Slurry Wizard

EXCEL SECURITY

You may need to alter your Excel security settings to enable the functions of the Slurry Wizard tool to work

Welcome to the Slurry Wizard Tool

The main aim of the Slurry Wizard is to identify whether there is adequate slurry storage and to explore different strategies to meet compliance.

The Slurry Wizard has four key components:
1. To calculate the existing slurry capacity.
2. To calculate the existing slurry production.
3. A report to look at the monthly production compared to existing storage.
4. To calculate the Nitrogen produced in organic manures per hectare.

The Slurry Wizard includes the typical costs of slurry storage and associated operating costs for slurry spreading. If you wish to you can change some of the operating costs and the capital costs to refine the report for your own situation.

Getting started

You may need to adjust your Excel security settings for the Slurry Wizard to work.
It is recommended you download the Slurry Wizard and save it to your hard drive. Always work from the saved version and save any changes with a new file name, so that you can go back to the original version if needed

Cells within this workbook are colour coded as follows:

User entry cell
Calculation cell
Total calculation cell and title cell

Read the guidance for using Slurry Wizard

Before you use the Slurry Wizard you should read the guidance below on how to use the calculator. It is recommended to seek clarification of the specific requirements of 'Nitrate Vulnerable Zones (England and Scotland)' (NVZ), 'Farming Rules for Water (England)', 'Silage, Slurry and Agricultural Fuel Oil Regulation (SSAFO)', and 'The Water Resources (Control of Agricultural Pollution)' (Wales) regulations for your farm. The calculations carried out using this tool will be based on figures provided by the user and AHDB cannot take responsibility for decisions made as a result.

Contains data supplied by UK Centre for Ecology & Hydrology.

Last update: Mar -2024

Slurry Wizard ~ Slurry Data Entry

Stores, yard and roof rainfall, parlour washings and wash water entry

Baseline farm data

Farm name / reference	HILL FARM
Total farmable area (hectares)	119 Ha
Slurry store 10 figure grid reference (e.g. SE3548629596)	SD0777799552
Cattle in herd/ pig herd size (includes calves, heifers, bulls, sows, finishers etc)	494 animals
Cows in milk	
Milk yield/cow	
Depreciation buildings (%)	5 %
Interest rate (%)	6.75 %
Water cost (£m3)	1.8 £m3
Slurry spreading cost (£/cubic metre)	3.0 £m3
Water storage cost (£/cubic metre)	85.0 £m3
Divert water cost (£/square metre)	5.0 £m2
Roofing cost (£/square metre)	120.0 £m2
Slurry store cost (£/cubic metre)	75.0 £m3

Slurry storage capacity for earth bank stores

	Total Depth Do NOT deduct freeboard from the total depth	Slurry store bank slope*	Top length	Bottom length	Top width	Bottom width	Total volume	750mm freeboard	Working volume	Surface area	Tick if Covered Store	Surface area to store (m2)
	(m)	Please select	(m)	(m)	(m)	(m)	(m3)	(m3)	(m3)	(m2)		
Store 1		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 2		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 3		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 4		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 5		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 6		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 7		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 8		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 9		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
Store 10		Bank slope of 1:1 (45 degrees)		0		0	0	0	0	0	☐	0
***Slope factor: click on cell for options**						**Totals**	**0**	**0**	**0**	**0**		**0**
Earth bank lagoons must have 750mm of freeboard to protect banks						**Total area**	**0**					

Slurry storage capacity for rectangular & circular tower stores

	Length (m)	Width (m)	Circumference of circular store (m)	Diameter of circular store (m)	Depth (m) (less 0.3m freeboard)	Capacity (m3)	Surface area (m2)	Surface area to store (m2)	Tick if Covered Store
Store 1						0	0	0	☐
Store 2						0	0	0	☐
Store 3						0	0	0	☐
Store 4						0	0	0	☐
Store 5						0	0	0	☐
Store 6						0	0	0	☐
Store 7						0	0	0	☐
Store 8						0	0	0	☐
Store 9						0	0	0	☐
Store 10						0	0	0	☐
Store 11 - circular			52	16.5	5	1075	215	215	☐
Store 12 - circular				0.0		0	0	0	☐
Store 13 - circular				0.0		0	0	0	☐
Store 14 - circular				0.0		0	0	0	☐
Store 15 - circular				0.0		0	0	0	☐
				Total existing capacity		**1075**	**215**	**215**	

Freeboard : reduce the depth to allow for freeboard (0.3 metres for a steel or concrete store)

Slurry storage capacity for slurry bags

	Volume (m3)
Store 1	
Store 2	

Store 3	
Store 4	
Store 5	
Store 6	
Store 7	
Store 8	
Store 9	
Store 10	
Total bag volume	**0**

Slurry separator

Do you operate a separator for the slurry entering the store(s)		
% reduction in slurry		Adjust the % to reflect the average reduction in slurry volume (refer to manufacturers guidance)

Parlour washings to slurry store

Parlour washings to slurry store		
Parlour washing litres per cow per day (l/hd/d)		Note: Suggested 5 to 15 l/hd/d robotic milkers (check with manufacturer). 20 l/hd/d low pressure system. 30 l/hd/d high pressure system.

Pig wash water to slurry store

Pig wash water to slurry store		Please select from drop-down list
Do you want to use preset NVZ wash water values?		Please select from drop-down list

Pigs	NVZ Preset Values Wash water l/place/day	User Entry Values Wash water l/place/day	User Entry Values Wash water total l/day
1 sow place inc. litters - Litter up to 7kg - With syn amino acid	1.43		
1 sow place inc. litters - Litter up to 7kg - No syn amino acid	1.43		
Dry sow - Above 150kg	0.08		
Weaner place - 7 to 13kg	0.28		
Weaner place - 13 to 31kg	0.37		
Grower place - 31 to 66kg - Dry fed	0.27		
Grower place - 31 to 66kg - Liquid fed	0.27		
Finisher place - Over 66kg - Dry fed	0.23		
Finisher place - Over 66kg - Liquid fed	0.23		
Maiden gilt place - Over 66kg	0.08		
Boar - 66kg to 150kg	0.08		
Boar - Over 150kg	0.08		

Uncovered areas of dirty yards, silage silos and earth bank surrounds to slurry store

Note: For each yard please either enter yard dimensions and the tool will calculate the yard area, or if yard area known please enter the yard area in m2.

	Length (m)	Width (m)	Area (m2)
Yard 1	21	15	315
Yard 2	34.5	9	311
Yard 3	12	4.5	54
Yard 4	27	4.5	122
Yard 5			0
Yard 6			0
Yard 7			0
Yard 8			0
Yard 9			0
Yard 10			0
Yard 11			0
Yard 12			0
Yard 13			0
Yard 14			0
Yard 15			0
Yard 16			0
Yard 17			0
Yard 18			0
Yard 19			0
Yard 20			0
		Total yard area	**801**

Roof water area to slurry store

	Length (m)	Width (m)	Area (m2)
Roof 1			0

Roof 2			0
Roof 3			0
Roof 4			0
Roof 5			0
Roof 6			0
Roof 7			0
Roof 8			0
Roof 9			0
Roof 10			0
Roof 11			0
Roof 12			0
Roof 13			0
Roof 14			0
Roof 15			0
		Total roof area	**0**

Slurry Wizard ~ Livestock Data Entry

Livestock	Age	Liveweight/milk yield (litres)	Number of livestock	% collected as slurry	Annual N output kg/year	Daily excreta (l/day)	Total collected as slurry (l/day)	Total N (kg/year)
Cattle								
Dairy Cow	After first calf	High (> 9000)		100%	115.0	64.00	0	0
Dairy Cow	After first calf	Medium (6000-9000)		100%	101.0	53.00	0	0
Dairy Cow	After first calf	Low (< 6000)		100%	77.0	42.00	0	0
Dairy heifer replacement	From 12 months to calving	-		100%	61.0	40.00	0	0
Dairy heifer replacement	2 to 12 months	-		100%	29.0	20.00	0	0
Beef Suckler	Over 24 months	Large (> 500)		100%	83.0	45.00	0	0
Beef Suckler	Over 24 months	Small (< 500)		100%	61.0	32.00	0	0
Grower	Over 24 months	-	120	100%	50.0	32.00	3840	6000
Grower	12 to 24 months	-		100%	50.0	26.00	0	0
Grower	2 to 12 months	-		100%	28.0	20.00	0	0
Bulls Beef	Over 2 months	-		100%	54.0	26.00	0	0
Bulls for breeding	Over 24 months	-		100%	48.0	26.00	0	0
Bulls for breeding	2 to 24 months	-		100%	50.0	26.00	0	0
Calf	Under 2 months	-		100%	1.4	7.00	0	0
		Total number of cattle	**120**			**Totals for cattle**	**3840**	**6000**
Pigs								
1 sow place inc. litters	Litter up to 7kg	With syn amino acid		100%	16.0	11.00	0	0
1 sow place inc. litters	Litter up to 7kg	No syn amino acid		100%	18.0	11.00	0	0
Dry sow	Above 150kg	-		100%	17.5	8.67	0	0
Weaner place	7 to 13kg	-		100%	1.0	1.00	0	0
Weaner place	13 to 31kg	-		100%	4.2	1.67	0	0
Grower place	31 to 66kg	Dry fed		100%	7.7	3.33	0	0
Grower place	31 to 66kg	Liquid fed		100%	7.7	6.00	0	0
Finisher place	Over 66kg	Dry fed		100%	10.6	4.33	0	0
Finisher place	Over 66kg	Liquid fed		100%	10.6	8.67	0	0
Maiden gilt place	Over 66kg	-		100%	11.1	4.33	0	0
Boar	66kg to 150kg	-		100%	12.0	5.00	0	0
Boar	Over 150kg	-		100%	17.5	8.67	0	0
		Total number of pigs	**0**			**Totals for pigs**	**0**	**0**
Sheep								
Ewe	Lamb under 6 months	<60kg		100%	7.60	3.33	0	0
Ewe	Lamb under 6 months	>60kg		100%	11.90	5.00	0	0
Lamb	6 to 9 months	-		100%	0.50	1.67	0	0
Lamb	Over 9 months	-		100%	0.70	1.67	0	0
Goats								
Goat	-	-		100%	15.00	3.67	0	0
Deer								
Breeding hinds	-	-		100%	15.20	5.00	0	0
Other deer	-	-		100%	12.00	3.67	0	0
Horses								
Horse	-	-		100%	21.00	24.67	0	0
Layers								
Replacement layer pullets	Under 17 weeks	-		100%	0.21	0.04	0	0
Laying hens - cages	Over 17 weeks	-		100%	0.40	0.12	0	0
Laying hens - free range	Over 17 weeks	-		100%	0.46	0.10	0	0
Broilers								
Broiler places	-	-		100%	0.33	0.05	0	0
Broiler breeder pullets	Under 25 weeks	-		100%	0.29	0.04	0	0
Broiler breeders	Over 25 weeks	-		100%	0.70	0.11	0	0
Turkeys								
Male	-	-		100%	1.23	0.14	0	0
Female	-	-		100%	0.91	0.11	0	0
Other								
Ducks	-	-		100%	0.75	0.08	0	0
Ostriches	-	-		100%	1.40	0.00	0	0
						Totals for all animal types	**3840**	**6000**

Slurry Wizard ~ Slurry Report

Export worksheets to PDF

Farm Nitrogen Loading **50 Kg Nitrogen per Ha**

NB This is the nitrogen loading BEFORE the import or export of manure

Action points	
Number of months of storage	**6**
Maximum likely 2 day rainfall	**170**
Recommended reception pit size (m3)	**138**
Farming Rules for Water recommendations	**You comply with the guidance for minimum storage of 6 months**
Roof water collection recommendations	
Slurry store cover recommendations	

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Days		30	31	30	31	31	28	31	30	31	30	31	31	365 days
Total cattle excreta as slurry (m3)		115	119	115	119	119	108	119	115	119	115	119	119	1402 m3
% Cattle excreta to slurry store (100% for housed dairy, 20 to 50% if housed overnight, 10% for grazed dairy)		24	24	24	24	24	24	24	24	24	24	24	24	
Total pig excreta as slurry (m3)		-	-	-	-	-	-	-	-	-	-	-	-	
% Pig excreta to slurry store														
Total other livestock excreta as slurry (m3)		-	-	-	-	-	-	-	-	-	-	-	-	
% Other excreta to slurry store														
Excreta to slurry store (m3)		28	29	28	29	29	26	29	28	29	28	29	29	336 m3
Slurry separated (m3)	/ %	-	-	-	-	-	-	-	-	-	-	-	-	- m3
Parlour washings (m3)	0.0	-	-	-	-	-	-	-	-	-	-	-	-	- m3
Pig wash water (m3)	0.0	-	-	-	-	-	-	-	-	-	-	-	-	- m3

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Grid reference average rainfall (mm)		105	148	117	135	118	87	108	68	60	63	78	82	1,169 mm
Own average rainfall (mm)														mm
Adjusted likely rainfall, (mm)		121	170	135	155	135	100	124	78	69	72	90	94	1,344 mm

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Storage required		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	
Yard run off area to slurry store (m3)	801 m2	97	136	108	124	108	80	99	62	56	58	72	76	1,076 m3
Slurry store rainfall to store (m3)	215 m2	26	37	29	33	29	22	27	17	15	15	19	20	289 m3
Roof water area to store (m3)	0 m2	-	-	-	-	-	-	-	-	-	-	-	-	- m3
Total cubic metres (m3)		150	201	165	186	166	128	154	-	-	-	-	-	1,151 m3
Cumulative production (m3)		150	352	516	702	868	996	1,151	1,151	1,151	1,151	1,151	1,151	1,151 m3
Total storage capacity (m3)	1075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075	1,075 m3
Capacity less production (m3)		925	723	559	373	207	79	***-76***	***-76***	***-76***	***-76***	***-76***	***-76***	***-76*** m3

0

Cost/Benefits	Net Benefit £/year
Divert roof water	0.0
Divert roof water & harvest	0.0
Roof dirty yard	**-3155.9**
Roof dirty yard & harvest water	**-12022.5**

The cost/benefit is based on a slurry storage cost of £75/cubic metre

Slurry Wizard - Further information

Guidance for using the tool is available: https://ahdb.org.uk/slurry-wizard

UPDATED AND HIGHER RESOLUTION RAINFALL

Rainfall data has been incorporated into this version of the Slurry Wizard tool using the Centre for Ecology and Hydrology's Gridded Estimates of Areal Rainfall (GEAR) 1km dataset, which covers the whole of the UK. In order to process this data for use in the Slurry Wizard tool this data was broken down into monthly values and scaled according to future climate change scenarios based on UKCP18 (UK Climate Projections 2018) key results for the probabilistic projections for aggregated regions.

What is the UKCP?

The UKCP18 project uses cutting-edge climate science to provide updated observations and climate change projections out to 2100 in the UK and globally. The project builds upon UKCP09 to provide the most up-to-date assessment of how the climate of the UK may change over the 21st century. The UKCP18 Governance Board has overall responsibility for the delivery of the project and provides strategic oversight of the UKCP18 project, signing off key deliverables and agreeing any recommendations for significant changes in scope. The Governance Board includes representatives from Defra, Met Office, Environment Agency, BEIS, Devolved Administrations, Adaptions Sub Committee and the UKCP18 Peer Review Panel (an independent panel of international climate experts).

A step-by-step methodology for the processing of the rainfall data used in the modified version of Slurry Wizard is provided below:
A pre-existing distributed GIS data set (raster) of the UK 1981-2000 GEAR monthly average rainfall dataset covering each month of the year was used as the base rainfall datasets. The 1981-2000 date range was used as it corresponds to the UKCP18 2022 key results baseline time horizon from which forecasted changes in rainfall and temperature are calculated.

Forward predictions for percentage changes in rainfall were selected for Representative Concentration Pathway (RCP) 6.0 at a future time horizon of 2050-2069 (in order to provide rainfall projections up to 30 years into the future). The 50th percentile key projections for each season (winter (December, January and February), spring (March, April and May), summer (June, July and August) and autumn (September, October and November)) were selected as the forward projection value.

The UKCP18 key results data is divided into geographical regions of the UK. The monthly 1981-2000 baseline GEAR datasets were split into each of these geographical regions using the UKCP18 spatial region data. 1km rainfall was extracted for each of these areas and linked to its associated 1km British National Grid square (also known as a Monad) grid reference.

The 1981-2000 monthly average rainfall data for the UK was extracted from all 12 grids and these data were exported to a spreadsheet (linked to their British National Grid square grid reference). The selected 50th percentile, 2050-2069, RCP 6.0 seasonal forward predictions for winter, spring, summer and autumn rainfall these were applied to the 1981-2000 baseline datasets to generate the monthly per Monad (a 1x1km grid square of the Ordnance Survey British National Grid) average rainfall, which was then incorporated into the updated version of Slurry Wizard as a new rainfall data table in a separate worksheet (similar to the current Manner rainfall data).

In order to access the rainfall values the user of the tool enters the location of their slurry store as a ten-figure grid reference in the Slurry Wizard Slurry data entry worksheet and the Slurry Wizard tool automatically calculates the four-figure grid reference to then use a lookup function to identify the monthly average rainfall for the slurry store location.

The rainfall data is then populated automatically into Surry Wizard and, as per agreement, the rainfall values are increased by 15% prior to their use in the slurry calculations similar to the original approach using the Manner data.

References:
Tanguy, M.; Dixon, H.; Prosdocimi, I.; Morris, D.G.; Keller, V.D.J. (2021). Gridded estimates of daily and monthly areal rainfall for the United Kingdom (1890-2019) [CEH-GEAR]. NERC EDS Environmental Information Data Centre. https://doi.org/10.5285/dbf13dd5-90cd-457a-a986-f2f9dd97e93c
Met Office, (2023). https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/summaries/headline-findings, *UKCP18-Key-results-2022.xslx*.