New Zealand PORK

PORK INDUSTRY GUIDE

Environmental Management

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Table of Contents

Acknowledgment 5
Introduction 6
Site Selection 6
Compliance Obligations 8
The Resource Management Act 8
What is an Effect? 9
Common Environmental Effects 9
Treaty of Waitangi 10
Stakeholder Requirements 11
Good Management Practices: Outdoor Pigs 12
Outdoor Piggeries 12
General Farm Management 14
Indoor Piggeries 14
Site layout/Building design 14
Drainage surrounding a piggery 14
Storage and disposal of containers and toxic substances 15
Managing the Effects of Discharging to Land and Water 16
Effluent Collection, Storage and Processing 16
Sumps/Storage Tanks 17
Pond systems and Biogas collection 17
Anaerobic (primary) ponds 17
Aerobic (secondary) pond 18
Constructed wetlands 18
Organic bedding systems 18
Composting 18
Carcass disposal 19
Application of Manure to Land 21
Land suitability - Soil type and hydraulic loading 22
Land application equipment 22
Manure applied off farm 22
Managing Discharges to Air 23
Odour 23
Other Management Requirements 25
Monitoring of resource inputs 25
Waste Management 25

Greenhouse gas emissions 26
Nutrient Management and Nutrient Budgets 28
Farm Environment Plans 28
Outdoor farms 28
Indoor piggeries 28
Emergency Management 28
References 30
Useful resources 30
Glossary 31
Appendix A: New Zealand legislation 35

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- NZPork Directors, Delegates, pork producers who were part of the Working Party, and a cross section of producers throughout the industry.

Important Note: This guide replaces EnviroPork™: pork industry guide to managing environmental effects (2005) which superseded New Zealand Pork Industry Board Code of Practice – Pig Farming (1997). Both of these documents may be referenced in regional council publications.

Edition 1: 2005
Edition 2: March 2017

Introduction

This guide provides pork producers, council officers, persons looking to enter into the pork industry, and other stakeholders a reference for acceptable practices to managing the environmental impacts of pork production. Specific information on nutrient management is covered in the Good Practice Guide – Nutrient Management in Pork Production which is available at www.nzpork.co.nz .

Pig farming (pork production) has long been an integral part of the rural scene in New Zealand. The pork industry supply chain contributes in excess of one billion dollars to the New Zealand economy.

Pig farms can be classified as being 'indoor', 'intensive', 'outdoor', 'extensive', 'dispersed' or 'hobby/lifestyle'. Over recent years the number of commercial farms has decreased, but the size of the sow herds are steadily increasing. This guide is applicable for all types of piggeries including smaller herds.

Environmental requirements should always be considered alongside the current Animal Welfare (Pigs) Code of Welfare and PigCare™ standards.

Site Selection

Many environmental issues can be avoided through good planning and site selection. Depending on your location the city or district council will define the areas (zones) for farming activities within the district plan. Each zone will have its own set of rules. The regional council also has regional rules that are documented within the relevant regional plans. Keep in mind that many councils will have an operative plan as well as a draft proposed plan. It is best to consider the proposed plan requirements to future proof your investment. Below is a list of items to consider during the environmental planning stages of a new venture:

- ✔ District plan zones
- ✔ Regional plan (air, land, water and coastal) rules including proposed rules
- ✔ Contaminated site status with the regional council
- ✔ Location of community drinking water supply
- ✔ Existing resource consent conditions and expiry dates
- ✔ Reliable water supply
- ✔ Access to electricity
- ✔ Weather
- ✔ Terrain
- ✔ Soil types
- ✔ Existing drainage systems
- ✔ Land area to meet the council buffer zones
- ✔ Sensitive neighbours or communities
- ✔ Cultural and spiritual considerations

Most New Zealand councils provide links to local online mapping tools. The property address can be searched on the map and 'overlays' added including existing consents, fish habitats, wells, rivers, streams, wetlands, nutrient allocation zones etc.

The New Zealand Historic Places Trust has published an extensive list of important cultural and historic sites and their location. The list is available online at: http://www.heritage.org.nz/the-list

Current and potential future reverse sensitivity issues should be considered when planning a new farm or expansion of an existing farm. Current concerns include nutrients, dust and odour.

Compliance Obligations

Pork production triggers a number of compliance obligations from both regulators and stakeholders. The section below outlines the main environmental compliance obligations for New Zealand pork producers. See Appendix A for a list of all the current legislation that is relevant to pork production in New Zealand.

The Resource Management Act

The Resource Management Act (RMA) is New Zealand's main piece of legislation that sets out how we should manage the environment. The RMA come into force in October 1991 and is currently being under review. This effects-based legislation focuses on the effects of any farming activities and requires any adverse effects to be avoided, remedied or mitigated.

The RMA provides regional and territorial authorities (district/city councils) with opportunities to manage the effects of activities such as pig farming to promote sustainable management. The types of rules councils may use in their plans and the types of resource consent a pork producer may require are summarised in the table below.

Table 1. Summary of activity and resource consent type requirements on local authorities under the RMA.

Local Authority	Types of Resource Consent	Type of Activity Rules in Council Plans
District/City Council	Land use consent - anything requiring consent under a district plan (most rural activities). Subdivision consent - includes leases, cross leases and unit titles.	Permitted activity allowed without a consent provided they comply with standards, terms and conditions in the plan. Controlled activity - will be granted a consent subject to conditions on the matters specified in the plan. Restricted discretionary activity – may be granted consent based on the authority's consideration of specified matters. Discretionary activity – may be granted a consent based on the authority's consideration of the application overall. Non-complying activity - contravenes the plan or is not specifically referred to, a consent may be granted if adverse effects on the environment
Regional Council	Land use consent – for activities on a lake or river bed, and also for certain activities requiring consent under a regional plan such as farming activities. Water consent - for taking, using, damming or diverting water. Discharge consent - for discharging water or contaminants into water, into or onto land or into air. Coastal consent - for any of the above activities other than subdividing land in a coastal marine area.	

		are minor and the activity is not contrary to the objectives and policies of the plan. Prohibited activity - cannot apply for a consent.

Pork producers and other persons having an interest in the establishment and/or expansion of a pig farm are strongly advised, at an early stage, to contact their local Regional and District Councils to seek compliance requirements with local rules relating to pig farms. The council maps and websites are available at: http://www.lgnz.co.nz/home/nzs-local-government/new-zealands-councils/

Under the Building Act a building consent will be required for all new buildings, additions to old buildings and, in some districts, effluent ponds.

What is an Effect?

The Resource Management Act requires all activities that have an effect on the environment need to be considered and planned for by district and regional councils. The RMA states that an 'effect' includes:

- Positive or adverse effects
- Temporary or permanent effects
- Past, present or future effects
- Cumulative effect which arises over time or in combination with other effects
- Any potential effect of high probability
- Any potential effect of low probability, which has a high potential impact.

Common Environmental Effects

This guide provides information so that pork producers' activities are aligned with the sustainable development goals of the RMA and Local Government Act.

This guide makes a distinction between 'effluent' and 'manure'. The term 'effluent' is defined as everything excreted by pigs (both solid and liquid). It also includes bedding, water used to hose, flush and clean piggery buildings. Manure is defined as being everything that is applied to land (once again including both solid and liquid parts). Once the effluent has been collected and/or processed, it then becomes manure if applied to land because of its benefits to soil structure and nutrient supply.

A major concern of the pork industry is the use of rural land for non-traditional purposes, such as rural subdivision. It is important to recognise that pig farming is a legitimate rural activity. Residential encroachment into the countryside can threaten this long-standing legitimacy. If residents' expectations mean a pig farm cannot operate within the rural area, this will threaten the sustainability of the pork industry. This concept is called Reverse Sensitivity and is now a recognised 'effect' (see Table 2), with many councils beginning to include controls for reverse sensitivity in their plans.

Table 2. Summary of potential effects of pig farming on the environment

Activity	Potential Effect	Potential Solution
Piggery Location	• Loss of productive soils • Odour, dust and noise emissions • Visual impact • Birds and rodents	• Appropriate design and landscaping • Appropriate zoning • Suitable climate, topography, soil type • Pest control
Piggery Design	• Odours • Pathogens • Nutrient leaching and runoff • Visual impact • Birds and rodents	• See solutions above • Drainage • Effluent processing systems • Nutrient management • Landscaping • Pest control
Piggery Operations	• All of the above	• Staff skill/ stockmanship • Hygiene • Maintenance
Public Relations	• Public perceptions of pork production	• Communication and cooperation* • Sensitivity to other activities

* Consultation with neighbours and/or Runanga may be required as part of a resource consent application.

Producers and other persons having an interest in the establishment and/or expansion of a pig farm are strongly advised, at an early stage, to contact their local Regional and City/District Councils to seek compliance requirements with local rules relating to pig farms.

Under the Building Act a building consent will be required for all new buildings, additions to old buildings and, in some districts, effluent ponds. See Appendix A for a list of all the legislation that is relevant to pig farming in New Zealand.

Treaty of Waitangi

The principles of the Treaty of Waitangi must be taken into consideration in decision making under the Resource Management Act.

Maori spiritual values are a primary concern of the Treaty of Waitangi. Maori consider that waste water is purified by being returned to the earth. Such a practice remains a very practical, environmentally sound option for disposing of manure. Maori concerns, ancient in origin and expressed in spiritual terms, are in many respects a forerunner of environmental law in New Zealand. Consultation with iwi in your area may be a part of obtaining a resource consent and the council will need to assess if your farming activities have taken into account the principles of the Treaty of Waitangi when making a decision on your resource consent application.

Regional Councils may also develop their own requirements for catchments that might be incorporated in a farm environmental plan such as mahinga kai management areas.

More information on the Treaty of Waitangi obligations can be found at the Quality Planning website:

http://www.qualityplanning.org.nz/index.php/plan-development-components/consultation-with-tangata-whenua/context-for-consultation-with-tangata-whenua

Stakeholder Requirements

There may be other compliance obligations that are not New Zealand legal requirements but are a condition of supply or trade or demonstrate commitment to the local community's values. These requirements are often documented in your contract with the stakeholder or may form part of a supply Code of Practice. Some communities may have developed a voluntary environmental accord such as those from a local stream care group. There may also be credence attributes that consumers expect from a product such as environmental stewardship even though they can't see them and could lead to participation of the farm in third-party certification.

Good Management Practices: Outdoor Pigs

Outdoor Piggeries

Farming of pig's outdoors is dependent on a range of environmental factors. Free-draining soil, low rainfall, ready access to straw for bedding and a temperate climate are all necessary for successful operation, which means that there are areas of New Zealand unsuitable for this system of production. Outdoor shelters can be purpose designed for a variety of functions including dry sow, farrowing, weaner and grower accommodation.

Factors to consider:

- ✔ Soil should be free draining.
- ✔ Pasture cover should be maintained throughout the year
- ✔ Recovery of pasture may require paddock rotation.
- ✔ Land area will depend on various factors including any nutrient management rules from the Council. In the absence of specific council requirements follow the GMP stocking rates.

NZPork was involved in the Matrix of Good Management project and the development of a set of *Industry-agreed Good Management Practices relating to water quality*. These Good Management Practices (GMPs) are applicable to all Canterbury farms and NZPork supports the adoption of the GMPs for all outdoor pig farms.

The current GMPs are listed in the table below located online at the Environment Canterbury farming website: http://www.canterburywater.farm/gmp/

Table 3. Good Management Practices for Outdoor Pigs (2015)

Good Management Practices (Outdoor Pigs)
Undertake a farm environment plan including a farm environment risk assessment
Maintain ground cover in accordance with GMP's below. Also farm on lower rainfall area. Outdoor pig production is on flat land (need flat land for huts) - therefore minimising the risk of runoff.
Exclude stock from natural waterways, drains, wetlands and water races that flow through the property. Install culverts or bridges at stock crossings.
If runoff from a paddock can get into a flowing waterway/drain an effective planted riparian margin is required
If runoff from tracks can get into a flowing waterway / drain, runoff management to prevent runoff from entering waterway. Place troughs, drinkers and gateways away from flow paths. Prevent runoff from wallows entering a waterway

Ground cover: For all dedicated outdoor pig units, or those in a pastoral rotation, the minimum ground cover is: • Dry and lactating sows (40% cover on 75% of land, < 40 % cover permissible of 25% land. • Each paddock to have on average >10% cover) and for farrowing sows (At least 70 %). • All outdoor pig units that form part of an arable operation the minimum ground cover is: for dry and lactating sows (25 % (100% to 0 % in 2 years)) and for farrowing sows (At least 70 %)
Reduce fallow, during and immediately after pig phase of rotation e.g. by planting catch crop
No NPK fertilizer to be applied to the pig breeding unit.
Apply any other fertilizer in accordance with the Fertiliser Association of New Zealand Code of Practice for Nutrient Management.
An appropriate diet and feed levels for physiological (reproductive) states of animal e.g. separate gestation diet and lactating diet (nutrition)
Dispose of dead stock in a biosecure manner. Site offal pits away from waterways and other sensitive areas such as bores (check in Council plan if there are guidelines.
Stocking rate: • Less than or equal to 17 total breeding animals/ha for a dedicated pig farm with no rotation. • Less than or equal to 21 total breeding animals/ha for a pig unit on a pastoral farm with rotation every 2 years (minimum of 2 year return period). • Less than or equal to 24 total breeding animals/ha for a pig unit on a pastoral farm with rotation every year (minimum of 1 year return period). • Less than or equal to 32 total breeding animals/ha for a pig unit on an arable farm with rotation at least every 2 years (minimum of 2 year return period)
No effluent to be spread on the breeder unit.
Housing dimension, area/sow and construction as per welfare standards under the Animal Welfare (Pigs) Code of Welfare (or equivalent legislation). Farrowing huts are shifted after each lactation.
Stock should have access to shelter in accordance with PigCare. Paddocks should be grazed top to bottom (ground slope). Stock should not be left on break feeding paddock when wet, or concentrated on small areas of paddock for long periods.

Source: Matrix of Good Management Project, 2015

Important Note: The GMPs will be reviewed periodically and it is expected that other councils may adopt them. This document will be updated accordingly. The latest list of GMPs will always be available on the NZPork corporate website (www.nzpork.co.nz).

There is currently no GMPs for indoor piggeries.

General Farm Management

There are a number of management techniques that can be used to minimise environmental effects. It is anticipated that a good producer will be able to achieve desired environmental outcomes through using a combination of management practices and systems, discussed below, that are best suited to their site.

Indoor Piggeries

Piggery location and building sites and manure application areas should be selected to minimise adverse effects.

Factors to consider:

- ✔ Compliance with council plans and application for a land use consent if required
- ✔ Surface run-off of manure should be controlled
- ✔ Proximity to sensitive activities
- ✔ Capacity of the area surrounding piggery to reduce potential nuisance
- ✔ Adequate land for buildings and effluent treatment with area available for expansion
- ✔ Land susceptible to flooding

Site layout/Building design

Building design can vary widely depending on the system for manure removal. This can be solid or liquid based. The most common types of housing systems for pigs are those with designed with deep litter bedding where the spent bedding is removed in a solid form or full/partially slatted floors based on a liquid manure system. Ventilation can range from a natural system to fully environmentally controlled ventilation.

Factors to consider:

- ✔ Flooring and other structure should be designed to be easily cleaned and to permit the efficient removal of all effluent.
- ✔ The specific regulatory requirements and standard should be adhered to, with regard to the general design and construction (Animal Welfare (Pigs) Code of Welfare.
- ✔ Permanent buildings on indoor piggeries should be constructed of materials having an expected service life of at least 10 years.
- ✔ Sheds should be sufficiently spaced from other buildings or trees for ventilation and dispersion of odour. For a new development, consideration of location and siting can be given more weight than when buildings are being added to an existing unit.
- ✔ Landscape design should result in the structures blending more readily into their surroundings.
- ✔ For a new development, consideration of location and siting can be given more weight than when buildings are being added to an existing unit.
- ✔ Landscape design should result in the structures blending more readily into their surroundings.

Drainage surrounding a piggery

It is important to divert storm water away from effluent streams.

Factors to consider:

- ✔ The effluent system should be designed to meet peak flow conditions.
- ✔ The effluent system should be maintained to ensure the integrity of the pipe work.
- ✔ Collected storm water can be stored for use for cleaning and/or as flushing water. Otherwise clean stormwater (i.e. rainwater) can be discharged by the most suitable means to a watercourse or ground soakage.
- ✔ Contaminated stormwater should be considered as forming a part of piggery effluent.
- ✔ Where ground cover is not maintained on outdoor pig farms there is a risk of erosion that can result in dust and runoff causing sedimentation in waterways.

Storage and disposal of containers and toxic substances

Producers will need to ensure they are compliant with the Hazardous Substances and New Organisms Act and associated regulations. Common hazardous substances used on the farm may include diesel, cleaning chemicals, rodent control, and herbicides/pesticides. If you import hazardous substances directly then there are requirement you must have provided your details to the Environment Protection Authority (EPA) (see http://www.epa.govt.nz/hazardous-substances/importing-manufacturing/Pages/default.aspx) and ensure that the substances have an EPA approval.

WorkSafe New Zealand are the regulator for the use and handling of hazardous substances in the workplace. Certain quantities of substances trigger regulations that may mean you need a location certificate, container certificate, approval handler, tracking, emergency plans, specific signage etc. You can check the requirements of common substances at: http://www.hazardoussubstances.govt.nz/

There are currently draft Health and Safety at Work (Hazardous Substances) Regulations 2016 which are due to come into effect in December 2017. These will replace a number of the Hazardous Substances and New Organisms Act regulations.

Small quantities of hazardous substances still require adequate secondary containment so they do not spill into waterways or onto land, a current Safety Data Sheet, appropriate personal protective equipment for substances that are corrosive, toxic or have the potential to have health impacts, and not be stored with incompatible substances and all flammables stored away from heat and ignition sources.

The Safety Data Sheet will state if there are any special disposal requirements for the substance. Many will just refer to the disposal being within the local council rules which means that there is no disposal to landfill or tradewaste system.

Factors to consider:

- ✔ Regional council requirements that go above the national legislation
- ✔ Obtain and read Safety Data Sheets (SDS) for all hazardous substances
- ✔ Inclusion of chemical use, storage and disposal in the farm health and safety systems
- ✔ Regular checks of personal protective equipment (PPE)
- ✔ Secure storage of all hazardous substances
- ✔ Secondary containment and bunding systems to catch any spills
- ✔ Flammables to be stored away from ignition sources
- ✔ Appropriate emergency procedures and emergency equipment e.g. fire extinguishers
- ✔ Clear labelling and signage

Managing the Effects of Discharging to Land and Water

Effluent Collection, Storage and Processing

There is a variation in the composition of raw pig manure across piggeries due to differences in pig diets, pig herd genetic makeup and 'on farm' conditions.

Given this variation, there are a number of systems used in New Zealand for effluent collection. Table 3 gives a description of these systems.

Table 4. Types of effluent collection systems

Collection system	Description of activity
Hydraulic	This system includes manual cleaning with hoses, flushing under slats, flushing open gutters (solid dunging channels) and under slat storage with periodic discharge (up to 3 weeks). The total volume of flush water required per day for adequate cleaning is dependent on many factors including: the availability and cost of water, building design, and effluent-handling system.
Mechanical	Scraper systems minimise the volume of effluent generated as they do not require water. These systems are used for off-site application of manure.
Solids Separation	Effluent can be separated into solid and liquid parts using sedimentation basins or screens. The most common system involves pumping the effluent over a wedge wire screen. The benefits of solid/ liquid separation of piggery effluent include: 10 - 30% reduction in Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) from the raw effluent, increased pump protection from large particles, allows liquid manure to infiltrate soil more quickly when irrigated, generates a solid by-product that can be composted. See table below.
Organic Bedding Matter	This is a housing system where the pigs are kept on a bedding or organic matter such as sawdust or straw. The effluent is slowly composted within the organic matter and is removed at regular intervals depending on the system used. This system has a number of benefits including: reduction in odour, little water required for cleaning/flushing, and the creation of a valuable compost product that can be applied to land or sold.

Factors to consider:

- ✔ Flushing, scraper blade and operating channel systems should be well designed and accurately dimensioned so minimal material is left in the drain.
- ✔ Routine management of the effluent collection system, including regular cleaning of screens, is essential for continued optimum effectiveness.
- ✔ Correct assessment of the flushing volume minimises the water use while ensuring adequate cleaning.

- ✔ Properly designed systems will minimise odour.
- ✔ In flushing systems, effluent should be removed, preferably at not greater than 24-hour intervals, from dung races and drains, including drains under slats.
- ✔ Collection/storage systems with effluent in pits under the shed will allow storage for a number of months before emptying (dependant on the design of the system).
- ✔ The use of pit fans to draw air down over the pits will minimise in shed odours.

Sumps/Storage Tanks

Sumps and storage tanks are used as temporary storage for effluent that has been collected from the piggery sheds. When applying for an effluent discharge consent the council may specify a particular standard that the tank needs to meet.

Factors to consider:

- ✔ Sumps and tanks should be made out of materials that are strong and corrosion resistant.
- ✔ When sizing sumps, consideration needs to be given to flushing frequency, volume, pumping frequency, pumping capacity and entry of storm water.

Pond systems and Biogas collection

Ponds are used for effluent processing on farm and may be anaerobic and/or aerobic. A pond treatment system comprising an anaerobic pond and aerobic pond in series can achieve up to 95% Biological Oxygen Demand (BOD) and up to 70% nitrogen reduction.

Pig effluent is a biomass feedstock and can be used to generate biogas which is converted to electricity. There are a number of successful examples of this on New Zealand pig farms. Australian Pork has developed a Code of Practice for On-farm Biogas Production and Use (Piggeries) which is available on their website at www.australianpork.com.au. There are also a number of publications available from Pork CRC as part of their Bioenergy Support Program (see http://porkcrc.com.au/research/program-4/bio-energy-support-program/).

The Energy Efficiency Conservation and Authority (EECA) have a funding programme which is updated annually. Further information is available on the EECA website www.eecabusiness.govt.nz.

Anaerobic (primary) ponds

Good pond design should reflect local climate, pig numbers (loading rate), piggery management systems and effluent pre-treatment systems. In areas where t

Factors to consider:

- ✔ At the time of construction, the anaerobic pond depth should be a minimum of 3-4 metres
- ✔ Ponds in permeable soils or high water table areas should be lined with a clay or synthetic liner to minimise the risk of leaching.
- ✔ Anaerobic ponds should be sited away from dwellings.
- ✔ Anaerobic ponds may need to be desludged depending on the loading rate, size/depth of pond, and if the effluent is screened.

Aerobic (secondary) pond

Aerobic ponds provide further breakdown of BOD, micro-organisms and nutrients in the presence of oxygen.

Factors to consider:

- ✔ Aerobic pond depth generally should not exceed 1.2 metres as a greater pond depth does not allow adequate sunlight for algal growth or sufficient surface area for oxygen diffusion.

Constructed wetlands

Constructed wetlands can be used as a polishing stage following aerobic pond treatment. The wetland allows for the uptake of further nutrients and organic matter. Well-designed and managed wetlands require low maintenance.

Organic bedding systems

These systems are a method of housing where the pigs are penned on a bed of sawdust, straw or other organic material. The bedding system contains all manure within the confines of the pen with material only being removed at intervals dependant on the management system.

Factors to consider:

- ✔ Water spillage into the bedding from drinkers should be avoided.
- ✔ Availability and cost of bedding material
- ✔ Greater space allowances per pig, compared to non-bedded systems.
- ✔ Utilisation of used bedding by spreading to land, composting, or sale off- farm.
- ✔ Well stockpiled used bedding is stable and will compost slowly.

Composting

Screened piggery effluent solids when combined with a carbon source such as sawdust or straw, or material from organic bedding systems can be successfully composted.

Factors to consider:

- ✔ Ensure the appropriate mix of water, carbon, nitrogen and oxygen is maintained.
- ✔ Aeration of the material will speed the composting process.
- ✔ Composting requires specific plant, machinery and adequate space.
- ✔ Composting operations must be located away from surface water or waterways. Regional councils often specify a separation distances in their regional rules.
- ✔ Composting operations should be located on impermeable surface so that nutrients do not leach to land.

Carcass disposal

If managed correctly, the disposal of carcasses will have a minimal effect on the environment. There are a range of disposal methods that can be used, such as composting, offal holes, or off farm rendering. It is important to check council plan rules as councils can vary in their approach to carcass disposal.

Treatment options	Advantages	Disadvantages
Offal pits	Simple Cost effective Easy to manage	May involve stricter condition from regional council Offal pit seepage can contaminate groundwater Predator and pest control is required
Composting	Useful product generated- added value. High composting temperature destroys pathogens and prevents fly incubation.	A reliable supply (cost) of carbon service, e.g. sawdust, shavings or straw is required Requires knowledge of composting. Predator and pest control is required (minimal)
Burial	Simple and cost effective	Predator and rat control required. Labour intensive. Can contaminate groundwater
Off-farm rendering	Unlikely to have significant adverse effects on the environment No further handling or labour input.	Only available in some areas Requires secure area to store carcasses before pickup Potentially expensive Strict rules regarding on-farm incineration (highly probable that these rules will be further tightened in the future).
Incineration	Carcass and pathogens are completely destroyed	Only applicable in some areas Potentially expensive Smoke can be an issue if using oil or diesel burners. Strict regional rules regarding on-farm incineration. May not be permitted in some areas except for Biosecurity Act purposes.

Source: adapted from the EMS for the New Zealand Pork Industry, 2005

A guide to carcass composting can be found on the New Zealand Pork corporate website: www.nzpork.co.nz

Application of Manure to Land

Most regional councils in New Zealand require producers to use systems that discharge pig manure to land. The nitrogen content of piggery manure is usually the major determinant of the land area required for application. In recent years, various councils have used 200kg N/hectare/year as a guide for applying effluent to land. However, using a nutrient budget may demonstrate that higher levels of nitrogen can be applied. As a general guide, the table below provides example nutrient content for fresh, untreated effluent from pigs.

Table 5. Predicted nutrient values of fresh, untreated effluent

Type of pig	No. for a typical 100-sow farrow-to-finish (26 weeks) piggery	Total solids (kg/hd/yr)	Total nutrient output (kg/yr)		
			N*	P	K
Gilt	5	197	12.0	4.6	4.0
Boar	5	186	15.0	5.3	3.8
Gestating sow	83	186	13.9	5.2	3.7
Lactating sow	17	310	27.1	8.8	9.8
Sucker	177	11.2	2.3	0.4	0.1
Weaner	253	422	3.9	1.1	1.1
Grower	249	54	9.2	3.0	2.4
Finisher	330	108	15.8	5.1	4.1
Total	**1,119**				

Source: adapted from Table 4.1 and 9.1, APL (2010)

*It is important to note that various systems for effluent collection, processing, and application to land can reduce the amount of nitrogen by as much as 90%. If using any form of effluent processing system, testing is recommended to determine specific NPK levels for the end product prior to application to land.

Land application of piggery manure can be used to:

- Apply nutrients to the soil and improve soil structure
- Reduce fertiliser costs
- Irrigate

Land suitability - Soil type and hydraulic loading

Factors to consider:

- ✔ Soil infiltration should be considered when determining application rate.
- ✔ Soil type and moisture holding capacity should be considered when determining application volume.
- ✔ Nutrient application should be balance with crop/pasture utilisation.
- ✔ Climatic factors
- ✔ High rainfall events will limit the amount of liquid manure that can be applied to land

Land application equipment

Manure can be applied to land using various types of equipment including: travelling irrigators, stationary irrigators, slurry tankers, and soil injectors.

Manure applied off farm

Where manure is applied to land off-farm this activity may be subject to the same resource consent controls as on-farm application (check with your regional council).

Managing Discharges to Air

Management practices should be adopted to minimise nuisance. Sections 2, 3 and 4 above also provide guidance in these management practices.

Odour

Odour can be an issue for pig farms and can cause adverse effects to neighbours. The Resource Management Act effectively requires that there should be no offensive or objectionable odour beyond the boundary of the farm. In recent years, case law has established that reverse sensitivity is a valid effect and should be considered by councils.

Some regional councils will require an intensive piggery to apply for an air discharge consent for odour originating from piggery buildings including effluent storage pits and food storage.

Determining the offensiveness of odour is complex and reliant on individual perception, council methods of measurement, and management practices of the pork producer. To determine whether an odour has an offensive or objectionable effect requires consideration of what is known as the FIDOL factors. Table 6 below described these factors.

Table 6. Description of the FIDOL factors

Frequency	How often an individual is exposed to the odour.
Intensity	The strength of the odour.
Duration	The length of exposure.
Offensive/character	The character relates to the 'hedonic tone' of the odour, which may be pleasant, neutral and unpleasant.
Location	The type of land use and nature of human activities in the vicinity of an odour source.

Source: Ministry for the Environment (MFE, 2016)

Australian Pork have produced guidelines for minimising odour from piggeries (APL, 2015a) which are relevant to the New Zealand situation. The guidelines go through a number of practical options for reducing odour the main areas that generate odour in indoor piggeries including:

- Indoor sheds
- Channel, drains and pipes
- Sumps
- Solids Separators
- Effluent Treatment ponds

Guidance is also provided by APL for rotational outdoor piggeries in the National Environmental Guidelines for Rotational Piggeries (APL, 2015b). Many of the anticipated effects can be mitigated through the site selection process. Details on methods for odour modelling and odour assessments sits within the Australian Pork National Environmental Guidelines for Piggeries (APL, 2010) available online at: http://australianpork.com.au/industry-focus/environment/national-environmental-guidelines-for-piggeries/

The Ministry for the Environment has produced the Good Practice Guide for Assessing and Managing Odour (MFE, 2016). While this is not specific to pig farming it is the official guide that is used by council staff, consultants and industry and is available online at: http://www.mfe.govt.nz/sites/default/files/media/Air/good-practice-guide-odour.pdf

Other Management Requirements

Monitoring of resource inputs

A Farm Environment Plan (FEP) and resource consent conditions will include monitoring requirements. There are also other items that can be monitored that have an environmental impact. Farmers may already be monitoring these from a cost perspective but it is a good idea to monitor quantities (units) with the aim of improving the efficiency of use of these inputs.

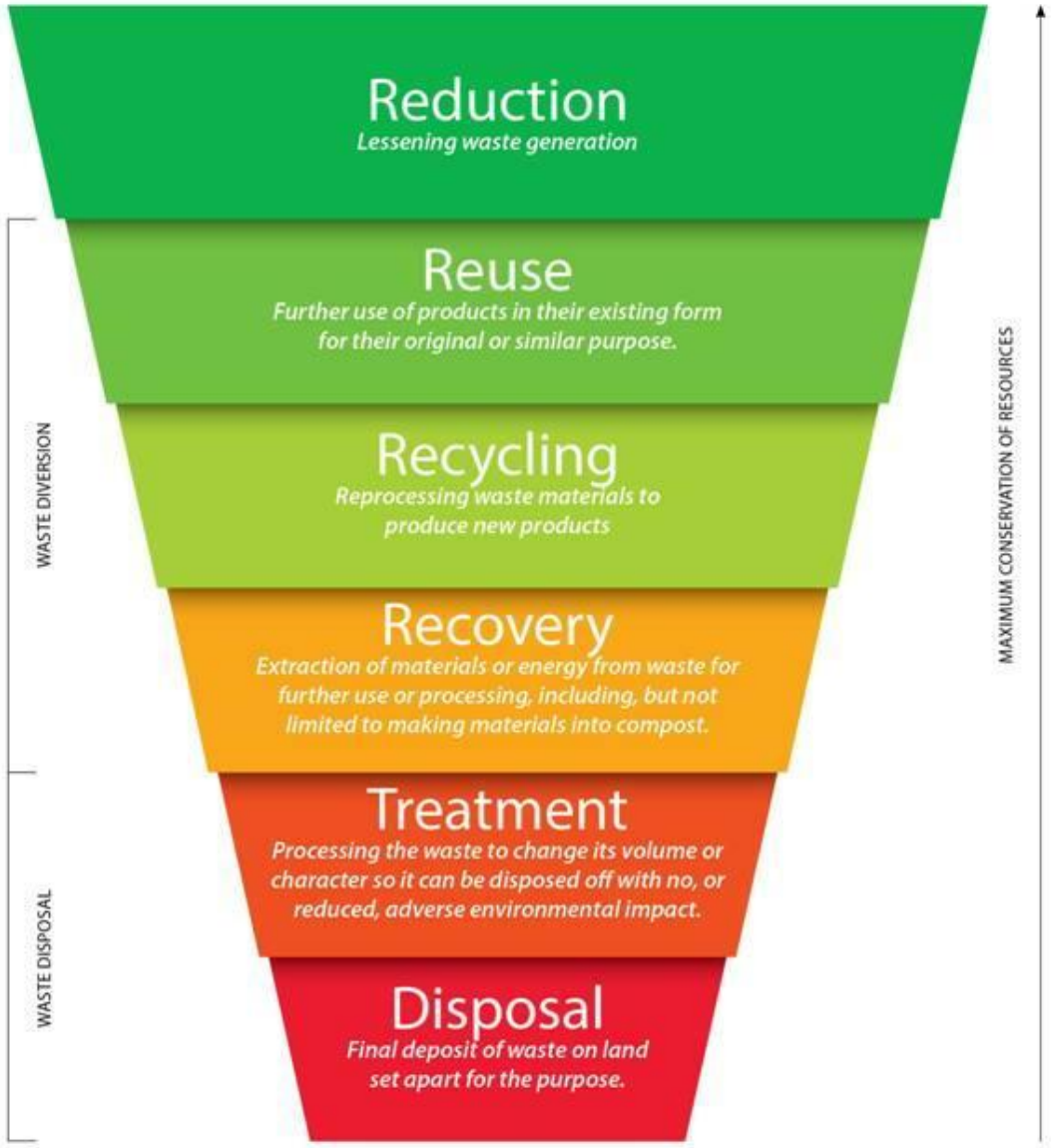
These may include but not limited to:

- Diesel consumed (litres)
- Natural gas consumed (kilograms or cubic metres)
- Electricity consumed (kilowatt hours)
- Water consumed (cubic metres or litres)
- Waste sent to landfill (cubic metres or kilograms)

It's a good idea to develop performance measures such as Key Performance Indicators (KPIs) that can be monitored and reported e.g. electricity (kwh) per kilogram of protein produced.

Waste Management

The generation of waste products not only causes environmental impacts but is a cost to the farm. While some regions allow for on farm landfills as a permitted activity it is expected that over time this will not be allowed or have tight controls. Organic waste buried in a basic 'pit' style landfill generates leachate that can contaminate groundwater and methane gas emissions. Non-organic wastes such as plastic, metal, treated timber, polystyrene etc. do not break down and can also cause contamination of land. The image below shows the waste management hierarchy with reduction at source being the most preferable option and disposal the less preferable.



Source: Kapiti Coast District Council (2016)

Greenhouse gas emissions

There are various methods of calculating emissions depending on what you are wanting to report. It is common calculate a 'carbon footprint' especially if you are reporting to consumers that are interested in issues such as 'food miles'. A carbon footprint often takes a Life Cycle Assessment (LCA) approach that looks at pre-farm emissions arising from the manufacture of inputs, on-farm emission during animal production and post-farm emissions arising from the processing and transportation of products to the retail point. A full LCA will also consider the post-retail emissions (e.g. refrigeration, cooking etc) and disposal (e.g. product packaging, meat leftovers etc).

If you are interested in a basic on-farm calculation then the current OVERSEER tool includes the ability to calculate on-farm emissions for methane, nitrous oxide and carbon dioxide. This requires

that you have data using for the same 12-month period as you are using for your nutrient budget for:

- Diesel
- Petrol
- Contractor fuel use (use can use the default values)
- Transport distances for animals (tonne/kilometre)
- Animal transport (brought in or sold stock) (tonne/kilometre)
- Waste sent to landfill (cubic metres or kilograms)
- Electricity (kilowatt hours)

There is also estimates made on the % of activity done using on-farm fuel for activities such as fertiliser spreading.

Nutrient Management and Nutrient Budgets

Nutrient management is becoming an important part of the regulatory landscape in New Zealand. This usually includes a nutrient budget being developed. There is the Good Practice Guide- Nutrient Management in Pork Production (NZPork, 2017) which is available at www.nzpork.co.nz . This guide is designed to assist pork producers in handling nutrients produced so that it does not pose an environmental risk to ground or surface water quality.

A commonly used nutrient budget tool is OVERSEER which is a software application. OVERSEER provides estimates of nutrient inputs and outputs on a per hectare basis. Nutrients from pig farms can be added as organic fertiliser. This will require the nutrient make-up of the material along with the application rate.

At present there has been a separate module for outdoor pigs developed and will be integrated with the main OVERSEER tool which is available at www.overseer.org.nz.

Note: indoor pig farms can use the main OVERSEER tool.

NZPork has developed guidance on how to use the outdoor pig module of OVERSEER and this is available at www.nzpork.co.nz

Farm Environment Plans

NZPork encourages all farmers to develop a Farm Environment Plan. The plan allows for a management system approach with a focus on continual improvement. The plan is a live document that is reviewed and updated regularly. There is information at www.nzpork.co.nz for those interested in developing a full Environmental Management System (EMS) such as ISO 14001 based on their existing Farm Environment Plan.

Outdoor farms

NZPork have developed a Farm Environment Plan (FEP) template for outdoor pig farms and guidance notes to meet the compliance requirements of Environment Canterbury. As more regional councils use FEPs as a regulatory tool then regional specific FEP templates will be developed. Download the latest FEP and guidance from www.nzpork.co.nz .

Indoor piggeries

NZPork is working to develop a Farm Environment Plan template and guidance for indoor pig farms. This will be announced to all farmers via our newsletter when available.

Emergency Management

There is a chance that an emergency may mean that the piggery may not be able to meet the above guidelines and legal obligations. For example,

- Industrial action/protesters, either on or off the farm
- Floods
- Other extreme weather events
- Earthquake
- Tsunami
- Fire

- Electric power failure

Despite the fact that these events are unavoidable, there should be a plan in place that ensures adverse effects on the environment are kept to a minimum. There are also animal welfare issues to consider.

WorkSafe New Zealand provides guidance for emergency planning for farms online at: http://www.saferfarms.org.nz/guides/a-guide-to-developing-safety-management-systems/#emergency-planning.

WorkSafe New Zealand in conjunction with the Environmental Protection Agency have developed a set of general emergency procedures that can be adapted to suit most situations. The template is available online at: http://www.worksafe.govt.nz/worksafe/information-guidance/all-guidance-items/emergency-procedures

Please note: that the WorkSafe guidance does not include farm protesters or animal welfare issues.

References

APL. (2010). *National Environmental Guidelines for Piggeries (2010)*, Australian Pork Ltd. Barton, ACT, Australia.

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APL. (2015b). Project 2013/031 Rotational Outdoor piggeries and the Environment (2015), Australian Pork Ltd, Barton, ACT, Australia.

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Matrix of Good Management. 2015. *Industry-agreed Good Management Practices relating to water quality. The Canterbury Matrix of Good Management project, April 2015. New Zealand.*

Ministry for the Environment. 2016. *Good Practice Guide for Assessing and Managing Odour*. Wellington.

NZPork. 2017. *Good Practice Guide- Nutrient Management in Pork Production*. New Zealand Pork Industry Board, Christchurch, New Zealand.

Useful resources

- The Industry Agreed- Good Management Practices for outdoor pigs (www.canterburywater.farm/gmp/)
- Australian Pork Limited environmental resources (http://australianpork.com.au/industry-focus/environment/)
- Energy Efficiency Conservation Authority (www.eecabusiness.govt.nz)
- Water New Zealand Good Practice Guide- Beneficial Use of Organic Materials on Land (www.waternz.org.nz)

Glossary

Aerobic Bacteria	Bacteria that require free oxygen for growth.They are involved in effluent treatment in an aerobic pond.
Aerobic	In the presence of free oxygen.
Aerobic Pond	A pond where effluent is treated in the presence of aerobic bacteria. Usually preceded by an anaerobic pond.
Anaerobic Bacteria	Bacteria that do not require free oxygen for growth. They are involved in effluent treatment in an anaerobic pond.
Anaerobic	In the absence of free oxygen.
Anaerobic Pond	The pond where effluent is treated anaerobically by anaerobic bacteria.
BOD	Biological Oxygen Demand - the quantity of oxygen required for breakdown of organic compounds in water.
COD	Chemical Oxygen Demand - the measure of the oxygen consuming capacity of inorganic and organic matter in water.
Composting	The process in which organic material undergoes biological aerobic degradation of solids to a stable end product.
Constructed Wetland	Includes man-made permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.
Contaminant	Includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat – 1) when discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; 2) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.

Controlled activity	An activity that complies with any standards, terms or conditions specified in the District or Regional Plan is assessed according to matters the Council has reserved control over, and is allowed only if a Resource Consent is obtained.
Organic bedding system	Housing system in which pigs are kept on a layer of organic bedding material, usually straw or sawdust.
Discharge Permit	A resource consent to do something (other than in a coastal marine area) that otherwise would contravene s15 of the Resource Management Act 1991.
Discharging	Includes 'emitting', 'depositing', or 'allowing to escape' any contaminant into the environment.
Discretionary Activity	An activity that requires a resource consent and is allowed at the discretion of the local authority.
District	An area in relation to, and under the management of, a District or City Council.
Effluent	Animal excreta and waste water containing animal excreta.
Effluent Treatment	Any treatment resulting in the alteration of the characteristics of effluent as it leaves the piggery, including anaerobic and aerobic lagoons, solids/liquids separators, bio-gas manufacture, chemical flocculation, composting, and package treatment systems.
Extensive Farming	Keeping, breeding or rearing for any purpose, of pigs on pasture (but including areas used for access to shelter) at a stocking density that sustains the maintenance of pasture or ground cover.
Farrowing	Giving birth to piglets.
Hydraulic Loading	Depth of water applied to an area of land (mm/ hectare).
Intensive Farming	The breeding or rearing of pigs where the predominant productive processes are carried out within buildings or closely fenced outdoor runs where the stocking density precludes the maintenance of pasture or ground cover.
Leaching	The removal of soluble constituents (e.g. salts, fertiliser nutrients) from the soil by water moving downward through the soil profile.

Lifestyle/Hobby farm	A farm where the *primary* motivation for farming is the enjoyment of the rural lifestyle and not financial gain.
Local Authority	A Regional Council or Territorial Authority(i.e. District Council, City Council or Unitary Authority).
Mahinga Kai	Traditional food or other natural resources (e.g. freshwater species) that have been traditionally used as food, tools, or other resources.
Manure	Any substance, e.g. dung, urine, compost (including 'fresh' effluent), or artificial material that is spread over, or mixed with soil, to fertilise it.
Mechanical Aeration	Mechanically mixing air and effluent together, using air pumps, agitators or liquid sprayers, in order to raise the concentration of dissolved oxygen within the effluent.
Micro-organisms	Microscopic organisms, such as bacteria, viruses, algae, protozoa and fungi that can live in water, soil, air, animals and plants.
Non-complying Activity	Contravenes a rule in a District or Regional plan and is allowed only if a resource consent is obtained from the relevant local authority
Permitted Activity	An activity that is allowed by a Regional Plan or District Plan without a resource consent if it complies in all respects with any standards, terms, or conditions.
Pig Farming	The keeping, raising or breeding of pigs for any purpose in numbers exceeding those defined as "Pig keeping".
Pig Keeping	The keeping, raising or breeding for any purpose, of not more that five pigs which have been weaned, or two sows, providing that any progeny are not retained beyond the weaner stage. See Pig Farming
Polishing	Where primary and secondary treated effluent undergoes a final treatment.
Pond system	A constructed ponding system. Usually comprises anaerobic pond followed by an aerobic pond.
Prohibited Activity	An activity that is expressly prohibited in a Regional or District plan.
Region	An area in relation to, and under the management of, the Regional Council.

Regional Plan	A plan prepared by the Regional Council for managing the use and protection of natural and physical resources (i.e. Land, river and lake beds, water, geothermal, air, and coast).
Resource Consents	refer to Resource Management Act 1991 (s87).
Reverse Sensitivity	The effects of the existence of a sensitive activity on a pre-existing activity in their vicinity leading to restraints in the carrying out of the pre-existing activity.
Sediment	Solid material (e.g. silt and sand) that is carried in water or effluent that will ultimately settle to the bottom of sumps, ponds, barrier ditches, constructed wetlands or waterways.
Silent Files	Sites that are of particular importance to local Maori these may be waahi tapu or other sacred sites. These sites are identified as a general location on a map without disclosing their precise location.
Sow	An adult female pig, which has had one or more litters.
Stocking Density	The number of pigs kept per square metre of pen area.
Stormwater	Rainwater that has drained from the farm buildings and yards and is collected in guttering/pipes, or has run off from the surrounding land.
Wahi Tapu	A sacred place to Maori in the traditional, spiritual, religious, ritual, or mythological sense.
Water	Means water in all its physical forms whether flowing or not and whether over or under the ground and includes fresh water, coastal water, and geothermal water and does not include water in any form while in any pipe, tank or cistern.
Water Table	The surface below which fissures or pores in the strata are saturated with water. It approximately conforms to the configuration of the ground. Where the water table rises above ground level a body of standing water exists.

Appendix A: New Zealand legislation

The table below lists the key legislation that include environmental provisions that may affect pork producers. Links to all of the Government Ministries mentioned below can be found at http://www.govt.nz.

Activity	Legislation	Regulator
Air Pollution Dust Odour Fumes	• Health and Safety at Work Act 2015 (incl. exposure standards) • Health Act 1956, section 29 (nuisance) • Resource Management Act 1991 (air discharge consent)	• WorkSafe New Zealand • Ministry of Health • Regional Council
Animal Welfare	• Animal Welfare Act 1999 • Animal Welfare (Pigs) Code of Welfare 2010	• Ministry for Primary Industries
Biogas	• Gas Act 1992 (gas manufacture on farm) • Energy Efficiency and Conservation Act 2000 • Resource Management Act 1991	• WorkSafe New Zealand • Energy Efficiency and Conservation Authority • Regional Council
Biosecurity	• Biosecurity Act 1993	• Ministry for Primary Industries • Regional Council (pest management)
Fire	• Fire Service Act 1975 • Fire Safety and Evacuation of Buildings Regulations 2006 • Forest and Rural Fires Act 1977	• New Zealand Fire Service • City or District Council • Department of Conservation
Land and Buildings	• Resource Management Act (Land Use) • Local Government Act 2002 (zoning, subdivision consent) • Building Act 2004	• Regional Council • City or District Council (consent, code of compliance, building warrant of fitness) • Ministry for Business, Innovation and Employment (Building code)

Noise	• Health and Safety at Work Act 2015 • Health Act 1956 (s29) • Resource Management Act 1991 • Local Government Act 2002 (zoning)	• WorkSafe New Zealand • Ministry of Health • Ministry for the Environment • Regional Council • City or District Council
Pork Industry	• Pork Industry Board Act 1997	• Ministry for Primary Industries
Waste disposal	• Health Act 1956. Nuisance, noise, water pollution • Hazardous Substances and New Organisms Act • Health and Safety at Work Act 201 • Local Government Act (waste bylaws) • Resource Management Act (pollution)	• Ministry of Health • Environmental Risk Management Authority • WorkSafe New Zealand • City or District Council • Regional Council
Water	• Health Act 1956 (se60, 62). Control of water pollution • Local Government Act 2002. Supply of water. • Resource Management Act 1991. Environmental protection	• Ministry of Health • Ministry for the Environment • City or District Council • Regional Council