Meat Processing Plant Discharge Consents

Application and Assessment of Environmental Effects

Prepared for

AFFCO New Zealand Limited

Prepared by

Lowe Environmental Impact

Version 5, Final. March 2015

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Meat Processing Plant Discharge Consents Application and Assessment of Environmental Effects

AFFCO New Zealand Limited

This report has been prepared for AFFCO New Zealand Limited by Lowe Environmental Impact (LEI). No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other parties.

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Revision Status			
Version	Date	Reviewer	What Changed & Why
5, Final	30/03/2015	HL	Revised proposed consent conditions.
4	23/02/2015	HL	Responses to Horizons comments on earlier draft.
3	15/09/2014	HL	ANZ; update river structures and details.

2	10/08/2014	HL	Changes made from internal ANZ review. Added discharge structure detail based on discussions with HRC

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1 APPLICATION

Form 9

APPLICATION FOR RESOURCE CONSENT
UNDER SECTION 88 and 145 OF THE
RESOURCE MANAGEMENT ACT 1991

To: Horizons Regional Council

1. **We, AFFCO New Zealand Limited,**
   P O Box 198
   Feilding 4740

   apply for the following types of resource consent:
   - Land use consent (1); and
   - Discharge permits (4)

2. **The Activities** to which the application relates (the **proposed activities**) are as follows:

   - The discharge of meatworks effluent, effluent sludge and paunch material to land owned and occupied by the applicant, by Byreburn Farm, and by Dalcam, by irrigation and direct application;
   - The discharge of odours and aerosols to the air arising from the discharge of meatworks effluent, effluent sludge and paunch material to land;
   - The discharge of meatworks effluent to groundwater by seepage from the wastewater treatment plant ponds;
   - The discharge of meatworks effluent to the Oroua River at times of high flow; and
   - The construction of a discharge diffuser and bed level control structure in the bank of the Oroua River and in the bed of the Otoku Stream which is a tributary to that river.

3. **The site** at which the proposed activity is to occur is as follows: AFFCO New Zealand's Feilding meat processing plant, and adjoining properties.

   Physical Location: 198 Campbell Road, Feilding; Oroua River and its tributary Otoku Stream.
   Legal Descriptions:
   a) **AFFCO** New Zealand Ltd, Campbell Road, Feilding.

   Legal Descriptions:

   - Lot 3, DP 89045; 16.7295 ha;
   - Sbdn 1, Sec 12, Block XIV Oroua SD; 0.73 ha;
   - Part Section 13, BLK XIV Kairanga SD; 18.32 ha;
   - Lot 21, DP 2688; 0.6 ha;
   - Lot 22, DP 2688; 0.6 ha;
   - Lot 23, DP 2688; 0.6 ha;

- Lot 24, DP 2688; 0.59 ha; and
- Lot 28, DP 2688; 0.67 ha.

b) **Byreburn Farm**, Aorangi Road, Feilding, adjacent to and generally to the north of AFFCO New Zealand Ltd, Campbell Road, Feilding.

Legal Descriptions:

- Part Section 225 Sbdn A Manchester DIST; 14.46 ha;
- Lot 191, DP 100; 13.7947 ha;
- Lot 2, DP 89128; 39.9744 ha;
- Lot 1, DP 57560; 22.7125 ha;
- Lot 1, DP 89045; 19.2740 ha (owned by ANZ, but occupied by Byreburn Farm);
- Lot 2, DP 89045; 11.7475 ha;
- Lot 31, DP 2688; 0.6171 ha;
- Lot 30, DP 2688; 0.6171 ha; and
- Sec 5, Blk XIV, Oroua SD; 32.2332 ha.

c) **Unoccupied Crown Land;** Oroua River bed adjacent to and west of AFFCO New Zealand Ltd site.

Legal Description:

- Legal River, ID 4105837, 47.2899 ha.

d) **Dalcam**; ex-St Dominic's School for the Deaf, Campbell Road, adjoining south side of AFFCO New Zealand Ltd site.

Legal Descriptions:

- Part Aorangi 1C Block; 4.09 ha;
- Lot 18 DP 2688; 0.81 ha; and
- Lot 18 DP 2688; 0.6 ha.

Map Reference of the site:

- River discharge, NZTM (RE79ss) 1819770E, 5543130N.
- Land discharge, 1821430E, 5543300N.
- Air discharge, 1821430E, 5543300N.
- Groundwater discharge, 1820160E, 5542960N.

4. **Owner/Occupier:**
   - Owner/occupier of Meat processing plant and ancillary land, including wastewater treatment ponds:

AFFCO New Zealand Ltd
P O Box 198
Feilding 4740

- Owner/occupier of riverbed at discharge location:

Unoccupied Crown Land, c/- LINZ

- Owners/occupiers of land discharge sites:

AFFCO New Zealand Ltd
P O Box 198
Feilding 4740

Byreburn Limited
c/- Bryan R Guy
14 Highfield Road
Feilding 4702

DALCAM Co. Ltd
P O Box 455
Feilding 4740

5. **There are no other activities** that are part of the proposal to which this application relates.

6. **No additional resource consents** are needed for the proposal to which this application relates.

7. **We attach an assessment of the proposed activity's effect** on the environment that:

   (a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and
   (b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and
   (c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

8. We attach **an assessment of the proposed activity against the matters set out in Part 2** of the Resource Management Act 1991.

9. We attach **an assessment of the proposed activity against any relevant provisions of a document referred to in section 104(1)(b)** of the Resource Management Act 1991, including information required by clause 2(2) of Schedule 4 of that Act.

10. **The value of the investment of the existing consent holder** is expressed in the facts that the plant employs over 370 staff, and processes in excess of 100,000 cattle-beasts per year.

Dated this 31st Day of March 2015.

~~Applicant~~/Person authorised to sign on behalf of applicant.

Hamish Lowe
Principal

Lowe Environmental Impact Limited

Contact Details
Address for service of applicant

Hamish Lowe,
Lowe Environmental Impact
P O Box 4667
Palmerston North 4442

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2 EXECUTIVE SUMMARY

Introduction
AFFCO New Zealand Limited ("ANZ") operates an export meat processing plant on the outskirts of Feilding, on a site that has housed a meat processing plant for about 100 years. Several of its activities require authorisation by way of resource consents from Horizons Regional Council ("HRC"). A process of replacing existing consents due to expire was commenced in 2010, and ten consents have already been granted, with expiry dates of 1 July 2029.

Consents to authorise discharges of condenser water, backwash and stormwater are under separate application.

This document is to provide the application and Assessment of Environmental Effects for consents to authorise the remaining activities which are not otherwise in process or granted, as follows:

- Discharge of treated meatworks effluent ("MWE") and associated solids and sludges to land;
- Discharge of odours and aerosols to air arising from the discharges to land;
- Discharge of MWE to groundwater by seepage from the wastewater treatment ponds;
- Discharge of MWE to the Oroua River; and
- The construction of a discharge structure and bed level control structure in the bed and banks of the Oroua River and its un-named tributary.

These five activities are inter-related, with the activity or effects of each having an influence on one or more of the others. For this reason this application for consents to authorise these activities addresses all five together, to ensure that mutual and cumulative effects are adequately addressed.

CLAWD
The key requirement of ANZ is to discharge wastes for which no commercial use or re-cycling is practicable; treated wastewater after solids removal needs to be safely discharged. The system for this discharge has evolved from total discharge to the adjacent Oroua River, to the present proposal involving a Combined Land and Water Discharge ("CLAWD"), with several refinements along the way.

The principle of the CLAWD system is the preferential discharge of MWE to land by irrigation at all times when soil conditions are suitable to receive it, which are usually when the weather is dry and river flow is low. At times when irrigation is not practicable, which are often when the weather is wet and river flow is high, the discharge is made to the river. Flexibility is added to this system by the availability of a large MWE storage capacity, to enable the plant to continue operating when conditions are not suitable for either a land discharge or a river discharge.

The environmental effects of the MWE discharge to land are managed by limiting the contaminant loadings that are applied to the soil's capacity to utilise them, and by ensuring that the hydraulic loading applied is no greater than the soil's available water holding capacity, in order to avoid both surface ponding/run-off and through-flow to groundwater.

The environmental effects of the MWE discharge to water depend on both the contaminant loading discharged, and the flow rate and existing quality of the receiving water. A given volume of discharged MWE will have much greater effect on the river when its flow is low, than when its flow is high. Added to this, there are seasonal recreational uses made of the river that could be compromised by a MWE discharge occurring at the same time.

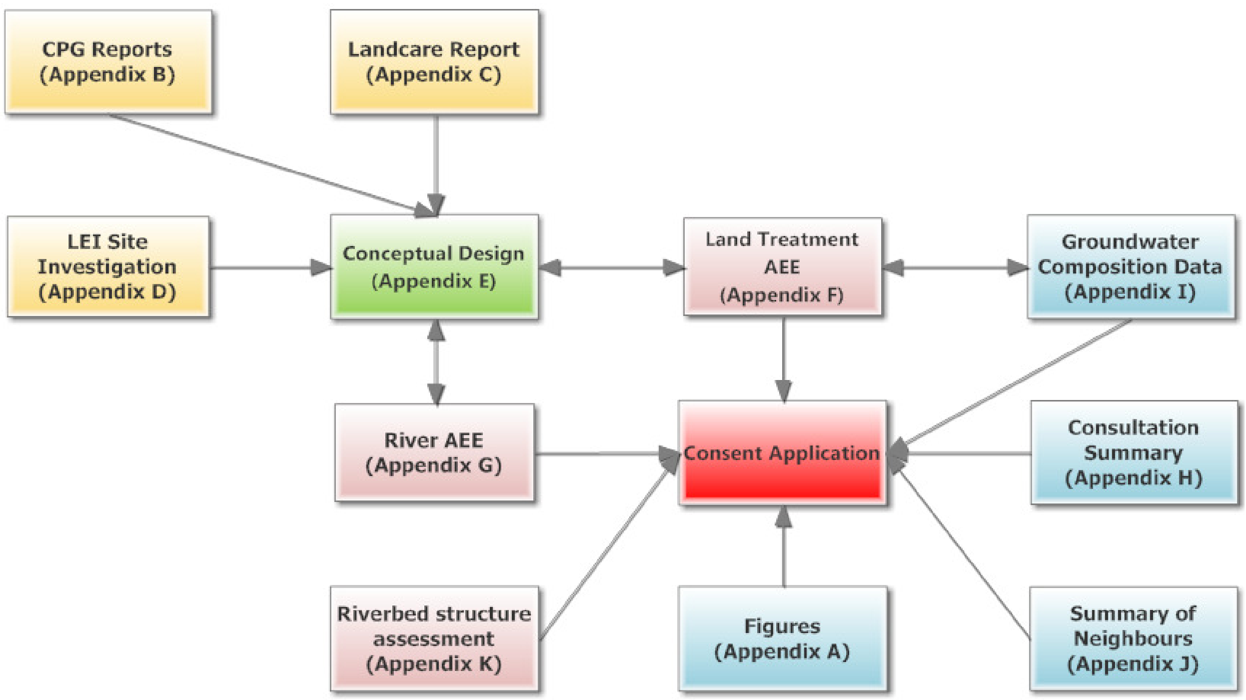
To be effective, a CLAWD system requires active management, with daily decision-making on whether, where, and how much to discharge. This system has been in place at ANZ for more than twenty years now, and in the light of operational experience and detailed monitoring the system can now be refined to substantially reduce environmental effects.

This Application and AEE
A large volume of information has been compiled to inform this consent application. To assist the digestion of this information, it has been presented in three levels of detail, as follows:

- This Executive Summary, which introduces and broadly explains the information;
- The full application and Assessment of Environmental Effects, which is the report that follows this Executive Summary; and
- The eleven Appendices to this report, that provide the full background to the material in this report.

Some of the Appendices provide background information, while others demonstrate the development of the proposed activities. The relationship between this report and its key appendices is shown in Figure 2.1 below.

Figure 2.1: Relationship between AEE Report and Key Appendices



MWE Flow, Quality and Storage
The quantity of MWE produced at ANZ is summarised in Table 1.1 below. The "future flows" are to provide the capacity for up to 20% increase in throughput at ANZ over the expected term of the consents under application.

Table 2.1: ANZ MWE Volumes

Flow statistics	Current Flows (2010-present) (m^3)	Future flows (m^3)
Annual average	256,100	307,400
Daily average	700	850
Daily minimum	250	300
Daily maximum	1,050	1,250
Daily median	760	912

The composition of the MWE produced at ANZ is summarised in Table 2.2 below.

Table 2.2: ANZ Wastewater Quality sampled at aerated pond outlet (Albert van Oostrom, 2013)

	TSS	$cBOD_5$	NO_x-N	NH_4-N	TIN (SIN)	TN	TP	DRP	E. coli	Ent
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	/100 mL	/100 mL
Mean	112	34	35	81	117	133	22	20	10,933	51,695
Median	85	29	23	84	119	132	22	20	9,550	1,000
95%ile	295	74	100	140	159	176	28	26	20,750	15,800
Max	770	115	127	170	171	190	30	29	24,000	8,700,000
Count	183	183	183	183	183	183	183	132	6	183

Ca tot	Na tot	K tot	Mg tot	SAR	Temp.	DO	pH	O&G
g/m³	g/m³	g/m³	g/m³		°C	g/m³		g/m³
26	229	46	9	10	16	4	8	5
26	198	44	9	9	15	3	8	3
32	403	52	12	16	24	8	9	12
35	442	59	12	17	30	13	9	54
19	19	19	19	19	179	177	175	176

The available MWE storage capacity at ANZ is for a volume of 64,500 m^3, which equates to around 92 days of MWE production under the current operation, and 76 days of production under proposed future operation.

Land Discharge Consent

A total of about 140 ha of land is available for the land application of MWE by irrigation, on land owned by ANZ, the Dalcam Trust, and Byreburn Farm. This area is 50% larger than the current 75 ha. The extra area provides for the safe application of the MWE, adding flexibility and contingency capacity. Irrigation is to be applied at rates calculated to not exceed the ability of the soils to receive it, using a range of low application rate methods to suit the various farming circumstances.

The land will be used mostly for farming purposes; being grazed pasture, cut-and-carry pasture, and maize cropping, with a small area of irrigated amenity around the ANZ plant. The land has been divided into four Land Management Units ("LMU's") to reflect different soil types, different land uses, and different irrigation regimes. In total there is capacity to safely discharge up to 331,775 m^3/y of MWE onto land, but in practice on average only 179,300 m^3/y will be discharged to land. Wastewater will be applied to land whenever conditions are suitable; but the difference between total irrigation capacity (theoretical) and actual land discharge will relate to the availability of wastewater at times when irrigation is possible.

In addition to the discharge of MWE, it is proposed to apply meatworks effluent sludge and paunch material (collectively referred to as Organic Amendments) to land, for its beneficial re-use as an alternative to being landfilled as waste. The regimes of MWE and Organic Amendment application are proposed to be limited by the same overall nitrogen loading limit.

The proposed land discharge regime differs from the currently authorised regime in having a larger area of land available, and reduced application rates to improve environmental impact.

Air Discharge Consent

Arising from the discharges to land will be the discharge to air of odours and aerosols. The standard requirement for such air discharges is that they must not cause effects at or beyond the property boundary that are offensive or objectionable. A range of operational measures are available to ensure that this requirement is met, including halting discharges when wind speed and direction may increase the likelihood of effects beyond the property boundary.

River Discharge Consent

The proposed river discharge criteria are given in Table 2.3 below.

Table 2.3: Proposed Criteria for ANZ River Discharge

Discharge criteria	Date Range	
Flow: Oroua River@Kawa Wool	**1 December – 31 March (Summer)**	**1 April – 30 November (Winter)**
Below median flow (0 – 7,590 L/s)	No discharge	No discharge
Median flow to 20th flow exceedance percentile (7,590 – 16,193 L/s)	No discharge	Discharge at rate based on DRP load to the river up to a maximum of 3,000 m^3/day.
Above 20th flow exceedance percentile (>16,193 L/s)	No discharge*	Up to 3,000 m^3/day.
* Emergency contingency above 3 x median (>20,913 L/s)	If land application is not possible and pond is 100 % full then up to 2,000 m^3/day.	NA

The criteria in Table 2.3 have the following key features:

- Median flow (MF) is used as a discharge cut-off since it represents an improvement on the present discharge regime and results in reduced effects to the Oroua River;
- The use of a date range which excludes flows over the summer period, when there are high daylight hours and elevated water temperatures, has been retained from the previous consent as it is considered good practice for the location;
- A variable discharge rate between MF and 20th flow exceedance percentile (20thFEP) is tied to the phosphorus loading from the discharge. A new minimum 3,800 times dilution ensures that the increase in the phosphorus in the receiving water is minimal;
- A discharge rate of 3,000 m^3/day above the 20thFEP corresponds to the flow regime used for One Plan target limits, whereby the parameter of concern changes from phosphorus to ammoniacal-nitrogen. At the proposed discharge rate the One Plan target is not exceeded; and
- The inclusion of the summer discharge under exceptional circumstances provides an assessable contingency for the system evaluation.

Pond Seepage Consent

ANZ has a wastewater treatment and storage pond system occupying a base area of about 6 ha. MWE is retained in the pond by a clay liner which was installed when the ponds were rebuilt about 40 years ago. There is likely to be a limited amount of seepage through this liner, although the rate of seepage is low enough to make its direct measurement impossible. An assessed "worst case" seepage scenario puts the seepage rate no higher than about 50 m^3/d, with a liner permeability of about 10^{-8} m/s.

Extensive investigations into groundwater levels, quality, and direction of movement in the general area around ANZ indicate the following:

- While some lateral diffusion of seepage to the river is possible, there is not a direct groundwater flow path from beneath the ponds to the Oroua River based on the direction of ground water flow;
- While there is an elevation in nitrogen concentrations in shallow groundwater close (~50 m) to the ponds, this elevation does not show up in samples from bores further away from the ponds;
- Both nitrogen and phosphorus concentrations in shallow groundwater are variable at best, but typically higher up-gradient than they are down-gradient from the ponds;
- With the adsorption of phosphorus onto clay minerals, the amount of P seeping from the ponds into the Oroua River (where it would cause ecological problems) is shown to be very small; and
- No evidence of contamination of deeper groundwater by seepage from the ponds was found.

It is proposed to retain the present clay pond liner, and to continue a program of groundwater monitoring to provide a continuing source of information on which to base any decision to replace the clay liner with a synthetic one.

Riverbed Structure Consent

It is proposed to install a new High Rate Overland Flow System in the bank of the Oroua River, both to replace the current discharge into the Otoku Stream which is a tributary to the river, and to incorporate a component of land passage into the river discharge.

Integrated with this will be a new bed level control structure over a steep reach of the bed of the un-named tributary for the purpose of securing that reach of stream bed against scour and improving ecological connectivity with the Oroua River. This is part of a package of enhancements negotiated with Iwi as mitigation of environmental effects of the discharges.

Environmental Effects

The key potential environmental effects are those on the Oroua River and its water quality. Horizons One Plan specifies 17 parameter limits ("water quality targets") for the Mana_12b (Middle Oroua) water management sub-zone, within which the river discharge occurs, in its Schedule D. The proposed discharge regime is shown to be able to comply with those water quality targets.

The main differences between the environmental effects of the proposed river discharge and those of the currently authorised discharge are as follows:

- Whereas at present discharges to the river are authorised down to a river flow of 3,000 L/s, the proposed discharges will never occur when river flows are less than 7,590 L/s; and
- The proposed discharge regime results in significant reduction in the proportion MWE loads discharged at flows below the 20th flow exceedance percentile. As a result, the effects of the proposed discharge on in-stream dissolved nutrient concentrations (DRP

and SIN) are predicted to be 87% less than under the current scenario despite an allowed 20 % increase in wastewater flows.

Environmental effects of the land discharge will also be improved from what is currently authorised, by the use of a larger area of land and by better specification of application rate limits in each of the four LMU's. This land area is greater than that needed in any one year, providing flexibility and contingency.

Environmental effects of the existing pond seepage are shown not to be sufficient to warrant the replacement of the existing clay liner with a synthetic one, but on-going monitoring is proposed to provide a basis for any change to that position.

The proposed riverbed structures are subject to regulation to ensure that they do not compromise the integrity and functionality of the existing flood control scheme on the Oroua River, and design and installation will ensure that this requirement is met.

Evaluation of Effects against One Plan
HRC's One Plan Operative Version (OPOV) has provisions against which the proposed discharges and riverbed structures must be evaluated. This evaluation has taken place and the requirements of OPOV are shown to be met by the proposals.

Consultation
There has been, and will continue to be, consultation on the proposed activities between the applicant ANZ and involved and affected parties, including Iwi Maori, neighbouring property owners, and neighbouring groundwater users. To date issues have not been raised in consultation that have not been able to be resolved.

Conclusion
The proposed discharge and riverbed structure activities at ANZ have been described, and their environmental effects demonstrated and evaluated against OPOV. With effects shown to be not greater than minor, it is concluded that the consents under application here may safely be granted.

3 INTRODUCTION

3.1 Purpose

This report is to provide the application to Horizons Regional Council (HRC) and Assessment of Environmental Effects for resource consents to authorise the discharge of meatworks effluent ("MWE") by AFFCO New Zealand Limited ("ANZ") at its Feilding plant to land, to groundwater, and to the Oroua River.

3.2 Background

ANZ has operated at its current Campbell Road site since May 1992. The site had previously been occupied by the larger Borthwick's meat processing plant for many decades (100 years in late 2014), and was closed for re-building in September 1991. The current plant operated for a time under the name "Manawatu Beef Packers", which was a subsidiary of AFFCO.

A variety of activities at the plant have been authorised by a suite of resource consents which were granted by the Manawatu-Whanganui Regional Council and expired on 14 May 2011. Applications were made by CPG Limited on behalf of ANZ in late 2010 and early 2011 to replace the expiring consents. New consents were also sought to authorise activities that had not previously been consented, including land application of paunch material and a boiler exhaust discharge to air.

3.3 Existing Consents

The status of the ANZ consent applications is shown in Table 3.1 below.

Table 3.1: Status of ANZ Consent Applications as at 9 June 2014

Consented Activity	Old Number	New Number	Date Granted	Expiry Date
River Water Take	101744	105670	24 Jun '11	1 Jul '29
River Diversion	4221	105571	25 Jan '11	1 Jul '29
Reservoir Outflow	4222	105572	9 May '11	1 Jul '29
Condenser Defrost	4220	105638		
Backwash, blowdown and hardstand stormwater	4223	105666; 105668		
Wastewater to River	4219	105677		
Air Discharge (Odour)	4236	105567	4 Mar '11	1 Jul '29
Boiler Exhaust	-	105664	10 Mar '11	1 Jul '29
Groundwater Take	912664	106205	24 Apr '12	1 Jul '29
Staff Wastewater	4224	105671	27 Sep '11	1 Jul '29
Pond Seepage	6191	105665		
Land Application	4226			
Paunch Discharge	-	105042; 105043; 105045	Feb '10	1 Jul '29

Consent applications for the discharge of condenser and defrost, backwash and blowdown, and hardstand stormwater were lodged with HRC in early 2011, and at the date of this report are the subject of s92 requests for further information. Recent investigations have shown that none of the hardstanding stormwater discharges are to the Oroua River, but run both to underground soakage and to land surface areas within the ANZ property.

Consent applications for the land application, pond seepage, and river discharge of meatworks effluent were lodged with HRC before 14 February 2011, but the processing of the applications has been deferred pending consideration of the cumulative effects of these three activities on the Oroua River.

A further consent is now required for the discharge of odours and aerosols to the air arising from land discharges. This requirement was previously met by air quality conditions within the land discharge consent, but current best practice is to regulate such discharges under a separate consent. A further consent is also required for the construction of a new diffuser discharge structure in the bank of the Oroua River; application for this consent is included here.

The existing consents for which replacements are now under application are as shown in Table 3.2.

Table 3.2: Currently operative consents for which replacements are now sought

Consent Number	Description	Type
4226	This consent authorises the discharge of up to 2,000 cubic metres per day of treated effluent on to no less than 75 hectares of land on Aorangi Road, Feilding, at or about map reference S21:304-051 shown on Plan C4226 attached to and forming part of this consent for a term expiring on 14 May 2011.	Discharge
6191	This consent authorises the discharge into ground by seepage of effluent from the anaerobic, aerobic and solids ponds on the Manawatu Beef Packers Limited Campbell Road, Feilding site for a term expiring on 14 May 2011.	Discharge
4219/1	This consent authorises the discharge of treated effluent from the Manawatu Beef Packers Limited Campbell Road, Feilding site to the Oroua River via the Effluent Outfall (approximate map reference NZMS 260 S23:298-048) for a term expiring on 14 May 2011. This discharge shall be restricted to: • A rate of up to 2,000 cubic metres per day while the river flow exceeds 4,000 litres per second; • A rate of up to 1,000 cubic metres per day while the river flow is between 3,000 and 4,000 litres per second, **during the period 31st March to 1st December; and:** A rate of up to 2,000 cubic metres per day while the river flow exceeds 20,913 litres per second, and when the pond storage levels are at 100% prior to discharge taking place, **during the period 2nd December to 30th March**.	Discharge

This report is to re-state the 2011 applications for the three meatworks effluent discharge activities, and to provide further information on their effects as well as description of process improvements that have occurred in the interim. The proposed discharge diffuser and bed level control structures have yet to be installed and have not previously been consented. The air discharge from land applications has previously been authorised by conditions on the land discharge consent, but a new specific air discharge consent is sought here.

In addition to the ANZ consents, Byreburn Farm, which is to receive most of the MWE by way of irrigation, also has current resource consents as shown in Table 3.3 below.

Table 3.3: Status of Byreburn Consents as at 9 June 2014

Consented Activity	Number	Date Granted	Expiry Date
Groundwater Take	103237	8 August 2007	1 July 2019
Discharge dairy shed effluent to land.	106705	21 May 2013	28 February 2031

3.4 Scope

The scope of this report is to describe the activities of the four discharge systems for meatworks effluent (to water, to land, to air, and to groundwater) and the proposed riverbed structure erection, to assess the effects of these activities on the environment, to evaluate these effects against the provisions of the relevant statutory and planning requirements, and to recommend conditions under which resource consents to authorise the activities may be granted.

4 DESCRIPTION OF THE RECEIVING ENVIRONMENTS

4.1 Location

AFFCO New Zealand Limited's Feilding Plant (ANZ) is situated on the south-east side of the Oroua River, accessed by Campbell Road off SH 54, on the Bunnythorpe side of Feilding. The plant is situated 1.5 km south-east of Feilding railway station, and some 500 m across the river from the nearest residential part of Feilding, as shown in the figure "Location" (Appendix A). ANZ land includes the site of the treatment ponds, as well as 9.2 ha of land to which MWE is to be applied.

Byreburn Farm is located adjacent to ANZ, directly bordering the plant to its north and east. It adjoins the south-east bank of the Oroua River, and includes land on both sides of Aorangi Road, although only land on the west side of Aorangi Road is proposed to receive MWE applications. The total farm area is 165.95 ha, and includes 12 titles comprising some 159 ha that have been considered for MWE application. The farm is deployed about its main home and facilities on Aorangi Road at NZTM 1820900E, 5543600N, and its situation is shown in Figure "Location" in Appendix A.

Dalcam's land is associated with the main heritage building and ancillary buildings of the former St Dominic's School for the Deaf, located on Campbell Road, immediately to the south of the ANZ property. Some of Dalcam's land is proposed to receive MWE if agreement on this is reached between ANZ and Dalcam. Dalcam's land is identified as ref. no. 27 on the Neighbouring Properties figure in Appendix J with the green area on this figure being the land allocated for potential MWE application.

The MWE discharge to the Oroua River is to be by way of a pipeline from the aerobic pond direct to the bank of the Oroua River at NZTM 1819770E, 5543125N. This location is shown in the first figure (Discharge Structure Location) in Appendix K (River Structure.) The pipeline from the treatment ponds will be located on the northern side of the open water course that enters the Oroua River.

4.2 Topography

The discharge sites at ANZ, at Byreburn Farm, and at the bank of the Oroua River lie within an extensive flat, occupying two terrace levels to the south-east of the Oroua River, at altitudes between 73 and 78 mamsl. Adjacent to the sites, the Oroua River runs in a south-westerly direction in a channel incised into its gravel terrace to a depth of about 5 m. Some 3.2 km west of the sites is the start of the rolling downlands which lie west of Feilding, while rolling downlands to the east of Bunnythorpe lie 7 km to the east of the sites. The shortest distance from the sites to the coast is 30 km, to the west.

4.3 Legal Descriptions

The legal descriptions of the landholdings where the activities are proposed are as follows;

ANZ:

- Lot 3, DP 89045; 16.7295 ha;
- Sbdn 1, Sec 12, Block XIV Oroua SD; 0.73 ha;
- Part Section 13, BLK XIV Kairanga SD; 18.32 ha;
- Lot 21, DP 2688; 0.6 ha;
- Lot 22, DP 2688; 0.6 ha;

- Lot 23, DP 2688; 0.6 ha;
- Lot 24, DP 2688; 0.59 ha; and
- Lot 28, DP 2688; 0.67 ha.

Byreburn Farm:

- Part Section 225 Sbdn A Manchester DIST; 14.46 ha;
- Lot 191, DP 100; 13.7947 ha;
- Lot 2, DP 89128; 39.9744 ha;
- Lot 1, DP 57560; 22.7125 ha;
- Lot 1, DP 89045; 19.2740 ha (owned by ANZ, but occupied by Byreburn Farm);
- Lot 2, DP 89045; 11.7475 ha;
- Lot 31, DP 2688; 0.6171 ha;
- Lot 30, DP 2688; 0.6171 ha; and
- Sec 5, Blk XIV, Oroua SD; 32.2332 ha.

Dalcam:

- Part Aorangi 1C Block; 4.09 ha;
- Lot 18 DP 2688; 0.81 ha; and
- Lot 18 DP 2688; 0.6 ha.

Riverbed:

- Legal River, ID 4105837, 47.2899 ha.

Apart from the riverbed which is unoccupied crown land, and Lot 1 DP 89045 which is owned by ANZ but occupied by Byreburn Farm, all land titles are held in fee simple.

4.4 Neighbourhood

The land adjoining the application sites is in various rural, rural residential, and industrial uses. Neighbouring properties are identified in the table, and shown on the plan, in Appendix J.

The town of Feilding, with a population of about 14,000, is centred about 2.0 km north-west of ANZ. Feilding's built-up area is about 3 km long on a north-south axis, and 2 km wide on an east-west axis. The closest encroachment of urban residential development to ANZ is about 500 m away, with housing in Owen Street. Between this residential area and ANZ is the industrial development of Mahinui Street and Awa Street, with the racecourse on the recreation reserve at South Street to the north of this. The industrial area and the racecourse are in turn separated from ANZ by the Oroua River. Further upstream the Oroua River separates 25 urban residential properties in Seddon St from the proposed irrigation area on Byreburn Farm by approximately 100 to 200 m.

To the south-west of ANZ, and separated from it by the North Island Main Trunk Railway and SH 54, lies the Feilding Golf Course.

To the south-east of ANZ lies Matai Street, running at right angles from Campbell Road in a north-easterly direction. The land on both sides of the road comprises some 20 rural smallholdings, mostly of about 0.6 ha. Of these, 5 are developed with rural residences, and the remainder are in various agricultural uses without residences on site. Between Matai Street and ANZ lies Dalcam Co's establishment on the site of the previous St Benedict's School for the Deaf. Ratanui Street forms a spur running north-westwards from the end of Matai Street in to ANZ. Like Matai Street, the land on both sides comprises about 10 smallholdings, mostly of 0.6 ha size. Only one of these sites is developed, housing Wallace Corp's skin processing plant.

To the north and east of ANZ is the Byreburn dairy farm, with its residence and other buildings some 500 m east from the closest part of ANZ. There are approximately 8 land owners with 5 rural residences developed on Aorangi Road opposite to the Byreburn Farm irrigation areas.

4.5 Climate

4.5.1 Rainfall and Evapotranspiration

The closest meteorological station with long term records for reported rainfall was Feilding at Sandon Road (NIWA Meteorological station number 3213, about 4 km west of the site). The closest meteorological station for monthly potential evapotranspiration (PET) was Palmerston North Ews (NIWA Meteorological station number 21963, about 10 km south of the site). Rainfall and PET records from 2000-2010 are referred to in this report. Table 4.2 below presents climate data provided by National Institute of Water and Atmospheric Research (NIWA). All data was collected from the database and averaged.

It is expected that the PET and rainfall at Palmerston North Ews and Feilding respectively will be close to those at ANZ, due to their physical proximity and the lack of significant topographical features separating them. A crop coefficient of 1.0 has been adopted because the site is usually covered in high-producing, short pasture grass.

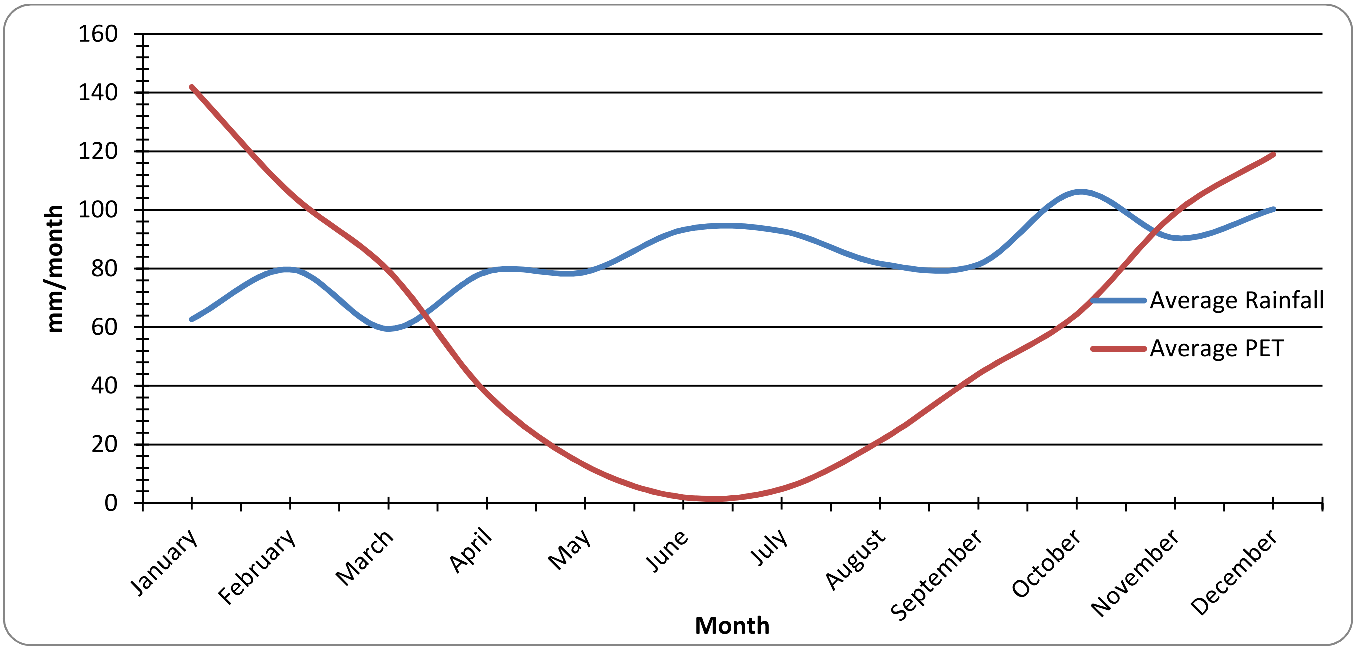
Table 4.2: ANZ – Assessed Mean Monthly Rainfall and Potential Evapotranspiration

Month	Rainfall (mm/month)	PET (mm/month)
January	63	142
February	80	106
March	59	79
April	79	37
May	79	13
June	93	2
July	93	5
August	82	21
September	81	44
October	106	64
November	90	99
December	100	119
Total	1,005	731
Site	NIWA Feilding	NIWA Palmerston North Ews
Years	2000-2010	2000 – 2010
Site No.	3213	21963

The data from Table 4.2 are illustrated in Figure 4.1 below.

The mean rainfall at Feilding is 1,005 mm/year. Rainfall is fairly evenly distributed throughout the year, peaking in October to December at 100 and 106 mm respectively. June and July are also wet months at 93 mm each, but at this time of year water loss due to evapotranspiration (represented by PET) is near 0. PET exceeds rainfall for the months November to March inclusive.

Figure 4.1: Mean Rainfall and PET, Palmerston North (2000-2010)



4.5.2 Wind

A discussion of the predominant wind directions and speeds expected to be experienced at the site are given the Land Treatment AEE (Appendix F). In short, the dominant winds in the vicinity of the site are from the west and from the east. Most winds are below 5.6 m/s, but stronger winds occur from the two prevailing directions in particular.

4.6 Geology

The regional geology is described in Section 4.6 of the CPG Land Application attached as Appendix B. In summary, the surficial geology in the vicinity of the land application site comprises Holocene aged (Recent) alluvium from the Oroua River. The material is dominantly gravel, sand and silt sized particles which vary vertically and horizontally across the site based on the flow regime that deposited them.

There are two surfaces of deposited alluvium at the application site, as follows.

- Recent floodplain (c. 73 mamsl), which is flat to undulating and mostly gravel; and
- Low terrace (c. 76 – 78 mamsl), which is flat to undulating.

The Oroua River, running alongside the application site, carries a bed load of Mesozoic greywacke cobbles, gravels and finer graded sediments derived by recent erosion from the Ruahine ranges.

4.7 Soils

The soils of the application area as they relate to this assessment are described and assessed in detail in Appendix D to this report. In particular, evaluation of the soil fertility (Section 6.5) and measurement of soil hydraulic conductivity (saturated and unsaturated) has been carried out to determine appropriate nutrient and hydraulic loading rates. Additional detail regarding the soils is given in Appendices B and C.

The soils are predominantly LUC Class 2 soils over the low terrace (Kairanga Series and Manawatu Series), and Class 4 soils over the floodplain (Rangitikei series and Rangitikei like soils).

4.8 Hydrogeology

The hydrogeology of the ANZ locality has been described in three previous reports submitted to HRC, as follows:

- CPG (2011b), which was the original resource consent application and AEE for the ANZ pond seepage discharge, dated 7 February 2011;
- CPG (2011c), which was the response to a s92 further information request by HRC arising from its consideration of the original application; and
- LEI (2013), which was a preliminary groundwater investigation report prepared for AFFCO Manawatu dated August 2013 and submitted to HRC.

These three reports in turn refer to further previous reports.

The application site is located in the Manawatu Groundwater Management Zone (Horizons Regional Council, 2008). The aquifer system from which bores extract groundwater is built up of at least a 400 m thick sequence of Quaternary alluvial gravels, sands, silts and clays and contains occasional peat and wood layers. The Tertiary deposits beneath the Quaternary deposits (Section 4.6 above) are considered to be the lower boundary of the hydrogeological system.

The groundwater flow system is bounded by geological structures that run in a south-western to north-eastern direction through the region, and flow is inferred to be generally towards the south-west. There are no clearly distinguishable aquifers and aquitards, the whole groundwater system being best regarded as a single, large, leaky aquifer.

Measurements in bores and piezometers in the vicinity of ANZ indicate a depth to shallow groundwater of about 5 m, which is consistent with the depth of incision of the Oroua River locally as noted in Section 4.2 above. Groundwater flow direction in the vicinity of ANZ has been investigated in order to inform this report, and is described in Section 5.6 below to be from the east bank of the river towards the river up-gradient from the ANZ plant, parallel to the river adjacent to the plant, and southwards away from the river down-gradient from the plant.

17 bores within 2 km of the ANZ site are listed in Table 2.1 (Section 2.3) of CPG 2011c. Where measured the bores identified have transmissivities of between 67 and 4,852 m^2/d, with a median of 200 m^2/d. Depth to the groundwater surface ranges from 1.0 m to 10.2 m, with no clear relationship between transmissivity and depth to water. Where listed the bore uses are for industrial, irrigation, farm use and monitoring. Bore number 325371, beside the potable water treatment plant on the ANZ site, has a depth to water of 10.2 m, and a total depth of 73.2 m, at about which depth the measured transmissivity of the gravels is 200 m^2/d.

4.9 Hydrology

The Oroua River is a tributary of the Manawatu River. It flows south-westward from its source in the Ruahine ranges, joining the Manawatu River near Rangiotu, between Palmerston North and Shannon. Above Feilding there is a point source discharge at Kimbolton, which is upstream of the ANZ plant. The Oroua River near Feilding also receives significant non-point discharges and urban stormwater, and is affected by abstractions for domestic use, town and rural water supplies, irrigation and industrial use.

Hydrological data relevant to the MWE discharge from ANZ is compiled by HRC for the Kawa Wool site, which is a calculated monitoring site that combines the flow from the Almadale and the Kiwitea Stream monitoring sites upstream. The flow statistics for the Kawa Wool site have been compiled in the NIWA report – (Henderson and Diettrich 2007). The key parameters are shown in Table 4.3 below, as presented in Appendix G, Section 3.2.

Table 4.3: Oroua River at Kawa Wools – Key Hydrological Parameters

Flow Statistic	Value 1967-2005 (L/s)*	Value 1992-2013 (L/s)
MALF	1,240	Not determined
Half median flow	3,486	3,795
Median flow	6,971	7,591
20th percentile exceedance flow (Q_{20})	16,078	16,193
3 x median flow	20,913	22,772

* Henderson and Diettrich (2007)

Data for the entire flow record (up to 2005) have been evaluated by NIWA (Henderson and Diettrich, 2007). The data used to develop the land application regime were for the period 1992-2013 and statistics generated from that data set were used as a basis for discharge decisions. It is noted that the statistics for the shorter data set are, in general, higher than for the longer data set. This potentially results in fewer discharges to the river and this, more conservative, approach is favoured.

Of significance in respect to the current ANZ discharge to the river is the half median flow. There are often limitations imposed on discharges to rivers below **half median flow** that would effectively disallow the current ANZ MWE discharge when river flow is below that level. Under the current consent (number 4219/1) discharges are allowed with river flow down to 3 m^3/s.

Flowing into the Oroua River immediately downstream from the ANZ water reservoir is the small Otoku Stream, which drains parts of Byreburn Farm and several farm properties further to the north-east, with an inferred catchment area of some 150 ha. The stream's original, natural course was historically to meander over the flats to meet with the Oroua River about 2 km downstream from the Aorangi bridge; it was evidently truncated and diverted at the ANZ site many years ago. The Otoku stream is probably supported by spring flows, and is known to dry out within the ANZ property during dry summers (such as February 2014.) The ANZ surface water discharge has been from the treatment pond system into this stream at a point some 300 m upstream from its Oroua River confluence. It is now proposed to remove this discharge entirely from this stream, diverting it straight to the Oroua River itself.

Some areas on Byreburn Farm have been drained with mole drains and gravel-backfilled drainage piping, with the drainage water flowing into the un-named stream.

4.10 Surface Water Quality

4.10.1 General

HRC monitors water quality parameters at three locations along the Oroua River (Apiti, Almadale and Awahuri) as part of its ongoing state of the environment (SOE) monitoring program. In general there is an increase in the SOE monitoring parameters ($cBOD_5$, SIN, *E. coli* and DRP) downstream, with a significant increase in all parameters between the Almadale and Awahuri sampling points. There are several point source discharges between these two points and there is likely to be a contribution from non-point source discharges due to the predominant farming land use throughout most of the catchment.

The Almadale sampling site is the nearest upstream site to the ANZ discharge and so has been considered to be representative of background concentrations. In addition, HRC undertakes sampling of the Oroua River upstream (Upstream ANZ) and downstream (Downstream ANZ) of the ANZ river discharge. The average concentrations of the main water quality parameters are given in Table 4.4 and described below.

ANZ has also been monitoring the Oroua River upstream and downstream of the discharge, as required for compliance with consent number 4219/1. Parameters measured, and imposed limits of each, are specified in the consent as:

- no conspicuous oil film, scum or foam or floatable suspended materials;
- no objectionable odour;
- Ammonia <1.1 g/m^3;
- cBOD$_5$ < 2.0;
- No decrease in water visibility >1 .6 m;
- No fungal, filament or slime growth;
- Enterococci <33/100 mL;
- Dissolved reactive phosphorus <15 mg/m^3.

The ANZ data indicates that the limits as given above have generally been met. For the purpose of defining water quality in this reach of the Oroua River HRC's results have been used in this report in preference due to the data having been collected and QCed for this purpose (water quality). Table 4.4 gives a summary of HRC monitoring results for the period 2007-2013.

Table 4.4: Horizons Monitoring of Middle Oroua Water Quality (Aquanet, 2014)

	Year round					
	All flow		**<20th FEP**		**<Med**	
	U/S	**D/S**	**U/S**	**D/S**	**U/S**	**D/S**
DRP (average, g/m^3)	0.011	0.027	0.01	0.023	0.008	0.022
SIN (average, g/m^3)	0.311	0.407	0.253	0.347	0.139	0.237
TNH$_3$-N (average, g/m^3)	0.027	0.027	0.026	0.102	0.027	0.105
TNH$_3$-N (95th %^{ile}, g/m^3))	0.085	0.328	0.08	0.349	0.081	0.475
E. coli (average, /100mL)	1680	1457	362	370	198	286
BD change (95th %^{ile}, % reduction)	25%		34%		49%	
ScBOD$_5$ (average, g/m^3)	N.D.	0.617	N.D.	N.D.	N.D.	0.619
POM (average, g/m^3)	N.D.	N.D.	N.D.	N.D.	N.D.	2.37
	Winter					
	All flow		**<20th FEP**		**<Med**	
	U/S	**D/S**	**U/S**	**D/S**	**U/S**	**D/S**
DRP (average, g/m^3)	0.012	0.03	0.011	0.032	0.008	0.031
SIN (average, g/m^3)	0.407	0.547	0.349	0.506	0.165	0.313

TNH$_3$-N (average, g/m^3)	0.024	0.136	0.023	0.157	0.02	0.141
TNH$_3$-N (95th %^{ile}, g/m^3))	0.056	0.386	0.054	0.508	0.044	0.424
	Winter		**Winter**		**Winter**	
	All flow		**All flow**		**All flow**	
	U/S		**U/S**		**U/S**	
E. coli (average, /100mL)	2267	1985	237	332	166	256
BD change (95th %^{ile}, % reduction)	16%		49%		48%	
ScBOD$_5$ (average, g/m^3)	N.D.	0.613	N.D.	0.595	N.D.	0.611
POM (average, g/m^3)	N.D.	8.01	N.D.	2.56	N.D.	2.34
	Summer					
	All flow		**<3xMed**			
	U/S	**D/S**	**U/S**	**D/S**		
DRP (average, g/m^3)	0.01	0.011	0.01	0.011		
SIN (average, g/m^3)	0.125	0.135	0.125	0.135		
TNH$_3$-N (average, g/m^3)	0.031	0.029	0.031	0.029		
TNH$_3$-N (95th %^{ile}, g/m^3))	0.092	0.058	0.092	0.058		
E. coli (average, /100mL)	529	422	529	422		
BD change (95th %^{ile}, % reduction)	N.D.		N.D.			
ScBOD$_5$ (average, g/m^3)	N.D.	0.625	N.D.	0.625		
POM (average, g/m^3)	N.D.	2.4	N.D.	2.4		

For water quality management, Horizons One Plan Operative Version (OPOV) includes the reach of the Oroua River around Feilding as part of the Middle Oroua Subzone (Mana_12b), as shown in Schedule E of OPOV. The key water quality targets identified for the discharge location are shown in Table 11.1 in Section 11.3 below, along with additional monitoring results. Water quality targets are a selected hierarchically whereby targets specific to the Mana_12b subzone are selected preferentially, followed by region wide OPOV targets and finally ANZECC guideline limits.

4.10.2 Water Quality Summary

The monitoring data indicates a steady increase in most parameters downstream (DRP, SIN, NH_4-N). DRP is at or above the target limit at both sites for all periods, however there is a more pronounced increase in P during the period that river discharge from ANZ occurs. This indicates that upstream activities are contributing P to the river, but the ANZ discharge causes a measureable change above background levels. This is discussed in more detail in Appendix G, including details of how this is proposed to change under the proposed discharge system.

All other measured parameters have averages within the target levels indicating assimilative capacity and suggesting that P is the most limiting parameter in the MWE.

It is noted that the greatest increase from the upstream to the downstream site is in NH_4-N, and so this parameter may also be limiting in the river.

SIN is demonstrated to comply with OPOV limits at average level.

4.11 River Ecology

Horizons Regional Council (1997) described the ecology of the Oroua River as follows.

"The Oroua River headwaters are in the Ruahine State Forest Park, and 80% of the catchment yield comes from its mountain land watershed. Demands placed on surface water in the Oroua catchment are considered to threaten instream values during summer months.

Upstream from Feilding at mean annual flow, the velocity and shallow water depths are suitable for benthic invertebrates, but the lack of deep water limits the amount of brown trout habitat. The Oroua River was included in the '100 rivers' survey undertaken by the former Fisheries Research Division of the Ministry of Agriculture and Fisheries in 1990. This survey did not rate the instream habitat quality of the Oroua River in this reach very highly when compared to other rivers studied in New Zealand. This reach of the river also provides habitat for native fish species, macroinvertebrates, and there is some periphyton growth on the riverbed stones."

The freshwater ecology of the Oroua River was investigated and reported by Stark (2011.) Stark's findings in respect of the MWE discharge are derived from analysis of samples taken from sites respectively about 60 m upstream, 337 m downstream, and 500 m downstream, from the mouth of the Otoku Stream into which ANZ's MWE has been discharged. Other known discharges to the river within that reach include ANZ's Condenser, Defrost water, and Roof Stormwater discharge, and ANZ's Backwash, Blowdown and Hardstand Stormwater discharges. Other discharges to this reach of the river have not been specifically identified here, but are expected to include stormwater discharges from other industrial properties on the right bank (Feilding side) of the river.

Stark's key findings are tabulated in Tables 4.5 and 4.6 as follows:

Table 4.5: Oroua River Periphyton, from Stark (2011)

Site	Bare (% cover)	Thin Films (% cover)	Mats (% cover)	Slimy Filamentous Algae (% cover)
2 (Upstream)	16.65	74	7.15	2.2
3 (337 m Downstream)	21.25	56.5	19.5	2.75
4 (500 m downstream)	12.95	70	18.5	3.55

Table 4.6: Oroua River Macroinvertebrates, from Stark (2011)

Site	MCI	QMCI	% EPT Richness	% EPT Abundance
2 (Upstream)	82	4.19	38.12	35.52
3 (337 m Downstream)	83	2.19	32.7	5.63

4 (500 m downstream)	88	2.44	34.14	7.68

The implication that Stark drew from these numeric findings was that the Oroua River changes from "fair" river health indicating moderate nutrient enrichment upstream from the discharge, to "poor" river health indicating severe nutrient enrichment downstream.

4.12 Land Use and Vegetation

Land within the ANZ property is used for the industrial meat processing plant and its ancillary activities. Permanent buildings house all indoor activities, and sealed pavements cover all areas used for vehicular access. The effluent ponds occupy 6 ha of the total 38.8 ha site, with the water supply reservoir occupying a further 1 ha. Outside of the buildings, pavements and ponds, a further area of 9.2 ha is grassed in a variety of stock holding paddocks and amenity areas.

To the south-west of the ANZ property is the Feilding Golf course. To the north-west beyond the Oroua River is the urban Feilding environment. To the north and east lie intensively managed pastoral farms, including Byreburn, onto which most of the land discharge will occur. To the south-east lie several rural smallholdings, some of which are developed with homes, trees and gardens, while others are undeveloped in open pasture.

Vegetation on the extensive farmed flats extending many kilometres in all directions from ANZ is now almost exclusively high producing pasture and crops, with sporadic windbreaks and woodlots of trees. Introduced turf species and sporadic specimen trees populate the attractively laid-out Feilding Golf Course to the west of the ANZ plant. The river banks are dominated by willows, with a miscellany of woody weeds; no significant indigenous vegetation now occurs in either the farm neighbourhood or the riverbank vicinity of the ANZ discharges.

4.13 Social and Cultural Environment

Feilding township adjoins the Oroua River west of ANZ. Feilding has a population of approximately 14,000 people. The ANZ plant is an integral part of the community, giving economic benefit as a major employer in the area. The Oroua riverbed immediately upstream from ANZ, and adjacent to Timona Park, is well used by Feilding residents, especially in summer. Uses include swimming, dog exercise, four-wheel driving and a limited amount of fishing. The Oroua River is in the Wellington Fish & Game region, and provides a brown trout angling opportunity, more particularly in the reaches upstream from Feilding.

The following Iwi organisations are known to have an interest in the Oroua River:

- Ngati Kauwhata;
- Rangitane (Tanenuiarangi Manawatu).

It is acknowledged that the Oroua River is of cultural importance to tangata whenua.

No archaeological sites are recorded within or near to the area of the ANZ discharges. The Dalcam main building on a property adjoining ANZ is designated as a Heritage Site (RH 12) in the operative district plan, but is not affected by the proposed activities.

4.14 Recreational Use and Public Access

The reach of the Oroua River adjacent to ANZ and downstream is characterised by a mostly single channel, meandering between gravel beaches on the insides of corners. While cadastral provision for the river course to remain in public ownership was made when landholdings were first surveyed, changes to the river's course over the ensuing 100+ years have resulted in land title boundaries alongside the river no longer accurately reflecting the river's current course.

The quality of the river water, and the fact that its course in this locality is now largely "run" with little development of riffles and pools, renders its recreational fishing quality only modest. The fact that the riverbed is physically, and more-or-less legally, publicly accessible and close to a good sized town means that a modest level of public recreational utilisation of the resource is expected.

This recreational use has not been specifically investigated for this consent application, and there are no hard facts on the extent, nature or timing of recreational use. Anecdotal information on recreational use of the river near Feilding is as follows;

- The extent of contact recreational use (swimming) downstream from the discharges is not known.
- There is known to be some angler use made of the river adjacent to Feilding and downstream, more particularly between October and March, following the winter spawning of trout and taking advantage of the lower and clearer water conditions of the summer.
- There is known to be some casual canoeing and, on pleasant summer evenings and weekends some riverside strolling, dog and family walking along the banks and bed.
- In winter and downstream from Feilding, the river is known to have been used for boat-assisted duck hunting, when river flows are at median or greater, and when no other recreational uses of the river are apparent.

Away from the river, significant public recreational use is made of the Feilding Golf Club, and of the recreation reserve on the opposite side of the Oroua River from the ANZ plant.

5 DESCRIPTION OF THE PROPOSED ACTIVITIES

5.1 General

The activities that are the subject of this application for resource consents are as follows:

- The discharge of meatworks effluent, effluent sludge and paunch material **to land** by irrigation (of wastewater) and by direct application (of sludge and paunch);
- The discharge of odours and aerosols **to air** arising from the land discharges;
- The discharge of meatworks effluent **to groundwater** by seepage from the wastewater treatment plant ponds;
- The discharge of meatworks effluent **to the Oroua River** at times of high flow; and
- The construction of a discharge diffuser and bed level control structure in the bank of the Oroua River and in the bed of the Otoku Stream which is a tributary to that river.

The two discharges to water and to land are the means by which ANZ disposes of waste materials arising from its primary meat production function, for which no other use, recovery, re-cycling or disposal option is considered to be viable. The pond seepage discharge is an unintended contingency arising from the operation of the treatment ponds. The air discharge is similarly an unintended contingency arising from the land discharges. The Combined Land and Water Discharge (CLAWD) is the managed means by which the great majority of meatworks effluent is discharged. The proposed river bed and bank structure is to enable the mitigation of some of the potential effects of the discharges.

Appendix E to this report (Conceptual Design) provides more specific detail of the proposed activities and the manner in which they are mutually balanced. Appendix E was prepared in September 2014 and since then details of the proposal have been further refined. The effect of this is that there are figures (numbers) that were first derived in the preparation of the Conceptual Design that have changed in the more recently-prepared AEE. However, in each case the AEE proposes a more conservative scenario than did the Conceptual Design.

This section of this report is to describe each of the proposed discharge activities and the proposed structure, and their inter-relationships in more general terms.

5.2 MWE Production, Collection, Treatment and Storage

Wastewater production and management at the ANZ plant are described in Section 4 of the Conceptual Design (Appendix E). A summary of key information for the determination of the effects of the activity follows.

MWE is derived from animal effluent, processing waste streams (unusable animal products), wash water containing detergents and processing waste from the Wallace Corp slink skin factory. The solids are separated out and the liquid waste is piped to a large (around 6 ha) treatment pond system. The pond system provides both aerobic and anaerobic treatment prior to discharge. The wastewater which is subject to this consent application contains **no** human wastes, which are managed separately from the MWE.

The ponds provide storage to enable discharge to either land or river to be withheld when conditions are unsuitable for discharge (as described below). In all there is **64,500 m^3 of storage** in excess of the system's treatment capacity i.e. 57,600 m^3 of dedicated storage and a further 6,900 m^3 of freeboard in the aerobic pond. This equates to around 92 days of MWE production under the current operation, and 76 days of production under proposed future operation. This reserve capacity is **in addition to** the minimum capacity that must be retained in the aerobic pond to ensure its efficient functioning, including the effective operation of the mechanical aerators.

5.3 MWE Flow and Quality

A detailed summary of the MWE flows and quality from ANZ is given in the Conceptual Design Report (Appendix E). The design of the proposed discharge regime allows for a 20 % increase in flows at the same concentration as the current MWE monitoring records. Tables 5.1 and 5.2 below summarise the MWE flow and quality on which the regime design is based.

Table 5.1: ANZ MWE Volumes

Flow statistics	Current Flows (2010-present) (m^3)	Future flows (m^3)
Annual average	256,132	307,358
Daily average	702	842
Daily minimum	257	308
Daily maximum	1,026	1,231
Daily median	760	912

As noted in the first bullet point in 5.1 above, as well as effluent there is sludge and paunch material to be applied to land, collectively referred to as Organic Amendments. The paunch material is semi-digested grass and proto-faeces, removed from the plant wastewater flow in the solids pond before the wastewater enters the anaerobic pond. This material is dried and composted in a dedicated (and consented) pit, from which it is removed and applied to land. Annual production of paunch material will total some 627 m^3/y, and its composition is characterised in Table 5.3 below.

The sludge material is the precipitated solids that need to be removed occasionally from the treatment ponds, with an expected annual production rate of 200 m^3/y, and a composition expected to be similar to that of the paunch material as described in Section 4.5 of the Conceptual Design.

Table 5.2: ANZ Wastewater Quality sampled at aerated pond outlet (Albert van Oostrom, 2013)

	TSS	cBOD5	NO_x-N	NH_4-N	TIN (SIN)	TN	TP	DRP	E. coli	Ent
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	/100 mL	/100 mL
Mean	112	34	35	81	117	133	22	20	10,933	51,695
Median	85	29	23	84	119	132	22	20	9,550	1,000
95%ile	295	74	100	140	159	176	28	26	20,750	15,800
Max	770	115	127	170	171	190	30	29	24,000	8,700,000
Count	183	183	183	183	183	183	183	132	6	183

Ca tot	Na tot	K tot	Mg tot	SAR	Temp.	DO	pH	O&G
g/m³	g/m³	g/m³	g/m³		°C	g/m³		g/m³
26	229	46	9	10	16	4	8	5
26	198	44	9	9	15	3	8	3
32	403	52	12	16	24	8	9	12
35	442	59	12	17	30	13	9	54
19	19	19	19	19	179	177	175	176

5.4 Combined Land and Water Discharge (CLAWD)

As noted in Section 5.3 above, it is proposed to discharge sludge and paunch material (Organic Amendments) to land. In addition there is the seepage of MWE from the ponds which is not subject to choices as to when, whether or at what rate it occurs.

However, setting to one side the Organic Amendments and the seepage which are addressed later, the great majority of the total discharge is of MWE in a directly managed fashion, as a CLAWD system. Under this system, decisions are made on a daily basis as to whether or not MWE will be discharged to land or to the Oroua River, and at what rate. While separate resource consents will authorise the land and water discharges respectively, under CLAWD operation the management of the two discharge regimes is closely and mutually coordinated.

The CLAWD has three components being:

- Discharge to land;
- Discharge to the Oroua River; and
- Provision of pond storage.

On any day that the wastewater treatment system will be operating the potential for a discharge to occur will be assessed by:

Step 1. Determining whether a **discharge to land** may occur by checking:

a. Whether the cumulative nutrient loading limit has been exceeded (i.e. has 60 kg P/ha/y already been applied to the area under consideration);
b. Whether the soil moisture is too high for safe irrigation (measured from climate data and/or soil moisture monitoring); and
c. Whether the current use of the land makes irrigation impracticable (e.g. stock in holding paddocks, harvest scheduled for cut and carry, etc.).

If all of these checks are negative then discharge to land may occur. If one or more of the checks are positive then no discharge will occur on the land to which these conditions apply, but discharge to a different area may occur if all checks are negative on that different area. If one or more of these conditions apply to the entire site, then no discharge to land will occur and the assessment proceeds to Step 2.

Step 2. Determining whether a **discharge to the river** may occur by reviewing the previous day's average flow (L/s) in the Oroua River at the Kawa Wool site. It is likely that this monitoring site will be changed to the Almadale Slackline site which is further upstream in the future to enable real time monitoring data to be used. For the purpose of conceptual design the existing Kawa Wool site data has been used. The potential for a discharge to water to occur is assessed by:

a. Whether the river flow is below median (MF, 7,590 L/s.) If yes then no discharge to the river may occur;
b. Whether the river flow is between MF and the 20th flow exceedance percentile (20FEP, 16,193 L/s.) If yes then the effects in the river due to dissolved reactive phosphorus (DRP) and soluble inorganic nitrogen (SIN) must be considered. Discharge to the river may occur at a rate which is determined based on the dilution factor of the river water; otherwise

c. Whether the river flow is higher than 20FEP. If it is then the effects in the river due to toxic levels of ammoniacal nitrogen (NH_4-N) must be considered. On this basis discharge of up to 3,000 m^3/day of wastewater may occur.

If no discharge to the river may occur then proceed to Step 3.

Step 3. Wastewater will be **stored** in ponds for discharge, either to land or to the river, when conditions allow. This requires active management of the storage volume to ensure that there is capacity available when it is needed i.e. discharge to land or water should occur on any day that conditions allow. As noted in Section 5.3 above, there is 64,500 m^3 of reserve storage available.

5.5 Discharge to Land

It is proposed to irrigate MWE onto land, within the adjoining Byreburn Farm and Dalcam properties, as well as within the holding paddock and amenity areas of the ANZ property itself.

5.5.1 System Description

Agreements have been made to enable land to be available for the application of MWE. Almost 60% of the annual MWE produced by ANZ, and critically, **all** of the summer wastewater production, can be applied to the land available.

Land discharge has historically been to parts of the adjacent Byreburn Farm via travelling irrigators. Limitations with this system were identified and described in the 2011 AFFCO land discharge consent application (Appendix B). As a result ANZ has arranged for a larger area of land to be available on Byreburn Farm, as well as a previously un-irrigated area within the ANZ and Dalcam properties, and for improvements to be made to the irrigation system. One advantage of the larger area and improved application system is that when some areas are unable to receive land discharge there is still potential for discharge to other areas.

The irrigation system will consist of low rate irrigation methods such as small moveable irrigators (e.g. k-line) or fixed impact sprinklers on areas that have not previously received MWE application. Over the previously used irrigation area, improved management will enable the continued use of travelling irrigators.

There is a total area of 182.49 ha available, of which 142.4 ha has been determined to be irrigable (allowing for buffers from boundaries, dwellings and waterways). While the conditions of consent number 106705 require not less than 9.6 ha on Byreburn Farm to be available for the application of farm dairy effluent, and require this area to be free from any ANZ waste material, this still leaves 132.8 ha both suitable and available for the application of MWE.

The available areas have been divided in to four management units based on soil properties and land use (current and historic). The four Land Management Units (LMUs) are described in detail in Appendix E, and may be summarised as follows:

Table 5.3: LMU Summary

	LMU 1	LMU 2	LMU 3	LMU 4
Description	Byreburn existing (rotorainer)	Byreburn existing	Byreburn new	ANZ and Dalcam
Ownership	Byreburn Limited	Byreburn Limited	Byreburn Limited	ANZ (9.2 ha) Dalcam Company Limited (4.2 ha)
Area (ha)	56	40	33	13.4
Dominant soil	Kairanga silt loam	Rangitikei sandy loam	Kairanga silt loam	Rangitikei sandy loam
Limiting parameter	P load (60 kg P/ha/year)	Instantaneous hydraulic / P load	Instantaneous hydraulic load	N load (100 kg N/ha/year)
Average application depth (mm/year)	152	152	152	59
Average N Load (/year)	203 kg N/ha	203 kg N/ha	202 kg N/ha	76 kg N/ha
Average P Load (/year)	34 kg P/ha	34 kg P/ha	33 kg P/ha	13 kg P/ha
Max volume (m^3/year)	114,000	109,000	98,700	10,075
Max application depth (mm/year)	250	250	300	75
Max N Load (/year)	360 kg N/ha	360 kg N/ha	400 kg N/ha	100 kg N/ha
Max P Load (/year)	60 kg P/ha	60 kg P/ha	66 kg P/ha	17 kg P/ha
# discharge events	Up to 7	Up to 20	Up to 25	Up to 7

It should be noted that, while in total there is capacity to discharge up to 331,775 m^3/y of effluent onto land, in reality on average 179,300 m^3/y will be discharged to land. There are two reasons for this, as follows:

- Full discharge would interfere in the management of the land both on the farm and around ANZ; and
- The storage required to withhold the peak inflow volumes during periods of no irrigation would be prohibitively large.

It is intended that the decision regarding where the MWE is applied will be based on land management requirements and will change from year to year. In practice this means that in a discharge year some areas may receive the maximum yearly application while others receive little or no application.

On LMUs 1-3 which are farmed, if the yearly MWE application does not provide an agronomic loading of the key nutrients supplementary nutrient applications may occur in the form of organic solids from ANZ, farm dairy effluent (FDE) from Byreburn (within terms of any FDE consents held) or conventional fertilisers. The agronomic loading is expected to be no more than is proposed to be applied by MWE i.e. the loadings given in Table 4.4 are the maximum to be received to any LMU.

Application of additional nutrient sources may take place on the site, particularly the farm. These additional nutrients will be applied in order to sustain full land productivity, but will be applied in such a manner as to ensure that nutrient limits are not exceeded. The additional nutrients may be supplied by conventional fertiliser or by Organic Amendments as described in Section 5.4 above.

5.5.2 Land Management

The manner in which the land to which MWE is to be applied is to be managed is described in detail in Appendix E, which includes a Plan showing the deployment of the LMU's. A summary of the management issues is as follows.

Responsibility. Most of the land to which MWE is to be applied is owned and managed by Byreburn Farm. ANZ has an agreement with Byreburn Farm which provides for the application of MWE to specified land areas. ANZ as consent holder will be responsible for the management and maintenance of irrigation infrastructure, including pumping facilities within the ANZ property. ANZ is also responsible for monitoring that the irrigation is being managed to comply with conditions of consent. Under the agreement, Byreburn will manage the day-to-day operation of the irrigation system in such a manner as to ensure the conditions of the consent are complied with. It is proposed that ANZ will directly manage the irrigation of MWE onto the Dalcam land.

Land Management Unit 1. A detailed evaluation of LMU 1 is given in Appendix B, which found that the daily hydraulic load needed to be better defined and managed, and that phosphorus (P) should be the limiting parameter for the MWE discharge on an annual basis.

The site is currently managed as grazed pasture and this is intended to continue. Stock are to be excluded from the application area during, and for not less than 48 hours after, each irrigation event. To manage elevated P levels in the soils of this area, one quarter of the available area (14 ha) is to be excluded from the irrigation schedule for one year out of four. During the nil irrigation year a maize crop will ideally be grown and removed from the site, i.e. not fed out on these paddocks. Under this management a four year rotation of areas will assist to "mine" P from the soil. In order to minimise mineralisation of soil nitrogen (N) stores, causing leaching, the maize and replacement pasture are to be direct drilled with no, or minimal, cultivation.

Land Management Unit 2. This area was also evaluated by CPG (Appendix B) and it was determined that excessive drainage was a key issue here. While CPG recommended discontinuing irrigation of LMU 2, it is now intended to continue with MWE irrigation, using a system capable of discharging at a low rate.

As with LMU 1 the site is currently managed as grazed pasture and it is expected that this will continue. Farm management will be the same as for LMU 1, but without the 4 yearly maize rotation.

Land Management Unit 3. A cut and carry (grass harvesting and baleage) operation, overseen by Byreburn but almost entirely carried out by contractor, is proposed as the most appropriate land use for LMU 3. Crop and nutrient management are described in detail in Appendix E.

Land Management Unit 4. This area comprises a variety of different land uses, all with a low potential to remove nutrients from the site. No changes to the management of LMU 4 from that currently occurring is proposed apart from the establishment of MWE irrigation.

5.6 Discharge to Groundwater

The ANZ effluent ponds are clay lined, and there will continue to be a discharge to groundwater by way of seepage from them. Key matters for consideration are the rate of seepage to groundwater from the pond system, and the environmental effects that such seepage may have. This discharge is not intentionally managed, but is rather an unintended contingency arising from the operation of the treatment ponds. The discharge occurs at all times that the ponds have MWE in them, which is all the time for the anaerobic and aerated ponds and occasionally for the storage ponds.

The discharge to groundwater and its effects have been described in 3 previous reports, as noted in Section 4.8 above. These reports (CPG 2011b, CPG 2011c, and LEI 2013) all describe the ANZ pond seepage, and all report on investigations that ANZ has commissioned to establish the extent, and effect, of pond seepage. Still further investigations have been undertaken more recently, the results of which are described below.

5.6.1 Quality of Discharged Material

Table 5.2 of this report gives details of the quality of the MWE generated and discharged at ANZ. Concentrations of key parameters from Table 5.2 are summarised in Table 5.4 below, to give an indication of the initial composition of the discharge to groundwater.

Table 5.4: ANZ MWE Parameter Concentrations, 2011/13

	$cBOD_5$ (g/m^3)	NH_4-N (g/m^3)	SIN (g/m^3)	DRP (g/m^3)
Mean	**28**	**80**	**110**	**19**
Median	**32**	**81**	**109**	**19**

5.6.2 Rate of Seepage

ANZ's effluent pond system has a base area of about 6.0 ha. The rate of seepage from the ponds has not been measured and this is problematic and virtually impossible to do *in situ.* The rate of leakage is considered to be comparatively low by virtue of pond water levels remaining constant during periods when there has been minimal inflow and no managed outflow.

The seepage is currently authorised by consent number 6191, which was granted by Manawatu-Whanganui Regional Council. The Officer's Report on application 6191, which was tabled at the hearing of the application on 24 April 1996, addressed the issue of seepage as follows;

"I agree with the comments of the applicant, that as a result of the elapsed time since the construction of the ponds (15 – 25 years), any leakage from the ponds into the ground can be expected to be minimal and any consequential environmental effects negligible."

It is noted that a further 18 years have now elapsed since that observation was made. Observation of the ponds does not reveal evidence of seepage. Fresh "clean-up" earthworks around the pond periphery in early 2014 revealed no wet spots than could be attributed to seepage. It also demonstrated that there was no pond-to-pond leakage when the storage ponds were completely drained.

There is data on inflows to and outflows from the pond system, but there has not been the precision of measurement that would enable a reliable flow balance to be calculated, especially in light of variations caused by evaporation. To put this in perspective a 1 mm loss per day by evaporation or leakage translates to 60 m^3/d of wastewater.

Pond inflows have been calculated for this report on the basis of the assessed use of 2.5 m^3 of processing water per cattle beast processed. While this figure is useful for some production assessments, it is clear that there will be variability around this, with actual wastewater volumes flowing into the treatment ponds likely to be less than this figure. This is reinforced by on-going improvements in water use efficiencies within the plant, driven by the cost of operating the potable water supply system and water take consent conditions.

Daily raw effluent volumes (i.e. pond inflows) for calendar years 2011, 2012, and 2013 have been assessed at maxima of 1,026 m^3/d, medians between 760 and 890 m^3/d, and means between 680 and 740 m^3/d. Outflows have not been tabulated in a way that would enable meaningful comparison with the calculated inflows, as there are two different receiving environments (land and water) and the frequency and volume of discharge is subject to management decisions.

A rate of leakage from the ponds that would equate to a pond liner permeability rate of 1 x 10^{-9} m/s would be a daily loss of depth of 0.0864 mm/d. This rate of permeability is applied by HRC (and other regional councils) as a requirement for farm dairy effluent ponds to meet a permitted activity criterion. Over a 6 ha pond base area, this rate of loss would equate to 5.184 m^3/d. While this rate of loss might potentially be calculated from accurate flow data, the very small change in depth is not itself practically measurable. Further, evaporative losses could account for anything up to 5 mm/d, equivalent to a volume loss of 300 m^3/d.

A practically measurable rate of leakage from the ponds would arise if a pond liner had a permeability rate of 1 x 10^{-7} m/s. This would equate to a daily loss of 8.64 mm/d. Over a 6 ha pond base area, this rate of loss would equate to 518.4 m^3/d. Such a rate of loss from the ponds would equate to about 75 % of assessed mean daily effluent inflow (assuming no evaporative loss); and a drop in effluent level in the pond system of more than 50 mm per week would be clearly apparent.

Because such a rate of loss is not apparent, a worst case rate of leakage may be considered to be less than 1 x 10^{-7} m/s and more likely in the order of 1 x 10^{-8}m/s. This would involve a daily drop in water level of 0.864 mm/d or 6.0 mm/wk, and a daily loss of volume of 51.84 m^3/d. The loss of depth of about 6 mm/week would scarcely be noticeable against a background of inflows, outflows, rainfall and evaporation, but by its very un-noticeability it is possible that it could be occurring.

This **50 m^3/d** is the worst case seepage scenario that is considered further here. It may be noted that CPG 2011c was also unable to definitively measure the rate of seepage, making the "*realistic and conservative assumption (of) a conductivity of 10^{-9} m/s and a liner thickness of 0.5 m, which results in 10.4 m^3/day of seepage."*

5.6.3 Groundwater Movement in ANZ Vicinity

A range of piezometers and standpipes has been installed into shallow groundwater at and around ANZ at various times to enable assessments of depth to, and quality of, shallow groundwater. On 13 June 2014 the location and elevations of 12 piezometers/standpipes were surveyed and water levels measured (depth to groundwater surface measured.) Elevations were also surveyed for 22 points at surface water level on the edge of the adjacent Oroua River. A contoured plot of the resultant data is shown in the Groundwater Surface Contours figure in Appendix A to this report.

The Groundwater Surface Contours figure shows 1.5 m contour intervals. It is considered that the direction of shallow groundwater movement is normal to (at right angles to) the contour lines, and on this basis the following groundwater movement behaviour can be deduced:

- In the area upstream from the 66 m contour, shallow groundwater movement is seen to be from beneath the left bank of the river **towards** the river;
- From the 66 m contour, downstream to the 64.5 m contour, the shallow groundwater movement is seen to be **parallel** to the river;
- Downstream from the 64.5 m contour, the shallow groundwater movement is seen to be **away from** to the river.

Seepage from the ponds may be expected to diffuse in the shallow groundwater, with some of it moving down to deeper groundwater, some of it running down the indicated shallow groundwater surface gradient, and some of it moving to the left and to the right of that down-gradient path. There is scope for a peripheral amount of pond leakage to enter the surface waters of the Oroua River, but in the 1 kilometre down-gradient from the ponds, the main path of leakage does not intersect the river.

CPG 2011c includes an assessment of contaminant transport in groundwater beneath the ANZ ponds. It indicates that dispersion in the groundwater will have led to concentrations of contaminants having declined to below 50% of the input concentration after 3.5 km and 40 years. It also suggests that much of any contaminant discharged by pond seepage may be intercepted by the existing ANZ bore, although it concedes that there is inadequate data available to confirm this.

An assessment of the impact of pond leakage on ground and surface water is provided in Section 8 below.

5.7 Discharge to Surface Water

5.7.1 General

The river discharge has historically been via the truncated and diverted Otoku Stream to the Oroua River. It is the preference of interested parties (ANZ and Iwi in particular) that the discharge should be removed from this stream. As a result the future discharge is to be via a piped discharge to a diffuser structure directly on the bank of the Oroua River. The discharge structure is described in the Conceptual Design report (Appendix E).

Significant changes to the existing river discharge regime are proposed to reduce the impact of the discharge to the Oroua River. A detailed description of the discharge is given in Appendix E. A summary of the proposed river discharge criteria is given in Table 5.5 below.

5.7.2 Surface Water Discharge Environment

The river discharge component of the ANZ CLAWD system is to the Oroua River. Details of the river environment including water quality and river health are given in Appendix G and summarised in Section 4.10 above. Key river parameters adopted for the design of the discharge are:

- <u>Median flow at Kawa Wool – 1993-2013 (MF)</u> – 7,590 L/s;
- <u>20th Flow exceedance percentile at Kawa Wool – 1993-2013 (20FEP)</u> – 16,193 L/s; and
- <u>Three times median flow at Kawa Wool – 1967-2005 (FRE3)</u> – 20,913 L/s.

River water quality has been monitored up and downstream of the site by ANZ and HRC, and is described in Section 4.10 above. Dissolved reactive phosphorus (DRP) is considered to be the most limiting water quality parameter in the Oroua River for the period (1 April to 30 November) that river discharge occurs.

5.7.3 Surface Water Discharge Criteria

The **current** discharge regime is controlled by consent conditions which vary by season and by river flow as follows:

1. *"This consent authorises the discharge of treated effluent from the Manawatu Beef Packers Limited Campbell Road, Feilding site to the Oroua River via the Effluent Outfall (approximate map reference NZMS 260 S23:298-048) for a term expiring on 14 May 2011. This discharge shall be restricted to:*

- *A rate of up to 2,000 cubic metres per day while the river flow exceeds 4,000 litres per second;*
- *A rate of up to 1,000 cubic metres per day while the river flow is between 3,000 and 4,000 litres per second,*

During the period 31st March to 1st December of any year; and:

A rate of up to 2,000 cubic metres per day while the river flow exceeds 20,913 litres per second, and when the pond storage levels are at 100% prior to discharge taking place,

During the period 2nd December to 30th March of any year."

Under the current surface water discharge regime it has been determined that there is an effect in the river likely to be caused or contributed to by the ANZ discharge (Stark, 2011; Aquanet, 2014 in Appendix G). Significant changes to the existing river discharge regime are proposed to reduce the impact of the discharge to the Oroua River.

The **proposed** river discharge criteria are given in Table 5.4 below.

Table 5.4: Proposed Criteria for ANZ River Discharge

Discharge criteria	Date Range	
Flow: Oroua River@Kawa Wool	**1 December – 31 March (Summer)**	**1 April – 30 November (Winter)**
Below median flow (0 – 7,590 L/s)	No discharge	No discharge
Median flow to 20th flow exceedance percentile (7,590 – 16,193 L/s)	No discharge	Discharge at rate based on DRP load to the river up to a maximum of 3,000 m^3/day.
Above 20th flow exceedance percentile (>16,193 L/s)	No discharge*	Up to 3,000 m^3/day.
* Emergency contingency above 3 x median (>20,913 L/s)	If land application is not possible and pond is 100 % full then up to 2,000 m^3/day.	NA

The criteria in Table 5.4 were adopted following a comprehensive assessment of the in-river effects and feasibility of operation for ANZ, explained in detail in Section 5.3 of Appendix E, and summarised as follows:

- Median flow (MF) was used as a discharge cut-off since it represents an improvement on the present discharge and results in reduced effects to the Oroua River;
- The use of a date range which excludes flows over the summer period, when there are high daylight hours and elevated water temperatures, has been retained from the previous consent as it is considered good practice for the location;

- A variable discharge rate between MF and 20th flow exceedance percentile (20thFEP) is tied to the phosphorus loading from the discharge. The minimum 3,800 times dilution ensures that the increase in the phosphorus in the receiving water is minimal. This is discussed further in the assessment of effects to water (Appendix G);
- A discharge rate of 3,000 m^3/day above the 20thFEP corresponds to the flow regime used for One Plan target limits, whereby the parameter of concern changes from phosphorus to ammoniacal-nitrogen. At the proposed discharge rate the One Plan target is not exceeded; and
- The inclusion of the summer discharge under exceptional circumstances provides an assessable contingency for the system evaluation.

The determination from day to day as to whether or not a discharge of MWE to the river may occur is by the procedure described in Section 5.5 above.

5.7.4 Days of Surface Water Discharge

The proposed discharge was modelled for the period 1993-present to determine how the discharge would have worked under the river conditions that actually occurred. The proposed discharge was compared to the actual discharge to enable environmental effects to be predicted. Over the modelled period the number of days on which the discharge would have occurred is given in Table 5.2 of Appendix E. The timing and frequency of the surface water discharge varies based on river flow conditions and production at the plant. The difference in number of discharge days between the current discharge regime and flows and the proposed regime and flows is given in Table 5.5 below. It should be noted that the proposed regime also provides for a 20 % increase in ANZ plant production.

Table 5.5: Comparison of Discharge Days – Current and Proposed River Discharge

	Current	Proposed
Average (days/year)	166	127
Minimum (days/year)	130	94
Maximum (days/year)	202	168
Median (days/year)	168	126

As show in Table 5.5 the proposed regime, while having increased flows from the plant, results in a lower number of discharge days. This is achieved by limiting the discharge to above MF, and by enabling a higher maximum discharge rate when the river is above 20FEP. The increased maximum discharge rate results in a greater proportion of the discharge occurring above the 20FEP, meaning there is less MWE in storage that may otherwise need to be discharged below 20FEP.

5.7.5 Volume, Rate and Mass Loading of Surface Water Discharge

If following the decision-making process given in Section 5.5 above, a river discharge is to occur, then the volume of wastewater discharged to the river is controlled by the P mass loading from the MWE (between MF and 20thFEP.) Table 5.6 below gives the key annual data for the river discharge including comparison to the current discharge. A detailed assessment of these is given in Appendix G.

Table 5.6: Comparison of ANZ Discharge Volumes and Mass Loading – Current and Proposed River Discharge

		Current	Proposed
Discharge volume (m^3/year) for average year	**Discharge Between MF and 20FEP**		
	Average	77,576	17,603
	Minimum	30,835	9,279
	Maximum	106,954	24,135
	Median	82,346	17,748
	Discharge over 20FEP		
	Average	38,624	108,862
	Minimum	16,789	70,248
	Maximum	77,204	150,056
	Median	35,213	107,355
Mass loading N (tonnes/year) for average year	**Discharge Between MF and 20FEP**		
	Average	9.54	2.17
	Minimum	3.79	1.14
	Maximum	13.16	2.97
	Median	10.13	2.18
	Discharge over 20FEP		
	Average	4.75	13.39
	Minimum	2.07	8.64
	Maximum	9.50	18.46
	Median	4.33	13.20
Mass loading P (tonnes/year) for average year	**Discharge Between MF and 20FEP**		
	Average	1.47	0.33
	Minimum	0.59	0.18
	Maximum	2.03	0.46
	Median	1.56	0.34
	Discharge over 20FEP		
	Average	0.73	2.07
	Minimum	0.32	1.33
	Maximum	1.47	2.85
	Median	0.67	2.04

Table 5.6 demonstrates that there is an increase in the total volume and mass loading to the river. However, there is a substantial decrease in the volume and nutrient mass loading at flows below 20^{th}FEP.

5.8 Discharge to Air

The discharge of odours and aerosols to air is a largely unavoidable consequential effect of the land discharge of MWE and Organic Amendments. It is standard practice for air discharges to be limited to causing no offensive or objectionable effects at or beyond the property boundary, and this requirement will be met at ANZ by:

- Appropriate buffer margins between land discharge activities and property boundaries;
- Specified limits to wind speed and direction conditions under which land discharges will be authorised; and
- Measures to ensure that MWE in transfer pipelines does not become anaerobic, including pipeline flushing when there is to be some delay before land discharge of MWE resumes.

5.9 Proposed River Discharge Structure

Following consultation with stakeholders, in particular local Iwi, ANZ is proposing to change the existing mode of discharge to the river. A design has been prepared which uses a planted diffusion structure to discharge MWE at the left bank of the Oroua River at an approximate location of 40.233591S, 175.583195E. Figure 5.1 below shows the proposed conceptual discharge structure design.

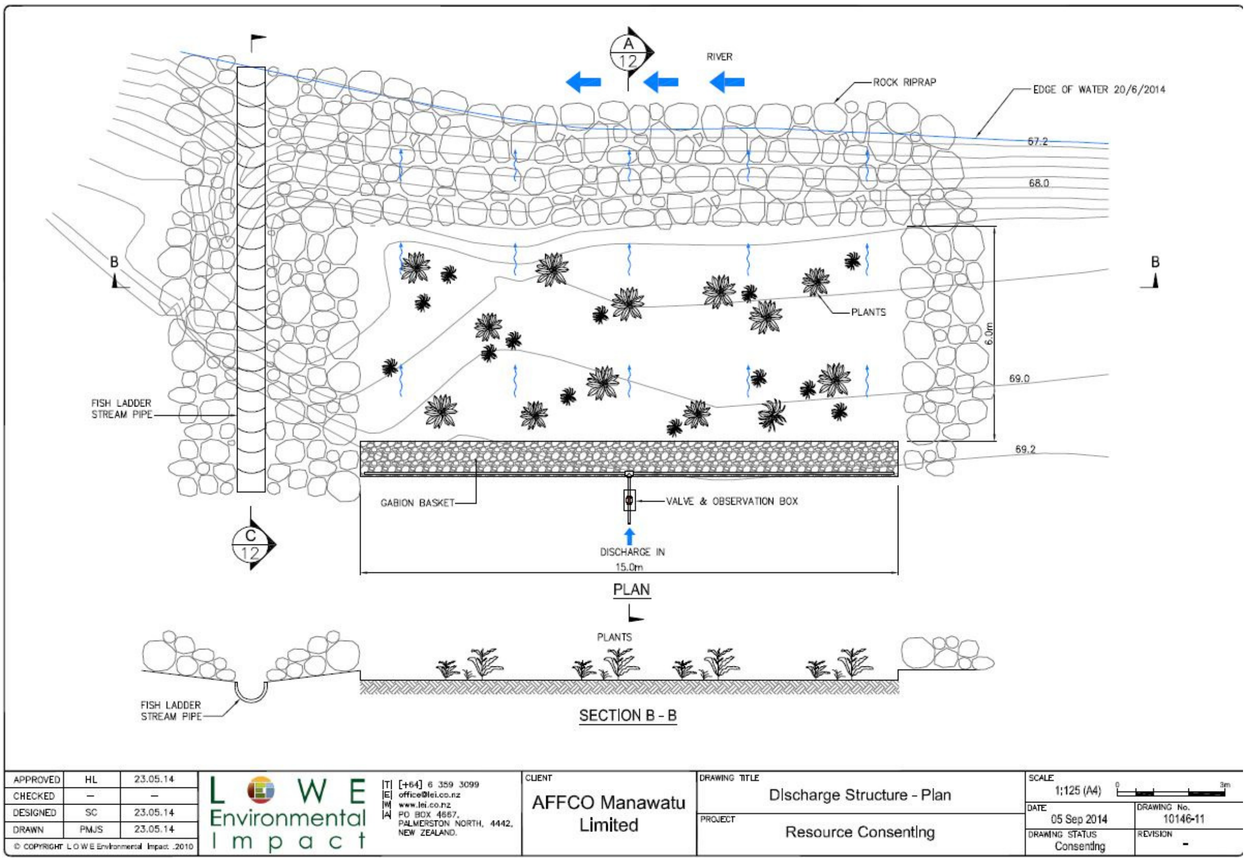


Figure 5.1 Conceptual Design for Proposed River Discharge Structure

The purpose of the proposed discharge structure is to provide both physical security for the discharge site, and a land passage component into the river discharge process, with the discharge structure securely anchored into the river bank so as to avoid effects on, or by, high river flows.

Associated with the proposed discharge structure, it is also proposed to install a bed level control structure in the mouth of the Otoku Stream that meets the Oroua River adjacent to the proposed MWE discharge point. The purpose of this structure will be to secure a short over-steep reach of the Otoku Stream bed against further down-cutting by scour, while sustaining ecological connectivity to and from the river. These measures are not directly related to ANZ's discharges or other activities, but are being negotiated with Iwi as potential mitigation of other environmental effects.

Specific details of the integrated discharge structure and bed level control structure are provided in Appendix K to this report.

It is not considered that either the discharge structure or the bed level control structure will have any environmental effects which would be cumulative upon the effects of the discharges themselves. Design to ensure full compatibility of the structures with flood control requirements has been undertaken, to provide a basis for agreement with HRC's river engineers.

6 CONSIDERATION OF ALTERNATIVES

6.1 General

At the coarsest level, the alternatives for the discharge of MWE from the ANZ Feilding plant are not to discharge, to discharge to the Feilding municipal wastewater system, a river discharge, and various alternative land discharge arrangements.

The discharge of treated wastewater from ANZ is an essential consequence of the operation of a meat processing plant. The consequence of not discharging would be the closure of the plant, which is an alternative that is not considered further.

A discharge to the Feilding municipal wastewater system would require an upgrade to the municipal plant's capacity, as well as new and/or upgraded sewer connections. Manawatu District Council's response to a request to consider such a connection in 2010 was to decline consideration. That position has changed, but in the meantime ANZ has elected to manage its own treatment and discharge system.

A river discharge was the original system deployed when a meat processing plant was first established on the site, some 100 years ago. It is still utilised as part of ANZ's Combined Land and Water Discharge (CLAWD), at times and at river flow rates that minimise adverse environmental effects. However, to revert from the present CLAWD system to a straight river discharge would entail environmental consequences that would not meet regional plan requirements or community expectations, so this alternative has not been considered further.

A land discharge can provide an opportunity to irrigate water and nutrients beneficially onto farm land, as well as to avoid the adverse effects of discharge to the river. However, it requires a significant area of land to be available, and may not necessarily be able to function at all the times that MWE is being produced.

6.1.1 Evaluation of Options

The existing Combined Land and Water Discharge (CLAWD) system has operated for over 20 years, so it is not a new concept. Experience with its operation has shown that there are opportunities to refine its effectiveness and to significantly reduce the potential for environmental effects.

An initial evaluation of the options was undertaken between September and November 2013. The evaluation compared the discharge outcomes resulting from changes to the treatment system and the land application system, both separately and in combination. The evaluation determined which changes resulted in the best improvements to the river discharge. From this ANZ was able to make informed decisions about where to focus its expenditure to improve the discharge system.

A base scenario was prepared which was considered to be achievable operationally, and to be consentable in terms of environmental impact. At this stage the environmental effects assessed were on a qualitative basis. The base scenario was modified using:

- Change land area;
- Change available storage;
- Modify river discharge criteria;
- Change nutrient and hydraulic loading to land;

- Include nitrogen and/or phosphorus reduction technologies in treatment system;
- Increase plant production (wastewater inflows);
- Change pump rate to river.

In total, 19 scenarios were prepared to determine which changes the discharge regime was most sensitive to. A preferred option was selected, and forms the basis for the conceptual design. Further refinement has been undertaken as outlined in the following sections.

6.2 Optimisation

Following the determination of the preferred option, a process of optimisation was undertaken to:

- Quantify effects to the Oroua River and land application areas;
- Compare the proposed regime with the existing discharge; and
- Include specific land management considerations.

The optimisation process was iterative, meaning the preferred option was evaluated, refined and further evaluated to ensure that an improvement was made over the current regime, and that the detectable effects to the receiving environments (land and water) were minimised.

6.2.1 Modelling the Current Discharge Regime

To enable the effects of the proposed discharge to be reliably predicted, a comparison with the current discharge regime was needed. To compare the current discharge regime to the proposed regime, first the current regime needs to be well understood. This assessment has previously been undertaken for the land treatment area and is described in the previous land discharge consent application (CPG, 2011a).

The correlation between the current river discharge and river water quality has not previously been quantified. The actual MWE discharge volume record was not sufficiently detailed and not of long enough duration to reliably compare the current discharge regime to the proposed discharge regime. What was well understood was the conditions under which the discharge has occurred, and the concentrations of N and P in the Oroua River up and downstream of the discharge point.

Based on the existing discharge record and the conditions under which the discharge to river is currently permitted to occur, the existing regime was estimated. To determine whether the estimated regime accurately reflected the actual discharge, the nutrient mass loadings were compared with actual water quality data in the Oroua River in the vicinity of the discharge. This process is discussed in further detail in the water AEE (Aquanet, 2014, Appendix G). Good agreement was reached between the estimated existing regime and water quality records, and this was adopted for comparison with the proposed regime.

6.2.2 Comparison of the Current and Proposed River Discharge

All variants of the proposed river discharge resulted in an improvement over the environmental result from the current consent conditions, and correspondingly from the effects due to that discharge. Because there is a high degree of confidence that the measured water quality can be predicted by the modelled flows based on the previous step, by comparing the different regimes there is a high degree of confidence that the effects predicted for the proposed regime are accurate.

6.2.3 Optimisation of the Proposed River Discharge

By adjusting the rules and criteria that control the discharge, particularly by adjusting the timing, river flow limits and discharge volume, the impact of discharging the same proposed volume can be varied. By examining how the impact changes, the optimum regime with respect to nutrient concentrations in the river can be, and has been, selected. The resulting optimised option is the subject of this consent application.

6.2.4 Optimisation of the Proposed Land Discharge

The preferred option was selected on the basis of the hydraulic loading of MWE to the soil (i.e. the rate and amount applied). Further refinement was undertaken to take into account the nutrient loading and management considerations such as cropping rotation and stock withholding. In addition the effects of different irrigation options were considered, including application depths and return periods. The resulting optimised option is the subject of this consent application.

6.3 Pond Seepage Options

The pond system is a necessary part of the ANZ industrial infrastructure, both for the treatment of MWE to achieve a quality that is suitable for discharge, and for the storage of MWE at times when it is being produced but cannot immediately be discharged.

Seepage from ponds arises irrespective of the lining material used, the issues being the rate at which seepage occurs, and the environmental effects of that seepage. There are two options for ANZ to manage the seepage from their ponds, as follows:

- Maintain the pond system with its current clay lining, or
- Replace the clay lining with a new synthetic pond liner.

The decision on which of these two options to adopt is driven by cost on the one hand, and by the environmental effect on the other. There is little or no cost in maintaining the existing clay liner, while the purchase and installation of a new synthetic pond liner would involve significant expense. The rate of seepage through the clay liner may be reduced by the installation of a synthetic liner, but it has not yet been established that this would necessarily result in any significant improvement in local groundwater quality. A synthetic liner would not be installed by ANZ unless an environmental advantage could be shown for doing so, but may need to be installed if pond seepage is shown to be the cause of a significant adverse environmental effect.

Synthetic pond liners can leak. While large areas of the liner material may be practically impermeable, synthetic liners can still be punctured, with the resultant leak negating the benefit of the large cost involved in their installation, without the existence of such a puncture/leak necessarily being apparent.

The key consideration at ANZ is whether the rate of seepage from the pond system, and the adverse environmental effects arising from such seepage, are sufficiently large to warrant the considerable expense of the synthetic liner alternative.

As described in Section 5.7 above, the rate of seepage has not been definitively measured, but a worst case assessment of a permeability rate of 1×10^{-8} m/s has been demonstrated, involving the loss by seepage from the ponds to groundwater of up to **about 50 m^3 of MWE per day**.

The environmental effects of this seepage are further described in Section 8 below. An assessment of shallow groundwater flow direction in Section 5.7.3 indicates that seepage from the ponds does not flow directly to the Oroua River. An assessment of the chemistry of shallow groundwater samples from local bores in Section 8.5.2 indicates that shallow groundwater quality down-gradient from the pond system does not appear to be adversely affected by seepage from the ponds. While high concentrations of Ammoniacal Nitrogen and SIN in the shallow groundwater immediately down-gradient from the ponds are acknowledged, their concentrations are on average lower down-gradient from the ponds than they are up-gradient. This introduces the likelihood that an expensive replacement of the 40 year-old clay pond liner with a new synthetic liner **may not cause any improvement in down-gradient shallow groundwater quality.**

Accordingly, it is proposed to retain the use of the existing clay liner, while continuing a groundwater quality monitoring program with the intention of detecting any significant changes that may cause a re-evaluation of the need to install a new synthetic liner.

6.4 Air Discharge Options

The discharges of odours and aerosols to air arising from land discharge activities are not avoidable without re-locating the discharge activities to some alternative site, where the same issues would also arise. Available options relate to the selection of measures to manage and limit the effects of the air discharges, and in this regard best practice is proposed to ensure compliance with consent conditions.

6.5 River Discharge Structure Options

The purpose of the discharge structure is to provide a physically secure wastewater outlet alongside the river, while providing a land passage component into the discharge. The best practicable option will be utilised to ensure that both physical security and land passage are provided without compromising the flood control requirements for the site.

7 STATUTORY PROVISIONS

In this Section of this report, the relevant national environmental standards and national, regional, and district statutory planning requirements are identified, where they are relevant to the proposed activities.

7.1 Resource Management Act

Sections 5 to 8 of the Act address purposes, matters of national importance, matters to be had regard to, and the Treaty of Waitangi.

Sections 9 to 15 of the Act set out the circumstances in which activities require resource consents.

Sections 88 to 108 of the Act set out provisions relating to notification of consent applications, consideration of applications, matters to be addressed in certain applications, and conditions on resource consents.

7.2 National Policy Statements and National Environmental Standards

The National Environmental Standard for Human Drinking Water, and the National Policy Statement for Freshwater Management 2014, potentially apply to the proposed activities.

7.3 Regional Policy Statement

Horizons Regional Council's (HRC's) One Plan Operative Version (OPOV) became operative on 19 December 2014, and contains objectives and policies that form the Regional Policy Statement (RPS).

The **Objectives** of the RPS relating to the proposed activities at ANZ are as follows:

- Objective 3-1: Infrastructure and other physical resources of regional or national importance;
- Objective 5-1: Water management values;
- Objective 5-2: Water quality;
- Objective 5-4: Beds of rivers and lakes; and
- Objective 7-1: Ambient air quality.

The **Policies** of the RPS relating to the proposed activities at ANZ are as follows:

- Policy 3-1: Benefits of infrastructure and other physical resources of regional or national importance;
- Policy 3-2: Adverse effects of other activities on infrastructure and other physical resources of regional or national importance;
- Policy 3-3: Adverse effects of infrastructure and other physical resources of regional or national importance on the environment;
- Policy 5-2: Water quality targets;
- Policy 5-3: Ongoing compliance where water quality targets are met;
- Policy 5-4: Enhancement where water quality targets are not met;
- Policy 5-6: Maintenance of groundwater quality;
- Policy 5-7: Land use activities affecting groundwater and surface water quality;
- Policy 5-9: Point source discharges to water;
- Policy 5-10: Point source discharges to land;

- Policy 5-22: General management of the beds of rivers and lakes;
- Policy 5-24: Activities in rivers or lakes and their beds with a Value of Flood Control and Drainage;
- Policy 7-1: National Environmental Standards (air quality);
- Policy 7-2: Regional standards for ambient air quality; and
- Policy 7-3: Regulation of discharges to air.

7.4 Regional Plan

HRC's OPOV is the regional plan under which the proposed activities will be regulated. Chapter 14 of the plan addresses discharges to land and water. Chapter 17 of the plan addresses Beds of Rivers and Lakes. Specific **Objectives and Policies** that are relevant to the proposed activities are as follows:

- Objective 14-1: Management of discharges to land and water and land uses affecting groundwater and surface water quality.
- Objective 15-1: Air quality.
- Objective 17-1: Regulation of structures and activities in artificial watercourses and in the beds of rivers and lakes, and damming.
- Policy 14-1: Consent decision-making for discharges to water.
- Policy 14-2: Consent decision-making for discharges to land.
- Policy 14-4: Options for discharges to surface water and land.
- Policy 14-5: Management of intensive farming land uses.
- Policy 14-6: Resource consent decision-making for intensive farming land uses.
- Policy 15-2: Consent decision-making for other discharges to air.
- Policy 17-1: Consent decision-making for activities in, on, under or over the beds of rivers and lakes (including modified watercourses but excluding artificial watercourses)

The **Rule** that addresses the proposed discharge to land and to water activities is Rule 14-30, which provides as follows:

> *"Discharges of water or contaminants to land or water not covered by other rules in this Plan or chapter…., or which do not comply with the permitted activity, controlled activity or restricted discretionary activity rules in this chapter, are **Discretionary Activities**."*

The **Rule** that addresses the air discharge of odours and aerosols is Rule 15-17, which provides for the activity in all its circumstances to be a **Discretionary Activity.**

The **Rule** that addresses the proposed erection of structures in the river bed is Rule 17-15, which provides as follows:

> *"Except as regulated by Rule 17-5,* (which relates to maintenance of existing structures) *the following activities pursuant to ss 9(2) and 13(1) RMA in, on or under an artificial watercourse or a reach of a river with a Schedule AB Value of Flood Control and Drainage or adjacent land as defined in (j) to (m):*
>
> *(b) the erection, placement or extension of any building or other structure (including accessways)…*
>
> *are **Discretionary Activities**."*

The proposed discharges to land, to groundwater and to the Oroua River, and the erection of the proposed riverbed structures, therefore require resource consents from HRC.

7.5 District Plan

The Manawatu District Plan became operative on 1 December 2002, and remains the operative district plan. It is currently under review, with 12 plan changes notified as at 16 June 2014. However, none of the 12 plan changes has any direct bearing on the proposed activity or its locality, so the 2002 plan is the one that is applicable here.

8 ASSESSMENT OF ENVIRONMENTAL EFFECTS

8.1 Receiving Environments

The four receiving environments for the proposed discharge activities are:

- For land application, the soil of Byreburn Farm and the Dalcam and ANZ properties, as described in Section 4 above. The potential secondary receiving environments are the shallow groundwater beneath the farm, and the air. A potential tertiary receiving environment is the surface water of the Oroua River.
- For the air discharge, the receiving environment is the air at and near the land application sites.
- For the pond seepage, the receiving environment is the shallow groundwater beneath and near the ponds, and a potential secondary receiving environment is the surface water of the Oroua River.
- For the surface water discharge, the receiving environment is the surface water of the Oroua River.

8.2 Sensitivities of the Receiving Environments

Environmental risks arising from discharges depend on three major factors, as follows:

- Source and type of contaminant;
- Migration pathways; and
- Receptors.

If one of these factors is absent, then the potential risk is greatly reduced. By removing the contaminant source, by containing the contaminant, or by the absence or removal of the receptor, the environmental risk is able to be significantly reduced.

The proposed discharges of treated MWE provide the source and type of contaminant.

8.2.1 Land Application Receptors and Sensitivities

For the land application, the irrigation and its timing, rate and placement are the primary migration pathway, with through-flow to groundwater providing a secondary migration pathway. The receptor is the soil in the first instance, groundwater in the second instance, and potentially the surface waters of the Oroua River in the third instance.

The sensitivity of the soil relates to its potential loss of productivity and versatility if the hydraulic application rate is excessive, or if nutrients are allowed to accumulate beyond optimum levels.

8.2.2 Air Discharge Receptors and Sensitivities

From the land application activities, the primary pathway of migration is wind that may carry odours and aerosols to sensitive environments. The receptor is members of the community who may find themselves enveloped in aerosol, and/or find the odour offensive and objectionable.

The sensitivity to the air discharge relates to the degree to which its effect is offensive and objectionable to receiving members of the community.

8.2.3 Pond Seepage Receptors and Sensitivities

The receiving environment for the seepage of wastewater from the ponds is the shallow groundwater in the vicinity of ANZ. The areal extent of the ponds is some 6 ha, on a total ANZ site of 38.84 ha, within an upstream catchment area estimated as 576 km^2. The river distance to the sea from the site is 87 km. Groundwater bores have a variety of uses in the locality, as tabulated in Tables 6.1 and 6.2 of LEI (2013) and these uses are all industrial, gardening, stock drinking or monitoring. There is a low sensitivity of these uses to changes in groundwater quality; the local shallow groundwater quality is generally not regarded as being suitable for domestic supply. On average the NH_4-N, SIN and DRP loadings in shallow groundwater up-gradient from the ANZ ponds are no better than they are down-gradient, so the down-gradient shallow groundwater may be considered to have a low sensitivity to the effects of pond seepage as it currently occurs.

For the pond seepage, through-flow to groundwater from the pond lining provides the primary migration pathway. The receptor is the shallow groundwater in the first instance, and potentially the surface waters of the Oroua River in the second instance.

8.2.4 River Discharge Receptors and Sensitivities

The Oroua River potentially receives MWE from three sources, being the piped river discharge, seepage from the treatment ponds by way of shallow groundwater movement, and through-flow and leachates from the land application/irrigation system, also by way of shallow groundwater movement.

For the river discharge, the piped discharge and its timing and relationship to river flow is the primary migration pathway. The receptor is the surface waters of the Oroua River. The limiting factors for the effects of the MWE discharge on the river are the ammoniacal nitrogen and the dissolved reactive phosphorus loading rates. Pathogens (*E. coli*) may be regarded as potentially limiting in the context of contact recreational use of the river.

For the pond seepage, the Oroua River could be considered to be sensitive to seepage of MWE at pond concentration, at the worst case rate of seepage of 50 m^3/d, if the entire seepage flow entered the river. Under this theoretical scenario, almost 1 kg of phosphorus would enter the river daily, and at times of summer low flow this is considered to be sufficient to trigger a sensitive response by the river ecology. However, even allowing that the seepage rate may be as high as the worst case cited, it is shown in Section 8.5 below that phosphorus in the seepage is below "pond strength" by a factor of at least 50. It is further shown in Section 5.7.3 above that there is not a direct shallow groundwater flow path from beneath the ponds to the river. Under the present (and proposed) configuration of the ponds, there may be some seepage from the ponds reaching the river, but while the daily volume and parameter loading of seepage reaching the river has not been quantified, it is considered unlikely that it would be sufficient to trigger a sensitive response in the river ecology.

Similarly for the land application of MWE, any over-application of MWE to an extent that would initiate through-flow could be expected to result in transport of nutrients, either from beneath the irrigated areas through shallow groundwater to the adjacent river, or through the farm drainage systems to the un-named stream which in turn discharges into the Oroua River. However, the proposed irrigation system is specifically designed and operated to avoid through-flow, and it is expected that any nutrients reaching the river from the irrigation activity will be relatively minor if detectable.

The river receiving environment is not a pristine or clean river when it reaches the area in which ANZ's discharges of MWE occur. There is a moderate sensitivity of the ecological condition of the river to the current discharge, which is shown to have resulted in poorer ecological condition downstream, but the river is in only fair ecological condition upstream from the discharge.

8.3 Summary of Discharge Effects

The activities that may produce actual or potential effects on the environment that need to be considered relate to:

- The discharge of MWE and Organic Amendments to land on Byreburn Farm and on the Dalcam and ANZ properties;
- The discharge of odours and aerosols to air resulting from land discharges;
- The discharge of MWE to groundwater by seepage from the ANZ treatment ponds; and
- The discharge of MWE to the surface waters of the Oroua River.

Actual or potential effects upon the environment to be considered further are:

- Effects of the land discharge on the soil;
- Effects of the land discharge on the air;
- Effects of the land and seepage discharges on groundwater quality;
- Effects of the land, seepage, and direct river discharge on surface water quality;
- Effects of the combined discharges on habitats;
- Effects of the combined discharges on Amenity, Community, Cultural and Heritage values; and
- Effects of the combined discharges on air quality.

There will be no effects that are not capable of satisfactory avoidance, remediation or mitigation. The individual effects are all not more than minor.

8.4 The Discharge of MWE to Land by Irrigation

The discharge to land of MWE has the potential to cause an effect to:

- Soil and plant health;
- Groundwater quality;
- Oroua River water quality;
- Social and cultural values of the environment; and
- Air quality.

The actual and potential effects are evaluated in Appendix F, the Assessment of Environmental Effects of the Discharge to Land. In particular, Section 5 details the assessment of effects while Sections 3 and 4 provide the background information (receiving environment and description of the activity) on which the assessment is based.

As described in the Appendix F report the potential effects due to land application are able to be avoided or mitigated by the proposed land discharge regime.

The effects of odours and aerosols discharged to air arising from land discharge activities are able to be mitigated by:

- Appropriate buffer margins between land discharge activities and property boundaries;
- Specified limits to wind speed and direction conditions under which land discharges will be authorised; and

- Measures to ensure that MWE in transfer pipelines does not become anaerobic, including pipeline flushing when there is to be some delay before land discharge of MWE resumes.

By adopting best practice in the management of the land discharge activities, including the specific measures listed above, it is considered that the effect of the discharges on the environment beyond the respective property boundaries will not be greater than minor.

8.5 The Discharge of MWE to Groundwater by Pond Seepage

8.5.1 General

As described in Section 5.7, MWE with mean and median composition tabulated in Table 5.4 is stored in ANZ's treatment ponds. Seepage from the treatment ponds into shallow groundwater has been assessed at **a "worst case" rate of about 50 m^3/d,** equivalent to a pond floor permeability rate of 1 x 10^{-8} m/s.

An assessment of the shallow groundwater surface in the vicinity of ANZ indicates that there is not a direct flow path for shallow groundwater from beneath the ponds to the Oroua River.

8.5.2 Shallow Groundwater Chemistry

The bores, piezometers and standpipes in which depth to the groundwater surface has been measured, as described in Section 5.7.3 above, have also been sampled and analysed, with data presented in Appendix I.

Samples have been taken from 14 bores on up to 3 occasions, and analysed for a list of 15 analytes. It should be noted that all the bores referred to here are less than 10 m deep, so it is shallow groundwater that is being studied (see Tables 6.1 and 6.2 in LEI 2013.) Of the 15 analytes, the key ones are considered to be Ammoniacal Nitrogen (NH_4-N), Soluble Inorganic Nitrogen (SIN), and Dissolved Reactive Phosphorus (DRP). Concentrations of these 3 key analytes in shallow groundwater samples are tabulated in Table 8.1 below, with the bores arranged in an approximate up-gradient to down-gradient order. Mean values of the concentrations of each analyte at each bore are given, and colour coded as follows:

- Narrow range; maximum is not more than **2** times the minimum;
- Medium range; maximum lies between **2 and 10** times the minimum;
- Wide range; maximum is more than **10** times the minimum.

Table 8.1: Concentrations of Key Shallow Groundwater Analytes, ANZ Locality

Bore	Sampling Date	[NH_4-N] (g/m^3)	[SIN] (g/m^3)	[DRP] (g/m^3)
325413 (upgradient)	17/06/2013	0.010	22.010	0.004
	14/04/2014	<0.010	0.138	<0.004
	15/05/2014	<0.010	0.970	<0.004
	Mean	0.010	7.706	0.004
325416B (upgradient)	17/06/2013	4.4	32.4	0.006
	14/04/2014	5.2	21.6	0.004
	15/05/2014	2.904	5.903	0.063
	Mean	4.168	19.967	0.024
325411 (upgradient)	17/06/2013	0.052	0.072	0.004
	14/04/2014	0.055	0.075	0.064

Bore	Sampling Date	[NH_4-N] (g/m^3)	[SIN] (g/m^3)	[DRP] (g/m^3)
	15/05/2014	0.075	0.085	0.075
	Mean	0.061	0.077	0.048
325016 (upgradient)	17/06/2013	1.030	1.050	0.004
	14/04/2014	0.870	1.070	0.280
	15/05/2014	0.820	0.920	0.260
	Mean	0.907	1.013	0.181
325275B (upgradient)	17/06/2013	0.017	0.020	0.004
	14/04/2014	0.033	0.323	0.004
	15/05/2014	<0.010	0.090	<0.004
	Mean	0.020	0.144	0.004
325273A (upgradient)	17/06/2013	0.013	0.433	0.004
	14/04/2014	0.034	0.036	0.004
	15/05/2014	0.020	0.170	<0.004
	Mean	0.022	0.213	0.004
325269C (downgradient)	17/06/2013	15.4	33.6	0.055
	14/04/2014	32	36.1	0.128
	15/05/2014	31	42.1	0.148
	Mean	26.133	37.266	0.110
31 Matai (downgradient)	17/06/2013	1.1	1.114	0.004
	14/04/2014	-	-	-
	15/05/2014	1.4	1.5	<0.004
	Mean	1.25	1.307	0.004
28 Aorangi (downgradient)	17/06/2013	0.3	0.35	0.113
	14/04/2014	0.28	0.29	0.260
	15/05/2014	-	-	-
	Mean	0.29	0.32	0.187
23 Matai (downgradient	17/06/2013	0.57	0.585	0.007
	14/04/2014	0.59	0.69	0.163
	15/05/2014	0.60	0.7	0.076
	Mean	0.587	0.658	0.082
1415 Waugh downgradient	17/06/2013	0.40	0.416	0.004
	14/04/2014	0.36	0.374	0.007
	15/05/2014	-	-	-
	Mean	0.380	0.395	0.006
1447 Waugh downgradient	17/06/2013	0.113	0.163	0.057
	14/04/2014	0.118	0.318	0.018
	15/05/2014	0.133	0.233	<0.004
	Mean	0.121	0.238	0.026
1427 Waugh downgradient	17/06/2013	0.370	0.387	0.009
	14/04/2014	0.350	0.379	0.004
	15/05/2014	0.390	0.49	0.065
	Mean	0.370	0.419	0.026
1459 Waugh downgradient	17/06/2013	0.016	0.646	0.004
	14/04/2014	-	-	-
	15/05/2014	-	-	-
	Mean	0.016	0.646	0.004

From the data in Table 8.1 the following features can be noted:

- Groundwater quality in the ANZ locality is **not constant in time**. Of the 3 key analytes over the 13 bores from which 2 or more samples were analysed, **25 showed a narrow range** of values with the maximum value not more than 2 times the minimum value. **5 showed a medium range** of values with the maximum value between 2 and 10 times the minimum value. **9 showed a wide range** of values with the maximum value more than 10 times the minimum value. Of the 13 bores from which 2 or more samples were taken, only 2 showed a narrow range of values for all three key analytes.

- Groundwater quality in the ANZ locality is **not constant in space**. Mean Ammoniacal Nitrogen concentrations vary between 0.010 g/m^3 and 26.133 g/m^3, a factor of over 2,000. Mean SIN concentrations vary between 0.077 g/m^3 and 37.26 g/m^3, a factor of over 480. Mean DRP concentrations vary between 0.004 g/m^3 and 0.187 g/m^3, a factor of over 46.

- Mean Ammoniacal Nitrogen concentrations that were significantly elevated (higher than 0.5 g/m^3) were found in 5 of the 14 bores. 2 of these bores (325416B, 326016) are over 500 m up-gradient from the ANZ ponds; one is immediately down gradient from bore 325269C; and 2 (31 Matai, 23 Matai) are 500 m south of the ponds.

- Mean SIN concentrations that were significantly elevated (higher than 0.5 g/m^3) were found in 7 of the 14 bores. 3 of these bores (325413, 325416B, and 325016) are over 500 m up-gradient from the ANZ ponds; one is immediately down gradient from the ponds (325269C); and 3 (31 Matai, 23 Matai, and 1459 Waugh) are not less than 500 m south of the ponds.

- Mean DRP concentrations that were significantly elevated (higher than 0.04 g/m^3) were found in 5 of the 14 bores. 2 of these bores (325411, 325016) are over 500 m up-gradient from the ANZ ponds; one is immediately down gradient from the ponds (325269C); and 2 (23 Matai, 28 Aorangi) are not less than 500 m south of the ponds.

- The highest mean concentration of Ammoniacal Nitrogen (26.133 g/m^3) was found in bore 325269C, immediately down-gradient from the ANZ ponds. Next highest (4.168 g/m^3) was bore 325416B, 1 kilometre up-gradient from the ponds.

- The highest mean concentration of SIN (37.26 g/m^3) was found in bore 325269C, immediately down-gradient from the ANZ ponds. Next highest (19.967 g/m^3) was bore 325416B, 1 kilometre up-gradient from the ponds.

- The highest mean concentration of DRP (0.187 g/m^3) was found in bore 28 Aorangi, 700 m south of the ANZ ponds. Next highest (0.181 g/m^3) was bore 325106, 500 m up-gradient from the ponds.

- Mean Ammoniacal Nitrogen concentration is highest in bore 325269C, which is immediately down-gradient from the ponds, and on its own this may be seen to be evidence of pond seepage. However, the mean NH_4-N concentrations in the 6 bores which are up-gradient from 325269C (bores 325413 to 325275A in Table 5.5 above) range between 0.010 and 4.168 g/m^3, with a mean (of means) concentration of 0.865 g/m^3. By comparison, the mean NH_4-N concentrations in the 7 bores which are down-gradient from 325269C (bores 31 Matai to 1459 Waugh in Table 5.5) range between 0.016 and 1.25 g/m^3, with a mean (of means) concentration of 0.431 g/m^3. Despite the high NH_4-N concentration in shallow groundwater immediately down-gradient from the ANZ ponds, concentrations down-gradient from the ponds are on average **lower** than those up-gradient. There is not an increase in NH_4-N concentration in shallow groundwater down-gradient that can be attributed to pond seepage.

- Similarly, mean SIN concentration is highest in bore 325269C, which is immediately down-gradient from the ponds, and on its own this may be seen to be evidence of pond seepage. However, the mean SIN concentrations in the 6 bores which are up-gradient from

325269C (bores 325413 to 325275A in Table 5.5) range between 0.077 and 19.967 g/m^3, with a mean (of means) concentration of 4.853 g/m^3. By comparison, the mean SIN concentrations in the 7 bores which are down-gradient from 325269C (bores 31 Matai to 1459 Waugh in Table 5.5) range between 0.238 and 1.307 g/m^3, with a mean (of means) concentration of 0.569 g/m^3. Despite the high SIN concentration in shallow groundwater immediately down-gradient from the ANZ ponds, concentrations down-gradient from the ponds are on average **lower** than those up-gradient. There is not an increase in SIN concentration in shallow groundwater down-gradient that can be attributed to pond seepage.

- Finally, mean DRP concentration in bore 325269C is the third highest of those recorded. However, the mean DRP concentrations in the 6 bores which are up-gradient from 325269C (bores 325413 to 325275A in Table 5.5) range between 0.004 and 0.181 g/m^3, with a mean (of means) concentration of 0.044 g/m^3. By comparison, the mean DRP concentrations in the 7 bores which are down-gradient from 325269C (bores 31 Matai to 1459 Waugh in Table 5.5) range between 0.004 and 0.187 g/m^3, with a mean (of means) concentration of 0.048 g/m^3. There is not a significant increase in DRP concentration in shallow groundwater down-gradient that can be attributed to pond seepage, or any other source around the ANZ site.

The assessment of the concentrations of the three key parameters in samples taken from shallow bores in the vicinity of ANZ indicates that, despite elevated concentrations of NH_4-N and SIN in bore 325269C immediately down-gradient from the ponds, these two parameters have higher average concentrations up-gradient than they do down-gradient from that bore. There are bores showing higher DRP concentrations, both up-gradient and down-gradient, than in bore 325269C. With a significant variability in the concentrations of the three key parameters considered, in both time and space, there is a good deal of "background noise" against which actual effects of pond seepage are not readily detected. The bore immediately down-gradient from the ponds (325269C), at a distance of perhaps 50 m from the nearest part of the pond system, is the only one of 14 bores examined within a 1 km radius of the ponds that shows mean parameter concentrations (26 g/m^3 NH_4-N, 37 g/m^3 SIN) that stand out sufficiently from the background to be potentially considered to be effects arising from ANZ pond seepage. However, it should be noted that bore 325269C is in the location of the old domestic wastewater discharge, which may potentially be affecting the results. Therefore, despite being downgradient of the ponds, care needs to be taken in drawing a conclusions that pond leakage is causing the elevated groundwater concentrations.

The absence of evidence of a "plume" of elevated parameter concentrations down-gradient from bore 325269C indicates the absence of an effect on shallow groundwater quality that could be considered to be more than minor and/or local.

A potential concern with pond seepage has been that DRP from the seepage may find its way through shallow groundwater into the Oroua River. DRP is considered in Section 5.8.2 to be the most limiting water quality parameter in the Oroua River for the period (1 April to 30 November) during which the river discharge occurs. If the seepage discharge was at the "worst case" rate of 50 m^3/d, and if the material being discharged had the DRP loading (both median and mean) of 19 g DRP/m^3 shown in Table 5.4, and if the direction of shallow groundwater flow was directly into the Oroua River, then 950 g/d DRP would be added to the river, and this would be considered to cause a significant adverse ecological effect.

However, phosphorus is readily adsorbed onto clay minerals in and beneath the pond liner, with the result that the seepage carries a significantly reduced DRP load from that which exists in the MWE within the pond. Further, the proportionate reduction in DRP concentration is found to be substantially greater than is found for NH_4-N or SIN. This is shown by comparison of the changes between concentrations of key parameters, between the pond MWE and the shallow groundwater in bore 325269C, as shown in Table 8.2 below. This however assumes that there is a detectable impact on groundwater quality from pond leakage.

Table 8.2: Comparison of Parameter Loadings between Pond MWE and Groundwater

Parameter	In Pond MWE	In Groundwater (bore 325269C)	Ratio of [Pond] : [Groundwater]
NH_4-N Concentration (g/m^3)	80	26.133	3.06
SIN Concentration (g/m^3)	110	37.266	2.95
DRP Concentration (g/m^3)	19	0.110	172.73

In Table 8.2 the pond concentrations of parameters are from Table 5.4, and the groundwater concentration is the mean of the 3 samples from bore 3258269C, the bore closest down-gradient from the ponds.

The ratios of pond concentration to groundwater concentration for NH_4-N and SIN are around 3, meaning that NH_4-N is three times more concentrated in the pond than it is in the samples from the nearby bore 325269C. However, the DRP is over 170 times more concentrated in the pond than it is in the samples from the bore. If pond seepage was leading directly to the observed elevations in parameter concentrations in the nearby bore, the signature or fingerprint of the pond MWE should be repeated in the nearby groundwater, albeit with some relatively minor changes that reflect specific analyte adsorption or transformations in the vadose and groundwater zones.

The 170-fold reduction in DRP concentration from the pond to the nearby groundwater, in the context of the 3-fold reduction in nitrogen species, strongly indicates either that nitrogen enrichment of groundwater is coming from another source in addition to pond seepage, or that phosphorus is being very substantially removed from the seepage on its passage from the pond to the bore involved.

The case for seepage of **up to 50 m^3/d** remains. However, while the DRP content in pond MWE has a mean concentration of 19 g/m^3, it is evident that DRP in pond seepage is at a much lower concentration than that. If **all** the nitrogen species and **all** the DRP measured in bore 325269C are derived from pond seepage, then by proportion the phosphorus concentration will have been reduced by a factor of about 57 during its passage from the pond to bore 325269C. And on this basis if the entire seepage flow found its way into the Oroua River, it would bring with it a DRP mass of not greater than **16.7 g/d.** With the river flowing at its Mean Annual Low Flow of 1,240 L/s, this seepage scenario would add a contribution of 0.00015 g DRP/m^3 to the river, which is less than 4% of the detection limit for DRP. And this is a worst case; most of the time the river flows at a greater rate, which would dilute the seeped DRP to an even lower concentration.

However, as noted above there is not a direct flow of shallow groundwater from the ponds to the river. There will be some lateral and vertical diffusion of MWE contaminants that have seeped from the ponds, laterally in such a manner as to enter the river. But as indicated from the shallow groundwater surface in the vicinity of the pond the bulk of the flow from beneath the ponds will be parallel to and/or away from the river, so only some fraction of the seepage and its parameter load can be considered likely to enter the river.

The effects of pond seepage on shallow groundwater quality in bores down-gradient from the ponds is shown to be not greater than minor. Nitrogen species are on average more concentrated in bores up-gradient from the ponds than in the down-gradient area that could possibly be affected by seepage. DRP is less concentrated in two bores away from the ponds than in bore 325269C, so it is unlikely that phosphorus is being elevated in local groundwater as a result of seepage beyond the immediate locality of the ponds. Further, as is shown in Tables 6.1 and 6.2 of LEI 2013, none of the down-gradient bores identified is used for domestic purposes.

The assessment of phosphorus concentrations and daily seepage mass indicate a less than minor P load being contributed directly to the Oroua River.

The effects of the pond seepage on shallow groundwater may therefore be considered to be no more than minor.

8.5.3 Deeper Groundwater Chemistry

Section 8.5.2 above addresses the assessed effects of pond seepage on groundwater intercepted by bores not greater than 10 m deep. There are also bores greater than 50 m deep in the ANZ area, and this section considers the measured effects of pond seepage on the groundwater accessed by these deeper bores.

In the ANZ vicinity are 5 bores accessing groundwater at a depth below 50 m. Details of the composition of samples taken from these bores are given in Table 8.3 below.

Issues illustrated in and arising from Table 8.3 are as follows:

- DRP concentration is in a narrow range between 0.004 and 0.008 g/m^3, the lower figure being the detection limit with the analytical method used.
- The highest concentrations of SIN (0.63 and 0.879 g/m^3) were found at comparatively up-gradient sites, being the ANZ water treatment site bore and Guy's bore, respectively. The three down-gradient deep bores, with SIN concentrations of 0.430, 0.457, and 0.570 g/m^3 respectively, cannot be considered to demonstrate evidence of contamination from the pond seepage.

It is noted that the Dalcam bore is no longer used by Dalcam. Precipitates from the water were leading to a requirement for frequent changes of the filtration system in use, so an arrangement was reached where ANZ provide potable water to meet all of Dalcam's needs. This agreement is not connected to any inference that ANZ is adversely impacting on groundwater quality.

No evidence has been found of any effect on the quality of deep groundwater that could be attributed to ANZ's pond seepage.

Table 8.3: Composition of Deep Bore Groundwater Samples, ANZ Locality

Identification	Unit	325047 (Golf Club)	325125 (ANZ Office)	325371 (Water Treatment)	325321 Dalcam	Guys
Sampling Date		15/05/2014	15/05/2014	15/05/2014	18/06/2014	18/06/2014
Bore depth	m	111.60	86.50	73.20	>50	>50
Temperature	^oC	NA	NA	NA	13.2	14
pH	pH Units	7.3	7.4	7.5	7.8	6.5
Electrical Conductivity (EC)	mS/m	30.3	30.9	29.9	28.4	14.4
Chloride	g/m^3	23	23	25	25	6.2
Total Nitrogen	g/m^3	0.45	0.36	0.63	0.51	0.94
Ammoniacal-N	g/m^3	0.40 #2	0.43 #2	0.63	0.57 #2	< 0.010
Nitrite-N	g/m^3	0.005	< 0.002	< 0.002	< 0.002	< 0.002
Nitrate-N	g/m^3	0.052	< 0.002	< 0.002	< 0.002	0.89
Nitrate-N + Nitrite-N	g/m^3	0.057	< 0.002	< 0.002	< 0.002	0.89
SIN	g/m^3	0.457	0.430	0.630	0.570	0.890
TKN	g/m^3	0.39 #2	0.35 #2	0.63	0.51 #2	< 0.10
DRP	g/m^3	0.008	0.006	< 0.004	< 0.004	0.005
Total Phosphorus	g/m^3	0.28	0.33	0.26	0.23	0.016
Total Sulphide	g/m^3	< 0.002	< 0.002	< 0.002	< 0.002	0.007
$cBOD_5$	g O_2 /m^3	< 2	< 2	< 2	< 2	< 2
Escherichia coli	MPN / 100mL	10	< 1	< 1	< 1	< 1

8.6 The Discharge of MWE to Surface Waters of the Oroua River

The full assessment of the effects of the proposed discharges is given in Appendix G, the findings of which are summarised below.

8.6.1 Summer Discharge, Current and Proposed

In summer, the discharge is not currently allowed to operate at flows below three times the median flow. This provision is also proposed to be carried forward into the new consent; however, this flow cutoff is higher (more stringent) than any of the flow cutoffs (median or Q_{20}) set in the OPOV water quality targets. As a result, the discharge (both current and proposed) during the summer months will comply with all the OPOV water quality targets containing flow cutoffs (DRP, SIN, POM, ScBOD5, water clarity, *E. coli*).

Some of the OPOV targets do, however, apply at all river flows. These are:

- total ammonia-nitrogen (chronic and acute);
- water clarity change; and
- biological indicators (periphyton biomass and cover, MCI and changes in QMCI).

The assessment presented in Appendix G shows that both the current and proposed river discharges are predicted to comply with the total ammonia-N and water clarity change targets at all times, and thus are not expected to result in any more than minor effects in relation to these water quality determinands.

8.6.2 Winter Discharge, Current

The modelling assessment presented in Appendix G indicates that the current discharge is not likely to cause any breaches of the OPOV targets relating to $scBOD_5$, POM, water clarity or total ammonia-nitrogen.

The OPOV targets were designed to be set at levels that, if complied with, avoid significant adverse effects on river values. The current discharge is therefore not expected to result in any significant adverse effects associated with these water quality determinands.

The current discharge is however predicted to result in material increases in in-river nutrient concentrations at flows below Q_{20}. The OPOV target for DRP concentration is just met upstream of the discharge, but is predicted to be largely exceeded downstream of the discharge. The OPOV target for SIN concentration is however expected to be met both upstream and downstream of the discharge in spite of predicted increase between the two sites.

Consequential effects on periphyton growth are difficult to predict with certainty, however, the three approaches undertaken (a qualitative risk assessment and two modelling approaches) indicate that the current discharge does occur at times when river flow conditions are suitable for periphyton growth and accumulation, and may result in periphyton increases in the order of 5 to 35%. Periphyton growth increases of this order may be measurable, which is supported by the measurable increase in periphyton cover reported by Stark (2011). However, whether these increases would lead to actual breaches of the OPECDV periphyton biomass and/or cover targets is not able to be assessed robustly due to insufficient data.

8.6.3 Winter Discharge, Proposed

The proposed discharge regime is predicted to result in about a 10% increase in the total annual volume of effluent and the total annual load of contaminants discharged to the river, compared with the current scenario. However, the timing of the proposed discharge to the river is different from the current scenario.

The proposed scenario sees a complete elimination of the discharge to the Oroua River at flows below the median flow. Periods of low river flow are usually considered the most critical times for discharges of contaminants to streams and rivers, due to (1) less dilution available due to lesser volumes of water in the river leading to higher contaminant concentration increases downstream of the discharge, and (2) a higher risk of biological effects of contaminants, for example, excessive periphyton growth and accumulation are more likely to occur during periods of stable/low river flows. By eliminating the discharge to the river at flows below median flow, the proposed discharge regime eliminates any risk of effects during the most critical times.

The modelling assessment presented in Appendix G predicts that the proposed discharge will cause lesser effects on water clarity and on concentrations of $scBOD_5$, POM, and total ammonia-nitrogen than the current scenario, and thus is unlikely to cause any breaches of the OPECDV targets relating to these water quality determinands. As a result, the proposed discharge is not expected to result in any significant adverse effects associated with these water quality determinands.

The proposed discharge regime also results in significant reduction in the proportion of effluent and contaminant loads discharged at flows below Q_{20}. As a result, the effects of the proposed discharge on in-stream dissolved nutrient concentrations (DRP and SIN) are predicted to be 87% less than under the current scenario.

Potential effects on periphyton growth were assessed by three methods: one qualitative and two modelling methods. All three methods are in general agreement that the effects of the proposed discharge are likely to be significantly less than those of the current discharge. Predicted concentration increases under the proposed scenario are in the order of 1 to 10%. If correct, increases of this magnitude would be very unlikely to be able to be detected using standard monitoring methods, given the large error generally associated with periphyton biomass measurements.

Although the effects of the discharge under the proposed scenario are predicted to be less than what they currently are, some increase over background is still expected, and it is not possible to assess with certainty whether or not this increase will result in exceedances of the OPOV periphyton biomass or cover targets. This is in part due to the lack of knowledge of the current effects of the discharge. For these reasons, further monitoring and modelling of periphyton growth in this reach of the Oroua River would be advisable when the proposed discharge regime is implemented.

8.7 Effects on Habitats

The primary habitat potentially affected by the proposed activities is the aquatic habitat of the Oroua River.

Phosphorus, nitrate nitrogen and ammoniacal nitrogen are the three parameters considered likeliest to have effects on habitat values. The effects of BOD, suspended solids and *E. coli* on habitat values are considered to be not greater than minor, given that those effects will occur only when river flows exceed 7.59 m^3/s outside the summer season, and when the river is at flood flows during the summer.

The effects of the MWE discharge on habitats were assessed as reported in Appendix G, with particular reference to periphyton and macroinvertebrates. The main effect on habitats will be an improvement in receiving water quality under the proposed river discharge regime, when compared to the present situation. As noted in Section 8.6 above, there will continue to be **no discharge** to the river during the period 1 December to 31 March unless the river flow exceeds 20.9 m^3/s and other specified conditions are met, so there is expected to be no effect on habitats during that summer period. During the balance of the year, at times when river flow lies between 7.59 m^3/s and 16.2 m^3/s, the rate of discharge will be calculated to ensure that DRP concentration in receiving waters does not increase by more than 0.005 g/m^3. Only at river flows exceeding 16.2 m^3/s during the winter will the discharge occur irrespective of DRP loading, but even then only at a rate not exceeding 3,000 m^3/d; at those high river flow levels bed mobility will ensure that no periphyton extension is caused. And as explained in Section 8.5.2 above, the DRP loading that may be expected as a worst case to be contributed to the river as a result of pond seepage will be some 25 times lower than can be detected, so habitat effects from pond seepage may be considered to be less than minor.

The discharge to date is thought to be having an adverse effect on the freshwater habitat of the Oroua River downstream of the discharge. Periphyton is not greatly changed, but macroinvertebrates are considered to have been significantly impacted (Stark, 2011; Aquanet, 2014-Appendix G). It is only possible to record and measure ecological change once it has occurred; predictions of changes in periphyton or macroinvertebrates that may occur in response to changes to the MWE discharge are imprecise. Nevertheless, a significant re-allocation of discharges to higher river flow brackets, a significant increase in the low flow cut-off below which there will be no discharge, and a significant increase in the allowed dilution factor are expected to contribute a significant improvement in the quality of the habitat of the Oroua River bed downstream from the discharge. This improvement is expected to be expressed as a visual improvement in the river environs as well as an enhancement in the habitat of trout.

The proposed discharge structure and bed level control structure are not expected to have any impact on the waters of the Oroua River itself; they will be constructed in the dry, and once in place will have no effect on river flows. The effect of the bed level control structure is intended to be an enhancement of ecological connectivity between the Otoku Stream and the Oroua River, without adverse effects.

Other habitats outside the Oroua River are not expected to be affected by the proposed discharges.

8.8 Effects on Infrastructure

The proposed discharges are not expected to have any impact on infrastructural assets.

There is the potential for the proposed discharge structure and bed level control structure to impact upon the integrity and functionality of the river control works which are managed by HRC Operations Group for the purpose of the prevention of damage by floods. It is for this reason that OPOV makes specific provision to regulate the erection of structures in waterways that have such river control works.

The proposed structures are designed to remain durably in place during flood flows, without in any way diverting or obstructing river flows. The structures will be for the purpose of securing the small areas of river bed and bank involved, and are expected to have a less than minor effect on the infrastructural assets associated with the river. Further detail is provided in Appendix K to this report.

8.9 Effects on Amenity, Community, Cultural and Heritage Values

The Mauri of the Oroua River is of relevance and significance to Iwi, both in the ANZ locality and downstream, and is not enhanced by the discharge of MWE. Any potential adverse effect from the discharge is, however, significantly reduced by avoiding any discharge when river flow is less than median flow (7.59 m^3/s), by avoiding any discharge during summer when river flow is less than 3 x median flow (21 m^3/s), and by discharging a significant proportion of the plant's total MWE flow to land rather than to the river.

The discharge structure that is proposed is being designed in consultation with local Iwi to maximise the interaction of the discharge to river with the soil and plants prior to discharge to the river. This includes allowing for a high rate land passage where the MWE can come into contact with vegetation and soil.

The amenity value of the river is not enhanced by the discharge. The potential adverse effect of the discharge is, however, significantly reduced by avoiding any discharge when river flow is less than median flow (7.59 m^3/s), by avoiding any discharge during summer when river flow is less than 3 x median flow (21 m^3/s), and by discharging a significant proportion of the plant's total MWE flow to land rather than to the river. Amenity value is also protected to a degree by the application of a high dilution factor requirement to the discharge, to ensure that any contaminants discharged are highly diluted in the receiving waters.

The community value of the river is not enhanced by the discharge. The adverse effect of the discharge is, however, significantly reduced in the same manner as for the Mauri and amenity values.

Heritage values that could be affected by the discharge have not been identified. The main Dalcam building on land adjoining ANZ is recorded as a heritage building in the operative district plan, but it will not be affected by the discharges in any way.

For the cultural, amenity and community values, the timing of the discharge to the river means there is no discharge under normal flow conditions during the summer, nor at low flows (below median) at other times of the year, when direct use of the river is most likely to be made. The times and river flow levels at which the discharge is proposed to be allowed are generally times and flows when the river is not likely to be directly used by members of the community.

It may be considered that while there is an effect on the Cultural, Amenity and Community values of the Oroua River as a result of the MWE discharge, the severity of this effect is not greater than minor.

The discharge to land will take place behind buffer margins from public roads and adjoining properties set to ensure that the activity has a less than minor effect on amenity and other values outside the land application areas. The discharge to groundwater is not expected to have any impact on amenity, community, cultural or heritage values.

The proposed bed level control structure in the Otoku Stream mouth is specifically intended to enhance the cultural value of the tributary stream, by improving its ecological connectivity with the Oroua River and enhancing the kai management opportunities for Iwi in that stream.

8.10 Effects on Air Quality

The various discharges to air from the operation of the ANZ plant are authorised by consents 105567 and 105664, which are not scheduled to expire until 2029.

The proposed discharges to surface water and to groundwater are not expected to have any effect on air quality.

The discharge of MWE to land by spray irrigation may be expected to have effects parallel with those of farm dairy effluent application, which is already authorised on part of Byreburn Farm by consent 106705, which is scheduled to expire in 2031. Potential effects arising from spray irrigation will be managed by the observance of buffer margins between irrigated areas and public roads or private properties. It is also proposed to develop irrigation operation protocols to factor wind speed and direction into operational decision-making, with a view to avoiding as far as practicable irrigation at times and/or in places that may carry a greater risk of odour propagation into potential receptor environments. These measures are expected to ensure that any such effects will be no greater than minor. This is further discussed in Appendix F.

9 MITIGATION OF ENVIRONMENTAL EFFECTS

9.1 Effects on Soil

The effects of the proposed land discharge of MWE from ANZ on soil will be mitigated by the measures described below.

9.1.1 Identification of Limiting Parameter

Under the current land discharge regime, P accumulation has been identified as the parameter of most concern. In the design of an application regime for the proposed activity P has been adopted as the limiting parameter. This means that if a limit is set for P and the other key parameters (available land, hydraulic load, and nitrogen load) are calculated based on the acceptable P load, then this will result in no exceedance of a recommended limit for any other parameter.

9.1.2 Determination of Maximum Application Rate of Limiting Parameter

It has been assessed that a P load of 60 kg P/ha/y can be sustainably applied to the site. At this rate plant uptake will account for most applied P with soil sorption accounting for any remainder.

9.1.3 Limitation of Additional Nutrient Sources

Limits are proposed for the total nutrient load to the site to avoid excessive application from all sources, including MWE.

9.1.4 Avoidance of Ponding and Run-off

The proposed land application system and its management will ensure that there is no ponding or surface run-off of MWE, nor any through-flow of applied MWE to shallow groundwater, thus ensuring there is no direct discharge of contaminants into any waterway.

9.1.5 Land Application as Mitigation

The proposed land application system is itself the primary mitigation measure against adverse effects of the discharge of MWE directly to the Oroua River. The application of an increased proportion of ANZ's total MWE production to land enables the avoidance of discharge to the river in times of low flow, and a reduction of the consequent environmental effects of that river discharge.

9.2 Effects on Groundwater

The effects of seepage from the ANZ wastewater treatment ponds on groundwater are mitigated by the measures described below.

9.2.1 Limited Permeability

It has been shown in Section 5.7.2 that as a "worst case" the permeability of the existing clay pond liner is of the order of 1 x 10^{-8} m/s, involving a rate of seepage of **up to 50 m^3/d**. The fact that the clay liner has been undisturbed in place for over 40 years has allowed an accumulation of anaerobic sludge to enhance the natural seal provided by the original clay liner material. While the rate of seepage from the ponds has not been definitively established, based on actual monitoring it is almost certainly not greater than the assessed worst case, and may yet be shown to be less than that.

9.2.2 Phosphorus Adsorption

As described in Section 8.5 (Table 8.1) the concentration of DRP in shallow groundwater from the bore closest down-gradient from the ponds (bore 325269C) is reduced by a factor of over 170 from the DRP concentration in the MWE in the ponds. The equivalent reduction in SIN concentration from the ponds to bore 325269C is about three-fold. If all the DRP and all the SIN detected in Bore 325269C are derived by seepage from the ponds, then much less of the DRP is getting as far as the bore than is the case for SIN. (It is noted here that there are elevated levels of both DRP and SIN in some bores up-gradient from the ponds, so **not all** of those parameters in bore 3255269C is necessarily derived from pond seepage.)

The explanation for the marked reduction in DRP concentration between the MWE in the ponds and groundwater in bore 325269C is that phosphorus is readily adsorbed onto clay minerals. Even if DRP is initially discharged with the seepage from the ponds, it does not propagate far in the underlying groundwater. An effect of the clay liner is a marked reduction in DRP in the seepage.

9.2.3 Distance from Other Users

There are other users of groundwater located down-gradient from the ANZ ponds. The nearest bores to the ponds are 31 Matai and 23 Matai, about 500 m away. Other bores for which details were available are listed in Table 5.5; these include 4 bores less than 10 m deep to the south side of SH 54, all at least 800 m distant from the ANZ ponds. Bore 28 Aorangi is located over 600 m south of the ponds, and not directly down-gradient from the ponds. This separation distance in itself serves as a form of mitigation.

9.2.4 Other Uses of Shallow Groundwater

The uses of shallow groundwater from bores in the ANZ locality for which data could be accessed are tabulated in Tables 6.1 and 6.2 of LEI (2013.) None of these bores are used for the delivery of domestic water supply. This is informally considered to be due to the comparatively poor quality of local shallow groundwater. This reduces the sensitivity of the local shallow groundwater to any effects of seepage from the ANZ ponds.

9.2.5 Other Uses of Deeper Groundwater

The users, uses and quality of groundwater deeper than 50 m below the land surface in the ANZ vicinity is described in Section 8.5.3 above. Deeper groundwater has the potential to move into other areas, potentially carrying any contamination with it to compromise the quality of deeper groundwater in those other places. However, with poorer deep groundwater quality up-gradient from the ponds than down-gradient, no such contamination as a result of pond seepage is evident. That contamination of deep groundwater is not shown to occur within 500 to 800 m down-gradient from the ponds mitigates the likelihood that such contamination is spreading any further afield.

9.3 Effects on Surface Water

The effects of the proposed discharge of MWE from ANZ to the surface waters of the Oroua River will be mitigated by the following measures:

9.3.1 Timing of Discharge to Oroua River

It is proposed that the discharge of treated MWE to the Oroua River will not occur between 1 December and 31 March, **unless** river flow is greater than 3 x median flow (>20,913 L/s), in which case a discharge may be allowed if specified criteria are met. This means at times of the year when contact recreational use of the river is an option, there will be no discharge of ANZ

MWE to the river. Contact recreational use of the river will not be compromised by the proposed discharge regime.

9.3.2 Flow Relationships of Discharge to Oroua River

It is proposed that discharges of MWE to the Oroua River will be coordinated with measured river flows, such that most discharge will only occur when river flow is over its 20th flow exceedance percentile (20th FEP) of 16,193 L/s.

It is also proposed that MWE discharges will occur when river flow is between Median (7,590 L/s) and 20th FEP, but only at a MWE discharge rate which will be low enough to ensure that OPOV water quality target values for phosphorus concentrations in the receiving water, after mixing, are not exceeded.

It is further proposed that **no** discharge of MWE will occur when flow in the Oroua River is below its Median Flow of 7,590 L/s.

These relationships between river flow and MWE discharge to the river mean that when the river has low flows, and is therefore most susceptible to the potential adverse effects of the proposed discharge, there will be no discharge of MWE. Releasing the discharge only when river flows exceed the proposed thresholds, is expected to significantly reduce the ecological effects of the discharge. Much of the discharge will in fact occur when river flow is so high that gravel bed mobility will ensure that no periphyton growth can take place, thereby protecting the river bed environment for the range of other values that it has.

The proposed discharge regime results in a significant reduction in the proportion of MWE and contaminant loads discharged at flows below 20th FEP. As a result, the effects of the proposed discharge on in-stream dissolved nutrient concentrations (DRP and SIN) are predicted to be **87%** less than under the current scenario.

9.4 Effects on Air Quality

As described in Section 8.10 above, there is scope for spray irrigation of MWE onto land to generate aerosols, which may propagate odours into potential receptor environments. There is a three-pronged approach to mitigating this effect, as follows:

- Buffer margins between irrigated areas and public roads or private properties will be excluded from irrigation of MWE and application of solids;
- Flushing of irrigation pipework with clean water following MWE application will reduce the likelihood of anaerobic conditions developing in residual MWE in that pipework; and
- It is proposed to develop irrigation operation protocols to factor wind speed and direction into operational decision-making, with a view to avoiding as far as practicable irrigation at times and/or in places that may carry a greater risk of odour propagation into potential receptor environments.

9.5 Effects of Riverbed Structures

The potential effects of the construction of the proposed structures on river water quality will be avoided by undertaking the construction work in the dry.

The potential adverse effect of the presence of the proposed structures on flood routing capacity and the integrity and functionality of nearby flood control assets and activities will be avoided by the structures being specifically designed and constructed so as to remain durably attached to their respective substrates, and so as to impose no reduction on channel cross sectional areas.

The proposed bed level control structure is specifically intended to provide mitigation for other environmental effects, by enhancing the ecological connectivity of the Otoku Stream with the Oroua River, and improving a kai management opportunity that has been negotiated with local Iwi.

10 MONITORING PROPOSED

10.1 Monitoring of Discharge to Land

A discussion of the proposed monitoring for the discharge to land is given in Appendix F, in particular, Section 6.1. It includes maintaining an irrigation register, sampling MWE, sampling groundwater in the vicinity of the land application, and monitoring of soil health.

10.2 Monitoring of Discharge to Air

Records are to be kept of where, when and how much MWE or Organic Amendments are applied to land. These records are to include reference to relevant meteorological data to be collected by an automated weather station near the ANZ WWTP. These records will enable audits to establish the extent to which consent conditions have been complied with in regard to suspending land discharge activities in specified weather conditions.

A complaints register and reporting protocol is the other means by which potential adverse effects on air quality will be monitored.

10.3 Monitoring of Discharge to Groundwater

Direct, in-field measurement of the permeability of the pond liners by non-destructive means is considered impracticable, and an ongoing program of monitoring this is considered futile. However, a program of monitoring of the effects of seepage on nearby shallow groundwater quality is considered an effective means of establishing, and tracking, the extent to which any seepage may be adversely affecting groundwater quality.

Piezometers have been installed and sampled to establish the extent of any effects from pond seepage, and a program of ongoing monitoring of these is proposed to provide ongoing assurance of continuing compliance.

The monitoring program is proposed to involve quarterly sampling from the network of piezometers, and laboratory analysis for the following parameters;

- pH;
- Dissolved oxygen;
- Electrical conductivity;
- Biochemical oxygen demand;
- Ammoniacal nitrogen;
- Nitrate plus nitrite nitrogen;
- Dissolved reactive phosphorus;
- *E. coli.*

An annual report on the interpretation of the comparison between the analyses from the samples is proposed to be provided as part of programmed compliance management.

10.4 Monitoring of Discharge to Surface Water

Monitoring requirements for the discharge of MWE to surface water are outlined in Appendix G and include record keeping, MWE flow monitoring, MWE quality sampling, upstream and downstream river sampling.

11 EVALUATION OF EFFECTS AGAINST STATUTORY PROVISIONS

11.1 Resource Management Act

The key requirements under the Act are prescribed by s15, which requires that:

> *(1) "No person may discharge any—*
> *(a) contaminant or water into water; or*
> *(b) contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or*
> *(c) contaminant from any industrial or trade premises into air; or*
> *(d) contaminant from any industrial or trade premises onto or into land—*
> *unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent."*

Discussion

The three proposed discharge regimes involve the discharge of contaminants (meatworks effluent) into water and onto land in circumstances which may result in the contaminant entering water. National standards and plan rules do not expressly allow these discharges, so they fall to be regulated by appropriate resource consents.

The Act's provisions and specified requirements are specified and catered for within the relevant regional plan, and so are not further addressed here.

11.2 National Policy Statements and National Environmental Standards

11.2.1 National Policy Statements

The National Environmental Standard for Human Drinking Water limits the ability of a regional council to grant a discharge permit for an activity that will occur upstream of an abstraction point that provides drinking water for more than 500 people if the discharge will result in the drinking water not meeting health quality criteria or exceeding aesthetic guidelines. It further requires a consent authority to consider whether an activity could result in an event, or a consequence of an event, that may have significant adverse effect on the water quality of water at any abstraction point serving at least 25 people for more than 60 calendar days a year.

Discussion

There are no known abstractions of human drinking water from the Oroua River downstream from the ANZ discharges, so the proposed discharges are not in conflict with this requirement.

11.2.2 National Environmental Standards

The National Policy Statement for Freshwater Management (2014) has objectives and policies that are relevant to this application as follows:

> ***"Objective A1**: To safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants.*

Objective A2: *The overall quality of fresh water within a region is maintained or improved while:*

a. protecting the quality of outstanding freshwater bodies;
b. protecting the significant values of wetlands; and
c. improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.

Policy A1: *By every regional council making or changing regional plans to the extent needed to ensure the plans:*

a. establish freshwater objectives and set freshwater quality limits for all bodies of fresh water in their regions to give effect to the objectives in this national policy statement, having regard to at least the following:

i. the reasonably foreseeable impacts of climate change;
ii. the connection between water bodies.

b. establish methods (including rules) to avoid over-allocation.

Policy A2: *Where water bodies do not meet the freshwater objectives made pursuant to Policy A1, every regional council is to specify targets and implement methods (either or both regulatory and non-regulatory) to assist the improvement of water quality in the water bodies, to meet those targets, and within a defined timeframe.*

Objective C1: *To improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment.*

Policy C1: *By every regional council managing fresh water and land use and development in catchments in an integrated and sustainable way, so as to avoid, remedy or mitigate adverse effects, including cumulative effects.*

Objective D1: *To provide for the involvement of iwi and hapū, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision-making regarding freshwater planning, including on how all other objectives of this national policy statement are given effect to.*

Policy D1: *Local authorities shall take reasonable steps to:*

a. involve iwi and hapū in the management of fresh water and freshwater ecosystems in the region
b. work with iwi and hapū to identify tāngata whenua values and interests in fresh water and freshwater ecosystems in the region and
c. reflect tāngata whenua values and interests in the management of, and decision-making regarding, fresh water and freshwater ecosystems in the region.

Discussion

The Objectives A1 and A2 are met by improvements in river water quality due to improvements in the flow staging of the river discharge, and by the aquatic habitat improvement that will be consequent upon water quality improvement.

Policies A1 and A2, as well as Objective C1 and Policy C1, have effect on regional council plans and processes, rather than any direct effect on this consent application.

While Objective D1 and Policy D1 make local authorities (in their role as regulatory authorities) responsible to incorporate the interests of Iwi and Hapu into management and decision-making, the applicant here has also taken steps to engage with Iwi and Hapu, to agree upon a package of works which will assist to mitigate adverse effects of the river discharge in particular on Taonga.

A further provision introduced with the 2014 version of the NES is for the maintenance of freshwater quality to a standard sufficient for wading or boating activities by members of the public to be undertaken with safety. It is not expected that the proposed surface water discharge regime will either occur at times or river flows when wading and boating are taking place, or have any adverse effect on the suitability of the Oroua River waters for those purposes.

11.3 Regional Policy Statement

11.3.1 River Bed Structures

The **Objectives** and **Policies** of the RPS relating to the placement of the proposed structures in the river bed are as follows:

"Objective 3-1: Infrastructure and other physical resources of regional or national importance.

Have regard to the benefits of infrastructure and other physical resources of regional or national importance by recognising and providing for their establishment, operation, maintenance and upgrading.

Objective 5-4: Beds of rivers and lakes.

The beds of rivers and lakes will be managed in a manner which:

(i) sustains their life supporting capacity;

(ii) provides for the in-stream morphological components of natural character;

(iii) recognises and provides for the Schedule B Values; and

(iv) provides for infrastructure and flood mitigation purposes.

The land adjacent to the bed of reaches with a Schedule B Value of Flood Control and Drainage will be managed in a manner which provides for flood mitigation purposes.

Policy 3-1: Benefits of infrastructure and other physical resources of regional or national importance.

(a) The Regional Council and Territorial Authorities must recognise the following facilities and assets as being physical resources of regional or national importance:

(ii) existing flood protection schemes;….

Policy 3-2: Adverse effects of other activities on infrastructure and other physical resources of regional or national importance.

The Regional Council and Territorial Authorities must ensure that adverse effects on infrastructure and other physical resources of regional or national importance from other activities are avoided as far as reasonably practicable, including by using the following mechanisms:
(a) ensuring that current infrastructure, infrastructure corridors and other physical resources of regional or national importance, are identified and had regard to in all resource management

decision-making, and any development that would adversely affect the operation, maintenance or upgrading of those activities is avoided as far as reasonably practicable."

Discussion
The effect of these provisions is to recognise a priority for the requirements to protect and maintain infrastructure, which includes existing flood protection schemes. The implication for the proposed riverbed structures is that they will need to be designed and installed to the satisfaction of the managers of the Oroua River Control Scheme.

11.3.2 Discharges

The **Objectives** of the RPS relating to the management of MWE at ANZ are as follows:

"Objective 5-1: Water management values

Surface water bodies and their beds are managed in a manner which safe guards their life supporting capacity and recognises and provides for the Values in Schedule B.

Objective 5-2: Water quality

(a) Surface water quality is managed to ensure that:

(i) water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule B;
(ii) water quality is enhanced in those rivers and lakes where the existing water quality is not at a level sufficient to support the Values in Schedule B;
(iii) and (iv) (not applicable).

(b) Groundwater quality is managed to ensure that existing groundwater quality is maintained or where it is degraded/over allocated as a result of human activity, groundwater quality is enhanced."

The reach of the Oroua River affected by the proposed activities is identified in OPOV as "Middle Oroua, Mana_12b." The values for which water is to be managed are laid out in Schedule B, which for Mana_12b are specified as follows, with the term "present" indicating the presence of the value concerned:

- Life Supporting Values: present, "Hill Mixed";
- Aesthetic: present;
- Contact Recreation: present;
- Mauri: present;
- Industrial Abstraction: present;
- Irrigation: present;
- Stockwater: present;
- Existing Infrastructure: present;
- Capacity to Assimilate Pollution: present;
- Sites of Significance – Riparian: present;
- Amenity: present;
- Trout Fishery: other trout fishery (neither outstanding nor regionally significant);
- Water Supply: present;
- Domestic Food Supply: present;
- Flood Control and Drainage: present.

The six values which are **not** scheduled as being present in Mana_12b are specified as follows:

- Natural State;
- Sites of Significance – Aquatic;
- Inanga Spawning;
- Whitebait Migration;
- Sites of Significance – Cultural; and
- Trout Spawning.

Discussion
Life supporting capacity in the Oroua River is safeguarded by the proposed reduction of the effects of the river discharge, as described in Section 8.6 above.

The proposed discharges will **improve** the ability of the Oroua River to accommodate the values listed, by an extension of the times and river flow regimes during which no river discharge will occur, and a reduction of the impact of the discharges on river water quality.

To the extent that existing river water quality is at a level sufficient to support the listed values, then that water quality will be maintained by the proposed discharges. To the extent that existing river water quality is **not** at a level sufficient to support the listed values, then that water quality will be enhanced by the proposed discharges, by virtue of the reduction of the effect of the present authorised ANZ discharges.

Groundwater quality will be maintained as a result of no changes being made to the proposed discharge to groundwater by seepage from the ANZ ponds. While a groundwater quality degradation has been detected and described in Section 8.5 above, that degradation has **not** been found to adversely affect other groundwater users or uses, and has **not** been found to significantly affect surface water quality in the Oroua River.

"Objective 7-1: Ambient air quality

A standard of ambient air quality is maintained which is not detrimental to amenity values, human health, property or the life-supporting capacity of air and meets the national ambient air quality standards."

Discussion
National ambient air quality standards relate to fine particle levels and certain chemicals, none of which are involved in the air discharges of odour and aerosols arising from the proposed land discharge activities. Amenity, health, property and life-supporting capacity aspects of air quality will be protected by the proposed limitations on the land discharge activities. The proposed air discharges will meet the requirements of this Objective.

The **Policies** of the RPS relating to the management of MWE at ANZ are as follows:

"Policy 5-2: Water quality targets.

In Schedule E, water quality targets relating to the Schedule B Values (repeated in Table 5.2) are identified for each Water Management Sub-Zone. Other than where they are incorporated into permitted activity rules as conditions to be met, the water quality targets in Schedule E must be used to inform the management of surface water quality in the manner set out in Policies 5-3, 5-4 and 5-5.

The water quality targets for Mana_12b are specified in Tables E.1 and E.2 of Schedule E to OPOV are as shown in Table 11.1 below.

Table 11.1: OPOV Water Quality Targets for Mana_12b.

Determinand		Target
E. coli/100 mL	<50th %ile	260
	<20th %ile	550
Periphyton filamentous cover	%	30
Diatom or cyanobacterial cover	%	60
QMCI	%Δ	20
pH	Range	7 to 8.5
	Δ	0.5
T^0C	<	22
	Δ	3
DO (% SAT)>	>	70
$scBOD_5$ (g/m^3)	<	2
POM (g/m^3)	<	5
Periphyton (Chl*a*, mg/m^2)		120
DRP (g/m^3)	<	0.010
SIN (g/m^3)	<	0.444
Sediment Cover (%)	≤	20
MCI	>	100
Nitrogen (g/m^3)	<	0.400
	Max	2.1
Tox	%	95
Visual Clarity (m)	<50th %ile	2.5
	%Δ	30

Discussion

The discharge to surface water has been optimised, as described in Section 6.2 above, to achieve the specified water quality targets as listed above.

Policy 5-3: Ongoing compliance where water quality targets are met.

(a)Where the existing water quality meets the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality must be managed in a manner which ensures that the water quality targets continue to be met beyond the zone of reasonable mixing (where mixing is applicable).

(b) For the avoidance of doubt:

(i) in circumstances where the existing water quality of a Water Management Sub-zone meets all of the water quality targets for the Sub-zone (a) applies to every water quality targets for the Sub-zone

(ii) in circumstances where the existing water quality of a Water Management Sub-zone meets some of the water quality targets for the Sub-zone (a) applies only to those water quality targets that are met.

(iii) For the purpose of (a) reasonable mixing is only applicable to a discharge from an identifiable location.

Policy 5-4: Enhancement where water quality targets are not met.

(a) Where the existing water quality does not meet the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality within that sub-zone must be managed in a manner that enhances existing water quality in order to meet:

(i) the water quality target for the Water Management Zone in Schedule E; and/or
(ii) the relevant Schedule B Values and management objectives that the water quality target is designed to safeguard.

(b) For the avoidance of doubt:

(i) in circumstances where the existing water quality of a Water Management Sub-zone does not meet all of the water quality targets for the Sub-zone, (a) applies to every water quality target for the Sub-zone;

(ii) in circumstances where the existing water quality of a Water Management Sub-zone does not meet some of the water quality targets for the Sub-zone, (a) applies only to those water quality targets not met.

Discussion
Water quality in the receiving environment of the Oroua River upstream from the surface water discharge point meets many of the quality targets specified, but at times exceeds target levels for certain determinands. The proposed discharge to surface water will protect those values, by virtue of not occurring when river flow is less than median flow, and by managing the discharge rate to ensure that DRP concentrations in particular do not exceed specified targets, as described in Section 8.6 above.

Policy 5-6: Maintenance of groundwater quality.

(a) Discharges and land use activities must be managed in a manner which maintains the existing groundwater quality, or where groundwater quality is degraded/over allocated as a result of human activity, it is enhanced. …

(b) An exception may be made under (a) where a discharge onto or into land better meets the purpose of the RMA than a discharge to water, provided that the best practicable option is adopted for the treatment and discharge system.

Discussion
The two activities with the potential to affect groundwater quality are the discharge of MWE to land by irrigation, and the discharge of MWE to groundwater by pond seepage. As described in Section 8.4 above, the effects of the land application of MWE are expected to be improved (reduced) when compared to the present situation, as a result of applying the MWE to a larger area of land, with specified improvements to application methodology.

The land discharge is considered to enable a large environmental improvement over the situation that would occur if the entire MWE discharge was to the Oroua River. That the best practicable option has been adopted for the proposal in demonstrated in the Optimisation process described in Section 6.2 above.

The groundwater quality in the vicinity of the ANZ effluent ponds is proposed to remain unchanged, with seepage to continue as at present. While a degradation in groundwater quality in the immediate vicinity of the ponds has been demonstrated in Section 8.5 above, no degradation in groundwater quality has been found in down-gradient bores on neighbouring properties that can be attributed to the pond seepage.

Policy 5-6: Land use activities affecting groundwater and surface water quality

The management of land use activities affecting groundwater and surface water must give effect to the strategy for surface water quality set out in Policies 5-2, 5-3, 5-4 and 5-5, and the strategy for groundwater quality in Policy 5-6, by managing diffuse discharges of contaminants in the following manner:

(a) identifying in the regional plan targeted Water Management Sub-zones. Targeted Water Management Sub-zones are those subzones where, collectively, land use activities are significant contributors to elevated contaminant levels in groundwater or surface water.

(b) identifying in the regional plan intensive farming land use activities. Intensive farming land use activities are rural land use activities that (either individually or collectively) make a significant contribution to elevated contaminant levels in the targeted Water Management Sub-zones identified in (a) above.

(c) actively managing, the intensive farming land use activities identified in (b) including through regulation in the regional plan, in the manner specified in Policy 5-8.

Discussion

The irrigation of MWE onto farm land is **part of** the activity of intensive farming, having the effect of contributing water and nutrients to enhance the productivity of the farming enterprise. The irrigation activity under application here is proposed to use best practice, to ensure that it contributes positively to the farming enterprise without disproportionate adverse effect on groundwater quality.

Policy 5-9: Point source discharges to water.

The management of point source discharges into surface water must have regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, while having regard to:

(a) the degree to which the activity will adversely affect the Schedule B Values for the relevant Water Management Sub-zone;

(b) whether the discharge, in combination with other discharges, including non-point source discharges will cause the Schedule E water quality targets to be breached;

(c) the extent to which the activity is consistent with contaminant treatment and discharge best management practices;

(d) the need to allow reasonable time to achieve any required improvements to the quality of the discharge;

(e) whether the discharge is of a temporary nature or is associated with necessary maintenance or upgrade work and the discharge cannot practicably be avoided;

(f) whether adverse effects resulting from the discharge can be offset by way of a financial contribution set in accordance with Chapter 19;

(g) whether it is appropriate to adopt the best practicable option.

Discussion

The proposed regime of discharge of MWE to surface water has been designed to meet the requirements of the specified strategies.

Schedule B values specified for the Mana_12b water management sub-zone are expected to be positively affected by the change from the currently authorised discharge regime to the proposed regime.

Schedule E water quality targets are not expected to be breached by the proposed discharge regime, and in fact are the basis for deriving the discharge regime.

Both treatment and discharge are carried out using what may be regarded as best industry practice. The discharge to surface water in particular has been optimised to ensure that adverse effects below median flow in the river are removed, and the adverse effects above median flow are compliant with specified targets.

The time considerations of 5-9(d) and (e) are not considered to apply; delay in implementation is not sought, and the discharge is not temporary. A financial contribution is not regarded as appropriate in the context of the changes to the river discharge regime proposed, and the best practicable option is considered to have been adopted.

Policy 5-9: Point source discharges to land

Discharges of contaminants onto or into land must be managed in a manner which:

(b) does not result in pathogens or other toxic substances accumulating in soil or pasture to levels that would render the soil unsafe for agricultural, domestic or recreational use;

(c) has regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, and the strategy for groundwater management set out in Policy 5-6;
(d) maximises the reuse of nutrients and water contained in the discharge to the extent reasonably practicable;

(e) results in any discharge of liquid to land generally not exceeding the available water storage capacity of the soil (deferred irrigation) ;

(f) ensures that adverse effects on rare habitats, threatened habitats and at-risk habitats are avoided, remedied or mitigated.

Discussion
The proposed regime of MWE discharge to land by way of irrigation involves plant, animal and food wastes that have been processed in an export meat processing plant. While products are used and included in the MWE that have cleaning and hygiene management purpose, these are not considered likely to accumulate in such a way as render the soil in any way unsafe for future use options. The combination of sunshine, normal soil processes and low application rates are expected to ensure that there is no accumulation of pathogens.

The proposed land discharge regime has been designed to reflect the specified surface water quality management strategies, and to increase the re-use of nutrients and water to a higher level than has previously occurred. The proposed land discharge regime is designed not to exceed the available water storage capacity of the soil following irrigation, and none of the specified habitat types are included in or affected by the proposed irrigation system.

Policy 7-1: National Environmental Standards
The National Environmental Standards set out in Table 7.1 must be adopted as ambient air quality standards for the Region and ambient air quality must be:
(a) maintained or enhanced in those areas which meet the standards, and

(b) enhanced in those airsheds which do not meet the standards in accordance with the air quality categories and designated responses in Table 7.2.

Policy 7-2: Regional standards for ambient air quality
In addition to the National Environmental Standards set out in Policy 7-1, ambient air quality must be managed in accordance with the regional standards set out in Table 7.3.

Policy 7-3: Regulation of discharges to air
Discharges of contaminants into air will be generally allowed, provided:
(a) the effects of the discharge are consistent with the approach set out in Policy 7-1 for implementing the National Environmental Standards for ambient air quality, and
(b) the discharge is consistent with the regional standards for ambient air quality set out in Policy 7-2."

Discussion
National ambient air quality standards relate to fine particle levels and certain chemicals, none of which are involved in the air discharges of odour and aerosols arising from the proposed land discharge activities.

The regional standard requires odours, dust, smoke, water vapour, agrichemicals, gases and other contaminants not to cause offensive or objectionable effects beyond the property boundary. The discharge of MWE and Organic Amendments to land is to be operated, and restricted, in such a way as to ensure that the regional standard is met at all times.

The discharge to air will be consistent with the specified standards, and therefore meets the requirements of the operative regional policy statement.

11.4 Regional Plan

HRC's One Plan Operative Version (OPOV) is the regional plan under which the proposed activities will be regulated. Specific Objectives and Policies of the plan that are relevant to the proposed activities are as follows:

Objective 14-1: Management of discharges to land and water and land uses affecting groundwater and surface water quality.

The management of discharges onto or into land (including those that enter water) or directly into water and land use activities affecting groundwater and surface water quality in a manner that:

(a) safeguards the life supporting capacity of water and recognises and provides for the Values and management objectives in Schedule B,

(b) provides for the objectives and policies of Chapter 5 as they relate to surface water and groundwater quality, and

(c) where a discharge is onto or into land, avoids, remedies or mitigates adverse effects on surface water or groundwater.

Discussion
The proposed discharges of MWE to land by irrigation, by seepage from the ANZ effluent treatment ponds, and by direct discharge to the Oroua River meet this Objective.

The discharges safeguard the life-supporting capacity of the Oroua River by meeting the following criteria:

- The proposed discharge to land by irrigation has been designed to reduce the effects of the current activity on groundwater by applying the MWE to a larger area of land, with an improved application regime;
- The proposed discharge to groundwater by pond seepage has been shown not to have a direct groundwater path from the ponds to the Oroua River, and the critical DRP loading of the seepage assessed as a worst case is demonstrated to have a less than minor impact on the river; and
- The direct discharge to the river is proposed to be managed in such a way as to avoid discharges when river flow is below Median value, and to ensure that DRP loading in the receiving waters after mixing does not exceed target concentration at all river flows between Median and 20thFEP, thus **improving** the quality of the waters of the Oroua River when compared to the presently authorised discharge.

The Objectives and Policies of Chapter 5 of OPOV are demonstrated to have been met, and the adverse effects of the land discharge and the pond seepage discharge potential adverse effects are shown to be avoided.

Policy 14-1: Consent decision-making for discharges to water.

When making decisions on resource consent applications, and setting consent conditions, for discharges of water or contaminants into water, the Regional Council must specifically consider:

(a) the objectives and policies 5-1 to 5-5 and 5-9 of Chapter 5,

and have regard to:

(b) avoiding discharges which contain any persistent contaminants that are likely to accumulate in a water body or its bed,
(c) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

(i) it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 5, or
(ii) the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water, and

(d) the objectives and policies of Chapters 2, 3, 6, 9 and 12 to the extent that they are relevant to the discharge.

Discussion
The compliance of the proposed discharges with the Objectives and Policies of Chapter 5 of OPOV has been demonstrated in Section 11.3 above.

The MWE material to be discharged does not contain significant amounts of persistent contaminants, and particularly not those likely to accumulate in the Oroua River or its bed. Best practicable option has been adopted, as demonstrated by the Optimisation in Section 6.2, by the improvements to the irrigation methodology described in Section 5.6, and by the finding in Section 8.5 that there is no significant adverse effect on groundwater quality beyond the ANZ property that can be attributed to pond seepage.

Chapters 2, 3, 6, 9 and 12 of OPOV respectively address Te Ao Maori, Waste, Indigenous Biodiversity, Natural Hazards and General Objectives and Policies. Te Ao Maori issues have been addressed in ANZ's consultation with Ngāti Kauwhata. Waste objectives are met by the recycling of nutrients that would otherwise be wasted, onto farm land. Indigenous biodiversity values are not impacted by the proposed discharges, and the discharges do not either exacerbate or suffer exposure to natural hazards to any greater extent than any other equivalent industrial activity.

Policy 14-2: Consent decision-making for discharges to land.

When making decisions on resource consent applications, and setting consent conditions, for discharges of contaminants onto or into land the Regional Council must have regard to:

(a) the objectives and policies of Chapter 5 regarding the management of groundwater quality and discharges,
(b) where the discharge may enter surface water or have an adverse effect on surface water quality, the degree of compliance with the approach for managing surface water quality set out in Chapter 5,
(c) avoiding as far as reasonably practicable any adverse effects on any sensitive receiving environment or potentially incompatible land uses, in particular any residential buildings, educational facilities, churches, marae, public areas, infrastructure and other physical resources of regional or national importance identified in Policy 3-1, wetlands, surface water bodies and the coastal marine area,
(d) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

(i) it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 5,
(ii) the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water,

(e) avoiding discharges which contain any persistent contaminants that are likely to accumulate in the soil or groundwater, and
(f) the objectives and policies of Chapters 2, 3, 6, 9 and 12 to the extent that they are relevant to the discharge.

Discussion
The compliance of the proposed activities with the Objectives and Policies of Chapter 5 of OPOV have been described in Section 11.3 above. Adverse effects on sensitive receiving environments are avoided as far as possible. Appropriate buffer margins are to be maintained between the land discharge activity and all waterbodies, roads, houses and non-ANZ properties. There are no wetlands nearby and the coastal marine area is 30 km away. The other policy references here have been addressed in relation to Policy 14-1 above.

Policy 14-4: Options for discharges to surface water and land

When applying for consents and making decisions on consent applications for discharges of contaminants into water or onto or into land, the opportunity to utilise alternative discharge options, or a mix of discharge regimes, for the purpose of mitigating adverse effects, applying the best practicable option, must be considered, including but not limited to:

(a) discharging contaminants onto or into land as an alternative to discharging contaminants into water,
(b) withholding from discharging contaminants into surface water at times of low flow, and
(c) adopting different treatment and discharge options for different receiving environments or at different times (including different flow regimes or levels in surface water bodies).

Discussion
This policy provision is met in full by the proposed activities. The land discharge component of the CLAWD system proposed is the alternative to a total river discharge. The river discharge is proposed to be withheld during non-high flows between 1 December and 31 March, and at all other times of the year when river flow is less than its Median value of 7.59 m^3/s. The CLAWD system is specifically to enable different discharge options for different environments at different times and circumstances.

Policy 14-5: Management of intensive farming land uses.

In order to give effect to Policy 5-7 and Policy 5-8, intensive farming land use activities affecting groundwater and surface water quality must be managed in the following manner:

(a) The following land uses have been identified as intensive farming land uses:

(i) Dairy farming
(ii) Commercial vegetable growing
(iii) Cropping
(iv) Intensive sheep and beef

(b) The intensive farming land uses identified in (a) must be regulated where:

(i) They are existing intensive farming land uses, in the targeted Water Management Sub-zones identified in Table 14.1.
(ii) They are new (i.e. established after the Plan has legal effect) intensive farming land uses, in all Water Management Sub-zones in the Region.

(c) Nitrogen leaching maximums have been established in Table 14.2.
(d) Existing intensive farming land uses regulated in accordance with (b)(i) must be managed to ensure that the leaching of nitrogen from those land uses does not exceed the cumulative nitrogen leaching maximum values for each year contained in Table 14.2, unless the circumstances in Policy 14-6 apply.
(e) New intensive farming land uses regulated in accordance with (b)(ii) must be managed to ensure that the leaching of nitrogen from those land uses does not exceed the cumulative nitrogen leaching maximum values for each year contained in Table 14.2.
(f) Intensive farming land uses regulated in accordance with (b) must exclude cattle from:

(i) A wetland or lake that is a rare habitat, threatened habitat or at-risk habitat.
(ii) Any river that is permanently flowing or has an active bed width greater than 1 metre.
(g) All places where cattle cross a river that is permanently flowing or has an active bed width greater than 1 metre must be culverted or bridged and those culverts or bridges must be used by cattle whenever they cross the river.

Discussion
The proposed land discharge is not in itself an intensive farming land use, but rather is part of a package of activities that collectively comprise intensive farming. The Mana_12b water management zone is not included in Table 14-1 of OPOV, and is therefore not a targeted water

management subzone. Nor is the intensive farming system, including its attendant MWE irrigation, a new activity; it has taken place on Byreburn Farm for some 20 years. Exclusions of cattle and culverting of streams relate to livestock management rather than to any facet of the proposed activity.

Objective 15-1: Air quality

The management of air quality in a manner that has regard to:

(a) maintaining or enhancing ambient air quality in a manner that safeguards the health of the Region's community,

(b) meeting the regional ambient air standards (Table 7.3) and National Environmental Standards (Table 7.1),

(c) managing air quality so that it is not detrimental to amenity values, and

(d) managing fine particle (PM10) levels to ensure that they are reduced in unacceptable airsheds and managed in other areas to ensure compliance with the national ambient air quality standard for PM10.

Discussion

The proposed discharges to air arising from the discharge of MWE and Organic Amendments to land will meet this Objective by maintaining ambient air quality beyond the boundaries of the properties involved, thereby meeting regional standards and protecting amenity values. Fine particle emissions are not expected.

Policy 15-2: Consent decision-making for other discharges into air

When making decisions on resource consent applications and setting consent conditions for discharges of contaminants into air, the Regional Council must have regard to:

(a) the objectives and policies of Chapter 7 including:

(i) the degree of consistency with the approach set out in Policy 7-1 for implementing the National Environmental Standards for ambient air quality,

(ii) the degree of compliance with the regional standards for ambient air quality set out in Policy 7-2, and

(iii) for discharges of fine particles, the approaches for managing fine particles (PM10) in Policies 7-5, 7-6 and 7-7, and the likely contribution of the proposed discharge to cumulative adverse effects in an unacceptable airshed or degraded area as identified under these policies,

(b) the guidelines in Section 15.3 for managing noxious, dangerous, offensive and objectionable effects,

(c) any national policy statements, national regulations, or nationally-accepted guidelines or codes of practice relevant to the activity,

(d) the location of the discharge in relation to, and any associated effects on, sensitive areas including, but not limited to:

(i) residential buildings,

(ii) public places and amenity areas where people congregate,

(iii) education facilities,

(iv) public roads,

(v) surface water bodies,

(vi) wāhi tapu, marae and other sites of significance to hapū and iwi,

(vii) domestic, commercial and public water supply catchments and intakes,

(viii) rare habitats, threatened habitats and at-risk habitats, and

(ix) sensitive crops or farming systems (including certified organically farmed properties and greenhouses),

(e) effects on scenic, landscape, heritage and recreational values,

(f) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

(i) numerical guidelines or standards establishing a level of protection for a receiving environment are not available or cannot easily be established,
(ii) insufficient monitoring data is available to establish the existing air quality with sufficient certainty, or
(iii) the likely adverse effects are minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on air quality,
(g) the need for contingency measures to avoid accidental discharges, including discharges arising from mechanical failure, and
(h) adverse effects on aircraft safety from high velocity vertical discharges to air.

Policy 15-3: Regional Rules for Air
The Regional Council must regulate discharges into air through regional rules in accordance with Objectives 12-1, 12-2 and 15-1 and Policies 12-1 to 12-8."

Discussion
The proposed discharges of odours and aerosols to air will meet the specified standards in these Policies. Buffer margins are proposed to protect all assets listed in Policy 15-2(d) from the effects of the discharge. The scenery will not be affected by the air discharge, and best practice is to be adopted in applying management measures to limit the likelihood of effects extending beyond the property boundaries involved. Any mechanical failure may be expected to stop the land discharge, and the consequent air discharge, rather than lead to any increase in adverse effects. No aspect of the air discharge is considered capable of impacting on aircraft safety.

The objectives and policies of Chapter 12 (General objectives and policies) deal with procedural matters for the consent authority, and address matters including consent conditions, duration, review and enforcement. As such they are applicable to the manner in which this consent application is to be processed, but not directly to the proposed activities or their effects.

The regional plan provisions regulating discharges to air are met by the proposed activity.

Policy 17-1: Consent decision-making for activities in, on, under or over the beds of rivers and lakes (including modified watercourses but excluding artificial watercourses)

When making decisions on resource consent applications, and setting consent conditions, for activities in, on, under or over the bed of a river or lake (including modified watercourses but excluding artificial watercourses) the Regional Council must:

(a) have regard to the extent to which the activity is consistent with best management practices,
(b) seek to avoid where reasonably practicable any adverse effects on any other lawful activity in, on, under or over the bed of the river or lake, including existing structures,
(c) have regard to whether the activity is of a temporary nature or is associated with necessary maintenance work, and
(d) have regard to the objectives and policies of Chapters 2, 3, 5, 6, 9 and 12 to the extent that they are relevant to the activity.

Discussion
The proposed construction of a discharge structure and a bed level control structure in the bed and banks of the Oroua River and the mouth of its Otoku Stream tributary will be designed and undertaken in such a manner as to meet the requirements of this policy. Best management practices will be adopted, and adverse effects will be avoided. While construction activity will be

temporary, the structures will be permanent. The objectives and policies of Chapters 2 to 12 have been addressed above, and no conflict with any of their provisions is anticipated.

11.5 District Plan

The land discharge is proposed to take place on land zoned in the district plan as Industrial (ANZ property, and part of the Byreburn Farm which occupies land leased from ANZ,) and Rural 1 (the balance of Byreburn Farm, plus the rural smallholdings located between Campbell Road, Matai Street, Ratanui Street, and the main ANZ landholding.)

The pond seepage occurs on Industrial zoned land, and the river discharge takes place on land zoned as Flood Channel 2.

The district plan provides at Rule 3B, Rural Zones, for farming (and farm buildings) to be a permitted activity. Rule B3.3 specifies standards for permitted activities within this zone; 21 issues are specified with such standards, the only one of which being applicable to the proposed discharge activity is "(I), Effluent disposal and effluent ponds", which specifies separation requirements for effluent ponds but makes no such reference to the activity of effluent application to the land. The proposed activity, being the irrigation of farm land with MWE, therefore meets plan requirements and may be considered to be a permitted activity.

The district plan provides at Rule 5B, Industrial Zone, for any industry other than High Impact Industries to be a permitted activity. High Impact Industries are defined in Rule E, Definitions (38) with a list of 13 such activities, none of which applies to the application of industrial wastewater to land as part of an industrial process. Rule B5.3 specifies standards for permitted activities within this zone; 13 issues are specified with such standards, none of which are directly applicable to the proposed discharge activity. The proposed activity is noted in the paragraph above to be part and parcel of a permitted farming activity. On the Industrial land there is no difference from what is proposed on the farm land, but the discharge of effluent is also an inevitable part and parcel of the permitted industrial process. It therefore meets plan requirements and may be considered to be a permitted activity.

The district plan provides at Rule 7B, Flood Channel Zones, for farming to be a permitted activity. Rule B7.3 specifies standards for permitted activities; 13 issues are specified with such standards, none of which are applicable to the proposed discharge activities. The proposed discharge activities on Flood Channel land therefore meet plan requirements and may be considered to be permitted activities.

The proposed erection of the discharge structure and bed level control structure in the bed and banks of the Oroua River and its un-named tributary will occur within the Flood Channel Zone, as addressed in Rule B7 of the operative district plan. The plan makes no reference to the structures proposed or to anything similar, whether as permitted, controlled, discretionary or prohibited activities. On this basis, and understanding that land use activities are deemed to be permitted unless a plan makes specific provision to regulate them, the proposed structures may be considered to be a permitted activity. This should nevertheless be checked with MDC before construction begins, as MDC has to date been unable to provide a definitive ruling on this matter.

As permitted activities in all three zones**, the proposed activities therefore have no requirement for resource consents from MDC.**

12 PROPOSED CONDITIONS

Proposed Consent Conditions are presented in Appendix L to this report.

13 CONSULTATION

This Section records the substance of the communications and meetings between the applicant and involved parties. Where appropriate, copies of letters and meeting minutes have been included within Appendix H to this report.

13.1 With Iwi

Table 13.1 below lists the consultative engagements between ANZ and local Iwi.

Table 13.1: ANZ Iwi Consultation Register

Date	Meeting with	Issues Addressed
29/07/10	Iwi Ngati Kauwhata (Dennis) with ANZ (Ann)	First meeting to discuss plans for renewal of consents.
31/05/11	Iwi Ngati Kauwhata (Dennis) with ANZ (Ann)	Walk through site and discussion on consent progress.
10/10/12	Iwi Ngati Kauwhata members with ANZ (Ann)	Walk through project with relevant Iwi representatives.
10/02/13	Iwi Ngati Kauwhata members with ANZ (Ann)	Walk through project with further relevant Iwi representatives.
23/04/13	Iwi Ngati Kauwhata (Dennis) with ANZ (Ann)	Confirmed that the current resource consent for ANZ was due to expire. Included in the options available was either - (1) a trade waste pipeline to the Feilding Sewage treatment plant or - (2) an internal land distribution process for the plant. Continuing to work with consultants and would keep Ngati Kauwhata Iwi informed of progress.
14/04/14	Iwi Ngati Kauwhata (Dennis) with ANZ (Ann) and Hamish (LEI)	Hamish outlined the proposal for the various consents including the balance between irrigation, storage and discharge. Discussed the proposal for separating the stream and the discharge and running the discharge through a vertical rock structure before entering the river and also a fish ladder for the stream.
05/06/14	Iwi, DoC Rangers	Walk through dam area and discharge point. Looked at site for discharge structure.
17/06/14	Iwi, ANZ neighbours	Presentation to Iwi and neighbours on progress of consent applications and opportunity for questions.
04/07/14	WINZ, on suggestion of Iwi	Walk through dam area and discharge point. Looked at site for discharge structure.
10/07/14	Iwi with ANZ personnel	Walk through planting area with office workers from Iwi.
08/01/15	Iwi and DoC	Discussed HRC grants for 2015 in relation to Otoku Stream project; discussed consenting timeline.
09/01/15	Oroua Catchment Care Group.	Discussed AFFCO consent application executive summary.

Discussions with Mr Dennis Emery of Ngati Kauwhata Iwi go back to 2010, when the issues of renewal of plant resource consents were first discussed.

There was a meeting with Dennis Emery on 14 April 2014, on mitigation of effects of the proposed discharges, involving the enhancement of the reach of the Otoku Stream running through the ANZ property. On 5 June 2014 members of local Iwi met at ANZ to view the ponds, the stream and location for the discharge structure.

A further meeting took place on 17 June 2014 where representatives from Iwi and neighbouring bore owners attended. A list of persons that attended and minutes from the meeting is included in Appendix J. The evening presentation included a description of the ANZ plant, the irrigation system that is proposed for the land applications, and the resource consenting process that is taking place. The groundwater monitoring process was explained particularly for the benefit of private bore owners that have had samples collected from their bores. Attendees asked questions to clarify their understanding of the circumstances and the reaction from a number of attendees was positive about what is proposed.

Meetings in early January 2015 with DoC and Oroua Catchment Care Group included Iwi representation; both meetings discussed AFFCO resource consent application.

Further discussions with Ngāti Kauwhata are ongoing.

13.2 With Nearby Bore Users

Individual shallow bore owners on properties near and adjacent to ANZ were approached in June 2013 and asked for access to the bores for the purpose of sampling and analysis to inform the preparation of the AEE document. Location of some bores was unclear so contact was made to properties within one kilometre of the ANZ property along Waughs Road, Campbell Road, Camerons Line, Matai Street and Aorangi Road. A letter from ANZ was provided to the seven bore owners identified who accepted the request, explaining the reason for the groundwater quality investigation.

Sampling was again carried out in April 2014 and the bore owners who agreed to samples being taken were provided with the results of the analysis for their individual bore. For varying reasons sampling was discontinued at three of the original seven private owners with shallow bores.

Owners of deep bores were contacted in May 2014 to further the investigation. This included deep bores located at ANZ, Byreburn Farm, Dalcam and the Feilding Golf Course. Farm owners beside the golf course were contacted but access was not made available.

After a further sampling round in May 2014 bore owners were invited to a meeting to explain what processes were taking place and request further visits over the next 6 months. Three bore owners attended this meeting as described above for the Iwi consultation. ANZ offered further consultation, which one land owner chose to follow up and continued communication has taken place to discuss the impact of irrigation around his property.

Ongoing sampling is proposed until December 2014 and regular contact with these property owners is continuing.

13.3 With Neighbours

Table 13.2 below lists the consultative engagements between ANZ and neighbouring property owners.

Table 13.2: ANZ Neighbour Consultation Register

Date	Meeting with	Issues Addressed
17/06/14	Neighbours	First meeting to discuss plans for renewal of consents; a PowerPoint presentation was given on consenting issues to be addressed.

14/08/14	Neighbours	Neighbours were invited by letter dated 27 July 2014; a PowerPoint presentation; minutes in Appendix H.
11/09/14	Neighbours	Neighbours were invited by letter dated 28 August 2014; there was a PowerPoint presentation on groundwater and odour issues, and a visit to the ponds and Otoku Stream; minutes in Appendix H.
18/03/2015	Neighbours	5 neighbours, B Guy, Sian Cass (LEI) and AFFCO personnel attended a field inspection of operating irrigation on Byreburn Farm. System was explained; queries and concerns were addressed. It was clear that the effluent did not have an objectionable odour, which had been a main concern for neighbours.

Many of the owners and residents on properties adjoining ANZ and Byreburn Farm have been regularly contacted by ANZ staff over the course of the operation of the plant. To update all neighbours on the consent plans a meeting was held in August 2014. A presentation was made with an overview of the ANZ resource consenting process, and issues that could potentially affect neighbours such as the irrigation programme. This was formatted similar to the Iwi meeting described above, with a viewing of the plant, ponds and discharge area. Attendees were provided with every opportunity to have any concerns addressed. At a further site meeting on 18 March 2015 neighbours were shown the current land application of MWE by irrigation.

While further community meetings are not planned, issues raised will continue to be addressed between ANZ and the neighbours concerned.

13.4 With Statutory Bodies

Table 13.3 below lists the consultative engagements between ANZ and statutory bodies.

Table 13.3: ANZ Statutory Body Consultation Register

Date	Communication with	Issues Addressed
03/03/15	DoC, Fish & Game.	E-mail heads-up that application is nearly ready to lodge, will provide more material shortly.
16/03/15	DoC, Fish & Game.	E-mail executive summary of AEE and bullet pointed summary, invite to meet to discuss.
17/03/15	Fish & Game.	E-mail acknowledgement of contact, will get back in touch shortly.

14 CONCLUSIONS AND RECOMMENDATIONS

The proposed discharges of meatworks effluent to land, to air, to groundwater, and to the Oroua River by AFFCO New Zealand Limited have been described with reference to the receiving environments for the discharges, the effects of the discharges on those environments, and the formal planning provisions that regulate those discharges and their effects. The proposed discharge structure and bed level control structure to be constructed in the bed and banks of the Oroua River and its un-named tributary have similarly been described and assessed.

Effects of the land discharge will be reduced from those that currently occur as a result of the use of a larger area of land and of improved application methods and management.

Effects of the discharge of odours and aerosols to air arising from land discharge activities will be managed to ensure that the over-arching requirement for no offensive or objectionable effect beyond the property boundary will be met.

The effects of the discharge on the surface water environment will be reduced from those that currently occur, as a result of changes to the river flow thresholds against which the discharge rates will be set, and as a result of enhanced irrigation and wastewater storage management. To allow for a 20% increase in ANZ productivity over the proposed term of the consents, there will be a 10% increase in the annual volume of wastewater discharged to the river, but an 87% reduction in the adverse environmental effect of that discharge from the present situation.

While an adverse effect from pond seepage has been found close to the pond system, extensive investigations have shown that this does not significantly affect the Oroua River, or deep or shallow groundwater quality beyond the ANZ property boundary.

The construction and existence of the proposed riverbed structures will not compromise the flood management requirements of HRC's asset managers.

It is shown that the effects of the discharges and proposed structures meet the requirements and targets of Horizons Regional Council's One Plan Operative Version, and with effects that are either less than minor or an improvement on the existing situation. The recommendation is made for the grant of the consents under application here.

15 REFERENCES

CPG 2011a: *AFFCO Manawatu Land Application of Meatworks Process Wastewater at Byreburn Farm, Feilding*. Resource Consent Application and Assessment of Environmental Effects, lodged with Horizons Regional Council. Dated February 2011, 68 pp plus Appendices.

CPG 2011b: *AFFCO Manawatu Discharge of Wastewater to Land by Pond Seepage*. Resource Consent Application and Assessment of Environmental Effects, lodged with Horizons Regional Council. Dated February 2011, 47 pp plus Appendices.

CPG 2011c: *AFFCO Pond Seepage – Response to Section 92 Questions Raised by Horizons Regional Council.* Unpublished report to Horizons Regional Council. Dated 16 September 2011, 15 pp plus Appendices.

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Kingma, J.T. 1962. *Geological Map of New Zealand*. 1:250,000. Sheet 11 - Dannevirke. New Zealand Geological Survey. Department of Scientific and Industrial Research, Wellington.

Stark, JD 2011: *Biomonitoring of the AFFCO beef processing plant discharge on the Oroua River near Feilding*. Stark Environmental Report number 2011-01, prepared for CPG. 32 pp.

16 APPENDICES

Appendix A	Figures
Appendix B	CPG Site Investigation Report
Appendix C	Landcare Research Site Investigation Report
Appendix D	LEI Site Investigation Report
Appendix E	Conceptual Design
Appendix F	Land Assessment of Environmental Effects
Appendix G	River Assessment of Environmental Effects
Appendix H	Consultation Summary
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