

Pocket guide to determine soil risk for farm dairy effluent application





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As co-developers of this guide, both Landcare Research Ltd and AgResearch Ltd have permission to use this publication. Graham Shepherd is thanked for providing photographs on p22 and p24.

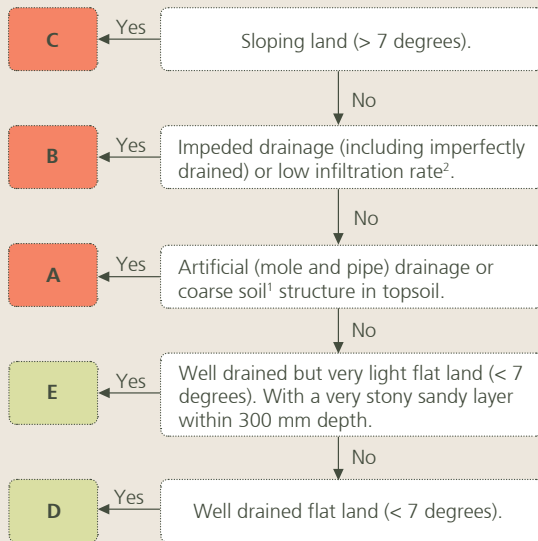


Soils across New Zealand have been classified into high and low soil risk categories for farm dairy effluent application.

Management practices need to be matched to soil and landscape risk in order to prevent loss of effluent into the surrounding environment.

This field guide will take you step by step through the process of working out the soil risk for a farm.

Soil risk categories overview



The soil risk decision tree shows the 5 risk categories with those in red **High Risk (A,B,C)** and those in green **Low Risk (D,E)**.

¹ Soils with 80% or more soil aggregates captured on a 10 mm sieve within the top 300 mm soil layer are considered to have coarse soil structure.

² Low soil infiltration rate is defined as 10 mm/hr or less.

Soil risk categories overview

Step 1. Check out soil information for the specific area on-line

Step 2. Understand the A,B,C,D,E risk profiles and what they mean

Step 3. Review the topography of the farm

Step 4. Verify soil risk on-farm by digging some test pits

Step 5. If unsure consult a soils expert

Step 1. Soil information on-line

Go to S-map on-line website <http://smap.landcareresearch.co.nz/home>

Choose the **maps and factsheets** button (be patient, it can take a minute or two to load)



The screenshot shows the homepage of S-mapOnline, a digital soil map for New Zealand. The page features a navigation menu at the top with links for Home, Getting Started, About, Help, Feedback, Contact, News & Events, and Site Information. The main heading is "The digital soil map for New Zealand". Below this, there is a map of New Zealand and two buttons: "Maps & Factsheets" and "Interactive Soil Maps". The "Maps & Factsheets" button is circled in red, and a red arrow points to it from above. Below the buttons, there are two columns of text: "What is S-map?" and "What is S-map Online?". The "What is S-map?" section describes the map's content and purpose, while the "What is S-map Online?" section lists the features of the online tool. At the bottom, there is a "Home | Online | Contact Us" button.

Read and accept the disclaimers to enter the site



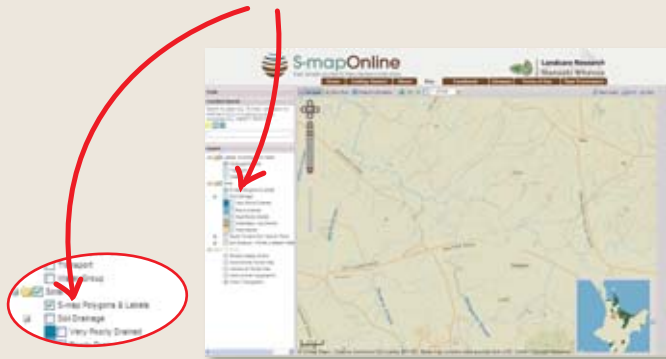
Step 1. Soil information on-line continued

Find the property by entering the address in the location search box, and then select the envelope to search for the address



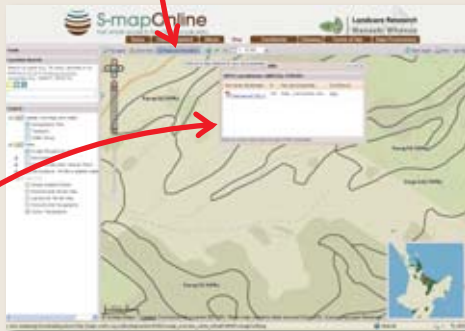
Alternatively, use the navigate and zoom buttons to find the area of interest. The map will automatically zoom to your location, and highlight as a red dot.

Turn on the soil map by selecting **S-map Polygons and Labels**



Step 1. Soil information on-line continued

To identify the soil type(s) select the **Feature information** button, and click on the map where you want info.



A **popup box** will appear listing the soil type(s) present. Click on the soil name to open a factsheet about the soil.

On page two of the fact sheet the dairy effluent risk category is shown.

Bypass flow	Medium
Hydrological soil group	A
Irrigability	Hilly and steep land with good drainage/permeability and soils with low PAZ
Contaminant management	
N leaching vulnerability	Medium
P leaching vulnerability	not available yet
Runoff potential	Very Low
Bypass flow	Medium
Dairy effluent (FDE) risk category:	C
Additional information	
Soil classification	Buried-allophanic Orthic Pumice Soils
Family	Paengeraf
Sibling number	2
Dominant texture 0 - 60 cm	Sandy
Soil profile material	Tephric soil
Rock class of stones/rocks	From Rhyolite Rock
Rock origin of fine earth	From Rhyolite Rock

Not all dairy farming areas in New Zealand have their soil risk classification known, if this affects your farm then give the local regional council a call or visit their website. They may have soil information to assist you.

Step 2. Understand the A,B,C,D,E risk profiles

This table describes effluent considerations related to the risk class.

Category	A	B	C	D	E
Soil and landscape feature	Artificial drainage or coarse soil structure	Impeded drainage or low infiltration rate	Sloping land (>7°) or land with hump & hollow drainage	Well drained flat land (<7°)	Other well drained but very light flat land (<7°)
Risk	High	High	High	Low	Low
Application depth (mm)	< SWD ¹	< SWD	< SWD	< 50% of PAW ²	≤ 10 mm & < 50% of PAW ²
Storage requirement	Apply only when SWD exists	Apply only when SWD exists	Apply only when SWD exists	24 hours drainage post saturation	24 hours drainage post saturation
Max depth: High rate tool	10 mm	10 mm	10 mm ³	25 mm ⁴ (10 mm at field capacity)	10 mm
Max depth: Low rate tool	25 mm	25 mm	10 mm	25 mm	10 mm

¹SWD is the soil water deficit

²PAW is the plant available water in the top 300 mm of soil

³Only applicable when instantaneous application rate from the irrigator is less than the infiltration rate

⁴Suggested maximum application depth when a suitable SWD exists (≥ 15 mm)

For all the risk categories the application rate should always be less than the soil infiltration rate otherwise you will get ponding (on sloping land the instantaneous application rate needs to be less than the soil infiltration rate or you will get run-off).

Step 3. Review the topography of the farm

Sloping land greater than 7°?

If, yes → Category **C High Risk**

If, no → Go to Step 4

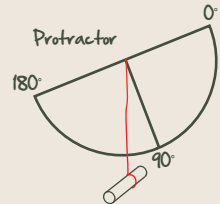
Clinometers (inclinometers) are tools for measuring slope angle. They can be sourced from suppliers of technical instruments.



Common clinometer



Compass clinometer
(Geological or Brunton compass)



Home made clinometer

Alternatively these photos of a car on a slope gives some idea of slope, 7 ° is not actually that steep!

Slope less than 7 degrees (actual slope of 6 degrees)



Slope less than 7 degrees (actual slope of 6 degrees)



Slope greater than 7 degrees (actual slope of 14 degrees)



Slope greater than 7 degrees (actual slope of 14 degrees)



Step 3. Review the topography of the farm continued

Those with smartphones can download apps for this. For example: iphoneappsplus.com/utilities/clinometer---max--precision-level-and-slope-finder/index.htm

Clinometer - level and slope finder



Last changed: Nov 11, 2009

Category: Utilities

Homepage: [Peter Breitling](http://PeterBreitling.com)

Rating: ★★★★★ (3012)

Version: 3.1.2

Size: 0.3 MB

Price: \$0.99 [GET APP](#)



Best to lay the phone along a length of wood to average out the land slope.

All hump and hollow drained land is Category **C High Risk**



Step 4. Verify soil risk category by digging a test pit

First check to ensure no underground services are near proposed pit site.

Dig a small soil pit about 300 x 300 mm square x 400 mm deep with a spade.



- Keep the sides of the pit vertical and observe the depth to gravels (if present)
- Clean up one side of the pit so it is smooth (ideally either facing the sun or completely in the shade – so it is uniformly light for photographing)
- Identify any boundaries of soil layers, usually identified by a change in soil colour (in the photo above the subsoil layer is apparent in the base of the pit in contrast to the brown colour of the topsoil above)

How many test pits are needed?

- Sloping land greater than 7 degrees is automatically Class **C High risk**, so there is no need to locate pits here
- Recommend that an average of one test pit per 6 hectares are dug (this is a mapping scale of 1:25,000)
- Avoid fencelines, gateways, trees and around troughs
- Digging multiple test pits will indicate any major soil variations between paddocks and locate areas of low risk soils on the farm
- Take a picture of the soil profile of each pit and record on farm map the rough location of each pit.

Step 4. Verify soil risk category by digging a test pit continued

Is the soil predominately peat?

If, yes → Category **B High Risk**

If, no → Keep working through this step



Peat soil like those in the photos above is characterised by a high level of organic matter that has accumulated in areas with a high water table. They can be recognised by black to very dark brown colours and when rubbed between the fingers, peat material often has a greasy feel. Plant material decomposes slowly in peat and is often observable in the soil pit.

Does the soil have impeded drainage?



Identifying impeded drainage, (imperfectly and poorly drained soils), is done primarily by soil colour and the presence, size and colour of soil mottles within 400 mm depth. Soil mottles are the 'spots' or 'blotches' of colour different from the predominant soil matrix colour (excluding pieces of topsoil), often specks of rusty orange or grey or bluish grey colours.

Can you see spots or blotches of colour in the side of the test pit?

If, yes → Category **B High Risk**

If, no → Keep working through this step

Step 4. Verify soil risk category by digging a test pit continued

Does it have low infiltration rate?

If, yes → Category **B High Risk**

If, no → Keep working through this step



Dark coloured top soil indicating a well aerated well drained topsoil which is likely to have a good infiltration rate



Soil with medium structure with signs of moderate to low infiltration then soil risk **Category B High Risk**



Pale grey soil colours with distinct large orange and grey mottles of a poorly drained soil with a low infiltration rate then soil risk **Category B High Risk**

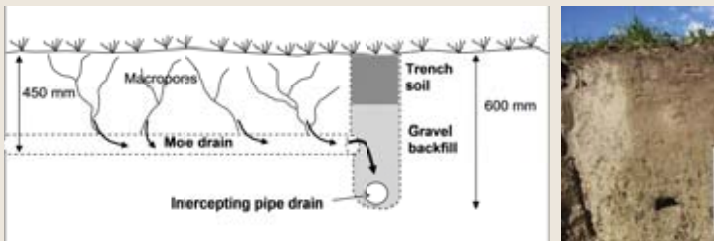
Does it have artificial (mole and pipe) drains?

Does it have artificial (mole and pipe) drains?

If, yes —————> Category **A High Risk**

If, no —————> Keep working through this step

Mole drains are very effective at draining wet areas of a farm. (Unfortunately they can also be a good way for effluent to enter waterways through the drainage network.



If possible mole drain areas should be avoided for effluent application. If you cannot avoid them then Category **A High Risk**.

Step 4. Verify soil risk category by digging a test pit continued

How to work out if soil has coarse soil structure in topsoil?

To check this category out, dig out a 200 mm x 200 mm x 300 mm deep sod from the wall of the pit. Tear it in half or cut with a spade.



Fine soil structure, not Category A



Medium soil structure, not Category A



Coarse soil structure, firm clods with few aggregate soil risk
Category **A High Risk**

Does it have coarse soil structure?

If, yes —————> Category **A High Risk**

If, no —————> Go to final check

Final check

- If sloping land greater than 7 degrees then **High Risk**
- Artificial (mole and pipe) drainage then **High Risk**
- Hump and hollow land then **High Risk**
- Impeded drainage then **High Risk**
- Peat present then **High Risk**
- Low infiltration rate then **High Risk**
- Coarse soil structure then **High Risk**

If the soil does not show any of these characteristics then likely to be **Low Risk**

Step 4. Verify soil risk category by digging a test pit continued

Examples of Category D Low Risk soils





Category **D Low Risk** from Southland, Canterbury, and Taranaki. These soils are well or moderately well drained soils, on slopes < 7 degrees, with very stony sand at depths greater than 300 mm

Step 4. Verify soil risk category by digging a test pit continued

Examples of Category E Low Risk soils

An example of a soil classified as Category **E Low Risk** with very stony sand within 300 mm depth.



Step 5. Consult a soils expert

If still unsure you might find it beneficial to contact a soils expert. This may be particularly important if the farm is located in a catchment of focused attention or soil risk is specified in your consent.

A list of available experts can be found on the New Zealand Society of Soil Science

<http://nzsss.science.org.nz>

Or contact:

Landcare Research Ltd

Sam Carrick (South Island) carricks@landcareresearch.co.nz

Sharn Hainsworth (North Island) hainsworths@landcareresearch.co.nz

AgResearch Ltd

Dave Houlbrooke david.houlbrooke@agresearch.co.nz

Andrew Manderson andrew.manderson@agresearch.co.nz

Your local regional council may also be worth contacting

dairynz.co.nz/effluent