

How to Calculate a Farms Seasonal Irrigation Water Limit using Irricalc

This procedure is designed to provide seasonal irrigation water use limits that comply with Environment Canterbury's policy that such limits be based on the assumption that irrigation application efficiency is 80% and provide sufficient water volume to meet reasonable irrigation water use 4 years out of 5, on average.

This procedure is also designed to provide seasonal irrigation water use limits for arable farms, as well as for pasture-based farms. The seasonal irrigation water use limit for an arable farm is based on the seasonal irrigation water use limit for the farm if the farm was pasture-based. The seasonal irrigation water use limit for the farm is determined for pasture first and then this number is converted to the arable farm equivalent.

Step 1: Determine the Soil Water Holding Capacity Class to use for your Farm

Do this by locating where your farm is on the Soil Water Holding Capacity (Soil WHC) map for your area. Kaikoura, Amuri, North Canterbury, Central Canterbury, Mid Canterbury, South Canterbury, Lower Waitaki & MacKenzie Basin.

Once you have located your farm on the Soil WHC map, use the colour at that location with the legend at the top left corner of the map to determine the Soil WHC for your farm.

For example, if your farm was located in the middle of the Burnham military camp (Central Canterbury Soil WHC Map) it would have a Soil WHC of 60mm.

If the soils information for a farm comes from a different source the following points need to be taken into account:

- Determining Soil WHC (mm) – The Soil WHC to be used with the Irricalc method is the soil water (mm) that is stored in the plant root zone between wilting point and field capacity. The depth of the plant root zone varies between crops/pasture/lucerne. For pasture a root zone depth of 600mm is recommended. Note that the Profile Available Water given in the ECan GIS system is for a soil depth of 900mm.
- Determining the Soil WHC Class – The Soil WHC class labelled as “60mm” represents the range of soil water holding capacities in the range 50mm to 69mm. The “80mm” class represents the range 70mm to 89mm, and so on.

Step 2: Find out the Seasonal Irrigation Water Limit for Pasture on your Farm

To do this you need to use the seasonal irrigation water use map that is labelled as the Soil WHC class of your farm AND 80% efficient irrigator AND the Soil WHC AND the “reliability” standard of 4 years in 5. Kaikoura, Amuri, North Canterbury, Central Canterbury, Mid Canterbury, South Canterbury, Lower Waitaki & MacKenzie Basin.

Locate your farm on the map that is labelled with the Soil WHC class of your farm AND 80% efficient irrigator AND the Soil WHC AND the “reliability” standard of 4 years in 5.

Once you have located your farm on this map, use the colour at that location with the legend at the top left corner of the map to find the seasonal volume contours that the farm lies between.

For example, if your farm was located in the middle of the Burnham military camp (Central Canterbury 60mm Soil WHC AND 80% efficient irrigator AND the “reliability” standard of 4 years in 5) it lies between the 700 and 750mm seasonal irrigation water use limits.

Linearly interpolate between the contours that lie either side of the farm to get the seasonal irrigation water use limit for that farm.

For this example the policy compliant seasonal irrigation water use limit is 745mm.

Step 3: If the farm is an Arable Farm, Convert the Seasonal Volume for a Pasture-based Farm to the Arable Farm equivalent.

Arable Farm Seasonal Volume = Pasture-Based Farm Seasonal Volume multiplied by 0.65

For example, if the farm at Burnham was an arable farm its seasonal volume would be 745mm x 0.65 = 484mm

Step 4: Convert the Seasonal Volume, in mm, to Seasonal Volume in cubic metres

Seasonal Volume in cubic metres = Seasonal Volume (in mm) x 10 x the area irrigated (in hectares).

For example, if Seasonal Volume from the map is 745mm and you irrigate 100 hectares the Seasonal Volume in cubic metres is 745 x 10 x 100 = 745,000 cubic metres.

Guidance Notes for more detailed applications

What if you have Several Soil Types or Several Irrigation Systems on your Farm?

Work out the seasonal volume for each relevant combination of soil type and 80% Efficient Irrigator and add the volumes up.

For example, if on the one farm at Burnham you had 150 hectares with SWHC of 60mm and another 50 hectares of 120mm SWHC soil, you would need to use the maps to look up seasonal volumes for each of the following and then add the volumes together.

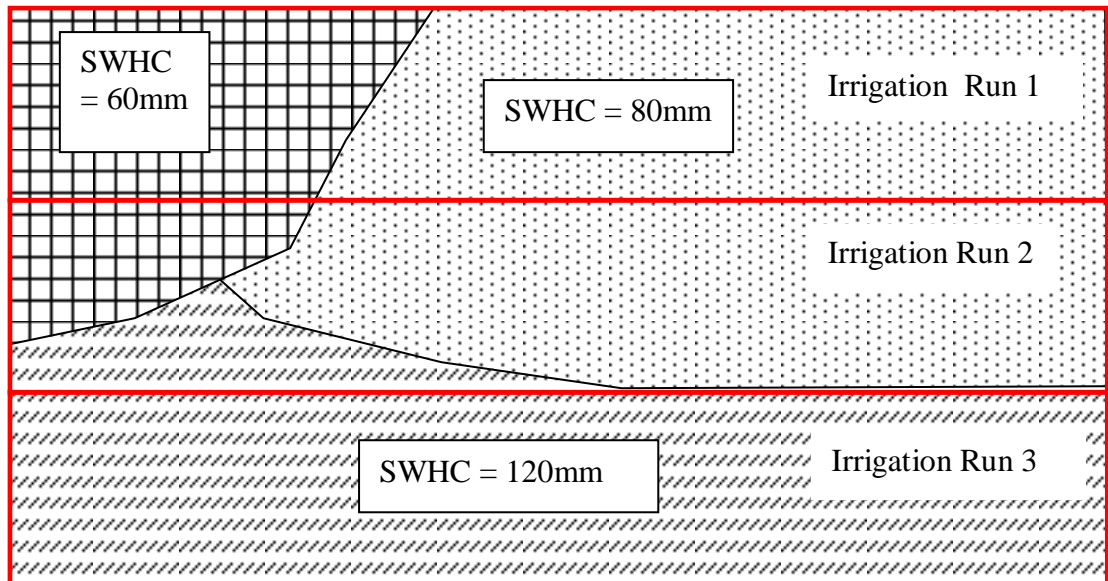
SWHC	Irrigator	Seasonal Use (mm) from map	Area (hectares)	Seasonal Use (cubic metres)
60 mm	80% Efficient	745	150	1,117,500
120 mm	80% Efficient	697	50	348,500
Total Seasonal Volume for Farm =				1,466,000

What if an Irrigator Passes more than One Soil Type on its Run – Which Soil do I Use?

Sometimes an irrigator will irrigate more than one soil type on its run. In this case the operation of the irrigator will probably be based on the soil type that has the smallest soil water holding capacity. It is this soil water holding capacity that should be used to calculate the

seasonal irrigation volume for that irrigator run. The seasonal volume should be calculated for each irrigator run (or circle) and added up to give the total for the farm.

The following diagram illustrates this situation



In this situation a judgement must be made about which Soil WHC to use for each irrigation run. Justification of the decision as to the Soil WHC s used is required. In this example use of a Soil WHC of 120mm and of 80mm for runs 3 and 2, respectively, is a straightforward decision. For run 1 it is not so clear-cut. If the crop grown is sensitive to soil water deficits then a Soil WHC of 60mm should be used. If it is not then a Soil WHC of 80mm would be more appropriate.

What if the Farm is Located in an Inland Basin, such as the Mackenzie Basin?

The IrriCalc method uses a crop factor that has been calibrated for growing conditions on the Canterbury Plains. The length of the growing season in inland, high altitude, basins is significantly shorter than the growing season on the Plains. This will change some characteristics of the crop factor to be used. The IrriCalc method should, in this situation, be used with a crop factor that has been constructed using information contained in FAO Paper 56, "Crop Evapotranspiration: Guidelines for computing crop water requirements", 1998. Justification of any subjective decisions made by the user in the construction of the crop factor is required.

Please contact Aqualinc for information on applying the Irricalc methodology in the inland basins.