The 4 Point Plan

Straightforward Guidance for Livestock Farmers to Minimise Pollution and Benefit Your Business

SCOTTISH EXECUTIVE SEPA Scottish Environment Protection Agency SAC NFUScotland SCOTTISH NATURAL HERITAGE WWF FWAG SCOTLAND THE ROC FOUNDATION

The 4 Point Plan

Introducing The 4 Point Plan

The 4 Point Plan (4PP) contains simple guidance on how to **reduce dirty water around the farm, improve nutrient use**, carry out a **land risk assessment for slurry and manure** and **manage your water margins**. The pack has been developed with guidance from working farmers, information from the Scottish Executive *Code of Good Practice for the Prevention of Environmental Pollution From Agricultural Activity* (the PEPFAA Code) and current scientific research to **benefit your business, minimise the risk of pollution** and **improve environmental standards**.

Pollution can lead to poor water quality.

Pollution – What is the problem?

Pollution is both an urban and a rural issue. It can be split into **point source pollution** and **diffuse pollution**. Point source pollution can be traced to one specific outlet, e.g. the end of a pipe. In contrast, diffuse pollution is a gradual and often unnoticed seepage of polluting material from a number of sources into the surrounding environment, making it harder to define, locate and control. Individually, these discharges can be of little significance. However, collectively, each discharge can contribute to a much bigger problem.

Slurry spread on to land and washed off by rainfall into a nearby burn is a common example of diffuse pollution. Magnified over several fields, this will add to the concentration of nutrients and bacteria down stream, potentially leading to the pollution of freshwater burns, rivers, coastal waters and groundwater.

The quality of Scotland's water is at risk from diffuse pollution containing **nutrients and bacteria* from both human and animal sources**. Bacteria found in excreta can have far-reaching consequences for human, livestock and wildlife health, for these reasons the agricultural sector, as well as many other industries, is now having to take a second look at some previously accepted practices.

** For the purposes of this information, 'bacteria' is used as a general term and includes parasites and viruses.*

What can farmers do?

Farmers already follow good agricultural practices but occasionally accidents or ongoing losses lead to the pollution of rivers and burns by livestock slurry and manure.
Following the guidance in The 4 Point Plan will demonstrate you are taking risks into account and following good practice as highlighted in the PEPFAA Code and the PEPFAA Do's and Dont's Guide. Implementing The 4 Point Plan on your farm will also qualify for points under the Rural Stewardship Scheme (RSS) and Organic Aid Scheme (OAS).

The first three sections of The 4 Point Plan include calculations that can be applied to your farm. These *'Working it out'* sections will help you to:

- Estimate the amount of **dirty water and rainwater** produced around the steading and its **contribution to storage**.
- Know the **nutrient value** of slurry and manure produced by housed livestock.
- Draw up **a risk assessment for spreading manure and slurry** on your land.

You can use this information to **review current practices**, identify any **financial savings** and **reduce pollution** risk from your farm.

Nitrate Vulnerable Zones
Additional guidance is available for farmers in Nitrate Vulnerable Zones (NVZ). The NVZ guidelines give an in-depth description of how to draw up a fertiliser and manure plan to comply with the Action Programmes that apply in these areas.

Farm Waste Management Planning
Having a professionally produced Farm Waste Management Plan (FWMP) for your farm may be used to justify less than six months slurry storage capacity as required under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003. A full FWMP for the purposes of the 2003 Regulations requires more detail than is provided by the step by step advice in this plan, guidance on how to move towards a FWMP should always be sought via a suitably accredited agricultural consultant or other specialist. More information on farm waste management planning is contained in Appendix 3 and the PEPFAA Code.

Exceeding storage capacity can increase pollution risk.

Finding out more

Useful addresses and contact details are contained in Appendix 1. Your local Scottish Executive Environment and Rural Affairs Department (SEERAD), Scottish Environment Protection Agency (SEPA), SAC (Scottish Agricultural College), Farming and Wildlife Advisory Group (FWAG) or local agricultural consultant should be able to assist you in finding out more about various aspects highlighted by The 4 Point Plan. Additional copies of the plan are available free from your local SEERAD office or can be downloaded from The 4 Point Plan website (www.sac.ac.uk/4pp).

1

Minimising dirty water around the steading

Dirty water around farm buildings may seem insignificant, but it can contain **valuable nutrients** and **harmful bacteria** from livestock manure and slurry, giving it a **high polluting potential**.

What are the benefits to you and your business?

Reducing dirty water around the steading can:

- **Leave more space for slurry or silage effluent storage.** Cutting down dirty and contaminated areas around the steading will reduce the amount of water you have to collect and handle, saving time and costs on storage and disposal.
- **Reduce your contractor bill.** Smaller amounts of slurry and dirty water require less handling.
- **Reduce the risk of causing pollution** from nutrients and bacteria washed down your farm drains and into local ditches, burns and rivers or into groundwater.

Contaminated material should not enter clean water drains.

Taking a closer look

There are many sources of dirty water around yards and steadings. Cattle crossing yards can deposit a significant amount of manure and slurry on yard surfaces, rainfall will wash some of these materials into drains and ditches around the farm. Rainfall running through middens, silage clamps, feeding areas and on to dirty yards collects nutrients and bacteria, adding to the problem of slurry and dirty water storage. Any run-off containing faecal matter, e.g. from yards or a midden, must be collected and contained in accordance with the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003.

Roofing silage clamps reduces the amount of runoff to collect and store.

Silage effluent does not usually contain any faecal bacteria, but it is **very acidic** and **highly polluting**. Applications of silage effluent to land should not exceed 25m^3/ha (2225 gallons/acre) at a dilution rate of 1:1 with water.

Use the steading dirty water audit at the end of this section to look at some of the problem areas around the farm and possible solutions. The calculations in the *'Working it out'* section can identify which sources make the biggest contributions to your storage facilities.

Recommended measures

- Keep clean and dirty water separate. Simple measures such as 'sleeping policemen' or drainage channels may help to separate dirty and clean areas and aid collection of dirty water.
- Work out how much contaminated yard water goes into your slurry or dirty water collection systems using the *'Working it out'* section; it may be much more than you think. Cutting down on this water entering your store leaves space for more slurry storage.
- Consider current hosing practices. More water used in hosing produces more dirty water. Where practical, scraping down surfaces to remove solid material before hosing makes it easier and reduces the amount of dirty water to collect and store. Using less water could increase financial savings if using a mains supply.

A suitably sited temporary field heap could be used instead of a yard midden.

- Look at stock routes around the steading. Could these be shorter or part-roofed to minimise the contaminated water produced, reducing the water you have to collect and handle?
- Consider roofing the midden. This could reduce the amount of water running through the midden and therefore the amount of effluent produced.
- Consider an alternative to the midden. Using a few well-sited temporary field heaps and leaving your midden clean and empty reduces the amount of effluent you have to collect. When choosing a location, try to avoid sites on sandy soil or gravel to protect groundwater. Temporary field heaps should not be sited within a minimum of 10m of a field drain or watercourse or within 50m of a well, spring or borehole.
- Ensure that guttering and down pipes are fitted to buildings and are not blocked with leaves or debris. Down pipes may be broken by stock or machinery. Replacement or repair of these can be a quick and simple job that could save you money.
- Collect and use rainwater. Installing a collection system and using clean rainwater for hosing down is an excellent additional source of water, especially if you are paying for mains water.
- Maintain drinking troughs. Leaking troughs will also add to yard water and could increase water costs if using a mains supply.

Steading dirty water audit

Consider your farm and the potential for pollution using the steading dirty water audit. It could help you to improve current good practices and give you ideas for minimising dirty water around the steading.

Question	Tick appropriate box	Action
Is contaminated run-off from yards, hard standings and tracks collected and disposed of in accordance with guidance in the PEPFAA Code?	Yes ☐	You may be able to further reduce run-off from these areas. The *'Working it out'* section will help you calculate the potential amount of rainwater collected on these areas and highlight which make the greatest contribution to storage.
	No ☐	Systems should be put in place to either prevent or collect contaminated run-off. Consider: • Roofing dirty areas to reduce contaminated rainwater on yards. • Minimising yard areas accessed by stock.
Do all buildings have serviceable gutterings and down pipes?	Yes ☐	Check serviceability of guttering and down pipes at regular intervals.
	No ☐	Repair or replace broken guttering and down pipes. Make sure clean rainwater is either collected or routed to a clean drainage system.
Are existing drainage and collection systems checked for serviceability, blockages and leaks?	Yes ☐	This will increase the chance that any breaks or blockages are quickly detected, reducing further problems.
	No ☐	Check your drainage systems are in good working order. Drainage failure could lead to a pollution incident, which may go undetected for some time.
Hosing down processes around the steading can generate large volumes of dirty water. Do you try to minimise water use?	Yes ☐	Less dirty water is produced and you have less slurry to collect, store, spread and handle.
	No ☐	Reducing water use means less to collect and handle, along with any financial savings on mains water. Consider: • Changing hosing practices; a high-pressure hose will use less water than a standard hose or volume washer. • Fitting a trigger mechanism to all hoses to stop flow when not in use. • Using recycled water. Installation of a simple tank can utilise rainwater collected from building roofs, reducing mains water use. You may need professional help to identify the most suitable option for your farm. Speak to your local agricultural consultant for more details.
Is your water from the mains supply metered?	Yes ☐	This will show how much water you use on a daily basis.
	No ☐	Consider fitting a water meter. Monitoring water use and knowing your average daily water consumption could highlight leaks which may have gone undetected for some time. You will be able to evaluate any measures taken to improve water use on the farm and work out possible savings.

Question	Tick appropriate box	Action
Are levels in both above and below ground storage tanks monitored?	Yes ☐	This will demonstrate how vulnerable your tanks are to filling up after heavy rainfall and indicate any operational failures.
	No ☐	Monitoring tank levels will allow you to reduce the risk of overflow and organise spreading with contractors well in advance.
Is all run-off from silage clamps collected?	Yes ☐	Roofing your silage clamps could further reduce the amount of effluent you are collecting.
	No ☐	Collection and proper storage of silage effluent is required under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003. You may need professional guidance to advise on installation of a suitable collection system.
Is all run-off from steading middens collected?	Yes ☐	Roofing your midden could further reduce the amount of run-off you are collecting.
	No ☐	Collection and proper storage of midden run-off is required under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003, as this runoff is classed as slurry. Consider: • Clearing out the midden and using a well sited, temporary field heap instead. Temporary field heaps should be sited at least 10m away from a field drain or watercourse and 50m from a spring, well or borehole.

Minimise quantities of water used and **keep clean and dirty water separate**. The cost of taking specialist advice should be offset by savings achieved through a change in practice.

Reducing dirty water production means less to collect and store, reducing the risk of overflow.

What you need to do next

Completing the *'Working it out'* section will highlight the volume of contaminated water produced around your steading, identifying areas that make the greatest contribution to your storage facilities and pose the biggest risk of causing pollution. This section will help if you are considering producing a farm waste management plan (FWMP).
Further guidance on FWMP is contained in Appendix 3.

Working it out

Calculating dirty water produced around the steading

Consider how dirty and contaminated water is dealt with around the steading and how much is produced on a monthly basis. Reducing the volume of contaminated water may **reduce pollution risk** and could lead to **cost savings** with less dirty water to collect, store, handle and spread. Additional advice is also available within the PEPFAA Code or from your local agricultural consultant.

Consider sources of contaminated water around the steading.
For example:

- Open yards and feeding areas with stock access.
- Clean water from building roofs running onto contaminated areas.
- Run-off through yard middens and silage clamps.

Tables 1, 2 and 3 will highlight the areas that generate the largest amount of dirty water around the steading. Metric conversion tables are contained in Appendix 2.

- Using Table 1, estimate the area in metres squared (m^2) around your steading that receives rainwater and comes into contact with slurry and manure. Any roof area should be included where roof water falls on to contaminated yards (e.g. via broken guttering or water from down pipes).

The total in Table 1 represents the potential area that produces dirty water. **Reducing this total can reduce the amount of water you have to collect, store and handle.**

- Put the **total value** from Table 1 into the red box in Table 2.

Table 1. Estimation of areas producing dirty water around the steading.

Location	Area (m^2)
Yards	
Silage clamps	
Yard middens	
Roofs without guttering	
Feed aprons	
Other	
Total	

Estimation of monthly dirty water production.

An approximation of annual rainfall figures are contained in Appendix 4.

- Take the monthly rainfall values for the part of the country in which you farm from Appendix 4 and put these into Table 2.
- In Table 2, multiply each monthly rainfall by the total entered in the red box (from Table 1). This will give you an indication of how much dirty water can be generated around your steading on a monthly basis.
- Estimate how much of this water is added to your storage systems (all contaminated water should be collected, yet may go to a dedicated dirty water collection facility rather than slurry storage facilities). This will show what contribution dirty water is making to your store on a monthly basis. You can calculate how many extra trips to the field this could be costing you.

Table 2. Estimation of monthly dirty water production.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)													
Total from Table 1		Multiply this value from Table 1 with the average rainfall figures above and divide by 1000 (to convert mm of rainfall into m). Add result to boxes below.											
Monthly dirty water production (m^3)													
Amount added to storage facilities (m^3)													

These values are an estimation and do not take into account severe weather events. In very wet conditions, dirty water production can be much greater, taking up a large proportion of storage space and leading to higher levels of slurry production and significanly increased risks of pollution.

Estimation of cleaning water used on dairy units

Water used in hosing operations can add to the amount of contaminated water you have to deal with. For example, on a dairy unit, typical values of 18 litres per cow per day could be used if washing using a high-pressure hose. This value can double to 35 litres per cow per day if using a high volume hose (see PEPFAA Code).

Bearing in mind any other treatment and disposal methods you use:

- Using Table 3 estimate the amount of water that is added to your storage systems from this source.
- A change in hosing practices could reduce this volume. If using mains water for cleaning operations, you can calculate costs on a monthly basis by multiplying monthly totals by the cost of your water per cubic metre (m^3).

Table 3. Estimation of water used in cleaning operations.

Month	No. of dairy cows	Multiply by 0.018m^3 (for high pres. hose) or by 0.035m^3 (high vol. hose)	Multiply by days in month	Multiply by cleans per day	Estimation of cleaning water used (per month) (m^3)
Example	100	x 0.035	x 31	x 2	= 217
October		x	x 31	x	=
November		x	x 30	x	=
December		x	x 31	x	=
January		x	x 31	x	=
February		x	x 28	x	=
March		x	x 31	x	=
April		x	x 30	x	=
May		x	x 31	x	=
June		x	x 30	x	=
July		x	x 31	x	=
August		x	x 31	x	=
September		x	x 30	x	=
Total volume of cleaning water produced					(m^3)
From this, estimate the volume of cleaning water added to store					(m^3)

Estimation of rainfall falling directly into slurry store or lagoon

Uncovered stores can collect significant amounts of rainfall, depending on geographical location. This can aid mixing, but also contributes to the overall volume you have to collect, store, handle and spread.

- Estimate how much rainfall is being added to your slurry storage facility using Table 4.

Example - Taking a slurry tower with a surface area of 300m^2 in a month with 120mm rainfall, the volume of rainwater added to the store would be 120mm multiplied by 300m^2 and divided by 1000 (to convert mm rainfall to m) to give a monthly rainwater addition of 36m^3.

Table 4. Estimation of rainfall falling directly into open storage facilities.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)													
Store surface area (m^2)		Multiply this value with the average rainfall figures above and divide by 1000 (to convert mm of rainfall into m). Add result to boxes below.											
Monthly contribution of rainfall to store (m^3)													

- The monthly totals will show when most rainwater is added to the storage facility.

With the calculations carried out in this section you can:

- Estimate how much contaminated water you are collecting, storing, handling and spreading.
- Identify which sources contribute most to your dirty water storage systems and where pollution risks are.
- Consider any potential for savings on mains water through re-using or reducing water use.
- Use some of these calculations as part of a farm waste management plan for your farm.

Your local agricultural consultant or specialist adviser will be able to provide guidance on taking these ideas further. Sources of further information are contained in Appendix 1.

Overflowing dirty water storage facilities can increase pollution and runoff.

2

Better nutrient use

Taking account of nutrients added to land in slurry and manure can lead to savings on the annual fertiliser bill. Nutrients lost to the surrounding environment represent a **financial loss to the business** as well as **contributing to pollution**.

What are the benefits to you and your business?

Improving nutrient use in slurry and manure can give rise to a number of benefits, for example:

- Identification of potential savings. On average, a 100 cow dairy herd could produce slurry with a nutrient value equivalent to a **saving of around £1500** on your annual fertiliser bill.
- Nutrient levels, especially phosphorus (P) and potassium (K) can build up in soils year on year. **It may not be necessary to add as much inorganic fertiliser as you think**. Soil testing on a five-yearly cycle will show if soil reserves are already high in P and K. Savings on P and K could cover the cost of soil testing.

Soil testing can lead to savings.

- Targeting manure and slurry applications to crop requirement can reduce nutrient loss. Most nitrogen (N) applied to fields during the late autumn and winter months is lost through leaching and low crop demand.

Nutrient values depend on a number of factors, including stock diet.

Taking a closer look

Slurry and manure from both housed and grazing livestock can make a significant contribution to the nutrient status of your land. Approximately three-quarters of nutrients in livestock feed are present in their dung and urine, making it a valuable source of NPK. Nutrients collected from housed livestock can be preserved through small changes in handling and storage of slurry and manure. For example, using a well-sited temporary field heap can reduce the amount of manure to be handled as the heap decomposes and make it easier to spread. Mixing slurry with water may make it easier to handle, but too much water will dilute the nutrient value and increase the total volume to be applied. Where possible, quick incorporation of slurry and manure into the soil will maximise nutrient potential. The less time nutrients are on the surface, the less chance they have to be washed away in surface run-off or escape to the air as a gas.

Recommended measures

- Establish nutrient levels in soil, manure and slurry. Knowing nutrient levels allows you to re-assess fertiliser applications. Thus you can maximise production, minimise cost and reduce pollution risk to ditches, burns, rivers and groundwater through nutrient loss.
- Plan and control when and how much manure and slurry are added to fields, matching this to crop or grass requirement.
- Reduce midden run-off. This will preserve the nutrient value within manure whilst also reducing the potential for pollution.
- Store solid manure in deep-sided stacks, preferably covered, to keep nutrient levels high.

Midden run-off contains high levels of nutrients and bacteria.

Matching slurry application to crop demand maximises nutrient use.

- Reduce the amount of water mixing with slurry or manure. Less water in the mixture will keep slurry and manure volume low and nutrient value high. The information on *'Minimising dirty water around the steading'* provides more information.
- Site field heaps away from sandy or gravelly sites and recently drained land. Make sure the heap is at least 10m away from any field drain or watercourse and 50m from a spring well or borehole.
- Devise a nutrient budget for your farm. This can highlight your nutrient efficiency and suggest ways of making the most out of nutrients in slurry and manure. Your agricultural consultant will be able to assist you with this.

What you need to do next

Working through the following section will allow you to estimate the nutrient potential of slurry and manure from your housed livestock and consider **potential savings** whilst building on current good practices.

Working it out

What is the potential nutrient value of manure and slurry?

After completing this section you will be able to estimate the amount of slurry* and manure generated by your housed livestock and its potential nutrient value.

**Note - Values in this section refer to animal excreta only and do not take into account any additional water. These values have been updated in this edition of The 4PP in response to new guidance.*

Using Tables 5 and 6, **calculate the volume of slurry produced by housed livestock.**

- Put the number of each type of livestock that you have into Table 5.
- Multiply this by the typical quantity of slurry produced by that type of animal per day, (using typical values from Table 6) and then by number of days each type of livestock is housed.
- The total in Table 5 gives an approximation of the amount of slurry produced over the housed period and added to your store.

Table 5. Volume of slurry produced over the housed period.

Type of livestock	**Number of livestock**	**Volume of slurry per day (from Table 6)**	**Number of days housed**	**Slurry produced over housed period (m^3)**
e.g. dairy cattle	100	x 0.053	x 182	= 965
		x	x	=
		x	x	=
		x	x	=
		x	x	=
		x	x	=
		Total volume of slurry		(m^3)

Example - Production from 100 housed dairy cattle during October would be:

Daily production = 0.053m^3 (average daily production per cow), multiplied by the number of cows (100) = **5.3m^3**.

Monthly production = Daily production multiplied by number of days = 5.3m^3 x 31 days (October) = **164.3m^3**.

Over the housed period = 5.3 x 182 days = **965m^3**.

Table 6. Typical values of undiluted slurry produced by housed livestock per day (adapted from the NVZ Guidelines). Information on pigs and poultry is contained in Appendix 5.

Livestock	% Dry matter	Typical volume of slurry produced per day (m^3)
Cattle (per animal)		
Dairy cow (650kg)	10	0.064
Dairy cow (550kg)	10	0.053
Beef cow (500kg)	10	0.032
Calf (100kg)	10	0.007
Store cattle (400kg)	10	0.026
Finishing cattle (500kg)	10	0.032

- Use the same method to calculate amount of **manure produced from housed livestock** using Tables 7 & 8.

Table 7. Weight of solid manure produced over the housed period.

Type of livestock	Number of livestock	Weight of manure per day (from Table 8)	Number of days housed	Manure produced over housed period (tonnes)
Beef cattle	100	x 0.030	x 182	= 546
		x	x	=
		x	x	=
		x	x	=
		x	x	=
		x	x	=
			Total volume of manure	

Table 8. Typical values of manure produced by housed livestock per day (adapted from SAC Technical Note T309). Information on pigs and poultry is contained in Appendix 5.

Livestock	% Dry Matter	Typical weight of solid manure produced per day (tonnes)
Cattle (per animal)		
Beef cow (500kg)	25	0.030
Calf (100kg)	25	0.008
Finishing cattle	25	0.019

You can use these methods to calculate how much slurry and/or manure from your housed livestock is added to storage systems on a monthly basis.

Calculate the potential nutrient value contained in manure and slurry

- Keeping totals for slurry and manure separate, calculate the potential nutrient values contained in slurry and manure using Table 9.
- Add your potential total and available nutrient values to Table 10.

Total or Available?

Total nutrients refer to the amount of nutrients contained within the slurry or manure. **Available** nutrients refer to the amount available to the crop in the season at application.

Table 9. Typical values of total NPK and available PK contained in slurry and manure.

		Potential total nutrients			Potential available nutrients	
	% dry matter	**N**	**P_2O_5**	**K_2O**	**P_2O_5**	**K_2O**
Slurry (kg/m^3)						
Dairy cattle	10	4	2.3	4.3	1.2	3.6
Young cattle 250kg	10	5	2.3	4.3	1.2	3.6
Finishing cattle	10	3.5	2.0	3.8	1.0	3.0
Manure (kg/tonne)						
Cattle (fresh)	25	5.5	3.5	8.0	2.0	5.0

Note - for the purposes of this information P_2O_5 and K_2O are used as units to describe P and K values in fertilisers and manures.

Example - To calculate the total P value contained in $965m^3$ of dairy slurry, multiply $965m^3$ by 2.3 kg/m^3 P (*from Table 9*), = 2219.5kg of **total** P.

Table 10. Potential total NPK and available PK contained in slurry and manure.

	Potential total nutrients (kg)			Potential available nutrients (kg)	
Type	**N**	**P_2O_5**	**K_2O**	**P_2O_5**	**K_2O**
Slurry					
Dairy cattle					
Store cattle					
Finishing cattle					
Manure					
Cattle (fresh)					
Total					

Your figures in Table 10 now provide a useful estimate of the potential **total NPK** and **available P and K** produced by your housed livestock.

Estimating financial value of total nutrients

- Take **total** P value.
- Multiply this by the cost of P per kg (around 33p/kg P_2O_5 at 2004 prices).
- This gives the purchase cost of the equivalent amount of P fertiliser.

Use the same method to estimate K, using the price per kg (around 20p/kg K_2O at 2004 prices).

Often, **all crop requirements for P and K** can be met through **wise slurry and manure application**, saving on your fertiliser bill. Calculations for estimation of **available N** have not been included in the tables, as many factors can influence levels.

With the calculations carried out in this section you can:

- Calculate the production of slurry and manure from housed livestock.
- Estimate the financial value of the nutrients (see box).
- Combine these figures with information on dirty water collection to indicate storage requirements and slurry and/or manure production on a monthly basis.

An agricultural consultant will be able to look at nutrient balances on your farm in detail, highlighting opportunities to improve nutrient use. Computer programs are available to calculate approximate N values within slurry and manure enabling you to make your own adjustments to N application. Sources of further information are contained in Appendix 1.

3

RAMS - a Risk Assessment for Manure and Slurry

Carrying out a simple **Risk Assessment for Manure and Slurry (RAMS)** is an easy way to **plan applications of manure and slurry** whilst following **good agricultural practice** and **reducing pollution risk**.

What are the benefits to you and your business?

RAMS can help to plan applications around your farm; it looks at land suitability and takes into account pollution risks. A RAMS will:

- Identify **no-spread zones** and spreading risks, providing a clear **guide for contractors and farmers spreading manure and slurry**. Precautions, spreading areas and spreading rate must always be agreed in advance with contractors so that water pollution does not result.
- **Demonstrate improvements** to current good practices. Following good agricultural practice means less likelihood of pollution occurring from your land, **protecting wildlife and habitats** around the farm.

Taking a closer look

All slurry, manure, silage effluent and contaminated run-off (such as rain water on dirty yards or wash water) around the steading must be collected, stored and spread in accordance with guidance in the PEPFAA Code. Many factors dictate when and how much slurry and manure can be spread, including soil type, structure, slope and crop nutrient demand. Timing of application is also important, spreading in wet conditions poses an increased risk of manures and slurry washing off fields and into surrounding ditches, burns and rivers. Planning slurry and manure applications in line with crop or grass requirement is essential to get the best use of nutrients. Guidelines contained in Table 11 suggest single surface application rates in optimum conditions, as promoted by the PEPFAA Code. Given satisfactory conditions, repeat applications of these volumes can be made after a minimum period of 3 weeks, in accordance with crop or grass nutrient demand. Maintaining a minimum 10m no-spread zone bordering any watercourse or 50m around wells, springs and boreholes (used for drinking or dairy units) will help to reduce bacteria and nutrients getting into the waters around your farm.

Manure application within recommended application rates provides valuable plant nutrients.

Maintain 10m no-spread zone around watercourses.

Slurry or manure?

The term slurry is used to define any excreta, including any liquid fraction, produced by livestock whilst in a yard or building or excreta of a consistency that allows it to be pumped. Manure is used to describe solid and semi-solid excreta. However, effluent or run-off from manure is also classed as slurry. A more thorough definition is contained in the PEPFAA Code.

Table 11. Surface application rates in optimum conditions. (Adapted from PEPFAA Code).

Material	Maximum application rate	Normal application rate
Slurry	50m^3/ha	20-30m^3/ha
Manure	50 tonnes/ha	30-50 tonnes/ha
Poultry manure	5-15 tonnes/ha	5-15 tonnes/ha
Contaminated water	50m^3/ha	25-30m^3/ha

Recommended measures

Low level spreading reduces odour nuisance.

- Carry out a **RAMS** for your farm. The *"Working it out"* section guides you through this.
- Target your manure and slurry applications. Controlling when and how much manure and slurry are added to your land means you will be making the most of **valuable plant nutrients** and could allow you to reduce inorganic fertiliser applications, saving on the annual fertiliser bill.
- Keep a **spreading logbook**. A notebook in the tractor cab simply listing the date and time of application, which fields received either slurry or manure, how much was applied and by whom. This record will help you plan future applications and demonstrate that applications on your land are within good practice guidelines.
- Follow good practice and observe **the minimum 10m no-spread zone** around watercourses and a **minimum of 50m no-spread zone around springs, wells and boreholes** used for drinking water or dairy units. This will reduce the likelihood of nutrients and bacteria entering watercourses and help to prevent deterioration of water quality.
- Use a competent and appropriately trained contractor who is aware of the pollution risk associated with spreading on your land.

What you need to do next

Complete the *'Working it out'* section. It contains step by step guidance on how to draw up a RAMS land plan for your farm. The Land Plan can be used to form the basis of a farm waste management plan (FWMP) More information on farm waste management planning is contained in Appendix 3.

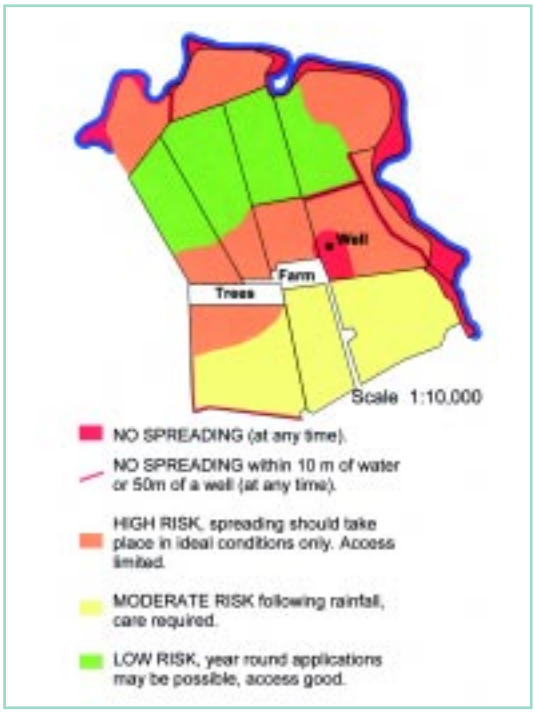
RAMS Land Plan – Identifying suitable spreading areas on your farm

Completing this section will give you a plan of suitable spreading areas on your farm, allowing you to make informed decisions regarding when, where and how much to spread, depending on risk factors and weather conditions.

To draw up the land plan for your farm you will need:

- A photocopy of the farm map showing ditches and fences (1:10 000 or larger), a copy of your IACS map would be ideal.
- Coloured pens/pencils (red, orange, yellow, blue and green).

By the end of this section, you should have a map of your farm with coloured sections, looking something like this.



Identification of the land area available for spreading

Draw on the map in blue all ditches, burns, rivers, lochs and any ponds or wet areas on your farm (especially marsh/bog areas and areas that are prone to flooding). Next, using the box below, consider any field areas which should be classed as no-spread zones and mark these on the map in red.

Areas where spreading cannot be carried out, for example wooded land, steading areas, farm roads and yards or any areas with separate management agreements such as SSSI and agri-environment schemes should be left white.

Remember to consider wells, boreholes and springs on neighbouring land and adjust your no-spread zone accordingly. Gradients also play a factor, as risk of runoff increases with slope. No-spread zones may need to be extended uphill of a water supply.

Heavy rain or snow melt after spreading increases run-off risk.

No-spread zones - mark these on the map in red:

- within 50m of a spring, well or borehole.
- within 10m of any ditch, stream, river, pond or loch.
- steeply sloping land, with slopes in excess of an 11˚ gradient (1 in 5)*
- unimproved land that has not previously received slurry or manure, e.g. land used for rough grazing.

** Site dependent. Can spread on land up to 15° (1 in 3) if soil, land and climatic factors of acceptable risk and no risk to local water quality.*

Risks and suitability of land for spreading

The remaining land can be further split into **high, moderate** and **low** risk areas. Within one field it is possible to have a number of risk categories, depending on individual circumstances. Assess potential spreading risks with reference to the following **three land categories** and mark these areas on your map.

High risk areas - Orange

- Spreading in these areas presents a **potentially high risk** that **pollution will occur** as a direct result of spreading.

High risk areas - mark these on the map in orange

- slopes with a gradient of between 8 and 11°* (approximately 1 in 7 to 1 in 5)
- areas with a risk of flooding more often than one in five years
- sandy or shallow soils (<30cm) over gravel or fissured rock
- fields with drainage installed in previous 12 months or
- poorly drained, waterlogged or severely compacted land.

** Site dependent. Can spread on land up to 15° (1 in 3) if soil, land and climatic factors of acceptable risk and no risk to local water quality.*

Moderate risk areas - Yellow

- Care will still have to be taken in areas categorised as moderate risk. Ground conditions should be checked before spreading.

Moderate risk areas - mark these on the map in yellow

- slopes with gradient of between 4 and 7° (approximately 1 in 14 to 1 in 8)
- land sloping towards watercourses or water supplies or
- imperfectly drained or saturated land.

Low risk areas - Green

- The remaining land presents a **lower pollution risk** and can be used throughout the year. Other factors that could change the spreading risk will still have to be taken into account.

Low risk areas - mark these remaining areas on the map in green

- slopes with gradient of between 0 and 3° (approximately up to 1 in 19)

  and

- land with no artificial drainage.

Consider slope when making risk assessment.

Don't spread if:

- The soil has been frozen for 12 hours or longer in the preceding 24 hours or if covered in snow.
- Land is compacted or waterlogged.
- Heavy snow or rainfall is forecast.
- Application would exceed recommended guidelines (see Table 11).
- Slurry or manure was previously applied to that field in the last 3 weeks.

Slurry application using an umbilical system.

The PEPFAA Code gives further guidance.

You should be left with a coloured map, with all fields colour coded on the basis of potential spreading risk.

With this map you can:

- Demonstrate risks associated with spreading on a field by field basis.
- Provide a guide for contractors spreading on your land.

4

Managing water margins

Spreading operations and livestock access to burns and rivers have the potential to pollute watercourses with **nutrients** and **faecal bacteria**. Reducing pollution entering the water could **benefit your livestock** as well as **improving local water quality and wildlife habitat.**

What are the benefits to you and your business?

Looking after your water margins can:

- Improve biosecurity. Keeping livestock out of water can reduce the risk of stock contracting or spreading **water-borne diseases** to other animals up and down stream.
- Intercept run-off reducing the risk of pollution from your land entering the water.
- Allow plant growth, which in turn could:
  - act as an **effective barrier or buffer strip** to prevent or reduce diffuse pollution entering the water
  - **provide shelter for stock**
  - **improve bank-side stability**
  - **reduce flooding**
  - **increase beneficial insect** and **wildlife** populations.

Try to prevent livestock access to watercourses.

Taking a closer look

Preventing stock access to ditches and burns will allow plant growth and the development of a buffer strip in the area of land next to the water known as the **water margin**. A simple buffer strip bordering ditches, burns and rivers would intercept contaminated run-off from fields and take up excess nutrients, helping to protect the watercourse and improve water quality and wildlife habitat. Keeping livestock away from the bank and watercourses using temporary or permanent fencing can reduce poaching, soil damage, and prevent dung being deposited directly into the water with no time on land to allow natural decomposition. Restricting livestock access also benefits stock, as it may minimise exposure to infections and reduce disease transfer. Parasitic infections from *Cryptosporidium,* fluke and worms and diseases caused by *Leptospirosis* and *E. coli* can all be transferred by water leading to illness and loss of condition of stock. Your livestock may be healthy, but what about other animals drinking and defecating into the water further up stream?

Siting of troughs, pumps and ring feeders should be carefully considered, as these areas are prone to poaching and livestock defecation.

Poor siting of feeding rings can increase pollution risk.

Recommended measures

- Site feeding rings and drinking troughs on flat ground as far away as is practical from watercourses, recent drainage schemes and open ditches to minimise soil, dung and urine gaining direct access to the water.
- Consider permanent or temporary fencing around watercourses in grazed fields.
- Investigate getting into the Rural Stewardship Scheme (RSS) or other conservation or woodland schemes. Financial assistance can be gained for protecting watercourses through fencing and buffer strip creation. Implementing The 4 Point Plan on your farm will award additional points to your RSS application. Your agricultural consultant will be able to provide details.
- Re-route stock or vehicle crossing points over rivers or burns using a hard crossing point or culvert. If choosing to add a culvert, check with your local consultant that this will not form an obstacle to fish or be detrimental to other wildlife.
- Remember the recommended **minimum 10m no-spread zone** around watercourses and **minimum 50m no-spread zone** around springs, wells and boreholes.

If possible, water troughs should be sited away from watercourses to reduce pollution risk.

What you need to do next

Buffer strips around ditches, burns and rivers will **reduce the risk of pollution** entering the water. Try to **prevent direct access of livestock** to watercourses around your farm. Consider your watercourses on the farm and decide where you could add a buffer strip or prevent livestock access to protect stock health and reduce pollution risk. Sources of further information are contained in Appendix 1.

Managing water margins leads to greater biodiversity and can reduce pollution risk.

The 4 Point Plan

Appendices

Further copies of The 4 Point Plan are available from your local SEERAD office or via The 4 Point Plan website on www.sac.ac.uk/4pp

Appendix 1

Finding out more

Sources of further information or advice are listed below.

Organisation/Publication	Services/Information	Contact details
Environmental Management for Agriculture (EMA).	A computer-based tool looking at manageable and affordable solutions to improve environmental and business performance. **Scottish version available in 2004.**	Contact local SEERAD Area Office.
Farming and Watercourse Management - A good practice handbook (SEPA, SNH and WWF Scotland).	Handbook identifies practical ways that management could be improved to benefit watercourses. Price £10	Available from Scottish Natural Heritage, Battleby, Redgorton, Perth P1 3EW Tel: 01738 444 177. www.snh.org.uk
Farming and Wildlife Advisory Group (FWAG Scotland).	Specialist and general advice on agri-environment and conservation issues. Able to provide nutrient budgeting service and point of contact for Rural Stewardship Scheme.	FWAG Scotland, Easter Poldar, Thornhill, Stirling FK8 3QT Tel: 01786 870 185 Fax: 01786 870 186. www.fwag.org.uk
Independent accredited agricultural consultants.	Provide a range of services from advice and guidance to soil sampling and drainage plans.	See local phone book. www.yell.co.uk
LEAF (Linking Environment And Farming).	Charity helping farmers to improve environment and business performance through network of demonstration farms.	LEAF, National Agricultural Centre, Stoneleigh, Warwickshire CV8 2LZ Tel: 02476 413 911 Fax 02476 413 636. www.leafuk.org
Managing River Habitats for Fisheries (SEPA, Fisheries Research Service, SNH and Scottish Executive).	Joint publication looking at planning, design and implementation of river management schemes.	Contact SEPA Corporate Office, Erskine Court, Castle Business Park, Stirling, FK9 4TR Tel: 01786 457 700 Fax: 01786 446 885.
Manure Nitrogen Evaluation Routine (Manner).	Computer programme used to predict the fertiliser nitrogen value of organic manure on a field specific basis.	Available free from ADAS Gleadthorpe Research Centre, Meden Vale, Mansfield, Notts NG20 9PF. Tel: 01623 844331. www.adas.co.uk/manner
NFU Scotland.	Provides political representation for Scottish farmers.	NFU Scotland, Rural Centre, West Mains, Ingliston, Newbridge, Midlothian EH28 8LT. Tel: 0131 472 4000. www.nfus.org.uk
Nitrate Vulnerable Zones (NVZ) Action Programme Guidance Notes.	Guidance for farmers within NVZs to help achieve compliance with NVZ rules.	Available free from local SEERAD Area Offices within NVZs.
Opportunities for saving money by reducing waste on your farm - A manual for farmers and growers. (PB4819)	Booklet highlighting cost effective techniques to minimise waste around the farm.	Available free from DEFRA Publications, Admail 6000, London SW1A 2XX. Tel: 08459 335577. www.defra.gov.uk
Ponds, pools and lochans. ISBN 1 901322 16 5	SEPA publication giving guidance on good practice in the management and creation of small waterbodies in Scotland.	Contact SEPA Corporate Office.
Prevention of Environmental Pollution From Agricultural Activity Code of Good Practice (PEPFAA Code) Do's and Don'ts Guide. ISBN 0 7559 0481 8	Abridged version of the PEPFAA Code.	Available free from local SEERAD Area Office.
Prevention of Environmental Pollution From Agricultural Activity Code of Good Practice (PEPFAA Code).	Scottish Code of Good Farming Practice. Due to be published 2004.	Available free from local SEERAD Area Office.
Rural Stewardship Scheme (RSS).	Competitive agri-environment scheme paying the farmer for carrying out environmentally friendly farming practices to maintain and enhance habitats on the farm. Fencing-off watercourses are one of the options funded under the scheme.	Further details of the RSS can be obtained from your local SEERAD Office or agricultural consultant.

Organisation/Publication	Services/Information	Contact details
Scottish Agriculture - A guide to grants and services. ISBN 0 7559 0470 2	Lists grants available for agricultural businesses in Scotland. Includes information on the Rural Stewardship Scheme and Scottish Forestry Grant Scheme.	Available free from local SEERAD Area Office.
SAC (Scottish Agricultural College).	Provides advisory and consultancy services to the agricultural sector. Provides a nutrient budgeting service and point of contact for Rural Stewardship Scheme. Subscribers to SAC receive Technical Notes covering a range of subjects, e.g. crop fertiliser requirements.	SAC, West Mains Road, Edinburgh EH9 3JG Tel: 0131 535 4000 Fax: 0131 535 4246. www.sac.ac.uk
Scottish Environment Protection Agency (SEPA).	Provides guidance on pollution prevention measures and enforces environmental legislation. Contact local SEPA office for site specific information.	Contact local SEPA office 24 hour Pollution hotline 0800 807 060 Floodline 0800 988 1188. www.sepa.org.uk
Scottish Executive Environment and Rural Affairs Department (SEERAD).	Government department responsible for legal and technical matters relating to agriculture and rural development.	SEERAD Scottish Executive, Pentland House, 47 Robbs Loan, Edinburgh, EH14 1TY Tel: 08457 741 741. www.scotland.gov.uk
Scottish Forestry Grant Scheme and Farmland Premium Scheme.	Grants may be available for planting and management of woodlands.	Forestry Commission, 231 Corstorphine Road, Edinburgh, EH12 7AT Tel: 0845 3673 787 www.forestry.gov.uk
Scottish Native Woods Restoring and Managing Riparian Woodlands. ISBN 0 9529283 2 9	Booklet covering topics such as planning riparian management, encouraging natural regeneration and establishing woodlands by direct planting.	Available from Scottish Native Woods, Tel: 01887 820 392. www.scottishnativewoods.org.uk
Scottish Natural Heritage (SNH).	Administers the Natural Care programme for farmers with sites of special scientific interest (SSSI) or Natura 2000 sites on their land. May have local management schemes for habitat enhancement or water protection, contact SNH Headquarters for details.	SNH Headquarters, 12 Hope Terrace, Edinburgh EH9 2AS Tel: 0131 447 4784. www.snh.org.uk Natural Care Team, Scottish Natural Heritage, Battleby, Redgorton, Perth, PH1 3EW Tel: 01738 444 177.
The Farm Management Handbook - SAC Publication.	The UK reference handbook for farm business management. Price £17.50	SAC, West Mains Road, Edinburgh EH9 3JG Tel: 0131 535 4000 Fax: 0131 535 4246. www.sac.ac.uk
WWF (formerly World Wildlife Fund).	Global Conservation Charity.	WWF (Scotland), 8 The Square, Aberfeldy, Perthshire. PH15 2DD. Tel: 01887 820449. www.panda.org

Abbreviations used in this document:

FWAG Scotland	Farming and Wildlife Advisory Group
FWMP	Farm Waste Management Plan
IACS	Integrated Administration and Control System
PEPFAA Code	Scottish Executive Code of Good Practice for the Prevention of Environmental Pollution From Agricultural Activity
RAMS	Risk Assessment for Manure and Slurry
RSS	Rural Stewardship Scheme
SAC	Scottish Agricultural College
SEERAD	Scottish Executive Environment and Rural Affairs Department
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SSSI	Site of Special Scientific Interest

Appendix 2

Conversion Factors

Metric	Imperial
Areas, weights and volumes	
1 hectare (ha)	= 2.47 acres
1 kilogramme (kg)	= 2.205 pounds
1 tonne (t)	= 0.984 ton
1 litre (l)	= 0.22 gallons
1 cubic metre (m^3) = 1000 litres	= 220 gallons
1 kg (fertiliser)	= 1.97 units
N, P_2O_5 or K_2O contents	
1 kg/tonne (manure)	= 2.0 units/ton
1 kg/m^3 (slurry)	= 8.9 units/1000gallons
Application rates	
1 kg/ha (N, P_2O_5 or K_2O)	= 0.8 units/acre
1t/ha (manure)	= 0.4 tons/acre
1m^3/ha (slurry)	= 89 gallons/acre

Appendix 3

Farm Waste Management Planning

Ideally, all farms should have a FWMP. There is a requirement under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003 for all storage facilities to have a minimum of 6 months slurry storage capacity, unless it can be demonstrated to SEPA's satisfaction through a FWMP that 6 months is not necessary. A FWMP may need guidance from an agricultural consultant or other specialist. Preparing the majority of these data yourself could cut down the time spent by a specialist and therefore reduce the end cost of the plan. A FWMP includes the following;

1. **RAMS assessment/Land availability schedule:**
   - Map showing the available spreading areas on the farm with risk areas clearly identified as high, medium or low.
2. **Slurry and manure production schedule:**
   - Amount of slurry, organic manure and contaminated water produced on a monthly basis, matched to RAMS assessment.
3. **Description of the systems in place for:**
   - Collection, storage, transport and land application of slurry, farmyard manure and contaminated water.
   - Detailed information about each system, including the storage capacity, how it is operated, how those operations are recorded and how the system is monitored and maintained.
4. **Details of available spreading days:**
   - Taking account of average monthly rainfall, dry days and frost days.
5. **Calculations to demonstrate that the systems in place are adequate to deal with the quantities of organic wastes produced.**

To be effective, a FWMP needs to be used and updated. Contractors should be made aware of the risk areas and ensure the FWMP is followed.

Appendix 4

Average rainfall values for the main agricultural areas of Scotland

Based on data supplied by the Met Office.

Use the town nearest your farm to give an approximation of average rainfall values.
These values are **approximations** only. Data more specific to your location may be available from your local agricultural consultant.

Table 4.1. Average rainfall (mm) per month for parts of **Caithness** and **Sutherland**.

	J	F	M	A	M	J	J	A	S	O	N	D
Bonar Bridge	80	70	60	60	65	55	70	85	75	85	85	95
Golspie	55	45	40	45	55	55	70	95	65	65	65	65
Helmsdale	90	70	60	50	50	55	70	80	80	90	95	95
Thurso	90	70	60	50	50	55	70	80	80	90	95	95
Wick	90	70	60	50	50	55	70	80	80	90	95	95

Table 4.2. Average rainfall (mm) per month for parts of **Western Isles**.

	J	F	M	A	M	J	J	A	S	O	N	D
Benbecula	129	86	89	62	65	76	83	83	119	139	140	132
Stornoway	115	77	80	66	62	67	72	74	103	126	129	125

Table 4.3. Average rainfall (mm) per month for parts of **Easter Ross** and **Inverness-shire.**

	J	F	M	A	M	J	J	A	S	O	N	D
Dingwall	80	70	60	60	65	55	70	85	75	85	85	95
Dores	80	70	60	60	65	55	70	85	75	85	85	95
Invergordon	55	45	40	45	55	55	70	95	65	65	65	65
Inverness	55	45	40	45	55	55	70	95	65	65	65	65

Table 4.4. Average rainfall (mm) per month for parts of **Nairn, Moray** and **Badenoch** and **Strathspey**.

	J	F	M	A	M	J	J	A	S	O	N	D
Dufftown	70	60	50	55	65	70	85	100	80	85	80	85
Fochabers	55	45	40	45	55	55	70	95	65	65	65	65
Grantown on Spey	70	60	50	55	65	70	85	100	80	85	80	85
Kingussie	70	60	50	55	65	70	85	100	80	85	80	85
Nairn	55	45	40	45	55	55	70	95	65	65	65	65
Rothes	70	60	50	55	65	70	85	100	80	85	80	85

Table 4.5. Average rainfall (mm) per month for parts of **Aberdeenshire** and **Banffshire**.

	J	F	M	A	M	J	J	A	S	O	N	D
Aberdeen	80	60	50	50	65	55	80	90	70	80	90	80
Ballater	85	65	55	55	70	60	80	95	80	90	95	95
Banchory	80	60	50	50	65	55	80	90	70	80	90	80
Banff	55	45	40	45	55	55	70	95	65	65	65	65
Fraserburgh	80	60	50	50	65	55	80	90	70	80	90	80

Keith	80	60	50	50	65	55	80	90	70	80	90	80
Inverurie	80	60	50	50	65	55	80	90	70	80	90	80
Turriff	80	60	50	50	65	55	80	90	70	80	90	80

Table 4.6. Average rainfall (mm) per month for parts of **Kincardineshire, Angus and Perthshire**.

	J	F	M	A	M	J	J	A	S	O	N	D
Blairgowrie	85	60	55	55	70	60	80	90	85	85	85	90
Carnoustie	65	45	45	45	65	50	70	80	65	65	70	70
Coupar Angus	65	45	45	45	65	50	70	80	65	65	70	70
Montrose	65	45	45	45	65	50	70	80	65	65	70	70
Perth	65	45	45	45	65	50	70	80	65	65	70	70
Pitlochry	85	60	55	55	70	60	80	90	85	85	85	90
Stonehaven	85	60	55	55	70	60	80	90	85	85	85	90

Table 4.7. Average rainfall (mm) per month for parts of **Perthshire, Stirlingshire, Renfrewshire** and **Clackmannanshire**.

	J	F	M	A	M	J	J	A	S	O	N	D
Armadale	80	60	55	55	70	65	85	95	85	80	90	90
Auchterarder	100	75	70	70	75	75	85	110	115	110	100	115
Doune	100	75	70	70	75	75	85	110	115	110	100	115
Dunblane	100	75	70	70	75	75	85	110	115	110	100	115
Dunfermline (Inland)	80	60	55	55	70	65	85	95	85	80	90	90
Dunfermline (Coastal)	60	50	45	45	60	55	75	85	65	65	70	65
Glasgow SE	80	60	55	55	65	65	80	90	95	90	85	90
Kirkcaldy	60	50	45	45	60	55	75	85	65	65	70	65
Ladybank	60	50	45	45	60	55	75	85	65	65	70	65
St Andrews	60	50	45	45	60	55	75	85	65	65	70	65
Stirling	80	60	55	55	70	65	85	95	85	80	90	90
Tillicoultry	100	75	70	70	75	75	85	110	115	110	100	115

Table 4.8. Average rainfall (mm) per month for parts of **Lothian** and **Borders**.

	J	F	M	A	M	J	J	A	S	O	N	D
Biggar	80	65	50	55	70	60	80	95	85	80	90	85
Carluke	75	60	50	55	65	65	85	90	95	85	85	85
Coldstream	65	50	40	45	55	55	65	85	65	65	75	65
Dalkeith	55	40	40	40	55	45	65	85	60	60	70	60
Dunbar	55	40	40	40	55	45	65	85	60	60	70	60
Duns	65	50	40	45	55	55	65	85	65	65	75	65
Edinburgh	55	40	40	40	55	45	65	85	60	60	70	60
Eyemouth	65	50	40	45	55	55	65	85	65	65	75	65
Galashiels	65	50	40	45	55	55	65	85	65	65	75	65
Jedburgh	65	50	40	45	55	55	65	85	65	65	75	65
Lanark	75	60	50	55	65	65	85	90	95	85	85	85
Lauder	65	50	40	45	55	55	65	85	65	65	75	65
Livingston	80	60	55	55	70	65	85	95	85	80	90	90
Penicuik	80	65	50	55	70	60	80	95	85	80	90	85
Selkirk	80	65	50	55	70	60	80	95	85	80	90	85

Table 4.9. Average rainfall (mm) per month for parts of **Ayrshire**.

	J	F	M	A	M	J	J	A	S	O	N	D
Ayr	85	55	55	55	60	65	80	95	105	100	90	95
Cumnock	95	70	65	65	65	70	95	105	120	120	110	115
Girvan	95	70	65	65	65	70	95	105	120	120	110	115
Newmilns	95	70	65	65	65	70	95	105	120	120	110	115
Saltcoats	95	70	65	65	65	70	95	105	120	120	110	115

Table 4.10. Average rainfall (mm) per month for parts of **Dumfries** and **Galloway**.

	J	F	M	A	M	J	J	A	S	O	N	D
Annan	105	70	65	65	75	70	85	105	115	105	105	105
Dalbeattie	105	70	65	65	75	70	85	105	115	105	105	105
Dumfries	105	70	65	65	75	70	85	105	115	105	105	105
Kirkudbright	105	65	70	65	70	65	80	100	115	115	115	115
Lochmaben	105	70	65	65	75	70	85	105	115	105	105	105
Newton Stewart	105	65	70	65	70	65	80	100	115	115	115	115
Stranraer	105	65	70	65	70	65	80	100	115	115	115	115

Appendix 5

Data for pig and poultry calculations

Table 5.1. Typical values of undiluted slurry or manure produced by housed pigs and poultry per day (adapted from the NVZ Guidelines).

Livestock weight (Kg)	Typical volume of slurry/manure produced m^3 per day
Pigs (per animal)	
Maiden gilt (90-130kg)	0.007
1 sow (130-225kg) & litter	0.011
Weaner (7-18kg)	0.001
Growers, dry meal (18-35kg)	0.002
Light cutter, meal fed (35-85kg)	0.004
Baconers, dry meal fed (35-105kg)	0.004
Baconers, liquid meal fed @ 4:1(35-105kg)	0.007
Poultry (per 1000)	
Laying hens (2,200kg)	0.112
Broiler places (2,200kg)	0.045
Broiler breeders (3,400kg)	0.167
Replacement pullets (1,600kg)	0.021

Table 5.2. Typical values of total NPK and available PK contained in poultry and pig slurry and manure *(adapted from SAC Technical Note T309)*.

		Total nutrients			Available nutrients	
	% dry matter	N	P_2O_5	K_2O	P_2O_5	K_2O
Manure (kg/tonne)						
Pig (Fresh)	25	7.0	7.0	6.0	4.0	4.0
Slurry (kg/m^3)						
Pigs	10	6.0	4.0	3.0	2.0	2.5
Poultry Manure (kg/tonne)						
Broiler/layer litter	70	24	22	14	11	10
Deep litter	70	17	18	13	9	10
Battery (fresh)	30	15	14	7	7	5