Infiltration Programme**
  The I/I programme has been developed to ensure that inflow and infiltration are managed to minimise the impact on the environment and reduce wastage. In summary:
  - Tauranga's I/I is generally within best practice guideline limits. However, certain "hot spots" (higher risk locations) have relatively high I/I and these are being targeted for further analysis and intervention, where justifiable.
  - TCC has developed a strategy for I/I management (Wastewater System Improvement and I/I Management Strategy). The strategy comprises a methodical approach to identifying and prioritising I/I, undertaking source detection (smoke detection, CCTV, gully trap inspections), monitoring of pump hours at pump stations, monitoring of flows at strategic locations and remedial works. The approach is in line with best practices (WSAA Guidelines) and incorporates recommended KPIs, economic thresholds and technologies.
  - Short and long term initiatives are proposed together with appropriate budgets.
  - The strategy also considers the broader impact of I/I on the wastewater infrastructure and implications on functional life of assets, potential overflows and environmental impacts.

Upcoming work in 2019/20 includes:

- Manhole inspection, smoke testing and gully trap check – PS037 Princess Road
- CCTV - PS041 Sylvania Drive, PS015 Sunrise Avenue, PS016 Seaspray Drive
- Repair of wastewater mains requiring rehabilitation - PS063 Ngatai Road
- Identify private laterals that have infiltration - PS040 Westwood Street
- Begin the development of a strategic network model

- **Demand Management**
  TCC employs Water Demand Management methods to manage non-revenue water and peak water demand within agreed, sustainable limits and KPIs. Coupled with Waterline programme initiatives (below), this also impacts on total water demand as well as wastewater flows.

- **Trade Waste Management**
  TCC employs a full time Trade Waste Officer to monitor and manage the trade waste produced by commercial and industrial users under the Tauranga Trade Waste Bylaw 2019. The role includes:
  - Advising industries on waste minimisation, reuse and cleaner production.

- Monitoring the volume and strength of trade wastes.
- Setting charges to ensure full cost recovery from industries for their trade wastes.

TCC has employed a second full time Trade Waste Officer starting in August 2019.

- **Waterline Education Programme**
  This programme has been developed for primary and intermediate schools. TCC's educator spends a week in each class providing an interactive learning experience. Students develop an understanding of why we need to conserve water and how, how our wastewater and stormwater systems work and how we can help those systems work efficiently. Some classes are taken to Chapel Street WWTP for a tour of the facility. TCC facilitates further education programmes associated with waste minimisation, resource efficiency and correct disposal of waste.

- **Fat Blockage Reduction Programme**
  This programme has been developed to investigate options for the reduction of blockages from fat deposits. Pollution prevention audits have been carried out at restaurants and food premises to investigate the condition of grease traps. The audits highlighted the need for a more proactive management by TCC.

- **Multi Criteria Asset Assessment**
  TCC is using a multi criteria asset assessment approach for the asset replacement based on asset performance, criticality and condition rather than age. Initiatives included:
  - Analysing capacity (performance) utilising hydraulic modelling.
  - Analysing reliability (performance) and reporting against key performance indicators.
  - Analysing criticality of specific assets and developing detailed risk plans.
  - Analysing condition utilising CCTV technology and core sampling investigation.

Procurement and construction decisions based on whole of life approach.

6.3 Tauranga City Council Wastewater Management 30 Year Plan

Every three years, TCC updates its 30 Year Wastewater Management Plan which describes wastewater treatment needs to meet levels of service and growth requirements. Capital works projects from this Plan are input to the Long Term Plan and Infrastructure Strategy. The Plan was last updated in 2017 and is due for review in 2020. It is based on the following key principles for management of the wastewater treatment system:

- No sewage discharges to the Tauranga Harbour;
- Transfer the treated wastewater from Chapel Street to Te Maunga for polishing in constructed wetlands before combined with effluent from the Te Maunga treatment plant;
- Pass all treated wastewater through wetlands before disposal to the ocean;
- Utilise the existing ocean outfall for disposal of all treated wastewater from Tauranga;
- No further reclamation of Rangataua Bay (Tauranga Harbour) for wastewater purposes;
- Utilise treated wastewater as a resource if possible.

7 Progress Towards SmartGrowth Stretch Targets

SmartGrowth is the spatial plan for the Western Bay of Plenty sub-region. It is a comprehensive, long term strategy which sets the strategic vision and direction for the growth and development of the Western Bay, on key issues across the spectrum of social, environmental, economic and cultural actions.

SmartGrowth brings together the strategy partners (Councils and Tangata Whenua), the SmartGrowth Partner Forums and other sectors, agencies and groups in the community. The strategy has a 50 year horizon with a strong focus on the next 20 year planning period. It considers a range of environmental, social, economic and cultural matters. The strategy identifies short, medium and long term opportunities for 'building the community'.

In 2001 a joint committee was formed comprising representatives from each of the local authorities and tangata whenua with the purpose of drafting a sub-regional growth management plan.

The original SmartGrowth Strategy (2004) had a primary focus on providing a robust framework for future land-use and growth management. The strategy recognised that growth places increasing demands on systems for the treatment and disposal of wastewater and has set out a "stretch target" conventional disposal approach to wastewater disposal. This approach comprises a number of specifically identifiable "stretch targets" that would result in specific improvements to the current systems specifically over the next 20 years and generally during the subsequent 30 years.

Since 2004, two more iterations of the SmartGrowth Strategy have been developed – in 2013 and 2018. The latest is the Proposed SmartGrowth Future Development Strategy which was updated to allow for recent legislative changes and initiatives from central government and the NZ Transport Agency. Submissions on the proposed strategy closed in late 2018. The strategy is currently on hold while the Urban Form and Transport Initiative (UFTI) is completed.

UFTI is a joint initiative between SmartGrowth and the NZ Transport Agency designed to provide a coordinated and aligned approach across the sub-region on key issues, such as housing, transport and urban development. A draft report is due in August 2019 and a final report in December 2019.

7.1 Implementation of Stretch Targets

The original SmartGrowth Strategy (2004) included six stretch targets. The table below outlines the progress towards their implementation.

Table 33: Implementation of SmartGrowth Stretch Targets

Stretch Target	Implementation
Monitoring the development of new and emerging technologies that support the achievement of stretch targets.	Two reports have been reported to the Wastewater Management Review Committee (CH2M Beca, March 2016 and Andrew Stewart, February 2011) Section 5 of this report meets the requirement and will be presented to the Committee.
Establish and retain a Wastewater Management Review Committee.	A Wastewater Management Review Committee has been established in 2006 and is still operational. The members of the Committee comprises equal numbers of Tauranga City Councillors and representatives of tangata whenua
Establish an Environmental Mitigation and Enhancement Fund.	An Environmental Mitigation and Enhancement Fund has been established. Any application will be considered by the Wastewater Management Review Committee. To date two allocations have been made from the Fund: • Manaaki Te Awanui Charitable Trust - $130,000. • Nga Potiki a Tamapahore trust - $27,100

Sensitivity: General

Stretch Target	Implementation
	The Committee is currently reviewing its processes for administering this fund.
Periodically consider appropriate pricing of water, wastewater, and trade waste discharges to encourage water conservation and industry recycling and other waste minimisation practices.	TCC has implemented a trade waste bylaw (updated in 2019) for commercial and industrial properties as well as a user pays approach to encourage water conservation.
Recommend low water use technology to be used in new development including dual flush toilet cisterns, low water use showers and washing machines.	TCC has an educational programme called Waterline which is aimed to educate the community on how to look after their drinking, waste and storm water with the objective to help households to lower their water bills, help prevent unnecessary wastewater spills and help keep the city waterways clean.
Waterless Toilet Disposal (Initiate an investigation in small communities involving waterless toilet disposal and other land based technology subject to consent being obtained from the Medical Officer of Health, undertake pilot schemes on multiple-owned Maori land and install and pilot waterless toilet disposal technology in appropriate territorial authority projects.)	TCC had previously considered a waterless toilet disposal system at Matapihi, but the investigation identified the project as not viable and was therefore not progressed further.

8 Additional Factors

8.1 Sustainability and Resource Recovery

8.1.1 Global Trends

There is a global trend focusing on recovery of resources from wastewater systems. This includes initiatives such as: extracting heat energy from sewer systems; nutrients such as nitrogen and phosphorus; increasing biogas yield from digesting biosolids; hydrogen from treated effluent and, of course, water. As well as these new areas of research and application, water utilities are continuing their sustainability efforts by making treatment facilities more energy efficient, safer to operate and more cost-effective.

8.1.2 TCC Energy Efficiency Study

With the assistance of an EECA grant, TCC carried out an energy and carbon efficiency study on the wastewater system in 2018/2019 to holistically review the energy consumption and greenhouse gas emissions from its two treatment plants and to consider future developments with a focus on ongoing improvement in energy consumption. TCC's stated goal for this review was to look at options which would improve or optimise energy performance of their existing wastewater systems, without causing any deterioration in treatment performance. Incorporation of new waste streams, ie for co-digestion, was excluded from the study.

The review was carried out in three stages, the first of which assessed the baseline energy efficiency of (and carbon emissions from) the existing wastewater treatment assets, and future upgrades allowed for in the existing master plan. (CH2M Beca, October 2018; CH2M Beca, November 2018)

The second stage assessed options for improvements in energy use and carbon emissions at a strategic level (CH2M Beca, March 2019), and the third stage looked further at the feasibility of short-listed improvement options, including high level cost estimates. (CH2M Beca, June 2019; CH2M Beca, July 2019)

Once the baseline energy efficiency and greenhouse gas emissions were assessed for the existing wastewater treatment assets and the projected upgrades allowed for in TCC's current master plan, two key areas were identified for development – energy production at Chapel St WWTP, and energy efficiency at Te Maunga WWTP. A long list of options to investigate was developed and prioritised based on TCC's stated objective of improving operation of the system using existing assets and feedstocks as much as possible, to identify which options warranted further consideration.

The initial list of options assessed was (CH2M Beca, March 2019):

- Energy efficiency improvements at Te Maunga
  - Primary solids removal to reduce the load on bioreactors
  - Re-configure the bioreactors to reduce overall aeration requirements
- Increase energy production at Chapel Street
  - Install recuperative thickening on the existing digesters
  - Install a thermal hydrolysis system
  - Convert Chapel Street to primary treatment only and increase fraction of flows treated

The energy use and efficiency review identified the following options:

For **recuperative thickening at Chapel St WWTP** (CH2M Beca, June 2019) the findings were:

- Implementing recuperative thickening increases gas production and could increase cogenerated energy production by 1.8M kWh/year
- Somewhat reduces sludge dewatered and transported to landfill but marginal benefit

- Increases the sludge treatment capacity of the system – this could be used to either increase the inlet load 'cap' at Chapel St, or to take sludge from Te Maunga primary filters
- Cost savings from reduced energy purchase is offset somewhat by additional opex costs. The NPV (net present value) is very sensitive to both biogas production rates and polymer cost and usage
- Combining recuperative thickening with solar sludge drying enhances emissions reductions

For **primary solids filtration at Te Maunga** (CH2M Beca, June 2019) it was estimated that:

- Implementation at Te Maunga could increase the treatment capacity of the existing system to the point that the currently programmed third bioreactor is not required within the masterplan timespan.
- Blower power use at Te Maunga could reduce by between 25% - 58% (standard vs enhanced removal).
- Enhanced removal requires coagulant, standard does not. Cost of coagulant for enhanced removal outweighs the benefit of the increase in solids recovery
- Creates an additional sludge stream which can either be taken to Chapel St for digestion or thickened and dewatered (and eventually dried) onsite.
- Digestion would be the preferred route for the primary solids stream but:
  - The full load can only be sent to Chapel St for 15 years. After that would have to deal with at least some sludge at Te Maunga, or build a third digester at Chapel Street
  - Transporting 5% DS sludge (the maximum achievable with the primary filters) to Chapel St for digestion adds a significant amount to the overall carbon emissions of the water system (CH2M Beca, July 2019). This increases further if the digested solids are then taken back to Te Maunga for drying.

As part of the project scope TCC also looked at potential efficiency improvements for the Chapel Street secondary treatment system, due to the age of the current aeration system. The scope of this investigation included the process configuration, diffuser replacement options, and blower replacement options. The key findings of the assessment were:

- There are limited opportunities to reduce the oxygen demand by adopting a different activated sludge configuration at Chapel Street WWTP, due to the low oxygen demand of the existing solids-contact configuration.
- It is unlikely that sufficient additional diffuser area of alternative diffusers could be installed in the existing tank to achieve a significant improvement in SOTE over the existing Aquablade diffusers.
- Replacing the existing blowers with high speed turbo type blowers could result in power savings of between 324 and 762 MWh per year, depending on the flow treated at the plant.
- The equivalent reduction in carbon emissions would be between 45 and 105 tonnes per year as CO_2e.

There is a benefit in terms of electricity cost savings that could be achieved by using alternative blower technology. For the Master Plan design flows and loads, the electricity cost savings alone do not recover the capital outlay on a NPV basis over a twenty year period - $2.1 million for retaining the existing blowers and $3.0 million for replacing the blowers.

However, if the solids stream pinch points were addressed and the flow to CSWWTP increased to 20,000 m3/d, the NPV for the two options would be similar.

8.2 Resilience to Natural Hazards and Climate Change

New Zealand's water and wastewater systems have always been vulnerable to natural hazards such as earthquakes, severe meteorological events and flooding in wet weather events. NZ design standards and TCC's own guidelines are applied when building new facilities or upgrading existing ones to provide resilience to such occurrences and natural risks. Climate change risks are now being added to this list of natural hazards when assessing the resilience of wastewater systems, which must be considered as a whole system when determining the operability of the system following any particularly severe event, or over a longer period of time.

A number of New Zealand councils have declared a “Climate Change Emergency” in their jurisdictions. The Bay of Plenty Regional Council has signalled its intention to follow suit. The primary risks associated with climate change for wastewater systems are sea-level rise and coastal flooding as well as the increasing frequency of mega wet weather events, often associated with high winds and unusually high tide levels. The two Tauranga WWTPs are vulnerable to these risks due to their proximity to the harbour and ocean, and their low-lying ground levels.

For the Te Maunga WWTP, which will have the greatest number of new process units under its proposed expansion, TCC has undertaken a “Resiliency Study” (as part of the Bioreactor No. 2 Concept Design) in order to determine the “Importance Level” for new and existing structures and buildings. The impact on the plant and the wastewater conveyance system from a range of different natural hazards and long-term climate change-induced scenarios were assessed, so that the appropriate design standards could be set for each plant component. These standards are particularly important for geotechnical and structural engineering as well as in setting floor levels.

The intent is not that the plant will be fully operable after any natural event, but that different levels of safe operation would be maintained depending on the severity of the event. The resiliency outcomes have been documented for the Te Maunga plant and its adjacent trunk pipelines and should be supplemented with a similar assessment for the Chapel Street plant, even though very few new works are planned for this facility.

8.3 Environmental Emissions and Natural Water Quality

8.3.1 Environmental Emissions - Carbon Efficiency Study

The Zero Carbon Bill is currently (August 2019) before the New Zealand Parliament and is due to be enacted by 2020. There is a realisation that all councils in NZ will need to focus on reducing their carbon emissions from activities that they undertake on behalf of their ratepayers. TCC is conscious of this new legislative driver and has undertaken a study of the emissions and carbon footprint associated with the two wastewater treatment plants (refer 8.1.1 above).

Emissions improvements were identified in three areas:

- Reduce the mass of wet sludge transported by bringing forward installation/sludge treatment capacity of a solar sludge dryer, which would reduce considerably the weight of water taken to landfill
- Reduce distance travelled for sludge disposal
- Use alternative transportation fuel (biogas or electric vehicles instead of diesel)

These were then developed into concept level designs with capital and operational cost estimates in order to further evaluate the effect of their implementation. The highest emissions are associated with the transporting of dewatered biosolids in diesel fuelled-trucks from the two plants to the current disposal location, Hampton Downs Landfill.

The study conclusions were:

- Optimising the proposed solar sludge dryer capacity and implementation time has a number of advantages:
  - Already programmed and budgeted for in TCC’s long term plan
  - Additional energy demand is low compared with a thermal dryer
  - Reduces transport emissions by approximately 30% over the base case, and also reduces transportation costs
  - Consolidates the sludges into one source by drying of all biosolids at Te Maunga for combined transportation to disposal
  - Provides flexibility for future disposal routes or, more importantly, for biosolids re-use

Sensitivity: General

- Use of either alternative fuel provides a very significant (over 90%) reduction in transportation emissions although there are implementation challenges including:
  - Procurement and maintenance of novel technology trucks in New Zealand
  - Logistics of fuel supply (or charging stations) for 300km trip
  - Both options increase grid electricity use – either directly for charging or indirectly through diversion of biogas from cogeneration at Chapel Street WWTP
  - Electric vehicles in particular are likely to become more widely available over time and so this option could be implemented at a later date

8.3.2 Natural Water Quality

The Government is taking an increasingly proactive stance towards elevating the quality of New Zealand's fresh, estuarine and marine waters. This is reflected in legislative changes either in train or foreshadowed by Ministers in 2019 (refer to 10.2.3).

The recent announcement on 31 July 2019 by Ministers of Local Government and the Environment (https://www.beehive.govt.nz/release/dedicated-watchdog-water-quality, accessed 8/08/19) that they intend to introduce minimum levels of treatment or "bottom-line" effluent quality targets for all wastewater discharges, and to introduce "best practice" guidelines for wastewater network operations (I.e. control of spills and overflows) could impact TCC right across the its wastewater system. At this time, there is too little detail around the proposed changes but it an area on which TCC must keep a watching brief.

9 Consultation

The first draft of this report was presented by its authors to the Wastewater Management Review Committee on 29 August 2019. The Committee agreed to engage a cultural consultant to work with tāngata whenua representatives (Ngā tāngata whenua o Te Tahuna o Rangataua) to prepare a cultural review of this report and management of the Tauranga wastewater scheme. Refer to Appendix B: Cultural Review for the Te Maunga Wastewater Treatment Plant Resource Consent, Conroy and Donald Consultants Limited, 2020.

The table below summarises the recommendations made in this report on behalf of Ngā tāngata whenua o Te Tahuna o Rangataua and TCC's response to these recommendations.

#	Recommendation	Report Reference	TCC Response
To the MUTR Report Writer			
1	Include acknowledgement to Iwi Planning Documents, Treaty Settlements, Tauranga Harbour Advisory Group and the new Wāhi Tapu Status for Te Tahuna o Rangataua.	2.1-2.4, 4	Beca to update MUTR report (completed)
To the Review Committee			
2	Operation of the Review Committee: a. Ensure there is regular reporting to the Tauranga Harbour Advisory Group and a feedback loop to the Review Committee. b. Become familiar with the provisions of relevant Iwi Planning Documents relating to wastewater treatment and disposal. For example, Policy 9 and Action 9.2 of the Tauranga Moana Iwi Management Plan as well as Section 6.3 of Tūhoromatanui: Ngā Pōtiki Environmental Plan 2019-2029. c. Further discussion is needed to progress towards a genuine partnership which is collaborative, enduring and involves shared decision making.	2.1, 3.1, 4	a. TCC reports quarterly to the Advisory Group b. Review Committee to discuss c. Review Committee to discuss
3	Pond decommissioning: a. Cease use of the ponds. b. Decommission the ponds, as in 'dismantle' and rehabilitate back to its natural state. c. Work on a post decommissioning landscape/wetland plan.	3.1	Ongoing discussion with Review Committee
4	Operation of the WWTP: a. Council take a network-wide perspective and consider a long- term strategic view, particularly responding to growth and climate change (covered further in section 4 of this report). b. Develop a communications strategy alongside the Wastewater Management Plan. c. Explore long-term land based discharge of treated wastewater.	3.1	a. Underway – 30 Year Infrastructure Strategy and other planning documents b. Communications strategy via Waterline – staff to work with Review Committee c. Potential study

Sensitivity: General

| Consultation |

#	Recommendation	Report Reference	TCC Response
5	Environmental Mitigation and Enhancement Fund: a. Review Committee to adopt and implement the environmental mitigation and enhancement fund policy manual. b. Clarify the purpose of the EMEF and develop a strategy to target the use of the fund for projects that meet agreed outcomes.	3.1	a. With Review Committee b. With Review Committee
6	Cultural Monitoring: a. Ensure greater connectivity with Manaaki Te Awanui Trust particularly those who are able to provide guidance to monitor impacts and changes from a unique Māori perspective. b. Confirm and implement a cultural monitoring programme for Te Tahuna o Rangataua. This is to ensure there is robust cultural monitoring data for the 2025 cultural review report. c. Duplicate Condition 19.1 d) and e) to condition 9 and provide opportunities through conditions 10 – 13 for tangata whenua to participate and gather information.	3.2	a. to c. Agreed in principle - TCC staff to progress with Trust and WWMRC
7	Review committee to consider innovative approaches to restoring mauri to Te Tahuna a Rangataua and/or ocean outfall site.	4	Review Committee to consider
To TCC - WWTP Operations, Planning and Consenting			
8	TCC to ensure that the review and development of the Wastewater Management Plan: • involves tangata whenua representatives from the Review Committee. • incorporates cultural values. • takes into account iwi planning documents • takes a long-term view and perspective • takes a whole system / network approach and provides greater linkages between the three waters (water, wastewater and stormwater). • considers ways to enable Māori land development.	4	Agreed
9	Carry out an updated review of treatment technologies, including an assessment in relation to cultural values and customary resources. This should include high rate algal ponds.	4	Staff to keep Review Committee updated on advances in treatment technologies. Review Committee to decide to commission cultural values and customary resources assessment
10	Be aware of the implications of coastal statutory acknowledgements, iwi planning documents and the waahi tapu status of Te Tahuna o Rangataua on resource consent processes (both renewals and variations).	2.1-2.4	Acknowledged

CH2M Beca

#	Recommendation	Report Reference	TCC Response
To the BOPRC – who administer the Tauranga Harbour Advisory Group			
11	The Terms of Reference for the Tauranga Harbour Advisory Group be reviewed. Representation is sought by Ngā Pōtiki ā Tamapahore Trust given the significance of Te Tāhuna o Rangataua to Ngā Pōtiki.	2.1, 2.4	BOPRC to advise

10 Implications of Changes in Legislation and Policy

The following assessment is provided to meet the requirements of Clause F of Condition 20.1 of resource consent 62878. This clause states the MUTR report should cover:

"The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme."

For the purposes of this assessment, only changes relevant to the ongoing operation or compliance of the WWTPs since the previous MUTR report (i.e. since 2015) have been considered in this section.

For clarity, matters directly relevant to section 104 of the Resource Management Act (RMA) (matters the consent authority must, subject to Part 2 of the RMA, have regard to when considering resource consent applications) have been considered in this assessment, given the MUTR requirements relate to regional consents. Other documents are also covered briefly.

10.1 National Policy Statements and National Environmental Standards

10.1.1 New Zealand Coastal Policy Statement 2010

The New Zealand Coastal Policy Statement (NZCPS) guides local authorities in their management of the coastal environment, and was first issued in 1994. A new NZCPS took effect in 2010. No changes to the NZCPS have occurred since 2010 and no further assessment is provided here.

10.1.2 National Policy Statement for Freshwater Management 2014 (Amended 2017)

The National Policy Statement for Freshwater Management 2014 (the NPS-FM) reflects Central Government's policy and directions to local government regarding the management of the nation's freshwater resources. Consent authorities must have regard to the NPS when considering resource consent applications for discharges to fresh water.

The NPS-FM was introduced in 2011. It was updated and replaced in 2014, and amended in 2017. Given the wastewater scheme discharges to coastal marine water, the NPS-FM is not considered to be relevant and no further assessment is provided here.

10.1.3 National Environmental Standard for Air Quality

In October 2004, the Government introduced the National Environmental Standards for Air Quality (the NES-AQ) which specifies concentration limits and, in some instances, allowable exceedances of those limits.

Furthermore, a review of the NES-AQ in 2011 introduced regulations to restrict the granting of resource consent for industry after 2013 if they exceed PM_{10} (fine and coarse particulate matter) concentrations.

No changes have occurred to the NES-AQ since 2011 and no further assessment is provided here.

10.2 Regional Planning Instruments

10.2.1 Bay of Plenty Regional Policy Statement

The Regional Policy Statement (RPS) provides a framework for sustainably managing the region's natural and physical resources. It highlights regionally significant issues with land, air, fresh and coastal water, infrastructure and biodiversity, including issues of significance to iwi. It sets out what needs to be achieved (objectives) and how it will be achieved (policies and methods).

It does not contain rules; instead it sets out how regional, city and district councils need to manage these resources. It is a directive policy document in relation to regional and district plans and the consideration of resource consents.

A number of changes have been made to the RPS since 2015 and a further assessment is provided here.

- **Change 1 (Coastal Policy)** – To give effect to the NZCPS 2010 (operative 20 October 2015). Changes made relate to natural character, allocation of public space in the coastal marine area and subdivision within the coastal environment. These changes are not considered relevant to this assessment, however any proposed future changes to the treated wastewater discharge structures in the coastal marine area will have to consider these matters (assumed to be a future separate resource consent process).

- **Change 2 (Natural Hazards)** - To insert provisions to guide regional, city and district plans and resource consent applications in managing land use and associated activities according to their level of natural hazard risk (operative 5 July 2016). Not considered relevant to this assessment.

- **Change 3 (Rangitāiki River)** - To recognise and provide for the vision, objectives and desired outcomes of the Rangitāiki River Document 'Te Ara Whanui o Rangitāiki' - 'Pathways of the Rangitāiki' (operative 9 October 2018). Not considered relevant to this assessment.

- **Change 4 (Tauriko West Urban Limit)** - To amend the current Urban Limit and indicative timing of growth in the Regional Policy Statement to provide for the urban development of Tauriko West (operative 30 October 2018). Not considered relevant to this assessment.

- **Update 1 Targets for Housing Capacity** - To include targets for housing development capacity for the western Bay of Plenty sub-region in accordance with the National Policy Statement on Urban Development Capacity 2016 (NPS-UDC) (operative 14 December 2018. Not considered relevant to this assessment.

10.2.2Operative Bay of Plenty Regional Coastal Environment Plan

The Plan covers the entire coastal environment including the coastal marine area (the area between mean high water spring tides and the '12 mile limit' of the territorial seas) and the land backdrop. It includes:

- Rules to regulate some activities in the coastal marine area. This includes building of structures, disturbance of the foreshore or seabed, reclaiming the sea, discharging contaminants and other activities. These activities generally require a coastal permit from BOPRC before they can be undertaken.
- Policies about important environmental issues on land adjacent to the sea. This includes issues relating to the natural character and landscape of the coast, public access and coastal hazards. These policies do not regulate people's activities directly but provide guidance in the preparation of district plans and consideration of resource consents.
- Fifteen schedules including site specific information on coastal values (including landscape, vegetation, bird habitat, conservation areas and culturally significant areas), development plans for the Ports of Tauranga and Whakatāne, water quality standards and environmental monitoring.

The Regional Coastal Environment Plan is in the process of being superseded by the Proposed Plan (described further below). Therefore, no updates have been made to this plan since 2014. The operative plan will remain active until the proposed plan is approved.

10.2.3 Bay of Plenty Regional Coastal Environment Plan

The BOPRC Regional Coastal Environment Plan became operative in December 2019.

Schedule 10 (Water Quality Classifications) is the most relevant to this assessment as this relates to '*standards relevant to receiving environments affected by the wastewater scheme*'. The standards apply after reasonable mixing of any contaminant or water with the receiving water and disregarding the effect of any natural perturbations that may affect the water body.

Whilst the standards would need to be considered fully in any new consent application for the discharge of treated wastewater to the coastal marine area, an assessment of the implications of Schedule 10 is provided in the below table, based off monitoring undertaken as part of the existing consent for the existing treated wastewater discharge.

Table 34: Assessment against the Implications of Schedule 10 of the Bay of Plenty Regional Coastal Environment Plan

Qualitative Standard	Quantitative Standard	Mātauranga Māori	Implications
There shall be no conspicuous change in the colour or visual clarity.	The decrease in secchi disc vertical depth or black disc horizontal range shall not be greater than 20%.	Te Hauora o te Wai / the health and mauri of water. Coastal waters support a healthy ecosystem appropriate to that locality (open coastal water, lagoon, estuary, coastal wetland, saltmarsh, intertidal areas, rocky reef system etc. Coastal water quality enables ecological processes to be maintained, supports an appropriate range and diversity of indigenous flora and fauna, and there is resilience to change.	No observations have been recorded in terms of conspicuous changes in the colour or clarity of receiving waters.
There shall be no significant adverse effects on aquatic life.	Refer to: Australian and New Zealand Guidelines for Fresh and Marine Water Quality Australian and New Zealand Environment and Conservation Council, 2000.		No significant adverse effects on aquatic life have been recorded based on monitoring undertaken to date.
There shall be no production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials.	None		No observations have been recorded in terms of conspicuous oil or grease films, scums or foams, or floatable or suspended materials in receiving waters.
There shall be no emission of objectionable odour	Refer to the Bay of Plenty Regional Air Plan		No objectionable odour has been observed at the discharge location.
The visual clarity of the water shall be suitable for bathing.	The horizontal sighting distance of a 200 mm black disc should exceed 1.6 metres (in the active surf zone it is not possible to use this method). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council, 2000.	Kei te ora te mauri (the mauri of the place is intact). Coastal resources are able to be used for customary use and customary practices are able to be exercised to the extent desired. Tikanga and preferred methods are able to be practised.	No observations have been recorded in terms of conspicuous changes in terms of the visual clarity of receiving waters.
The water shall not be rendered unsuitable for bathing by the presence of contaminants.	Microbiological: The concentration of enterococci must not exceed 280 cfu/100mL. See Microbiological Water Quality Guidelines for		Monitoring of water quality sites have shown no exceedances of the limit of 280 cfu/100mL.

Qualitative Standard	Quantitative Standard	Mātauranga Māori	Implications
	methodology (MfE & MoH, 2003).		
Aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants.	Microbiological The median faecal coliform content of samples taken over a shellfish gathering season shall not exceed a Most Probable Number (MPN) of 14/100 mL, and not more than 10% of samples should exceed an MPN of 43/100 mL (using a five-tube decimal dilution test). See Microbiological Water Quality Guidelines for methodology (MfE & MoH, 2003).	Kaimoana is safe to harvest and eat.	Shellfish monitoring is undertaken as a specific requirement of the resource consent (as described in section 4.1.3). This shellfish monitoring is considered to be more appropriate than sampling overlying waters.
There shall be no undesirable biological growths as a result of any discharge of a contaminant into the water.			There is no evidence of any undesirable biological growths occurring as a result of the treated wastewater discharge.
The natural temperature of the water shall not be changed by more than 3 degrees C.			There is no evidence of the natural temperature of the water being changed by more than 3 degrees C.
The concentration of dissolved oxygen shall exceed 80% of saturation concentration.			There is no evidence of the centration of dissolved oxygen reducing below 80% of saturation concentration as a result of the treated wastewater discharge.

10.2.4Bay of Plenty Natural Resources Plan

BOPRC has incorporated the following documents into one document called the Bay of Plenty Natural Resources Plan:

- On-site Effluent Treatment Regional Plan
- Regional Air Plan
- Regional Water and Land Plan
- Regional River Gravel Management Plan
- Rotorua Geothermal Regional Plan
- Regional Plan for the Tarawera River Catchment

Chapters relevant to the Tauranga wastewater scheme are the Regional Air Plan and the Regional Water and Land Plan. No recent changes have been made to these chapters and no further assessment is provided here.

10.3 Cultural Legislative, Planning and Governance Framework

10.3.1 Treaty Settlement Legislation

The following Tauranga Moana iwi have Treaty of Waitangi settlement legislation in place:

- Ngāti Pūkenga Claims Settlement Act 2017
- Tapuika Claims Settlement Act 2014
- Waitaha Claims Settlement Act 2013

Deeds of Settlement are still pending for Ngāti Ranginui, Ngai Te Rangi and Ngā Potiki.

The settlement legislation above provide for Statutory Acknowledgement (Crown recognition of the particular cultural, spiritual, historical and traditional association of iwi with a site of significance or resource identified as a statutory area) with regard to the coastal marine area. Statutory Acknowledgements are considered during consent processes, e.g. wastewater discharge to the coastal marine area.

10.3.2 Marine and Coastal Area (Takutai Moana) Act 2011

The Marine and Coastal Area (Takutai Moana) Act 2011 provides for protection of customary rights in the marine and coastal area. Applications for recognition of customary rights have been made by Tauranga Moana hapu and iwi groups and are awaiting decisions. Claimants under this Act should be consulted during consenting processes which affect the marine and coastal area.

10.3.3 Iwi Planning Documents

The following iwi/hapu environmental and resource management plans are relevant to Tauranga Moana and the wastewater scheme.

- Ngāi Te Ahi Hapū Management Plan, 2013
- Ngāi Te Rangi Iwi Resource Management Plan, 1995
- Ngāti Pūkenga Iwi ki Tauranga Trust Iwi Management Plan, 2013
- Ngāti Tapu Ngāi Tukairangi Hapū Management Plan, 2014
- Tapuika Environmental Management Plan, 2015
- Tauranga Moana Iwi Management Plan - A joint Environmental Plan for Ngāti Ranginui, Ngāi Te Rangi and Ngāti Pūkenga, 2016
- Tūhoromatanui: Ngā Pōtiki Environmental Plan, 2019
- Waitaha Iwi Management Plan, 2014

10.3.4 Tauranga Moana Advisory Group

Once the Tauranga Moana Iwi Collective Deed of Settlement (currently with select committee) is passed into law, it will require a Tauranga Moana governance group to be established. In preparation for this Ngāi Te Rangi, Ngāti Ranginui, Ngāti Pūkenga, Bay of Plenty Regional Council, Tauranga City Council and Western Bay of Plenty District Council established the Tauranga Moana Advisory Group. This Group has met quarterly since November 2014 with the purpose of coordinating, sharing and integrating activities across its member organisations.

TCC reports to this Group on a quarterly basis.

10.3.5 Te Tahuna o Rangataua

In 2019, Heritage New Zealand (Pouhere Taonga) registered Te Tahuna o Rangataua (Rangataua Bay) as a wāhi tapu area. This status will be considered in regional and territorial plans in the future and would be consider during consent processes. The Te Maunga WWTP is located within Te Tahuna o Rangataua.

10.4 Other Documents/Regulations

10.4.1 Climate Change Response (Zero Carbon) Amendment Act 2019

The Climate Change Response (Zero Carbon) Amendment Act was enacted in November 2019. The Act provides a framework for the development of climate change policies which contribute to the Paris Agreement (to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels) and allow New Zealand to prepare for, and adapt to, the effects of climate change.

Key changes in the Act are:

- new domestic greenhouse gas emissions reduction targets for 2030 and 2050
- a system of emissions budgets to act as stepping stones towards the long-term target
- requirements for the Government to develop and implement policies for climate change adaptation and mitigation
- establishment of a new, independent Climate Change Commission to provide expert advice and monitor progress towards long-term goals.

This legislation will likely affect how TCC operates and maintains its services and how TCC implements capital works. We recommend TCC maintains a watching brief on implications from this legislation.

10.4.2 Three Waters Review

The Government is reviewing how to improve the regulation and supply arrangements of drinking water, wastewater and stormwater (three waters) to better support New Zealand's prosperity, health, safety and environment. Most three waters assets and services, but not all, are owned and delivered by local councils.

The Three Waters Review is a cross-agency initiative led by the Minister of Local Government. Other involved agencies and portfolios include: Health, Environment, Finance, Business Innovation and Employment, Commerce and Consumer Affairs, Primary Industries, Climate Change, Infrastructure, Civil Defence and Emergency Management, Housing and Urban Development, Transport, Conservation, and Rural Communities.

As of July 2020, the Government approved a suite of regulatory reforms to help ensure safe drinking water, and deliver improved environmental outcomes from New Zealand's wastewater and stormwater systems.

A new dedicated water regulator (Taumata Arowai) has been established to oversee the regulatory regime (Taumata Arowai—the Water Services Regulator Act 2020 enacted 22 July 2020). The regulator has a range of responsibilities and functions, including sector leadership; standards setting; compliance, monitoring and enforcement; capability building; information, advice and education; and performance reporting.

The Water Services Bill is a companion piece of legislation to the Taumata Arowai—the Water Services Regulator Act was first introduced to Parliament in July 2020. It proposes to provide the tools and framework for Taumata Arowai. At this stage this Bill applies to drinking water rather than stormwater and wastewater.

In July 2020, the Government announced a funding package to support the delivery of three waters services in response to the Covid-19 pandemic and also plans to transform the industry to large scale service providers over the next three years.

It is likely that the service provider and consent holder for the Tauranga wastewater scheme will change from TCC to a new utility in the next five years. We recommend that as a large population centre within the Bay of Plenty that TCC taking a proactive, leading role in the Three Waters Review and in monitoring its implications for the Tauranga wastewater scheme.

10.4.3 Waste Minimisation Act 2008

The Waste Minimisation Act encourages a reduction in the amount of waste generated and disposed of in New Zealand. The aim is to reduce the environmental harm of waste and provide economic, social and cultural benefits for New Zealand.

To encourage waste minimisation, the Act imposes a levy on all waste disposed of in municipal landfills to generate funding to help local government, communities and businesses minimise waste.

This levy has an impact on the cost of biosolids disposal to landfill. Currently the levy is $10 per tonne of material disposed.

10.4.4 Draft Good Practice Guide for the Beneficial Re-use of Organic Solids on Land - Water New Zealand 2017

The draft Water New Zealand Good Practice Guide for the Beneficial Use of Organic Waste Products on Land was published in 2017. This guide will update the 2003 Biosolids Guidelines and includes for a range of other organic material.

The Good Practice Guide for the Beneficial Use of Organic Waste Products on Land contains information and recommendations to assist producers, applicators and consent authorities gain the benefits of applying good quality organic material to land to increase soil fertility and productivity. This guide will be referred to in developing the biosolids treatment and disposal options for treatment plants at Chapel Street and Te Maunga.

11 Conclusions and Recommendations

This MUTR report has reviewed TCC's performance and compliance with its wastewater consents from 2015 to 2019. Section 11.1 below provides specific comment on monitoring, sampling and reporting as required by condition 20d of consent 62878. Our conclusions and recommendations based on all of condition 20 of consent 62878 are shown in section 11.4.

11.1 Monitoring, sampling and reporting

The following provides comments on the adequacy and scope of monitoring and sampling as required by condition 20d of consent 62878.

Titiko monitoring – condition 6.4 consent 62881

The current titiko monitoring programme is providing limited benefit due to the naturally high variability in abundance, distribution being affected by natural environmental variables and no relationship being detected between size/abundance and seepage location. The titiko monitoring programme could be refocussed to other aspects of titiko health, such as body burden of contaminants and indicator bacteria at a range of sites where titiko are present (and potentially harvested) within Rangataua Bay.

Establishing a carbon baseline

Diffuse and point emission sources of CO_2 and CH_4 at the two treatment plants could be identified and annually measured and reported as CO_2e emissions on an annualised basis to establish a carbon footprint for the wastewater scheme.

Emerging contaminants

Sampling of the treated wastewater for a typical suite of emerging contaminants (e.g. contaminants from personal care products etc.) could be undertaken on an annual basis to provide a trend of these contaminants to inform MTUR reports and consents. future These contaminants are routinely tested for as requirements of new consents. This information would be useful to inform future consent processes where in other projects tāngata whenua and other stakeholders routinely enquire with regards to the effects of these contaminants.

Overflow volume and discharge rates

TCC currently estimates overflow volume and discharge rates when these events occur. It is recommended that TCC investigates ways to improve the accuracy of these records.

Toi Te Ora

TCC notifies BOPRC of any non-compliances in marine bacterial and shellfish monitoring. It is recommended this is extended to Toi Te Ora Pubic Health as required in conditions 11.3 and 12.2 of consent 62878.

11.2 Consultation

Tāngata whenua representatives (Ngā tāngata whenua o Te Tahuna o Rangataua) commissioned a cultural review of the wastewater scheme (Cultural Review for the Te Maunga Wastewater Treatment Plant Resource Consent, Conroy and Donald Consultants Limited, July 2020). This report made recommendations with regard to:

- Acknowledgement to Iwi Planning Documents, Treaty Settlements, Tauranga Harbour Advisory Group and the new Wāhi Tapu Status for Te Tahuna o Rangataua in the MUTR report (completed)

- Operation of the WMRC
- Pond 1 decommissioning
- Operation of the WWTP
- Environmental Mitigation and Enhancement Fund
- Cultural Monitoring
- Considering innovative approaches to restoring mauri to Te Tahuna a Rangataua and/or ocean outfall site
- Review and development of the Wastewater Management Plan
- Review of treatment technologies, including an assessment in relation to cultural values and customary resources, including high rate algal ponds
- Awareness of the implications of coastal statutory acknowledgements, iwi planning documents and the waahi tapu status of Te Tahuna o Rangataua on resource consent processes (both renewals and variations)
- BOPRC to consider representation of Ngā Pōtiki ā Tamapahore Trust on the Tauranga Harbour Advisory Group given the significance of Te Tāhuna o Rangataua to Ngā Pōtiki

It is recommended that TCC and the WMRC review and agree actions from the recommendations made in the Cutural Review report. Progress on these actions should be reported regularly to the WMRC.

11.3 Implications of Changes in Legislation and Policy

Climate Change Response (Zero Carbon) Amendment Act 2019

This legislation will likely affect how TCC operates and maintains its services and how TCC implements capital works. We recommend TCC maintains a watching brief on implications from this legislation.

Three Waters Review

It is likely that the service provider and consent holder for the Tauranga wastewater scheme will change from TCC to a new utility in the next five years. We recommended TCC take a proactive role in the Three Waters Review and monitoring its implications for the Tauranga wastewater scheme.

Sensitivity: General

11.4 Conclusions and recommendations by condition 20 of consent 62878

The table below summarises our conclusions and recommendations based on the subclauses of condition 20 of consent 62878 which sets out the matters to be addressed in the MUTR report.

Table 35: Conclusions and recommendations against consent conditions

Consent Condition	Conclusion	Recommendation
Progress towards TCC's objective of "towards zero waste"	Since the last review TCC has progressed its objective of "towards zero waste" by updating plans associated with waste minimisation and responding to and mitigating wastewater overflows. TCC has also participated in drafting a regional best practice guide for managing wastewater overflows. TCC has continued to develop its various programmes to reduce wastewater blockages and stormwater and groundwater from entering the wastewater network.	It is recommended that TCC continues with its development of current programmes and reviews them regularly to achieve and maintain best industry practice. This includes a review of its biosolids strategy.
Progress in adoption or promotion of SmartGrowth Stretch Targets	The 2004 SmartGrowth Strategy had six stretch targets. TCC has implemented the actions required under these targets.	It is recommended that TCC continues to participate in the implementation of SmartGrowth initiatives and sets further targets to improve its wastewater management as set out in a. above.
Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems	TCC recovers biogas from processes at Chapel St WWTP and is investigating further options for improving energy efficiency. TCC has also conducted an energy and carbon efficiency review of both WWTPs. Options investigated over the past five years to improve processes have been summarised in this report. There has been a focus on improving processing of biosolids. TCC is also looking options for end use of biosolids.	It is recommended that TCC continues to review options to increase capacity due to growth and to improve treatment processes in line with technological changes and advances.
The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling.	The overall performance of the wastewater scheme, as measured by the treated wastewater quality at the point of compliance and with respect to the various environmental monitoring requirements of this resource consent, has been consistently good.	Refer to section 11.1 above.

CH2M Beca

Sensitivity: General

Consent Condition	Conclusion	Recommendation
Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions.	Overall, consent compliance has been high. The UV plant was installed and commissioned in late 2015. However the plant has been shut down due to operational issues on occasion, notwithstanding the treated wastewater discharges have all been compliant with consent conditions. Pond 1 stopped receiving sludge in April 2019 after the commissioning of a new thickening and dewatering facility. Future use of this pond is yet to be agreed with the Wastewater Management Review Committee and Bay of Plenty Regional Council.	Refer to section 11.1 above.
The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme	Upcoming legislation on climate change and how wastewater is managed in New Zealand will affect the TCC wastewater scheme. The Proposed Regional Coastal Environment Plan sets water quality classification standards relevant to new consent applications. Based on monitoring information provided by TCC, no observations have been made to suggest these standards are not currently being complied with.	It is recommended that TCC maintains a close watching brief on these developments and implications on the future wastewater scheme.
The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue	The costs of any potential technological changes have been assessed in the various options studies out to increase capacity due to growth and to improve treatment processes. This is summarised in TCC's 30 Year Wastewater Management Plan which describes wastewater treatment needs to meet levels of service and growth requirements. Capital works projects from this Plan are input to the Long Term Plan and Infrastructure Strategy. The Plan was last updated in 2017 and is due for review in 2020.	It is recommended that TCC continues to carry out multi-criteria analysis (which consider the social, cultural, environmental and economic effects) in determining the best practicable option for delivering its wastewater services.

11.5 Additional Factors

TCC has also carried out studies in the last five years with regard to:

- Sustainability and resource recovery
- Resilience to natural hazards
- Environmental emissions

It is recommended that TCC continues to incorporate these factors into its planning for Tauranga's wastewater network, including the update of its biosolids strategy. TCC should also keep a watching brief on how changes in global trends and legislation may affect the management of its wastewater network, in particular any regional or national requirements to more actively identify and implement climate change adaptation solutions.

Sensitivity: General

12 References

12.1 Report References

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Sensitivity: General

12.2 Literature

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A

Appendix A – Resource Consents

Consent Number: **62722**

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A discharge permit pursuant to section 15(1)(c) of the Resource Management Act 1991 to **Discharge Odorous Gases From Chapel Street Wastewater Treatment Plant to the Air** subject to the following conditions:

1 Purpose

To discharge odorous gases and other gases as by-products of biological breakdown and stripping of sewage such as sulphides, amines and organic fatty acids from the Chapel Street Wastewater Treatment Plant located at Chapel Street, Tauranga.

2 Points of Discharge

To the air from the wastewater treatment plant as shown on BOPRC Plan Number RC 62722.

3 Map Reference

At or about map reference NZMS 260 U14: 8928-8731 at the site of the plant.

4 Legal Description

DPS 88129 and Section 9 SO43580, Block X, Tauranga SD (Tauranga District).

5 Emission Limits and Controls

5.1 There shall be no discharge of odour, in the opinion of an enforcement officer, as a result of exercising this permit that is noxious, dangerous, offensive or objectionable beyond the boundary of the "Wastewater Treatment" designation relating to the plant.

5.2 The permit holder shall adopt the best practicable option to avoid or mitigate any potential adverse effects on the environment in order to ensure compliance with condition 5.1, arising as a result of discharges from the permit holder's activities. Adoption of the best practicable option shall include but not be limited to the following requirements:

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a) Ensuring that all three primary sedimentation tanks are enclosed within two years of this permit being granted, and ventilated to odour control equipment from that time onwards;

b) Ensuring that prior to the covering of the primary sedimentation tanks, they are operated in a manner that minimises the potential for odour emissions from the site;

c) Ensuring that flares on site shall be operated in such a manner as to prevent visible emissions and to have a flame present at all times the flare is in operation.

6 Odour Management Plan

6.1 The permit holder shall prepare and maintain an Odour Management Plan for the Chapel Street site. As a minimum, the Odour Management Plan shall set out:

a) Management and operational requirements necessary to comply with the conditions of this permit.

b) Procedures for community odour survey and monitoring as required by conditions 7 and 8.

6.2 The permit holder shall operate and undertake activities at the site in accordance with the Odour Management Plan required pursuant to condition 6.1.

7 Community Survey

7.1 The permit holder shall undertake a community-based odour survey within six months of the commencement of the permit and every two years thereafter for the term of the permit, for the purpose of assessing the effectiveness of odour control at the plant and the levels of off-site odour. The survey shall be carried out in accordance with procedures set out in the Odour Management Plan.

7.2 The results of the survey including a discussion as to the implication of these results shall be provided to the Regional Council within 2 months of the survey being undertaken.

8 Odour Monitoring

8.1 The permit holder shall undertake monitoring of odour discharge rates at least once every twelve months. The monitoring shall be on:

a) All biofilters, unless agreed otherwise in writing; and

b) A secondary sedimentation tank; and

c) The contact stabilisation tank; and

d) One representative primary sedimentation tank if uncovered.

8.2 The monitoring shall be carried out in accordance with the procedures set out in the Odour Management Plan. The monitoring shall be by Dynamic Dilution Olfactometry and shall include sufficient samples to fully quantify odour discharge rates from each source.

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8.3 That the permit holder shall undertake a walkover inspection of the treatment plant and surrounding neighbourhood on at least a monthly basis. Any evidence of actual odour shall be recorded and investigated. Where necessary remedial action shall be undertaken as soon as practicable. The procedures for the walkover, recording of the results and remedial actions shall be detailed in the Odour Management Plan.

8.4 The permit holder shall ensure that weather conditions in the vicinity are continuously measured and recorded. The parameters measured shall include:

a) Wind velocity and direction; and

b) Rainfall; and

c) Temperature.

9 Reporting

9.1 The permit holder shall make all records, monitoring and test results that are required by the conditions of this permit available on request, during operating hours, to an enforcement officer and shall be kept for a minimum period of 24 months from the date of each entry.

9.2 The permit holder shall notify an enforcement officer as soon as practicable in the event of any significant increase in the discharge of contaminants to air, which has resulted or may result in adverse effects on the environment. In the event of an incident occurring, the permit holder shall provide a written report to the Regional Council within 10 days of the occurrence. The report shall give reasons for the incident, mitigation measures taken and any measures taken to prevent its reoccurrence.

9.3 That the permit holder shall log all air quality complaints received. The complaint details shall include:

a) The date, time, position and nature of the complaint; and

b) The name, phone number and address of the complainant, unless the complainant refuses to supply these details: and

c) Any remedial actions undertaken.

9.4 Details of any complaints received shall be provided to the Regional Council as soon as practicable and at least within 24 hours of receipt of the complaint(s).

10 Access

The permit holder shall provide access to Regional Council staff to carry out periodic inspections to ascertain compliance with this permit.

11 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

Consent Number: **62722**

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit; and

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

12 Term of Permit

This permit shall expire on 30 April 2040.

13 Resource Management Charges

The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

14 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes:

1. *Reports as required by the conditions of this permit shall be directed in writing to the Principal Compliance Officer, Environment Bay of Plenty, and should include the permit number.*

2. *The permit holder is advised that non-compliance with permit conditions may result in enforcement action against the permit holder and/or their contractors.*

Consent Number: **62722**

3. *The permit holder is responsible for ensuring that all contractors carrying out works under this permit are made aware of the relevant permit conditions, plans and associated documents.*

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Consent Number: 62723

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A discharge permit pursuant to section 15(1)(c) of the Resource Management Act 1991 to **Discharge Odorous Gases From Te Maunga Wastewater Treatment Plant to the Air** subject to the following conditions:

1 Purpose

To discharge odorous gases and other gases as by-products of biological breakdown and stripping of sewage such as sulphides, amines and organic fatty acids from the Te Maunga Wastewater Treatment Plant located at Tip Road, Mount Maunganui.

2 Points of Discharge

To the air from the wastewater treatment plant and associated operations including sludge removal from the treatment plant as shown on BOPRC Plan Number RC 62723.

3 Map Reference

At or about map reference NZMS 260 U14: 9500-8532 at the site of the plant.

4 Legal Description

Part Papamoa Sec 2 Sec 10a2c5 South portion, Block XI, Tauranga SD (Tauranga District).

5 Emission Limits and Controls

5.1 There shall be no discharge of odour, in the opinion of an enforcement officer, as a result of exercising this permit that is noxious, dangerous, offensive or objectionable beyond the boundary of the "Waste Management" designation of the plant.

5.2 The permit holder shall adopt the best practicable option to avoid or mitigate any potential adverse effects on the environment in order to ensure compliance with Condition 5.1 arising as a result of discharges from the permit holder's activities. Adoption of the best practicable option shall include but not be limited to the following requirements:

Consent Number: 62723

a) That screening takes place within a fully enclosed building that is fitted with appropriate odour control.

b) That the "Sludge Lagoon Pond" shall be decommissioned within 7 years of the permit being granted.

6 Odour Management Plan

6.1 The permit holder shall prepare and maintain an Odour Management Plan for the Te Maunga site. As a minimum, the Odour Management Plan shall set out:

- Management and operational requirements necessary to comply with the conditions of this permit.
- Procedures for the community odour survey and monitoring as required by conditions 7 and 8.

6.2 The permit holder shall operate and undertake activities at the site in accordance with the Odour Management Plan required pursuant to condition 6.1.

7 Community Survey

7.1 The permit holder shall undertake a community-based odour survey within six months of the commencement of the permit and every two years thereafter for the term of the permit, for the purpose of assessing the effectiveness of odour control at the plant and the levels of off-site odour. The survey shall be undertaken in accordance with procedures set out in the Odour Management Plan.

7.2 The results of the survey including a discussion as to the implication of these results shall be provided to the Regional Council within 2 months of the survey being undertaken.

8 Odour Monitoring

8.1 The permit holder shall undertake monitoring of odour discharge rates once every twelve months. The monitoring shall be on:

a) All biofilters, unless agreed otherwise in writing; and

b) A secondary sedimentation tank; and

c) At least two locations within the aeration ditch.

8.2 The monitoring shall be by Dynamic Dilution Olfactometry and shall include sufficient samples to fully quantify odour discharge rates from each source.

8.3 The permit holder shall undertake a walkover inspection of the treatment plant and surrounding neighbourhood on at least a monthly basis. Any evidence of actual odour shall be recorded and investigated. Where necessary remedial action shall be undertaken as soon as practicable.

Consent Number: 62723

8.4 The permit holder shall ensure that weather conditions in the vicinity are continuously measured and recorded. The parameters measured shall include:

a) Wind velocity and direction; and

b) Rainfall; and

c) Temperature.

9 Reporting

9.1 The permit holder shall make all records, monitoring and test results that are required by the conditions of this permit available on request, during operating hours, to an enforcement officer and shall be kept for a minimum period of 24 months from the date of each entry.

9.2 The permit holder shall notify an enforcement officer as soon as practicable in the event of any significant increase in the discharge of contaminants to air, which has resulted or may result in adverse effects on the environment. In the event of an incident occurring the permit holder shall provide a written report to the Regional Council within 10 days of the occurrence. The report shall give reasons for the incident, mitigation measures taken and any measures taken to prevent its reoccurrence.

9.3 The permit holder shall log all air quality complaints received. The complaint details shall include:

a) The date, time, position and nature of the complaint; and

b) The name, phone number and address of the complainant, unless the complainant refuses to supply these details: and

c) Any remedial actions undertaken.

9.4 Details of any complaints received shall be provided to the Regional Council as soon as practicable and at least within 24 hours of receipt of the complaint(s).

10 Access

The permit holder shall provide access to Regional Council staff to carry out periodic inspections to ascertain compliance with this permit.

11 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

Consent Number: 62723

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit; and

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

12 Term of Permit

This permit shall expire on 30 April 2040.

13 Resource Management Charges

The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

14 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes:

1. *Reports as required by the conditions of this permit shall be directed in writing to the Principal Compliance Officer, Environment Bay of Plenty, and should include the permit number.*

2. *The permit holder is advised that non-compliance with permit conditions may result in enforcement action against the permit holder and/or their contractors.*

Consent Number: 62723

3. *The permit holder is responsible for ensuring that all contractors carrying out works under this permit are made aware of the relevant permit conditions, plans and associated documents.*

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Resource Consent

BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

Resource Consent 62878-AP

Following the processing of the Application received on the 28 October 2004, the Bay of Plenty Regional Council has granted the applicant(s):

Tauranga City Council

Consent(s) to:

62878.0.02-DC+	Discharge to Water	Expiry	30 April 2040
62878.0.03-CC	Occupy Coastal Space	Expiry	30 April 2040
62878.0.04-CC	Coastal Structure	Expiry	30 April 2040

CH17-00785	Approval	14 November 2017
CH-62878.0.01	Approved	21 February 2013

The consent(s) are subject to the conditions specified on the attached schedule(s) for each activity. Advice notes are also provided as supplementary guidance, and to specify additional information to relevant conditions.

The Resource Consent hereby authorised is granted under the Resource Management Act 1991 does not constitute an authority under any other Act, Regulation or Bylaw.

DATED at Whakatane this 9th day of September 2005

For and on behalf of The Bay of Plenty Regional Council

M Macleod

Mary-Anne Macleod
Chief Executive

Report Date: 14 November 2017 Report ID: BRCCONRP042 Page: 1 of 32

The change of the whole of this resource consent was approved under delegated authority of the Bay of Plenty Regional Council dated 14 November 2017.

Consent Number: **62878.0.02-DC+**

Bay of Plenty Regional Council

Resource Consent

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **hereby grants**:

A resource consent:

- **Pursuant to section15 (1)(a) of the Resource Management Act 1991 to Discharge Treated Wastewater from Chapel Street Wastewater Treatment Plant and Te Maunga Wastewater Treatment Plant to the Coastal Marine Area**

subject to the following conditions:

1 Purpose

1.1 For the purpose of discharging secondary-treated and disinfected wastewater from the Chapel Street Wastewater Treatment Plant and secondary-treated wastewater from the Te Maunga Wastewater Treatment Plant into the Coastal Marine Area.

1.2 To provide for the ongoing occupation of the coastal marine area by the Omanu ocean outfall structure and the potential retrofit (relining) of the structure.

2 Location Of Discharge

2.1 Into the Pacific Ocean through an existing 950 metre outfall pipe located off Omanu Beach as shown on BOPRC Plan Number RC 62879/1.

2.2 The Omanu ocean outfall pipe extends perpendicular to the Papamoa shoreline for a distance of 950 metres (distance from the beach manhole to the seaward diffuser) as shown on BOPRC plan number RC 62879/1.

3 Map Reference

3.0 At or about map reference NZMS 260 U14: 9695-8730.

The Omanu ocean outfall pipe is located between map references NZMS 260 U14 9720 8710 and NZMS 260 U14 9720 8710.

4 Legal Description

4.0 Foreshore and Seabed, Pacific Ocean (Tauranga District).

5 Quantity and Rate

5.0 The average daily quantity of treated wastewater to be discharged shall not exceed 50 000 cubic metres per day, with a maximum wet weather discharge of 900 litres per second. (see advice note 1).

6 UV Disinfection

Change: CH17-00785

6.1 No later than nine years after the issue of this permit the wastewater discharged from both the Chapel

Street and Te Maunga treatment plants shall be secondary treated and UV disinfected. The discharge of wastewater during planned and unplanned UV Plant maintenance is authorised, subject to conditions 6.2 & 6.3.

6.2 Planned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during planned maintenance periods:

- The wastewater pumps to the ocean outfall will be turned off during planned maintenance of the UV Plant (no discharge to the ocean), where possible - See advice note 9.
- Where practicable planned maintenance of the UV Plant will be undertaken during winter months where there are reduced bacteria/loads in the wastewater.
- The maximum downtime period of the UV Plant during planned maintenance periods shall be no more than two weeks.

6.3 Unplanned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during unplanned maintenance activities:

- The wastewater pumps to the ocean outfall shall be turned off during unplanned maintenance of the UV Plant (no discharge to the ocean), where possible.
- Actions to remedy the situation will be undertaken as quickly as possible and in a manner that minimises the length of downtime of the UV Plant.
- After the unplanned event, the consent holder shall submit to BOPRC a report detailing the event, including the date, time and extent of downtime of the UV plant and the actions undertaken to remedy the situation. This report will be provided to BOPRC within two weeks of the event being remedied.
- On any occasion that the event extends for more than 2 weeks, the consent holder shall provide an interim report to BOPRC stating, as a minimum, the cause of the event, likely duration of the event and the actions being undertaken to remedy the situation. Update reports shall be provided 4 weekly from the date of the interim report until the situation is remedied.

6.4 Where wastewater that is not UV treated is discharged to the ocean the quality of the wastewater discharged shall not exceed the standards required by Condition 10.2.

7 Outfall

7.1 The discharge shall be through a diffuser section at least 22.5 metres long.

7.2 The outfall diffuser shall be reconfigured to maximise initial dilution by no later that 1 January 2010.

7.3 The outfall diffuser shall be inspected at least once per annum. A report on the results of the inspection shall be sent to the Regional Council within one month of inspection.

8 Operations and Maintenance

8.1 The wastewater treatment and disposal system shall be operated and maintained at all times to ensure that the treatment is in accordance with sound engineering practices.

8.2 Treated wastewater from both the Chapel Street treatment plant and the Te Maunga treatment plant shall pass through a wetland prior to discharge via the ocean outfall.

9 Monitoring

9.1 The permit holder shall continuously monitor and record the flow rate and volume of treated wastewater entering the outfall pipeline.

9.2 The permit holder shall take grab samples and 24-hour flow proportioned samples of treated wastewater discharged twice each week. The samples shall be analysed for the constituents and at the frequency listed in Schedule 1 below.

9.3 The permit holder shall provide a suitable wastewater sampling station for the monitoring required by condition 9.2. The sampling station shall be located at the outfall pumping station, immediately prior to the entry of wastewater into the ocean outfall pipeline.

9.4 All quality analysis pursuant to condition 9.2 shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater" - APHA - AWWA - WPCF or such other method as may be approved by the Chief Executive of the Regional Council or delegate.

9.5 All quality analysis of the wastewater discharge shall be undertaken in a laboratory with IANZ or similar accreditation.

9.6 The permit holder shall make results of monitoring undertaken (as required by conditions of this permit) available to the Regional Council on request. Data records for each 3-month period ending April, July, October and January shall be forwarded to the Regional Council in a suitable electronic format, within 30 days after the end of each 3-month period.

9.7 The Permit Holder shall notify the Regional Council within 1 week of any non-compliance being determined in respect of condition 10 of this permit.

10 Treated Wastewater Quality

10.1 Based on twice-weekly sampling, as required by condition 9.2 of this permit, and take over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year during the term of this permit, all wastewater discharged through the ocean outfall shall meet the following BOD5 and total suspended solids standards:

Analyte Sample Type

No more than 16 values shall exceed

No more than 3 values shall exceed

BOD5 (mg/L) Composite

25

30

Total suspended solids (mg/L) Composite

50

80

(See advice notes 3 & 4)

10.2 The following enterococci standard shall apply to all wastewater discharged through the ocean outfall:

- Based on twice-weekly sampling as required by condition 9.2 of this permit, and taken over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year, no more that 16 enterococci values shall exceed 3 500 cfu/100mL.

11 Receiving Water Monitoring

11.1 The permit holder shall monitor the enterococci concentration on the receiving water at nine locations offshore of the beach adjacent to the outfall. Five water samples are to be collected per station per month during December, January, February and March to give a total of 20 samples per station per year. The monitoring stations shall be situated approximately 400 metres offshore of the beach at the following locations:

a) 2000 metres northwest of the outfall
b) 1500 metres northwest of the outfall
c) 1000 metres northwest of the outfall
d) 500 metres northwest of the outfall
e) On the outfall alignment
f) 500 metres southeast of the outfall
g) 1000 metres southeast of the outfall
h) 1500 metres southeast of the outfall
i) 2000 metres southeast of the outfall

11.2 Based on 20 coastal water samples collected each year in accordance with condition 11.1, the treated wastewater discharge shall not cause more than 13 enterococci values to exceed 35 enterococci per 100 mL, or cause any single sample to exceed 104 enterococci per 100 mL. (see advice note 5).

11.3 If, in any December to March period, the enterococci standard is exceeded at any sampling station, the permit holder shall immediately notify the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of the end of that period.

11.4 The discharge of wastewater authorised by this permit shall not cause any of the following effects beyond a distance of 100m from the midpoint of the diffuser:

a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials; and
b) any conspicuous changes in colour or visual clarity; or
c) any significant adverse effects on aquatic life.

12 Shellfish Monitoring

12.1 The permit holder shall monitor the Escherichia coli, arsenic, and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content in the soft tissue of inter-tidal shellfish (tuatua) collected from five stations off the beach adjacent to the outfall. Five replicate shellfish samples shall be collected per station during February of each year. The monitoring stations shall be within the inter-tidal zone at approximately the following locations:

a) 2000 metres northwest of the outfall
b) 1000 metres northwest of the outfall
c) On the outfall alignment
d) 1000 metres southeast of the outfall
e) 2000 metres southeast of the outfall

12.2 For shellfish samples collected in accordance with condition 12.1 the following shall apply:

a) No more than 1 out of 5 replicate shellfish samples shall exceed 230 E. coli per 100g and none of the 5 replicate samples shall exceed 700 E. coli per 100g.

b) None of the 5 replicates shall exceed the following trace metal concentrations (all values mg/kg):

- arsenic (inorganic) 2 (see advice note 6)
- copper 30
- lead 0.5
- mercury 0.5
- nickel 2
- zinc 40

c) If on any sampling occasion, any sample exceeds any of the above limits, the permit holder shall notify immediately the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of that sampling occasion.

12.3 The permit holder shall monitor the arsenic and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content of the three replicate mussel samples collected from the outfall pipeline diffuser to provide a worst-case measure of trace metal accumulation. The three replicate shellfish samples shall be collected from the diffuser section of the pipeline during February of each year.

13 Comprehensive Ecological Survey

13.0 The permit holder shall undertake a broad spatial study of the benthic biota and sediments in the vicinity of the outfall (comparable to that carried out by Cawthron Institute in 2003) in the years 2014 and 2024. The results of such studies are to be provided to the Regional Council within three months of each survey being undertaken.

14 Occupation of Space

14.1 The area occupied by the ocean outfall structure shall not exceed 950m2 in total area and shall be generally as shown on BOPRC plan number RC 62879/1.

14.2 There shall be free and unrestricted public access through the area occupied by the ocean outfall structure except where restrictions are necessary during regular inspection and/or maintenance works to ensure public health and safety.

14.3 The permit holder shall take any necessary precautions to ensure the safety of the public using the area occupied by the ocean outfall structure.

15 Notifying the Regional Council of Works

15.0 The permit holder shall notify the Chief Executive of the Regional Council or delegate no less than five working days prior to commencing any inspection and/or maintenance works under this consent.

16 Retrofit (Relining) Works

16.1 Retrofit and/or relining works under this consent shall be carried out generally in accordance with information submitted with the application for this consent including:

- Section 10 of the application document titled "Tauranga City Council Wastewater Consents Project: Resource Consents Application, Notice of Requirement to Alter a Designation, and Assessment of Effects on the Environment, Application Edition, October 2004"; and
- An approved Construction Management Plan as required by condition 16.2 of this consent.

16.2 The consent holder shall submit a Construction Management Plan for any retrofit or relining works under this consent to the Regional Council for technical approval, no less than twenty one working days prior to commencing those works. The Construction Management Plan shall include but not be limited to the following;

- Type of construction method; and
- Proposed construction timeframe; and
- Access arrangements and protective measures including transportation, storage and use of machinery, tools and materials within the foreshore and marine area; and
- Mitigating measures to minimise actual or potential adverse effects; and
- Risk management procedures; and
- Any other issues that may be identified.

17 Maintenance

Change: CH17-00785

17.1 The permit holder shall ensure that the ocean outfall structure is maintained in an effective capacity at all times, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

17.2 The consent holder shall maintain all parts of the wastewater treatment system in effective working order at all times and in accordance with the manufacturer’s instructions for any mechanical elements, to ensure that the wastewater treatment plant operates efficiently and meets the discharge quality set by conditions of this consent, and shall undertake any maintenance works immediately if so directed by the Bay of Plenty Regional Council.

18 Wastewater Management Review Committee

18.1 The permit holder shall establish, and retain, as a committee of the Tauranga City Council under clause 30 of the Seventh Schedule to the Local Government Act 2002, the Wastewater Management Review Committee ("Review Committee").

18.1.1 The permit holder shall facilitate the role and function of the Review Committee by providing reasonable organisational and administrative support for the duration of the permit.

18.1.2 The Review Committee required pursuant to condition 18.1 shall operate in accordance with the Wastewater Management Review Committee Management Plan.

18.1.3 The permit holder shall submit the Wastewater Management Review Committee Management Plan, to the Chief Executive of the Regional Council or delegate for approval within three months of the commencement of this permit. The permit holder may amend the Wastewater Management Review Committee Management Plan with the written approval of the Chief Executive of the Regional Council or delegate.

18.2 The Wastewater Management Review Committee Management Plan shall address:

a) the membership of the Review Committee

b) the frequency that the Review Committee shall meet

c) the meeting protocols of the Review Committee having regard to the customary practices of the tangata whenua of Tauranga Moana and shall operate in accordance with the principles of the Treaty of Waitangi (especially the principles of consultation, active participation and partnership).

d) the functions of the Review Committee

18.3 Notwithstanding condition 18.2(d), the functions of the Review Committee shall include, but not be limited to the following functions:

a) To receive reports on the operation of the Wastewater Scheme, including reports in relation to monitoring and permit compliance, and to make recommendations to the permit holder on the development of Tauranga City Council's policies in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies and standards addressed in the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

b) To make decisions about the application of the Environmental Mitigation and Enhancement Fund established in accordance with Condition 19 of this permit.

c) To make recommendations to the permit holder as to physical measures and initiatives to address or compensate for actual or potential effects of the Tauranga City Wastewater Scheme (in the broadest environmental sense).

d) Without limiting the generality of Condition 18.3(c), to make recommendations to the permit holder as to the implementation of the works to be undertaken in accordance with Permit Number 62881, namely:

- Decommissioning of the Te Maunga Sludge Pond and the future use of the pond.
- Conversion of the Te Maunga Oxidation Ponds to wetlands.

e) To make recommendations to the permit holder in relation to the independent consultant to be appointed to undertake the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

f) To make recommendations to the Permit Holder as to enhancing the involvement of tangata whenua in sampling, testing and monitoring.

g) Assessment of the scope and adequacy of sampling and monitoring.

h) Notification to appropriate parties of activities that may have adverse effects.

i) To receive, review and recommend action following receipt of wastewater reports.

j) To recommend the commissioning of reports and future Tauranga City Council actions on wastewater management, treatment and disposal issues and options, including:

(i) Development of alternatives to waterborne wastewater systems.
(ii) Options for further treatments;
(iii) Options for methods of disposal;
(iv) Monitoring effects on the environment.

k) To co-ordinate and oversee education of the community on wastewater management, treatment and disposal issues.

l) To identify and make recommendations to the permit holder as to sources of funding which may be available to supplement the Environmental Mitigation and Enhancement Fund established pursuant to Condition 19 hereof and to be applied for the purposes specified in that condition.

m) To make recommendations to the permit holder as to changes to conditions of these permits pursuant to section 127 of the Resource Management Act 1991, in light of the exercise of the Review Committee's functions, including reports received and information received as a result of monitoring, etc, or to avoid, remedy or mitigate actual or potential adverse effects associated with the operation of the Wastewater Scheme.

n) To foster robust relationships and dialogue between the Review Committee, the permit holder, the Western Bay of Plenty District Council and the Bay of Plenty Regional Council in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies.

o) To make recommendations to the Bay of Plenty Regional Council as to amendments to the conditions of these permits which could be implemented via a review under section 128 of the Act in accordance with condition 22.

18.4 Prior to making any:

a) Decisions as to the allocation of the Environmental Mitigation and Enhancement Fund in accordance with Condition 18.3(b) hereof or,

b) Recommendations to the permit holder in relation to physical environmental mitigation or enhancement or mitigation works in accordance with Condition 18.3(c) hereof;

the Review Committee will exercise its best endeavours to ascertain the existence of any persons or bodies who may have a particular interest or stake in the ecological health of the Tauranga Harbour (particularly the Upper Harbour/Rangataua Bay area) and to consult with those bodies or persons as to appropriate initiatives and measures to be so recommended (in accordance with Condition 18.3(b)) or undertaken (in accordance with Condition 18.3(c)). As a minimum, the Review Committee shall consult with

- Nga Potiki hapu and iwi of Ngaiterangi, Ngati Ranginui and Ngati Pukenga and Te Arawa and their respective hapu which hold kaitiaki status over the wider Tauranga Moana district, including any Working Group established by those hapu or iwi;
- Bay of Plenty Regional Council and the Western Bay of Plenty District Council in relation to issues that may affect those councils in accordance with their function under Condition 18.3(m) hereof.

18.5 Not later than one month following the first anniversary of the commencement of these permits and on each anniversary thereafter, the Wastewater Management Review Committee shall forward to the Chief Executive of the Bay of Plenty Regional Council, a report on the exercise of its activities and functions, including where appropriate a report on the effectiveness of measures undertaken pursuant to the Environmental Mitigation and Enhancement Fund.

18.6 Not less than six months following the first anniversary of this permit and each fifth anniversary thereafter, the Wastewater Management Review Committee's annual report shall contain a review of its activities over the previous five year period and recommendations for appropriate initiatives over the next five year period, including any recommendations for changes to conditions of these permits, or the Wastewater Management Review Committee Management Plan, which may be considered necessary or desirable. This report shall be available at least three months prior to the date on which the Bay of Plenty Regional Council is entitled to review the conditions of these permits in accordance with condition 22 hereof.

A copy of this report shall also be provided to the Chief Executive, Tauranga City Council.

19 Environmental Mitigation and Enhancement Fund

19.1 The permit holder shall establish a fund, to be entitled the Environmental Mitigation and Enhancement Fund, of not less than $250,000 (comprising one payment of $50,000 one month after the commencement of the permit, and four further such payments the second, third, fourth and fifth anniversary of the commencement of the permits).

The purpose of the fund shall be to fund and facilitate measures and initiatives (particularly in the Upper Tauranga Harbour) to:

a) Avoid, remedy or mitigate the actual or potential effects of the Wastewater Scheme (in its broadest sense);or

b) To acknowledge and provide mitigation by way of environmental compensation for ongoing adverse environmental effects (including by way of offence to tangata whenua cultural and spiritual values) associated with the Wastewater Scheme.

Initiatives which the fund may be applied to may include but are not limited to:

c) Providing opportunities for promoting and/or implementing initiatives for capacity building of tangata whenua; and

d) The carrying out by tangata whenua of monitoring the cultural effects associated with the operation of the Wastewater Scheme.

e) Providing opportunities for promoting and/or implementing involvement of tangata whenua in sampling, testing and monitoring.

f) Research into issues relevant to water quality and ecological issues, particularly in the Upper Harbour.

g) Research into the health and size of shellfish populations and the relocation and/or re-seeding of such populations where appropriate.

19.2 The fund shall be applied by the permit holder in accordance with recommendations of the Review Committee established pursuant to Condition 18 of this permit.

19.3 The permit holder shall review the effectiveness of the application of the fund at least two months prior to the third anniversary of the commencement of these permits with a view to making further funds available on the same basis as Condition 19 hereof, having regard to the reports of the Review Committee.

20 Monitoring, Upgrade and Technology Review Report

20.1 Not later than the fourth anniversary of the commencement of these permits, and every five years thereafter, the permit holder shall commission the preparation of a comprehensive assessment of the wastewater discharge and the operation and effects of the Wastewater Scheme and technological developments in relation to wastewater treatment and disposal and re-use systems and techniques, and the preparation of a report thereon, to be entitled the Monitoring, Upgrade and Technology Review Report. The assessment shall be undertaken by a suitably qualified independent New Zealand specialist or specialists in wastewater systems. In appointing the specialist in accordance with this condition, the permit holder shall take account of any recommendation made by the Review Committee under Condition 18.3(e) hereof.

The scope of the assessment should address but is not limited to the following:

a) Progress towards the permit holder's objective of "towards zero waste".

b) Progress in adoption or promotion of SmartGrowth Stretch Targets.

c) Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems.

d) The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling.

e) Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions.

f) The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme.

g) The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue.

20.2 The permit holder shall instruct the independent consultant commissioned to prepare the report to consult with the Review Committee, the Consent Authority, and any key stakeholders or iwi groups identified by the Review Committee in preparing its report. (It is contemplated that tangata whenua will prepare a paper for submission to the independent consultant on the outcomes of any cultural monitoring or any other issue relevant to the operation of the permits.)

20.3 The permit holder shall use its best endeavours to ensure that the report is received at least six months before the date on which the Regional Council is entitled to review the conditions of this permit in accordance with Condition 22 hereof, so that the Regional Council is able to take account of the report in deciding whether to initiate a review.

20.4 The permit holder shall ensure that copies of the Monitoring, Upgrade and Technology Review Report are forwarded to the Chair of the Review Committee, the Chief Executive of the Bay of Plenty Regional Council and the Chief Executive of the Tauranga City Council within 10 working days of receipt.

21 Repeal of Mount Maunganui Borough Reclamation and Empowering Act 1975

21.1 As soon as reasonably practicable after the existing designation for the Te Maunga plant is extended to include the existing oxidation ponds and wetlands and all associated legal formalities have been completed, the permit holder shall commence procedures to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 and shall exercise its best endeavours to secure the repeal of the legislation.

21.2 The permit holder shall keep the Review Committee advised as to progress in achieving Condition 21.1.

21.3 Nothing in condition 21.1 and 21.2 requires the consent holder to take steps to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 until a title has been issued to the Tauranga City Council confirming its ownership of the land comprised in the pond and the Waste Management designation has been placed on the pond area.

22 Review of Permit Conditions

22.0 The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this discharge permit; and

c) Implementing any recommendations of the Review Committee made in accordance with Condition 18.3 hereof; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with condition 20 hereof.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

23 Term of Permit

23.0 This permit shall expire on 30 April 2040.

24 Resource Management Charges

24.0 The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

25 The Permit

25.0 The Permit hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes

1

1. *For the purpose of condition 5, the average daily quantity of treated wastewater discharged shall be determined for each year.*
2. *All reports required by the conditions of this permit shall be directed in writing to the Principal Compliance Officer, Environment Bay of Plenty, and should include the permit number.*
3. *Up to 16 exceedences out of 26 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. (From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
4. *Up to 3 exceedences out of 26 samples are permitted to meet a 95-percentile discharge compliance standard based on a discharger's risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
5. *Up to 13 exceedences out of 20 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
6. *The Regional Council has determined that inorganic arsenic typically makes up 10% of the total arsenic in shellfish and that a total arsenic value of 20 mg/kg can be used as an equivalent standard.*
7. *The permit holder is advised that under the provisions of section 64A of the Resource Management Act 1991, this permit may become subject to charges for the occupation of Crown seabed and/or foreshore. At the time of issuing this permit there is no charging system in place however this permit may be affected by any charging regime implemented in the future.*
8. *The permit holder is advised that the proposal put forward at the consent hearing in regard of Wastewater Management Review Committee membership, meeting frequency and protocols would meet the requirements of condition 18.2.*
9. *Prior to planned maintenance periods, take into account forecast weather to avoid significant rainfall events.*

Consent Number: **62878.0.03-CC**

Bay of Plenty Regional Council

Resource Consent

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **hereby grants**:

A resource consent:

- **Pursuant to section 12(2)(a) of the Resource Management Act 1991 and Rule 12.2.4(a) of the Bay of Plenty Regional Coastal Environment Plan to Occupy Space in the Coastal Marine Area**

subject to the following conditions:

1 Purpose

1.1 For the purpose of discharging secondary-treated and disinfected wastewater from the Chapel Street Wastewater Treatment Plant and secondary-treated wastewater from the Te Maunga Wastewater Treatment Plant into the Coastal Marine Area.

1.2 To provide for the ongoing occupation of the coastal marine area by the Omanu ocean outfall structure and the potential retrofit (relining) of the structure.

2 Location Of Discharge

2.1 Into the Pacific Ocean through an existing 950 metre outfall pipe located off Omanu Beach as shown on BOPRC Plan Number RC 62879/1.

2.2 The Omanu ocean outfall pipe extends perpendicular to the Papamoa shoreline for a distance of 950 metres (distance from the beach manhole to the seaward diffuser) as shown on BOPRC plan number RC 62879/1.

3 Map Reference

3.0 At or about map reference NZMS 260 U14: 9695-8730.

The Omanu ocean outfall pipe is located between map references NZMS 260 U14 9720 8710 and NZMS 260 U14 9720 8710.

4 Legal Description

4.0 Foreshore and Seabed, Pacific Ocean (Tauranga District).

5 Quantity and Rate

5.0 The average daily quantity of treated wastewater to be discharged shall not exceed 50 000 cubic metres per day, with a maximum wet weather discharge of 900 litres per second. (see advice note 1).

6 UV Disinfection

Change: CH17-00785

6.1 No later than nine years after the issue of this permit the wastewater discharged from both the Chapel Street and Te Maunga treatment plants shall be secondary treated and UV disinfected.

The discharge of wastewater during planned and unplanned UV Plant maintenance is permitted, subject to conditions 6.2 and 6.3.

6.2 Planned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during planned maintenance periods:
• The wastewater pumps to the ocean outfall will be turned off during planned maintenance of the UV Plant (no discharge to the ocean), where possible - See advice note 9.
• Where practicable planned maintenance of the UV Plant will be undertaken during winter months where there are reduced bacteria/loads in the wastewater.
• The maximum downtime period of the UV Plant during planned maintenance periods shall be no more than two weeks.

6.3 Unplanned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during unplanned maintenance activities:
• The wastewater pumps to the ocean outfall shall be turned off during unplanned maintenance of the UV Plant (no discharge to the ocean), where possible.
• Actions to remedy the situation will be undertaken as quickly as possible and in a manner that minimises the length of downtime of the UV Plant.
• After the unplanned event, the consent holder shall submit to BOPRC a report detailing the event, including the date, time and extent of downtime of the UV plant and the actions undertaken to remedy the situation. This report will be provided to BOPRC within two weeks of the event being remedied.
• On any occasion that the event extends for more than 2 weeks, the consent holder shall provide an interim report to BOPRC stating, as a minimum, the cause of the event, likely duration of the event and the actions being undertaken to remedy the situation. Update reports shall be provided 4 weekly from the date of the interim report until the situation is remedied.

6.4 Where wastewater that is not UV treated is discharged to the ocean the quality of the wastewater discharged shall not exceed the standards required by Condition 10.2.

7 Outfall

7.1 The discharge shall be through a diffuser section at least 22.5 metres long.

7.2 The outfall diffuser shall be reconfigured to maximise initial dilution by no later that 1 January 2010.

7.3 The outfall diffuser shall be inspected at least once per annum. A report on the results of the inspection shall be sent to the Regional Council within one month of inspection.

8 Operations and Maintenance

8.1 The wastewater treatment and disposal system shall be operated and maintained at all times to ensure that the treatment is in accordance with sound engineering practices.

8.2 Treated wastewater from both the Chapel Street treatment plant and the Te Maunga treatment plant shall pass through a wetland prior to discharge via the ocean outfall.

9 Monitoring

9.1 The permit holder shall continuously monitor and record the flow rate and volume of treated wastewater entering the outfall pipeline.

9.2 The permit holder shall take grab samples and 24-hour flow proportioned samples of treated wastewater discharged twice each week. The samples shall be analysed for the constituents and at the frequency listed in Schedule 1 below.

9.3 The permit holder shall provide a suitable wastewater sampling station for the monitoring required by condition 9.2. The sampling station shall be located at the outfall pumping station, immediately prior to the entry of wastewater into the ocean outfall pipeline.

9.4 All quality analysis pursuant to condition 9.2 shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater" - APHA - AWWA - WPCF or such other method as may be approved by the Chief Executive of the Regional Council or delegate.

9.5 All quality analysis of the wastewater discharge shall be undertaken in a laboratory with IANZ or similar accreditation.

9.6 The permit holder shall make results of monitoring undertaken (as required by conditions of this permit) available to the Regional Council on request. Data records for each 3-month period ending April, July, October and January shall be forwarded to the Regional Council in a suitable electronic format, within 30 days after the end of each 3-month period.

9.7 The Permit Holder shall notify the Regional Council within 1 week of any non-compliance being determined in respect of condition 10 of this permit.

10 Treated Wastewater Quality

10.1 Based on twice-weekly sampling, as required by condition 9.2 of this permit, and take over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year during the term of this permit, all wastewater discharged through the ocean outfall shall meet the following BOD5 and total suspended solids standards:

Analyte Sample Type

No more than 16 values shall exceed

No more than 3 values shall exceed

BOD5 (mg/L) Composite

25

30

Total suspended solids (mg/L) Composite

50

80

(See advice notes 3 & 4)

10.2 The following enterococci standard shall apply to all wastewater discharged through the ocean outfall:

- Based on twice-weekly sampling as required by condition 9.2 of this permit, and taken over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year, no more that 16 enterococci values shall exceed 3 500 cfu/100mL.

11 Receiving Water Monitoring

11.1 The permit holder shall monitor the enterococci concentration on the receiving water at nine locations offshore of the beach adjacent to the outfall. Five water samples are to be collected per station per month during December, January, February and March to give a total of 20 samples per station per year. The monitoring stations shall be situated approximately 400 metres offshore of the beach at the following locations:

a) 2000 metres northwest of the outfall
b) 1500 metres northwest of the outfall
c) 1000 metres northwest of the outfall
d) 500 metres northwest of the outfall
e) On the outfall alignment
f) 500 metres southeast of the outfall
g) 1000 metres southeast of the outfall
h) 1500 metres southeast of the outfall
i) 2000 metres southeast of the outfall

11.2 Based on 20 coastal water samples collected each year in accordance with condition 11.1, the treated wastewater discharge shall not cause more than 13 enterococci values to exceed 35 enterococci per 100 mL, or cause any single sample to exceed 104 enterococci per 100 mL. (see advice note 5).

11.3 If, in any December to March period, the enterococci standard is exceeded at any sampling station, the permit holder shall immediately notify the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of the end of that period.

11.4 The discharge of wastewater authorised by this permit shall not cause any of the following effects beyond a distance of 100m from the midpoint of the diffuser:

a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials; and
b) any conspicuous changes in colour or visual clarity; or
c) any significant adverse effects on aquatic life.

12 Shellfish Monitoring

12.1 The permit holder shall monitor the Escherichia coli, arsenic, and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content in the soft tissue of inter-tidal shellfish (tuatua) collected from five stations off the beach adjacent to the outfall. Five replicate shellfish samples shall be collected per station during February of each year. The monitoring stations shall be within the inter-tidal zone at approximately the following locations:

a) 2000 metres northwest of the outfall
b) 1000 metres northwest of the outfall
c) On the outfall alignment
d) 1000 metres southeast of the outfall
e) 2000 metres southeast of the outfall

12.2 For shellfish samples collected in accordance with condition 12.1 the following shall apply:

a) No more than 1 out of 5 replicate shellfish samples shall exceed 230 E. coli per 100g and none of the 5 replicate samples shall exceed 700 E. coli per 100g.

b) None of the 5 replicates shall exceed the following trace metal concentrations (all values mg/kg):

- arsenic (inorganic) 2 (see advice note 6)
- copper 30
- lead 0.5
- mercury 0.5
- nickel 2
- zinc 40

c) If on any sampling occasion, any sample exceeds any of the above limits, the permit holder shall notify immediately the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of that sampling occasion.

12.3 The permit holder shall monitor the arsenic and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content of the three replicate mussel samples collected from the outfall pipeline diffuser to provide a worst-case measure of trace metal accumulation. The three replicate shellfish samples shall be collected from the diffuser section of the pipeline during February of each year.

13 Comprehensive Ecological Survey

13.0 The permit holder shall undertake a broad spatial study of the benthic biota and sediments in the vicinity of the outfall (comparable to that carried out by Cawthron Institute in 2003) in the years 2014 and 2024. The results of such studies are to be provided to the Regional Council within three months of each survey being undertaken.

14 Occupation of Space

14.1 The area occupied by the ocean outfall structure shall not exceed 950m2 in total area and shall be generally as shown on BOPRC plan number RC 62879/1.

14.2 There shall be free and unrestricted public access through the area occupied by the ocean outfall structure except where restrictions are necessary during regular inspection and/or maintenance works to ensure public health and safety.

14.3 The permit holder shall take any necessary precautions to ensure the safety of the public using the area occupied by the ocean outfall structure.

15 Notifying the Regional Council of Works

15.0 The permit holder shall notify the Chief Executive of the Regional Council or delegate no less than five working days prior to commencing any inspection and/or maintenance works under this consent.

16 Retrofit (Relining) Works

16.1 Retrofit and/or relining works under this consent shall be carried out generally in accordance with information submitted with the application for this consent including:

- Section 10 of the application document titled "Tauranga City Council Wastewater Consents Project: Resource Consents Application, Notice of Requirement to Alter a Designation, and Assessment of Effects on the Environment, Application Edition, October 2004"; and
- An approved Construction Management Plan as required by condition 16.2 of this consent.

16.2 The consent holder shall submit a Construction Management Plan for any retrofit or relining works under this consent to the Regional Council for technical approval, no less than twenty one working days prior to commencing those works. The Construction Management Plan shall include but not be limited to the following;

- Type of construction method; and
- Proposed construction timeframe; and
- Access arrangements and protective measures including transportation, storage and use of machinery, tools and materials within the foreshore and marine area; and
- Mitigating measures to minimise actual or potential adverse effects; and
- Risk management procedures; and
- Any other issues that may be identified.

17 Maintenance

Change: CH17-00785

17.1 The permit holder shall ensure that the ocean outfall structure is maintained in an effective capacity at all times, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

17.2 The consent holder shall maintain all parts of the wastewater treatment system in effective working order at all times and in accordance with the manufacturer's instructions for any mechanical elements, to ensure that the wastewater treatment plant operates efficiently and meets the discharge quality set by conditions of this consent, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

18 Wastewater Management Review Committee

18.1 The permit holder shall establish, and retain, as a committee of the Tauranga City Council under clause 30 of the Seventh Schedule to the Local Government Act 2002, the Wastewater Management Review Committee ("Review Committee").

18.1.1 The permit holder shall facilitate the role and function of the Review Committee by providing reasonable organisational and administrative support for the duration of the permit.

18.1.2 The Review Committee required pursuant to condition 18.1 shall operate in accordance with the Wastewater Management Review Committee Management Plan.

18.1.3 The permit holder shall submit the Wastewater Management Review Committee Management Plan, to the Chief Executive of the Regional Council or delegate for approval within three months of the commencement of this permit. The permit holder may amend the Wastewater Management Review Committee Management Plan with the written approval of the Chief Executive of the Regional Council or delegate.

18.2 The Wastewater Management Review Committee Management Plan shall address:

a) the membership of the Review Committee

b) the frequency that the Review Committee shall meet

c) the meeting protocols of the Review Committee having regard to the customary practices of the tangata whenua of Tauranga Moana and shall operate in accordance with the principles of the Treaty of Waitangi (especially the principles of consultation, active participation and partnership).

d) the functions of the Review Committee

18.3 Notwithstanding condition 18.2(d), the functions of the Review Committee shall include, but not be limited to the following functions:

a) To receive reports on the operation of the Wastewater Scheme, including reports in relation to monitoring and permit compliance, and to make recommendations to the permit holder on the development of Tauranga City Council's policies in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies and standards addressed in the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

b) To make decisions about the application of the Environmental Mitigation and Enhancement Fund established in accordance with Condition 19 of this permit.

c) To make recommendations to the permit holder as to physical measures and initiatives to address or compensate for actual or potential effects of the Tauranga City Wastewater Scheme (in the broadest environmental sense).

d) Without limiting the generality of Condition 18.3(c), to make recommendations to the permit holder as to the implementation of the works to be undertaken in accordance with Permit Number 62881, namely:

- Decommissioning of the Te Maunga Sludge Pond and the future use of the pond.
- Conversion of the Te Maunga Oxidation Ponds to wetlands.

e) To make recommendations to the permit holder in relation to the independent consultant to be appointed to undertake the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

f) To make recommendations to the Permit Holder as to enhancing the involvement of tangata whenua in sampling, testing and monitoring.

g) Assessment of the scope and adequacy of sampling and monitoring.

h) Notification to appropriate parties of activities that may have adverse effects.

i) To receive, review and recommend action following receipt of wastewater reports.

j) To recommend the commissioning of reports and future Tauranga City Council actions on wastewater management, treatment and disposal issues and options, including:

(i) Development of alternatives to waterborne wastewater systems.
(ii) Options for further treatments;
(iii) Options for methods of disposal;
(iv) Monitoring effects on the environment.

k) To co-ordinate and oversee education of the community on wastewater management, treatment and disposal issues.

l) To identify and make recommendations to the permit holder as to sources of funding which may be available to supplement the Environmental Mitigation and Enhancement Fund established pursuant to Condition 19 hereof and to be applied for the purposes specified in that condition.

m) To make recommendations to the permit holder as to changes to conditions of these permits pursuant to section 127 of the Resource Management Act 1991, in light of the exercise of the Review Committee's functions, including reports received and information received as a result of monitoring, etc, or to avoid, remedy or mitigate actual or potential adverse effects associated with the operation of the Wastewater Scheme.

n) To foster robust relationships and dialogue between the Review Committee, the permit holder, the Western Bay of Plenty District Council and the Bay of Plenty Regional Council in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies.

o) To make recommendations to the Bay of Plenty Regional Council as to amendments to the conditions of these permits which could be implemented via a review under section 128 of the Act in accordance with condition 22.

18.4 Prior to making any:

a) Decisions as to the allocation of the Environmental Mitigation and Enhancement Fund in accordance with Condition 18.3(b) hereof or,

b) Recommendations to the permit holder in relation to physical environmental mitigation or enhancement or mitigation works in accordance with Condition 18.3(c) hereof;

the Review Committee will exercise its best endeavours to ascertain the existence of any persons or bodies who may have a particular interest or stake in the ecological health of the Tauranga Harbour (particularly the Upper Harbour/Rangataua Bay area) and to consult with those bodies or persons as to appropriate initiatives and measures to be so recommended (in accordance with Condition 18.3(b)) or undertaken (in accordance with Condition 18.3(c)). As a minimum, the Review Committee shall consult with

- Nga Potiki hapu and iwi of Ngaiterangi, Ngati Ranginui and Ngati Pukenga and Te Arawa and their respective hapu which hold kaitiaki status over the wider Tauranga Moana district, including any Working Group established by those hapu or iwi;
- Bay of Plenty Regional Council and the Western Bay of Plenty District Council in relation to issues that may affect those councils in accordance with their function under Condition 18.3(m) hereof.

18.5 Not later than one month following the first anniversary of the commencement of these permits and on each anniversary thereafter, the Wastewater Management Review Committee shall forward to the Chief Executive of the Bay of Plenty Regional Council, a report on the exercise of its activities and functions, including where appropriate a report on the effectiveness of measures undertaken pursuant to the Environmental Mitigation and Enhancement Fund.

18.6 Not less than six months following the first anniversary of this permit and each fifth anniversary thereafter, the Wastewater Management Review Committee's annual report shall contain a review of its activities over the previous five year period and recommendations for appropriate initiatives over the next five year period, including any recommendations for changes to conditions of these permits, or the Wastewater Management Review Committee Management Plan, which may be considered necessary or desirable. This report shall be available at least three months prior to the date on which the Bay of Plenty Regional Council is entitled to review the conditions of these permits in accordance with condition 22 hereof.

A copy of this report shall also be provided to the Chief Executive, Tauranga City Council.

19 Environmental Mitigation and Enhancement Fund

19.1 The permit holder shall establish a fund, to be entitled the Environmental Mitigation and Enhancement Fund, of not less than $250,000 (comprising one payment of $50,000 one month after the commencement of the permit, and four further such payments the second, third, fourth and fifth anniversary of the commencement of the permits).

The purpose of the fund shall be to fund and facilitate measures and initiatives (particularly in the Upper Tauranga Harbour) to:

a) Avoid, remedy or mitigate the actual or potential effects of the Wastewater Scheme (in its broadest sense);or

b) To acknowledge and provide mitigation by way of environmental compensation for ongoing adverse environmental effects (including by way of offence to tangata whenua cultural and spiritual values) associated with the Wastewater Scheme.

Initiatives which the fund may be applied to may include but are not limited to:

c) Providing opportunities for promoting and/or implementing initiatives for capacity building of tangata whenua; and

d) The carrying out by tangata whenua of monitoring the cultural effects associated with the operation of the Wastewater Scheme.

e) Providing opportunities for promoting and/or implementing involvement of tangata whenua in sampling, testing and monitoring.

f) Research into issues relevant to water quality and ecological issues, particularly in the Upper Harbour.

g) Research into the health and size of shellfish populations and the relocation and/or re-seeding of such populations where appropriate.

19.2 The fund shall be applied by the permit holder in accordance with recommendations of the Review Committee established pursuant to Condition 18 of this permit.

19.3 The permit holder shall review the effectiveness of the application of the fund at least two months prior to the third anniversary of the commencement of these permits with a view to making further funds available on the same basis as Condition 19 hereof, having regard to the reports of the Review Committee.

20 Monitoring, Upgrade and Technology Review Report

20.1 Not later than the fourth anniversary of the commencement of these permits, and every five years thereafter, the permit holder shall commission the preparation of a comprehensive assessment of the wastewater discharge and the operation and effects of the Wastewater Scheme and technological developments in relation to wastewater treatment and disposal and re-use systems and techniques, and the preparation of a report thereon, to be entitled the Monitoring, Upgrade and Technology Review Report. The assessment shall be undertaken by a suitably qualified independent New Zealand specialist or specialists in wastewater systems. In appointing the specialist in accordance with this condition, the permit holder shall take account of any recommendation made by the Review Committee under Condition 18.3(e) hereof.

The scope of the assessment should address but is not limited to the following:

a) Progress towards the permit holder's objective of "towards zero waste".

b) Progress in adoption or promotion of SmartGrowth Stretch Targets.

c) Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems.

d) The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling.

e) Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions.

f) The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme.

g) The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue.

20.2 The permit holder shall instruct the independent consultant commissioned to prepare the report to consult with the Review Committee, the Consent Authority, and any key stakeholders or iwi groups identified by the Review Committee in preparing its report. (It is contemplated that tangata whenua will prepare a paper for submission to the independent consultant on the outcomes of any cultural monitoring or any other issue relevant to the operation of the permits.)

20.3 The permit holder shall use its best endeavours to ensure that the report is received at least six months before the date on which the Regional Council is entitled to review the conditions of this permit in accordance with Condition 22 hereof, so that the Regional Council is able to take account of the report in deciding whether to initiate a review.

20.4 The permit holder shall ensure that copies of the Monitoring, Upgrade and Technology Review Report are forwarded to the Chair of the Review Committee, the Chief Executive of the Bay of Plenty Regional Council and the Chief Executive of the Tauranga City Council within 10 working days of receipt.

21 Repeal of Mount Maunganui Borough Reclamation and Empowering Act 1975

21.1 As soon as reasonably practicable after the existing designation for the Te Maunga plant is extended to include the existing oxidation ponds and wetlands and all associated legal formalities have been completed, the permit holder shall commence procedures to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 and shall exercise its best endeavours to secure the repeal of the legislation.

21.2 The permit holder shall keep the Review Committee advised as to progress in achieving Condition 21.1.

21.3 Nothing in condition 21.1 and 21.2 requires the consent holder to take steps to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 until a title has been issued to the Tauranga City Council confirming its ownership of the land comprised in the pond and the Waste Management designation has been placed on the pond area.

22 Review of Permit Conditions

22.0 The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this discharge permit; and

c) Implementing any recommendations of the Review Committee made in accordance with Condition 18.3 hereof; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with condition 20 hereof.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

23 Term of Permit

23.0 This permit shall expire on 30 April 2040.

24 Resource Management Charges

24.0 The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

25 The Permit

25.0 The Permit hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes

1

1. *For the purpose of condition 5, the average daily quantity of treated wastewater discharged shall be determined for each year.*
2. *All reports required by the conditions of this permit shall be directed in writing to the Principal Compliance Officer, Environment Bay of Plenty, and should include the permit number.*
3. *Up to 16 exceedences out of 26 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. (From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
4. *Up to 3 exceedences out of 26 samples are permitted to meet a 95-percentile discharge compliance standard based on a discharger�'s risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
5. *Up to 13 exceedences out of 20 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
6. *The Regional Council has determined that inorganic arsenic typically makes up 10% of the total arsenic in shellfish and that a total arsenic value of 20 mg/kg can be used as an equivalent standard.*
7. *The permit holder is advised that under the provisions of section 64A of the Resource Management Act 1991, this permit may become subject to charges for the occupation of Crown seabed and/or foreshore. At the time of issuing this permit there is no charging system in place however this permit may be affected by any charging regime implemented in the future.*
8. *The permit holder is advised that the proposal put forward at the consent hearing in regard of Wastewater Management Review Committee membership, meeting frequency and protocols would meet the requirements of condition 18.2.*
9. Prior to planned maintenance periods, take into account forecast weather to avoid significant rainfall events.

Consent Number: **62878.0.04-CC**

Bay of Plenty Regional Council

Resource Consent

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **hereby grants**:

A resource consent:

- **Pursuant to section 12(3)(a) of the Resource Management Act 1991 and Rule 13.2.4(h) of the Bay of Plenty Regional Coastal Environment Plan to Use a Structure in, on, under or over Foreshore and/or Seabed**

subject to the following conditions:

1 Purpose

1.1 For the purpose of discharging secondary-treated and disinfected wastewater from the Chapel Street Wastewater Treatment Plant and secondary-treated wastewater from the Te Maunga Wastewater Treatment Plant into the Coastal Marine Area.

1.2 To provide for the ongoing occupation of the coastal marine area by the Omanu ocean outfall structure and the potential retrofit (relining) of the structure.

2 Location Of Discharge

2.1 Into the Pacific Ocean through an existing 950 metre outfall pipe located off Omanu Beach as shown on BOPRC Plan Number RC 62879/1.

2.2 The Omanu ocean outfall pipe extends perpendicular to the Papamoa shoreline for a distance of 950 metres (distance from the beach manhole to the seaward diffuser) as shown on BOPRC plan number RC 62879/1.

3 Map Reference

3.0 At or about map reference NZMS 260 U14: 9695-8730.

The Omanu ocean outfall pipe is located between map references NZMS 260 U14 9720 8710 and NZMS 260 U14 9720 8710.

4 Legal Description

4.0 Foreshore and Seabed, Pacific Ocean (Tauranga District).

5 Quantity and Rate

5.0 The average daily quantity of treated wastewater to be discharged shall not exceed 50 000 cubic metres per day, with a maximum wet weather discharge of 900 litres per second. (see advice note 1).

6 UV Disinfection

Change: CH17-00785

6.1 No later than nine years after the issue of this permit the wastewater discharged from both the Chapel Street and Te Maunga treatment plants shall be secondary treated and UV disinfected.

The discharge of wastewater during planned and unplanned UV Plant maintenance is permitted, subject to conditions 6.2 and 6.3.

6.2 Planned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during planned maintenance periods:
• The wastewater pumps to the ocean outfall will be turned off during planned maintenance of the UV Plant (no discharge to the ocean), where possible - See advice note 9.
• Where practicable planned maintenance of the UV Plant will be undertaken during winter months where there are reduced bacteria/loads in the wastewater.
• The maximum downtime period of the UV Plant during planned maintenance periods shall be no more than two weeks.

6.3 Unplanned UV Plant Maintenance - The consent holder shall ensure that the following mitigation measures are undertaken during unplanned maintenance activities:
• The wastewater pumps to the ocean outfall shall be turned off during unplanned maintenance of the UV Plant (no discharge to the ocean), where possible.
• Actions to remedy the situation will be undertaken as quickly as possible and in a manner that minimises the length of downtime of the UV Plant.
• After the unplanned event, the consent holder shall submit to BOPRC a report detailing the event, including the date, time and extent of downtime of the UV plant and the actions undertaken to remedy the situation. This report will be provided to BOPRC within two weeks of the event being remedied.
• On any occasion that the event extends for more than 2 weeks, the consent holder shall provide an interim report to BOPRC stating, as a minimum, the cause of the event, likely duration of the event and the actions being undertaken to remedy the situation. Update reports shall be provided 4 weekly from the date of the interim report until the situation is remedied.

6.4 Where wastewater that is not UV treated is discharged to the ocean the quality of the wastewater discharged shall not exceed the standards required by Condition 10.2.

7 Outfall

7.1 The discharge shall be through a diffuser section at least 22.5 metres long.

7.2 The outfall diffuser shall be reconfigured to maximise initial dilution by no later that 1 January 2010.

7.3 The outfall diffuser shall be inspected at least once per annum. A report on the results of the inspection shall be sent to the Regional Council within one month of inspection.

8 Operations and Maintenance

8.1 The wastewater treatment and disposal system shall be operated and maintained at all times to ensure that the treatment is in accordance with sound engineering practices.

8.2 Treated wastewater from both the Chapel Street treatment plant and the Te Maunga treatment plant shall pass through a wetland prior to discharge via the ocean outfall.

9 Monitoring

9.1 The permit holder shall continuously monitor and record the flow rate and volume of treated wastewater entering the outfall pipeline.

9.2 The permit holder shall take grab samples and 24-hour flow proportioned samples of treated wastewater discharged twice each week. The samples shall be analysed for the constituents and at the frequency listed in Schedule 1 below.

9.3 The permit holder shall provide a suitable wastewater sampling station for the monitoring required by condition 9.2. The sampling station shall be located at the outfall pumping station, immediately prior to the entry of wastewater into the ocean outfall pipeline.

9.4 All quality analysis pursuant to condition 9.2 shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater" - APHA - AWWA - WPCF or such other method as may be approved by the Chief Executive of the Regional Council or delegate.

9.5 All quality analysis of the wastewater discharge shall be undertaken in a laboratory with IANZ or similar accreditation.

9.6 The permit holder shall make results of monitoring undertaken (as required by conditions of this permit) available to the Regional Council on request. Data records for each 3-month period ending April, July, October and January shall be forwarded to the Regional Council in a suitable electronic format, within 30 days after the end of each 3-month period.

9.7 The Permit Holder shall notify the Regional Council within 1 week of any non-compliance being determined in respect of condition 10 of this permit.

10 Treated Wastewater Quality

10.1 Based on twice-weekly sampling, as required by condition 9.2 of this permit, and take over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year during the term of this permit, all wastewater discharged through the ocean outfall shall meet the following BOD5 and total suspended solids standards:

Analyte Sample Type

No more than 16 values shall exceed

No more than 3 values shall exceed

BOD5 (mg/L) Composite

25

30

Total suspended solids (mg/L) Composite

50

80

(See advice notes 3 & 4)

10.2 The following enterococci standard shall apply to all wastewater discharged through the ocean outfall:

- Based on twice-weekly sampling as required by condition 9.2 of this permit, and taken over each 13-week period commencing on 1 February, 1 May, 1 August, and 1 November of each year, no more that 16 enterococci values shall exceed 3 500 cfu/100mL.

11 Receiving Water Monitoring

11.1 The permit holder shall monitor the enterococci concentration on the receiving water at nine locations offshore of the beach adjacent to the outfall. Five water samples are to be collected per station per month during December, January, February and March to give a total of 20 samples per station per year. The monitoring stations shall be situated approximately 400 metres offshore of the beach at the following locations:

a) 2000 metres northwest of the outfall
b) 1500 metres northwest of the outfall
c) 1000 metres northwest of the outfall
d) 500 metres northwest of the outfall
e) On the outfall alignment
f) 500 metres southeast of the outfall
g) 1000 metres southeast of the outfall
h) 1500 metres southeast of the outfall
i) 2000 metres southeast of the outfall

11.2 Based on 20 coastal water samples collected each year in accordance with condition 11.1, the treated wastewater discharge shall not cause more than 13 enterococci values to exceed 35 enterococci per 100 mL, or cause any single sample to exceed 104 enterococci per 100 mL. (see advice note 5).

11.3 If, in any December to March period, the enterococci standard is exceeded at any sampling station, the permit holder shall immediately notify the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of the end of that period.

11.4 The discharge of wastewater authorised by this permit shall not cause any of the following effects beyond a distance of 100m from the midpoint of the diffuser:

a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials; and
b) any conspicuous changes in colour or visual clarity; or
c) any significant adverse effects on aquatic life.

12 Shellfish Monitoring

12.1 The permit holder shall monitor the Escherichia coli, arsenic, and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content in the soft tissue of inter-tidal shellfish (tuatua) collected from five stations off the beach adjacent to the outfall. Five replicate shellfish samples shall be collected per station during February of each year. The monitoring stations shall be within the inter-tidal zone at approximately the following locations:

a) 2000 metres northwest of the outfall
b) 1000 metres northwest of the outfall
c) On the outfall alignment
d) 1000 metres southeast of the outfall
e) 2000 metres southeast of the outfall

12.2 For shellfish samples collected in accordance with condition 12.1 the following shall apply:

a) No more than 1 out of 5 replicate shellfish samples shall exceed 230 E. coli per 100g and none of the 5 replicate samples shall exceed 700 E. coli per 100g.

b) None of the 5 replicates shall exceed the following trace metal concentrations (all values mg/kg):

- arsenic (inorganic) 2 (see advice note 6)
- copper 30
- lead 0.5
- mercury 0.5
- nickel 2
- zinc 40

c) If on any sampling occasion, any sample exceeds any of the above limits, the permit holder shall notify immediately the Regional Council and Pacific Health, and shall carry out investigations into the likely cause of that exceedence. The permit holder shall forward an investigations report to the Regional Council within 30 days of that sampling occasion.

12.3 The permit holder shall monitor the arsenic and trace metal (cadmium, chromium, copper, mercury, lead, nickel, zinc) content of the three replicate mussel samples collected from the outfall pipeline diffuser to provide a worst-case measure of trace metal accumulation. The three replicate shellfish samples shall be collected from the diffuser section of the pipeline during February of each year.

13 Comprehensive Ecological Survey

13.0 The permit holder shall undertake a broad spatial study of the benthic biota and sediments in the vicinity of the outfall (comparable to that carried out by Cawthron Institute in 2003) in the years 2014 and 2024. The results of such studies are to be provided to the Regional Council within three months of each survey being undertaken.

14 Occupation of Space

14.1 The area occupied by the ocean outfall structure shall not exceed 950m2 in total area and shall be generally as shown on BOPRC plan number RC 62879/1.

14.2 There shall be free and unrestricted public access through the area occupied by the ocean outfall structure except where restrictions are necessary during regular inspection and/or maintenance works to ensure public health and safety.

14.3 The permit holder shall take any necessary precautions to ensure the safety of the public using the area occupied by the ocean outfall structure.

15 Notifying the Regional Council of Works

15.0 The permit holder shall notify the Chief Executive of the Regional Council or delegate no less than five working days prior to commencing any inspection and/or maintenance works under this consent.

16 Retrofit (Relining) Works

16.1 Retrofit and/or relining works under this consent shall be carried out generally in accordance with information submitted with the application for this consent including:

- Section 10 of the application document titled "Tauranga City Council Wastewater Consents Project: Resource Consents Application, Notice of Requirement to Alter a Designation, and Assessment of Effects on the Environment, Application Edition, October 2004"; and
- An approved Construction Management Plan as required by condition 16.2 of this consent.

16.2 The consent holder shall submit a Construction Management Plan for any retrofit or relining works under this consent to the Regional Council for technical approval, no less than twenty one working days prior to commencing those works. The Construction Management Plan shall include but not be limited to the following;

- Type of construction method; and
- Proposed construction timeframe; and
- Access arrangements and protective measures including transportation, storage and use of machinery, tools and materials within the foreshore and marine area; and
- Mitigating measures to minimise actual or potential adverse effects; and
- Risk management procedures; and
- Any other issues that may be identified.

17 Maintenance

Change: CH17-00785

17.1 The permit holder shall ensure that the ocean outfall structure is maintained in an effective capacity at all times, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

17.2 The consent holder shall maintain all parts of the wastewater treatment system in effective working order at all times and in accordance with the manufacturer’s instructions for any mechanical elements, to ensure that the wastewater treatment plant operates efficiently and meets the discharge quality set by conditions of this consent, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

18 Wastewater Management Review Committee

18.1 The permit holder shall establish, and retain, as a committee of the Tauranga City Council under clause 30 of the Seventh Schedule to the Local Government Act 2002, the Wastewater Management Review Committee ("Review Committee").

18.1.1 The permit holder shall facilitate the role and function of the Review Committee by providing reasonable organisational and administrative support for the duration of the permit.

18.1.2 The Review Committee required pursuant to condition 18.1 shall operate in accordance with the Wastewater Management Review Committee Management Plan.

18.1.3 The permit holder shall submit the Wastewater Management Review Committee Management Plan, to the Chief Executive of the Regional Council or delegate for approval within three months of the commencement of this permit. The permit holder may amend the Wastewater Management Review Committee Management Plan with the written approval of the Chief Executive of the Regional Council or delegate.

18.2 The Wastewater Management Review Committee Management Plan shall address:

a) the membership of the Review Committee

b) the frequency that the Review Committee shall meet

c) the meeting protocols of the Review Committee having regard to the customary practices of the tangata whenua of Tauranga Moana and shall operate in accordance with the principles of the Treaty of Waitangi (especially the principles of consultation, active participation and partnership).

d) the functions of the Review Committee

18.3 Notwithstanding condition 18.2(d), the functions of the Review Committee shall include, but not be limited to the following functions:

a) To receive reports on the operation of the Wastewater Scheme, including reports in relation to monitoring and permit compliance, and to make recommendations to the permit holder on the development of Tauranga City Council's policies in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies and standards addressed in the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

b) To make decisions about the application of the Environmental Mitigation and Enhancement Fund established in accordance with Condition 19 of this permit.

c) To make recommendations to the permit holder as to physical measures and initiatives to address or compensate for actual or potential effects of the Tauranga City Wastewater Scheme (in the broadest environmental sense).

d) Without limiting the generality of Condition 18.3(c), to make recommendations to the permit holder as to the implementation of the works to be undertaken in accordance with Permit Number 62881, namely:

- Decommissioning of the Te Maunga Sludge Pond and the future use of the pond.
- Conversion of the Te Maunga Oxidation Ponds to wetlands.

e) To make recommendations to the permit holder in relation to the independent consultant to be appointed to undertake the Monitoring, Upgrade and Technology Review Report required by Condition 20 of this permit.

f) To make recommendations to the Permit Holder as to enhancing the involvement of tangata whenua in sampling, testing and monitoring.

g) Assessment of the scope and adequacy of sampling and monitoring.

h) Notification to appropriate parties of activities that may have adverse effects.

i) To receive, review and recommend action following receipt of wastewater reports.

j) To recommend the commissioning of reports and future Tauranga City Council actions on wastewater management, treatment and disposal issues and options, including:

(i) Development of alternatives to waterborne wastewater systems.
(ii) Options for further treatments;
(iii) Options for methods of disposal;
(iv) Monitoring effects on the environment.

k) To co-ordinate and oversee education of the community on wastewater management, treatment and disposal issues.

l) To identify and make recommendations to the permit holder as to sources of funding which may be available to supplement the Environmental Mitigation and Enhancement Fund established pursuant to Condition 19 hereof and to be applied for the purposes specified in that condition.

m) To make recommendations to the permit holder as to changes to conditions of these permits pursuant to section 127 of the Resource Management Act 1991, in light of the exercise of the Review Committee's functions, including reports received and information received as a result of monitoring, etc, or to avoid, remedy or mitigate actual or potential adverse effects associated with the operation of the Wastewater Scheme.

n) To foster robust relationships and dialogue between the Review Committee, the permit holder, the Western Bay of Plenty District Council and the Bay of Plenty Regional Council in relation to wastewater management, treatment and disposal, particularly following the review of wastewater treatment in light of new technologies.

o) To make recommendations to the Bay of Plenty Regional Council as to amendments to the conditions of these permits which could be implemented via a review under section 128 of the Act in accordance with condition 22.

18.4 Prior to making any:

a) Decisions as to the allocation of the Environmental Mitigation and Enhancement Fund in accordance with Condition 18.3(b) hereof or,

b) Recommendations to the permit holder in relation to physical environmental mitigation or enhancement or mitigation works in accordance with Condition 18.3(c) hereof;

the Review Committee will exercise its best endeavours to ascertain the existence of any persons or bodies who may have a particular interest or stake in the ecological health of the Tauranga Harbour (particularly the Upper Harbour/Rangataua Bay area) and to consult with those bodies or persons as to appropriate initiatives and measures to be so recommended (in accordance with Condition 18.3(b)) or undertaken (in accordance with Condition 18.3(c)). As a minimum, the Review Committee shall consult with

- Nga Potiki hapu and iwi of Ngaiterangi, Ngati Ranginui and Ngati Pukenga and Te Arawa and their respective hapu which hold kaitiaki status over the wider Tauranga Moana district, including any Working Group established by those hapu or iwi;
- Bay of Plenty Regional Council and the Western Bay of Plenty District Council in relation to issues that may affect those councils in accordance with their function under Condition 18.3(m) hereof.

18.5 Not later than one month following the first anniversary of the commencement of these permits and on each anniversary thereafter, the Wastewater Management Review Committee shall forward to the Chief Executive of the Bay of Plenty Regional Council, a report on the exercise of its activities and functions, including where appropriate a report on the effectiveness of measures undertaken pursuant to the Environmental Mitigation and Enhancement Fund.

18.6 Not less than six months following the first anniversary of this permit and each fifth anniversary thereafter, the Wastewater Management Review Committee's annual report shall contain a review of its activities over the previous five year period and recommendations for appropriate initiatives over the next five year period, including any recommendations for changes to conditions of these permits, or the Wastewater Management Review Committee Management Plan, which may be considered necessary or desirable. This report shall be available at least three months prior to the date on which the Bay of Plenty Regional Council is entitled to review the conditions of these permits in accordance with condition 22 hereof.

A copy of this report shall also be provided to the Chief Executive, Tauranga City Council.

19 Environmental Mitigation and Enhancement Fund

19.1 The permit holder shall establish a fund, to be entitled the Environmental Mitigation and Enhancement Fund, of not less than $250,000 (comprising one payment of $50,000 one month after the commencement of the permit, and four further such payments the second, third, fourth and fifth anniversary of the commencement of the permits).

The purpose of the fund shall be to fund and facilitate measures and initiatives (particularly in the Upper Tauranga Harbour) to:

a) Avoid, remedy or mitigate the actual or potential effects of the Wastewater Scheme (in its broadest sense);or

b) To acknowledge and provide mitigation by way of environmental compensation for ongoing adverse environmental effects (including by way of offence to tangata whenua cultural and spiritual values) associated with the Wastewater Scheme.

Initiatives which the fund may be applied to may include but are not limited to:

c) Providing opportunities for promoting and/or implementing initiatives for capacity building of tangata whenua; and

d) The carrying out by tangata whenua of monitoring the cultural effects associated with the operation of the Wastewater Scheme.

e) Providing opportunities for promoting and/or implementing involvement of tangata whenua in sampling, testing and monitoring.

f) Research into issues relevant to water quality and ecological issues, particularly in the Upper Harbour.

g) Research into the health and size of shellfish populations and the relocation and/or re-seeding of such populations where appropriate.

19.2 The fund shall be applied by the permit holder in accordance with recommendations of the Review Committee established pursuant to Condition 18 of this permit.

19.3 The permit holder shall review the effectiveness of the application of the fund at least two months prior to the third anniversary of the commencement of these permits with a view to making further funds available on the same basis as Condition 19 hereof, having regard to the reports of the Review Committee.

20 Monitoring, Upgrade and Technology Review Report

20.1 Not later than the fourth anniversary of the commencement of these permits, and every five years thereafter, the permit holder shall commission the preparation of a comprehensive assessment of the wastewater discharge and the operation and effects of the Wastewater Scheme and technological developments in relation to wastewater treatment and disposal and re-use systems and techniques, and the preparation of a report thereon, to be entitled the Monitoring, Upgrade and Technology Review Report. The assessment shall be undertaken by a suitably qualified independent New Zealand specialist or specialists in wastewater systems. In appointing the specialist in accordance with this condition, the permit holder shall take account of any recommendation made by the Review Committee under Condition 18.3(e) hereof.

The scope of the assessment should address but is not limited to the following:

a) Progress towards the permit holder's objective of "towards zero waste".

b) Progress in adoption or promotion of SmartGrowth Stretch Targets.

c) Technological changes and advances in relation to wastewater management, treatment and disposal and beneficial re-use technologies which may be relevant to the ongoing operation of the Wastewater Scheme, including the availability of alternatives to the current waterborne wastewater system such as waterless toilet systems.

d) The results and associated assessment of the permit holder's sampling monitoring undertaken in accordance with the resource consents, including the adequacy and scope of such monitoring and sampling.

e) Ongoing compliance with the requirements of all relevant resource consents particularly in relation to any reported non-compliance with consent conditions.

f) The implications of any relevant changes in legislation or policy relevant to the ongoing operation or compliance of the Wastewater Scheme, including standards relevant to receiving environments affected by the Wastewater Scheme.

g) The cost of any potential technological changes having regard to the best practicable option for addressing the relevant issue.

20.2 The permit holder shall instruct the independent consultant commissioned to prepare the report to consult with the Review Committee, the Consent Authority, and any key stakeholders or iwi groups identified by the Review Committee in preparing its report. (It is contemplated that tangata whenua will prepare a paper for submission to the independent consultant on the outcomes of any cultural monitoring or any other issue relevant to the operation of the permits.)

20.3 The permit holder shall use its best endeavours to ensure that the report is received at least six months before the date on which the Regional Council is entitled to review the conditions of this permit in accordance with Condition 22 hereof, so that the Regional Council is able to take account of the report in deciding whether to initiate a review.

20.4 The permit holder shall ensure that copies of the Monitoring, Upgrade and Technology Review Report are forwarded to the Chair of the Review Committee, the Chief Executive of the Bay of Plenty Regional Council and the Chief Executive of the Tauranga City Council within 10 working days of receipt.

21 Repeal of Mount Maunganui Borough Reclamation and Empowering Act 1975

21.1 As soon as reasonably practicable after the existing designation for the Te Maunga plant is extended to include the existing oxidation ponds and wetlands and all associated legal formalities have been completed, the permit holder shall commence procedures to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 and shall exercise its best endeavours to secure the repeal of the legislation.

21.2 The permit holder shall keep the Review Committee advised as to progress in achieving Condition 21.1.

21.3 Nothing in condition 21.1 and 21.2 requires the consent holder to take steps to secure the repeal of the Mount Maunganui Borough Reclamation and Empowering Act 1975 until a title has been issued to the Tauranga City Council confirming its ownership of the land comprised in the pond and the Waste Management designation has been placed on the pond area.

22 Review of Permit Conditions

22.0 The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this discharge permit; and

c) Implementing any recommendations of the Review Committee made in accordance with Condition 18.3 hereof; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with condition 20 hereof.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

23 Term of Permit

23.0 This permit shall expire on 30 April 2040.

24 Resource Management Charges

24.0 The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

25 The Permit

25.0 The Permit hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes

1

1. *For the purpose of condition 5, the average daily quantity of treated wastewater discharged shall be determined for each year.*
2. *All reports required by the conditions of this permit shall be directed in writing to the Principal Compliance Officer, Environment Bay of Plenty, and should include the permit number.*
3. *Up to 16 exceedences out of 26 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. (From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
4. *Up to 3 exceedences out of 26 samples are permitted to meet a 95-percentile discharge compliance standard based on a discharger's risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
5. *Up to 13 exceedences out of 20 samples are permitted to meet a 50-percentile (median) discharge compliance standard based on a discharger's risk of no more than 10%. From "New Zealand Municipal Wastewater Monitoring Guidelines", NZWERF/MfE 2002).*
6. *The Regional Council has determined that inorganic arsenic typically makes up 10% of the total arsenic in shellfish and that a total arsenic value of 20 mg/kg can be used as an equivalent standard.*
7. *The permit holder is advised that under the provisions of section 64A of the Resource Management Act 1991, this permit may become subject to charges for the occupation of Crown seabed and/or foreshore. At the time of issuing this permit there is no charging system in place however this permit may be affected by any charging regime implemented in the future.*
8. *The permit holder is advised that the proposal put forward at the consent hearing in regard of Wastewater Management Review Committee membership, meeting frequency and protocols would meet the requirements of condition 18.2.*
9. *Prior to planned maintenance periods, take into account forecast weather to avoid significant rainfall events.*

Consent Number: **62881**

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A discharge permit pursuant to section 15(1)(b) of the Resource Management Act 1991 to **Discharge Contaminants to Land Where it May Enter Water** subject to the following conditions:

1 Purpose

For the purpose of discharging seepage of treated wastewater from oxidation ponds into Rangataua Bay

2 Discharge Quantity

The daily quantity discharged shall not exceed 43.2m^3/day. The rate of discharge shall not exceed 1.0 litres per second

3 Location

At Mangatawa Drain, Rangataua Bay, Tauranga Harbour as shown on BOPRC Plan Number RC 62883/2 submitted with the application for this consent.

4 Map Reference

At or about map reference NZMS 260 U14: 9510-8442.

5 Legal Description

Block XI, Tauranga SD (Tauranga District).

6 Monitoring

6.1 In the month of February each year the permit holder shall take samples from:

a) One up-gradient shallow groundwater bore and;

b) Three down-gradient shallow groundwater bores.

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The bores shall penetrate at least 2 meters below the lowest summer groundwater level. The exact location of the groundwater bores shall be determined in consultation with the Chief Executive of the Regional Council or delegate.

6.2 The samples shall be analysed for:

- pH
- Conductivity
- COD
- BOD_5
- Dissolved Reactive Phosphorus
- Nitrate-N
- Ammonia-N
- Sulphate
- Chloride
- Faecal coliforms

6.3 In the month of February each year, at or near low tide, the permit holder shall undertake an inspection of the intertidal sand flats in a band extending 100m seaward of the ponds. The aim of the inspection is to identify any indicator organisms or unusual biological features that could indicate the presence of leakage from the ponds.

6.3.1 At each location where leakage is suspected, water samples shall be collected by excavation of a depression in the sand at the base of a seep and allowing the depression to fill.

6.3.2 At each location where leakage is suspected, the following field measurements of the water shall be made:

- Estimate of flow rate from seepage
- Temperature
- Dissolved oxygen
- Salinity

6.3.3 At each location water samples shall be collected and analysed for:

- Faecal coliform bacteria
- Ammonia-N
- Nitrate-N
- Dissolved Reactive Phosphorus

6.4 In the month of February each year, at of near low tide, the permit holder shall undertake a survey of titiko (*Amphibola crenata)* abundance at six locations. The methodology and location of sampling stations shall be consistent with that described by Bioresearches (1996) and MWH (2002).

7 Review of Permit Conditions

The Regional Council may under section 128 of the Act initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes;

Consent Number: **62881**

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit;

c) Implementing any recommendations of the Review Committee made in accordance with condition 18.3(c) and 18.3(d) of consent number 62878;

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with condition 20 of consent number 62878.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

8 Term of Permit

This permit shall expire on 30 April 2040.

9 Resource Management Charges

The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

10 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw**.**

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Consent (Restricted Coastal Activity) Number 62882
SAR 05 36 04 08

COASTAL PERMIT

SAR 05 36 04 08

EBOP Permit No 62882

Pursuant to the provisions of section 119 of the Resource Management Act 1991, I, Chris Carter, Minister of Conservation, hereby grant to Tauranga City Council a permit (coastal permit SAR 05 36 04 08) to carry out a Restricted Coastal Activity involving the discharge of treated wastewater overflows during extreme wet weather events, from the Chapel Street treatment plant to Tauranga Harbour, Map Reference NZMS 260 U14: 8926-8743, in accordance with the information supplied with the application and subject to the attached conditions of consent.

Dated at Wellington this 7th day of November 2005

Hon Chris Carter MP
Minister of Conservation

Consent (Restricted Coastal Activity) Number 62882
SAR 05 36 04 08

CONDITIONS OF CONSENT
SAR 05 36 04 08

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A coastal permit pursuant to section 15(1)(a) of the Resource Management Act 1991 to **Discharge Treated Wastewater into the Coastal Marine Area** subject to the following conditions:

1 Purpose

For the purpose of discharge of secondary treated and disinfected wastewater overflow into the Coastal Marine Area (Tauranga Harbour) during extreme wet weather.

2 Location

At Chapel Street, Tauranga Harbour as shown on BOPRC Plan Number RC 62883/1 submitted with the application for this permit.

3 Map Reference

At or about map reference NZMS 260 U14: 8926-8743.

4 Legal Description

DPS 88129 and Section 9 SO43580, Block X, Tauranga SD (Tauranga District).

5 General

5.1 The discharge, authorised by this consent shall only consist of secondary treated and disinfected wastewater.

5.2 The activity permitted by this permit shall be under taken generally in accordance with the description included in the Assessment of Environmental Effects (AEE) submitted with the application except where otherwise required by conditions of this permit.

Consent (Restricted Coastal Activity) Number 62882
SAR 05 36 04 08

5.3 Following a flood event which results in discharge to the Tauranga Harbour authorised under this permit, within 24 hours after the discharge ceasing, the permit holder shall inspect the area around the overflow structure, identify any damage or erosion caused by the discharge, and shall notify the Regional Council and the Director, Toi te Ora Public Health (or successor) of the event. Any damage shall be made good as soon as practical.

5.4 Within 10 working days of the cessation of a discharge, the permit holder shall provide the Regional Council a brief report detailing the exercise of permit, including causes, discharge duration, estimated volume of wastewater discharged and results of inspection pursuant to condition 5.2, and any remedial works intended including the anticipated program and completion date.

5.5 Within 3 months of the commencement of this permit the permit holder shall provide the Regional Council a public health communication plan that has been prepared in consultation with the Director, Toi te Ora Public Health (or successor).

The plan shall detail the following:

a) Signage and/or other appropriate means of advertising to the general public and any potentially affected parties, of the area affected by the discharge; and

b) Any other matters that will assist in avoiding or mitigating any health risk associated with the discharge.

5.6 Within five years of the commencement of this permit, the permit holder shall undertake and complete all planned works to ensure that only treated wastewater is discharged, as described in the documents attached to the application and further evidence given at the consent hearing.

6 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes;

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit;

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878;

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

Consent (Restricted Coastal Activity) Number 62882
SAR 05 36 04 08

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

7 Term of Permit

This permit shall expire on 30 April 2040.

8 Resource Management Charges

The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

9 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Consent Number: **62883**

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A coastal permit:

a) Pursuant to section 12(2)(a) of the Resource Management Act 1991 and Rule 12.2.4(a) of the Bay of Plenty Regional Coastal Environment Plan to **Occupy Space in the Coastal Marine Area;** and

b) Pursuant to section 12(3)(a) of the Resource Management Act 1991 and Rule 13.2.4(h) of the Bay of Plenty Regional Coastal Environment Plan to **Use a Harbour Overflow Structure in, on, under or over the Foreshore of Tauranga Harbour;**

subject to the following conditions:

1 Purpose of this Resource Consent

To provide for the ongoing occupation of the coastal marine area and use of the Chapel Street harbour overflow structure.

2 Location

The Chapel Street harbour overflow structure is located adjacent to the Chapel Street facility as shown on BOPRC Plan Number RC 62883 /1.

3 Map Reference

At or about map reference NZMS 260 U14 8926 8743 (Chapel Street harbour overflow structure).

4 Legal Description

Foreshore, Crown Land (Tauranga Harbour).

Consent Number: **62883**

5 Occupation of Space

5.1 The area occupied by the Chapel Street harbour overflow structure shall not exceed $10m^2$ in total area.

5.2 There shall be free and unrestricted public access through the area occupied by the harbour overflow structures except where restrictions are necessary during regular inspection and/or maintenance works to ensure public health and safety.

5.3 The permit holder shall take any necessary precautions to ensure the safety of the public using the area occupied by the harbour overflow structures.

6 Notifying the Regional Council of Works

The permit holder shall notify the Chief Executive of the Regional Council or delegate no less than five working days prior to commencing any maintenance works under this consent.

7 Maintenance

The permit holder shall ensure that the harbour overflow structures are maintained in an effective capacity at all times, and shall undertake any maintenance works immediately if so directed by the Chief Executive of the Regional Council or delegate.

8 Resource Management Charges

The permit holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

9 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit; and

Consent Number: **62883**

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878; and

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

10 **Term of Permit**

This permit shall expire on 30 April 2040.

11 **The Coastal Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes:

1 *This permit does not authorise the discharge of any contaminant.*

2 *This activity may require authorisation under the Building Act 1991.*

3 *The permit holder is advised that under the provisions of section 64A of the Resource Management Act 1991, this permit may become subject to charges for the occupation of Crown seabed and/or foreshore. At the time of issuing this permit there is no charging system in place however this permit may be affected by any charging regime implemented in the future.*

4 *Notification pursuant to condition 6 of this permit should be made in writing to the Principal Compliance Officer, Environment Bay of Plenty, Box 364 (or fax 0800 368 329) including the consent number.*

5 *The permit holder is responsible for ensuring that all contractors carrying out works under this permit are made aware of the relevant consent conditions, plans and associated documents.*

Consent Number: **62883**

6 *The permit holder is advised that non-compliance with permit conditions may result in enforcement action against the permit holder and/or their contractors.*

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Consent Number: **62885**

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A discharge permit pursuant to section 15(1)(b) of the Resource Management Act 1991 to **Discharge of Secondary Treated Wastewater to Land then to Water** subject to the following conditions:

1 Purpose

For the purpose of discharging secondary treated wastewater and disinfected wastewater overflow in extreme wet weather conditions to the Tauranga Harbour via an unnamed tributary of Mangatawa drain.

2 Discharge Quantity

The daily quantity discharged shall not exceed 12,000m^3. The rate of discharge shall not exceed 343 L/s.

3 Location

At Te Maunga, Tauranga as shown on BOPRC Plan Number RC 62885 submitted with the application for this consent.

4 Map Reference

At or about map reference NZMS 260 U14: 9532-8465.

5 Legal Description

Block X Tauranga SD (Tauranga District).

Consent Number: **62885**

6 General

6.1 The discharge, authorised by this consent shall only consist of secondary treated and disinfected wastewater.

6.2 The activity permitted by this permit shall be undertaken generally in accordance with the description included in the Assessment of Environmental Effects (AEE) submitted with the application except where otherwise required by conditions of this permit.

6.3 Following a flood event which results in discharge to the Tauranga Harbour authorised under this permit, within 24 hours after the discharge ceasing, the permit holder shall inspect the area around the overflow structure, identify any damage or erosion caused by the discharge, and shall notify the Regional Council and the Director, Toi te Ora Public Health (or successor) of the event. Any damage shall be made good as soon as practical.

6.4 Within 10 working days of the cessation of a discharge, the permit holder shall provide the Regional Council with a brief report detailing the exercise of consent, including causes, discharge duration, estimated volumes of wastewater discharged, results of inspection pursuant to condition 6.3, and any remedial works intended including the anticipated program and completion date.

6.5 Within 3 months of the commencement of this permit the permit holder shall provide the Regional Council a public health communication plan that has been prepared in consultation with the Director, Toi te Ora Public Health (or successor).

The plan shall detail the following:

a) Signage and/or other appropriate means of advertising the general public and any potentially affected parties, of the area affected by the discharge; and

b) Any other matters that will assist in avoiding or mitigating any health risk associated with the discharge.

7 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes;

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit;

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878;

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

Consent Number: **62885**

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

8 Term of Permit

This permit shall expire on 30 April 2040.

9 Resource Management Charges

The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

10 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Consent Number: **62886**

Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 September 2005, **Hereby Grants** to:

TAURANGA CITY COUNCIL

Private Bag 12022
TAURANGA

A discharge permit pursuant to section 15(1)(b) of the Resource Management Act 1991 to **Discharge Reclaimed Water From the Chapel Street Wastewater Treatment Plant on to Land at Various Sites in the Tauranga District** subject to the following conditions:

1 Purpose

For the purpose of discharging secondary-treated and UV disinfected reclaimed water from the Chapel Street wastewater treatment plant by spray irrigation to various sites within the Tauranga district.

2 Discharge Quantity

The daily quantity of reclaimed water discharged shall not exceed 8,750 cubic metres.

3 Location

Irrigation of reclaimed water shall be limited to eight sites within the Tauranga City boundary as listed below:

a) Tauranga Domain (main field)

b) Sulphur Point Reserve (north of the BMX track)

c) Roadside reserves each side of the causeway to Mount Maunganui

d) The grass runways at the Airport

e) The Airport Reserve (an area of agricultural land between the airport and Omanu Golf Course)

f) The Omanu Golf Links

g) Bayfair Reserve

h) Links Reserve

Consent Number: **62886**

4 Water Treatment and Water Quality

4.1 All water discharged under the conditions of this consent shall, as a minimum, be secondary-treated and UV disinfected in the Chapel Street Wastewater Treatment Plant. Discharge shall immediately cease where effluent has not been secondary treated or UV disinfected.

4.2 The reclaimed water discharge to irrigation shall meet the following quality standards:

a) The geometric mean total suspended solids concentration shall not exceed 35 g/m^3, and

b) The geometric mean *Escherichia coli* concentration shall not exceed 200 per 100 mL.

In each case the geometric mean shall be calculated from at least 5 consecutive samples collected in each month during the irrigation season.

4.3 The permit holder shall undertake an investigation into the relationship between UV transmittance and *Escherichia coli* concentrations in the treated wastewater, and shall investigate the possibility of specifying a UV transmittance threshold level, above which irrigation of reclaimed water would cease. The results of this investigation shall be reported to the Regional Council within 12 months of the issue of the new consent.

5 Treated Wastewater Monitoring

5.1 The permit holder shall maintain an easily accessible sampling point at the Chapel Street UV facility where a representative sample of reclaimed water can be obtained for the analyses specified in conditions 5.4, 5.5 and 5.6.

5.2 All quality analysis pursuant to conditions 5.5 and 5.6 shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater" – APHA – AWWA – WPCF or such other method as may be approved by the Chief Executive of the Regional Council or delegate.

5.3 All quality analysis of the wastewater discharge shall be undertaken in a laboratory with IANZ or similar accreditation.

5.4 The permit holder shall monitor and record the flow rate of reclaimed water disposed to irrigation.

5.5 The permit holder shall collect a "24-hour flow proportional composite sample" of reclaimed water on at least 5 days in each month during the irrigation season. Each sample shall be tested for suspended solids.

5.6 The permit holder shall collect a grab sample of reclaimed water on at least 5 days in each month during the irrigation season. Each sample shall be tested for *Escherichia coli* bacteria concentration.

Consent Number: **62886**

6 Irrigation Methods and Control

6.1 Irrigation at all locations will take place at night, between the hours of 7 pm and 7 am, except at the Airport and Airport Reserve where irrigation may take place at any time.

6.2 The permit holder shall place and maintain signs at the main access points to each irrigation area. The signs shall advise that reclaimed water ("treated wastewater") is irrigated at each site, and (except at the Airport and Airport Reserve) advise against entry to those areas between the hours of 7 pm to 7 am.

6.3 The method of irrigation may be by a medium or low pressure irrigation system, or by subsurface irrigation.

6.4 The following buffer zone minimum distances shall apply (buffer zones are measured from the outside wetted diameter of a sprinkler or jet to the boundary or concern):

- Open waterways: 20 m (except on Omanu Golf Course where irrigation nozzles directed away from the water course may be within 5 m of the central water course)
- Groundwater bore (domestic consumption): 20 m
- Property boundaries: 10 m for medium pressure sprinklers
5 m for low pressure sprinklers
0.5 m for subsurface irrigation
- On the north west boundary of the Airport adjacent to Te Awanui Huka Pak's property, a 60 m buffer zone shall be maintained.

6.5 The irrigation systems will be monitored and controlled by automatic mechanisms to immediately stop any irrigation cycle where wind is causing spray drift onto neighbouring properties, or breaching buffer zone distances.

6.6 The manager at each irrigation site shall record and maintain the following records:

a) A daily soil-moisture balance over the irrigation season, or use other suitable technology to measure and record soil moisture deficit.

b) A log of daily water applications including application depth, duration and block irrigated.

6.7 The irrigation application will only be used to control soil moisture deficits. Water shall not be applied to areas which are not in moisture deficit and applications shall not increase moisture levels above field capacity.

6.8 The application of reclaimed water shall not result in surface ponding or run-off to watercourses.

7 Management Plan

7.1 The permit holder shall prepare a Management Plan for each of the irrigation sites. This plan shall include all requirements of this permit pertaining to each irrigation site. A copy of the plan shall be submitted to the Regional Council within three months of this permit being granted. The plan shall include, but not be limited to:

Consent Number: **62886**

- Hours of irrigation;
- Frequency and duration of irrigation;
- Type of irrigation to be undertaken;
- Applicable buffer distances;
- Applicable public notification; and
- Name and contact of irrigation manager

7.2 Each irrigation site shall have one person nominated as the irrigation manager responsible for ensuring the conditions of the Management Plan are adhered to. The permit holder shall notify the Regional Council in writing of the names of the irrigation managers for each site.

7.3 The permit holder shall undertake the discharge, authorised under this consent, in accordance with the Management Plan described in condition 7.1.

8 Reclaimed Water Irrigation Management

The permit holder shall be responsible for the overall management of the irrigation of reclaimed water, and shall undertake the following:

a) Maintain a register of operational sites

b) Before the permit holder authorises a site for irrigation of reclaimed water it must be satisfied that the site and the staff can meet all conditions of this permit.

c) The permit holder shall be responsible for training individual irrigation site staff to ensure that they understand and comply with the Management Plan.

d) The permit holder shall undertake and annual audit of all irrigation sites using reclaimed water to ensure that all sites comply with the Management Plan. A report on this audit shall be submitted to the Regional Council by 31 July each year. This report shall detail any areas of each system that do not comply with the plan and any actions to amend problems causing non-compliance.

9 Review of Permit Conditions

The Regional Council may under section 128 of the Resource Management Act 1991 initiate a review of the conditions of these permits on the fifth anniversary of the commencement of these permits and on every 5 years thereafter.

The review of conditions shall be for the purpose of:

a) Reviewing the effectiveness of the standards in these permits in meeting environmental outcomes; and

b) Reviewing any refinements to, or reduction in, the monitoring programmes specified in this permit; and

c) Implementing any recommendations of the Review Committee made in accordance with the requirements of consent number 62878; and

Consent Number: **62886**

d) Implementing any recommendations made in the Monitoring, Upgrade and Technology Review Report prepared in accordance with the requirements of consent number 62878.

The review of conditions shall allow for:

a) The deletion or amendment of any of the conditions of this permit; and/or

b) The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment, including any unforeseen adverse environmental effects.

If necessary and appropriate the review, as provided for under this condition, may require the permit holder to adopt the Best Practicable Option to prevent or minimise significant adverse effects on the environment.

10 Term of Permit

This permit shall expire on 30 April 2040.

11 Resource Management Charges

The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

12 **The Permit** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

DATED at Whakatane this 17th day of October 2005

For and on behalf of
The Bay of Plenty Regional Council

J A Jones
Chief Executive

Consent Number: **65178**

Bay of Plenty Regional Council

Resource Consent

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 1 September 2009, **Hereby Grants** to:

TAURANGA CITY COUNCIL

A coastal permit under section 12(2)(a) of the Resource Management Act 1991 and Rule 12.2.4(a) of the Bay of Plenty Regional Coastal Environment Plan being to **Occupy the Coastal Marine Area with Wastewater Infrastructure** subject to the following conditions:

1 Purpose

For the purpose of authorising the continued occupation of space in the coastal marine area (Tauranga Harbour) by existing wastewater infrastructure.

2 Location

At various locations within Tauranga Harbour as shown on *Tauranga Harbour and Approximate Location of Structures*, referenced as B.O.P.R.C. Plan Number RC 65178/1, submitted with the application for this consent.

3 Legal Description

Foreshore and Seabed of Tauranga Harbour. Crown Land (Tauranga District).

4 Wastewater structures

4.1 The existing public wastewater pipelines and manholes authorised by this consent shall be located, maintained and used generally in accordance with information submitted with the application for this consent including:

- The application document prepared by Andrew.Stewart Limited titled *Tauranga City Council Wastewater Pipe and Manhole Coastal Consents – Resource Consent Application and Assessment of Environmental Effects*; and
- *64472 – Structure Locations* referenced as B.O.P.R.C. Plan Number RC 64472/1;

4.2 There shall be free public access to all structures authorised by this consent except when the restriction of public access is required during maintenance or reconstruction works for health and safety reasons.

Consent Number: **65178**

5 Maintenance Works

5.1 The consent holder shall ensure that the structures authorised by this consent are maintained in a safe and structurally sound condition at all times, and shall undertake any maintenance work immediately, if so directed by the Chief Executive of the Regional Council or delegate.

5.2 For the purpose of this consent, normal maintenance works would are defined as works which do not result in any of the following;

- An increase in the external length, width or height of any structure;
- Disturbance of the foreshore and/or seabed (see Advice Note 4);
- The discharge of contaminant(s) to the coastal marine area;
- A restriction of public access to and along the coastal marine area including restrictions on safe navigation and the launching and retrieval of vessels exceeding 10 consecutive working days;
- A requirement to construct temporary coastal structures for reconstruction works and/or obtain necessary authorisations for land disturbance or earthworks (above mean high water springs) associated with reconstruction works; or
- Any works that may breach the water quality classifications identified in Schedule 13.2.2 of the Bay of Plenty Regional Coastal Environment Plan or any subsequent water quality classification where superseded.

5.3 SEE CHANGE 1 Any maintenance works under this consent shall be undertaken during daylight hours with the exception of cleaning, CCTV and relining works. Works shall not be undertaken on public holidays or during daylight hours during weekends.

5.4 Machinery undertaking maintenance works under this consent shall, as far as practicable, be kept out of the coastal marine area.

5.5 Where vehicle movements in the coastal marine area are necessary, those movements shall be undertaken in the dry (above sea level at the time of vehicle movement), where practicable.

5.6 No refuelling activities or fuel storage shall be carried out within the coastal marine area, on the foreshore or within 20 metres above mean high water springs. The consent holder shall employ methods to avoid or minimise any fuel spillage, including the provision of appropriate security and containment measures, where necessary.

5.7 Individual maintenance works under this consent shall be completed as soon as practicable after commencement.

5.8 All plant, machinery, equipment and debris associated with this operation shall be removed from the foreshore and coastal marine area at the completion of the operation.

Consent Number: **65178**

6 Monitoring and Reporting

6.1 The consent holder shall notify the Chief Executive of the Regional Council, or delegate, and Toi Te Ora Public Health as soon as practicable, and within 24 hours of knowing that an event has occurred, of any sewage overflow from any of the structures authorised by this consent.

6.2 The consent holder shall, within 6 months of the commencement of this consent, facilitate the formation of a consultative group comprising, but not restricted to, relevant staff from Tauranga City Council, Environment Bay of Plenty, Toi Te Ora Public Health, Ngaiterangi Iwi Incorporated Society and Ngati Ranginui Iwi Society. The purpose of the consultative group is to establish and/or further develop, and maintain, appropriate protocols to be followed in the case of a break or spillage associated with the structures authorised under this consent.

6.3 The consent holder shall, after consultation with Environment Bay of Plenty, Toi Te Ora Public Health, Ngaiterangi Iwi Incorporated Society and Ngati Ranginui Iwi Society and such other interested parties as the consent holder chooses at its discretion to consult with, and within two years of the commencement of this consent, submit a detailed Water Quality Protocol for a Sewage Overflow Event to the Chief Executive of the Regional Council or delegate for approval.

6.4 The consent holder shall submit reports to the Chief Executive of the Regional Council or delegate by the 5th, 10th, 15th, 20th, and 25th anniversary of the granting of this consent. The reports shall cover the preceding 5-year period and shall include, but not be restricted to the following details:

- Records of any necessary maintenance works that may have been undertaken;
- Results of regular internal (12 monthly) and external (6 monthly) inspections.
- Report of any meetings held by the consultative group formed under condition 6.2 and any updated protocols.
- Records of any discharges from the pipes including the following information:
    - Date and time;
    - Location;
    - Volume of discharge; and
    - Details of response including clean up and notification procedures followed.
- Records of any issues regarding public access and any complaints or inquiries that may have been received regarding wastewater structures under this consent within the reporting period;
- Any necessary maintenance works that may be scheduled for the next reporting period;

Consent Number: **65178**

6.5 Notwithstanding condition 6.4 the report to the Chief Executive of the Regional Council or delegate by the 30th anniversary of the granting this consent shall be considered a final report under this consent. In addition to the reporting requirements of condition 6.4, the final report shall include the following;

- A description of any ongoing maintenance works requirements;
- A written statement of intent regarding long term commitment and responsibility for each structure under this consent (beyond the duration of this consent); and
- Any recommendations regarding the long term presence of wastewater structures under this consent.

7 Review of conditions

The Regional Council may, within six months of receiving reports as required by condition 6 of this consent or any other report demonstrating that the continued occupation of space in the coastal marine areas by the structures is have a significant adverse environmental effect, serve notice on the consent holder under sections 128(a)(i), (ii) and/or (iii) of the Resource Management Act 1991, of its intention to review conditions of this consent for the purpose of reviewing the location, design and/or material components of individual structures under this consent or amending any other condition of this consent that may avoid, remedy or mitigate any unforeseen adverse environmental effect that may arise as a result of the ongoing presence and use of structures under this consent. The reasonable costs of the review process shall be borne by the consent holder where deemed appropriate.

8 Term of Consent

This consent shall expire on 31 July 2044.

9 Resource Management Charges

The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

10 **The Consent** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Advice Notes

1 This consent does not authorise any activities associated with replacement or reconstruction of structures. In particular, disturbance of the foreshore and/or seabed and discharges are likely to require other authorisations.

Consent Number: **65178**

2 *The consent holder is advised that the coastal structures authorised by this consent should comply with relevant OSH and building code requirements.*

3 *Reporting required by conditions 6.3 and 6.4 of this consent should be made in writing to the Manager Pollution Prevention,, Environment Bay of Plenty, Box 364, Whakatane 3158 (or fax 0800 368 329 or email notify@envbop.govt.nz) including the consent number 65178.*

4 *The consent holder is advised that the disturbance of the foreshore or seabed by the use of vehicles for the purpose of maintaining the wastewater infrastructure is permitted by Rule 14.2.4(f) of the Bay of Plenty Regional Coastal Environment Plan provided the vehicles do not exceed 1.8 tonnes kerb weight.*

5 *The consent holder is responsible for ensuring that all contractors carrying out works under this consent are made aware of the relevant consent conditions, plans and associated documents.*

6 *The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractors.*

7 *The consent holder is advised that under the provisions of section 64A of the Resource Management Act 1991, this consent may become subject to charges for the occupation of Crown seabed and/or foreshore. At the time of issuing this consent there is no charging system in place, however, this consent may be affected by any charging regime implemented in the future.*

DATED at Whakatane this 1st day of September 2009

For and on behalf of
The Bay of Plenty Regional Council

W E Bayfield
Chief Executive

Consent Number: **65178**

Change 1

The change to the resource consent was approved under delegated authority of the Bay of Plenty Regional Council dated, 11 March 2011 as follows;

1 Change condition 5.3 to read:

Any maintenance works under this consent shall be undertaken during daylight hours **with the exception of cleaning, CCTV and relining works. Works** ~~and~~ shall not be undertaken on ~~weekends or~~ public holidays **or during daylight hours during weekends**.

Helen Creagh
Consent Manager

for W E Bayfield
Chief Executive

Your Ref:
Our Ref: **1370 67894**

Bay of Plenty REGIONAL COUNCIL

9 July 2014

John Gibbons-Davies
Tauranga City Council
Private Bag 12022
Tauranga 3143

Telephone: 0800 884 880
Facsimile: 0800 884 882
Email: info@boprc.govt.nz
Website: www.boprc.govt.nz
Pollution Hotline: 0800 884 883
International: +64 7 922 3390

RECEIVED
11 JUL 2014
TAURANGA CITY COUNCIL

Dear Sir

Resource Consent Application Number 67894: Non-Notified

I am pleased to advise you that on 9 July 2014 a decision was made on your consent application and the consent granted.

Reasons for the decision:

1 The decision meets the purpose of the Resource Management Act 1991 and is consistent with the provisions of Part 2 of the Act.

2 The activity is not contrary the relevant rules, objectives and policies of the Bay of Plenty Regional Policy Statement, proposed Regional Policy Statement, the New Zealand Coastal Policy Statement or Bay of Plenty Regional Water and Land Plan.

3 The effects of the activity are considered to be less than minor, subject to compliance with consent conditions.

4 The term is considered appropriate for the activity given the site constraints.

Enclosed for your information are:

1 A copy of the consent conditions.
2 An invoice and a statement for costs associated with processing the application.
3 A schedule showing the timeframes the consent was processed in, including time extensions or requests for further information.

There are four things for you to consider if you are unhappy with the decision:

a) Your application was processed within Statutory Timeframes (20 working days, excluding any authorised time extensions), therefore a discount under the Resource Management Act Discount Regulations does not apply. If you do not agree that your application was processed within Statutory Timeframes then please put your reasons in writing to Helen Creagh and we will reassess your situation.

b) Under the provisions of section 357 of the Resource Management Act 1991, you may lodge an objection to the decision with the Bay of Plenty Regional Council. Any objection should be in writing, and should give the reasons for the objection within 15 working days of this letter.

c) Under the provisions of section 120 of the Resource Management Act 1991, you may, within 15 working days of receiving this letter, appeal to the Environment Court, Department of Justice, PO Box 7147, Wellesley Street, Auckland 1141 against the decision.

d) If you think there are minor administrative errors with the consent conditions that need fixing please get in touch with a Water Administration Officer as soon as possible and we can consider whether these adjustments can be made under s133 of the Resource Management Act 1991.

All parties named in this resource consent should read the attached conditions thoroughly and make sure that any contractor or other person acting on your behalf is given a copy and are made aware of the conditions. Failure to comply with any of the attached consent conditions may result in enforcement action being taken against any party named as consent holder, or any party acting on behalf of the consent holder(s).

Please be aware that you may be required to pay annual charges under section 36(1)(c) of the Resource Management Act 1991. These charges are invoiced annually at the end of September. The Section 36 Charges Policy is available on www.boprc.govt.nz.

In accordance with section 125 of the Resource Management Act 1991, if you do not use this consent within five years from the date of this letter the consent will lapse and cannot be used.

Please call a Water Administration Officer on 0800 884 880, if you have any queries.

Yours faithfully

Helen Creagh
Consents Manager

for General Manager Environmental Management

Consent Schedule

Consent Number: 67894 - 0

Date Type:	Description:	Actioned Date:	Day Count:
APPLODGE	Date of Records stamp on application	30 May 2014	0
APPDATE	Application Ready to Process date	04 Jun 2014	2
ACKLETTER	Acknowledgement letter	05 Jun 2014	3
TIME37A std	Less Than Twice – Applicant Agrees (section 37A(4)(	17 Jun 2014	10
TIME EXTst	Clock re start for time extensions	23 Jun 2014	10
Proc NN	Processing as Non Notified Consent	01 Jul 2014	16
TIME37A std	Less Than Twice – Applicant Agrees (section 37A(4)(	03 Jul 2014	17
TIME EXTst	Clock re start for time extensions	07 Jul 2014	17
APPROVED	Date the consent approved	09 Jul 2014	19
NOTDEC	Notification of decision	09 Jul 2014	19
Issued	Date the consent issued	09 Jul 2014	19

Time Frames	
Application Type:	Non Notified No Hearing
Statutory Days:	20
Days Processing:	
Discount:	0%

Printed: 09 Jul 2014 15:20 p.m. Page 1 of 1

COST REPORT

Bay of Plenty REGIONAL COUNCIL

From: Marlene Bosch
Consents Officer

File reference: 1370 67894 Date: 07 July 2014

Subject: **Costs associated with processing Application Number 67894 – Tauranga City Council**

Costs incurred in respect of the processing of application number: 67894

1.1 Fixed Charge	$500.00		
1.2 Staff Time - Processing			
M Bosch - 31.5 hours	$3,375.00		
S Pinkerton - 3.5 hours	$315.00		
Total Costs	$4,190.00		
Discount (no site visit)		$0.00	
Less deposit fee (GST exclusive) paid		$ 673.04	
Total (GST exclusive)			$3,516.96
plus GST			$527.54
EXTRA COSTS TO PAY			**$4,044.50**

Recovery code : 678940 APP.4741
Debtor Code: 4248

Marlene Bosch
Consents Officer

Approved **Date** 9 July 2014

Helen Creagh
Consents Manager

Consent Number: **67894**

Bay of Plenty Regional Council

Resource Consent

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 9 July 2014, **Hereby Grants** to:

TAURANGA CITY COUNCIL

A resource consent:

(a) Under section 9(2)(a) of the Resource Management Act 1991 and Rule 35 of the Bay of Plenty Regional Water and Land Plan to undertake a discretionary activity being to **Disturb Contaminated Land and undertake Earthworks to Create Disposal Trenches;** and

(b) Under section 9(2)(a) of the Resource Management Act 1991 and Rule 1C of the Bay of Plenty Regional Water and Land Plan to undertake a discretionary activity being to **Disturb Contaminated Land and undertake Earthworks to Create Disposal Trenches;** and

(c) Under section 15(1)(b) and (d) of the Resource Management Act 1991 and Rule 37 of the Bay of Plenty Regional Water and Land Plan to undertake a discretionary activity being to **Discharge a Contaminant (dewatered sludge) to Land;** and

(d) Under section 15(1)(b) of the Resource Management Act 1991 and Rule 37 of the Bay of Plenty Regional Water and Land Plan to undertake a discretionary activity being to **Temporarily Discharge Sediment Contaminated Stormwater to Land;** and

(e) Under section 15 (1)(c) of the Resource Management Act 1991 and Rule 19(w)(ii) of the Air Plan for a discretionary activity, being the **Discharge of Contaminants and Odour into Air from the Treatment and Disposal of Waste.**

subject to the following conditions:

1 Purpose of this Resource Consent

To authorise and set conditions on earthworks for the creation of trenches on the Te Maunga Landfill, Tip Lane, Tauranga and the deposition of anaerobically digested and stabilised, dewatered sludge into the trenches.

2 Location

Te Maunga Landfill, Tip Lane, Tauranga as shown on B.O.P.R.C. Plan Number RC 67984/1.

Consent Number: **67894**

3 Map References

Earthworks: At or about map reference NZTM 188489; 582352.

Discharge: At or about map reference NZTM 188489; 582352.

4 Legal Description

Part 2 ML 20538 Lot 2 DPS 18910 Lot DPS 18910 Part A12 SO 43893 Lot 1 DPS 65413 Lot 1 DPS 75442 Part Section 9A ML 10594 Part Mangatawa Papamoa Blk ML 20903 Part 2 ML 8133 3B1 ML 21769 3A ML 20903 4E ML 14880 5 ML 8133 4A1 ML 14880 Part ML 20294.

5 Notifying the Regional Council of Works

5.1 No less than five working days prior to the overall start of works under this consent, the consent holder shall request (in writing) a site meeting between the principal site contractor and the Chief Executive of the Regional Council or delegate. Notification at this time shall include details of who is to be responsible for site management and compliance with consent conditions (see Advice Note 1).

5.2 The consent holder shall notify the Chief Executive of the Regional Council or delegate (in writing) no less than five working days before each sludge dredging operation is undertaken.

5.3 The consent holder shall notify the Chief Executive of the Regional Council or delegate (in writing) no less than five working days before the completion of works for each sludge dredging operation undertaken, prior to the removal of erosion and sediment controls (see Advice Note 1).

5.4 Prior to the completion of works under this permit, the consent holder shall commission a suitably qualified person to inspect the integrity of the trenches and completed capping works over the trenches to demonstrate that the sludge is suitably contained and the trenches geotechnically stable. Results of the assessment shall be submitted to the Chief Executive of the Regional Council or delegate within 30 days prior to the expiry of this consent (see Advice Note 1).

6 Works

6.1 Earthworks shall be carried out in general accordance with the information submitted with the application for this consent including the following drawing:

- The Te Maunga Landfill Sludge Disposal diagram, referenced as B.O.P.R.C. Plan Number 67894/1.

6.2 The consent holder shall provide the Regional Council with a Site Operational Management Plan (SOMP) for approval by the Chief executive of the Regional Council or delegate, prior to any works being undertaken under this consent. The SOMP shall as a minimum contain:

- Site management and responsibilities;
- Areas and volumes of soils to be disturbed;
- Desludging and dewatering methodology and procedures;

- Excavation and soil management procedures;
- Proposed trench stabilisation and capping;
- Management of any waste encountered;
- Vapour and odour management;
- Odour, dust and particular matter management;
- Stockpile management;
- Dewatered sludge quality management;
- Stormwater management (including stormwater diversion, erosion and sediment control plans and stormwater treatment as appropriate);
- Contingency Plans (including but not limited to spill management);
- Monitoring and reporting; and
- Tracking and decontamination procedures.

6.3 All works shall be undertaken in accordance with the SOMP approved under condition 6.2 or any future revision of the SOMP that has been approved in writing by the Chief executive of the Regional Council or delegate.

6.4 The consent holder shall ensure that the trenches constructed for sludge disposal are:

- No larger than 30 m x 15 m x 4 m deep; and
- Constructed at spacing no closer than 4 m between the trenches; and
- Located no closer that 10m from the edge of the trench to the start of the side slope on the top of the landfill; and
- Filled to no more than 0.5 m from the top of the trench (proposed new ground level); and
- Filled in with no less than 0.2 m of sawdust immediately after receiving dewatered sludge; and
- Capped with no less than 0.5m of capping material.

6.5 Only topsoil and trench excavation material sourced on-site or imported cleanfill shall be used as capping material for capping the trenches. Excavated material shall be free of any buried landfill material.

6.6 The trenches shall be constructed sequentially, with only one trench being filled at any given time (see Advice Note 4).

6.7 The consent holder shall ensure that no more than 0.25 hectares of earth is exposed on site at any one time.

6.8 The consent holder shall not excavate more than 0.4 metres into the landfill capping material.

Consent Number: **67894**

6.9 The consent holder shall ensure that each trench is capped and effectively stabilised against erosion by vegetative cover or other methods as soon as practicable once the trench is filled, to the satisfaction of the Chief Executive or delegate of the Regional Council.

6.10 No contaminated material, other than the stabilised sludge consented under condition 10.1, shall be brought to site from an external source for placement anywhere on site. The consent holder shall ensure that where imported fill is required, only cleanfill is deposited on site, or any other fill that has received written approval from the Chief Executive or delegate of the Regional Council.

6.11 For the purposes of this consent, the definition of cleanfill shall include only natural materials such as clay, soil, rock and such other materials as concrete, brick or demolition products that are free of:

(a) Combustible or putrescible components (including green waste) apart from up to 10 percent by volume untreated timber in each load

(b) Hazardous substances or materials (such as municipal waste) likely to create leachate by means of biological or chemical breakdown

(c) Any products or materials derived from hazardous waste treatment, stabilisation or disposal processes

(d) Any other material that has received written approval from the Chief Executive of the Regional Council or delegate.

6.12 Any surplus soils that are excavated on the landfill shall remain on site or be disposed of at an approved disposal facility.

6.13 The consent holder shall ensure that earthworks do not damage the leachate collection system.

6.14 The development of the landfill site and the creation of capped trenches shall at no point on the site exceed a relative level (Moturiki Datum) of 16.5 metres.

6.15 The consent holder shall ensure that the general contour and integrity of the landfill cap is maintained so as to prevent cracking, slumping or collapse.

7 Tracking

7.1 Sludge shall be covered when in transit.

7.2 The consent holder shall ensure that no sludge leaks, or is spilled from trucks during transport from the dewatering area to the landfill.

7.3 The consent holder shall ensure that all practicable measures are taken to ensure that no material is tracked off site, to the satisfaction of the Chief Executive of the Regional Council or delegate. Measures undertaken may include, but are not limited to wheel and truck washing.

7.4 The consent holder shall ensure that at no time are vehicles or machinery allowed to leave the Te Maunga site and travel on public roads whilst carrying sludge or contaminants thereof derived from the Te Maunga Waste Water Treatment Plant Sludge Pond.

Consent Number: **67894**

8 Erosion and Sediment Control

8.1 The consent holder shall divert uncontaminated catchment runoff away from the area of earthworks on the landfill.

8.2 The consent holder shall ensure that sediment contaminated water generated on the landfill site is contained within the site and discharges to ground soakage.

8.3 All stormwater that has been in contact with sludge shall be treated as leachate and managed accordingly.

8.4 The consent holder shall divert uncontaminated catchment runoff away from the sludge dewatering area.

8.5 The consent holder shall ensure that the dewatering area is bunded and contaminated stormwater generated in this area is discharged to the oxidation ponds.

8.6 The consent holder shall ensure that where runoff controls (such as diversion channels, bunds, contour drains etc.) have slopes greater than 2%, then the runoff controls shall be protected from erosion by the use of geotextile materials, rock or other suitable materials.

8.7 All erosion and sediment controls shall be installed prior to the commencement of construction works for each trench.

8.8 Sediment controls shall be installed around the edge of the work site to ensure that sediment contaminated water does not discharge from the site.

8.9 The consent holder shall ensure that the erosion and sediment controls remain in place until such time as the site is fully stabilised to the satisfaction of the Chief Executive or delegate of the Regional Council.

8.10 Unless otherwise specified in this consent, the consent holder shall ensure that all erosion and sediment controls comply with specifications set out in Bay of Plenty Regional Council Guideline No. 2010/01 - "Erosion and Sediment Control Guidelines for Land Disturbing Activities" or its successor.

9 Dust Control

9.1 The consent holder shall adopt a proactive strategy for dust control, specifically by complying with the principles of dust management as set out in the Bay of Plenty Regional Council Guideline No. 2010/01 - "Erosion and Sediment Control Guidelines for Land Disturbing Activities" or its successor, so as to prevent a dust nuisance from occurring beyond the property boundary.

9.2 The consent holder shall ensure that an adequate supply of water for dust control (sufficient to apply a minimum of 5 mm/day to all exposed areas of the site), and an effective means for applying that quantity of water, is available on site at all times during construction and until such time as the site is fully stabilised.

9.3 The consent holder shall ensure that, at all times, the soil moisture level of exposed areas is sufficient, under prevailing wind conditions, to prevent dust generated by normal earthmoving operations from remaining airborne beyond the boundary of the work site.

9.4 The consent holder shall ensure that, outside of normal working hours, staff are available on-call to operate the water application system for dust suppression.

Consent Number: **67894**

9.5 Despite conditions 9.2 to 9.4, excessive water application can lead to the production of excessive leachate and the consent holder shall undertake the following measures as required, to control dust and minimise leachate production:

(a) Cover soil stockpiles; and

(b) Cease the operation of machinery and vehicles generating airborne dust, where wind conditions render dust control impracticable, until such time as effective dust control can be re-established; and

(c) Undertake additional or alternative dust control measures to the satisfaction of the Chief Executive of the Regional Council or delegate, as directed.

10 Sludge Disposal

10.1 The consent holder shall ensure that only dewatered sludge obtained from the dredging of Te Maunga Wastewater Treatment Plant Oxidation Ponds as identified on B.O.P.R.C. Plan Number 67894/1, is discharged to trenches under this consent.

10.2 The sludge disposed of in the trenches shall contain no less than 16% solids by weight to be verified by a laboratory analysis taken from no less than one composite sample per 500 cubic metres of dewatered sludge discharged.

10.3 All dewatered sludge shall be disposed of into the disposal trenches. There shall be no discharge of dewatered sludge to land outside of the trenches.

10.4 The consent holder shall ensure that there is no discharge of sludge under this consent to land after the 30 March 2024.

10.5 The Consent holder shall ensure that all areas exposed as a result of works under this consent are stabilised by the 31 May 2024.

11 Odour

11.1 The consent holder shall take all practicable measures to ensure that there is no odour beyond the boundary of the Wastewater Treatment Plant or the Te Maunga Landfill site. Odour mitigation measures shall include, but not be limited to:

(a) Odour sprays;

(b) Lime application; or

(c) Covering of the sludge with suitable material (e.g. soil, sawdust, etc.).

11.2 Before any ceasing of daily works, the consent holder shall ensure that all dredged material is processed and committed to land, and any open, partially filled pits are monitored and treated in accordance with condition 11.1, to prevent the occurrence of odour beyond the boundary.

12 Signage

Prior to the commencement of works under this consent, the consent holder shall erect a prominent sign adjacent to the dewatering area and the main entrance to the landfill site, and maintain it throughout the period of the works. The sign shall clearly display, as a minimum, the following information:

- The consent holder;

Consent Number: **67894**

- A 24 hour contact telephone number for the consent holder or appointed agent;
- A clear explanation that the contact telephone number is for the purpose of receiving complaints and information from the public about dust nuisance, odour, or any other problem resulting from the exercise of this consent.

13 Maintenance

13.1 The consent holder shall ensure that the erosion and sediment controls, spillways and associated erosion protection devices and dust controls are maintained in an effective capacity at all times during works and until the site is stabilised in accordance with conditions of this consent.

13.2 The consent holder shall ensure that, as far as practicable, any necessary maintenance of erosion and sediment controls identified by inspection under conditions of this consent or by Regional Council staff, is completed within 24 hours.

13.3 The integrity of the cap of the trenches shall be inspected annually and repaired within 3 months if required.

14 Monitoring and Reporting

14.1 The consent holder shall ensure that the erosion and sediment controls are inspected -

- At least weekly during the duration of this consent; and
- Within 12 hours of each rainstorm event which is likely to impair the function or performance of the erosion and sediment controls.

14.2 The consent holder shall maintain records of -

- The date and time of every inspection of erosion and sediment controls on the site;
- The date, time and description of any maintenance work carried out.
- The source and type of any cleanfill brought to site;
- All soil disposal documentation;
- All sludge analysis results;
- All leachate analysis required under conditions of this consent.

14.3 The consent holder shall forward a copy of the sludge and leachate analysis to the Regional Council within one week of the receipt of the results and any other records required by conditions of this consent to the Regional Council within 48 hours of its request (see Advice Note 1).

14.4 The consent holder shall undertake groundwater monitoring, as follows:

(a) Groundwater samples will be taken from onsite monitoring bores TMG1, TMG3 and TMG4 within the four weeks prior to the commencement of sludge disposal under this permit

(b) Once sludge disposal commences, groundwater samples shall be taken from onsite monitoring bores TMG1, TMG3 and TMG4, bi-annually in the months of March and September, for the duration of the consent.

Consent Number: **67894**

(c) The water samples taken in condition 14.4(a) and (b) shall be analysed for the following constituents:

- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Zinc

(d) The consent holder shall within 2 weeks of receiving the results from the water sample analysis from condition 14.4(c), forward them to the Regional Council (see Advice Note 1).

14.5 All water analysis required by conditions of this consent shall be undertaken by an IANZ accredited laboratory.

14.6 The consent holder shall repeat the sampling and analysis within one month if the results obtained under condition 14.4 (c) exceed the Australia New Zealand Environmental Conservation Council Guidelines for Fresh and Marine Water Quality (ANZECC, 2000 Guidelines), 80% trigger value for marine water.

14.7 If the second set of analysis undertaken as per condition 14.6, exceeds the ANZECC, 2000 Guidelines 80% trigger value for marine water, the consent holder shall provide to the Regional Council a Contingency and/or Remediation Plan for approval by the Chief Executive of the Regional Council or delegate.

14.8 Any Contingency and/or Remediation Plan approved under condition 14.7 shall be implemented in the time-frame as agreed to in writing with the Regional Council.

14.9 The consent holder shall annually, in May of each year, compile a report containing:

- The results of all monitoring undertaken during the year.
- An interpretation of these results.
- An assessment of any potential environmental impacts of the sludge disposal on the environment.
- A summary of the soil disturbance activities undertaken;
- The volume of sludge disposed of in the trenches;
- The monitoring results (groundwater, sludge moisture);
- Disposal records;
- The origin, quantity, and source of imported soil;
- Updated maps indicating where new trenches have been placed;
- In the final year of the consent final as-built maps shall be provided to indicate the current trench profile of the site after placement of sludge throughout the duration of the consent;

Consent Number: **67894**

- For any actions undertaken under condition 14.7, the report shall include a summary of any remedial actions undertaken and an assessment of environmental effects; and
- An updated SOMP, if required.

14.10 One month prior to the expiry of this consent the consent holder shall provide to the Regional Council a final geotechnical report, compiled by a suitably qualified person, to verify that the landfill has been effectively capped at a height of no greater than RL16.5 (Moturiki Datum) and that the landfill is geotechnically stable.

15 Review of Conditions

15.1 The Regional Council may, serve notice on the permit holder under s.128(1)(a)(ii) and/or (iii) of the Resource Management Act 1991 of its intention to review the conditions of this permit. The purpose of such a review is to assess the need for additional erosion and sediment control, the prevention of dust nuisance, and to impose additional control conditions, if appropriate.

15.2 The Regional Council may, upon receipt of any analysis or report received under conditions of this consent or compliance report, that shows there is an adverse effect on the environment and groundwater quality, as a result of any discharge or land disturbance or use activity, serve notice on the consent holder under s. 128(1)(a) of the Resource Management Act 1991 of its intention to review the conditions of this consent. The purpose of the review is to assess the potential cause of the adverse effect and to review conditions related to earthworks volumes, the SOMP, sludge characteristics and monitoring requirements.

15.3 The Regional Council may, upon completion of any impact, environmental investigation or compliance report carried out by the Regional Council that shows there is an adverse effect on the environment as a result of any discharge or land disturbance or use activity, serve notice on the permit holder under s. 128(1)(a) of the Resource Management Act 1991 of its intention to review the conditions of this consent. The purpose of the review is to assess the need for further impact investigation, any addition controls, monitoring and if necessary require action to avoid; remedy or mitigate any adverse environmental effects.

16 Resource Management Charges

16.1 The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

16.2 The consent holder shall pay the Bay of Plenty Regional Council for staff and/or consultant costs associated with the review of any future SOMP submitted for approval by the Regional Council under conditions of this consent. Such hourly staff charge rates are set annually by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

17 Term of Consent

This consent shall expire on 31 July 2024.

The Resource Consent hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

Consent Number: **67894**

Advice Notes

1 *Reporting, notification and submission of plans required by conditions of this consent be directed (in writing) to the Pollution Prevention Manager, Bay of Plenty Regional Council, PO Box 364, Whakatane or fax 0800 884 882 or email notify@boprc.govt.nz, this notification shall include the consent number 67894.*

2 *The consent holder is responsible for ensuring that all contractors carrying out works under this consent are made aware of the relevant consent conditions, plans and associated documents.*

3 *The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractors.*

4 *It is anticipated that 3 trenches will be worked at any given time. One being closed and stabilised, a second being filled and the third being constructed.*

5 *The consent holder is advised that any review of the consent undertaken as per conditions 16.1, 16.2 and 16.3 will incur staff costs associated with the review. Staff costs are fixed annually by the Regional Council in accordance with section 36 of the Resource Management Act 1991.*

DATED at Whakatane this 9th day of July 2014

For and on behalf of
The Bay of Plenty Regional Council

M Macleod

Mary-Anne Macleod
Chief Executive

Tauranga City

Te Maunga Landfill Sludge Disposal

BOPRC PLAN NUMBER

RC 67894/1

Information shown on this plan is indicative only. Tauranga City Council accepts no liability for its accuracy and it is your responsibility to ensure that the data contained herein is appropriate and applicable to the end use intended. Cadastral information is sourced from the LINZ Data Service http://data.linz.govt.nz/layer/772-nz-primary-parcels/. Crown Copyright Reserved.

B

Appendix B – Cultural Review

Cultural Review for the Te Maunga Wastewater Treatment Plant Resource Consent

A technical report prepared for Tauranga City Council
on behalf of ngā tāngata whenua o Te Tahuna o Rangataua

Prepared by Conroy and Donald Consultants Limited
& Rolleston Advisory Serves
July 2020

Kia marama taku titiro ki Tauranga
Ko Rangihouhiri, Ko Ranginui
Kei Rangataua, Ko Tamapahore
Ngā Papaka o Rangataua
He paruparu te kai
He taniwha ngā tāngata

Keenly I look across to Tauranga
There dwells Te Rangihouhiri and Ranginui
Over at Te Tahuna o Rangataua dwells Tamapahore
The crabs of Rangataua
They eat mud, and have the boldness of demigods

DOCUMENT HISTORY

Version	Date	Updated by	Update details
Draft 1.0	20 Dec 2019	Elva Conroy	First draft of collated content, excluding workshop outcomes.
Draft 1.1	6 Mar 2020	Elva Conroy	Second draft for initial peer review. Includes ecological monitoring information (sec 3.2).
Revised 2.0	4 May 2020	Elva Conroy	Receipt of minutes, and inclusion of outcomes, from November workshop.
Revised 2.1	5 June 2020	Elva Conroy	Receipt of feedback from tangata whenua representatives on the draft report.
Revised 2.1	27 July 2020	Shad Rolleston	Inclusion of Background - Iwi Relationships section (new section 2). All section cross-references updated.

Contents

1. Introduction

Te Maunga Wastewater Treatment Plant ('WWTP') is located next to Te Tahuna o Rangataua / Rangataua Estuary, an area of cultural significance to tangata whenua[1]. Tauranga City Council ('TCC') hold multiple resource consents associated with the operation of, and discharge from, the WWTP.

Condition 20 of resource consent 62878 requires a five yearly Monitoring, Upgrade and Technology Review ('MUTR') Report. Condition 20.2 also requires the report writer to consult with the:

> *"Review Committee, the Consent Authority, and any key stakeholders or iwi groups identified by the Review Committee in preparing its report. (It is contemplated that tangata whenua will prepare a paper for submission to the independent consultant on the outcomes of any cultural monitoring or any other issue relevant to the operation of the permits.)".*

The last MUTR and cultural review[2] reports were prepared in 2016.

1.1 Purpose

This document is an updated cultural review report to satisfy Condition 20.2 of Resource Consent 62878. It will:

- Review progress against the recommendations within the 2016 cultural review report.
- Provide a cultural lens or overlay to the draft MUTR Report (reviewed in late 2019).
- Provide recommendations to the MUTR report writer; TCC and the Wastewater Management Review Committee ('Review Committee'). This includes where further work should be done to address the effects of the wastewater scheme on tāngata whenua and/or to improve the operation of the permits in relation to cultural matters.

Most significantly, this report will clarify the position of tangata whenua in relation to the operation of the WWTP over the last five years including ways to reduce impacts on cultural values and customary practices.

This report was commissioned by the tangata whenua representatives of the Review Committee. It builds on from the previous cultural review report which was prepared in 2016. Some of the aspects of the 2016 report remain unchanged and therefore are not repeated in this report (e.g. cultural association of tangata whenua).

The geographic scope of this review is *primarily* Te Tahuna o Rangataua / Rangataua Estuary as well as the ocean outfall. It is important to note however, the need to consider the whole wastewater network and not just the discharge points / areas. This is because the impacts from the wastewater discharge is reliant on the effectiveness of the whole system.

[1] In particular, Nga Potiki, Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pukenga
[2] Prepared by Nga Potiki a Tamapahore Trust

1.2 Methodology

This report was informed by the following process:

- Start-up meeting with the MUTR report writers on 11 November 2019.
- Desktop review of:
  - The previous cultural review report (2016) and draft MUTR report (2019).
  - All relevant treaty settlements and Iwi planning documents (also known as Iwi or hapū management plans).
- Discussions with tangata whenua members of the Review Committee, in person and via workshop (28 November 2019).

It is important to note that the 2016 cultural review report included wide engagement with tangata whenua kaitiaki, to identify the issues arising from the impacts of the WWTP on them, their whanau, marae and hapū. The report also drew on views from experts in the areas of culture, history, tikanga, and Maori health. The input from kaitiaki and experts provides important context to the relationship of tangata whenua to the area and issues arising from the WWTP.

The engagement carried out to inform this report is not intended to relitigate or re-interpret their views but to assess change. Rather, key questions were asked to understand the changes since 2016 report.

1.3 Report structure

Section 2 report provides a brief over of the relationships of Ngāti Ranginui, Ngāi Te Rangi and Nga Potiki with Te Tahuna o Rangataua and the coastal marine area.

Section 3 summarises the key changes to the cultural landscape since the 2016 cultural report. This includes treaty settlement, iwi planning documents and a new wahi tapu status for Te Tahuna o Rangataua.

Section 4 provides an overview of actions, monitoring and observations by tangata whenua over the last five years. This includes actions to progress the recommendations in the 2016 cultural report.

Section 5 outlines specific comments, from a cultural perspective, in relation to the draft MUTR report.

Finally, Section 6 of this report provides a summary of the key findings of the above, while Section 7 outlines the key recommendations.

2. Background – Iwi Relationships

Ngāti Ranginui

The Takitimu canoe and its crew landed at Tirikawa, at the base of Mauao, near the entrance to the Tauranga harbour. The commander of the canoe, Tamatea Arikinui went ashore and gave thanks to his Atua for safe landfall after a long sea journey. He then climbed to the summit of Mauao and performed the ancient ceremony of implanting the mauri, the spirit or life force of his people, in the hill establishing an enduring presence of his descendants in the area.

Tamatea Arikinui and some of his people stayed in Tauranga and built pa on Mangatawa, and when he died he was buried on Mauao. The canoe Takitimu continued south to Te Wai Pounamu, and came to rest far up the Waiau river in Southland. The Takitimu mountain range commemorates the place.

A grandson of Tamatea Arikinui, traversed Aotearoa by land and became known as Tamatea Pokai Whenua. He settled for a time in Tauranga, in the Mangatawa-Papamoa area. Tamatea Pokai Whenua had a number of sons to his wives, namely Ranginui, Kahungunu, Whaene, and Haumanga among others. Ranginui and Kahungunu have become eponymous tribal ancestors.

Kahungunu, lived at Mangatawa for a time before he departed after a dispute with his half-brother, Whaene. The brothers along with other men from the pa were on the beach at Otira hauling fishing nets. Kahungunu became excited and rushed in to seize the biggest fish for himself. Whaene scolded him for not following tikanga and offering the first fish back to Tangaroa. Whaene picked up a fish and threw it at Kahungunu who was pricked by the sharp fin of the snapper. When he calmed down, Kahungunu realised he had broken tikanga, and left the area humiliated. He stayed near Opotiki for a time with a cousin and her husband. While he was there, she gave birth to baby boy and named him Tutamure (the pick of the snapper) in remembrance of the incident with Whaene at Tauranga.

Kahungunu soon left Opotiki and after many adventures, he settled in the Wairoa area, then Mahia where he married Rongomaiwahine. He became the ancestor of the tribe Ngati Kahungunu whose lands covered the whole of the Hawkes Bay-Wairarapa district. The principal ancestor of Ngati Ranginui of Tauranga Moana was Ranginui, another son of Tamatea Pokai Whenua.

Takitumu Waka
Tamatea Arikinui
Rongokako
Tamatea Pokai Whenua

Ranginui	Whaene	Kahungunu
(Ngati Ranginui)	Taka	(Ngati Kahungunu)
	Hou-rangi	
	Uira-Roa	
	Rongotangiawa	
Paewhitu =	Rongomainohorangi	= Tu Wairua
Rangihouhiri		Tamapahore
(Ngāī Te Rangi)		(Ngā Potiki)

Ngāi Te Rangi

The ancestors of Ngāi Te Rangi originally lived in the Opotiki area. They are descendants of Toroa from the Mataatua waka, and Takitimu waka through Whaene the great grandson of Tamatea Arikinui.

Their pā was Tawhitirahi set above the stream, Kukumoa. After a disagreement over a pet Tui, a battle followed resulting in the pa being sacked and many of the inhabitants killed. The survivors fled inland leaving their home.

The refugees from Tawhitirahi trekked inland through the Waioeka Gorge, Waikohu Valley, Waimata, Turanganui in the Poverty Bay area and finally arriving at Whanagara on the East Coast. There they lived for many years under sufferance and under the protection of Te Waho o Te Rangi, a chief of Ngati Rangihokaia a hapu of Te Aitanga a Hauiti. As Te Waho o Te Rangi grew old he feared that his slaves might be taken over by another tribe after his death so he decided to kill them all. However, they had become stronger and resisted Te Waho o Te Rangi's intention. By mutual agreement Te Rangihouhiri and his tribe were allowed to leave in peace.

Travelling from Whangarā around the East Coast and into the Bay of Plenty they arrived at Torere. They settled there and built themselves a pā called Hakuranui. They did not feel totally comfortable living at Torere as there was always the threat of attack from the local tribes. After a small skirmish with locals, Te Rangihouhiri decided to move on westward. They passed their old pa at Tawhitirahi, but decided against stopping there due to continued antagonism and finally arrived at Whakatane.

They were merely tolerated by Ngāti Awa at Whakatane making their situation insecure so it was decided to move west again and to Matata (Te Awa o Te Atua). While at Whakapaukorero, they fought Te Arawa in the battle of Herekaki which resulted in the death of Tutengaehe, the eldest son of Te Rangihouhiri. On hearing of his son's death he predicted his own death stating "haere e tama mou tai ahiahi, moku tai awatea – Go my son, on the evening tide, I will follow on the morning tide." After Te Rangihouhiri's death at Poporohuamea (Maketu) the tribe became known as Ngāti Te Rangihouhiri (later to become Ngāi Te Rangi).

Te Rangihouhiri's son Tuwhiwhia and grandson Tauaiti, were killed by a raiding party from Ngati Ranginui and Waitaha, which resulted in the youngest son, Kotorerua, seeking revenge and planning the assault on Mauao which was occupied by Kinonui, chief of Ngati Ranginui. The result was the battle of Kokowai, in which Kinonui was killed and his pa destroyed. From the time Ngāi Te Rangi established themselves in and around Tauranga.

Nga Potiki

Ngā Potiki is an abbreviation for Ngā Potiki a Tamapahore, the descendants of Tamapahore. The ancestors of Ngā Potiki were part of a group with origins from the Mataatua canoe which migrated from eastern Bay of Plenty, and Whaene a descendant of the Takitimu canoe.

It was on the death of Rangihouhiri at Poporohuamea (Maketu) that Tamapahore comes to prominence as the leader of the confederation, now taking the name Ngāi Te Rangi, in memory of Rangihouhiri, and who lead Ngai Te Rangi from Maketū into the Tauranga area referred to as Te Heke o Tamapahore.

The attack on Mauao is known as 'Kokowai'. The incident is also remembered for Tamapahore's hesitation to carry out and participate in the attack. As such, following disagreements, Tamapahore and his family and followers did not stay at Mauao but moved to the Pāpāmoa area establishing pā at Hikutawatawa and Karamaumu, before establishing at Mangatawa, Maungatapu and Te Akau a Pāpāmoa from Parakiri to Maketu and inland to Otawa and Te Tahuna o Rangataua. Tamapahore's sons and grandchildren took the name Ngā Pōtiki a Tamapahore and through them his mana extended across Rangataua, Papamoa, Otawa and Maketū.

Mataatua waka

Toroa

Ruaihona

Tahingaotera

Awanuiarangi

Rongotangiawa

Paewhitu = Rongomainohorangi = Tu Wairua

Rangihouhiri Tamapahore

(Ngāi Te Rangi) (Ngā Potiki)

The whakapapa demonstrates the inextricable relationship between the descendants of Rangihouhiri and Tamapahore as Mataatua kin and part of the confederation which took the name Ngāi Te Rangi, and yet also distinguishes Ngā Potiki as a distinct group with its own mana.

This unique relationship is evident in kōrero recorded in the Crown Commissioners Hearing into the Mangatawa Block 1901 and submissions to the Waitangi Tribunal in 1999 held at Tamapahore Marae, where it was pointed out that Ngā Potiki is not a hapū of Ngāi Te Rangi in the true sense, as Tamapahore was a half-brother of Rangihouhiri, yet, they are still kinship groups who have supported each others mana in Tauranga Moana and extending to Maketu. For Ngā Potiki, they are a distinct group, but are also part of the confederation of iwi/hapū that migrated to Tauranga under the banner of Ngai Te Rangi.

The tauparapara below, associates three significant tūpuna of Tauranga moana namely Ranginui (Ngāti Ranginui), Ngāi Te Rangi (Rangihouhiri) and Tamapahore (Ngā Potiki) with specific areas, and explains the traditional and present day association of Ngā Potiki with Te Tahuna o Rangataua and its surrounds:

> Kia marama taku titiro ki Tauranga Ko Rangihouhiri, Ko Ranginui
> Kei Rangataua, Ko Tamapahore Ngā Pāpaka o Rangataua
> He paruparu te kai
> He taniwha ngā Tangata
>
> Keenly I look across to Tauranga
> Where dwells Te Rangihouhiri and Ranginui
> And over at Te Tāhuna o Rangataua dwells Tamapahore
> The crabs of Rangataua
> They eat mud, and have the boldness of demigods

Evidence and historical reports help to describe the activity and importance of Karikari as follows:

> "Tamapahore marae was built in approximately 1875 at Karikari. It was officially opened by Te Kooti in one of his visits to Tauranga in 1883. In remained there until 1953…"
>
> "Karikari became a thriving community … with all the hapu having their own plantations. The Kiriwera at Waiotapu had large gardens with maize, potato, and kumara, so too did Ngāti Kaahu at Taumata-a-nuku, the Te Akau area had a plantation of Harakeke grown, harvested and taken to the Tapsell mills… this was worked by all men, women and children of various hapu of Ngā Potiki. Ngāti Puapua had their gardens at Waihaue and Kurawaituhi mostly covered in bush …. Ngātimateika and others of Ngā Potiki held the Ratanui and Ruakawai area…"

Karikari remains an important pa site for Ngā Potiki to this day. The establishment of the ponds outside Karikari Pā remains a constant source of distress for Ngā Potiki.
Ngā Potiki's political, cultural and economic epicentre is centred around Mangatawa and Te Tahuna o Rangataua. Ngā Potiki are referred to as Ngā Papaka o Rangataua (the mud-crabs of Rangataua) on account of this association and references to the strong hold of Ngā Potiki on this area. This area is also part of an ancestral pathway (both physically and spiritually) for Ngā Potiki from the Mangatawa and Rangataua centre to the Pāpāmoa coastal area.

3. Changes to the cultural landscape

This section provides a brief update to the cultural landscape since the 2016 cultural review report.

3.1 Relevant Treaty Settlements

The 2016 report refers to Deeds of Settlement signed for Ngāti Pukenga; Ngai Te Rangi and Ngā Potiki; Nga hapū o Ngāti Ranginui; and, the Tauranga Moana Iwi Collective (TMIC). At the time of writing this report:

- The Ngāti Pūkenga Claims Settlement Act was enacted in August 2017.
- The remaining Deeds of Settlement are still pending.

Treaty settlement legislation is also in place for Waitaha (2013) and Tapuika (2014).

IMPLICATIONS OF STATUTORY ACKNOWLEDGEMENTS

The coastal marine area, to which the wastewater is discharged, is subject to a Statutory Acknowledgement under the Ngāti Pukenga, Waitaha and Tapuika Treaty Settlements. This is the Crown's formal acknowledgement of the cultural, historical, spiritual and traditional association of a group with a specified area or site.

Statutory Acknowledgements will impact TCC when renewing or varying resource consents for an activity "within, adjacent to, or directly affecting a statutory area" (i.e. coastal marine area discharge).

In this case:

- consent authorities must forward summaries of the resource consent application to relevant post-settlement governance entities.
- consent authorities, in determining whether there are affected parties to the resource consent application, must have regard to statutory acknowledgment areas.
- consent authorities, the Environment Court and NZ Historic Places Trust must have regard to the statutory acknowledgement.

IMPLICATIONS OF CO-GOVERNANCE ARRANGEMENTS

There is only one co-governance arrangement of relevance to the WWTP. The Tauranga Moana Iwi Collective Deed of Settlement provides for the establishment of the Tauranga Moana Governance Group. Although the treaty settlement process is incomplete, the three Councils and Tauranga Moana iwi are already working together through an interim partnership arrangement (Tauranga Harbour Advisory Group). This group meets quarterly.

Regular reporting is needed to the Tauranga Harbour Advisory Group about the WWTP. This has been occurring through the TCC representatives on the Advisory Group[3]. Ngā Pōtiki ā Tamapahore Trust raise concerns that they do not have representation in this group.

3.2 Marine and Coastal Area (Takutai Moana) Act 2011

The deadline for making High Court and Crown applications under the Marine and Coastal Area (Takutai Moana) Act 2011 closed in 2017 with 8 overlapping applications potentially affecting Tauranga City Council wastewater discharge consents. The applications were submitted by:

- Ngā Hapū ō Ngāi Te Rangi;
- Ngā Pōtiki;
- Ngāi Tamarawaho ;
- Ngāti He;
- Ngāti Makino and Ngāti Pikiao;
- Ngāti Pūkenga;
- Ngati Ranginui; and
- Waitaha.

Applicants had the option of submitting to either or both the High Court or directly to the Crown to determine their claims to title under the legislation.

If the Court agrees to hear claimants applications, claimants will have a hearing where a judge will decide whether claimants meet the tests in the Act.

If claimants wish to proceed with direct negotiations with the Crown, the Minister responsible for Treaty Negotiations will determine (through Te Kāhui Takutai Moana at Te Arawhiti) if claimants meet the legislative tests. The Minister would make a final decision on whether to enter into a recognition agreement with the applicant.

Those preparing and lodging resource consent applications, must seek the views of claimants that may be affected by consents.

In the meantime, no decisions have been made by either the High Court or the Minister regarding claims within Tauranga Moana.

IMPLICATIONS OF TAKUTAI MOANA ACT

The potential confirmation of title, will impact discharges and structures in the coastal marine area. Claimants would have property rights in the coastal marine area.

[3] https://www.boprc.govt.nz/your-council/council-and-region/committees/tauranga-moana-advisory-group/

3.2 Relevant Iwi planning documents

The 2016 cultural review report refers to two Iwi Planning Documents: Te Awanui Tauranga Harbour Iwi Management Plan 2008; and, Ngāi Te Ahi Hapū Management Plan, 2013. It does not specifically mention the following Plans[4], even though they were lodged with Councils prior to 2016:

- Ngāti Pūkenga Iwi ki Tauranga Trust Iwi Management Plan, 2013
- Ngāti Tapu Ngāi Tukairangi Hapū Management Plan, 2014
- Waitaha Iwi Management Plan, 2014
- Tapuika Environmental Management Plan, 2015
- Ngāi Te Rangi Iwi Resource Management Plan, 1995

Two Iwi Planning Documents have since been lodged with Councils:

- Tauranga Moana Iwi Management Plan - A joint Environmental Plan for Ngāti Ranginui, Ngāi Te Rangi and Ngāti Pūkenga, 2016
- Tūhoromatanui: Ngā Pōtiki Environmental Plan, 2019

COMMON THEMES

The reviewed Iwi Planning Documents (refer Section 8) highlight the importance of Te Tahuna o Rangataua and the coastal marine area. Concerns primarily relate to the impact of the WWTP on kai gathering, manaakitanga and cultural identity as well as inadequate recognition of tangata values and interests. These concerns are already noted in the 2016 cultural review report.

Ngā Pōtiki ā Tamapahore Trust (2019) highlight their frustrations over the reasons for the continued decline in the health of Te Tahuna o Rangataua.

> *There has been a long history of concern and frustration over water issues within our takiwā, particularly relating to water quality. This is formally recorded within multiple Waitangi Tribunal Claims (e.g. WAI 215 & WAI 717) as well as submissions and appeals to resource consent and plan change processes. Specific examples include:*
>
> - *oxidation ponds and a former landfill located immediately adjacent to Te Tāhuna o Rangataua.*
> - *wastewater from Te Maunga wastewater treatment plant no longer discharges into Te Tāhuna o Rangataua but instead is piped to Te Akau - through our urupā - and out to the ocean (via 3km pipe) where we gather food.*
> - *the Kaiate Stream is often closed for swimming due to health warnings relating to unsafe faecal contamination levels.*

[4] Where the area of interest included Te Tahuna o Rangataua (WWTP site) and/or the coastal marine area

- *Kaiate Stream (at Kaiate Falls) has a permanent health warning due to health warnings relating to unsafe faecal contamination levels. This means that the stream is unsuitable for swimming.*
- *our natural waterways are conduits for stormwater discharges from roads and urban areas.*

The issues are not new and there are worries that water quality will degrade further with a growing population.

- Section 6.3 of Tūhoromatanui: Ngā Pōtiki Environmental Plan 2019-2029

The objectives and policies within relevant Iwi Planning Documents include the following matters:

- Avoiding further degradation of water quality.
- Taking a more holistic, coordinated and whole-systems approach to improving the health and wellbeing of Te Tāhuna o Rangataua.
- Ensuring that tangata whenua are actively involved in resource management processes and decisions as well as research and monitoring.
- Progressing the decommissioning of the Te Maunga Oxidation Ponds.
- Ensuring that research and monitoring utilises matauranga - traditional knowledge.

A number of Iwi Planning Documents also seek to ensure that tangata whenua values and interests are part of any assessment of alternative wastewater treatment and/or disposal options.

Require:

a) additional treatment and/or alternative disposal methods of wastewater and stormwater such as the use of new technology, land based disposal or greater use of wetlands.

b) local authorities to afford appropriate weight to tangata whenua values when assessing:

i) the costs and benefits of alternative treatment and disposal methods of wastewater and stormwater.

ii) resource consent applications for wastewater and stormwater discharges.

c) a limited duration of no more than 15 years for resource consents associated with wastewater and stormwater discharges.

d) the use of mātauranga-based tools to measure and monitor the cultural impact of discharges.

e) enforcement action for non-compliance of consented discharges.

f) an annual compliance monitoring report of all consented wastewater and stormwater discharges within Tauranga Moana

- Action 9.2 of the Tauranga Moana Iwi Management Plan, 2016

IMPLICATIONS OF IWI PLANNING DOCUMENTS

The Regional Policy Statement has a number of provisions which elevate the role of Iwi Management Plans in decision making processes, including resource consent processes.

> *Policy IW 4B Ensure iwi and hapū resource management plans are taken into account in resource management decision making processes.*

Method 3 of the RPS requires consenting authorities to have regard to this policy when considering a resource consent. Method 12 of the RPS requires iwi and hapū resource management plans to be taken into account when assessing environmental effects.

It is essential to note that the use of Iwi Planning Documents should not be limited to resource consent processes. The provisions within these documents can provide support and guidance for the Review Committee.

3.3 Wāhi Tapu Status for Te Tahuna o Rangataua

On 6 May 2019, Te Tāhuna o Rangataua became a registered wāhi tapu area under the Heritage New Zealand Pouhere Taonga Act 2014. This provides formal recognition of the value of the inner harbour as a significant historical and cultural heritage area.

IMPLICATIONS OF WAHI TAPU STATUS

The Māori Heritage Council also recommended to TCC and the Bay of Plenty Regional Council that the wāhi tapu area be included in relevant planning documents. This has implications for the City Plan, in terms of protections which should be afforded to Te Tāhuna o Rangataua.

In relation to TCC resource consent applications, s6(e) and 6(f) of the Resource Management Act are matters of national importance.

3.4 Summary

There are additional requirements for TCC, as a result of a changing landscape, including:

- Regular reporting to the Tauranga Harbour Advisory Group.
- Implications of coastal statutory acknowledgements, Marine and Coastal Area (Takutai Moana) Act applications, iwi planning documents and the waahi tapu status of Te Tāhuna o Rangataua on resource consent processes (both renewals and variations).

As noted above, the use of Iwi Planning Documents should not be limited to resource consent processes. The provisions within these document can provide support and guidance for the Review Committee.

Ngā Pōtiki ā Tamapahore Trust raise concerns that they do not have representation on the Tauranga Harbour Advisory Group. Given the importance of Te Tāhuna o Rangataua to Ngā Pōtiki, it is suggested that the Terms of Reference for this group be reviewed.

4. Reflecting on the last five years

This section provides an overview of actions, monitoring and observations by tangata whenua over the last five years.

4.1 Progressing the 2016 recommendations

The 2016 cultural review report was prepared by Nga Potiki a Tamapahore Trust. The report outlined significant concerns about the ongoing operation and maintenance of the wastewater treatment plant and continued non-compliance of resource consents.

> *"tāngata whenua clearly expressed the on-going pain and suffering caused by the very presence of the wastewater treatment activities on the shores of their pātaka kai. The comments were made that at each and every marae occasion, the people suffer the whakamā and disappointment of not being able to manaaki their manuhiri from the bounty of their pātaka kai."*

> *"the on-going loss and degradation of the harbour by the wastewater treatment ponds is a takahi mana and a major cause of cultural and spiritual harm."*

In particular, agreed actions (e.g. pond decommissioning and UV plant commissioning) had not occurred. There was continued pond seepage into the estuary and odour from the WWTP. There was also a feeling of frustration and powerlessness from the lack of recognition of tangata whenua values with Te Tahuna o Rangataua.

It goes without saying that these concerns and feelings extend beyond the five-year timeframe of the 2016 report. They have been intergenerational since the establishment of the WWTP in 1979.

This report provides an update on progress against these recommendations, clustered via three topic areas.

POND DECOMMISSIONING

2016 cultural review report	
Concerns raised in the cultural review report	Anger and resentment as the condition requiring decommissioning of the treatment ponds had not been complied with. Ngā Potiki reinforced their views and expectation that the wastewater treatment ponds should be immediately decommissioned.

Recommendations from cultural review report	• Ponds reinstated to their original natural harbour environment so that the customary rights of the harbour can be restored. • If the ponds cannot be reinstated to their natural state, Ngā Potiki consider the reclaimed lands should be transferred to Ngā Potiki title and customary use. • The conditions of consent be reviewed to address this matter and to provide a program for decommissioning the ponds, including transferring the lands to Ngā Potiki.
2020 Update	
Update provided in the draft MUTR report 2019	Pond 1 has been decommissioned as a sludge pond. There has been no sludge to the pond since April 2019. The sludge currently in the pond is stabilising and will remain in place for at least 12 months before removal and disposal.
Update provided at project start up meeting with the MUTR report writers	From an operational point of view, 'pond decommissioning' mean no new sludge to the pond. However, the pond will still be used for flow buffering / balancing.
Tangata whenua views and perspectives	
Literature review	No change to the view of Nga Potiki in 2016. This is reflected in Policy 6.3.9 of their Environmental Plan (Tūhoromatanui): “Progress the decommissioning of the Te Maunga Oxidation Ponds”.
Feedback from the tangata whenua members of the Review Committee	The collective view is that the ponds should not be reconstituted into another use. The ordinary dictionary meaning of decommissioning is “to dismantle”. Council has been deceitful in its interpretation of decommissioning by using the ponds for water storage. The main reason for pond decommissioning was due to seepage and contamination into the estuary. While there is no new sludge to the pond, the use for water storage seems to defeat the intended purpose for decommissioning. The previous cultural report made it clear the view and position of tangata whenua; that decommissioning would allow for the area to be rehabilitated back to its natural state. That view and position remains unchanged.
Recommendations	• Cease use of the ponds. • Decommission the ponds, as in ‘dismantle’ and rehabilitate back to its natural state. • Work on a post decommissioning landscape/wetland plan.

WWTP OPERATION

2016 cultural review report	
Concerns raised in the cultural review report	**UV Plant** Concerns were raised about the failure of Council to commission the UV Plant. This was considered a further breach of resource consents. **Continued Pond Seepage** Concerns were raised about continued seepages from the ponds: "The increased seepages to Te Tahuna o Rangataua as a result of the 2015 desludging should not have occurred given that the ponds should have been decommissioned before this time. In effect, this increased seepage is non-compliant with the resource consents. Notwithstanding this, Council rely on the seepage conditions which provide for a seepage well in excess of what was occurring at the time of the consents and what has now occurred as a result of the desludging. There is no proper basis for such an extensive seepage to be authorised by the consents". **Impacts on Māori Health** Concerns were raised about the impacts from the WWTP on Māori health: "Moreover, stressors associated with the WWTP not only arise from the presence of the WWTP, but also arise from the powerlessness or inability for tāngata whenua views to be heard and properly recognised and valued. There are significant tensions between Council imperatives and the views of tāngata whenua in relation to the WWTP. The ceasing of the enhancement fund and the failure of the Council to comply with its resource consents are examples of these issues and concerns." **Odour** Concerns were raised about continued odour from the WWTP: "It is embarrassing that visitors and our whanau who return for the holidays will be smelling the ponds from our marae."
Recommendations from cultural review report	• Review the seepage conditions. • Consider measures to address health effects on tāngata whenua. • Review the review conditions to provide clearer provision for tāngata whenua issues to be considered over the term of the consents.

2020 Update	
Update provided in the draft MUTR report 2019	The UV plant was installed and commissioned in late 2015. The MUTR report notes that the UV plant has been shut down due to operational issues. Other upgrade works include: • Aeration upgrade - to maximise aeration capacity of the existing bioreactor. • Receiving chamber - construction of a new raw sewage chamber due to increased capacity. • Emergency generator - installation of a larger standby power generator. • Pond 1 - sludge has been removed twice from this pond, dewatered and placed in cells on the old landfill in Tip Lane. • Thickening & dewatering plant- construction of a new sludge thickening and dewatering plant to allow pond 1 to be decommissioned as a sludge pond (no longer receives sludge from the treatment plant). • Final Effluent Line and Ponds bypass design - construction (underway in 2019) to replace the bypass pipeline to improve seismic resilience; accommodate increased future flows and align with proposed works. • Grit upgrade - construction (underway in 2019) of a new system to improve the removal of grit from incoming wastewater. Overall, consent compliance has been high and that, according to wastewater and marine receiving water quality monitoring, the performance of the scheme is "consistently good". High quality wastewater is produced, as measured at the outfall pump station. Oxidation pond seepage monitoring indicates that the seepages are "not anticipated to have any significant adverse effects on estuarine water quality. Titiko surveys were increased from annual to quarterly to coincide with planned desludging work. Titiko abundance was highly variable spatially (i.e. across the 23 impact and 5 control sites) and temporally (monitoring dates).

Information from Review Committee Meeting Notes	• 27 June 2018 meeting: concerns raised about the culturally significant impact of emergency discharges into the harbour and highlighted the need for cultural monitoring and investigation of that impact.
	• 29 May 2019 meeting:
	  – UV plant has been offline since December 2018 due to electrical faults.
	  – Community odour survey completed. There were 85 respondents in the vicinity of the WWTP.
	  – The majority of residents surveyed consider the odour level emitted from the WWTP as acceptable.

	• 26 February 2020 meeting: – UV plant working well over summer. – Monitoring of seepages during the final effluent pipeline upgrade works (where pond 1 has been offline) has identified a significant reduction in seepages. Staff are looking into a possible variation to RC 62881 (Seepages consent) to assist the planned desludging works on pond 1 due to begin Oct 2020. – A regional best practice guide for the management of wastewater overflows has been developed.
Tangata whenua views and perspectives	
Feedback from the tangata whenua members of the Review Committee	Discharging and receiving wastewater from one rohe into another was discussed. The group suggested that the piping and transportation of waste from one rohe inappropriate from a cultural perspective. In their view, waste generated in one rohe should remain in that rohe and not be transferred. Also the view that land based treatment is considered more appropriate. Ngati Ranginui noted in particular issues around Chapel Street wastewater overflows and the cumulative impacts on the Waikareao estuary, and the need for a long term strategy around how the whole wastewater network is managed. The planned growth over the next 30 years as a result of SmartGrowth and the recently released Urban Form transport Initiative (UFTI) highlights the need for a long term strategy. Greater consideration is needed about the whole wastewater network and not just the issues of discharge. The collection, transportation, storage, treatment, and discharge of wastewater all affect tangata whenua in some way. There tended to be a high focus on the treatment and discharge of wastewater; but Council also needs to consider the performance of the entire network. There needs to be better communication and engagement with tangata whenua and the community about the wastewater scheme, to better understand issues. A communications strategy would connect well with the long-term planning.
Recommendations	• Council take a network-wide perspective and consider a long-term strategic view, particularly responding to growth and climate change (covered further in section 5 of this report). • Develop a communications strategy alongside the Wastewater Management Plan. • Explore long-term land based discharge of treated wastewater.

ENVIRONMENTAL MITIGATION AND ENHANCEMENT FUND

The Environmental Mitigation and Enhancement Fund (EMEF) was established via condition of resource consent to provide a way of offsetting effects from the WWTP.

2016 cultural review report	
Concerns raised in the cultural review report	• Major concerns about the way that the EMEF has been managed through the Review Committee and the basis on which the provision of funds have ceased, despite the on-going and even increasing cultural and spiritual effects. • The EMEF policy does not align with consent conditions. • The conflicts policy has removed decision-making role of tāngata whenua.
Recommendations from cultural review report	• Restructure the EMEF and its management, including conditions identifying specific proposals for addressing effects on tāngata whenua. • Consent conditions be amended to provide clear mitigation outcomes for tāngata whenua.
2020 Update	
Information from Review Committee Meeting Notes	• 26 February 2020 meeting: Updated EMEF policy manual presented. This was developed by tangata whenua representatives of the Review Committee to provide a set of eligibility criteria for potential projects, the skills required by those on the independent panel and a set of assessment criteria for projects to be assessed against.
Tangata whenua views and perspectives	
Feedback from tangata whenua representatives of the Review Committee	Concerns raised about the lack of projects funded by the EMEF. It is important to note that the EMEF was not intended to be used for cultural monitoring, but to mitigate and enhance the environment through projects. The administration of the EMEF needs to be clarified, particularly taking into account the long-term aspirations of tangata whenua – like alternatives and/or restoration of the natural environment. A clear strategy needs to be developed about how best to use the EMEF. How can the EMEF be best targeted towards projects that address tangata whenua concerns and provide a positive benefit to the environment. Discussion was also held about wider studies that might sit outside the EMEF but provide an improved understanding of the environment, e.g. tangata whenua health and well-being, historical assessment etc.

Recommendations	• Review Committee to adopt and implement the environmental mitigation and enhancement fund policy manual. • Clarify the purpose of the EMEF and develop a strategy to target the use of the fund for projects that meet agreed outcomes.

OPERATION OF THE REVIEW COMMITTEE:

2016 cultural review report	
Concerns raised in the cultural review report	• The current state and operations of the committee is a very unsatisfactory and unhealthy situation. • Decision-making powers of the committee are limited to recommendation powers only, marginalised the tāngata whenua input and decision making ability • The committee lacked any real voice and that genuine concerns and environmental impacts that carry major weight under the RMA were being undermined by LGA process and considerations.
Recommendations from cultural review report	• All conditions associated with the Review Committee be fully reviewed to consider more appropriate mechanisms. • Review the review conditions to provide clearer provision for tāngata whenua issues to be considered over the term of the consents.
2020 Update Tangata whenua views and perspectives	
Information from Review Committee Meeting Notes	Continuing issues in terms of the imbalance of power in decision making. Unless the tangata whenua members can get the buy-in of majority of committee or Council, it is not easy to influence change. Working in partnership means working together in good faith. It is about realising and valuing our contribution and intergenerational knowledge as tangata whenua and kaitiaki. The lack of leadership and long-term planning from Council will defer costs and mitigation to future generations.
Recommendations	Further discussion is needed to progress towards a genuine partnership which is collaborative, enduring and involves shared decision making.

4.2 Outcomes of cultural monitoring

There has been no cultural monitoring, associated with the WWTP, over the last five years.

PLANNING FOR CULTURAL MONITORING

Boffa Miskell Ltd has developed the following for TCC and/or tangata whenua:

- Cultural Monitoring Framework – To identify a way for tangata whenua to measure and monitor culture values to contribute to TCC's Cultural and Environmental Monitoring Programme ('CEMP').
- Cultural and Environmental Monitoring Plan - To provide a robust framework which integrates cultural indicators; provides a robust framework for the delivery of research projects; and guide the focus of current and future cultural and environmental monitoring.

While these documents are related to CEMP and EME Fund, they contribute to, or progress, cultural monitoring of Te Tahuna o Rangataua.

RESEARCH AND MONITORING BY MANAAKI TE AWANUI TRUST

Manaaki Te Awanui Trust have been carrying research and monitoring within Te Tahuna o Rangataua for a number of years. Of particular relevance to the WWTP:

- A Cultural Review of the Health of Te Awanui, Tauranga Harbour.
- Development of a Coastal Cultural Health Index to determine the health of the area using a set of cultural indicators.
- An ecological survey of an estuarine area adjacent to the Wastewater Treatment Ponds.
- A survey of microbial and metal contaminants in titiko found adjacent to the Wastewater Treatment Ponds.

Some of this work was completed prior to 2016 but was not acknowledged within the previous cultural review report.

TANGATA WHENUA FEEDBACK

Cultural monitoring is not a form of mitigation; nor does it enhance the environment; but provides information and data about the state of the environment and compliance with consent conditions. Cultural monitoring is a tool and should be undertaken as a matter of course, like water quality or ecological monitoring. That is, cultural monitoring under condition 19.1 d) and e), should be provided for in conditions 9 to 13.

Wider health effects and the impacts on tangata whenua well-being were discussed. This included access to natural resources (kaimoana), quality and quantity of resources, and ability to manaaki manuhiri (act as hosts) etc.

Monitoring the abundance of titiko needs to be integrated and balanced with studies that look at the quality of resources. This provides improved understanding about what is going on in the coastal marine area or catchments.

It would be useful for the council to explore opportunities to connect with other agencies for its other activities (e.g. stormwater) particularly where there are discharges to the coastal marine area. This provides Council, tangata whenua and the general public with a more comprehensive/global view of what is going on in catchments, rather than focusing activity by activity.

RECOMMENDATIONS

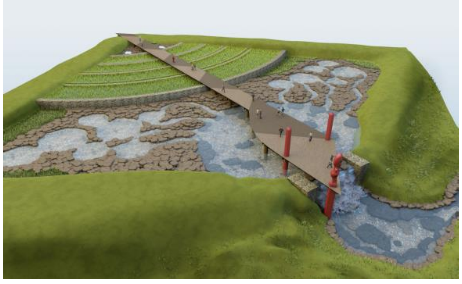
- Greater connectivity is needed between the Review Committee and Manaaki Te Awanui Trust. This is to ensure that Review Committee decisions are informed by a breadth of sources, particularly those who are able to provide data to monitor impacts and changes from a unique Māori perspective.
- Review Committee to confirm and implement a cultural monitoring programme for Te Tahuna o Rangataua. This is to ensure there is robust cultural monitoring data for the 2025 cultural review report.
- Duplicate Condition 19.1 d) and e) to condition 9 and provide opportunities through conditions 10 – 13 for tangata whenua to participate and gather information.

5. Review of the draft MUTR

The following are specific comments, from a cultural perspective, in relation to the draft MUTR report.

Reference and description	Review and recommendation
Section 5.6 Emerging and alternative technologies	This information is repeated from the 2015 MUTR. Further work is needed to reflect tangata whenua concerns and aspirations. Recommendations: • TCC to carry out an updated review of treatment technologies, including an assessment in relation to cultural values and customary resources. • TCC to continue exploring the use of algae to enhance wastewater treatment (refer Appendix 1). Section 5.5.2 refers to high rate algal ponds but it appears to be missing from the assessment table in Section 5.5.3. • Review committee to consider innovative approaches to restoring mauri to Te Tahuna a Rangataua and/or ocean outfall site. Refer to the Rotorua Lakes Council contact bed example[5].

[5] https://www.youtube.com/watch?v=BvULxgXai2w&feature=emb_title

Reference and description	Review and recommendation
	 This project provides an example of enhanced wastewater treatment that was co-designed with tangata whenua and guided by matauranga Māori. 
Section 6.3 (p86) and Section 11.2 (p102) Conclusions and recommendations	TCC's Wastewater Management 30 Year Plan is due for review in 2020. The principles within the 30 Year Plan are supported, in particular: • No sewage discharges to the Tauranga Harbour; • Pass all treated wastewater through wetlands before disposal to the ocean; • No further reclamation of Rangataua Bay (Tauranga Harbour) for wastewater purposes; • Utilise treated wastewater as a resource if possible. Tangata whenua representatives of the Review Committee discussed the Wastewater Management Plan. They were involved in the development of Council's Waste Management and Minimisation Plan and consider a similar process could apply for the review and development of the Wastewater Management Plan. In addition to tangata whenua involvement in plan review and development, it is expected that Iwi planning documents will also be reviewed to inform and guide the plan.

Reference and description	Review and recommendation
	Key questions for the Wastewater Management Plan to address: • what are the long-term aspirations for wastewater management? • how can Council better manage its wastewater, particularly in light of population growth and climate change? • how does Council manage growth? how is SmartGrowth planning for wastewater? Greater consideration is needed about the whole wastewater network, like Chapel Street, pump-stations, harbour crossings and not just the issues of discharge. The collection, transportation, storage, treatment, and discharge of wastewater all affect tangata whenua in some way. There tended to be a high focus on the treatment and discharge of wastewater; but Council also needs to consider the performance of the entire network. Greater connectivity is also needed between the three waters: water, wastewater and stormwater. Greater consideration is also needed to the development of Māori land and access to infrastructure. Many Māori communities were rurally based and the cost of developing land for papakāinga housing meant landowners had to consider stand alone or small-scale septic systems. Connecting to Council network made it cost prohibited. The group felt that more needed to be done to find solutions that enable Maori landowners to develop. **Recommendation:** TCC to ensure that the review and development of the Wastewater Management Plan: • involves tangata whenua representatives from the Review Committee. • incorporates cultural values. • takes into account iwi planning documents. • takes a whole system / network approach and provides greater linkages between the three waters (water, wastewater and stormwater). • considers ways to support and enable Māori land development (i.e. access to infrastructure).
Section 10 (p94) and Section 11.2 (p102) Conclusions and recommendations	**Iwi Planning Documents** There is no reference within the report to Iwi Planning documents, which have statutory weight under the Regional Policy Statement and Resource Management Act. These documents are listed in Section 8 of this report.

Reference and description	Review and recommendation
	Treaty Settlements There is no reference to the Ngāti Pukenga, Waitaha and Tapuika Treaty Settlements, all of which impact resource consent processes. This is due to statutory acknowledgments of the coastal marine area. **Tauranga Harbour Advisory Group** There is no reference or acknowledgment to the regular updates about the WWTP to the Tauranga Harbour Advisory Group – a group formed to pre-empt eventual co-governance of the Tauranga Harbour and via treaty settlement. **Recommendations:** • MUTR report to acknowledge Iwi Planning Documents, Treaty Settlements, Tauranga Harbour Advisory Group and the new Wāhi Tapu Status for Te Tāhuna o Rangataua. • TCC to continue providing updates at the Tauranga Harbour Advisory Group meetings and provide a feedback loop at Review Committee Meetings.
Section 11.1 (p100) Monitoring, sampling and reporting	**Titiko Monitoring (condition 6.4 of consent 52881)** – Recommendation within this report to only monitor shellfish health and not abundance. The view of the Ngā Pōtiki ā Tamapahore Trust is that shellfish monitoring should include health and abundance. **Emerging contaminants** The report noted planned annual sampling of treated wastewater for emerging contaminants (e.g. from personal care products, contraceptive pills) to inform future consent processes. This is supported. **Overflow volume and discharge rates** Recommendation within this report for TCC to find ways to improve accuracy of overflow volumes and discharge rates (currently estimated). This is supported. **Notification for non-compliance** Currently BOPRC are notified if there are non-compliance in marine bacterial and shellfish monitoring. The report states that TCC should also notify Toi Te Ora Public Health. This is supported. In this case, tangata whenua also be specifically notified.

6. Summary

This section outlines our key findings based on the matters discussed in Sections 2-5 of this report.

6.1 Have our views and perspectives changed since 2016?

No. Overall, the views and perspectives of tangata whenua relating to the:

- continued presence and impacts of the WWTP; and,
- challenges associated with tangata whenua views being heard and properly recognised and valued.

have not changed since the 2016 cultural review report. It goes without saying this has been the case since the establishment of the WWTP in 1979.

6.2 Have actions been taken to address our concerns?

Yes, actions are being taken to address these concerns, as outlined in Section 4.1 of this report.

However, significant concerns remain about:

- Pond decommissioning. The collective view is that the ponds should not be reconstituted into another use. The ordinary dictionary meaning of decommissioning is "to dismantle". The previous cultural report made it clear the view and position of tangata whenua; that decommissioning would allow for the area to be rehabilitated back to its natural state. That view and position remains unchanged.
- the lack of projects funded by the EMEF. It is notable that the EMEF was not intended to be used for cultural monitoring, but to mitigate and enhance the environment through projects.

6.3 Are things getting better or worse?

Based on monitoring, including our observations, things are not getting worse. However, progress is incredibly slow. For example, five years on, we are still transitioning in terms of pond decommissioning.

The functionality of the Review Committee and the relationship between tangata whenua and Council representatives appears to have improved somewhat since the previous cultural review report was written. Continuing concerns remain in terms of the imbalance of power in decision making.

6.4 What needs to happen over the next five years?

At a practical level:

- Completion of outstanding recommendations from the 2016 review report.
- Actioning of recommendations from this report, particularly long-term planning of wastewater services across the whole network.

OUR ASPIRATIONS FOR THE SCHEME AND THE MOANA

The following statement, provided during engagement on the Tauranga Moana Iwi Management Plan, articulates where we want to be:

"My aspiration for Tauranga Moana for the next 20 years is the inner harbour continues to be a traditional contaminant free food basket for coming generations".

It goes without saying, that the above statement represents how we've always felt and how we'll always feel about Te Tahuna o Rangataua. The tangata whenua representatives of the Review Committee discussed the overall aspiration for the wastewater scheme and there was general consensus that there should be no discharges of wastewater into natural waterbodies, including the coastal marine area. Land-based treatments systems are considered to better provide for cultural values.

The group also sought to see the restoration of the health and well-being of Rangataua Bay extending into the wider Tauranga Harbour and Te Moana a Toi.

Greater consideration is needed about the whole wastewater network and not just the issues of discharge. The collection, transportation, storage, treatment, and discharge of wastewater all affect tangata whenua in some way. There tended to be a high focus on the treatment and discharge of wastewater; but Council also needs to consider the performance of the entire network. Greater connectivity is also needed between the three waters: water, wastewater and stormwater. This aligns with our worldview, which is a holistic, whole systems approach.

FOR THIS ASPIRATION TO BECOME A REALITY

We need to see our cultural values embedded into wastewater management, planning and decision making. This provides an enhanced way of working, particularly enhanced relationships.

We need to see a cultural monitoring plan in place – and implemented – so that the Review Committee has **data** to monitor the impacts and changes from a cultural perspective. It helps to build awareness and understanding, particular with the general public, as to the scale of change and impact to tangata whenua. Cultural monitoring helps to tell that story.

Finally, we need better communication and engagement with tangata whenua and the community about the wastewater scheme, to better understand the issues and impacts.

7. Recommendations

#	Recommendation	Report Reference
To the MUTR Report Writer		
1	Include acknowledgement to Iwi Planning Documents, Treaty Settlements, Tauranga Harbour Advisory Group and the new Wāhi Tapu Status for Te Tahuna o Rangataua.	2.1-2.4, 4
To the Review Committee		
2	Operation of the Review Committee: a. Ensure there is regular reporting to the Tauranga Harbour Advisory Group and a feedback loop to the Review Committee. b. Become familiar with the provisions of relevant Iwi Planning Documents relating to wastewater treatment and disposal. For example, Policy 9 and Action 9.2 of the Tauranga Moana Iwi Management Plan as well as Section 6.3 of Tūhoromatanui: Ngā Pōtiki Environmental Plan 2019-2029. c. Further discussion is needed to progress towards a genuine partnership which is collaborative, enduring and involves shared decision making.	2.1, 3.1, 4
3	Pond decommissioning: a. Cease use of the ponds. b. Decommission the ponds, as in 'dismantle' and rehabilitate back to its natural state. c. Work on a post decommissioning landscape/wetland plan.	3.1
4	Operation of the WWTP: a. Council take a network-wide perspective and consider a long-term strategic view, particularly responding to growth and climate change (covered further in section 5 of this report). b. Develop a communications strategy alongside the Wastewater Management Plan. c. Explore long-term land based discharge of treated wastewater.	3.1
5	Environmental Mitigation and Enhancement Fund: a. Review Committee to adopt and implement the environmental mitigation and enhancement fund policy manual. b. Clarify the purpose of the EMEF and develop a strategy to target the use of the fund for projects that meet agreed outcomes.	3.1

#	Recommendation	Report Reference
6	Cultural Monitoring: a. Ensure greater connectivity with Manaaki Te Awanui Trust particularly those who are able to provide guidance to monitor impacts and changes from a unique Māori perspective. b. Confirm and implement a cultural monitoring programme for Te Tahuna o Rangataua. This is to ensure there is robust cultural monitoring data for the 2025 cultural review report. c. Duplicate Condition 19.1 d) and e) to condition 9 and provide opportunities through conditions 10 – 13 for tangata whenua to participate and gather information.	3.2
7	Review committee to consider innovative approaches to restoring mauri to Te Tahuna a Rangataua and/or ocean outfall site.	4
To TCC - WWTP Operations, Planning and Consenting		
8	TCC to ensure that the review and development of the Wastewater Management Plan: • involves tangata whenua representatives from the Review Committee. • incorporates cultural values. • takes into account iwi planning documents. • takes a long-term view and perspective • takes a whole system / network approach and provides greater linkages between the three waters (water, wastewater and stormwater). • considers ways to enable Māori land development.	4
9	Carry out an updated review of treatment technologies, including an assessment in relation to cultural values and customary resources. This should include high rate algal ponds.	4
10	Be aware of the implications of coastal statutory acknowledgements, iwi planning documents and the waahi tapu status of Te Tahuna o Rangataua on resource consent processes (both renewals and variations).	2.1-2.4
To the BOPRC – who administer the Tauranga Harbour Advisory Group		
11	The Terms of Reference for the Tauranga Harbour Advisory Group be reviewed. Representation is sought by Ngā Pōtiki ā Tamapahore Trust given the significance of Te Tāhuna o Rangataua to Ngā Pōtiki.	2.1, 2.4

8. References

Reports

Boffa Miskell Limited (2016). Te Tahunga [sic] o Rangataua: Cultural Monitoring Framework. Prepared for Tauranga City Council.

Boffa Miskell Limited (2017). *DRAFT Te Tahuna o Rangataua: Cultural and Environmental Monitoring Plan*. Prepared for Tauranga City Council.

CH2M Beca Ltd (2019). *DRAFT Wastewater Treatment Plant Monitoring Upgrade and Technology Review Report (2014-2019)*. Prepared for Tauranga City Council.

Conroy and Donald Consultants Limited (2016). *Tauranga Moana Iwi Management Plan: Engagement Summary Report, August - October 2015.* Prepared for Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pukenga.

Ngā Potiki a Tamapahore Trust (2016). *Cultural Review for the Te Maunga Wastewater Treatment Plant Resource consent*. Prepared for Tauranga City Council.

Taiapa, C., Bedford-Rolleston, A. and Rameka, W. (2014). *Ko te Hekenga i te Tai a Kupe, A Cultural Review of the Health of Te Awanui, Tauranga Harbour*. Manaaki Taha Moana Research Report No 3. Massey University, Palmerston North.

Taikato, V., Taiapa, C., Rameka, W., Bedford-Rolleston, A & Lovett, P. (2016). *Te Maunga Wastewater Project: Ecological survey of an estuarine area adjacent to Wastewater Treatment Ponds, Tauranga*. Manaaki Taha Moana Research Report No 27. Massey University, Palmerston North.

Taikato, V., Taiapa, C., Rameka, W., Bedford-Rolleston, A & Lovett, P. (2016). *Te Maunga Wastewater Project: Microbial and metal contaminants in an estuarine taonga species (Amphibola crenata) found adjacent to Wastewater Treatment Ponds, Tauranga*. Manaaki Taha Moana Research Report No 27. Massey University, Palmerston North.

Treaty Settlement Documents and Legislation

Ngāi Te Rangi and Ngā Potiki Settlement Bill 2015

Ngāti Pūkenga Claims Settlement Act 2017

Ngāti Rangiwewehi Claims Settlement Act 2014

Tapuika Claims Settlement Act 2014

Tauranga Moana Iwi Collective Redress and Ngā Hapū o Ngāti Ranginui Claims Settlement Bill 2015

Waitaha Claims Settlement Act 2013

Iwi Planning Documents

Where the area of interest included Te Tahuna o Rangataua (WWTP site) and/or the coastal marine area

Ngāi Tapu Ngāi Tukairangi Hapū Management Plan, 2014

Ngāi Te Ahi Hapū Management Plan, 2013

Ngāi te Rangi Iwi Resource Management Plan, 1995

Ngāti Pūkenga Iwi ki Tauranga Trust Iwi Management Plan, 2013

Tapuika Environmental Management Plan, 2014

Tauranga Moana Iwi Management Plan - A joint Environmental Plan for Ngāti Ranginui, Ngāi Te Rangi and Ngāti Pūkenga, 2016

Te Awanui: Tauranga Harbour Iwi Management Plan, 2008

Tūhoromatanui: Ngā Pōtiki Environmental Plan 2019

Waitaha Iwi Management Plan, 2015

Appendix 1. Relevant feedback from Tauranga Moana Iwi Management Plan Engagement 2014

The Tauranga Moana Iwi Management Plan is a pan-tribal plan developed by, and for, Ngāti Ranginui, Ngāi Te Rangi and Ngāti Pukenga. Whanau engagement was carried out in 2014.

Whanau were asked for their aspirations for Tauranga Moana, which includes the inner harbour, estuaries and coastal marine area. The following statement is of most significance to the WWTP:

> "My aspiration for Tauranga Moana for the next 20 years is the inner harbour continues to be a traditional contaminant free food basket for coming generations".

Specific feedback of relevance to the WWTP[6]:

- Operational matters: Remove as much chemicals from the wastewater as possible.
- Use of innovation and technology: Use algae to treat wastewater at Te Maunga.

  "Closing Te Maunga Wastewater Treatment Plant and ending of wastewater discharge to the ocean outfall - Hopefully this will be achieved by using Algae to eat the sewage. The algae can be then used to produce animal feed, bio-fuels, cosmetics, chemicals and nutrition. Here is an example from France. https://www.youtube.com/watch?v=L4QyZujKP0I. TCC has given Professor Chris Battershill of the Environmental Research Institute of the University of Waikato permission into looking at using algae to treat sewage at Te Maunga. Algae to treat sewage is included in the Ngati Ruahine and Ngati He hapu management plan outlines. Recommendation: As the Tauranga Harbour IMP Te Awanui supports looking for better ways of dealing with sewage. The recommendation is that Algae Treatment of wastewater be mentioned in the updated [iwi management] plan."

- Research and monitoring: Research the effects of Tauranga wastewater and ocean outfall on sea lettuce and algae bloom due to high nutrient levels.

  "Sewage and Ocean outfall and its effects on sea lettuce and algae bloom - Professor Chris Battershill of the Environmental Research Institute of the University of Waikato in looking at Tauranga's sewage disposal and how it affects sea lettuce and algal bloom. This is included in the Ngati Ruahine and Ngati He hapu management plan outlines. Recommendation: Support the investigation of the effects of Tauranga sewage and ocean outfall has on sea lettuce and algae bloom due to high nutrient levels."

[6] Tauranga Moana Iwi Management Plan: Engagement Summary Report, August - October 2015

10 DISCUSSION OF LATE ITEMS

11 CLOSING KARAKIA