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MENTERA

Technical Report for Farm infrastructure

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Category	**Technical Grassland & Crop Management**
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Ariennir gan
Lywodraeth Cymru
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1. Introduction

1.1 Objectives of this Report

The purpose of this report is to:

- **To estimate the volume of slurry produced over the 5 month winter period.**
- **Calculate additional slurry storage requirement.**
- **Design specification for a cylindrical slurry store.**
- **Consider storage requirements for Farm Yard Manure.**

1.2 Disclaimer

This report is prepared from physical and financial information supplied by the farming client. The report is prepared in good faith and every effort has been made to ensure accuracy, however Kebek Ltd cannot accept liability for errors and omissions. Responsibility for actions taken lies with the client. Professional advice and statutory advice should be taken as appropriate.

1.3 Farming Connect

AgriPlan Cymru Ltd has been approved to deliver the Advisory Service on behalf of Farming Connect. This Technical Report should be part-funded through Farming Connect.

2. Summary

2.1 Background and opportunities



Figure 1 Aerial view of Porthygan Farm

Porthygan Farm is a 180 acre dairy farm located to the southeast of Wrexham town. (see fig 1). The farm has access to a further 40 acres of summer grazing land. The farm building complex is traditional red brick buildings with two modern portal framed buildings overlooking a central open dirty yard with a slurry store at the lowest point at the rear of the farm.

There are 90 milking cows in total of which 80 cows are housed on cubicles and bedded on straw and 10 dry cows are loose housed. The youngstock are loosed housed and bedded on straw.

At present slurry from the cubicle housing and soiled straw bedding is pushed to a corner of the open dirty yard and loaded into a rotary muck spreader on a daily basis. The farm acknowledges that this practice is in breach of the Water Resources Control of Agricultural Pollution Regulations (CoAPR) and is seeking advice from Farming Connect on how to rectify this as soon as possible.

The farm business has applied to the Nutrient Management Investment Scheme (NMIS) for financial support towards a new slurry store. The Expression of Interest for the grant has been accepted and the second stage of the application process is underway. The farm business is looking for advice on how to reduce the volume of slurry produced on the farm and the options for additional slurry storage.

When considering the design specification of a new slurry store, it is important to consider the environmental constraints that might be in place.

Porthygan Farm is located within the Afon Dee catchment and the perimeter of the farm building complex borders an area at risk of flooding as stated in the NRW Flood Risk Map (see fig 2) refer to NRW website link NRW flood-map-for-planning-development-advice-map

The Flood Risk Map shows that Porthygan farm is located within the flood plain (see fig 2- C2 flood risk assessment) of the Afon Dee. The location of the farm, on flat land within a natural flood plain of the Afon Dee, suggests that there is a high groundwater level. A high groundwater level will exert hydraulic pressure on any engineered structure placed within it. Hydraulic pressure, exerted by groundwater, can cause issues such as water infiltration and structural failure and collapse. The hydraulic pressure can be so severe as to cause the structure to 'pop out' of the ground, particularly when empty. For this reason, is it advised that a new slurry store is located outside the flood risk zone and not in an area with high groundwater.

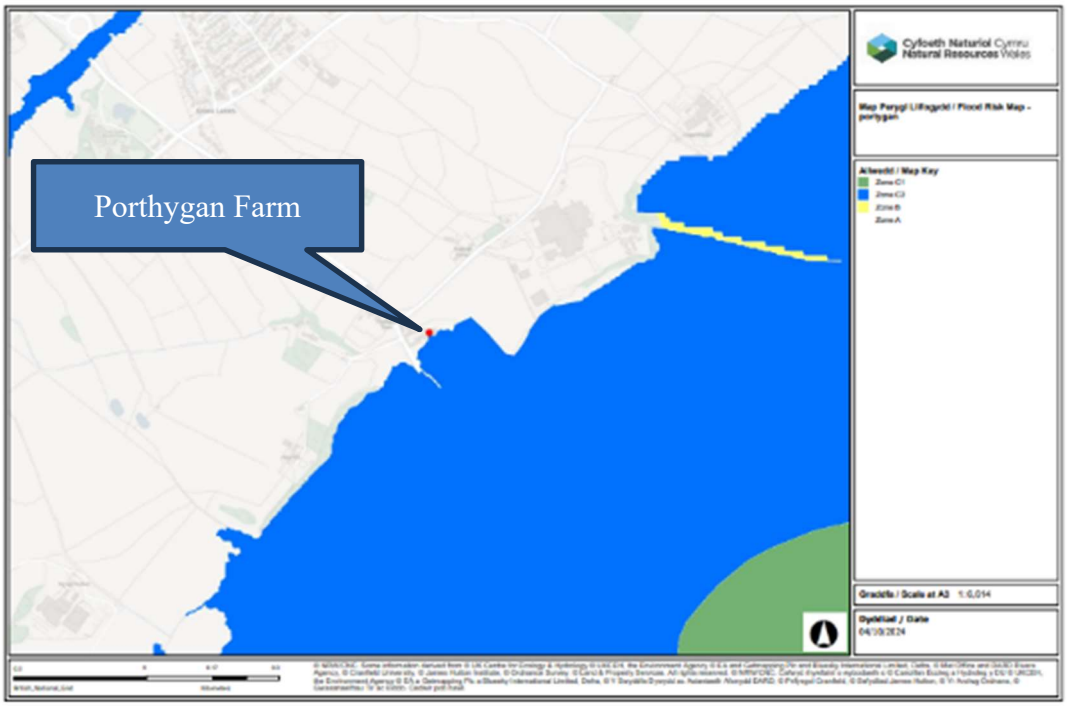


Figure 2 Natural Resources Wales Flood risk assessment for Porthygan Farm



Figure 3 Open slurry store and slurry runoff at Porthygan Farm

The dairy cows have an average annual milk yield of 7000 litre per head. Around 80 milking cows are housed on cubicles and bedded on straw with around 10 dry cows loose housed and bedded on straw. The dairy herd are fed undercover at covered feed stances that run the length of the cubicle housing.

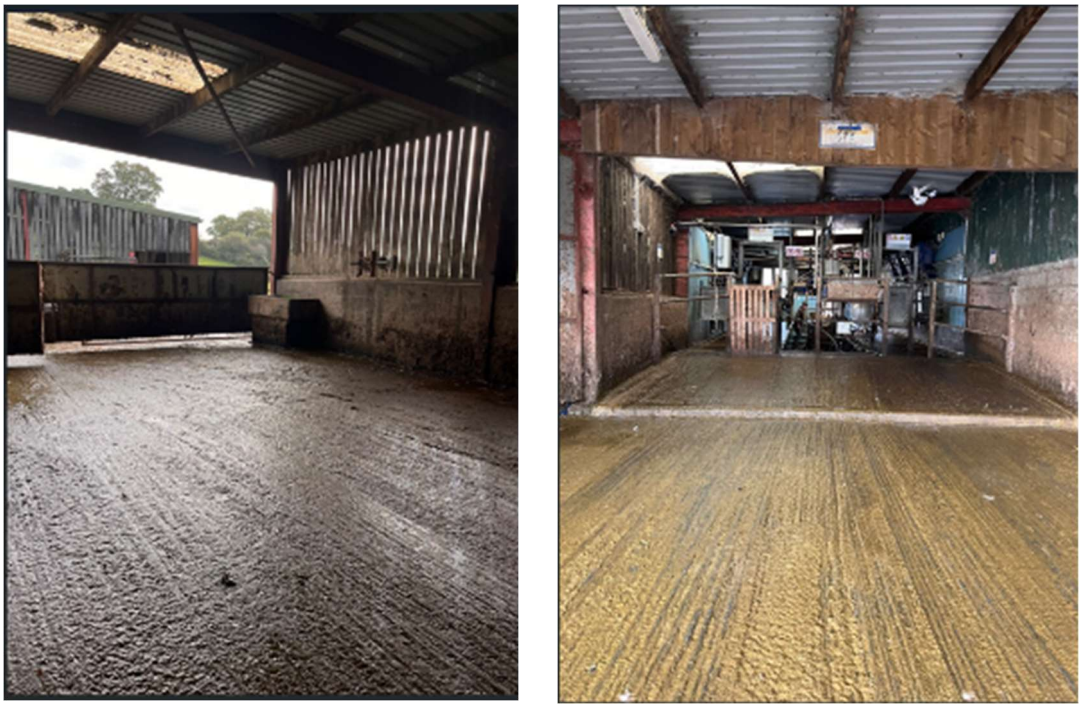


Figure 4 Covered collecting yard and milking parlour at Porthygan Farm

Prior to milking the dairy cows access an open access yard and an open collecting yard. The cows walk to a covered collecting yard and into the milking parlour. The cows leave the milking parlour via a covered exit yard and return to the cubicle housing.

The dairy and parlour washings are stored separate from slurry in a 5000 litre tank.

Slurry from the cubicles housing, the covered feed passages and the open and covered collecting yard is scraped across a sloping concrete yard and pushed into a corner of the yard. The slurry is loaded into a tractor bucket and dropped into a rotary muck spreader daily.

Slurry overflows from the storage area and also flows down the open dirty yard, passes through a gateway and onto the field below. Slurry from the open collecting yard is also flowing from the concreted area and into the adjacent field at the rear of the dry cows housing.

Clean rain that falls onto a dirty yard is contaminated with slurry held on the yard. The rain contaminated with slurry, is classed as slurry and must be collected and contained in a slurry store that complies with CoAPR.

The lack of collection and containment of slurry, in a slurry store that complies with CoAPR, is a breach of CoAPR. The contamination of groundwater is also an offence under the Environmental Permitting Regulations.

Mr Richards is aware of this and is looking to Farming Connect for advice on how to rectify this situation as soon as possible.

Mr Richards has applied to the Nutrient Management Investment Scheme (NMIS) for financial support to improve the storage facility for organic manure on the farm. The Expression of Interest, submitted by Mr Richards, has been accepted and the farm is now in the second phase of the NMIS application process.

CoAPR require that all farms that produce slurry must have 5 months slurry storage capacity by 1st of August 2024 for the volume of slurry produced from 1st of October to the 1st of March.

CoAPR also state that of 1st of August 2024 there is a restriction for when slurry can be applied to land. **The period of time, at which slurry is not permitted to be applied to land, is called the Closed Period.**

The closed period is determined by the soil type and land use and there are exemptions in place, but as a general guide, the closed period, shown in Fig 5, applies to organic manures with high readily available nitrogen i.e., organic manures with more than 30% of the total nitrogen content is available to the crop at the time of spreading. **The readily available nitrogen content of Farm Yard Manure (FYM) is generally below 30% and, as such, the closed period does not apply to FYM, but does apply to slurry.**

Table to show the “closed period” of slurry application to land The Water Resources (Control of Agricultural Pollution Regulations) (Wales) 2021 (see fig 5)

Soil Type	Grassland	Tillage land
Sandy or shallow soil	1st September to 31st December	1st August to 31 December
All other soils	15th October to 15th January	1st October to 31st January

Figure 5 Closed period for application of organic manures with high readily available nitrogen to land

The current practice of applying dairy and parlour washings to land by the low rate irrigator throughout the winter period can continue providing that the ground and weather conditions are suitable.

The farm business acknowledges that there is insufficient slurry storage capacity on the farm and has a farm improvement plan in place to reduce the volume of slurry first before considering the design specification of a new slurry store. The provision of 5 months slurry storage capacity will enable the farm to comply with the closed period by storing slurry over the winter period.

This report will offer advice to reduce the volume of slurry first and to calculate the size and capacity of a slurry store and offer advice on the storage of Farm Yard Manure (FYM).

2.2 Agreed route forward.

The business will assess the advice in the report and implement the improvement works to the infrastructure. The construction and installation of a new slurry store or Farm Yard Manure store will need planning permission, and I would recommend that this process begins as soon as possible. Ensuring all improvement works and new structures have the relevant planning permission is also essential under the new regulations. It is especially important that the business has all relevant permissions in place and NRW are informed of all works.

Natural Resources Wales (NRW) need to be informed of all improvement works to regulatory compliant structures **14 days prior to commencement of works** on site via their prior notification form. This is a legal requirement of the CoAPR.

The notification of the improvement works can be found on the NRW website and should be emailed to NRW prior to commencement of works on site.

Alternatively, notification of the improvement works can be submitted to NRW via the following link

Preconstruction notification of new slurry store and silage store

The NMIS grant scheme also requires that evidence is provided that the relevant and appropriate authorisations are in place, such as notification to the local planning authority.

3. Business Profile

3.1 The Farm

Porthygan Farm is run as a dairy enterprise. The holding covers a total of 180 acres of land, the majority of the land is suitable for slurry disposal if land and weather conditions are suitable.

When assessing the volume of slurry, that has to be collected and contained over the 5 month winter period, a key factor is the amount of rain that falls onto the slurry store and the open yards over the 5 month winter period.

At Porthygan Farm 388 mm of rain will fall over the 5-month winter period as stated on the Welsh Government data map https://datamap.gov.wales/maps/974. This equates to a monthly average rainfall of 78 mm per winter month.

The dairy herd of 90 cows, are housed on cubicles within a modern portal framed building. The dairy cows are fed plastic wrapped round baled silage at covered feed stances within the cubicle housing facilities.

At the front gable end of the loose housing is an open yard which slopes towards the slurry store at the far end of the yard. To the right hand side of the open dirty yard is an open collecting yard with a modern portal framed building used for housing the dry cows on the lower side. Slurry from the open collecting yard is flowing into the field. The concrete plinth of the loose housing floor is visible under the steel access gate of the loose housing and presents a risk of slurry entering the loose housing if the runoff from the yard is not managed appropriately.



Figure 5 Slurry flowing from open collecting yard onto field

3.2 Livestock Numbers and slurry production

Livestock type and number – 80 milking cows housed on cubicles with remaining livestock loose housed and bedded on straw.

Farm management	Volume (m^3) of slurry per month
80 milking cows with average annual milk yield of 7000 litre per head housed on cubicles producing 53 litres/cow/day for 30 days.	**127**
10 dry cows loose housed and bedded on straw producing FYM only Up to 50 youngstock producing approx. 32 litres/cow/day spending 40% of time on open feed yard area.	**0**
Remaining calves all loose housed and bedded on straw producing FYM only.	**0**
Open dirty yard with surface area of 445 m^2 collecting 78 mm surface rainfall each winters month.	**35**
Total current monthly production of slurry	**162**

Figure 5 Estimated volume of slurry produced per month at Porthygan Farm

The estimated volume of slurry produced per month at Porthygan Farm is 162 m^3 per month. This equates 810 m^3 over a 5 month winter period.

3.3 Slurry storage capacity

The existing slurry storage area has two retaining wooden sleeper walls. The slurry is pushed against the wooden sleeper walls prior to loading the rotary muck spreader. Slurry that remains in the slurry storage area flows under the gate and into the adjacent field. The lack of retaining walls offers no available slurry storage capacity on the farm.

To minimise the risk of causing pollution, there is a requirement for a slurry store to have four retaining impermeable walls and a freeboard. The freeboard is the distance from the surface of the slurry held in the store and the top of the retaining walls or embankments. The required freeboard of an earth banked slurry lagoon is 750 mm and 300 mm for all other stores. The CoAPR state that a slurry store must have a freeboard maintained at all times.

The slurry storage capacity must also allow for the volume of rain that will fall onto the surface of the slurry store over a 5 month winter period if it remains open.

The rain fall value is 388 mm over 5 month winter period

The shortfall in slurry storage capacity at Porthygan Farm based on current farm practices is 810 m^3 plus an allowance for the 300 mm freeboard and 388 mm of rain that will fall onto the surface of the slurry store should it remain open.

4. FARM ADVICE AND RECOMMENDATIONS.

- **Reduce slurry/dirty water production.**

At present the area of open dirty yard at the front of the cubicle housing is 445 m^2. This area of open dirty yard can be reduced to 221 m^2 by placing a transfer channel across the yard from gate stanchion on the left hand side of the yard to the corner of the dry cow loose housing. Slurry from the cubicles could be pushed into the slurry transfer channel.

The slurry from the open collecting yard is currently spilling on to adjacent field. I recommend that a concrete shoulder is placed under the gate to the field and also along the steel access gate to the loose housing to prevent slurry entering and spoiling the straws beds of the dry cows.

The concrete shoulder will define the dirty yards area and direct slurry that collects on the open yard into the transfer channel.

- **Design specification for new concrete slurry store**

The business is aware that reducing the open dirty yard areas will reduce the capacity and cost of any additional slurry storage. However, the holding wants to calculate the capacity of the additional slurry storage based on the existing layout. Any works that are carried out in the future to roof open dirty yards will result in additional buffer slurry storage capacity in the slurry store.

To comply with CoAPR the design specification of the new slurry store must hold the volume of slurry produced over a 5 month winter period plus an allowance for freeboard and the rain that will fall onto the surface of the slurry store if it remains open.

At Porthygan Farm the volume of slurry to be stored is 810 m^3 plus an allowance of 300 mm freeboard and 388 mm of rain that will fall onto the surface of the slurry store over a 5 month winter period.

As a guide based on current farm practices

> A cylindrical slurry store 15.36 m in diameter and 5.63 in height will provide sufficient slurry storage capacity to meet the 5 month storage requirement of CoAPR.

If the open dirty yard is reduced to 221 m^2 by placing a transfer channel across the yard the storage capacity of the cylindrical slurry store is reduced.

> A cylindrical slurry store 14.516 m in diameter and 5.63 in height will provide sufficient slurry storage capacity to meet the 5 month storage requirement of CoAPR.

I recommend that the cylindrical slurry store is placed outside the flood risk area as identified in Fig 2.



Figure 6 potential site for cylindrical slurry store

If the ground conditions are suitable the cylindrical slurry store could be sited on the raised ground near the concrete sleeper cow track and outside the flood risk area (see fig 6) .

The cylindrical slurry store will require a reception pit. The slurry will either be collected in the transfer channel and stored in the reception pit or pushed directly into the reception pit. The slurry will be pumped from the reception pit into the above ground cylindrical slurry store.

The minimum storage capacity of the reception pit is 2 days of slurry production plus a 300 mm freeboard plus an allowance for 2 days of rain that falls onto the surface of the slurry store if it remains open.

Based on current farm practice the minimum available slurry storage capacity of the reception pit is 11 m^3 plus an allowance for a 300 mm freeboard plus an allowance for 2 days of rain that falls onto the surface of the slurry store if it remains open.

A reception pit 4 m long by 2 m wide by 2 m deep will provide sufficient available slurry storage capacity with an allowance for a 300 mm freeboard and 2 days of rain that falls onto the surface of the slurry store if it remains open.

The reception pit will be sited near the cylindrical slurry store with a twin gated valve between the reception pit and the cylindrical slurry store. It is a requirement of CoAPR that the valve gates are 1 m apart and lockable. This is a pollution prevention measure to reduce the risk of a branch or blockage interfering with both gates and preventing the valve from closing.

- **Farm yard manure store**

  During my visit to the farm, we discussed the options of the storage of Farm Yard Manure (FYM). As mentioned earlier in this report, FYM can be applied to land during the closed period.

  CoAPR permit the storage of FYM, from the loose housing, as temporary field heaps and specifies how the FYM should be stored in order to minimise the risk of causing pollution.

  FYM stored in temporary field heaps should not be sited in the same place each year as they tend to form hotspots of leachate into the soil profile.

  The regulations specify that solid FYM field heaps should not be located:

  - Within 10m of a surface water or land drain
  - Within 50m of a spring or borehole
  - On land that is likely to become waterlogged
  - On land likely to flood
  - On any single position for more than 12 successive months
  - On land that is not steeply sloping

  There should be a two-year gap before returning to the same site. FYM should be able to be stacked in a freestanding heap without slumping. FYM cleaned out from the livestock housing accommodation could be carried to the FYM temporary field heaps and stored until the land conditions and weather are suitable for spreading.

  If FYM is stored under cover within an impermeable FYM store, no slurry is produced from the FYM store under the current regulations.

  A new covered FYM store could be a simple portal framed building (see fig 7).

  A covered FYM store needs an impermeable concrete floor and 3 walls to form an enclosure. Ideally the floor needs to slope slightly to the rear of the building. The wall floor joint needs to be sealed to prevent leaking or seepage. The facility must be roofed to prevent any contamination of rainfall.



Figure 7 example of a covered FYM store

A covered FYM store does not need any collection tank, however it is important to prevent any ingress of clean water runoff into the facility via the open front elevation. Clean water should be diverted away from the FYM store by placing a concrete shoulder across the front of the FYM store.

- **Habitat Sites**

The Afon Dee is a protected Habitat site and is within 420 m to the farm. As a consultee for planning consultations NRW has a legal obligation to carry out an appropriate assessment of any plan or permission that is 'likely to have a significant effect on a European site in Great Britain (either alone or in combination with other plans or projects)', under Regulation 62 of the Conservation of Habitats and Species Regulations 2010 (Habitats Regulations).

In this instance, as part of the planning application process, the Local Authority may require an assessment of the impact of ammonia emissions and nitrogen deposition from the livestock development may have upon sensitive receptors.

To assess the potential impact there is a free on-line modelling tool called SCAIL (Simple Calculations of Atmospheric Impact Limits from Agricultural Sources (www.scail.ceh.ac.uk) can be used.

A summary of the type of information that is required to complete SCAIL is provided below:

Farm location can be found on the modelling tool with a Landranger map.

Details of protected sites is provided by SCAIL once the farm location is given.

Breakdown of animal numbers by type and by type of housing.

Area of floor space of the housing in square metres and type of ventilation system.

The quantity of manure stored on the livestock unit at any one time (in tonnes).

The surface area in square metres of any slurry storage facility on the site (including lagoons) and the type of cover used - this is provided as a drop-down menu.

Open dirty yard areas.

Grazing platform for all livestock.

Application rate and method of organic manures to land.

Some of the information held in this report will be applicable for an ammonia assessment using the SCAIL model.

- **Sustainable Urban Drainage Scheme (SUDS)**

For the NMIS grant, there is an obligation to provide evidence that that the Sustainable Urban Drainage (SUDS)System Regulations have been complied with.

Sustainable Urban Drainage Systems (SuDS) is a process by which the speed of water from developed sites is slowed down sufficiently to minimise the risk of flooding downstream. In Wales new legislation under the Schedule 3 of the Flood and Water Management Act (FWMA) 2010 requires surface water drainage for new developments to comply with mandatory National Standards for sustainable urban drainage (SuDS).

This new legislation that came into force on the 7th January 2019 and is most relevant for agricultural developments and construction that have a surface area of 100 m^2 or more.

The County Council, as the Local Authority, is the approval body and is referred to as the Sustainable Urban Drainage Systems Approval Body (SAB).

For the NMIS grant you are required to provide evidence that you have met the obligation of SUDS. I recommend that you contact your local County Council SAB as soon as possible, by e mail, to ascertain if SUDS approval is required or not, for the cylindrical slurry store.

If SUDS approval is not required, you can use the written response from Wrexham SAB as evidence that you have complied with SUDS, and present this as part of the NMIS submission.

If SUDS approval is required, I suggest that the application process is started as soon as possible. The SUDS application process takes around 8 weeks to determine, and construction cannot commence until approval is granted.

5. Action Plan

Objective	Action required	Responsible Person	Time Frame	Outcome
Define dirty yard areas.	Place concrete shoulder on perimeter of open collecting yard.	Mr Richards	ASAP	Reduce risk of causing pollution.
Reduce volume of slurry.	Consider placing transfer channel across open dirty yard to reduce open dirty yard area.	Mr Richards	ASAP	Improve efficiency of farm business.
Ensure compliance with Local Planning Regulations.	Contact Wrexham County Council Planning Department before constructing new slurry store.	Mr Richards	ASAP	Ensures regulatory compliance.
Ensure compliance with Sustainable Urban Drainage Scheme (SUDS).	Contact Wrexham County Council Sustainable Approval Body.	Mr Richards	As soon as possible to see if SUDS approval is required or not. SUDS approval takes at least 8 weeks to determine, and construction cannot commence until approval is granted.	Ensures regulatory compliance.
Complete notification form.	Contact NRW 14 days before construction of new slurry store.	Mr Richards	At least 14 days before construction commences.	Ensures regulatory compliance.
Ensure adequate slurry storage capacity is provided.	Construct new slurry storage facility.	Mr Richards	ASAP	Ensures regulatory compliance.

6. Further Guidance

Natural Resources Wales Guidance

Guidance for Farming

General guidance for the Farming sector

Notification of the improvement works can be submitted to NRW via the following link.

Preconstruction notification of new slurry store and silage store

Farming Connect Guidance

Farming Connect home page.
Farming Connect home page

Control of agricultural pollution slurry storage fact sheet

Slurry storage Fact sheet

Control of agricultural pollution storage of silage

Silage storage Fact sheet

Farm Nutrient workbook guidance

Farm nutrient workbook guidance

Risk map guidance

Producing a risk map guidance

Construction Guidance for Livestock manure and silage storage

Ciria: Livestock Manure and Silage storage infrastructure for agriculture – this guidance is available in 2 parts – part 1 is a selection guidance and part 2 is design and construction**. The documents are free to download.**

Construction guidance for manure and silage store

Statutory Guidance

The Water Resources (Control of Agricultural Pollution Regulations) (Wales) (2021)

Control of Agricultural Pollution Regulations