TRADE WASTE CHARGES – A SPECTATORS VIEW

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ABSTRACT

In New Zealand many of the rural based councils have historically attracted industry into the region, especially large food processing plants, so that local employment is maintained. Many of these plants enjoyed low trade waste costs for many years as a result of this implicit social benefit relationship.

In the past 10 years, trade waste costs have crept up across New Zealand due to a number of issues, including but not limited to tighter wastewater discharge consent limits of the council owned wastewater treatment plants and community perception requiring the councils to improve their wastewater treatment. Many councils have now approached wastewater treatment as direct cost recovery so increased wastewater treatment costs are passed onto as increased trade waste charges for industries in the region.

The methodology councils use to charge trade waste dischargers are not consistent across New Zealand. The council jurisdiction in which the industry lies can have a significant impact on the trade waste cost. This paper assess four North Island councils (two rural and two urban) for the trade waste discharge of a raw wastewater from a typical beef processing plant. The cost difference between the councils varies by over 100% for the standardised wastewater. Due to the significant portion of load that rural industry can place on a rural centre sewage treatment plant, trade waste cost escalation can result which evident in at least one of the councils investigated.

On-site treatment can be an expensive option, requiring significant capital costs and on-going operational costs. However, considering the increasing trade waste charges being experienced in some centres, on-site wastewater treatment is viable option as it provides a saving over long term trade waste charges, despite the initial capital costs. Partial onsite treatment with continued discharge to trade waste has the potential to enable industries to remain in rural towns by buffering against trade waste cost escalation.

KEYWORDS

Trade waste, meat processing wastewater, sewage treatment.

1 INTRODUCTION

Wastewater management for food based industries is a key consideration in establishing industrial sites, as is water supply and labour sourcing. Depending on the plant location, large industrial processing sites either treat and discharge their wastewater directly to the receiving environment, or if available, discharge to council owned sewerage networks as a trade waste (with or without partial treatment). In New Zealand many of the rural based councils have historically attracted industry into the region, especially large food processing plants, so that local employment is maintained. Many of these plants enjoyed low trade waste costs for many years as a result of this implicit social benefit relationship.

In the past 10 years, trade waste costs have crept up across New Zealand for a number of reasons, including tighter wastewater discharge consent limits placed on the council owned sewage treatment plants and community perception requiring the councils to improve their standard of treatment. Increased treatment system capital costs and operational costs are resulting in councils now approaching trade waste charging as direct cost recovery so increased wastewater treatment costs are passed on as increased trade waste charges in order to provide for an equitable distribution of costs between all dischargers of waste to the network. Under some councils, trade waste charges are becoming a sizeable annual operating cost for industrial sites which has the potential to limit on-going operation in those towns.

With the meat industry being a high wastewater load generator and nearly half of the 66 meat processing plants in New Zealand discharging to trade waste, the meat industry provides for a good example of how industry is being affected due to increases in trade waste charges across the country. This paper assesses four North Island councils (two rural and two urban) for the trade waste discharge of a raw wastewater from a typical beef processing plant. Wastewater generated from a moderate sized beef plant (1000 beef animals per day capacity) is used as an example for assessment of the following factors:

- A comparison against the four different trade waste charging regimes to identify if there is substantial differences in large urban and rural town trade waste charges; and

- An assessment of the cost differences between discharging to trade waste and operating an onsite treatment plant for partial treatment prior to discharge to trade waste or maintaining a consented discharge to the receiving environment following full wastewater treatment..

This paper does not intend to identify specific councils as more or less costly for trade waste management and as such the trade waste charging systems utilized in this assessment have been kept anonymous. The intention of the investigation for this paper is to establish if trade waste charging has the potential to influence the location of industry within New Zealand and whether treatment options may counteract increasing trade waste charges.

2 COUNCIL TRADE WASTE CHARGING

Wastewater treatment plants around the country are subject to different resource consent requirements due to their ultimate discharge receiving environment. Some wastewater treatment plants discharge hundreds of metres offshore, via an ocean outfall, while others discharge into a small river which runs through the local town. Generally the wastewater quality of a treatment plant discharging into a small river will be more stringent than that from a treatment plant discharging into the ocean.

The level of treatment required to meet the consent limits to avoid degrading the environment, depends on the treatment plant’s receiving environment. Discharges into the ocean may only have been through primary and secondary treatment, where as a discharge to a river would likely require significantly more treatment, which may include a primary, secondary and tertiary treatment with high levels of nutrient removal and microbial disinfection.

The different discharge qualities, as determined by the varying discharge resource consents, ultimately determines the capital and operational costs of the treatment plant. Tightening of discharge limits, particularly for discharges to smaller receiving environments, which is more common in smaller communities, ultimately results in a significant increase to trade waste charges

The trade waste systems utilised for this analysis have been selected to represent large urban and small rural urban towns, sea and large river outfalls and small river discharges. The selected trade waste systems are summarized as follows:

Trade Waste Authority A: Operates a system from a large urban centre with a sea outfall. The trade waste authority is undergoing an amendment to its trade waste charging regime and is proposing to switch a charge based on flow rate only.

Trade Waste Authority B: Operates a system for a large urban centre with discharge to a major river. The trade waste authority operates a trade waste charging regime whereby the trade waste discharger pays an annual capital contribution for reserve treatment capacity for peak discharge, and a monthly operating charges based on actual loads and flows discharged.

Trade Waste Authority C: Operates a system for rural town system that discharges to a small river system. Similar to Trade Waste Authority B, the trade waste authority operates on a two-tier capital and operational costing regime to recoup the costs for the wastewater treatment plant. The capital cost is charged for the maximum consented discharge and the operating cost is based on a four month average of composite samples taken monthly.

Trade Waste Authority D: Operates a system for a rural town that discharges to a small to moderate sized river system. The trade waste authority operates on a cost-recovery method where the cost of each parameter fluctuates per month depending on the flow and load that the treatment plant receives in order to meet a predetermined monthly cost.

2.1 ASSUMPTIONS

Councils or trade waste authorities utilise different charging structures for establishing trade waste charges. Some authorities have a charging regime for significant contributors, and a blanket charge for smaller discharges, such as from a single bakery or restaurant. It has been assumed that the meat processing plant case study used in this paper will be a significant contributor to the trade waste network, so is subject to flow and load related trade waste charges.

Trade waste authorities also apply a discount factor when the wastewater discharged is within the set limits and a penalty charge when the wastewater load or flow is above the agreed limit. For ease of comparison between councils, the costing assessment undertaken in this paper only considers the ‘actual’ cost, not an artificial cost inflated by penalties or reduced by discounts. It is assumed that the wastewater discharged is a compliant discharge within the trade waste agreement limits as set out in the trade waste agreement between the trade waste authority and the trade waste user.

2.2 TRADE WASTE AUTHORITY A

Trade Waste Authority A is in the process of consulting on a revised trade waste bylaw and it is anticipated that the proposed bylaw will be a flow only charge. While the discharge to surface water consent (sea outfall) contains relatively strict limits on nutrient levels, the size of this large urban centre has seen a decline in portion of wastewater from trade waste. Therefore the trade waste authority has deemed it appropriate to switch to flow based charging only with no load base charging.

The proposed trade waste charging criteria for Authority A is summarizsed in Table 1, based on a high water use rate associated with the typical beef plant model:

Table 1: Authority A Trade Waste Charging (Provisional 2012/2013)

Parameter	**Unit**	**Charge per Unit**
Annual fixed flow charge	-	$75,000
Volumetric charge	m^3	$2.79

2.3 TRADE WASTE AUTHORITY B

Trade Waste Authority B operates a system for a large urban centre that discharges treated wastewater to a significant river system. The urban centre consists of a number of industrial plants that discharge moderate flows and loads to trade waste. At the time of writing, Authority B was in the process of introducing a new trade waste charging regime mainly to include additional costs associated with the upgrade of the wastewater treatment plant to meet new consent requirements, particularly nutrient management.

Authority B operates a two-tier trade waste charging system; an annual (or capital) charge and an operational charge. The annual (capital) charge is based on the peak loads and flows possible, from the trade waste source. This ensures the wastewater treatment plant has the capacity to accept and treat the trade waste. The second charge is an operation cost, which is based on the monthly average load and flow discharged.

Both the capital and operational trade waste charges are based on the following parameters:

- Flow (m^3/day)
- Flow (L/sec)
- Biochemical Oxygen Demand (BOD) load,
- Chemical Oxygen Demand (COD) load,
- Total Suspended Solids (TSS) load,
- Total Nitrogen (TN) load,
- Total Phosphorus (TP).

The costs applied to each parameter are shown in Table 2 below.

Table 2: Authority B Trade Waste Charging (2012)

Parameter	**Unit**	**Capital Charge per Unit**	**Operational Charge per Unit**
Flow	m^3/day	$0.25	$0.05
Flow	L/sec	$7,654.88	$1.20
Biochemical Oxygen Demand (BOD)	kg/day	$31.49	$0.60
Chemical Oxygen Demand (COD)	kg/day	$2.79	$0.05
Total Suspended Solids (TSS)	kg/day	$17.30	$0.68
Total Nitrogen (TN)	kg/day	$54.46	$1.22
Total Phosphorus (TP)	kg/day	$198.48	$3.32

Note: The Capital charge is based on the maximum flow or load that the trade waste user could discharge, and is apportioned on an annual basis. The operational cost is based on the average load or flow discharged on a monthly basis.

The capital and operational costs proposed in the Council B methodology ensure the trade waste user pays for the ability for the treatment plant to have capacity to treat the peak flow and load scenario, as well as paying for the treatment of the average monthly wastewater load discharged.

2.4 TRADE WASTE AUTHORITY C

Trade Waste Authority C manages sewage treatment plants for several rural towns, with individual pricing structures for each town. The pricing structure utilised in this assessment is for a small to moderately sized rural town with two major industries contributing significant portions to the flow and load managed by the sewage system. The treated sewage is discharged to a moderately sized inland river.

The trade waste charging system was recently revised for a plant upgrade that was implemented for tighter discharge consent limits. Authority C has a two-tier charging program; an annual capital trade waste contribution, as apportioned between the two major industries and the domestic sources, and operational trade waste charge based on load. The annual capital charge is calculated on the consented maximum flow and load from the plant. The operational trade waste charge is based on a 4 month rolling average, of 24 hour composite samples which are taken monthly. Flow is recorded continuously.

The annual trade waste charges are based on the operating and capital expenditure for the previous January to December period and remain constant throughout the following financial year i.e. Authority C aims to recoup the cost of the previous year's treatment plant operation and capital costs through the current years charging regime.

The trade waste charge of each of the parameters is shown in Table 3 below.

Table 3: Authority C Trade Waste Charging (2012)

Parameter	Unit	Unit Rate
Capital Contribution	Annual	$305,500
Flow	m^3	$0.26
Chemical Oxygen Demand (COD)	kg	$0.265
Total Suspended Solids (TSS)	kg	$0.186
Total Kjeldahl Nitrogen (TKN)	kg	$1.183

2.5 TRADE WASTE AUTHORITY D

Trade Waste Authority D is based around a single small to moderately sized rural town with two industries contributing significant flows and loads to the sewage treatment system. The treated sewage is discharged to a small to moderately sized inland river.

The trade waste charging regime was revised in the past two years, to recover costs associated with a sewage treatment plant upgrade that was required as a result of tighter discharge consent limits. Authority D takes a cost recovery approach, where the annual cost of the wastewater treatment plant operations and capital are split between the two main trade waste dischargers and the domestic sources based on the following parameters:

- Flow (m^3/day),
- Biochemical Oxygen Demand (BOD) load,
- Total Suspended Solids (TSS) load,
- Total Nitrogen (TN) load,
- Total Phosphorus (TP) load.

The annual cost to treat each parameter is spilt into an average monthly cost. The monthly cost is then apportioned to each trade waste discharge user and the domestic discharge, based on the proportion of load for that parameter that plant receives. For example, if the plant receives a lower nitrogen load one month, from domestic and trade waste sources, then the unit cost charged to the trade waste user will be higher in order to recover that monthly cost. For the next month, if there is a greater nitrogen load received by the plant, then the unit cost charged to the trade waste user will be lower. Consequently, the unit costs for each parameter vary month to month based on what the other trade waste users are discharging.

An average of the costs and range for the parameters for the 2012 year is displayed in Table 4.

Table 4: Authority D Trade Waste Charging (2012)

Parameter	Unit	Average Charge per Unit	Range of Charge per Unit
Flow	m^3/day	\$0.41	\$0.31 - \$0.51
Biochemical Oxygen Demand (BOD)	kg/day	\$1.75	\$1.01 - \$2.61
Total Suspended Solids (TSS)	kg/day	\$1.05	\$0.72 - \$1.41
Total Nitrogen (TN)	kg/day	\$6.51	\$4.85 - \$8.30
Total Phosphorus (TP)	kg/day	\$4.18	\$3.26 - \$5.15

The range of charge per unit varies because of the annual cost being split into equal monthly amounts, which are then charged based on the load received at the plant. This makes forecasting for trade waste users particularly difficult, as their monthly charge depends on what the other trade waste users are discharging too.

3 TYPICAL BEEF PROCESSING WASTEWATER

A typical beef processing plant has been selected as a case study industry as beef plants exist throughout New Zealand, in both rural and urban centres and the beef industry generates a significant amount of high strength wastewater.

The level of contaminants and the volume of meat processing wastewater generated by a processing plant is largely dependent on the number of animals killed, type of processing undertaken and the equipment used in the plant. A modern beef plant, processing up to 1,000 animals per day, employing best practice technologies for water conservation but with no onsite treatment (other than screening), has been selected for this case study. By-products processing is not included in this assessment.

Wastewater is generated throughout beef processing and sources include:

- Truck wash;
- Stockyard wash down;
- Slaughter floor and boning rooms;
- Gut wash; and
- Cool stores.

The slaughter floor, boning rooms and cool stores produce about 75% of the wastewater volume. The remaining 25% of the wastewater flow is generated from the truck and stockyard wash and the gut processing. Most meat processors operate blood collection along with screening for renderable material. Gut processing separates the bulk of the paunch content from waste streams and offal material is collected for rendering. The resultant waste streams are therefore, reduced of load as far as possible without the aid of onsite treatment.

Table 5 below shows the typical wastewater generated by a low-water use moderate sized beef processing plant.

Table 5: Typical Moderate Sized Beef Processing Plant Raw Wastewater

Parameter	Unit	Concentration
Peak daily flow	m^3/day	1,000
Annualised average daily flow	m^3/day	560
Total suspended solids (TSS)	g/m^3	1,270
Biochemical Oxygen Demand (BOD)	g/m^3	1,700
Chemical Oxygen Demand (COD)	g/m^3	3,600
Total Kjeldahl Nitrogen (TKN)	g/m^3	260
Ammoniacal Nitrogen (NH_4-N)	g/m^3	85
Total Phosphorus (TP)	g/m^3	30
pH	pH units	6.7

3.1 TRADE WASTE CHARGES

Table 6 compares the different costs imposed by each council on a "typical" beef processing raw wastewater for both the total daily trade waste costs but also the components of each.

Table 6: Daily Trade Waste Charging Comparison for a Typical Beef Processor

Trade Waste Authority	Annual Capital Charges	Annual Operational Charges	Total Annual Trade Waste Charges
Authority A	$75,000	$570,680	**$645,680**
Authority B	$269,300	$522,280	**$791,580**
Authority C	$305,500	$354,420	**$659,920**
Authority D		$1,347,630	**$1,347,630**

Table 6 illustrates that for Authorities A, B and C trade waste charges are relatively similar at approximately $700,000 per annum. Considering that Authorities A, B and C represent both urban and rural centres and discharges to large and small receiving environments trade waste charges can be maintained as standard.

However, with Authority D, the trade waste charges are considerably higher, at approximately double the annual charges of the other authorities for the same trade waste. While the town size and receiving environment are similar to the Authority C example, the costs are significantly higher due to the higher operating unit charges utilised by Authority D.

It is apparent that the use of a fixed annual capital charges and standardized load charges provides for more stable trade waste charges than the cost sharing alternative. In 2009, at the time of establishment of trade waste agreements under Authority D, forecast trade waste charges would have resulted in the meat plant trade waste charges being similar to Authorities A, B and C, however, the cost sharing method utilised by Authority D, in a small community, has resulted in escalation of the trade waste charges as trade waste customers are lumped with excessive operational costs which are essentially out of their control.

4 ONSITE TREATMENT TO MANAGE TRADE WASTE CHARGES

While industrial sites may have been attracted to rural communities with favourable water and trade waste costs, escalation of costs due to increase treatment demands placed on the trade waste authority means that locating an industry in a small rural town is not necessarily so attractive any longer. Other than land prices, large urban centres would currently be more attractive to new industries given less risk of water and trade waste price escalation and easier access to skilled labour. However, for those industries that are already established in rural towns and connected to trade waste, there are greater options for treating the wastewater on site to either decrease trade waste charges or discharge treated wastewater directly to the receiving environment.

Continuing with the meat industry case study, potential cost savings have been investigated for partial treatment of wastewater against the Authorities C and D charging methodologies and costs only as rural centres are more at risk to excessive trade waste charge escalation than larger urban centres. While onsite treatment is possible in a larger urban setting, it is likely to be a lesser degree of treatment due to the cost of land for substantial treatment systems and limited opportunities for disposal other than to trade waste.

The risk for rural trade waste authorities, if a major industry either partially treats or fully treats the wastewater to reduce trade waste charges, then the authority loses a revenue source for funding the capital and operating costs of an existing but upgraded system. The capital costs and operating costs would then have to be borne by the other trade waste dischargers and domestic wastewater charges. This would likely result in an escalation in unit charges. For the purpose of this assessment it is assumed that unit rates would remain static except for standard CPI increases.

4.1 TREATMENT OPTIONS

Large industrial processing plants have three methods of disposing of their wastewater:

- Discharge raw effluent to the council-owned trade waste network,
- Partial treatment of the wastewater on-site and discharge to the council-owned trade waste network,
- Fully treat the wastewater on-site and discharge directly to a water body or to land.

Most industrial trade waste dischargers will have a form of pre-treatment such as coarse screening to remove gross solids and some may have a grease trap to remove floatable materials to meet permitted trade waste standards. Pre-treatment can also include pH adjustment if required by the authority prior to discharge to the trade waste network. In meat processing plants, pre-treatment often consists of a rotating milliscreen or equivalent to remove gross solids.

4.1.1 PARTIAL TREATMENT

Partial treatment could consist of either primary or primary and secondary treatment, to achieve significant reductions in trade waste charges, particularly targeting significant reductions in suspended solids, biochemical oxygen demand and potentially nitrogen. For the meat industry, primary treatment will generally consist of either dissolved air flotation or anaerobic treatment. Secondary treatment will generally be aerated biological treatment in a continuous or sequencing batch reactor activated sludge lagoon. For this assessment, the following system has been utilised to establish capital and operating costs.

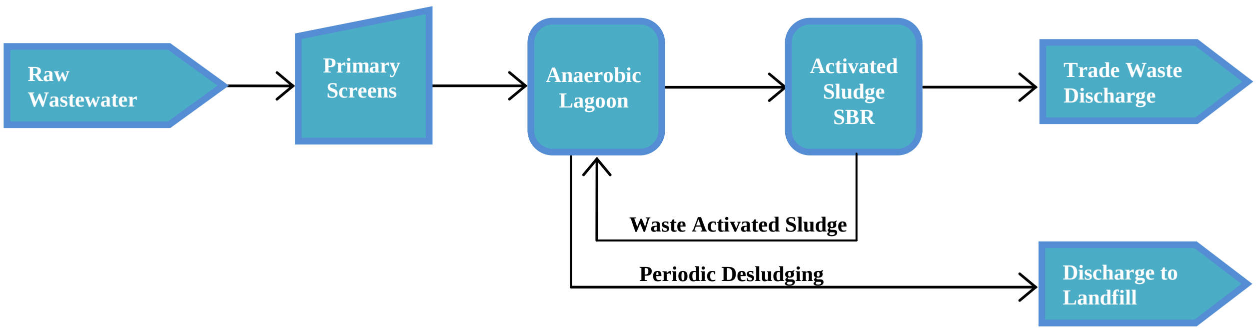

Figure 1: Typical Meat Processing On-Site Partial Treatment Train

While partial treatment will significantly reduce loads associated with the trade waste discharge, a flow based unit charge will still result in addition to some minor load based charges and the onsite wastewater treatment plant operation and maintenance costs.

4.1.2 FULL TREATMENT

To enable discharge to the receiving environment the wastewater would require a significantly higher level of treatment than a discharge to trade waste. It is assumed that treatment would need to be sufficient enable discharge to a receiving surface water body such as a moderately sized river. Therefore, a full onsite treatment system would need to target a high rate of removal of suspended solids, biochemical oxygen demand, total nitrogen, phosphorus and E. coli. While it may be possible to discharge to land, this would not necessarily be available year round.

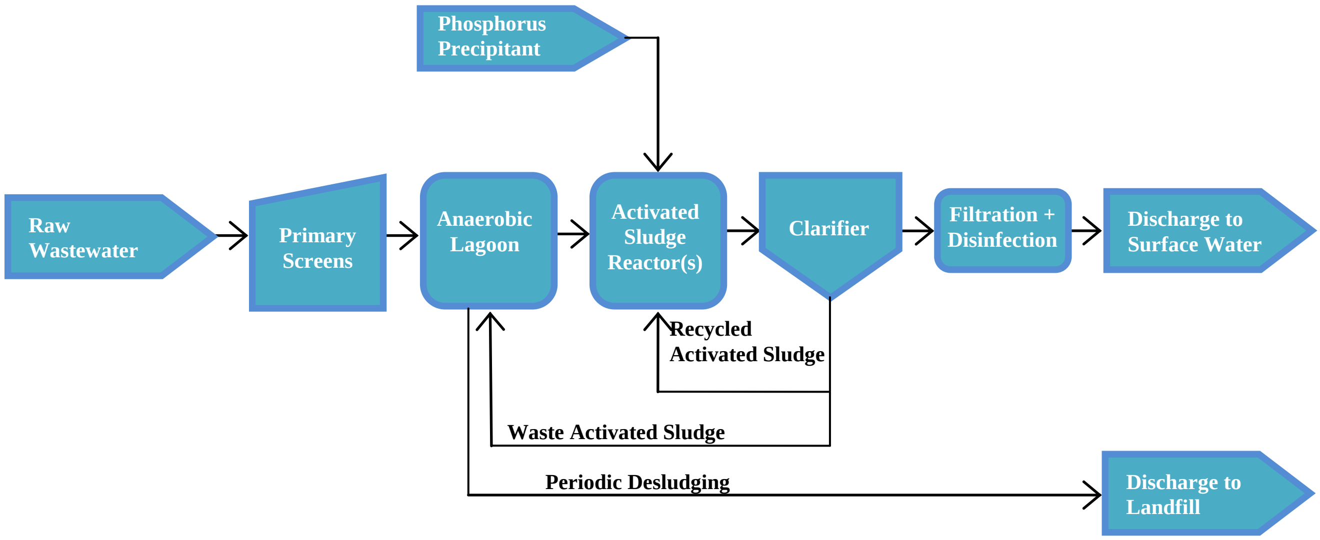

Figure 2: Typical Meat Processing On-Site Full Treatment Train

In order to enable discharge to the receiving environment, resource consent will need to be obtained which will dictate the level of treatment required, subject to input from stakeholders such as iwi, nearby residents, environmental groups, health boards, governmental agencies and other interested parties. However, once the consent is granted, there will be minimal cost associated with discharge to the receiving environment other than treatment plant operational and maintenance costs, unlike a discharge to trade waste which will incur an on-going charge from an external party.

4.2 TREATED EFFLUENT CHARACTERISTICS

Table 7 summarises the typical effluent qualities that are achievable based on the partial and full treatment systems outlined above.

Table 7: Typical Treated Effluent Characteristics

Parameter	Unit	Raw Effluent	Partially Treated	Fully Treated
Peak daily flow	m^3/day		1,000	
Annualised average daily flow	m^3/day		560	
Total suspended solids (TSS)	g/m^3	1,270	100	50
Biochemical Oxygen Demand (BOD)	g/m^3	1,700	50	20
Total Nitrogen (TN)	g/m^3	260	80	50
Ammoniacal Nitrogen (NH_4-N)	g/m^3	85	50	20
Total Phosphorus (TP)	g/m^3	30	20	5
E. coli	cfu/100ml	1×10^6	1×10^6	1×10^2

4.2.1 TREATMENT PLANT COSTS

The cost to set up a new wastewater treatment plant will include consenting, design, construction, commissioning and operational cost. An estimated breakdown of costs is shown Table 8 below.

Table 8: Estimated Wastewater Treatment Plant Costs

Item	**Partial Treatment**	**Full Treatment**
Capital Costs		
Land Purchase (2 ha)	$150,000	$150,000
Consenting	N/A	$200,000
Design and Construction	$1,750,000	$2,920,000
Total Capital Cost	**$1,900,000**	**$3,270,000**
Annual Operational Costs		
Maintenance Costs	$25,000	$45,000
Operational Costs	$45,000	$100,000
Sludge dewatering and disposal	$40,000	$40,000
Total Operational Costs (per annum)	**$110,000**	**$185,000**

4.3 TRADE WASTE CHARGES VERSUS TREATMENT COST COMPARISON

Based on the wastewater characteristics summarised in Table 7 and the capital and operating costs detailed in Table 8, cumulative wastewater management costs over a 10 year period (ignoring cost fluctuations) can be established for the treatment options under both Council C and D, as summarised in Figure 3

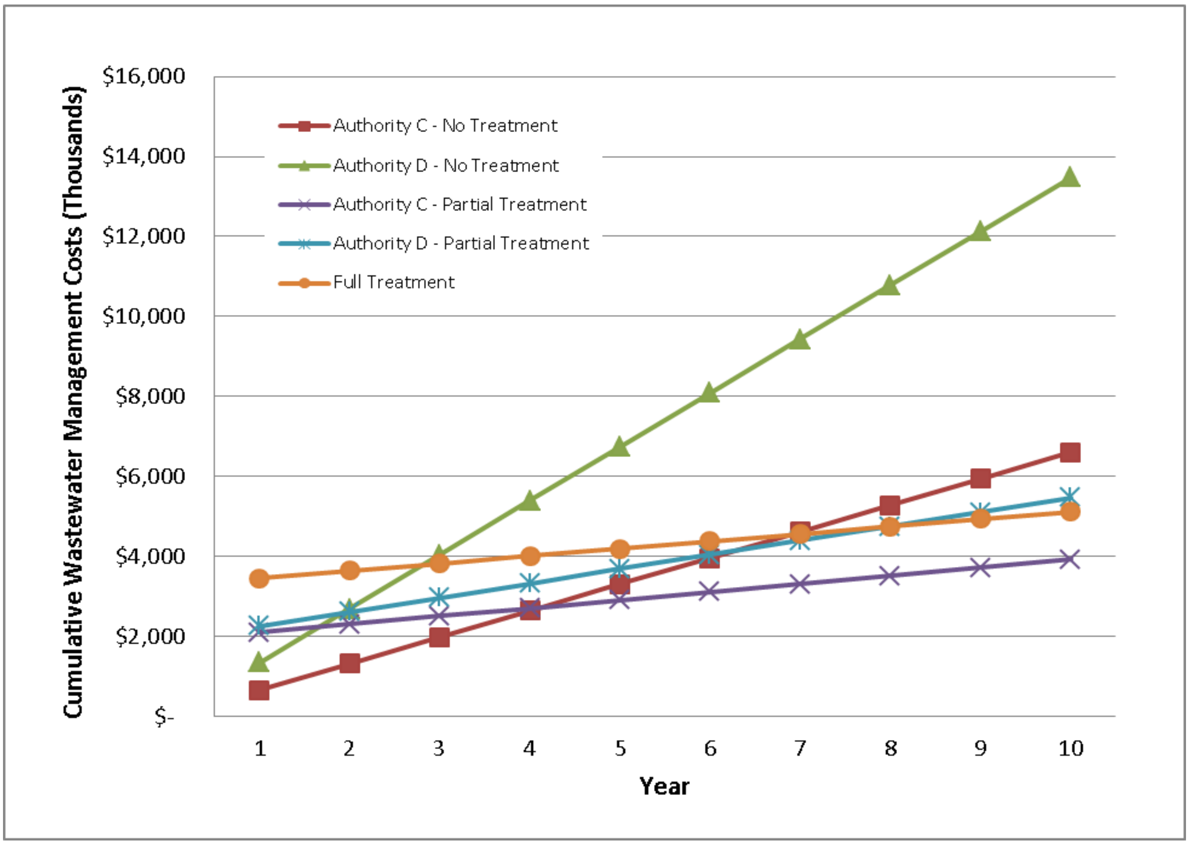

Figure 3: Trade Waste Costs compared with Partial and Full Treatment Costs

As illustrated in Figure 3, partial treatment of the wastewater will provide a short term payoff period in the cases of both trade waste authorities, with a two year payoff period under Authority D and a four year payoff period under Authority C. Removal of capital contribution requirements under Authority C (on the proviso of partial treatment) provides for significant annual savings.

Installing a full treatment system with discharge to the receiving environment provides little cost benefit over partial treatment, with a net cost recovery under full treatment with Authority D, after 8 years only. Given that there is security from future cost escalation if a discharge to trade waste is not required, the partial treatment could be extended to full treatment at a later date if trade waste charges escalated further.

5 CONCLUSIONS

The cost assessment of four trade waste authorities in this case study of a typical beef processing wastewater indicates significant differences in trade waste costing methodologies and costs. This has the potential to impact on the feasibility of operating industrial sites on trade waste in certain areas of New Zealand, particularly in smaller rural centres. However, given that onsite partial treatment can offer significant savings on trade waste charges then there is potential for industries in rural centres to remain competitive in comparison to those in larger urban centres.

Implementation of partial or full onsite wastewater treatment at industries in rural centres already connected to trade waste has the potential to undermine the costing structure of sewage treatment systems that have already been established to meet tighter resource consent limits. Particularly if there has not been a separate capital contribution charge set up.

It is therefore essential in rural centres that trade waste authorities involve larger industries discharging to trade waste at the resource consenting stage, providing an accurate estimate of future trade waste charges going forward. Equally important is setting up a fair and consistent method of trade waste charging to avoid unnecessary cost escalation such as that is being encountered with Authority D.