

MEAT PROCESSING EFFLUENT TREATMENT PLANT UPGRADE – CONSENTS TO COMMISSIONING

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ABSTRACT

Prior to a recent upgrade of the effluent treatment plant at the Silver Fern Farms Limited Finegand meat processing plant, near Balclutha in South Otago, had been discharging up to 22,000 m³/d of primary treated meatworks effluent to the Koau Branch of the Clutha River. The discharge contained high levels of biochemical oxygen demand, total suspended solids, total Kjeldahl nitrogen, phosphorus and *E. coli*.

Silver Fern Farms undertook parallel engineering options investigations to determine the upgrade route of the effluent treatment plant to satisfy anticipated tightened discharge limits for continued discharge into surface water. One of the key constraints for the continued discharge was to maintain very low levels of *E. coli* as the Otago Regional Council Water Plan required the Clutha River to meet primary contact recreation status. The effluent treatment options available to Silver Fern Farms included a physico-chemical treatment plant and a biological treatment plant. The biological treatment plant was determined as the most likely treatment option to satisfy the requirements for continued discharge into the Clutha River.

During the resource consents process, Silver Fern Farms had recognised that a modified layout of a physico-treatment plant would satisfy the requirements to enable microbial disinfection at a much lower capital cost, while maintaining a small footprint of the proposed wastewater treatment facility.

Silver Fern Farms undertook a pilot scale trial of the physico-chemical treatment plant at its Belfast meat processing plant site, and continued to advance its proposal to construct the full scale treatment plant at its Finegand site once the trial was deemed successful.

The construction and commissioning of the full-scale \$12 million treatment plant was undertaken by Silver Fern Farms within a tight timeframe and the new treatment plant was commissioned in November 2007.

KEYWORDS

Meat processing, effluent, resource consent, commissioning, discharge

1 INTRODUCTION

Silver Fern Farms is the largest meat export company in New Zealand with processing sites located from Dargaville to Invercargill. Silver Fern Farms employs about 8,000 workers at the peak of the season with over 1,000 employees at their Finegand plant near Balclutha. The Finegand plant is the largest processing plant for Silver Fern Farms Limited, responsible for about 15% of the company's production throughput.

The Finegand meat processing plant had been discharging up to 22,000 m³/d of primary treated wastewater to the Koau Branch of the Clutha River for many years.

2 RESOURCE CONSENTS PROCESS

2.1 ORC POLICY AND WATER PLAN IMPACT ON FINEGAND PLANT

Otago Regional Council (ORC) Regional Plan Water plan was publicly notified in February 1998 and became operative on 1 January 2004. In 1998, when the Regional Plan was proposed, Silver Fern Farms reviewed the proposed Regional Plan and did not make any submissions as the matters outlined in the plan were satisfactory and did not impact Silver Fern Farms in any manner that would have compromised its ability to continually discharge primary treated wastewater in the manner the resource consents granted to Silver Fern Farms allowed. This effectively excluded Silver Fern Farms Limited from any future consultation with the progress of the Regional Plan when changes were being made during the submissions and hearing process period.

During the process of submissions, hearings and appeals, Otago Regional Council adopted “Clause 7.6 Policies for the Enhancement of Water Quality” which had a direct impact on Silver Fern Farms Finegand Plant. Clause 7.6 states the following:

7.6 Policies for the enhancement of water quality

7.6.1 To enhance the water quality in the following bodies so that they become suitable to support primary contact recreation:

....

(f) Koau Branch of the Clutha River/Mata-Au

....

The basis of ORC adopting Clause 7.6.1(f) was that the Koau Branch of the Clutha River/Mata-Au met the requirements of Policy 6.5.5 of the operative Regional Policy Statement for Otago (1 October 1998). Policy 6.5.5, which among many other aspects states that:

6.5.5 To promote a reduction in the adverse effects of contaminant discharges into Otago’s water bodies through;

(a) Adopting the existing water quality of Otago’s water bodies as a minimum acceptable standard and

(b) Investigating and where appropriate, enhancing water quality so that as a minimum standard it is suitable for contact recreation and aquatic life where:

....

(iv) There is a direct discharge containing human sewage or wastes from commercial or industrial activities;

....

The implementation of Policy 6.5.5(b)(iv) essentially required Silver Fern Farms to address the ongoing discharges from the Finegand Plant so that the discharges were suitable to meet the likely enhanced water quality required by ORC so that the Koau Branch of the Clutha River/Mata-Au satisfied the requirements to support primary contact recreation in terms of the microbial limits as set out in the Otago Regional Plan for Water.

2.2 RMA AND ORC PLAN RULES ABOUT DISCHARGES

For any consent to be granted, compliance with S107 of the Resource Management Act, 1991 (RMA) (S107 – restriction on grant of certain discharge permits) is the bottom line and needs to be satisfied at all times. S107 relevant to Silver Fern Farms Finegand proposal states that:

107 Restriction on grant of certain discharge permits

(1) Except as provided in subsection (2), a consent authority shall not grant a discharge permit:

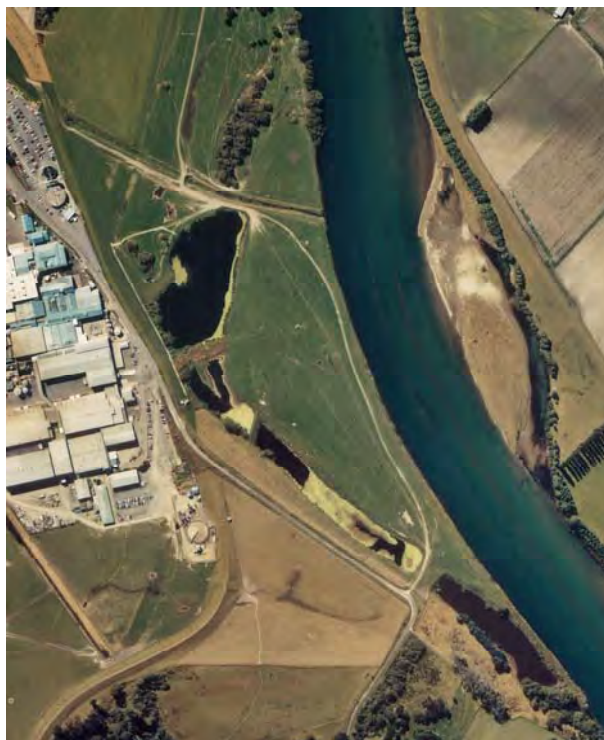
....

if, after reasonable mixing, the contaminant.....,is likely to give rise to all or any of the following effects in receiving waters:

- (c) *the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;*
 - (d) *any conspicuous change in the colour or visual clarity;*
 - (e) *any emission of objectionable odour;*
 - (f) *the rendering of fresh water unsuitable for consumption by farm animals;*
 - (g) *any significant adverse effects on aquatic life.*
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The key matters for ORC and Silver Fern Farms Finegand was the issue of defining the zone of “*reasonable mixing*” (better termed “non-compliance” zone) and having an agreement on the extent of reasonable mixing and the avoidance of “*any conspicuous change in colour or visual clarity*” for the discharge.

The discharge from Silver Fern Farms Finegand plant created two distinct plumes at the point of discharge in the Clutha River/Mata-Au that was visible for an extended length of the river until the plumes dissipated into the river body (see Photograph 1, dated 4 March 2005).



Photograph 1: Silver Fern Farms Finegand discharge showing two distinct discharge plumes

Since there were distinct visible plumes and allowing the discharge to occur would have contradicted the requirements of S107(d) of the RMA, Silver Fern Farms Finegand had determined very early during its environmental investigations that the discharge of primary treated effluent into surface water would not be accepted by the wider community and planned for the upgrade of the existing facilities where the effluent would be treated to secondary and tertiary level prior to discharge to the Koau Branch of the Clutha River/Mata-Au. This treatment of the effluent to a tertiary level to reduce various contaminant levels would have improved the discharge to such an extent that S107(d) would have been in compliance.

The main issue that required agreement between Silver Fern Farms and ORC was defining an acceptable mixing zone. ORC determined very early in the resource consents process that a very short mixing zone was necessary for the Clutha River/Mata-Au. Silver Fern Farms argued during the resource consents process that standards relating to water quality were subject to an allowance for reasonable mixing. The ORC stated that S107 of the RMA must be complied with at all times and its requirement is the bottom line. ORC considered that the mixing zone must not be considered as a “non-compliance zone”.

The ORC Water Plan has a policy on mixing zone. The Water Plan Policy 7.7.6 states:

- 7.7.6 *Where a mixing zone is required for the discharge of contaminants to water, to ensure that it is limited to the extent necessary to take account of:*
- (a) *The sensitivity of the receiving environment;*
 - (b) *The natural and human use values identified in Schedule 1;*
 - (c) *The natural character of the water body;*
 - (d) *The amenity values supported by the water body;*
 - (e) *The physical processes acting on the area of discharge; and*
 - (f) *The particular discharge, including contaminant type, concentration, and volume.*

The ORC believed that notwithstanding the ORC Water Plan policy on mixing zone, ORC could set higher discharge requirements than provided in S107 of the RMA. This meant that if ORC chose to provide a “no zone of non-compliance” in a consent, such practice would not have breached S107. In addition to this, ORC determined that if any waterway was to be managed for contact recreation, the direct assumption would be that the “whole of the waterway” is accessible for contact recreation and provision for zone of non-compliance for contact recreation would not be available at all as it would directly conflict with the intended outcome of ORC Water Plan Policy 7.6.1.

2.3 LIMITS FOR MIXING ZONES AND MICROBIAL DISCHARGES

This requirement to meet the microbial limits to achieve contact recreation levels for the Koau Branch of the Clutha River/Mata-Au meant that the ORC took a “as a matter of principle” approach and recommended setting the discharge limits for microbial contaminants (especially for *Escherichia coli* (*E. coli*)) at 260 cfu/100mL, the same level as that is acceptable for contact recreation, effectively setting no provision of mixing zone for *E. coli*. The Silver Fern Farm position during the consents process was that it is a requirement of the RMA that any standards relating to water quality contained within a plan be subject to an allowance for reasonable mixing. To have no mixing zone is inconsistent with the RMA and the provisions of the ORC Regional Policy Statement and the Water Plan.

The independent commissioners of the Hearing Panel did not accept Silver Fern Farms’ contention that for every discharge there must be a mixing zone. However, the panel accepted that the RMA and the ORC policies and plans required consideration of what a “reasonable” mixing zone should be, alluding to the concept that in some circumstances it would be *reasonable* not to have a mixing zone, and in others it would be *unreasonable*.

The panel determined in its decision that it was not reasonable to provide for “no mixing zone” for *E.coli* because requiring additional treatment technology to achieve a discharge of sufficient quality that no mixing zone is required was not appropriate, given, the level of improvement from previous levels proposed, the level of effects on the Clutha River/Mata-Au that would result, the uncertain level of performance that could be achieved with the additional technology, and its cost.

In setting limits for *E. coli* the hearing panel was mindful of the need to set limits that ensured high levels of on-site treatment performance at all times. There was a non-acceptance that just because significant dilution was available in the Clutha River/Mata-Au, that a poorer microbial quality in the discharge would be accepted. Silver Fern Farm had proposed a rolling 90-percentile *E.coli* level of 15,000 cfu/100mL, and ORC had suggested a maximum limit of 5,000 cfu/100mL.

The hearing panel determined that while the 15,000 cfu/100mL limit would ensure that the primary contact recreation standard would be satisfied in the receiving water within approximately 35 metres of the discharge point, but did not accept that at that level alone was a suitable control to ensure that the wastewater treatment plant is installed and operated to the highest possible standard at all times. In addition to setting the 15,000 cfu/100mL as a 90-percentile level, the median *E. coli* level of 2,000 cfu/100mL was also set as it was determined that various options for the wastewater treatment plant could achieve this limit.

Silver Fern Farms provided information that suggested that recognised water quality criteria would be achieved within 60 metres of the discharge, noting of course that full mixing does not occur for a considerable distance downstream. There was a general agreement from both the ORC and Silver Fern Farms that the 60 metres for the length of the mixing zone was a reasonable approach even though biochemical oxygen demand water quality criteria was not met at this point. The hearing panel determined that a 60 metre mixing zone therefore allows primary contact recreation to be achieved within a short distance, and considered that it was reasonable in relation to use of the river banks in the area around the discharge

2.4 EVOLUTION OF DISCHARGE PERMIT CONDITIONS

Silver Fern Farms Finegand site (then owned by Waitaki NZ Refrigerating Ltd) was granted a discharge permit by ORC's predecessor Otago Catchment Board in October 1982 to expire in October 1987 to allow discharge of 18,000 m³/d of wastewater into the Clutha River/Mata-Au. Apart from compliance limits set on the flow, there were no compliance limits set on any of the main wastewater characteristics. However, the monitoring of the wastewater characteristics of the discharge was required to be done on a monthly basis. From the expiry of this permit in 1987 to a new permit being granted by Otago Regional Council in May 1995, the site did not have any formal resource consent and continued to operate on the basis of the 1982 discharge permit. During this intervening period on-going Clutha River/Mata-Au investigations were being carried out between the then Otago Catchment Board and all other parties discharging to the river.

The granting of the 1995 resource consent allowed an increase in the volume of the wastewater. The wastewater compliance limits were set to reflect the maximum concentrations that were monitored during the previous years, namely between 1982 and 1995. This consent expired in October 2004.

During the exercise of the 1995 discharge permit, the Otago Regional Council progressively developed the regions policies and plans. Following the implementation of the operative ORC Regional Policy Statement and the Regional Water Plan, and having it well established, the compliance limits of the discharged wastewater proposed by Silver Fern Farms to continue the discharge to surface water reflected the need to improve the quality of the wastewater discharged into the Clutha River/Mata-Au.

Silver Fern Farms was granted new resource consent for a term of 15 years in May 2006 following the Environment Court Order after mediation between Silver Fern Farms and ORC. The key discharge compliance limits that have evolved over the last two resource consents are given in Table 1.

The key compliance limits were for the microbial contaminants, enumerated as *E. coli* as an indicator organism, biochemical oxygen demand (BOD₅), total suspended solids (TSS) and oil & grease (O&G). The compliance levels were based on the treatment technology that was proposed by Silver Fern Farms and therefore reflects slightly higher levels for BOD₅ and dissolved reactive phosphorus (DRP). The ammoniacal nitrogen limit had been set at a slightly higher level because the proposed treatment technology resulted in the removal of a substantial amount of total Kjeldahl nitrogen (TKN), and the resultant discharge of ammoniacal nitrogen would not have resulted in adverse effects. A tighter limit for formaldehyde was set as it was determined that the higher formaldehyde concentrations may have been contributing to fish tainting in the river.

Compliance Parameter	Discharge Permit Limits	
	1995	2006
Flow (m ³ /d)	22,000	20,000
pH (pH units)	6.5 – 8.7	6.5 – 9.7
<i>E.coli</i> (cfu/100mL)	NL	15,000 [2,000]
Temperature (°C)	NL	30
5-day soluble BOD	1,500	210
Total suspended solids	1,200	70
Oil & Grease	600	26
Dissolved Reactive Phosphorus	12	15
Ammoniacal Nitrogen	50	63
Total Sulphide	10	NL
Total Chromium	0.5	NL
Formaldehyde	50	6
<p><i>Notes:</i></p> <ol style="list-style-type: none"> 1. All compliance limits in mg/L unless otherwise stated. 2. BOD = Biochemical oxygen demand 3. NL – no limit. 4. Prior to 1995, the limits only applied to flow set a maximum flow of 18,000 m³/d. 5. The 1995 consents reflected the effluent discharge limits post primary level treatment and are set as maxima except for pH set as a range. 6. The <i>E.coli</i> limits set in 2006 consent is set as 90-percentile limit as well as [median limit]. All other parameters except pH are set as 90-percentile limits. pH is set as a range. 7. Sulphide and chromium limits became less relevant for secondary and tertiary treatment in the 2006 consent. 		

Table 1: Evolution of Discharge Compliance Limits

The tightening of the discharge limits for the key contaminants, namely BOD₅, TSS, O&G allowed Silver Fern Farms to select one of the treatment options that had been proposed (discussed elsewhere in this paper) so long as the microbial disinfection of the treated wastewater could be achieved.

3 WASTEWATER TREATMENT PLANT UPGRADE

3.1 ENGINEERING OPTIONS ANALYSIS

From the outset, Silver Fern Farms made a decision that the wastewater treatment system at the Finegand site would be upgraded to secondary and tertiary treatment level, to meet the requirements of the ORC Regional Plan and demonstrate continual improvement in environmental performance than in any recognition of adverse effects. Silver Fern Farms accepted that increased levels of wastewater treatment are the norm in New Zealand for discharges to surface water.

During the start of the environmental investigations, Silver Fern Farms undertook a preliminary engineering costing for the likely treatment options and determined that three possible treatment technologies could fit with the likely tightening discharge limits that may be imposed for the site. To assist through the resource consents process, Silver Fern Farms presented the outcomes of the likely treatment options and indicated the typical treated wastewater characteristics that could be predicted in terms of treatment effectiveness.

Silver Fern Farms shortlisted three options for secondary treatment and two options for tertiary treatment. The treatment options included:

1. Option 1 - A biological wastewater treatment plant consisting of anaerobic lagoons (3.5 ha, 6 m deep), lamella plate separator, aerated lagoon (1.1 ha, 5 m deep) and secondary clarifier if tertiary treatment using ultraviolet (UV) disinfection; or
2. Option 2 - A biological wastewater treatment plant consisting of anaerobic contact lagoon (0.5 ha, 6 m deep) and lamella plate separator if tertiary treatment using facultative pond (24 ha) and maturation ponds (10.5 ha); or
3. Option 3 - A physico-chemical treatment plant using MIRINZ double pH-adjustment method and using dissolved air flotation (DAF) unit, with flow equalisation basins upstream and downstream of the DAF unit, and tertiary treatment using UV disinfection.

Silver Fern Farms determined the expected treatment efficiencies for various contaminants of the proposed options as outlined in Table 2.

Compliance Parameter	Treatment Options Proposed		
	Option 1	Option 2	Option 3
pH (pH units)	7.0 – 8.5	7.0 – 8.5	8.5 – 9.1
<i>E.coli</i> (cfu/100mL)	15,000 [2,000]	15,000 [2,000]	33,000 [6,300]
Temperature (°C)	30	20	30
5-day soluble BOD	30	25	240
Total suspended solids	80	120	109
Oil & Grease	30	25	26
Total phosphorus	15	15	3
Dissolved Reactive Phosphorus	13	13	< 1
Total nitrogen	174	174	79
Ammoniacal Nitrogen	160	160	63
Total Sulphide	< 1	< 0.5	1.3
Formaldehyde	undetected	undetected	7.8
<p><i>Notes:</i></p> <ol style="list-style-type: none"> 1. All compliance limits in mg/L unless otherwise stated. 2. BOD = Biochemical oxygen demand 3. Option 1 – Anaerobic Lagoon and UV disinfection. 4. Option 2 – Anaerobic Contact Lagoon and Facultative/Maturation Ponds. 5. Option 3 – Physico-Chemical DAF and UV disinfection. 6. All predicted discharge compliance limits are shown for 90-percentile values, except for <i>E. coli</i> also shown as [median] and for pH shown as a range. 			

Table 2: Treatment Options and Predicted Treated Wastewater Quality

During the peer review of the proposal and resource consents process and after the decisions on consents, Silver Fern Farms recognised that a modified layout for Option 3 (physico-chemical DAF and UV disinfection) was able to provide a better wastewater quality, especially in relation to further reduce *E. coli* as the clarity of the discharge was considerably improved. The modified process layout was a patented process developed by Pattle Delamore Partners Ltd.

Silver Fern Farms appealed the consent decision at the Environment Court. In order to ensure that the modified Option 3 wastewater treatment plant would achieve better than the predicted wastewater quality (for Option 3) and would be below the limits set for resource consent, during the appeal process with the agreement from the Court and ORC, Silver Fern Farms commissioned a 10 m³/h pilot scale trial at their processing plant at Belfast, Christchurch.

3.2 PILOT SCALE DAF-IN-SERIES PLANT TRIAL

The use of chemically assisted dissolved air flotation (DAF) to remove contaminants from meat processing plants is a well established practice in New Zealand and generally uses pH adjustment to precipitate the proteins

out of meat processing wastewater in order to assist nitrogen removal before the proteins are mineralised. The dissolved air in the DAF unit is then utilised to separate the solids from the effluent and generally a clear subnatant is discharged.

The MIRINZ double step pH adjustment process utilises an acid phase step and an alkali phase step to precipitate various dissolved contaminants prior to utilising a DAF plant for the separation of the solids from the liquid. A generalised block diagram of the treatment process is given in Figure 1.

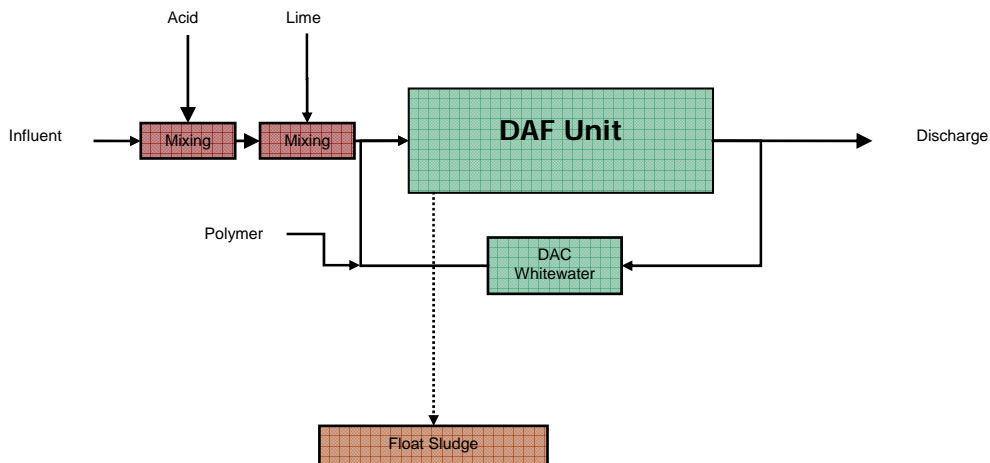


Figure 1: MIRINZ Double step pH Adjustment Process

An innovative modification of the MIRINZ double step pH adjustment process is the separation of the pH adjustment steps with intermediate solids separation, using the DAF-in-Series principle. This results in the reduced chemical requirements, especially in the alkali phase and the significant improvement of water clarity in the final chemically treated wastewater. A generalised block diagram of the treatment process is given in Figure 2.

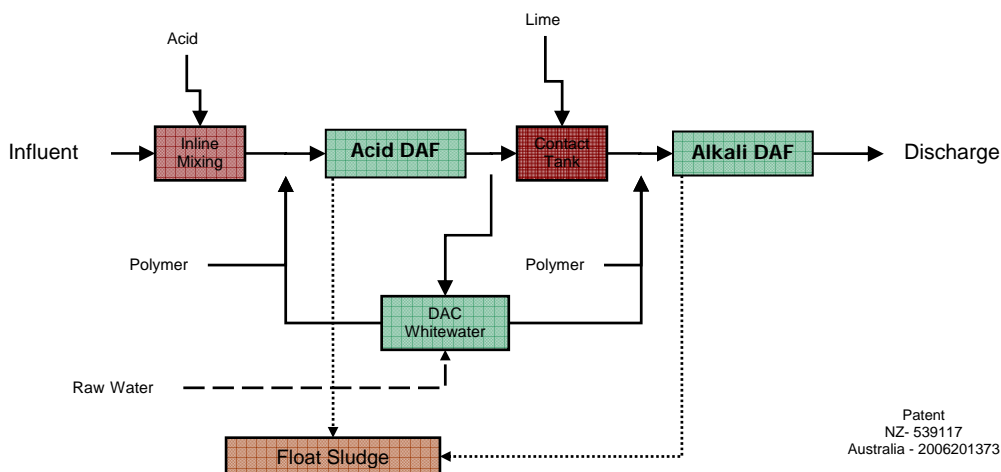


Figure 2: PDP DAF-in-Series Patented System

Silver Fern Farms commissioned a DAF-in-Series trial on meat processing wastewater from the combined sheep/beef processing plant at Belfast, Christchurch. The units were operated at 10 m³/hr, having the ability to treat up to 200 m³/d (20-hour operation), estimated at 1:100 scale trial.

The influent and treated wastewater characteristics monitored during the trial is given in Table 3. A comparison of the key discharge limits that were recommended by ORC is also given for comparison.

Monitored Parameter	Influent	Pilot Scale Trial	Consent Limit
<i>E.coli</i> (cfu/100mL)	3.5E+06 [2.0E+06]	6,900 [1,000]	15,000 [2,000]
5-day soluble BOD	477	169	210
Total suspended solids	1,655	36	70
Oil & Grease	857	< 20	26
DRP	13.2	< 0.6	15
TKN	153	54	-
Ammoniacal Nitrogen	58	38	63
<i>Notes:</i> <ol style="list-style-type: none"> All parameter concentrations in mg/L unless otherwise stated. BOD = Biochemical oxygen demand; DRP = Dissolved reactive phosphorus. All data is based on 90-percentile values. For <i>E. coli</i> the [median] values are also given. 			

The results obtained during the pilot scale trial provided a considerable amount of confidence to Silver Fern Farms that the modified Option 3, using the innovative process of DAF-in-Series, would satisfy the treatment objectives that were set by Silver Fern Farms and also meet the discharge limits.

3.3 FEED, CONSTRUCTION AND COMMISSIONING

In order to ensure that the new wastewater treatment plant was built on time, Silver Fern Farms explored outsourcing the capital project as a possible design & build project from a third party. This resulted in Silver Fern Farms requesting for proposal from various design/build teams where treatment options other than DAF-in-Series would also be explored to design a new treatment plant to meet the consent limits. All proposals received by Silver Fern Farms recommended DAF-in-Series option.

The front end engineering design (FEED) was contracted to a third party construction company who had exclusive arrangements with the patent owners. The FEED documents were prepared within two months and submitted to Silver Fern Farms for project execution. Silver Fern Farms decided that progress to construction could be undertaken internally by Silver Fern Farms engineering teams and internalised the detailed design programme.

The FEED documents were prepared to a level that much of the detailed engineering could be avoided and the construction of the new treatment plant could be undertaken based on the process and instrumentation diagram layouts. The long lead mechanical items identified during the FEED were pre-ordered while the civil design and electrical design was completed in-house by Silver Fern Farms. Specialist engineering advice on various civil, electrical and mechanical design was outsourced from various local specialist engineering organisations.

The construction programme was generally over the winter months when the processing plant was in shutdown season. The construction of the \$12M capital works project was completed within 10 months after the FEED documents were prepared and Silver Fern Farms commissioned the new wastewater treatment plant at the start of the processing season in November 2007 in time for the new discharge limit that came into effect on 1 December 2007.

During the first processing season (2007 – 08) of operation, Silver Fern Farms has been making process improvements to reduce chemical usage for treatment. Additional up the pipe remedial works are being undertaken to reduce the amount of contaminant discharge, especially oil & grease, into the treatment plant so that there would be progressive treatment efficiency gains.

The general layout and overall view of the upgraded treatment plant is shown Photograph 2. The layout shows the existing primary screening facilities and the primary clarifier in the far right, the newly constructed flow equalisation basin at the left and the DAF-in-Series system in the centre of the photograph with the ancillary

chemical facilities, UV disinfection units and control room. The processing plant facilities are shown on the top left of the photograph.



Photograph 2: Overall layout of the Finegand Upgraded Wastewater Treatment Plant

3.4 SOLIDS MANAGEMENT STRATEGY

In parallel to the use of innovative wastewater treatment process upgrade at the Finegand site, Silver Fern Farms also undertook an innovative process to manage the solids generated from the wastewater treatment facilities. The solids are generated from the primary treatments processes and the DAF-in-Series system. All the wastewater treatment solids except the stockyard wastes are collected and combined with the DAF float sludge. The mixed sludge is then heated using steam and then centrifuged. The dry solids from the centrifuge is then fed to purpose built boiler that incinerates the wastewater sludge together with wood waste for the meat processing plant's hot water and steam generation. The boiler can also handle a proportion of coal fines as supplementary fuel. The waste liquid from the centrifuge is fed back to the wastewater treatment plant. Silver Fern Farms considers that the incineration of the wastewater solids eliminates the need for landfilling of sludge and reduces the need for composting of the sludge which requires a large amount of bulking material with limited disposal options. Silver Fern Farms Finegand, however, undertakes some composting as a parallel option to handle primary screen solids unsuitable for centrifuging and as a backup to the boiler operation.

4 CONCLUSIONS

Silver Fern Farms Finegand plant has upgraded its wastewater treatment plant to meet the tightening environmental limits imposed on the site as a result of implementation of the ORC Regional Policy Statement and the Regional Water Plan.

During the resource consents process, Silver Fern Farms had recognised that a modified layout of a physico-chemical treatment plant using DAF would achieve the compliance limits imposed on the site by ORC. Silver Fern Farms Finegand confirmed the use of an innovative process prior to the upgrade by commissioning a pilot scale DAF-in-Series (NZ Patent) at their Belfast meat processing plant. The upgrade of the facilities resulted in maintaining a very small footprint against the other alternatives available to Silver Fern Farms Finegand.

The design, construction and commissioning was completed within 12 months of granting the resource consent with fine tuning of the upgraded plant occurring throughout the processing season.

ACKNOWLEDGEMENTS

Silver Fern Farms Limited is thanked for all the information provided for this paper.