How to use the Dairy Effluent Storage Calculator (DESC)

Instructions to calculate effluent storage requirements

DairyNZ

For more information visit **dairynz.co.nz**

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Ministry for Primary Industries
Manatū Ahu Matua

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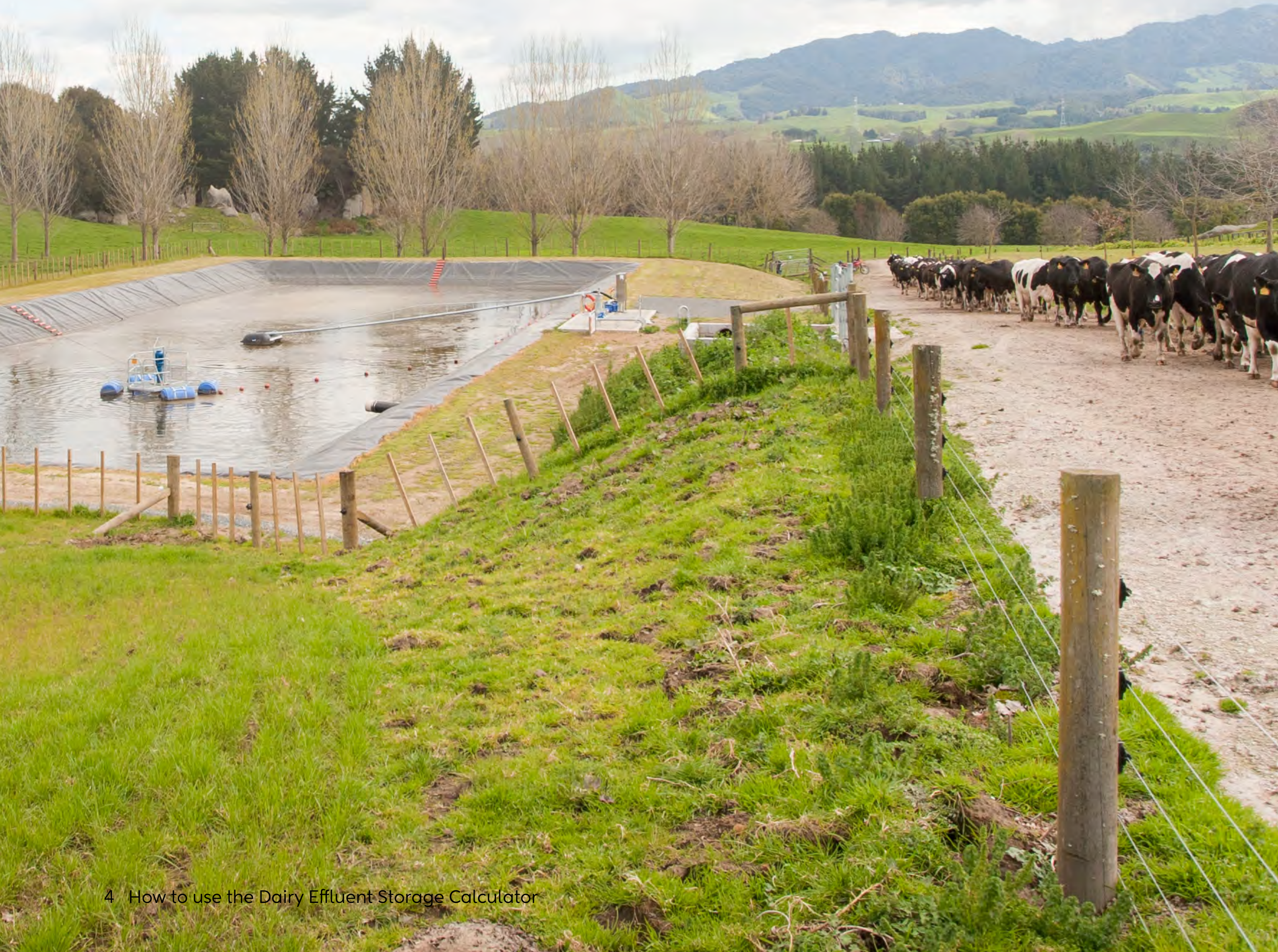
Introduction

This guide has been written as a supporting resource to assist you in using the DESC tool correctly and interpreting the outputs. DairyNZ strongly supports the use of Farm Dairy Effluent System Accredited Design companies when making decisions or investing in effluent systems.

This guide provides an explanation of the software and the assumptions behind it and gives step by step guidance on how to use the DESC to calculate storage requirements.

The DESC is only as good as the data and information that you enter. The recommendations are appropriate at a particular point in time. If there are any farm system changes, the DESC needs to be recalculated. The DESC assumes that the farm will be irrigated on every occasion when soil conditions are suitable.

It is assumed that you have completed a nutrient budget to determine the effluent block size requirements before using the DESC. The DESC assumes application is evenly spread across high-risk soils when there are multiple soil types. The DESC is based on soil hydraulic principles. It is NOT a nutrient calculator. Soil risk level is based on runoff and preferential flow, not nutrient load. Low risk soils still have the potential to have high nutrient loadings if effluent is over applied.



Adequate dairy effluent storage

Having adequate farm dairy effluent (FDE) storage capacity for your dairy farm is the basis of sustainable and successful FDE irrigation. Sufficient effluent storage enables you to irrigate FDE at a time that suits you and your soils, to maximise the nutrient and water value of FDE.

If your farm does not have the capacity to store adequate quantities of FDE, then no farm management strategies, technological innovation or good intention will allow successful FDE irrigation at all times of the year.

The purpose of FDE systems is to capture and apply FDE to land. This maximises the beneficial use of nutrients for plant growth and minimises contamination of ground water and surface water bodies. The consequences of inadequate FDE storage capacity can lead to environmental damage to our waterways and financial/production losses to the farming system.

Environmental damage and non-compliance with regional council FDE regulations continues to be an issue in many regions of New Zealand. Common causes of non-compliance with regional council guidelines include:

- FDE storage overflow
- FDE ponding, surface runoff and/or drainage caused by excessive FDE application rates or application depths for the conditions.

Attempts to identify FDE storage requirements using an industry average is not a robust or recommended strategy. Each farm requires a unique storage volume to successfully practice deferred FDE irrigation.

Deferred irrigation

The purpose of FDE systems is to maximise the beneficial use of nutrients for plant growth. This is not always achieved due to poorly timed application of FDE, namely when there is insufficient soil water deficit. This occurs because the farm has inadequate FDE storage capacity. Deferred irrigation involves storing effluent in a pond, tank or bladder, then irrigating strategically when there is a suitable soil water deficit.

For FDE application to be sustainable, effluent must be retained in the soil to allow plant uptake of nutrients. The longer the effluent stays in the soil's active root zone, the greater the opportunity for the soil to physically filter the effluent while decreasing potential contaminants and making the nutrients available to plants.

The objective of the DESC is to highlight opportunities to:

- improve returns on FDE application
- improve nutrient use efficiency
- reduce the risk of nutrient loss.

By improving the uptake and understanding of FDE systems, you can be more strategic in the management of nutrients within your operations and ultimately become more profitable and sustainable.

How to use the Dairy Effluent Storage Calculator

The Dairy Effluent Storage Calculator (DESC) is a software tool developed by Horizons Regional Council and Massey University to determine the effluent storage requirements of a farm. DairyNZ has updated this tool based on improved evidence and created an online DESC that is easily accessible for industry use.

The DESC looks at a farm's inputs of the effluent blocks soil risk, catchment areas, feedpads and barns. Then it considers their use, the amount of wash water in the dairy, effluent irrigation depths, and then calculates the daily volume of effluent that can be irrigated.

The DESC uses 30 plus years of rainfall and evapotranspiration data from a local climate site, supplied by NIWA and Plant & Food Research. DESC can calculate a daily soil water balance to determine how often effluent irrigation could occur, or if conditions are unsuitable, how much effluent should be directed to storage.

The DESC produces a graph showing the maximum storage volume and the 90th percentile required for each season over 30 plus years. It provides charts with effluent volumes generated, irrigation days available, and solids storage volumes.

The calculator can be used to check existing pond volumes if there is a pond already on-farm. It can help determine pond volumes for new systems, and for running scenarios to compare the different inputs to find out where you can get the best value for money.

The DESC can help with questions like:

- What happens if I put in a green water yard wash?
- What would happen if I put in low depth irrigation?
- What will a storm water diversion do to my storage requirements?
- What if I shift the effluent block to include an area of low-risk soil?
- What type of storage should I install (Bladder, Tank, Pond, etc)?

By investigating each of the input variables, and the impact these have on storage requirements, you can make informed decisions on effluent system designs or changes for individual farms.

What information do you need?

Before using the DESC, there are individual farm details you need to know. These will impact the quantity of Farm Dairy Effluent (FDE) produced by the farm system. These input details include:

- Climate
- The soil risk factor: Soils under FDE irrigation are classified as either 'high' or 'low' risk.
  - Low risk soils are free draining with a slope of less than 7 degrees.
  - High risk soils include artificial or impeded drainage, and/or with slope equal or greater than 7 degrees. Refer to the Pocket guide to determine soil risk for FDE application.
- Effluent Block size to irrigate on, and area of each soil risk factor.
- Rainfall catchment areas: These include the shed roof, yards, tanker aprons, sumps, stone traps, feed pads, silage bunkers, and any other hard, impervious area that drains storm water to the FDE pond.
- Wash water and farm dairy water use volumes: water used to clean the milking plant and to wash the yard.
- Storage pond: Current size and/or estimate of likely size.
- Irrigation: The volume of FDE applied each day and the irrigation depth. These are related to irrigator type and irrigator management.
- Descriptive, individual farm details.

Recommended expertise to use the DESC

It is strongly recommended to consult with an experienced effluent system advisor when completing a DESC calculation (Accredited system designer or WOF Assessors for example). While this guide provides the step-by-step instructions for using the calculator, working with an experienced user will provide the reassurance that you have correctly inputted data that reflects your effluent system and management, ensuring the storage calculation is the best fit for your farm.

Opening the DESC

Open the DESC online at **dairynz.co.nz/desc**

You will need to set up a login account to use and save the calculator.

When the calculator opens, the screen will flash for a few seconds while it starts up. On the top of the website, you will see *Create New*. Select this and then fill in your farm details to set up the farm file.

Main screen overview

The farm file main data screen provides an overview of the inputs and outputs of the DESC. Some boxes, such as the Catchments box, require you to click through the 5 tabs, whereas others, such as irrigation, will open a separate data screen for irrigation inputs.

You must enter individual farm data in all input fields so that the output data is relevant for your farm.

It is important to save changes often to avoid any loss of inputs. To ensure you understand the inputs, use the description box to describe the inputs and system design in more detail.

Inputs

There are seven input sections (Climate, Soil Risk, Catchments, Irrigation, Solids, Storage and Description) on the main screen. You MUST fill in every tab to get a meaningful, individualised output report.

1. Climate

The Climate field requires information about your average local rainfall levels. Some areas receive more rainfall and evapotranspiration than others, which directly influences the storage capacity required. Generally, higher rainfall areas require greater storage volume. However, it is not only the volume of rainfall falling on the catchment areas that dictates the required volume. The pattern of rainfall and evapotranspiration throughout the year determines soil moisture deficits on any given day.

Regional climate data has been supplied by regional councils, NIWA and Plant & Food Research, and is built into the calculator. There are limited climate sites on the DESC, so selecting a climate site requires a level of flexibility. It is best to choose a site that is geographically close to you if the rainfall and altitude is similar. When loading the farm file, the DESC uses the farm address that has been entered to find the nearest site as your baseline site. If the site closest to you has significantly different rainfall, then choose an alternate site that is better aligned with your farm. This can be achieved by ensuring the altitude of the climate site selected reflects your farm altitude (and is within the general location). This may impact on the reliability of the soil water balance.

Step 1

The default rainfall site is set on the closest site to the farm address you put in the description.

Step 2

If this is not the correct site, you can use the map feature to move around to find your nearest site.

Step 3

Select the rainfall site nearest to your farm by clicking on the 'rain cloud' icon. When you select the site, the data will flow into the main climate field.

2. Soil risk

The Soil Risk tab records the amount of low risk and high-risk soils that you will be applying effluent to. There are two soil classifications for soil risk, low' or 'high'. Effluent moves through low-and high-risk soils differently. See our guide on how to determine soil risk on farm for farm dairy effluent application at dairynz.co.nz/soil-risk

Low risk soils:

Are generally described as free draining soils. Low risk soils can retain nutrients more efficiently, as effluent moves through the profile in a uniform manner (matrix flow), without any preferential or overland flow. Therefore, it is possible to apply effluent more frequently than on high-risk soils.

High risk soils:

Are generally soils which have impeded drainage and/or artificial drainage, or land with a slope equal to or greater than 7 degrees. These soils are at high risk of preferential flow due to artificial drainage and overland flow due to low infiltration rates and/or slope. High risk soils are more vulnerable to effluent losses when soils are near or reach saturation, either through the profile, due to the preferential flow, or as run off on low permeable soils and require drier soil conditions to irrigate to (deficit irrigation).

Matrix flow

Low-risk soil

Preferential flow

High-risk soil

Surface runoff

High-risk soil

Soil type

Understanding your farm and its different soil types is an important step in effective effluent irrigation. Having a farm scale soil map is a major benefit when designing an FDE system.

The major soil types for each region have been classified as either high or low risk, based on the Soil Risk Framework developed by AgResearch.

S-map is the national online soils database; it allows you to search geographically or by soil type name, and to access the information relating to that soil. The associated fact sheet for each soil type has the soil risk shown as A to F.

Soil water deficit: Is the amount of water or effluent required to bring the soil moisture content back to field capacity. Therefore, any effluent that is applied in excess of the soil moisture deficit will drain and/or possibly run off the soil.

The DESC makes a theoretical decision about effluent irrigation based on the following:

- For low-risk soils, irrigation can take place after 24 hours of drainage post saturation. Irrigation depths can be greater than field capacity when applying at depths below 10mm.
- For high-risk soils, irrigation can only take place when the soil water deficit is greater than the application depth. Irrigation depths greater than soil water deficit will cause preferential flow, run off, or ponding, and result in reduced uptake of nutrients through the soil profile and increased nutrient losses from the system.

The DairyNZ pocket guide to determine soil risk for FDE application can be ordered online at **dairynz.co.nz/soil-risk**

Effluent block area

To work out the appropriate effluent block area, you need to understand how many hectares are required to comply with local regulations and have a nutrient budget. Too much effluent applied over a small area creates both water quality and animal health risks which need to be managed. 150kg N per ha is often used throughout regional councils as a maximum loading rate.

This area can be found when you complete an Overseer nutrient budget. This total effluent area needs to be divided into high and low risk areas, if you have both. As low risk soils allow more irrigation days, it is beneficial to have more low-risk areas available. Enter the maximum area of low-risk soil available on-farm into the low-risk box. The minimum remaining high-risk area to meet your nutrient loading requirement needs to be entered into the high-risk soil box. If your total actual effluent block is greater than the required effluent block based on your nutrient budget, then record any additional high-risk area in the Remaining area for effluent irrigation box.

When undertaking a storage calculation for an existing system, you can use a nutrient sample from the effluent pond to calculate the required loading rate. This requires an assessment of the total volume pumped from the effluent pond to paddock to determine the total area required. When using industry averages, it is essential to disclose and reference the average used as this is not tailored to the farm.

This assessment is less accurate when calculating storage for new systems and does not provide information on additional nutrients being applied; therefore does not provide a complete picture of how efficiently the farm uses those nutrients.

Example of the correct way to enter the effluent block:

Correct allocation of the effluent block

If 20 ha is the minimum required effluent area indicated by your nutrient budget, but your actual effluent block is 30 ha, of which 10ha is low risk, you should allocate it as follows:

- Low risk area 10 ha
- Minimum area for high risk soil 10 ha
- Remaining available area for irrigation 10 ha

Total storage required for an example farm = 1796 m^3

This situation apportions 50% to low risk soil and 50% to high risk soil

If you do not follow the correct method of allocation, you will significantly influence your storage requirements.

Incorrect allocation of the effluent block

If 20 ha is the minimum required effluent area indicated by your nutrient budget, but your actual effluent block is 30 ha, of which 10ha is low risk and you incorrectly allocate it as follows:

- Low risk area 10 ha
- Minimum area for high risk soil 20 ha
- Remaining available area for irrigation 0 ha

Total storage required for an example farm = 2520 m^3

This situation apportions 33% to low risk soil and 66% to high risk soil

The calculator assumes that the size of the effluent area you have entered is accurate as determined by a nutrient budget. Note – If a nutrient budget has not been used to determine the minimum application area, then it must be disclosed and referenced in the additional comments section of the DESC.

Step 1

You need to know the size of your effluent block (ha) and the respective areas of high and low risk soils within it. See previous notes. Having a nutrient budget will help establish the appropriate effluent area for your farm.

Step 2

Low risk area: Enter the total area of low-risk soil you currently have available to spread your FDE.

Step 3

Minimum area for high-risk soil: If, according to your nutrient budget, you need more irrigation area to meet your nutrient loading limits over and above the low-risk area you have, you need to enter the additional area required in this box.

Step 4

Remaining area available for irrigation: If your current high risk effluent irrigation area is larger than the area required as determined by your nutrient budget, then enter the extra high-risk area in this field.

3. Catchments

The catchment information informs the calculator how much rainfall is being collected and directed into the effluent system and the contribution that rainfall is making to the overall effluent storage volume.

A catchment area is any area where rain is collected and directed to the effluent system. If you have an area which is covered and runoff water does not enter the effluent system, it is not considered catchment area. Storage ponds, tanks, weeping walls and solids bunkers are entered as catchment areas later in the DESC.

If you have a covered feedpad, it is not considered a catchment area provided the roof runoff does not enter the effluent system.

Remember to include the tanker apron, vat stands, silage pits, and under pass areas if they flow into the effluent system.

Step 1

Identify what catchment areas are relevant to your farm.

Step 2

For shed, enter the dairy shed roof catchment area (m2) and select yes if diverted.

Step 3

Enter dairy yard catchment area, diversion details, milking season start and end dates, average daily milking cow numbers, average daily milking hours, and average daily wash water details (these can be entered either as a daily wash volume (m3/day) or by clicking on the swap button entering litres/cow).

If you select 'yes' for storm water diversion, enter the start and finish dates when runoff is diverted from the FDE system. For example: If over the period when cows are dry and the shed is not being used, you have the yard stormwater diversion in place, then enter the period that you are dry for.

If you choose to divert runoff from your yard all year round, then you can check the tick box. However, this requires the yard to always be clean, other than during times of milking and wash down.

Step 4

If a feed pad or animal shelter is present and collected effluent is discharged into the effluent system, then enter the catchment area. If covered, check the covered box, and enter storm water diversion details if diversion is present. Then populate the fields of Average daily cow numbers, Average daily hours on pad and Average daily wash volume if washed with fresh water.

Average daily wash water volumes can be entered or changed in the details section. This can be entered monthly. Wash water volumes may change through the season as milking routines and herd sizes vary. However, there is generally not enough variation to change these figures through the season.

NB: Average industry wash water estimates of 70l/cow/day are misleading and should not be used. This figure can vary anywhere from 30-120 l/cow/day. We recommend that you measure the actual water use on-farm and change the default value using accurate information for the farm.

Worksheet: How to estimate water use in the farm dairy

Metering water use in the farm dairy is the best and most accurate way to track water consumption over time. In the absence of meters, you can use this form to record all your water uses, then do the calculation to estimate total use.

Measure	Record
A. Milk cooling Measure exit flow during milking: Time how long it takes to fill a 200 litre drum and use it to gauge the flow rate (in litres/min). Determine total milking time for the day.	**Water use A** = _____ l/min (flow) x _______ minutes milking time = _______ litres
B. Plant/vat wash Wash tubs and hot water cylinders use set amounts of water. Refer to washing routine instructions supplied by the detergent companies.	**B =** ____________________ litres
C. Yard wash down To do a bulk tank cnlculatlon, follow these steps. • Turn off any automatic tank refilling from source water during measurement (milking). • Turn off stock water tap during measurement period if it draws off this tank. • Turn off connections to other tanks. **Measure amount of water drawn off during the whole milking time** (Remove the lid and use a stick to measure the difference in cm bwtween 'start' and 'finish' water levels.) Divide this by 10 cm (for 25,000 L tank) or 9 cm (for 30,000 L tank) to approximate water volume in m^3. Multiply by 1,000 to convert to litres. This amount is the "**change**" For **single tanks**: C = "change" minus B For **multiple tanks** (tank for yard wash down): If there is more water in the tank at finish due to refill from milk cooler greater than use, then C = A minus "change ". If less water in the tank, C = A plus "change". If you run out of water for yard wash, refill the tank to provide tile water needed to finish. Measure the flow rate x amount of time to refill and call this volume "E". In this case, C = A + "change" + E	**C =** ____________________ litres Note: For tanks other than 25,000 or 30,000 litres, divide 1,000 by 3.14 x r^2 (i.e. radius of the tank squared) to determine the "volume/height" per cubic metre.
D. Other water uses These uses of water are captured under C (bulk tank calculation) above. If you are interested in quantifying this water consumption, use appropriate procedures (measure water flow rate, etc). This can include skirt and cluster wash in rotaries, for example, and use of dairy shed water outside of milking activities.	Note: For estimating purposes, D (other water uses) is included in the C calculation above.
Calculate	
If you use milk cooling water for yard wash B + C Water use per milking ________ + ________ = ________ litres ÷ 1,000 = _______________ m^3 **If you do not us milk cooling water for yard wash** A + B + C Water use per milking ________ + ________ + ________ = ________ litres ÷ 1,000 = __________ m^3	**Total water use for twice-a-doy milking** _____ m^3/milking x 2 = _____ m^3

Recycled/green water wash down

A change to the New Zealand Code of Practice for the Design and Operation of Farm Dairies (NZCP1) allows farmers to use Farm Dairy Effluent (FDE) water for yard wash-down, but strict guidelines and criteria must be followed. Using recycled or green water to wash down your yard has significant benefits including:

- Less freshwater abstraction and use
- Reduction of the amount of effluent storage volume required
- Less effluent to manage and irrigate

Using recycled FDE for yard wash must be managed to prevent any possible risk to food safety.

If you are washing the feedpad with clean water, you must enter the volume used in the calculator. If the feedpad is not washed, or only scraped, or uses green water, leave the volume at 0.0. If the routine for the feedpad is not the same each day (you might wash every third day or have different cow numbers present), then you must total the value and average it out to a daily rate.

In the bottom right corner of the inputs, for each month, there is a ***drag to populate*** feature, where cow numbers, hours in shed or wash down volumes are the same month to month.

4. Irrigation

The Irrigation field collects information about your FDE irrigation practices.

The less you irrigate, the more FDE storage you will need. Irrigation is closely related to your soil type. If you have low risk soil, you will be able to irrigate on many more days than you would if you have high-risk soil.

The values you enter here become your critical deficit/irrigation threshold for application to high-risk soils. Unless you have a soil water deficit greater than the depth values set here, the calculator will not allow irrigation to take place, unless you have low risk soils.

It's important the depths and volumes are realistic; these can have major impacts on storage requirements and should not be estimated. Ensure your irrigation depth complies with regional council requirements and/or resource consents, and your irrigation frequency aligns with how you manage the system.

Irrigation depth

Step 1

Measure your irrigation depth. Do not rely on manufacturer's specifications as this will vary based on each specific situation i.e. your system pressure, flow and maintenance.

Step 2

Enter the irrigation depth (mm) in the create new irrigation depth tab. When there are Winter-Spring rates, and for the Spring-Autumn rates, you can add multiple irrigation depths to match. Make sure you enter the irrigation depth not the irrigation rate.

Irrigation pump volume

Irrigation volume is the amount of effluent you pump daily to land.

Step 1

If known, enter your irrigation volume (m3/day) for each application depth entered.

Step 2

If you do not know your irrigation volume, click on either Option 1 or Option 2.

- Option 1 – If you know the hourly pump rate and time.
- Option 2 – If you only have the travelling irrigator run details.

Option One – Pump rate and time

a. Check the tick box on the right-hand side of the description box.

b. Enter pump rates (m3/hr) for each season.

c. Enter the time (hrs) you are pumping per day for each season.

d. Click OK.

Option Two – Travelling irrigator run details

a. Check the tick box on the right-hand side of the description box.

b. Enter the details for the length of run, width of run and number of runs for each season.

c. Click OK.

Step 3

Will you irrigate throughout the year?

Yes

Assumes you will be irrigating every day when the conditions are suitable.

No

You can select a period of the year that you will not irrigate, e.g. calving. Enter the dates of the period you will not be irrigating by heading to the Calander tab and enter periods under the Non irrigation calendar.

5. Storage

The Storage tab calculates the amount of useable or pumpable storage pond/tank volume (working volume). It requires dimensions and information about either the existing pond/tank system, or the intended system if constructing new ponds/tanks. Pumping information is also required.

Any storage ponds/tanks on-farm are also considered catchment areas for rainfall and will contribute volume to the effluent system. If you currently do not have a pond/tank, the one you install will become a catchment area. The calculator needs to account for the increase in catchment area.

A pond/tank which is not pumped is not considered a storage facility. The surface area of the pond/tank should be based on the physical dimensions of the top of the pond, not at the effluent level. The more ponds/tanks you have, or the greater surface area, the more your storage requirements will increase.

If you have existing ponds/tanks:

Step 1

Emergency storage is required to allow for unforeseen situations such as breakdowns.
Enter the number of emergency storage days required. Each regional council will have a specific requirement for this. The Dairy Effluent Code of Practice provides guidance on best practice for emergency storage requirements. In the absence of specific guidance, 3-5 days is sensible to account for mechanical failure or emergencies (pump failure, loss of power etc).

Step 2

To add storage, press ***Add storage***. If ponds are of regular shape or are tanks/bladders, select the option ***on farm*** and the number of ponds or tanks, then go to Step Four.

Step 3

If ponds are irregularly shaped, select the irregular pond option and check the activation box. Work out the total volume, freeboard volume, unpumpable volume and surface area of all irregular shaped ponds and enter their associated boxes.

Step 4

Tanks, regular shaped ponds and saucers - if the storage is a saucer, select the round option and fill in diameter, total depth, freeboard and sludge/unpumpable heights and batter.

- If storage is square or rectangular, enter the length, width, total depth, freeboard height, sludge/unpumpable height and batter.
- If storage is a tank, fill in dimensions as above.
- Tick the pumped box if the storage can be pumped.
- Tick if the storage is covered.

If you have no existing ponds/tanks

If there are no existing ponds/tanks currently on-farm and you are planning to include one in the system, it is important to account for the proposed pond/tank in terms of its influence as a catchment area.

Step 1

Ensure all other parameters in the DESC are filled in. The pond/tank dimensions should be the last ones you enter.

Step 2

Emergency storage is required to allow for unforeseen situations such as breakdowns.
Enter the number of emergency storage days required. Each regional council will have a specific requirement for this.

Step 3

Choose either regular ponds or storage tanks, whichever option reflects the type of storage proposed.

Step 4

Add the number of ponds or tanks. Circular ponds are round ponds with battered walls,; much like a Canterbury saucer, whereas tanks have a vertical wall.

Step 5

The Required Storage Volumes tab will show the maximum storage required for each year, or if sizing is in accordance with the FDE COP, you can go to the CDF of Required Storage Volumes tab to get the FDE COP 90% volume. Estimate storage dimensions and enter these into the length, width, total height, sludge/ unpumpable height, freeboard height and batter boxes.

Step 6

A dotted green line will appear across the screen of the Required Annual Storage Volumes. Is the volume depicted by the green line equal to, or greater than, the desired amount of storage? If yes, this step is complete.

If No, go back to Step 5 and alter the input dimensions to resize the pond or tank. This is an iterative process of fine-tuning storage dimensions to get the desired storage volume. It's important to note that as dimensions change, so does the required storage volume due to the surface area of the pond changing and altering the amount of rainfall caught and evaporation lost.

6. Solids

It is not uncommon for farmers with cow housing, barns or feedpads to severely underestimate the volume of solids storage they need. Therefore, this tab has been added to calculate the volume of solids collected or separated, and the size of bunkers or weeping walls needed to contain these solids.

Step 1

Click on the Solids tab and add a separation unit. Under the ***General tab***, name the unit and input the Dry Matter, Separator Efficiency %, and the input sources the unit is separating from. Select the input sources the unit is capturing from.

Step 2

Bunker type tab - Enter the solids bunker or weeping wall dimensions if regular shaped. The calculator needs to know both the volume of solids storage and the solids storage surface area to account for rainfall. Therefore, if your bunker is of an irregular shape, you need to determine both the volume and surface area of the bunker and enter these accordingly.

It is recommended that dual weeping walls are entered as two separate solids separation units. It's recommended to adjust the days when the system is not separating, under the Separation tab.

Step 3

Choose an emptying option under the ***Empty Days*** tab. Select a minimum soil moisture deficit required before spreading can take place and, if required, adjust the four-day forecast SWD excess.

The four-day soil water deficit excess (mm) forecast is your self-imposed limit of soil water deficit excess (drainage and/or runoff (mm)) over a four-day period after the intended solids spreading date.

Soil water deficit excess will be caused by the net effect of rainfall events and evapotranspiration exceeding the soil's water holding capacity over the next four days and resulting in a certain amount of drainage/runoff. If the limit is exceeded, the calculator will not empty the bunker and will continue to store solids.

The purpose is to mitigate the possible runoff loss of applied effluent due to a forecast rainfall event over the next four days - this will be particularly relevant to high-risk soils.

Use the ***calendar feature*** to enter the dates that solids emptying will be able to occur. Select ***Create Solid Unit*** at the bottom of the table.

7. Description

This tab is for administration information and for adding details to the summary report. It's good practice to review and check all the input data is correct. DESC reports must be printed if those without the DESC programme want to review/read the outputs.

Step 1

Enter a written description of the data inputs in the ***General Description*** details. This must include any assumptions you have made e.g. assumed water use – not measured, assumed soil risk, assumed pond dimensions, assumed pump application depths etc. It may also include the following:

- farm descriptors
- soil type
- drainage systems
- comments
- notes
- other relevant information.

Step 2

Check your inputs. Create a report summary and review it. Click on the output tab – ***Summary report*** to double check your data.

Reporting

Now that you have entered all the inputs, a customised series of graphs and reports is available. These are accessed via the seven output functions.

Required storage volumes and 90th percentile

This shows a graph of the **Required Annual Storage Volume** required (m3) to successfully irrigate FDE for each year over the past 30 plus years. The 90th Percentile window shows the 90th Percentile.

Required Storage Volumes can be viewed while entering input data. When you enter input data, you can see how each input section impacts your storage requirements as the Required Storage Volumes will immediately respond to every input field.

If you hover over each bar on the graph, you can see the actual volume figure required for that season. The year with the maximum storage requirement is highlighted in orange. If your farm currently has storage ponds, this volume is also depicted via a green dashed line. This figure is the working volume.

Effluent volumes

The two graphs show the **total volume of effluent produced each year** and the **monthly distribution** season to season. This includes effluent, wash water and rainfall.

You can adapt the graph to see the volumes of effluent produced over a specific period of the year by changing the season and month box in grey. For example, if you just want to know how much effluent was produced over winter, you could specify the graph to look at dates between 1 June and 30 August for a given year.

Irrigation days

These graphs show the **total number of days** you will be able to irrigate FDE on to your effluent block over a season, and monthly over a particular season. This has been calculated using your customised input information, rainfall data, soil risk and critical deficit irrigation values. Irrigation is determined by the size of the soil water deficit. You can adapt the graph by using the season and month box in grey.

Summary report

The DESC will produce a summary report by exporting the file into a PDF, which you can share with others. This provides the details and outputs of the model for the specific farm.

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