

Meadowvale Stud Farm Piggery
Monitoring Programme
Annual Report
2006-2007

Technical Report 2007-27

ISSN: 0114-8184(Print)
ISSN:1178-1467 (Online)
Document: 315434

Taranaki Regional Council
Private Bag 713
STRATFORD

November 2007

Executive summary

The Meadowvale Stud Farm piggery operates a piggery located at Midhirst, in the Manganui River catchment. This report for the period July 2006-June 2007 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds a total of two resource consents, which include a total of 25 conditions setting out the requirements that the Company must satisfy. The Company holds resource consent 0351 to allow the discharge of treated effluent to land and into the Rumkeg Creek and consent 5249 allowing the discharge of emissions into the air from the piggery site.

The Council's monitoring programme for the year under review included six inspections, two wastewater and receiving water physicochemical sampling surveys and one summer biomonitoring survey of the receiving waters.

During the year, the Company has demonstrated a good level of environmental performance and compliance with the resource consents. No unauthorised discharges relating to partially treated piggery effluent being discharged to a waterbody and no odour complaints emanating from piggery operations were received by the Council. The Company has greatly increased discharges to land in preference to discharging to water.

Meadowvale Piggery Stud Farm has addressed several piggery operational maintenance issues during the monitoring period. These include desludging both anaerobic ponds, making repairs to the solids separator roof and side walls, addressing minor leaks, making repairs to sumps in an attempt to prevent unauthorised overflows and replacing the effluent spray lines around the top pond and towards the neighbouring property where effluent is spray irrigated.

The summer bio monitoring survey indicated there had been no recent significant downstream effects on the biological communities of the receiving waters. During this period the consent holder had reduced wastewater discharges to surface water by partial irrigation to land.

Meadowvale and other pork produces had competed against imported chilled product from Australia during April 2007 which financially burdened some growers.

The riparian planting programme required by a consent condition is almost complete and will greatly improve the natural habitat, water quality and add aesthetic value along the Rumkeg Creek. This program was temporary put on hold due to financial constraints.

Meadowvale piggery is trialling the "Overseer Nutrient Budget Program", which is being designed to help assist the pork growers to manage pig effluent disposal more effectively. The New Zealand Pork Board is undertaking work to identify pig manure values so these can be incorporated into the Overseer program to assist nutrient management for pig farmers. Effluent and soil samples are being taken from twelve individual pig farms, once per month for a period of six months.

This report includes recommendations for the 2007-2008 year including a reduction in the inspectorial component of the monitoring programme.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2006 to June 2007 by the Taranaki Regional Council and it is the second annual monitoring programme to be associated with resource consents held by Meadowvale Stud Farm.

The consent holder operates a piggery situated at Midhirst, in the Manganui catchment, a subcatchment of the Waitara River. The piggery has operated from its current site since 1945 and has held consents since 1977. The piggery has a total of 2000-2200 pigs, which equates to 1550 (50kg) pig equivalents.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by Meadowvale Stud Farm relating to discharges to land, water and air.

One of the intents of the Resource Management Act (1991) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Taranaki Regional Council has generally integrated its environmental monitoring programmes and reports the results of the programmes jointly.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the Resource Management Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by Meadowvale Stud Farm in the Waitara catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the Meadowvale Stud Farm.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretation, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2007-2008 monitoring year.

A glossary of common abbreviations and scientific terms and a bibliography are presented at the end of the report.

1.1.3 The Resource Management Act (1991) and monitoring

The Resource Management Act primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- (a) the neighbourhood or the wider community around a discharger, and may include cultural and socio-economic effects;
- (b) physical effects on the locality, including landscape, amenity and visual effects;
- (c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- (d) natural and physical resources having special significance (eg, recreational, cultural, or aesthetic);
- (e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Taranaki Regional Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the Meadowvale Stud Farm Piggery in the Waitara catchment during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or trivial (such as data supplied after a deadline) non-compliance with conditions.
- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the year were negligible or minor at most, items of concern were resolved positively, co-operatively, and quickly, the Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with.
- **improvement desirable** indicates that the Council may have been obliged to record a verified unauthorised incident involving significant environmental impacts against the company, and/or abatement notices may have been issued; there were adverse environmental effects arising from activities and intervention by Council staff was required, and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at end of the period under review.
- **poor** performance is used when there were grounds for prosecution or infringement notice

1.2 Process description

Piggery wastewater from the various collection sumps passes through a separator screen which provides primary treatment by separation of solid components from the waste. These solids are composted, bagged and sold as garden fertiliser. The separator reduces solids, the biochemical oxygen demand (BOD₅) and some nutrients contained in the liquid wastewater which is directed to the treatment pond system.



Figure 1 Piggery and disposal system

- | | |
|-----------------------------|---|
| (1) initial anaerobic pond. | (4) staff gauge at Denbigh Road Bridge |
| (2) middle anaerobic pond | (5) offal disposal |
| (3) final aerobic pond | (6) & (7) showing spray irrigated areas |

The treatment pond system consists of three ponds (Figure 1). These have been designed to operate as an initial anaerobic pond, followed by two aerobic ponds. However, the second pond appears to be operating as an anaerobic pond. Therefore in effect there are two anaerobic ponds and one aerobic pond. These ponds are adequately sized for the requisite treatment of the piggery wastes provided that the system is regularly maintained.

From the treatment pond system, effluent is discharged to the Rumkeg Creek or spray irrigated to surrounding farmland which includes neighbouring properties.

Rumkeg Creek is a tributary of the Manganui River in the Waitara catchment and joins the Manganui River 750m downstream of the discharge.

Wastewater from the treatment system is to be discharged to natural water only when flow conditions in Rumkeg Creek provide for no less than 250 times effluent dilution. When low receiving water flow conditions preclude this discharge, treated wastewater is to be spray irrigated onto nearby farmland. As insufficient land is available for this purpose on the consent holder's property, agreements have been reached with neighbouring property owners to use their land also.

Wastewater which is spray irrigated to land is pumped via the second treatment pond.

1.3 Resource consent

1.3.1 Water and Land discharge permit

Section 15(1)(a) of the Resource Management Act stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

Sections 15(1)(b) and (d) of the Resource Management Act stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

Meadowvale Stud Farm holds consent **0351** to discharge treated piggery effluent from a ponds treatment system into the Rumkeg Creek, a tributary of the Manganui River in the Waitara catchment (during high flow conditions) and to discharge piggery effluent to land (see resource consent in Appendix I). This consent was issued by the Taranaki Regional Council on 5 September 2003 as a resource consent under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2015.

The discharge of treated wastewater of this nature may affect the water quality of a stream, particularly if there is insufficient dilution. Some effects may be obvious (eg appearance, turbidity) while biological effects may be more subtle.

The discharge of piggery effluent to land greatly improves soil fertility. However it has the potential to contaminate groundwater and surface water if managed inappropriately.

Fourteen special conditions are attached to Resource Consent **0351**:

Discharge to water

Special Conditions 1, 2 and 3 define the mixing zone and prohibit certain effects on the receiving waters.

Special Condition 4 requires the consent holder to operate and maintain the treatment and discharge system to ensure compliance.

Special Condition 5 requires the maintenance of a minimum dilution rate at all times in the receiving water.

Special Condition 6 requires the consent holder to monitor, maintain and supply records of the discharge.

Special Condition 7 requires riparian fencing and planting within 3 years, at a stipulated rate.

Discharge to land

Special Conditions 8 and 9 limit effluent application rates to land in terms of nutrient loadings.

Special Condition 10 limits the areas and locations of land discharge.

Special Condition 11 prohibits discharge of contaminants to surface water.

Special Condition 12 limits surface ponding of the discharge.

Special Condition 13 requires the consent holder to monitor and maintain records of the land discharge.

Special Condition 14 requires that the discharge to land shall be maximised and used in preference to discharge to water.

1.3.2 Air discharge permit

Section 15(1)(c) of the Resource Management Act stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

Meadowvale Stud Farm holds air discharge permit **5249** to discharge emissions into the air from a pig farming activity and associated activities, including solids composting, effluent treatment and irrigation and other waste management activities. This permit was issued by the Taranaki Regional Council on 2 September 1998 as a resource consent under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2009.

Piggery effluent has the potential to have significant odour especially when discharged to land. Nine special conditions are specified in resource consent **5249**.

Special Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effects on the environment.

Special Conditions 2 and 3 require the consent holder to minimise offsite odour effects by reference to certain activities and control measures.

Special Condition 4 requires the anaerobic pond to be desludged.

Special Condition 5 controls alterations to the pig farming and effluent disposal processes, operations, equipment or layout which may significantly change the nature or quantity of contaminants emitted from the site.

Special Condition 6 requires the consent holder to minimise the emissions and impacts of air contaminants discharged from the site.

Special Condition 7 requires the consent holder to operate the piggery and associated activities substantially in accordance with information provided.

Special Condition 8 limits the discharges of suspended or deposited dust at or beyond the boundary of the site.

Special Condition 9 provides for review of any or all of the conditions of this consent.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the Resource Management Act sets out an obligation for the Taranaki Regional Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

The Taranaki Regional Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.

The monitoring programme for the Meadowvale Stud Farm Piggery site consisted of four primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Taranaki Regional Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application, in discussion over monitoring requirements, preparation for any reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

The Meadowvale Stud Farm Piggery site was visited six times during the monitoring period. With regard to consents for the discharge to water and land, the main points of interest were the piggery waste collection areas, the separator and composting system and the treatment ponds system with potential or actual discharges to receiving watercourses, including potential odour.

As far as practical, inspections in relation to air emissions were integrated with inspections undertaken for other purposes eg, effluent discharges. The air monitoring programme had been costed on the basis of an integrated approach to resource monitoring.

1.4.4 Physicochemical sampling

The Taranaki Regional Council undertook sampling of both the discharge from the site and the water quality of Rumkeg Creek upstream and downstream of the discharge point and mixing zone.

The treated effluent discharge was sampled on two occasions, and the samples analysed for carbonaceous biochemical oxygen demand (CBOD₅), chloride,

conductivity, suspended solids, dissolved reactive phosphorus (DRP), un-ionised ammonia, pH, turbidity and temperature.

Rumkeg Creek was sampled on the same two occasions, upstream and downstream of the treated discharge, and the samples analysed for filtered carbonaceous biochemical oxygen demand (FCBOD₅), chloride, conductivity, suspended solids, dissolved reactive phosphorus (DRP), un-ionised ammonia, pH, turbidity and temperature.

The monitoring programme allows for the discharge and receiving water to be sampled on two occasions under treated effluent discharge conditions.

1.4.5 Biomonitoring survey

A biological survey was undertaken in May 2007 at three established sites. The bio-monitoring sites monitored, need to be associated with areas actually receiving the effluent. Because of the increased effluent volume discharged to land and for the potential of wastes entering both ground and surface water, the three sites monitored were upstream and downstream of the tributary that rises in the neighbouring upstream farm, and entering the Rumkeg Creek approximately 75 metres upstream of pond one and downstream of the pond discharge to assess any effect from the ponds.

Taranaki Fish and Game Council in the past had noted impacts on the biological quality of the Manganui River particularly in the vicinity of the Rumkeg Creek confluence. These impacts, and the appearance of 'undesirable heterotrophic growths' on the bed of the Rumkeg Creek from time to time, had indicated the inability of the receiving waters to adequately assimilate the discharge of treated piggery wastes under low flow conditions. As recently as August 2003 these growths had been recorded on the bed of Rumkeg Creek.

2. Results

2.1 Water

2.1.1 Inspections

Inspection of 23 August 2006

This first inspection for the monitoring period was carried out during fine weather conditions with a light south westerly breeze after a period of wet weather. Slight piggery odours were found to be emanating mainly from the first anaerobic pond and not from the middle or final aerobic ponds. All wastes were well contained and showed no recent overflow discharges into the Rumkeg Creek.

The consent holder had made repairs to the top pump and sump which had recently overflowed to the lower backup holding pond where the effluent was maintained. Weeds growing on a floating island on the second aerobic pond required to be sprayed. This island had progressively increased in size reducing the pond surface area therefore reducing the ponds efficiency in aeration. No treated effluent was being discharged into the Rumkeg Creek or partially treated effluent being spray irrigated to land on this occasion.

Inspection of 25 October 2006

This inspection was carried out during wet, overcast weather conditions after a period of recent rain. Treated effluent was being discharged into the Rumkeg Creek, and receiving water and effluent discharge samples were collected on this occasion. The wastewater discharge flow to the Rumkeg Creek was measured at 0.7 litres /second and Rumkeg Creek had a flow of 1,100 litres /second. The dilution ratio in this instance was 1:1570, well above the consent requirement of 1:250. The records received from the consent holder show this discharge was measured earlier on in the morning at 2.0 litres/second and the Rumkeg Creek had a flow of 577 litres/second. The dilution ratio in this instance was 1:289, also indicating the dilution of the wastewater was in compliance with consent conditions. The consent holder had sprayed the weeds growing on the floating island on the middle pond.

It was noted that normal piggery odours were emanating from around the piggery site and that all was satisfactory.

Inspection of 18 January 2007

This compliance inspection of the piggery was conducted three days after contractors had pumped out the first and second anaerobic ponds and irrigated the contents to a neighbouring farm, 500 metres west of the Meadowvale property.

The Rumkeg Creek was showing low flow conditions, running clean and clear with no sign of sewage fungus growing on the stream bed at the treated effluent discharge point. The solids separation and composting system was working well with wastes being directed back to the separator sump. Some piggery odours were noticeable directly around the solids separator and pond perimeters, although odours were insignificant around the farm boundary. The piggery housed up to 2000 pig units, which was slightly lower than the previous month's production. The feeding regime had been altered, having no noticeable odour effects.

The neighbouring spray-irrigated paddocks were also inspected. It was estimated that 1.5 hectares of land had been irrigated and there were no signs of ponding or surface run-off into a nearby waterway. There were found to be no downwind odours associated to spray irrigating, nor were there any odour complaints received

by the Council. The offal pits were found to be well covered with odours being controlled.



Photo 1 Sludge removal from second anaerobic pond

Inspection of 6 March 2007

This inspection of the piggery operation and ponds system was carried out during overcast weather conditions with a light northerly breeze after a period of fine weather. The Rumkeg Creek was showing low flow conditions and no discharge to land or water was occurring at the time of this inspection.

The irrigators were being moved to another paddock to continue spray irrigating. It was noted that discharging to the land was in preference to discharging to the Rumkeg Creek.

The pond system was operating as per design although the second anaerobic pond still required the removal of an island found to be floating in the middle. The final aerobic pond was only quarter full and had dried up along the western end. Effluent pumped to land from the second anaerobic pond had reduced flow into the final pond.

The offal pits were also inspected and were found to be well managed and covered, controlling odours to “noticeable” levels.

Inspection of 15 March 2007

Notification was received from the consent holder that a discharge of treated wastes from the pond system into the Rumkeg Creek had commenced. This inspection of the piggery was carried out during wet weather conditions. The Rumkeg Creek was running turbid brown after a period of heavy rain. Samples were taken from the treated effluent and receiving waters on this occasion. The effluent discharge was measured volumetrically at 0.67 litres/second. The staff gauge reading was measured at 0.34 metres equating to a river flow of 577 litres /second. The dilution ratio in this instant was 1:860, indicating the dilution of the wastewater was well in compliance with allowable consent conditions of 1:250.

The aerobic pond was brown-red in colour displaying a distinctive red algal bloom covering the pond surface, indicating the presence of sulphur bacteria.

Piggery odours were noticed mainly around the separator area. The ponds system showed normal levels and all discharge points were well maintained, directing flows back to sumps.

Inspection of 7 May 2007

This final inspection for the monitoring period was carried out during fine weather conditions with a slight northerly breeze. The Rumkeg Creek was showing low flow conditions with no discharge occurring to the receiving waters. The consent holder was irrigating from the second anaerobic pond at the time of inspection to the southern end paddocks. The irrigated area looked good, showing no signs of ponding or surface run-off into the nearby waterways. The ponds system looked satisfactory, with the first pond displaying active anaerobic activity, the second pond still had the floating island covering a large area of pond surface, and the third pond showed a low level with some solids building up along the western end. The burial pits were covered, and piggery odours were "moderate" emanating from onsite.

2.1.2 Results of discharge monitoring

2.1.2.1 Treated piggery wastewater

Prior to the 2006-2007 monitoring period the treatment ponds system had been sampled for various reasons. These results are summarised in Table 1. (Note that the treatment system has varied in design over the sampling periods).

Table 1 Summary of treated wastewater analyses from the Meadowvale Stud Farm piggery for the period 1992 to June 2006

Parameter	Unit	Number of samples	Range	Median
Conductivity @ 20°C	mS/m	17	107-398	200
pH		14	7.8-8.6	8.05
Total carbonaceous BOD ₅	g/m ³	18	44-360	120
Filtered carbonaceous BOD ₅	g/m ³	6	6.2-46	11
Ammoniacal nitrogen	g/m ³ N	19	23.4-410	196
Dissolved reactive phosphorus	g/m ³ P	15	12.8-49.8	34.1
Turbidity	NTU	3	98-280	150
Suspended solids	g/m ³	21	97-750	300

These results illustrate the variability in piggery effluent quality measured from this system over the period prior to the current consent monitoring programme. Some of this variability has been related to stormwater infiltration into the system and may also have coincided with changes in the configuration and degrees of treatment provided by the treatment system over the fourteen-year period surveyed.

The analytical results for which turbidity (NTU) is shown in the above table differ slightly than in previous reports because the previous turbidity meter (nephelometry, Hach 2100A meter) was replaced with a new (WTW Cyberscan) turbidity meter in 2005.

The current treatment system's effluent was monitored on two occasions during the 2006-2007 period, before and after the anaerobic ponds had been cleaned out. These results are summarised in Table 2 for comparative purposes.

Table 2 Summary of treated wastewater analyses from the Meadowvale Stud Farm piggery for the period July 2006 to June 2007

Parameter	Unit	25 October 2006	15 March 2007
Conductivity @ 20°C	mS/m	213	121
pH		7.9	7.7
Total carbonaceous BOD ₅	g/m ³	220	89
Ammoniacal nitrogen	g/m ³ N	328	78.6
Dissolved reactive phosphorus	g/m ³ P	38.4	37.1
Turbidity	NTU	170	220
Suspended solids	g/m ³	410	310
Temperature	°C	11.5	11.3
Chloride	g/m ³	73.1	81.3

Monitoring of the wastewater quality during the 2006-2007 year indicated an improved effluent quality during the later part of the 2006-2007 period in comparison with historical quality in terms of median total carbonaceous BOD₅ and some improvement in quality in terms of median nutrient concentrations. However, a wide range of waste loadings (turbidity and suspended solids) were measured during the period with higher concentrations for several parameters in the later part of the 2006-2007 period.

These results should be compared with one another and with the range/median of previous results until June 2006.

There was a marked decrease in conductivity, BOD and ammonia, with relatively little change in DRP and solids/turbidity.

The results indicate that this was caused by increased dilution/lower loading rather than by better treatment following desludging (which would have increased ammonia rather than lowering it).

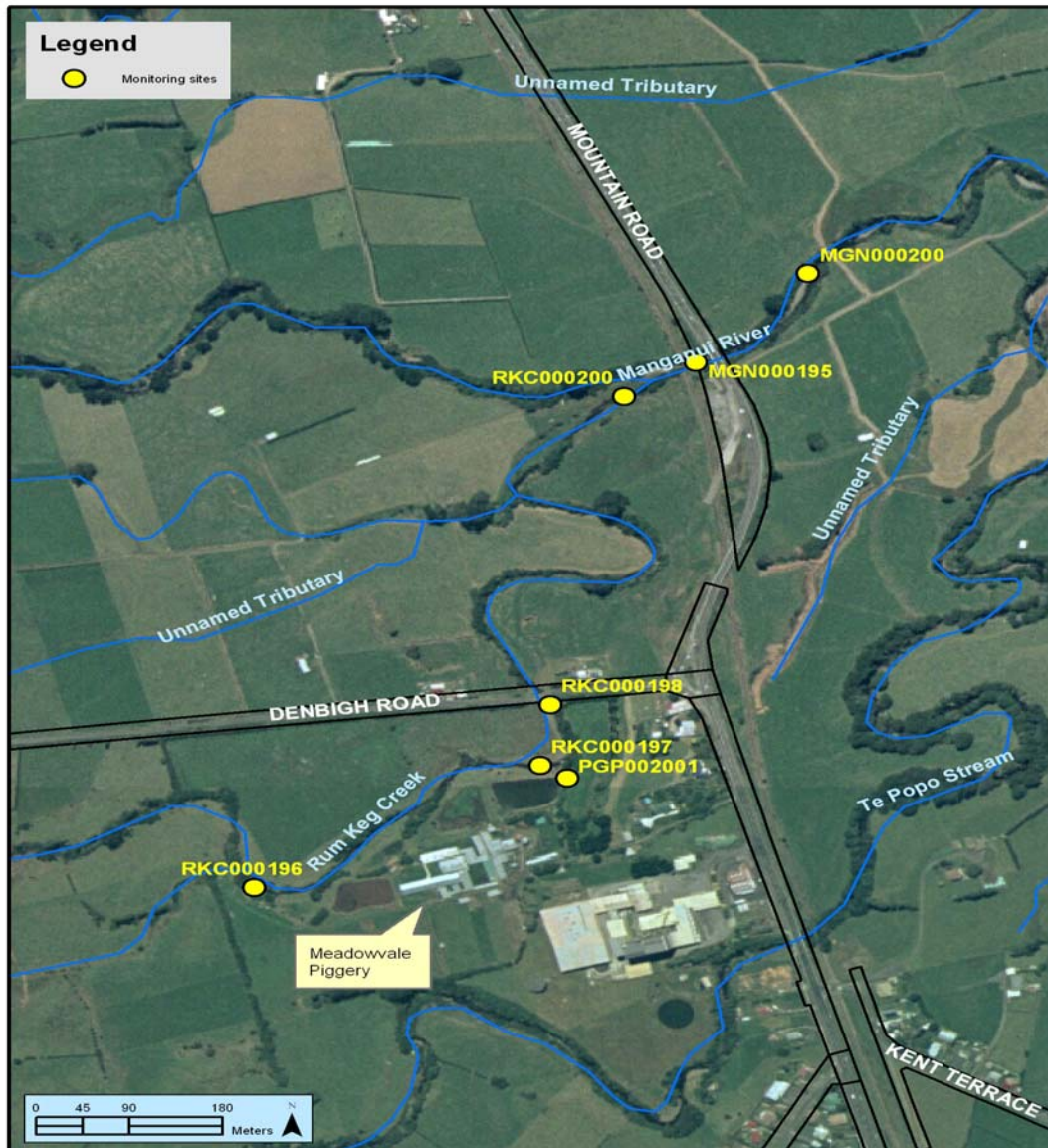


Figure 2 Aerial photograph of monitoring sites

2.1.3 Results of receiving environment monitoring

2.1.3.1 Receiving waters physicochemical monitoring

Figure 2 shows the Meadowvale's piggery site in relation to the receiving waters of Rumkeg Creek and Manganui River. Te Popo Stream also borders the Meadowvale property on the southern side. Environmental monitoring sites (Table 3) are also illustrated in relation to the piggery operation.

The sites monitored for physicochemical purposes are listed in Table 3.

Table 3 Location of sites in Rumkeg Creek, a tributary of the Manganui River

Site	Site code	Map reference	Location
Rumkeg Creek	RKC000197	Q20:186124	20 meters upstream of piggery discharge
Piggery effluent	PGP002001	Q20:189125	At discharge outlet from aerobic pond
Rumkeg Creek	RKC000198	Q20:188127	Denbigh Road Bridge

2.1.3.2 October 2006 survey

Results of the survey performed on 25 October 2006 are presented in Table 4.

Table 4 Results from Meadowvale Stud Farm piggery and Rumkeg Creek, sampled on 25 October 2006

Site location		Rumkeg Creek u/s	Piggery final effluent	Rumkeg Creek d/s
Site code		RKC000197	PGP002001	RKC000198
Parameter	Unit			
Time	NZST	0845	0850	0915
Temperature	°C	10.5	11.5	10.5
Conductivity @ 20°C	mS/m	8.8	213	8.9
Chloride	g/m ³	9.9	73.1	10.1
pH		7.3	7.9	7.3
Total carbonaceous BOD ₅	g/m ³	-	220	-
Filtered carbonaceous BOD ₅	g/m ³	1.0	-	0.9
Ammoniacal nitrogen	g/m ³ N	0.177	328	0.372
Unionised ammonia	g/m ³ NH ₃	0.00083	6.52	0.00175
Dissolved reactive phosphorus	g/m ³ P	0.028	38.4	0.056
Turbidity	NTU	3.2	170	3.4
Suspended solids	g/m ³	7	410	8
Appearance		Turbid, brown	Discharge: 0.70 l/sec Pond brown reddish	Turbid, brown (staff gauge= 0.40m)

These results indicate that the treated effluent discharge dilution ratio at the time of sampling was above the required minimum ratio of 1:250 as set out in special consent condition 6. Special consent conditions 2 & 3 (unionised ammonia, filtered carbonaceous BOD₅ and turbidity) limits were in compliance, 50 metres downstream from the treated effluent discharge point. The final effluent BOD₅ and suspended solids showed slightly elevated results indicating that further desludging of the anaerobic ponds system and maintaining effective solids removal in the separation process will further improve these results. This survey was done before contractors desludged both (top and middle) anaerobic ponds.

2.1.3.3 March 2007 survey

Results of the survey performed on 15 March 2007 are presented in **Error! Reference source not found.**

Table 5 Results from Meadowvale Stud Farm piggery and Rumkeg Creek, sampled on 15 March 2007

Site location		Rumkeg Creek u/s	Piggery final effluent	Rumkeg Creek d/s
Site code		RKC000197	PGP002001	RKC000198
Parameter	Unit			
Time	NZST	0920	0915	0940
Temperature	°C	11.2	11.3	11.1
Conductivity @ 20°C	mS/m	12.4	121	12.4
Chloride	g/m ³	19.4	81.3	19.6
pH		7.4	7.7	7.4
Total carbonaceous BOD ₅	g/m ³	-	89	-
Filtered carbonaceous BOD ₅	g/m ³	1.0	-	1.1
Ammoniacal nitrogen	g/m ³ N	0.214	78.6	0.309
Unionised ammonia	g/m ³ NH ₃	0.00133	0.97782	0.00191
Dissolved reactive phosphorus	g/m ³ P	0.070	37.1	0.140
Turbidity	NTU	7.4	220	11
Suspended solids	g/m ³	10	310	20
Appearance		Turbid, brown	Discharge: 0.67 l/sec Reddish brown	Turbid, brown (staff gauge= 0.34m)

These results indicated a high dilution ratio in Rumkeg Creek (1:860) with minimal impacts on the receiving waters in compliance with special condition 2, 3, and 4 of the consent. Wastewater quality results showed a lowered BOD₅ and suspended solids result compared to the previous October 2006 results, which may have been directly attributed to desludging the top and middle anaerobic ponds three months prior or better removal of solids in the separation process. Conductivity and ammonia levels were also lower which may have been attributed to high rainfall periods during the previous two months and effluent spray irrigated from the middle pond reducing the loading on the final aerobic pond.

2.1.4 Biological receiving water monitoring

The Council's standard 'kick-sampling' technique was used at three established sites to collect streambed macroinvertebrates from Rumkeg Creek in order to assess whether the Meadowvale Piggery has had any adverse effects on the macroinvertebrate communities of these streams. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

Table 6 Biomonitoring sites in Rumkeg Creek and the Manganui River, surveyed in relation to Meadowvale Piggery

Site No	Site code	Map reference	Location
1	RKC000196	Q20:186-124	400 metres upstream of Denbigh Road bridge
2	RKC000198	Q20:188-126	Denbigh Road bridge
M1	MGN000195	Q20:190-130	Upstream of confluence with Rumkeg Creek

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the

presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The macroinvertebrate survey conducted on 17 May 2007 indicated that the discharge from the Meadowvale Piggery, being both the discharge from the oxidation ponds, and also through irrigation onto land, in the month preceding this survey had had no detrimental effects on the macroinvertebrate communities of the Rumkeg Creek. Further, no undesirable heterotrophic growths were observed on the streambed at the time of the survey. This is consistent with the compliance of the discharge with special conditions of resource consent 0351, where, allowing for a mixing zone of 50 metres below the discharge point, the discharge shall not give rise to any significant adverse effects on aquatic life, habitats or ecology in Rumkeg Creek.

The macroinvertebrate communities of Rumkeg Creek contained moderate proportions of 'sensitive' taxa at all sites and the communities were generally dominated by both 'sensitive' and 'tolerant' taxa. Taxonomic richness (number of taxa) was similar between all three sites, and any differences in MCI were attributable to subtle changes in community composition, such as a 'highly sensitive' rare (i.e., less than five individuals) taxon that was present at site 1.

There is no evidence to suggest that the discharge of effluent from Meadowvale Piggery to land or to the Rumkeg Creek was having an adverse effect on the Rumkeg Creek in the weeks preceding this survey.

2.1.5 Gauging water flow

To determine flow rates in the Rumkeg Creek a rating curve is maintained by Council. This enables the consent holder to assess treated wastewater discharge compliance with the minimum dilution ratio of 1:250 (one part effluent to two hundred and fifty parts receiving water flow).

The staff gauge installed on the Denbigh Road Bridge provides the consent holder with the stream level (or height) and a rating chart produced by Council showing water flow rates at any given stream rate. This rating was updated during the 2006-2007 period from reported hydrological gaugings.

2.1.6 Liaison with consent holder

During the 2006-2007 monitoring period, the Taranaki Regional Council liaised with the consent holder regarding several operational issues, additional to those required in the monitoring programme.

Topics discussed: Annual draft reports, compliance fees, pond maintenance, bio-monitoring program, piggery operations, overseer nutrient programme etc.

21 August 2006

The Consent holder notified the Council, that the "draft report" had been read and that no changes were required.

17 October 2006

The Council contacted the consent holder regarding the frequency of treated wastes being discharged into the Rumkeg Creek as a bio-monitoring survey was programmed as per the monitoring programme. Fewer discharges to water had occurred in recent weeks, partly because of low river flow conditions and that discharging to land had preference. The bio-monitoring sites monitored, need to be associated with areas actually receiving the effluent. Because of the increased effluent volume discharged to land and for the potential of wastes entering both ground and surface water, the sites to be monitored will be upstream and downstream of the tributary that rises in the neighbouring upstream farm, and entering the Rumkeg Creek approximately 75 meters upstream of pond one. The site downstream of the pond discharge will be retained, to assess any effect from the ponds.

15 January 2007

The consent holder notified the Council that contractors were about to desludge the second anaerobic pond and spray irrigate to a neighbouring property as performed the previous year. The Council allowed spray irrigating to commence as no problems had occurred previously.

22 June 2007

The Council had a meeting with the consent holder to discuss operational issues prior to drafting the 2006-2007 annual report.

The Council received copies of the treated wastewater discharge (to water) records and copies of the Nutrient Overseer Project analysis records undertaken by the New Zealand Piggery Board.

Consent and compliance monitoring program activities were also discussed to establish the possibility of reducing compliance fees. Meadowvale and other Taranaki pork producers have experienced financial hardship during the financial period due to competition from chilled pork imported from Australia and a failed grain contract leaving the growers financially burdened.

The riparian planting project was not completed and will be completed next year. An update on production pig units and the feeding regime was also received by the Council.

2.1.7 Treated effluent discharge records

Discharge to water

Special Condition 6 of consent **0351-3** requires a minimum dilution rate of 1 part effluent to 250 parts receiving water at the point of discharge and maintained at all times during discharge events.

Special condition 7 of consent **0351-3** requires the consent holder shall monitor and maintain discharge records, including date, time, rate, staff gauge reading and duration of discharge. These records are to be supplied to the Council quarterly or as requested.

During the 2006-2007 monitoring period the Council received from Meadowvale piggery, records showing 77 daily discharges to the Rumkeg Creek. These records indicated that the consent holder maintained a minimum dilution rate of 1 part

effluent to 250 parts receiving water at the point of discharge on all occasions. 109 daily discharges were recorded during the previous 2005-2006 monitoring period.

Discharge to land

Special condition 14 of Consent **0351-3** requires that the consent holder shall monitor and maintain records of discharge, including date, application area, rate and duration of discharge. These records are to be supplied to the Council quarterly or as requested.

Special condition 15 of consent **0352-3** requires the consent holder to maximise discharge to land in preference to discharge to water.

During the 2006-2007 monitoring period no records were received by Council in relation to discharge to land although the consent holder had recorded pump irrigating hours.

The consent holder is trialling the Overseer nutrient budget program, initially developed for dairy farmers, to assist in managing application of dairy effluent to land. Recognising the nutrient composition of pig manure is different to cow manure, the NZPIB is undertaking work to identify pig manure values so these can be incorporated into the Overseer, program to assist nutrient management for pig farmers.

Greater emphasis in monitoring the effluent application rates to land is required ensuring that the effluent application rate does not exceed the recommended 200 kg nitrogen/ha/year, during the 2007-2008 monitoring period.

The Council strongly encourages pork producers to use systems that discharge pig manure to land rather than water. The nitrogen content of piggery manure is usually the major determinant of land area required.

2.2 Air

2.2.1 Inspections

As far as was practicable, inspections in relation to air emissions were integrated with inspections undertaken for other purposes eg, effluent discharges. The air monitoring programme had been costed on the basis of an integrated approach to resource monitoring.

2.2.2 Results of air monitoring

Odours emitted from normal piggery operations are influenced mainly by weather conditions (ie wind direction), operating of the oxidation treatment ponds, solids storage & disposal, irrigating to land and general piggery hygiene operations.

The offensiveness of odour is reliant on individual perception, Council methods of measurement, and management practices of the pork producer. The Environmental Management System (EMS) deals with piggery operational practices ensuring the effect of odour is taken into account when the pork producer is undertaking activities relating to areas of the piggery.

All inspections carried out during the monitoring period noted that odours were more prevalent around the separator and pond areas. The consent holder has been made aware of these issues and improvements are to be made.

2.3 Register of incidents (air and water)

The Taranaki Regional Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The register ('unauthorised incident register') includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Incidents may be alleged to be associated with a particular site. If there is an issue of legal liability, the Council must be able to prove by investigation that the identified Company is indeed the source of the incident. (or that the allegation cannot be proven).

In the 2006-2007 year no unauthorised incidents were recorded by the Council in relation to the Meadowvale Stud Farm Piggery.

2.4 Discussion of plant performance

During the year, the Company has demonstrated that a **good** level of environmental performance and compliance issues relating with the resource consents was achieved.

Meadowvale Piggery Stud Farm has addressed several piggery operational maintenance issues during the monitoring period. These include desludging both anaerobic ponds, making repairs to the solids separator roof and side walls, addressing minor leaks, making repairs to sumps in an attempt to prevent unauthorised overflows and replacing the effluent spray lines around the top pond and towards the neighbours property where effluent is spray irrigated.

During the monitoring period, both of the anaerobic ponds were desludged and contents spray irrigated to a neighbouring (Cliff Johns) property. The middle pond still requires removing a floating island on the pond surface to help prevent the pond from overloading and short-circuiting. Overloaded ponds reduce the effectiveness in breaking down organic matter. A well maintained pond treatment system, comprising of an anaerobic and aerobic pond in series, can achieve up to 95% BOD removal, and up to 70% nitrogen reduction. The BOD₅ concentration recorded from the final piggery effluent at the time of the survey performed toward the end of the 2006-2007 monitoring period was lower, compared with previous results. There may be several contributing factors why lower BOD₅ results were achieved in the final treated effluent but the desludging program undertaken in May 2007 may have been a contributing factor. Meadowvale piggery has now programmed contractors to carry out an annual desludge program on all three ponds as required.

No piggery odour complaints were received by the Council during the 2006-2007 monitoring period nor were there any complaints received by the consent holder. Special attention was made to spray irrigating during favourable wind conditions, maintaining the ponds system by desludging when required, disposal of pig carcasses in a well managed, covered, offal pit and in general, maintaining a reasonably tidy workplace. Continual piggery operational improvements to manage odour discharges to air are required to prevent potential odour problems. The RMA (1991)

effectively requires that *'there should be no offensive or objectionable odour beyond the boundary of the farm'*. Compliance with managing discharges to air is mentioned in the EnviroPork work book and it would be prudent for the Consent holder to discuss these guidelines with the New Zealand Pork Industry Board (NZPIB).

Meadowvale piggery is trialling the "Overseer Nutrient Budget Program", which is being designed to help assist the pork growers to managing pig effluent disposal more effectively. The NZPIB is undertaking work to identify pig manure values so these can be incorporated into the Overseer program to assist nutrient management for pig farmers. Effluent samples are being taken from twelve individual pig farms, once per month for a period of six months. Effluent samples are collected from the point of discharge (middle pond) and sent to Hill Laboratories for an analytical report where the results are forwarded to the producers. Collated data will be assessed for variability in nutrient values, and any patterns checked (eg, seasonal patterns, significant management changes or factors such as size of ponds). It is intended that soil samples will be collected at a later stage for further research work.

The absence of 'sewage fungus' growth on the Rumkeg Creek streambed was again the direct result of limiting discharging final effluent to suitable conditions which provide adequate dilution, or to land irrigation.

Disposal of treated wastewater to land was also performed, although no records of discharge were received by Council. Discharge to land has been maximized in preference to discharge to water especially during periods of low flow conditions. The nitrogen content of piggery manure discharged to land is usually the major determinant of the land area required. For this reason it is important to keep accurate spray irrigation records to prevent exceeding an application rate of 200kg N/hectare/year. For the Overseer trial to be effective, spray application rates and land area irrigated will require accurate recording.

Maintenance planned for the coming twelve month period include: extending a concrete pad in front of the separator /compost storage area. This is a high work load area, where solids are mechanically removed from the separator by tractor and bucket which are then stockpiled and drained ready for composting. Part of the loading area had a concrete pad laid previously but extending this pad will help keep the area clean and tidy, containing all solids with wastes being directed back to the separator sump. This should also help control odours which are frequently noticeable around this work area.

Work is to be carried out strengthening the effluent pond walls. Erosion, cattle and mechanical damage has occurred, thinning the pond walls in some areas. Ponds should be maintained at lower levels until the pond walls are repaired. High levels in the ponds may attribute to overflows which would have a detrimental environmental effect on the Rumkeg Creek if this were to occur.

Meadowvale have up to 1,900 -2,000 pig units at any one time. Stock units include 200 breeding sows producing 225,000kgs of product, 40 gilts (young breeders), 12 boars, 400 piglets on sows (up to 4 weeks old in farrowing grates), 500 weaners (up to eleven weeks old) and 800 growers up to 21-22 weeks old before going to the market.

The feeding program has been up-graded resulting in pigs going to market ten days earlier with an average weight gain of 2 kgs.

The new diet includes fish meal and a higher percentage milk powder for the young piglets/wieners and 1,800 litres of either whey, cream or brewers yeast (ex brewery) for the growers and sows.

Mixed feed includes 75% barley (some wheat), 5% dried blood (Walkers Hawera), 18% meat and bone meal (Taranaki by Products), and 2% vitamins and minerals. This new feeding regime was started late November 2006 and any environmental effects, if any, are yet to be established.

2.5 Environmental effects of exercise of water and land discharge permit

2.5.1 Exercise of water discharge consent

The physicochemical monitoring had indicated that the discharge of treated piggery effluent into the Rumkeg Creek had resulted in no adverse downstream environmental effects. The absence of 'sewage fungus' growth on the Rumkeg Creek streambed was a direct result of discharging final effluent under high flow conditions and otherwise irrigating to land. The consent holder complied with the required dilution ratio of 1:250 on all occasions.

Piggery effluent is about ten times more concentrated than dairy effluent and consequently has greater polluting potential. Piggery wastes assimilation may remove much of the available oxygen in the receiving water and add excess amounts of nutrients (nitrogen and phosphorus), leading to the formation of nuisance biological growths on streambeds.

2.5.2 Exercise to land discharge consent

Wastewater discharge to land is generally preferred to discharging to flowing surface waters. However, land discharges can have adverse affects on waterbodies, groundwater and grazing stock if not appropriately managed.

The application of nutrients (in particular, nitrogen, phosphorus, and potassium) in excess of plant utilisation can result in leaching of nutrients to groundwater. In addition, irrigating too close to a waterbody or in excess of soil hydraulic conductivity can result in runoff to waterbodies.

It is important that the consent holder keeps records of all land discharges to minimise any environmental effects and to be able to monitor the application as part of best management practices to eliminate any irrigation run off to neighbouring waterbodies (Te Popo Stream and Rumkeg Creek) thus preventing any further unauthorised discharges to a waterbody.

2.6 Environmental effects of exercise of air discharge permit

2.6.1 Exercise of air consent

Operation of the piggery has resulted in some objectionable odour off site from time to time. Odour has been the result of general operations and adverse weather conditions. As the piggery is located on a small site within a residential area in Midhirst there is no real buffer zone.

The RMA (1991) effectively requires that there should be no offensive or objectionable odour beyond the boundary of the farm.

The pork industry ('EnviroPork') guide to managing environmental effects, deals with management practices ensuring the effect of odour is taken into account when undertaking activities relating to farm operations.

No complaints concerning piggery odour emissions was received by the Council during the 2006-2007 period.

2.7 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Table 7 and Table 8

Table 7 Summary of performance for consent 0351 - discharge of treated piggery effluent to Rumkeg Creek and land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Operation and discharge in accordance with application	Inspection of data and discharge point monitoring	Yes
2. Maximum concentrations in receiving water after mixing	Physicochemical sampling	Yes
3. Maximum increase in turbidity after mixing	Physicochemical sampling	Yes
4. Constituents not permitted in receiving water after mixing	Monitoring inspections of receiving waters	Yes
5. Operation and maintenance of treatment and discharge system	Monitoring Inspections	Yes
6. Minimum dilution rate in receiving waters	Consent holder's discharge records and monitoring	Yes
7. Records of discharge	Consent holder's discharge records received by Council	Yes
8. Riparian fencing and planting	Monitoring inspections and liaison with consent holder	No
9. Maximum effluent application rate to land	Liaison with consent holder	Yes
10. Mitigating measures for high effluent application rate to land	Not yet assessed by Council	N/A
11. Proximity of discharge to dwelling or water body	Inspections	Yes
12. Contamination of surface water not permitted from land irrigation	Monitoring inspections	Yes
13. Extended surface ponding not permitted	Monitoring inspections	Yes
14. Records of discharge to land	Consent holder's records	No

Condition requirement	Means of monitoring during period under review	Compliance achieved?
15. Maximisation of discharge to land over water	Consent holder's records and monitoring inspections	Yes
16. Optional review provision	Next permit review - June 2007	N/A

Table 8 Summary of performance for consent 5249 - discharge of emissions into the air and waste management activities

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of action to minimise adverse environmental effects	Monitoring inspections	Yes
2. Action to minimise offsite odour effects	Monitoring inspections	Yes
3. Objectionable odour at site boundary not permitted	Monitoring inspections	Yes
4. Desludging of anaerobic pond and related notification prior to action	Monitoring inspections	Yes
5. Consultation and approval prior to alterations to plant or process	Liaison with consent holder	Yes
6. Minimisation of impact and emissions through use of equipment and suitable methods	Monitoring inspections and liaison with consent holder	Yes
7. Operation in accordance with application	Monitoring inspections	Yes
8. Objectionable dust levels at site boundary not permitted	Monitoring inspections	Yes
9. Optional review provision	Permit has no review date	N/A

N/A = not applicable

During the year, Meadowvale Stud Farm Piggery has demonstrated a good level of environmental performance and compliance with the resource consents.

2.8 Recommendations from the 2005-2006 Annual Report

In the 2005-2006 Annual Report, it was recommended:

1. THAT monitoring of air emissions from the Meadowvale Stud Farm piggery in the 2006-2007 year continue at the same level as in the 2005-2006 period.
2. THAT monitoring of discharges from the Meadowvale Stud Farm piggery in the 2006-2007 year continues at the same level as in the 2005-2006 period. That the physicochemical sampling component remains at two occasions during the four inspection visits.

3. THAT the consent holder continues to clean and maintain the anaerobic ponds and final (aerobic) pond of accumulated solids, thereby providing the necessary retention time in the system for adequate wastes treatment.
4. THAT the consent holder be advised that in the interim period, prior to implementation of Recommendation 3, that maximisation of land discharge (required by Special Condition 15 of consent 0351) be complied with, and that close attention be given to maintenance of sufficient dilution of any discharge of treated wastes in the receiving waters to prevent the development of any 'undesirable biological growths' on the bed of Rumkeg Creek.
5. THAT the consent holder provides the Council with details of the location of areas to be irrigated with piggery wastes.

Recommendations 1, 2, 3 and 4 have been achieved.

Recommendation 5 was partly achieved. The Council has been provided with information on where the piggery wastes have been irrigated but discharge records are required.

2.9 Alterations to monitoring programmes for 2007-2008

In designing and implementing the monitoring programmes for air/water discharges in the region, the Taranaki Regional Council has taken into account the extent of information made available by previous authorities, its relevance under the Resource Management Act, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

In consideration of the Meadowvale Piggery's environmental performance as regard to treated piggery wastewater discharge and its effects, it is recommended that piggery inspections carried out by Council increase from six to four regularly spaced inspections per year.

It is also recommended that provision be made for physicochemical impact monitoring to continue from twice per year to three times per year, under normal stream flow conditions (ie not during stream freshes). This extra sampling run will only to be undertaken if the downstream receiving waters are showing signs of adverse environmental effects (ie presence of 'sewage fungus' in the Rumkeg Creek or high waste loadings from the treatment system).

2.10 Exercise of optional review of consents

Consent 0351 held by Meadowvale Stud Farm Piggery provided for an optional review in June 2007 which was not recommended for review.

Consent 5249 held by Meadowvale Stud Farm Piggery does not provide for an optional review in 2008 and expires June 2009.

3. Recommendations

1. THAT monitoring of air emissions from the Meadowvale Stud Farm piggery in the 2007-2008 year continue at the same level as in the 2006-2007 period.
2. THAT monitoring of wastewater discharges from the Meadowvale Stud Farm piggery in the 2007-2008 year continues from two to three physicochemical surveys if receiving water conditions require such an increase.
3. THAT the piggery inspections in the 2007-2008 period be reduced from six inspections as in the 2006-2007 period to four inspections and these inspections to be carried out tri-monthly.
4. THAT the consent holder continues to clean the anaerobic ponds and final (aerobic) pond of accumulated solids every two years or as required thereby providing the necessary retention time in the system for adequate wastes treatment.
5. THAT the consent holder be advised that maximisation of land discharge (required by Special Condition 15 of consent 0351) be complied with, and that close attention be given to maintenance of sufficient dilution of any discharge of treated wastes in the receiving waters to prevent the development of any 'undesirable biological growths' on the bed of Rumkeg Creek.
6. THAT the consent holder provides the Council with details of the location of areas to be irrigated with piggery wastes and provide records as required by Special Condition 14 of Consent 0351.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
fresh	elevated flow in a stream, such as after heavy rainfall
g/m ³	grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
mS/m	millisiemens per metre
mixing zone	the zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH ₄	ammoniacal nitrogen, normally expressed in terms of the mass of nitrogen (N)
NH ₃	unionised ammonia nitrogen, normally expressed in terms of the mass of nitrogen (N)
NO ₃	nitrate, normally expressed in terms of the mass of nitrogen (N)
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.

physicochemical	measurement of both physical properties(e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment
resource consent	refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and subsequent amendments
sewage fungus	Growths of bacteria and/or fungi responding to increased concentrations of organic material in the water.
SS	suspended solids,
temp	temperature, measured in °C
turb	turbidity, expressed in NTU
UIR	Unauthorised Incident Register entry- an event recorded by the Council on the basis that it had potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan

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New Zealand Pork Industry Board
Pork Industry guide to managing environmental effects
EnviroPork 2005

Ministry For The Environment June 1992:
Resource Management Water Quality Guidelines No.1. Guidelines for the Control of Undesirable Biological Growths in Water

Appendix I

Resource consents held by Meadowvale Stud Farm Piggery

Appendix II
Biomonitoring report

Appendix III

Flow rating for Rumkeg Creek

Rumkeg Creek above Confluence

River Height vs Flow Values

Prepared for Meadowvale Stud Farm Limited

(Update March 2006)

A staff gauge has been installed on the Rumkeg Creek Denbigh Road Bridge for monitoring of the river level (or height).

Table 1 shows river levels at this bridge and the corresponding flow for each level. All flows are expressed in litres per second.

River Level	Flow (litres/second)	River Level	Flow (litres/second)
0.1	20	0.5	2,726
0.11	24	0.51	2,959
0.12	29	0.52	3,205
0.13	34	0.53	3,465
0.14	39	0.54	3,739
0.15	46	0.55	4,036
0.16	54	0.56	4,350
0.17	62	0.57	4,681
0.18	72	0.58	5,028
0.19	82	0.59	5,393
0.2	95	0.6	5,789
0.21	110	0.61	6,207
0.22	126	0.62	6,647
0.23	144	0.63	7,109
0.24	164	0.64	7,592
0.25	189	0.65	8,098
0.26	216	0.66	8,625
0.27	246	0.67	9,174
0.28	279	0.68	9,744
0.29	315	0.69	10,337
0.3	359	0.7	10,991
0.31	406	0.71	11,674
0.32	459	0.72	12,386
0.33	516	0.73	13,127
0.34	577	0.74	13,897
0.35	648	0.75	14,695
0.36	725	0.76	15,523
0.37	808	0.77	16,380
0.38	897	0.78	17,266
0.39	993	0.79	18,181
0.4	1,101	0.8	19,180
0.41	1,217	0.81	20,219
0.42	1,341	0.82	21,296
0.43	1,474	0.83	22,413
0.44	1,615	0.84	23,568
0.45	1,772	0.85	24,763
0.46	1,939	0.86	25,996
0.47	2,118	0.87	27,269
0.48	2,307	0.88	28,581
0.49	2,507	0.89	29,932



At 0.30m (river level) the flow is 359

River Level	Flow (litres/second)
0.9	31,365
0.91	32,845
0.92	34,372
0.93	35,946
0.94	37,567
0.95	39,235
0.96	40,950
0.97	42,712
0.98	44,520
0.99	46,376
1	48,591

